

# **ECONOMIC POTENTIAL OF HIGH SPEED RAIL FOR CALIFORNIA**

Senior Project

By

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2010



## APPROVAL PAGE

TITLE:	Economic Potential for High-Speed Rail For California
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DATE SUBMITTED:	June 10 <sup>th</sup> , 2010

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## Acknowledgements

I wish to express my sincere appreciation to all those who helped me in diverse ways in the conduct of this study. I would like to mention especially the following:

Cornelius Nuworsoo, Assistant Professor at Cal Poly San Luis Obispo. Professor Nuworsoo's guidance, support, and assistance, throughout the course of this project have been invaluable.



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## **Executive Summary**

Ever since the construction of the national highway network in the 1950s, the primary method of growth and development in the United States has been highway-oriented. Highways made it easy for land-uses to be separated far from each-other. As a result of these segregated uses, sprawling, automobile-oriented development has taken over at the expense of walking, biking, and transit use. The auto-transportation sector is now the biggest source of greenhouse gases and many of our roadways are approaching capacity. As a result of neglecting other modes, many suburban street networks and land-uses discourage pedestrian or bicycle use. In the wake of climate change, traffic congestion, and a slow economy, America's political leaders are starting to look toward public transportation including high-speed rail. The long-term vision for high-speed passenger rail in the United States is among one of the President's most important priorities. \$8 billion of President Obama's American Recovery and Reinvestment Act (ARRA) will go toward the construction of high-speed rail and the improvement of existing rail lines to accommodate higher-speeds. Of all the awarded recipients, California received the largest amount (\$2.35 billion) of the federal ARRA grant funding for its first phase- twice the amount of any other corridor (FRA, 2009). This report will examine the economic benefits that high-speed rail has to offer and identify opportunities for California's High-speed Rail network.

High-speed rail is extremely relevant to City Planning because it can potentially reshape and revitalize urban areas through sustainable, walkable transit-oriented development. Transit Oriented Development (TOD) is one of the strongest selling points for high-speed rail as it could help provide much needed housing in city centers, spur the development of other mixed-use, commercial, and retail properties. Station areas can also help act as magnets for bringing growth back into the cities and away from the exurban sprawl that characterized California's last period

of economic growth. The high speed train stations across the state will offer cities the opportunity to develop sustainable and prosperous city centers that anchor local transit systems and economies. California's network has the potential to provide enormous economic, environmental, and societal benefits the state and could be a catalyst for transforming transportation and development policy across the state and the nation. This report discusses the economic potential of the current California proposal, examines international cases of high-speed rail spurring economic growth, extracts key lessons, and proceeds to make recommendations for California's system. Case studies include Saku City and Shin-Yokohama of the Shinkansen Network in Japan, and Lyon Part-Dieu and Lille of the TGV network in France. From these findings and comparisons, the report proceeds to recommend a set of three criteria for developing high-speed rail stations in California – 1) *Station Location*: stations should be located in the central areas of cities. 2) *Station Connectivity*: stations should act as multimodal hubs for many types of transportation; high-quality transit connections should be provided to get HSR passengers to their final destinations so they don't have to drive. 3) *City involvement*: cities must take an active role in planning for development around the stations; they should adopt smart growth policies that restrict outward growth while encouraging more growth back into central city areas. Development around the stations should be attractive urban activity centers that foster walk-ability and reduce reliance on the automobile. Central Valley cities must also have or attract economic sectors that take advantage of high-speed rail. Just like the construction of the highway network in the 1950s, it seems as though high-speed rail may be on the verge of defining the next big era in intercity transportation and urban planning.

## **1.0 Introduction**

### ***The California High-speed Rail Proposal***

The state of California is moving toward the implementation of a state-wide network of high-speed rail. High-speed rail (HSR) refers to high speed ground transportation by rail operating at speeds exceeding 125 mph (or 200 km per hour). The proposed California network (Figure 1-1) will stretch more than 800 miles from San Francisco and Sacramento in the north to Los Angeles and San Diego in the south. The proposed California HSR network will have the capacity to carry approximately 116 million passengers annually (California High Speed Rail Authority and Federal Railroad Administration, 2009). The alignment will run through California's Central Valley connecting the fast-growing cities of Bakersfield, Fresno, Merced, Modesto and Stockton to the major cities of San Francisco and Los Angeles. With speeds of up to 220mph, the travel time from San Francisco to Los Angeles is estimated at approximately two hours and forty minutes and the network would carry between 41 million and 55 million intercity passengers annually by 2035 according to the CAHSRA 2009 business plan. The California HSR network, if considered as one project, will be the largest public works project in California's history.

In November 2008, California voters approved \$9.95 billion in bond sales to help fund the first phase of the first true high-speed rail project in the nation. Phase I calls for a 520-mile system connecting Anaheim and Los Angeles through the Central Valley to San Francisco's revamped Transbay Terminal by 2020 at a cost of \$42.6 billion. Phase II would extend the system north to Sacramento and south to San Diego by 2026. Phase I has a projected annual ridership of between 35 and 58 million passengers, depending on

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where the fare is set; at full build-out, California expects up to 102.4 million passengers per year on 300 trains a day, making it one of the busiest passenger rail lines in the world.

Figure 1-1: California High-Speed Rail Map



Source: CAHSRA website, 2010. <[www.cahighspeedrail.ca.gov](http://www.cahighspeedrail.ca.gov)>

The rail authority completed a program EIR for the overall system in 2005, and in 2008 chose Pacheco Pass (near San Luis Reservoir) instead of Altamont Pass for the connection between the Bay Area and the Central Valley. A few components of this EIR are being revised as a result of a lawsuit filed by some San Francisco Peninsula cities. The trains on the proposed system would run down the Peninsula in tandem with the electrified Caltrain corridor at about 125 mph before accelerating to 220 mph when they reach the Central Valley. If all goes well, service is planned to start by 2020, with the first segment opening as early as 2017.

### ***Problem Statement***

Since the 1950s, the prevalent method of growth outside of metropolitan areas has primarily consisted of sprawling suburbia. The almost single-minded focus on highway-oriented development (HOD) from the 1950s through the 1980s encouraged spread-out housing, and made it easy for different uses to be separated from each-other, far from traditional, walk-able communities (SmartGrowthAmerica, 2009). As a result of these segregated uses, the automobile has become the dominant way to travel. The transportation sector is now the biggest source of greenhouse gases and many roadways are approaching capacity. As a result of neglecting other modes, many suburban street networks and land-uses discourage pedestrian or bicycle use. The nature of the curvilinear streets and busy arterials associated with suburbs make walking or biking unsafe and inconvenient.

## ***Study Hypothesis***

Transit Oriented Development (TOD) is one of the strongest selling points for high speed rail, as it will help provide needed new housing in city centers, spur the development of other housing, commercial, and retail properties, and help act as magnets for bringing growth back into the cities and away from the exurban sprawl that characterized California's last period of economic growth (Jackson, K., 1985). By coupling compact, mixed-use, walk-able communities around the high-speed rail stations, we can help alter our pattern of unsustainable suburban development that currently threatens critical agricultural lands and precious open space. There is an incredible amount that California can learn from other HSR systems around the world and their effects on areas in which they stop. HSR stations all over the world can and do act as anchors for re-inventing entire neighborhoods and city centers to shift the focus back from cars to pedestrians.

## ***Study Purpose***

The purpose of this study is to review successful cases of High Speed Rail applications around the world, examine their approaches to success or encounters with challenges, and analyze how their lessons can be applied to the California HSR project.

## ***Study Methodology***

This study involved a desk review of multiple international experiences with development around high-speed rail stations. Specifically, it examined literature on Japan and France's high-speed rail stations as magnets for economic growth back into cities. From these, the study extracts key lessons that can be applied to cities on the California HSR line.

## **2.0 Background**

### ***Population, Travel and Climate Change***

Today with ever increasing population and traffic congestion, humans are contributing more to climate change than ever. Levels of Green house gases continue to rise at unprecedented levels with the largest source of carbon emissions coming from transportation. Traffic congestion, along with the population, is on a steady rise and will soon become less and less confined to “rush-hours” unless the people of California consider other alternatives to the automobile. In order to accommodate growth while at the same time combating climate change, society needs to make a big investment in cleaner, more efficient modes of transportation. One of the elements that will fill in the missing gap in our transportation network and push California toward the fast track to sustainability could be high-speed rail.

