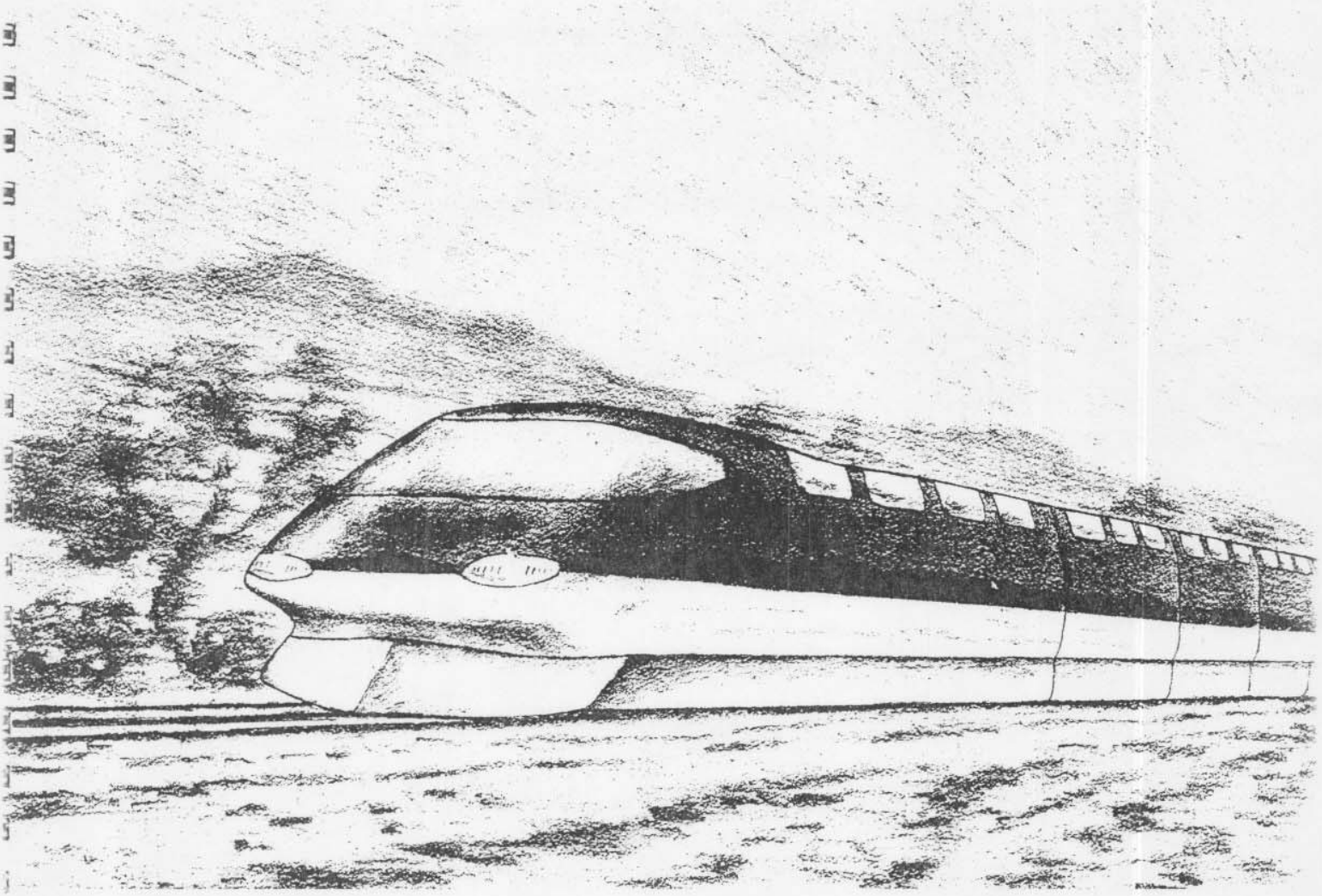
Summary Report

Economic Impact and Benefit/Cost of High Speed Rail for California



Submitted to California Intercity High Speed Rail Commission
Prepared by Economics Research Associates
September, 1996

ACKNOWLEDGEMENTS

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Prepared by Economics Research Associates
September, 1996—Project No.11475 Contract No. 75W230
This report was funded by the State of California, Department of Transportation

DISCLAIMER

The contents of this report reflect the views of the author, who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration. This report does not constitute a standard, specification or regulation.

INTRODUCTION

The State of California Intercity High Speed Rail (HSR) Commission was established under Senate Concurrent Resolution (SCR) No. 6 with the responsibility of overseeing the preparation of a 20-year high-speed intercity ground transportation plan for the State of California. SCR No. 6 specifically requested that the Intercity HSR Commission, with support from its staff, contractors and consultants who are experts in rail planning, economics, financing, and construction, prepare this feasibility study and 20-year plan. Four technical studies were conducted by the Commission in the development of this plan. They are: An Economic Impact Analysis and Mode Cost Comparison Study; The Ridership Demand/ Market Analysis Study; The Corridor Evaluation and Environmental Constraints Analysis; and The Institutional Analysis and Financing Options Evaluation. In addition, there was a public participation program and a contract to integrate the technical study into a comprehensive plan.

In February of 1995, the Commission retained Economics Research Associates (ERA), assisted by a team of subconsultants, to perform the Economic Impact Analysis and Mode Cost Comparison Study. The final report for that study compared the overall and component economic impacts of two high-speed rail alternatives, the very high-speed steel wheel alternative and the maglev alternative, on the California economy. This document is a summary of that final report. ERA procured a detailed simulation and forecasting model of the California economy from Regional Economic Models, Inc. (REMI) in order to perform the statewide economic impact analysis. In addition, the study examined the benefit versus cost relationship of the two HSR alternatives and evaluated station area development, land value impacts and social equity issues.

A number of firms assisted ERA with this assignment. Wilbur Smith Associates (WSA) had the lead responsibility for the mode cost and benefit/cost evaluations. Flight Transportation Associates and James R. Ramos Associates assisted WSA. Pittman & Hames Associates had primary responsibility for the land value and social equity analyses and contributed to the station area development work. Brady & Associates examined future land uses around proposed stations. CR Communciations produced the final and summary reports.

Overview of the California Economy

With a gross regional product (GRP) in the vicinity of one trillion dollars, California constitutes approximately one-seventh of the United States economy. As depicted in **Figure 1**, if California were a nation, its economy would rank eighth in the world and be comparable in size to Italy or Brazil. By 2020, California's GRP is projected to exceed $1.4 trillion, and the state could have the fifth or sixth largest economy in the world. To have a measurable impact on this economy, any single investment decision must be substantial.

California's population has grown from 23.8 million in 1980 to 32.7 million in 1995, an increase of 8.9 million. In 1995, just under 30.6 million resided in counties defined to be within the HSR Corridor. Of the State's increase over the past 15 years, 60 percent was in Southern California and 19 percent was in the Central Valley. During this period, the annual growth rate in Southern California was 2.1 percent, compared to 2.0 percent for the State as a whole. Between 1980 and 1995, the Central Valley was the fastest growing region in California with an annual growth rate of 2.8 percent.

Base Case Forecast

According to ERA's Base Case model forecasts, using the REMI model and adjusting to the State Department of Finance forecast, California's population will increase to 48.8 million by the year 2020. Just over 94 percent of this population, or 45.9 million, will live in counties within the HSR Corridor in 2020. Over the next 25 years, California's population will increase by 16.1 million.

