CAMBRIDGE SYSTEMATICS

California High-Speed Rail 2012 Business Plan

Ridership and Revenue Forecasting

final technical memorandum

prepared for

Parsons Brinckerhoff for the California High-Speed Rail Authority

prepared by

Cambridge Systematics, Inc.

April 12, 2012

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Cambridge Systematics, Inc.
100 CambridgePark Drive, Suite 400
Cambridge, MA 02140

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1.0 Overview

1.1 Background

In 2004, as part of its development of the Bay Area Regional Rail Plan, the Metropolitan Transportation Commission (MTC) retained Cambridge Systematics to develop a new statewide multimodal travel demand model to help evaluate alignments for high-speed train (HST) service in and out of the San Francisco Bay Area, and understand interaction of HST with potential regional rail improvements. The California High-Speed Rail Authority (Authority) provided technical support on HST service characteristics through its Program Manager and used the results in its 2007 Bay Area – Central Valley Program EIR/EIS.

In the fall of 2007, the Authority engaged Cambridge Systematics to conduct further work with the same model to support alternatives analyses and project-level EIR/EIS work. Numerous additional runs were made, with different operating plans, fare inputs, travel costs, and parking costs assumed at stations. Refinements were made to the MTC portion of the model, but no changes were made to the structure of the models, including constants and coefficients, used to forecast interregional or intra-SCAG trips. Additional work was done to estimate the modes of access and volumes of parking demand at specific stations and to extrapolate to years other than the 2030 model forecast year. The Program Manager used the CS forecasts developed for the environmental studies as the starting point for ridership and revenue forecasts in the Authority's 2009 *Report to the Legislature.*

In 2010 and 2011, Cambridge Systematics prepared model runs and other relevant research to support the Program Manager's analysis of different service options, culminating in modeling used to support the *California High Speed Rail Program Draft 2012 Business Plan*. That work included some updates to the model and was documented in a draft technical memorandum.[1] After receipt of public comment, the Authority made changes to the scenarios being considered in the business plan, and CS updated the model assumptions and prepared forecasts in support of the *California High Speed Rail Program Revised 2012 Business Plan*. This Technical Memorandum is the documentation of the ridership and revenue forecasts used to support the Revised 2012 Business Plan.

[1] Cambridge Systematics, Inc., "California High-Speed Rail 2012 Business Plan, Ridership and Revenue Forecasting, Draft Technical Memorandum," prepared for Parsons Brinckerhoff for the California High-Speed Rail Authority, October 19, 2011.

1.2 Model Overview

The approach to this statewide model recognizes the unique characteristics of both intraregional and interregional travel demand. Intraregional travel is defined as travel that stays within a certain region; whereas interregional travel is travel that crosses regional boundaries.

The interregional travel models rely on the statewide characteristics of highways, conventional rail and air services, local urban area highway and transit networks, and traveler behavior associated with longer-distance travel. The intraregional travel models rely on local urban area highway and transit network characteristics and behavior associated with shorter distance and more frequent trip making.

This subsection discusses the potential users (market segments) of the proposed high-speed rail system and the overall structure of the HST R&R model. Further details regarding the ridership and revenue model development and use can be found in documentation prepared for the Authority's 2011 project-level environmental reports.[2] Modifications to the original models are described in this Technical Memorandum.

Understanding Markets

In order to model high-speed rail ridership, it is important to understand and examine all of the potential markets that would be served by the system. Market segmentation was carried out by trip purpose and attributes of the households and travelers making the trips. Income and household size are common examples of the latter. Widely accepted research has shown that the travel characteristics of these different market segments differ significantly, such that modeling them all together would result in less accurate travel forecasts. Market segmentation avoids this bias in the modeling results by using rates and relationships appropriate to each market segment. These differences were distilled from the revealed- and stated-preference surveys used to construct the model.

Inter- versus Intraregional Travel Market

The initial market segmentation is geographical. The proposed HST system will serve both interregional and intraregional travel. The regions used for the HST R&R model are shown in Figure 1.1.

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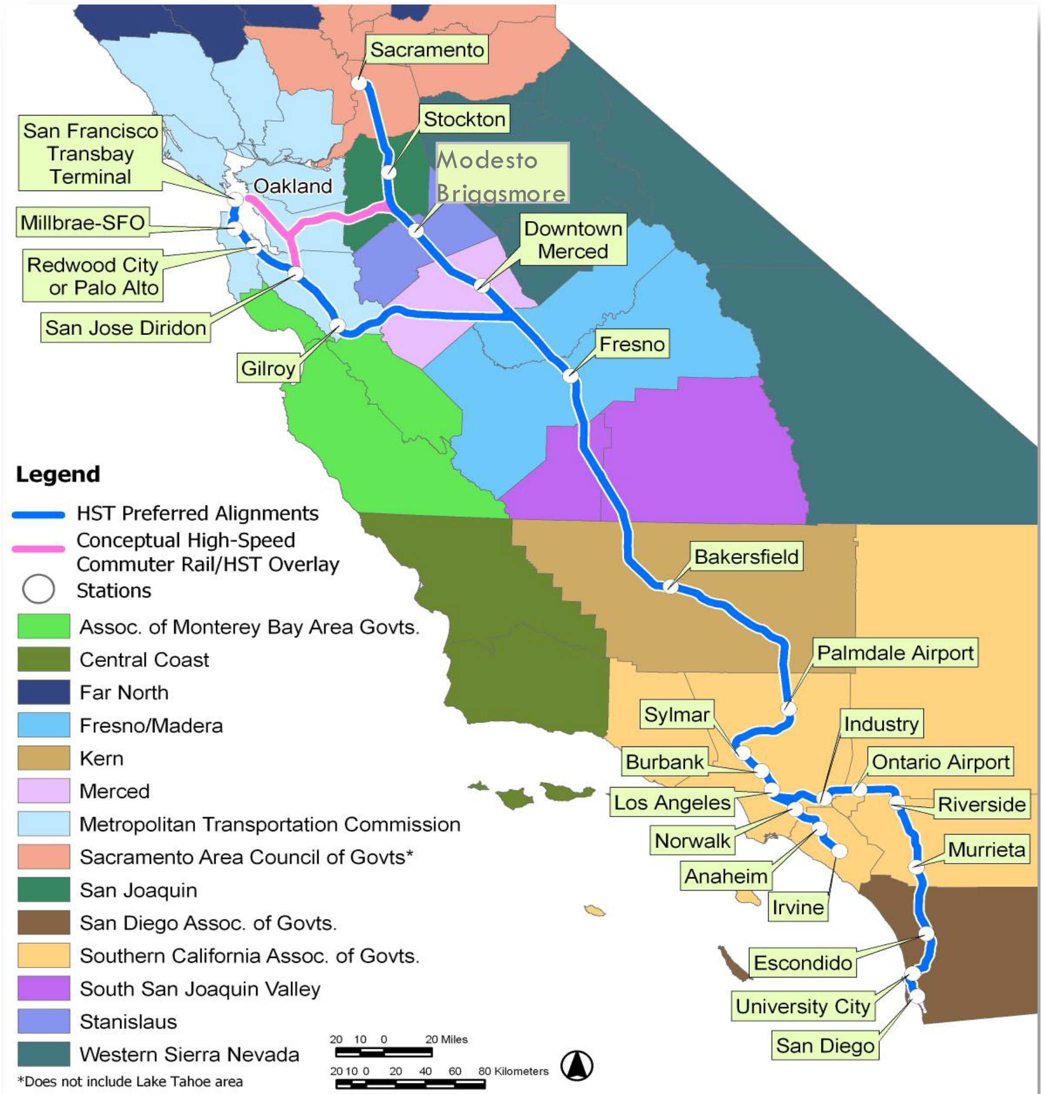
[2] *California High-Speed Rail Ridership and Revenue Model Development, Application, and Project-Level EIR/EIS Forecasts*, prepared by Parsons Brinckerhoff, with Cambridge Systematics Inc., for the California High-Speed Rail Authority November 2010. http://www.cahighspeedrail.ca.gov/Ridership_and_Revenue_Forecasting_Study.aspx.

Figure 1.1 Regional Definition in the Travel Demand Model



Interregional travel crosses the market boundaries while intraregional travel represents travel made within a region. The HST R&R model for interregional travel was developed based on surveys and other statewide travel information.

Intraregional travel models from the MTC and SCAG regions were adapted for use in the HST R&R model from the models maintained by the Metropolitan Planning Organizations (MPOs) for those regions. In the San Diego region, a factoring process was used to estimate intra-SANDAG ridership. Those three regions are the only regions anticipated to be served by multiple HST stations.

Long-Distance and Short-Distance Travelers

Long- and short-distance interregional trips were modeled separately to differentiate between the characteristics of these trips. For example, short-distance trips might be more likely to be made on a daily basis to more familiar areas while long-distance trips might be more likely to be special trips made to less familiar areas and requiring more planning than the short-distance trips. One hundred miles was chosen as the breakpoint for segmenting short distance from long-distance trips. This breakpoint was selected based upon an evaluation of the trip length frequency distributions for interregional trips for each trip purpose from the surveys along with judgment about behavior for short versus long trips. This value was also used in the past as the lower limit for long-distance trips in the 1995 American Traveler Survey (ATS) conducted by the U.S. Departments of Transportation and Commerce. The ATS represents the only large-scale travel survey conducted to date in the United States.

Business Travelers, Commuters, and Other Travelers

The 2001 California statewide household activity/travel survey data set was used to determine the magnitude of the existing interregional travel market by purpose. Based on the 2,820 interregional trips captured in the survey, business travelers and commuters comprised more than 50 percent of the interregional travel market. The remaining market share was split between recreational and other travelers.

It is important to treat these purposes separately since the various markets have different characteristics, such as reimbursement for travel expenses and travel party size – which can have a significant effect on travel decisions.

The market segments for intraregional travel include the typical urban travel demand model trip purposes: home-based purposes for work, school, university, shopping, social-recreational, and other trips, as well as nonhome-based trips for work and nonwork-related purposes.

Household Characteristics and Travel Party Size

Several household market segmentations were used for the interregional models:

- Household Size – 1 person, 2 people, 3 people, more than 4 people;
- Household Income Range – Low, medium, or high;
- Household Auto-Ownership – 0 autos, 1 auto, 2 or more autos; and
- Household Number of Workers – 0 workers, 1 worker, 2 or more workers.

Party size (traveling alone versus traveling with others) is a segmentation variable primarily for the recreation and other segments because it has a large effect on the travel cost of the car mode versus the other modes, and thus, on the choices throughout the model chain.

Induced Travel

New travel would be induced by the gain in accessibility to destinations as a result of high-speed rail service. In effect, this market is an output of the interregional modeling process and, more specifically, the trip frequency and destination choice model component (see section 5.4).

Model Structure

A key consideration in model design was the recognition that interregional and intraregional travel have different trip purposes and other attributes, and are influenced in some cases by different factors. It was decided to model each separately in order to capture these distinctions accurately. This led to the development of separate, but integrated, interregional, and intraregional models. The former was designed to explicitly estimate induced demand.

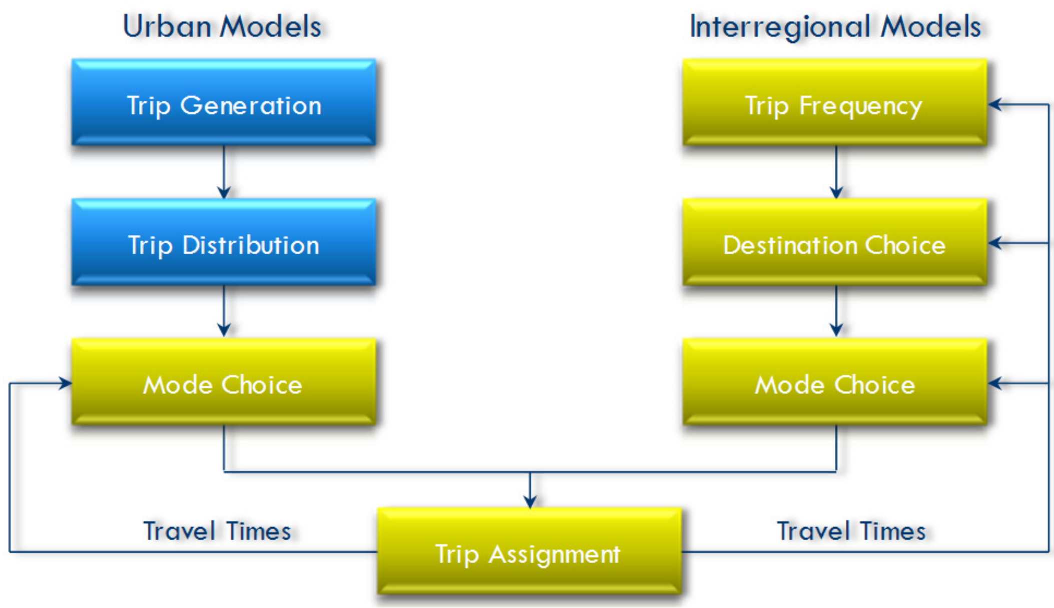
The overall model design includes the following principal components:

- **Intraregional Travel –** All trips with both ends in one of the three urban areas with more than one proposed high-speed rail station. These areas are the San Francisco Bay Area, Greater Los Angeles, and San Diego regions.
- **Interregional Travel –** All trips with both ends in California and whose origins and destinations are in different regions having proposed high-speed rail stations.
- **External Travel –** Trips with one end outside California and one end in an urban area with a proposed high-speed rail station. During the design and data collection of interregional trips through intercept surveys at air and rail stations, it was decided that resources for data collection should be focused on travel within California. As a result, there are no data on external travel by air and rail that may access the high-speed rail system in California (a conservative, low-side assumption,) but external auto trips were included in auto assignments to accurately reflect the congestion caused by these external trips.
- **Trip Assignment –** The modal trip tables are assigned to highway, rail and air networks after the urban, interregional, and external trips are merged.

Both the intra- and interregional models consider both peak and off-peak conditions for an average weekday. Weekend travel demand and annual ridership estimates are developed using annualization factors based on Western U.S. and California travel patterns and data on high-speed rail systems around the world. The model base year is 2000 and the forecast year is 2030.

The integrated modeling process for the development of the statewide model is presented in Figure 1.2. This process shows that the accessibility of the system (represented by travel time) is included in the mode choice models and in the interregional trip frequency and destination choice models. Intraregional trip generation and trip distribution are performed by the MPOs using the regional travel models. The intraregional travel component included in the HST R&R model uses trip tables generated by the normal MPO modeling processes as input.

Figure 1.2 Integrated Urban and Interregional Models



1.3 Model Updates and Enhancements

At the beginning of the Authority's FY 2010/2011, CS began the first steps of a multiyear update of the existing Ridership and Revenue (R&R) model to provide enhanced capabilities for analysis of refined operating plan and pricing options, and develop independent, risk-based forecasts for use by both public and private investors. The work plan involved these items:

- Develop improvements to the model's input and output procedures to create a more efficient work flow;
- Engage with an Authority-selected Peer Review Panel (PRP) to review prior work and develop an approach to improving the model for future applications, including the 2012 Business Plan;
- Carry out a new trip frequency survey, since both CS and the PRP were concerned that trip frequencies may have changed over time, especially considering changes to the California economy;
- Obtain new data to enable recalibration and validation to 2008 conditions; and
- Begin developing longer-term enhancements to improve forecasts and develop approaches for risk-based forecasting.

Peer Review Panel

The Authority engaged an independent Peer Review Panel (PRP) in December 2010. Reporting to the Authority's CEO, the Panel was charged with providing a comprehensive in-depth review of the models used to estimate ridership and revenue and the forecasts derived from them. The Panel consists of four members[3]:

1. Frank Koppelman, Ph.D., Professor Emeritus of Civil Engineering, Northwestern University (chair);
2. Kay W. Axhausen, Dr. Ing., Professor, Institute for Transport Planning and Systems, ETH Zürich (Swiss Federal Institute of Technology Zurich);
3. Eric Miller, Ph.D., Professor, Department of Civil Engineering and Director, Cities Centre, University of Toronto; and
4. Kenneth A. Small, Ph.D., Professor Emeritus, Department of Economics, University of California-Irvine.

The panel was provided with a complete set of the report documentation, met in January 2010 to review the documentation, and prepared a report summarizing their questions. The panel divided their questions into several categories, in the indicated sections of the report:

- Section 3.0 – Incomplete documentation;
- Section 4.0 – Short-term issues;
- Section 5.0 – Long-term issues;
- Section 6.0 – Econometric issues; and
- Section 7.0 – Data requirements for model enhancement.

CS provided responses to all substantive questions and concerns raised by the PRP in a series of memoranda. CS met with the PRP several times in person and in conference calls to discuss the issues and the implications for forecasting work for the Business Plan and beyond. CS worked with the PRP and the Authority to arrive at a common understanding of how the R&R forecasting fit within the context of anticipated decisions – and the timing of those decisions – that need to be made by the HSRA and other public entities involved in funding and operations. CS provided descriptions of the Business Plan scenarios to the PRP for review before running scenarios for the update to the Draft Business Plan, and the PRP also reviewed the findings from those forecasts. The PRP concluded

[3] Billy Charlton, from the San Francisco County Transportation Authority, is no longer part of the panel.

that the model is fit for Business Plan analysis. The Panel's reports and CS responses are available separately on the Authority's web site.[4]

In addition to basic questions about the model's sensitivity to alternative input assumptions, the PRP also asked about how the model would react to service levels similar to those provided by the Acela Express in the Northeast Corridor. CS carried out this analysis and demonstrated that when the much slower, less frequent, and more expensive Acela service assumptions were used, the ridership and revenue forecast by the model was considerably lower and very close to the existing and forecasted ridership on ACELA than forecasts with the service assumptions from the 2012 Business Plan. Appendix A provides the details of these sensitivity tests.

Approach to Developing the Business Plan Forecasts

CS worked with the Program Manager to develop an approach to preparing forecasts for use in the Authority's 2012 Business Plan predicated on the following concepts:

- The R&R model produces reasonable forecasts with reasonable sensitivities to changing conditions.
- Models are not perfect, and their imperfections need to be understood and reflected in the forecasts used for business planning purposes through prudent adjustments and interpretation.
- There are several areas where improvements to the R&R model are warranted. Some of these were identified by CS several years ago, and others were identified by the peer review panel. None of the improvements are sufficiently significant to terminate forecasting for current planning efforts, including the business plan.
- Since it could be done within the schedule constraints of the business planning effort, further investigation of the frequency of trips greater than 50 miles – those that are candidates for HST travel – was warranted.
- Similarly, changes in conditions since the model was first developed warrant updates for use in the Business Plan. In particular:
  - Airline fares and frequencies have changed, and the potential for further change, in particular in response to the introduction of HST service (see Section 2.1);

[4] Both peer review panel reports and CS' responses are available on the Authority's web site: http://www.cahighspeedrail.ca.gov/Ridership_and_Revenue_Forecasting_Study.aspx.

  - Conventional rail fares and frequencies have changed (see Section 2.2);
  - Economic conditions have changed, and the outlook for future population and employment has changed (see Section 3.0); and
  - The outlook on automobile fleet fuel economy in the future has changed; as have forecasts of gasoline prices (see Section 2.3).
- Future conditions cannot be known with certainty. The forecasts used for business planning purposes need to recognize those uncertainties and present a reasonable range. There is an ample body of literature supporting this approach.

CS worked with the Program Manager and the PRP to develop a forecasting process that would provide a reasonable range of R&R forecasts for use in the business plan. Consistent with the findings and recommendations of the peer review panel that process involved these steps:

- Continue to use the existing model to test scenarios important for the business plan.
- Update the existing transportation system to reflect current conditions, planned changes, and forecast future conditions, specifically:
  - Fares, routes, and service frequencies for conventional rail and air service; and
  - Cost of auto travel.
- Incorporate revisions to socioeconomic growth assumptions, involving an updated range of population, housing, and employment forecasts for 2030 to reflect observed changes between 2000 and the present as well as the impacts of the recession of 2007-2009.

In parallel with the above efforts, CS developed and conducted, with input from the PRP, an on-line survey of long-distance travel made by California residents over the previous two-month period. The survey was designed to provide current information regarding travel of 50 miles, including trip frequencies, trip purposes, origins, and destinations of trips, and mode used for travel. The primary use of the data is to calibrate and validate a refined version of the R&R model to 2008 conditions – work that is being performed with input from the PRP and is scheduled for completion in 2012. Until the calibration and validation of the refined model, the survey data was incorporated into the existing modeling process through the factoring of results of model runs performed for the business plan. The results of the investigations into alternative assumptions regarding trip frequencies are in Section 4.0.

From this starting point, CS worked with the Program Manager to test a range of potential scenarios documented originally in the draft of this Technical Memorandum. In the interim, the Program Manager refined the phasing options being considered in the 2012 Business Plan. This Final Technical Memorandum presents the ridership and revenue forecasts for high and low scenarios for four potential phases of the project:

- Initial Operating Segment: Merced to San Fernando Valley;
- Bay-to-Basin: San Jose to San Fernando Valley, with a spur to Merced;
- Blended Phase 1: San Francisco to Los Angeles, with a spur to Merced; and
- Phase 1: San Francisco to Anaheim, with a spur to Merced.

The remainder of this technical memorandum documents the details of the work performed under this overall framework. Section 2.0 describes the service assumptions for competing modes. Section 3.0 covers socioeconomic forecasts. Section 4.0 summarizes the new surveys of long-distance trip making in California. Section 5.0 reports on the specific assumptions related to HST and connecting bus service as well as ridership and revenue forecasts. Section 6.0 describes a sensitivity test whereby service levels and fares similar to the Acela service in the Northeast Corridor were assumed for the California HST project.

2.0 Revised Service Assumptions for Air, Conventional Rail, and Automobile

CS updated the model to reflect changes in current and anticipated future airfares and airline service frequencies, current fares, and service frequencies for conventional rail in California, and assumed costs of driving automobiles.

2.1 Airline Fares, Service Frequencies, and Competitive Responses

The ridership and revenue forecasts made for all work prior to the 2012 Business Plan were based on assumed airfares and airline service frequencies that reflected the air service patterns in effect in the California Corridor markets between Northern and Southern California in 2005. Additionally, several reviewers of the prior forecasts had expressed concerns about the lack of analysis of possible airline competitive response to the introduction of high-speed train (HST) service and its effect on the forecast.

CS engaged Aviation System Consulting, LLC (ASC), a California-based expert firm to address these issues. ASC analyzed the past decade of U.S. Department of Transportation data on airline service and fare levels, explained the economic factors affecting airline responses to changes in competition and capacity, and helped determine scenarios of potential airline competitive response to the introduction of HST service. ASC's memorandum is in Appendix B, with a summary below.

Both the airline industry in general and the air service patterns in the California Corridor markets have changed significantly since 2005, due to increased competition from low-cost airlines, entry of new carriers and airline consolidation, rising fuel costs, and efforts by the legacy carriers to reduce costs. In particular, the entry of Virgin America in the San Francisco to Los Angeles market in August 2007 and the San Francisco to San Diego market in February 2008 and the competitive response from other airlines, particularly JetBlue Airways and Southwest Airlines, has significantly changed the patterns of air service between the Bay Area and Southern California.

Furthermore, in previous forecasts, CS made no adjustments for possible airline competitive response to the introduction of HST service. This response could take one of two forms. Airlines could reduce service frequency and/or increase fares to offset reduced load factors as air travel in these markets drops due to the diversion of trips to HST. Alternatively, they could attempt to retain market share by reducing fares. At the same time, the competitive response of the existing airlines to the entry of Virgin America offers some indication of the likely airline response to the introduction of HST service. From the perspective of an individual airline, it really does not matter whether a loss of market share results from service entry by a new airline or a new intercity mode (such as HST). The airline has to decide whether to accept the resulting loss of market share and adjust the level of air service and fare structure accordingly, or attempt to retain as much of its market share as possible by reducing fare levels and/or changing aircraft size in order to maintain service frequencies.

The introduction of HST service is likely to lead to a reduction in traffic in each of the markets as some potential air passengers choose to use the HST service. Depending on the extent of the mode shift from air to HST and the growth in air travel demand between now and the start of HST service, the remaining air passenger traffic in the Corridor may still be comparable to current levels or even higher. However, there will most likely be a significant decline from the levels immediately prior to the start of HST service. Therefore, the airlines will need to reduce capacity in order to maintain load factors at an economically viable level. This could happen by either reducing frequency or using smaller aircraft.

ASC suggests that the baseline assumption for fares in 2030 be the same as they were in 2009, with a Low-Fare Scenario 9 percent lower (Table 2.1). The High-Fare Scenario would be an increase in real fares by $12 to $18 dollars depending on the market, averaging 16 percent to 2009 average fares.

Table 2.1 Air Service Assumptions for Use in Future HST Ridership Forecasts

	Airfares	Average Load Factor	Average Aircraft Size	Flight Frequency
Baseline Scenario	2009 average fares by market in constant 2005 dollars	75%	Increase in average aircraft size in each market with a smaller average aircraft size to the median aircraft size in 2009 for markets from the Northern California airports to the relevant Southern California airport, plus a further increase of 2 percent in all markets	Determined from flight frequency equation for the assumed market diversion ratio
Low-Fare Scenario	9% reduction in real fares from 2009 levels	78%	A further increase of 6% above the Baseline Scenario	Same
High-Fare Scenario	Increase in real fares over 2009 levels by $12 to $18 in 2030 depending on market, averaging 16%	70% or 73% depending on market	Same as Baseline Scenario	Same

Source: Aviation System Consulting.

In developing the Business Plan cases, the Authority determined that this range of scenarios drove the Medium scenario that will be used for the planning case to be on the optimistic side, so all the Business Plan scenarios assume that airfares stay constant at 2009 levels (but are adjusted for inflation.)

2.2 Revised Conventional Rail Service and Fare Assumptions

Conventional rail (CVR) service and fare assumptions for 2030 were updated to reflect 2011 current and forecasted conditions. The updated CVR lines include:

- Pacific Surfliner (Santa Barbara – Los Angeles – San Diego);
- San Joaquin (Oakland and Sacramento to Bakersfield);
- Capitol Corridor (San Jose – Oakland – Sacramento);
- Altamont Commuter Express (Stockton – East Bay Area);
- Multiple Los Angeles area Metrolink services; and
- Caltrain San Jose-San Francisco service.

CS updated the fare assumptions for all lines to on-line published fares in 2011. These 2011 fares were converted to 2005 dollars using California CPI values for April 2011 (234.113) and the 2005 average value (202.6).

The 2011 operating plans, including the stop pattern, peak and off-peak service frequency, and travel times were obtained from the on-line published weekday schedule. Consistent with previous assumptions, the peak period was assumed to include 3 hours during the a.m. peak, and 3 hours during the peak period. The off-peak period was 10 hours. CS then converted the published daily trips to headways.

Table 2.2 summarizes the differences in service between 2011 and 2030. Additional details are provided in the documentation of each scenario provided in Section 5.0.

Table 2.2 Source and Summary of 2030 CVR Operating Plan Forecasts

	Source of 2030 Forecasts	Summary of Service Changes from 2011
Pacific Surfliner	California State Rail Plan, 2008, assumed 2020 service frequencies	Increase by two daily round-trip services between San Diego and Los Angeles and by one daily round-trip service between Los Angeles and Santa Barbara
San Joaquin	California State Rail Plan, 2008, assumed 2020 service frequencies	Increase to six daily round trips between Stockton and Oakland and to three daily round trips between Stockton and Sacramento
Capitol Corridor	California State Rail Plan, 2008, assumed 2020 service frequencies	Increase by two daily round-trip services between Oakland – Sacramento and between San Jose-Oakland
Altamont Commuter Express	Current 2011 Service Plan	N/A
Metrolink	2010 LOSSAN Strategic Assessment, assumed 2030 service plan	Includes planned Metrolink service extensions
Caltrain	Caltrain, Short-Range Transit Plan, Fiscal Year 2009 through Fiscal Year 2018, December 2009, assumed 2030 service plan	Increase by four trains per hour between San Jose and San Francisco and by two trains per hour between San Jose and Gilroy in the peak period

2.3 REVISED AUTOMOBILE OPERATING-COST ASSUMPTIONS

The following sections described the approach used to forecast the auto operating costs in 2030. Cambridge Systematics updated the assumptions used in the original Draft 2012 Business Plan based on more recent forecasts of fuel costs and efficiencies.

Gasoline Price Forecasts

The U.S. Energy Information Administration (EIA) provides motor gasoline forecasts out to year 2035 for three different scenarios in its 2011 Annual Energy Outlook (AEO): reference, low, and high. Table 2.3 shows the EIA 2011 motor gasoline forecasts from 2015 to 2035 in 2009 dollars.[5] The ridership and revenue forecasts are at 2030 levels. The spread between the low and high forecast for 2030 is considerable – from $2.24 at the low to $5.26 at the high – a spread of over $3.00. This spread is greater than developed by other sources, such as those by

[5] Different forecasters expressed prices in constant dollars based on different years, and usually show historical prices in nominal terms. In this memo, we show the values used by the original forecasters, but then convert to 2011 dollars for use in the Business Plan.

the California Energy Commission that forecast a range of about $3.10 to $4.80 in 2008$.[6]

Table 2.3 Forecast U.S. Transportation Motor Gasoline Prices
2015-2035, in 2009 Dollars

Year	Low	Reference	High
2015	$2.17	$3.13	$4.27
2020	$2.30	$3.38	$4.85
2025	$2.12	$3.54	$5.12
2030	$2.24	$3.64	$5.26
2035	$2.12	$3.71	$5.36

Source: Annual Energy Outlook 2011.

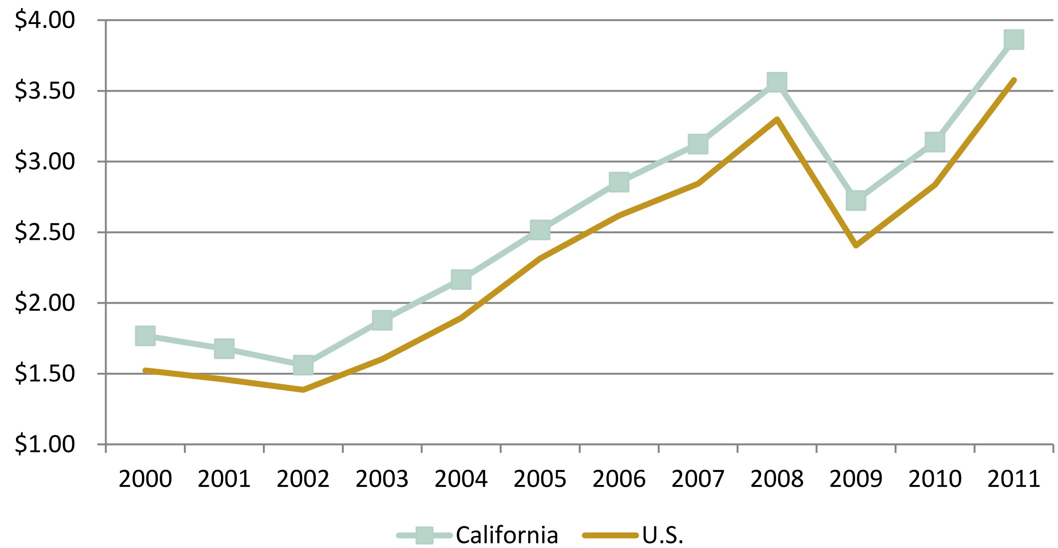
Sales weighted-average price for all grades, includes Federal, state, and local taxes.

Historically, California retail gasoline prices have been an average of 12 percent higher than the U.S. average (Figure 2.1). CS developed a forecast of California gasoline prices by taking the 2030 forecasts from EIA (from Table 2.3) and increasing by 12 percent (Table 2.4). The currency conversions use the California consumer price index (CPI) values of:

- 202.6 for 2005;
- 224.110 for 2009; and
- 232.931 for 2011.

[6] California Energy Commission, Transportation Energy Forecasts and Analyses for the 2009 Integrated Energy Policy Report, Final Staff Report, May 2010.

Figure 2.1 Annual Retail Gasoline Prices (Dollars per Gallon)
2000-2011, Nominal Dollars



Source: U.S. Energy Information Administration: Annual All Grades All Formulations Retail Gasoline Prices.

Table 2.4 Forecast 2030 Motor Gasoline Price in California
Expressed in 2005, 2009, and 2011 Dollars

Currency Year	Description	Low	Reference	High
2009$	Based on EIA; increased by 12% for California	$2.51	$4.07	$5.88
2005$	Used in travel demand model	$2.26	$3.68	$5.32
2011$	**2012 Business Plan**	**$2.60**	**$4.23**	**$6.11**

Source: CS analysis of Annual Energy Outlook 2011.

Vehicle Fuel Economy Forecast

The U.S. Energy Information Administration also provides projections on fuel economy (mpg) for light-duty vehicles through year 2035 for three cases:

- **Reference Case –** In 2007, the Energy Independence and Security Act (EISA) was signed into law to tighten the Corporate Average Fuel Economy (CAFE) Standards. The law established a target of 35 miles per gallon for the combined fleet of new cars and light trucks by model year 2020 starting with model year 2011. In 2009, the President implemented a new national policy (a.k.a. National Program) and set stringent CAFE standards to increase fuel efficiency and reduce greenhouse gas emissions for all new cars and trucks sold in the United States beginning in 2012. The new CAFE standards apply to model years 2012-2016 for all passenger vehicles, including cars, light trucks, and SUVs. Significant improvements in fuel efficiency are required on all new vehicles in 2012 model, with yearly gains of 5 percent or more in subsequent years. In 2010, California accepted compliance with these Federal GHG standards as meeting similar state standards and incorporated the national standards into their motor vehicle emissions program.[7,8] We interpret this to mean that in the future, national and California standards will be the same, even though in the past, California standards have been more stringent.

The *AEO2011 Reference case* includes the attribute-based CAFE standards for light-duty vehicles (LDV) for model year (MY) 2011 signed originally in 2007 and the 2009 CAFE standards for MY 2012 to MY 2016. The reference case results in fleet fuel economy for new cars of 35.8 miles per gallon by 2030.

- **CAFE 3% Growth** – Per a Presidential memorandum submitted in 2010 to NHTSA and EPA, a new proposal to further reduce GHG and improve fuel economy for model years 2017-2025 is under way. These Federal agencies, along with the California Air Resources Board (CARB), are collaborating on the second phase of the program and are developing new standards for the new generation of clean vehicles. In 2011, the NHTSA and EPA issued a Supplemental Notice of Intent (NOI) outlining the agencies' plans for proposing the model years 2017-2025 standards. The State of California provided letters of support for the program.

  EIA provide forecasts that approximate the effects of the second phase of the National Program. The CAFE 3% Growth (CAFE3) case is a modified Reference case that assumes a 3-percent annual increase in fuel economy standards for MY 2017 through MY 2025 LDVs, starting from the levels for MY 2016 LDVs, with the subsequent post-MY 2025 standards held constant. By 2030, this would result in fleet fuel economy for new cars of 46.3 miles per gallon.

- **CAFE 6% Growth** – The CAFE 6% Growth (CAFE6) case assumes a 6-percent annual increase in fuel economy standards for new LDVs from MY 2016 levels for MY 2017 through MY 2025, with the subsequent standards held constant. The fleet fuel economy for new cars by 2030 would be 59.5 miles per gallon under this scenario.

Table 2.5 shows the fuel economy projections for the Reference, CAFE3 and CAFE6 cases, as well as an average between CAFE3 and CAFE6 for the entire fleet of vehicles (not only new vehicles.)

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[7] EPA (http://yosemite.epa.gov/opa/admpress.nsf/1e5ab1124055f3b28525781f0042ed40/6f34c8d6f2b11e5885257822006f60c0!OpenDocument).

[8] California Air Resources Board, Statement of the California Air Resource Board Regarding Future Passenger Vehicle Greenhouse Gas Emission Standards, May 21, 2010.

Table 2.5 Projections of Fuel Economy of Light-Duty Vehicle

	Light-Duty Stock[1] (mpg)			
	Reference	3% LDV Fuel Economy Growth	6% LDV Fuel Economy Growth	Average of 3% and 6% Fuel Economy Growth
2015	22.1	22.1	22.1	22.1
2025	25.7	28.6	30.2	29.4
2030	27.0	31.8	35.3	33.6
2035	27.9	34.0	39.4	36.7

Source: Annual Energy Outlook 2011, Transportation Sector Key Indicators and Delivered Energy Consumption.

Notes: Combined "on-the-road" estimate for all cars and light trucks.

2030 Auto Operating Cost Forecasts

CS estimated a range for auto operating costs incorporating both fuel and nonfuel components (Table 2.6).

Fuel Component

While the lowest auto operating cost could be achieved by combining the high fuel efficiency with the low gasoline price, and the highest cost could be achieve by assuming the reverse, it is more reasonable to assume that high prices will coincide with high fuel economy, and low prices with low fuel economy. While fuel economy is not nearly as volatile as fuel prices, it is reasonable to assume that over a long period of time, high prices will drive the demand for better fuel economy. Since we do not know where the CAFE standards will land (at CAFE3 or CAFE6), we used an average of the two for the High HST case, and the reference standard for the Low HST case.

Nonfuel Component

For the original model calibration effort in 2006-2007, non-gasoline operating costs were assumed to be 67 percent of the gasoline costs.[9] For the 2012 Draft Business Plan work, CS used 9 cents per mile in 2005$ as the non-gasoline operating costs for autos (56 percent of the assumed 16 cents per mile gasoline cost). However, the non-gasoline operating costs are likely to be less volatile than fuel prices, so it is reasonable to keep this as a constant amount, modified

[9] Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study, Levels of Service Assumptions and Forecast Alternatives, prepared for Metropolitan Transportation Commission and California High-Speed Rail Authority, prepared by Cambridge Systematics, Inc., August 2006, Table 2-1, page 2-2.

only by inflation over time. We retain this fixed amount per mile in these calculations, which equates to 10.3 cents per mile in 2011$.

Based on the foregoing assumptions, CS used $0.20/mile in 2011 dollars for 2030 total auto operating cost for the Low model run scenarios of the Business Plan and $0.28/mile for the 2030 total auto operating cost for the High model run scenarios.

Table 2.6 2030 Auto Operating Cost Assumptions for 2012 Business Plan

	Low Range		High Range	
	2005$	**2011$**	**2005$**	**2011$**
Motor Gasoline	$2.26	$2.60	$5.32	$6.11
Fuel Efficiency (mpg)	27.0	27.0	33.6	33.6
Gas Operating Cost ($/mile)	$0.08	$0.10	$0.16	$0.18
Non Gasoline Operating Cost ($/mile)	$0.09	$0.10	$0.09	$0.10
2030 Auto Operating Cost ($/mile)	**$0.17**	**$0.20**	**$0.25**	**$0.28**

Source: Cambridge Systematics, Inc. Analysis based on EIA forecasts and CAFE standards.

3.0 Socioeconomic Forecast Updates

3.1 Background

The 2030 population, household and employment forecasts used for the original R&R model were developed in 2006-2007 from local agency socioeconomic projections, including those developed and updated by the Association of Bay Area Governments (ABAG), the Southern California Association of Governments (SCAG), the San Diego Association of Governments (SANDAG), and the Sacramento Council of Governments (SACOG), as well as from California State Department of Finance (DOF) and Caltrans projections. The forecasts developed by these agencies were based, in part, on observed data such as the 2000 Census. As such, the forecasts were influenced by the strong period of economic growth in California fueled, in part, by the "dot com" boom.

Whereas the forecasts used for environmental studies are required to use officially adopted government forecasts, those used for a financial business plan are usually developed using independent forecasts. Independent forecasts can be more responsive to changing economic conditions.

The recession of 2007-2009 has dampened expectations regarding future population, household, and employment growth. State and local agencies currently are in the process of developing 2035 forecasts that reflect the downturn in the economy, but those forecasts are not yet available.

To develop R&R forecasts for the 2012 Business Plan, CS updated the socioeconomic forecasts to reflect the best available information readily available from independent sources. Two forecasts were developed – one representing higher potential ridership conditions and one representing lower conditions. Forecasts for future business plans or those that might be needed for "investment-grade" work will delve even deeper into potential socioeconomic outcomes with independently developed forecasts.