Like any healthy body, a comprehensive public transportation network has several components that must work together to ensure seamless connectivity. The first element is the spine, which spans the entire network and connects major cities. The second element is intercity rail, which connects major metropolitan areas to smaller cities along the spine together like the Capitol Corridor, Pacific Surfliner, and San Joaquin intercity rail lines. The third element is regional transit systems which provide connections to the surrounding areas, similar to SLO RTA, BART, and Caltrain. The fourth element is the local transit, bike, and pedestrian systems which provide connectivity within a city or community. While California is starting to form a body for a good transportation network, the spine that connects everything together is still in the brewing stages. However with the passage of prop 1A, the spine will eventually come to fruition in the



form of high-speed rail. This technology may be by far, the best option to fill in California's sorely needed transportation niche between auto and air travel. It could help rejuvenate the economy, reduce our impact on the environment, and improve our mobility.

### ***The Need***

In 2009, there were roughly 38 million people living in California. By the year 2020, that number is forecast to reach more than 50 million (CAHSR Business Plan, 2009). Many of the State's freeways are overflowing, many airports are already at capacity, and pollution is only getting worse. The notion that California can expand its airports and freeways to accommodate the growing traffic demand is pure fantasy. In addition, auto transportation accounts for over 38% of all green house emissions in California, (Greve, 2008). Considering that the State's transportation infrastructure is the biggest source of green house gas emissions, widening and expanding only roadway and air networks may not be the optimal course of action. While, most Californians may never give up their cars altogether, with the right improvements, more commuters will want to choose public transportation over gridlock. As just one example, California's Capitol Corridor Intercity Rail ridership jumped 32 percent from 2007 to 2008 (CCJPA, 2008). This study asserts that the State needs the political will and adequate funding to invest in a world-class public transportation system.

First, let us review some history of how rail travel in America went from innovator to third-world status. The railroad symbolizes a long lost dream that got overshadowed by the automobile craze. It promotes advancement in transportation while at the same time reminding us of our historic roots. Railroads are one of the key forces that

determined the location, shape, and size of early 20<sup>th</sup> century cities and suburbs in America (Muller, 1995). It was a place where the old met the new, a hub of bustling activity and flowing energy, a gateway to and from the city for hundreds of people a day, a check point for countless goods and supplies which rumbled through the country, and an outlet to a network that originally bound the nation together. While other countries have long prospered from expanded rail, America abandoned that rail dream in the 1950s and “left Amtrak with the federal funding equivalent of a shoe string” (“Keystone” Patriot News). America instead opted to build more roads and the interstate highway network. Many urban rail systems were torn out in major cities. With the explosion of the automobile, the railroads were left behind as not much more than an after-thought.

### ***Mentality toward Rail***

As the state’s largest rail infrastructure project in nearly a century, high-speed rail faces some real challenges. Despite the traces of skepticism hovering around the project, high-speed rail may have the potential to improve our every day quality of life. One of the common misconceptions in the US about train travel today is that it is always slow, inefficient, and limited. However, around the world, rail networks have proven to be just the opposite if planned in the right fashion.

When most other developed countries have long reaped the benefits from extensive rail systems connected by high-speed rail, Americans still seem reluctant to give the railroads a chance while they complain about how much traffic there is on the freeways. Sadly, in many parts of California, rail travel is still often viewed as the lower alternative to driving, and it’s not hard to see why. Since the 1950s, California has had a love affair with the automobile. The interstate highway network, along with the post-war

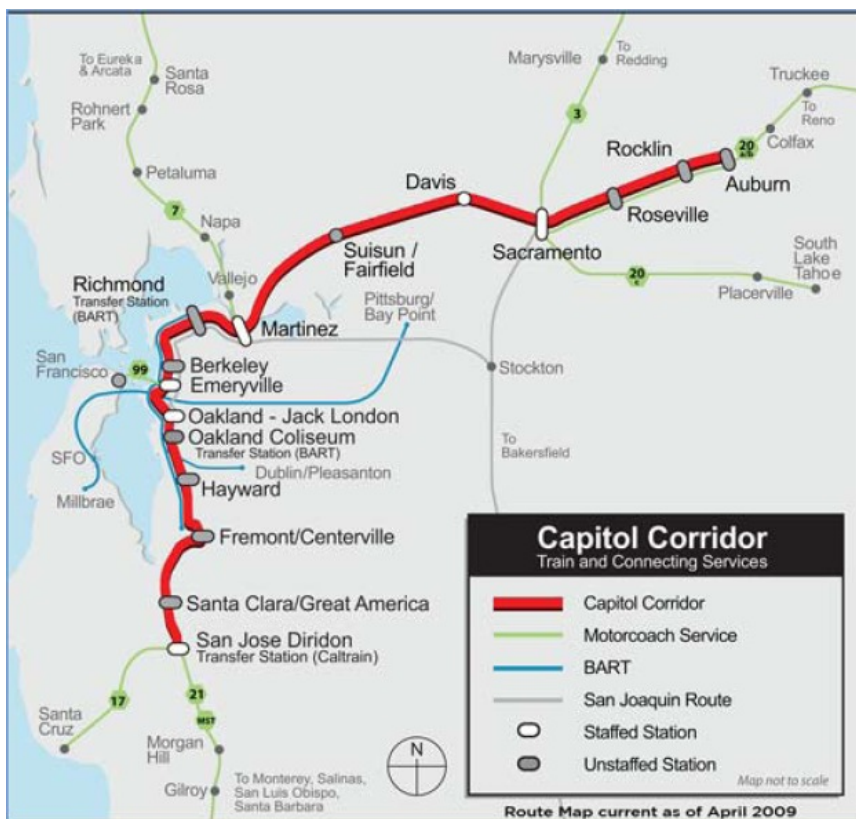
housing boom, created sprawling suburbs, which were built to rely exclusively on the automobile (Jackson, K., 1985). Consequently the average car-loving Californian does not know much about trains. Their idea of getting around is centered on the two things they know best: automobiles and airplanes. While trains are seen as a quaint part of history, some Californians view their cars as status symbols, an extension of ego and class distinction. In addition, powerful developers and contractors that profit from road and highway construction and maintenance have had a long history of advocating for transportation funds to go to roads and highways, and not to public transit. California currently spends less than one-fifth of statewide transportation funds on public transit, but transit funding is still vulnerable to frequent budget cuts (Calpirg, 2008). Consequently, the classic Californian mentality is “why take the train when I could drive?” Most Californians have just not experienced what a good integrated rail network is like. When most people think of train travel, they think of Amtrak. When comparing America to other developed countries, the name “Amtrak” puts rail travel to shame. Amtrak’s poor ridership, straggling revenue, and lack of federal support have contributed to its poor service. Through this ongoing cycle, Amtrak has created a bad image for rail travel in America, with the exception of the North East Corridor and California state-federal partnership routes.

### ***Existing California Intercity Rail***

This issue brings one of the most common questions asked by critics about high-speed rail, and that is whether Californians would ride it if it is built. With high gas prices and frustrating traffic congestion, rail travel is starting to pick up steam in California, especially with commuters. Take for example the success story of the Capitol Corridor

Intercity Rail Service in California (Fig. 2-1). This service is one of three California rail lines that are managed and owned by the state and contracted with Amtrak for operations and maintenance. According to the Capitol Corridor Performance report, The Capitol Corridor was first initiated by Amtrak and Caltrans in 1991 with three daily round-trips—then “The Capitol Corridor Joint Powers Authority [CCJPA] assumed management responsibility for the service in 1998; since then, it has become one of the fastest growing intercity passenger rail services in the nation with thirty-two trains daily from Sacramento to the Bay Area” (CCJPA, 2008).

Figure 2-1: Map of Capitol Corridor Intercity Rail Service



Source: CCJPA [www.capitolcorridor.org](http://www.capitolcorridor.org), 2009.

Despite a flat state funding and equipment restraints, Managing Director, Gene Skoropowski exclaims that “Today, the Capitol Corridor is the third busiest Amtrak-

operated route in the nation, with nearly 1.8 million annual riders.” If anything, the Capitol Joint Powers Authority’s success has simply proved that if a fast, frequent, reliable, and affordable train service is built, even Californians will ride trains. Amtrak’s annual performance report states that California has the highest Amtrak usage of any state in the country (Amtrak State Facts, 2007, 4)! More and more people are discovering how nice this service is compared to their long, wasteful commute on the freeways. It seems somewhat ironic that the very inventions that brought on the demise of urban and intercity railroads are now prompting their revival. While California is slowly starting to make a comeback in rail travel, the State still has a long way to go before we can even begin to compare our services with the rail systems of Europe or Asia.

