Economic Growth Effects Analysis for the Bay Area to Central Valley Program-Level Environmental Impact Report and Tier 1 Environmental Impact Statement

final

report

prepared for

California High-Speed Rail Authority

prepared by

Cambridge Systematics, Inc.

with

Economic Development Research Group
Michael Reilly, Ph.D.

July 2007

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1.0 Executive Summary

1.0 Executive Summary

This report presents an analysis of the potential economic development and growth effects for the alternatives considered in the Bay Area to Central Valley Program-Level Environmental Impact Report (EIR) and Tier 1 Environmental Impact Statement (EIS). The intent of the analysis is to understand the extent of statewide, regional, and local growth effects in terms of population and employment change, and land consumption associated with these changes. This report:

- Identifies the potential statewide-, regional-, and county-level employment and population changes associated with each alternative;
- Identifies the urban area size needed to accommodate population and employment growth; and
- Identifies the potential for employment and population concentration in the vicinity of high-speed train (HST) stations.

The report presents results for existing conditions (years 2002 and 2005) and a forecast year of 2030.

1.1 Economic Growth and Development Analysis

The potential economic growth stimulus of a transportation investment may be measured not only in terms of its *overall magnitude*, but also in terms of its *relative distribution* among different geographic areas. In economic terms, this distinction is the "generative" versus "distributive" dimensions of growth. Transportation investments, such as airports, highways, transit, and high-speed train, comprise just one of many factors that determine how much growth will occur, and whether it will be generative versus distributive in nature. Other major growth factors, such as education level, housing affordability, land availability, and others, interact in complex and sometimes unpredictable ways for communities, regions, and entire states. Public and private policy tools, such as land use planning and zoning, enterprise development zones, and infrastructure funding, can also influence both the magnitude and the distribution of economic growth.

The results presented in this report were developed in the Transportation Economic Development Impact System (TREDIS), which combines business attraction and macroeconomic simulation model, together with an employment allocation routine and a residential spatial allocation model. The process considered the effects that changes in travel options transportation congestion and delay between existing conditions and future years would have on the State's economic growth. The process also modeled several dimensions of growth and spatial reallocation that could occur with any of the system alternatives, and considered many possible impacts of high-speed train on jobs, population, and land development, including the following:

- Increased employment because of attraction of new businesses to California, or expansion by businesses already located in the State;
- Reallocation of employment because of changes in business location by firms already located in California;
- Population growth associated with business attraction, expansion, and spatial shift;
- Shift in residential population between counties (with fixed employment location) due to changed accessibility for the HST Alternatives (i.e., long-distance commutes);
- Shift in employment for retail and personal service establishments that follow shifts in residential location;
- Changes in densification and development patterns over time, both with and without the presence of an HST station;
- Allocation of population and employment between currently developed and undeveloped areas within each county; and
- Consumption of undeveloped or "raw" land to house projected population and employment growth.

■ 1.2 Statewide and Regional Growth Effects

Statewide population is expected to grow by about 33 percent between 2005 and 2030 (Table 1.1). Compared to the No-Project Alternative, the population growth is roughly 1.3 to 1.4 percent higher for the HST Alternatives. These population differences between alternatives represent the increased accessibility provided by the transportation investments; hence, an HST investment would lead to greater economic growth within the State than the No-Project Alternative. These statewide figures follow the same general pattern at the regional level, with the exception of the North Central Valley, where population growth is about 2 to 3 percent higher for the HST Alternative than the No-Project Alternative. San Diego County is also project to experience 4 to 5 percent higher population growth with the HST alternatives.

The HST population growth rate represents a statewide increase of 500,000 people over the No-Project Alternative. However, the greatest population increase is between 2005 existing conditions and the 2030 No-Project Alternative, with relatively small increases in population growth occurring between alternatives in the year 2030. Specifically, California is projected to add about 12 million people between 2005 and the 2030 No-Project Alternative. Compared to the No-Project Alternative, the Altamont HST Alternative is projected to add about 495,000 people, while the Pacheco HST Alternative is projected to add about 501,000 people.

Table 1.1 Projected Population Growth Rate by Region

Region	Year 2005 Population	Growth Rate (2005 to 2030)		
		No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative
Alameda County	1,451,065	40.5%	41.4%	41.6%
Contra Costa County	1,017,644	51.6%	52.3%	51.9%
San Francisco County	741,025	7.4%	9.3%	8.1%
San Mateo County	701,175	16.1%	17.1%	17.9%
Santa Clara County	1,705,158	26.3%	28.1%	28.8%
Study Area – Bay Area	5,616,067	30.8%	32.0%	32.2%
Fresno County	878,089	47.8%	49.7%	49.5%
Madera County	142,530	54.2%	61.1%	61.0%
Merced County	242,249	80.8%	86.7%	84.7%
Sacramento County	1,363,423	68.2%	69.1%	69.8%
San Joaquin County	664,796	85.0%	86.7%	88.7%
Stanislaus County	505,492	47.3%	50.0%	55.1%
Study Area – Central Valley	3,796,579	63.9%	66.0%	67.1%
Core Study Area	9,412,646	44.1%	45.7%	46.3%
South Sacramento Valley	658,108	65.7%	66.0%	66.2%
South San Joaquin Valley	1,311,579	51.7%	56.2%	56.1%
Southern California	16,843,742	23.8%	24.6%	24.4%
San Diego County	2,936,609	36.4%	41.2%	40.7%
Rest of California	4,991,463	32.5%	32.6%	32.5%
Statewide Total	**36,154,147**	**33.1%**	**34.5%**	**34.4%**

Source: Cambridge Systematics, Inc., 2007.

Statewide and regional employment growth rates are generally similar to the population growth rates, as shown in Table 1.2. Statewide employment is projected to increase by 37 percent under the No-Project Alternative, with an additional increase of 1.5 percent for the HST Alternative. The HST employment growth rate represents a statewide increase of about 320,000 jobs over the No-Project Alternative, with the Pacheco and Altamont HST Alternatives having nearly identical levels of statewide employment growth. As with population growth, however, this level of difference between the alternatives is very small compared to the overall level of growth represented by the No-Project Alternative relative to the 2005 existing conditions.

Table 1.2 Projected Employment Growth Rate by Region

Region	Year 2005 Employment	Growth Rate (2005 to 2030)		
		No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative
Alameda County	953,937	30.8%	32.0%	31.9%
Contra Costa County	508,854	50.0%	51.2%	50.8%
San Francisco County	779,357	25.2%	26.2%	25.9%
San Mateo County	522,830	37.2%	38.4%	38.5%
Santa Clara County	1,323,920	33.7%	34.8%	34.8%
Study Area – Bay Area	4,088,898	33.9%	35.0%	34.9%
Fresno County	435,769	35.2%	38.2%	38.0%
Madera County	56,892	60.6%	69.0%	69.3%
Merced County	87,365	31.7%	40.1%	38.5%
Sacramento County	805,978	56.3%	57.4%	57.7%
San Joaquin County	274,155	34.5%	37.0%	38.4%
Stanislaus County	224,491	41.1%	44.2%	48.2%
Study Area – Central Valley	1,884,650	45.4%	48.0%	48.7%
Core Study Area	5,973,548	37.5%	39.1%	39.2%
South Sacramento Valley	456,834	59.6%	60.4%	60.7%
South San Joaquin Valley	576,935	40.1%	44.8%	44.6%
Southern California	9,290,841	32.5%	33.8%	33.7%
San Diego County	1,895,002	46.9%	49.3%	49.7%
Rest of California	2,709,974	39.3%	40.1%	39.9%
Statewide Total	**20,903,134**	**36.9%**	**38.4%**	**38.4%**

Source: Cambridge Systematics, Inc., 2007.

These modest statewide differences, however, conceal more substantial differences that are revealed by comparing some key differences at the regional and county levels:[1]

- Compared to the No-Project Alternative, the HST Alternatives exhibit higher employment and population growth rates in all regions and all counties.
- For the Pacheco HST Alternative, Madera and Merced Counties exhibit the largest relative increase in both population and employment, adding about 12,000 jobs and 24,000 people compared to the No-Project Alternative. Population and employment growth are also relatively strong in the other Central Valley locations, with relative employment growth larger than relative population growth.

[1] Regional results for the HST Alternatives are expressed relative to the No-Project Alternative, unless noted otherwise.

- For the Altamont HST Alternative, Madera, Merced, and Stanislaus Counties exhibit the largest relative increase in both population and employment. As with the Pacheco HST Alternative, population and employment growth also are relatively strong in the other Central Valley locations, with relative employment growth larger than relative population growth.

- Model results suggest that the additional population growth in the HST Alternative is driven by internal job growth related to initiation of HST service, rather than population shifts from the Bay Area and Southern California with commensurate long-distance commuting. Model results suggest a stronger propensity for redistribution of population *within* the Central Valley, with long-distance commuters relocating to lower cost and better positioned (for HST service) housing in areas such as Merced and Stanislaus Counties.

- For the rest of California, the HST Alternative exhibits a small, yet positive growth rate for both population and employment.

The HST Alternatives exhibit noticeable differences in the types of jobs that are attracted to different regions. Table 1.3 depicts the percent of growth by major industry group for the increment of jobs that are induced by the two HST alternatives (i.e., job growth above and beyond the No-Project Alternative). The HST Alternative exhibits a tendency to attract a higher proportion of jobs in the services; government; and finance, insurance, and real estate (FIRE) sectors. The strongest employment sectors for the HST Alternatives tend to be the most compatible for location in higher-density settings, such as near potential HST sites.

A variety of HST network, alignment, and station options were also evaluated in the Bay Area to Central Valley study area. Population and employment growth levels across the study area are projected to be similar among all the options. In general, systemwide growth inducement can be expected to change at similar rates to changes in ridership between HST Network Alternatives due to the close correspondence between HST ridership, highway and air congestion reduction, and traveler benefits. At a county and local level, growth inducement effects will be higher if a county has an HST station for a particular network alternative, and will decrease if no HST station is present. Differences are most likely in cases where HST service is split among multiple Bay Area termini or terminate in San Jose (for the Pacheco HST Alternative) or Union City (for the Altamont HST Alternative).

Table 1.3 Percent of Incremental Growth by Industry
Years 2005 to 2030

Incremental Growth Rate for Induced Employment	**Farming and Mining**		**Construction and Manufacturing**		**TCU and Trade**		**FIRE and Services**		**Government**	
	Pacheco HST	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**	**Pacheco HST**	**Altamont HST**
Study Area – Bay Area	0%	0%	6%	5%	28%	29%	62%	63%	3%	3%
Study Area – Central Valley	2%	2%	6%	4%	25%	21%	63%	68%	5%	4%
Subtotal – Core Study Area	*1%*	*1%*	*6%*	*5%*	*27%*	*25%*	*62%*	*66%*	*4%*	*4%*
Southern Sacramento Valley	1%	2%	10%	9%	34%	33%	50%	52%	6%	5%
Southern San Joaquin Valley	5%	5%	4%	4%	20%	19%	66%	67%	4%	4%
Southern California	0%	1%	6%	7%	27%	29%	62%	60%	4%	4%
San Diego	0%	0%	4%	3%	32%	26%	59%	66%	4%	4%
Rest of California	4%	4%	9%	10%	38%	45%	44%	36%	5%	6%
Statewide Total	**1%**	**1%**	**6%**	**5%**	**28%**	**27%**	**61%**	**62%**	**4%**	**4%**

Source: Cambridge Systematics, Inc., 2007.

■ 1.3 Local Growth and Land Consumption

Urbanized areas in the Bay Area and northern Central Valley are expected to grow by 39 percent between 2002 and 2030 under the No-Project Alternative, as shown in Table 1.4. This rate represents an increase of about 392,000 acres from today's 1,001,000 acres within the core study area. Urbanized area growth is expected to be an additional 2 percent (14,500 acres) higher for the Altamont HST Alternative and 1 percent (9,600 acres) higher for the Pacheco HST Alternative. As with the population and employment growth, the level of difference between alternatives for urbanized area size is very small when compared to the overall level of growth represented by the No-Project Alternative relative to the 2000 existing conditions.

Table 1.4 Increase in Urbanized Area Size by Region

Area	Year 2002 Urbanized Area Acreage	Percent Increase (Year 2002 to 2030)		
		No-Project Alternative	Altamont Pass Alternative	Pacheco Pass Alternative
Alameda County	141,654	32%	33%	32%
Contra Costa County	142,467	29%	30%	29%
San Francisco County*	23,277	29%	30%	30%
San Mateo County	70,869	13%	13%	14%
Santa Clara County	184,481	13%	13%	15%
Study Area – Bay Area	562,748	22%	23%	23%
Fresno County	96,977	55%	58%	58%
Madera County	23,255	56%	63%	62%
Merced County	31,712	91%	96%	94%
Sacramento County	157,101	51%	52%	52%
San Joaquin County	74,250	96%	95%	97%
Stanislaus County	55,426	34%	34%	39%
Study Area – Central Valley	438,721	61%	62%	63%
Core Study Area	1,001,469	39%	40%	41%

Source: Cambridge Systematics, Inc., 2007.

* Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Because "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

In general, HST station areas will establish a relatively stronger market for commercial and office development than the No-Project and Modal Alternatives. Research conducted for the Statewide Program EIR/EIS of urban rail systems in North America and the high-speed rail systems in Europe and Asia supports this conclusion. This research found that industries needing large numbers of highly skilled and specialized employees are most attracted to rail station area development, and that a noticeable densification pattern is likely to emerge in the vicinity of many HST stations under regular real estate market forces.

In fact, the research and analysis indicate that the considerably stronger draw of an HST station, when compared to a conventional intercity rail station or freeway interchanges, provides a potent tool for encouraging more compact development patterns. These development patterns would likely offer many businesses a competitive advantage within their industry, because of close proximity to ancillary industries (i.e., industry clustering) and a well-educated labor force. These advantages, known as *economies of agglomeration*, have emerged around the French and Japanese HST stations, and are accepted norms for land use planning for many urban transit station areas in Europe and North America.

The research also found that regulatory-style efforts by cities to encourage increased density and a mix of land uses near rail stations have been effective in creating even denser developments. A Central Valley city, for example, would have an easier time directing new development to downtown sites adjacent to their HST station than the outlying real estate markets created by freeway interchanges under the No-Project Alternative. Furthermore, the strong markets around HST stations are likely to attract development that would otherwise locate throughout a dispersed suburban region. Thus, development around HST stations will consist of both consolidation of currently projected growth (under the No-Project Alternative) and new regional employment and population associated with the HST Alternative.

■ 1.4 Significance of Findings

Overall, the No-Project and HST Network Alternatives represent very similar levels of growth effects in terms of urbanized area size and land consumption needs. The incremental effect of the HST Alternatives relative to the No-Project Alternative is very small when compared to the incremental effect of the No-Project Alternative relative to existing conditions.

Analysis of results for individual counties largely follows these general statewide results. Nonetheless, the HST Alternatives do create some larger incremental growth in some Central Valley locations. However, the incremental employment effect is much larger than the incremental population effect, suggesting that the HST Alternative does a better job at distributing employment throughout the State. Also, this result suggests that HST will not lead to wholesale shifts in residential location from the Bay Area and Los Angeles into the Central Valley.

Experiences in other countries have shown that an HST system can provide a location advantage to those areas that are in proximity to an HST station, while at the same time facilitating broader economic expansion for a much wider geographic region. HST's potential economic boost arises in two ways:

1. An HST system would provide user benefits (travel time savings, cost reductions, accident reductions) and accessibility improvements for California's citizens; these user benefits can accrue not only to HST travelers, but also to travelers on other modes as trips are diverted from highways and airports resulting in reduced congestion.

2. HST would improve accessibility to labor and customer markets, thereby, improving the competitiveness of the State's industries and the overall economy. With this second effect, businesses that locate in close proximity to an HST station can operate more efficiently than businesses that locate elsewhere. Experience from overseas suggests that this competitive advantage is quite pronounced in high-wage employment sectors that are frequently in high demand in many communities. This second effect is much stronger for the HST Alternatives than the No-Project Alternative.

One of the most telling summary statistics is to combine population and employment growth projections with land consumption forecasts, providing a measure of "land consumed per new job and resident." Essentially, this metric tells us how efficient each alternative is at accommodating the projected growth; since the alternatives have very similar levels of overall growth, the efficiency by which that growth is accommodated becomes very important. Table 1.5 provides the relevant data and resulting metric for each of the alternatives; lower values of the metric suggest greater efficiency. The results indicate that the Pacheco HST Alternative is the most efficient of the alternatives, providing an incremental development density that is 1.3 percent more efficient (i.e., less land per new job and resident) than the No-Project Alternative, while the Altamont Alternative is 0.8 percent more efficient than the No-Project Alternative. The efficiency gains for both HST alternatives are achieved in conjunction with the higher population and employment growth projections compared to the No-Project Alternative.

Table 1.5 Marginal Land Consumption

	No-Project Alternative	**Pacheco HST Alternative**	**Altamont HST Alternative**
Land Consumption (thousands of ac)	392	402	407
Job Growth (thousands of jobs)	2,241	2,337	2,343
Population Growth (thousands of people)	4,155	4,304	4,354
Acres Consumed Per New Job and Resident*	***0.0613***	***0.0605***	***0.0608***
Efficiency Gain/Loss Relative to No-Project Alternative	–	+1.3%	+0.8%

Source: Cambridge Systematics, Inc., 2007.

*Value found by dividing land consumption by the sum of job growth and population growth.

1.5 Conclusions

All alternatives are associated with robust forecasts of population and employment growth throughout California. The alternatives are similar in terms of potential economic growth effects and land consumption. The major growth effect occurs for the No-Project Alternative in relation to existing conditions, with population and employment growth rates between 30 percent and 90 percent for nearly all counties.

The major difference between the system alternatives relates to the relative level of employment and population growth in different regions of the State. However, these relative differences are small, with a maximum county-level growth rate for the HST Alternatives (relative to the No-Project) of eight percent, and most counties having a differential growth rate of less than three percent.

In spite of these general findings, HST does provide synergistic opportunities to combine with regulatory-based development strategies that could limit land consumption in many counties to roughly the level needed for the other No-Project Alternative. While the HST Alternative leads to modest statewide increases in employment and population, it channels this growth into the areas where it can be managed with regulatory-style land use policies, and spares the vast regions of the State that would otherwise be unlikely to develop the jobs/housing balance and infrastructure to reduce sprawl and long-distance commuting.

2.0 Baseline/Affected Environment

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2.1 Employment and Population Patterns

Over the last 30 years, California's population has grown from 20 million to over 36 million residents, while at the same time adding over 11 million jobs. Starting with the Gold Rush in 1849, California has continuously experienced rapid population and economic growth. Distance from eastern urban areas, an abundance of natural resources, a desirable climate, and numerous other factors have contributed to California's growth into the largest state in the nation.

Though California's economy is one of the most diverse in the world, as shown by the data in Table 2.1, over the last 30 years, its service sector has become the major economic motor increasing its participation over total employment from 21 to 36 percent during that period, while manufacturing and the government sectors decreased their participation from 18 to 9 percent and from 20 to 13 percent, respectively.

Table 2.1 California Employment Growth by Industry

Industry	Employment (1,000s)		Growth	Industry Share	
	1970	2005		1970	2005
Farming	360	628	74%	4%	3%
Mining, Construction	401	1,093	173%	4%	5%
Manufacturing	1,595	1,835	15%	18%	9%
Transportation, Communications and Utilities (TCU)	486	915	88%	5%	4%
Trade	1,801	4,159	131%	20%	20%
Finance, Insurance and Real Estate (FIRE)	724	1,929	166%	8%	9%
Services	1,865	7,568	306%	21%	36%
Government	1,825	2,778	52%	20%	13%
Total	**9,057**	**20,903**	**131%**	**100%**	**100%**

Source: Cambridge Systematics, Inc., 2007.

Year 2005 employment data by industrial sector and region are shown in Table 2.2. These data indicate the diversity in employment mix between different subregions within California. California's Central Valley is one of the most productive agriculture regions, making California the number one agricultural state for the last 50 years. Nearly one-third of all employment in the Central Valley is in agricultural-related enterprises, with nearly one-fifth of total employment in the South Central Valley directly in the farming industry. The Central Valley also exceeds the state average in government jobs, while trailing other regions in manufacturing and service-related employment.

The Bay Area has long been a source of finance and high technology. Gold Rush era financiers were headquartered in San Francisco, and much of the wealth generated during that period made its way through San Francisco's financial center. The Bay Area continues to be a financial center and was one of the major locations for the Internet boom of the late 1990s. Silicon Valley has one of the largest concentrations of computer manufacturers and research and development firms in the country. Currently, the Bay Area continues to lead the State in the percent of total jobs in service-related sectors, while trailing other regions in government-related employment.

Los Angeles is the second largest metropolitan area in the U.S., behind New York. Home to over 15 million residents, the Southern California region, which includes Los Angeles, Orange, and San Bernardino Counties, has developed from an agricultural and resort-based economy to a diverse economy, including the major location for the motion picture industry, defense contracting, and services.

Overall, California's economy like the nation's has become less focused on production of goods and more focused on services, entertainment, and trade. These trends hold when one looks beyond employment numbers to the contribution of different industry groups to the overall size of the economy, as shown in Table 2.3. Three service sector industries – business, social, and legal – are among the 10 fastest growing industries in California, with business services' contribution to gross state product (GSP) growing by 1,400 percent since 1977. The overall services sector grew by over 400 percent in real terms. The services and FIRE sectors accounted for nearly one-half of the growth in GSP since 1977, with the combined contribution of these groups growing from 31 to 55 percent of the total economy in California.

As of 2005, California was estimated to have about 36 million residents and nearly 21 million jobs. Table 2.4 displays county-level population and employment totals for the individual counties and county groupings that were included in one of the analysis regions. This table also displays an estimate of current urbanization magnitudes in each county for 2002. As expected, the inner Bay Area Counties, Sacramento County, as well as Southern California have the highest current levels of urbanization, with most other counties in the State having less than 10 percent of land at urbanized densities. All of these values serve as baseline estimates for the analysis of economic growth effects.