3.2 2030 Forecasts: High and Low Scenarios

CS developed two alternate forecasts of population, households, and employment to account for decreased expectations regarding future socioeconomic growth. CS developed the two alternative forecasts as follows:

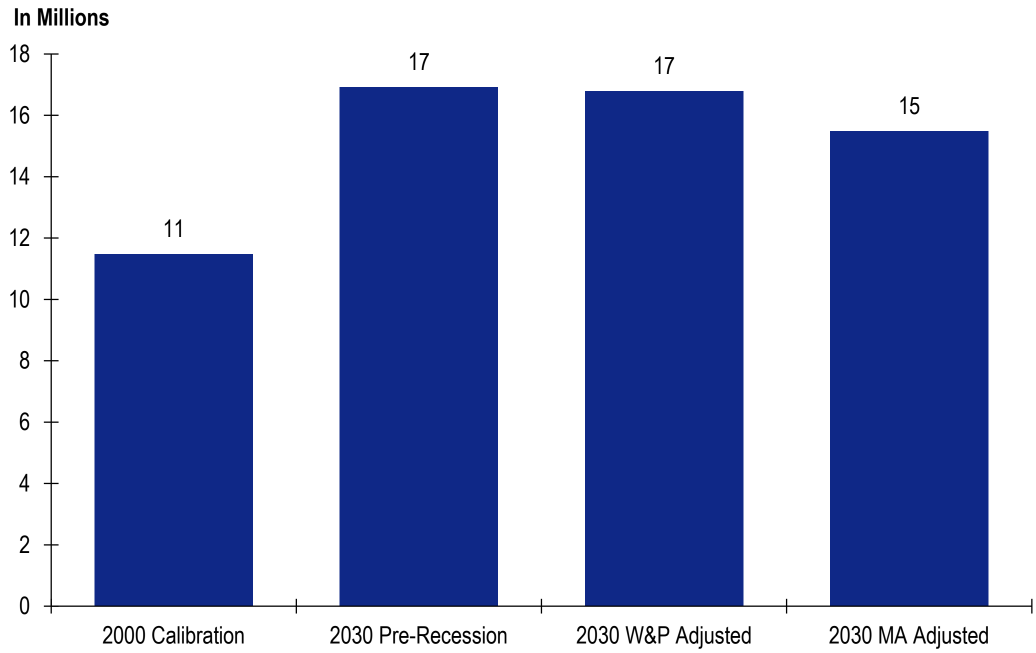
- **Business Plan High, Based on Woods &Pool (W&P) Forecasts –** The initial alternate forecast was developed using forecasts purchased from Woods and

Poole Economics, Inc. (W&P) at two points in time. The W&P forecasts were for county-level population, households, and total employment for the State. One of the forecasts was made in 2008 (prior to the recession) and one produced in 2011 (after the recession). The ratios of the two W&P forecasts for 2030 were used to factor the original 2030 Pre-Recession forecasts on a county-by-county basis. For example, the ratio of the 2011 W&P forecast of total employment for Alameda County for 2030 to the 2008 forecast of employment for 2030 was 0.95. Thus, the 2030 Pre-Recession forecast of employment for Alameda County was factored by 0.95. The resulting differences in population, households, and employment by county were allocated to traffic analysis zones (TAZ) comprising the counties in such a way to reflect the growth, or lack of growth, in individual TAZs. Therefore, TAZs that were originally forecast to remain stable between 2000 and 2030 Pre-Recession also were stable between 2000 and 2030 W&P Adjusted. TAZs that had high growth originally, also had high growth in the revised forecast.

- **Business Plan Low – Based on 2030 Moody's Analytics Adjusted Forecast –** A second 2030 alternate forecast was developed using 2011 forecasts for 2030 purchased from Moody's Analytics. Moody's Analytics data include county-level forecasts of population, households, and employment by economic sector for the State. In contrast to the 2030 W&P Adjusted forecasts, the 2030 Moody's Analytics Adjusted forecasts of population and households by county were used directly for the 2030 county control totals. An alternate procedure was required for the employment data. Since the employment data included forecasts by economic sector, it was possible to aggregate the employment to the retail, service, and other employment groups used by the R&R model. However, the Moody's Analytics data do not include estimates of agricultural employment and proprietors. Thus, adjustment factors for the county-level employment forecasts by employment group were developed by comparing the 2000 Moody's Analytics employment estimates to the 2000 employment data used in the original R&R model calibration and validation.

Figure 3.1 summarizes the statewide household estimates and forecasts for 2000, 2030 Pre-Recession, 2030 W&P Adjusted, and 2030 Moody's Analytics Adjusted. The 2000 estimate (2000 Calibration) has been summarized from the data used for the original R&R model calibration and validation. Only households have been summarized since they are used in the R&R model. Population is not directly used in the R&R forecasting process. The 2030 W&P Adjusted forecast of households is about one percent lower than the 2030 Pre-Recession forecast and the 2030 Moody's Analytics Adjusted forecasts is about eight percent lower.

Figure 3.1 Statewide Household Estimates and Forecasts

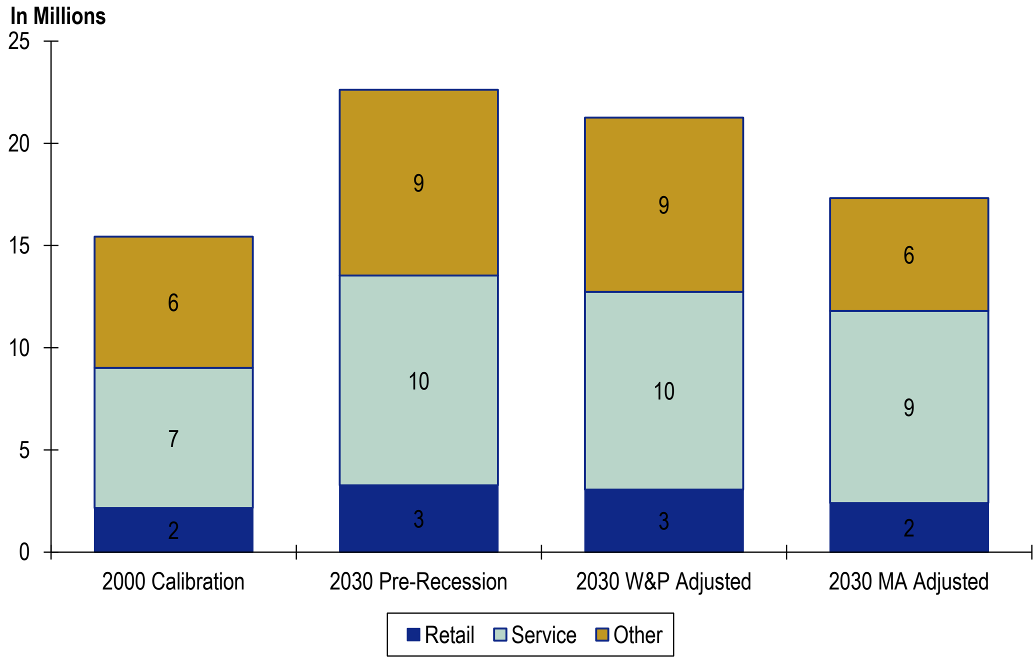


Source: Cambridge Systematics analysis of various data sources:

- 2000 Calibration from 2000 data used for HST R&R model calibration and validation.
- 2030 Pre-Recession from data developed in 2006-2007 for HST R&R travel forecasts.
- 2030 W&P Adjusted – adjusted 2030 data based on forecasts produced by Woods & Poole Economics, Inc.
- 2030 MA Adjusted – adjusted 2030 data based on forecasts produced by Moody's Analytics.

Figure 3.2 summarizes the statewide employment estimates and forecasts for 2000, 2030 Pre-Recession, 2030 W&P Adjusted, and 2030 Moody's Analytics Adjusted. Color coding in the figure represents retail, service, and other employment. The 2030 W&P Adjusted forecast of total employment is about 6 percent lower than the 2030 Pre-Recession forecast and the 2030 Moody's Analytics Adjusted forecasts is about 23 percent lower.

Figure 3.2 Statewide Employment Estimates and Forecasts by Employment Group



Source: Cambridge Systematics analysis of various data sources:

- 2000 Calibration from 2000 data used for HST R&R model calibration and validation.
- 2030 Pre-Recession from data developed in 2006-2007 for HST R&R travel forecasts.
- 2030 W&P Adjusted – adjusted 2030 data based on forecasts produced by Woods & Poole Economy, Inc.
- 2030 MA Adjusted – adjusted 2030 data based on forecasts produced by Moody's Analytics.

3.3 Diverging Relationships between Jobs and Population

It is common for ridership forecast models to be predicated on the basic assumption that the future will be much like the present, only more or less so. Past relationships that tie the amount and type of travel with the amount and location of households and different kinds of employment are the basis for estimates of trip frequency and trip distribution. Over the course of many years, these historical relationships can change, and it is difficult to predict the implications that these changes will have on travel.

As we emerge from the recession of 2007-2009 and look into the future, CS noticed that future forecasts from a variety of sources of the relationship between population and jobs are considerably different from recent trends. This could have significant, yet unknowable implications for future ridership on the California HST system. A summary of this emerging issue is provided in Appendix C.

4.0 Alternative Trip Frequency Assumptions

One of the most important drivers of the demand for high-speed train service in California is the frequency with which Californians take trips of the distances best served by high-speed train (HST) service. Both CS and the Peer Review Panel (PRP) identified the estimates of trips in the greater-than-50-mile category as an important area of uncertainty in the forecasts.

To help address this issue, CS developed a Long-Distance Travel Survey to collect current long-distance travel data to help provide perspective for the 2012 Business Plan, as well as for the revalidation of the California High-Speed Rail Ridership and Revenue Model (R&R Model). CS contracted with Harris Interactive for the data collection, and the survey was fielded in May 2011. The survey provided a comprehensive source of data for all trip purposes for home-based interregional travel in California. Survey responses from the 2011 survey were expanded to match the estimated 2008 population[10] for the State of California.

The expanded results provide an updated picture of medium- and long-distance interregional travel in California from that used for the 2000 calibration and validation of the existing R&R Model. Appendix D has complete documentation of the trip frequency survey. Key survey findings were:

- The overall number of medium-distance (50-99 miles) interregional trips (one-way linked trips) within California estimated for 2008, 478,400, was 36 percent lower than those used for the 2000 model calibration and validation (752,000).
- The overall number of long-distance (100+ miles) interregional trips within California estimated for 2008, 526,600, was 5 percent higher than those used for the 2000 model calibration and validation (499,000).
- The overall trips rates for medium- and long-distance interregional trips within California for 2008 were 0.037 and 0.041 person trips per household per day, respectively. In comparison, the overall 2000 trip rates were 0.065 and 0.044 for the same trip lengths.

[10]The estimate of 2008 population for California was developed from a population synthesis process by UC Davis.

- Overall, the combined trip rate for all interregional trips made by California residents to destinations within California over 50 miles from home was 28 percent less in 2008 than in 2000.
- The composition of medium- and long-distance trips by trip purpose estimated for 2008 are substantially different than the shares used for the 2000 model calibration and validation. The estimated 2008 long-distance trip shares for the combined business/commute trip purpose and the combined recreation/other trip purpose were 17 percent and 83 percent, respectively. In comparison, the shares for the combined business/commute and recreation/other trip purposes for the 2000 calibration and validation were 50 percent each.
- Main travel mode shares for medium distance trips (50-99 miles) for 2008 were similar to those used for the 2000 model calibration and validation for the business/commute and recreation/other trip purposes. For long-distance travel (100+ miles), the estimated 2008 data show substantially lower auto mode shares for business/commute travel than those used for the 2000 model calibration and validation (64 percent for 2008 and 88 percent for 2000); the decreased auto shares shown for 2008 were balanced by substantially higher air shares for the business/commute trips (33 percent for 2008 versus 11 percent for 2000). Main travel mode shares for recreation/other travel estimated for 2008 were similar to those used for the 2000 model calibration and validation.

Results from the survey were used to develop factors that could be applied to a forecast from the original R&R model to provide a preliminary idea of impacts of the updated picture of long-distance travel in California. The factors were derived by comparing the medium- and long-distance trip rates from the 2011 survey to the original data used for the 2000 model calibration and validation by purpose for the MTC, SANDAG, SACOG, and SCAG regions as well as for the rest of California as a whole. The estimated impacts of the updated trip rates are presented in Section 5.0.

CS used 2005 trip frequency surveys for the Business Plan high scenario forecasts and 2011 trip frequency surveys for the Low scenario forecasts. The former being more in favor of HST ridership and the latter more conservative, thus providing a suitable range for the Business Plan.

5.0 Ridership and Revenue Forecasts for HST Scenarios

5.1 INTERREGIONAL TRAVEL MARKET

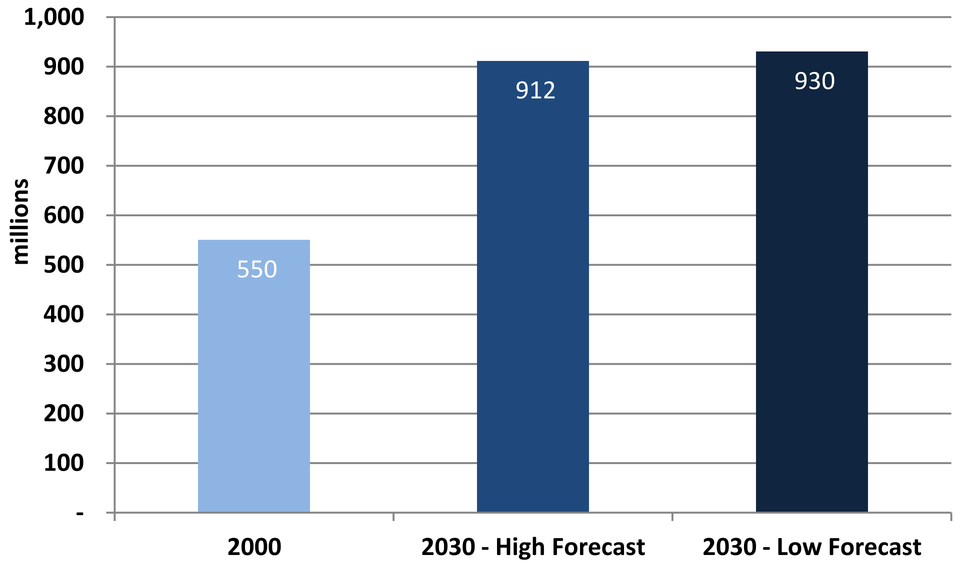
The market for travel on high-speed trains in California is predicated on the overall market for travel in the State. An important component of the market for HST trips comes from interregional travel, which was estimated to be over 500 million annually for all trip purposes in 2000 – the calibration year for the travel demand model.

CS developed two forecasts of growth in interregional travel through 2030 based on different assumptions of auto operating cost, socioeconomic forecasts, long distance trip frequency by California residents, and air fares as described in Sections 2.0 through 4.0 of this Technical Memorandum – one for use the Authority's Low forecast and one for the High (see Table 5.1). The resulting forecast of travel market for the no-build condition – which excludes an induced travel due to HST service – is expected to be similar for the both the high and low forecast: over 900 million (Figure 5.1).

Table 5.1 Growth Assumptions for 2030 Annual Interregional Trips

Attribute	Low HST Ridership Forecast Assumptions	High HST Ridership Forecast Assumptions
Auto Operating Cost (2011$)	$0.20	$0.28
Socioeconomic Forecast	Based on forecasts by Moody's Analytics prepared in 2011	Based on comparison of Woods & Poole forecasts before and after 2008
Trip Frequency Assumptions	Based on 2011 survey	Based on 2005 survey
Air Fares	Actual 2009 fares	Actual 2009 fares

Figure 5.1 Forecast Growth in Total Annual Interregional Market
2000-2030



The overall market in the low scenario is higher than in the high scenario, which seems counterintuitive. However, the scenarios were constructed with the aim of creating a range of outcomes of HST ridership, rather than the overall market. For the low scenario, lower auto operating costs would lead to more people choosing to drive rather than take high-speed trains – a lower mode share for HST. However, low operating costs would also tend to result in more overall interregional travel. The effect of low operating cost on the HST mode share was more pronounced than on the total desire to make interregional trips.

The socioeconomic forecasts and trip frequency assumptions for the low and high scenarios both tend to affect interregional travel as expected – the lower household and employment forecast from Moody's Analytics and the lower trip frequency dataset developed in 2011 were both used for the low scenario forecast.

5.2 PHASED PROJECT SCENARIO OVERVIEW

CS developed ridership and revenue forecasts for four phased high-speed train (HST) scenarios specified by the Program Manager (see Figure 5.2).

Figure 5.2 HST Scenarios

- **Initial Operating Segment (IOS):**
  - A north terminal in the Central Valley at Merced and a south terminal at San Fernando.
  - Dedicated coach services:
    - Merced to the Bay Area and Sacramento destinations; and
    - San Fernando to LA Basin destinations.
  - Conventional rail connection:
    - Amtrak-San Joaquin service between Merced to the Bay Area and Sacramento. Note that the existing San Joaquin service south of Merced to Bakersfield is assumed to be discontinued upon the initiation of HST service.
- **Bay to Basin**:
  - North terminal at San Jose and a southern terminal at San Fernando.
  - Dedicated coach services:
    - Merced to the Bay Area and Sacramento destinations; and
    - San Fernando to LA Basin destinations.
  - Conventional rail connections:
    - Amtrak-San Joaquin service between Merced to the Bay Area and Sacramento. Note that the existing San Joaquin service south of Merced to Bakersfield is assumed to be discontinued upon the initiation of HST service.
    - Coordinated Caltrain feeder service at San Jose to San Francisco peninsula destinations.
- **Phase 1-Blended:**
  - North terminal at San Francisco and a south terminal at Los Angeles Union Station.
  - Dedicated coach services from Merced to Sacramento.
  - Conventional rail connections:
    - Amtrak-San Joaquin service between Merced to the Bay Area and Sacramento. Note that the existing San Joaquin service south of Merced to Bakersfield is assumed to be discontinued upon the initiation of HST service.
    - HST will operate on the Caltrain tracks from San Jose to San Francisco at lower speeds.
    - Coordinated Metrolink feeder service at Los Angeles Union Station to Los Angeles Basin destinations.

- **Phase 1 Full Build (Option)**:
  - North terminal at San Francisco and the south terminal at Anaheim.
  - Dedicated coach services from Merced to Sacramento.
  - Conventional rail connections:
    - » Amtrak-San Joaquin service between Merced to the Bay Area and Sacramento. Note that the existing San Joaquin service south of Merced to Bakersfield is assumed to be discontinued upon the initiation of HST service.
    - » Coordinated Metrolink feeder service at LA Union Station, Norwalk and Anaheim.

As specified by the Program Manager, CS tested each scenario with two sets of assumptions that would lead to "High" and"Low" outcomes. The High and Low model runs within each of the main scenarios share the same operating plan (e.g., service frequencies) and uses the same fare policies for HST, air, and conventional rail. Features that differentiate the High and Low model runs are:

- Auto operating costs;
- Socioeconomic forecasts; and
- Trip frequencies per household.

Section 5.5 below provides a more detailed comparison of the scenarios and their respective model runs.

5.3 SUMMARY OF ASSUMPTIONS

Common HST Fare and Service Assumptions

HST fares for all 2012 Business Plan scenarios were based on the following formula (see Table 5.2):

- For station pairs between the San Francisco Bay Area and the Los Angeles Basin, HST fares were 83 percent of the passenger-weighted average of expected 2030 airfares between the San Francisco Bay Area and the Los Angeles Basin, which amounted to $83 in 2011 dollars.
- For other station pairs:
  - $30.91 + $0.1855 per mile (in 2011 dollars) for interregional fares;
  - $22.67 + $0.1546 per mile (in 2011 dollars) for intraregional fares for SCAG region; and
  - $14.43 + $0.1237 per mile (in 2011 dollars) for intraregional fares for MTC and SANDAG regions.

Fares for three movements were capped at $83 so that they would not be higher than the Bay Area to Los Angeles Basin movements. Further details on the derivation of these fares are provided in Appendix E.

Service assumptions varied by scenario. The details of the service frequencies are described in Table 5.4. The stopping patterns are provided in Appendix F.

Table 5.2 Assumed HST Fares
2011 Dollars

HST Stations	San Francisco (Transbay)	Millbrae	Redwood City	San Jose	Gilroy	Merced	Fresno	Visalia	Bakersfield	Palmdale	San Fernando	Los Angeles Union Station	Norwalk	Anaheim
San Francisco (Transbay)		$16	$17	$21	$23	$55	$66	$72	$83	$83	$83	$83	$83	$83
Millbrae			$16	$18	$22	$55	$66	$71	$83	$83	$83	$83	$83	$83
Redwood City				$17	$21	$54	$63	$69	$82	$83	$83	$83	$83	$83
San Jose					$17	$52	$59	$64	$77	$83	$83	$83	$83	$83
Gilroy						$48	$55	$61	$72	$83	$83	$83	$83	$83
Merced							$41	$48	$63	$79	$80	$83	$83	$83
Fresno								$38	$52	$68	$69	$72	$75	$78
Visalia									$47	$63	$64	$68	$70	$72
Bakersfield										$47	$48	$52	$54	$56
Palmdale											$30	$31	$32	$34
San Fernando												$25	$28	$30
Los Angeles Union Station													$25	$28
Norwalk														$25
Anaheim														

Source: Parsons Brinckerhoff.

Notes: $83 Fare constrained to $83.
$83 Fare for San Francisco Bay Area to Los Angeles Basin.

In addition to HST fare policies, the forecasts used common assumptions for air and conventional rail service and fares among the four scenarios:

- **Air Fares and Service** – Actual 2009 airfares and service, as described in Section 2.1.
- **Conventional Rail Fares and Service** – Actual 2011 fares and expected 2030 service, as described in Section 2.2. All scenarios assumed that the Amtrak San Joaquin service would terminate at Merced once the HST service opened.

High and Low Assumptions

CS evaluated each of the four HST service scenarios using assumptions that would generate a range of ridership and revenue outcomes in 2030, from high to low. The fundamental differences between the high and low model runs involve (see Table 5.3):

- Auto operating costs (described in Section 2.3);
- 2030 socioeconomic forecasts (described in Section 3.0); and
- Trip Frequencies (described in Section 4.0).

Table 5.3 Assumptions Used for High and Low Scenarios

	Auto Operating Costs (2011$)	2030 Socioeconomic Forecast	Trip Frequencies
High Scenarios	28 cents/mile	Based on comparison of 2008 to 2011 Woods and Poole Forecast for 2030	Based on 2005 Survey
Low Scenarios	20 cents/mile	Based on 2011 Moody's Analytics Forecast for 2030	Based on 2011 Survey

Summary of Assumptions for all Business Plan Scenarios

Table 5.4 summarizes the assumptions used on all the scenarios used for the Business Plan.

Table 5.4 HST Scenario Assumptions

Scenario	Run #	Range	North Terminus	South Terminus	Motor Fuel 2011$	Socioeconomic Data (SE)	Trip Rate	Peak TPH	HST Service Summary	Dedicated Peak Bus Coach Connections	Conventional Rail Connections
IOS	12-040e	High	Merced	San Fernando	28 cents/mile	Based on comparison of 2008 to 2011 Woods and Poole Forecast for 2030	2005 Survey	4	• 4 peak TPH from Merced and San Fernando (2 in off-peak)	**South:** • 4 BPH from San Fernando to LAUS • 4BPH from San Fernando to West LA • 4BPH from San Fernando to Santa Anita **North:** • 4 BPH from Merced to Sacramento • 4 BPH from Merced to San Francisco • 4 BPH from Merced to San Jose	• Existing Amtrak San Joaquin service terminates at Merced (service to Bakersfield discontinued
	12-041d	Low	Same	Same	20 cents/mile	Based on 2011 Moody's Analytics Forecast for 2030	2011 Survey	Same	Same	Same	Same
Bay to Basin	12-044b	High	San Jose	San Fernando	28 cents/mile	Based on comparison of 2008 to 2011 Woods and Poole Forecast for 2030	2005 Survey	6	• 4 peak TPH from San Jose to San Fernando (3 in off-peak) • 2 peak TPH from Merced to San Fernando (1 in off-peak)	**South:** • 6 BPH from San Fernando to LAUS • 6 BPH from San Fernando to West LA • 6 BPH from San Fernando to Santa Anita **North:** • **2** BPH from Merced to Sacramento • 2 BPH from Merced to San Francisco	• Coordinated Caltrain service from San Jose to San Francisco • Existing Amtrak San Joaquin service terminates at Merced (service to Bakersfield discontinued
	12-045c	Low	Same	Same	20 cents/mile	Based on 2011 Moody's Analytics Forecast for 2030	2011 Survey	Same	Same	Same	Same

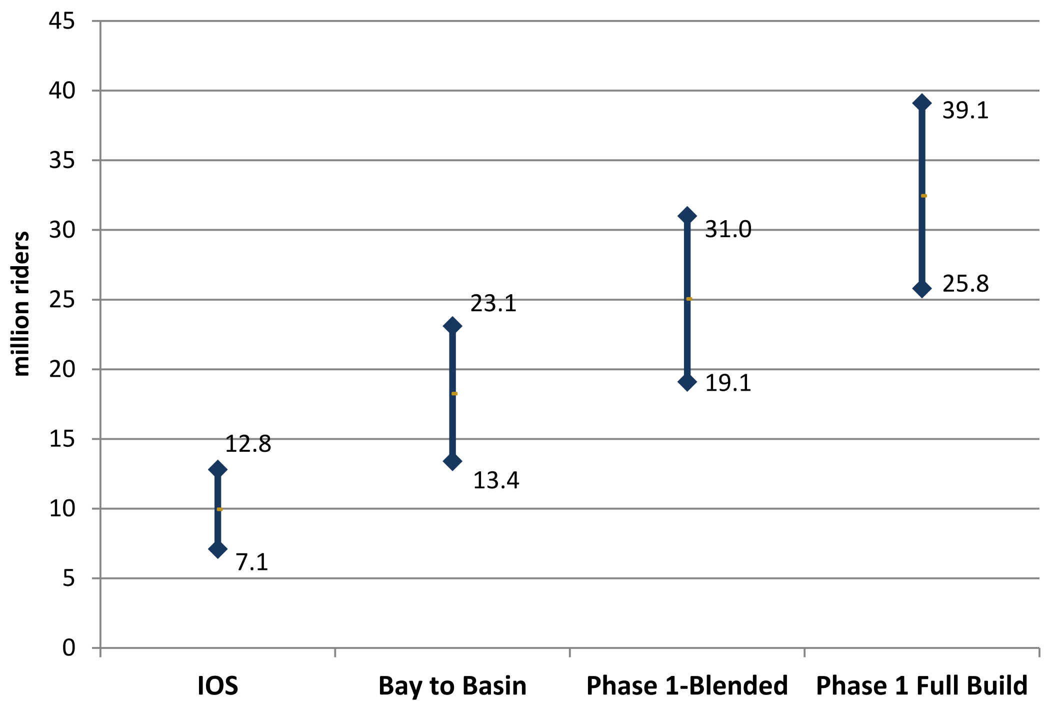
Table 5.4 HST Scenario Assumptions (continued)

Scenario	Run #	Range	North Terminus	South Terminus	Motor Fuel 2011$	Socioeconomic Data (SE)	Trip Rate	Peak TPH	HST Service Summary	Dedicated Peak Bus Coach Connections	Conventional Rail Connections
Phase 1-Blended	12-042d	High	San Francisco	Los Angeles	28 cents/mile	Based on comparison of 2008 to 2011 Woods and Poole Forecast for 2030	2005 Survey	8	• 4 peak TPH from San Francisco to Los Angeles (same for off-peak) • 2 peak TPH from San Jose to Los Angeles (0 in off-peak) • 2 peak TPH from Merced to Los Angeles (1 in off-peak)	**North:** • 2 BPH from Sacramento to Merced.	• Metrolink connections at Los Angeles Union Station • Amtrak San Joaquin service to Merced (with San Joaquin service terminated south of Merced to Bakersfield)
	12-043d	Low	Same	Same	20 cents/mile	Based on 2011 Moody's Analytics Forecast for 2030	2011 Survey	Same	Same	Same	Same
Phase 1 Full Build	12-046	High	San Francisco	Anaheim	28 cents/mile	Based on comparison of 2008 to 2011 Woods and Poole Forecast for 2030	2005 Survey	9	• 3 peak TPH from San Francisco to Anaheim (same in off-peak) • 2 peak TPH from San Francisco to Los Angeles (1 in off-peak) • 2 peak TPH from San Jose to Los Angeles (0 in off-peak) • 2 peak TPH from Merced to Los Angeles (1 in off-peak)	**North:** • 2 BPH from Merced to Sacramento	• Metrolink connections at Los Angeles Union Station • Amtrak San Joaquin service to Merced (with San Joaquin service terminated south of Merced to Bakersfield)
	12-047b	Low	Same	Same	20 cents/mile	Based on 2011 Moody's Analytics Forecast for 2030	2011 Survey	Same	Same	Same	Same

5.4 Summary of 2030 Ridership and Revenue Forecasts

The low forecasts for ridership in 2030 range from 7.1 million per year for IOS to 25.8 million per year for full Phase 1 Full Build (Figure 5.3). The high forecasts range from 12.8 million per year for IOS to 39.1 million per year for full Phase 1 Full Build. The spread of the forecasts is 29 percent around the average of the High and Low ranges for IOS, and 20 percent for full Phase 1.[11]

Figure 5.3 Summary of Annual Ridership Forecast: 2030[12]
High to Low Range

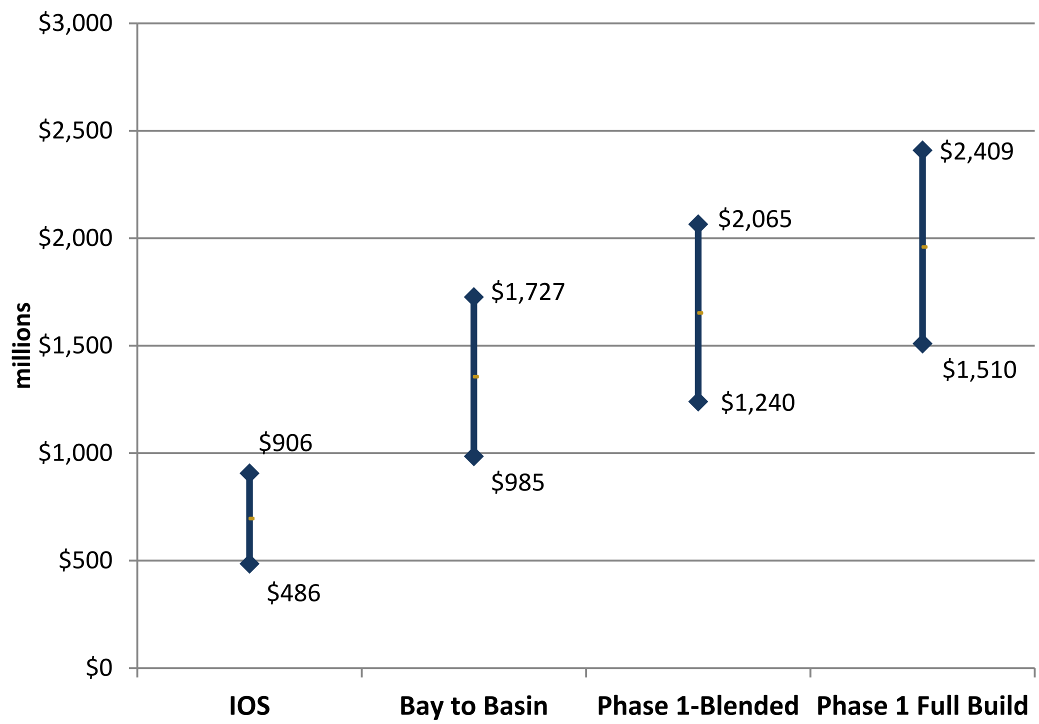


[11] The Draft Revised 2012 Business Plan has similar charts to Figures 5.3 and 5.4, but they are not identical. This Technical Memorandum reports on 2030 forecasts. The Business Plan document shows forecasts developed by the Program Manager for 2040 based on CS's 2030 forecasts (described herein) and reasonable growth factors derived from model runs.

[12] The ridership presented in the 2012 Business Plan is in 2040 using a 0.5 percent growth per annum.

Forecast 2030 annual revenue for the four scenarios ranges from $486 million for IOS to $1,510 million for Phase 1 Full Build (Figure 5.4). The spread of the revenue around the average of the high and low cases is about 30 percent for IOS and 23 percent for Phase 1 Full Build. The ranges are different between ridership and revenue because not all riders pay the same fare and markets are served differently by the phased scenarios.

Figure 5.4 Summary of Annual Revenue Forecast: 2030[13]
High to Low, 2011$



The IOS scenario provides limited HST service compared to the other scenarios. The IOS scenario provides four peak trains per hour (TPH) but only runs between Merced and San Fernando. Although dedicated coach services are provided at the terminals, the lack of express service in the Bay Area and in the LA Basin results in longer travel times in the peninsula and in the Basin.

The HST extension to San Jose (Bay to Basin scenario) and improvements in the frequency of service to 6 peak TPH increases systemwide trips by about 80 percent. Similarly, extending the HST service in the Bay Area to San Francisco

[13] Revenues presented in the 2012 Business Plan include additional ancillary revenue and bus feeder service revenue in 2040.

and south to LA Union Station (Phase 1 Blended scenario) provides more access to the populous regions in these markets. Systemwide trips increase on average 37 percent in the Phase 1 Blended scenario when compared to the Bay to Basin scenario. The extension of HST service in the Bay Area significantly increases HST travel between the Bay Area and points south since passengers would not have to transfer using Caltrain. In the same way, having the south terminal at Anaheim (Phase 1 Full Build scenario), where it is accessible by even a larger portion of Los Angeles Basin travelers, and improved HST frequency from 8 to 9 peak TPH increases systemwide ridership by 30 percent when compared to the Phase 1 Blended scenario. The related increase in revenue is 12 percent.

The LA Basin-Bay Area is the most consistent market with the highest HST ridership across all scenarios (Tables 5.6 and 5.7) ranging from 1.2 million per year on the IOS scenario to 5.6 million per year in the full Phase 1 scenario for the low scenario. HST is forecast to capture nearly 7 percent of the LA Basin to Bay Area travel market with the IOS scenario. However, once express service is extended to San Jose in the Bay to Basin scenario, the HST share is expected to increase to 27 percent for that movement. HST trips are expected to account for 31 percent of the market in the Phase 1 Blended scenario, and 32 percent in the Phase 1 Full Build scenario.

For the high scenarios, HST ridership is forecast in the LA Basin to Bay Area market is expected to range from 2.1 million per year in the IOS scenario to 8.6 million per year in the Phase 1 Full Build scenario, where HST trips account for from 10 percent of the market (IOS South) to 38 percent of the market for Phase 1.

New transportation services can induce new trips. We forecast that from 1.6 percent to 2.4 percent of the statewide interregional trips expected to use the HST system will be induced, depending on the scenario (Table 5.5). Note that this figure represents trips that would not have been made at all if the HST system did not exist. It does not include trips that may change their destination from one place to another because of the improved accessibility offered by the HST. For example, a trip that might have been made from Merced to Sacramento might be replaced by a trip from Merced to Bakersfield because of the improved accessibility between Merced and Bakersfield. Such a trip replacement is not counted as an “induced” trip.

Table 5.5 Statewide Interregional HST Trips that are Induced

	IOS	Bay to Basin	Phase 1 Blended	Phase 1 Full Build
Low Forecast	1.6%	1.7%	2.0%	2.1%
High Forecast	1.9%	2.0%	2.2%	2.4%

Table 5.6 Forecast of 2030 Annual Region-to-Region Ridership and Revenue – Low Scenarios

Millions; Revenue in 2011 Dollars

	Run 12-041d IOS (Low)			Run 12-045c Bay to Basin (Low)			Run 12-043d Phase 1 Blended (Low)			Run 12-047b Phase 1 Full Build (Low)		
Major Markets	**HST Ridership**	**HST Revenues**	**HST Share**	**HST Ridership**	**HST Revenues**	**HST Share**	**HST Ridership**	**HST Revenues**	**HST Share**	**HST Ridership**	**HST Revenues**	**HST Share**
LA Basin – Sacramento	0.2	$19	4.3%	0.2	$15	3.4%	0.3	$27	5.8%	0.4	$30	6.4%
LA Basin – San Diego	0.0	$1	0.0%	0.1	$2	0.0%	0.4	$14	0.1%	1.2	$41	0.3%
LA Basin – Bay Area	1.2	$97	7.0%	4.6	$385	26.6%	5.4	$449	30.9%	5.6	$469	32.2%
Sacramento – Bay Area	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
San Diego – Sacramento	0.0	$0	0.1%	0.0	$0	0.0%	0.0	$0	0.3%	0.0	$2	1.3%
San Diego – Bay Area	0.0	$2	0.4%	0.2	$19	2.8%	0.8	$69	10.5%	1.5	$128	19.5%
Bay Area – San Joaquin Valley	0.2	$10	0.6%	1.8	$126	6.6%	2.2	$157	7.9%	2.3	$163	8.2%
San Joaquin Valley – LA Basin	3.8	$267	7.8%	3.5	$242	7.2%	3.7	$263	7.7%	4.1	$291	8.5%
Sacramento – San Joaquin Valley	0.0	$2	0.8%	0.0	$1	0.5%	0.0	$2	0.7%	0.0	$1	0.5%
San Diego – San Joaquin Valley	0.0	$0	11.5%	0.0	$0	10.6%	0.0	$1	17.0%	0.0	$1	17.5%
Within Bay Area Peninsula*	0.0	$0	0.0%	0.0	$0	0.0%	1.3	$23	0.0%	1.8	$33	0.0%
Within North LA Basin*	0.7	$20	0.0%	0.6	$19	0.0%	2.2	$63	0.0%	2.7	$75	0.0%
Within South LA Basin*	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	1.0	$24	0.0%
North LA – South LA*	0.0	$0	0.0%	0.0	$0	0.0%	0.4	$11	0.0%	2.5	$68	0.1%
Within San Diego Region	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
Within San Joaquin Valley	0.1	$6	0.0%	0.1	$5	0.0%	0.1	$5	0.0%	0.1	$5	0.0%
Other	0.7	$59	0.0%	2.1	$171	0.0%	2.3	$156	0.0%	2.5	$181	0.0%
Total	**7.1**	**$486**	**0.0%**	**13.4**	**$985**	**0.0%**	**19.1**	**$1,240**	**0.0%**	**25.8**	**$1,510**	**0.1%**
Within San Diego Region	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
Within Entire LA Basin	0.7	$20	0.0%	0.6	$19	0.0%	2.5	$75	0.0%	6.2	$167	0.0%
Within Entire MTC	0.0	$0	0.0%	0.0	$0	0.0%	1.3	$23	0.0%	1.8	$33	0.0%
Within Other Regions	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
Total between Regions	6.4	$466	0.7%	12.7	$966	1.4%	15.3	$1,142	1.6%	**17.8**	**$1,310**	1.9%

Note: Revenues exclude ancillary and bus feeder services.

Table 5.7 Forecast of 2030 Annual Region-to-Region Ridership and Revenue for the Major Markets – High Scenarios

Millions; Revenue in 2011 Dollars

	Run 12-040e IOS (High)			Run 12-044b Bay to Basin (High)			Run 12-042b Phase 1 Blended (High)			Run 12-046 Phase 1 Full Build (High)		
Major Markets	**HST Ridership**	**HST Revenues**	**HST Share**	**HST Ridership**	**HST Revenues**	**HST Share**	**HST Ridership**	**HST Revenues**	**HST Share**	**HST Ridership**	**HST Revenues**	**HST Share**
LA Basin – Sacramento	0.6	$52	8.5%	0.5	$44	7.2%	0.8	$68	10.7%	0.7	$58	9.2%
LA Basin – San Diego	0.0	$1	0.0%	0.0	$1	0.0%	0.1	$2	0.1%	0.2	$6	0.1%
LA Basin – Bay Area	2.1	$171	9.5%	7.2	$597	31.9%	8.2	$676	36.0%	8.6	$714	38.0%
Sacramento – Bay Area	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
San Diego – Sacramento	0.0	$0	0.3%	0.0	$0	0.1%	0.0	$0	0.3%	0.0	$2	1.6%
San Diego – Bay Area	0.1	$9	1.2%	0.3	$25	3.5%	1.0	$79	10.8%	1.9	$160	21.8%
Bay Area – San Joaquin Valley	0.9	$54	1.2%	4.6	$332	6.2%	5.4	$408	7.4%	5.6	$421	7.6%
San Joaquin Valley – LA Basin	5.4	$395	7.7%	4.7	$337	6.7%	5.1	$373	7.3%	5.5	$396	7.8%
Sacramento – San Joaquin Valley	0.3	$19	1.3%	0.2	$12	0.9%	0.3	$18	1.1%	0.2	$13	0.8%
San Diego – San Joaquin Valley	0.0	$2	10.2%	0.0	$2	9.3%	0.1	$4	16.4%	0.1	$4	16.9%
Within Bay Area Peninsula*	0.0	$0	0.0%	0.0	$1	0.0%	2.1	$39	0.0%	3.4	$64	0.0%
Within North LA Basin*	0.7	$21	0.0%	0.7	$21	0.0%	2.6	$75	0.0%	3.2	$89	0.0%
Within South LA Basin*	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	1.2	$29	0.0%
North LA – South LA*	0.0	$0	0.0%	0.0	$0	0.0%	0.5	$16	0.0%	2.8	$80	0.1%
Within San Diego Region	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
Within San Joaquin Valley	1.2	$65	0.0%	0.9	$48	0.0%	0.9	$49	0.0%	0.9	$51	0.0%
Other	1.4	$115	0.0%	4.0	$308	0.1%	4.0	$257	0.1%	4.8	$320	0.1%
Total	**12.8**	**$906**	**0.0%**	**23.1**	**$1,727**	**0.0%**	**31.0**	$2,065	**0.1%**	**39.1**	**$2,409**	**0.1%**
Within San Diego Region	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
Within Entire LA Basin	0.7	$21	0.0%	0.7	$21	0.0%	3.1	$91	0.0%	7.2	$198	0.0%
Within Entire MTC	0.0	$0	0.0%	0.0	$1	0.0%	2.1	$39	0.0%	3.4	$64	0.0%
Within Other Regions	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%	0.0	$0	0.0%
Total between Regions	12.1	$885	1.3%	22.4	$1,705	2.5%	25.8	$1,935	2.8%	**28.4**	**$2,148**	3.1%

Note: Revenues exclude ancillary and bus feeder services.