### ***Benefits for a Growing Travel Demand***

One downside to California’s booming intercity rail ridership is that the trains and their host railroads are currently running beyond full seating capacity. Many trains routinely have standing room only. Standing on the metro for a short trip is one thing, but to stand on a train for 80 miles is another. Without a significant expansion in the near future, these conditions could result in a loss in rail ridership and a gain in auto congestion. The State’s existing rail and highway networks are not adequate to meet the growing traffic demand. High-speed rail will help meet the future intercity travel demand that will be unmet by the present transportation modes (auto, air, and Amtrak). By the year 2020, Californians are expected to make another 98 million intercity trips annually and high speed rail is predicted to carry 68 million of those with the capacity for twice that amount (“Bullet” SF Cityscape). So without the construction of high-speed rail, where would

some 68 million riders go? Those riders would spill onto the freeways and airports of course, which in the year 2020 would translate to a drive from San Francisco to LA taking another hour, and door to door travel time by air taking another ½ hour (“Ridership Study” CAHSR).

### **Air Traffic**

Although freeways tend to be at the center of attention on the topic of traffic congestion, air traffic is also bending under similar pressure. According to the National Bureau of Transportation Statistics, only 71% of all flights coming into SFO were within 15 minutes of their schedule. This is a direct result of what happens when an airport operates at capacity. High speed rail can free up valuable time slots for longer flights by eliminating the need for short-hop flights. A New York Times article noted that for journeys up to 3 hours (or 500 miles), airlines find it difficult to compete with high-speed rail. For example, "when Germany introduced its high-speed ICE trains in 1991, Lufthansa shut down its Hanover-to-Frankfurt route (216 miles). In 2001, Air France discontinued flights from Paris to Brussels (188 miles), crushed by competition from the new Thalys train" (Tagliabue, 2001). All over the world, many airlines cut back or cancelled their services altogether along short-hop corridors where high-speed rail has been constructed. This is not to say, however that the implementation of high-speed rail would be detrimental or competitive towards the airlines. High-speed rail could, in fact, reduce air traffic congestion in California and enable the airlines to concentrate on more profitable longer-haul and international flights, rather than cheaper short-haul flights. Even if a trip from Los Angeles to San Francisco may take a little longer on the train than flying, high-speed rail still retains an ability to divert air travel demand due to its inherent

comfort, lower price, and reduced stress. On the train, there are no seat belt signs, no turbulence, and no delays. Also unlike airlines, HSR commonly takes you directly to the city center. In general, people in Europe and Asia tend to favor high-speed rail over air travel for intercity trips of 3 hours or less.

### High-speed Rail around the World

In terms of rail travel, the U.S. lags far behind most other developed countries. Around the world there are now at least a dozen other countries with high-speed trains, including Japan, France, England, Germany, Spain, Italy, China, Taiwan and South Korea. Other countries are in the planning or construction stages (including Brazil, Morocco, Indonesia, Saudi Arabia, Iran, Singapore, Argentina...). Japan, the pioneer of high-speed rail, is no bigger than the state of California. However despite a sizable chunk of its land being uninhabitable due to mountainous terrain, Japan's population is roughly close to half that of the United States! The country was practically destroyed in World War II, and "by 1964 they had a bullet train" (Dukakis, 2009).

When I went on a 10-day trip to Japan in 2004, I found that for the people of Japan, trains are a way of life. Cars are merely an old tool to be used only when necessary. For some, trains provide space to relax, relieve stress, get work done, sleep (hopefully not through their station stop), or even meditate before a full day of hard work. Many people rely on the railroad on a daily basis as an alternative to traffic congestion or high gas prices. I once asked my foreign host why he didn't drive to school everyday. He replied with a very heavy accent, "Why drive, when I can take the train?" After my exhilarating experience on the legendary "Shinkansen" (or bullet train), I could not have agreed more.

While operating hundreds of high-speed trains each day, the Japanese have a perfect safety record and near perfect on-time performance with an average deviation from schedule of only 24 seconds (“CAHSR Business Plan”, 2008). If trains in California had that kind of punctuality, many more people would ride them. According to the Online Journal of Bay Area Urban Design, in the year 2005, high-speed rail accounted for almost 81% of all intercity trips made between the cities of Tokyo and Osaka [the equivalent distance of LA to San Francisco] (JR Central, 2009). So only 19% of all trips between those cities were made by auto, air, or marine travel! In comparing Japan’s standards of rail service to the United States, Amtrak is pitiful. Where in Japan, train drivers can be harshly punished or suspended for arriving even 1 minute late into a station, here in America, a train has to arrive 5 minutes or more behind schedule to be considered late (“CCJPA”, Appendix). In the few weeks I spent in Japan, I found the trains there to be extremely punctual, fast, quiet, and easy to use, even for a tourist like I was.

If so many other developed countries have been running high-speed rail systems successfully for decades, what is the U.S. waiting for? With the recent slump in the nation’s economy, many critics and politicians question whether we can afford to construct one of the largest transportation infrastructure projects in the country. Some opponents of the high-speed rail say that the project costs too much. They say that the money could be better spent improving the existing transportation infrastructure. Besides comparing costs, it is asserted that widening freeways would do very little, if anything, to solve today's challenges regarding the environment or the economy. Programs for alternative fuel and electric vehicles are great for reducing carbon



emissions, but they do nothing to reduce the amount of vehicles on the roads. There is a well-known phrase among planners that definitely applies here: “if you build it, they will come”. Spending more on roadways and programs designed to improve fuel efficiency will only invite more cars, more congestion, and more pollution. It reinforces our dependence on the automobile by encouraging people to drive. One glaring example of this took place several years ago in Sacramento when city officials decided to widen a bridge. Even with the interchange improvements, the increase in traffic was incredible. The Watt Avenue Bridge is now busier than it ever was, creating backup for miles into the city.

### **Environment**

Looking at the impacts of high-speed rail on California, some opponents say that high speed rail would be damaging to the environment. The truth is that high-speed rail would help reduce humans’ impact on the environment. The electrically-powered trains would reduce pollutant and greenhouse emissions and reliance on fossil fuels. Here are several statistics from the CA High-speed Rail Authority (CAHSRA). The total predicted emissions savings of the CAHSR system is “up to 17.6 billion pounds of CO<sub>2</sub> per year by 2030” and would grow with higher ridership. The system is also “projected to save 22 million barrels of oil per year by 2030”, even with future improvements in auto fuel efficiency. Comparing the energy required to carry a passenger one kilometer, “the HSR needs only one-third that of an airplane and one-fifth that of an automobile trip” (CAHSRA EIR, 70-78). Not only would high-speed rail help in reducing congestion, it would also help in reducing pollution. According to the International Railway Journal, “HSR emissions of carbon dioxide, the main cause of the greenhouse

effect, are 7.5 times lower than those of an airplane and 4.5 times lower than those of a car" (March 2001). The emissions do not come from the trains themselves, but from the power plant providing the electricity to run them. Therefore the emissions are only marginally affected by increase in riders, unlike auto and air traffic. Furthermore, the authority has indicated its intention to get power from a zero-carbon, renewable energy source.

### **Safety**

Another concern regarding high-speed rail is one of safety and noise, especially in residential and urban areas. One misconception that is often heard from residents living along the planned high-speed rail alignment is that the increased number of trains barreling through the town will present an enormous increase in noise compared to that of existing trains through the area. The peninsula cities along the line have a right to be concerned given that their assumptions are based solely upon the only rail line they've ever lived next to – the roaring diesel locomotives and blaring horns of Caltrain. Caltrain operates 96 daily commuter trains that serve a 77 mile line from San Jose up the peninsula to San Francisco with peak service to Gilroy (Caltrain Ridership, 2009). The truth is that HSR, even at its top speed, will create significantly less noise and vibration than the existing trains such as Caltrain or BART. According to the California HSR Authority, the electric trains would be lighter and cause less noise and vibration from wheel-track interaction despite their higher speeds (CAHSRA EIR, 2009). According to the San Francisco Chronicle, Japan has a national noise standard for the Shinkansen, limiting the noise it generates to 70 decibels in residential areas and 75 decibels in dense urban areas (Cabanatuan, M., 2010). For comparison, a vacuum cleaner at 10 feet

produces 70 dB, and a car passing 10 feet away measures 80 dB. Furthermore, because HSR is entirely grade-separated, trains will not sound their horns. This aspect of HSR will also address serious safety concerns along the current alignment. Over the years, Caltrain has been plagued by an ongoing slew of tragedies along the rail line due to trespassers. Mercury News reports that in 2009 alone, there were 19 fatal collisions involving Caltrain (Fernandez, L., 2009). Because high-speed trains operate on an exclusive grade-separated right-of-way, there are no crossings with any other mode of transportation. Another concern is seismic activity caused by the San Andreas Fault. According to the Authority, the entire high-speed rail line will be armed 24 hours a day with surveillance and earthquake detection equipment, which will stop trains in the event of an emergency (CAHSRA, 2008). These system-wide benefits go far beyond the San Francisco Peninsula. In fact, by shifting people off the freeways and onto high-speed trains, the system can help prevent thousands of automobile fatalities up and down the state from among the many traffic accidents that occur daily on highways. The Bureau of Transportation Statistics reports that in 2007 there were an estimated 3,974 highway fatalities in California (BTS, 2007). Due to its incredible safety record, HSR rail could help prevent an estimated 10,000 yearly auto accidents and their associated deaths, injuries, and property damage compared to expanding only highways (Kopp, Q., 2008). HSR systems operating all over the world have had an impeccable safety record. In 44 years of high-speed train operation in Japan, it is a well-known fact that there has not been a single passenger fatality in the entire network. This is largely due to the separation of the rail line from roads, and the myriad of safety features and operating procedures incorporated into the service. California's high-speed trains are fully capable

of mirroring the outstanding safety record of overseas systems, because these same companies including Japan Central Railways are among a group of 32 companies bidding to build the trains and track infrastructure for California's HSR network. So the question now is, can we afford not to build a high-speed rail network?

