5 ECONOMIC GROWTH AND RELATED IMPACTS

5.1 INTRODUCTION

Transportation investments can lead to reduced travel time or cost, improved accessibility to regions or parts of regions, or reduced accidents or air pollution. These effects contribute to economic growth by allowing time and money previously spent on travel to be used for other purposes, attracting businesses and residents to places with increased accessibility or improved quality of life, and reducing overall costs to society. The population and employment growth that result comprise the *growth-inducing effects* of transportation investments. This growth can contribute to additional impacts beyond those directly attributable to the changes in the transportation system. These effects are known as *indirect impacts*.

This chapter presents an analysis of the potential growth-inducing effects and related indirect impacts of the alternatives considered in this Program EIR/EIS. The intent of the analysis is to understand the extent of potential statewide, regional, and local growth effects in terms of population and employment change and land consumption associated with these changes. This section identifies and describes the following.

- Existing population and employment conditions in the study area.
- Methodology and data sources used to assess potential growth-induced effects.
- Potential statewide and interregional employment and population changes associated with each alternative.
- Urban area size needed to accommodate projected population and employment growth associated with each alternative.
- Potential for employment and population concentration in the vicinity of high-speed train (HST) stations.
- Potential impacts related to growth and development, and potential strategies for managing these impacts.

5.2 AFFECTED ENVIRONMENT

5.2.1 Existing Conditions

Over the last 30 years, California's population has grown from 20 million to more than 34 million people. At the same time, more than 10 million additional jobs have been created in California. Starting with the Gold Rush in 1849, California has been continuously experiencing rapid population and economic growth. Distance from eastern urban areas, location on the Pacific Rim, an abundance of natural resources, a desirable climate, and many other factors have contributed to California's growth into the most populous state in the nation.

California's economy is one of the most diverse in the world. Manufacturing, wholesale and retail trade, services, and government each account for more than 10% of total employment, and together have consistently comprised more than three-quarters of total employment over the past 30 years. California's economy, like the nation's, has become less focused on production of goods and more focused on services, entertainment, and trade. 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% since 1977. The overall services sector has grown by more than 800% since 1977. The finance, insurance, and real estate (FIRE) sectors and services sector has

accounted for nearly one-half of the growth in GSP since 1977, with the combined contribution of these groups growing from 33% to 46% of the total economy in California.

As of 2002, California was estimated to have about 35.8 million people and 19.8 million jobs. Table 5.2-1 lists county-level population and employment totals, as well as an estimate of current urbanization magnitudes in all 58 counties in the state for 2002. As expected, the inner Bay Area counties, as well as Orange, Los Angeles, and Sacramento Counties, have the highest levels of land considered to be urbanized, while less than 10% of land in most other counties is at urbanized densities.

Table 5.2-1
Year 2002 Population, Employment, and Urbanized Densities

County	Population	Employment	Acreage of Land at Urbanized Densities for Employment and/or Population	Percent of Land Area at Urbanized Densities
Alameda	1,513,356	899,901	141,654	30%
Contra Costa	953,069	483,812	142,467	31%
San Francisco	795,577	771,599	23,277	78%
San Mateo	770,102	501,712	70,869	25%
Santa Clara	1,826,362	1,281,313	184,481	22%
Solano	416,292	164,167	53,757	10%
Bay Area*	**6,274,758**	**4,102,504**	**616,505**	**24%**
Madera	135,695	59,123	23,255	2%
Merced	224,709	90,070	31,712	3%
Sacramento	1,259,423	756,313	157,101	25%
San Joaquin	607,331	268,325	74,250	8%
Stanislaus	485,123	216,690	55,426	6%
Yolo	170,518	113,826	26,342	4%
North Central Valley*	**2,882,799**	**1,504,347**	**368,086**	**6%**
Fresno	839,582	429,002	96,977	3%
Kern	712,198	322,774	111,468	2%
Kings	132,092	51,289	29,479	3%
Tulare	397,616	181,804	48,656	2%
South Central Valley*	**2,081,488**	**984,869**	**286,580**	**2%**
Los Angeles	10,007,779	5,452,745	763,373	29%
Orange	2,910,976	1,878,327	273,713	54%
Riverside	1,681,186	656,839	255,230	6%
San Bernardino	1,816,378	731,420	237,905	2%
San Diego	3,066,423	1,754,622	340,837	13%
Southern California*	**19,482,742**	**10,473,953**	**1,871,058**	**8%**
Rest of State	**5,080,451**	**2,722,219**	**3,142,229**	**6%**
Statewide Total	**35,802,238**	**19,787,892**	**6,284,458**	**6%**

* Only includes counties within a region that have a high-speed rail station with the HST Alternative, or highway or aviation improvements within the Modal Alternative. Other counties are included in the Rest of State category.

Sources: California Department of Finance (population data); Woods & Poole Economics, Inc. (employment); Cambridge Systematics, Inc. (urbanized acres); and U.S. Bureau of the Census (urbanization percentage).

5.2.2 Study Area and Alternatives

For the purposes of the growth inducement analysis, California's 58 counties were grouped into five geographic regions that would contain components of the HST or Modal Alternative.[1] The regions also reflect the economic interdependence among some counties and relate to widely recognized geographic regions in California. The 10 Central Valley counties were split into north and south regions based on each county's economic relationship with either the San Francisco Bay Area (Northern Central Valley) or the Los Angeles/San Diego region (Southern Central Valley). The five regions and associated counties, which are displayed in Figure 5.2-1, are as follows.

- Bay Area: Alameda, Contra Costa, San Francisco, Santa Clara, San Mateo, and Solano Counties.
- Northern Central Valley: Madera, Merced, Sacramento, San Joaquin, Stanislaus, and Yolo Counties.
- Southern Central Valley: Fresno, Kern, Kings, and Tulare Counties.
- Southern California: Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties.
- Rest of California: Remaining 37 counties not included in one of the other four regions.

For this chapter, the first four regions—Bay Area, Northern Central Valley, Southern Central Valley, and Southern California—represent the HST study area.

This analysis of potential induced growth and indirect impacts considered the three alternatives as described in Chapter 2, *Alternatives*, of this Program EIR/EIS—the No Project/No Action (No Project) Alternative (existing, programmed, and funded transportation facilities), the Modal Alternative (No Project Alternative plus additional highway and air improvements in many intercity corridors), and the proposed HST Alternative.

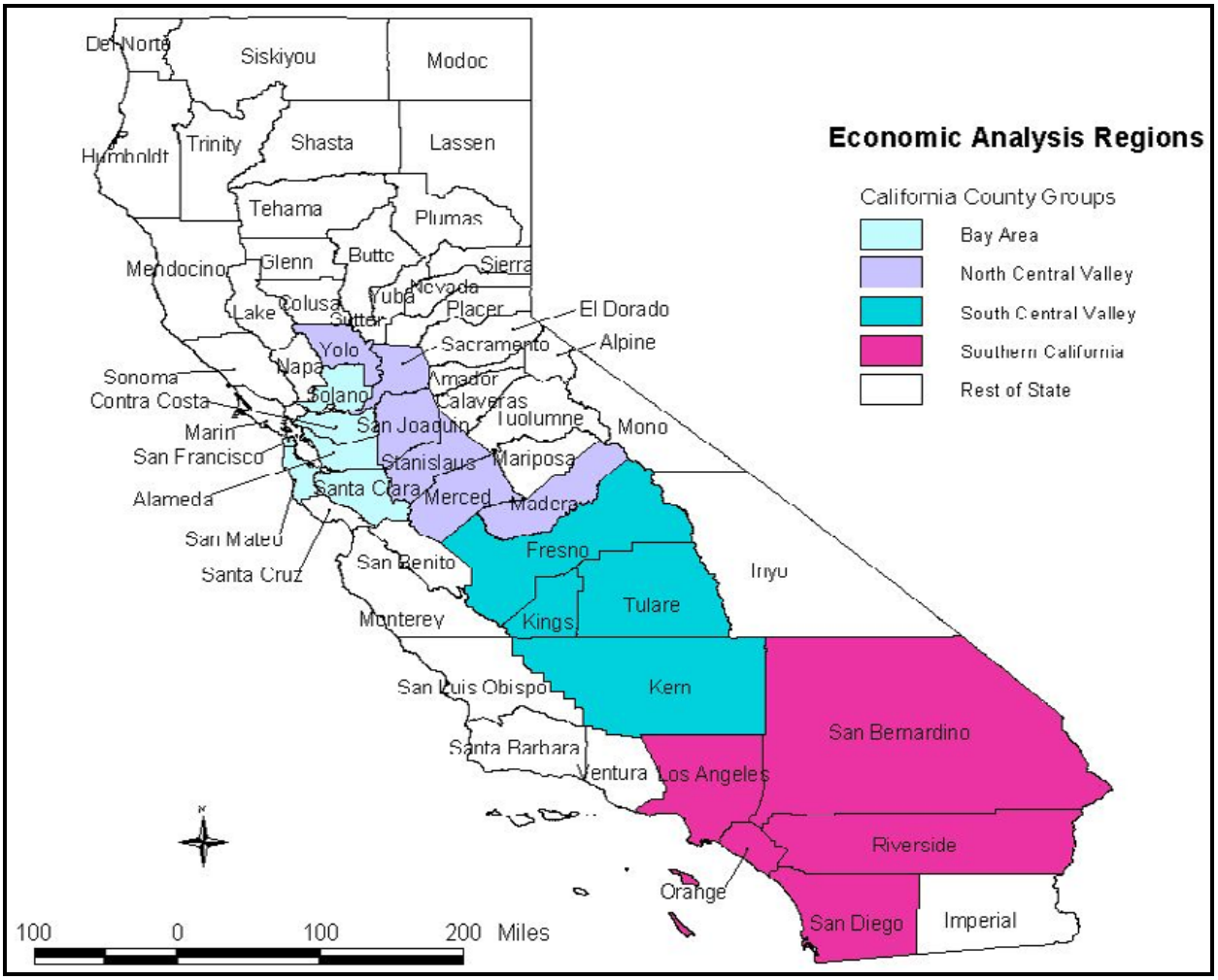
The analysis of growth-inducing effects considered a base HST scenario and several optional scenarios (Cambridge Systematics, Inc. 2003). Each of these HST Alternative scenarios includes a unique combination of alignment options and potential station options; physical characteristics of the other intercity modes were assumed to be identical for the base HST scenario and each alignment option. The key physical characteristics of each HST scenario considered in this analysis are as follows.

- Base HST Scenario: HST service would be provided between San Francisco and downtown San Diego via the Pacheco Pass, I-5/Grapevine, and Inland Empire, with an HST extension through the Northern Central Valley to Sacramento. Incremental service improvements would be made in the Los Angeles to San Diego via Orange County (LOSSAN) corridor. Stations would generally be located in the downtown area of each community (except Stockton and Sylmar). HST operating features and costs would be as assumed in the California High Speed Rail Authority's (Authority's) final business plan (Business Plan) (California High Speed Rail Authority 2000).
- Palmdale Scenario: This option is identical to the base alternative, except that the corridor would follow the Palmdale/Soledad Canyon alignment (instead of I-5/Grapevine) between Bakersfield and Los Angeles. An additional station would be provided in Palmdale.
- Diablo Range Direct Scenario: This option is identical to the base alternative, except that the corridor would follow the Diablo Range alignment (instead of Pacheco Pass) between the Bay Area and Central Valley. Stations in Gilroy and Los Banos would not be included under this design option.

[1] All counties that would have an improvement under either the HST or Modal Alternative were grouped into one of the four core regions. "Rest of California" includes all counties without an improvement under either the HST or Modal Alternative.

- Irvine Scenario: This option is identical to the base alternative, with the addition of a stub extension, or difficult curved track configuration connection, between Los Angeles Union Station (LAUS) and Irvine. Additional stations would be provided in Norwalk, Anaheim, and Irvine.
- East Bay Scenario: This option is identical to the base alternative, except that some service north of San Jose would follow an additional alignment though the East Bay to Oakland, with additional stations at Fremont, Oakland International Airport, and near downtown Oakland. The East Bay alignment scenario would be in addition to the base alignment along the Peninsula between San Jose and San Francisco. This alignment option would involve the same service levels as provided in the base alternative, with HST service north of San Jose evenly split between the Peninsula and East Bay alignments.
- Outlying Stations Scenario: This option is identical to the base alternative, except that the San Diego terminus would be at East Mission Valley instead of downtown San Diego. Central Valley stations in Modesto, Merced, Tulare, and Bakersfield would be placed at suburban locations that are outside of the existing downtown areas.

Figure 5.2-1
Regions and Counties



5.2.3 Analysis Years

The growth-inducement analysis was conducted for forecast years of 2020 and 2035. The 2020 forecast year provides for consistency with analyses that were conducted for other resource areas, while the 2035 forecast year provides a longer time horizon to consider full market response after completion of the proposed HST or Modal Alternative. Year 2035 results are described in this Program EIR/EIS because they provide a better reflection of the full growth inducement potential of each alternative, as well as a better basis for understanding the full range of possible secondary impacts.

The extent of potential growth-inducing effects in any given year is 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 would be generated in an area in 2020 or 2035 is sensitive to the year in which HST service or some other transportation service is assumed to first be available in that area. As described below, planning assumptions regarding service phasing were made to identify the year in which travel changes would begin accruing in different areas.