Table 2.2 Year 2005 Employment by Industrial Group

	Study Area – Bay Area	% of Regional Total	Study Area – Central Valley	% of Regional Total	Southern Sacramento Valley	% of Regional Total	Southern San Joaquin Valley	% of Regional Total	Southern California	% of Regional Total	San Diego	% of Regional Total	Rest of California	% of Regional Total	Statewide Total	% of Regional Total
Farming	52,986	1%	153,017	8%	23,496	5%	112,116	19%	134,414	1%	41,123	2%	110,438	4%	**627,589**	**3%**
Mining	3,749	0%	1,214	0%	672	0%	10,023	2%	10,066	0%	1,158	0%	4,406	0%	**31,288**	**0%**
Construction	200,188	5%	110,494	6%	35,876	8%	25,670	4%	445,411	5%	101,481	5%	142,577	5%	**1,061,697**	**5%**
Manufacturing	414,079	10%	127,765	7%	25,702	6%	27,893	5%	891,553	10%	122,773	6%	225,106	8%	**1,834,872**	**9%**
TCU	190,166	5%	75,965	4%	18,525	4%	25,136	4%	433,885	5%	60,648	3%	110,200	4%	**914,524**	**4%**
Wholesale	179,813	4%	67,563	4%	16,841	4%	16,446	3%	507,724	5%	66,127	3%	117,540	4%	**972,053**	**5%**
Retail	579,787	14%	297,432	16%	79,839	17%	82,911	14%	1,439,244	15%	285,675	15%	421,947	16%	**3,186,834**	**15%**
FIRE	394,036	10%	149,453	8%	42,296	9%	30,336	5%	893,749	10%	172,543	9%	246,424	9%	**1,928,837**	**9%**
Services	1,630,699	40%	550,584	29%	137,730	30%	135,745	24%	3,467,334	37%	684,891	36%	960,561	35%	**7,567,544**	**36%**
Government	443,395	11%	351,163	19%	75,858	17%	110,659	19%	1,067,460	11%	358,582	19%	370,778	14%	**2,777,895**	**13%**
Total	**4,088,898**	**100%**	**1,884,650**	**100%**	**456,834**	**100%**	**576,935**	**100%**	**9,290,841**	**100%**	**1,895,002**	**100%**	**2,709,974**	**100%**	**20,903,134**	**100%**

Source: Cambridge Systematics, Inc., 2007.

Table 2.3 California Gross State Product by Major Industries

Industry	Gross State Product (2005 Million Dollars)		Growth
	1977	2005	
Farming	14,897	17,773	19%
Mining	6,814	7,441	9%
Construction	25,542	58,768	130%
Manufacturing	93,380	120,744	29%
Transportation & utilities	41,065	48,008	17%
Wholesale trade	37,236	71,109	91%
Retail trade	54,708	87,517	60%
FIRE	89,323	292,279	227%
Services	80,983	405,608	401%
Government	77,216	137,096	78%
Total	**521,163**	**1,246,343**	**139%**

Source: U.S. Bureau of Economic Analysis.

Table 2.4 Year 2005 Population, Employment, and Urbanized Densities

County	Year 2005		Year 2002	
	Population	Employment	Acreage of Land at Urbanized Densities for Employment and/or Population	Percent of Land Area at Urbanized Densities
Alameda County	1,451,065	953,937	141,654	30
Contra Costa County	1,017,644	508,854	142,467	31%
San Francisco County	741,025	779,357	23,277	78%
San Mateo County	701,175	522,830	70,869	25%
Santa Clara County	1,705,158	1,323,920	184,481	22%
Study Area – Bay Area	***5,616,067***	***4,088,898***	***562,748***	***29%***
Fresno County	878,089	435,769	96,977	3%
Madera County	142,530	56,892	23,255	2%
Merced County	242,249	87,365	31,712	3%
Sacramento County	1,363,423	805,978	157,101	25%
San Joaquin County	664,796	274,155	74,250	8%
Stanislaus County	505,492	224,491	55,426	6%
Study Area – Central Valley	***3,796,579***	***1,884,650***	***438,721***	***12%***
Core Study Area Counties	**9,412,646**	**5,973,548**	**1,001,469**	**22%**
Southern Sacramento Valley	658,108	456,834	116,980	4%
Southern San Joaquin Valley	1,311,579	576,935	189,603	2%
Southern California	16,843,742	9,290,841	1,530,221	25%
San Diego County	2,936,609	1,895,002	340,837	13%
Rest of California	4,991,463	2,709,974	3,105,348	6%
Statewide Total	**36,154,147**	**20,903,134**	**6,284,458**	**6%**

2.2 Alternatives Considered

This economic growth analysis considered the three system alternatives developed for the Bay Area to Central Valley Program-Level Environmental Impact Report (EIR) and Tier 1 Environmental Impact Statement (EIS). These system alternatives included No-Project, and two High-Speed Train (HST) Network Alternatives. The physical features of each alternative were followed in preparing the growth analysis. Therefore, the following descriptions of the three alternatives focus on the characteristics that most influence the growth analysis, including key assumptions regarding operational features. Transportation demand results for each system alternative were derived using high end cost assumptions in the MTC Statewide High-Speed Rail Travel Demand Model.

2.2.1 No-Project Alternative

The No-Project Alternative represents the State's transportation system (highway, air, and conventional rail) as it is today and with implementation of programs or projects that are in regional transportation plans and have identified funds for implementation by 2030. This alternative is depicted in Figure 2.1. Chapter 2 of the Program-Level EIR/EIS describes general physical features of the No-Project Alternative in the year 2030.

2.2.2 Altamont and Pacheco HST Alternatives

The Authority has defined a proposed statewide high-speed train system capable of speeds in excess of 200 miles per hour on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems. Steel-wheel on steel rail technology will be considered for the system that would serve the major metropolitan centers of California (extending from Sacramento and the San Francisco Bay Area through the Central Valley, to Los Angeles and San Diego). A specific system of corridors was defined and considered to establish the ridership forecasts. These corridors reflect the Authority's adoption of certain alignment and station preferences following completion of the Statewide Program EIR/EIS. This current analysis is focused on the portion of the statewide system between the Bay Area and Central Valley, with multiple alignment and station options available for Altamont Pass and Pacheco Pass alternatives. These HST alignment and station options are depicted in Figure 2.2.

Quantitative analysis of induced growth and secondary impacts was performed on one HST network alternative each for the Altamont Pass and Pacheco Pass. For both HST alternatives, quantitative modeling was performed using the alignments for the San Francisco and San Jose termini (Network Alternatives A1 and P1[1]) since prior studies conducted by the HSRA suggested that these termini are likely to produce the highest system ridership, and hence the highest potential for induced growth and secondary impacts. Within the core study area, the following HST stations were included in the network alternatives used for quantitative modeling:

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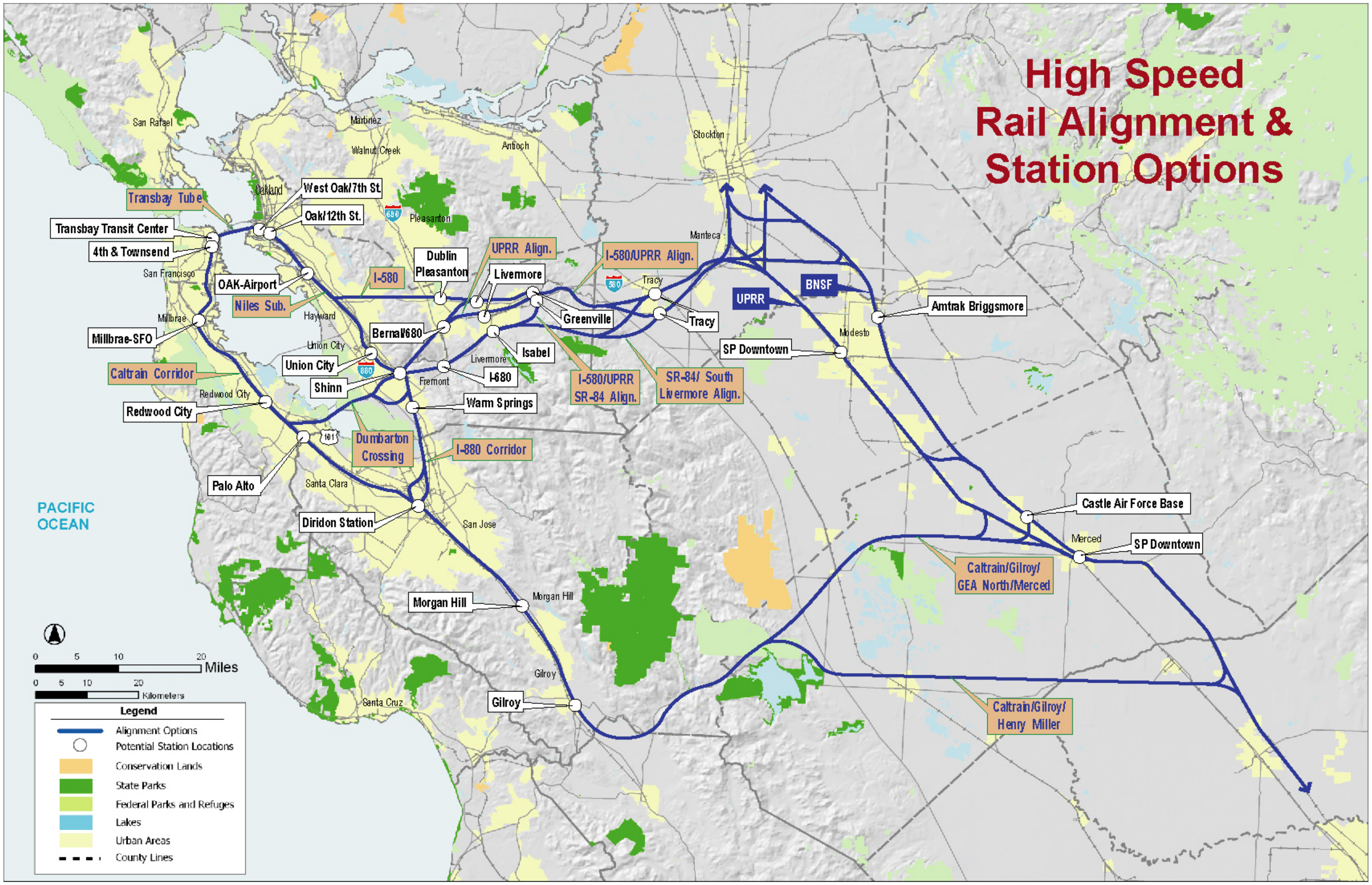
[1] Bay Area to Central Valley Program Level EIR and Tier 1 EIS, Chapter 2, Table 2.5-1.

Figure 2.1 No-Project Alternative – California Transportation System

Figure 2.2 Altamont and Pacheco HST Alternatives



- **Pacheco Pass.** Transbay Transit Center; Millbrae-SFO; Redwood City; San Jose (Diridon Station); Morgan Hill; Gilroy; Merced (SP Downtown); and Modesto (Amtrak Briggsmore).
- **Altamont Pass.** Transbay Transit Center, Millbrae-SFO, Redwood City, Fremont (Warm Springs), San Jose (Diridon Station), Pleasanton (I-680/Bernal Road), Tracy (SP), Modesto (SP Downtown), and Merced (SP Downtown).

2.2.3 Service Phasing

Economic growth effects in any given year are sensitive to the length of time over which changes in economic conditions are assumed to occur. In terms of this analysis, the number of jobs or people that will be generated in an area in 2030 is sensitive to the year in which HST service or some other transportation service is assumed to first be available to that area. For both HST Alternatives, HST service along a trunk line between the Bay Area and LAUS was assumed to begin on January 1, 2016. Service to Irvine, San Diego and Sacramento was assumed to begin on January 1, 2019 for all alignment options.

3.0 Evaluation Methodology

3.0 Evaluation Methodology

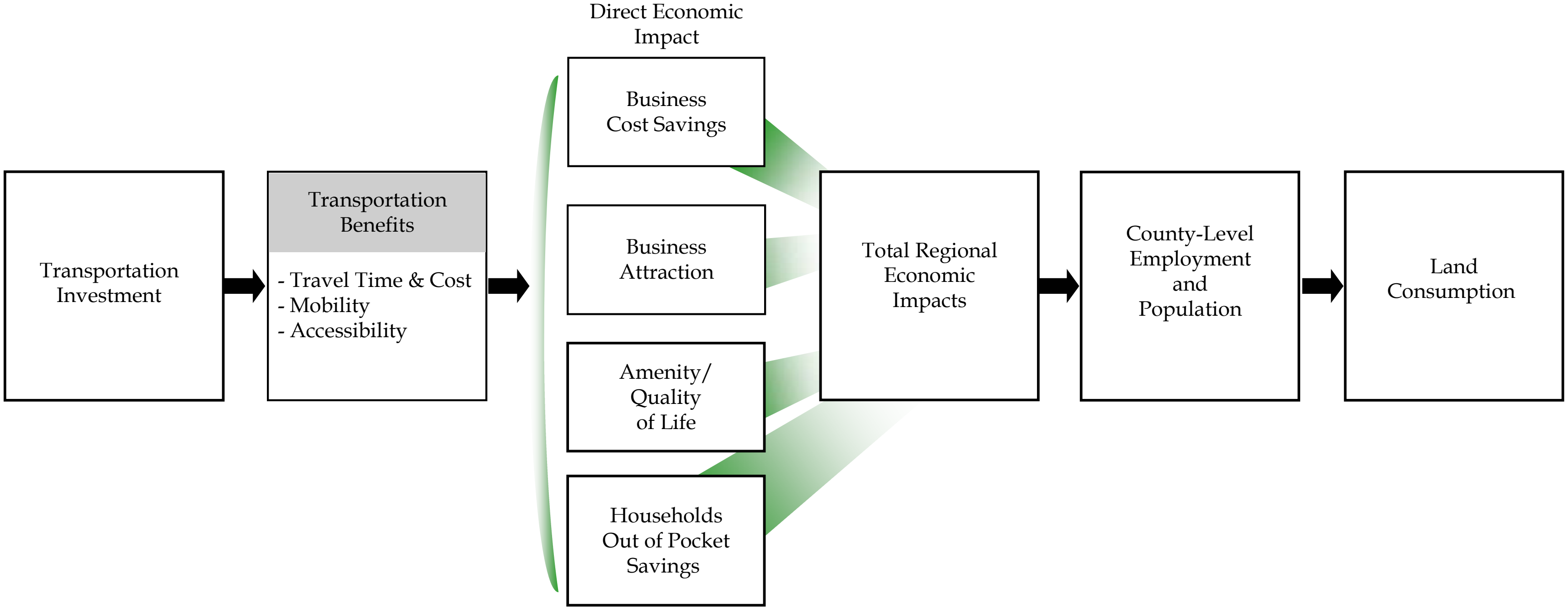
■ 3.1 Overview of Methodology

The analytical process to estimate the economic growth effects of the system alternatives requires significant modeling tools and data. Nonetheless, the entire process, which is depicted in Figure 3.1, can be summarized by a few key steps:

- **Define transportation investments –** This analysis considers the two HST alternatives described in Section 2.0. Within this analysis, the future baseline conditions are assumed to represent the No-Project Alternative, and the economic modeling process is used to forecast the incremental changes of the Altamont and Pacheco HST Network Alternatives.
- **Estimate transportation benefits –** Using results from the HSRA's intercity travel demand model, estimate benefits such as reduced travel times and/or costs of each system alternative for air, highway, or conventional rail trips. The quantification of travel time, cost, accessibility, and societal (pollution or accident reduction) benefits reflects the mobility enhancement provided through improved system performance of non-HST modes, as well as the additional travel option of the HST Alternatives.
- **Estimate direct economic impacts –** Direct economic impacts, which are generated from the transportation benefits of each alternative, generally fall into one of four categories:

  1. Business cost savings – Reductions in travel time and/or cost for long-distance business travelers and commuters benefiting from the transportation improvements;
  2. Business attraction effects – New and relocated firms taking advantage of market accessibility improvements provided through transportation investments;
  3. Amenity (quality of life) changes – Non-business travel time and other societal benefits improve the attractiveness of a region; and
  4. Household out-of-pocket savings – Better modal alternatives and improved levels of service lower household expenditures on fares, vehicles, fuel, and maintenance.

Figure 3.1 Evaluation Methodology



- **Determine total regional economic impacts –** Many of the direct economic impacts have the potential to create additional multiplier effects on the regional and statewide economies of California. Total regional impacts were estimated using the TREDIS framework, which includes a model of California's economy[1] and a business attraction model (BAM) that adjusts for market access change. For this analysis, total economic impacts include population and industry-specific employment, with impacts forecasted for the 11 counties in the core study area and the remaining five multicounty regions.

- **Estimate land consumption –** County-level population and employment were allocated throughout each county to determine the infill potential and magnitude of currently undeveloped land needed to accommodate growth for each alternative. This analysis was driven by three key pieces of information:

    1. Local land use, zoning, and employment data;
    2. National and international experience with station-area development trends related to HST and fixed guideway transit; and
    3. County-level industry employment and population estimates.

The remainder of Section 3.0 is divided into two parts that focus on statewide and regional growth effects (i.e., population and employment estimates); and local and station area growth effects (i.e., land consumption).

3.2 Statewide and Regional Growth Effects

3.2.1 Evaluation Elements

This section is organized into three parts. The first part describes the development of population and employment forecasts to represent the No-Project Alternative to use as input to the economic modeling process. The second part summarizes the concepts that underlie how transportation improvements lead to economic benefits for the Altamont and Pacheco HST Alternatives. The third part describes how travel time, cost, and accessibility changes lead to the four categories of direct economic benefits and, ultimately, to total economic benefits.

[1] Transportation and Economic Development Impact System (TREDIS) is an integrated framework that combines a businesses attraction model and an economic model for the California economy and subregions. The economic model combines input-output, cost/response, and trend-forecasting elements.

Base Forecasts for Population and Employment

The growth effects analysis requires forecasts of future population and employment for analysis year 2030. As noted previously, this forecast represents the No-Project Alternative for the analysis year, and is also used as an economic modeling input to estimate incremental population and employment changes of the other system alternatives. Given the products required from this analysis, it was necessary to develop county-level population and employment forecasts for 2030, with employment broken out by one-digit Standard Industrial Classification (SIC) codes. Baseline population forecasts for each county were taken from the California Department of Finance. Baseline employment forecasts were taken from the California Statewide High-Speed Rail Travel Demand Model, and aggregated to the county level. Table 3.1 shows population and employment forecasts.

Table 3.1 Population and Employment Forecasts for the No-Project Alternative

County	2005		2030	
	Population	**Employment**	**Population**	**Employment**
Alameda County	1,451,065	953,937	2,038,482	1,247,413
Contra Costa County	1,017,644	508,854	1,543,053	763,445
San Francisco County	741,025	779,357	796,208	975,823
San Mateo County	701,175	522,830	814,065	717,526
Santa Clara County	1,705,158	1,323,920	2,152,963	1,769,498
Study Area – Bay Area	5,616,067	4,088,898	7,344,771	5,473,705
Fresno County	878,089	435,769	1,297,476	589,226
Madera County	142,530	56,892	219,832	91,364
Merced County	242,249	87,365	437,880	115,054
Sacramento County	1,363,423	805,978	2,293,028	1,259,792
San Joaquin County	664,796	274,155	1,229,757	368,745
Stanislaus County	505,492	224,491	744,599	316,686
Study Area – Central Valley	3,796,579	1,884,650	6,222,572	2,740,867
North Central Valley*	9,412,646	5,973,548	13,567,343	8,214,572
Southern Sacramento Valley	658,108	456,834	1,090,299	729,293
Southern San Joaquin Valley	1,311,579	576,935	1,989,111	808,196
Southern California	16,843,742	9,290,841	20,844,795	12,308,179
San Diego County	2,936,609	1,895,002	4,005,624	2,783,258
Rest of California	4,991,463	2,709,974	6,613,499	3,774,366
Statewide Total	**36,154,147**	**20,903,134**	**48,110,671**	**28,617,864**

Source: Cambridge Systematics, Inc., 2003.

Benefits of Transportation Improvements for the HST Alternatives

Economic analyses of transportation investments necessarily begin with a clear conceptual estimate of changes to transportation demand and service levels (i.e., travel times and costs) over time and between alternatives. These demand and service level changes lead to different types of economic benefits. The primary benefits that were considered in this analysis include the following:

- **Mode shift benefits (travel time and cost savings, induced trips) –** Benefits for users of the HST system were estimated separately by trip purpose for intercity and intraregional trips. The benefits essentially compare the out-of-pocket travel costs, travel times, and special features by mode, as well as travelers' inherent modal preferences to discern the benefits of transportation improvements[2]. These benefits are quantified through a process known as a log sum calculation. This process closely follows procedures employed on earlier HST studies.[3] The computation methodology is described in more detail in Appendix A.

  Travel efficiency benefits are also generated by induced trips.[4] Since these new travelers were previously content not to travel, the average user benefit for induced trips is less than for those who switch mode from air, highway, or conventional rail to HST. Using consumer surplus theory, the average benefit for induced travel is one-half the benefit for a similar county-to-county trip for a mode switcher. Estimation of induced trips uses a weighted average of switchers from automobile and air, based on the proportion of induced trips using each of these modes.

- **Congestion reduction benefits (auto and air delay savings, air operating cost savings) –** To the extent that HST diverts traffic from highways and airports to HST, it frees up highway and airport capacity, and leads to travel efficiency benefits in the form of reduced travel times. The potential for reduced highway delay was forecasted directly in the MTC Statewide High-Speed Rail Travel Demand Model. Diversion of

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[2] As an example, an HST trip between San Francisco and Los Angeles may take slightly more time than traveling by air, but be less expensive enough to make HST an attractive option. Conversely, when compared to an auto trip on the highway, HST is likely more expensive, but typically reduces travel times between cities in California. In addition, some travelers value the productivity (e.g., ability to read, work on a computer, use a cell phone); comfort (e.g., eat, meet people, travel in comfort); and/or safety (e.g., avoid accidents or the fear of accidents) provided by HST on top of pure travel time and cost considerations. Finally, the calculation estimates the benefit that travelers receive by having an additional travel option from which to choose.

[3] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix C, Charles River Associates, January 2000. *Economic Impact and Benefit/Cost of High-Speed Rail for California*, Final Report, Economics Research Associates, September 1996. *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

[4] Induced trips are generated by the enhanced mobility option provided by HST, whereby, travel that normally would not occur will now be made due to the presence of HST.

trips from air to HST was assumed to lead to a reduction in in-state flights, thereby, decreasing delay at California airports for remaining flight operations. These air delay reductions would provide benefits to travelers and the airline industry due to reduced aircraft operating delays.