### **Jobs and Finance**

Given the current economic downturn, the estimated \$45 billion dollar price tag for the California high-speed rail may seem like a large sum to pay at first, but the truth is that high-speed rail can accommodate the most people for the least amount of money. In a video produced by the California High-Speed Rail Authority, Chairman Quentin L. Kopp says, "Of course freeways and airports will no doubt have to be expanded some either way in the future. However, to add the capacity that high-speed rail promises to deliver would require three-thousand new lane-miles of freeways, another ninety-two gates at airports, five more major runways, and over eighty-five billion dollars to pay it off", he scoffs, "High-speed rail can provide that same capacity and improve our air quality for less than half that price" (CAHSRA, 2008). In addition, high-speed rail would include funds to make the existing intercity rail systems that connect with HSR more efficient by improving their infrastructure and efficiency. Furthermore, the statewide high-speed train project will require the state to draw upon and expand California's skilled workforce. High-speed rail is predicted to help the economy by creating hundreds of thousands of new permanent jobs. According to the HSR Business Plan, the project will create nearly 160,000 construction-related jobs to plan, design and build the system (2008). An additional 450,000 permanent jobs are expected to be created by 2035 as a result of the economic growth the train system will bring to California (2008). It is for

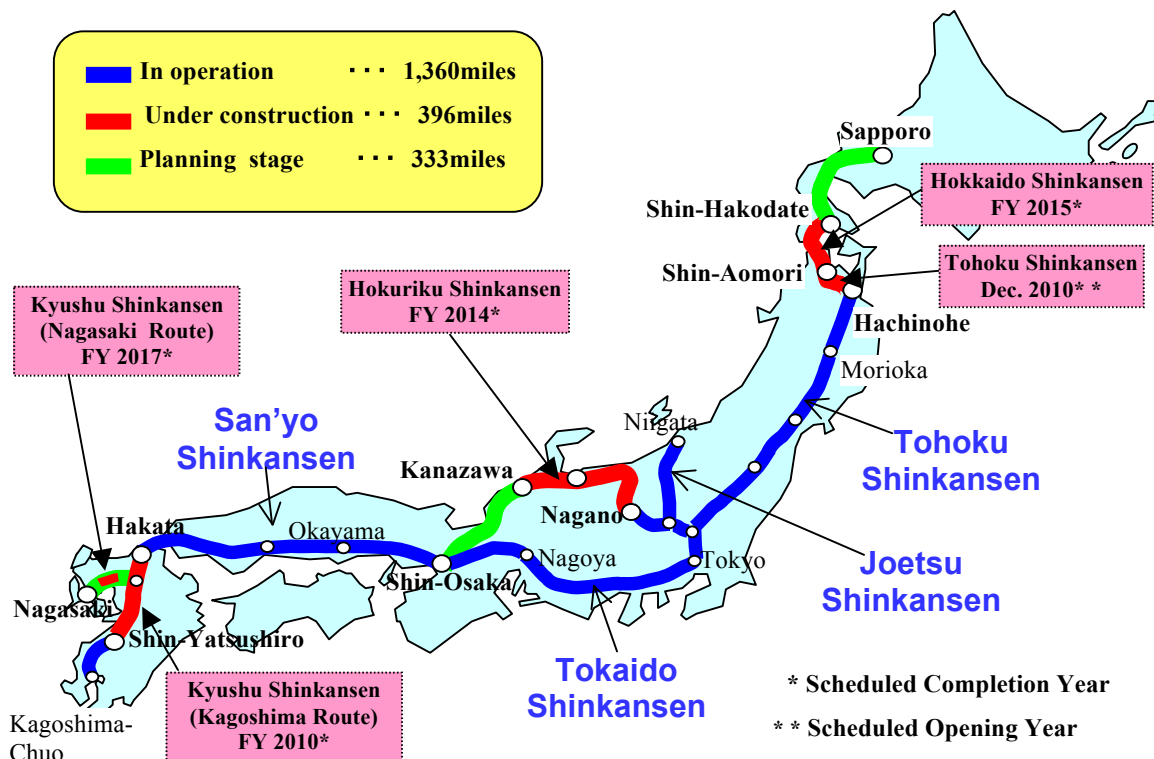
this reason that high-speed rail for the United States is one of President Obama's top transportation priorities for the economy; however, this is not the only reason. High-speed rail can also result in desirable economic effects for towns and cities along the route. One of the most influential powers that HSR brings with it is its ability to generate thriving economic development in cities where it stops. In this way, HSR will soon become a major opportunity for city planners to rejuvenate their city centers, especially those in the sprawling central valley.

### **3.0 Case Studies**

#### ***Case Study of Japan's Shinkansen***

As the original pioneer of high-speed rail, Japan continues to operate the busiest rail network in the world. In 2009, Japan Railways (JR) carried 8.64 billion riders (JR, 2010). Today, the Shinkansen, which means "new trunk line" in Japanese, covers about 1,400 miles on five lines (Fig. 3-1). Another 400 miles of extensions are under construction and 300 miles are planned (JR, 2010).

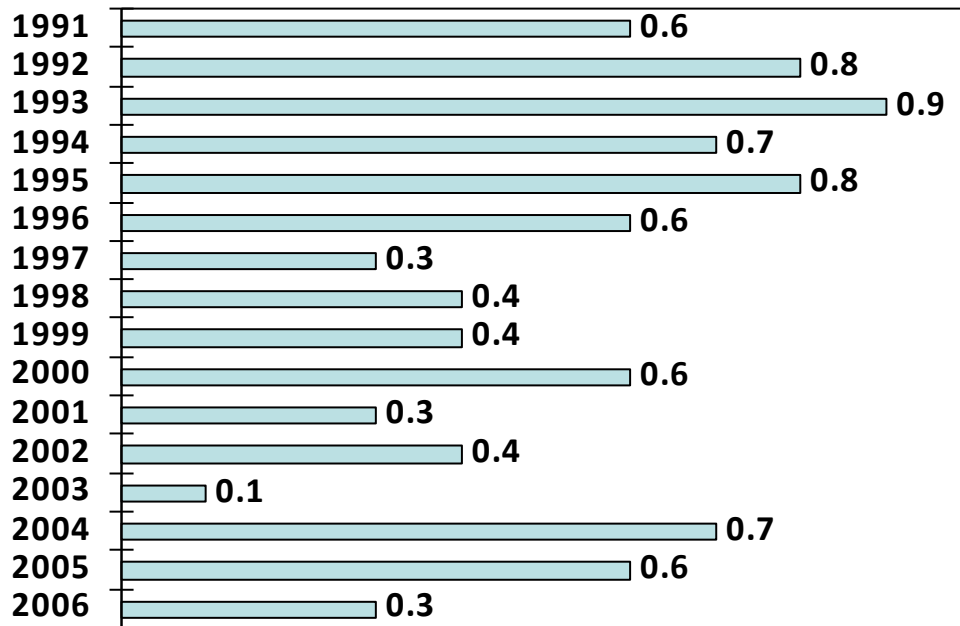
Figure 3-1: Shinkansen Network 2010



Source: JR Central, 2009

Three private rail companies run the trains at speeds up to 186 mph on tracks built and maintained by the national government. As noted in the background information section, Japan's high-speed trains run with an efficiency, frequency and reliability unimaginable to those familiar with Amtrak or U.S. commuter railroads. The sleek trains with the distinctive long noses depart as often as 14 times an hour - and they're almost always on time (JR, 2010). Over the past 45 years, the average delay is less than one minute - and that includes stoppages because of floods, earthquakes, accidents and natural disasters (Fig. 3-2).