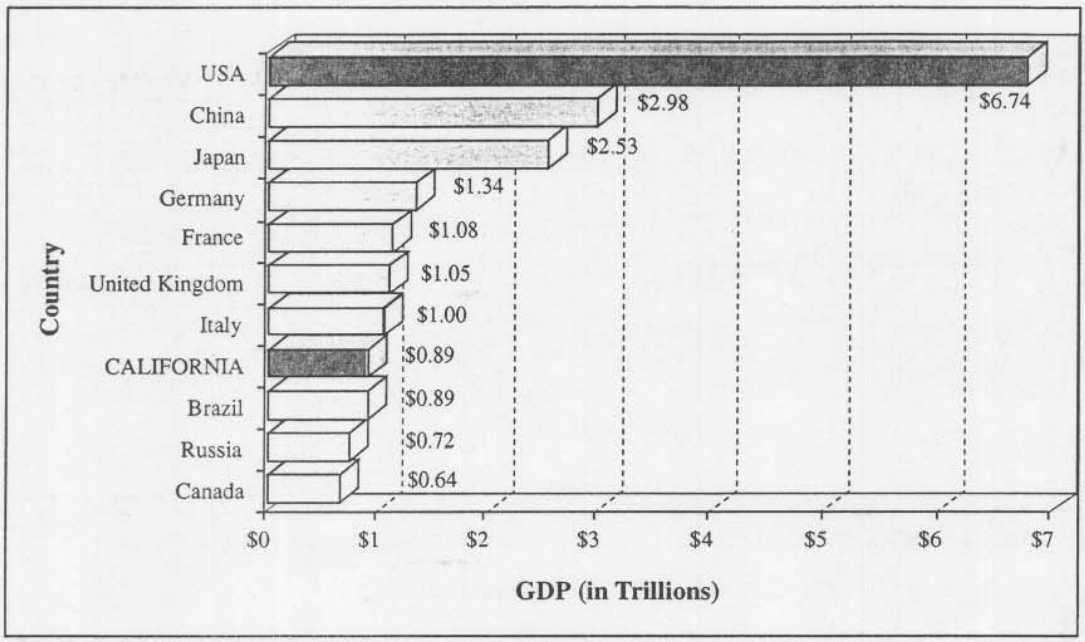
Between 1995 and 2020, Southern California, facilitated in part by the rapid development of the Antelope Valley, will continue to dominate by capturing nearly 58 percent of statewide population growth. During this period, however, the Central Valley will continue to be the fastest growing region in California. Over the next 25 years, the Central Valley is projected to have an annual population growth rate of 2.5 percent, compared to 1.6 percent for the State as a whole. Population in the Central Valley will increase from 4.7 million in 1995 to 8.8 million by 2020. This 4.1 million increase will account for one-fourth of the State's population growth.

Employment growth patterns mirrored that of population growth. California gained 4.2 million jobs over the past 15 years. Fifty-four percent of the job gain was in Southern California and 16 percent was in the Central Valley. The annual rate of employment increase in the Central Valley was 2.5 percent, considerably faster than the statewide and HSR Corridor average of 1.9 percent.

California suffered its most severe recession since World War II during the 1990 to 1993 period. By the end of 1995, however, California had regained all of the jobs lost during the economic downturn. The recession and recovery accelerated a major restructuring of the California economy. In recent years, the state economy has shifted from defense related manufacturing toward business and other services. A growing portion of the work force now requires knowledge and information to perform its job. The key industries of the next two decades include telecommunications, computer software, multimedia, biotechnology, entertainment services and technology guided manufacturing. Exports to Pacific Basin and Latin American countries are of increasing importance to California.

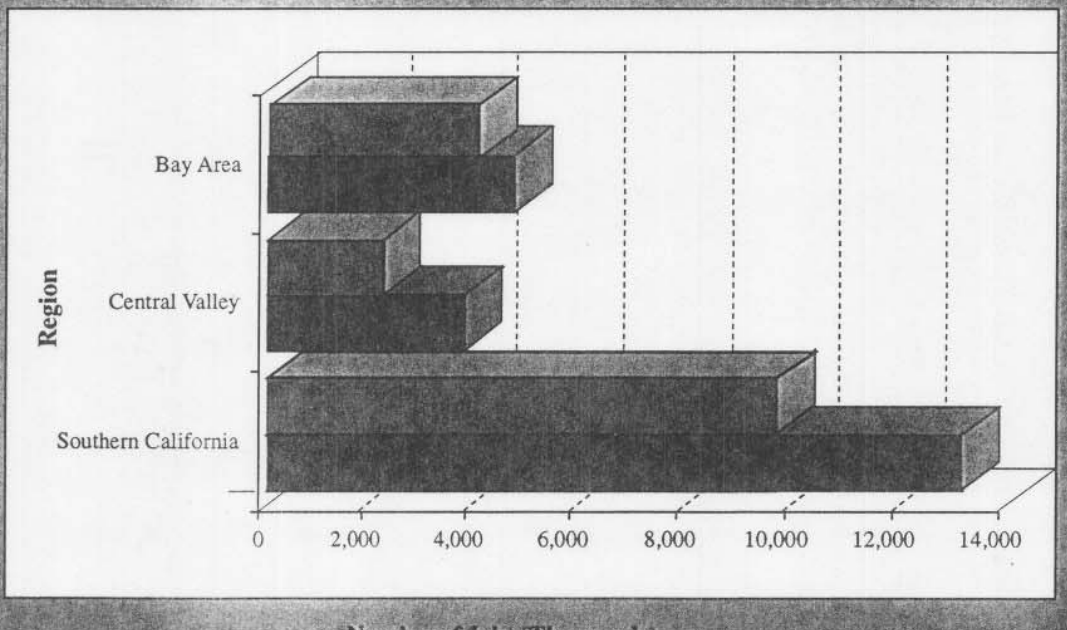
With the "baby boomer" population retiring from the work force over the next 25 years and

Figure 1
Comparison of California Gross Regional Product to GDP of Foreign Countries



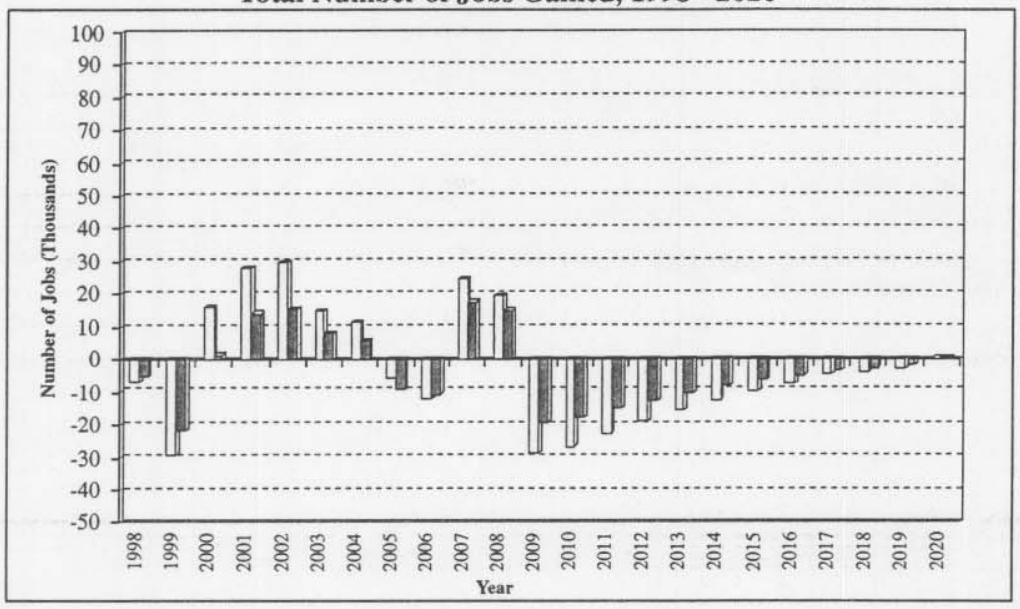
Source: Central Intelligence Agency and REMI.

Figure 2
Base Case Total Employment by Region, 1995 and 2020



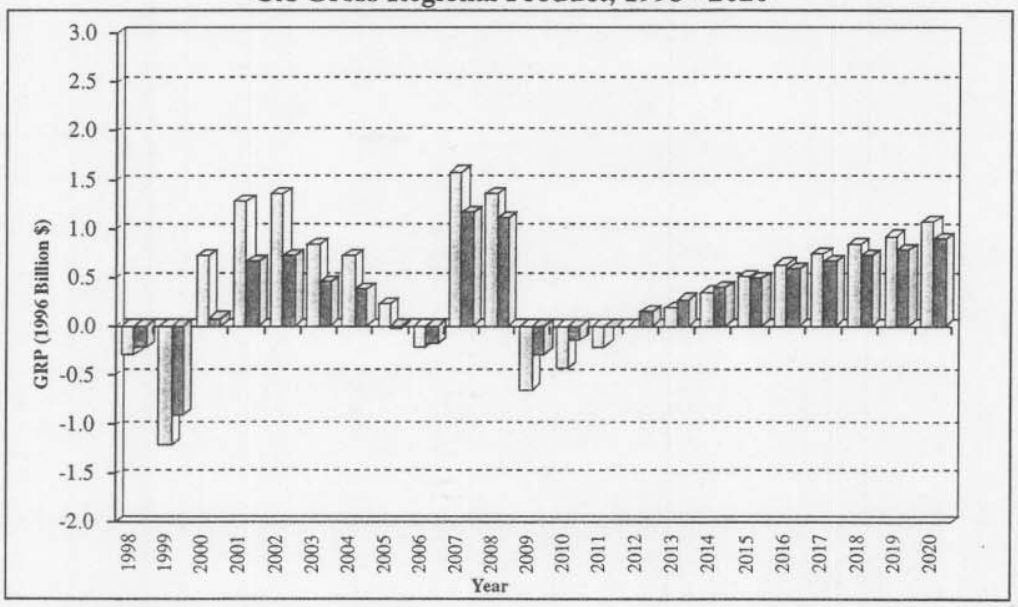
Source: ERA using REMI

Figure 3
Overall Impact of the Alternatives
As Compared to Base Case
Total Number of Jobs Gained, 1998 - 2020



Source: ERA using REMI.