- For the HST Alternative, HST service along a trunk line between San Francisco and LAUS would begin on January 1, 2016, for all alignment options. Service to San Diego and Sacramento would begin on January 1, 2019, for all alignment options. For the Irvine alignment scenario, service from LAUS and Irvine would begin on January 1, 2019. For the East Bay alignment scenario, service between San Jose and Oakland would begin on January 1, 2016.
- For the Modal Alternative, aviation and highway components that serve travel markets along the HST trunk line would open on January 1, 2016. This assumption would include airport and highway projects in all analysis counties except Sacramento, Yolo, San Joaquin, Stanislaus, and San Diego. All other elements of the Modal Alternative would open on January 1, 2019.

5.3 POTENTIAL GROWTH-INDUCING EFFECTS

5.3.1 Methodology and Data Sources

The potential economic growth stimulus of a transportation investment can be measured not only in terms of its *overall magnitude* (i.e., number of new jobs and people), but also in terms of its *relative distribution* (i.e., location of new jobs and people) among different geographic areas. In economic terms, this distinction is the generative (i.e., creates growth) versus distributive (i.e., redistributes existing population and infrastructure) dimensions of growth. Transportation investments, such as airports, highways, transit, and HST, comprise just one of many factors that determine how much growth will occur and whether it will be generative or distributive in nature. Other major growth factors, such as education level of residents, housing affordability, and land availability, interact in complex and sometimes unpredictable ways for communities, regions, and states. Land use planning and zoning, enterprise development zones, and infrastructure funding can also influence both the magnitude and the distribution of economic growth.

A. SCOPE OF ANALYSIS

The growth inducement results presented in this section were developed in a multi-phased process that combined the Regional Economic Models, Inc. (REMI)[2] macroeconomic simulation model, with a business attraction model, an employment allocation model, and a residential spatial allocation model. The process considered the potential effects that changes in transportation congestion and

[2] The *REMI model* is a regional economic analysis that can be used to estimate the macroeconomic impacts of policies or investments that change some aspect of the business climate in the region. It is the most widely used and accepted economic impact tool in the country, with unique capabilities for transportation analyses.

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 under any of the alternative options, and considered many possible impacts of the proposed HST and Modal Alternatives on jobs, population, and land development, including the following.

- Increased employment because of attraction of new businesses to California, or expansion of businesses already located in the state.
- Reallocation of employment because of changes in location of businesses 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 because of the Modal or HST Alternative (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 both with and without the presence of an HST station.
- Allocation of population and employment between currently developed and undeveloped areas within each county.
- Consumption of currently undeveloped land to house projected population and employment growth.

B. KEY DATA SOURCES

The growth-inducement analysis required forecasts of future population and employment for the 2020 and 2035 analysis years. This forecast represented the No Project Alternative for the analysis years, and was also used as an economic modeling input to estimate incremental population and employment changes of the other alternatives. The analysis of potential induced growth and indirect effects necessitated that county-level population and employment forecasts be developed for 2020 and 2035, with employment forecasts broken out by one-digit standard industrial classification (SIC) codes.

The California Department of Finance (DOF) prepares county-level population forecasts for each year through 2040. However, there is no similar official state employment forecast at the county level, and no single source of employment projections provides sufficient industry, geographic, or time detail. Therefore, the No Project Alternative employment forecasts were developed using a combination of multiple sources.

Population

The DOF forecasts were used directly as the No Project Alternative population forecast for this study since they are a source of population projections prepared by and for the state, and their use in this analysis would be consistent with the approach used in earlier HST studies.

Employment

Employment data for the No Project Alternative were developed by combining forecasts from the California Department of Transportation (Caltrans) and Woods & Poole (W&P)[3] and through application of the REMI model. The Caltrans forecasts have recently been developed and provide

[3] Woods & Poole is a private economic forecasting firm that produces employment (and other economic indicators) at the one-digit SIC level for historical years starting in 1970 and forecast years ending in 2025 for every county and state in the country.

county-level estimates by one-digit SIC code to 2020. Since the Caltrans forecasts do not account for all employment (i.e., they do not include the self-employed and other groups), W&P data were used to estimate the level of employment for all industries. The employment concept used by W&P is consistent with the U.S. Bureau of Economic Analysis full-employment data.

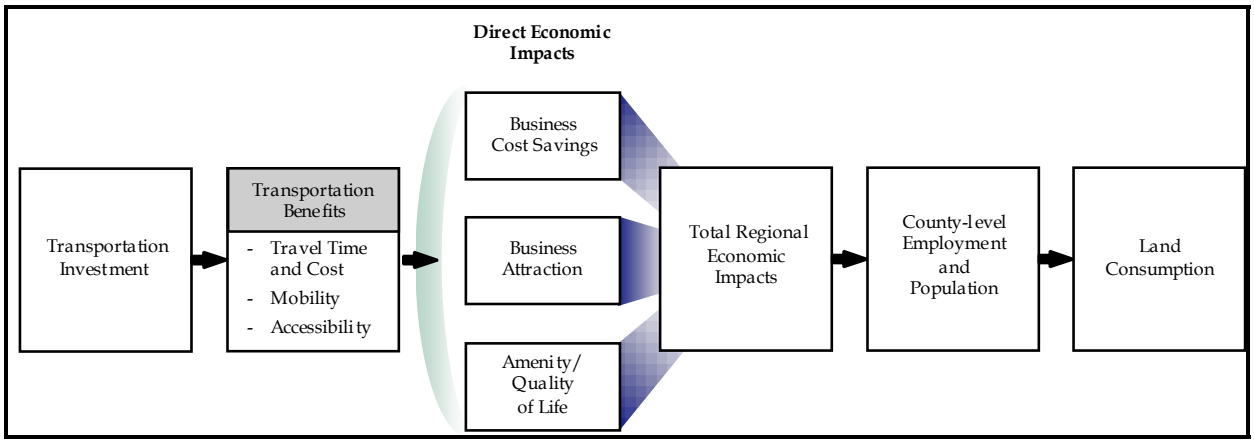
The 2020 No Project Alternative forecast was developed from Year 2002 W&P employment estimates and Year 2002–2020 industry-specific growth factors inferred from the Caltrans forecasts. These No Project Alternative forecasts were used to adjust Year 2020 employment values within the REMI model, with the REMI model then used to forecast employment changes from 2020 to 2035. The 2035 estimates essentially are a long-run extrapolation from the 2020 Caltrans/W&P estimates. These estimates were compared to historical averages and regional-level forecasts (from various councils of governments and metropolitan planning organizations) to ensure that the resulting employment-to-population ratios for 2020 were within a reasonable range.

C. METHODOLOGY OVERVIEW

The analytical process to estimate the growth-inducing effects of the alternatives required significant modeling tools and data. Nonetheless, the entire process, which is depicted in Figure 5.3-1, can be summarized in a few key steps.

- Define transportation investments: This analysis considers the alternatives and HST alignment options described in Chapter 2. For 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 associated with the implementation of the Modal and HST Alternatives.
- Estimate transportation benefits: Using results from the Authority's intercity travel demand model, benefits such as reduced travel times and/or costs of each alternative for air, highway, or conventional rail trips were estimated. The quantification of travel time, cost, accessibility, and societal (pollution or accident reduction) benefits reflects the mobility enhancement provided through system expansion under the Modal Alternative or additional travel options under the proposed HST Alternatives.

Figure 5.3-1
Methodology Overview



- <u>Estimate direct economic impacts</u>: Direct economic impacts, which are generated from the transportation benefits of each alternative, generally fall into one of three categories.
  - Business cost savings: Reductions in travel time and/or cost for long-distance business travelers and commuters benefiting from the transportation improvements.

  - Business attraction effects: New and relocated firms taking advantage of market accessibility improvements provided through transportation investments.
  - Amenity (quality of life) changes: Non-business travel time and/or cost benefits and other societal benefits improve the attractiveness of a region.
- Determine total regional economic impacts: The direct economic impacts all have the potential to create additional multiplier effects on the regional and statewide economies of California. Total regional impacts were estimated using the REMI macroeconomic simulation model. For this analysis, total economic impacts include population and industry-specific employment.
- Allocate regional economic impacts on California counties: A county-level post-processing model was developed to allocate regional employment and population impacts on California counties. The primary drivers of the post-processor are the magnitudes of direct economic impacts (generated at the county level), with adjustments made to reflect economic multiplier effects and population movements from improved long-distance commuting accessibility (especially for counties with HST stations).
- Estimate land consumption: County-level population and employment were allocated throughout each county to determine the infill potential and magnitude of land needed to accommodate growth for each alternative. This analysis was driven by three key pieces of information.
  - Local land use, zoning, and employment data.
  - National and international experience with station-area development trends related to HST and fixed guideway transit.
  - County-level industry employment and population estimates.

Essentially, this land consumption analysis provided an estimate of the population and employment growth that can fit within the currently urbanized areas of each county (i.e., infill potential), and additional acreage of currently undeveloped land that would need to be converted to urbanized densities to accommodate any remaining growth. Estimates of land needed to accommodate employment uses were developed using a statistical analysis based on current development patterns in California, adjusted to reflect expected densification trends over time.[4] The California Urbanization and Biodiversity Analysis model was used to allocate population growth to various locations in each county and to predict land consumption resulting from residential construction.

5.3.2 Financing of Alternatives

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 Modal and HST Alternatives are both projected to have significant capital costs in excess of the costs needed to fund the No Project Alternative. The Business Plan estimated the total capital cost of the HST Alternative to be on the order of $25 billion, while initial estimates of the capital cost of the Modal Alternative was roughly $56 billion. After this analysis was prepared, the cost estimates rose to $33-37 billion for the HST Alternative and $82 billion for the Modal Alternative and are discussed as a sensitivity analysis at the end of this chapter.

For the purposes of this analysis, it was assumed that the total cost of the HST Alternative and the first $25 billion in cost for the Modal Alternative would be funded through revenue sources that would not

[4] Since this analysis was conducted at the county level, it does not explicitly reflect potential land designation or policy constraints that are included in each jurisdiction's general plan. Rather, the analysis reflects market forces that currently exist and are projected to exist in the future for counties of similar location, size, development intensity, and potential HST service. The densities that are allowed under zoning and general plan designations are implicitly included in the analysis to the extent that existing development patterns and market forces have been influenced by past zoning and general plan decisions.

require direct tax increases or significant diversion of general fund revenues. Examples of these revenue sources include general obligation bonds,[5] federal grants or loans, existing airport user fees and passenger facility charges, private sector participation, local funds (from existing sources), and existing state transportation revenue sources (e.g., gas tax, sales tax on gas).

The remaining cost of the Modal Alternative, about $31 billion (in Year 2002 dollars), is assumed to come from revenue sources that have traditionally been used for highway and aviation improvements in California. These additional funding requirements for the Modal Alternative would divert consumer expenditures to pay for increased gas taxes and higher airport fees, as well as reduce state and local government spending in other areas to cover bonds and grants.

5.3.3 Statewide Comparison of Alternatives

Statewide population is expected to grow by about 54% between 2002 and 2035 under the No Project Alternative (Table 5.3-1). Compared to the No Project Alternative, the statewide population growth is projected to be roughly 1% higher under the Modal Alternative and 2% higher under the HST Alternative. These population differences among alternatives represent the increased accessibility provided by the transportation investments. An investment in HST is projected to lead to greater economic growth within the state than the Modal or No Project Alternatives. These statewide figures follow the same general pattern at the regional level, with the exception of the Northern Central Valley, where population growth is projected to be about 4% higher under the HST Alternative than under the other two alternatives.

Table 5.3-1
Projected Population Growth Rate by Region

Area	Year 2002 Population (Millions)	Growth Rate (Year 2002 to 2035)		
		No Project Alternative	Modal Alternative	HST "Base" Alternative
Bay Area	6.3	28%	29%	30%
North Central Valley	2.9	77%	78%	81%
South Central Valley	2.1	87%	88%	89%
Southern California	19.5	53%	54%	55%
Rest of California	5.1	66%	66%	67%
Statewide Total	**35.8**	**54%**	**55%**	**56%**

Source: Cambridge Systematics, Inc. 2003.

The population growth rate in the study area under the HST Alternative represents a statewide increase of 700,000 people more than that projected under the No Project Alternative, and 340,000 people more than the Modal Alternative. However, the greatest population increase is projected between 2002 existing conditions and the 2035 No Project Alternative, with relatively small differences in population growth occurring between the Modal and HST Alternatives in the Year 2035.

Statewide and regional employment growth rates are projected to be generally similar to the population growth rates, although employment would grow more under the HST Alternative in the Central Valley regions, especially the Northern Central Valley, than population (Table 5.3-2). Statewide employment is

[5]The debt service on General Fund State Revenue bonds is often 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.

projected to increase by 46% under the No Project Alternative, with an additional increase of 1% under the Modal Alternative and 2% under the HST Alternative. The employment growth rate under the HST Alternative represents a statewide increase of about 450,000 jobs over the No Project Alternative, and 200,000 jobs over the Modal Alternative. As with population growth, however, this level of difference between the Modal and HST Alternatives is very small compared to the overall level of growth represented by the No Project Alternative relative to the 2002 existing conditions.

Table 5.3-2
Projected Employment Growth Rate by Region

Area	Year 2002 Employment (Millions)	Growth Rate (Year 2002 to 2035)		
		No Project Alternative	Modal Alternative	HST Base Alternative
Bay Area	4.1	36%	37%	39%
North Central Valley	1.5	60%	62%	67%
South Central Valley	1.0	56%	57%	59%
Southern California	10.5	48%	50%	50%
Rest of California	2.7	40%	39%	40%
Statewide Total	**19.8**	**46%**	**47%**	**48%**

Source: Cambridge Systematics, Inc. 2003.