Figure 3-2: Shinkansen Reliability



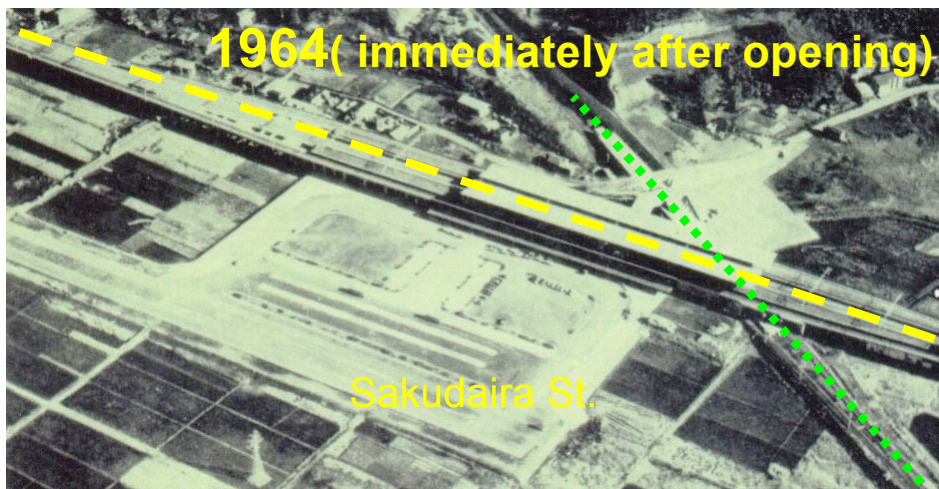
Source: JR Central, 2009

Their Shinkansen network has served as a model for many other systems around the globe. Japan and California share a surprising number of geographic and demographic factors which make Japan an ideal role model. One of these factors is population. California's population distribution is similar to that of Japan, making it a logical choice for a case study. Furthermore, Japan's 46 years of operation will allow us to examine the long-term effects of HSR on their cities. The following case studies will examine two very different cities in Japan. The first study is of a Shinkansen station located on the fringe of a dense city like San Francisco. The second is located in a more rural area akin to the planned California HSR stops in the Central Valley. From this, it may be reasonable for us to expect our HSR to be capable of attracting similar proportions of economic development around our stations as experienced by those in Japan. The following contains statistics provided by JR Central, 2009, except where noted.

**Shin-Yokohama Station (Yokohama City)**

Yokohama City, also known as the sister city of San Diego, has a population of 3,574,443 (City of Yokohama, 2009). The Shinkansen station, Shin-Yokohama, is located 3.1 miles from the center of the city and about 19 miles from Tokyo Station. The station opened in 1964, as part of the original Tokaido Shinkansen line from Tokyo to Osaka. At that time, the surrounding area was completely rural, but the site was selected because it was the intersection of the Tokaido Shinkansen tracks with the existing JR Yokohama Line (Fig. 3-3).

Figure 3-3: Shin-Yokohama Station in 1964 before development



Source: JR, 2009

In 1965, one year after the grand opening of the Shinkansen, a land adjustment of 200 acres commenced around the station and was completed in 1980. The station was connected to Yokohama City by means of the Yokohama Municipal Subway system on March 14, 1985. In conjunction with the opening of the subway, the area around the Shinkansen station experienced a massive influx of economic development. The improved connectivity made possible by shorter travel times to Nagoya and Osaka,



prompted mid-sized companies and firms to move their offices here. The arrival of new companies turned this area into a new business district. This development was soon followed by the construction of a new event arena and sports arena (the largest in Japan). This sports arena housed the FIFA World Cup in 2002. The Shin Yokohama Station soon turned into a vibrant and thriving front entrance of Yokohama City. Over a period of 40 years, the area around Shin-Yokohama station became a newly developed city center of Yokohama City thanks to the Shinkansen station and its connection to the city (Fig. 3-4).

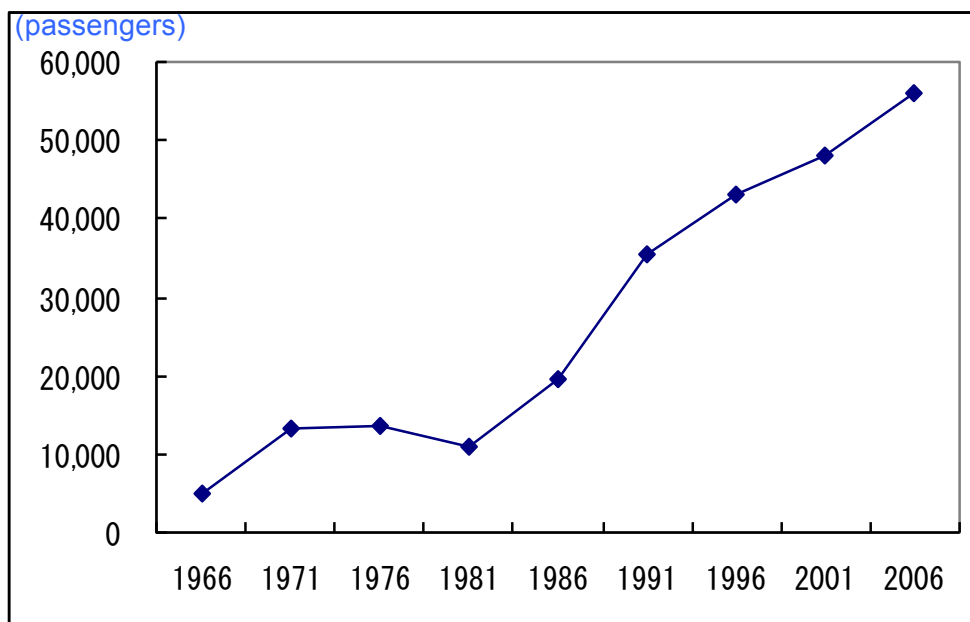
Figure 3-4: New Development Area around Shin-Yokohama Station.



Source: JR, 2009

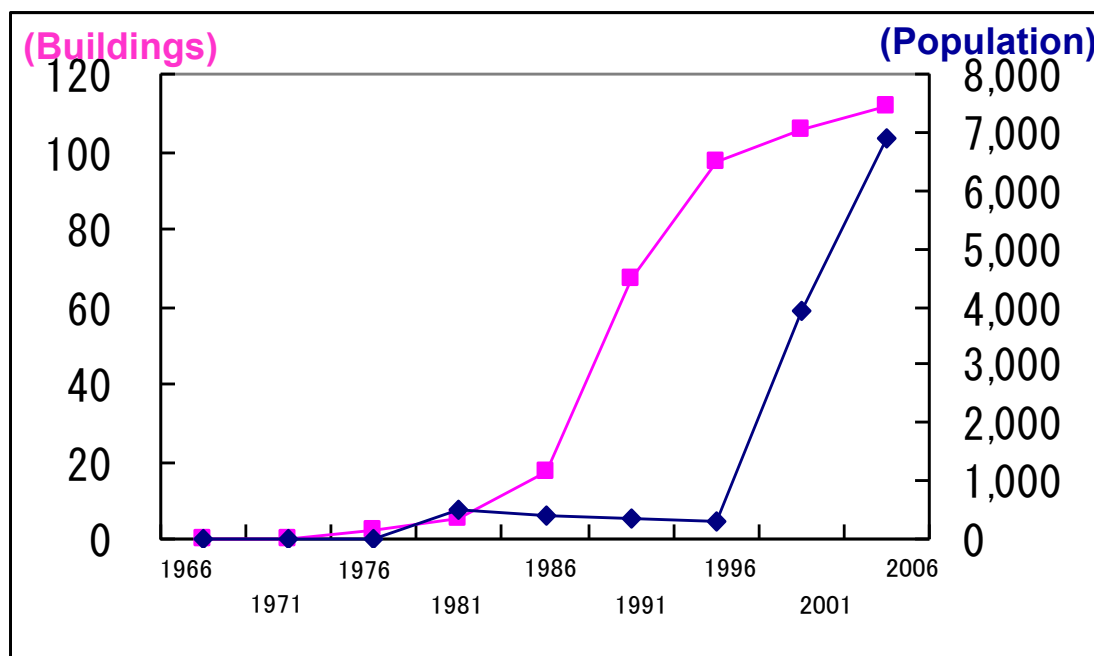
The following figures 3-5 to 3-6 illustrate the commercial development and population growth over the 40 year period.

Figure 3-5: The number of passengers using Shin-Yokohama Station.