Further details on these procedures are provided in Appendix B.

- **Market accessibility benefits (labor, customer, buyer, and supplier) –** Beyond pure travel efficiency benefits, HST may also generate additional economic activity due to better access to labor, supplier, and consumer markets. Simply, if a region gains new or better access to these factors of production (and consumption), then the increased productivity may induce existing firms to expand, or outside firms may be attracted to the area. As such, improvements in accessibility interact with *local economic characteristics*, including land and labor costs and workforce characteristics, to determine the overall level of economic benefit associated with improved transportation networks. The business attraction analysis uses specific measures of accessibility to estimate the magnitude of these impacts. Accessibility is measured not based on the number of trips, but rather by the increased reach to population, employment centers, and other attractions (e.g., airports) afforded through improved travel times and lower costs. Access to consumer markets, for example, is defined as the number of people that can be reached within 60 minutes, while the threshold for producer markets is 90 minutes. The entire market accessibility and business attraction process is described in Appendix C.

- **Societal benefits (accidents, air quality) –** Any auto travel reductions for the HST Alternative could lead to secondary societal benefits, including reduced highway air pollution and reduced highway crash costs. These benefits were estimated by multiplying projected reductions in highway vehicle-miles traveled (VMT) by estimates of the marginal societal cost of auto crashes and air pollution. This analysis relied on marginal costs that were assumed in previous HST studies,[5] including $0.07 per VMT (2005 dollars) for auto crashes and $0.009 per VMT (2005 dollars) for pollution.

Transportation benefits were forecasted largely through application of the MTC Statewide High-Speed Rail Travel Demand Model, as indicated in Appendices A through C. Quantitative analysis of induced growth was performed on specific HST Network Alternatives for the Altamont Pass and the Pacheco Pass.

The potential induced growth effects of other alignment and station options were assessed qualitatively by comparing travel demand model results, reviewing comparable results from the Final Statewide Program EIR/EIS[6], and professional experience.

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[5] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix C, Charles River Associates, January 2000.

[6] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, California High-Speed Rail Authority, July 2003.

Direct Economic Effects

Each of the benefits described above enters one of four input variables in the TREDIS framework as described below and depicted in Figure 3.2:

1. **Production cost savings by industry –** Dollar value of cost savings due to improved HST, air, and highway travel;

2. **Business attraction benefits by industry –** Number of new employees by industry, phased in over 10 years;

3. **Household out-of-pocket savings** – Dollar amount saved by households from lower fares, less fuel consumption, and reduced accidents; and

4. **Amenity changes by region –** Dollar value of societal benefits that increase the livability and attractiveness of California regions.

The direct benefits described above were estimated for each HST alignment scenario as compared to the No-Project Alternative. The TREDIS model was then used to estimate total impacts. Results reflect analysis year 2030 and are shown in detail in Appendix D.

Production Cost Savings

The business trip portion of the travel efficiency benefits leads to production cost savings in terms of increased competitiveness, increased profitability, and the expansion of firms already located in California. Production cost savings can be thought of as a *first-order*, or *direct* economic effect, as these benefits accrue directly to California firms simply by using a more efficient means of travel.[7] Note that for businesses, both travel time savings and other cost savings (on such things as fares, fuel, and maintenance) lead to lower production costs.

Production cost savings in this analysis arise from four sources:

1. Mode shift benefits for business travelers and commuters, both intercity and intraregional;

2. Air and highway congestion savings for business travelers;

3. Accident reductions for business travelers; and

4. Aircraft operation cost savings, which accrue only to the air transportation industry.

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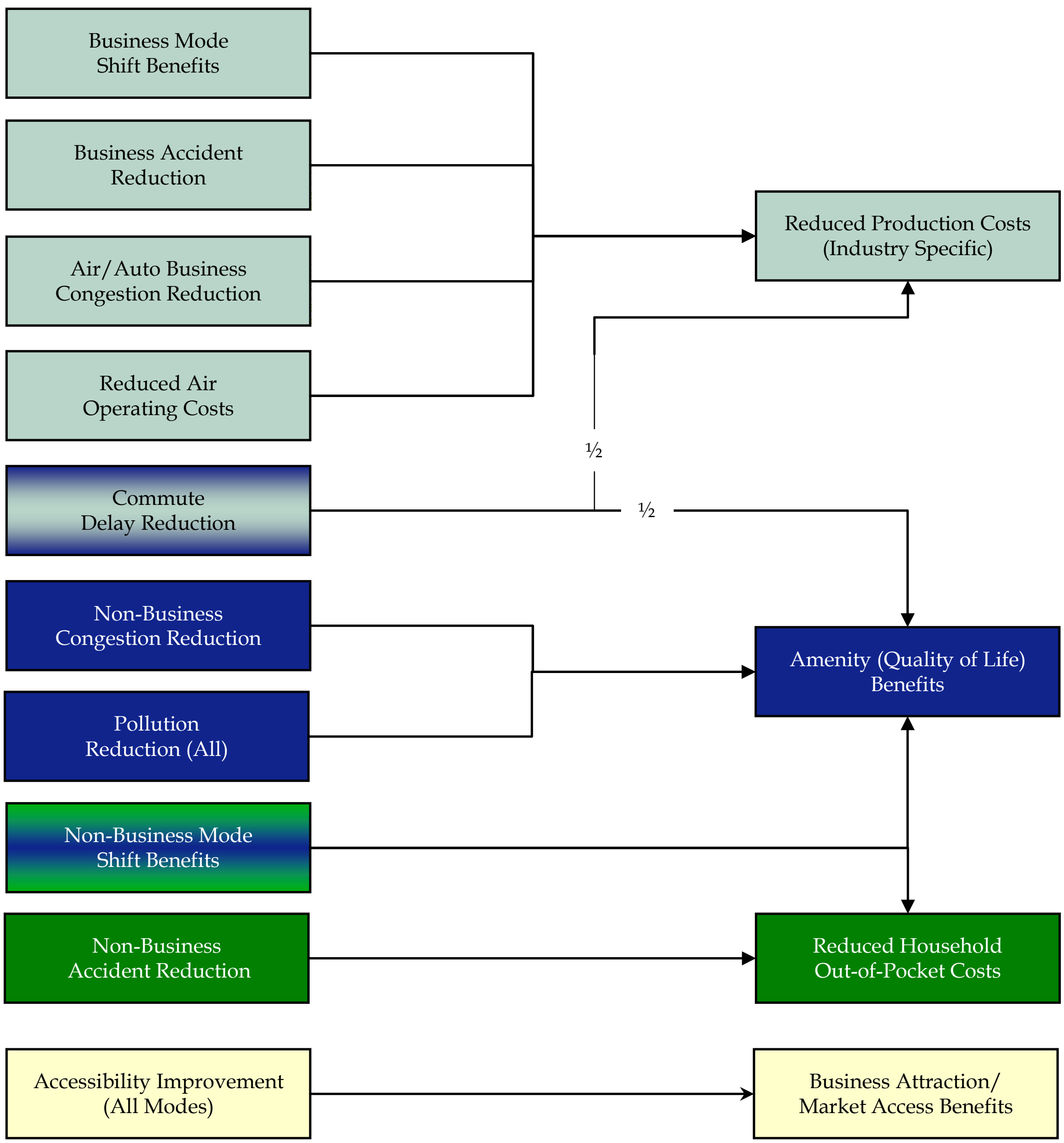
[7] It is important to distinguish between the technical definition of productivity in economics and the use of the term in this context. The *mobility option* of working while one travels does not change the underlying mix of labor and capital that businesses use to produce a unit of goods or services. This mix of production factors (which also includes energy) determines a business' productivity.

Figure 3.2 How Benefits Accrue to TREDIS Inputs



Though all of the HST user benefits estimated for business travelers are considered production cost savings in TREDIS, only one-half of the commute benefit is treated as production cost savings. The remainder is treated as a time savings to households, and therefore accrues to the amenity input category. This assumption is consistent with the urban planning literature and economic research.

For intercity travel, the production cost savings were allocated one-half to origin counties and one-half to destination counties. The savings are then allocated to industries within each region to perform the economic impact analysis[8]. The allocation of cost savings to industries is based on the following key factors:

- Industry size – Employment and output by region and industry; and
- Transportation usage by mode by industry from the Transportation Satellite Accounts[9].

Business Attraction

A potential also exists for firms to change their location and expansion decisions based upon improved accessibility afforded by the HST Alternatives. These business attraction effects include the siting of new activities that would otherwise be located outside the HST regions, either elsewhere in California or elsewhere in the U.S. These business attraction effects are driven by improvements in accessibility to customers, workers, and international airports. These improvements have the effect of expanding the effective market areas of HST regions, reducing costs associated with accessing non-local markets, or reducing costs and improving quality of available inputs. These improvements are key factors in shaping business growth in an area. A business attraction model (see Appendix C) was applied to capture how incremental improvements in market access and cost interact with the existing local economic base and characteristics to generate new employment in the HST regions.

Quality of Life/Amenity

Several transportation benefits do not directly affect business competitiveness, but still provide meaningful, quantifiable benefits that affect the quality of life and attractiveness of the State. This analysis incorporated the following four categories of benefits into an "amenity" component for economic modeling purposes:

[8] The TREDIS model of California's economy has 55 industrial sectors (most at 3-digit NAICS).

[9] The most up-to-date Transportation Satellite Accounts were used in this study. They are jointly produced by the U.S. Bureau of Transportation Statistics and the U.S. Bureau of Economic Analysis.

1. The time component of mode shift benefits for non-business travelers, both intercity and intraregional;

2. Air and highway congestion savings for non-business travelers;

3. Commuter highway congestion reductions (portion not accruing to production cost savings); and

4. Air pollution reductions from changes in highway VMT.

The first category of benefits is a composite of travel time and cost savings. It was separated into value-of-time and out-of-pocket components based on average incomes in each region. Only the value-of-time component was included in the amenity variable.

The amenity variable captures personal time and quality of life benefits that are perceived by local residents to have a value, although they do not directly affect the flow of dollars in the economy. As such, increases in a regional amenity may yield a greater quality of life, thereby, attracting more residents and increasing property values. In this analysis of growth effects for the Bay Area to Central Valley Program EIR/EIS, the amenity variable is included in the analysis of population and employment impacts to provide an upper limit of land use impacts for each HST alternative. As with production cost savings, the amenity benefits are allocated one-half to origin counties and one-half to destination counties.

Household Out-of-Pocket Savings

Finally, transportation improvements affect household spending patterns. In particular, savings in fares, fuel, maintenance, and vehicles frees up more disposable income for households, which may then be spent on other goods and services. This distinction between household out-of-pocket benefits and amenity benefits is important. While both benefits accrue to households, the out-of-pocket savings benefit local businesses through increased consumer spending; whereas, the amenity benefits have no direct economic link to local businesses. This analysis recognizes two sources of household out-of-pocket savings:

1. The cost component of mode shift for non-business travelers, both intercity and intraregional; and

2. Non-business accident reduction.

The first category includes the portion of mode shift benefits not allocated to the amenity input category.

Public Financing Effects of the Modal Alternative

In any analysis of proposed public investments, it is important to consider the potential sources of public financing and how they may affect future public revenue needs (i.e., government expenditures) and consumer spending. The HST Network Alternative is projected to have significant capital costs in excess of the costs needed to fund the No-Project Alternative. For the purposes of this analysis, it was assumed that the total cost of the HST Network Alternative would be funded through revenue sources that would not require direct tax increases or significant diversion of general fund revenues. Examples of these revenue sources include general obligation bonds[10]; Federal grants or loans; private sector participation; local funds (from existing sources); and existing state transportation revenue sources (e.g., gas tax, sales tax on gas). The net effect of this assumption is that the induced growth and secondary impacts presented in this section are in no way influenced by whatever financing plan is eventually established for a potential HST system.

3.2.2 Evaluation Process

Total Regional Economic Impacts

The various direct economic effects are used as inputs to the TREDIS framework. The economic model used in this study is a 16-region model composing the State of California, with 55 industry-sector detail – similar to models used throughout the State and in earlier versions of the HST study. Each regional model contains information about industry production, employment, trade, and household consumption, as well as about how industries respond to changes in transportation costs. Total effects are calculated based on the interconnected response of a region's entire economy to a direct economic "shock." While the TREDIS model provides a number of industry-specific results, the present study focuses on employment by industry as its primary result. Population impacts were then estimated for each region based on the employment results, amenity effects, accessibility impacts, and other region-specific variables.

Economic Analysis Regions

California's 58 counties were grouped into 16 regions for the economic analysis in order to reflect the presence of components of the HST Alternatives in a county, while providing detail within the primary study area for the Bay Area to Central Valley Program-Level EIR/EIS. The regions also reflect the economic interdependence among some counties and relate to widely recognized geographic regions in California. The five counties that comprise the core study area within the Bay Area (Alameda, Contra Costa, San Francisco, San Mateo, and Santa Clara) were kept as separate economic modeling regions in order to better simulate the population and employment growth effects for each system alterna-

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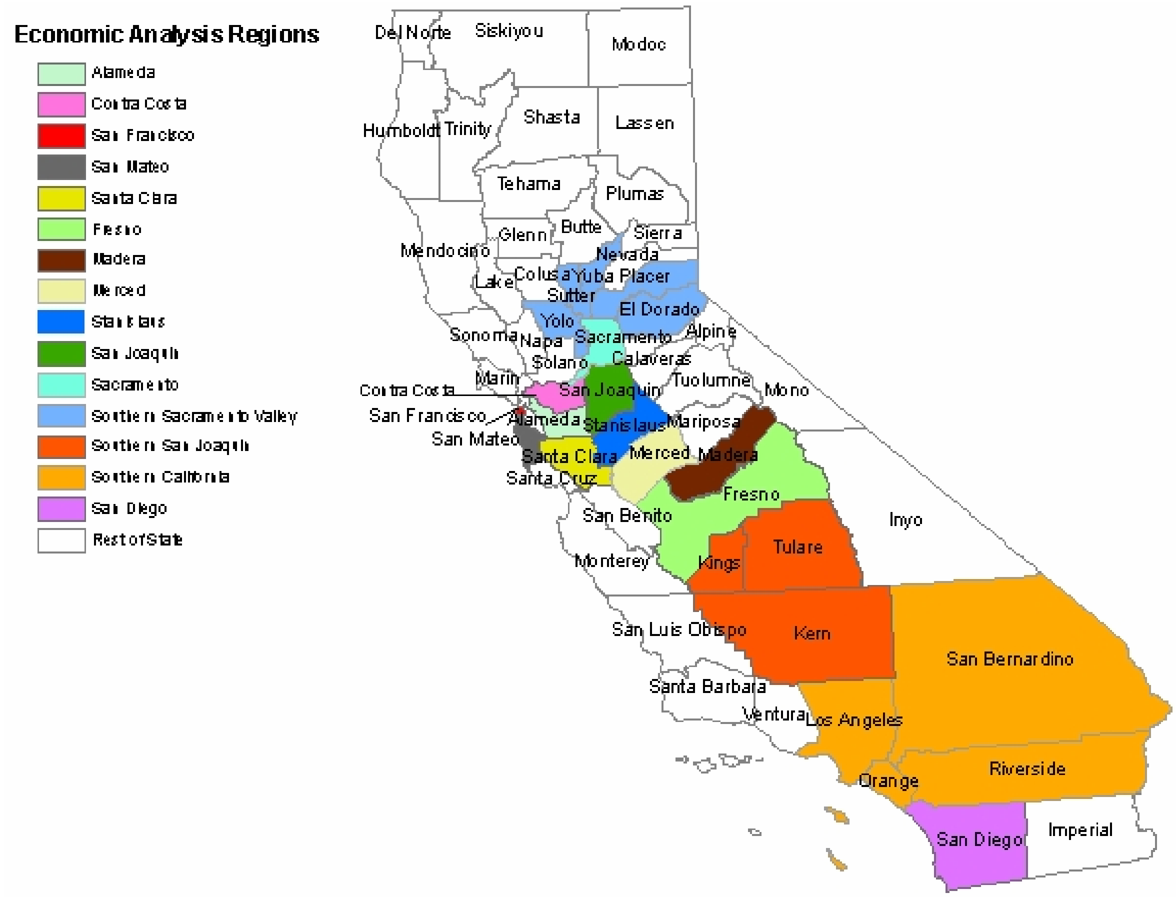
[10]The debt service on General Fund State Revenue bonds often is paid through a commitment of the general fund revenue with no additional tax or other revenue source. A preliminary analysis by the project team suggests that the annual debt service on a $10 billion bond may be within the range of the State's historical and future bonding patterns. While this source of funding does not directly increase taxes, it does divert state expenditures from budget items to debt service. Nevertheless, this diversion is not assumed in this analysis to result in any significant reduction in state expenditures.

tive. A similar process was followed for the six counties that comprise the core study area within the Central Valley. The counties grouped into Southern Sacramento Valley, Southern San Joaquin Valley, Southern California, and San Diego regions were gathered based on economic relationships between the counties. With the exception of the Southern Sacramento Valley, all of these regions were identified for direct HST service in the Final Statewide Program EIR/EIS. The counties gathered as rest of California would not be directly served by any of the HST alternatives. The county groupings that comprise these regions are displayed in Figure 3.3.

The regions and associated counties, which are displayed in Figure 3.3, are the following:

- Core Study Area – Bay Area:
  - Alameda County,
  - Contra Costa County,
  - San Francisco County,
  - San Mateo County, and
  - Santa Clara County;
- Core Study Area – Central Valley:
  - Fresno County,
  - Madera County,
  - Merced County,
  - Stanislaus County,
  - San Joaquin County, and
  - Sacramento County;
- Southern San Joaquin Valley: Kern, Kings, and Tulare Counties;
- Southern California: Los Angeles, Orange, Riverside, and San Bernardino Counties;
- San Diego County;
- Southern Sacramento Valley: El Dorado, Placer, Sutter, Yolo, and Yuba Counties; and
- Rest of California: Remaining 34 counties not included in any of the other 15 regions.

Figure 3.3 Regions Used for Economic Modeling



■ 3.3 Local and Station Area Analysis

The county-level population and employment forecasts served as a key input for conducting a detailed assessment of potential local and station area growth effects. This local area analysis focused on the concept of *land consumption*, or the amount of currently undeveloped land that would be needed to accommodate projected growth in each county. Essentially, the analysis provided an estimate of the population and employment growth that can fit within the currently urbanized areas of each county, and additional acreage of currently undeveloped land that would need to be converted to urbanized densities to accommodate any remaining growth.

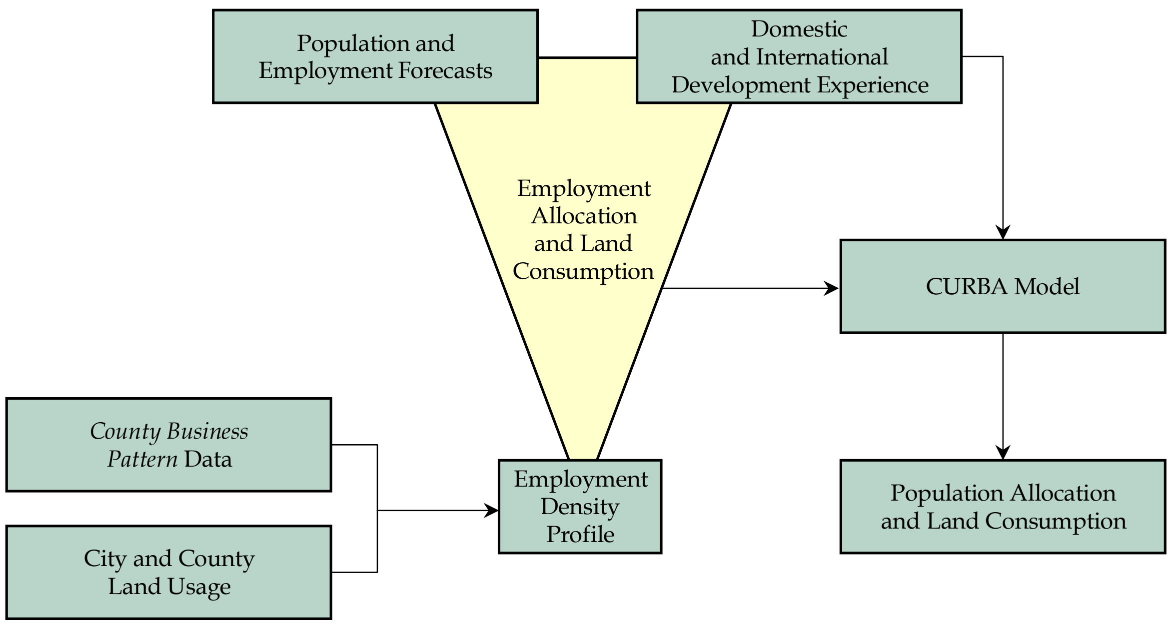
The analysis of these localized effects was guided to a large extent by international experience in HST station area development, and a more fine-grained analysis of the effects of population and employment growth and development pattern changes on the land area required to accommodate urban functions. This work was organized into the following two basic steps:

1. Estimation of land area required to accommodate forecast employment growth for each alternative; and

2. Estimation of the land area required to accommodate forecast population growth (residential land use) for each alternative.

The general analysis steps, which incorporate work undertaken for the Statewide Program-Level EIR/EIS, are depicted in Figure 3.4 and discussed in the following sections.

Figure 3.4 Land Consumption Analysis Process



Estimation of Employment-Related Land Requirements

Estimates of land required to accommodate employment uses were developed using a statistical analysis based on current development patterns in the State of California, adjusted to reflect expected densification trends over time. The approach provides an estimate of the employment growth that can fit within the currently urbanized areas of each county, and the consumption of currently undeveloped land for any remaining employment growth. The approach is sensitive to differences in development patterns between areas within California, development needs and history by industry, density potential based on location within an urban area, and density patterns related to either market conditions or regulatory strategies.

The analytical process consisted of the following three main steps:

1. **Development of an employment density profile –** This profile, which was developed using zip code-level employment data, expressed the range of current employment densities by industrial class for different county groupings and specific subregions within the counties. This profile was developed during preparation of the economic growth effects analysis for the Statewide Program-Level EIR/EIS.

2. **Employment allocation –** Forecasted employment was allocated to subregions in each county in a step-wise fashion through the use of the density profiles and the existing employment in each county.