Urbanized areas in California are expected to grow by 48% between 2004 and 2035 under the No Project Alternative, as shown in Table 5.3-3. This growth would represent an increase of about 1.5 million acres (ac) (0.61 hectares [ha]) over today's 3.1 million ac (1.3 million ha) within the core analysis counties. Compared to the No Project Alternative, urbanized area growth is expected to be about 1.4% (65,500 acres [26,507 ha]) higher under the Modal Alternative and 0.1% (2,600 acres [1,052 ha]) less under the HST Alternative. As with the population and employment growth, the level of difference between alternatives for urbanized area size is small compared to the overall level of growth represented by the No Project Alternative relative to the 2002 existing conditions. Nonetheless, the results indicate that the HST Alternative would be able to accommodate more population and employment growth on less land than the other alternatives.

For the rest of California, the HST Alternative is projected to generate a small yet positive growth rate for both population and employment, while the Modal Alternative is projected to decrease both population and employment compared to the No Project Alternative. Results for the Modal Alternative are affected, in part, by increased taxation and user fees that might be needed to fund the higher initial capital costs of this alternative; these higher taxes and fees may result in a slight reduction in economic growth, and hence population and employment, compared to what would occur if no additional taxation or fees were required. Overall, it is estimated that the public financing needs for the Modal Alternative would result in decreases in employment of 20,000 and in population of 45,000 on a statewide basis, compared to what would occur if the alternative could be funded without tax or user fee increases.

Table 5.3-3
Increase in Urbanized Area by Region

Area	Year 2002 Urbanized Area Acreage (Thousands)	Percent Increase (Year 2002 to 2035)		
		No Project Alternative	Modal Alternative	HST Base Alternative
Bay Area	617	21.7%	22.4%	22.8%
North Central Valley	368	57.1%	58.3%	55.8%
South Central Valley	287	91.8%	93.3%	95.1%
Southern California	1,871	48.0%	50.8%	47.2%
Influence Area Total	**3,143**	**47.9%**	**50.0%**	**47.8%**
Source: Cambridge Systematics, Inc. 2003.				

The Modal and HST Alternatives exhibit noticeable differences in the types of jobs they are projected to attract to different regions. Table 5.3-4 depicts the percentage of growth by major industry group for the increment of jobs that may be "induced" by these two 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 FIRE sectors, while the Modal Alternative is relatively stronger in transportation, communications, and utilities (TCU); wholesale and retail trade; and construction and manufacturing. The strongest employment sectors for the HST Alternative tend to be the most compatible for location in higher density settings, such as near potential HST sites where offices and retail development could be expected. On the other hand, the employment sectors dominated by the Modal Alternative tend to be associated with less dense development settings, such as those currently found on the outer edges of California's urban areas.

Table 5.3-4
Percent of Incremental Growth by Industry

		Incremental Growth Rate for Induced Employment (Year 2002 to 2035)				
		Farming and Mining	Construction and Manufacturing	TCU and Trade	FIRE and Services	Government
Bay Area	Modal	0%	15%	34%	44%	7%
	HST	0%	16%	30%	46%	8%
North Central Valley	Modal	0%	14%	31%	44%	11%
	HST	0%	9%	19%	64%	9%
South Central Valley	Modal	1%	17%	23%	48%	12%
	HST	1%	14%	21%	51%	13%
Southern California	Modal	0%	17%	31%	43%	8%
	HST	0%	18%	30%	44%	9%
Statewide Total	Modal	0%	16%	31%	44%	9%
	HST	0%	15%	27%	48%	10%
Source: Cambridge Systematics, Inc. 2003.						

A. DETAIL FOR NO PROJECT ALTERNATIVE

On a statewide basis, population is projected to increase from Year 2002 levels by about 19.4 million by 2035. This increase represents growth rates of 27% between now and 2020, and 54% between now and 2035. The long-term growth rate averages to about 1.4% annually, which is slightly less than California's 1.8% annual population growth rate since 1970, but would be consistent with long-term population forecasts by the California DOF and the U.S. Census Bureau. Employment growth rates are similar, with jobs increasing by 46% (9.1 million) between now and 2035. The long-term growth rate averages about 1.3% per year, which is one-half of the 2.6% annual employment growth rate since 1970.

On a statewide basis, population and employment growth under the No Project Alternative are expected to require approximately an additional 1.5 million ac (0.61 ha) of urbanized land in 2035 than the current estimated urbanized area of approximately 3,142,000 ac (1,271,523 ha).[6] This represents an increase in urbanized areas of 48% over less than 35 years. Urbanization of land is expected to occur at lower rates than overall population and employment growth, reflecting a number of factors.

- A reduction in availability of land for development in some counties in the Bay Area and Southern California, creating higher land costs and market forces for denser development.
- Slight increases in infill and redevelopment, as seen recently in many urban communities, and blighted areas that receive new development.
- An increase in marginal residential densities that has occurred over recent years[7].

B. DETAIL FOR HST ALTERNATIVE

Statewide population and employment forecasts for the HST Alternative are similar to those for the No Project Alternative. For Year 2020, the HST Alternative is projected to add about 170,000 more people and 240,000 more jobs than the No Project Alternative. These 2020 values represent relative increases of 0.4% for population and 0.9% for employment over the No Project Alternative forecasts. For year 2035, the HST Alternative is projected to add about 700,000 more people and 450,000 more jobs than the No Project Alternative. These 2035 values represent relative increases of 1.3% to 1.5% over the No Project Alternative forecasts.

These forecasts suggest that the incremental population effect (i.e., increase in population relative to the No Project Alternative) is slower to develop than the incremental employment effect. Specifically, about 25% of the population effect would occur by 2020, while about 50% of the employment effect would occur in the same timeframe. These results are consistent with economic theory that suggests that the direct employment effects from a major stimulus (i.e., a new HST system) would occur shortly after the stimulus (i.e., service initiation) occurs. Since for purposes of this analysis the HST Alternative is assumed to open between 2016 and 2019, a significant amount of the total employment effect would occur by 2020. Population growth tends to lag behind the direct employment effect for two key reasons.

[6] 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.

[7] California's housing plan update (*Raising the Roof: California Housing Development Projections and Constraints, 1997–2020*; California Department of Housing and Community Development; May 2000; Exhibit 17) analyzed changes in gross population densities between 1984 and 1986. This analysis included data for 11 of the 21 counties in the study area (see Section 5.2). In 9 of these 11 counties, the density of new residential development that occurred between 1984 and 1996 was between 50% and 585% higher than the average residential density that existed in 1984.

- Jobs generated by the direct employment effect tend to be filled through the existing labor pool initially, rather than through migration.
- Population increases tend to be driven more by growth in indirect and induced employment, both of which tend to be spread out in time.

Land consumption for all the alternatives is projected to be of the same magnitude because of the predominant effect of population growth. When assessing the relative differences among the alternatives, the HST Alternative is projected to consume somewhat less land than the other alternatives, even though the HST Alternative is associated with slightly higher levels of population and employment growth. In 2035, approximately 2,600 ac (1,052 ha), or 0.1%, less urbanized land is expected to be needed to accommodate the population and employment under the HST Alternative than under the No Project Alternative. The HST Alternative would also need less land than the Modal Alternative; in 2035, the HST Alternative would consume approximately 68,100 ac (27,559 ha) fewer, or 1.4% less, of non-urbanized land than the Modal Alternative. These results are driven by stronger employment growth in the services and FIRE sectors and market forces supporting denser station-area development for office-style facilities.

C. DETAIL FOR MODAL ALTERNATIVE

Statewide population and employment forecasts for the Modal Alternative are similar to those for the No Project Alternative. For Year 2020, the Modal Alternative is projected to add about 85,000 more people and 135,000 more jobs than the No Project Alternative. These 2020 values represent relative increases of 0.2% for population and 0.5% for employment over the No Project forecasts. For year 2035, the Modal Alternative is projected to add about 360,000 more people and 250,000 more jobs than the No Project Alternative. These 2035 values represent relative increases of 0.7% to 0.8% over the No Project forecasts.

Statewide results for the Modal and HST Alternatives are also similar, although the Modal Alternative is projected to generate about 200,000 (0.7%) fewer jobs and about 330,000 (0.6%) fewer residents than the HST Alternative in 2035. These slightly more modest growth effects projected for the Modal Alternative can be linked in part to the need for increased gas taxes, user fees, and other funding that would be needed to pay for the additional cost of the Modal Alternative relative to the HST Alternative.

Land consumption under the Modal Alternative is projected to be of the same general magnitude as under the No Project Alternative when compared to 2002 existing conditions. By 2035, the Modal Alternative is expected to require approximately 65,500 ac (26,507 ha) more, or 1.4%, than the No Project Alternative. These land consumption increases relative to the No Project Alternative are larger than the corresponding increases in population and employment. This result suggests that the Modal Alternative stimulates slightly more lower-density development than is projected to occur under the No Project Alternative. The result also likely reflects the fact that the Modal Alternative would have its strongest relative employment growth in lower-density industrial sectors, such as TCU and retail.

5.3.4 Regional and County Effects

Each of the alternatives has varied effects on different parts of the state. Part of this difference is in terms of overall population, employment, and urbanization projections. Another part of the difference is related to the type of industries that are projected to experience employment growth under each alternative.

Table 5.3-5 presents population and employment projections for each county and region analyzed. Figures are provided for Year 2002 existing conditions, and projections are provided for the three

alternatives in Year 2035. On an absolute basis, the counties that are currently most populous are projected to exhibit the largest increases in population and employment from 2002 to 2035. Los Angeles, San Diego, and Orange Counties are each projected to add about one million or more people and jobs, while San Bernardino and Riverside Counties are projected to add more than one million additional people. Under all alternatives, the 5 counties in the Southern California region are projected to add more people and jobs than the remaining 53 counties in the state. Of the remaining regions, the Bay Area is projected to add the most jobs, followed by the Rest of the State, Northern Central Valley, and Southern Central Valley. For population, the Rest of the State is projected to add the most people outside of Southern California, followed by the Northern Central Valley, Southern Central Valley, and the Bay Area.

A. POPULATION GROWTH RATES

A relative comparison of county-level population data is depicted graphically in Figures 5.3-2 through 5.3-4. Figure 5.3-2 displays the relative change in population for each county from Year 2002 to Year 2035 under the No Project Alternative. (Darker shades indicate higher relative changes.) These data suggest continuation of recent trends in which counties in the Central Valley and the high desert region east of Los Angeles exhibit disproportionately large population growth rates. The lowest relative population growth rates are projected to occur in the core areas of the Bay Area and Los Angeles basin.

Figures 5.3-3 and 5.3-4 display county-level population growth rates for the Modal and HST Alternatives, respectively, compared to the No Project Alternative. Results suggest that both the Modal and HST Alternatives have a propensity to reverse the historic trend towards dispersed population growth, with "inner" portions of the Bay Area and Southern California exhibiting strong population growth rates under both alternatives. Under the Modal Alternative, population growth rates are projected to be highest in San Francisco, Orange, and San Diego Counties, while under the HST Alternative, Merced, San Francisco, and Sacramento Counties are projected to exhibit the highest growth rates. Compared to the Modal Alternative, the HST Alternative exhibits higher population growth rates in all regions and all counties except Orange, Riverside, and San Joaquin.

Table 5.3-5
Year 2035 Employment and Population County and Regional Totals

County	Employment				Population			
	2002 Existing Conditions	2035			2002 Existing Conditions	2035		
		No Project	Modal	HST (Base)		No Project	Modal	HST (Base)
Alameda	899,901	1,273,557	1,282,085	1,287,498	1,513,356	2,004,985	2,016,457	2,027,153
Contra Costa	483,812	723,006	727,862	732,194	953,069	1,227,082	1,233,977	1,242,398
San Francisco	771,599	918,391	926,652	939,928	795,577	705,619	716,763	738,467
San Mateo	501,712	636,802	642,062	652,637	770,102	930,793	938,120	954,896
Santa Clara	1,281,313	1,785,474	1,799,462	1,816,613	1,826,362	2,498,528	2,516,989	2,546,153
Solano	164,167	251,790	253,901	256,421	416,292	661,762	664,753	669,301
Bay Area*	**4,102,504**	**5,589,020**	**5,632,024**	**5,685,292**	**6,274,758**	**8,028,769**	**8,087,059**	**8,178,369**
Madera	59,123	149,752	150,520	151,305	135,695	312,674	313,763	315,340
Merced	90,070	164,898	167,050	174,870	224,709	421,175	423,879	449,329
Sacramento	756,313	1,037,902	1,048,771	1,097,473	1,259,423	2,002,082	2,017,634	2,061,967
San Joaquin	268,325	502,655	513,877	518,037	607,331	1,153,260	1,165,636	1,164,907
Stanislaus	216,690	383,284	388,080	397,966	485,123	920,782	927,228	934,388
Yolo	113,826	174,955	175,594	178,343	170,518	278,724	279,696	282,497
North Central Valley*	**1,504,347**	**2,413,446**	**2,443,892**	**2,517,994**	**2,882,799**	**5,088,697**	**5,127,837**	**5,208,428**
Fresno	429,002	688,186	698,767	709,524	839,582	1,411,889	1,424,683	1,441,577
Kern	322,774	522,862	526,022	528,661	712,198	1,468,936	1,474,792	1,479,979
Kings	51,289	74,942	75,555	75,945	132,092	244,219	244,801	245,137
Tulare	181,804	248,178	248,800	249,205	397,616	761,893	762,731	763,163
South Central Valley*	**984,869**	**1,534,168**	**1,549,145**	**1,563,334**	**2,081,488**	**3,886,937**	**3,907,007**	**3,929,857**
Los Angeles	5,452,745	7,406,409	7,482,434	7,502,773	10,007,779	13,302,934	13,415,179	13,454,864
Orange	1,878,327	2,870,740	2,906,688	2,901,398	2,910,976	3,910,017	3,959,760	3,950,770
Riverside	656,839	1,162,051	1,172,098	1,163,500	1,681,186	3,983,299	3,999,336	3,965,826
San Bernardino	731,420	1,220,510	1,229,392	1,245,657	1,816,378	3,798,899	3,813,001	3,867,414
San Diego	1,754,622	2,867,144	2,909,471	2,921,375	3,066,423	4,789,883	4,852,256	4,870,658
Southern California*	**10,473,953**	**15,526,855**	**15,700,084**	**15,734,703**	**19,482,742**	**29,785,032**	**30,039,532**	**30,109,532**
Rest of State	**2,722,219**	**3,809,552**	**3,791,825**	**3,815,877**	**5,080,451**	**8,420,610**	**8,411,353**	**8,475,119**
Statewide Total	**19,787,892**	**28,873,042**	**29,116,970**	**29,317,201**	**35,802,238**	**55,210,045**	**55,572,788**	**55,901,305**

Only includes counties within a region that have a high-speed rail station with the HST Alternative, or highway or aviation improvements within the Modal Alternative. Other counties are included in Rest of State category.
Source: Cambridge Systematics, Inc. 2003.