Figure 4
Net Overall Impact of the Alternatives
Compared to Base Case
CA Gross Regional Product, 1998 - 2020



Source: ERA using REMI.

a growing minority group population which tends to have larger families, California's rate of population growth will exceed its rate of employment growth. The State will still gain 6.2 million employees by 2020, of which approximately one-fourth will be in the Central Valley. Between 1995 and 2020, the Central Valley and Antelope Valley combined will account for approximately 30 percent of statewide employment growth. **Figure 2** shows the Base Case total employment by region for 1995 and 2020 for the HSR Corridor.

The HSR Alternatives

The economic impact of HSR is determined by comparing the above Base Case or control forecast with two HSR investment alternatives: Alternative A — Very High Speed Rail (VHSR) and Alternative B — Maglev. The route for both alternatives runs from Los Angeles Union Station to downtown San Francisco via State Route 99 with a cross over at the Altamont Pass. Extensions to San Diego and Sacramento are included. A summary of their key characteristics is presented below.

Summary of Economic Impact Findings

The construction and operations of the HSR system, using either steel wheel or magnetic levitation technology, generates a positive impact on the California economy. System construction provides a major positive impact during the 2000 to 2008 period. Construction of the VHSR Alternative creates 314,000 person-years of employment during this period, and the Maglev Alternative creates 450,000 person-years of employment. Lower average housing cost, facilitated by HSR, stimulates economic growth during the 2010 to 2020 period and beyond.

However, these positive impacts are partially offset by the negative influence of the tax increase and some reduction in employment in the air and conventional rail modes. The motor fuel tax increase required to support system capital costs is six cents for the VHSR Alternative or eight cents for the Maglev Alternative.

Because of these conflicting influences, the economic impact fluctuates widely. However, the longer term employment impact is likely to become increasingly positive as HSR operation improves California competitiveness. **Figure 3** presents a comparison of the overall employment impact of the VHSR and Maglev Alternatives for the period 1998 to 2020 as compared to the Base Case.

Summary of HSR Alternatives

	Alternative A VHSR	*Alternative B Maglev*
Technology	Steel Wheel	Magnetic Levitation
Extensions to San Diego and Sacramento	Yes	Yes
Los Angeles to San Francisco Travel Time	2.6 Hours	2.0 Hours
Construction Period	2000 - 2008	2000 - 2008
Per Gallon Fuel Tax Required	6 cents	8 cents
Total Capital Cost (1996 Dollars)	$18.18 Billion	$25.23 Billion

Economic impact can be expressed in many ways. ERA has selected the number of jobs in addition to the Base Case as one unit of measurement. The change in the state's GRP is also used as an indicator of impact. The development and operations of the HSR system substantially increase the California GRP over the Base Case Alternative. The change in GRP from the Base Case fluctuates from year to year between 1998, which is the initial year of the tax increase, and 2012. This fluctuation is due to the conflicting influences of the tax and the construction impacts (see **Figure 4**). However, after 2012 the impacts are positive and steadily increasing as the added mobility benefits of HSR come into play. The cumulative net GRP increase from 1998 through 2020, expressed in constant 1996 dollars without a discount for future dollars, is $7.7 billion for the VHSR Alternative and $10.3 billion for the Maglev Alternative. Considering that California GRP is higher and climbs steadily while population and employment remains essentially unchanged at year 2020, the state economy is more productive and the average Californian has more income with HSR.

While HSR does slightly change the overall growth of the California economy, it significantly accelerates employment growth in the Central Valley where unemployment rates have been two to three times higher than in the major metropolitan areas (see **Figures 5 and 6**).

Method of Analysis and Variables Examined

ERA leased a simulation and forecast model of the California economy from Regional Economic Model, Inc. (REMI) to measure the impacts of the different variable associated with the alternative high-speed rail systems. Established in 1980, the REMI model is designed to estimate major investment or policy changes on the national, state, or regional economy. The important attributes of the REMI model are as follows:

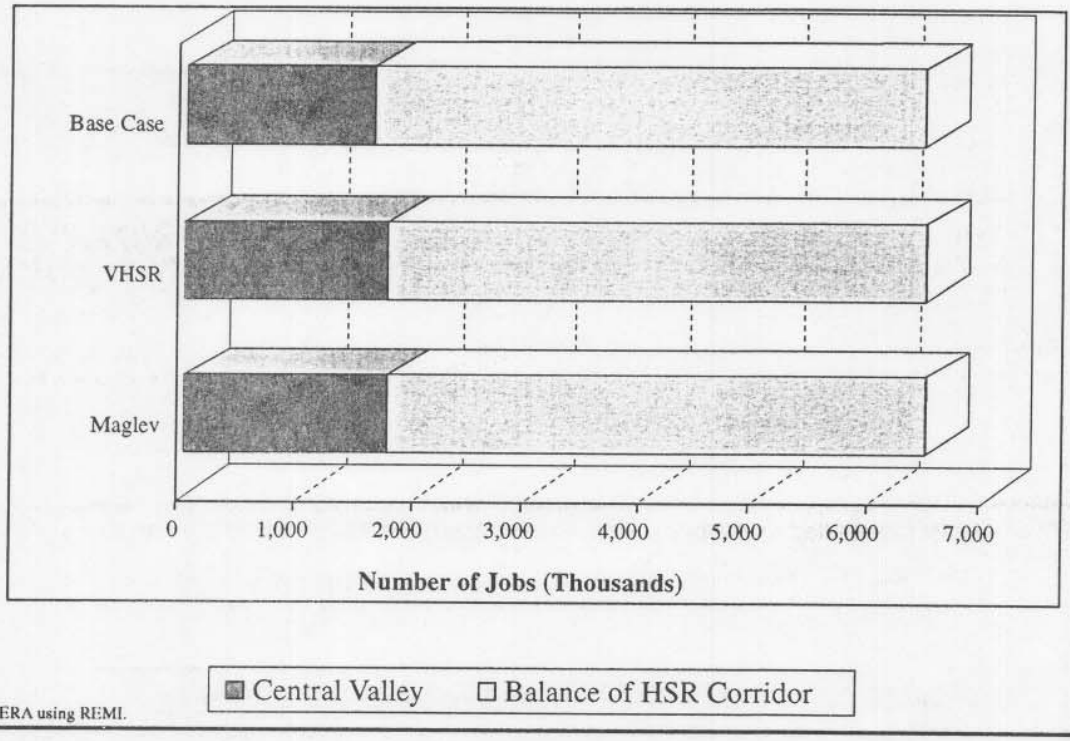
- It starts with the inter-industry relationships in the United States economy and the projected changes of those relationships over time .
- It is adjusted to California to reflect the State's industrial concentration in the different sectors and the proportion of local demand which is produced in California.
- The California model then calculates the amount of labor and capital required to produce the State's output.
- The model also predicts population and labor force availability and calculates wages, prices, and profits.
- These factors are then used to estimate California's competitiveness and labor force migration to and from the State.