Forecast Interregional HST Trips by Origin Region

Forecast annual interregional HST trips by origin region are shown in Figures 5.5 and 5.6 for the Low and High forecasts, respectively. Ridership is forecast to increase in every region as the HST service area is expanded. An exception is a forecast decrease of 21 percent in trips originating from Sacramento when comparing the IOS scenario and the Bay to Basin scenario. The forecast reduction is possibly due to the elimination of 2 peak BPH to Merced under this scenario when Merced is no longer the end of the line.

Interregional trips originating from the Bay Area are expected to increase significantly (over 300 percent) when HST is extended to San Jose. Moderate increases are expected as the HST service is extended to San Francisco and farther south in the LA Basin.

Interregional trips originating from San Diego are expected to increase 350 percent in the Low forecast of the Blended Phase 1 scenario and 200 percent under the High forecast. The extension to Anaheim increases interregional trips originating from this region by 100 percent over the Blended Phase 1 levels.

Figure 5.5 Annual HST Ridership by Origin Region
Low Scenarios

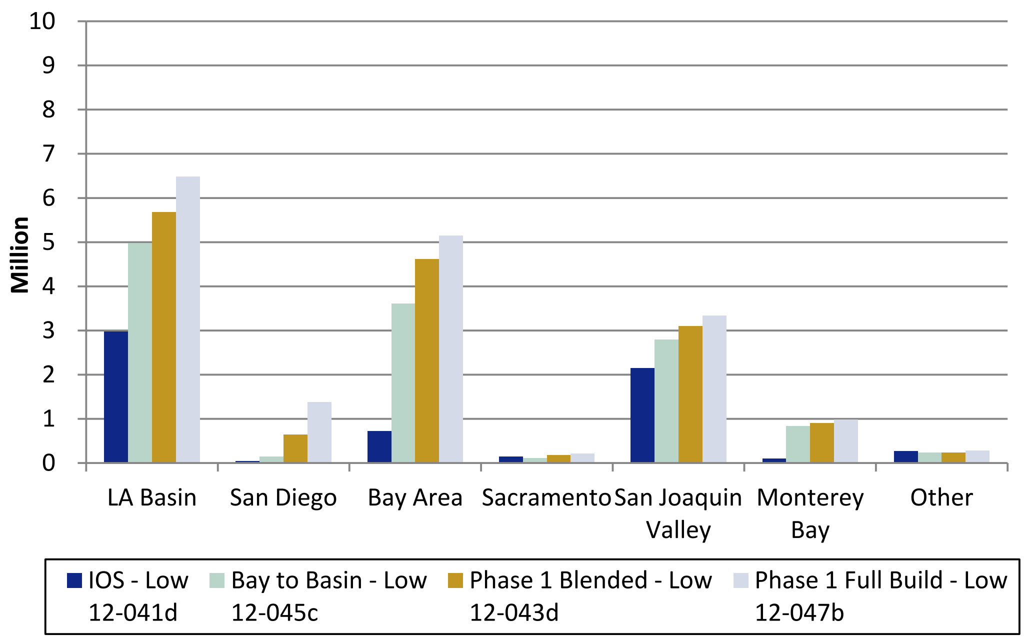
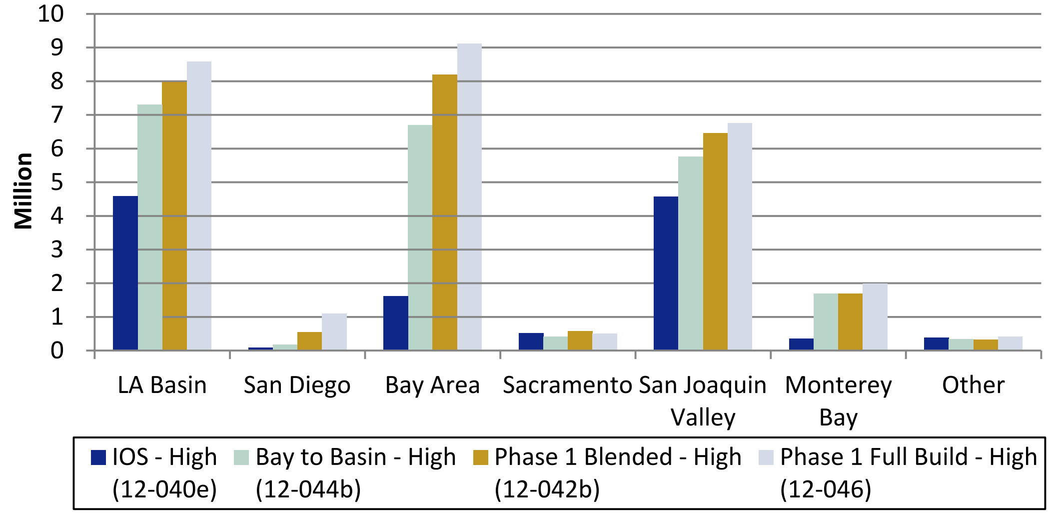


Figure 5.6 Annual Interregional HST Ridership by Origin Region
High Scenarios



Forecast Source of Interregional HST Trips by Mode

Under all scenarios, autos represent the biggest source of HST travelers, ranging from 67.5 percent for the Phase 1 Full Build High to 81 percent for the IOS low (Table 5.8) Air is expected to be the second largest source of HST passengers, representing from 14 percent to 25 percent of total passengers. Further details on the forecast source of passengers for particular movements and by trip purpose are provided in Appendix F.

Table 5.8 Forecast Source of Interregional Trips by Mode

Scenario	Range	Auto	Conv. Rail	Air	Induced
IOS	Low	81.2%	3.0%	14.2%	1.6%
	High	70.3%	11.7%	16.1%	1.9%
Bay to Basin	Low	74.8%	1.6%	21.9%	1.7%
	High	68.2%	5.7%	24.0%	2.0%
Phase 1 Blended	Low	74.2%	1.4%	22.3%	2.1%
	High	68.3%	5.2%	24.3%	2.2%
Phase 1 Full Build	Low	74.4%	1.4%	22.1%	2.1%
	High	67.5%	4.7%	25.4%	2.4%

The remainder of Section 5.0 provides further detail on ridership and revenue forecasts for the four Business Plan scenarios.

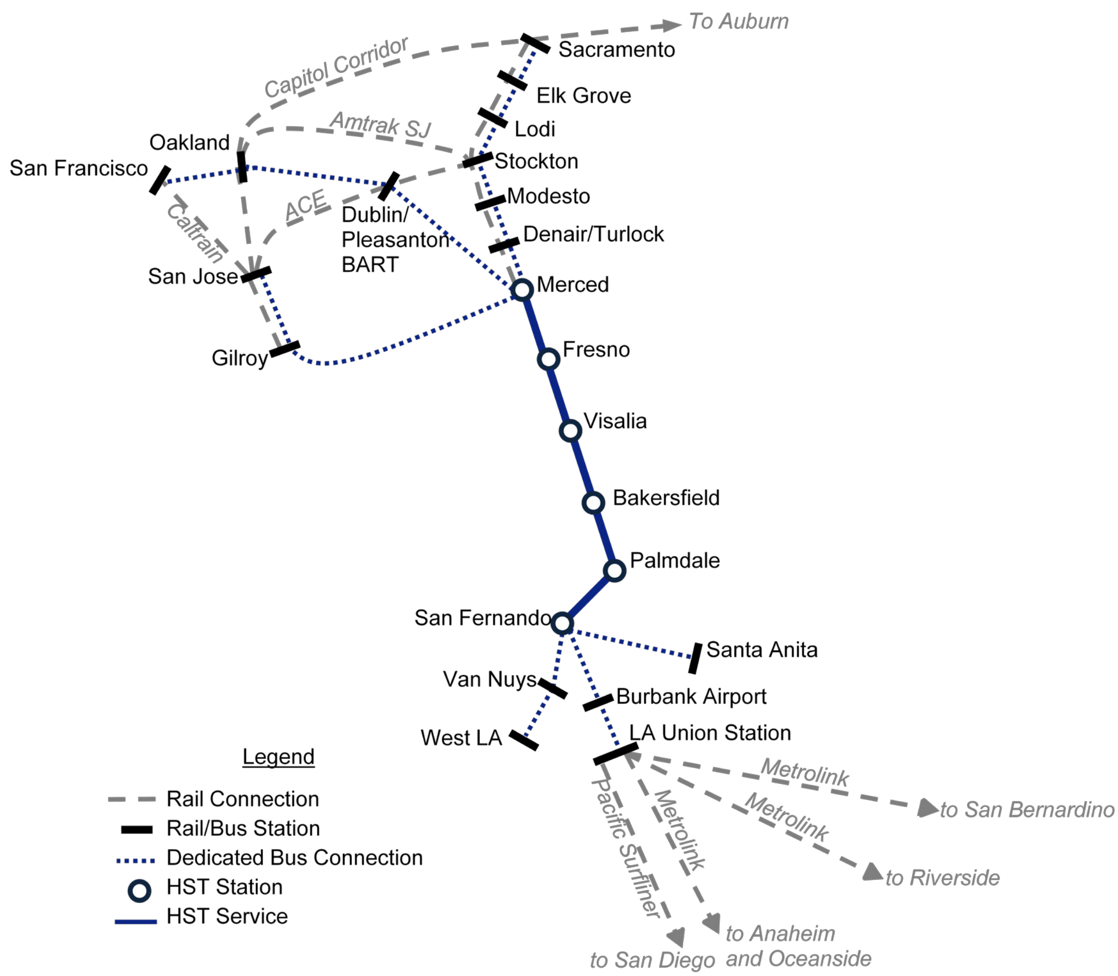
5.5 Details of 2030 Ridership and Revenue Forecasts for Business Plan Scenarios

This subsection provides details of the forecasts for each of the four Business Plan scenarios. Additional details on the train operating patterns and the expected geographic and modal source of HST trips can be found in Appendix F.

IOS

This scenario tests the potential of an initial operating segment (IOS) featuring a north terminal in Merced and a south terminal in San Fernando (Figure 5.7).

Figure 5.7 IOS – HST and Conventional Rail Services



Note: Existing Amtrak – San Joaquin service to Bakersfield discontinued at Merced.

Ridership and Revenue Forecasts

Systemwide annual HST ridership ranges from 7.1 million in the Low scenario to 12.8 million in the high scenario (Figures 5.8 and 5.9 and Tables 5.9 and 5.10). Interregional ridership accounts for approximately 90 percent of the total trips and 96 percent of total revenue in the Low forecast and about 94 percent of trips with 98 percent of revenue in the High.

The market with the highest HST ridership is San Joaquin-LA Basin, which accounts for 53 percent of the total HST ridership under the low scenario (42 percent under the high scenario.) Eight percent of the 48.5 million trips that are forecasted between these two regions are expected to use HST with both High and Low forecasts.

The LA Basin-Bay Area is expected to have the second most ridership with 1.2 million forecasted HST trips under the Low scenario (7 percent mode share) and 2.1 million trips in the high scenario (10 percent mode share).

Table 5.9 IOS Low (12-041d) – Annual Region to Region Forecasts by Mode
Year 2030

		Ridership (Millions)					Mode Share			Average Fare (2011$$)			HST Revenue (2011$$)
	Market	Air	Conv. Rail	HST	Auto	Total	Air	Conv. Rail	HST	Auto	HST	Air	
1	LA Basin – Sacramento	1.7	0.0	0.2	3.7	5.6	30.5%	0.0%	4.3%	65.2%	$81	$184	$19
2	LA Basin – San Diego	0.1	7.8	0.0	461.0	468.9	0.0%	1.7%	0.0%	98.3%	$30	$0	$1
3	LA Basin – Bay Area	6.8	0.0	1.2	9.4	17.3	39.0%	0.0%	7.0%	54.1%	$81	$173	$97
4	Sacramento – Bay Area	0.0	1.4	0.0	50.2	51.6	0.0%	2.7%	0.0%	97.3%	$0	$284	$0
5	San Diego – Sacramento	1.4	0.0	0.0	0.2	1.5	89.8%	0.0%	0.1%	10.1%	$81	$109	$0
6	San Diego – Bay Area	5.4	0.0	0.0	2.4	7.9	69.1%	0.0%	0.4%	30.5%	$81	$101	$2
7	Bay Area – San Joaquin Valley	0.2	0.1	0.2	27.4	27.8	0.6%	0.4%	0.6%	98.4%	$59	$355	$10
8	San Joaquin Valley – LA basin	0.6	0.0	3.8	44.1	48.5	1.3%	0.0%	7.8%	90.9%	$70	$722	$267
9	Sacramento – San Joaquin Valley	0.0	0.0	0.0	3.6	3.7	0.6%	0.2%	0.8%	98.4%	$60	$105	$2
10	San Diego – San Joaquin Valley	0.0	0.0	0.0	0.0	0.0	35.5%	0.0%	11.5%	52.9%	$74	$386	$0
11	Within Bay Area Peninsula*	0.0	116.8	0.0	6,645.0	6,761.9	0.0%	1.7%	0.0%	98.3%	$0	$0	$0
12	Within North LA basin*	0.0	2.7	0.7	8,188.6	8,192.0	0.0%	0.0%	0.0%	100.0%	$30	$0	$20
14	Within South LA basin*	0.0	1.0	0.0	10,162.8	10,163.8	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
15	North LA – South LA*	0.0	3.1	0.0	2,779.1	2,782.2	0.0%	0.1%	0.0%	99.9%	$0	$0	$0
18	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.0	0.1	4,782.3	4,782.4	0.0%	0.0%	0.0%	100.0%	$50	$258	$6
20	Other	2.8	0.1	0.7	6,255.4	6,259.1	0.0%	0.0%	0.0%	99.9%	$80	$587	$59
	Total	**19.0**	**133.1**	**7.1**	**47,842.7**	**48,001.9**	**0.0%**	**0.3%**	**0.0%**	**99.7%**	**$69**	**$0**	**$486**
	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.8	0.7	21,130.5	21,138.0	0.0%	0.0%	0.0%	100.0%	$30	$0	$20
	Within entire MTC	0.0	116.8	0.0	6,645.0	6,761.9	0.0%	1.7%	0.0%	98.3%	$0	$0	$0
	Within other regions	0.0	0.0	0.0	10,744.2	10,744.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	19.0	9.5	6.4	895.4	930.3	2.0%	1.0%	0.7%	96.3%	$73	$0	$466

NOTES: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.
Revenue excludes ancillary and bus feeder service.
Auto Operating Cost = 20 cents per mile per person (2011$).

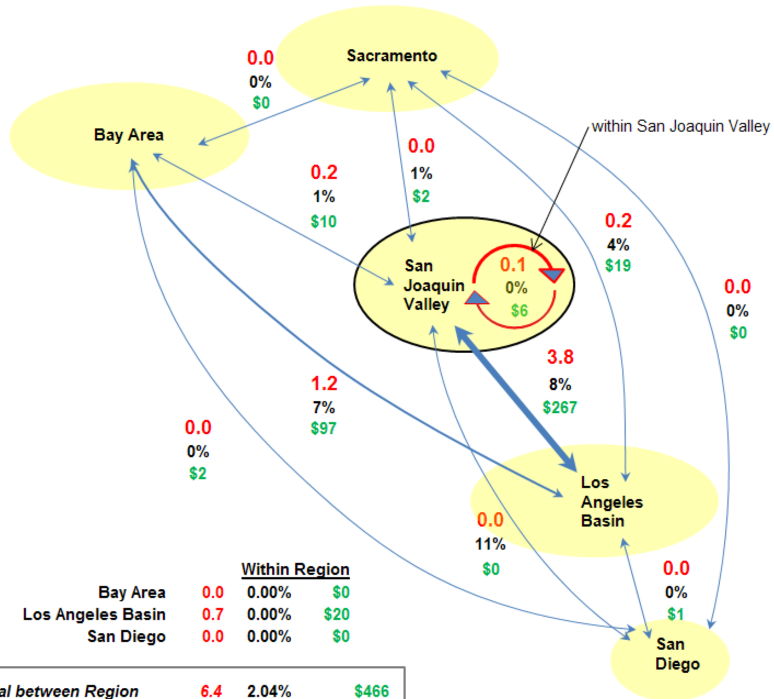
Table 5.10 IOS High (12-040e) – Annual Region to Region Forecasts by Mode
Year 2030

		Ridership (Millions)					Mode Share				Average Fare (2011$)		HST
	Market	Air	Conv. Rail	HST	Auto	Total	Air	Conv. Rail	HST	Auto	HST	Air	Revenues 2011$
1	LA Basin – Sacramento	2.5	0.0	0.6	4.5	7.6	32.7%	0.0%	8.5%	58.8%	$81	$166	$52
2	LA Basin – San Diego	0.0	7.9	0.0	131.4	139.4	0.0%	5.7%	0.0%	94.3%	$30	$0	$1
3	LA Basin – Bay Area	10.8	0.0	2.1	9.5	22.4	48.1%	0.0%	9.5%	42.4%	$81	$168	$171
4	Sacramento – Bay Area	0.0	3.9	0.0	70.3	74.2	0.0%	5.3%	0.0%	94.7%	$0	$279	$0
5	San Diego – Sacramento	1.8	0.0	0.0	0.0	1.8	97.4%	0.0%	0.3%	2.4%	$81	$109	$0
6	San Diego – Bay Area	7.6	0.0	0.1	1.2	8.8	85.6%	0.0%	1.2%	13.2%	$81	$102	$9
7	Bay Area – San Joaquin Valley	0.9	0.8	0.9	70.9	73.5	1.2%	1.1%	1.2%	96.5%	$64	$377	$54
8	San Joaquin Valley – LA basin	1.1	0.0	5.4	63.3	69.9	1.6%	0.0%	7.7%	90.6%	$73	$729	$395
9	Sacramento – San Joaquin Valley	0.3	0.1	0.3	21.9	22.5	1.3%	0.4%	1.3%	97.0%	$63	$105	$19
10	San Diego – San Joaquin Valley	0.1	0.0	0.0	0.2	0.3	26.4%	0.1%	10.2%	63.3%	$73	$417	$2
11	Within Bay Area Peninsula*	0.0	169.0	0.0	7,596.9	7,765.8	0.0%	2.2%	0.0%	97.8%	$0	$0	$0
12	Within North LA basin*	0.0	3.1	0.7	8,432.3	8,436.1	0.0%	0.0%	0.0%	100.0%	$30	$0	$21
14	Within South LA basin*	0.0	1.1	0.0	10,465.7	10,466.7	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
15	North LA – South LA*	0.0	2.6	0.0	2,858.3	2,860.8	0.0%	0.1%	0.0%	99.9%	$0	$0	$0
18	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.1	1.2	6,266.2	6,267.6	0.0%	0.0%	0.0%	100.0%	$55	$579	$65
20	Other	4.1	0.4	1.4	7,329.5	7,335.5	0.1%	0.0%	0.0%	99.9%	$80	$629	$115
	Total	**29.2**	**189.1**	**12.8**	**51,599.5**	**51,830.5**	**0.1%**	**0.4%**	**0.0%**	**99.6%**	**$71**	**$0**	**$906**
	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.7	0.7	21,756.3	21,763.7	0.0%	0.0%	0.0%	100.0%	$30	$0	$21
	Within entire MTC	0.0	169.0	0.0	7,596.9	7,765.8	0.0%	2.2%	0.0%	97.8%	$0	$0	$0
	Within other regions	0.0	0.0	0.0	13,112.2	13,112.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	29.1	13.3	12.1	856.7	911.3	3.2%	1.5%	1.3%	94.0%	$73	$0	$885

NOTES: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.

Revenue excludes ancillary and bus feeder service.
Auto Operating Cost = 28 cents per mile per person (2011$).

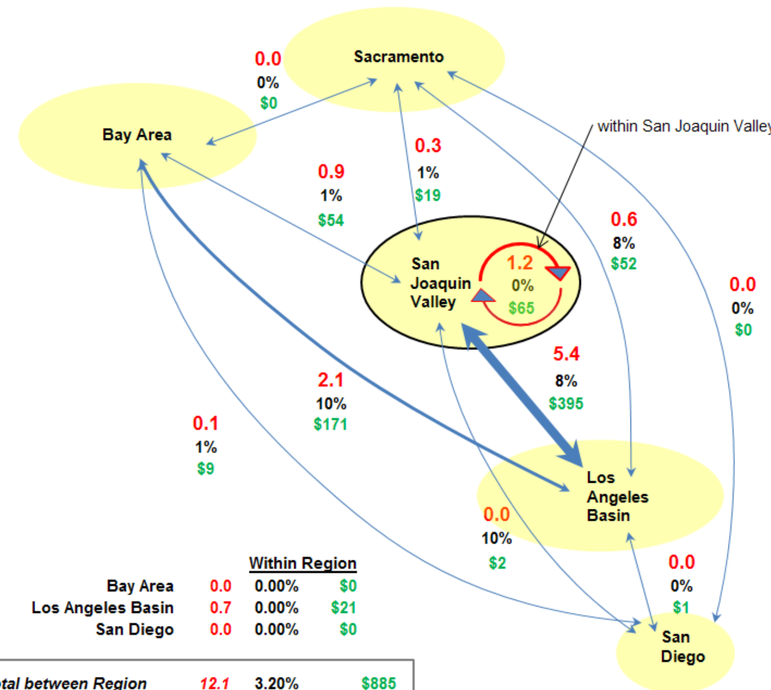
Figure 5.8 IOS – Low Scenario
Major Market Forecast: 2030



	Within Region		
Bay Area	0.0	0.00%	$0
Los Angeles Basin	0.7	0.00%	$20
San Diego	0.0	0.00%	$0

Total between Region	*6.4*	2.04%	$466
Total within Region	*0.7*	0.00%	$20
Total System	*7.1*	0.01%	$486

Figure 5.9 IOS – High Scenario
Major Market Forecast: 2030



	Within Region		
Bay Area	0.0	0.00%	$0
Los Angeles Basin	0.7	0.00%	$21
San Diego	0.0	0.00%	$0

Total between Region	*12.1*	3.20%	$885
Total within Region	*0.7*	0.00%	$21
Total System	*12.8*	0.02%	$906

KEY:
X.X = Annual HSR Ridership (in millions)
X% = HSR Mode Share
$X = Annual Revenue (in millions - yr 2011 dollars)

Revenues exclude ancillary and bus feeder services.

The busiest stations in 2030 are expected to be the two end-of-line stations – Merced (with 6,000 daily boardings under the Low Scenario and 13,700 under the high) and San Fernando (with 9,100 under the Low Scenario and 13,900 under the high) – see Table 5.11. Palmdale is also expected to be a busy station, with 2,000 daily boardings under the Low Scenario and 3,000 under the high. In the Low Scenario the majority of the boardings at Palmdale are expected to be for trips within the SCAG region while in the high scenario will be for interregional trips.

Table 5.11 Forecast of Daily Station Boardings – IOS
2030

	Low Scenario (12-041d)			High Scenario (12-040e)		
Station	**Between Regions**	**Within SCAG**	**Total**	**Between Regions**	**Within SCAG**	**Total**
Merced	6,000		6,000	13,700		13,700
Fresno	1,300		1,300	1,900		1,900
Visalia	600		600	900		900
Bakersfield	1,100		1,100	2,500		2,500
Palmdale	700	1,300	2,000	1,700	1,300	3,000
San Fernando	7,800	1,300	9,100	12,600	1,300	13,900
Daily	17,500	2,600	20,100	33,300	2,600	35,900
Annual (Millions)	6.4	0.7	7.1	12.1	0.7	

Source: Cambridge Systematics, Inc.

Bay to Basin

The Bay to Basin scenario extends the HST service from Merced into the Bay Area to San Jose, while the southern terminal remains at San Fernando (Figure 5.10).

Figure 5.10 Bay to Basin – HST and Conventional Rail Services

Note: Existing Amtrak – San Joaquin service to Bakersfield discontinued at Merced.

Ridership and Revenue Forecasts

The extension of high-speed service to San Jose increases forecast systemwide ridership by approximately 83 percent compared to the IOS scenario. Its annual HST ridership is expected to range from 13.4 million in the Low Scenario (Figure 5.11 and Table 5.12) to 23.1 million in the high scenario (Figure 5.12 and Table 5.13). The HST service extension allows for an increase in interregional travel to/from destinations in the LA Basin, the Bay Area, San Joaquin Valley, and Monterey Bay Area. The most significant increases over the IOS scenario are expected to occur between the LA Basin and the Bay Area (280 percent for the Low Scenario and 242 percent for the low) and between the Bay Area and the San Joaquin Valley (800 percent for the low and 411 percent for the high). Ridership in the LA Basin-Sacramento market is expected to decrease by 20 percent in the low scenario and 15 percent in the high scenario because service frequencies to Merced decreased from 4 TPH to 2 TPH. Similarly, ridership between the San Joaquin Valley and Sacramento decreases by 33 percent in the low scenario and 37 percent in the high scenario.

The Los Angeles Basin to Bay Area market is expected to account for 34 percent (4.6 million) of the total HST ridership in the low scenario and 31 percent (7.2 million) in the high scenario. HST is forecast to capture nearly 30 percent of the market share between these regions.

Table 5.12 Bay to Basin, Low (12-045c) – Annual Region to Region Forecasts by Mode

Year 2030

		Ridership (Millions)					Mode Share				Average Fare (2011$$)		HST Revenue
	Market	**Air**	**Conv. Rail**	**HST**	**Auto**	**Total**	**Air**	**Conv. Rail**	**HST**	**Auto**	**HST**	**Air**	**2011$**
1	LA Basin – Sacramento	1.7	0.0	0.2	3.7	5.6	30.7%	0.0%	3.4%	65.9%	$80	$184	$15
2	LA Basin – San Diego	0.1	7.8	0.1	461.0	468.9	0.0%	1.7%	0.0%	98.3%	$29	$0	$2
3	LA Basin – Bay Area	5.3	0.0	4.6	7.5	17.5	30.5%	0.0%	26.6%	42.9%	$83	$175	$385
4	Sacramento – Bay Area	0.0	1.4	0.0	50.1	51.5	0.0%	2.7%	0.0%	97.3%	$49	$282	$0
5	San Diego – Sacramento	1.4	0.0	0.0	0.2	1.5	89.9%	0.0%	0.0%	10.1%	$80	$109	$0
6	San Diego – Bay Area	5.3	0.0	0.2	2.3	7.8	67.5%	0.0%	2.8%	29.7%	$83	$101	$19
7	Bay Area – San Joaquin Valley	0.1	0.1	1.8	25.8	27.9	0.4%	0.4%	6.6%	92.6%	$69	$347	$126
8	San Joaquin Valley – LA basin	0.6	0.0	3.5	44.3	48.5	1.3%	0.0%	7.2%	91.4%	$69	$720	$242
9	Sacramento – San Joaquin Valley	0.0	0.0	0.0	3.7	3.7	0.6%	0.2%	0.5%	98.7%	$59	$105	$1
10	San Diego – San Joaquin Valley	0.0	0.0	0.0	0.0	0.0	35.8%	0.0%	10.6%	53.6%	$74	$387	$0
11	Within Bay Area Peninsula*	0.0	116.6	0.0	6,645.2	6,761.9	0.0%	1.7%	0.0%	98.3%	$17	$0	$0
12	Within North LA basin*	0.0	2.7	0.6	8,188.6	8,192.0	0.0%	0.0%	0.0%	100.0%	$29	$0	$19
14	Within South LA basin*	0.0	1.0	0.0	10,162.8	10,163.8	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
15	North LA – South LA*	0.0	3.1	0.0	2,779.1	2,782.2	0.0%	0.1%	0.0%	99.9%	$0	$0	$0
18	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.0	0.1	4,782.3	4,782.4	0.0%	0.0%	0.0%	100.0%	$50	$263	$5
20	Other	2.5	0.1	2.1	6,254.2	6,259.0	0.0%	0.0%	0.0%	99.9%	$80	$468	$171
	Total	**17.1**	**132.9**	**13.4**	**47,838.4**	**48,001.8**	**0.0%**	**0.3%**	**0.0%**	**99.7%**	**$74**	**$0**	**$985**
	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.8	0.6	21,130.5	21,138.0	0.0%	0.0%	0.0%	100.0%	$30	$0	$19
	Within entire MTC	0.0	116.6	0.0	6,645.2	6,761.9	0.0%	1.7%	0.0%	98.3%	$17	$0	$0
	Within other regions	0.0	0.0	0.0	10,744.2	10,744.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	17.1	9.4	12.7	891.0	930.3	1.8%	1.0%	1.4%	95.8%	$76	$0	$966

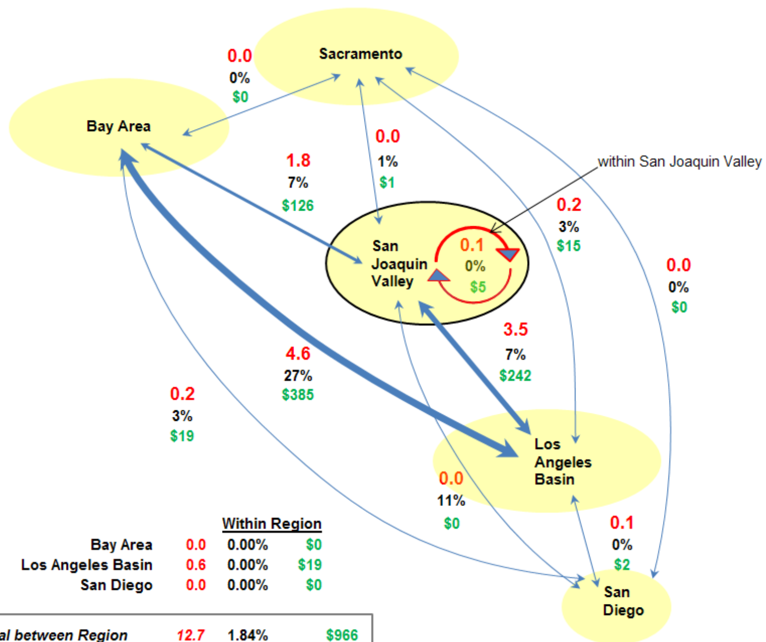
NOTES: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.
Revenue excludes ancillary and bus feeder service.
Auto Operating Cost = 20 cents per mile per person (2011$).

Table 5.13 Bay to Basin, High (12-044b) – Annual Region to Region Forecasts by Mode
Year 2030

		Ridership (Millions)					Mode Share				Average Fare (2011$$)		HST Revenue
	Market	Air	Conv. Rail	HST	Auto	Total	Air	Conv. Rail	HST	Auto	HST	Air	2011$
1	LA Basin – Sacramento	2.5	0.0	0.5	4.6	7.6	33.0%	0.0%	7.2%	59.8%	$80	$166	$44
2	LA Basin – San Diego	0.0	7.9	0.0	131.4	139.4	0.0%	5.7%	0.0%	94.3%	$30	$0	$1
3	LA Basin – Bay Area	8.2	0.0	7.2	7.2	22.6	36.3%	0.0%	31.9%	31.8%	$83	$171	$597
4	Sacramento – Bay Area	0.0	3.9	0.0	70.2	74.1	0.0%	5.3%	0.0%	94.7%	$48	$280	$0
5	San Diego – Sacramento	1.8	0.0	0.0	0.0	1.8	97.5%	0.0%	0.1%	2.4%	$80	$109	$0
6	San Diego – Bay Area	7.4	0.0	0.3	1.1	8.8	83.9%	0.0%	3.5%	12.7%	$83	$102	$25
7	Bay Area – San Joaquin Valley	0.6	0.8	4.6	67.6	73.6	0.8%	1.1%	6.2%	91.9%	$73	$378	$332
8	San Joaquin Valley – LA basin	1.2	0.0	4.7	63.9	69.8	1.7%	0.0%	6.7%	91.6%	$72	$734	$337
9	Sacramento – San Joaquin Valley	0.3	0.1	0.2	22.0	22.5	1.4%	0.4%	0.9%	97.4%	$62	$105	$12
10	San Diego – San Joaquin Valley	0.1	0.0	0.0	0.2	0.3	26.6%	0.1%	9.3%	64.0%	$73	$417	$2
11	Within Bay Area Peninsula*	0.0	169.0	0.0	7,596.8	7,765.8	0.0%	2.2%	0.0%	97.8%	$17	$0	$1
12	Within North LA basin*	0.0	3.1	0.7	8,432.3	8,436.1	0.0%	0.0%	0.0%	100.0%	$29	$0	$21
14	Within South LA basin*	0.0	1.1	0.0	10,465.7	10,466.7	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
15	North LA – South LA*	0.0	2.6	0.0	2,858.3	2,860.8	0.0%	0.1%	0.0%	99.9%	$0	$0	$0
18	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.1	0.9	6,266.5	6,267.6	0.0%	0.0%	0.0%	100.0%	$55	$615	$48
20	Other	3.6	0.4	4.0	7,327.3	7,335.4	0.0%	0.0%	0.1%	99.9%	$77	$399	$308
	Total	**25.7**	**189.0**	**23.1**	**51,592.6**	**51,830.4**	**0.0%**	**0.4%**	**0.0%**	**99.5%**	**$75**	**$0**	**$1,727**
	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.7	0.7	21,756.3	21,763.7	0.0%	0.0%	0.0%	100.0%	$30	$0	$21
	Within entire MTC	0.0	169.0	0.0	7,596.8	7,765.8	0.0%	2.2%	0.0%	97.8%	$17	$0	$1
	Within other regions	0.0	0.0	0.0	13,112.2	13,112.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	25.7	13.3	22.4	849.8	911.2	2.8%	1.5%	2.5%	93.3%	$76	$0	$1,705

NOTES: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.
Revenue excludes ancillary and bus feeder service.
Auto Operating Cost = 28 cents per mile per person (2011$)

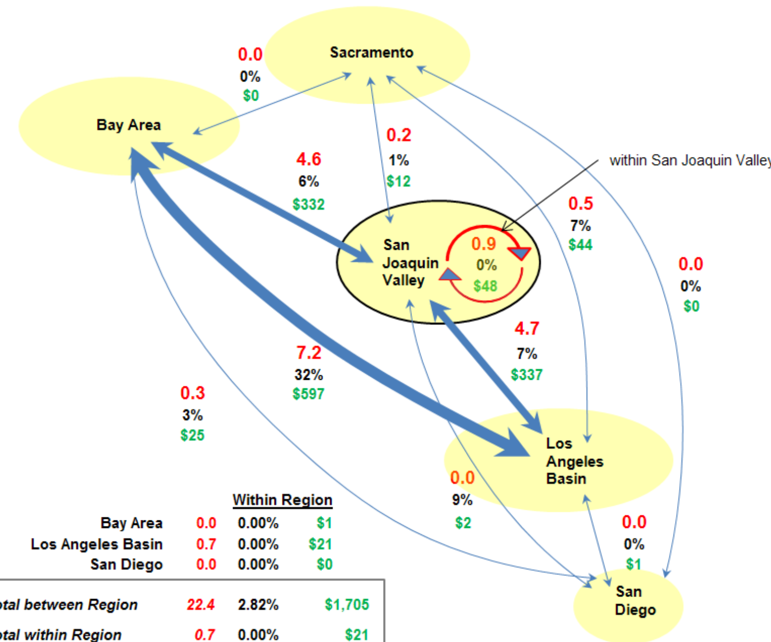
Figure 5.11 Bay to Basin – Low Scenario
Major Market Forecast: 2030



Within Region			
Bay Area	0.0	0.00%	$0
Los Angeles Basin	0.6	0.00%	$19
San Diego	0.0	0.00%	$0

Total between Region	*12.7*	1.84%	$966
Total within Region	*0.7*	0.00%	$19
Total System	*13.4*	0.03%	$985

Figure 5.12 Bay to Basin – High Scenario
Major Market Forecast: 2030



Within Region			
Bay Area	0.0	0.00%	$1
Los Angeles Basin	0.7	0.00%	$21
San Diego	0.0	0.00%	$0

Total between Region	*22.4*	2.82%	$1,705
Total within Region	*0.7*	0.00%	$21
Total System	*23.1*	0.04%	$1,727

KEY:
X.X = Annual HSR Ridership (in millions)
X% = HSR Mode Share
$X = Annual Revenue (in millions - yr 2011 dollars)

Note: Revenues exclude ancillary and bus feeder services.

Besides the two end-of-line stations, Merced is expected to be a busy station, with 3,300 daily boardings under the low scenario and 7,300 under the high scenario (Table 5.14). These are a little more than half of the forecast under the IOS South scenarios, reflecting that Merced would no longer be the end of the line, but still in a position to attract riders from the Central Valley.

Nearly 1 percent of the daily boardings at San Jose and 4 percent of the daily boardings at Gilroy are expected to be for trips within the Bay Area region under the high scenario. Fourteen percent of the combined daily boardings at Palmdale and San Fernando are forecast to be for trips within the SCAG region in the low scenario (10 percent for the high scenario).

Table 5.14 Forecast of Daily Station Boardings – Bay to Basin: 2030

	Low Scenario (12-045c)				High Scenario (12-044b)			
Station	**Between Regions**	**Within SCAG**	**Within MTC**	**Total**	**Between Regions**	**Within SCAG**	**Within MTC**	**Total**
San Jose	10,100	–	–	10,100	18,800	–	100	18,900
Gilroy	1,500	–	–	1,500	2,700	–	100	2,800
Merced	3,300	–	–	3,300	7,300	–	–	7,300
Fresno	2,100	–	–	2,100	2,700	–	–	2,700
Visalia	1,000	–	–	1,000	1,300	–	–	1,300
Bakersfield	1,800	–	–	1,800	4,500	–	–	4,500
Palmdale	1,500	1,200	–	2,700	3,600	1,300	–	4,900
San Fernando	13,500	1,200	–	14,700	20,500	1,300	–	21,800
Daily	34,800	2,400	–	37,200	61,400	2,600	200	64,200
Annual (Millions)	12.7	0.6	0.0		22.4	0.7	0.0	

Source: Cambridge Systematics, Inc.

Phase 1 Blended

The Phase 1 Blended scenario has a north terminal at San Francisco and a south terminal at Los Angeles with HST operating on the existing Caltrain tracks from Gilroy to San Francisco at slightly slower speeds than under the Phase 1 Full Build configuration.

Figure 5.13 Phase 1 Blended
HST and Conventional Rail Connections

Note: 1. Existing Amtrak – San Joaquin service to Bakersfield discontinued at Merced.

2. HST operating on the existing Caltrain tracks from Gilroy to San Francisco at slightly slower speeds than under the full Phase 1 configuration.

Ridership and Revenue Forecasts – Blended Phase 1

Systemwide annual HST ridership forecasts ranges from 19.1 million in the low scenario to 31.0 million in the high scenario (Figures 5.14 and 5.15 and Tables 5.15 and 5.16). This is 42 percent higher than the Bay to Basin scenario under the low scenario and 34 percent higher under the high scenario. The extension of HST service in the Bay Area to San Francisco and in the LA Basin to Los Angeles, combined with improvements to the frequency of service, is expected to significantly increase HST travel between the Bay Area and points south since passengers would not have to transfer. For instance, the travel time from San Francisco to LA Union Station is reduced by 43 percent. The extension to LA Union Station also provides more HST access to the populous regions of the LA Basin. Existing Metrolink commuter rail routes (i.e., San Bernardino, Riverside, Oceanside) contribute acting as feeder services.

HST ridership between the Bay Area and LA Basin destinations is forecasted to range from 5.4 to 8.2 million in the low and high scenarios, respectively; an average increase of 15 percent compared to the Bay to Basin scenario. HST mode share is expected to range from 31 percent in the low scenario to 36 percent in the high scenario for this market. The HST share in both scenarios is higher than the air share and in the high scenario is 6 percent points higher that auto.

Other notable ridership increases, compared to the Bay to Basin scenario, occur in the Bay Area-San Diego market (260 percent increase on average), within the LA Basin (330 percent increase on average) and between the Bay Area-San Joaquin Valley market (20 percent increase on average).