Figure 5.3-2
County-Level Population Growth under No Project Alternative

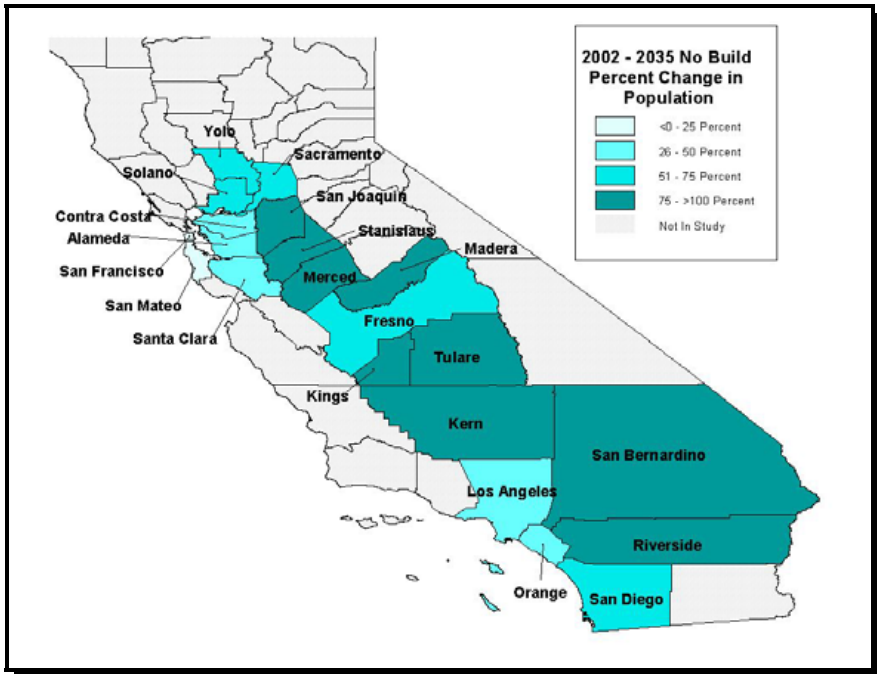


Figure 5.3-3
County-Level Population Growth under Modal Alternative

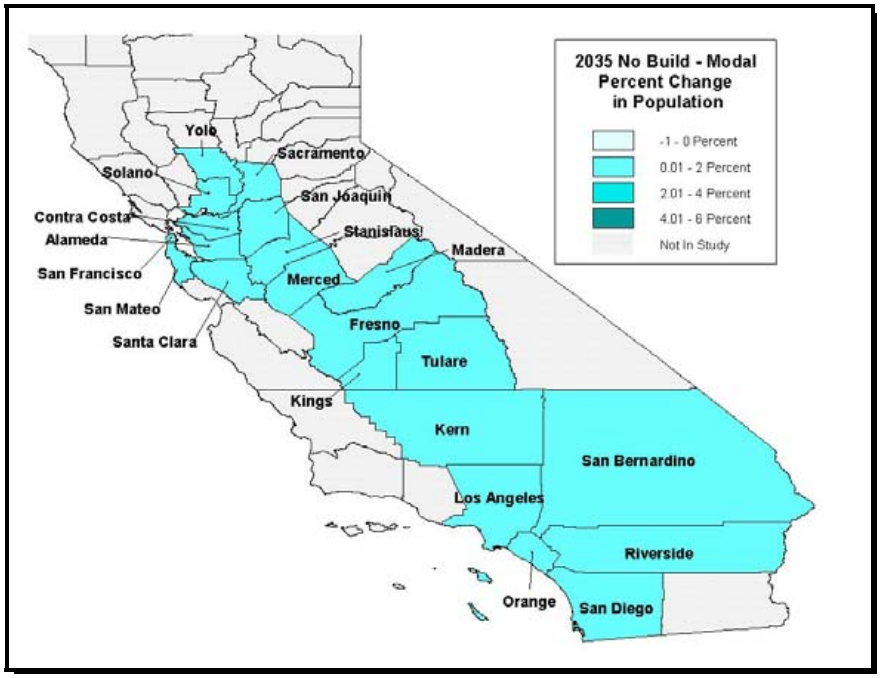
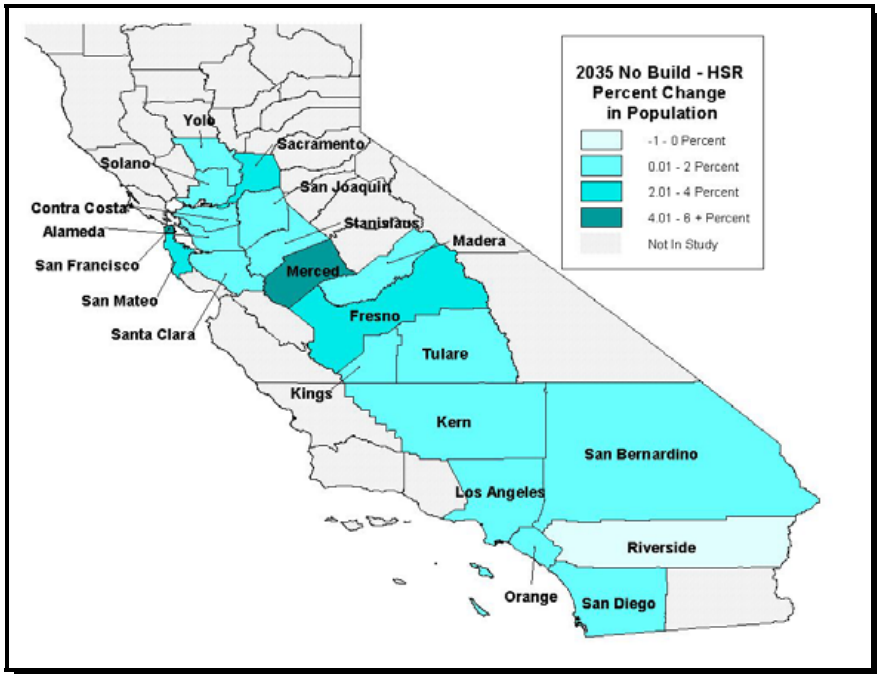


Figure 5.3-4
County-Level Population Growth under HST Alternative

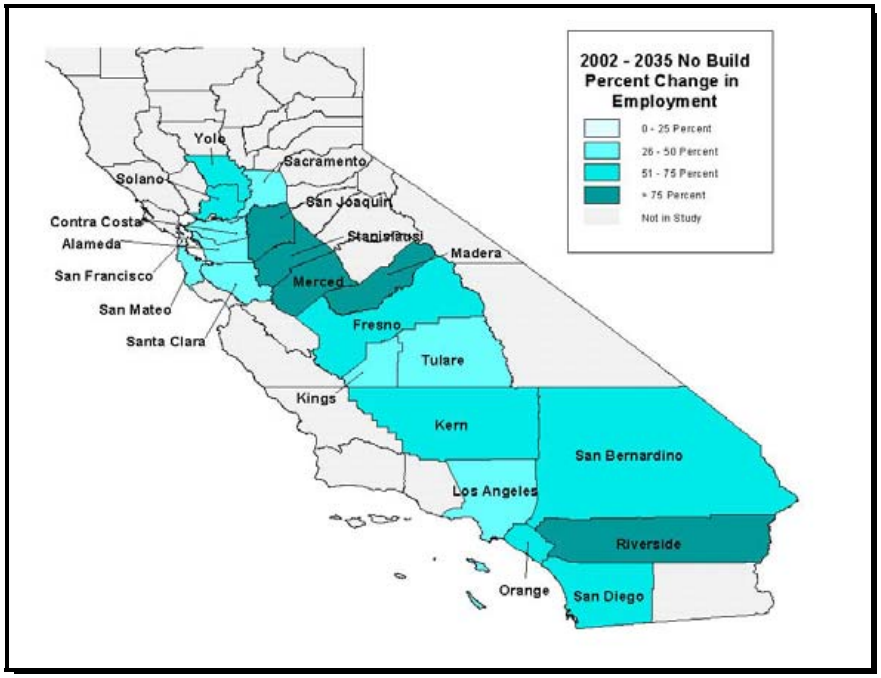


Analysis results suggest that the additional population growth under the HST Alternative is driven by internal job growth (i.e., job growth that occurs in the same county as population growth) related to initiation of HST service, rather than by potential population shifts from the Bay Area and Southern California accompanied by long-distance commuting. The results suggest a stronger propensity for redistribution of population within the Central Valley, with long-distance commuters relocating from Sacramento and San Joaquin Counties to lower-cost and better-positioned (for HST service) housing in areas such as Merced and Stanislaus Counties.

B. EMPLOYMENT GROWTH RATES

Figures 5.3-5 through 5.3-7 provide a graphic depiction of county-level employment growth rates. Figure 5.3-5 displays the relative change in employment for each county from Year 2002 to Year 2035 under the No Project Alternative. (Darker shades indicate higher relative changes.) These data suggest a continued decentralization in employment patterns, with strongest employment growth occurring in the Northern Central Valley and Riverside County. Unlike population growth, however, strong employment growth rates are also projected to exist in some of the traditional job centers such as Orange and San Diego Counties. San Francisco, Sacramento, and Los Angeles Counties are projected to experience the lowest relative employment growth.

Figure 5.3-5
County-Level Employment Growth under No Project Alternative



Figures 5.3-6 and 5.3-7 display county-level employment growth rates for the Modal and HST Alternatives, respectively, compared to the No Project Alternative. Compared to the Modal Alternative, the HST Alternative exhibits higher employment growth rates in all regions and all counties except Riverside. The Modal Alternative is projected to exhibit a more dispersed pattern of incremental employment growth with only one county, San Joaquin, exhibiting an employment growth rate in excess of 2%. The pattern is quite different for the HST Alternative, with eight counties exhibiting growth rates in excess of 2%, and Sacramento and Merced Counties exhibiting incremental employment growth in excess of 5%. While population and employment growth rates are relatively strong under the HST Alternative in most Central Valley counties, relative employment growth is larger than relative population growth in all of these cases except for Merced County.

The Northern Central Valley 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 into farming, and from manufacturing, trade, and TCU into FIRE and services. Incremental job growth under the Modal Alternative is projected to roughly follow historical statewide averages, with 39% of job growth in manufacturing, trade, and TCU; and 44% in FIRE and services. The HST Alternative, on the other hand, is projected to have incremental job growth that is much more heavily oriented toward FIRE and services (63% of total), with manufacturing, trade, and TCU accounting for about 23% of incremental growth. This is the largest shift in the nature of employment for any region and alternative, and suggests that the HST Alternative could be a strong influence in attracting higher-wage jobs to the Central Valley.