The economic impact analysis covered all of the high-speed rail system investment variables which had a measurable impact on the State and HSR corridor economy. It includes the direct, indirect, induced and displacement effects on the economy. The variables which served as inputs into the REMI model and their sources are detailed in the full report. These variables are also summarized below:

HSR System Construction and Operation

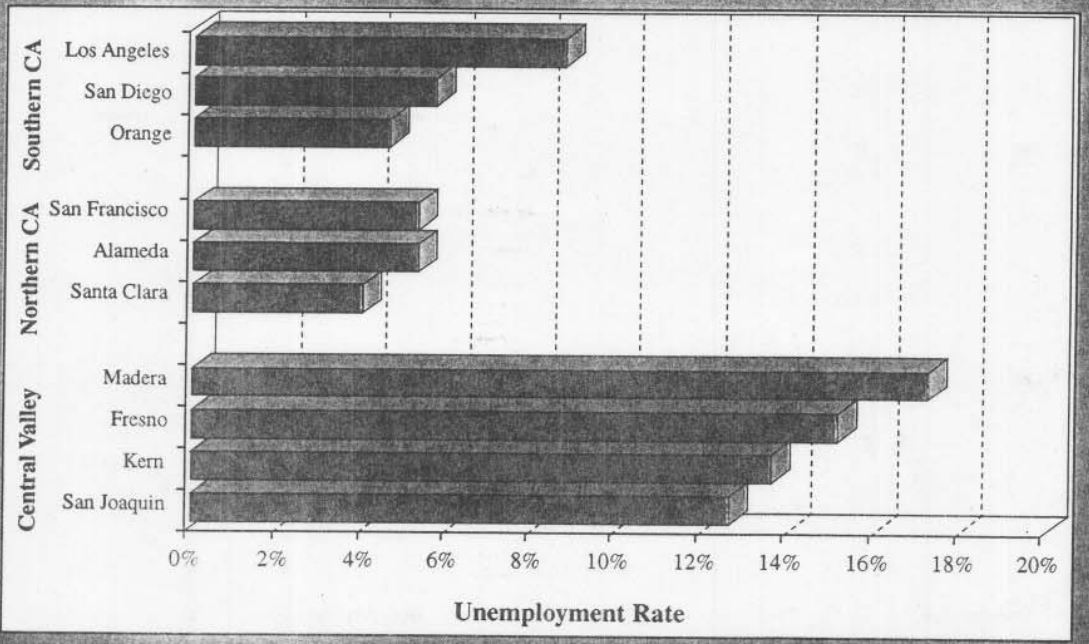
- The total construction cost of the two alternative HSR systems.
- The estimated share of the manufacturing of the high-speed rail train sets which takes place in California.
- The operation and maintenance of the two alternative HSR systems.
- The diversion of local government construction from other areas of the community to HSR station areas.

Figure 5
Estimated Shift in HSR Corridor Employment Growth
Total 1995 to 2020 Growth



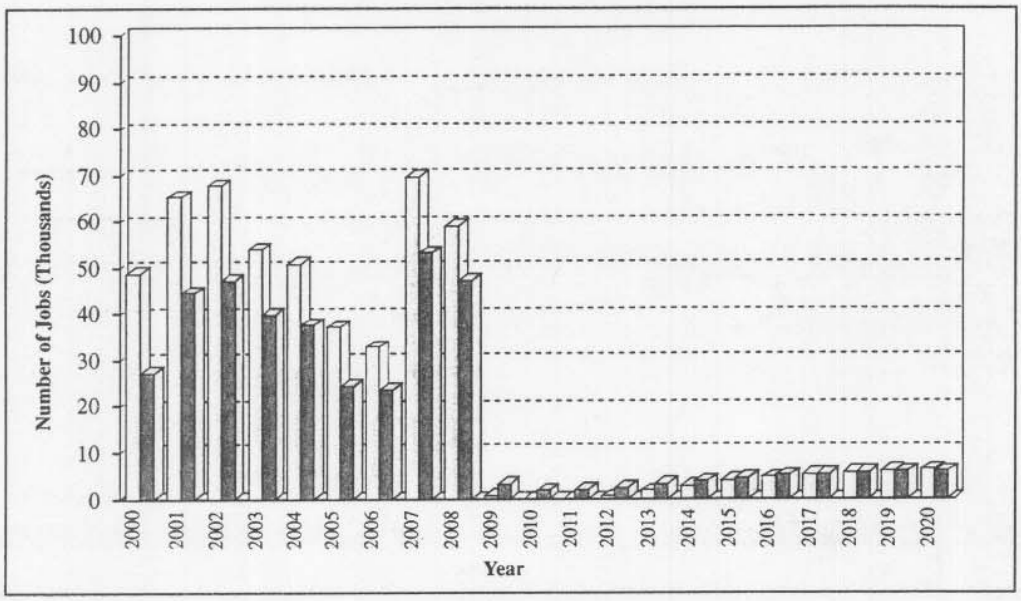
Source: ERA using REMI.

Figure 6
Comparison of Unemployment Rates
By County, April 1996



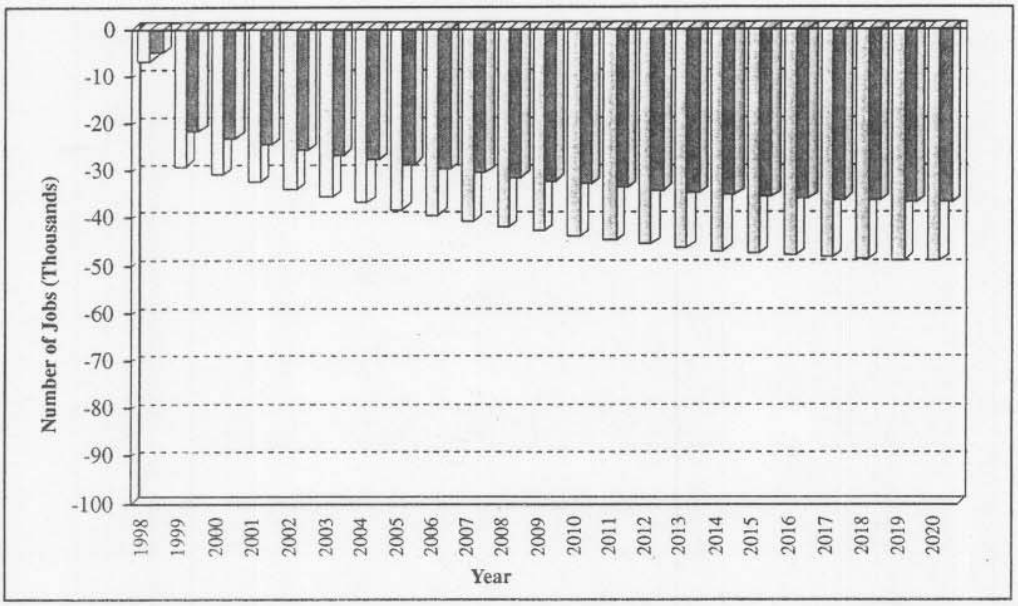
Source: California State Department of Employment and Development

Figure 7
HSR System Construction, Procurement, and Operations
Total Number of Jobs Gained, 2000 - 2020



Source: ERA using REMI.

Figure 8
Increase in Gas Tax
Total Number of Jobs Lost, 1998 - 2020



Source: ERA using REMI.

Aviation Sector Savings

- Reduction in airport terminal area investment.
- Increases in commercial air carrier operating efficiency.
- Increases in business productivity due to reduction in business travel delays.
- Reduction in non-business travel delays and resulting improvement in California attractiveness.

Highway Sector Savings

- Reduction in number and cost of accidents.
- Increases in trucking industry efficiency due to reduced highway congestion.
- Increases in business productivity due to reduction in highway business travel delays.
- Reduction in non-business highway travel delays and resulting improvement in California attractiveness.
- Reduction in automobile operating cost by HSR system users.
- Improvement in California attractiveness due to reduction in air pollution.

Savings in the Conventional Rail Sector

- Reduction in operating and maintenance cost.

Consumer Surplus Due to New HSR Mode

- Increases in business productivity due to lower HSR travel cost for business travelers as compared to alternate modes.
- Increases the relative attractiveness of California due to additional mode choice for non-business travelers.

Housing Cost

- Reduces average housing cost in the HSR Corridor due to a slight acceleration of growth into lower-cost areas of California such as the Central Valley and the Antelope Valley.

Change in Consumer Spending

- The difference between the cost of travel on HSR versus air carriers or via automobile results in some difference in disposable income available for consumption of other goods and services.

Impact of Tax Increase - Assumes Six- to Eight-Cent Fuel Tax

- Reduces disposable income available for consumption of other goods and services.
- Increase in the operating cost of the trucking industry.

The Economic Impact of Key Variables

The analysis, detailed in Section III, examines the impact of each of the above variables individually and then collectively. Based on the detailed analysis, three sets of variables emerged as having the most significant impact on the California economy. These are discussed below:

HSR System Construction, Procurement and Operations

The construction of any $18- to $25-billion dollar project will have an impact on the state economy. As shown in **Figure 7**, the construction of the alternative HSR systems will have two peaks. The first reflects the construction of the base system from Los Angeles to San Francisco during the 2000 to 2005 period, and the second is the construction of the extensions to San Diego and Sacramento during the 2006 through 2008 period. The construction of the

HSR system between 2000 and 2008 creates a large number of direct and indirect jobs. For the VHSR Alternative, the number is 314,000 person-years of employment. For the more expensive Maglev Alternative, the person-years of employment created is 450,000. During some of the peak years, the gain in number of direct and indirect jobs is nearly 70,000.