3. **Land consumption tabulation –** Employment acreage requirements were estimated for each county by comparing the urbanized acreage for employment-related land use in each future year with the current urbanized acreage.

This process is described in greater detail in Appendix E.

Estimation of Residential Land Requirements

The California Urbanization and Biodiversity Analysis (CURBA) model was used to allocate population growth to various locations in each county, and to predict raw land consumption resulting from residential construction. CURBA is a spatial decision support system developed within the ESRI ArcGIS software package by the University of California at Berkeley's Institute of Urban and Regional Development.

CURBA uses a number of historically-calibrated spatial statistical models to assign projected population residential growth to various locations in and around the existing urban area. By modifying CURBA's employment distribution, infill allocation, and raw land development densities to reflect information generated as part of the employment analysis, the package was used to estimate the nature and amount of raw land consumption under the various alternatives. The basic steps in the residential analysis included the following:

- **Model calibration –** A spatial-statistical model of historical development patterns was calibrated using detailed land coverage inventories from the California Department of Conservation.

- **Development probabilities –** A binomial logit model was used to estimate development probability for undeveloped sites based on a site's job accessibility, physical and land use constraints, characteristics of adjacent sites, and local land use policies and regulations.

- **Residential infill and redevelopment –** A cross-sectional regression model was used to relate current county infill shares to remaining supplies of undeveloped land, and then project population shares for future analysis years.

- **Growth allocation –** Another cross-sectional regression model was used to project land use densities in each county based on remaining supplies of undeveloped land. Population growth was then allocated to individual sites in order of development probabilities until all population growth is accommodated.

This iterative process is described in greater detail in Appendix F.

4.0 Statewide and Regional Growth Effects

4.0 Statewide and Regional Growth Effects

This chapter describes results of the statewide and regional economic modeling process for the year 2030. The key results presented in this chapter include county- and regional-level population and employment forecasts for each HST Alternative. The first section compares each system alternative in terms of statewide population and employment, while the second section compares the alternatives in terms of regional- and county-level forecasts. The third section compares results for the HST network, alignment, and station options in the Bay Area to Central Valley study area. The fourth section compares these results to ones calculated for the Statewide Program-Level EIR/EIS. Finally, the fifth section provides an overview of the significance of these population and employment forecasts. The discussion in this chapter is supplemented by detailed tables of employment forecasts by industry group in Appendix G.

4.1 Statewide Comparison of System Alternatives

Table 4.1 displays year 2030 population and employment forecasts for the No-Project Alternative and the two HST Network Alternatives. Table 4.2 displays population and employment growth rates for the year 2030; the growth rates in these tables are referenced to 2005 existing conditions. Table 4.3 compares growth rates for HST Alternatives relative to the No-Project Alternative for the year 2030.

4.1.1 No-Project Alternative

On a statewide basis, population is projected to increase by about 12 million, which represents a 33 percent rise between 2005 and 2030. The long-term growth rate averages to about 1.2 percent (0.5 million) annually, which is less than California's 1.8 percent annual population growth rate since 1970, but consistent with long-term population forecasts by the California Department of Finance and the U.S. Census Bureau.

Employment growth rates are somewhat similar, with jobs increasing by about 7.7 million (37 percent) between 2005 and 2030. The long-term growth rate averages about 1.3 percent (0.26 million) per year, which is one-half of the 2.6 percent annual employment growth rate since 1970.

Table 4.1 Year 2030 Employment and Population

	Employment				Population			
		2030				2030		
Region	**2005 Conditions**	**No-Project Alternative**	**Pacheco HST Alternative**	**Altamont HST Alternative**	**2005 Conditions**	**No-Project Alternative**	**Pacheco HST Alternative**	**Altamont HST Alternative**
Alameda County	953,937	1,247,413	1,259,563	1,257,894	1,451,065	2,038,482	2,051,196	2,054,014
Contra Costa County	508,854	763,445	769,521	767,521	1,017,644	1,543,053	1,549,526	1,546,206
San Francisco County	779,357	975,823	983,634	981,068	741,025	796,208	809,680	801,192
San Mateo County	522,830	717,526	723,835	723,899	701,175	814,065	821,063	826,885
Santa Clara County	1,323,920	1,769,498	1,785,181	1,784,281	1,705,158	2,152,963	2,183,649	2,196,405
Study Area – Bay Area	4,088,898	5,473,705	5,521,734	5,514,663	5,616,067	7,344,771	7,415,114	7,424,702
Fresno County	435,769	589,226	602,155	601,294	878,089	1,297,476	1,314,824	1,312,891
Madera County	56,892	91,364	96,173	96,293	142,530	219,832	229,648	229,492
Merced County	87,365	115,054	122,374	121,040	242,249	437,880	452,166	447,409
Sacramento County	805,978	1,259,792	1,268,687	1,271,311	1,363,423	2,293,028	2,305,071	2,314,484
San Joaquin County	274,155	368,745	375,491	379,476	664,796	1,229,757	1,241,285	1,254,281
Stanislaus County	224,491	316,686	323,679	332,624	505,492	744,599	758,256	783,839
Study Area – Central Valley	1,884,650	2,740,867	2,788,559	2,802,038	3,796,579	6,222,572	6,301,250	6,342,396
Core Study Area	5,973,548	8,214,572	8,310,293	8,316,701	9,412,646	13,567,343	13,716,364	13,767,098
South Sacramento Valley	456,834	729,293	732,903	733,942	658,108	1,090,299	1,092,658	1,093,615
South San Joaquin Valley	576,935	808,196	835,245	833,977	1,311,579	1,989,111	2,048,889	2,047,375
Southern California	9,290,841	12,308,179	12,435,533	12,421,683	16,843,742	20,844,795	20,988,962	20,950,544
San Diego County	1,895,002	2,783,258	2,828,805	2,837,183	2,936,609	4,005,624	4,147,239	4,132,577
Rest of California	2,709,974	3,774,366	3,795,828	3,791,032	4,991,463	6,613,499	6,618,328	6,614,836
Statewide Total	**20,903,134**	**28,617,864**	**28,938,605**	**28,934,518**	**36,154,147**	**48,110,671**	**48,612,439**	**48,606,045**

Source: Cambridge Systematics, Inc., 2007.

Table 4.2 Year 2030 Employment and Population

Percentage Change from Year 2005 Existing Conditions

Region	Employment			Population		
	No-Project Alternative	Pacheco Alternative	Altamont Alternative	No-Project Alternative	Pacheco Alternative	Altamont Alternative
Alameda County	30.8%	32.0%	31.9%	40.5%	41.4%	41.6%
Contra Costa County	50.0%	51.2%	50.8%	51.6%	52.3%	51.9%
San Francisco County	25.2%	26.2%	25.9%	7.4%	9.3%	8.1%
San Mateo County	37.2%	38.4%	38.5%	16.1%	17.1%	17.9%
Santa Clara County	33.7%	34.8%	34.8%	26.3%	28.1%	28.8%
Study Area – Bay Area	33.9%	35.0%	34.9%	30.8%	32.0%	32.2%
Fresno County	35.2%	38.2%	38.0%	47.8%	49.7%	49.5%
Madera County	60.6%	69.0%	69.3%	54.2%	61.1%	61.0%
Merced County	31.7%	40.1%	38.5%	80.8%	86.7%	84.7%
Sacramento County	56.3%	57.4%	57.7%	68.2%	69.1%	69.8%
San Joaquin County	34.5%	37.0%	38.4%	85.0%	86.7%	88.7%
Stanislaus County	41.1%	44.2%	48.2%	47.3%	50.0%	55.1%
Study Area – Central Valley	45.4%	48.0%	48.7%	63.9%	66.0%	67.1%
Core Study Area	37.5%	39.1%	39.2%	44.1%	45.7%	46.3%
Southern Sacramento Valley	59.6%	60.4%	60.7%	65.7%	66.0%	66.2%
Southern San Joaquin Valley	40.1%	44.8%	44.6%	51.7%	56.2%	56.1%
Southern California	32.5%	33.8%	33.7%	23.8%	24.6%	24.4%
San Diego County	46.9%	49.3%	49.7%	36.4%	41.2%	40.7%
Rest of California	39.3%	40.1%	39.9%	32.5%	32.6%	32.5%
Statewide Total	**36.9%**	**38.4%**	**38.4%**	**33.1%**	**34.5%**	**34.4%**

Source: Cambridge Systematics, Inc., 2007.

4.1.2 HST Alternatives

Statewide population and employment forecasts for the HST Alternatives are very similar to the No-Project Alternative. For year 2030, the Pacheco HST Alternative is projected to add about 501,000 (1.04 percent) more people and 320,000 (1.12 percent) more jobs than the No-Project Alternative. The Altamont HST Alternative is projected to add 495,000 (1.03 percent) more people and 316,000 (1.11 percent) more jobs than the No-Project Alternative. This incremental growth for the HST network alternatives represents about an additional year's worth of economic growth above and beyond the No-Project Alternative in year 2030.

■ 4.2 Regional and County Growth Effects

Each of the system alternatives has varied effects on different parts of the State. Part of this difference is in terms of overall population and growth projections displayed previously in Tables 4.1 and 4.2. Another part of the difference is related to the type of industries that is projected to experience employment growth under each system alternative. Table 4.3 displays industry-specific employment forecasts for 2030 for the three alternatives. Data in Table 4.3 are summarized by the major economic analysis regions, while Appendix G presents county-level detail. Table 4.4 presents the allocation of year 2030 incremental employment growth[1] by industry group for the HST Alternatives. Essentially, Table 4.4 provides a picture of the types of jobs that would be generated by an investment in either the No-Project or HST Alternatives.

4.2.1 San Francisco Bay Area

Under the No-Project Alternative, the Bay Area region is projected to add about 1.4 million jobs and 1.7 million people between 2005 and 2030. These values represent a relative increase of nearly 31 and 34 percent, respectively, over the 2005 conditions. In absolute terms, Alameda County is projected to add the most population (587,000), while Santa Clara is projected to add the most employment (445,000) from current levels. However, growth rates will be higher in Contra Costa County, with increases of over 50 percent between 2005 and 2030 for both population and employment. Among the Bay Area counties, the employment growth rate exceeds the population growth rate for San Francisco and San Mateo.

Under the Pacheco HST Alternative regional population is projected to increase by 70,000 people, while employment is expected to increase by 48,000 jobs over the No-Project Alternative. Under the Altamont HST Alternative, population growth is slightly higher than the Pacheco Alternative, with an increase of near 80,000 people, whereas employment growth is slightly lower than the Pacheco Alternative with an increase of 41,000 jobs over the No-Project Alternative. Santa Clara County is projected to experience the largest absolute increase in population and employment in both HST alternatives. In relative terms for the Pacheco HST Alternative, Alameda County has the highest increase in employment, while San Francisco shows the highest increase in population compared to the No-Project Alternative. For the Altamont HST Alternative, San Mateo County shows the highest relative increase in employment, while Santa Clara shows the highest relative increase in population compared to the No-Project Alternative.

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[1] Incremental employment growth refers to employment that is generated by the HST Alternatives above and beyond the employment projected for the No-Project Alternative.

Table 4.3 Comparison of Employment by Industry Grouping for REMI Regions
Year 2030

	Study Area – Bay Area	% of Total	Study Area – Central Valley	% of Total	Southern Sacramento Valley	% of Total	Southern San Joaquin Valley	% of Total	Southern California	% of Total	San Diego	% of Total	Rest of California	% of Total	Statewide Total	% of Total
Farming	52,986	1%	153,017	8%	23,496	5%	112,116	19%	134,414	1%	41,123	2%	110,438	4%	627,589	3%
Mining	3,749	0%	1,214	0%	672	0%	10,023	2%	10,066	0%	1,158	0%	4,406	0%	31,288	0%
Construction	200,188	5%	110,494	6%	35,876	8%	25,670	4%	445,411	5%	101,481	5%	142,577	5%	1,061,697	5%
Manufacturing	414,079	10%	127,765	7%	25,702	6%	27,893	5%	891,553	10%	122,773	6%	225,106	8%	1,834,872	9%
TCU	190,166	5%	75,965	4%	18,525	4%	25,136	4%	433,885	5%	60,648	3%	110,200	4%	914,524	4%
Wholesale	179,813	4%	67,563	4%	16,841	4%	16,446	3%	507,724	5%	66,127	3%	117,540	4%	972,053	5%
Retail	579,787	14%	297,432	16%	79,839	17%	82,911	14%	1,439,244	15%	285,675	15%	421,947	16%	3,186,834	15%
FIRE	394,036	10%	149,453	8%	42,296	9%	30,336	5%	893,749	10%	172,543	9%	246,424	9%	1,928,837	9%
Services	1,630,699	40%	550,584	29%	137,730	30%	135,745	24%	3,467,334	37%	684,891	36%	960,561	35%	7,567,544	36%
Government	443,395	11%	351,163	19%	75,858	17%	110,659	19%	1,067,460	11%	358,582	19%	370,778	14%	2,777,895	13%
Total	**4,088,898**	**100%**	**1,884,650**	**100%**	**456,834**	**100%**	**576,935**	**100%**	**9,290,841**	**100%**	**1,895,002**	**100%**	**2,709,974**	**100%**	**20,903,134**	**100%**

Source: Cambridge Systematics, Inc., 2007.

Table 4.4 Allocation of Incremental Employment Growth by Industry Groupings

Year 2030

Incremental Growth Rate for Induced Employment (Year 2005 to 2030)	Farming and Mining		Construction and Manufacturing		TCU and Trade		FIRE and Services		Government	
Study Area – Bay Area	0%	0%	6%	5%	28%	29%	62%	63%	3%	3%
Study Area – Central Valley	2%	2%	6%	4%	25%	21%	63%	68%	5%	4%
Subtotal – Core Study Area	1%	1%	6%	5%	27%	25%	62%	66%	4%	4%
Southern Sacramento Valley	1%	2%	10%	9%	34%	33%	50%	52%	6%	5%
Southern San Joaquin Valley	5%	5%	4%	4%	20%	19%	66%	67%	4%	4%
Southern California	0%	1%	6%	7%	27%	29%	62%	60%	4%	4%
San Diego	0%	0%	4%	3%	32%	26%	59%	66%	4%	4%
Rest of California	4%	4%	9%	10%	38%	45%	44%	36%	5%	6%
Statewide Total	1%	1%	6%	5%	28%	27%	61%	62%	4%	4%

Source: Cambridge Systematics, Inc., 2007.

Historically, this region has had the highest share of FIRE and services industry jobs. This trend is projected to be intensified under the No-Project Alternative. Incremental job growth for the HST Alternatives (i.e., additional jobs created over the No-Project Alternative) are projected to follow historical norms for this region, with 62 percent of the new jobs created in FIRE and services and 34 percent in construction, manufacturing, trade, and TCU.

4.2.2 Northern Central Valley

Under the No-Project Alternative, the northern Central Valley region is projected to add about 855,000 (45 percent) jobs and 2.4 million (64 percent) people between 2005 and 2030. Sacramento County is projected to add the most population (929,000) and employment (453,000) from 2005 levels. In relative terms, population growth will be the highest in San Joaquin County with an 85 percent increase over 2005 conditions, while employment growth will be the highest in Madera County with a 61 percent increase. The key conclusion from these results is that this region will be experiencing tremendous population growth, regardless of the implementation of the HST, and experiences the largest differential between employment and population growth rates.

Under the Pacheco HST Alternative, regional population is projected to increase by a further 79,000 people, while employment is expected to increase by 48,000 jobs over the No-Project Alternative. Under the Altamont HST Alternative, population and employment growth is higher than the Pacheco Alternative, with an increase of nearly 120,000 people and 61,000 jobs over the No-Project Alternative.

The counties in this area all have population growth rates that greatly exceed the statewide average under the No-Project Alternative. All six counties have noticeably higher population growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No-Project and HST Alternatives; this result also holds for Stanislaus County in the Altamont HST Network Alternative. As a group, the population growth rate in these Central Valley counties is highest for the Altamont HST Network Alternative, although Fresno, Madera, and Merced Counties actually have slightly higher growth rates for the Pacheco HST Network Alternative.

These counties also have a wide variation in employment growth rates under the No-Project Alternative with values ranging between 31 percent and 60 percent. All six counties have noticeably higher employment growth rates for the HST Network Alternatives, with Merced and Madera Counties showing the largest numeric difference in growth rates between the No-Project and HST Network Alternatives; this result also holds for Stanislaus County in the Altamont HST Network Alternative. The employment growth rate in these counties as a group is highest for the Altamont HST Network Alternative, with the Altamont HST Network Alternative having the highest growth rate in four of the six counties.

This region has historically exceeded statewide averages for government and farming jobs, while lagging in all other industry groups. This general pattern is projected to change slightly under the No-Project Alternative, with employment shifts from government, farming, manufacturing, trade, and TCU into FIRE and services. The HST Alternatives, on the other hand, are projected to have incremental job growth that is much more heavily oriented towards FIRE and services (66 percent of total), with construction, manufacturing, trade, and TCU accounting for about 28 percent of incremental growth. This region, along with the Southern Central Valley, would experience the largest shift in the nature of employment, and suggests that the HST Alternative will be a strong influence in attracting higher wage jobs to the Central Valley.

4.2.3 Southern Sacramento Valley

Under the No-Project Alternative, the Southern Sacramento Valley region is projected to add about 272,000 jobs and 434,000 people between 2005 and 2030. These values represent an increase of 60 and 66 percent, respectively, over 2005 conditions.

Under the Pacheco HST Alternative, population is projected to increase by about 2,350 people and employment by about 3,600 jobs in 2030 over the No-Project Alternative. Under the Altamont Alternative, both population and employment are expected to be slightly higher than under the Pacheco Alternative, increasing population by 3,300 people and the number of jobs by 4,600 compared to the No-Project Alternative.

As with the northern Central Valley, this region has historically exceeded statewide averages for government and farming jobs, while lagging in all other industry groups to a larger extent than any other region. This general pattern is projected to change under the No-Project Alternative, with employment shifts from farming and government into FIRE and services. However, this region will still lag statewide averages in manufacturing, FIRE, and services, while exceeding statewide averages in government. About one-half on incremental job growth of HST Alternatives is projected to occur in FIRE and services and one-third in trade and TCU.

4.2.4 Southern San Joaquin Valley

Under the No-Project Alternative, the southern Sacramento Valley region is projected to add about 231,000 (40 percent) jobs and 677,000 (52 percent) people between 2005 and 2030. Under the Pacheco HST Alternative, population is projected to increase by about 60,000 people and employment by about 27,000 jobs in 2030 over the No-Project Alternative. Population and employment are expected to be slightly lower for the Altamont HST Alternative than for the Pacheco HST Alternative, increasing population by 58,000 people and 26,000 jobs compared to the No-Project Alternative.

This region currently has the highest share of agricultural employment in the State (one-fifth of the total employment) and the lowest share of FIRE and services jobs (one-third of the total employment), and this general pattern is not projected to change under the No-

Project Alternative. However, incremental job growth under the HST Alternatives is projected to be heavily oriented towards FIRE and services jobs, with about 67 percent of growth occurring in this sector. This region and the northern Central Valley are expected to experience the largest shift in the nature of employment, which suggests that the HST Alternative will be a strong influence in attracting higher wage jobs to these regions.

4.2.5 Southern California

Under the No-Project Alternative, the southern California region is projected to add about 3.0 million (32 percent) jobs and 4.0 million (24 percent) people between 2005 and 2030. Under the Pacheco HST Alternative, population is projected to increase by about 144,000 people and employment by about 130,000 jobs in 2030 over the No-Project Alternative. Under the Altamont HST Alternative, both population and employment are expected to be lower than under the Pacheco HST Alternative, increasing by about 105,000 people and 113,000 jobs compared to the No-Project Alternative.

This region has nearly one-half of total employment in the FIRE and services sectors, and this general pattern is projected be accentuated under the No-Project Alternative. Incremental job growth of HST Alternatives is projected to be more heavily oriented towards FIRE and service sectors, with about 60 percent of growth occurring in this sector.

4.2.6 San Diego County

Under the No-Project Alternative, San Diego County is projected to add about 900,000 (47 percent) jobs and 1.0 million (36 percent) people between 2005 and 2030. Under the Pacheco HST Alternative, population is projected to increase by about 141,000 people and employment by about 45,000 jobs in 2030 over the No-Project Alternative. Under the Altamont Alternative, population is expected to be slightly lower than under the Pacheco Alternative, while employment slightly higher, with population increasing by 126,000 people and the number of jobs by 54,000 compared to the No-Project Alternative.

This region has an average statewide share of FIRE and service jobs (45 percent of the total employment), and this general pattern is projected to be intensified under the No-Project Alternative. Incremental job growth of HST Alternatives is projected to be heavily oriented towards FIRE and services jobs, with about 66 percent of growth occurring in this sector.

■ 4.3 HST Network Alternatives, Alignment Alternatives, and Station Location Options

The discussion of induced growth compares the general nature of impacts associated with the HST Network Alternatives to the No-Project Alternative. Although quantitative employment and population impacts were not generated for every alignment and station location option, qualitative distinctions nevertheless can be made among these options.

For this discussion, the difference in impacts will be most significant between the two general choices of the Altamont and Pacheco Network Alternatives. In the primary study area of this environmental analysis, the Altamont HST Network Alternative would be expected to have a greater influence on growth inducement than the Pacheco HST Network Alternative for two reasons. First, the Altamont HST Network Alternative is projected to induce about 6,000 more jobs and 50,000 more residents than the Pacheco HST Network Alternative in the Bay Area to Central Valley study area. Second, the Altamont HST Network Alternative is likely to have more stations in total than the Pacheco HST Network Alternative, leading to more geographic locations that could experience local and station area growth effects.

Madera and Merced Counties are likely to experience the greatest magnitude of growth effects among all study area counties for both HST Network Alternatives. Stanislaus County is likely to exhibit an equally high magnitude of growth effects with the Altamont HST Network Alternative; under the Pacheco HST Network Alternative, Stanislaus County's growth effects are likely to be much lower.

Many of the HST Network Alternatives have different termini locations in the Bay Area, with some network alternatives having multiple termini locations. Growth inducement is likely to differ for these network alternatives, with differences arising both on a system level and in individual Bay Area counties affected by the HST Network Alternatives. In general, systemwide growth inducement can be expected to change at similar rates to changes in ridership between HST Network Alternatives due to the close correspondence between HST ridership, highway and air congestion reduction, and traveler benefits. At a county and local level, growth inducement will be higher if a county has an HST station for a particular network alternative, and will decrease if no HST station is present.