Figure 5.3-6
County-Level Employment Growth under Modal Alternative

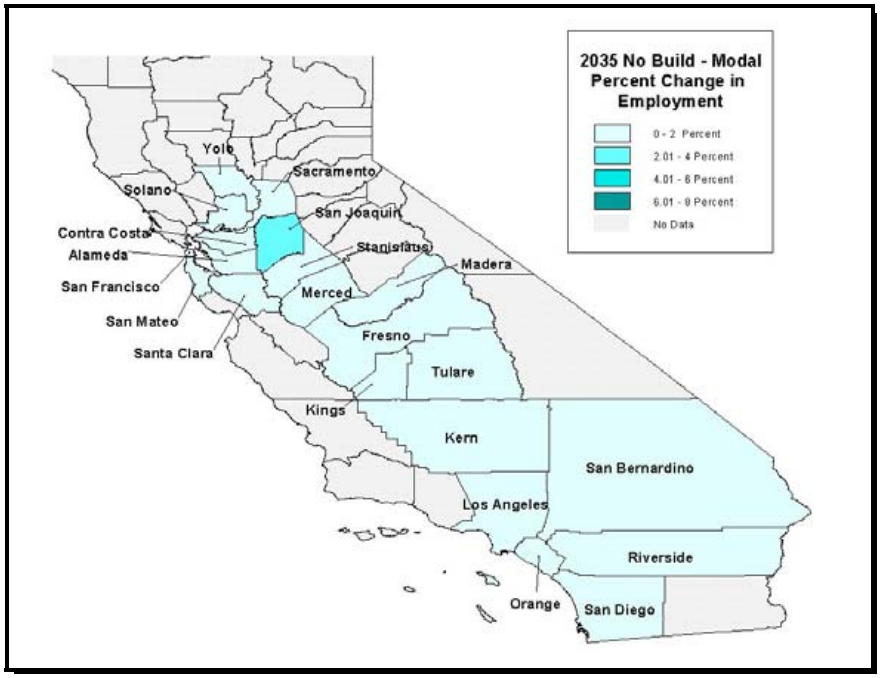
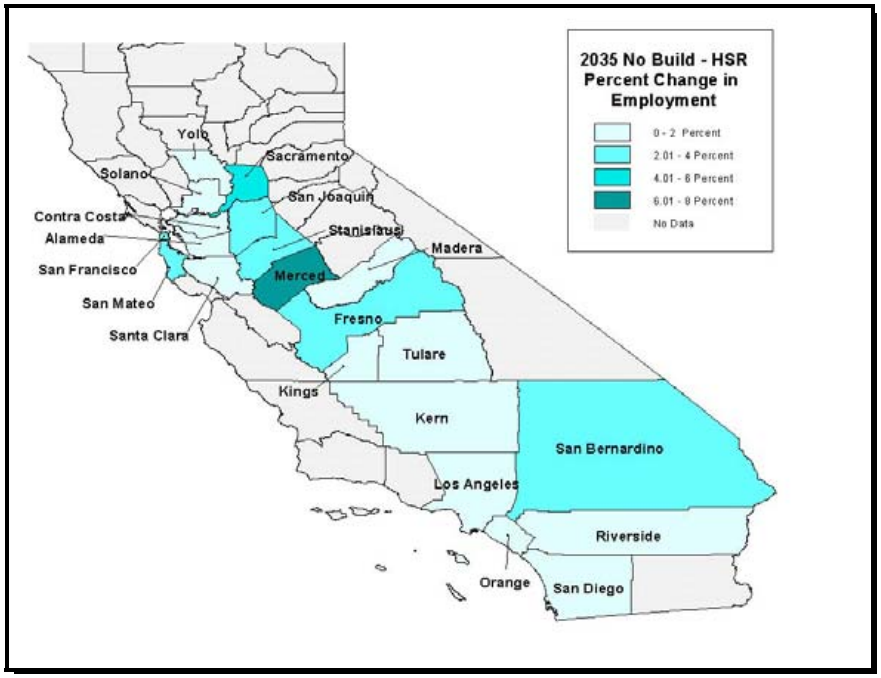


Figure 5.3-7
County-Level Employment Growth under HST Alternative



C. URBANIZATION

Table 5.3-6 presents projections for increases in urbanized areas for each region and county being analyzed. Existing conditions are provided for Year 2002, and projections are provided for the three alternatives in Year 2035. While population and employment increases were projected to be concentrated in the counties that are currently most populous, urbanization patterns do not follow this trend. Riverside and San Bernardino Counties are projected to exhibit the largest degree of urbanization under the No Project Alternative. Los Angeles, San Diego, and Orange Counties, which currently have the largest extent of land at urbanized densities, would experience a much lower rate of additional urbanization than Riverside and San Bernardino Counties.

The five counties that comprise the Southern California region would account for 60% of the future increase in urbanized acreage under the No Project Alternative for the counties included in this analysis. Outside of Southern California, the Southern Central Valley is projected to experience the most urbanization, followed by the Northern Central Valley and the Bay Area. Kern, Fresno, and San Joaquin are the only counties outside of Southern California that are projected to each experience an urbanization increase greater than 50,000 ac (20,234 ha) under the No Project Alternative; all five Southern California Counties are projected to exceed the 50,000 ac (20,234 ha) threshold.

Compared to the No Project Alternative, the Modal Alternative is projected to exhibit an increase in urbanization for all counties, with the greatest relative urbanization increase in Riverside, San Diego, Fresno, and San Joaquin Counties. The HST Alternative, on the other hand, is projected to experience a decrease in the extent of future urbanization, compared to the No Project Alternative in seven counties (Madera, San Joaquin, Stanislaus, Yolo, Tulare, Los Angeles, and Orange), the Northern Central Valley and Southern California regions, and the state as a whole.

Table 5.3-6
Year 2035 Size of Urbanized Area by Alternative
County and Regional Totals

	Urbanized Area (Acres)			
		2035		
County	**2002 Existing Conditions**	**No Project**	**Modal**	**HST (Base)**
Alameda	141,654	170,941	171,868	171,225
Contra Costa	142,467	163,617	164,216	164,874
San Francisco	23,277	27,921	28,081	28,345
San Mateo	70,869	80,517	80,930	81,267
Santa Clara	184,481	232,167	233,601	235,404
Solano	53,757	75,121	75,791	76,634
Bay Area*	**616,505**	**750,284**	**754,488**	**757,749**
Madera	23,255	46,926	47,047	45,329
Merced	31,712	55,964	56,242	57,212
Sacramento	157,101	197,843	198,820	202,471
San Joaquin	74,250	142,650	144,711	137,960
Stanislaus	55,426	96,993	97,968	93,562
Yolo	26,342	37,874	38,002	37,022
North Central Valley*	**368,086**	**578,250**	**582,790**	**573,557**
Fresno	96,977	186,908	189,641	189,503
Kern	111,468	221,030	222,407	226,851

County	Urbanized Area (Acres) 2002 Existing Conditions	2035 No Project	2035 Modal	2035 HST (Base)
Kings	29,479	43,576	43,655	44,910
Tulare	48,656	98,077	98,192	97,841
South Central Valley*	**286,580**	**549,590**	**553,895**	**559,105**
Los Angeles	763,373	916,904	926,720	881,982
Orange	273,713	328,269	328,795	323,189
Riverside	255,230	516,122	549,163	539,816
San Bernardino	237,905	496,637	497,983	498,004
San Diego	340,837	510,542	518,224	510,567
Southern California*	**1,871,058**	**2,768,473**	**2,820,884**	**2,753,557**
Statewide Total	**3,142,229**	**4,646,596**	**4,712,057**	**4,643,968**

* Only includes counties within a region that have a high-speed train station with the HST Alternative, or highway or aviation improvements within the Modal Alternative.

Source: Cambridge Systematics, Inc. 2003.

5.3.5 HST Alignment Options

The modeling process was also used to look at potential system-wide growth sensitivity for proposed HST alignment options. County-level growth projections were nearly identical between the base HST scenario and the different alignment options. One exception involved the Irvine alignment scenario, for which Orange County could gain about 5,000 jobs (0.2% increase in jobs) and 9,000 people compared to the base HST scenario. Nonetheless, in nearly all cases the magnitude of difference among the HST alignment options was less than the difference among the alternatives.

The analysis also suggested that most of the alignment options would not create meaningful differences in overall urban area size or station-area development density.[8] The one exception is the outlying stations alignment scenario in which the location of Central Valley and San Diego HST station sites outside of the downtown areas would likely weaken the economies of agglomeration[9] for businesses within these communities. In particular, a San Diego terminus at East Mission Valley instead of downtown San Diego is projected to increase countywide land consumption by about 12,000 ac (4,856 ha), or 0.5%, relative to the base HST scenario. The analysis suggests an advantage, both in terms of potential HST ridership inducement and growth control, with locating HST stations in or near the downtown areas instead of in suburban or undeveloped areas.

5.3.6 Summary of Effects

Overall, the alternatives and proposed HST alignment options would represent very similar levels of growth effects in terms of potential changes in urbanized area size and land consumption needs. The additional effect of the Modal and HST Alternatives relative to the No Project Alternative is small compared to the difference between the No Project Alternative relative to 2002 existing conditions.

[8] For the Palmdale scenario analysis, results suggest that the likely growth effect in the Antelope Valley (including potential station sites in both Palmdale and Sylmar) would be on the order of 25,000 people and 15,000 jobs relative to the No Project Alternative, and 3,000 people and 1,000 additional jobs relative to the base HST scenario.

[9] *Economies of agglomeration* refers to the competitive advantage that a business can achieve by locating in close geographic proximity to ancillary industries.

The HST Alternative would stimulate additional growth relative to the other alternatives in some Central Valley counties between Sacramento and Fresno. In all cases except Merced County, the incremental employment effect is much larger than the incremental population effect, suggesting that the HST Alternative might be more effective at distributing employment throughout the state. Also, this result suggests that the HST Alternative would not stimulate large 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. The HST Alternative would contribute to a potential economic boost in two ways.

- An HST system would provide user benefits (travel-time savings, cost reductions, accident reductions) and accessibility improvements for California's citizens; in addition to HST travelers, travelers on other modes of transportation can accrue these user benefits, as trips are diverted from highways and airports resulting in reduced congestion.
- An HST system would improve accessibility to labor and customer markets, thereby potentially 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 could operate more efficiently than businesses that locate elsewhere. Experience from overseas suggests that this competitive advantage may be quite pronounced in high-wage employment sectors that are frequently in high demand in many communities. This second effect would be much stronger under the proposed HST Alternative than under the other alternatives.

One of the most telling summary statistics comes from combining population and employment growth projections with land consumption forecasts, providing a measure of "land consumed per new job and resident." Essentially, this calculation tells us how efficient each alternative is at accommodating the projected growth. Since the alternatives have similar levels of overall growth, the efficiency by which that growth would be accommodated becomes more important. Table 5.3-7 provides the relevant data for each of the alternatives; lower values of the calculation suggest greater efficiency. The results indicate that the HST Alternative is the most efficient of the alternatives, providing an incremental development density that is 4% more efficient than the No Project Alternative, while the Modal Alternative is 2.3% less efficient than the No Project Alternative. This efficiency for the HST Alternative is achieved in conjunction with the highest population and employment growth rates of all alternatives and would be 6.3% more efficient than the Modal Alternative.

Table 5.3-7
Potential Land Consumption Efficiencies

	No Project Alternative	Modal Alternative	HST Alternative
Land Consumption (thousands of ac)	1,505	1,570	1,501
Job Growth (thousands of jobs)	9,085	9,328	9,529
Population Growth (thousands of people)	19,408	19,771	20,099
Acres Consumed per New Job and Resident*	0.0528	0.0540	0.0507
Efficiency Gain/Loss Relative to No Project Alternative	–	-2.3%	+4.0%

* Value found by dividing land consumption by the sum of job growth and population growth.
Source: Cambridge Systematics, Inc. 2003.

5.4 POTENTIAL INDIRECT IMPACTS OF INDUCED GROWTH

This section explores the potential indirect impacts related to incremental population and employment growth, and associated changes in urbanization. Potential indirect impacts are described for the Modal and HST Alternatives, with the No Project Alternative used as the reference point.

As described above, the HST and Modal Alternatives may have positive, albeit relatively small, statewide effects on population and employment growth compared to the No Project Alternative. At the county level results vary, but two-thirds of counties in the study area are projected to experience less than 2% more population growth under the HST Alternative than under the No Project Alternative in 2035. Employment also is projected to grow by less than 2% in the majority of counties under the HST Alternative compared to the No Project Alternative in 2035.

Despite the relatively small magnitude of this additional population and employment growth compared to the No Project Alternative, these changes could contribute to indirect impacts on the human or natural environment in addition to the direct impacts created by construction and operation of one of the alternatives. Many of these impacts may derive from the increased urbanization needed to accommodate the additional population and employment. In 2035, the total size of urbanized areas in California would be virtually the same under the proposed HST Alternative as under the No Project Alternative. Under the Modal Alternatives, approximately 65,500 ac (26,507 ha) more than the No Project Alternative (1.4%) are expected to become urbanized.

Much of the potential incremental growth associated with each alternative is likely to focus around points of access to the transportation system (i.e., proposed stations for the HST Alternative and interchanges or airports for the Modal Alternative). While the statewide and regional effects may differ only slightly, the localized effects could be larger near these points of access for the HST and Modal Alternatives compared to the No Project Alternative.

5.4.1 Transportation

This section discusses the potential impacts of induced growth on traffic conditions for highways, roadways, passenger transportation services (i.e., bus, rail, air, intermodal), goods movement, parking, and transit facilities within the study area.

Currently, the study area highway and roadway corridors considered in this analysis represent some of the worst traffic conditions in the nation. Traffic conditions throughout all five regions of California are expected to worsen. Vehicle volume to capacity (V/C) ratios are projected to deteriorate by 41% between Years 2002 and 2020, and each region would have more level of service F segments under the No Project Alternative compared to existing conditions. When compared to this projected degradation in traffic conditions under the No Project Alternative, the traffic conditions projected for the HST and Modal Alternatives would improve in all five regions, despite the estimated 2% increase in statewide population and employment under the proposed HST Alternative, and the estimated 1% increase for both population and employment under the Modal Alternative. The potential impacts of the induced growth, to the degree that they can be detected, would be most apparent around urban HST stations and airports, where the additional traffic generated by induced growth is expected to be concentrated. Under the Modal Alternative, however, roadway and interchange capacity would be increased in many of the areas that would otherwise see minor traffic increases from induced growth.