Table 5.15 Phase 1 Blended, Low (12-043d) – Annual Region to Region Forecasts by Mode
Year 2030

		Ridership (Millions)					Mode Share				Average Fare (2011$)		HST Revenue
	Market	Air	Conv. Rail	HST	Auto	Total	Air	Conv. Rail	HST	Auto	HST	Air	2011$
1	LA Basin – Sacramento	1.7	0.0	0.3	3.6	5.6	30.2%	0.0%	5.8%	63.9%	$83	$184	$27
2	LA Basin – San Diego	0.1	7.8	0.4	460.4	468.7	0.0%	1.7%	0.1%	98.2%	$31	$0	$14
3	LA Basin – Bay Area	5.0	0.0	5.4	7.1	17.5	28.8%	0.0%	30.9%	40.3%	$83	$174	$449
4	Sacramento – Bay Area	0.0	1.4	0.0	50.1	51.5	0.0%	2.7%	0.0%	97.3%	$25	$279	$0
5	San Diego – Sacramento	1.4	0.0	0.0	0.2	1.5	89.7%	0.0%	0.3%	10.1%	$83	$109	$0
6	San Diego – Bay Area	5.0	0.0	0.8	2.1	7.9	63.0%	0.0%	10.5%	26.5%	$83	$101	$69
7	Bay Area – San Joaquin Valley	0.1	0.1	2.2	25.5	27.9	0.3%	0.4%	7.9%	91.4%	$71	$317	$157
8	San Joaquin Valley – LA basin	0.6	0.0	3.7	44.1	48.5	1.3%	0.0%	7.7%	90.9%	$70	$720	$263
9	Sacramento – San Joaquin Valley	0.0	0.0	0.0	3.6	3.7	0.6%	0.2%	0.7%	98.5%	$69	$105	$2
10	San Diego – San Joaquin Valley	0.0	0.0	0.0	0.0	0.0	34.9%	0.0%	17.0%	48.1%	$76	$396	$1
11	Within Bay Area Peninsula*	0.0	116.1	1.3	6,644.5	6,761.9	0.0%	1.7%	0.0%	98.3%	$18	$0	$23
12	Within North LA basin*	0.0	2.7	2.2	8,187.2	8,192.1	0.0%	0.0%	0.0%	99.9%	$29	$0	$63
14	Within South LA basin*	0.0	1.0	0.0	10,162.8	10,163.8	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
15	North LA – South LA*	0.0	3.1	0.4	2,778.8	2,782.3	0.0%	0.1%	0.0%	99.9%	$30	$0	$11
18	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.0	0.1	4,782.3	4,782.4	0.0%	0.0%	0.0%	100.0%	$50	$263	$5
20	Other	2.6	0.1	2.3	6,254.1	6,259.0	0.0%	0.0%	0.0%	99.9%	$69	$466	$156
	Total	**16.5**	**132.4**	**19.1**	**47,833.8**	**48,001.8**	**0.0%**	**0.3%**	**0.0%**	**99.6%**	**$65**	**$0**	**$1,240**
	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.8	2.5	21,128.8	21,138.1	0.0%	0.0%	0.0%	100.0%	$30	$0	$75
	Within entire MTC	0.0	116.1	1.3	6,644.5	6,761.9	0.0%	1.7%	0.0%	98.3%	$18	$0	$23
	Within other regions	0.0	0.0	0.0	10,744.2	10,744.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	16.5	9.4	15.3	888.8	930.1	1.8%	1.0%	1.6%	95.6%	$75	$0	$1,142

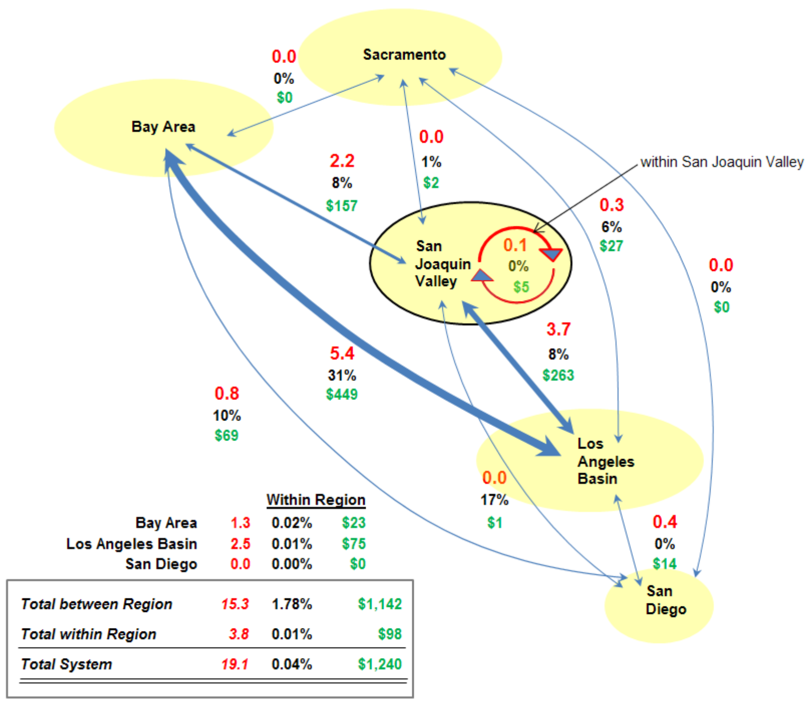
Notes: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.
Revenue excludes ancillary and bus feeder service.
Auto Operating Cost = 20 cents per mile per person (2011$).

Table 5.16 Phase 1 Blended, High (12-042b) – Annual Region to Region Forecasts by Mode
Year 2030

		Ridership (Millions)					Mode Share				Average Fare (2011$)		HST Revenue
	Market	Air	Conv. Rail	HST	Auto	Total	Air	Conv. Rail	HST	Auto	HST	Air	2011$
1	LA Basin – Sacramento	2.5	0.0	0.8	4.3	7.6	32.4%	0.0%	10.7%	56.9%	$83	$166	$68
2	LA Basin – San Diego	0.0	7.9	0.1	131.3	139.3	0.0%	5.7%	0.1%	94.3%	$31	$0	$2
3	LA Basin – Bay Area	7.7	0.0	8.2	6.7	22.6	34.2%	0.0%	36.0%	29.7%	$83	$170	$676
4	Sacramento – Bay Area	0.0	3.9	0.0	70.2	74.1	0.0%	5.3%	0.0%	94.7%	$23	$277	$0
5	San Diego – Sacramento	1.8	0.0	0.0	0.0	1.8	97.3%	0.0%	0.3%	2.4%	$83	$109	$0
6	San Diego – Bay Area	6.9	0.0	1.0	1.0	8.8	78.0%	0.0%	10.8%	11.2%	$83	$102	$79
7	Bay Area – San Joaquin Valley	0.6	0.8	5.4	66.8	73.6	0.8%	1.1%	7.4%	90.8%	$75	$345	$408
8	San Joaquin Valley – LA basin	1.2	0.0	5.1	63.4	69.8	1.8%	0.0%	7.3%	90.9%	$73	$735	$373
9	Sacramento – San Joaquin Valley	0.3	0.1	0.3	21.9	22.5	1.3%	0.4%	1.1%	97.2%	$72	$105	$18
10	San Diego – San Joaquin Valley	0.1	0.0	0.1	0.2	0.3	25.9%	0.1%	16.4%	57.6%	$74	$421	$4
11	Within Bay Area Peninsula*	0.0	168.2	2.1	7,595.6	7,765.9	0.0%	2.2%	0.0%	97.8%	$18	$0	$39
12	Within North LA basin*	0.0	3.1	2.6	8,430.7	8,436.4	0.0%	0.0%	0.0%	99.9%	$29	$0	$75
14	Within South LA basin*	0.0	1.1	0.0	10,465.7	10,466.7	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
15	North LA – South LA*	0.0	2.6	0.5	2,857.9	2,861.0	0.0%	0.1%	0.0%	99.9%	$30	$0	$16
18	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.1	0.9	6,266.5	6,267.6	0.0%	0.0%	0.0%	100.0%	$55	$562	$49
20	Other	3.7	0.4	4.0	7,327.2	7,335.4	0.1%	0.0%	0.1%	99.9%	$64	$398	$257
	Total	**24.8**	**188.2**	**31.0**	**51,587.1**	**51,831.1**	**0.0%**	**0.4%**	**0.1%**	**99.5%**	**$67**	**$0**	**$2,065**
	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.7	3.1	21,754.3	21,764.1	0.0%	0.0%	0.0%	100.0%	$30	$0	$91
	Within entire MTC	0.0	168.2	2.1	7,595.6	7,765.9	0.0%	2.2%	0.0%	97.8%	$18	$0	$39
	Within other regions	0.0	0.0	0.0	13,112.2	13,112.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	24.8	13.3	25.8	847.5	911.4	2.7%	1.5%	2.8%	93.0%	$75	$0	$1,935

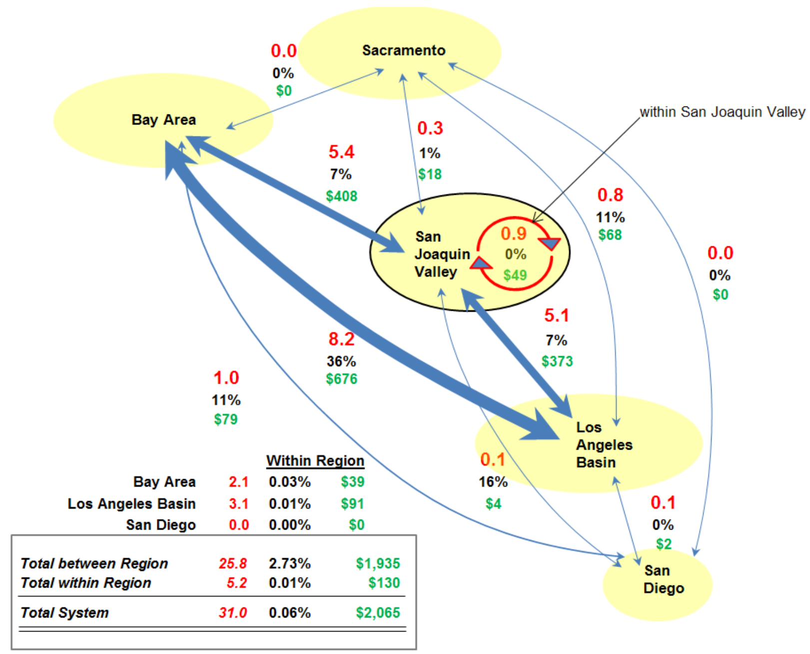
Notes: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.
Revenue excludes ancillary and bus feeder service.
Auto Operating Cost = 28 cents per mile per person (2011$).

Figure 5.14 Phase 1 Blended– Low Scenario
Major Market Forecast: 2030



Within Region			
Bay Area	1.3	0.02%	$23
Los Angeles Basin	2.5	0.01%	$75
San Diego	0.0	0.00%	$0
Total between Region	*15.3*	1.78%	$1,142
Total within Region	*3.8*	0.01%	$98
Total System	*19.1*	0.04%	$1,240

Figure 5.15 Phase 1 Blended– High Scenario
Major Market Forecast: 2030



Within Region			
Bay Area	2.1	0.03%	$39
Los Angeles Basin	3.1	0.01%	$91
San Diego	0.0	0.00%	$0
Total between Region	*25.8*	2.73%	$1,935
Total within Region	*5.2*	0.01%	$130
Total System	*31.0*	0.06%	$2,065

KEY:
X.X = Annual HSR Ridership (in millions)
X% = HSR Mode Share
$X = Annual Revenue (in millions - yr 2011 dollars)

Note: Revenues exclude ancillary and bus feeder services.

With Los Angeles Union Station at the south end of the line, boardings at the San Fernando station – 1,400 under the Low Scenario – are expected to be significantly less than with the Bay to Basin Scenario – 13,500. Similarly, the station boardings at San Jose under this scenario – 2,800 are considerably less than the 10,100 forecast under the Bay to Basin Scenario (under the Low Scenario).

Table 5.17 Forecast of Daily Station Boardings – Phase 1 Blended
2030

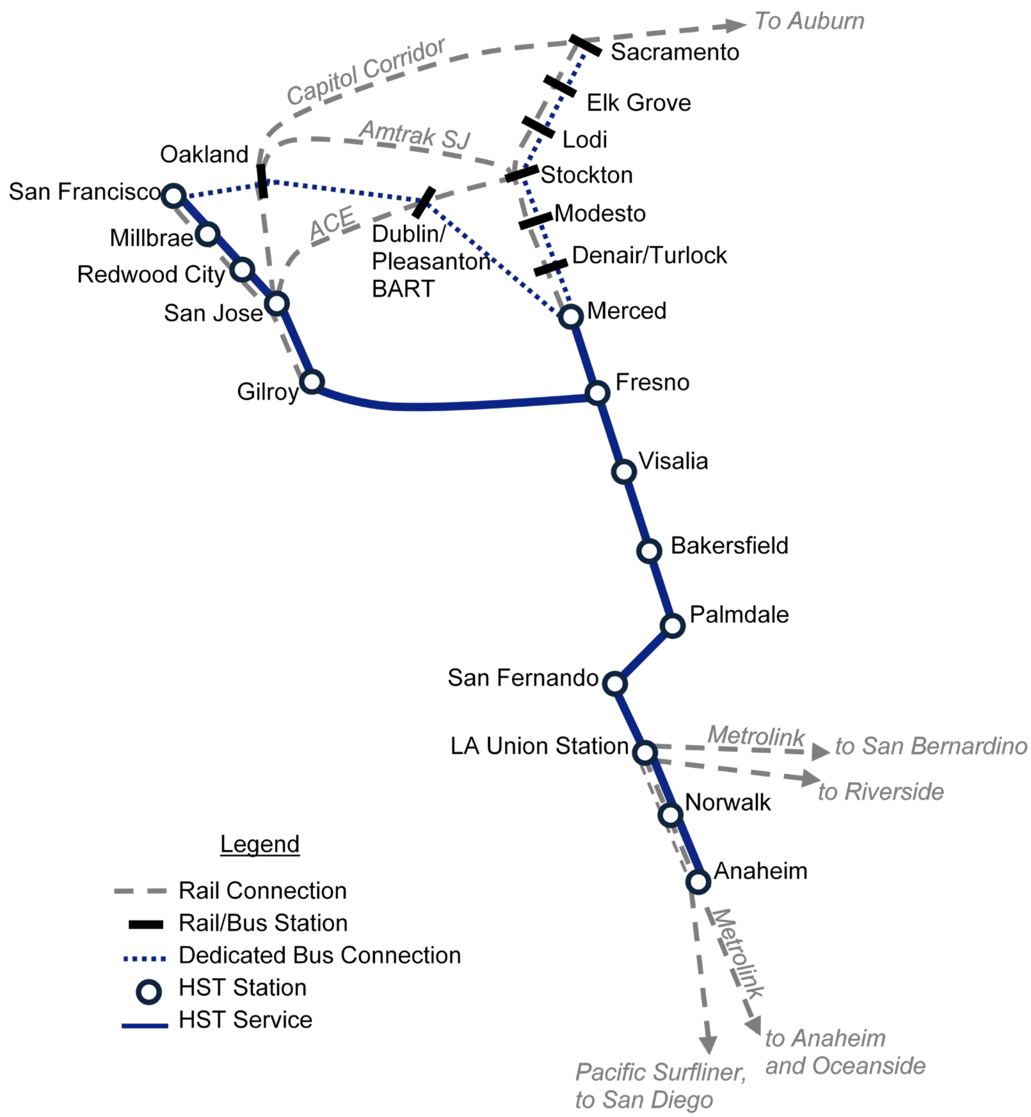
	Low Scenario (12-043d)				High Scenario (12-042b)			
Station	**Between Regions**	**Within SCAG**	**Within MTC**	**Total**	**Between Regions**	**Within SCAG**	**Within MTC**	**Total**
San Francisco (Transbay)	9,300	–	2,200	11,500	16,900	–	3,600	20,500
Millbrae	1,100	–	1,500	2,600	2,000	–	2,200	4,200
San Jose	2,800	–	500	3,300	5,000	–	1,100	6,100
Gilroy	2,000	–	300	2,300	3,400	–	500	3,900
Merced	3,300	–	–	3,300	7,000	–	–	7,000
Fresno	2,200	–	–	2,200	3,100	–	–	3,100
Visalia	1,100	–	–	1,100	1,500	–	–	1,500
Bakersfield	2,000	–	–	2,000	5,000	–	–	5,000
Palmdale	2,000	3,500	–	5,500	3,800	4,300	–	8,100
San Fernando	1,400	2,300	–	3,700	2,100	2,700	–	4,800
Los Angeles Union Station	14,800	3,600	–	18,400	20,800	4,500	–	25,300
Daily	42,000	9,400	4,500	55,900	70,600	11,500	7,400	89,500
Annual (Millions)	15.3	2.5	1.3	19.1	25.8	3.1	2.1	31.0

Source: Cambridge Systematics, Inc.

Phase 1 Full Build (option)

The Phase 1 Full Build scenario has a northern terminus at San Francisco and southern terminus at Anaheim. Dedicated coach service would be provided from Merced to Sacramento (Figure 5.16). HST trains will have dedicated tracks from San Jose to San Francisco, rather than sharing tracks with Caltrain, which allows for faster and more frequent service. In addition, a HST station at Redwood City is provided.

Figure 5.16 Phase 1 Full Build – HST and Conventional Rail Services



Note: Existing Amtrak – San Joaquin service to Bakersfield discontinued at Merced.

Ridership and Revenue Forecasts

Systemwide HST ridership is expected to increase approximately 30 percent compared to the Phase 1 Blended scenario (Table 5.18 and 5.19 and Figure 5.17 and 5.18). The average increase is due to the extension of HST service south to Anaheim, where it is accessible by a larger portion of LA Basin travelers, and improved HST services. CS forecast that HST ridership will range from 25.8 million in the low scenario and 39.1 million with the high scenario. Nearly 70 percent of the trips are expected to be interregional.

The market with the highest HST ridership is LA Basin-Bay Area (5.6 million in the low scenario and 8.6 million in the high scenario). HST mode share is also expected to be higher than air in this market. The San Joaquin Valley-LA Basin is expected to be the second highest market, with 4.1 million in the Low Scenario and nearly 5.5 million in the high scenario (Tables 5.18 and 5.19). Intraregional travel in the Los Angeles Basin is expected to increase substantially, from 2.5 million in Phase 1 Blended (Low) to 6.2 million in Phase 1, due to the additional service to Anaheim.

Table 5.18 Phase 1 Full Build, Low (12-047b) – Annual Region to Region Forecasts by Mode

Year 2030

		Ridership (Millions)					Mode Share			Average Fare (2011$)			HST Revenue
	Market	Air	Conv. Rail	HST	Auto	Total	Air	Conv. Rail	HST	Auto	HST	Air	2011$
1	LA Basin – Sacramento	1.7	0.0	0.4	3.6	5.6	30.1%	0.0%	6.4%	63.5%	$83	$185	$30
2	LA Basin – San Diego	0.1	7.8	1.2	459.8	468.9	0.0%	1.7%	0.3%	98.1%	$35	$0	$41
3	LA Basin – Bay Area	5.0	0.0	5.6	6.9	17.5	28.6%	0.0%	32.2%	39.2%	$83	$174	$469
4	Sacramento – Bay Area	0.0	1.4	0.0	50.1	51.5	0.0%	2.7%	0.0%	97.3%	$25	$280	$0
5	San Diego – Sacramento	1.4	0.0	0.0	0.2	1.5	88.7%	0.0%	1.3%	10.0%	$83	$109	$2
6	San Diego – Bay Area	4.5	0.0	1.5	1.8	7.9	57.2%	0.0%	19.5%	23.3%	$83	$101	$128
7	Bay Area – San Joaquin Valley	0.1	0.1	2.3	25.4	27.9	0.4%	0.4%	8.2%	91.1%	$71	$315	$163
8	San Joaquin Valley – LA basin	0.7	0.0	4.1	43.7	48.5	1.3%	0.0%	8.5%	90.1%	$70	$719	$291
9	Sacramento – San Joaquin Valley	0.0	0.0	0.0	3.7	3.7	0.6%	0.2%	0.5%	98.7%	$69	$105	$1
10	San Diego – San Joaquin Valley	0.0	0.0	0.0	0.0	0.0	35.0%	0.0%	17.5%	47.5%	$77	$406	$1
11	Within Bay Area Peninsula*	0.0	116.3	1.8	6,643.9	6,762.0	0.0%	1.7%	0.0%	98.3%	$18	$0	$33
12	Within North LA basin*	0.0	2.7	2.7	8,186.6	8,192.1	0.0%	0.0%	0.0%	99.9%	$28	$0	$75
14	Within South LA basin*	0.0	1.0	1.0	10,161.2	10,163.2	0.0%	0.0%	0.0%	100.0%	$24	$0	$24
15	North LA – South LA*	0.0	3.1	2.5	2,776.1	2,781.7	0.0%	0.1%	0.1%	99.8%	$27	$0	$68
18	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.0	0.1	4,782.3	4,782.4	0.0%	0.0%	0.0%	100.0%	$50	$264	$5
20	Other	2.5	0.1	2.5	6,253.9	6,259.0	0.0%	0.0%	0.0%	99.9%	$72	$465	$181
	Total	**16.0**	**132.5**	**25.8**	**47,826.8**	**48,001.0**	**0.0%**	**0.3%**	**0.1%**	**99.6%**	**$59**	**$0**	**$1,510**
	Within San Diego region	0.0	0.0	0.0	8,427.5	8,427.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.8	6.2	21,124.0	21,136.9	0.0%	0.0%	0.0%	99.9%	$27	$0	$167
	Within entire MTC	0.0	116.3	1.8	6,643.9	6,762.0	0.0%	1.7%	0.0%	98.3%	$18	$0	$33
	Within other regions	0.0	0.0	0.0	10,744.2	10,744.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	16.0	9.4	17.8	887.2	930.4	1.7%	1.0%	1.9%	95.4%	$74	$0	$1,310

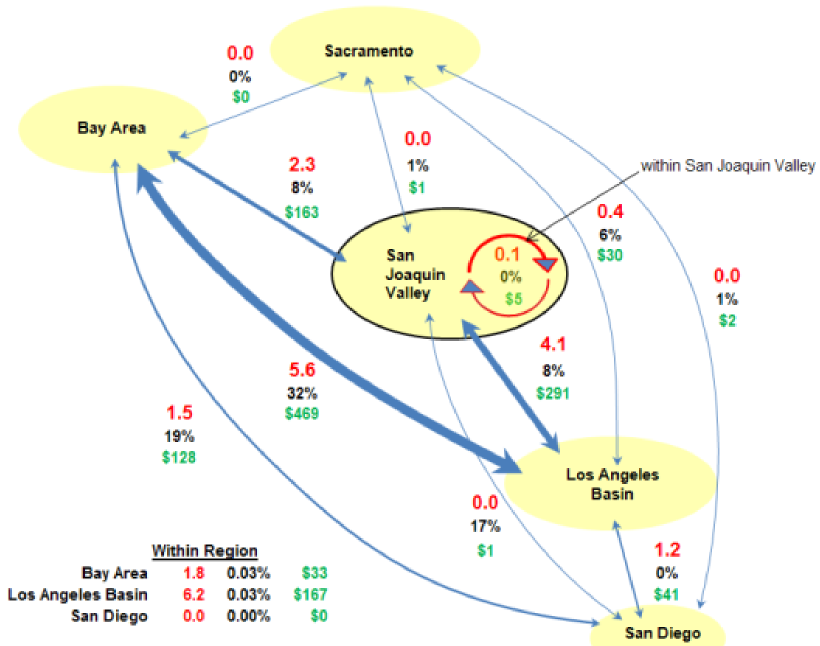
Notes: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.
Revenue excludes ancillary and bus feeder service.
Auto Operating Cost = 20 cents per mile per person (2011$).

Table 5.19 Phase 1 Full Build, High (12-046) – Annual Region to Region Forecasts by Mode *Year 2030*

		Ridership (Millions)					Mode Share			Average Fare (2011$)			HST Revenue
	Market	Air	Conv. Rail	HST	Auto	Total	Air	Conv. Rail	HST	Auto	HST	Air	2011$
1	LA Basin – Sacramento	2.5	0.0	0.7	4.5	7.6	32.2%	0.0%	9.2%	58.5%	$83	$166	$58
2	LA Basin – San Diego	0.0	7.9	0.2	131.3	139.3	0.0%	5.7%	0.1%	94.2%	$34	$0	$6
3	LA Basin – Bay Area	7.7	0.0	8.6	6.4	22.7	33.8%	0.0%	38.0%	28.2%	$83	$170	$714
4	Sacramento – Bay Area	0.0	3.9	0.0	70.2	74.1	0.0%	5.3%	0.0%	94.7%	$24	$278	$0
5	San Diego – Sacramento	1.7	0.0	0.0	0.0	1.8	96.0%	0.0%	1.6%	2.3%	$83	$109	$2
6	San Diego – Bay Area	6.1	0.0	1.9	0.8	8.9	69.3%	0.0%	21.8%	8.9%	$83	$102	$160
7	Bay Area – San Joaquin Valley	0.6	0.8	5.6	66.7	73.6	0.8%	1.1%	7.6%	90.5%	$75	$358	$421
8	San Joaquin Valley – LA basin	1.2	0.0	5.5	63.1	69.9	1.8%	0.0%	7.8%	90.4%	$72	$728	$396
9	Sacramento – San Joaquin Valley	0.3	0.1	0.2	22.0	22.5	1.4%	0.4%	0.8%	97.4%	$72	$105	$13
10	San Diego – San Joaquin Valley	0.1	0.0	0.1	0.2	0.3	26.0%	0.1%	16.9%	57.0%	$75	$421	$4
11	Within Bay Area Peninsula*	0.0	168.0	3.4	7,594.7	7,766.1	0.0%	2.2%	0.0%	97.8%	$19	$0	$64
12	Within North LA basin*	0.0	3.1	3.2	8,430.1	8,436.4	0.0%	0.0%	0.0%	99.9%	$28	$0	$89
14	Within South LA basin*	0.0	1.1	1.2	10,464.1	10,466.3	0.0%	0.0%	0.0%	100.0%	$25	$0	$29
15	North LA – South LA*	0.0	2.6	2.8	2,855.1	2,860.5	0.0%	0.1%	0.1%	99.8%	$28	$0	$80
18	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
19	Within San Joaquin Valley	0.0	0.1	0.9	6,266.5	6,267.6	0.0%	0.0%	0.0%	100.0%	$56	$547	$51
20	Other	3.6	0.4	4.8	7,326.6	7,335.4	0.0%	0.0%	0.1%	99.9%	$67	$397	$320
	Total	**23.9**	188.0	39.1	51,579.6	51,830.6	0.0%	0.4%	0.1%	99.5%	**$62**	**$0**	**$2,409**
	Within San Diego region	0.0	0.0	0.0	8,277.5	8,277.5	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Within entire LA basin	0.0	6.7	7.2	21,749.3	21,763.2	0.0%	0.0%	0.0%	99.9%	$28	$0	$198
	Within entire MTC	0.0	168.0	3.4	7,594.7	7,766.1	0.0%	2.2%	0.0%	97.8%	$18	$0	$64
	Within other regions	0.0	0.0	0.0	13,112.2	13,112.2	0.0%	0.0%	0.0%	100.0%	$0	$0	$0
	Total between regions	23.9	13.3	28.4	846.0	911.6	2.6%	1.5%	3.1%	92.8%	$76	$0	$2,148

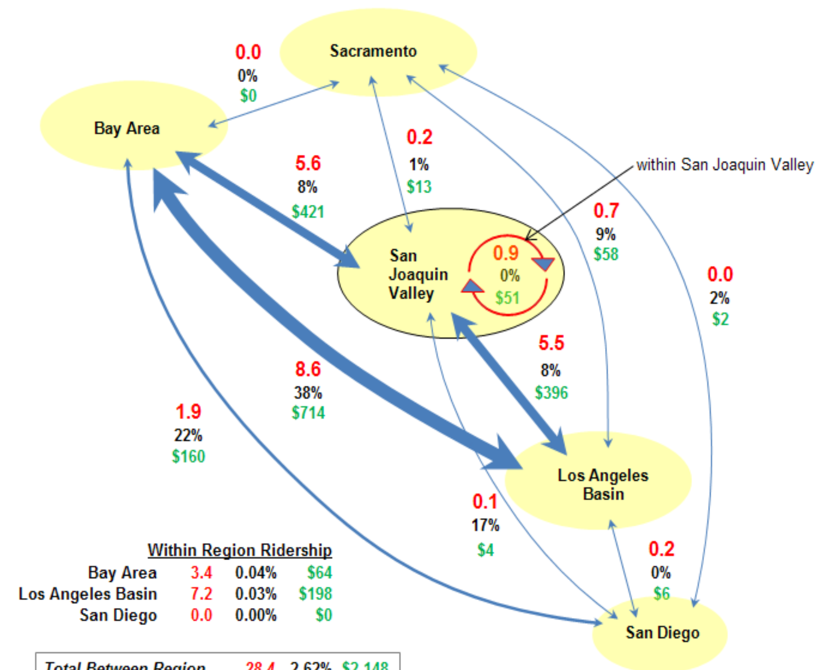
Notes: Conventional rail includes Metrolink and Surfliner within the LA Basin, and BART, Caltrain, ACE and Capitol Corridor within the Bay Area.
Revenues exclude ancillary and bus feeder services.
Auto Operating Cost = 28 cents per mile per person (2011$).

Figure 5.17 Phase 1 Full Build – Low Scenario
Major Market Forecast: 2030



Total between Region	*17.8*	1.72%	$1,310
Total within Region	*8.0*	0.02%	$200
Total System	*25.8*	0.05%	$1,510

Figure 5.18 Phase 1 Full Build – High Scenario
Major Market Forecast: 2030



Total Between Region	*28.4*	2.62%	$2,148
Total Within Region	*10.6*	0.02%	$262
Total System	*39.1*	0.08%	$2,409

Note: Revenues exclude ancillary and bus feeder services.

KEY:
X.X = Annual HSR Ridership (in millions)
X% = HSR Mode Share
$X = Annual Revenue (in millions - yr 2011 dollars)

With the southern terminus further south at Anaheim, daily station boardings at Los Angeles Union Station are expected to drop to 11,800 under the Low Scenario from the 18,400 under the Phase 1 Blended (Table 5.20).

Table 5.20 Forecast of Daily Station Boardings – Phase 1 Full Build
2030

	Low Scenario (12-046)				High Scenario (12-047b)			
Station	Between Regions	Within SCAG	Within MTC	Total	Between Regions	Within SCAG	Within MTC	Total
San Francisco (Transbay)	10,900	–	3,100	14,000	19,700	–	5,600	25,300
Millbrae	400	–	1,300	1,700	700	–	1,900	2,600
Redwood City	800	–	800	1,600	1,200	–	1,500	2,700
San Jose	2,700	–	800	3,500	4,900	–	2,000	6,900
Gilroy	2,000	–	400	2,400	3,700	–	600	4,300
Merced	3,400	–	–	3,400	6,900	–	–	6,900
Fresno	2,400	–	–	2,400	3,300	–	–	3,300
Visalia	1,100	–	–	1,100	1,500	–	–	1,500
Bakersfield	2,300	–	–	2,300	5,500	–	–	5,500
Palmdale	3,000	3,900	–	6,900	3,800	5,100	–	8,900
San Fernando	2,000	3,600	–	5,600	3,400	4,300	–	7,700
Los Angeles Union Station	3,300	8,500	–	11,800	4,200	9,500	–	13,700
Norwalk	1,700	3,300	–	5,000	2,500	3,600	–	6,100
Anaheim	12,700	3,100	–	15,800	16,600	3,700	–	20,300
Daily	48,700	22,400	6,400	77,500	77,900	26,200	11,600	115,700
Annual (Millions)	17.8	6.2	1.8	25.8	28.4	7.2	3.4	39.1

Source: Cambridge Systematics, Inc.

5.6 ADJUSTMENTS FOR STARTING DATE RAMP-UP AND GROWTH

When new transportation or other services are introduced, it generally takes time to reach their full long-term market potential. For HST this implies that ridership will ramp up over time, and experience from other HST introductions conforms to the general expectation. Figure 5.19 shows the growth in ridership for six European services from France (TGV), Britain (Eurostar), Spain (Madrid-Seville), and Belgium (Thalys).

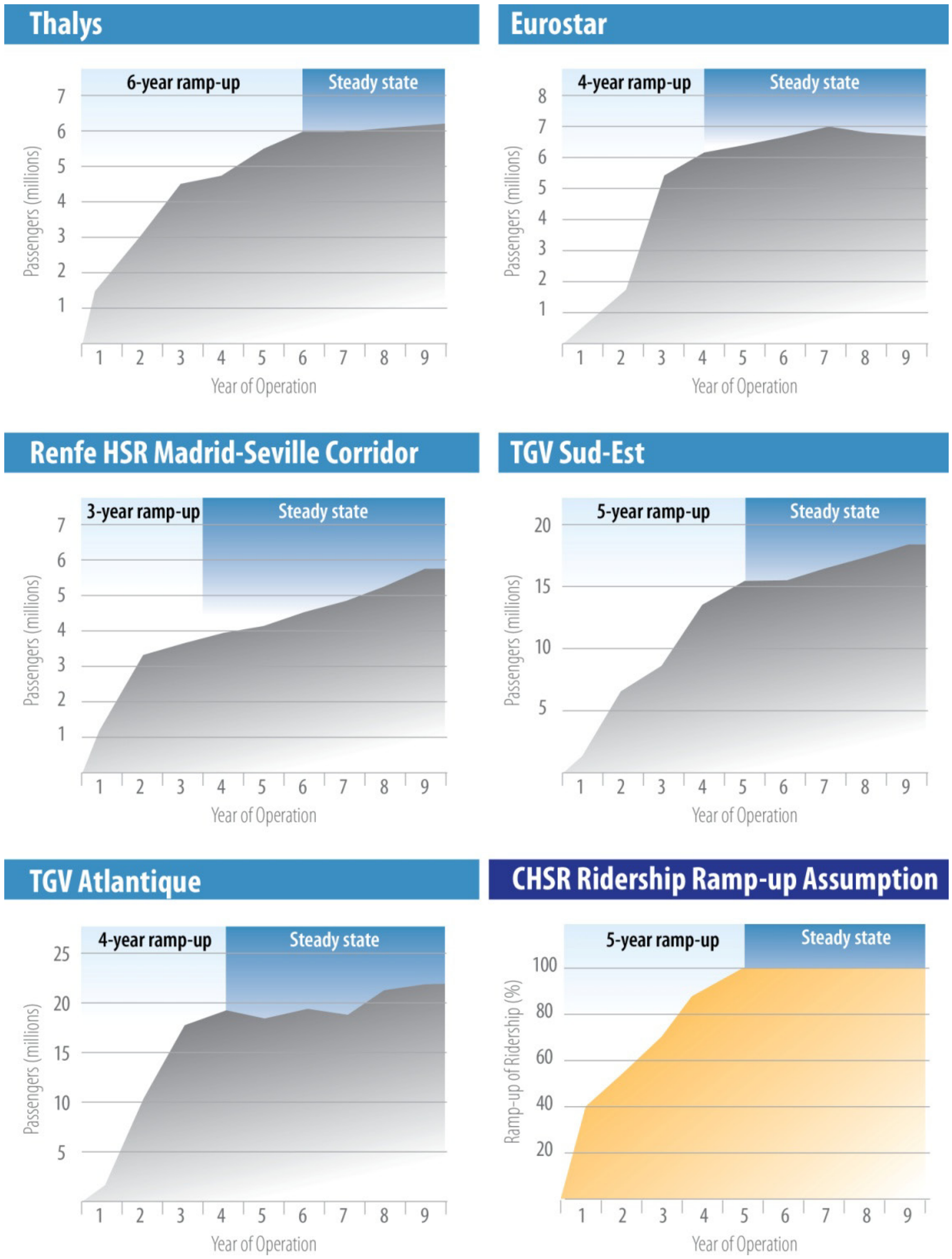
- The fastest ramp-up was in the Madrid-Seville line with an increase over two years to a steady growth in ridership.
- The next fastest was the TGV between Paris and the Atlantic Coast regions, reaching "steady state" ridership in the third to fourth year, followed by a steady period, and then more growth reflecting further line improvements.
- At the slower end, the Thalys system – among Belgium, Holland, western Germany, and France – took six years to reach a steady point.

In developing its ramp-up assumption for the ridership forecast, the Authority drew upon this international experience (see additional discussion below). For the California forecast, a five-year ramp-up of ridership and revenue was assumed after each of the implementation steps is opened for revenue service according to the following schedule.

- Forty percent of the expected ridership potential is achieved in year 1;
- Fifty-five percent in year 2;
- Seventy percent in year 3;
- Eighty-five percent in year 4; and
- One hundred percent in year 5.

In addition to ramping up at the start of service, ridership and revenue will grow as population, employment, and trip-making increases. To support financial planning efforts associated with this Business Plan, the 2030 forecasts were decreased by 1.0 percent per year to produce estimates for the years 2022 to 2029. To produce forecasts for the years 2031 to 2060, the 2030 forecasts were increased by 0.5 percent per year. These rates are based on the changes in results among three test forecasts using post-recession population and demographic information from Woods & Poole for the years 2020, 2030, and 2050.

Figure 5.19 Ridership Ramp Up and Growth
Representative European HST Systems



Source: Parsons Brinckerhoff.

5.7 DISCLAIMER

The information and results presented in this memorandum are estimates and projections that involve subjective judgments, and may differ materially from the actual future ridership and revenue. This memorandum is not intended nor shall it be construed to constitute a guarantee, promise, or representation of any particular outcome(s) or result(s). Further, the material presented in this memorandum is provided for solely purposes of the Authority's business planning and should not be used for any other purpose.

A. Analysis of an “Equivalent” Northeast Corridor)NEC) Alternative (“NE-like”) for the California High-Speed Rail (CHSR) Phase 1 System

Memorandum

TO: California High Speed Rail Authority
Ridership and Revenue Forecasting Peer Review Panel

FROM: Cambridge Systematics

DATE: January 8, 2012 (Revised)

RE: Analysis of an "Equivalent" Northeast Corridor (NEC) Alternative ("NEC-like") for the California High Speed Rail (CHSR) Phase 1 System

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The purpose of this memo is to address the frequently raised question regarding the CHSR project, along the lines of: "How can the California High Speed Rail (CHSR) system have 30 or 40 million riders when the denser, more transit-friendly Northeast Corridor (NEC) has only 3 million?" To do this we developed a CHSR scenario that has service levels comparable to those offered by Acela service in the NEC between Washington, D.C. and Boston. We compared the 2030 ridership from this "NEC-like" service to CHSR service as proposed in the CHSR 2012 Business Plan as well as to the NEC itself.

The analysis proves the reasonableness of the existing CHSR model used to support the Business Plan. When we modeled the much slower, far less frequent, and far more expensive "NEC-like" operating conditions in the CHSR corridor for Phase 1 in 2030, we found that:

- The model run of the California HSR system with "NEC-like" service produces 23 percent—less than one quarter—of the ridership with a comparable model run with planned CHSR service levels,

- The interregional ridership from the model run of the California HSR system with "NEC-like" service is about the same as projected 2030 ridership on the premium Acela service in the Northeast corridor. Since the Acela does not have intraregional service, this is the best comparison between the two different systems. This demonstrates that the ridership forecasts being used for the California system are not 10 or more times that in the Northeast when you put them on similar footing. Using similar assumptions, the two systems are actually quite comparable.

These results provide additional support to the robustness of the existing CHSR model and its ability to project the range of rail ridership for different fare and level of service scenarios.

CS ran this test using the CHSR model that was used to support the current Business Plan without any other modifications. In particular, no changes were made to any modal constants or to the coefficients of any model component. Finally, there has been no effort to validate the existing model in preparation for this "NEC-like" model run. We only made changes to model inputs to match NEC service levels: travel times, speeds, and fares.

This memo covers these aspects of the analysis:

1. A summary of similarities and differences between the corridors and the findings;

2. NEC background;

3. A description of the "NEC-like" service used for the analysis;

4. Forecasts for an "NEC-like" rail service in California, and a comparison to CHSR service under service levels proposed by the California HSRA and those with "NEC-like" conditions; and

5. Forecasts of ridership growth in the NEC, and comparisons with the CHSR service under NEC-like conditions in 2030.

1.0 Summary

Any comparisons between the NEC and the CHSR corridors must recognize the differences in terms of underlying transportation and urban geographies, the most important of which are:

- The speeds of the existing NEC system and the planned California system are vastly different. The NEC average speed between Washington and Boston is about 70 miles per hour while the HSR Phase 1 system average speed between San Francisco and Los Angeles is planned to be approximately 140 miles per hour.

- The frequencies of service for the existing NEC system and the planned California system are vastly different. The NEC has 9-15 trains per day while the HSR Phase 1 system would have up to 48 trains per day, depending on the market.

- Acela is the premium portion of the Northeast Corridor rail system, with a parallel slower service with more stops. Acela carries about 31 percent of the total rail ridership in the NEC. The California HSR system would not have a parallel slower service, although it would have regional rail service in some markets.

- Acela does not serve an intraregional market, which the California system would.

- The Acela fare structure is substantially higher than the planned CHSR fare structure, because the CHSR fares were designed to be 83 percent of airfares from the San Francisco Bay Area to the Los Angeles Basin, with lower fares for shorter trips.

- Any comparison between CHSR and Acela should be done in a common year. The basic premise of the question at the beginning of this memo compares Acela ridership today with CHSR ridership almost 20 years from now. In this memo, we compare forecast 2030 Acela ridership with forecast 2030 California HSR ridership.

When we mimic the speeds, frequencies, and fare structure of the NEC for the California HSR system, ridership is significantly less than the 2030 forecasts for the CHSR planned service. The "NEC-like" scenario draws only 23 percent of the total ridership projected under the Phase 1 service levels (Scenario 14b)[1] and 19 percent of the larger interregional market (Table S-1).

Table S-1: Comparison of 2030 CHSR ridership Scenario 14b versus NEC-like

	2030 CHSR Ridership (millions)		Ratio of "NEC-like" to 14b Scenario
	Scenario 14b	"NEC-like"	
Interregional	28.6	5.5	19%
Intraregional	8.5	3.0	35%
Total	37.1	8.5	23%

Source: CHSR model runs.

When we compare the slower, less frequent, and more expensive "NEC-like" service applied in California to the NEC itself, we expect the total ridership in California (interregional plus intraregional) to be about 93 percent of projected 2030 ridership on the premium Acela service in the NEC—about the same (Table S-2.) Since the Acela does not have intraregional service, this is the best comparison between the two different systems. This demonstrates that the ridership forecasts being used for the California system are not 10 or more times that in the Northeast—when you put them on similar footing, they are about the same.