Among the Pacheco HST Network Alternatives, service to either the Oakland or San Francisco termini is likely to result in similar levels of systemwide growth inducement. Similar levels of growth inducement are likely for service to Oakland <u>and</u> San Francisco via a Transbay Tube. Service to Oakland <u>and</u> San Francisco via Peninsula and East Bay alignments is likely to experience lower growth inducement due to lower HST ridership potential; growth inducement are also likely to be more evenly distributed among the Bay Area counties than for the other HST Network Alternatives. A San Jose-only terminus would likely have the lowest overall growth inducement potential of the Pacheco Network Alternatives due to the much lower HST ridership potential.

For the Altamont HST Network Alternatives, service to a single Bay Area terminus (San Francisco or Oakland) is likely to result in similar levels of systemwide growth inducement. Similar levels of growth inducement are likely for service to Oakland and San Francisco via a Transbay Tube. HST Network Alternatives with split HST service among any two or three termini are likely to experience lower growth inducement due to lower HST ridership potential; the lowest growth inducement potential is likely for split service to all three Bay Area termini.

All of the Altamont HST alignment alternatives are likely to create equal magnitudes and spatial patterns of induced growth since all alignments offer relatively similar travel time and station location options in the Bay Area.

The two Pacheco HST alignment alternatives, Henry Miller and GEA North, also are likely to produce similar patterns of induced growth for all counties in the core study area. Although these two Pacheco alignment alternatives provide noticeably different HST travel times between the Bay Area and northern Central Valley, there are equally noticeable, yet opposite, travel time differences between the Bay Area and locations south of Merced County. The net effect is that the slight congestion reduction and HST ridership benefits provided by the Henry Miller alignment offset the accessibility benefits (between the Bay Area and northern Central Valley) provided by the GEA North alignment.

For the Pacheco with Altamont HST Network Alternatives, overall growth inducement will be the same or lower than similar termini combinations for either Pacheco or Altamont.

Adding, dropping, or changing station locations will lead to changes in potential growth effects at the station in question, as well as in the HST system as a whole. In individual counties, the most notable situation is in Merced County, where the SP Downtown station could be on either the Sacramento or Southern California HST lines, depending upon the alignment followed west of Merced. The Castle Air Force Base (AFB) station, on the other hand, always would be served by HST service between the Bay Area and Sacramento. In Stanislaus County, the Amtrak Briggsmore station could lead to the urbanization of 1,000 more acres in the County than the SP Downtown station site.[2] This difference between station sites accounts for about 35 percent of the difference in urbanized area size between the Altamont and Pacheco HST Network Alternatives noted for Stanislaus County. In the East Bay, HST stations that interface with the BART system may induce larger overall growth attributable to improved regionwide accessibility. On the San Francisco Peninsula, all proposed HST stations offer the opportunity for intermodal transfers with Caltrain, and all proposed station sites have substantial station-area activity of one form or another. The most likely location for differences in areawide growth inducement is with the San Francisco station location. The Transbay Transit Center offers better access than the 4th/Townsend site to the high density employment and activity center in Downtown San Francisco; this improved accessibility creates higher systemwide HST ridership and is therefore likely to lead to the potential for additional growth inducement.

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[2] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, California High-Speed Rail Authority, Section 5.2, July 2003.

Alternative station locations in the same general vicinity may have different localized growth effects, but overall effects throughout the study area are likely to be similar. Different areawide effects will arise from adding or dropping an HST station for a community or subarea as a whole. For example, not providing an HST station in the Tri-Valley or Tracy areas would likely lower overall growth inducement, because job accessibility and business attraction benefits throughout the study area would be lower. A similar situation would occur for the Pacheco HST Network Alternative if a station were not provided in Gilroy or Morgan Hill; in such a situation, access to the HST system from Monterrey, San Benito, and Santa Cruz Counties would be reduced.

■ 4.4 Comparison of Procedures and Results to the Statewide Program-Level EIR and Tier 1 EIS

The overall economic growth forecasts for this Bay Area to Central Valley Program EIR/EIS are consistent with the results generated in 2003 for the Statewide Program EIR/EIS. The current analysis projects an incremental statewide growth inducement of about 320,000 jobs and 500,000 people by year 2030. The analysis for the 2003 Statewide Program EIR/EIS projected an incremental statewide growth inducement of 240,000 jobs and 170,000 people by year 2020, and 450,000 jobs and 700,000 people by year 2035.

There are several differences in the analysis procedures that help explain these differences between the 2003 and current results. Many of these differences stem from use of the new Metropolitan Transportation Commission (MTC) Statewide High-Speed Rail Travel Demand Model for the current growth inducement analysis.

First, the new travel model used in the current analysis assumes a much higher ridership for high-speed rail than the 2003 analysis. This result essentially follows from a more sophisticated treatment of mode choice variables. In other words, the new model allows for a greater range of mode choices (for example, walking to an HST station instead of driving), and a more complete treatment of travel costs than the previous analysis. The result is that the direct travel time/cost benefits flowing from travelers switching to HST are higher than in the 2003 report.

Second, the present analysis has a more complete treatment of effects on non-HST modes. The most significant difference is that the new travel demand model includes intraregional (local) car and truck trips in addition to intercity trips; whereas, the previous travel model only included the latter. As a result, highway delay reductions are higher in the current analysis, leading to a larger overall impact.

Finally, the TREDIS framework in the current analysis uses the CRIO-IMPLAN model of economic adjustment; whereas, REMI was used for the 2003 analysis. Although both models are well-established for this type of analysis, differences between the model structures affected the treatment of certain variables. For example, the previous analysis treated household value-of-time and out-of-pocket cost savings through a variable that primarily drives demographic migration. In contrast, the current analysis treats household out-of-pocket savings as changing consumer spending patterns, thereby affecting local business output more directly.

4.5 Key Findings

Overall, the No-Project and HST Network Alternatives present very similar levels of growth effects in terms of population and employment growth from year 2005. The incremental effect of the HST Alternatives relative to the No-Project Alternative is very small when compared to the incremental effect of the No-Project Alternative relative to 2005 conditions. California is projected to add about 7.7 million jobs and 12 million people between 2005 and 2030 under the No-Project Alternative, while the HST Alternatives would add around 320,000 (1.11 percent) jobs and 500,000 (1.04 percent) people over the No-Project Alternative.

Analysis of results for individual counties largely follows these general statewide trends among system alternatives. Southern California is projected to add the most jobs and people of all regions for the HST Alternatives in 2030. On a relative basis, southern San Joaquin Valley and the northern Central Valley are expected to show the largest percentage increase in population and jobs under the HST Alternative compared to the No-Project Alternative. Under the HST Alternatives, the statewide incremental employment growth relative to the No-Project Alternative is expected to be higher than the population growth, suggesting that the HST Alternative has a stronger influence in distributing employment throughout the State.

The Altamont HST Alternative is projected to induce the largest incremental population and employment growth rates in Madera, Merced, and Stanislaus Counties. The Pacheco HST Alternative is projected to induce the largest incremental population and employment growth rates in Madera and Merced Counties. The two HST alternatives are projected to have similar growth inducement effects for the Bay Area as a whole, while the Altamont HST Alternative is projected to have a larger growth inducement effect for the Northern Central Valley as a whole.

Regarding the nature of employment generated, the data suggest that under the HST Alternatives, the FIRE and service sectors are the most encouraged with around 61 percent of total incremental employment generated in this sector. The southern San Joaquin Valley and the northern Central Valley are expected to experience the largest shift in the nature of employment, which implies that the HST Alternative will be a strong influence in attracting higher wage jobs to these regions.

5.0 Station Area Growth Effects

5.0 Station Area Growth Effects

This chapter describes how regional population and employment growth could influence the amount of urbanized land required to accommodate the people living and working in each part of the State. The first section compares results for the system alternatives, while the second section compares results by geographic area. The final section provides a summary overview of the significance of these findings. The discussion in this chapter is supplemented by detailed tables of results in Appendices H (Employment Suballocation) and I (Breakout of Employment and Residential Components).

■ 5.1 Comparison of System Alternatives

Table 5.1 summarizes the total acreage of land at urbanized densities needed to accommodate projected employment or population in 2030. Table 5.2 shows the percent change in urbanized land area from the 2002 conditions, as well as the No-Project Alternative.

5.1.1 No-Project Alternative

Population and employment growth under the No-Project Alternative in the core study area is expected to require approximately 392,000 more acres of urbanized land in 2030 than the current estimated urbanized area of approximately 1.0 million acres.[1] This increase is about 40 percent over 2002 conditions. The Northern Central Valley is expected to experience the largest increase in urbanized acreage with a 61 percent increase over 2005 conditions, while the Bay Area is expected to experience an increase of 22 percent.

[1] Estimates of current urbanized area are based on urban land cover data provided by the California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation.

Table 5.1 Year 2030 Size of Urbanized Area by System Alternative
County and Regional Totals

Area	Year 2002 Urbanized Area Acreage	Year 2030 Urbanized Area (In Acres)		
		No-Project Alternative	HST Alternative	
			Pacheco	Altamont
Alameda County	141,654	186,683	187,808	186,942
Contra Costa County	142,467	183,869	184,596	184,288
San Francisco County*	23,277	30,013	30,246	30,172
San Mateo County	70,869	80,304	80,386	80,543
Santa Clara County	184,481	207,833	209,352	211,324
Study Area – Bay Area	562,748	688,702	692,388	693,269
Fresno County	96,977	150,223	153,574	153,243
Madera County	23,255	36,366	37,793	37,778
Merced County	31,712	60,455	62,212	61,611
Sacramento County	157,101	237,818	238,066	239,245
San Joaquin County	74,250	145,776	145,046	146,104
Stanislaus County	55,426	74,267	74,179	76,886
Study Area – Central Valley	438,721	704,905	710,870	714,867
Core Study Area	1,001,469	1,393,607	1,403,258	1,408,136

Source: Cambridge Systematics, Inc., 2007.

* Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Since “greenfield” land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

Table 5.2 Year 2030 Size of Urbanized Area by System Alternative

Area	Percent Change from 2002 Existing Conditions			Percent Change from 2030 No-Project Alternative	
	No-Project Alternative	HST Alternative		HST Alternative	
		Pacheco	Altamont	Pacheco	Altamont
Alameda County	32%	33%	32%	0.6%	0.1%
Contra Costa County	29%	30%	29%	0.4%	0.2%
San Francisco County*	29%	30%	30%	0.8%	0.5%
San Mateo County	13%	13%	14%	0.1%	0.3%
Santa Clara County	13%	13%	15%	0.7%	1.7%
Study Area – Bay Area	22%	23%	23%	0.5%	0.7%
Fresno County	55%	58%	58%	2.2%	2.0%
Madera County	56%	63%	62%	3.9%	3.9%
Merced County	91%	96%	94%	2.9%	1.9%
Sacramento County	51%	52%	52%	0.1%	0.6%
San Joaquin County	96%	95%	97%	-0.5%	0.2%
Stanislaus County	34%	34%	39%	-0.1%	3.5%
Study Area – Central Valley	61%	62%	63%	0.8%	1.4%
Core Study Area	**39%**	**40%**	**41%**	**0.7%**	**1.0%**

Source: Cambridge Systematics, Inc., 2007.

* Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Since "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table.

As discussed in Section 4.0, population is projected to grow by 44 percent between 2002 and 2030, with employment projected to grow by 37 percent over the same period. Hence, urbanization of undeveloped land is expected to occur at slightly lower rates than overall population and employment growth, reflecting a number of factors:

- A reduction in availability of undeveloped land in some urban counties in the Bay Area, creating higher land costs and market forces for denser development;
- Slight increases in infill and redevelopment, as seen recently in many of the urban counties; and
- An increase in marginal residential densities that has occurred over recent years.[2]

[2] *Raising the Roof: California Housing Development Projections and Constraints, 1997–2020,* California Department of Housing and Community Development; May 2000; Exhibit 17.

5.1.2 HST Alternative

Land consumption for the HST Alternatives is projected to be of the same general magnitude as the No-Project Alternative, when compared to the 2002 conditions. Results show that the Pacheco Alternative is expected to require slightly less urbanized land than the Altamont Alternative, entailing an increase of 40 percent and 41 percent, respectively, over 2005 conditions. Compared to the No-Project Alternative, the Pacheco HST Alternative is projected to urbanize an additional 9,600 acres, while the Altamont HST Alternative is projected to urbanize 14,500 more acres.

5.1.3 Sensitivity Analysis

Unlike the other system alternatives, a high-speed train provides an opportunity for local governments to focus more intensive land uses around rail stations. This opportunity arises from the competitive advantage that some industry groups might draw from proximity to an HST service.[3]

As reported in the technical report for the Statewide Program EIR/EIS[4], higher density, mixed-use development has been observed around rail stations in Europe, Japan, and the United States. While much of this densification is a result of market forces, research suggests that government intervention can accelerate or increase its effect. Strategies for *increasing* station area development include policies such as zoning that encourages mixed use, density bonuses, and maximum parking requirements. Strategies for *accelerating* station area development include joint development under public-private partnerships, tax-increment finance, locating civic institutions near stations, tax abatement programs, and other subsidies.

In addition to the base analysis, a sensitivity analysis was performed as part of the Statewide Program EIR/EIS to test the land consumption effects of land use densification strategies to modestly increase development density in the vicinity of HST stations. The sensitivity analysis included two assumptions:

1. For the residential land area projections, the rate of infill development around HST stations would double; and

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[3] These competitive advantages accrue to some industries due to their need for close proximity to ancillary industries (i.e., industry clustering) and a well-educated labor force. These advantages, known as *economies of agglomeration*, have emerged around the French and Japanese HST stations, and are an accepted norm for land use planning for many urban transit station areas in Europe and North America.

[4] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, California High-Speed Rail Authority, Section 3.3, July 2003.

2. For the employment land area projections, the development density in the station area was increased from the 55th percentile to the 65th percentile in 2020, and from the 75th percentile to the 90th percentile in 2035. Development densities outside of the station area were not modified.

This scenario could reduce statewide land urbanization by approximately 24,000 acres (0.61 percent) less than the No-Project Alternative in 2020, and approximately 33,000 acres (0.71 percent) in 2035 compared to the No-Project Alternative.

These results represent a low-end estimate of the possible effects of land use densification strategies in combination with the introduction of HST service. This sensitivity test assessed the effects of densification strategies within a nominal one-mile band of a potential HST site. Research suggests that other jurisdictions have had some success in implementing more aggressive and regionwide land use strategies (e.g., urban growth boundaries, maximum parking requirements, jobs housing balance, more diversity of land uses, higher densities, higher service levels of mass transit, etc.) in conjunction with high-capacity intercity and urban transit services. Experience in these areas suggests that more aggressive strategies might be more attractive to policy-makers since HST could offer the economic rationale to developers to cluster their new commercial, industrial, and residential development within easy access to the HST stations. In general, the No-Project Alternative provides no such market incentive.

■ 5.2 Regional and County Growth Effects

Each of the system alternatives has varied effects on different parts of the State. This section describes how population and employment growth is projected to influence the need for urbanized land in various regions and counties.

5.2.1 Bay Area

Under the No-Project Alternative, the Bay Area is projected to experience an increase in urbanized land area of approximately 125,000 acres between 2002 and 2030. This represents a change of 22 percent over 2002 conditions. Alameda County is projected to encounter the largest percent change, adding more than 45,000 acres (32 percent) to 2002 levels of urbanized area of approximately 142,000 acres.

Under the Pacheco HST Alternative, the Bay Area urbanized land is projected to require approximately 3,700 additional acres (0.5 percent) in 2030 compared to the No-Project Alternative. Under the Altamont HST Alternative, the Bay Area urbanized land is projected to require approximately 4,500 additional acres (0.7 percent) in 2030 compared to the No-Project Alternative. The largest absolute and relative increase for both HST alternatives is projected to occur in Santa Clara County requiring nearly 3,500 additional acres or 1.7 percent increase over the No-Project Alternative.

5.2.2 Northern Central Valley

Under the No-Project Alternative, the northern Central Valley is projected to experience an increase in urbanized land area of approximately 266,000 acres between 2002 and 2030. This represents a change of 61 percent over 2002 conditions. Urbanized acreage in Merced and San Joaquin Counties is projected to almost double in order to accommodate population and employment growth between 2002 and 2030. Sacramento County is projected to experience the largest absolute increase in urbanized acreage – 80,000 acres – between 2002 and 2030.

Under the Pacheco HST Alternative, the northern Central Valley urbanized land is projected to require approximately 6,000 additional acres (0.8 percent) in 2030 compared to the No-Project Alternative, while under the Altamont HST Alternative, an additional 10,000 acres (1.4 percent) is projected to be required. Under both alternatives the largest absolute increase is projected to occur in Fresno County; whereas, the largest percent increase is projected to take place in Madera County. Under the Pacheco HST Alternative, the acreage required to accommodate growth decreases for San Joaquin and Stanislaus Counties by 0.5 and 0.1 percent, respectively, compared to the No-Project Alternative.

■ 5.3 Key Findings

Overall, the No-Project and HST Alternatives present very similar levels of growth effects in terms of urbanized area size and land consumption needs. The incremental effect of HST Alternative relative to the No-Project Alternative is very small when compared to the incremental effect of the No-Project Alternative relative to 2002 conditions.

Analysis of results for individual counties largely follows these general statewide results. Nonetheless, the HST Alternatives do create some larger incremental growth relative to the No-Project Alternative. However, the results suggest that HST will not lead to wholesale shifts in residential location from the Bay Area and Los Angeles into the Central Valley.

One of the most telling summary statistics is to combine population and employment growth projections with land consumption forecasts, providing a measure of "land consumed per new job and resident." Essentially, this metric tells us how efficient each alternative is at accommodating the projected growth; since the alternatives have very similar levels of overall growth, the efficiency by which that growth is accommodated becomes very important. Table 5.3 provides the relevant data and resulting metric for each of the alternatives; lower values of the metric suggest greater efficiency. The results indicate that the Pacheco HST Alternative is the most efficient of the alternatives, providing an incremental development density that is 1.3 percent more efficient (i.e., less land per new job and resident) than the No-Project Alternative, while the Altamont Alternative is 0.8 percent more efficient than the No-Project Alternative. The efficiency gains for both HST alternatives are achieved in conjunction with the higher population and employment growth projections compared to the No-Project Alternative.

Table 5.3 Marginal Land Consumption

	No-Project Alternative	Pacheco HST Alternative	Altamont HST Alternative
Land Consumption (thousands of ac)	392	402	407
Job Growth (thousands of jobs)	2,241	2,337	2,343
Population Growth (thousands of people)	4,155	4,304	4,354
*Acres Consumed Per New Job and Resident**	*0.0613*	*0.0605*	*0.0608*
Efficiency Gain/Loss Relative to No-Project Alternative	–	+1.3%	+0.8%

Source: Cambridge Systematics, Inc., 2007.

*Value found by dividing land consumption by the sum of job growth and population growth.

6.0 Preparers

6.0 Preparers

The following individuals participated in the analysis of statewide, regional, local, and station area growth effects.

George D. Mazur, P.E., Cambridge Systematics, Inc.

Project Role: Project Manager for consultant team; development of analysis methodologies; lead author of technical reports; processing of travel demand output for use in economic growth models; and estimation of non-user benefits.

Education: B.S. in Civil Engineering from Purdue University; and M.S. in Transportation Engineering from University of California, Berkeley.

Experience: Sixteen years experience in transportation planning and policy, travel demand forecasting, and environmental analysis; registered Professional Engineer in Georgia and California.

Abigail Rolon, Cambridge Systematics, Inc.

Project Role: Lead analyst for estimating traveler benefits and post-processing travel demand and economic model results.

Education: B.A. in Economics from the Center of Economic Research (CIDE), Mexico City, Mexico; and M.A. in Urban Planning from University of California Los Angeles.

Experience: Four years of experience in economic analysis, and two years of experience in transportation planning with emphasis in transportation economics.

Cecily Way, Cambridge Systematics, Inc.

Project Role: Refinement and application of employment land consumption analysis.

Education: B.S. in Civil Engineering from Massachusetts Institute of Technology; M.S. in Transportation Engineering from University of California, Berkeley; and M.C.P. from University of California, Berkeley, in progress.

Experience: Two years in transportation system analysis and planning, with emphasis on land use impacts of transit.

Glen Weisbrod, Economic Development Research Group, Inc.

Project Role: Design and initial construction of the economic growth model to forecast county-level business and population attraction impacts; and technical reviewer for CRIO-IMPLAN model forecasts.

Education: B.A. in Economics from Brandeis University; M.S. in Civil Engineering (Transportation) from Massachusetts Institute of Technology; and M.C.P. in City Planning from Massachusetts Institute of Technology.

Experience: Twenty-six years experience in consulting relating to economic development, economic impact modeling, and transportation; 15 years experience in the application of various economic models to transportation investments; Chair of the Committee on Transportation and Economic Development – Transportation Research Board; current President of Economic Development Research Group.

Lisa Petraglia, Economic Development Research Group, Inc.

Project Role: Design and initial construction of the economic growth model to forecast county-level business and population attraction impacts; and technical reviewer for CRIO-IMPLAN model forecasts.

Education: B.S. from the University of Massachusetts, Amherst; and M.S. in Applied Economics from the University of Massachusetts, Amherst

Experience: Over 15 years experience in economic modeling and policy analysis, focusing on economic impact evaluation; extensive experience with input-output and general equilibrium economic models, including their application to address transportation investments/policies.

Brian Baird, Economic Development Research Group, Inc.

Project Role: Construction and analysis of the TREDIS framework, including the economic growth model and business attraction model.

Education: B.S. in Civil Engineering from the University of Connecticut; and M.S. in Transportation Engineering and M.A. in Economics from the University of Connecticut.

Experience: Seven years experience in consulting and university research related to transportation, economics, and urban systems; five years experience working on interfacing travel demand models and economic impact models.

Rimon Rafia, Consultant

Project Role: Construction and analysis of TREDIS model.

Education: B.A. in Economics from Hebrew University in Jerusalem; and M.A. in Economics from Tel Aviv University

Experience: Mr. Rafiah has over a decade of work experience in transportation economics, including applications of economic analysis for transportation infrastructure investments around the world.