The largest increase in population and employment (4%) would occur in the Northern Central Valley region under the HST Alternative. This increase has the greatest potential to generate impacts from traffic accessing the potential HST station sites. Most of these communities have considerable capacity on roadways and intersections in areas surrounding potential downtown or outlying HST station sites. The potential traffic generation impacts of a projected 6% more residents and employees, such as that

projected for Merced County, would be unlikely to have measurable impacts on roadway and intersection level of service.

As an overall conclusion, the indirect effects of induced growth on transportation for the Modal Alternative would be dispersed. To the degree that they are concentrated, their impacts are likely to be focused on property surrounding freeway interchanges and airports. The potential transportation impacts of induced growth under the HST Alternative are likely to concentrate around proposed HST station sites. Project-level environmental studies would be expected to provide the appropriate opportunity to investigate more localized impacts.

5.4.2 Air Quality

Section 3.3, *Air Quality*, describes the potential impact of induced growth on air pollution. The induced growth analysis for the highway component of the Modal Alternative assumed that vehicle miles traveled (VMT) would likely increase approximately 1.1% above the level for the No Project Alternative. The Modal Alternative, therefore, is predicted to increase the amount of regional pollutants generated by 1.1% as compared to the No Project Alternative. Potential impacts range from low to medium within all the air basins analyzed. The analysis of direct effect found no air quality impacts from induced growth under the Modal Alternative for air travel or conventional rail.

The HST Alternative would accommodate an estimated 68 million people annually that would otherwise use the roadways and airports, leading to a potential VMT reduction on the state highway system. Thus, the HST Alternative is projected to decrease the amount of mobile-source air quality pollutants statewide and in all air basins analyzed as compared to the No Project Alternative. The additional 2% increase in population and employment from induced growth would generally be expected to increase traffic and mobile-source air pollutants by a proportional amount.

At the local level, however, the HST Alternative has more potential to affect local sites than the Modal Alternative because of expected increases in local traffic near HST station locations. It is expected that the induced growth could concentrate near HST stations, and thus the direct and indirect air quality effects could be larger around the station areas. The severity of these local impacts, however, cannot be reliably quantified without local and detailed traffic modeling and impact analysis, which is outside the scope of analysis for this Program EIR/EIS. Project-level environmental studies would be expected to provide the appropriate opportunity to investigate more localized impacts.

5.4.3 Noise and Vibration

Increased population and employment related to induced growth would not increase the likelihood or possible levels of potential noise and vibration impacts. Therefore, no indirect impacts from induced growth are expected in the areas of noise and vibration.

5.4.4 Energy

A. STATEWIDE

There would not be any significant differences in potential energy use among the alternatives resulting from general population and employment growth projections because the magnitude of the incremental statewide population and employment growth is expected to be similar, regardless of which alternative is chosen. However, the expected propensity of the proposed HST Alternative to concentrate employment and population near HST stations, and the resulting incremental development density benefit, would tend to reduce the number and length of vehicle trips for work, leisure, and commerce compared to the No Project and Modal Alternatives. Such an effect would decrease the amount of energy directly used for transportation. The potential increased density in the vicinity of proposed HST station sites would also limit the amount of energy required for

construction of and access to future infrastructure projects by reducing the distance between structures and reducing the number of structures that would be required to serve new population and employment growth. In addition, higher density would reduce demand for the large-volume transportation-related infrastructure projects required for a highly automobile-oriented transportation network.

Though little difference is projected in overall statewide employment under any of the proposed alternatives, the potential differences that are projected in the statewide industry composition associated with the alternatives considered could affect the consumption of electricity specifically and overall statewide energy in general. The Modal Alternative would promote relatively stronger growth in TCU, construction and manufacturing, and wholesale and retail trade, and therefore a relatively larger incremental growth in energy use than the proposed HST Alternative, which would encourage relatively larger incremental growth in FIRE, services, and government sectors. The latter industries would result in relatively smaller incremental growth in energy use by industry.

B. REGIONAL

The projected population and employment distributive effect of the project could create the need for some change in the incremental development of overall energy and electricity generation and/or transmission capacity among regions. For example, Merced County would exhibit the largest relative increase in both population and employment with implementation of the HST Alternative. Relatively high incremental growth is also expected in other counties within the Central Valley. San Francisco would exhibit the highest relative increase in population, while San Diego, Orange, and Fresno Counties would exhibit higher incremental employment growth relative to other counties. These differences in growth rates among counties would potentially require more incremental production and/or transmission capacity to be developed in some areas with implementation of the HST Alternative as compared to the No Project or Modal Alternatives.

The additional energy and electricity infrastructure required by population and employment growth in the Central Valley might be somewhat reduced because employment growth would be slightly higher in the FIRE and services industries, which are relatively less energy intensive than the construction and manufacturing, trade, and TCU industries. On the other hand, Southern California would see a somewhat higher relative incremental growth in the construction and manufacturing industries, which would increase the energy consumption of this region.

5.4.5 Electromagnetic Frequency and Electromagnetic Interference

Increased population or employment related to induced growth would not increase the likelihood or potential severity of electromagnetic frequency (EMF) and electromagnetic interference (EMI) associated with operation of the proposed HST or Modal Alternative. Therefore, no indirect impacts from induced growth are expected in the areas of EMF/EMI.

5.4.6 Land Use, Communities and Neighborhoods, Property, and Environmental Justice

This section describes the potential impacts of induced growth attributable to the Modal and HST Alternatives on land use compatibility, communities and neighborhoods, property, environmental justice, and socioeconomics.

A. COMPATIBILITY WITH EXISTING LAND USE AND FUTURE LAND USE PLANS

The analysis results indicate that employment is projected to increase under both the Modal and HST Alternatives, with employment potentially available for individuals possessing a broad range of education or job skills. Increased employment opportunities should lead to personal income growth in all regions of the state; this growth might be most pronounced in counties of the Northern Central

Valley under the HST Alternative, since that region is projected to experience the largest employment gain.

The relationship between employment, income growth, and the socioeconomic composition of a community is complex. Increases in employment and income opportunities, however, would tend to make a community more attractive to a broader range of individuals. Since induced growth under the Modal and HST Alternatives would be relatively small (compared to the growth from existing conditions to the No Project Alternative), it is expected that socioeconomic changes would also be small.

The Modal Alternative is projected to require approximately 79,000 ac (31,970 ha) of land more, or 1.4%, than the No Project Alternative by 2035. This additional development may make the Modal Alternative slightly less consistent with local land use plans. The Modal Alternative would add capacity to the most congested freeways and interchanges and have its strongest relative employment growth in lower density industrial sectors, such as TCU and retail. These two impacts are likely to place additional development pressure on urban and suburban areas. Furthermore, any large increase in roadway capacity and new freeway interchanges would create an opportunity for sprawl around the interchanges.

The HST Alternative is projected to push employment growth 2% higher statewide than the No Project Alternative. The development pressures associated with the HST Alternative would be concentrated in the service and FIRE industries, which generally occupy office developments and have been shown to locate close to transit stations. Recent trends among local jurisdictions show a growing consideration of land use policies that are intended to encourage high-density, mixed-use development close to downtown and other areas in which HST stations may be located.

B. COMMUNITIES AND NEIGHBORHOODS

The induced growth associated with either the Modal or HST Alternative would not create new barriers within neighborhoods and would not result in impacts on community cohesion because the growth would generally follow existing transportation corridors and rights-of-way. The induced employment growth associated with the HST Alternative would have some modest potential to increase office/commercial development densities around HST station sites.

C. PROPERTY

The induced population and employment growth that would be attributable to the Modal and HST Alternatives is not projected to create the need for any additional right-of-way for wider highways, new interchanges, additional runways, or other auto or air travel infrastructure.

The highest potential for property impacts under the HST Alternative would be expected to occur where the induced growth leads to larger or denser development adjacent to HST stations. The planning policies and general plans of most jurisdictions in which potential HST station sites would be located, however, are directing present and future development into their urban centers and to in-fill sites independent of possible future HST implementation. Thus, the additional density induced by the location of proposed HST station sites would be difficult to detect and would be expected to have little impact on adjacent property. It is possible that the induced employment growth in some of the highest-growth counties could place modest development pressure on land immediately adjacent to the most impacted stations. An increase in density, if not designed to minimize impacts on adjacent properties, would have some potential to affect property. The methods of analyzing the potential property impacts of the alternatives are discussed in Section 3.7, *Land Use and Planning, Communities and Neighborhoods, Property, and Environmental Justice*.

D. ENVIRONMENTAL JUSTICE

The induced growth attributable to the Modal or HST Alternative should not have disproportionate impacts on minority and low-income populations. The induced growth from the Modal or HST Alternative would have the potential to offer improved employment opportunities to local communities. These opportunities may arise from more diversified regional economies and robust employment growth in regions that would not benefit in the same way under the No Project Alternative.

The role of induced growth in the patterns of personal income growth and job creation across the state is mixed. The No Project Alternative would continue the historical trends—the Northern Central Valley region exceeding statewide averages for government and farming jobs, while lagging in all other industry groups. Incremental job growth under the Modal Alternative is projected to roughly follow historical statewide averages, with 44% of job growth in FIRE and services and 39% in manufacturing, trade, and TCU. The small increase in job growth expected under the Modal Alternative would offer lower wage and seasonal workers modest improvements in employment opportunities, especially in the manufacturing, trade, and TCU sectors that offer year-round employment at somewhat higher wages than agriculture and services. Incremental job growth under the HST Alternative, on the other hand, is projected to focus more on FIRE and services (63% of total), with manufacturing, trade, and TCU accounting for about 23% of incremental growth.

The consequence of growing employment in the service industries would be a diversification in the Central Valley away from agriculture and into more non-agricultural jobs. The impact of these new jobs (and the population growth and new development that it would stimulate) on minority and low-income populations in each county cannot be identified in this Program EIR/EIS. In general, FIRE and service job growth would tend to be attracted to station areas (HST Alternative), and highway interchanges and airports (Modal and No Project Alternatives). The extent to which this development would potentially use land occupied by minority and low-income populations would deserve consideration at the project-level review of potential environmental justice issues. The growth in FIRE and service sector employment would tend to offer more jobs to high-skilled members of the work force than to low-skilled workers. Many service-sector jobs, however, would be accessible to low-skilled workers, and any increase in employment would generally have multiplier effects that would tend to generate indirect and induced job growth across many occupations.

5.4.7 Farmland and Agriculture

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in each county reflected in the analysis. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based information used in Chapter 3 showing the location of lands in agricultural use to produce estimates of the extent to which farmland might be converted to urbanized areas.

Table 5.4-1 provides estimates of farmland acreage that could be converted to urbanized land uses for the three alternatives in each analysis region. Results are presented separately for categories of prime farmland, farmland of statewide importance, unique farmland, and farmland of local importance. The difference between the No Project and Modal and HST Alternatives provides an estimate of the indirect impact of induced growth on farmland and agriculture.

In total, induced growth associated with the Modal Alternative is projected to impact about 21,000 ac (8,498 ha) more of farmland on a statewide basis than the No Project Alternative, including about 3% more prime farmland and farmland of statewide importance, 5% more unique farmland, and 7% more farmland of local importance. Farmland of local importance is expected to experience the largest amount

of conversion to non-agricultural use (about 9,300 ac [3764 ha]) of the four categories. The largest percentage difference would occur in the Bay Area and Southern California regions, with Southern California also accounting for the largest conversion of farmland (about 13,000 ac [5,261 ha]). Among individual counties, Riverside is projected to experience the largest conversion of farmland to non-agricultural use from induced growth (about 7,200 ac [2,914 ha]), with Fresno and San Joaquin Counties also expected to experience the conversion of more than 1,000 ac (405 ha) of farmland due to induced growth.

Table 5.4-1
Farmland Resources Potentially Affected by Future Urbanization

Analysis Region	Acreage of Resource Potentially Affected by Future Urbanization* (Percent Change from No Project Alternative)		
	No Project Alternative	Modal Alternative	HST Alternative
Prime Farmland			
Bay Area	15,100	16,000 (6%)	17,000 (13%)
North Central Valley	66,900	68,500 (2%)	63,400 (-5%)
South Central Valley	111,500	113,800 (2%)	116,400 (4%)
Southern California	51,500	52,800 (3%)	53,200 (3%)
Total	**245,000**	**251,100 (3%)**	**250,000 (2%)**
Farmland of Statewide Importance			
Bay Area	4,600	5,000 (8%)	5,300 (14%)
North Central Valley	53,400	54,800 (8%)	53,600 (0%)
South Central Valley	15,800	16,100 (3%)	16,100 (2%)
Southern California	15,400	16,000 (4%)	15,200 (-1%)
Total	**89,300**	**91,900 (3%)**	**90,200 (1%)**
Unique Farmland			
Bay Area	1,900	2,000 (8%)	2,300 (19%)
North Central Valley	17,900	18,200 (2%)	16,400 (-8%)
South Central Valley	7,500	7,700 (4%)	7,700 (3%)
Southern California	26,900	28,700 (7%)	25,000 (-7%)
Total	**54,200**	**56,600 (5%)**	**51,300 (-5%)**
Farmland of Local Importance			
Bay Area	3,800	4,100 (8%)	4,400 (15%)
North Central Valley	23,000	24,400 (2%)	23,000 (0%)
South Central Valley	7,100	7,200 (1%)	6,600 (-8%)
Southern California	100,900	109,400 (8%)	93,700 (-7%)
Total	**134,800**	**144,100 (7%)**	**127,700 (-5%)**

* Values in the table indicate the resource acreage that is located within areas that are projected to become urbanized between the years 2002 and 2035 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff, Inc. 2003.