Source: JR Central, 2009

Figure 3-6: Number of commercial buildings and population around Shin-Yokohama Station



Source: JR Central, 2009

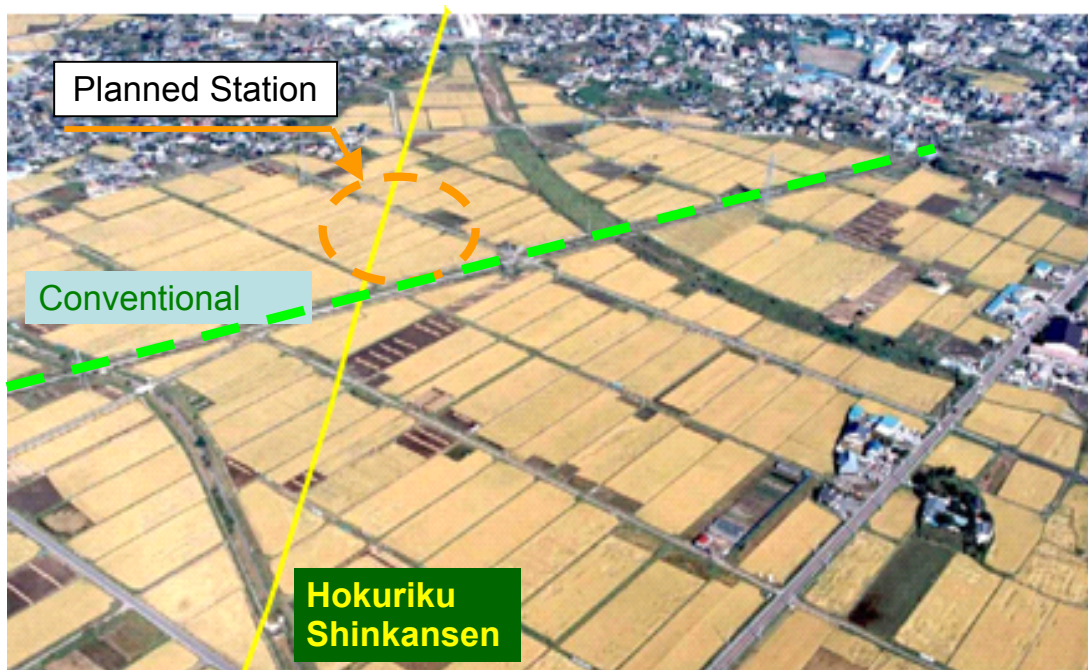
From the charts, it appears that the physical development and ridership took a while to start building after the opening of the Shinkansen station. After a peak in ridership of about 15,000 in 1974, ridership only averaged about 10,000 per day for the next decade. Ridership jumped to 27,000 in 1989, however, giving the station the highest ridership increase of any Shinkansen station since the system's introduction in 1964 (Sands, B., 1993). The data suggests the main reason for this rather stagnant ridership and population growth was the lack of connectivity to the Shinkansen Station. As soon as the subway connector was completed between the Shinkansen station and the main city, ridership and economic development around the station really began to sky-rocket. Soon after development picked up, population began to rise rapidly as more people saw the incredible value in living in an area with easy access to a high-speed rail station. Another reason for the boost in the city's economy was the added tourism that was enabled by Shinkansen. Because so many people use the Shinkansen system daily, the station areas are extremely attractive spots for commercial, retail and tourist oriented businesses to be located. According to a study by Brian Sandes (1993), the cities of Hakata and Hiroshima (at the end of the Sanyo Shinkansen line) experienced massive increases of visitors from other prefectures – 93.5% and 52.3% respectively. Similarly, Shin-Yokohama over recent years has become famous among Japanese and foreign tourists alike for its unique Ramen Musuem and Amusement Park located within walking distance of the Shinkansen station (City of Yokohama, 2009).

### **Saku-daira Station (Saku City)**

The Saku-daira Station is located 103 miles from Tokyo and 0.93 miles from the center of Saku City. The station is located on the Hokuriku line, one of the more recent

additions to the Shinkansen network. The Hokuriku line from Tokyo to Nagano was completed in 1997 in time for the 1998 Winter Olympics in Nagano. Like the Shin-Yokohama Station, the 148 acre area surrounding the Sakudaira station was originally rural, but the site was selected once again based on the cross connection to the conventional rail line operated by JR (Fig. 3-7).

Figure 3-7: The 148 acre station site pre-1997



Saku City can be seen just north of the station location.  
Source: JR, 2009

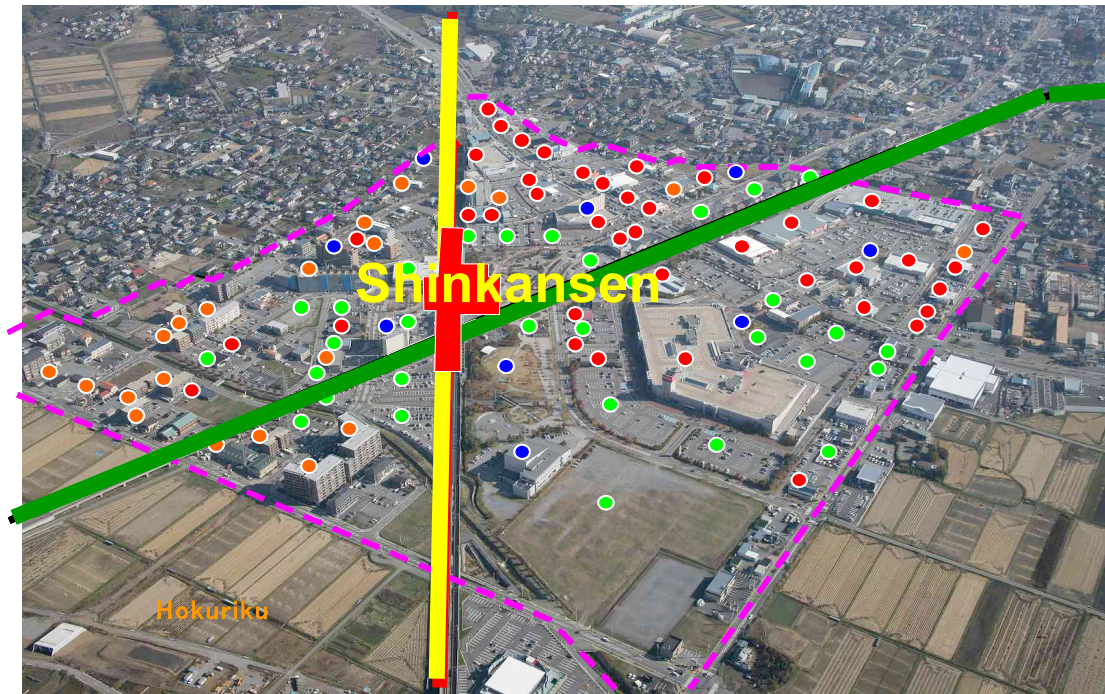
The Saku City local Government implemented a massive urban development program around the station area. Within five years after the opening of Saku-daira Shinkansen station, the city government had completed the development of roads, parks, open space, toll parking, and other crucial framework necessary for a new urban center. The city's involvement of public and private partnerships in the planning of the station area has been crucial to the great economic success of the area. To this day, the private sector is



developing commercial establishments such as apartments, condos, toll parking, etc...

(Fig. 3-8).

Figure 3-8: The Site location around Saku-daira Station in 2007 (ten years after opening)



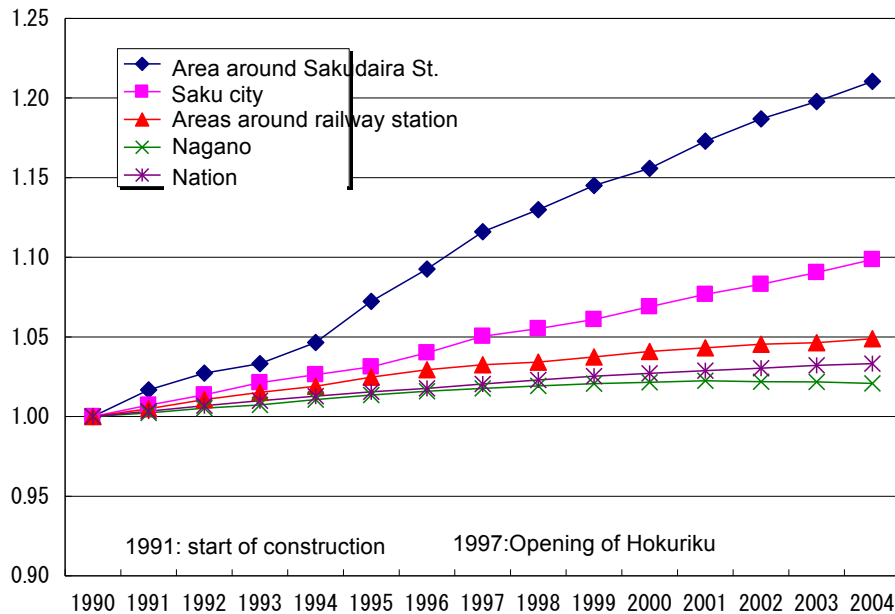
Source: JR Central, 2009

Site location around Sakudaira st.