Michael Reilly, Stanford University

Project Role: Technical lead for development of residential land consumption; modified and ran CURBA model; and performed environmental overlay analysis for secondary impacts.

Education: B.A. in Anthropology from University of California; M.C.P. from the University of California; and Ph.D. program in Urban and Regional Planning at University of California.

Experience: Ten years research experience in urban and transportation analysis and modeling, with focus on California land use and development patterns; 10 years research in developing and applying CURBA model.

Appendix A

Estimation of Mode Shift Benefits

Appendix A. Estimation of Mode Shift Benefits

Mode shift benefits for HST system users were estimated through a process known as log-sum calculation. The log-sums results from the 1999 high-speed rail travel demand model were used as a base to forecast mode shift benefits, with a series of adjustments made to reflect differences between the 1999 and current travel demand models, as well as between the Pacheco and Altamont HST network alternatives.

■ A.1 Log-Sum Values from 1999 Travel Demand Model

Travel efficiency benefits for users of the HST system were estimated separately for intercity business users, intercity non-business users, and long-distance commuters. The benefits were estimated through a process known as a log-sum calculation. Using this process, the total benefit for switching from each mode to HST is calculated as a function of the log sum of utilities for travelers of that mode using the following equation:

$$B_{\text{mode}} = \frac{\mu_{\text{mode}} - \ln(e^{\mu_{\text{mode}}} + e^{\mu_{HSR}})}{\beta_{\text{cost}}}$$

where B_{mode} is the total benefit for that mode, μ_{mode} is the utility of travel on that mode, μ_{HSR} is the utility of travel on high-speed train, and β_{cost} is the coefficient of cost for travel on that mode (to monetize the benefits). The utility of a particular mode is calculated as a function of travel time and out-of-pocket costs, as follows:

$$\mu_{\text{mode}} = \alpha + \beta_{xost} \times Cost + \beta_{IVT} \times IVT + \beta_{Access} \times Access + \beta_{OVT} \times OVT$$

Where β_{cost} is the coefficient of cost for travel on that mode; β_{IVT} is the coefficient of line haul (in vehicle) time on that mode; β_{Access} is the coefficient of access/egress time on that mode; and β_{OVT} is the coefficient of out-of-vehicle (i.e., wait, terminal processing, etc.) on that mode.

These calculations use coefficients from the mode choice model developed for previous work by the HSRA, and travel time and cost information developed for the prior model. The mode choice coefficients for the relevant modes are shown in Table A.1. Monetary values that resulted from these coefficients were adjusted to 2002 dollars for purposes of the REMI analysis in the Statewide Program EIR/EIS.

Table A.1 Values of Time from Previous HST Mode Choice Models

	Local Air	Conventional Rail	Private Auto	
			Short Distance	Long Distance
Business Trips				
Modal Constant	0.0993	0.7848	-0.6600	-0.7995
Line-haul Time (IVT)	-0.0357	-0.0254	-0.0142	-0.0110
Access/Egress Time	-0.0382	-0.0325	-0.0175*	-0.0184
Wait Time (OVT)	-0.0207	-0.0225		-0.0060
Cost	-0.0505	-0.1046	-0.0450	-0.026
Non-Business Trips				
Modal Constant	0.1174	0.5226	-1.0369	-0.8768
Line-haul Time (IVT)	-0.0373	-0.0197	-0.0057	-0.0066
Access/Egress Time	-0.0141	-0.0212	-0.035**	-0.0093
Wait Time (OVT)	-0.0321	-0.0144		-0.0031
Cost	-0.0744	-0.0860	-0.0553	-0.0293

Source: Charles River Associates, 1996.

* This access/egress coefficient is applied the following ratio of travel times – (*OVT*)*(1.5**access*)/*IVT*.

** This access/egress coefficient is applied the following ratio of travel times – (0.5**OVT*)*(1.5**access*)/*IVT*.

A.2 Adjustments to Prior Log-Sum Values

A series of adjustments were undertaken to the prior log-sum values in order to reflect changes between the 1999 and current versions of the high-speed rail travel demand models. The adjustments accounted for differences in the following:

- Structure of analysis regions used for the economic forecasting, necessitating reallocation of log-sum totals;
- Forecasted source of HST ridership (e.g., auto, air, conventional rail, induced travel);
- Values of time;
- Number of trips by mode under high end assumptions;
- Inclusion of non-commute intraregional trips in the new HST travel demand model; and
- Travel model results by region for the Altamont and Pacheco HST network alternatives.

Appendix B

Estimation of Non-User Benefits

Appendix B. Estimation of Non-User Benefits

This appendix describes technical procedures that were followed to estimate non-user benefits for the HST Alternatives. The term "non-user benefits" refers to savings that accrue to individuals who do not use the HST system after service begins. Nonetheless, these individuals might receive residual benefits from travel delay reductions or related areas that arise from diversion of trips to HST from auto, air, and/or conventional rail modes.

B.1 Auto Congestion Reduction Benefits

The HST Alternatives involve diversion of trips from the auto mode to the HST mode. The alternatives also assume that the highway network from the No-Project Alternative remains in place to serve the remaining auto demand of the HST Alternatives. The combination of constant highway capacity and decreased travel demand via auto will lead to reductions in travel delay for individuals who remain in the auto mode.

Auto congestion reduction benefits for each HST alternative were estimated by calculating the absolute difference between the vehicle hours traveled (VHT) under the HST Alternatives and the No-Project Alternative. This calculation relied on results from the MTC Statewide High-Speed Rail Travel Demand Model. For HST, travel demand model results were used for the HST Network Alternatives representing service to San Jose and Oakland termini in the Bay Area. VHT results were tracked separately for trips wholly within a single metropolitan area (intraregional trips), as well as trips between metropolitan areas (intercity trips). Intraregional truck and auto VHT in the Bay Area and Southern California are forecast separately in the travel demand model, and were tracked separately for the congestion reduction calculations. For intraregional trips in other areas and all intercity trips, the travel demand model calculates total VHT. This total was split into auto and truck components using VHT splits of 96.8 percent auto and 3.2 percent truck for intraregional, and 95 percent auto and 5 percent truck for intercity[1].

VHT changes were converted to monetary values by multiplying the absolute change in VHT by values of time (VOTs) corresponding to different trip purposes and regions. For intraregional trips, average hourly wages for the Bay Area, Los Angeles, and the State

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[1] *Truck Miles of Travel on the California State Highway System, 1989-2004*, California Department of Transportation Division of Transportation System Information, August 2006.

were compiled from the Bureau of Labor Statistics and converted into hourly values by trip purposes using shares of wage rates by trip purpose that were determined by MTC. Table B.1 summarizes these intraregional VOTs. For intercity trips, VOTs from the MTC Statewide High-Speed Rail Travel Demand Model were used. These intercity VOTs are shown in Table B.2.

Table B.1 Intraregional Values of Time by Trip Purpose
(2005 Dollars Per Hour)

	Share of Wage Rate	Bay Area	Southern California	California State
Average Hourly Wage		**$24.00**	**$20.40**	**$20.44**
Home-Based Work	46%	$11.20	$9.30	$9.50
Home-Based Shopping	32%	$7.60	$6.30	$6.50
Home-Based Social/Recreational	4%	$0.90	$0.80	$0.80
Home-Based Grade School	2%	$0.40	$0.30	$0.30
Home-Based High School	1%	$0.30	$0.20	$0.20
Home-Based College	3%	$0.80	$0.60	$0.70
Non-Home-Based	5%	$1.30	$1.00	$1.10
Trucks	100%	$24.00	$20.40	$20.44

Source: U.S. Bureau of Labor Statistics and Metropolitan Transportation Commission (http://www.mtc.ca.gov/maps_and_data/datamart/forecast/table4.htm).

Table B.2 Intercity Values of Time by Trip Purpose
(2005 Dollars Per Hour)

	Business Trips	Commute Trips	Other Trips	Truck Trips
Long Trips (>100 miles)	$57.71	$57.71	$18.33	$30.00
Short Trips (<100 miles)	$27.60	$10.12	$7.93	$30.00

Source: *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Interregional Model System Development*, Cambridge Systematics, Inc., August 2006, Table 3.14.

■ B.2 Pollution and Accident Reduction Benefits

As in the case of congestion reduction benefits, pollution and accident reduction benefits arise from the reduction in vehicle miles traveled (VMT) between the No-Project and the

HST Alternatives, given that the HST Alternatives involve diversion of trips from the auto mode to the HST mode.

Pollution and accident reduction benefits for each HST alternative were estimated by calculating the change in VMT between the No-Project and HST Alternatives. VMT estimates for each economic analysis region were forecast in the MTC Statewide High-Speed Travel Demand Model. VMT changes were then converted to monetary values using conversion rates of $0.07 per VMT to estimate accident reduction benefits, and $0.009 per VMT to estimate pollution reduction benefits. These values were taken from previous HST studies[2] and adjusted for inflation.

■ B.3 Air Delay Reduction Benefits

The HST Alternatives include transportation system changes that could lead to delay reductions for air travelers when compared to the No-Project Alternative. Specifically, reduction in intrastate air travel with the HST Alternative could reduce the number of intrastate flights needed to accommodate this air demand, thereby, saving time for remaining intrastate, interstate, and international air travelers due to fewer takeoffs and landings at major airports.

This analysis considered the potential for air delay reduction benefits at airports throughout California. As with a previous analysis performed for the HSRA,[3] this analysis focused on airside delay reductions to passengers and aircraft operations at nine major airports in California. Unlike the earlier analysis, however, this current analysis considered the potential for air delay reduction benefits to accrue to other locations throughout the State. Although air carrier airports in these other locations were unlikely to experience meaningful changes in airside travel time, a portion of the air delay reduction benefit from major airports would actually accrue to the regions around these other airports due to changes in overall flight time for intrastate air travel.

Airport Capacity

Airport capacity was determined on a regional basis, which allowed for continuation of assumptions from the earlier HSRA work that flights (particularly intrastate) could shift from airports with high levels of delay to less congested airports in the same region. The following regional groupings were used for major airports:

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[2] *Economic Growth Effects of the System Alternatives for the Program Environmental Impact Report/ Environmental Impact Statement*, Cambridge Systematics, Inc., July 2003.

[3] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix A, Charles River Associates, January 2000.

- **Los Angeles –** Los Angeles International, Burbank-Glendale-Pasadena, Ontario International, and Orange County (John Wayne Airport);
- **Bay Area –** San Francisco International, San Jose International, and Oakland International;
- **Sacramento –** Sacramento International; and
- **San Diego –** San Diego International (Lindbergh Field).

Airside operational capacity (annual service volume) was estimated on a regional basis using the existing number of runways and terminal gates, and improvements defined for the No-Project Alternative in the Bay Area to Central Valley Program EIR/EIS. For this analysis, it was assumed that runway and terminal configurations were identical between the No-Project and HST Alternatives. Physical facilities were converted to operational capacity using the following assumptions:

- Gate utilization factor of 525,000 passengers per gate per year[4];
- Gate to runway ratio of 30[5]; and
- Average aircraft load of 74 passengers per operation[6].

The larger of the two values derived from runway and terminal gate improvements was assumed to represent the operational capacity in each region. A summary of the airport physical features and operational capacity used for this analysis is presented in Table B.3.

Table B.3 Airport Characteristics of the System Alternatives

	Airport Physical Features				Annual Service Volumes (Thousands of Operations)	
	Year 2005		Increase from Year 2005 for No-Project and HST Alternatives			
Region	**Runways**	**Gates**	**Runways**	**Gates**	**Year 2002**	**Year 2030**
Los Angeles	10	194	0	24	2,153	2,307
Bay Area	10	172	0	29	1,267	1,455
Sacramento	2	30	0	14	315	405
San Diego	1	41	0	8	270	322

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[4] *System Alternatives Definition – Deliberative Draft*, California High-Speed Rail Authority, November 18, 2002.

[5] ibid

[6] This value is a statewide average for major airports, and was derived from data presented in Appendix A of the *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California.*

Air Travel Demand

Results for each system alternative from the MTC Statewide High-Speed Rail Travel Demand Model provided the region-to-region air flows for intrastate air travel. These region-to-region flows were aggregated to flow totals that reflected the regional airport grouping presented earlier. This allocation of analysis regions to the regional groupings was as follows:

- **Los Angeles –** Los Angeles, Orange, Riverside, San Bernardino, and Ventura;
- **Bay Area –** Alameda, Contra Costa, San Francisco, San Mateo, Santa Clara and a portion of the "rest of California";
- **Sacramento –** El Dorado, Placer, Sacramento, Sutter, Yolo and Yuba;
- **San Diego –** San Diego;
- **Northern Central Valley –** Fresno, Madera, Merced, San Joaquin, and Stanislaus;
- **Southern Central Valley –** Kern, Kings, and Tulare; and
- **Rest of State –** The remainder of the "rest of California" not included in the Bay Area.

Estimates were also made of interstate and international enplanements and deplanements in each major region. These estimates were based on results from a previous HSRA analysis that had used travel model results for the Business Plan assumptions.[7] The difference between total airport demand (from the HSRA analysis) and intrastate airport demand (from the MTC Statewide High-Speed Rail Travel Demand Model) provided a year 2030 estimate of interstate and international airport demand (enplanements and deplanements). The total regional airport demand for this current analysis was estimated as the sum of the interstate/international airport demand and the intrastate travel model results for each system alternative.

Commercial aircraft operations within each region were estimated using an assumed average of 74 passengers per operation.

[7] *Independent Ridership and Passenger Revenue Projections for High-Speed Rail Alternatives in California*, Appendix A, Charles River Associates, January 2000.

Airport Delay

Regional airport delay was estimated for each system alternative and HST design option using the equation:[8]

$$Delay\ per\ aircraft\ operation\ (\text{min.}) = 0.19 + 2.33 * \left(\frac{annual\ operations}{annual\ service\ volume} \right)^6$$

Operations and service volume estimates for each system alternative were taken from previous steps. The delay reduction for the Altamont and Pacheco HST Alternatives was derived by subtracting the delay value from these alternatives from the delay value for the No-Project Alternative. Delay reductions, which ranged from 0.1 minute at Sacramento up to 2.7 minutes in the Bay Area, are summarized in Table B.4.

Table B.4 Year 2030 Annual Delay Reduction from No-Project Alternative for Aircraft Operations

	Altamont HST Alternative		**Pacheco HST Alternative**	
	Time Saved Per Operation (In Minutes)	**Annual Delay Reduction (Thousands of Passenger Hours)**	**Time Saved Per Operation (In Minutes)**	**Annual Delay Reduction (Thousands of Passenger Hours)**
Los Angeles Region	0.98	3,914	1.00	4,004
Bay Area	2.62	7,455	2.67	7,609
Sacramento	0.09	46	0.10	46
San Diego	2.09	2,147	2.14	2,183
Northern Central Valley	–	4	–	4
Southern Central Valley	–	1	–	1
Rest of State	–	29	–	25
Statewide Total	**–**	**13,596**	**–**	**13,872**

Source: Cambridge Systematics, Inc., 2003.

Total delay reduction was calculated for aircraft operators and air travelers in each region by multiplying the delay reduction per operation by the estimated number of aircraft operations and air travel demand, respectively. Separate tabulations were maintained for intrastate and interstate/international travelers.

[8] Levinson, D., and D. Gillen, *The Full Cost of Air Travel in the California Corridor*, presented at the Annual Meeting of the Transportation Research Board, Washington, D.C., January 1999. This equation was used in previous work by the HSRA.

Total regional delay savings for air travelers were split into business and non-business components, assuming that business travel represented about 54.3 percent of total air travel. This percentage represents a statewide average for intrastate air travel using travel demand results from the No-Project Alternative. This percentage was assumed to apply equally to intrastate and interstate/international air travelers.

A portion of the delay reduction within the four major airport regions was assumed to accrue to airports elsewhere in the State. This allocation considered time savings for intra-state air travelers from the northern and southern Central Valley and the rest of the State that travel into or through airports in one of the four major regions. Average delay reductions for flights at each major airport were applied to estimates of air travel between the four major airport regions and elsewhere in the State. The resulting delay reductions were applied to the other airports, and then subtracted from the original delay reduction estimates for the major airports (to avoid double-counting of benefits).

Monetized Benefits

The delay reduction benefits were converted to monetary benefits using the following "values of time" (expressed in 2005 dollars):

- $57.72 per hour for a business or commute traveler;
- $18.33 per hour for a non-business/commute traveler; and
- $2,910 per aircraft operating hour.

The monetary benefits were assumed to accrue one-half at the origin end and one-half at the destination end of each trip. For interstate and international flights, this assumption means that one-half of delay savings is "lost" to some other location, either domestically or internationally.

Appendix C

Analysis of Business Attraction

Appendix C. Analysis of Business Attraction

This analysis considered the potential for increased business activity within the study area as a result of better access to markets. This effect is separate from (and additional to) the economic benefits of improved travel efficiency. Business attraction captures the benefit of new locational advantages resulting from better transportation linkages and expanded market access.

In producing goods, firms rely on access to suppliers and a quality labor force. In addition, many firms also rely on proximity to consumer markets to sell their goods. Transportation projects have the potential to change these economic landscapes by expanding the area within which a business will access suppliers, customers, or workers. This effect may be achieved either by creating new transportation linkages, or by increasing speeds on existing transportation networks. In either case, the new linkages may facilitate scale economies through improved access to producers and skilled labor markets. Over time, this increased productivity may enable existing firms to increase output and employment, and it may draw other firms to the region. The net result is increased output and employment.

These general effects of transportation investments on economic development will depend on changes in accessibility to input (workers and supplies) and output markets, industry sector characteristics, and local economic characteristics. These three factors, which are summarized in Table C.1, comprise the general framework used in the business attraction model (BAM) within TREDIS. Modeling the effects of any particular transportation improvement, however, requires fine-tuning of a generalized BAM to capture the unique characteristics associated with the affected transportation modes and the economic geography of the areas being modeled.

Table C.1 General Business Attraction Modeling Framework

Element	General Indicator
Accessibility Measures	
Product Markets and Suppliers	Level of economic activity within radius
Regional/International Markets	Time to airports, rail centers, ports, etc.
Labor Market Access	Number of workers within fixed radius
Local Area Characteristics	
Labor Cost	Relative manufacturing wage
Office/Warehouse Cost	Relative rents or land/housing costs
Skilled Workers	Percent of population with bachelor's degree
Industry Sector Characteristics	
Space Intensity	Average floor space per worker
Skill Intensity	Percent production workers; average wage
Transportation Intensity	Transportation as % of production costs

■ C.1 Business Attraction Framework

Accessibility Measures

Accessibility effects capture the absolute influence of transportation improvements on access to labor, supplier, and buyer markets. The relevant radius for labor market access is generally smaller (e.g., 60 to 90 minutes) than for supplier and buyer market access (e.g., 180 to 240 minutes). Accessibility measures capture the effects of transportation improvements on existing firms in an area that will experience lower transportation costs, as well as the overall attractiveness of an area as a site for new firms. Transportation improvements also improve access to regional and international markets by reducing the time and costs to key transportation modes (e.g., airports, rail centers, and sea and river ports). The level of these improvements is measured by the percent reduction in time needed to access these modes and points.

Local Area Characteristics

Improvements in accessibility interact with *local economic characteristics*, including land and labor costs and workforce characteristics, to determine the overall level of economic benefit associated with improved transportation networks. For existing firms, access to new sources of labor is a key factor; with improved access, firms might increase market share or expand the range of activities at existing sites. New firm locations are influenced by similar factors. For example, areas with relatively low-cost land and labor can expect to increase their chances of attracting labor- and land-intensive industrial activities, while those with access to highly skilled labor will be attractive to skilled manufacturing, high-end services, management, and engineering activities.

Industry Sector Characteristics

Industry sector characteristics are important for identifying the types of industries that will be drawn to an area after transportation improvements. The key industry sector characteristics modeled include the following:

- The space intensity of the industry, which measures the average amount of floor space required for each worker;
- Skill intensity, which captures each industry's dependence on skilled labor; and
- Transportation intensity, which reflects the percent of total production costs that go to transportation-related expenses.

Local areas with low costs of industrial space (e.g., land, offices, plants, warehouses) will be attractive to industries that require large amounts of footage per employee. Local areas with a high proportion of skilled workers will be attractive to industries that require highly skilled workers in production and support activities like research and development. In all cases, industries with higher transportation intensities will be more strongly affected by improvements – and associated cost and time savings – associated with infrastructure improvements.

■ C.2 Modeling Transportation Alternatives for California

Business Attraction Model Modifications

Two primary modifications had to be made to the BAM for this project. First, unlike highway or airport improvements that increase the efficiency with which people *and* freight can be transported, international experience suggests that HST is used almost exclusively for the transport of people. To address this, modifications were made to categorize industries based on the relative weights of personnel versus freight movements in total transportation costs. Second, the economic geography of California is unique: unlike rural areas, where economic activity is more dispersed and networked, or states such as Massachusetts, where a large portion of economic activity is centered around one city (Boston), California is characterized by two primary concentrations of activity – the Bay Area and Los Angeles. To address this, each county affected by HST was categorized according to the likely influence of the Bay Area and Los Angeles on their business attraction potential. Modifications to the BAM used for analysis of California HST are summarized in Table C.2.

Table C.2 Modifications to General Business Attraction Model for HST Analysis

Unique Feature	Modification to BAM
Modal Characteristics	
HST transports primarily people	Industry dependence on business travel
Other modes transport people and freight	Industry dependence on freight movements
Local Area Characteristics	
Concentration of activity in Bay Area	Develop production costs for each county in Bay Area and Northern Central Valley relative to San Francisco
Concentration of activity in Los Angeles	Develop production costs for each county in Southern California and Southern Central Valley relative to Los Angeles
Industry Sector Characteristics	
Cost competitiveness	Off/plant and labor costs
Skill base	Educational attainment levels

Two sets of business attraction effects were modeled for the HST alternatives:

1. The direct accessibility effects of the introduction of HST; and
2. The indirect benefits associated with reductions in highway congestion as highway users switch to HST.

In addition, improvements associated with access to international airports were recognized in the enhanced economic impact model. These are associated with ease of accessing major national and international markets.

For new business attraction, the analysis of HST and highway infrastructure effects proceeded in three steps:

1. Estimation of labor, market, and airport accessibility numbers, with changes used to generate estimates of the overall increases in market size;
2. Characterization of industry sector to estimate the potential of change on activity in each industry, based on the industry's transportation and skill requirements; and
3. Characterization of each county's business environment to translate potential maximum industry sector growth into actual business attraction by county.