The potential induced growth associated with the HST Alternative is projected to impact about 4,100 ac (1,659 ha) fewer of farmland on a statewide basis than the No Project Alternative, including about 5% less unique farmland and farmland of local importance, 2% more prime farmland, and 1% more farmland

of statewide importance. Prime farmland is expected to experience the largest absolute loss (about 5,000 ac [2,023 ha]) of the four categories. The largest percentage and acreage of farmland conversion to non-agricultural use is projected to occur in the Bay Area, while the Northern Central Valley and Southern California are projected to experience a reduction in farmland conversion compared to the No Project Alternative. Among individual counties, Sacramento, Santa Clara, Fresno, and Merced are each projected to experience farmland conversions of more than 2,000 ac (809 ha) due to potential induced growth under the HST Alternative. Los Angeles, San Joaquin, and Stanislaus Counties are each projected to have more than 3,000 ac (1,214 ha) less of farmland conversion under the HST Alternative than under the No Project Alternative. In Riverside County, about 7,000 ac (2,833 ha) of additional prime farmland is projected to be converted due to potential induced growth under the HST Alternative (compared to the No Project Alternative); at the same time, about 9,000 ac (3,642 ha) fewer of farmland of local importance are projected to be converted due to potential induced growth for the HST alternative; considering all four categories of farmland, about 1,600 ac (647 ha) fewer of farmland in Riverside County are projected to be converted due to potential induced growth under the HST alternative.

Except for the outlying stations scenario, the HST alignment options all would result in less farmland conversion than the base HST scenario, with the Palmdale scenario showing the largest reduction (2,800 ac [1,133 ha]). The outlying stations scenario is projected to increase farmland conversion by about 6,100 ac (2,469 ha) over the base HST scenario, with almost all of this increase occurring in San Diego County. The Diablo Range direct scenario options are projected to reduce farmland conversion in Santa Clara County by about 700 ac (283 ha) of mostly prime farmland, and the Palmdale scenario is projected to reduce prime farmland conversion in Tulare County by about 1,000 ac (405 ha). The other counties exhibit very similar results among the HST alignment options.

5.4.8 Aesthetics and Visual Resources

Aesthetics and *visual resources* refer to the natural and human-made features of a landscape that characterize its form, line, texture, and color. The character of the existing landscape takes shape and would change in each region over time as a result of land uses, development, and urban growth that may occur under any of the alternatives. Increased population or employment related to induced growth could contribute to these impacts, although the impact of the HST or Modal Alternative compared to the No Project Alternative would probably be insignificant. It would be speculative to attempt to characterize these potential changes at the program level without more specific information about what might be built.

5.4.9 Utilities and Public Services

To indicate potential impacts in this analysis, utilities and public services include electrical transmission lines, natural gas facilities, and wastewater treatment facilities. The capacity and extent of these utilities and services would be expected to expand gradually or in increments to accommodate the growth in population, employment, and urbanized land area expected to occur in California between now and 2035. Because the additional population, employment, and land consumption related to growth potentially induced by the HST and Modal Alternatives are relatively small compared to the total growth from existing conditions under the No Project Alternative, no considerable impacts are expected in the areas of utilities and public services.

5.4.10 Hazardous Materials and Wastes

Increased population or employment related to growth potentially induced by the HST and Modal Alternatives would not be expected to increase the likelihood or potential severity of exposure to hazardous materials and wastes. No indirect impacts from induced growth are expected in the areas of hazardous materials and wastes.

5.4.11 Cultural and Paleontological Resources

Future growth is expected to result in large areas of land within and outside of cities being developed to urban densities levels. However, it would be speculative to identify the likelihood or extent of potential impacts of development on prehistoric archaeological sites, historic archaeological sites, traditional cultural properties, historic structures, and paleontological resources at the program level without knowledge of the precise locations where development projects may be built.

Increased population or employment related to growth potentially induced by the Modal or HST Alternative would not increase the likelihood or extent of potential impacts on cultural or paleontological resources. No indirect impacts from induced growth are expected in the areas of cultural and paleontological resources.

5.4.12 Geology and Soils

Increased population or employment related to growth potentially induced by the Modal or HST Alternative would not increase the likelihood or extent of potential impacts related to geologic formations, seismic hazards, slope stability, oil and gas fields, or mineral resources. No indirect impacts from induced growth are expected in the areas of geology and soils.

5.4.13 Hydrology and Water Resources

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in each county reflected in the analysis. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based maps showing general waterway locations to identify waterways that would be located within future areas of urbanization. Table 5.4-2 provides estimates of the miles of waterways that are within future growth areas and that, in turn, could be affected by this future growth. The difference between the No Project and the Modal and HST Alternatives provides an estimate of the potential indirect impact of induced growth on hydrology and water resources.

In total, induced growth associated with the Modal Alternative is projected to impact about 300 mi (483 km) more of waterways (8%) on a statewide basis than the No Project Alternative. The largest percentage and area difference is projected to occur in Southern California, with the other three regions exhibiting similar results for the Modal and No Project Alternatives. Among individual counties, Los Angeles is projected to have the most mileage of waterways (about 155 mi [249 km]) potentially affected by induced growth. Riverside is also expected to have more than 80 mi (129 km) of waterways potentially affected by induced growth.

Induced growth associated with the HST Alternative is projected to impact about 270 mi (435 km) more of waterways (7%) on a statewide basis than the No Project Alternative. The largest percentage and area increase is projected to occur in Southern California, with the other three regions exhibiting very similar results for the HST and No Project Alternatives. It should be noted, however, that the HST Alternative is projected to affect fewer waterways in the Northern Central Valley region than the No Project Alternative.[10] Among individual counties, Los Angeles is projected to have the most mileage of waterways (about 115 mi [185 km]) potentially affected by induced growth. Riverside, Sacramento, San Bernardino, Santa Clara, and Solano are also expected to experience noticeable increases in waterway mileage ranging from 3 mi (4.8 km) to 60 mi (96.6 km). Orange, San Joaquin, Stanislaus, and Yolo

[10] This result occurs because the HST Alternative is projected to experience less conversion of undeveloped land to urbanized uses than the No Project Alternative in the Northern Central Valley.

Counties are each projected to have noticeably less waterway mileage potentially affected by induced growth.

Except for the outlying stations scenario, the HST alignment options all would result in about the same extent of waterway mileage potentially affected by induced growth. The outlying stations alignment scenario is projected have about 60 mi (96.6 km) more of waterway potentially affected by induced growth than the base HST scenario, with almost all of this increase occurring in San Diego, Stanislaus, and Kern Counties. In the Irvine alignment scenario, Los Angeles County is projected to have about 10 mi (16 km) more of waterways potentially affected by induced growth. The other counties exhibit very similar results among the HST alignment options.

Table 5.4-2
Hydrology and Water Resources Potentially Affected by Future Urbanization

Analysis Region	Waterways Within Areas of Projected Urbanization*, in Miles (Percent Change from No Project Alternative)		
	No Project Alternative	Modal Alternative	HST Alternative
Bay Area	430	450 (4%)	460 (6%)
North Central Valley	530	540 (2%)	510 (-4%)
South Central Valley	570	580 (2%)	590 (3%)
Southern California	2,170	2,430 (12%)	2,410 (11%)
Total	**3,700**	**4,000 (8%)**	**3,970 (7%)**

* Values in the table indicate the mileage that is located within areas that are projected to become urbanized between the years 2002 and 2035 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff, Inc. 2003.

5.4.14 Biological Resources

The urbanization forecasts that were developed for the analysis of potential growth inducement resulted in conceptual urbanization footprints showing the potential future locations of developed areas in each county reflected in the analysis. The footprints show the areas that would be the most likely to become urbanized in the future, based on the levels of projected population and employment growth, current development patterns, land accessibility, and local regulations and policies. These urbanization footprints were combined with GIS-based maps showing general locations of habitats in which threatened and endangered species may be found, to identify biological resources that could be affected by areas of future urbanization. Table 5.4-3 provides estimates of the acreage of potential habitat for threatened and endangered species that could be affected by this projected future growth. The difference between the No Project and the Modal and HST Alternatives provides an estimate of the indirect impact of induced growth on biological resources.

In total, induced growth associated with the Modal Alternative is projected to impact about 17,300 ac (7,001 ha) more of threatened and endangered habitat (4%) on a statewide basis than the No Project Alternative. The largest percentage and acreage increase is projected to occur in Southern California, while the two Central Valley regions exhibit very similar results for the Modal and No Project Alternatives. Riverside County is projected to account for more than 12,000 ac (4,856 ha) of the 17,300 ac (7,001 ha) of threatened and endangered habitat affected by induced growth. Los Angeles and San Diego Counties are each projected to have more than 1,500 ac (607 ha) of threatened and endangered habitat affected by induced growth, with most other counties experiencing an increase of about 200 ac (81 ha) or less due to induced growth.

Induced growth associated with the HST Alternative is projected to impact about 8,400 ac (3,399 ha) more of threatened and endangered habitat (2%) on a statewide basis than the No Project Alternative. The largest percentage increase is projected to occur in the Bay Area, while the largest acreage increase (5,100 ac [2,064 ha]) is projected to occur in the Southern Central Valley. The Northern Central Valley is projected to experience a decrease in the acreage of threatened and endangered habitat affected by future growth. Kern and Riverside Counties are each projected to have more than 4,000 ac (1,619 ha) of threatened and endangered habitat potentially affected by induced growth. Riverside County is projected to have about 1,500 ac (607 ha) of threatened and endangered habitat potentially affected by induced growth, but this amount is much smaller than the 12,000 ac (4,856 ha) projected for the Modal Alternative. Merced County is projected to experience a decrease of about 750 ac (304 ha) in threatened and endangered habitat affected by future growth compared to the Modal Alternative.

The Palmdale, Diablo Range direct, and Irvine alignment scenarios are projected to exhibit nearly identical levels of potential impact on possible threatened and endangered habitat from induced growth to that projected for the base HST scenario. The East Bay alignment scenario is projected to experience an additional 2,000-ac (809-ha) impact on potential habitat in Alameda County, while the outlying stations scenario is projected to experience an additional 1,500 ac (607 ha) impact in Kern County.

Table 5.4-3
Biological Resources Potentially Affected by Future Urbanization

Analysis Region	Habitat of Threatened and Endangered Species Within Areas of Projected Urbanization*, in Acres (Percent Change from No Project Alternative)		
	No Project Alternative	Modal Alternative	HST Alternative
Bay Area	20,400	21,200 (4%)	21,500 (6%)
North Central Valley	46,700	47,600 (2%)	45,000 (-4%)
South Central Valley	129,200	129,700 (0%)	134,300 (4%)
Southern California	236,600	251,700 (6%)	240,400 (2%)
Total	**432,900**	**450,200 (4%)**	**441,300 (2%)**

* Values in the table indicate the resource acreage that is located within areas that are projected to become urbanized between the years 2002 and 2035 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff, Inc. 2003.

5.4.15 Wetlands

The urbanization footprints described above in the discussion of farmland and agriculture were combined with GIS-based maps showing general wetland locations to identify wetlands that could be affected by areas of future urbanization. (See Section 3.15, *Biological Resources and Wetlands*.) Table 5.4-4 shows estimates of the wetland acreage that could be affected by this future growth. The difference between the No Project and the Modal and HST Alternatives provides an estimate of the potential indirect impact of induced growth on wetlands.

In total, induced growth associated with the Modal Alternative is projected to impact about 600 ac (243 ha) more of wetlands (2%) on a statewide basis than the No Project Alternative. The largest percentage and acreage increase is projected to occur in the Northern Central Valley. Sacramento County is projected to have about 250 ac (101 ha) of wetlands that could potentially be affected by induced growth. Merced and San Joaquin Counties also exhibit noticeable losses in wetlands due to induced growth, while Stanislaus County exhibits no additional wetland loss under the Modal Alternative than under the No Project Alternative.

Induced growth associated with the HST Alternative is projected to impact about 330 ac (134 ha) more of wetland (1%) on a statewide basis than the No Project Alternative. The largest acreage and percentage increase is projected to occur in the Northern Central Valley, while Southern California is projected to exhibit a reduction in wetland loss due to future urbanization. Sacramento County is projected to have about 300 ac (121 ha) of wetland that could potentially be affected by induced growth. Contra Costa, Kings, Merced, and Riverside Counties also show noticeable (ranging from 17 ac [7 ha] to 54 ac [22 ha]) losses in wetlands due to induced growth; while Los Angeles, Stanislaus, and Tulare Counties exhibit less wetland loss under the HST Alternative than under the No Project Alternative.

The Palmdale, Diablo Range direct, Irvine, and East Bay alignment scenarios are projected to exhibit nearly identical levels of wetland loss from induced growth as the base HST scenario. The outlying stations scenario is projected to experience an additional 160-ac (65-ha) wetland impact in San Diego County, but no difference in other counties.