A Tax Increase

Any tax increase, if viewed in isolation without considering the investments made with the revenue collected, slows economic growth and decreases employment. As depicted in **Figure 8**, the VHSR Alternative, which requires a six cent per gallon increase, decreases employment in the state by approximately 35,000 per year. The Maglev Alternative, which requires an eight cent per gallon increase, decreases employment by nearly 50,000 per year.

When the analysis is prepared in constant dollars (excluding inflation), there are two differences between a fuel tax geared to the amount of fuel consumption and a sales tax:

- A sales tax is likely to keep pace with California's population and income growth, while a fuel tax may not, because of the increasing fuel efficiency of new automobiles and the possible growing use of alternative fuel vehicle like electric vehicles.
- A sales tax reduces consumer disposable income and spending directly. A fuel tax that raises the same amount of money receives approximately 85 percent of the revenue from consumers and the other 15 percent from the trucking industry. However, the higher cost of trucking has a secondary effect on many sectors of the California economy.

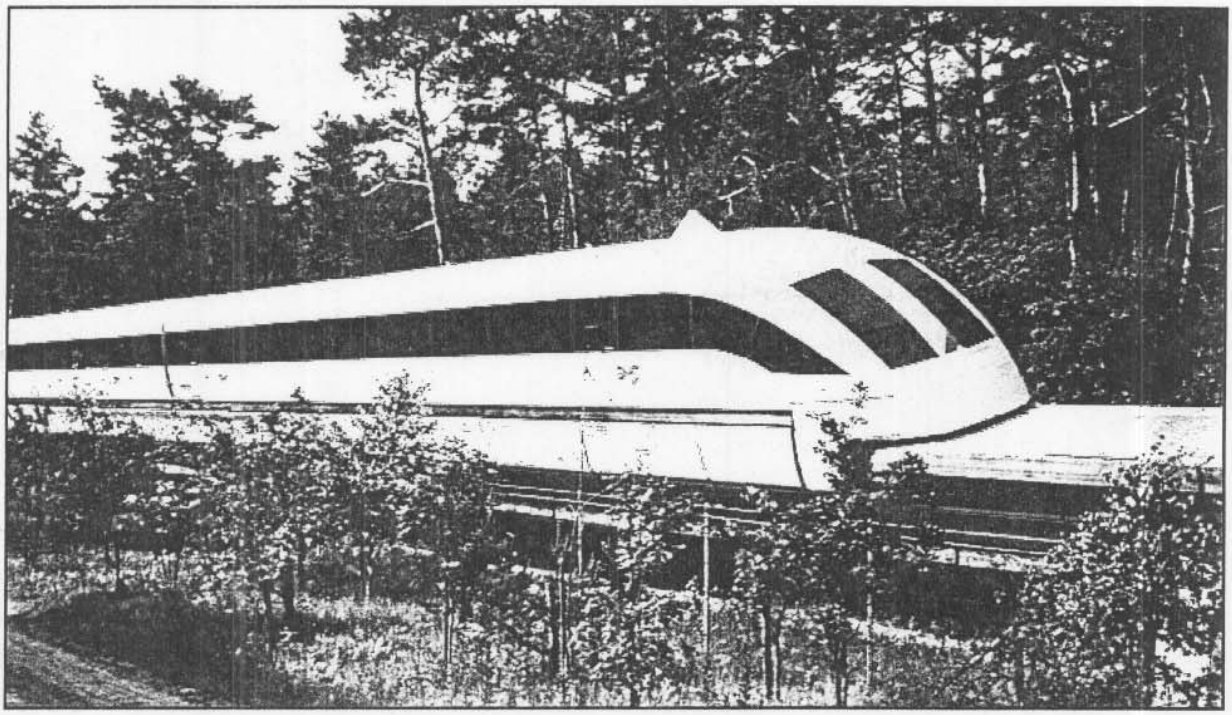
The sales tax revenue stream is expected to increase at a faster rate than the fuel tax revenue stream. This faster tax revenue growth translates into more direct revenue for HSR development but also greater adverse impact on California job growth. However, if the two revenue streams were made equal, the fuel tax has more adverse impact on California job growth. When compared to the Base Case Alternative, the 2020 job loss for the Maglev Alternative is 37,200 for the sales tax scenario and 49,100 or 32 percent higher for the fuel tax scenario. For the same amount of revenue raised, the fuel tax has more adverse economic impact on California job growth because the resulting higher operating cost for the trucking industry has a secondary cost impact on many sectors of the economy. If a per-gallon fuel tax is used, the State may wish to exempt diesel fuel.

The Reduction in Corridor Average Housing Cost

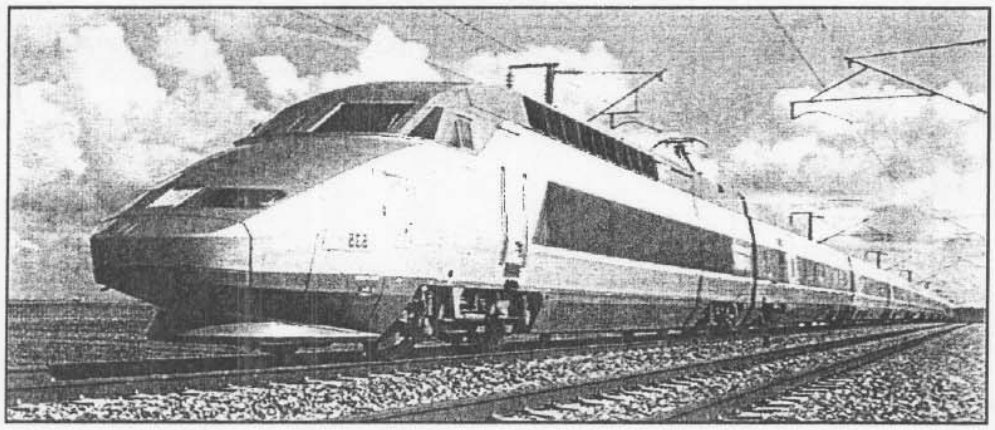
During thf,past 15 years, high housing cost has been the single most significant factor adversely affecting the competitiveness of California. Even a slight reduction in average housing cost will increase California's attractiveness for both employees and employers. Some of California's largest home builders interviewed by ERA have indicated that they would give preference to communities served by HSR stations in the construction of entry level single family homes. The HSR systems will tend to induce additional residential construction in communities, such as the Antelope Valley and San Joaquin and Stanislaus Counties, which are able to provide lower land and labor costs and yet be within commuting reach of major metropolitan areas such as the Los Angeles basin or the San Francisco Bay Area. It is the expansion of these metropolitan areas which will drive California's economic growth over the next 25 years.

This additional residential construction in the Central Valley and the Antelope Valley will