If you take into account the entire NEC rail system—both the Acela express and the slower Northeast Regional Service, and compare it to the entire California HSR System—both interregional and intraregional, the "NEC-like" California system is forecast to have about 45 percent of the ridership of the NEC itself (Table S-2.) Since the rail system in the northeast is so much more extensive than that planned in California, it is reasonable that the California system would have much less ridership.

[1] As documented in the "Draft Technical Memorandum, California High-Speed Rail 2012 Business Plan, Ridership and Revenue Forecasting," October 12, 2011, (Section 5.1), CS ran 30 scenarios to test alternatives related to the Business Plan. Of these, five were used directly in the Plan, and two reflected anticipated Phase 1 conditions (14b and 17c.) Scenario 14b was used by the Program Manager to create the Business Plan High scenario. We used the Scenario 14b model as the basis for the "NEC-like" run, excluding any further adjustments, to ease the comparison. Therefore, the values for Scenario 14b match those in the CS tech memo, not the numbers in the 2012 Business Plan document.

Table S-2: Comparison of 2030 CHSR ridership with ”NEC-like” Service to Forecast NEC Ridership in 2030 (millions)

	2030 CHSR Annual Ridership with "NEC-like" Service	Expected 2030 Annual Ridership1 in NEC	Ratio: CHSR w/ "NEC-like" to NEC
Interregional (HSR or Acela)	5.5	5.9	93%
Intraregional (HSR)	3.0	–	N/A
Northeast Regional Service	–	13.1	N/A
Total	8.5	19.0	45%

Sources: CS analysis of the Northeast Corridor Infrastructure Master Plan and CHSR model runs

2.0. NEC Background

2.1. Acela Fares

Table 1 shows the 2011 Acela fare structure.

2.2. Acela Schedule

Table 2 shows the 2011 Acela schedule. Hourly departures are offered from Washington between the hours of 5 AM and 7 PM, with some of the trains terminating at New York City Penn Central Station and some running through to Boston.

The schedule provides the following daily frequency of express service between the major NEC city pairs:

- New York to Boston: 10 express trains/day
- Washington to New York: 15 express trains/day
- Washington to Boston: 9 express trains/day

Table 1. Year 2011 Acela Fares (One-Way Advance Purchase Fares) *In 2011 Dollars*

	South Station	Back Bay	Route 128	Providence	New London	New Haven-Union Station	Stamford	NYC Penn Station	Newark Penn Station	MetroPak	Trenton Rail Station	Phily - 30th Street Station	Wilming-ton Station	Baltimore Penn Station	BWI Rail Station	Wash DC Union Station
Boston: South Station		n/a	n/a	$35	$40	$100	$103	$103	$104	$104	n/a	$150	$160	$160	$160	$160
Boston: Back Bay	n/a		n/a	$35	$71	$96	$97	$101	$101	$104	n/a	$148	$155	$160	$160	$160
Route 128	n/a	n/a		$35	$60	$94	$97	$102	$101	$104	n/a	$147	$155	$160	$160	$160
Providence	$35	$35	$35		$49	$77	$94	$99	$102	$98	n/a	$140	$156	$160	$160	$160
New London	$40	$71	$60	$49		$48	$82	$93	$115	$98	n/a	$153	$161	$177	$177	$177
New Haven-Union Station	$100	$96	$94	$77	$48		$50	$67	$69	$82	n/a	$106	$115	$140	$140	$155
Stamford	$103	$97	$97	$94	$82	$50		$67	$69	$73	n/a	$100	$109	$140	$140	$152
NYC Penn Station	$103	$101	$102	$99	$93	$67	$67		$40	$45	$76	$109	$110	$144	$140	$149
Newark Penn Station	$104	$101	$101	$102	$115	$69	$69	$40		$43	$67	$108	$110	$144	$138	$138
MetroPark	$104	$104	$104	$98	$98	$82	$73	$45	$43		$63	$94	$98	$150	n/a	$156
Trenton Rail Station	n/a	n/a	n/a	n/a	n/a	n/a	n/a	$76	$67	$63		$53	$76	$139	n/a	$146
Phila - 30th Street Station	$150	$148	$147	$140	$153	$106	$100	$109	$108	$94	$53		$46	$90	$86	$110
Wilmington Station	$160	$155	$155	$156	$161	$115	$109	$110	$110	$98	$76	$46		$65	$66	$95
Baltimore Penn Station	$160	$160	$160	$160	$177	$140	$140	$144	$144	$150	$139	$90	$65		$25	$40
BWI Rail Station	$160	$160	$160	$160	$177	$140	$140	$140	$138	n/a	n/a	$86	$66	$25		$35
Washington Union Station	$160	$160	$160	$160	$177	$155	$152	$149	$138	$156	$146	$110	$95	$40	$35	

Source: Amtrak website.
Note: Fares are for Monday June 27, 2011; business class seat (lowest Acela fare). When there were multiple fares, the average was taken.

Table 2. Year 2011 Acela Scheduled Travel Times in Minutes (Northbound)

	Distance From Washington	Scheduled Travel Time by Departure Time							
		5 AM	6 AM	6:20AM	7AM	8 AM	9 AM	10 AM	11 AM
Washington	0.0	0	0		0	0	0	0	0
BWI	30.0		21		21	21	21	21	21
Baltimore	41.0	30	35		35	35	35	35	35
Wilmington	109.9	71	76		76	76	76	76	76
Philadelphia	135.2	90	93		93	93	93	93	93
Trenton	168.2								
Metropark	201.7								
Newark, NJ	215.7	150	150		150	150	150	150	150
NYC Penn Station	225.7	163	161	0	165	161	161	164	163
Stamford	261.7	223		44	223		224	224	
New Haven, CT	300.9	266		90	267		267	270	
New London	351.5			138					
Providence	413.7	355		176	355		348	348	
Route 128	445.9	384		205	385		381	382	
Back bay	456.9	395		215	395		391	391	
South Station, MA	458.0	400		221	402		397	400	

Source: Amtrak timetables.

Table 2. Year 2011 Acela Scheduled Travel Times in Minutes (Northbound) (Continued)

	Distance From Washington	Departure Time							
		12PM	1PM	2PM	3PM	4PM	5PM	6PM	7PM
Washington	0.0	0	0	0	0	0	0	0	0
BWI	30.0				21				
Baltimore	41.0	30	30	30	35	30	30	30	30
Wilmington	109.9	71	71	71	76	71	71	71	71
Philadelphia	135.2	88	88	88	93	90	90	90	90
Trenton	168.2								115
Metropark	201.7	128	128	128		131	131	131	131
Newark, NJ	215.7	150	150	150	150	150	150	150	150
NYC Penn Station	225.7	165	165	165	165	165	165	165	165
Stamford	261.7			223	227	224			
New Haven, CT	300.9		266	270		270			
New London	351.5					312			
Providence	413.7	348	355	355	354	355			
Route 128	445.9	381	386	385	384	385			
Back bay	456.9	391	396	395	395	395			
South Station, MA	458.0	397	402	401	402	401			

Source: Amtrak timetables.

2.3. *Acela Ridership*

Table 3 shows the Acela ridership and revenue for fiscal years 2007 through 2010.

Table 3. Acela Ridership for Fiscal Years 2007 through 2010

Acela Express	FY 2007	FY 2008	FY 2009	FY 2010
Ridership (millions)	3.2	3.4	3.0	3.2
Ticket Revenue (millions)	$403.6	$467.8	$409.3	$440.1
Average Revenue/Rider	$126	$138	$136	$137

Note: Fiscal year starts in October
Source: Amtrak News Release – ATK-09-074 from October 12, 2009; ATK-10-134 from October 11, 2010.

2.4. *Overall Ridership in the NEC*

Acela serves only 31 percent of the overall interregional rail ridership in the NEC (Table 4.) This is important because the Northeast Regional component of the NEC carries significant numbers of riders who elect to use the non-express component due to lower prices, different frequencies of service, better connections, or other reasons.

Table 4. Rail Ridership in the Northeast Corridor in FY 2010

Type of Service	Ridership	Percent
Acela Express	3.2	31%
Northeast Regional	7.1	68%
Total	**10.4**	**100.0%**

Source: Amtrak News Release
Notes: Fiscal Year is from October 1 to September 30.
Numbers may not add due to rounding.

2.5. *Comparison of Air Markets between NEC and California*

The NEC and California interregional air markets are comparable in size, based on the analysis of FAA data prepared by America 2050[2] (Table 5). However, the NEC air market is a little smaller and spread among more city pairs than the California market.

[2] America 2050, "High Speed Rail in America," January 2011.

Table 5. Regional Air Markets in the Northeast and in California

City Pair	Annual 2009 Passengers (mil)
Northeast Corridor	
New York to Boston	1.3
New York to Washington	1.2
Washington to Boston	0.8
Baltimore to Providence	0.4
Richmond to New York	0.3
Baltimore to Boston	0.3
Hartford to Baltimore	0.3
Hartford to Washington	0.2
Washington to Philadelphia	0.2
Providence to Washington	0.2
New York to Providence	0.1
Total	**5.1**
California Corridor	
San Francisco to Los Angeles	3.1
Los Angeles to Sacramento	1.0
San Diego to San Francisco	1.2
Los Angeles to San Jose	1.1
Total	**6.4**

Source: America 2050, "High Speed Rail in America,", January 2011.

3.0 "NEC-like" Service for CHSR

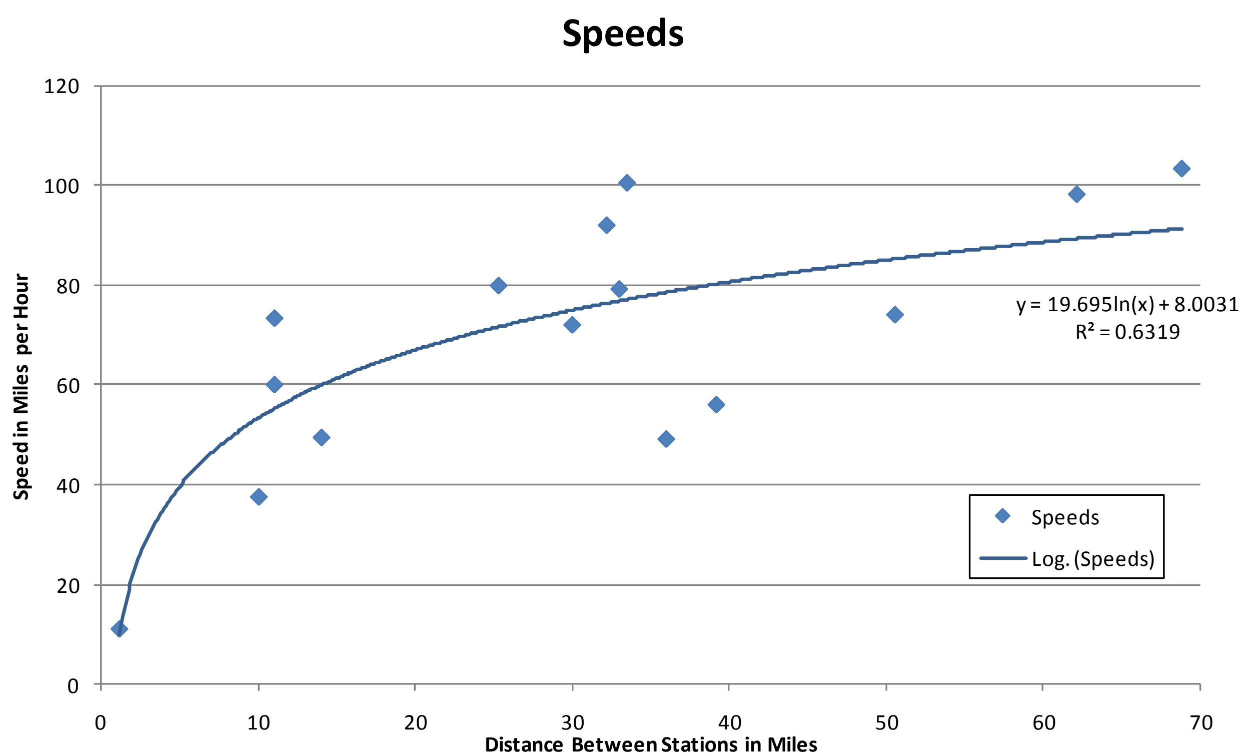
Information from the NEC service described in Section 2 was used to specify similar "NEC-like" levels of service to test the ridership for the CHSR Phase 1 system.

3.1. CHSR Speeds and Travel Times for the "NEC-like" Alternative

Information from Table 2, coupled with the station-to-station distance information was used to develop a speed model for the "NEC-like" service, and a regression model was fit to the data. Figure 1 shows the speed data by inter-station distance along with the resulting model that were used to estimate "NEC-like" station-to-station speeds for CHSR system:

$$\text{Speed} = 8.0 + 19.7 \times \text{Ln}(\text{Distance})$$

Figure 1. Acela Inter-Station Speeds and Resulting CHSR Speed Model



Source: CS from Amtrak parameters.

3.2. CHSR Fares for the "NEC-like" Alternative

CS developed fare models for the "NEC-like" system using data from Table 1 coupled with station-to-station distances. We stratified the Acela data by short distance/low fares, and longer distance/higher fare origin-destination pairs to represent intraregional and interregional fares and developed regression models that resulted in boarding- and distance-based fare components. The "NEC-like" fare structures are substantially higher than the fare structures assumed for the CHSR system. Table 6 shows hypothetical fares under the proposed CHSR service and CHSR service under an "NEC-like" fare structure by distance. Table 7 shows the resulting station-to-station fare matrix for the "NEC-like" CHSR service.

Table 6. Hypothetical Fares by Distance (in 2011 Dollars)

Distance (in Miles)	Proposed CHSR Fare Structure	CHSR Fare Structure Based on "NEC-like" Fare Structure
100	$29.95	$94.40
200	$41.18	$117.54
300	$52.42	$140.70
400	$63.65	$163.84

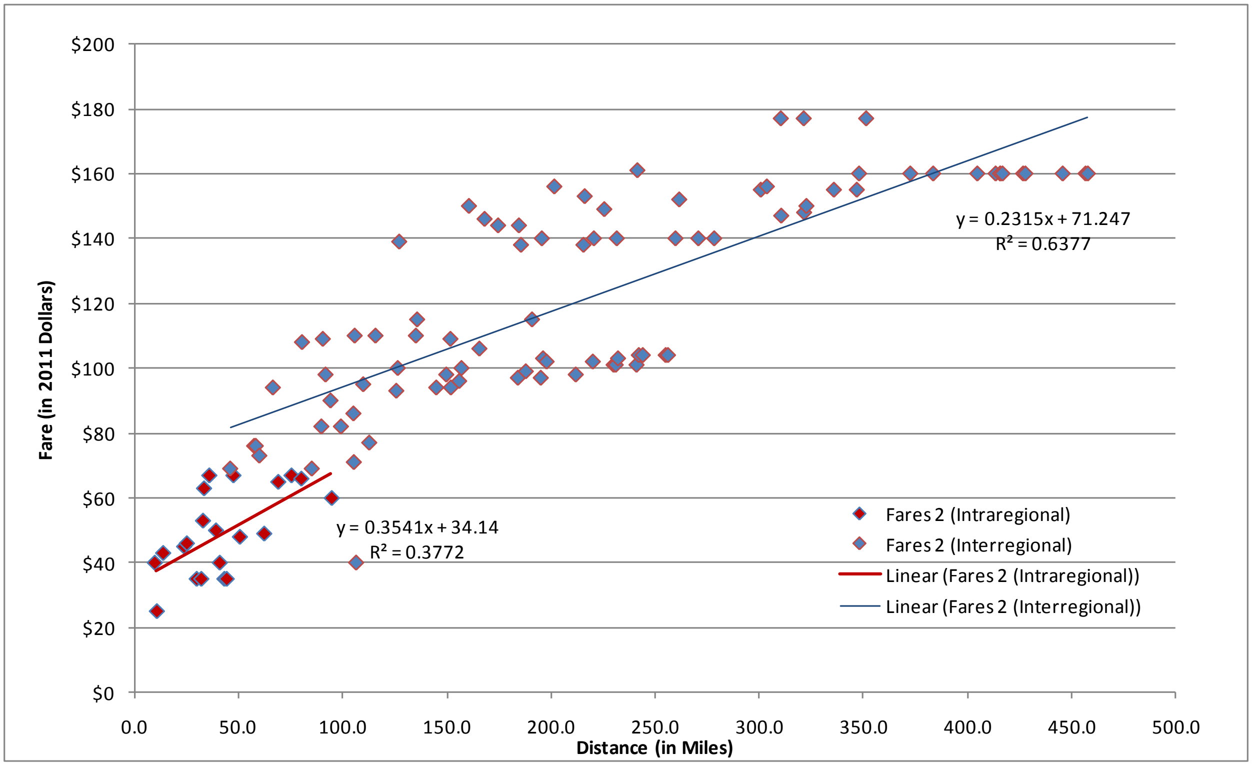
Table 7. Station to Station Fares for "NEC-like" Model Run (in 2011 Dollars)

	San Francisco (Transbay)	Millbrae	Redwood City	San Jose	Gilroy	Merced	Fresno	Visalia	Bakersfield	Palmdale	San Fernando Valley	Los Angeles Union Station	Norwalk	Anaheim
San Francisco (Transbay)	0	39	44	52	59	102	116	124	140	158	158	163	165	169
Millbrae	39	0	38	46	54	102	114	121	136	155	155	159	162	165
Redwood City	44	38	0	43	51	101	112	119	134	153	153	156	159	163
San Jose	52	46	43	0	43	97	106	113	128	147	147	151	155	157
Gilroy	59	54	51	43	0	92	102	109	124	142	142	147	149	153
Merced	102	102	101	97	92	0	86	94	111	132	133	136	140	143
Fresno	116	114	112	106	102	86	0	80	98	118	119	124	126	129
Visalia	124	121	119	113	109	94	80	0	91	112	113	117	120	124
Bakersfield	140	136	134	128	124	111	98	91	0	91	92	97	101	103
Palmdale	158	155	153	147	142	132	118	112	91	0	50	53	57	61
San Fernando Valley	158	155	153	147	142	133	119	113	92	50	0	40	45	51
Los Angeles Union Station	163	159	156	151	147	136	124	117	97	53	40	0	39	44
Norwalk	165	162	159	155	149	140	126	120	101	57	45	39	0	39
Anaheim	169	165	163	157	153	143	129	124	103	61	51	44	39	0

The assumed CHSR fare structure is based on a policy to keep fares to 83 percent of the Los Angeles Basin to San Francisco Bay Area air fares, with lower fares for shorter distances.

Figure 2 shows the Acela fares plotted against distance traveled and the resulting fare models for the CHSR system upon which we based the fares in Table 7.

Figure 2. Acela Advanced Purchase Fares by Distance and Resulting CHSR Fare Models (in 2011 Dollars)



Source: CS analysis based on Amtrak data.

The resulting "NEC-like" CHSR fare models are (in 2011$):

Intraregional: Fare = \$34.13 + \$0.354 × Distance in Miles (Eqn. 1)

Interregional: Fare = \$71.25 + \$0.231 × Distance in Miles (Eqn. 2)

In comparison, the existing CHSR fare models are:

Intraregional: Fare = \$8.74 + \$0.0748 × Distance in Miles (Eqn. 3)

Interregional: Fare = \$18.72 + \$0.1123 × Distance in Miles (Eqn. 4)

3.2. Air Fares for the "NEC-like" Alternative

Assumed 2030 air fares for the "NEC-like" CHSR run were the same as those used for the recent travel forecasts made for the 2011 business plan. Table 8 shows comparisons between "NEC-like" CHSR fares and Acela fares to air fares for selected interchanges in California and the

NEC. Air fares may be more or less than the "NEC-like" CHSR or Acela fares depending on the interchange served.

Table 8. Comparison of Air and Rail Fares (fares in 2011 Dollars)

CHSR Corridor				
From	**To**	**Air Fare (2011$)**	**CHSR Fare: "NEC-Like" (2011$)**	**Air Fare / Rail Fare**
San Francisco	Los Angeles	$93	$162	57%
San Francisco	Bakersfield	$236	$139	169%
San Francisco	Fresno	$291	$115	253%
Los Angeles	Fresno	$200	$123	163%
Northeast Corridor				
From	**To**	**Air Fare (2011$)**	**Acela Fare (2011$)**	**Air Fare / Rail Fare**
Boston	New York	$100	$103	97%
Boston	Philadelphia	$85	$150	57%
Boston	Washington	$122	$160	76%
New York	Washington	$165	$149	111%
Philadelphia	Washington	$175	$110	159%

Notes: NEC airfares from Orbitz for two week advance purchase. Site accessed 6/27/2011.
California fares based on 2005 fares factored to 2011. California CPI for 2005: 202.6. CPI for August 2011: 233.256

As a further check to ensure comparable travel times and speeds, Table 9 compares various station pairs between the "NEC-like" CHSR run and Acela.

Table 9. Comparison of Travel Time, Distance, Speed, and Stops for "NEC-like" CHSR Run and Acela

"NEC-like" CHSR Run			Acela		
San Jose to Fresno			***Washington to Philadelphia***		
Travel Time	75	minutes	Travel Time	88	minutes
Distance	130	miles	Distance	135	miles
Avg Speed	104	mph	Avg Speed	92	mph
Number of Stops	1		Number of Stops	6	
San Francisco Transbay to Bakersfield			***Washington to NYC Penn Station***		
Travel Time	225	minutes	Travel Time	165	minutes
Distance	296	miles	Distance	226	miles
Avg Speed	79	mph	Avg Speed	82	mph
Number of Stops	7		Number of Stops	6	
San Francisco Transbay to Anaheim			***Washington to South Station, MA***		
Travel Time	357	minutes	Travel Time	402	minutes
Distance	422	miles	Distance	458	miles
Avg Speed	71	mph	Avg Speed	68	mph
Number of Stops	12		Number of Stops	11	

4.0 Forecasts for an "NEC-like" Rail Service in California

Table 10 shows the results of a CHSR "NEC-like" model run summarizing region-to-region ridership and revenue forecasts for year 2030. The "NEC-like" service would be expected to serve 8.5 million riders per year in 2030, of which 5.5 million would be interregional.

Table 10. Year 2030 Annual Ridership and Revenue by Major Market (millions) "NEC-like" Rail Service in California

Market	HSR Ridership	HSR Revenue (2010$)
LA Basin – Sacramento	0.2	$29
LA Basin – San Diego	0.2	$12
LA Basin – Bay Area	0.7	$118
Sacramento – Bay Area	0.0	$0
San Diego – Sacramento	0.0	$0
San Diego – Bay Area	0.1	$13
Bay Area – San Joaquin Valley	1.2	$145
San Joaquin Valley – LA Basin	1.6	$187
Sacramento – San Joaquin Valley	0.1	$8
San Diego – San Joaquin Valley	0.1	$7
within Bay Area Peninsula	1.0	$43
within North LA Basin	1.0	$45
within South LA Basin	0.2	$7
North LA – South LA	0.8	$36
within San Diego region	0.0	$0
within San Joaquin Valley	0.2	$17
Other	1.2	$113
Total	**8.5**	**$779**
Intraregional Total (LA and SF):	*3.0*	*$131*
Interregional Total	*5.5*	*$649*

The "NEC-like" service would yield 23 percent of the total ridership expected under one of the Phase 1 scenarios (14b), and 19 percent of interregional ridership (Table 11.)

Table 11: Comparison of 2030 CHSR ridership Scenario 14b versus NEC-like

	2030 CHSR Ridership (millions)		Ratio of "NEC-like" to 14b Scenario
	Scenario 14b	"NEC-like"	
Interregional	28.6	5.5	19%
Intraregional	8.5	3.0	35%
Total	37.1	8.5	23%

Source: CHSR model runs.

5.0. Forecasts of Ridership Growth in the NEC and Comparison to CHSR with "NEC-like" Service

CS's California HSR ridership and revenue model runs have been for 2030, so any comparison to the NEC should be at a common year. The Northeast Corridor Infrastructure Master Plan[3] forecasts NEC ridership growth by segment, but this forecast is for all services—the Acela express service, the slower Northeast Regional service, and other local commuter rail services. When taken as a whole, the NEC is expected to grow by 84 percent overall between 2010 and 2030 (Table 12). CS derived this estimate by adding the individual segment ridership forecasts and comparing the totals for 2030 and 2010. The "total" line in Table 11 does not represent total ridership in the corridor, since it counts the same rider multiple times when traveling from segment to segment. But it is a useful means of estimating a corridor growth factor.

Table 12. Forecast Increase in Annual NEC Ridership by 2030 by Segment

From	To	Ridership		
		2010	2030	Growth
South Station, MA	Westerly, RI	2.0	3.9	95%
Westerly, RI	New Haven, CT	2.3	4.5	96%
New Haven, CT	New Rochelle, NY	2.8	5.4	93%
New Rochelle, NY	Penn Station, NY	2.8	5.4	93%
Penn Station, NY	Trenton, NJ	6.3	11.2	78%
Trenton, NJ	Newark, DE	6.3	11.3	79%
Newark, DE	Washington, Union Station	5.0	8.9	78%
Total (to estimate overall growth)		**27.5**	**50.6**	**84%**

Source: The Northeast Corridor Infrastructure Master Plan.

Note: Ridership figures include Amtrak regional and Acela; Forecasts are by segment, so ridership that uses more than one segment is counted multiple times. Therefore, the "total" row does not represent total ridership. The total line was developed by CS solely for the purpose of estimating a corridor-wide growth rate.

Applying the overall NEC corridor growth rate derived from the Northeast Corridor Infrastructure Master Plan (see Table 12) to the 2010 ridership levels for Acela and Northeast Regional services yields an estimate of 2030 ridership 19.0 million (Table 13). Assuming the ratio of Acela to NEC interregional riders remains constant at 31 percent, there would be 5.9 million Acela riders in 2030.

Table 13. Forecast Growth in NEC Ridership by 2030

Type of Service	2010	2030
Acela Express	3.2	5.9
Northeast Regional	7.1	13.1
Total	**10.4**	**19.0**

Source: CS analysis of data in Amtrak News Release.
Notes: Fiscal Year is from October 1 to September 30.
Numbers may not add due to rounding.

[3] The NEC Master Plan Working Group, 2010. *The Northeast Corridor Infrastructure Master Plan*.

5.2. Comparison of California "NEC-like" Service to NEC in 2030

Table 14 compares the forecast 2030 HSR ridership in California under the "NEC-like" service to the forecast 2030 annual ridership on Acela and the Northeast Regional service in the NEC. The interregional HSR ridership in California under "NEC-like service" conditions is very close to the expected 2030 projected Acela ridership—5.5 million annual riders in California versus 5.9 million in the Northeast Corridor—a difference of 7 percent.

When the intraregional service in California and the slower Northeast Regional Service in the NEC are added in, the total rail ridership in California is expected to be 45 percent of the total forecast 2030 ridership in the NEC itself. Since the rail system in the northeast is so much more extensive than that planned in California, it is reasonable that the California system would have much less ridership.

Table 14. 2030 Forecasts for CHSR with "NEC-like" Service Versus 2030 NEC Forecast

	2030 CHSR Annual Ridership with "NEC-like" Service (Millions)	Expected 2030 Annual Ridership[1] in NEC (Millions)	Ratio: CHSR w/ "NEC-like" to NEC
Interregional (HSR or Acela)	5.5	5.9	93%
Intraregional (HSR)	3.0	–	N/A
Northeast Regional Service	–	13.1	N/A
Total	8.5	19.0	45%

Source: Cambridge Systematics

1 From CS analysis of Northeast Corridor Infrastructure Master Plan

Memorandum

TO: California High Speed Rail Ridership and Revenue Peer Review Panel

FROM: Cambridge Systematics

DATE: January 19, 2012 (Revised)

RE: Addendum to Analysis of an "Equivalent" Northeast Corridor (NEC) Alternative ("NEC-like") for the California High Speed Rail (CHSR) Phase 1 System: 2008 Conditions

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This memorandum presents the supplemental analysis related to the frequently raised question regarding the CHSR project, along the lines of: "How can the California High Speed Rail (CHSR) system have 30 or 40 million riders when the denser, more transit-friendly Northeast Corridor (NEC) has only 3 million?"[1] In the January 8, 2012 memo, we reported on an analysis of a CHSR scenario that has service levels comparable to those offered by Acela service in the NEC between Washington, D.C. and Boston. We then compared the 2030 ridership from this "NEC-like" service to CHSR service as proposed in the CHSR 2012 Business Plan as well as to the forecast ridership on the NEC itself.

In this addendum, we forecast CHSR ridership and revenue for "NEC-like" service for 2008 conditions (instead of 2030) conditions, and compared the result to actual 2008 ridership on the Acela and the rest of the Northeast Corridor. The run is identical to that used for the 2030 "NEC-like" run, except for the following:

- 2008 socioeconomic conditions were based on data provided by the UC Davis ULTrans group. The UC Davis estimates are based on a population synthesis they developed for Caltrans. It is the best information available at the traffic analysis zone level for California. CS will be using the UC Davis population synthesis for the 2008 high speed rail model calibration and validation, and for 2020, 2035 and 2050 in future forecasting work.

- Driving costs were set to 20 cents in 2005 dollars, reflecting 2010 cost of driving (rather than a forecast of 2030 cost of driving)

[1] See memorandum of January 8, 2012, *Analysis of an "Equivalent" Northeast Corridor (NEC) Alternative ("NEC-like") for the California High Speed Rail (CHSR) Phase 1 System*

100 CambridgePark Drive, Suite 400
Cambridge, MA 02140
tel 617-354-0167 www.camsys.com **fax** 617-354-1542

Interregional HSR travel in California would be expected to be 2.7 million riders in 2008, with another 1.0 million intraregional riders (Table 1.) Overall, this is 10 percent of the forecast in 2030 under Scenario 14b – the most comparable model run used for the 2012 Business Plan. This big difference is attributable to

- Growth and changes in location/composition of population and employment over the 22 year period,
- Effects of slower, less frequent, and more expensive service characteristics.

Table 1: Comparison of CHSR ridership
Scenario 14b versus NEC-like
2030 and 2008

	2030 CHSR Ridership (millions)		Ratio of "NEC-like" to 14b Scenario: 2030	2008 CHSR "NEC-like" Ridership (millions)	Ratio of 2008 "NEC-like" scenario to 2030 14b Scenario:
	Scenario 14b	"NEC-like"			
Interregional	28.6	5.5	19%	2.7	9%
Intraregional	8.5	3.0	35%	1.0	12%
Total	37.1	8.5	23%	3.7	10%

Source: CHSR model runs.

The model run of 2008 interregional ridership with NEC-like service (2.7 million riders, see Table 2) is 79 percent of the actual Acela service in the Northeast Corridor (3.4 million riders). Overall ridership in the NEC-like scenario in 2008 is 34 percent of total ridership in the NEC, when intraregional riders are counted in California and Northeast Regional Service riders are counted in the NEC.

Table 2: Comparison of 2008 CHSR ridership with
"NEC-like" Service to Actual NEC Ridership in 2008 (millions)

	2008 CHSR Annual Ridership with "NEC-like" Service	Annual Ridership in NEC	Ratio: CHSR w/ "NEC-like" to NEC
Interregional (HSR or Acela)	2.7	3.4	79%
Intraregional (HSR)	1.0	–	N/A
Northeast Regional Service	–	7.5	N/A
Total	3.7	10.9	34%

Sources: CS analysis of the Northeast Corridor Infrastructure Master Plan and CHSR model runs

A simple comparison of mega region populations shows that the CHSR corridor has about 76 percent of the northeast corridor population in 2000 (Table 3). By 2025, this ratio is expected to grow to 90 percent. Therefore, an outcome that shows CHSR with NEC-like conditions in 2008 with 79 percent of the actual 2008 NEC ridership is reasonable. Further, the 2030 estimate of interregional NEC-like service in California being 93 percent of the forecast 2030 NEC service is also reasonable (from the previous memo.)

**Table 3: Mega Region Population Comparison (millions)
2000 and 2025**

	2000	2025
Northeast	49.6	58.1
California		
Northern	*12.7*	*17.3*
Southern	*24.9*	*34.7*
California Total	37.6	52.0
Ratio: California/Northeast	76%	90%

Source: Wikipedia
http://en.wikipedia.org/wiki/Megalopolis_%28city_type%29#North_America

These results demonstrate even more dramatically than the original memo that compared 2030 forecasts that the ridership and revenue model used for CHSR forecasts is reasonably sensitive to speed, frequency and fares. When faced with much slower service, operating far less frequently at higher fares—similar to those used for the Acela service in the NEC— under "today's" conditions, expected ridership plunges to the level that most observers would expect—something less than the amount actually traveling on the Acela.

B. Potential Airline Response to High-Speed Rail Service in California

Potential Airline Response to High-Speed Rail Service in California

August 2011

Prepared for

Cambridge Systematic, Inc.
100 CambridgePark Drive, Suite 400
Cambridge, MA 02140

Aviation System Consulting, LLC
805 Colusa Avenue
Berkeley, CA 94707-1838

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Introduction

The current ridership and revenue forecasts prepared for the California High-Speed Rail Authority are based on assumed airfares and airline service frequencies that reflect the air service patterns in effect in the California Corridor markets between Northern and Southern California in 2005. No adjustments are made in the ridership forecast analysis for possible airline competitive response to the introduction of high-speed rail (HSR) service. This response could take one of two forms. Airlines could reduce service frequency and/or increase fares to offset reduced load factors as air travel in these markets is reduced by the diversion of trips to HSR. Alternatively, they could attempt to retain market share by reducing fares. Furthermore, both the airline industry in general and the air service patterns in the California Corridor markets have changed significantly since 2005, due to increased competition from low-cost airlines, entry of new carriers and airline consolidation, rising fuel costs, and efforts by the legacy carriers to reduce costs. In particular, the entry of Virgin America in the San Francisco to Los Angeles market in August 2007 and the San Francisco to San Diego market in February 2008 and the competitive response from other airlines, particularly JetBlue Airways and Southwest Airlines, has significantly changed the patterns of air service between the Bay Area and Southern California.

At the same time, the competitive response of the existing airlines to the entry of Virgin America offers some indication of the likely airline response to the introduction of HSR service. From the perspective of an individual airline, it really does not matter whether a loss of market share results from service entry by a new airline or a new intercity mode (such as HSR). The airline has to decide whether to accept the resulting loss of market share and adjust the level of air service and fare structure accordingly, or attempt to retain as much of its market share as possible by reducing fare levels and/or changing aircraft size in order to maintain service frequencies.

This technical memorandum discusses the underlying economic factors that influence airline service decisions and presents the results of an analysis using U.S. Department of Transportation data on airline service and fare levels to document the trends in air service in the California Corridor markets since 2005 and in particular the airline response to the introduction of service by Virgin America. Based on the findings of this analysis, alternative air service scenarios are proposed for use in future HSR ridership forecasting that take into account potential airline competitive response to the introduction of HSR service.

The memorandum concludes by discussing the potential opportunity for a more detailed case study of the experience with airline response to the introduction of the Acela service in the Northeast Corridor.

Economic Factors Influencing Airline Service Decisions

The decision by an airline whether to enter a given market, or continue to offer service in that market if it is already serving the market, and the details of the service offered in terms of flight frequencies, fare levels, and the type of aircraft equipment used are influenced by a number of considerations, the most important of which is whether it can make a profit doing so. However, determining whether a particular service is profitable involves a number of considerations and is not always a straightforward matter. While the fare revenue derived from the passengers flying in the market has to at least cover the direct operating cost of the aircraft used to serve the market, unless the airline is willing to cross-subsidize the service from other markets for some reason, there are other costs involved in operating an airline that also have to be covered from the overall revenue of the airline, but do not necessarily have to be covered proportionately by the revenue from each market.

These costs include the overall corporate management and administration, including marketing costs, the capital costs of the aircraft, which of course will be used to serve many different markets during a given period of time, and the costs of operating the airline's facilities at each airport, usually referred to as station costs. Since a given station may serve flights in a wide range of markets with different fare levels, the way in which the airline allocates those costs to each flight is somewhat arbitrary. In general, adding flights at a station will incur some additional costs, due to the additional personnel required to handle the passengers and baggage and service the aircraft and possibly additional facilities, such as gate positions, check-in counters, and so forth. However, the number of additional personnel required will depend on the overall staff utilization at the time the flights are scheduled. Similarly, whether the airline would need additional facilities to handle the flights will depend on whether they are scheduled at times when the existing facilities are heavily utilized or not.

It is common in airline economics to divide airline costs into direct operating costs (DOC), which comprise those costs involved in operating the aircraft, and indirect operating costs (IOC), which comprise everything else. However, even this distinction involves some arbitrary assignment of costs to one category or the other, since obviously the aircraft cannot be operated without ground support infrastructure. The three largest components of DOC are the costs of flight crew, fuel, and aircraft maintenance. Historically cabin crew have been considered part of IOC, because they are not directly involved in operating the aircraft, but for passenger service it makes more sense to include the cabin crew costs as part of DOC, together with flight crew. In the past, flight and cabin crew costs have been the largest component of DOC, but with the recent rise the price of oil, fuel has become the largest single component. If oil prices continue to rise, fuel will form an increasingly large component of DOC.

Over the past two decades the airlines have succeeded in increasing average load factors, *i.e.* the percentage of seats on each flight that are occupied by passengers. This helps spread the DOC of each flight over more passengers, and has been one strategy by which airlines have managed to continue to reduce fares at a time when fuel costs have been rising. However, this process has pretty much run its course by now and there is limited opportunity to achieve further increases in average load factor. At the same time, the legacy network carriers have managed to bring their DOCs (and indeed other costs) closer to those of the low-cost carriers by achieving wage and benefit concessions from their employees, particularly flight crew.

Another cost-reducing strategy that the legacy network carriers have pursued is to make greater use of their regional airline partners to serve shorter-haul or less dense markets. This has two advantages. Regional airlines generally pay lower wages than mainline airlines for similar positions, particularly flight crew. Traditionally airline flight crew wages vary with the size of the aircraft, with flight crew operating larger aircraft having higher pay, so flight crew operating regional airline aircraft would tend to be paid less anyway, but the regional airlines often pay even less than the mainline airlines do for similar aircraft types. The other advantage is that the smaller aircraft operated by regional airlines allow more frequent service in less dense markets, and this higher frequency tends to offset any competitive advantage that low-cost carriers might have by offering lower fares. Business travelers tend to care more about having a wider choice of flights, so that they can plan their travel at a convenient time relative to the purpose of their trip, and are often willing to incur a fare difference in order to fly on an airline with a higher frequency in the market.

Role of Fare Competition

A major factor in determining what fare revenue an airline can expect to obtain in a given market is the extent of competition from other airlines in the market and the fare levels that they are charging in the market. Air travelers have ready access to fare information from airline websites and online booking portals such as Travelocity and Orbitz, so an airline need to offer similar fares to its competitors in a market or it will not attract many passengers. Of course, there is not a single fare for a given market, but a range of fares that depend on how long before the travel date the reservation is made and how full the flights are. Airline yield management systems restrict the availability of more deeply discounted fares at more popular times and as the flights fill up, so the fare actually available in a given market for a given traveler will depend on the choice of flight departure time and how close to the travel date the booking is made.

As airlines add flights in a market, or new carriers enter the market, more capacity becomes available and flights take longer to fill up. As a result, more passengers are able to get more deeply discounted fares and the average fare in the market goes down. The airlines may also reduce fares (or increase the availability of cheaper fares) in order to stimulate demand and attempt to fill the additional capacity. In the past this has led to fare wars, in which none of the airlines competing in a market end up making much or any money, but in recent years the airlines have been more disciplined in not adding too much capacity to markets and driving average fares down. With the reduction in air travel demand in the recent recession, the airlines were able to reduce capacity in order to maintain average fares and avoid fare wars.

However, a related consideration is the need to maintain market share. An airline can reduce capacity by eliminating flights, but if as a result the other airlines in the market offer more frequent service, the airline may see its market share drop and offset the advantage of reducing capacity, leaving it with reduced load factors and fewer flights. Replacing service with mainline aircraft with service by a regional airline partner is a way to reduce capacity without reducing frequency. However, passengers generally prefer traveling on larger aircraft if the choice is available, so reducing capacity in this way may result in loss of market share if the competition continues to operate mainline aircraft.

Implications for Competition between Air and High-Speed Rail

The introduction of HSR service in the California Corridor will present airlines with two competitive issues. If HSR fares are significantly below the comparable air fare for travel at a given time and the same extent of advance purchase, then some travelers who would otherwise choose air travel will take the HSR service instead. This will reduce demand and result in lower load factors if capacity is not reduced proportionately. The lower load factors will reduce passenger revenue for each flight and could result in many of these flights becoming unprofitable. Reducing capacity in the market by reducing flight frequency could cause a greater shift in demand to HSR, particularly if, as a result, the HSR service offers more frequent service.

An alternative competitive approach would be to reduce fares closer to those offered by the HSR service, in order to retain as much market share as possible. However, depending on the fares offered by the HSR service, it may not be economically viable to continue offering service at these lower fares.

Defining the California Corridor Air Markets

The California Corridor is one of the busiest air markets in the U.S. and is generally understood to consist of air services between airports in the San Francisco Bay Area and Sacramento area in Northern California and airports in Southern California, including San Diego. It also includes airports in the San Joaquin Valley and Central Coast region between Monterey in the north and Santa Barbara in the south. However, because most passengers flying between the San Joaquin Valley airports and airports in the Bay Area (primarily San Francisco International Airport (SFO)) and Southern California (primarily Los Angeles International Airport (LAX)) are connecting to other flights at those airports, while the planned California high-speed rail system will not directly serve the Central Coast region communities, these markets have been excluded from the analysis of recent trends in the Corridor markets.