Table 5.4-4
Wetlands Potentially Affected by Future Urbanization

Analysis Region	Wetlands Within Areas of Projected Urbanization* (Acres) (Percent Change from No Project Alternative)		
	No Project Alternative	Modal Alternative	HST Alternative
Bay Area	16,290	16,430 (1%)	16,550 (2%)
North Central Valley	3,010	3,340 (11%)	3,310 (11%)
South Central Valley	2,590	2,600 (1%)	2,720 (5%)
Southern California	9,630	9,750 (1%)	9,260 (-4%)
Total	**31,520**	**32,130 (2%)**	**31,850 (1%)**

* Values in the table indicate the resource acreage that is located within areas that are projected to become urbanized between the years 2002 and 2035 under each alternative. Each alternative, including the No Project Alternative, is projected to have a unique urbanization footprint; therefore, values are presented for each alternative.

Source: Cambridge Systematics, Inc. and Parsons Brinckerhoff, Inc. 2003.

5.4.16 Section 4(f) and 6(f) Resources (Public Parks and Recreation)

Increased population or employment related to induced growth would not increase the likelihood or extent of potential impacts on or uses of Section 4(f) and 6(f) resources, including publicly owned land from parks, recreation lands, wildlife and waterfowl refuges, and historic sites. No indirect impacts from induced growth are expected on Section 4(f) and 6(f) resources.

5.5 MANAGING GROWTH-INDUCING AND INDIRECT EFFECTS

5.5.1 Avoidance and Minimization Strategies

In general, HST station areas would offer a more attractive market for commercial and office development than the No Project and Modal Alternatives. Research for this project that considered urban rail systems in North America and high-speed rail systems in Europe and Asia supports this conclusion (Cambridge Systematics, Inc. 2003). This research found that industries needing many highly skilled and specialized employees are the most attracted to rail-station area development, and that a noticeable densification pattern would be likely to emerge in the vicinity of potential HST stations in response to real estate and market forces.

The research and analysis further indicates that an HST station is a considerably stronger draw for business development than a conventional intercity rail station or freeway interchange. This can

encourage more compact development patterns, which has the potential to help avoid or minimize indirect impacts. 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 access to a well-educated labor force. These advantages, known as economies of agglomeration, have emerged around the French and Japanese HST stations.

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 attracting higher-density development. A Central Valley city, for example, would have an easier time redirecting new development to downtown sites adjacent to their HST station site than the outlying real estate markets created by freeway interchanges under the No Project and Modal Alternatives. Furthermore, the strong real estate markets around HST stations are likely to attract development that would otherwise locate throughout a dispersed suburban region. Thus, development around HST stations would potentially consist of both consolidation of currently projected growth (under the No Project Alternative) and new regional employment and population associated with the HST Alternative. With the HST Alternative such consolidation would lead to a lower level of indirect impacts from future urban development to natural resources as compared to the Modal Alternative.

The potential effect of regulatory style land-use strategies was tested in this analysis. Results suggest that even a modest strategy focused on the immediate station areas could reduce the potential urbanized acreage by an additional 30,000 ac (12,141 ha) (0.6% of total urbanized acreage in study area) under the HST Alternative. These results represent a low-end estimate of the possible densification effects of regulatory strategies in combination with the market forces likely to occur following the introduction of HST service. The research suggests that other jurisdictions have had some success in implementing more aggressive and region-wide regulatory-style strategies[11] 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 an economic rationale to developers to cluster new commercial, industrial, and residential development to provide easy access to the HST stations. In general, the No Project and Modal Alternatives do not have the potential for such market incentive.

In short, the HST Alternative provides a strong incentive for directing urban growth and minimizing a variety of impacts that are frequently associated with growth. This outcome would be seen in results for resource topics such as farmland, hydrology, and wetlands, where the indirect effects of the HST Alternative are less than the Modal Alternative, and in some cases less than the No Project Alternative, even with more population and employment expected with the HST Alternative. Additional land use strategies, which would be highly compatible with the HST Alternative, could be considered to further reduce development impacts on sensitive natural resources; provide further concentration of employment in central areas that tend to be more readily accessible to minority and low-income populations; and provide further concentration of a wide variety of activities making local transit options more feasible and, possibly, reducing local automobile travel.

5.5.2 Sensitivity of Results to Base Population and Employment Forecasts

The methodology for this analysis provides reliable estimates of the differences (or *deltas*) between employment and population projected to result from the No Project Alternative, and those projected to result from the Modal and HST Alternatives. The methodology, however, does not confirm, alter or change in any way the validity, reliability, or details provided in the base case population and employment forecasts. These base case forecasts relied on data developed by the DOF, Caltrans, W&P, and REMI, which represent the best available information on long-term economic and demographic

[11] Examples of these strategies include urban growth boundaries, maximum parking requirements, jobs-housing balance, more diversity of land uses, higher densities, and higher service levels of mass transit.

conditions in the state. The base-case forecasts, however, of necessity rely on many assumptions related to future conditions and are subject to the same uncertainties as any other long-range forecast.

The population and employment deltas, measured in percentage terms, are not likely to differ as a result of changes in the base-case population and employment forecasts if these changes are somewhat equally distributed throughout the state or across many economic sectors. A change that is concentrated in one part of the state or within one sector of the economy, however, could lead to different deltas. It is reasonable, therefore, to consider how a significant change from the base-case population or employment forecasts would affect the delta calculated by the methodology. This sensitivity discussion investigates three possible scenarios to illustrate how the delta might change under alternative base-case forecasts of population and employment.

A. REDUCED EMPLOYMENT GROWTH IN THE FIRE SECTOR

The analysis indicated that the HST Alternative could lead to higher growth in the FIRE sector because this sector would be expected to benefit more than manufacturing and warehousing from accessibility to HST improvements. FIRE employment has been growing steadily in California during the past 50 years, and the economic downturns have not resulted in any significant long-term change in this growth pattern. It is possible to project a scenario in which FIRE employment would stagnate because of growing automation and offshore substitution (e.g., in-house software design and call centers moving out of California to India, for example). Such a scenario would diminish the potential advantages HST could bring to the FIRE sector and thus reduce the employment delta for FIRE under the HST Alternative. It would be expected, however, that the Central Valley region would still see disproportionately higher growth in the FIRE sector because some of the state's existing FIRE jobs would migrate to the Central Valley HST station areas because of cheaper land and lower wage rates outside of the Southern California and Bay Area regions. This scenario would be expected to reduce the extent of indirect impacts in the Bay Area and Southern California, and either slightly reduce or maintain the extent of indirect impacts in the Central Valley.

B. RAPID GROWTH IN WAREHOUSING AND MANUFACTURING ACTIVITY

The Modal Alternative is expected to stimulate stronger growth in the TCU sector because this sector depends on trucking and warehousing activities that would benefit from the Modal Alternative's increased roadway capacity. TCU employment trends have been more variable than the FIRE sector, but nonetheless growing in California due to the increase in import and export activity through California's major ports. As trade activity recovers from the Asian recessions and manufacturing continues to move overseas, warehousing and distribution throughout California could accelerate under the base-case employment forecasts. This scenario might be expected to lead to a larger increase in the TCU employment delta for the Modal Alternative (relative to the HST Alternative). Although this scenario would increase overall employment growth under both the Modal and HST Alternatives, the difference in total statewide employment between these two alternatives would be less than the 200,000-job difference, as identified in Section 5.3.3, under the original base-case forecasts. The increased TCU employment growth would be expected to increase some of the indirect effects on natural resources noted in previous sections, with the Modal Alternative exhibiting a proportionately larger increase than the HST Alternatives. Noticeable differences in indirect effects to other resource categories would not be expected.

C. HIGHER THAN EXPECTED GROWTH IN STATE POPULATION

While natural drivers of population growth (birth rates and death rates) may be projected with some certainty, political factors influencing in-migration and out-migration could lead to differences from the base-case population forecast. A prolonged recession in Mexico or other Central or South American nations, for example, could increase immigration into California. This divergence from the California DOF forecast could swell the ranks of labor throughout the state. The impacts on the

employment and population deltas, however, would be minimal because the Modal and HST Alternatives would tend to attract additional population related to employment opportunities in specific industry sectors. These industry sectors tend to rely on access to skilled labor and goods movement, and even a drastic increase in unskilled labor would have a minimal effect on industry growth under the Modal and HST Alternatives. This minimal effect on population and employment would be expected to lead, in turn, to minimal changes in projected indirect impacts for all resource categories.

5.5.3 Sensitivity of Results to Project Cost and Funding Assumptions

Analysis results presented in this chapter were based on assumed costs of approximately $25 billion for the HST Alternative and $56 billion for the Modal Alternative. Since the time that this analysis was completed, project costs have been refined and will continue to be refined as each alternative evolves and the design concept and scope become more fully defined. It is reasonable, therefore, to consider how a cost increase for the Modal or HST Alternative, or a change in project funding assumptions, might affect the population and employment *deltas* calculated by the methodology. The following sensitivity discussion considers both project costs and funding assumptions.

As noted in Section 5.3.2, analysis results reflect an assumption that project costs for the Modal Alternative in excess of costs for the HST Alternative, would be funded through a combination of tax increases, user fees, and federal grants. This cost differential amounted to $31 billion under original project cost assumptions. Analysis results indicate that funding of this cost differential through tax increases and user fees would reduce statewide growth by about 20,000 jobs and 45,000 people for the Modal Alternative. These values correspond to a 7.7% (0.25% per $1 billion) decrease in incremental job growth and 11.1% (0.36% per $1 billion) decrease in incremental population growth compared to results that would be obtained if project costs were not considered.[12] These relationships between project cost and job and population growth are likely linear within the range of costs likely to be encountered.[13] Given this linear relationship, the following general inferences can be drawn about the sensitivity of results to project cost.

- For the Modal Alternative, an increase in the overall assumed cost from $56 billion to $82 billion might lead to an additional statewide loss of between 37,000 and 53,300 jobs, and between 83,100 and 120,000 people compared to the results shown in the last row of Table 5.3-5.[14]
- For the HST Alternative, the effect of an increase in the overall assumed cost from $25 billion to $37 billion would depend upon how the increased cost was funded.
    - If the cost increase was assumed to come from the same existing revenue sources as described in Section 5.3.2 (i.e., the cost increase would not require direct tax increases or significant diversion of general fund revenues), then there would be no effect on statewide job or population growth.
    - If the $12 billion cost increase was assumed to come from increased taxes and user fees, then a statewide loss of 13,300 jobs and 29,900 people might occur, compared to the results shown in the last row of Table 5.3-5 for the HST Alternative.

[12] Incremental growth refers to the growth in jobs and population above and beyond the amount that is expected to occur for the No Project Alternative.

[13] This conclusion is based on the analysts' prior experience with economic forecasting in general, and the REMI model in particular.

[14] The lower values for population and employment correspond to an assumption that only the cost increase of $26 billion ($82 billion minimum $56 billion) would require funding from increased taxes and user fees. The higher values for population and employment correspond to an assumption that both the cost increase ($26 billion) and the original $25 billion in funding from existing sources (as described in Section 5.3.2) would require funding from increased taxes and user fees.

- If the entire $37 billion project cost was assumed to come from increased taxes and user fees, then a statewide loss of 41,100 jobs and 92,100 people might occur, compared to the results shown in the last row of Table 5.3-5 for the HST Alternative.

Population and employment deltas are sensitive to assumptions regarding the use of existing versus new revenue sources, as well as the extent to which new revenues are assumed to come out of the local economy (i.e., through increases in user fees or state/local taxes). The previous discussion of project cost sensitivity assumed that a mix of funding sources[15] would be used to pay for the project costs. This mix included the following.

- Federal sources: 37.5% of project costs from federal funds.
- State and local tax sources: 50% of project costs from an increase in the state gas tax, and 4.1% of project costs from local general funds.
- Private sources: 4.2% of project costs from airport passenger facility charges, and an additional 4.2% of project costs from other airport revenues.

The interaction between these individual funding sources and economic growth is somewhat complex, but some general inferences can be drawn.[16]

- As the proportion of funding from federal sources increases, the sensitivity of population and job growth to project cost increases becomes smaller. Similarly as the proportion of funding from federal sources decreases, the sensitivity of population and job growth to project cost increases becomes larger.
- Within the general category of state and local tax funding, population and employment growth is likely more sensitive to raising revenue from new taxes (which, in turn, reduces personal consumptions), as opposed to substituting one kind of government spending for another (e.g., reducing education or welfare spending in order to pay off a general obligation bond).
- Population and employment growth is likely more sensitive to a narrowly focused tax or user fee as opposed to a broad-based tax increase.[17] While an increased sales or income tax would affect more people than a narrowly-focused tax, the broad-based taxes would be a smaller per capita amount and would be more dispersed throughout the larger consumer economy. A narrowly focused tax or user fee within the transportation industry (e.g., gasoline tax, airport passenger facility charge, toll roads, etc.) would affect a smaller population base to a larger amount, and could in turn have a dampening effect on air and car travel and hence mute some of the mobility and accessibility benefits provided by a transportation system investment.

[15] This mix was described in general terms in Section 5.3.2 and was assumed to be used for funding the incremental project cost for the Modal Alternative.

[16] These inferences are based on the analysts' prior experience with economic forecasting in general, and the REMI model in particular.

[17] In order to raise a certain amount of money, a narrow tax or user fee affecting a certain segment of the population would need to be larger (in nominal terms) than a broad-based sales or income tax that would be spread across the entire population.