- Exchange and relaxation
- Commercial and amusement establishments
- Administrative and parking
- Residential and others

Since the construction of the Shinkansen, the growth rate of this area of Saku City has been tremendous. Today, the growth still continues with new development. Figure (Fig. 3-9) from JR illustrates the rapid growth increase since the line was constructed (2009).

Figure 3-9: Increase of the population in the area around Sakudaira Station



Increase in population in area around the Saku-daira Station versus the City, Prefecture, and Japan as a whole.

Source: JR Central, 2009

Despite the near-stagnant population of the Nagano Prefecture, the population around the Saku-daira Station increased at a rapid rate. This is attributed to the concentration of development around the station as opposed to growth into surrounding areas. The increased connectivity that the Shinkansen provided by its shorter travel times was the main reason for this concentration of growth. In essence, the connectivity provided by the Shinkansen rejuvenated the economy of the rural town that would have otherwise been too distant from major cities.

## Case Study of France's Train à Grande Vitesse (TGV)

### Lyon, France:

Lyon is a regional city in southeast France that experienced high ridership growth after HSR brought it within two hours of Paris. Lyon was the first major city to be linked to Paris by the French TGV network. The opening of the TGV Sud-Est put it at 2 hours

from Paris, the key business distance. Before the opening of the TGV line, all main line services operated through the south end of historic Old Lyon, located on the peninsula between the two rivers. The physical constraints of this central area had already led the city authorities to start development of a major area of commercial activity to the east of the centre, named Part-Dieu. As the TGV line was implemented, a major new station was built adjacent to the emerging commercial area. Over time the new Lyon Part-Dieu station became the focus of most trains serving the city. According to a study performed by the Brain Stanke, one initial fear when HSR service started from Paris to Lyon was that regional firms would be drawn away to Paris (Stanke, 2009). In the case of Lyon, it was the reverse; Lyon was a great transportation and economic development success. Regional firms used the TGV to penetrate the Paris market and grow while many international firms located national branches in Lyon. Land values in the neighborhood increased as office demand rose 5.2% per year between 1983 and 1990 for a total growth of 43% (Stanke, 2009). As a result, the area around the TGV station is now the most sought-after location for office space in Lyon: it has almost 40 per cent of the city's total office space, and in 1990 it had 60 per cent of the city's planned office projects (Sands, B., 1993).

### **Lille, France:**

Lille, France on the Paris-to-London branch of the TGV Nord line is another example of successful city regeneration created in part by the introduction of HSR service. A former military base underwent a major redevelopment project to include the new TGV station Lille-Europe, an adjacent business park, retail center, hotels, public housing, and conference center (Harman, 2006). The remaining part was built into a park. This infill

development project helped extend the city center and was just one part of a strategic program for continued development. The regeneration of the region has also extended to the nearby towns. According to a report by Cornelius Nuworsoo, a program of metropolitan area-wide adaptive reuse of facilities resulted in major reorganization of land uses and activity locations (Nuworsoo, 2009). This program was so successful that in 2004, Lille gained the recognition as the European City of Culture. The very active programs run throughout the year highlighted what had been achieved and gave impetus for further initiatives (Harman, 2006).

Figure 3-10: TVG Map showing the locations of the Lyon and Lille Stations





Source: Project Mapping <<http://www.projectmapping.co.uk/index.html>>

## **4.0 Conclusions and Recommendations:**

These case studies demonstrate quite well that HSR enhances land-value and brings economic development with growth in population and employment. It is also notable that the station locations were deliberately selected to be inter-modal connecting points.

This enabled the feeding of passengers between modal systems thereby enhancing accessibility to multiple destinations. In the two Japanese case studies, the inter-modal connection appears to trump proximity to an existing city center or downtown.

Conclusions that may be drawn from the case studies include the following (also see the comparison table (Fig. 4-1):

- Land value increases significantly in cities with HSR access
- Commercial and industrial estate developments around HSR stations result in jobs and fiscal revenues
- HSR gives impulses for touristic development and provides high-capacity transport for events
- Inter-modal connections are just as important as proximity to existing activity centres.

The effect of high speed rail services in the selected case studies has resulted in changes to the location and form of the urban centers by redirecting growth from the outer edges of the city and other parts of the region towards the area around the station. As seen in the Japanese case studies, the arrival of HSR service led to centralization of economic activity (information exchange, retail, hotel, etc...) around the city center and station area of the host city at the expense of outlying areas within the same prefecture (Sands, 1993;

JR 2009). Similarly the introduction of HSR service to the California Central Valley could lead to the slowing of population dispersal and the potential re-concentration of population within the urban areas of Central Valley cities that have HSR stations.

**Figure 4-1: A Comparison of Case Study Characteristics**

A Comparison of Case Studies						
Station	Characteristics					
	Year Built	Location Type	Distance from city center	Connectivity	Distance from major city	Level of Economic Development
<b>Shin-Yokohama</b>	1965	Peripheral Greenfield (on the fringe of the City).	3.1 miles	JR Conventional Rail Line (in place before HSR) Municipal Subway to city center (1985)	19 miles to Tokyo (18 min.)	Low, then high: Minimal until connection to city center was made via subway. The area developed into a new city soon thereafter.
<b>Saku-daira</b>	1997	Within an undeveloped portion of the City.	0.93 miles	JR Conventional Rail Line (in place before HSR)	103 miles to Tokyo (1 hr., 18 min.) 36 miles to Nagano (23 min.)	High: Massive urban development program implemented by the city.
<b>Lyon Part-Dieu</b>	1981	City -near developing Area	N/A	Metro; Tram; TER Regional Trains	292 miles to Paris (2 hrs.)	High - Attracted regional firms and businesses. In 1993 Lille-Europe held 60% of all planned office uses in the city
<b>Lille-Europe</b>	1994	City Center adjacent to redevelopment project.	N/A	Metro; Tram	143 miles to Paris (1 hr.)	High- major urban infill development implemented by the city.

### ***Lessons/Implications for California***

The case studies revealed that the high-speed rail stations enabled vacant areas in the station vicinity to become new thriving urban centers. In the Yokohama City case, the Shinkansen station was located on the undeveloped outskirts of one of the largest cities in Japan. This case would be an appropriate example of the amount of potential development that could occur in San Diego or San Francisco. In Saku City, the Shinkansen station was located in an undeveloped area within a smaller city. The Saku City case study would be a more appropriate example of the potential development that could be seen by a secondary Central Valley City such as Stockton, Merced, Fresno, or Bakersfield as a result of having a high-speed rail station. Like the Central Valley Cities, Saku was located in a more rural area that lacked convenient connections to major cities. The Shinkansen enabled Saku City to become closer to major centers and hubs by decreasing travel times. It is Shinkansen's connectivity that rejuvenated the city's economy. High-speed rail in California's Central Valley can have the same effect if planned correctly. In both cases, ridership, population, and economic growth, were all highly dependent on two factors. One is the provision of good quality transportation links to the new station – especially rail transportation from the existing urban centers if the station is not already located in the city center. In Shin-Yokohama, this critical connection was missing until 1985. For about the first twenty years, the area around the station saw very little development take place due to low ridership levels. The other factor is city policies regarding growth and transit-oriented development. In Lille, the TGV station was built in conjunction with an urban infill project on an old military base, which was one part of a program implemented by the city. A similar project is being

implemented in downtown Sacramento. The city is redeveloping its abandoned rail-yards into an urban, mixed-use district. Like Shin-Yokohama, there are proposals for a new sports arena for the Sacramento Kings. When completed, this project will nearly double the size of downtown. A new multi-modal transit center serving intercity trains, long-distance Amtrak trains, light-rail, street-car, buses, and eventually high-speed rail is proposed to be the cornerstone of the largest urban-infill project in the nation (City of Sacramento, 2009). Urban transportation goes hand in hand with one of the most important factors—land-use and zoning policies that encourage and implement transit-oriented development (TOD) in the areas around the station. From the examples described earlier, it is clear that TOD cannot happen without the support and vision of the cities. Without these policies in place, high-speed rail stations could easily perpetuate the Central Valley Cities' current trend of highway –oriented development that destroys precious wildlife habitat and agricultural lands. Harman remarks on the importance of municipal and regional planning in these outcomes:

The selection of the location for the high-speed rail station is critical. It must be developed in line with a master plan, one that fits high-speed rail into the strategy for the city as a whole. The station location has to fit with the city strategy. The opportunity for regenerating rundown and disused areas may include railway land and redundant industrial areas. (Harman 2006)

If not planned in the correct way, Stockton, Modesto, Merced, Fresno, and Bakersfield could turn into the ultimate sprawling bedroom communities for bay area commuters. In conclusion, these lessons gained from Japan and France can be summed up into three main criteria for potential economic development. Three criteria have been found to

determine HSR service's potential impact on secondary cities. All three of these criteria interact to determine the development potential of a city.