Both the Bay Area and the Los Angeles Basin are served by multiple airports with airline passenger service. Although not every airport in Northern California has air service to every airport in Southern California, every airport in Northern California has air service to at least one airport in Southern California and most airports have air service to the majority of airports at the other end of the Corridor. Thus there are a large number of airport-pair markets in the Corridor and air travelers in the Corridor have a substantial choice of alternative airports that they could use.

For the purpose of this analysis, Northern California comprises the Bay Area and the Sacramento area. The Bay Area is served by four airports: SFO, Oakland International Airport (OAK), Mineta San José International Airport (SJC) and Charles M. Schulz Sonoma County Airport (STS). The Sacramento area is served by one airport with passenger airline service, Sacramento International Airport (SMF). At the other end of the Corridor, Southern California comprises the 6-county Los Angeles basin (including Imperial County to the east) and San Diego

County. This region is served by seven airports that currently have passenger airline service to Northern California: LAX, Ontario International Airport (ONT), Bob Hope Burbank Airport (BUR), Long Beach Airport (LGB), John Wayne Orange County Airport (SNA), Palm Springs International Airport (PSP), and San Diego International Airport (SAN). There are also a number of smaller airports that have commuter airline service, but these do not currently have service to Northern California and have not been included in the analysis.

Data Sources for Analysis of California Corridor Air Markets

The principal source of data on air travel in the California Corridor used in the analysis presented in this memorandum is the passenger traffic data reported by the airlines to the U.S. Department of Transportation and available from the Bureau of Transportation Statistics (BTS) website. These data comprise two separate datasets:

1. Monthly traffic data reported by large certificated air carriers on Schedule T-100 of Form 41 (referred to as T-100 data). These data include passengers, freight and mail transported by flight segment and on-flight market, together with data on the number of aircraft operations scheduled and performed, available capacity (seats), and aircraft hours operated by aircraft equipment type.

2. Quarterly data on passenger itineraries and fares reported by large certificated air carriers as part of the Airline Origin and Destination Survey (referred to as database DB1B or the 10 percent O&D Survey). This is not strictly a survey, but a sample of 10 percent of all passenger itineraries obtained from the airline tickets or equivalent records. The data consists of the quarterly count of the number of sampled passengers traveling on a given itinerary (where an itinerary is defined as a specific sequence of flight segments at a given fare).

There are a number of important considerations that need to be borne in mind when interpreting these data. These are briefly discussed in the following paragraphs, but it should be appreciated that a full discussion of all the issues that can arise in interpreting the data is beyond the scope of this memorandum.

The BTS divides the monthly T-100 data into two datasets: T-100 market and T-100 segment data, where the T-100 market data provides a count of the number of passengers (or amount of freight or mail) transported on the same flight by a given airline between a given origin and destination airport. The T-100 segment data provides a count of the number of passengers (or amount of freight or mail) transported on each non-stop flight between a given origin and destination airport, by airline and aircraft equipment type. The difference between market traffic and segment traffic can be understood by considering a passenger who takes a flight from (say) Oakland International Airport (OAK) to Phoenix Sky Harbor Airport (PHX) that makes an intermediate stop at Ontario International Airport (ONT). This flight has two segments: OAK to ONT and ONT to PHX. This passenger will be counted in the T-100 market dataset as having an origin of OAK and a destination of PHX. The same passenger will be counted twice in the T-100 segment dataset, once for the non-stop segment OAK to ONT and again for the non-stop segment ONT to PHX.

In the case of passengers taking a non-stop flight from their origin to their destination, they will be counted once in both the T-100 market and T-100 segment data for that airport pair. Expressed in another way, the segment data is the number of passengers on board the flight for a given flight segment, while the market data is the number of passengers flying *on the same flight* between a given origin airport (where they board the flight) and a given destination airport (where they leave the flight). The market origin and destination airport may not be the airports where the passengers began their air trip or their final destination. Passengers boarding a flight at a given airport include both those who are beginning their (directional) air trip and those connecting from other flights at that airport. Similarly, passengers leaving a flight at a given airport include those for whom this is their final destination and those connecting to other flights to continue their trip.

The O&D Survey database is divided into three components: a coupon database, a market database, and a ticket database. A given passenger's ticket is divided into a number of coupons, where each coupon corresponds to a different flight on the itinerary. The market database provides information on the directional origin and destination. Thus the passenger count in the market from SFO to LAX will include both passengers from the Bay Area on the outbound leg of a round trip as well as passengers from Southern California on the return leg of a round trip. The ticket database indicates the first airport on the itinerary, and thus by combining the market database with the ticket database, it is possible to separate the passenger count in a directional market into passengers on the outbound and return legs of their trips.

However, the market database does not distinguish the route taken between the origin and destination, and whether this was on a direct or connecting flight. Thus the passenger count from the market database for travel between SFO and San Diego (say) will include both passengers on direct flights between the two airports as well as those making connections at an intermediate airport, such as LAX. While this is generally more of a concern in longer-distance markets, where there may be a significant amount of traffic connecting at intermediate hubs (or indeed there may be no direct flights and it may be necessary to take connecting flights), there is some connecting traffic between the Bay Area airports and San Diego that typically changes flights at LAX.

In order to analyze connecting traffic, it is necessary to use the coupon database, where there is a separate record for each coupon in an itinerary. Since each segment of an itinerary involving a connection will have a separate coupon in the ticket, it is possible to construct the complete itinerary and identify any intermediate stops to change flights. However, because a passenger traveling on the same flight that makes an intermediate stop will only have one coupon for that flight, it is not possible to distinguish between passengers on non-stop flights between a given origin and destination and those on one-stop or multi-stop flights.

Although the O&D Survey data reported by the U.S. airlines include passengers on international itineraries, including the domestic portion of itineraries involving both domestic and international legs, these data are restricted and not included in O&D Survey data available on the BTS website.

O&D Survey Expansion

Because the O&D Survey is only a sample (approximately 10 percent) of all passenger itineraries, the passenger counts need to be expanded to give the total number of passengers in a given market. If it were an accurate 10 percent sample, it would simply be a matter of multiplying the O&D Survey passenger counts by 10 to give the number of passengers with a given itinerary. However, for a variety of reasons, the O&D Survey passenger counts for a given market often differ from the T-100 market counts by a factor of more or less than 10.

In order to determine the appropriate expansion factors to use for the California Corridor analysis, a comparison was made between the T-100 market data and the O&D Survey coupon data for each of the airport-pair markets in the Corridor for 2009, as described in more detail in Appendix A. This showed that the survey expansion factors for Southwest Airlines and Virgin

America are significantly lower than those for the other airlines in the Corridor markets and well below 10, averaging 9.4 in the case of Southwest and 9.7 in the case of Virgin America. The survey expansion factors for JetBlue were very close to 10, and averaged 10.0 for the full year for the two markets between OAK and LGB and between SJC and LGB. For the other airlines, after allowing for the proportion of passengers in each market who had an itinerary that involved both domestic and international segments (and as a result were excluded from the O&D Survey passenger counts), it appears reasonable to use survey expansion factors of 10 for true domestic itineraries.

These survey expansion factors were then used to estimate the number of passengers with a trip origin at one of the California Corridor airports and a final destination at one of the airports at the other end of the Corridor.

Recent Trends in Air Service in the California Corridor

Table 1 shows the recent trend in the local passenger traffic for the California Corridor markets between the Bay Area and Southern California (including San Diego), based on the O&D Survey. It can be seen that the annual local passenger traffic in the Corridor markets at the four Bay Area airports combined declined significantly from 2000 to 2005 to about 82% of the 2000 traffic level, then grew to 2007, although to a level of only about 90% of the 2000 traffic level, before declining again in 2008 and 2009.

However, the market shares of each airport changed dramatically over this period, particularly in recent years, with SFO steadily increasing both its traffic and market share over the period 2005 to 2009, ending up with passenger traffic in the Corridor markets about 23% above the 2000 traffic level, for the reasons explained in the following discussion.

Table 2 shows the corresponding trend in local passenger traffic between Sacramento and Southern California. Unlike the Bay Area, the annual local passenger traffic in the Corridor markets increased slightly from 2000 to 2005, and continued to grow until 2007 to a level 15% above that in 2000. With the onset of the recession in late 2007, the traffic declined in 2008 and 2009 to a level of about 92% of the 2000 traffic level.

Table 1. Recent Trends in Local Passengers – Bay Area to Southern California

		Estimated O&D Passengers (both ways)					
		2000	2005	2006	2007	2008	2009
OAK	BUR	839,381	883,892	908,204	949,173	841,825	766,718
	LAX	1,530,030	1,146,316	1,102,921	1,051,679	786,624	644,502
	LGB	0	464,270	421,730	399,030	357,050	231,190
	ONT	597,163	635,396	607,986	628,693	557,329	465,069
	SNA	762,539	796,070	834,669	878,171	680,503	508,620
	SAN	708,623	1,009,027	1,069,535	1,019,128	780,109	647,300
		4,437,737	4,934,971	4,945,046	4,925,874	4,003,439	3,263,399
Pct 2000			111.2%	111.4%	111.0%	90.2%	73.5%
SFO	BUR	450,020	99,310	156,150	145,300	97,240	71,420
	LAX	1,419,830	721,490	950,160	1,246,503	1,738,201	1,877,739
	LGB	0	70	0	0	32,980	168,780
	ONT	200,800	38,330	89,360	46,740	38,990	38,800
	PSP	95,310	137,210	158,850	158,880	149,380	143,810
	SNA	589,490	242,500	246,380	220,600	201,473	650,727
	SAN	1,008,678	347,100	319,910	626,552	1,012,399	1,119,464
		3,314,108	1,486,700	1,764,660	2,185,867	3,173,422	3,999,321
Pct 2000			44.9%	53.2%	66.0%	95.8%	120.7%
SJC	BUR	460,199	437,295	439,554	480,809	450,996	410,556
	LAX	1,147,415	682,634	750,511	748,327	615,371	529,173
	LGB	0	0	0	0	108,450	147,740
	ONT	354,157	344,121	352,678	377,853	328,405	273,450
	PSP	26,370	3,210	5,130	9,590	10,450	10,800
	SNA	871,380	639,536	635,255	672,910	622,661	524,100
	SAN	844,152	753,072	791,918	773,408	674,107	603,983
		3,703,674	2,859,868	2,975,044	3,062,897	2,810,439	2,499,802
Pct 2000			77.2%	80.3%	82.7%	75.9%	67.5%
STS	LAX	2,880	0	0	54,360	69,770	61,280
Bay Area		11,908,419	9,380,849	9,840,900	10,487,704	10,154,310	9,895,222
Pct 2000			78.8%	82.6%	88.1%	85.3%	83.1%

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

However, the changes in the individual markets from 2000 to 2007 were not the same, with traffic in some markets declining while that in other markets grew. In particular, the traffic in the market between SMF and LAX declined significantly, while that in the markets between SMF and BUR and between SMF and ONT declined slightly from 2000 to 2005, before recovering to a level in 2007 slightly above the 2000 traffic level. In contrast, traffic in the markets between SMF and SNA and between SMF and SAN grew strongly from 2000 to 2007, while service commenced between SMF and LGB in 2006, increased in 2007, then declined to 2009 like all the other markets.

Table 2. Recent Trends in Local Passengers – Sacramento to Southern California

		Estimated O&D Passengers (both ways)					
		2000	2005	2006	2007	2008	2009
SMF	BUR	567,214	540,621	539,260	575,691	522,194	467,032
	LAX	810,428	612,360	627,871	598,030	526,060	459,380
	LGB		0	116,140	153,240	134,770	124,530
	ONT	657,539	633,628	647,810	674,237	602,531	514,927
	PSP	8,730	27,390	29,030	31,310	30,030	27,020
	SNA	215,250	492,551	508,460	551,398	486,521	448,992
	SAN	697,861	778,632	777,320	828,208	738,532	678,050
		2,957,023	3,085,182	3,245,893	3,412,114	3,040,638	2,719,931
Pct 2000			104.3%	109.8%	115.4%	102.8%	92.0%

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

Air Fares

The corresponding data on average fares for markets between the Bay Area and Southern California are shown in Table 3. These data show that a major factor in the shift of traffic from OAK and SJC to SFO has been the drop in average fares in Corridor markets to and from SFO compared to those to and from OAK and SJC, particularly since Southwest and Virgin America started service at SFO in 2007 and JetBlue began serving Southern California from SFO in October 2008. In 2005, average fares at SFO were significantly higher than those at OAK and SJC in all markets. By 2009, SFO had the lowest average fare in all markets except BUR, which was not served from SFO by any of the low-cost airlines, and between SJC and LGB, where the average fares were essentially the same.

Average fares increased in all markets to and from OAK and SJC between 2000 and 2009, with the exception of LGB (which was not served in 2000). However, the change in average fares in markets to and from SFO between 2000 and 2009 showed opposite effects, with average fares in some markets decreasing while those in other markets increased. In general, the average fares in those markets that experienced an introduction of service by the low-cost carriers declined, while the average fares in markets that were only served by the legacy carriers or their regional airline partners increased.

Table 3. Recent Trends in Average Air Fares – Bay Area to Southern California

		Average Fares (current $) (each way)					
		2000	2005	2006	2007	2008	2009
OAK	BUR	80.38	95.18	100.46	94.10	105.28	104.22
	LAX	77.74	91.32	97.19	91.60	101.04	99.92
	LGB		82.58	88.03	83.26	84.30	76.47
	ONT	77.39	89.03	93.77	89.56	99.30	99.41
	SNA	83.82	96.21	100.37	96.33	112.05	108.21
	SAN	83.20	96.75	102.97	93.46	98.97	99.62
SFO	BUR	103.23	164.80	157.71	165.72	182.84	167.98
	LAX	102.66	144.28	122.84	109.19	103.25	89.94
	LGB		152.34			82.37	72.74
	ONT	95.17	104.97	106.15	162.82	167.93	95.38
	PSP	118.78	125.66	123.46	120.76	126.97	248.44
	SNA	112.01	154.60	163.52	178.32	183.84	85.70
	SAN	81.98	144.29	156.25	104.44	97.48	85.99
SJC	BUR	80.60	93.56	99.39	97.35	103.70	102.00
	LAX	78.54	92.61	100.11	97.40	104.15	102.41
	LGB					74.60	71.95
	ONT	78.30	87.93	93.10	87.46	96.13	96.69
	PSP	117.81	140.03	161.02	129.51	131.39	115.07
	SNA	86.34	97.78	104.84	102.65	108.92	102.99
	SAN	85.16	99.39	108.05	102.14	107.31	102.69
STS	LAX	126.12			107.45	117.52	109.16

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

Table 4 shows the average fares in the markets between SMF and Southern California. These show two opposite effects, with the average fares in some markets increasing between 2000 and 2009, while those in other markets declined. The average fares in the markets between SMF and BUR, LAX, ONT and SAN increased significantly between 2000 and 2009, while those in the markets between SMF and PSP and between SMF and SNA declined. JetBlue commenced service in the market between SMF and LGB in 2006, and although the average fare increased slightly over the period from 2006 to 2009, by 2009 this market had the lowest average fare of any market between SMF and Southern California.

Table 4. Recent Trends in Average Air Fares – Sacramento to Southern California

		Average Fares (current $) (each way)					
		2000	2005	2006	2007	2008	2009
SMF	BUR	78.18	91.22	95.70	92.04	100.75	105.49
	LAX	77.05	89.16	94.66	94.34	105.05	107.80
	LGB			79.72	81.91	89.27	88.41
	ONT	78.47	88.70	93.65	91.71	101.03	104.91
	PSP	153.70	123.86	132.60	126.00	133.25	121.31
	SNA	123.81	95.53	100.66	98.14	111.31	107.89
	SAN	78.74	92.02	99.03	95.50	106.45	105.20

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

Tables 5 and 6 shown the foregoing average fares expressed in constant 2005 dollars, using the Consumer Price Index for all urban consumers (CPI-U) for the three largest metropolitan regions in the California Corridor. Fares between Northern California and the Los Angeles basin were adjusted to constant dollars using the average of the CPI-U for the Bay Area and Los Angeles-Riverside-Orange County Consolidated Metropolitan Statistical Area (CMSA), while fares between Northern California and San Diego were adjusted using the average of the CPI-U for the Bay Area and San Diego CMSA.

Airline Market Share

Southwest Airlines has remained the dominant carrier in all the Southern California markets from OAK and SJC with the exception of LGB, which was served by JetBlue from OAK from September 2002 and from SJC starting in May 2008. The recent trend in the Southwest Airlines market share in the other California Corridor markets from OAK and SJC is shown in Table 7, together with the markets from SFO which it served.

Table 5. Recent Trends in Average Air Fares – Bay Area to Southern California (Constant Dollars)

		Average Fares (2005 $) (each way)					
		2000	2005	2006	2007	2008	2009
OAK	BUR	92.39	95.18	96.87	87.86	95.11	94.14
	LAX	89.36	91.32	93.72	85.53	91.27	90.26
	LGB		82.58	84.89	77.74	76.15	69.08
	ONT	88.95	89.03	90.43	83.62	89.70	89.80
	SNA	96.34	96.21	96.79	89.94	101.22	97.75
	SAN	96.85	96.75	99.68	88.00	90.05	90.32
SFO	BUR	118.65	164.80	152.08	154.74	165.17	151.75
	LAX	118.00	144.28	118.46	101.95	93.27	81.25
	LGB		152.34			74.41	65.71
	ONT	109.39	104.97	102.36	152.02	151.70	86.16
	PSP	136.53	125.66	119.05	112.76	114.69	224.43
	SNA	128.75	154.60	157.69	166.50	166.07	77.42
	SAN	95.44	96.75	151.26	98.34	88.69	77.96
SJC	BUR	92.64	93.56	95.85	90.90	93.67	92.14
	LAX	90.28	92.61	96.54	90.95	94.08	92.51
	LGB					67.39	64.99
	ONT	90.00	87.93	89.78	81.66	86.84	87.34
	PSP	135.42	140.03	155.28	120.92	118.69	103.94
	SNA	99.25	97.78	101.10	95.85	98.40	93.04
	SAN	99.14	96.75	104.60	96.18	97.64	93.10
STS	LAX	144.96			100.32	106.16	98.61

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

Table 6. Recent Trends in Average Air Fares – Sacramento to Southern California (Constant Dollars)

		Average Fares (2005 $) (each way)					
		2000	2005	2006	2007	2008	2009
SMF	BUR	89.86	91.22	92.29	85.94	91.01	95.29
	LAX	88.57	89.16	91.28	88.08	94.90	97.38
	LGB			76.88	76.48	80.64	79.86
	ONT	90.20	88.70	90.31	85.63	91.26	94.77
	PSP	176.67	123.86	127.87	117.65	120.37	109.58
	SNA	142.32	95.53	97.07	91.63	100.55	97.46
	SAN	91.66	92.02	95.87	89.93	96.86	95.37

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

Table 7. Recent Trends in Southwest Airlines Market Share – Bay Area to Southern California

		Southwest Airlines Market Share					
		2000	2005	2006	2007	2008	2009
OAK	BUR	99.4%	99.6%	99.7%	99.7%	99.8%	99.9%
	LAX	74.1%	92.6%	90.0%	92.3%	94.2%	99.4%
	ONT	97.6%	99.0%	99.1%	99.2%	99.5%	99.6%
	SNA	62.4%	65.9%	67.7%	69.2%	87.3%	99.2%
	SAN	94.7%	98.4%	98.5%	98.8%	99.0%	99.4%
SFO	LAX				6.4%	27.5%	32.8%
	SNA					0.1%	34.1%
	SAN	44.5%			26.0%	43.1%	47.3%
SJC	BUR	99.9%	99.9%	100.0%	100.0%	100.0%	100.0%
	LAX	50.3%	80.6%	74.9%	76.8%	82.1%	82.2%
	ONT	97.8%	99.3%	99.3%	99.4%	99.6%	99.7%
	SNA	44.4%	57.1%	58.3%	64.5%	70.1%	79.7%
	SAN	65.1%	75.5%	76.1%	77.1%	84.4%	88.9%

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

It can be seen that Southwest has steadily increased its market share in all the markets that it serves. After entering the SFO to LAX and SFO to SAN markets in 2007, by 2009 it had achieved a market share of over 30% in the former and almost 50% in the latter, and had achieved the largest market share of any carrier in both markets, exceeding United Airlines, previously the dominant carrier in both markets, and Virgin America, which also entered both markets in 2007. After entering the SNA market in 2009, it achieved a market share of 34% for the year as a whole (reaching 42% in the fourth quarter), the largest market share of any carrier.

The corresponding market shares for Southwest Airlines in the Southern California markets that it serves from SMF are shown in Table 8.

In 2000, Southwest Airlines was the dominant carrier in all Southern California markets from SMF with the exception of LGB, PSP and SNA, none of which it served in 2000 (no carrier served the SMF to LGB market in 2000). By 2005 Southwest had become the dominant carrier in the SMF to SNA market, and from 2005 to 2009 steadily increased its market share of the SMF to LAX market.

Table 8. Recent Trends in Southwest Airlines Market Share – Sacramento to Southern California

		Southwest Airlines Market Share					
		2000	2005	2006	2007	2008	2009
SMF	BUR	98.2%	99.0%	99.1%	99.2%	99.3%	99.4%
	LAX	57.0%	81.3%	80.2%	82.7%	88.7%	89.1%
	ONT	96.4%	98.6%	98.5%	98.9%	99.1%	99.1%
	SNA		95.9%	90.8%	89.0%	96.4%	98.5%
	SAN	94.6%	96.9%	96.8%	97.8%	97.7%	98.0%

Source: Analysis of U.S. DOT 10% O&D Survey airline data from Bureau of Transportation Statistics

Flight Frequencies

The recent changes in average flight frequency in each of the California Corridor markets are shown in Tables 9 and 10. In general, the changes in flight frequency correspond to the changes in estimated O&D passenger traffic shown in Tables 1 and 2, although flight frequency is influenced by the total segment passenger traffic, which includes through and connecting passengers as well as O&D passengers.

Direct service from SJC to PSP in 2005 and 2006 was very intermittent and most passengers in this market used one-stop or connecting flights through LAX. Similarly, there was no direct service between STS and LAX in 2000, but passengers in this market used one-stop or connecting flights through SFO.

Airline Response to the Introduction of Service by Virgin America

In 2004 the Virgin Group announced that it planned to start a new low-cost U.S. airline, initially called Virgin USA and later changed to Virgin America, and selected SFO as its hub airport. After some delays in obtaining operating authority the airline began service on August 8, 2007 with flights to LAX and John F. Kennedy International Airport (JFK) in New York. In May 2007 JetBlue began service from SFO, initially serving JFK and Boston, and in August 2007, soon after Virgin America began operating, Southwest Airlines also began service from SFO, initially serving San Diego International Airport, Las Vegas and Chicago Midway. Over the next three years, all three airlines steadily expanded their service from SFO, in spite of the economic recession that began in late 2007.

Table 9. Recent Trends in Flight Frequency – Bay Area to Southern California

		Average Daily Departures (both ways)					
		2000	2005	2006	2007	2008	2009
OAK	BUR	27.8	26.6	29.5	30.2	29.0	26.6
	LAX	64.1	52.2	50.8	56.0	44.6	28.9
	LGB		11.0	10.8	10.3	8.9	6.0
	ONT	23.5	24.2	22.8	22.5	20.0	18.1
	SNA	22.6	24.7	26.6	26.7	19.8	16.1
	SAN	20.9	33.6	37.5	37.1	31.0	24.7
SFO	BUR	21.1	13.9	7.5	13.1	11.0	10.6
	LAX	76.2	45.7	53.2	68.5	84.1	76.5
	LGB					1.1	5.9
	ONT	11.0	1.2	6.3	7.6	8.6	7.5
	PSP	5.0	5.2	8.3	9.1	8.8	9.1
	SNA	19.6	20.2	20.0	20.0	20.9	31.6
	SAN	37.7	17.4	19.2	29.4	42.6	42.0
SJC	BUR	15.0	16.7	16.7	17.9	18.1	16.7
	LAX	57.8	55.0	54.9	59.0	48.0	16.7
	LGB					3.6	5.3
	ONT	13.4	16.7	16.6	16.5	14.8	12.1
	PSP	0.9			0.3	0.6	0.7
	SNA	29.3	29.1	30.3	27.9	29.1	25.4
	SAN	28.4	35.6	36.0	36.0	28.4	24.8
STS	LAX				3.3	4.3	3.7

Source: Analysis of U.S. DOT Form 41 airline traffic data from Bureau of Transportation Statistics

Table 10. Recent Trends in Flight Frequency – Sacramento to Southern California

		Average Daily Departures (both ways)					
		2000	2005	2006	2007	2008	2009
SMF	BUR	18.5	18.5	18.5	20.0	18.6	17.5
	LAX	28.4	30.7	30.2	36.6	31.2	24.4
	LGB			4.0	4.6	4.0	3.9
	ONT	20.2	22.2	22.3	22.2	20.7	18.7
	PSP		2.0	2.0	2.0	2.0	2.0
	SNA	8.3	13.5	15.8	17.1	13.8	13.0
	SAN	21.0	26.3	26.5	26.5	24.9	22.6

Source: Analysis of U.S. DOT Form 41 airline traffic data from Bureau of Transportation Statistics

As air travel to and from the Bay Area declined overall, air service was reduced significantly by all carriers at both OAK and SJC, with some carriers ceasing all service at those airports. The increased competition at SFO caused fares to drop in the markets served by the low-cost airlines and the combined effect of lower fares at SFO and reduced service at OAK and SJC caused a significant shift of regional passenger traffic from OAK and SJC to SFO.

In the California Corridor markets, Virgin America introduced service to San Diego International Airport on February 12, 2008 and Orange County John Wayne Airport (SNA) on April 29, 2009. However the service to John Wayne Airport was terminated in late May 2010. Southwest began service to LAX from SFO on November 4, 2007 and added service to SNA on May 9, 2009. JetBlue began service to Long Beach Airport from SFO on October 18, 2008. Thus by mid-2009 low-cost carrier competition from SFO to Southern California destinations had increased significantly, with Southwest and Virgin America providing competing service to LAX, John Wayne, and San Diego, while JetBlue provided service to Long Beach.

Although average fares declined in the three California Corridor markets served by Virgin America following the entry of Virgin America and Southwest in those markets, as shown in Table 3, Southwest did not significantly reduce the average fares in those markets from OAK and SJC in order to reduce the shift in market share from those airports to SFO. Of course, Southwest was also gaining some of the traffic that shifted to SFO. As average fares from SFO to LAX and SNA declined, JetBlue reduced the average fare in the SFO to LGB market and also reduced the average fare in the OAK and SJC to LGB markets, although not by as much. Thus there does appear to have been an attempt by JetBlue to retain some its market share at OAK and SJC. Although it was the only carrier serving LGB from any of the airports, LGB is located between LAX and SNA, and all three airports are serving essentially the same market in the southern part of the Los Angeles basin. In particular, prior to the entry of Virgin America and Southwest in the SFO to SNA market, the JetBlue service to LGB provided the lowest fare service between the Bay Area and Orange County. Although Southwest had provided service to SNA from OAK and SJC for many years, as shown in Table 7, the average fares in these two markets were significantly higher than the average fares in the markets from OAK and SJC to LGB, or from SFO to LGB when that service began in October 2008.

The other interesting aspect of the airline response to the introduction of service by Virgin America is the response of United Airlines in the markets from SFO to LAX, SNA and

SAN. Prior to the entry of Virgin America and Southwest in these markets, United (together with its regional partner United Express) had been not only the dominant carrier in these markets, but had been able to achieve much higher average fares in these markets than the competing service by Southwest from OAK and SJC, as can be seen from Table 3. In 2006, United had a 62% market share in the SFO to LAX market, a 66% market share in the SFO to SNA market, and an 89% market share in the SFO to SAN market. This market share eroded dramatically with the new competition in these markets from Virgin America and Southwest. United was forced to reduce its average fares in these markets to remain competitive with the new entrants. United's average fare in these markets in 2009 was typically somewhat higher than that of either Virgin America or Southwest, but significantly below the level that it had previously achieved.

However, the overall increase in traffic in these markets due to the shifts between the different airports stimulated by the lower fares resulted in United and its regional partner handling slightly more O&D traffic in the markets between SFO and LAX and SFO and SAN in 2009 than it handled in 2006 and significantly more in the market between SFO and SNA, as shown in Table 11 below. Of course, it was serving this traffic at a much lower average fare, so the overall revenue had declined significantly and these services had become much less profitable. Whether they were actually unprofitable is not clear.

In the market between SFO and LAX, United reduced its average fare from about $131 in 2006 to about $124 in 2007, and its O&D passengers increased by about 4%. United increased the average fare to about $127 in 2008 as Southwest and Virgin America greatly increased their market share at significantly lower average fares, and as a result United's O&D passengers declined by about 16%. United then reduced its average fare to about $98 in 2009 and its O&D passenger traffic recovered to slightly below the 2007 level but just above the 2006 level.

In the market between SFO and SAN, United reduced the average fare sharply from about $160 in 2006 to about $118 in 2007, and its O&D passengers increased by 19%. However, more modest reductions in average fare to about $111 in 2008 and about $96 in 2009 were not enough to offset the increasing market share of Southwest and Virgin America at average fares well below those of United, and its O&D passengers declined by 11% in 2008 and a further 5% in 2009, ending up about 1% above the 2006 level.

Table 11. Response of United Airlines to Market Entry by Southwest Airlines and Virgin America

			2006	2007	2008	2009
Average Fares *(current $) (one way)*						
SFO	LAX	United	131.08	123.92	127.05	97.77
		Southwest		75.67	98.09	82.87
		Virgin America		*Note 2*	84.77	81.02
	SAN	United	159.92	118.46	110.51	96.19
		Southwest		82.25	96.56	83.00
		Virgin America			82.11	80.67
	SNA	United	167.14	178.79	188.91	135.53
		Southwest				77.47
		Virgin America				77.25
Estimated O&D Pax *(both ways)*						
SFO	LAX	United	587,760	608,540	512,310	591,140
		Southwest		79,345	477,605	616,358
		Virgin America		113,407	413,986	391,851
	SAN	United	285,800	339,860	303,560	288,920
		Southwest		162,752	436,827	529,380
		Virgin America			257,011	285,355
	SNA	United	162,090	143,990	137,180	181,780
		Southwest				221,699
		Virgin America				173,038
Average Daily Departures *(both ways)*						
SFO	LAX	United	32.6	32.6	29.8	29.6
		Southwest		15.0	20.6	21.4
		Virgin America		10.2	12.0	11.4
	SAN	United	18.0	19.0	17.6	16.1
		Southwest		15.4	17.2	17.2
		Virgin America			8.8	8.7
	SNA	United	11.1	10.7	11.9	12.4
		Southwest				10.4
		Virgin America				8.3

Source: Analysis of U.S. DOT 10% O&D Survey and Form 41 airline traffic data from Bureau of Transportation Statistics

Notes:
1. For air service that commenced during the year, the average daily departures were calculated by averaging the total departures over the days of operation.
2. Virgin America did not file 10% O&D Survey reports for 2007. O&D passengers have been estimated from segment traffic reported on Form 41.

Southwest and Virgin America did not enter the market between SFO and SNA until 2009. From 2006 to 2008 United steadily increased its average fare in the market from about $167 in 2007 to about $189 in 2008. As a result, its O&D passenger traffic declined by 11% in 2007 and a further 5% in 2008. With the entry of Southwest and Virgin America, United reduced its average fare to about $136 in 2009, still well above those of Southwest and Virgin America, and its O&D passengers increased by 33% to a level some 12% above that in 2006.

Thus it appears that the changes in United's O&D passenger traffic in each of the markets between 2006 and 2009 were due partly to changes in market share as a result of the difference in average fare between United and Southwest and Virgin America and partly due to changes in the total level of O&D traffic in the market resulting from changes in the average fare. The two markets between SFO and LAX and SFO and SNA are not independent, but form part of the larger market between the Bay Area and the Los Angeles basin. In particular, the market between SFO and SNA draws passengers who might otherwise use LGB or ONT as well as LAX, so the changes in average fare in the market between SFO and SNA relative to the average fares in competing markets at the other airports affects the share of the total regional O&D traffic between the Bay Area and Los Angeles basin attracted to use SNA.

In spite of the small increase in O&D passengers on United and United Express from 2006 to 2009 in the markets between SFO and LAX and SFO and SAN, United reduced the flight frequency in both markets between 2006 and 2009, particularly after 2007. The overall reduction from 2006 to 2009 was about 9% in the market between SFO and LAX and about 11% in the market between SFO and SAN. This was achieved by a significant increase in load factor over the period of about 7 percentage points in the market between SFO and LAX (reaching about 77% load factor in 2009) and about 6 percentage points in the market between SFO and SAN (reaching about 75% load factor in 2009). In addition, United increased the average size of the aircraft serving both markets slightly between 2006 and 2009, by about 2% in the market between SFO and LAX (to an average of 147 seats per aircraft) and about 6% in the market between SFO and SAN (to an average of 142 seats per aircraft).

In contrast, United increased the flight frequency in the market between SFO and SNA from 2006 to 2009 by about 11%, or slightly less than the increase in O&D passengers over the same period. However, this was accomplished by reducing the number of mainline flights by about 26% and expanding the number of United Express flights by about 80%, giving a reduction in seat capacity of about 11% over the period, resulting in an increase in load factor of about 10 percentage points, reaching a 69% load factor in 2009. Of course, as a result the average aircraft size in the market declined (from an average of 120 seats per aircraft in 2006 to an average of 96 seats per aircraft in 2009).

Thus United appears to have attempted to address the reduction in average fares in the markets between SFO and LAX and between SFO and SAN by increasing average load factors through reduced flight frequency, while in the market between SFO and SNA it both increased load factors and substituted regional airline flights for mainline flights. However, in neither case does it appear that the resulting reduction in cost would have been enough to offset the loss of fare revenue due to the lower fares, which varied from about a 9% reduction in the market between SFO and SNA to a massive 39% reduction in the market between SFO and SAN.

It is of course quite likely that the average fare levels in 2006 in all of these markets, particularly the markets between SFO and SAN and between SFO and SNA, made these markets highly profitable for United, and thus while the reduction in average fares significantly reduced the profitability of the markets, they may still have been economically viable for United at the 2009 fare levels.

In summary, the entry of Virgin America into the California Corridor markets prompted two rather different competitive responses from the existing airlines with a major presence in these markets. In the case of the low-cost carriers, Southwest and JetBlue, which had previously not served these markets out of SFO, they initiated service from SFO in direct competition to Virgin America, generally matching Virgin America's fares in the case of Southwest and undercutting Virgin America's fares in the case of JetBlue. In comparing fare levels between Virgin America and Southwest or JetBlue, it should be noted that Virgin America charges $25 to check the first bag, while Southwest and JetBlue do not. These baggage fees are not included in the fares reported in the 10% O&D Survey data. However, even in the case of Virgin America, the majority of the travelers in the California Corridor markets are making fairly short duration trips (in many cases same-day or overnight trips) and therefore are likely to be able to avoid checking baggage.

In the case of United Airlines, it reduced the average fare levels to respond to the entry of the low-cost carriers, but not as low as the average fares offered by the low-cost carriers. In addition it increased load factors by reducing flight frequency, and in the case of the market between SFO and SNA substituted regional airline aircraft for mainline aircraft, thereby reducing seat capacity while increasing flight frequency. In the case of the markets between SFO and LAX and between SFO and SAN, it also slightly increased the average size of the aircraft serving the markets.

Alternative Air Service Scenarios for Use in Future HSR Ridership Forecasts

Forecasts of HSR ridership need to consider two issues: the likely future pattern of air service and air fares in the absence of HSR service and the potential airline response to the introduction of competition from HSR. The evolution of air service in the California Corridor markets in recent years has been characterized by two phenomena:

1. The increasing market share of Southwest Airlines in almost all the markets in the corridor with the exception of the smaller markets between Northern California and LGB or PSP, the very small market between STS and LAX, and the markets between SFO and BUR or ONT.
2. Introduction of service by Virgin America from SFO to three of the larger markets in Southern California (LAX, SAN and SNA) and by JetBlue between the four largest Northern California airports and LGB.

In many of the markets, Southwest is effectively the only carrier serving the market, and even in those markets where the legacy network airlines (America Airlines and United Airlines, or their regional airline partners) still maintain a presence, the market share of the network carriers has steadily eroded and in several of the markets may be becoming too small to remain viable.

SFO is the hub airport for Virgin America. Introducing service to airports in Southern California allows it to feed connecting or through passengers to and from its transcontinental services, so it is unlikely to introduce service to Southern California from other Northern California airports. However, it may introduce service from SFO to other Southern California airports that it does not currently serve. The most likely candidate is ONT, which currently has very limited service from SFO by United Express (four round trips per day) and higher average fares than service to ONT by Southwest from OAK and SJC.

JetBlue Airways currently serves the four primary Northern California airports from LGB, its focus airport in Southern California. However, LGB has a limit on the number of flights that can be scheduled due to community noise concerns, and this limit is likely to be reached fairly soon. Therefore the opportunities to expand service between Northern California and LGB are limited. The California Corridor flights are generally operated as a continuation or feeder segment of transcontinental flights to or from the Northern California airports. It seems likely that as its transcontinental service to and from the Northern California airports expands, JetBlue will introduce service between those airports and other airports in Southern California. The most likely candidate markets are between SFO and BUR or ONT. However, this is likely to depend on whether Virgin America or Southwest decides to begin service in those markets first.

However this plays out, it seems highly probable that by the time the HSR service begins, there will be expanded low-cost carrier service in the markets between SFO and both BUR and ONT, as well as potentially some competition from JetBlue in markets from OAK, SJC or SMF to Southern California airports that are currently dominated by Southwest. This expanded competition will constrain the future growth of fares in constant dollars, although increases in fuel prices will affect all airlines more or less equally and will need to be covered by higher fares.

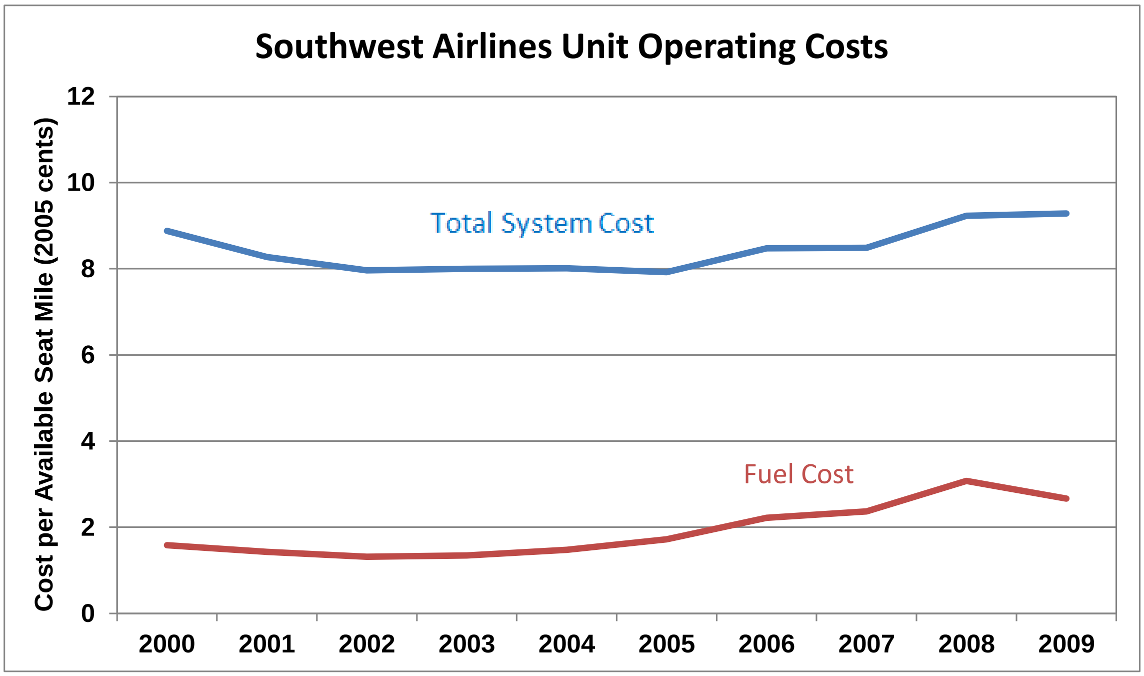
This suggests that further HSR ridership forecasts should consider at least two air fare scenarios: a baseline scenario in which average fares remain at 2009 levels in real terms and a higher fare scenario in which average fares increase in real terms to reflect a potential increase in the real price of fuel, assuming other cost components remain constant in real terms. In addition, the possibility that airfares continue to decline in real terms cannot be ruled out, whether due to increased competition in some markets or improved airline productivity and cost control measures, giving a third scenario.

Since Southwest Airlines is the dominant carrier in most of the California Corridor markets, its cost structure is likely to determine the influence of future fuel costs on fares. The recent trends in Southwest's unit costs are shown in Figure 1.

Although fuel costs have risen significantly from 2003 to 2009, other costs have remained relatively constant in real terms, although an increase in other costs (particularly labor) in 2009 offset the reduction in fuel costs. According to the most recent forecast of future prices of jet fuel by the U.S. Energy Information Administration (US EIA, *Annual Energy Outlook*, April 2011), the price of jet fuel is projected to rise by about 196% between 2009 and 2030.