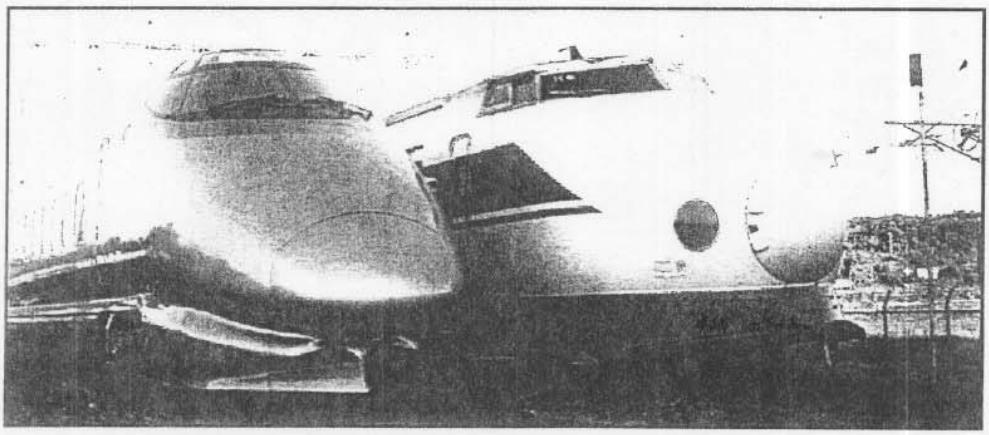
HIGH SPEED RAIL IN ASIA AND EUROPE



German Transrapid Maglev System

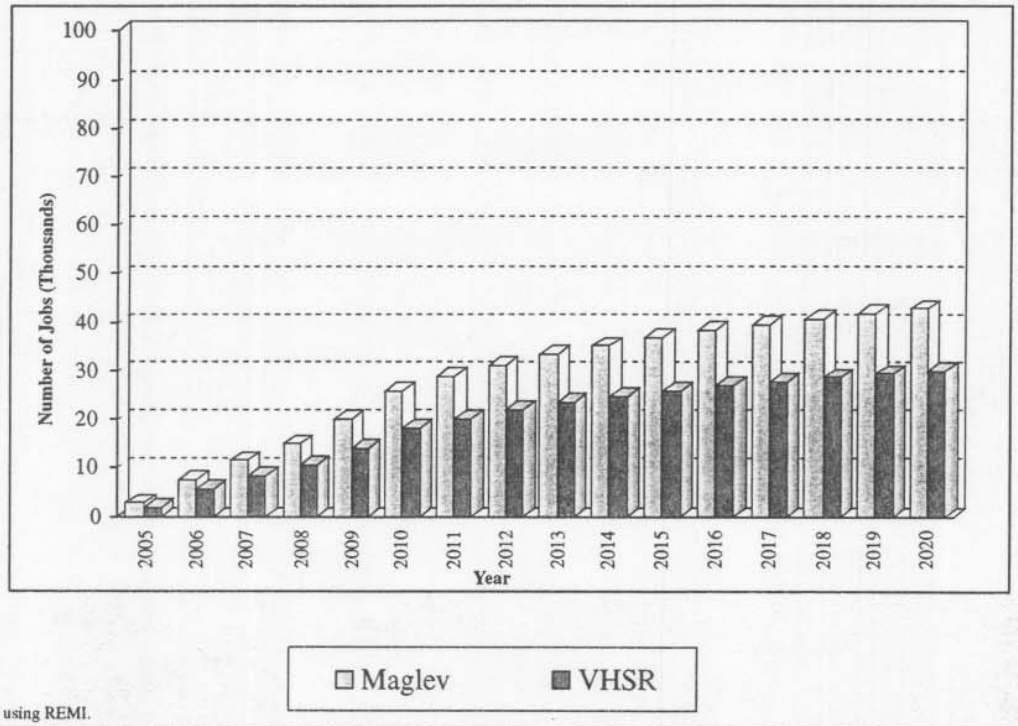


French
Train a Grande
Vitesse (TGV)



Japanese
Shinkansen

Figure 9
Reduction in HSR Corridor Average Housing Cost
Total Number of Jobs Gained, 2005 - 2020



Source: ERA using REMI.

accelerate population growth in these lower housing cost areas. This, in turn, will tend to lower average housing cost in the entire HSR Corridor. The lower average housing cost increases California's attractiveness to workers and then to employers because they are able to pay lower wages.

The expected seven to ten percent additional incremental population growth in the Central Valley and Antelope Valley between 1995 and 2020, results in a slight reduction in housing cost throughout the HSR Corridor. The percent reduction in housing cost is actually very small: under 0.4 percent for the VHSR Alternative and about 0.5 percent for the Maglev Alternative. However, because the competitiveness of the California economy relative to other states is very sensitive to housing cost, HSR's influence in this area is one of its most important contributions to California's long term economic growth. This impact is illustrated in **Figure 9**.

Impact by Industry Sector

Agriculture

The HSR system represents a mixed blessing to the agricultural sector. The HSR induced acceleration in population and employment growth in the Central Valley will increase the economic pressure for the conversion of agricultural lands to urban and suburban use. The three to five percent additional total population expected in the Central Valley by 2020 due to HSR can easily be accommodated by improved local government land-use planning. By encouraging somewhat higher urban and suburban densities and adopting policies which protect prime agricultural areas, the additional pressure on the agricultural sector can be contained.

Depending upon the efficiency of the interface between the HSR system and major international airports, the new HSR system is in a position to stimulate the export of high value agricultural products grown in the Central Valley to distant markets (an example would be the increase in shipment of premium-quality and individually-packed fruits shipped by air transport from San Francisco or Los Angeles International Airports to Japan).

The HSR system could be used during off peak evening hours for the shipment of high value freight, including both agricultural and non agricultural products. Freight revenue from operations, like passenger revenue, is addressed in the Institutional Analysis and Financing Options Study. The economic impact consideration is its displacement of air or trucking freight revenue and employment, and those impacts are very minor.

Manufacturing

The HSR system does not have a major impact on California's manufacturing sector. The gas or sales tax increase would tend to impede the growth of this sector during the earlier years of its implementation. This negative impact is offset by the procurement of the rail cars which are only three percent (Maglev) to five percent (VHSR) of total system capital cost. In the longer term, HSR will induce residential construction in lower cost areas, such as the Central Valley and the Antelope Valley. The increased housing construction in these relatively more affordable areas will lower overall HSR Corridor housing cost. This will, in turn, increase the competitive position of California relative to other states and lead to growth of all sectors, including manufacturing.

Several California high technology firms indicated that having an HSR system serving the Highway 99 Corridor would not necessarily increase their likelihood of locating branch plants in the Central Valley. Some firms simply use their corporate aircraft to travel to where they need to go, others cited their increasing reliance on telecommunications, and still others indicated their concern with the quality and

training of the Central Valley labor force for high- technology production.

Construction

The construction sector benefits in many ways from the HSR system. The construction of the HSR system between 2000 and 2008 creates a large number of direct and indirect jobs. For the VHSR Alternative, the number is 314,000 person-years of employment. For the more expensive Maglev Alternative, the person-years of employment created is 450,000. Clearly, building this multi-billion dollar system will provide many opportunities for businesses and employees in this sector. The construction of the HSR system will also induce an acceleration in time of commercial construction around the stations and residential construction in the communities served by HSR. In addition, the increase in California competitiveness resulting from slightly lower average housing costs will stimulate in-migration and additional construction of all types over the long term.

Finance, Insurance, and Real Estate

This sector actually experiences the largest relative impact within the California economy. Major owners of real estate around the stations and financiers participating in system construction will likely receive the greatest benefits. Real estate developers, brokers, and financiers active in the HSR Corridor should also do very well.

Wholesale and Retail Trade

The HSR impact on this sector is essentially in proportion to its impact on the California economy as a whole. Growth of the wholesale and retail trade sectors are essentially functions of population and income growth. Because of somewhat higher population growth, retail and wholesale businesses in the Central Valley will benefit.

Services

The services sector derives three types of benefit from the development of the high-speed rail system. First, the more specialized professional services firms located in the major urban centers, because of the travel convenience provided by HSR, will be able to increase their market reach into the smaller communities which are not able to support such professionals. For example, a lawyer with a specialty practice based in downtown Los Angeles will better be able to serve clients in San Diego, Bakersfield and Fresno.

Second, tourist establishments located in desirable destinations that are near HSR stations will experience an increase in business. Hotels, restaurants, and the convention center in downtown San Diego should experience a substantial increase in performance because of their waterfront location and HSR station proximity. If there is an Anaheim station, visitor attractions like Disneyland and Knotts Berry Farm will see an increase in attendance due to HSR. The Music Center, Museum of Modern Art, Chinatown, Dodger Stadium, Little Tokyo and Olvera Street areas of central Los Angeles should all experience additional patronage due to HSR service to Union Station. The Magic Mountain theme park would benefit from a Santa Clarita station. Theaters, restaurants, hotels, retail shops and even the new Giants baseball stadium will benefit from a downtown San Francisco HSR station.

Third, establishments which provide personal or business services in areas such as the Central Valley and Antelope Valley will experience an increase in business due to the acceleration in population and employment growth induced by HSR service.

Government

Development of the HSR system will cause some growth in state and local government employment. The formation of a new entity,

state agency, or joint powers board will probably be required to oversee the construction, operation, and maintenance of the system. Local government employment in the Central Valley and the Antelope Valley will likely expand to keep pace with a higher rate of population growth.

Land Related Impacts

Station Area Development Impacts

The ERA team has analyzed the amount and value of new development expected to occur within one-half mile of 21 potential HSR stations over the year 2000 to 2020 time horizon. For the area within one-half mile of these HSR stations, a total of $7.7 billion in new real estate development is expected during the 20-year time span from 2000 to 2020. Of this total, an estimated 22 to 27 percent or $1.7 to $2.0 billion can be attributed to the presence of the HSR station. The development impact considers both the time period in anticipation of HSR system completion and the period after completion.

The highest dollar value impact will be at the major downtown stations. Since these downtown locations will expect a considerable amount of future land development even without HSR, the HSR percentage contribution may be fairly small. However, the absolute dollar value impact will be considerable. HSR will add strength to downtowns which are viewed favorably by the development community.