In short, the process can be thought of as a matching between industry sector demands and county characteristics that yields estimates of business attraction by industry, county, and mode.

Labor, Market, and Airport Accessibility

Introduction of HST and improvements in highways and airports will increase access to labor and output markets. For HST modeling, the increase in labor market accessibility was modeled by the increase in the number of workers (as proxied by total employment levels) within a 90-minute radius; for highway improvements, a 60-minute radius was used. Different radii were used to reflect different valuations of time for commuters in each mode: while HST commuters can read, write, and work while commuting, highway users cannot. The proportion of lost time will be higher for highway commuters and, accordingly, acceptable commute lengths lower.

In both alternatives, increased market access is modeled by the change in access to economic activity (as proxied by total employment levels) within a 180-minute radius. With improved market access, existing firms (that can be assumed to have already developed some competitive advantage) expand the potential market areas for their products. These improvements translate into greater sales and employment for existing firms. Thus, firms in counties like Los Angeles, with a broad and deep economic base already in place, are expected to experience growth in the size or range of functions by firms already located there as the effective market area expands. At the same time, greater market access makes peripheral counties with less developed economic bases more attractive locations for the siting of new firms. With improved access, smaller or more remote counties enjoy a greater effective market area and become more attractive than in the past vis-à-vis large economic centers like Los Angeles and San Francisco. In this way, improved market access will be expected to increase the competitiveness of all sites relative to other locations in the U.S., while at the same time improving the attractiveness of California counties that lie on the periphery of the existing industrial centers.

The accessibility estimates were prepared using the MTC Statewide High-Speed Rail Travel Demand Model. For each alternative, the number of people and jobs that were accessible within certain time bands was calculated. The time band was estimated using door-to-door travel times on the fastest available mode between each origin-destination pair. The time band information was then combined with the population and employment forecasts to estimate the total labor and business market access in each county (for each trip purpose, mode, and alternative). In addition, the model was used to estimate the average auto travel time necessary to travel to a major airport from each of the 16 California regions.

Industry Sector Characteristics

The effect of industry sector characteristics was modeled based on the intensity and type (i.e., the relative importance of freight shipments versus personnel movements) of transportation requirements associated with each industry. Intuitively, access to HST would seem to affect most strongly industries, such as legal services, finance, insurance, and management services that utilize transportation services primarily to move persons (an assumption borne out by case studies of business attraction effects of HST in Europe, North America, and Asia). Improvements in highways, on the other hand, will more strongly influence industries that utilize transportation services primarily to move freight, such as manufacturing, warehousing, and distribution firms.

Industry estimates of freight versus personnel movement were developed based on typical business travel expenses calculated from national input/output coefficients from the U.S. Bureau of Economic Analysis. Effects on different industry sectors will also be influenced by the types of workers required by each industry. In general, industries that require higher proportions of skilled and specialized labor benefit from improved labor market access more than those that rely more heavily on low skilled workers. To capture this effect, skill-intensity measures were developed for each industry, based on the proportions of production and non-production workers and average industry sector wages, as reported by the U.S. Department of Labor.

County Characteristics

Two sets of county characteristics were developed:

1. Cost-competitiveness, based on local labor and office/plant/warehouse costs; and

2. Workforce characteristics based on educational attainment levels of the population in each county.[1]

For each county in the Bay Area and northern Central Valley, an overall indicator of cost competitiveness was determined by the costs of land and labor relative to San Francisco County; for counties in the southern Central Valley and Southern California, comparisons were made to Los Angeles County. In conjunction with data on the baseline economic structure (i.e., employment levels by industry in the comparator and other modeled counties), data on county characteristics provide a measure competitiveness of each county relative to the San Francisco and Los Angeles. Combined with county-level accessibility measures, these data are used to estimate the shift in economic activity from the comparator counties to the outlying counties.

Final Adjustments

The business attraction model operates separately and independently for each of the 15 regions directly impacted by the HST alignments. Thus, gross results include some "double-counting" of job creation because jobs drawn to one affected region may have been attracted away from another affected area. For example, some of the BAM-forecasted jobs attracted to Fresno may be drawn away from San Francisco (among other

[1] Data on labor costs were taken from the *County Business Patterns*, U.S. Census Bureau; data on land and office costs were derived from county housing and rental costs from U.S. Census Bureau; and county educational attainment levels were taken from U.S. Census Bureau.

counties). To account for this effect for all of California, a model was developed that determines the likely source of predicted job attraction for each of the 15 BAM regions. The model operates at the county level, and the source county for each attracted job is based on several factors:

- The attracted job's industrial sector;
- The amount of sector-specific employment in any potential source county;
- The sector-specific employment trend in any potential source county relative to the U.S. trend; and
- The effective time and cost involved in travel between the potential source county and county to which jobs are attracted

The model was run for each of the 15 California regions with market access benefits, pooling jobs drawn from any California county. Results were then aggregated back to the 16 regions, and the totals were subtracted from the gross BAM results to determine net business attraction.

Appendix D

Detailed Tabulation of Traveler Benefits

Appendix D. Detailed Tabulation of Traveler Benefits

Table D.1 Year 2030 Traveler Benefit Detail for the Pacheco HST Alternative
(Thousands of 2005 Dollars)

	Core Study Area Bay Area	Core Study Central Valley	Southern Sacrament o Valley	Southern San Joaquin	Southern California	San Diego County	Rest of California	Total
Mode Shift Benefits for Intercity Business Travelers	947,872	362,010	71,181	44,578	1,351,478	475,810	261,219	**3,514,149**
Mode Shift Benefits for Intercity Non-Business Travelers	527,229	219,507	45,256	37,669	656,523	217,917	134,539	**1,838,639**
Auto Delay Reduction for Intercity Business Travelers	156,257	408,393	34,499	243,477	711,366	225,321	199,312	**1,978,625**
Auto Delay Reduction for Intercity Non-Business Travelers	235,942	809,914	72,051	379,687	792,745	302,503	343,730	**2,936,572**
Accident Reduction for Business Travelers	163,020	102,355	6,653	61,788	450,053	46,100	78,253	**908,222**
Accident Reduction for Non-Business Travelers	186,809	117,290	7,624	70,805	515,726	52,827	89,672	**1,040,752**
Air Pollution Reduction for Business Travelers	21,525	13,499	877	8,149	60,383	6,080	10,321	**120,834**
Air Pollution Reduction for Non-Business Travelers	24,666	15,469	1,005	9,338	69,194	6,967	11,827	**138,466**
Mode Shift Benefits for Intra-Regional Travelers	40,811	0	0	0	87,862	16,801	0	**145,474**
Auto Delay Reduction for Intra-Regional Travelers	941,251	18,634	3,194	12,036	3,102,342	420,824	341,437	**4,839,716**
Air Delay Reduction for Business Travelers	140,181	957	130	29	73,503	49,351	782	**264,933**
Air Delay Reduction for Non-Business Travelers	37,528	256	35	8	19,678	13,212	209	**70,926**
Air Delay Reduction for Operators	160,076	1,092	80	18	83,935	56,355	484	**302,041**

Table D.2 Year 2030 Traveler Benefit Details for the Altamont HST Alternative
(Thousands of 2005 Dollars)

	Core Study Area Bay Area	Core Study Central Valley	Southern Sacramento Valley	Southern San Joaquin	Southern California	San Diego County	Rest of California	Total
Mode Shift Benefits for Intercity Business Travelers	928,552	388,268	81,512	45,506	1,355,622	476,292	270,770	**3,546,522**
Mode Shift Benefits for Intercity Non-Business Travelers	491,795	229,688	51,966	36,926	634,307	202,223	132,047	**1,778,952**
Auto Delay Reduction for Intercity Business Travelers	142,673	386,877	35,221	225,115	479,047	187,137	186,994	**1,643,064**
Auto Delay Reduction for Intercity Non-Business Travelers	205,091	766,351	74,044	335,205	685,815	251,690	301,676	**2,619,872**
Accident Reduction for Business Travelers	60,474	99,105	11,371	56,664	433,540	41,757	75,804	**778,715**
Accident Reduction for Non-Business Travelers	69,298	113,566	13,031	64,933	496,803	47,850	86,866	**892,347**
Air Pollution Reduction for Business Travelers	7,976	13,071	1,500	7,473	57,178	5,507	9,998	**102,702**
Air Pollution Reduction for Non-Business Travelers	9,139	14,978	1,719	8,564	65,522	6,311	11,456	**117,689**
Mode Shift Benefits for Intraregional Travelers	40,811	0	0	0	88,036	16,627	0	**145,474**
Auto Delay Reduction for Intraregional Travelers	242,322	25,873	30,511	12,610	3,040,712	517,834	175,307	**4,045,170**
Air Delay Reduction for Business Travelers	137,400	945	125	30	71,891	48,700	888	**259,979**
Air Delay Reduction for Non-Business Travelers	36,784	253	33	8	19,246	13,038	238	**69,600**
Air Delay Reduction for Operators	156,900	1,079	78	19	82,094	55,612	550	**296,330**

Appendix E

Land Consumption Analysis for Employment

Appendix E. Land Consumption Analysis for Employment

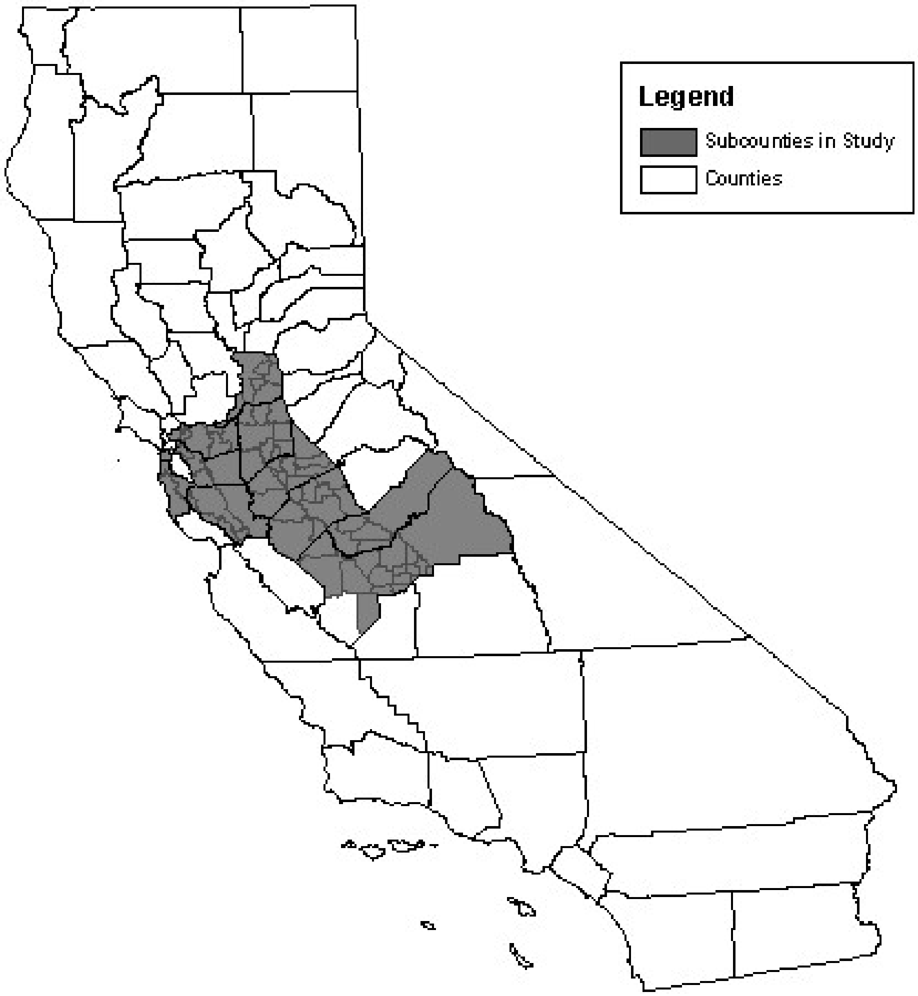
The analytical process for estimating employment-related land consumption was identical to the process followed for the Statewide Program EIR/EIS. This process consisted of three main steps, including development of a database of current employment density for every ZIP code, allocation of forecast employment to segments of the urbanized area around each station, and tabulation of resulting land consumption.

The process began by classifying every ZIP code in the study area into subcounties associated with each station. Subcounties are the basic area of influence assumed for each station. Where no single HST alternative proposes more than one station in a county, the area of influence generally consists of the entire county. Where multiple HST stations exist within a county, the county was divided along ZIP code boundaries into subcounties associated with each station. For large counties with boundaries that extend well beyond 25 miles from the proposed alignment, such as Fresno County that extends far east and west of the corridor, only the portion of the county within the study area was used. By focusing on only those ZIP codes closest to the proposed HST alignment, the influence of development patterns typical of less densely populated portions of the State on the statistical analysis was minimized. Furthermore, the study area boundary concentrates development impacts of HST generally within 25 miles of the corridor, which leads to more reliable results. Figure E.1 shows the subcounties and the study area included in the analysis.

Each subcounty is associated with one "prototype" based on the position of a potential HST station within the system and the nature of existing development patterns in the subcounty. Prototypes included the following:

- Terminal (station at the end of a line in a major city downtown);
- Urban (through station in a small city downtown or other densely urbanized area);
- Suburban (through station in a lower density urbanized area);
- Urban-outlying (through station in a city independent of a major metropolitan area, such as in the Central Valley); and
- Rural (through station in a small rural community).

Figure E.1 Subcounties and Study Area for Employment Land Consumption



Each subcounty is further subdivided into three subregions, which include the following:

1. **Downtown –** Traditional central business district;
2. **Infill –** Rest of currently urbanized area as defined by the U.S. Census; and
3. **Other –** Undeveloped land located outside of the currently urbanized area.

E.1 Disaggregation of Statewide and Regional Employment Forecasts

County-level employment forecasts by industry were allocated to subcounties based on the total current employment in the ZIP codes contained in each subcounty. These disaggregation factors were based on the number of establishments by size class and industry as reported by the U.S. Census in its 1997 ZIP Code Business Patterns (CBP) data; adjusted to 2002 county control totals as reported by Woods and Poole.

E.2 Development of Current Employment Density Profile

Employment density was calculated by industry for each ZIP code in the study area. Employment by ZIP was based on the CBP data. Employment land area was based on land use data provided by each jurisdiction in the study area. Existing land available for employment uses was derived from the calculations of land zoned for employment by one-digit SIC for each ZIP code. In counties for which no zoning data was available, the land available for each industry was calculated using average percentages of total land area available for each use.[1] Different averages were used for each prototype-subregion combination to better reflect local conditions.

Density profiles were developed for each of the 15 prototype-subregion combinations to represent the range of development patterns encountered across the study area. Densities are expressed as employees per acre of land zoned for employment in each industry. The profiles include densities in five percentile increments from the 0th to 100th. Table E.1 shows the median (50th percentile) density value for each industry and prototype-subregion combination.

[1] In Fresno and Madera Counties, the land available was computed based on statewide average shares of total land area by prototype and subregion. In Alameda, Contra Costa, Santa Clara, San Francisco, and San Mateo Counties, land available was computed based on statewide shares of total employment area by prototype and subregion using employment land area data provided by the Association of Bay Area Governments (ABAG). These averages were derived from the calculations by ZIP for the rest of the State.

Table E.1 Median Employment Density by Industry

Subregion	Number of ZIP Codes in Sample	Employment Density (Employees Per Acre)									
		Farming	Mining	Construction	Manufacturing	TCU	Wholesale	Retail	FIRE	Services	Government
Terminal											
Downtown	29	0	0	23	35	36	13	30	72	112	366
Infill	66	0	0	31	3	23	6	19	10	44	324
Other	9	0	0	1	0	0	2	4	2	11	0
Urban											
Downtown	32	0	0	68	35	14	13	20	63	62	405
Infill	430	0	0	42	17	9	9	20	32	36	240
Other	4	0	0	68	17	0	11	644	5	9	3
Suburban											
Downtown	0										
Infill	167	0	0	56	14	4	8	22	49	26	222
Other	16	0	0	15	0	1	0	6	4	16	23
Outlying											
Downtown	11	0	2	49	2	4	4	26	7	50	781
Infill	71	0	0	11	2	2	2	12	4	14	88
Other	12	0	0	10	1	4	1	3	1	1	247
Rural											
Downtown	0										
Infill	69	0	0	23	5	118	5	20	3	24	158
Other	18	0	0	0	2	109	11	4	0	5	194

Note: Development in suburban and rural downtowns is assumed to be the same as in their respective infill areas, because downtowns in these locations are generally not distinguishable from the rest of the urban area at the ZIP code level of geographic detail.

The profile presents the range of densities encountered in all counties potentially served by HST. Assumptions were made based on the review of domestic and international experience about how station area development would intensify over time. Major conclusions from the research translated into the following densification assumptions:

- Expected development intensity of new real estate investment is assumed to be 50^{th} percentile (median) at present in all areas, with normal ongoing infill and refill increasing intensity to 60^{th} percentile by 2030 in downtown and infill areas. *Other* areas continue to develop at median intensity through 2030.

- The No-Project Alternative has no further development intensification effect in downtown, infill, or other areas.

- The HST Alternatives have no further intensification effect outside of the station influence area. While it has been assumed the influence area generally extends in a one-mile radius from a station, this distance can vary due to the ZIP code granularity of the analysis.

- Under regular market forces, the HST Alternatives are assumed to have an intensification effect in station influence area by 2030 (75th percentile).

Table E.2 summarizes the development density gradient of each alternative throughout the station subcounty.

Table E.2 Density Gradient

Alternative	Percentile Value of Assumed Density for Subregion and Alternative			
	Station Area	Downtown Area	Infill Area	Other Area
2005 Existing Conditions	n/a	50	50	50
2030 No-Project	n/a	60	60	50
2030 Altamont HST	75	60	60	50
2030 Pacheco HST	75	60	60	50

Note: For Altamont and Pacheco HST Alternatives, subregions are defined as the rest of the No-Project subregion that is not included in the station area.

■ E.3 Allocation of Employment to Subregions and Calculation of Land Requirements

Land consumption was computed for a subcounty by allocating future employment to each subregion in a step-wise fashion. For the No-Project Alternative, a subcounty's forecasted employment was first allocated to the downtown area. The number of additional employees that could be accommodated in the downtown area is computed as the future carrying capacity of the subregion less the current employment in the subregion. The carrying capacity for each industry group is defined as the product of the acres of land available and the assumed employment density per acre based on the density gradient. If the current employment in the downtown area is greater than the assumed future carrying capacity, no additional employment was allocated. Any employment not accommodated in the downtown area was assumed to overflow to the infill area. The above process was then repeated for the infill area, with any remaining employment then assumed to overflow to the other area. The other area employment (by industry) was divided by the appropriate employment density values to arrive at a land consumption estimate for each subcounty, with results then aggregated to the county level.

The step-wise process was modified slightly for the Altamont and Pacheco HST Alternatives, with employment allocation first occurring for the station influence area. If the station is located in the downtown subregion, employment was next allocated to the rest of the downtown area, then to the infill area. If the station is located in the infill or other areas, employment was next allocated to the rest of the infill area, then to the downtown area. In both cases, any remaining employment was allocated to the other area as occurred for the No-Project Alternative.

■ E.4 Tabulation of Results

For this analysis, land consumption was defined as the increase in the acreage of land at urbanized densities in each county. This value is equal to the land acreage in other areas that is needed to accommodate growth in employment and population. The calculation of employment-related land consumption is described in this appendix, while the calculation of population-related values is described in Appendix F. Results for each county are shown in Appendix I.

Appendix F

Land Consumption Analysis for Population

Appendix F. Land Consumption Analysis for Population

The allocation of population growth to various locations along the HST system and the prediction of land consumption resulting from residential construction on raw land were estimated using the California Urbanization and Biodiversity Analysis (CURBA) model. CURBA is a spatial decision support system developed within the ESRI ArcGIS software package by the University of California at Berkeley's Institute of Urban and Regional Development.

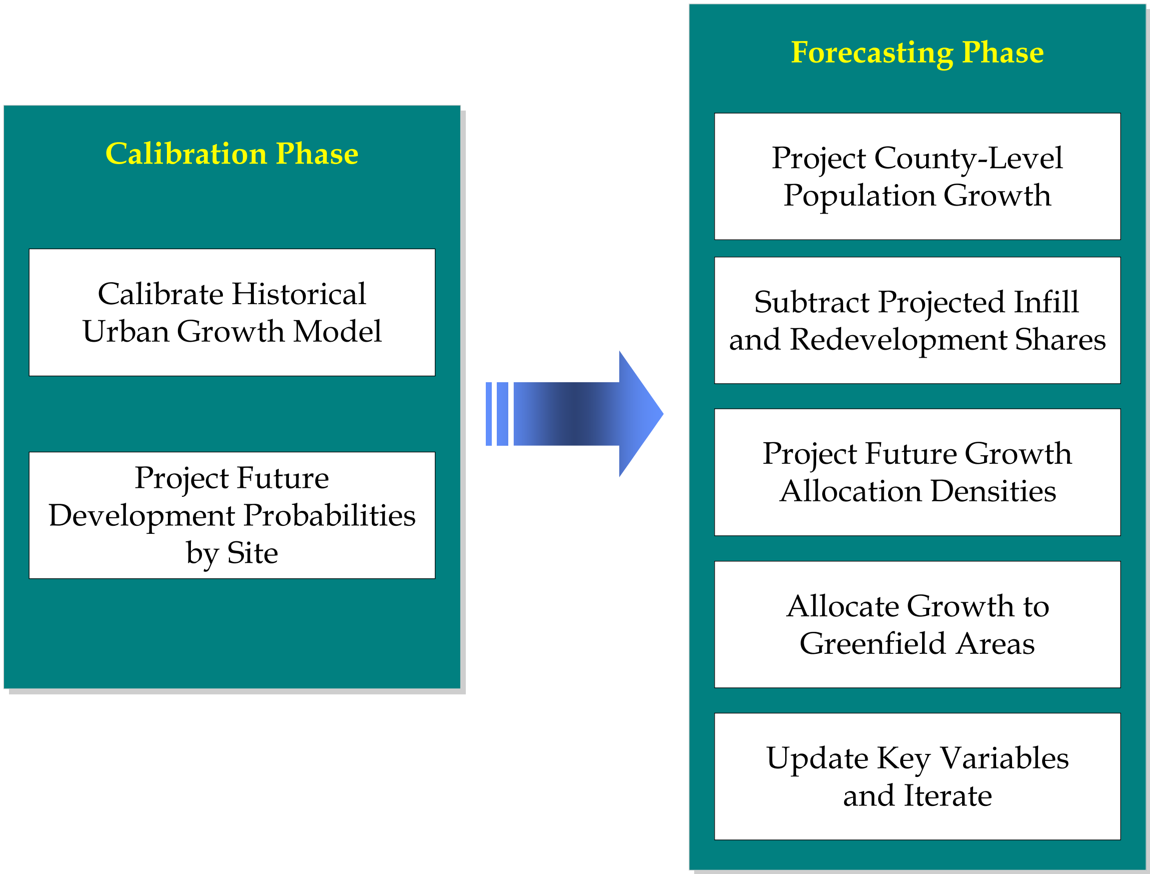
CURBA takes employment and population growth information, and uses a number of historically-calibrated spatial statistical models to assign residential growth to various locations in and around the existing urban area. By modifying CURBA's employment distribution, infill allocation, and raw land development densities, the package was used to estimate the nature and amount of raw land consumption under the various alternatives. An overview of the CURBA forecasting methodology is illustrated in Figure F.1.