This would give an annual average increase in the unit fuel cost for Southwest Airlines of about 0.12 cents per available seat mile. Assuming an average load factor of 75%, this would increase airfares between the Bay Area and Los Angeles basin airports by about $12 from 2009 and 2030 in constant 2005 dollars, and by about $15 between the Bay Area airports and San Diego and between Sacramento and the Los Angeles basin airports, and by about $18 between Sacramento and San Diego.

Figure 1. Recent Trend in Southwest Airlines Unit Costs



Source: Analysis of US DOT Form 41 airline cost data from MIT Airline Data Project

The most recent national aviation forecasts by the Federal Aviation Administration (FAA) (*FAA Aerospace Forecast Fiscal Years 2011-2031*, February 2011) is based upon a much more optimistic view of future jet fuel prices that assumes that these prices will rise by only 9.6% in constant dollars from 2009 to 2030. Under this assumption the FAA projects that real passenger yields (fare revenue per passenger-mile) will decline by about 9% from 2009 to 2030. While passenger yields are strictly not the same thing as airfares (which for the purpose of this analysis include taxes and fees, which may not change in the same way as the underlying fares set by the carriers), this provides a reasonable basis for a scenario in which future airfares decline in real terms.

Potential Effect on Airfares of Capacity Constraints

The foregoing airfare scenarios do not consider the potential impact of capacity constraints at California Corridor airports that could lead to higher airfares in the future. SFO, BUR, LAX, LGB, SNA, and SAN all face limits of one sort or another on the total number of air passengers they will be able to handle in the future. As each of these airports approaches its capacity limit, which is likely to occur well before 2030, it can be expected that airfares will rise above levels that would occur in the absence of these capacity constraints, shifting some of the unserved demand to other unconstrained airports. However, the extent to which this will occur will depend on the growth in other markets from those airports, as well as the strategies that the airports decide to implement to limit their traffic growth.

Some indication of the fare premium that might occur at a capacity-constrained airport can be inferred from past experience where airlines have been unable to add flights to meet demand due to slot controls at a congested airport or where lack of competition in a market has led to higher fares than have been experienced in related markets where alternative service has been provided by a low-cost carrier.

Slot Controlled Airports

Before Congress changed the high-density rule as part of the Air 21 legislation in 2000, the ability of airlines to add flights at the four slot-controlled airports (New York Kennedy, New York LaGuardia, Washington National, and Chicago O'Hare) was restricted by the slot limits imposed by the U.S. Department of Transportation. While the mechanism of slot controls is different from the likely situation at capacity-constrained California airports, the resulting effect is similar -- airlines are unable (or unwilling if they are limiting flights to avoid making delays worse) to add flights and average fares rise to balance supply and demand. An analysis of fare premiums at the four slot-controlled airports by Prof. Steven Morrison in 1997[1] showed that fares at LaGuardia and O'Hare were about 11% higher than for comparable routes from non-controlled airports on average, while those at Washington National were about 15% higher. However, fares at Kennedy showed no fare premium (actually they were about 2% below

[1] *Airline Deregulation and Fares at Dominated Hubs and Slot-Controlled Airports*, Statement of Steven A. Morrison, Professor of Economics, Northeastern University, at a Hearing before the Committee on the Judiciary, United States House of Representatives, November 5, 1997.

comparable routes on average). These fare differences were reported as being equivalent to $33 to $44 per round trip.

The differences in fare premiums between the slot-controlled airports seem reasonable. The capacity constraints at Kennedy primarily relate to peaking of international flights and airlines generally did not have difficulty adding flights at other times of day (as evidenced by JetBlue Airways obtaining the necessary slots to start service at Kennedy in early 2000). On the other hand, Washington National is much more convenient to downtown Washington than either Dulles International or Baltimore-Washington International and in addition to its slot limitations also has a perimeter rule and runway length constraints that limit the use of larger aircraft, all factors that would tend to allow airlines to obtain a higher fare premium.

However, to the extent that fare premiums are determined by the willingness of air travelers to use less convenient airports that are not capacity constrained, it would seem more appropriate to express them in dollars, rather than a percentage of airfare, since the inconvenience of using a more distant airport is largely independent of the airfare. Thus a one-way fare premium of $16.50 in 1996 would be equivalent to about $21 in 2005 dollars, although it could be expected that the fare premium might increase over time in constant dollars, as travelers' real value of time increases with increased real incomes. Of course, as indicated by the fare premium difference between La Guardia and Washington National, the fare premium is likely to vary with the relative convenience of the capacity-constrained and alternative unconstrained airports. In the Bay Area there is not much difference in the accessibility of OAK and SFO from downtown San Francisco, and OAK and SJC are more convenient than SFO from large parts of the Bay Area. However, in Southern California the situation is likely to be very different if LAX, BUR, SNA and LGB all start to experience capacity constraints, since ONT (the only airport with current commercial air service that is not expected to experience capacity constraints by 2030) is much less accessible from large parts of the Los Angeles basin.

Therefore it seems plausible that the airfare premium in California Corridor markets due to airport capacity constraints could be substantially higher than $21 in 2005 dollars.

The San Francisco to Orange County Market

The second case that provides some evidence for likely fare premiums at capacity constrained airports is the history of fares in the SFO to SNA market prior to the entry of Virgin America and Southwest Airlines. During the period from 2000 to 2007, United was the dominant carrier in this market and fares were significantly higher than the markets between OAK or SJC and SNA, in both of which Southwest was the dominant carrier. In 2000, when American also had a significant presence in the SFO to SNA market, the average fare premium compared to OAK to SNA was $32 one-way (in 2005 dollars). By 2005 American had replaced its mainline service in the SFO to SNA market with service by American Eagle, its regional airline subsidiary, while United had started to serve the market with a combination of mainline service and United Express flights using regional jets operated by Sky West. its regional partner, and the average fare premium has increased to $58 one-way. By 2007 the average fare premium had reached $77 one-way, although this dropped to $65 the following year.

During this period the SFO to SNA market was a situation where travelers (at least some) were willing to pay a higher average fare to use their preferred airports (SFO and SNA) rather than incur the inconvenience of using a more distant airport where fares were less. This is exactly the situation that would be faced if some of the airports start to experience capacity constraints but others that are less convenient still have enough capacity to allow airlines to add flights (e.g. if LAX is capacity constrained but ONT still has plenty of capacity). In fact there was a capacity constraint of a sort at SNA before Virgin America and Southwest entered the SFO to SNA market, because American and United reduced capacity by shifting some or all of their flights to their regional airline partners with smaller equipment, so the number of available seats was reduced.

The reason that airlines are able to increase the average fare in a capacity-constrained market is precisely because some travelers are willing to pay a higher fare to avoid the inconvenience (and greater access cost) of using a different airport where fares are lower. If this was not the case, as the airlines tried to raise the fares, passengers would simply switch to the alternative markets where fares are lower and there would be insufficient demand to sustain the higher fares. Airlines would not necessarily have to make an explicit decision to raise the base fare in a capacity-constrained market since the yield management systems will automatically raise the average fares if demand exceeds supply by restricting the number of seats available for the more deeply discounted fares.

Obviously, the relative inconvenience of alternative airports depends on both the local geographic situation as well as the characteristics of the traffic (business travelers and those on one-day trips presumably valuing airport access convenience more than those making personal or multi-day trips). Thus the premium that could be sustained at LaGuardia (where Kennedy and Newark are not that much further from Manhattan) is likely to be different from the premium that could be sustained in California Corridor markets where the alternative airport (which is likely to be ONT) is much further than the closest airport for the majority of air travelers with a ground trip end in the Los Angeles basin.

Thus the experience in the SFO to SNA market is probably a much better indicator of the likely fare premiums in the California Corridor markets as SFO and the Southern California airports start to experience capacity constraints than the experience at LaGuardia. It also has the merit of being based on much more recent data and the presence of low-cost airlines in competing markets (which was not true at the New York airports in 1996).

During the period under consideration air travelers between SFO and SNA had the option of using OAK or SJC, or flying between SFO and LAX or ONT. The average fare premium in 2007 in the SFO to SNA market compared to SFO to LAX was $65 one-way (again in 2005 dollars), while that compared to SFO to ONT was only $14 one-way. However, by 2007 United had replaced mainline service in the SFO to ONT market with service by United Express operated by its regional partner Sky West and fares had risen significantly. In 2005, when United still provided mainline service between SFO and ONT, the average fare premium in the SFO to SNA market compared to the SFO to ONT market was $50 one-way.

Thus it appears that some air travelers in the SFO to SNA market were willing to pay average fare premiums of as much as $75 one-way to avoid having to use OAK, SJC, LAX or ONT instead.

There is one important caveat to this finding. In 2007 there were approximately 878,000 local passengers in the OAK to SNA market, about 673,000 in the SJC to SNA market, but only about 220,000 in the SFO to SNA market. So clearly a large proportion of the travelers between the Bay Area and SNA did in fact chose to use the less expensive Southwest service from OAK and SJC. It is of course not known whether those who chose to fly between SFO and SNA did so because they felt that avoiding the inconvenience of using OAK or SJC was worth the fare difference or because they were simply unaware of the huge difference in fares. It is also possible that business travelers whose fares were being paid by their firm or someone else chose to fly on American or United to earn the frequent flier miles, even though the fares were much higher than on Southwest.

Implications for Potential Future Airfares in the California Corridors

Given that the average fares in the Bay Area to Southern California markets in 2009 were under $100 each way (in 2005 dollars), these fare premiums have significant implications for future fare levels in the California Corridor markets, if the airports begin to experience their anticipated capacity constraints

Flight Frequencies

Developing assumptions for future flight frequencies in each market is a little more complex than for airfares, because flight frequencies are a function of passenger traffic, average load factors, and average aircraft size, all of which are likely to change in the future. In particular, if air travel demand continues to grow, airlines will need to add capacity to handle the additional traffic and cannot simply continue to offer the same flight frequencies as today.

While some increases in average load factor and average aircraft size are likely, the potential for significant future increase in either in the California Corridor markets is limited. The factors that constrain the ability of airlines to increase average load factors and average aircraft size include:

1. Load factors are already at fairly high levels in many of the markets. The inherent variability of travel demand will make further increases progressively more difficult to achieve. Airlines can always fill empty seats by lowering fares, but if this reduces the total revenue from a flight that is not worth doing.

2. The options for using larger aircraft are limited in the California Corridor markets, given Southwest's dominant market share and its current fleet and fleet replacement plans. The introduction of B737-800 by Southwest may lead to a modest increase in average aircraft size, but it is not clear how much this aircraft would be used in the short-haul California Corridor markets, since it is more suited to the longer-distance transcontinental markets. Neither of the other two low-cost carriers (JetBlue and Virgin America) has announced any plans to acquire larger aircraft than their current Airbus A320 equipment. In fact, JetBlue is in the process of acquiring more of the smaller Embraer 190 aircraft and increasing the use of these aircraft in the California Corridor markets.

3. While the busier California Corridor markets may have enough traffic to be able to support the use of larger aircraft, typically aircraft do not fly back and forth in a single market, but are routed over the airline's network in the course of a day. Thus a given flight between OAK and BUR, say, may begin in Seattle, fly to Portland, then to OAK, then to BUR, and on to Las Vegas or Phoenix. The choice of aircraft equipment has to consider the expected passenger loads in all the markets served by that flight.

4. The more airlines that there are competing in a given market, the less traffic there will be for each airline. Since flight frequency is an important determinant of market share, there is a strong incentive to keep aircraft size as small as economically feasible in order to offer more flights. This is one reason why the legacy airlines have increased the use of their regional airline partners in many markets, since this allows them to use smaller aircraft, such a regional jets, and increase flight frequency.

An analysis of recent trends in average load factors in the California Corridor markets shows that for the total market between the Bay Area and the Los Angeles basin airports, the average load factor declined by about 2 percentage points from 2005 to 2009, giving an average load factor of 67% in 2009, about I percentage point below the level in 2000, while the average load factor for the market between the Bay Area airports and San Diego declined by about 3 percentage points from 2005 to 2009, giving an average load factor of 71% in 2009, about 5 percentage points below the level in 2000. For the total market between Sacramento and the Los Angeles basin airports, the average load factor declined by about 4 percentage points from 2005 to 2009, giving an average load factor of 67% in 2009, about 6 percentage points below the level in 2000. However, in the market between Sacramento and San Diego the average load factor increased by almost 5 percentage points to reach an average load factor of 76% in 2009, less than half a percentage point above the level in 2000.

Undoubtedly, some of the reduction in load factor between 2005 and 2009 in many of the markets has been due to a combination of the recent recession and the additional capacity resulting from market entry by Virgin America and the other low-cost carriers. As demand for air travel rises in the future, it should be possible for the airlines to take advantage of their yield management systems to increase load factors to levels similar to those experienced in 2000 or even somewhat higher. Therefore for the baseline (constant real airfares) scenario, it seems reasonable to assume an average load factor of 75% across all markets. In the case of the lower fare scenario, which would tend to stimulate more traffic, it seems reasonable to increase this to 78%, while for the high fare scenario, it seems reasonable to assume average load factors of 73% in the markets between SFO and Southern California, between STS and LAX and between Sacramento and San Diego, and 70% is other markets.

A similar analysis of recent trends in average aircraft size in the California Corridor markets shows that for the total market between the Bay Area and the Los Angeles basin airports, the average aircraft size increased by about 3% from 2005 to 2009, while for the market between the Bay Area and San Diego for the same period the average aircraft size increased by about 8%. However, these increases were largely due to replacement of service by the regional airline partners of the legacy carriers in key markets by low-cost carrier entrants using larger aircraft. There are only two markets (between SFO and BUR and between SFO and ONT), both fairly small, where this process has yet to occur.

To the extent that lower average airfares would tend to encourage the airlines to attempt to achieve higher load factors or use larger aircraft (or increases in load factor or average aircraft size could allow lower average airfares), it seems reasonable to assume a somewhat higher average aircraft size in the case of the low airfare scenario than the other two scenarios. It also seems reasonable that markets that had a lower average aircraft size in 2009 would experience a larger increase in average aircraft size than those that already had a higher average aircraft size, due to the replacement of smaller aircraft by a fleet mix more typical of the markets with higher average aircraft size. Therefore for the baseline and high airfare scenario, it is assumed that the average aircraft size in those markets for which the average aircraft size is below the median average aircraft size across all markets from Northern California airports to the Southern California airport in question (with the exception of the market between STS and LAX) will increase to the median level, and then the average aircraft size in all markets will increase by a further 2% (corresponding to the increase in average aircraft size by United Airlines in the market between SFO and LAX following entry by Virgin America and Southwest). For the low airfare scenario, it is assumed that the average aircraft size will increase above that for the baseline scenario by a further 6% (corresponding to the increase in average aircraft size by

United Airlines in the market between SFO and SAN following entry by Virgin America and Southwest).

In the case of the SJC and SMF to PSP markets, the average aircraft size under the Baseline scenario was not increased by 2 percent above the median value across the major markets under current conditions, but rather the average aircraft size was increased by 2 percent above the current average aircraft size in each of the two markets. Due to the assumed diversion to HSR in these markets in 2030, replacing regional airline aircraft with larger equipment in these markets would not give a reasonable daily frequency, so it was assumed that they would continue to be served with regional airline aircraft.

The flight frequency in a given market needed to accommodate the traffic in the market can be determined from following equation:

$$F = P * (1+ R) / (L * S) \qquad (1)$$

where F = Average daily flights in the market
P = Average daily O&D air passengers in the market
R = Ratio of connecting and through passengers to O&D passengers in the market
L = Average load factor
S = Average aircraft size (seats)

For each market, the ratio of connecting and through passengers to O&D passengers can be obtained from recent trends. While this ignores the effects of any future changes in airline network structure and market share in the connecting and through markets, and different rates of growth in those markets from the California Corridor markets, this is consistent with the simplifications typically assumed (often implicitly) in most aviation demand forecasting.

The future growth in each of the markets from the Bay Area to Southern California has been estimated as part of the aviation demand forecasts prepared for the current update of the Bay Area Regional Airport System Plan Analysis, as shown in Table 12. Although these forecasts did not address demand between Sacramento and Southern California, it seems reasonable to assume that the growth rate in each market would be similar to that from the Bay Area.

Based on an analysis of the recent trends in the composition of traffic in each market, together with expected future changes in air service, the assumed ratio of connecting and through passengers to O&D passengers in each of the markets is given by Table 13.

Table 12. Forecast Growth in O&D Passengers – 2009 to 2030

	OAK	SFO	SJC	STS	SMF
BUR	106%	373%	143%		136%
LAX	194%	91%	173%	129%	129%
LGB	86%	111%	109%		100%
ONT	104%	400%	130%		131%
PSP		136%	272%		146%
SNA	150%	117%	146%		136%
SAN	150%	121%	158%		139%

Source: Bay Area Regional Airport System Plan Analysis

Table 13. Assumed Ratio of Connecting and Through Passengers to O&D Passengers

	OAK	SFO	SJC	STS	SMF
BUR	0.11	0.12	0.13		0.12
LAX	0.37	0.59	0.60	0.21	0.53
LGB	0.08	0.06	0.08		0.10
ONT	0.20	0.21	0.21		0.14
PSP		0.52			0.45
SNA	0.11	0.22	0.11		0.05
SAN	0.23	0.38	0.20		0.21

Source: Analysis of US DOT 10% O&D Survey and Form 41 airline data from Bureau of Transportation Statistics

One important caveat to the foregoing approach is that it calculates flight frequency on an industry basis (i.e. for all airlines serving a market in combination). However, in markets served by more than one airline, the flight frequency of each airline will vary depending on its average aircraft size and load factor, not that of the market as a whole, and of course will be less that the flight frequency for all airlines combined. Since an air passenger has to buy a ticket on a given airline, the flight frequency faced by that traveler once they have chosen an airline is that of the airline, not the market. Even allowing for the fact that travelers may select an airline based on the most convenient flight time for their travel plans, since competing airlines often offer flights at similar times, the average headway between departures will be longer than it would be if the total number of daily flights were spread uniformly throughout the day.

Competitive Response to HSR Service

The introduction of HSR service is likely to lead to a reduction in traffic in each of the markets as some potential air passengers choose to use the HSR service. Depending on the extent of the mode shift from air to HSR and the growth in air travel demand between now and the start of HSR service, the remaining air passenger traffic in the Corridor may still be comparable to current levels or even higher. However, there will most likely be a significant decline from the levels immediately prior to the start of HSR service. Therefore the airlines will need to reduce capacity in order to maintain load factors at an economically viable level. This could happen by either reducing frequency or using smaller aircraft.

The opportunity to reduce aircraft size is very limited given the airlines that account for the majority of the service in the Corridor. The dominant airline in most of the markets (indeed the only airline currently serving many of the markets) is Southwest, which does not currently have a regional airline partner and has standardized its fleet on the Boeing 737. Virgin America and JetBlue both operate the Airbus A320, although JetBlue began deploying the smaller Embraer 190 in some California Corridor markets in 2008. However, JetBlue's operating plan in the California Corridor markets makes extensive use of aircraft that continue on as transcontinental flights from the Northern California airports or that arrived at those airports as transcontinental flights. This has important scheduling advantages given the time difference between the West and East Coast and the flight time between the two coasts, and allows both a higher aircraft utilization while allowing transcontinental flights to be scheduled at convenient times. However, this makes it difficult to substitute the Embraer 190 for many of the Airbus A320 flights in the California Corridor markets. Virgin America operates its aircraft in a similar way in the California Corridor markets that it serves, and thus far has neither a regional airline partner nor a smaller aircraft in its fleet.

Although the legacy network carriers could in principle substitute flights by their own equipment with flights operated by their regional partners using smaller aircraft, in most of the relatively few Corridor markets that they still serve they have already done so, so the opportunity to further reduce average aircraft size is quite limited.

Therefore it would seem more likely that all the airlines would tend to reduce frequency rather than aircraft size. This would have the effect of making the air service less convenient, particularly for travelers who have less flexibility over when they would prefer to travel.

Because the flight schedules of JetBlue and Virgin America in the Corridor markets that they serve are tied to their transcontinental schedules, the opportunity for those carriers to reduce frequency is more limited than is the case for Southwest. While they could use the aircraft to serve markets for which the HSR service is not a viable alternative, there are very few such markets that would be likely to generate enough traffic to make this economically viable. Also, because these services in the California Corridor currently perform an important role in feeding traffic to the transcontinental flights from the Bay Area, the two airlines might be willing to operate their California Corridor flights at a lower load factor than the rest of their system and accept that these flights may not generate enough revenue from the local passengers to fully cover the cost of operating the Corridor flights. However, as they expand direct service in transcontinental or other long-haul markets from airports in Southern California, the need to flow traffic from those airports through the Bay Area airports will reduce, and with it the ability to use that traffic to support service in the California Corridor markets.

Therefore it seems most likely that Southwest Airlines would be forced to reduce the frequency of its flights in the Corridor markets in order to maintain a viable load factor. The extent of the reduction is likely to vary by market, depending how much diversion to HSR service occurs in each market, and by whether JetBlue and Virgin America have continued to maintain the number of flight departures offered in those markets that they serve. Ideally the extent of any reduction would be assessed through an iterative analysis, in which the flight frequency would be reduced, the effect of this on the diversion of air trips to HSR service would be calculated, and the resulting average load factor calculated. If this is deemed too low to be economically viable, the flight frequency would be adjusted and the process repeated until an equilibrium load factor is obtained.

In the absence of such an approach, it is possible to use prior estimates of the diversion of air trips to HSR made as part of past modeling to develop ridership and revenue forecasts for the planned California HSR system as a basis to estimate the potential effect of the diversion of air trips to HSR on air passenger traffic and hence flight frequency. As part of the current update of the Bay Area Regional Airport System Plan Analysis, an analysis was performed of the potential diversion of air trips between the Bay Area and Southern California, using the results of prior ridership modeling performed for the California High-Speed Rail Authority by a consultant team led by Cambridge Systematics. This gave the diversion estimates for 2030 shown in Table 14, based on the planned full system, including the segment from Los Angeles to San Diego, and assuming HSR fares at 83% of airfares in the comparable market. Although no estimates were made of the potential diversion of air trips between Sacramento and Southern California, it would seem reasonable that these would be similar to those for SJC, given the similarity of the markets and urban form in Sacramento and Santa Clara County and the relative location of the airport and HSR station in each city.

Table 14. Assumed Diversion of Air Trips to HSR by Market - 2030

	OAK	SFO	SJC	STS	SMF
BUR	50.8%	67.7%	67.7%		67.7%
LAX	49.4%	65.8%	65.8%	31.4%	65.8%
LGB	38.2%	50.9%	50.9%		50.9%
ONT	42.7%	57.0%	57.0%		57.0%
PSP		31.4%	31.4%		31.4%
SNA	38.1%	50.8%	50.8%		50.8%
SAN	24.8%	33.1%	33.1%		33.1%

Source: Bay Area Regional Airport System Plan Analysis

The resulting flight frequency can be calculated using a modified version of Equation (1), as follows:

$$F = P * (1 - D + R) / (L * S) \qquad (2)$$

where D = Proportion of O&D passengers in the market diverted to HSR
and other terms are as defined for Equation (1)

However, the foregoing diversion percentages are obviously influenced by the fare differential between air and HSR. In the previous analysis, it was assumed that average HSR fares would be set at 83% of average airfares in comparable markets. But this raises the question of whether airlines would be willing to let such a situation exist, or would lower their fares to compete. Assuming that airfares in the absence of HSR have been set at profit maximizing levels given the competitive environment, the question is whether they would be better off lowering their fares or accepting the loss of traffic. Answering this question requires an understanding of the dynamics of modal competition between air and HSR.

Not only are the airlines at a fare disadvantage if HSR fares are lower than airfares, but the diversion of air passenger trips to HSR will cause the airlines to reduce flight frequency, further increasing the relative attractiveness of HSR service and increasing the diversion from air to rail. If the diversion elasticity with respect to the fare differential between air and rail (the percentage increase in diversion for each percent increase in the fare differential) is greater than one, then reducing airfares may reduce the diversion of trips by enough to offset the loss of revenue from the lower fares. In this case, airlines may be driven to lower their fares to compete with HSR, violating the assumption about HSR fares being 83% of air fares. (Obviously, the HSR system cannot keep reducing fares in such a situation, since it too has to cover its operating and infrastructure costs).

Analyzing the dynamics of this situation is beyond the scope of this technical memorandum, but is critical to understanding the economic viability of the planned California HSR system. For the purposes of the current analysis, it is assumed that the airlines will continue to offer the same fares as they would in the absence of HSR, and adjust their flight frequencies to match the lower traffic levels.

Summary

Table 15 on the following page summarizes the assumptions proposed for each of the scenarios. The resulting air service levels for each of the major California Corridor markets under each of the three scenarios applying the proposed assumptions and approach are presented in Appendix B, together with the input values to the flight frequency calculations for each market.

Air Service in Minor California Corridor Markets

In addition to the major California Corridor markets discussed above, there are a number of minor markets in the Corridor in which some air trips may be diverted to HSR service. These include markets between Central Valley communities that will be served by the HSR system and the Bay Area, Southern California, and San Diego, as well as air service between LAX and Palm Springs and San Diego, and between Sacramento and SFO. In order to include service assumptions for these markets in HSR ridership modeling, airfares and service frequencies were determined for each of these markets for 2009, as shown in Appendix C.

Table 15. Air Service Assumptions for Use in Future HSR Ridership Forecasts

	Airfares	Average Load Factor	Average Aircraft Size	Flight Frequency
Baseline Scenario	2009 average fares by market in constant 2005 dollars	75%	Increase in average aircraft size in each market with a smaller average aircraft size to the median aircraft size in 2009 for markets from the Northern California airports to the relevant Southern California airport, plus a further increase of 2% in all markets	Determined from flight frequency equation for the assumed market diversion ratio
Low-Fare Scenario	9% reduction in real fares from 2009 levels	78%	A further increase of 6% above the Baseline Scenario	Same
High Fare Scenario	Increase in real fares over 2009 levels by $12 to $18 in 2030 depending on market	70% or 73% depending on market	Same as Baseline Scenario	Same

Since the majority of the air passengers in most of these markets are connecting to other flights at the larger airport, the approach used for developing future air service scenarios for major California Corridor markets cannot be applied to project likely changes in flight frequencies in the minor markets. These markets are mainly served by American Eagle or United Express using smaller regional airline aircraft, primarily to provide connecting service to other flights at either LAX or SFO, with occasional operations by other airlines using larger equipment, mainly between LAX and SAN.

Given the limited passenger demand in these markets, it is unlikely that this situation will change significantly in the future. Whether an increase in overall passenger traffic in the minor markets would lead to additional flights in those markets or the use of larger regional airline aircraft for some flights is unclear, since this is likely to depend on the available fleet and network strategy of the regional airlines serving the markets. However, for the purpose of projecting future flight frequencies in the markets in 2030, it would be reasonable to assume that flight frequencies would increase proportionally to overall passenger traffic.

The forecasts prepared as part of the Bay Area Regional Airport System Plan Analysis projected the growth in connecting passengers at SFO from 2009 to 2030 from Sacramento and the Central Valley cities, as follows:

- Bakersfield 139%
- Fresno 148%
- Modesto 137%
- Sacramento 152%

It would be reasonable to assume a similar growth in total passengers in each market, and the same growth rate from Fresno to LAX as Fresno to SFO. For the markets from LAX to PSP and SAN, it would be reasonable to assume the same growth rate as the markets between SFO and each airport. Where there was no direct service in a market in 2009 (such as between Bakersfield and SMF), it can be assumed that air travelers would connect through SFO, so the flight frequency between the Central Valley city and SFO would be the governing frequency.

Conclusions

The market entry of Virgin America into several California Corridor markets starting in 2007 provides a useful case study into likely airline response to the introduction of competing service by the planned California HSR system, although there are important differences between the two situations. Perhaps the most important difference is that the two principal low-cost carriers that were serving the California Corridor markets prior to the entry of Virgin America had the ability to also commence competing service from SFO, which significantly affected the competitive position of Virgin America at SFO, as well as attracted air passenger traffic to SFO from the other airports in the Bay Area. In response, United Airlines, which was previously the dominant carriers in these markets from SFO, reduced its fares significantly to levels somewhat above those offered by the low-cost carriers. There are obvious limitations on the ability to repeat this response in the face of competition from HSR.

The response of Southwest Airlines and JetBlue Airways at the other two principal Bay Area airports is perhaps more indicative of how airlines may respond to a loss of traffic due to competition from HSR. JetBlue significantly reduced both its average fares and flight frequency in the market between OAK and LGB. The response by JetBlue at SJC is less clear because it had only started service there in 2008, so it is hard to separate competitive effects from start-up effects. On the other hand, Southwest maintained fare levels more or less unchanged in most markets from OAK and SJC but reduced flight frequencies in all markets to reflect the diversion of traffic to SFO. However, by adding service at SFO both airlines were able to continue serving much of the traffic that was attracted to SFO from OAK and SJC, so the loss of traffic at OAK and SJC was partially offset by the new traffic at SFO. This would not be the case with the introduction of HSR service, since the airlines would lose all the traffic attracted to HSR.

Unfortunately there is only limited U.S. experience to date to observe how airlines have responded to improvements in rail services. Although there is considerable experience in Europe with airline response to the introduction of high-speed rail services, the differences between the situation faced by airlines serving European markets in competition with high-speed rail and that faced by U.S. airlines serving short-haul domestic markets raises concerns about the transferability of the European experience. However, one opportunity to examine possible airline response to the introduction of HSR service arises from the improvement in train travel times in the Northeast Corridor with the introduction of the Acela service between Boston, New York, Philadelphia, and Washington, D.C. This experience has the appeal that it specifically addresses airline response to improved rail service rather than inferring this from the competitive response to service entry by other airlines. It is suggested that a detailed case study of this experience be considered for future work in order to compare the actual experience in the Northeast Corridor with the conclusions of the analysis of the California Corridor markets presented in this memorandum.

Appendix A

ORIGIN AND DESTINATION SURVEY EXPANSION

The air passenger itineraries reported by U.S. airlines to the U.S. Department of Transportation in the Origin and Destination (O&D) Survey are intended to represent a sample of 10 percent of all passenger itineraries. Therefore the passenger counts from the O&D survey need to be expanded to give the total number of passengers in a given market. If the survey were an accurate 10 percent sample, it would simply be a matter of multiplying the O&D Survey passenger counts by 10 to give the number of passengers with a given itinerary. However, for a variety of reasons, the O&D Survey passenger counts for a given market typically differ from the passenger counts in a given market reported on Schedule T-100 of Form 41 by a factor of more or less than 10.

Perhaps the most significant factor accounting for this difference is the fact that the domestic O&D Survey counts do not include the domestic portion of passenger itineraries involving both domestic and international segments, while the T-100 passenger counts for domestic segments or markets count all passengers on board flights in those segments or markets, and thus do include passengers with an itinerary involving international segments. Since the passengers with itineraries involving domestic and international segments are counted in the T-100 passenger counts but not the domestic O&D Survey passenger counts, this should result in the ratio of the T-100 counts to the domestic O&D Survey counts for a given market being greater than 10. The greater the proportion of passengers with an itinerary involving international segments in the market, the more the ratio should exceed 10.

Other factors that could result in a ratio different from 10 include under- or over-reporting of either the T-100 data or the O&D Survey data.

In order to determine the appropriate expansion factors to use for the California Corridor analysis, a comparison was made between the T-100 market data and the O&D Survey coupon data for each of the airport-pair markets in the Corridor for 2009. Since the T-100 market data is a count of passengers boarding a flight at one airport and deplaning at the other, it includes both local passengers (those for whom the airport-pair represents the origin and destination of their entire air trip) and passengers who are connecting from or to other flights at one or other airport (or even both airports). The corresponding data in the O&D survey is the coupon database, since both types of passenger will have one ticket coupon for their flight between the two airports in the market, whether this is a nonstop flight or makes one or more intermediate stops.

When comparing T-100 passenger counts with O&D Survey counts it is generally necessary to combine the data for an airline and its regional airline partners. Although the T-100 passenger counts distinguish between a mainline airline and each of its regional airline partners, since each airline reports its T-100 data separately, the distinction can become blurred in the O&D Survey data, since the regional airline flights typically carry the airline code of the mainline partner, so a ticket coupon will show the mainline airline as the operating carrier, even if the flight is in fact operated by the regional airline.

One further complication in the comparison, discussed further below, is that the T-100 market passenger counts include domestic legs of passengers on a combined domestic and international itinerary, while these passengers are excluded from the O&D Survey coupon database as noted above.

Bay Area Markets

Table A-1 shows the O&D survey expansion factors computed from the T-100 market passengers and the O&D survey coupon count for the Corridor markets between Oakland International Airport (OAK) and Mineta San José International Airport (SJC) in the Bay Area and Bob Hope Airport, Burbank (BUR), Los Angeles International Airport (LAX), Long Beach Airport (LGB), Ontario International Airport (ONT), John Wayne Airport, Orange County (SNA), and San Diego International Airport (SAN) in Southern California, together with the market between Sonoma County Airport (STS) and LAX.

It can be seen that the expansion factors vary by quarter and airline. The expansion factors for American Airlines and United Airlines combine passenger and coupon counts for their mainline flights with those for their regional airline partners (American Eagle and SkyWest Airlines). The expansion factors for Southwest Airlines are generally well below 10, with a weighted average value (weighted by coupon counts) for the full year of 9.4 at both airports. The expansion factor for JetBlue Airways for the full year is 10.0 for both airports, while the expansion factors for American Airlines and United Airlines in the market between SJC and LAX are higher than 10, particularly for American. This may well result from the presence of passengers in the market who are connecting to or from international flights at LAX. Such passengers are more likely to fly on American between SJC and LAX, due to the larger number of international flights offered by American at LAX compared to SFO, the larger market share of American in the SJC to LAX market, and because SFO is a major international gateway for United. Passengers to and from the South Bay flying internationally on United or its Star Alliance partners would be more likely to use SFO than use SJC to connect to an international flight at LAX.. The expansion factors for American flights between SJC and SNA or San Diego are fairly close to 10, which appears consistent with these markets being unlikely to attract a significant number of passengers on international itineraries.

Table A-1. O&D Survey Expansion Factors for California Corridor Markets from OAK, SJC and STS

Market	Airline	2009Q1	2009Q2	2009Q3	2009Q4	2009
OAK-BUR	Southwest	9.5	9.0	9.2	9.1	9.2
OAK-LAX	Southwest	9.7	9.3	9.3	9.3	9.4
OAK-LGB	JetBlue	10.2	9.8	10.1	9.9	10.0
OAK-ONT	Southwest	9.6	9.4	9.6	9.3	9.5
OAK-SNA	Southwest	9.4	9.4	9.3	9.3	9.4
OAK-SAN	Southwest	9.8	9.4	9.6	9.4	9.5
Wt Avg	Southwest	9.6	9.3	9.4	9.3	9.4
SJC-BUR	Southwest	9.5	9.2	9.3	9.3	9.3
SJC-LAX	American	12.0	10.8	11.2	12.3	11.6
	United	11.3	10.3	11.0	10.1	10.6
	Southwest	9.5	9.2	9.2	9.2	9.3
SJC-LGB	JetBlue	10.5	10.1	9.7	9.9	10.0
SJC-ONT	Southwest	9.7	9.6	9.4	9.3	9.5
SJC-SNA	American	9.8	9.4	9.9	13.7	10.0
	Southwest	9.3	9.4	9.2	9.2	9.3
SJC-SAN	American	9.8	10.4	10.0		10.1
	Southwest	9.7	9.4	9.5	9.3	9.5
Wt Avg	Southwest	9.5	9.3	9.3	9.3	9.4
STS-LAX	Horizon Air	11.1	10.4	10.2	10.1	10.4

The expansion factors for Horizon Air flights between STS and LAX are somewhat higher than 10, but not as high as the American and United flights between SJC and LAX. This is consistent with a moderate proportion of passengers connecting to international flights at LAX, particularly to Alaska Airlines flights to Mexico (Horizon Air is the regional airline partner of Alaska Airlines). It is notable that the expansion factor is highest in the first quarter, which is the most popular season for travel to Mexico.

Table A-2 shows the corresponding O&D survey expansion factors for the same Corridor markets from SFO, together with the market from SFO to Palm Springs Airport (PSP), which is not served from either OAK or SJC.

Table A-2. O&D Survey Expansion Factors for California Corridor Markets from SFO

Market	Airline	2009Q1	2009Q2	2009Q3	2009Q4	2009
SFO-BUR	United	10.3	9.8	10.5	9.7	10.0
SFO-LAX	Alaska	28.1	17.9	18.7	19.8	20.4
	American	12.7	12.1	12.7	14.2	12.9
	United	12.5	11.6	11.9	11.5	11.9
	Southwest	9.6	9.3	9.5	9.2	9.4
	Virgin America	9.7	9.5	9.9	9.7	9.7
SFO-LGB	JetBlue	10.2	9.7	9.9	9.7	9.9
SFO-ONT	United	10.5	9.6	8.4	8.3	9.0
SFO-PSP	Alaska	10.2	10.7	10.7	10.1	10.4
	United	11.4	11.5	10.4	10.8	11.1
SFO-SNA	American	9.5	9.4	9.8	13.7	9.7
	United	10.5	10.3	10.6	10.0	10.3
	Southwest		9.2	9.5	9.4	9.4
	Virgin America		9.7	9.9	9.3	9.6
SFO-SAN	United	12.3	11.4	11.4	11.3	11.6
	Southwest	9.7	9.3	9.7	9.2	9.4
	Virgin America	10.0	9.8	10.0	9.3	9.7
Wt Avg	United	11.9	11.1	11.3	10.9	11.3
	Southwest	9.6	9.3	9.6	9.2	9.4
	Virgin America	9.8	9.6	9.9	9.5	9.7

The expansion factors for Southwest Airlines are consistent with those for markets from OAK and SJC, while the expansion factors for Virgin America are somewhat higher but still less than 10. The expansion factors for American Airlines in the LAX market are well over 10 and higher than those from SJC to LAX, consistent with a high proportion of passengers connecting to international flights at LAX, while the American expansion factors in the SNA market are generally somewhat below 10 and quite close to those for Virgin America, except for the fourth quarter

The expansion factors for United Airlines vary widely by market. In the LAX market they vary between 11.5 and 12.5, while in the San Diego market they are slightly lower, varying between 11.3 and 12.3. This is consistent with a significant proportion of passengers connecting to or from international flights at SFO or LAX. The United expansion factors in the BUR, ONT and SNA markets are generally closer to 10, and in some cases below 10, particularly in the ONT market in the second and third quarter, where they are between 8.3 and 8.4, well below anything observed in any of the other markets or for other carriers, suggesting there may be a problem with the data for these quarters. The United expansion factors in the PSP market vary between 10.4 and 11.5, consistent with a significant proportion of passengers in this market connecting to or from international flights at SFO.

The expansion factors for Alaska Airlines in the LAX market are extremely high, varying between about 19 and 28. This is undoubtedly due to a high proportion of passengers in this market connecting to flights to Mexico at LAX. Alaska has extensive service to Mexico from LAX and because LAX is the international gateway, passengers generally have to connect to different flights at LAX. Thus they would be counted in the T-100 data for flights between SFO and LAX but not counted in the domestic O&D data for that market. Consistent with the expansion factors for the Horizon Air service between STS and LAX, the highest expansion factor (implying the highest proportion of international connecting passengers) occurs in the first quarter. The Alaska expansion factors for the PSP market are somewhat above 10 but nowhere near as high as the LAX market. This is consistent with a smaller proportion of passengers connecting to or from international flights at SFO. As could be expected, this proportion appears to be lower than for United Airlines in the same market (actually the service was provided by SkyWest, operating as United Express). Passengers connecting to or from international flights at

SFO are more likely to choose United for the segment between SFO and PSP due to its more extensive international service at SFO.

Sacramento Markets

Table A-3 shows the O&D survey expansion factors for the same California Corridor markets from Sacramento International Airport (SMF), the only airport with passenger airline service in the Sacramento area. Because of the location of SMF to the northwest of the City of Sacramento, this airport also attracts some passengers from the northern counties of the Bay Area (primarily Solano and Napa Counties), for whom it is more convenient to access than the primary airports in the Bay Area, particularly during the morning and evening commute periods, when the freeways between Napa and Solano Counties and OAK are heavily congested.

Table A-3. O&D Survey Expansion Factors for California Corridor Markets from SMF

Market	Airline	2009Q1	2009Q2	2009Q3	2009Q4	2009
SMF-BUR	Southwest	9.6	9.5	9.2	9.1	9.4
SMF-LAX	United	11.2	10.9	12.1	11.2	11.3
	Southwest	9.8	9.5	9.4	9.5	9.5
SMF-LGB	JetBlue	10.2	10.0	10.1	10.0	10.1
SMF-ONT	Southwest	9.5	9.2	9.2	9.1	9.3
SMF-PSP	Horizon Air	10.6	10.2	11.2	9.7	10.4
SMF-SNA	Southwest	9.6	9.6	9.5	9.5	9.5
SMF-SAN	Southwest	9.7	9.4	9.5	9.4	9.5
Wt Avg	Southwest	9.6	9.4	9.4	9.3	9.4

The expansion factors for Southwest Airlines in all the markets served from SMF are similar to those for markets served from the Bay Area airports, and the weighted average value across all markets for the full year is effectively identical. The expansion factors for United Airlines in the LAX market (the only market served by United from SMF) range from 10.9 to 12,1, with a value for the full year of 11.3, perhaps coincidentally the same as the weighted average value for United for the year across all markets served from SFO. This is consistent with a moderately high proportion of passengers connecting to or from international flights at

LAX. This seems reasonable, since SMF had very limited international service, so passengers making international trips would have to fly to a gateway airport such as SFO or LAX and connect there to international flights. Since it is feasible for passengers from the Sacramento area to drive to SFO to catch international flights, the somewhat lower proportion of passengers connecting to or from international flights at LAX implied by the expansion factors compared to those for the market between SFO and LAX seems reasonable.