A HSR station built in isolation may not be sufficient to reverse a decaying downtown area which no longer has the geographic location for a central business district. The arrival of HSR, however, can be used by local government as a catalyst to stimulate a comprehensive urban core area revitalization program.

The stations in the relatively undeveloped areas will experience the highest percentage impact from the arrival of HSR. The low amount of expected development at those locations without HSR contributes to the high percentage impact of HSR. Major California home builders indicated that they would give preference to the communities and areas which will enjoy HSR service.

The HSR stations will have their highest relative impact on land development in the Central Valley and at suburban locations where land is abundant and relatively inexpensive. However, the largest absolute dollar value impact will be at the major downtown stations. A high-speed rail system will tend not only to accelerate growth and economic development in the communities which it serves, but it will also tend to concentrate land development around the stations. Rail service, historically in this country and currently in Europe and Japan, encourages and supports urban development patterns which are more compact than those sustained by automobiles. With the appropriate land use and urban development policies in place, high-speed rail stations can become the focal point of a significantly different form of urban development as compared to the automobile dominated growth of the past four decades.

Land Value Impacts
Station Area Land Value Effects

The HSR system will increase land values around all station types. The range of value increase attributable to HSR is nearly zero to 20 percent for urban and suburban stations.

- Mid-size city centers, particularly those with express or semi-express service would have land value increases of up to 20 percent, due to comparatively lower land costs and the ability to provide infrastructure and access to support HSR.
- Generally, the percent increase in land values in major city centers would be less than mid-size cities due to a largely devel-

oped area and less land available for high-impact station area development.

- Rural or exurban station areas, particularly those in communities which are within commute distance of major urban employment centers such as Los Angeles and the Bay Area, would have the largest increase in land values (up to 45 percent).

Corridor Land Value Effects Outside Station Areas

Land values within 1,000 feet of HSR alignments, but outside the station influence areas, would remain neutral or decrease under both strong and weak economic influences. Rural areas could experience the most significant decreases in land value (up to 15 percent).

- Within major and mid-size city corridors land value effects would be typically minor (neutral or negative five percent), as most alignments proposed for HSR are within existing intercity, commuter or freight rail alignments.
- Suburban areas could experience land value decreases of up to ten percent, particularly for new alignments that are not currently in active rail corridors.
- Rural areas would experience the most negative impacts because new HSR alignments could restrict the cross movement of farm equipment, goods, and people. Also new alignments may bisect farmland and diminish access to parcels for crop production. The lower construction cost alternative, which will have fewer grade separated crossings, would tend to have a greater adverse impact on rural area land values.

Construction Land Value Effects

Construction of the HSR system could have a temporary negative impact on land values of property adjacent to the alignment. Construction along new rail alignments is expected to have the largest negative impact on land values, while construction along existing rail alignments will not impact land values in most cases. Residential land uses along the alignment are more likely to be affected by HSR construction than industrial uses. Construction impacts on new alignments would be more pronounced if an elevated or below-grade alignment is required and heavy construction equipment is used for extended periods.

Benefits Not Modeled

While the consultant team has made every effort to provide a rigorous quantitative analysis of the impacts of HSR, there are a number of issues worthy of discussion which were outside the scope of the quantitative analysis.

Benefits Accrue Over Time

The economic impact analysis examines a 25-year period to the year 2020. Because the full system is not expected to be operational until 2009, the analysis period only includes eleven years of full system operation. Since the HSR investment is expected to last 50 to 100 years or more, the analysis strongly suggests that the benefits grow over time, well beyond the time horizon when the initial construction cost is fully amortized. This is because the HSR system wil have capacity to handle patronage volume growth well into the 21st century.

Reduces Dependence on Foreign Oil

Unlike automobiles and airplanes, the HSR system uses electricity which is generated domestically. In the event that the supply of imported oil is interrupted by an international crisis, a California with HSR will suffer far less adverse economic impact than a California without HSR.

Because HSR is considerably more energy-efficient than either automobile or air travel, it

will conserve approximately two billion gallons of fuel from inception through 2020. The savings is 1.8 billion gallons for VHSR and 2.4 billion gallons for Maglev.

One More Mode Option to Cope With Natural Disaster

When the San Francisco/Oakland Bay Bridge was damaged and put out of service by the Loma Prieta earthquake, the BART system preserved the critical economic linkage between the residential areas of the East Bay and the employment center in downtown San Francisco. Without BART the Bay Area economy would have suffered a much more severe blow from that earthquake. When a critical portion of Interstate 5 was destroyed by the Northridge earthquake, the Metrolink rail service provided an important transportation alternative.

The investment in HSR expands the intercity mode alternatives available to California. In the event of a major natural disaster, California will have a better chance of preserving its intercity mobility and resulting economic productivity if it had an additional mode option.

Reduces Traffic Congestion Into the Major Downtowns

HSR, by directly serving major downtown areas such as San Francisco and Los Angeles, reduces the surface traffic into these congested urban core areas. If the existing intercity travel pattern is perpetuated, the volume of shuttle van, taxi and rental car traffic from regional airports into these major downtowns will grow. This growth compounds an already severe congestion problem caused by local traffic. HSR, by serving the major downtowns, improves access into these urban cores for the local metropolitan area population by removing some intercity surface traffic. The result is greater downtown vitality due to improved intercity and local metropolitan area population access.

Enhances State Image

A state-of-the-art HSR system will reestablish California as the state leading the nation into the 21st century. That forward-looking image will enhance California's ability to compete with other states and other parts of the world.

Policy Implications

Super Commute Linkage

Because California's competitiveness is very sensitive to housing cost, the economic analysis indicates that one of the important economic contributions of the HSR system is its ability to strengthen the linkage between expanding metropolitan areas, such as the Los Angeles basin, the San Francisco/Oakland Bay Area, the Silicon Valley, and the communities that offer more affordable housing. For people living in these lower-cost communities in the Central Valley or the Antelope Valley, the linkage does not necessarily imply a daily commute on HSR. It means having a commute option and more convenient access to the specialized services, recreation, and entertainment opportunities offered by the major urban centers.

More than one-half of California's growth over the next 25 years will be in Southern California. With recovery from the severe early 1990s recession, the Los Angeles basin economy will need to expand in all directions. Improved access to the lower cost housing stock provided by the communities in the Antelope Valley facilitates the expansion of the Southern California economy.

A similar situation is also true for the San Francisco Bay Area. The HSR linkage between expanding economic hubs of the Bay Area, such as San Francisco and Silicon Valley, and lower housing cost communities, such as Modesto and Merced, will provide positive benefits as well.

From a California economic development perspective, the analysis suggests that the HSR system should have the following alignments:

- The Southern California region would benefit from service to the Antelope Valley because it links the communities of Palmdale and Lancaster, which are able to provide less expensive housing, to Burbank, the new capital of the entertainment industry, and downtown Los Angeles.
- In Northern California, the Altamont Pass alignment would serve a comparable function by linking communities such as Modesto and Merced with the major economic hubs of downtown San Francisco and Silicon Valley.

As the importance of serving the long-haul commute market becomes more apparent, the HSR connection with the urban rapid transit systems of the major metropolitan areas becomes more critical. Convenient transfers between HSR and Metro Rail at Union Station in downtown Los Angeles and with BART in downtown San Francisco are of paramount importance. However, opportunities for additional HSR connections with BART or Metro Rail should be examined.

Major Urban Centers

Over half of the incremental employment induced by HSR is in the finance, insurance, real estate (FIRE) and services sectors. The firms in these sectors tend to be concentrated in the major urban centers. Providing HSR service to California's major urban centers, such as the downtowns of Los Angeles, San Francisco, San Diego, and Sacramento, is therefore very important if California is to fully collect the economic returns of this major investment. This issue can be viewed from two perspectives:

- The highly specialized service firms in fields such as law, engineering, accounting, architecture and management consulting located in these major downtowns will benefit from improved market reach into the rapidly growing communities of the Central Valley. The entertainment and recreation establishments in these urban centers would receive similar benefit. The greater market reach provided by HSR strengthens these downtowns.
- The residents of Central Valley and Antelope Valley communities will benefit from the improved access to services, retail, entertainment, recreation, and public assembly venues available in these major urban centers. These would include fine restaurants, more specialized shops, theaters, performing arts facilities, museums, major league sports, attractions, and even ethnic commercial districts. The HSR access improves the quality of life for residents in these lower-cost communities and thereby improves California's ability to compete against states which promote their cost advantage.

Catalyst for Downtown Area Revitalization

Many of California's cities have experienced deterioration of their urban cores as the new growth moved to the periphery. In most cases, a HSR station built in isolation will not generate sufficient momentum to reverse a downtown's downward spiral. However, local governments will have the opportunity to use the arrival of HSR as part of a comprehensive revitalization program, to stimulate private sector investment in their core areas.