F.1 Calibration Phase

The model begins by calibrating a spatial-statistical model of historical development patterns (Step A). Land use change information was obtained from the California Farmland Mapping and Monitoring Program (CFMMP), a division of the California Department of Conservation. Through a combination of remote-sensing and local ground-truthing, the CFFMP conducted detailed bi-annual land cover inventories of urban development in 1988 and 1998. CFMMP data is generally accurate down to the one-hectare level.

The calibrated model parameters are then used with contemporary spatial data to generate a development probability surface describing the likelihood that particular undeveloped sites will subsequently be developed (Step B). Binomial logit models with four categories of independent variables were estimated using a maximum likelihood procedure. To better account for regional variations, three separate models were used, covering all counties in the HST study area. Categories of independent variables include:

Figure F.1 CURBA Forecasting Methodology



- Demand variables, which measure the demand for sites as a function of their accessibility to job opportunities and job growth, as well local income levels, such as the number of jobs within 90-minute travel time of a grid cell and the ratio of community median household income to county median household income;

- Own-site variables, which measure the physical and land use characteristics of each grid-cell as determinants of its development potential, such as the squared distance from each site to the nearest freeway, whether the site is classified as prime farmland by the CFMMP, the average percentage slope of each site, and whether the site falls within the FEMA-designated 100-year flood zone;

- Adjacency and neighborhood variables, which summarize the environmental and land use characteristics of adjacent and neighboring grid-cells, such as the average slope of the cells within near each subject site, and the share of sites near the subject site which are located in the FEMA 100-year flood zone; and

- Regulatory and administrative variables, which are intended to capture the development-encouraging or constraining effects of different land use policies and regulations, such as whether or not a site is located within an incorporated city.

F.2 Forecasting Phase

As shown in Figure F.1, the forecasting process included five distinct steps. The timing of development is predicted as a function of State and county population growth pressures (Step 1), the share of population accommodated through infill development (Step 2), and the density at which development occurs (Step 3). Projected population growth, net of infill, is then allocated to allowable development sites in order of their projected development probability (from Step B) at designated development densities. The county-level population forecasts were developed as part of an earlier phase of this overall project, and are described in Section 3.0 of the main report. Remaining steps are described in more detail below.

Infill and Redevelopment Shares

Projected infill and redevelopment shares were subtracted to reflect the fact that a significant share of projected population growth will occur within the existing urban footprint in the form of infill or redevelopment. Infill shares tend to rise over time as remaining undeveloped areas are used up and as developers reconsider previously passed-over infill lands. A cross-sectional regression model was developed relating current county infill shares to remaining supplies of undeveloped land. This model was then used to project future population shares in infill and currently undeveloped areas for the year 2030.

Future Growth Allocation Densities

The amount of undeveloped land consumed by future population growth will depend both on the magnitude of growth and on its gross density. Marginal gross densities – that is the gross densities of new development – were estimated for each county by dividing the change in the population between 1988 and 1998 by the change in urbanized land area for the same period. Theory suggests that densities should rise as available supplies of undeveloped land are used up, as developers seek to use remaining lands more intensely. A cross-sectional regression model was developed relating marginal densities to remaining supplies of undeveloped land. This model was then used to project future allocation densities by county for the year 2030. These county-specific estimates are then converted into hectare-specific densities using a rule set reflecting the manner in which General Plans and zoning measures modify allowable densities of development in regards to regional location and natural factors.

Allocate Growth to Currently Undeveloped Areas

Remaining population growth was allocated to undeveloped sites in each county in order of development probability. Starting with the hectare-scale development probability scores derived above, a series of exclusion conditions are developed identifying which sites are to be precluded from development. Projected population growth (from Step 2) for the period 2000-2030 is then allocated to sites at projected densities (from Step 3) in order of development probability (from high to low), subject to any exclusion conditions.

F.3 Key Assumptions

Several assumptions are embedded in the employment and residential land requirements forecasting procedures and their components:

- The same factors that shaped land development patterns in the recent past will continue to do so in the future, and in the same ways. With the exception of the immediate area around HST stations, the employment forecasting procedure allocates future growth to subregions of each metropolitan area based on existing development patterns observed around the State and areas currently designated for employment uses. The residential forecasting procedure allocates future development to individual sites based on their projected development probability, which are estimated using the results of a statistical model calibrated for the period 1988 to 1998. While the exact role of particular factors varies by region, several influences are consistently important, including proximity to freeways, access to jobs, site slope, and site incorporation status. To the extent that these factors are less important in the future, or are important in different ways – or, as is even more likely, that other factors become important – the model results may vary from what is presented here.

- Employment will continue decentralizing within California's four major urban regions – Southern California, the greater San Francisco Bay Area, the Sacramento region, and the southern San Joaquin Valley. Taking advantage of improved freeway access, less expensive land, and lower development costs, job growth during the last 50 years has favored suburban locations over core cities. To the extent that this trend continues – given the increasing importance of telecommunications in shaping economic geography, and in the absence of countervailing policies, there is no reason to believe that it should not – decentralizing job growth will continue to pull population outward, leading to more decentralized growth patterns.

- Average infill rates and population densities will increase with additional development. It is an axiom of economics that scarce resources are used more intensely than plentiful ones. Following this logic, as available supplies of developable land are used up, developers seek ways to use remaining land more intensely, either by increasing densities or through redevelopment. Thus, both development densities and infill activity should increase with population growth. Counteracting this tendency is the desire of many residents to preserve a rural or suburban lifestyle. Thus, there are many parts of California where infill activity and development densities are below what theory suggests they should be. For the purposes of analyzing all alternatives, it is assumed that future infill activity and development densities will continue to increase. To the extent that they do not, additional sites will be needed to accommodate projected population growth.

- With respect to the No-Project Scenario, it is assumed that no major changes in transportation accessibility (e.g., new freeways or transit lines, significant improvements in travel time, etc.) will occur. Although it is abundantly clear that California's growing population will need additional transportation infrastructure, it is unclear what the infrastructure should be, where it should go, and how it should be planned and financed. Lacking these specifics, and for the purposes of constructing a No-Project scenario, we assumed no change in transportation technology or facilities beyond what is currently available or included in the No-Project Alternative. The effect of this assumption is to direct additional growth largely to locations already served by transportation infrastructure rather than to new or different areas.

Appendix G

Employment Forecasts by Industry Sector

Appendix G. Employment Forecasts by Industry Sector

Table G.1 Employment Estimate by Industry Grouping
Year 2005 Existing Conditions

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	8,426	587	52,136	92,698	49,912	62,029	135,138	72,224	353,661	127,126	953,937
Contra Costa	12,003	1,765	35,399	26,425	21,746	14,423	79,999	69,879	194,725	52,491	**508,854**
San Francisco	3,758	438	25,495	25,418	40,306	22,346	115,445	100,321	336,694	109,138	**779,357**
San Mateo	9,584	327	27,326	33,166	39,994	21,332	70,882	55,872	227,400	36,947	**522,830**
Santa Clara	19,215	633	59,832	236,372	38,208	59,683	178,323	95,739	518,220	117,694	**1,323,920**
Study Area – Bay Area	**52,986**	**3,749**	**200,188**	**414,079**	**190,166**	**179,813**	**579,787**	**394,036**	**1,630,699**	**443,395**	**4,088,898**
Fresno	65,687	402	22,321	29,345	16,743	16,676	64,956	29,734	122,108	67,798	**435,769**
Madera	13,956	133	2,979	4,052	1,744	1,015	7,158	2,948	13,434	9,473	**56,892**
Merced	14,687	63	3,680	11,754	3,027	1,820	14,222	4,526	19,442	14,146	**87,365**
Sacramento	11,002	316	50,892	34,557	27,997	25,950	124,757	78,688	258,932	192,887	**805,978**
San Joaquin	24,952	201	17,238	24,020	17,543	12,344	45,017	19,627	74,798	38,417	**274,155**
Stanislaus	22,734	100	13,385	24,037	8,910	9,759	41,323	13,930	61,870	28,443	**224,491**
Study Area – Central Valley	**153,017**	**1,214**	**110,494**	**127,765**	**75,965**	**67,563**	**297,432**	**149,453**	**550,584**	**351,163**	**1,884,650**
Southern Sacramento Valley	23,496	672	35,876	25,702	18,525	16,841	79,839	42,296	137,730	75,858	**456,834**
Southern San Joaquin Valley	112,116	10,023	25,670	27,893	25,136	16,446	82,911	30,336	135,745	110,659	**576,935**
Southern California	134,414	10,066	445,411	891,553	433,885	507,724	1,439,244	893,749	3,467,334	1,067,460	**9,290,841**
San Diego	41,123	1,158	101,481	122,773	60,648	66,127	285,675	172,543	684,891	358,582	**1,895,002**
Rest of California*	110,438	4,406	142,577	225,106	110,200	117,540	421,947	246,424	960,561	370,778	**2,709,974**
Statewide Total	**627,589**	**31,288**	**1,061,697**	**1,834,872**	**914,524**	**972,053**	**3,186,834**	**1,928,837**	**7,567,544**	**2,777,895**	**20,903,134**

Source: Cambridge Systematics, Inc., 2007.

Table G.2 Employment Forecast by Industry Grouping
Year 2030 No-Project System Alternative

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	10,124	481	64,565	92,589	71,038	92,044	145,006	90,013	556,853	124,700	**1,247,413**
Contra Costa	15,531	2,580	53,353	26,639	37,104	19,007	100,791	131,401	303,759	73,281	**763,445**
San Francisco	5,310	433	32,303	19,286	49,366	18,035	152,065	111,806	458,112	129,107	**975,823**
San Mateo	10,457	363	33,630	32,273	50,885	23,743	76,676	68,961	379,510	41,029	**717,526**
Santa Clara	25,251	792	81,335	248,590	54,959	82,741	225,955	119,148	785,617	145,110	**1,769,498**
Study Area – Bay Area	**66,674**	**4,648**	**265,185**	**419,378**	**263,352**	**235,569**	**700,492**	**521,329**	**2,483,851**	**513,227**	**5,473,705**
Fresno	89,163	629	26,278	34,335	19,505	17,212	84,223	34,095	205,186	78,600	**589,226**
Madera	21,484	181	3,533	4,534	2,208	1,089	9,977	4,451	29,105	14,802	**91,364**
Merced	16,981	71	4,080	11,777	3,684	1,825	18,811	5,504	31,909	20,411	**115,054**
Sacramento	15,148	365	72,129	38,557	35,238	26,466	164,779	119,220	490,560	297,331	**1,259,792**
San Joaquin	28,822	212	24,000	26,655	27,393	11,328	60,905	23,945	114,279	51,206	**368,745**
Stanislaus	27,980	119	17,702	27,093	11,601	15,123	57,147	18,351	101,790	39,780	**316,686**
Study Area – Central Valley	**199,578**	**1,576**	**147,722**	**142,950**	**99,630**	**73,044**	**395,841**	**205,567**	**972,828**	**502,130**	**2,740,867**
Southern Sacramento Valley	30,908	762	55,733	35,628	26,452	27,447	129,051	61,442	255,152	106,719	**729,293**
Southern San Joaquin Valley	157,166	13,243	33,952	30,379	28,745	19,543	114,871	37,444	222,377	150,475	**808,196**
Southern California	165,193	12,419	609,079	942,523	580,227	633,457	1,801,205	1,156,033	4,979,096	1,428,949	**12,308,179**
San Diego	51,403	1,479	129,589	149,752	99,985	92,274	369,287	215,569	1,214,279	459,642	**2,783,258**
Rest of California*	143,604	5,427	195,584	251,388	150,553	150,378	544,935	329,692	1,500,836	501,970	**3,774,366**
Statewide Total	**814,525**	**39,555**	**1,436,843**	**1,971,997**	**1,248,945**	**1,231,714**	**4,055,681**	**2,527,075**	**11,628,419**	**3,663,112**	**28,617,864**

Source: Cambridge Systematics, Inc., 2007.

Table G.3 Employment Forecast by Industry Grouping *Year 2030 Pacheco HST Alternative*

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	10,149	491	64,961	92,948	72,388	92,843	146,553	90,970	563,026	125,234	**1,259,563**
Contra Costa	15,543	2,582	53,609	26,743	37,773	19,242	101,686	131,845	307,015	73,485	**769,522**
San Francisco	5,312	435	32,790	19,359	50,026	18,400	152,808	112,423	462,727	129,354	**983,634**
San Mateo	10,475	365	33,787	32,454	51,597	24,094	77,594	69,474	382,783	41,214	**723,836**
Santa Clara	25,300	799	81,619	249,194	55,900	83,322	228,820	120,932	793,737	145,556	**1,785,181**
Study Area – Bay Area	66,779	4,673	266,766	420,698	267,683	237,901	707,461	525,643	2,509,288	514,843	**5,521,735**
Fresno	89,620	634	26,839	34,622	21,600	17,878	85,739	34,813	211,220	79,190	**602,155**
Madera	21,600	184	3,658	4,586	2,542	1,159	10,336	5,493	31,586	15,029	**96,173**
Merced	17,113	72	4,345	11,891	4,304	1,930	19,484	6,787	35,725	20,720	**122,373**
Sacramento	15,176	370	72,514	38,730	35,874	27,031	165,999	120,030	495,162	297,804	**1,268,688**
San Joaquin	28,911	213	24,239	26,774	28,042	11,504	61,550	24,329	118,424	51,505	**375,491**
Stanislaus	28,127	120	17,925	27,223	12,252	15,296	57,805	19,378	105,489	40,064	**323,679**
Study Area – Central Valley	200,547	1,594	149,520	143,826	104,613	74,796	400,914	210,831	997,607	504,311	**2,788,558**
Southern Sacramento Valley	30,960	764	55,994	35,720	26,840	27,690	129,631	61,712	256,674	106,919	**732,904**
Southern San Joaquin Valley	158,458	13,323	34,800	30,722	31,091	20,167	117,239	40,707	237,099	151,640	**835,244**
Southern California	165,710	12,528	612,940	946,929	591,215	641,556	1,816,609	1,164,246	5,049,808	1,433,993	**12,435,535**
San Diego	51,517	1,491	130,590	150,696	109,073	93,770	373,284	217,983	1,238,754	461,648	**2,828,806**
Rest of California	144,447	5,446	196,800	251,997	153,575	151,762	548,701	331,101	1,508,878	503,122	**3,795,829**
Statewide Total	**818,416**	**39,819**	**1,447,410**	**1,980,588**	**1,284,091**	**1,247,642**	**4,093,838**	**2,552,224**	**11,798,107**	**3,676,476**	**28,938,611**

Source: Cambridge Systematics, Inc., 2007.

Table G.4 Employment Forecast by Industry Grouping
Year 2030 Altamont HST Alternative

Region	Farming	Mining	Construction	Manufacturing	TCU	Wholesale Trade	Retail Trade	FIRE	Services	Government	Total
Alameda	10,138	490	64,858	92,874	72,315	92,712	146,162	90,937	562,271	125,136	**1,257,894**
Contra Costa	15,538	2,582	53,562	26,719	37,639	19,227	101,472	131,733	305,622	73,428	**767,522**
San Francisco	5,311	434	32,536	19,342	49,888	18,390	152,703	112,253	460,911	129,299	**981,068**
San Mateo	10,467	364	33,733	32,426	51,661	24,030	77,375	69,524	383,124	41,196	**723,900**
Santa Clara	25,274	797	81,496	249,002	55,688	83,145	228,931	121,219	793,271	145,457	**1,784,281**
Study Area – Bay Area	**66,728**	**4,667**	**266,186**	**420,363**	**267,192**	**237,503**	**706,643**	**525,666**	**2,505,199**	**514,517**	**5,514,664**
Fresno	89,629	634	26,811	34,612	21,404	17,862	85,677	34,773	210,737	79,155	**601,294**
Madera	21,615	185	3,665	4,589	2,558	1,165	10,356	5,512	31,612	15,037	**96,293**
Merced	17,118	72	4,348	11,881	4,255	1,926	19,437	6,519	34,807	20,676	**121,039**
Sacramento	15,178	371	72,512	38,747	36,064	27,057	166,087	120,318	497,101	297,878	**1,271,312**
San Joaquin	28,913	213	24,224	26,812	28,286	11,541	61,738	24,503	121,592	51,654	**379,476**
Stanislaus	28,066	120	17,881	27,265	12,741	15,334	58,172	20,924	111,751	40,370	**332,624**
Study Area – Central Valley	**200,519**	**1,595**	**149,440**	**143,905**	**105,308**	**74,885**	**401,467**	**212,549**	**1,007,600**	**504,769**	**2,802,039**
Southern Sacramento Valley	30,979	765	56,032	35,740	26,973	27,727	129,761	61,780	257,213	106,971	**733,943**
Southern San Joaquin Valley	158,431	13,319	34,727	30,705	30,962	20,127	117,084	40,571	236,475	151,572	**833,976**
Southern California	165,677	12,521	612,557	946,628	590,807	641,198	1,815,734	1,163,611	5,039,324	1,433,629	**12,421,685**
San Diego	51,513	1,492	130,540	150,685	108,235	93,775	373,521	218,161	1,247,373	461,890	**2,837,184**
Rest of California	144,248	5,444	196,725	251,922	153,504	151,693	548,091	330,671	1,505,794	502,942	**3,791,033**
Statewide Total	**818,095**	**39,803**	**1,446,208**	**1,979,950**	**1,282,980**	**1,246,909**	**4,092,301**	**2,553,010**	**11,798,978**	**3,676,290**	**28,934,524**

Source: Cambridge Systematics, Inc., 2007.

Appendix H

Employment Allocation Within Counties

Appendix H. Employment Allocation Within Counties

Table H.1 Employment Allocation by Subregion

County	Percentage of Year 2030 Total County Employment by Subregion											
	No-Project Alternative				Altamont HST Alternative				Pacheco HST Alternative			
	Station Area	Downtown Area	Infill Area	Other Area	Station Area	Downtown Area	Infill Area	Other Area	Station Area	Downtown Area	Infill Area	Other Area
Alameda	–	–	11%	89%	2%	–	10%	88%	2%	–	10%	88%
Contra Costa	–	–	18%	82%	–	–	18%	82%	–	–	18%	82%
San Francisco*	–	-	–	100%	–	–	–	100%	–	–	–	100%
San Mateo	–	1%	9%	90%	5%	–	10%	85%	5%	–	10%	85%
Santa Clara	–	7%	49%	44%	8%	6%	49%	37%	8%	6%	49%	37%
Fresno	–	1%	12%	88%	0%	1%	17%	83%	0%	1%	17%	83%
Madera	–	–	88%	12%	–	–	84%	16%	–	–	84%	16%
Merced	–	–	100%	–	72%	–	28%	0%	70%	–	30%	–
Sacramento	–	12%	13%	75%	17%	1%	13%	69%	17%	1%	13%	69%
San Joaquin	–	–	84%	16%	35%	–	55%	11%	33%	–	57%	11%
Stanislaus	–	–	1%	99%	10%	–	–	90%	7%	–	–	93%
Total for Core Study Area	–	**4%**	**23%**	**73%**	**8%**	**2%**	**23%**	**67%**	**8%**	**2%**	**23%**	**67%**

*Projected development in "other areas" for San Francisco County is a function of the average densities and uniform analysis process used to calculate employment acreage. Since "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through further densification and infill rather than through development in "other areas" as implied in this table.

Appendix I

Land Consumption Allocation by Employment and Residential Components

Appendix I. Land Consumption Allocation by Employment and Residential Components

Table I.1 Increase in Size of Urbanized Area – Year 2002 to 2030
(In Acres)

Area	Residential Land Uses			Employment Land Uses		
	No Project	HST Pacheco	HST Altamont	No Project	HST Pacheco	HST Altamont
Alameda County	25,840	26,886	26,128	19,189	19,268	19,160
Contra Costa County	33,000	33,360	33,175	8,402	8,769	8,646
San Francisco County*	0	0	0	6,736	6,969	6,895
San Mateo County	2,597	2,703	2,841	6,838	6,814	6,833
Santa Clara County	17,031	18,899	20,891	6,321	5,972	5,952
Study Area – Bay Area	**78,469**	**81,848**	**83,035**	**47,485**	**47,792**	**47,486**
Fresno County	39,960	41,301	41,146	13,286	15,296	15,120
Madera County	13,111	14,441	14,420	–	97	103
Merced County	28,743	30,500	29,899	–	–	–
Sacramento County	74,439	75,226	76,352	6,278	5,739	5,792
San Joaquin County	67,462	68,479	69,792	4,064	2,317	2,062
Stanislaus County	12,471	13,254	15,417	6,370	5,499	6,043
Study Area – Central Valley	**236,186**	**243,201**	**247,026**	**29,998**	**28,948**	**29,120**
Core Study Area	314,655	325,049	330,061	77,483	76,740	76,606

Source: Cambridge Systematics, Inc., 2007.

*Projected increases in urbanized area for San Francisco County are a function of the average densities used to calculate employment acreage. Since "greenfield" land is not available in San Francisco County, employment growth will need to be accommodated through densification and infill rather than through increases in urbanized area size implied in this table