1. Station Location

- a. City Center Preferable
- b. Fringe location acceptable if high-quality transit connection is provided to the city center.

2. Station Connectivity

- a. Stations should act as multimodal hubs for many types of transportation. High-quality transit connections should be provided to get HSR passengers to their final destinations so they don't have to drive.
- b. Intermodal connections are just as important as proximity to existing city centers or downtown.

3. Cities must take an active role in planning for development around the stations.

- a. Adopt policies that restrict outward growth while encouraging more growth back into city centers.
- b. Land-uses must work hand-in-hand with transportation. Development around the stations should be attractive urban activity centers that foster walk-ability and reduce reliance on the automobile.
- c. Like Saku city, Central Valley cities must also have or attract economic sectors that take advantage of high-speed rail.

***Looking to the Future***

While Japan and the Shinkansen show the promise of high-speed rail to California, they also reveal the challenges involved. As mentioned in the background section, Japan and California have two very different cultures and mentalities when it comes to transportation and development. Even before the Shinkansen's debut, Japan was a rail-oriented society. Michael Cabanatuan, staff writer for the San Francisco Chronicle notes that the Shinkansen, now with five lines operating, remains just a small part of the nation's extensive rail infrastructure. On his fellowship to Japan, Cabanatuan found that one can get just about anywhere in Tokyo without a car, and around the country as well. "Trains are coming every three to four minutes, the coverage is phenomenal, and the efficiency is amazing" (Cabanatuan, M., 2010). In comparing the two countries, Japan (especially Tokyo) is the epitome of rail culture, and California (especially Los Angeles) is the epitome of car culture. California lacks such an extensive transit network, even in the Bay Area, and the tradition of traveling by train disappeared more than half a century ago, replaced by a culture of driving and flying. The Bay Area and Los Angeles have only recently begun to catch on to the TOD trend. But that trend will hopefully accelerate with high-speed rail, as it has in Japan. Some skeptics of California HSR bond initiative argued that California is not ready for HSR because the local transit networks are not as developed as they are in Western Europe or East Asia; however, according to Sands, the experience of many smaller TGV cities in France was that TGV service preceded, and may have precipitated, local tramway service (Sands, B., 2009). The Central Valley cities of Fresno and Bakersfield had tram/streetcar service in the past and have had official discussions regarding rebuilding a tram/streetcar or light rail network

(Stanke, 2009). It is likely that the construction of downtown HSR stations in both cities would increase local efforts to reintroduce local rail transit. Whether HSR can succeed in California really depends on the ability of cities and the CAHSRA to work with each other to ensure their station areas follow the criteria mentioned above.

### **High-speed Rail on the National Agenda**

If anything, the high-speed rail will magnify the positive effect that systems such as BART and Caltrain have already had in regards to the economic development of the areas in which they stop. In the business and travel sector, high-speed rail will bring destinations that were once far away, closer. It will also end the central valley's isolation from the major coastal airports and financial centers, thus encouraging people to travel more frequently.

What the State needs is strong political willpower and proper amounts of funding to modernize the rail transportation system into a world-class network. It is the state and federal governments which will ultimately decide the fate of the antiquated rail infrastructure in the US; however up till now, the federal administration has been less than keen on funding for rail. Political leaders in Washington shared the typical Californian car-loving mentality that train travel is always slow, inefficient, and limited. Politicians such as Senator John McCain and President George Bush have opposed any form of investment in the old and inadequate passenger rail systems. In fact Joan Lowy of the S.F. Chronicle reported that up till just recently, President Bush has opposed anything more than minimal money for the rail service over the previous eight years (Lowry, 2008). Because of the lack of attention that the railroads have been getting, much of the nation's 21st century rail systems are still operating on early 20th century

track. Senator Dianne Feinstein lamented that it is just sad to think that it took the deaths of 25 people in the recent Metrolink accident in September to finally get little more than a trickle of funding from the government for rail infrastructure (D. Feinstein, Testimony). Following the crash in 2008, Bush finally signed the Rail Safety Bill which would pay for technology designed to prevent such an incident from happening again. But even then, President Bush still expressed opposition to the portions of the bill giving additional funding to Amtrak. Many parts of the nation still share this misconception about railroads with President Bush. Fortunately the new leader of the United States, Barack Obama, along with the Governor, Arnold Schwarzenegger, have seen the light on high-speed rail in regards to the economy and climate change. High-speed rail has emerged as the cornerstone of Obama's ambitious attempt to remake the nation's transportation agenda, which for half a century has focused primarily on building highways and roads. According to the Washington Post:

“Nearly half of the \$48 billion in stimulus money for transportation projects will go toward rail, buses and other non-highway projects, including \$1.3 billion for Amtrak and its successful rapid rail service, Acela. The Transportation Department also would receive \$2 billion more under Obama's proposed 2010 budget, most of it for rail and aviation improvements”. (Eggen, D. 2009)

In addition, Obama was responsible for a last minute addition of an \$8 billion “down payment” to construct high-speed rail corridors across the nation, “the most startling national pledge to rail since the Pacific Railway Act under President Lincoln” (Pierce, 2009). This goes to show that high-speed passenger rail networks are one of President Obama’s most important policy initiatives. In fact, Obama's new transportation budget



for 2010 goes beyond the \$8 billion, asking for another \$5 billion in high-speed-rail commitment over five years (Pierce, 2009). At this rate, Obama may become known in history as the “high-speed rail” president. Currently, the closest thing in the US to high-speed rail is the Acela Express in the Northeast Corridor which hits a top speed of 150 mph briefly, but averages only 86mph due to poor track and signal conditions. Both Amtrak's Northeast Corridor and California’s services continue to set ridership records, and while the Acela is speedy by U.S. standards, it falls far short of the fast trains in Europe and Japan (Grossman, 2009). Shanghai is currently home to the fastest commercial train service in the world, operating at 268mph. In a recent address to the national public radio, President Obama said, “I don't want to see the fastest train in the world built halfway around the world in Shanghai- I want to see it built right here in the United States of America" (Eggen, 2009). In August of 2009, Governor Arnold Schwarzenegger submitted California’s application (among 44 applications from across the nation) to the FRA in hopes of receiving a chunk of the stimulus money to help construct the high-speed rail system and make improvements to the existing intercity rail connections. On January 28<sup>th</sup>, 2010, President Obama awarded federal grants to 13 high-speed rail corridors including California. California received \$2.25 billion for the construction of the proposed high-speed rail system and \$99 million for the three intercity rail lines. This is more than twice the amount received by any other high-speed rail corridor. The grant requires that the project begin construction by 2012 and have at least one segment completed by 2017. Despite competition from 12 other potential high-speed rail corridors for stimulus funding, California was in a strong position to receive a significant amount of stimulus funding for high-speed rail. This is because California

was the furthest along in the planning process and could easily meet the President's requirement that eligible projects must be shovel-ready by 2012. I can only hope that the government will at least sustain this level of funding for high-speed rail and transit for years to come. This level of funding may seem like a lot to many Americans, but that is only because we have been neglecting our transit and rail infrastructure for over half a century. It really took another economic depression to make us realize how far behind we are in terms of transportation. The truth is that 8 billion dollars is not enough money to construct even a single high-speed rail line. This "seed money" or "down payment" is really just the start. Hopefully state, regional and local officials will follow President Obama's lead and make transportation funding a policy priority.

In order to ensure that future generations can live healthy lives, we must change our lifestyles for the better. This involves reducing our consumption of energy, and reducing our green-house gas emissions. In the wake of ever increasing population, traffic congestion, and climate change issues, high-speed rail will become the most crucial part of our rail network as an efficient, environmentally friendly, alternative means of getting around. High-Speed rail has the potential to improve our quality of life and the way we think about California.

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## List of Acronyms:

<b>ARRA:</b>	American Recovery and Reinvestment Act
<b>BART:</b>	Bay Area Rapid Transit District
<b>BTS:</b>	Bureau of Transportation Statistics
<b>CAHSRA:</b>	California High-Speed Rail Authority
<b>Caltrans:</b>	California Department of Transportation – Division of Rail
<b>CCJPA:</b>	Capitol Corridor Joint Powers Authority
<b>EIR:</b>	Environmental Impact Report
<b>FRA:</b>	Federal Railroad Administration
<b>HOD:</b>	Highway-oriented Development
<b>HSR:</b>	High-Speed Rail
<b>ICE:</b>	Intercity Express – HSR in Germany.
<b>JR:</b>	Japan Railways Companies
<b>SLO RTA:</b>	San Luis Obispo Regional Transit Authority
<b>TOD:</b>	Transit-oriented Development
<b>TGV:</b>	Train A Grande Vitesse – HSR in France.