Central Valley Land Use Planning

The State's investment in HSR and its selection of the Highway 99 Corridor will increase the pressures for conversion of agricultural lands in the Central Valley to urban and suburban uses. The urban encroachment into highly productive agricultural areas can be contained by the implementation of more rigorous land use plans

and policies. City and county governments in the Central Valley could use the arrival of HSR as an opportunity to create updated general plans and land use policies which support more land efficient and rail compatible urban development patterns.

High Speed Train Manufacturing

The manufacturing of high-speed rail train sets does not appear to offer a major industrial development opportunity for California. The reasons are detailed in Section V and summarized below:

- The cost of the train sets are a minor portion, three percent for Maglev and five percent for VHSR, of total HSR system capital cost.
- Manufacturing of VHSR steel wheel train sets is a mature technology which would require substantial cost and time for California to replicate. A buy California only approach would substantially increase train set procurement cost and the reliability risks associated with a new product.
- An exact parallel is not true for Maglev technology. California has two options in terms of Maglev technology. First, the state can make the investment necessary to "leap frog" the knowledge already acquired by the Germans and the Japanese. The American Maglev Association at one time estimated the United States investment needed to be in the range of $750 to $800 million dollars. Even if California were able to gain "first mover" advantages in Maglev train system manufacturing with a high level of investment, the downstream market opportunities are very uncertain. Second, California firm can use existing foreign technology under a licensing agreement, and the German technology appears to be closest to commercial application. Unlike the steel wheel systems, the German Maglev system has its propulsion system in the road bed. California firms would need to develop expertise in the construction of such guideways. However, any down stream advantages accruing to California firms would need to be shared with the German developer of the technology in accordance to the licensing agreement.
- The existing rail industry in the United States is scattered in many different states through the East Coast and the Mid West. California does not have the competitive advantage of established strength in this industry. Major subsidies, or protectionist policies which translate into higher procurement cost, would likely be required to foster the development of this industry within California.
- The California economy is evolving away from manufacturing and toward services and information technology which are likely growth sectors for the next 20 years. Policies directing state investment to high-speed rail equipment manufacturing would not amplify the current market based evolution of the California economy.

High Technology Sector

Although the impact on manufacturing jobs is likely to be modest, the construction and procurement of HSR will have a significant impact on California's higher technology sectors. The procurement of a Maglev system will add an estimated 1,700 jobs per year during the peak production years 2000 through 2005. However, the signals and communications, engineering services and program implementation components add an average of 11,600 jobs per year over this period. These jobs are tabulated within the construction sector. During the peak construction and train production period of 2000 through 2005, California will add an average of 13,300 higher-technology jobs and three-quarters of a billion dollars in additional GRP per year over

the Base Case. It should be noted, however, that a large majority of these more sophisticated jobs are in the service rather than the manufacturing sector.

Integration of the Central Valley into High Tech California

As California rebounds from the recession of the early 1990s, the industries leading the recovery are telecommunications, high-technology manufacturing, computer software, multimedia, entertainment, business and professional services, and biotechnology. These industries will be the growth industries of the early twenty-first century. An economy whose competitive advantage is based upon knowledge-oriented services requires a well educated labor force. The Central Valley needs educational facilities, like the proposed UC Merced campus, to produce such a labor force. However, it also needs communities which are able to offer a high quality of living at a reasonable cost to retain this labor force. The HSR system improves the ability of the Central Valley communities to provide that combination by increasing their access to metropolitan areas which offer employment and entertainment opportunities.

Accelerating Job Growth Where It's Most Needed

Very possibly, HSR's most important economic contribution to California is its ability to accelerate employment growth in the Central Valley, where unemployment rates have been two to three times that of the major metropolitan areas.

Overall Impact

The development and operations of the HSR system substantially increase the California GRP over the Base Case Alternative. The cumulative net GRP increase from 1998 through 2020, expressed in constant 1996 dollars without a discount for future dollars, is $7.7 billion for the VHSR Alternative and $10.3 billion for the Maglev Alternative. The longer term implication of HSR for the California economy are clearly positive, even when the impact of the tax increase necessary to construct the system is considered.

Benefit/Cost Evaluation

Major transportation projects such as HSR can create economic value in either of two ways:

- *Economic Impacts* - A new HSR system can encourage economic activity to shift to California. If the HSR investment enables the attraction of additional business to California, or allows existing businesses to be more productive, then the transportation investment can aid the economic development process. These net economic development impacts attributable to HSR were examined above.

- *Transportation Efficiency Benefits* - Transportation efficiencies brought about by trip maker cost savings that result from the introduction of HSR are true benefits to California. When travelers experience time savings, greater safety, greater comfort, or reduced costs, their gain is not offset by losses to other people. Savings of these types act the same as income or value increases by making resources available for other purposes. If the effective increase in value brought about by the HSR project exceeds its cost, the project is said to be efficient and the people of California are better off. These types of issues are examined in the Benefit/Cost analysis

The benefit/cost analysis, calculated over a 50-year period,yields three indicators of "economic feasibility" for each HSR option:

Net Present Value - All costs and benefits in future years are discounted back to the base year (1996) using a seven percent real (constant dollar) discount rate. When the sum of the

Table 1: Total Discounted Costs and Economic Benefits[a] Years 2000-2050 ($ Million)				
	Basic System LA-SF		Basic System Plus Extensions	
	VHSR	Maglev	VHSR	Maglev
Costs:				
Capital Cost	$7,584	$10,375	$10,528	$14,697
Residual Value	(97)	(139)	(155)	(216)
Total Costs	$7,487	$10,596	$10,373	$14,481
Economic Benefits:				
Other Mode Savings:				
Highway	$983	$1,085	$2,068	2,307
Air	2,882	3,936	5,133	6,615
Conventional Rail	259	259	485	521
HSR User Benefits	1,792	3,112	3,400	5,541
HSR Operating Surplus	1,199	2,252	2,607	4,190
Total Benefits	7,116	$10,645	$13,693	$19,473
Net Benefits	$(371)	$49	$3,320	$4,992

[a] This table indicates cumulative costs and cumulative benefits over die period 2000 2050, discounted annually at the discount rate of 7%. For example, the total present value of the Highway mode savings 2006-2050 for the VHSR Basis System is $983 million.

Source: WSA

discounted benefits is greater than the sum of the discounted costs, the "net present value" is positive and the HSR option is deemed to be "economically feasible

Discounted Benefit/Cost Ratio - After the future streams of costs and benefits are discounted, the sum of the discounted benefits are divided by the sum of the discounted costs. When the result is 1.0 or greater, the HSR is considered to be "economically feasible".

Internal Rate of Return - This calculation determines that discount rate at which the net present value difference between costs and benefits is zero. If the rate of return, expressed as a percentage, is equal to or greater than die discount rate (seven percent), then the investment option is deemed to be "economically feasible."

These benefit/cost results presented in **Tables 1 and 2** indicate some key economic findings:

HSR in California Is Economically Feasible - The full HSR system including extensions to Sacramento and San Diego is feasible.

- Benefit/cost ratios of 1.32 and 1.34 indicate a very feasible HSR undertaking.
- Positive net present values of $3.3 to $5.0 billion indicate a feasible undertaking.
- A constant price level rate of return of 8.6 percent to 8.*8 percent is quite attractive.*

Table 2: Economic Benefit/Cost Results 1996-2050 Life Cycle				
	Basic System LA-SF		Basic System Plus Extensions	
	VHSR	Maglev	VHSR	Maglev
Net Present Value ($ Millions)	($371)	$49	$3,320	$4,922
Internal Rate of Return (%)	6.72%	7.03%	8.64%	8.79%
Benefit/Cost Ratio	0.95	1.00	1.32	1.34

The Basic HSR System (LA-SF) Is Less Feasible - The more limited Los Angeles to San Francisco basic system is only marginal, with benefit/cost ratios of .95 to 1.00. These calculations show quite clearly that the HSR network, including the extensions, is superior to the San Francisco to Los Angeles basic system.

Little Economic Difference Between VHSR and Maglev - Although Maglev will cost about 50 percent more than VHSR, its economic benefits are also about 50 percent higher. Therefore, its feasibility indicators are about equal to those of the VHSR option.

HSR will not only help the traveler that chooses to ride the system; it will also provide benefits for those who choose not to ride it. In summary, there appear to be solid economic reasons for California to pursue HSR. The economy of California will be better off with HSR built than if it is not built.