It is of course entirely possible (and indeed quite likely) that some proportion of the passengers on Southwest flights to LAX are also connecting to international flights there. However, because Southwest does not serve international markets or offer joint ticketing with other airlines, this would not be picked up in the O&D survey. There is no way to know from the O&D survey data whether passengers on Southwest for whom LAX is the destination airport have reached their final destination or are connecting to an international flight at LAX, booked on a separate ticket.

The survey expansion factors for JetBlue in the LGB market varies between 10.0 and 10.2, averaging 10.1 for the full year, slightly higher than observed in the LGB market from the Bay Area airports. The expansion factors for the Horizon Air service in the PSP market range from 9.7 to 11.2, averaging 10.4 for the full year. Since it is implausible that there would be any passengers connecting to international flights at either SMF or PSP, these differences are most likely due to reporting or sampling errors.

Summary

Although the survey expansion factors vary from quarter to quarter for a given market, overall the expansion factors for Southwest Airlines are consistently lower than those for other airlines, averaging around 9.4. Virgin America also has somewhat lower expansion factors than other airlines apart from Southwest, averaging around 9.7. It is unclear why these two carriers have survey expansion factors below 10.

The survey expansion factors for JetBlue are generally around 10. Although the expansion factor for the market between SMF and LGB is slightly higher than 10 for the full year, that between SFO and LGB is slightly lower. Whether these minor differences across the different markets reflect systemic differences between the markets or are simply a consequence of the sampling strategy is unclear. The airlines are supposed to report the itinerary of every passenger with a ticket number ending in zero. Thus depending how reservations in different markets are assigned ticket numbers (or selected for reporting, since with online reservation systems there are no tickets as such), it is possible that sampling rates vary from 10 percent across different markets.

The survey expansion factors for the network carriers, Alaska Airlines (and its regional partner Horizon Air), American Airlines and United Airlines, are substantially higher than 10 in those markets where there is likely to be a significant proportion of passengers connecting to or from international flights, as would be expected, and generally fairly close to 10 in those markets where the proportion of passengers making international trips is likely to be very small or non-existent. Therefore it appears reasonable to use a survey expansion factor of 10 for true domestic itineraries on these carriers.

Appendix B

AIR SERVICE ASSUMPTIONS FOR 2030 WITH HIGH-SPEED RAIL

Major California Corridor Markets

Table B-1. Baseline Scenario

Market		Airfares (2005 $)	Avg Daily Frequency (each way)	Estimated O&D Pax (both ways) (2009)	Assumed Growth (2030)	Connect & Thru Ratio	Avg Aircraft Size (seats) (current)	Avg Aircraft Size (seats) (2030)	Avg Load Factor	Assumed Diversion to HSR
OAK	BUR	94.00	12.4	766,718	106%	0.11	137	140	75%	50.8%
	LAX	90.00	21.7	644,502	194%	0.37	137	140	75%	49.4%
	LGB	69.00	3.6	231,190	86%	0.08	150	153	75%	38.2%
	ONT	90.00	9.6	465,069	104%	0.20	137	140	75%	42.7%
	PSP	No Direct Service								
	SNA	98.00	12.1	508,620	150%	0.11	137	140	75%	38.1%
	SAN	90.00	20.7	647,300	150%	0.23	137	140	75%	24.8%
SFO	BUR	93.00	2.0	71,420	373%	0.12	137	140	75%	67.7%
	LAX	81.00	42.1	1,877,739	91%	0.59	142	145	75%	65.8%
	LGB	66.00	2.3	168,780	111%	0.06	150	153	75%	50.9%
	ONT	86.00	1.6	38,800	400%	0.21	137	140	75%	57.0%
	PSP	115.00	5.3	143,810	136%	0.52	90	140	75%	31.4%
	SNA	77.00	13.1	650,727	117%	0.22	120	140	75%	50.8%
	SAN	78.00	33.9	1,119,464	121%	0.38	137	140	75%	33.1%
SJC	BUR	92.00	5.9	410,556	143%	0.13	137	140	75%	67.7%
	LAX	93.00	17.8	529,173	173%	0.60	100	140	75%	65.8%
	LGB	65.00	2.3	147,740	109%	0.08	109	140	75%	50.9%
	ONT	87.00	5.3	273,450	130%	0.21	137	140	75%	57.0%
	PSP	104.00	0.9	10,800	272%	0.23	70	71	75%	31.4%
	SNA	93.00	10.1	524,100	146%	0.11	137	140	75%	50.8%
	SAN	93.00	17.7	603,983	158%	0.20	137	140	75%	33.1%
STS	LAX	99.00	2.9	61,280	129%	0.21	76	78	75%	31.4%
SMF	BUR	91.00	6.4	467,032	136%	0.12	137	140	75%	67.7%
	LAX	95.00	12.0	459,380	129%	0.53	111	140	75%	65.8%
	LGB	80.00	1.8	124,530	100%	0.10	150	153	75%	50.9%
	ONT	91.00	8.8	514,927	131%	0.14	137	140	75%	57.0%
	PSP	110.00	1.9	27,020	146%	0.45	70	71	75%	31.4%
	SNA	98.00	7.5	448,992	136%	0.05	137	140	75%	50.8%
	SAN	95.00	18.6	678,050	139%	0.21	137	140	75%	33.1%

Table B-2. Low-Fare Scenario

Market		Airfares (2005 $)	Avg Daily Frequency (each way)	Estimated O&D Pax (both ways) (2009)	Assumed Growth (2030)	Connect & Thru Ratio	Avg Aircraft Size (seats) (current)	(2030)	Avg Load Factor	Assumed Diversion to HSR
OAK	BUR	86.00	11.3	766,718	106%	0.11	137	148	78%	50.8%
	LAX	82.00	19.7	644,502	194%	0.37	137	148	78%	49.4%
	LGB	63.00	3.3	231,190	86%	0.08	150	162	78%	38.2%
	ONT	82.00	8.7	465,069	104%	0.20	137	148	78%	42.7%
	PSP	No Direct Service								
	SNA	89.00	11.0	508,620	150%	0.11	137	148	78%	38.1%
	SAN	82.00	18.9	647,300	150%	0.23	137	148	78%	24.8%
SFO	BUR	85.00	1.8	71,420	373%	0.12	137	148	78%	67.7%
	LAX	74.00	38.1	1,877,739	91%	0.59	142	154	78%	65.8%
	LGB	60.00	2.1	168,780	111%	0.06	150	162	78%	50.9%
	ONT	78.00	1.5	38,800	400%	0.21	137	148	78%	57.0%
	PSP	105.00	4.9	143,810	136%	0.52	90	148	78%	31.4%
	SNA	70.00	11.9	650,727	117%	0.22	120	148	78%	50.8%
	SAN	71.00	30.8	1,119,464	121%	0.38	137	148	78%	33.1%
SJC	BUR	84.00	5.4	410,556	143%	0.13	137	148	78%	67.7%
	LAX	85.00	16.1	529,173	173%	0.60	100	148	78%	65.8%
	LGB	59.00	2.1	147,740	109%	0.08	109	148	78%	50.9%
	ONT	79.00	4.8	273,450	130%	0.21	137	148	78%	57.0%
	PSP	95.00	0.9	10,800	272%	0.23	70	75	78%	31.4%
	SNA	85.00	9.2	524,100	146%	0.11	137	148	78%	50.8%
	SAN	85.00	16.1	603,983	158%	0.20	137	148	78%	33.1%
STS	LAX	90.00	2.7	61,280	129%	0.21	76	83	78%	31.4%
SMF	BUR	83.00	5.8	467,032	136%	0.12	137	148	78%	67.7%
	LAX	86.00	10.9	459,380	129%	0.53	111	148	78%	65.8%
	LGB	73.00	1.6	124,530	100%	0.10	150	162	78%	50.9%
	ONT	83.00	8.0	514,927	131%	0.14	137	148	78%	57.0%
	PSP	100.00	1.8	27,020	146%	0.45	70	75	78%	31.4%
	SNA	89.00	6.8	448,992	136%	0.05	137	148	78%	50.8%
	SAN	86.00	16.9	678,050	139%	0.21	137	148	78%	33.1%

Table B-3. High-Fare Scenario

Market		Airfares (2005 $)	Avg Daily Frequency (each way)	Estimated O&D Pax (both ways) (2009)	Assumed Growth (2030)	Connect & Thru Ratio	Avg Aircraft Size (seats) (current)	Avg Aircraft Size (seats) (2030)	Avg Load Factor	Assumed Diversion to HSR
OAK	BUR	107.00	12.6	766,718	106%	0.11	137	148	70%	50.8%
	LAX	103.00	21.9	644,502	194%	0.37	137	148	70%	49.4%
	LGB	82.00	3.6	231,190	86%	0.08	150	162	70%	38.2%
	ONT	103.00	9.7	465,069	104%	0.20	137	148	70%	42.7%
	PSP	No Direct Service								
	SNA	111.00	12.3	508,620	150%	0.11	137	148	70%	38.1%
	SAN	106.00	21.0	647,300	150%	0.23	137	148	70%	24.8%
SFO	BUR	105.00	1.9	71,420	373%	0.12	137	148	73%	67.7%
	LAX	93.00	40.7	1,877,739	91%	0.59	142	154	73%	65.8%
	LGB	78.00	2.3	168,780	111%	0.06	150	162	73%	50.9%
	ONT	98.00	1.6	38,800	400%	0.21	137	148	73%	57.0%
	PSP	127.00	5.2	143,810	136%	0.52	90	148	73%	31.4%
	SNA	89.00	12.7	650,727	117%	0.22	120	148	73%	50.8%
	SAN	93.00	32.9	1,119,464	121%	0.38	137	148	73%	33.1%
SJC	BUR	105.00	6.0	410,556	143%	0.13	137	148	70%	67.7%
	LAX	106.00	18.0	529,173	173%	0.60	100	148	70%	65.8%
	LGB	78.00	2.3	147,740	109%	0.08	109	148	70%	50.9%
	ONT	100.00	5.3	273,450	130%	0.21	137	148	70%	57.0%
	PSP	117.00	1.0	10,800	272%	0.23	70	75	70%	31.4%
	SNA	106.00	10.3	524,100	146%	0.11	137	148	70%	50.8%
	SAN	109.00	17.9	603,983	158%	0.20	137	148	70%	33.1%
STS	LAX	111.00	2.8	61,280	129%	0.21	76	83	73%	31.4%
SMF	BUR	107.00	6.5	467,032	136%	0.12	137	148	70%	67.7%
	LAX	111.00	12.1	459,380	129%	0.53	111	148	70%	65.8%
	LGB	96.00	1.8	124,530	100%	0.10	150	162	70%	50.9%
	ONT	107.00	9.0	514,927	131%	0.14	137	148	70%	57.0%
	PSP	126.00	2.0	27,020	146%	0.45	70	75	70%	31.4%
	SNA	114.00	7.6	448,992	136%	0.05	137	148	70%	50.8%
	SAN	113.00	18.1	678,050	139%	0.21	137	148	73%	33.1%

Appendix C

AIR SERVICE IN MINOR CALIFORNIA CORRIDOR MARKETS

2009

Market		Estimated O&D Pax (both ways)	Average Fare Current $ (one way)	Average Fare 2005$ (one way)	Avg Daily Frequency (both ways)	CPI Factor (2005 = 100)	CPI Source
LAX	PSP	3,980	252.76	228.52	13.7	110.6	*(note 2)*
	SAN	26,720	211.09	191.55	60.0	110.2	*(note 3)*
SMF	SFO	2,280	268.29	242.35	13.7	110.7	*(note 4)*
BFL	SFO	4,630	226.59	204.69	4.9	110.7	*(note 5)*
	SMF	880	217.47	196.45	*(note 1)*	110.7	*(note 5)*
FAT	SFO	4,750	279.65	252.61	12.8	110.7	*(note 4)*
	LAX	26,940	192.08	173.51	22.3	110.7	*(note 5)*
	SNA	910	270.26	244.14	*(note 1)*	110.7	*(note 5)*
	SAN	26,930	143.54	130.13	*(note 1)*	110.3	*(note 6)*
MOD	SFO	2,290	51.82	46.81	8.9	110.7	*(note 4)*
	LAX	6,300	119.70	108.13	*(note 1)*	110.7	*(note 5)*
	SNA	3,330	97.20	87.81	*(note 1)*	110.7	*(note 5)*
	SAN	5,210	107.25	97.24	*(note 1)*	110.3	*(note 6)*

Notes:
1. No direct service
2. Southern California CPI
3. Average CPI for Southern California and San Diego
4. Bay Area CPI
5. Average CPI for Bay Area and Southern California
6. Average CPI for Bay Area and San Diego

Airport codes:
- BFL Bakersfield Meadows Field Airport
- FAT Fresno Yosemite International Airport
- MOD Modesto City-County Airport

C. Diverging Relationships between Jobs and Population

C. Diverging Relationships between Jobs and Population

Most forecast models are predicated on the basic assumption that the future will be much like the present, only more or less so. Past relationships that tie the amount and type of travel with the amount and location of households and different kinds of employment are the basis for estimates of trip frequency and trip distribution. Over the course of many years, these historical relationships can change, and it is difficult to predict the implications that these changes will have on travel. As the U.S. emerges from the recession of 2007-2009 and look into the future, Cambridge Systematics, Inc. (CS) noticed that future forecasts from a variety of sources of the relationship between population and jobs are considerably different from recent trends. This could have significant, yet unknowable implications for future ridership on the California HST system. CS summarizes the issue below.

C.1 Population and Jobs Growth – Historical Linkages

Population and jobs form the foundation for the forecasts that attempt to predict future traffic volumes, transactions, and revenues for transportation systems and individual facilities.

Logically, there is a connection between population and jobs growth. A growing population can feed an expanding jobs base and people are attracted to locations that have plentiful employment opportunities. Although population and jobs are linked, they do not always grow in tandem. Between the 1970s and 1990s, employment frequently grew faster than population as the workforce expanded as more women took jobs. Sensing opportunity, the expanding economy of that same period also encouraged working age people, men and women, who may not have necessarily chosen to be economically active to enter the workforce.

The trend toward greater workforce participation and economic expansion in the latter half of the previous century that generated jobs in excess of population growth stalled in the 2000s. Jobs declined precipitously in the 2007-2009 recession while population continued to grow. This changed dynamic is now translating to different future growth scenarios with population growth rates higher than jobs growth rates. This changed dynamic is finding its way into forecasts used for land use and transportation planning in California, suggesting that this may not be a short-term phenomenon.

C.2 Changing Long-Term Forecasts in California Reflect a New Dynamic in the Relationship Between Population and Jobs

Long-term forecasts in California and elsewhere until recently have shown the rate of increase for population and jobs increasing in tandem, based on the premise that population and jobs growth are closely correlated (or maintain historical relationships in relative growth rates into the future). Based on the population associated with the post-2000 forecasts, the direct and proportional relationships between population and jobs growth in long-term projections is beginning to show signs of breaking down or at least changing.

Why the Population and Jobs Growth Dynamic Is Changing and Is it Sustainable?

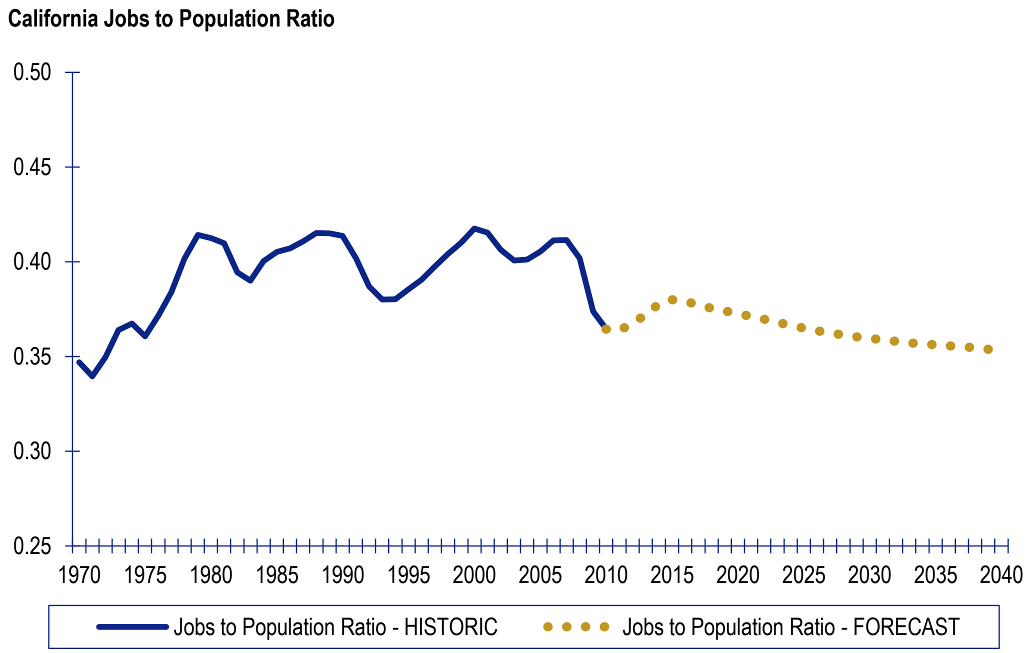
In California, the ratio between jobs and population is at the lowest point it has been in over 30 years (see Figure B.1). After reaching a record high of 0.42 in 2000, the height of the 1990s boom, the ratio declined with tech bubble burst in 2001-2002 and then recovered with the economy through 2007. The effects of the 2007-2009 recession and economic downturn can be readily seen in Figure B.1 and by 2010, the jobs to population ratio had fallen to 0.36. Since 1980, the ratio has followed economic cycles, falling in recessions and rising during periods of growth. However, the forecast for the recent recession appears to be different, with the jobs-population ratio never rising above 0.4, a rate common during recent historical periods of economic expansion.

The decline of the jobs-population ratio indicates that, relative to recent historical norms, a smaller portion of the population will be working. In California, this points to a period of fairly strong population growth accompanied by a slower pace of jobs growth. While this is a national trend, the question must be asked if a relatively lower number of people working can sustain an expanding population in California. If people are not finding economic opportunity, might this translate to lower foreign and domestic in-migration and lower birthrates and thus lower population growth than currently indicated?

The downward shift in the jobs to population ratio may be attributed to factors described below:[1]

[1] Points from an interview with Moody's Analytics' economist, Sophia Koropeckyj.

Figure C.1 Historic and Long-Term Jobs to Population Ratio Forecast in California
1970-2040



Source: Moody's Analytics, April 2011; the historic jobs data are based on (and the forecast stems from) a combination of the U.S. Department of Labor's Current Employment Statistics (CES) and Quarterly Census of Employment and Wages (QCEW) data series.

- Labor Force Participation:
  - Fewer 16- to 24-year olds in workforce. There is a long-term decline in labor force participation with this work group. With fewer jobs available, young people are scaling back their job searches and, instead, enrolling in school. Longer term, this group is expected to continue staying out of the workforce, in part due to job competition from retirees and immigrants as well as to attend school.
  - Working age men are less likely to be working. Men in the core 25 to 55 working ages are experiencing a declining labor force participation rate. The long-term trend is now being exacerbated by high rates of unemployment due to the economic downturn.
  - Older core working age people, between 56 and 65 also are experiencing a significant drop in labor force participation.
  - People older than 65 are now increasing their labor force participation rate.
  - The aging of the population contributes to a lower overall labor force participation rate. This trend will lessen future rebounds in the labor force participation rate tied to economic cycles.

- Population Growth:
  - International in-migration is expected to remain strong, a key factor in California's long-term population growth.
  - Although birth rates do go down with economic downturns, the United States maintains high-fertility rates compared to other developed countries. This is expected to continue into the future.

C.3 POTENTIAL IMPLICATIONS FOR LONG-DISTANCE TRAVEL

Since the trip generation component of the R&R model is driven primarily from population, fewer jobs per person will not be reflected in a change in long-distance travel. CS expects that this change will affect the frequency of future long-distance travel and as such, the future market for high-speed rail in California. CS does not see an easy way to quantify this, other than to acknowledge this potential trend, and recognize that it could have implications for future travel – probably in the negative direction (although changes in leisure travel may turn out to be on the positive side). For now, the approach to consider a range of potential forecasts should be adequate to capture this risk, but this demographic trend should be explored in more detail in future updates.

D. Long-Distance Interregional Survey Results

Memorandum

TO: CAHSRA Peer Review Panel Members

FROM: Cambridge Systematics

DATE: September 22, 2011

RE: California High Speed Rail Ridership and Revenue Forecasting
Long Distance Interregional Travel Survey Results – 3rd Draft

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Executive Summary

The 2011 CAHSRA Long Distance Travel Survey was used to collect current long distance travel data for the revalidation of the California High Speed Rail Ridership and Revenue Model (CAHSR R&R Model). The data collected in this survey provide a comprehensive source of data for all trip purposes for home-based interregional travel in California.

Survey responses from the 2011 survey were expanded to match the 2008 population synthesis data for the state of California that will be used as a basis for the recalibration and revalidation. The expanded results provide a different picture of medium and long distance interregional travel in California than those used for the 2000 calibration and validation of the existing CAHSR R&R Model. Key survey findings were:

- The overall number of medium distance (50-99 miles) interregional trips (one-way linked trips) [1] within California estimated for 2008, 478,400, was 36 percent lower than those used for the 2000 model calibration and validation (752,000);
- The overall number of long distance (100+ miles) interregional trips within California estimated for 2008, 526,600, was 5 percent higher than those used for the 2000 model calibration and validation (499,000);
- The overall trip rates for medium and long distance interregional trips within California for 2008 were 0.037 and 0.041 person trips per household per day, respectively. In comparison, the overall 2000 trip rates were 0.065 and 0.044 for the same trip lengths;
- The composition of medium and long distance trips by trip purpose estimated for 2008 are substantially different than the shares used for the 2000 model calibration and validation. The estimated 2008 long distance trip shares for the combined business/commute trip purpose and the combined recreation/other trip purpose were 17 percent and 83 percent,

[1] Unless otherwise noted, the term "trips" is used to describe "linked one-way trips" throughout this document.

140 East 19th Avenue, #400
Denver, CO 80203
tel 303-832-2998 www.camsys.com fax 303-825-1585

respectively. In comparison, the shares for the combined business/commute and recreation/other trip purposes for the 2000 calibration and validation were 50 percent each; and

- Main travel mode shares for medium distance trips (50-99 miles) for 2008 were similar to those used for the 2000 model calibration and validation for the business/commute and recreation/other trip purposes. For long distance travel (100+ miles), the estimated 2008 data show substantially lower auto mode shares for business/commute travel than those used for the 2000 model calibration and validation (64 percent for 2008 and 88 percent for 2000); the decreased auto shares shown for 2008 were balanced by substantially higher air shares for the business/commute trips (33 percent for 2008 versus 11 percent for 2000). Main travel mode shares for recreation/other travel estimated for 2008 were similar to those used for the 2000 model calibration and validation.

Objective and Overview

Cambridge Systematics (CS) conducted a long distance travel survey to estimate interregional medium and long distance travel characteristics of California residents in order to revalidate CS's ridership and revenue forecasting model for the California High Speed Rail (CA HSR) project. CS designed the survey mechanism and hired Harris Interactive to conduct the survey in May and June, 2011. Harris employed a web-based polling methodology to contact California residents and perform the survey on line.

The survey will be used to recalibrate and validate the model to 2008 conditions. Therefore, the 2011 data was factored to 2008 conditions. Throughout this memo, we refer to this survey and factoring effort as the 2011/2008 Trip Frequency Survey.

The 2011 CAHSRA Long Distance Travel Survey collected data for trips to all locations that were at least 50 miles from home, including locations outside of the State of California. However, since the CA HSR R&R Model only models trips within the State of California, all trip records for locations outside of California were deleted from the trip database before the survey expansion tasks. Preliminary examination of the raw survey data shows that approximately 80 percent of the unweighted trips (before survey cleaning and expansion) reported were made to locations within the State of California, and that the remaining 20 percent of long distance trips were made to either interstate (18%) or international (2%) locations.

The survey was restricted to trips made to or from California residents' home region, so it didn't include non-home based medium and long distance trips (medium and long distance trips made between locations outside of the resident's home region), nor did it include visitor medium and long distance trips made by non-residents of the state of California.

"Trip" Naming Conventions

Unless otherwise noted, the term "trips" is used to describe "linked one-way trips" throughout this document.

Following are definitions of the different types of trips analyzed in this document:

- *Long distance trips* are all trips made by California residents to locations greater than 100 miles from home, regardless of whether the destination is inside the State of California.
- *Long distance trips within California* are the subset of long distance trips that are made to locations within the state.
- *Long distance interregional trips* are the subset of long distance trips within California that start and end in different regions (14 identified within the state). These are the long distance trips that we deal with in the CAHSR R&R Model.

- *Long distance intraregional trips* are the subset of long distance trips within California that start and end in the same region. These are mostly within the two largest regions - SCAG and MTC.
- *Medium distance trips* are trips in the 50 to 99 mile range. Interregional and intraregional medium distance trips can be defined using the same logic as used above in defining long distance interregional and intraregional trips.

Changes in 2nd Draft

The 1st draft of this document was presented to the Peer Review Panel meeting held in San Francisco on August 10-11, 2011. This 2nd draft has been amended to address concerns and suggestions of the Peer Review Panel, and to refine the survey processing and analysis.

The most significant change in the approach for the survey analysis is the change to the variables used to aggregate surveys for expansion purposes. The Peer Review Panel expressed concern with the use of vehicle availability as the wealth variable, due to international observations that behavior changes are reducing the status of vehicle availability as a wealth surrogate. The Panel suggested replacing the vehicle availability variable with a combination of household income and age variables.

The most significant changes to the procedures in this 2nd draft include:

- Revised variables used for data expansion from three dimensions (respondent worker status × number of vehicles available to respondent's household × geographic region) to four dimensions (respondent worker status × household income range of respondent's household × respondent age range × geographic region);
- Prepared tabulation of expanded data estimated for all medium and long distance trips in California, not just interregional medium and long distance trips as presented in the 1st draft;
- Included discussion and comparison of effects of using full dataset (all surveys) vs. reduced dataset (surveys with all required variables available);
- Added discussion of relative medium and long distance trip frequencies obtained from other sources;
- Completed more detailed analysis of "Trip Purpose" variable to confirm relative distribution of commute/business vs. recreational/other trips;
- Identified and corrected a mapping problem in GIS process to correct geocoding of trip origin-destination results to appropriate regions, which affected about 500 survey records; and
- Identified and deleted survey records that were determined to be either invalid or fraudulently reported.

Changes in 3rd Draft

The 2nd draft of this document was distributed to the Peer Review Panel on September 9, 2011. This 3rd draft has been amended to address additional concerns and suggestions of the Peer Review Panel and other reviewers. Aside from minor text edits to clarify terminology, the most significant changes to the procedures in this 3rd draft include:

- Added brief analysis of out-of-state travel to allow comparison of survey results to other jurisdictions; and
- Added text and charts illustrating trip length frequency distribution and mode shares by trip lengths.

Description of Survey

The 2011/2008 Trip Frequency survey was designed to collect medium and long distance travel characteristics of adult California residents. We defined medium and long distance trips as trips to locations that were at least 50 miles from home. Since the survey was restricted to trips made to or from the resident's home region, it did not include non-home based medium and long distance trips (medium and long distance trips made between locations outside of the resident's home region), nor did it include visitor medium and long distance trips made by non-residents of the state of California.

The two month time period covered by the survey (essentially April and May, 2011) represents an "average" time of year when most employed residents are working and most students are in school. More medium and long distance trips would be expected during the summer months for vacation travel, and fewer medium and long distance trips would be expected during the winter months. The survey time period includes one of the major holiday weekends (Memorial Day) that is normally associated with recreational weekend travel. The inclusion of one major holiday weekend is appropriate for the two-month survey time frame, since almost any two-month time period on the calendar includes one such major holiday weekend.

In analyzing the survey, we divide the trips into two categories:

- Long distance (greater than or equal to 100 miles from home); and
- Medium distance (50-99 miles from home)

These definitions are compatible with the structure of the existing CA HSR R&R Model; the CAHSR R&R Model focuses on interregional trips, defined as trips traveling between two of the fourteen modeling regions defined for the model. Thus, the CA HSR R&R Model considers all interregional trips less than 100 miles in the "short distance" interregional trip group. However, we recognize that excluding intraregional trips from the tabulation makes it difficult to understand the bigger picture of long distance trip making in the State of California. Therefore, we provide summary tabulations of trip characteristics separately for "medium and long distance trips within California" and for "medium and long distance interregional trips."

To understand the full scope of trip making we present summary tabulations of all "medium and long distance trips." To provide consistency between the 2011/2008 Trip Frequency Survey and the CA HSR R&R Model, the more detailed analyses of medium and long distance trips from the 2011/2008 Trip Frequency Survey exclude intraregional trips (with the regions being defined as the same fourteen regions used in the CA HSR R&R Model).

The survey was designed to collect trip information and personal information for each of the variables used in the ridership and revenue forecasting model. Trip information includes the following details for all medium and long distance trips completed in the previous two months:

- Trip origin and destination (city and/or zip code);
- Trip purpose (was this trip made for business, commuting, recreation, or another purpose);
- Trip frequency (how often was this trip repeated for the same purpose during the past two months);
- Group size (how many people – total and household members – traveled with respondent);
- Trip main travel mode (e.g. auto, air, rail, and bus);
- Access mode (to and from airport or rail/bus station for trips using non-auto modes); and
- Trip duration (return same day or number of nights before return trip).

Personal information collected includes:

- Gender;
- Age;
- Employment status (appended after completion of survey, not available for all respondents);
- Household size (total and adults);
- Number of workers in household;
- Number of vehicles available to household; and
- Household income (optional, not available for all respondents).

Survey Mechanism and Pre-test

CS provided the survey questionnaire to Harris Interactive, who prepared the on-line version of the survey. The on-line version of the survey was designed to restrict the responses to the target audience (California residents at least 18 years of age) and included logic checks to ensure the reasonableness of significant responses, such as household size. The original version of the survey questions were shared with the Peer Review Panel prior to submittal to Harris Interactive and panel suggestions were incorporated to the extent possible.

The allowed responses for significant trip characteristics, such as trip purpose and main travel mode, were sorted in random order to reduce any bias caused by the order of the responses.

For repeated trips, respondents were asked to record the number of times each trip had been completed within the previous two months. This allowed for the collection of recent trip-making by most survey participants, without overly challenging the memory or patience levels of participants.

The survey was designed to allow respondents to describe up to eight unique medium and long distance trips completed in the previous two-month period. Full details were collected for the most recent trip, while a reduced set of details were collected for additional trips completed during the previous two months. Table 1 shows which trip characteristics were collected for the most recent trip and for additional trips completed during the previous two months.

Table 1. Trip Details Collected for Most Recent and Additional Medium and Long Distance Trips

Data Item	Most Recent Trip	Additional Trips
Start Location	X	X
Trip Purpose	X	X
Primary Destination	X	X
Trip Frequency (in Last 2 Months)	X	X
Group Size	X	
Main Travel Mode	X	X
Airports or Transit Stations Used	X	
Access and Egress Modes	X	
Trip Duration (Same Day or Overnight)	X	X
Return Trip	X	

Survey responses were limited to trips made by the respondent, not trips made independently by other household members. For the detailed responses regarding the most recent medium and long distance trip, respondents were asked if the trip was made in a group and, if so, how many of the group members were from the respondent's household. These questions provide information for the estimation and application of a group-size variable in future demand forecasts. The group size variable also allows for the estimation of long distance travel by children accompanying adult household members. This is necessary because the CAHSR R&R Model includes trips made by children ages 5 to 17, and the survey is designed to interview only adults age 18 and above.

CS conducted a review and pre-test of the on-line survey, using both industry professionals and lay people to test the functionality of the survey tool. The survey mechanism was tested to ensure that an average respondent could complete the survey within ten minutes, in order to avoid respondent fatigue. Several significant changes were made during the pre-testing procedure, including restructuring the grid used to report trip characteristics for "additional trips" to simplify the reporting process. The Peer Review Panel was also provided with links to test the on-line survey instrument, albeit after the survey was "opened" for live responses.

The final survey mechanism is presented in Appendix 1.

Sampling Plan

The sampling plan was designed to complete at least 15,000 surveys, with at least 500 completed surveys coming from each of eight different regions within the State of California. The survey sample was limited to California residents who are members of on-line poling panels, such as the panel employed by Harris Interactive.

We recognize that there are biases involved with the restrictions of these panels, however, we are unable to quantify these biases with respect to the desired Long Distance Travel Survey data. Instead, we designed the survey to collect information about variables that are significant to travel behavior that could be compared to statewide data sources, such as wealth, household and work status, so that any biases encountered could be corrected through the application of expansion factors. Given that, we made all efforts possible to contact a representative cross-section of the population. The most obvious bias identified was with regard to the age of respondents. When 30 percent of the sample was completed, we found that there was a substantial bias toward older residents – not surprising for a survey panel. Consequently, we instructed Harris to focus their remaining data collection efforts on the younger members of their panels (ages 18 to 40)[2].

Completed and Acceptable Survey Summary

Harris Interactive returned a database of 15,067 completed surveys. Surveys were considered complete by Harris if all questions were answered and the respondents met qualification standards (e.g. at least 18 years of age and California residents). Upon further analysis of the survey records by CS, 669 of these surveys were deleted from the database for a variety of reasons, including:

- inconsistent or incomprehensible personal data;
- home locations outside of California; or
- fraudulent data (several dozen surveys appear to have been complete by the same person).

The net result of these deletions was a database of 14,398 surveys for the estimation of key trip variables.

Based on Peer Review Panel suggestions regarding expansion procedures, subsequent review and data cleaning identified 2,412 additional surveys that lacked other important information for expansion, such as worker status or income range of the respondent’s household. A “reduced” database of 11,986 fully acceptable and geocoded surveys resulted from the additional review and cleaning of the data.

In order to assess the statistical impact of removing the additional 2,412 surveys from the database, we also processed the survey results for an “enhanced” dataset that included the

[2] Age was used as a classification variable for expansion of the survey results to negate the impact of the sampling bias for this variable.

14,398 surveys originally identified as acceptable. For the enhanced dataset, the missing worker status and/or income range variables were imputed using other personal characteristics. The procedure for income imputation was as follows:

- Distributions of the respondents by income group (low, medium, high, or missing) were produced for each *household size* and *number of vehicles available* stratum;
- Respondent records with missing income information were allocated to one of the three income categories (low, medium, high) based on a uniform random distribution with a seed.

For example, for respondents with household size = 1 and number of vehicles = 0, there were 23 observations with missing income data, four observations reported high income levels, 17 observations reported medium income levels, and 225 observations reported low income levels. Each of the 23 observations with missing income data was assigned a uniformly distributed random number which was, in turn, used to assign an income group based on the cumulative marginal distribution of reported incomes within the specified bin (household size=1, number of vehicles=0).

The procedure for worker status imputation is similar to that used for income imputation. In place of the distributions of respondents reporting household income for each household size/number of vehicles stratum, distributions of workers (and implied non-workers) from the 2009 Labor Force Participation shown below in Table 2 were used. Imputation for missing worker status information (worker or non-worker) was performed based on gender and age of the respondent using a uniform random distribution.

Table 2. Year 2009 Labor Force Participation

Gender	Age Range		
	16-24	25-54	55+
Male	55.4%	88.1%	46.4%
Female	53.3%	74.6%	33.6%

Source: US Census Bureau - *Labor Force Participation Rate for Selected Age Groups: 2008 and 2009* (Issued October 2010)

The marginal population characteristics of the survey respondents for the reduced and enhanced databases are summarized in Table 3.

Expansion Factoring

The results of the 2011/2008 Trip Frequency Survey were analyzed by aggregating the survey responses into various personal, household, socioeconomic and geographic strata. Trip rates for different cross-classifications of strata were compared to determine which variables displayed the greatest explanatory power with respect to medium and long distance trip generation rates.

Table 3. Marginal Distributions of Surveys

	Enhanced Dataset (14,398 Records)		Reduced Dataset (11,986 Records)	
Category	Number	Percent	Number	Percent
Gender				
Male	6,452	45%	5,485	46%
Female	7,946	55%	6,501	54%
Employment Status (Imputed for Portion of Enhanced Dataset)				
Worker	8,935	62%	7,515	63%
Non-Worker	5,463	38%	4,471	37%
Age Range				
18-29	2,062	14%	1,679	14%
30-39	1,843	13%	1,601	13%
40-49	2,111	15%	1,780	15%
50-64	5,382	37%	4,479	37%
65+	3,000	21%	2,447	20%
Household Size				
1	3,115	22%	2,754	23%
2	6,286	44%	5,216	44%
3	2,224	15%	1,784	15%
4+	2,773	19%	2,232	19%
Mean Size	2.456		2.415	
Workers in Household				
0	3,509	24%	2,957	25%
1	5,198	36%	4,268	36%
2+	5,691	40%	4,761	40%
Mean Value	1.262		1.258	
Household Vehicles				
0	408	3%	367	3%
1	4,193	29%	3,689	31%
2+	9,797	68%	7,930	66%
Mean Value	2.067		2.018	
Household Income Range (Reported – Excluding "Declines")				
Under $10,000	388	3%	382	3%
Between $10,000 and $29,999	1,537	12%	1,500	13%
Between $30,000 and $44,999	1,595	13%	1,548	13%
Between $45,000 and $59,999	1,534	12%	1,464	12%
Between $60,000 and $74,999	1,420	11%	1,369	11%
Between $75,000 and $89,999	1,334	11%	1,292	11%
Between $90,000 and $104,999	1,162	9%	1,107	9%
Between $105,000 and $119,999	786	6%	744	6%
Between $120,000 and $134,999	647	5%	606	5%
Between $135,000 and $174,999	928	7%	875	7%
$175,000 or more	1,204	10%	1,099	9%
Household Income Range (Imputed for Portion of Enhanced Dataset)				
Low (Under $45,000)	3,987	28%	3,430	29%
Medium ($45,000 - $89,999)	4,918	34%	4,125	34%
High ($90,000 or more)	5,493	38%	4,431	37%
Geographic Region				
SACOG	1,289	9%	1,055	9%
SANDAG	1,693	12%	1,388	12%
MTC	2,588	18%	2,125	18%
SCAG	4,764	33%	4,047	34%
Remainder of State	4,064	28%	3,371	28%

The expansion factoring process was completed for two separate datasets – the reduced dataset and the enhanced dataset. As described previously, the reduced dataset includes 11,986 survey records that have complete information for all pertinent variables, and the enhanced dataset includes the full set of 14,398 survey records that have acceptable data for most pertinent variables, and for which missing data are imputed. This dual analysis approach was undertaken in order to document the statistical significance of employing the reduced dataset.

Originally, three variables were identified as possessing the greatest explanatory power: employment status, number of vehicles available within the respondent's household, and geographic location. After consultation with the Peer Review Panel we decided to replace the vehicle availability variable with household income and age group variables.

The Harris panel restricts panel members to one per household. Thus, by design, the survey was a survey of persons, not households. Surveyed trip records were expanded to represent the adult population of California by comparing the population in households for the state to the numbers of observed records (completed surveys) using a four-dimensional cross-classification scheme resulting in 150 possible strata. The four dimensions and strata used were:

- Geographic region (five super-regions in state: SCAG, MTC, SANDAG, SACOG, and the rest of the state);
- Worker status of the respondent (worker or non-worker);
- Household income range of the respondent's household (three groups: low income – less than $45,000, medium income - $45,000-$89,999, and high income – over $90,000); and
- Age range of the respondent (five groups: 18-29, 30-39, 40-49, 50-64, and over 65).

The numbers of observed (surveyed) records for each cell of the population cross-classification are summarized in Tables 4 and 5. Table 4 displays the numbers of observed records for each cell for the reduced dataset (11,986 records) and Table 5 displays the numbers of observed records for each cell for the enhanced dataset (14,398 records). These tables includes boxes drawn around groups of cells representing the aggregations of cells necessary to maintain minimum observations (target=20) for expansion purposes.

University of California-Davis Population Synthesis Data

We used the California Statewide Travel Demand Model (CSTDM) Synthetic Population Database for 2008 as developed by the University of California-Davis (see Appendix 2) to estimate the total adult population in each cell of the four-way cross-classification. This population synthesis includes all residents of California, excluding those living in group quarters. The synthetic data for the adult population are summarized in Table 6.

Table 4. Observed Surveys by Four-Dimensional Cross-Classification - Reduced Dataset

	Household Income Range						
	Non-workers			Workers			
Region/Age Range	< $45k	$45k-$90k	>$90k	< $45k	$45k-$90k	>$90k	Total
SACOG Region (Sacramento)							
18-29	24	14	3	40	38	22	141
30-39	15	11	11	21	37	42	137
40-49	14	9	2	22	36	68	151
50-64	47	50	45	41	93	122	398
65 and over	69	70	45	7	18	19	228
Total	169	154	106	131	222	273	1,055
SANDAG Region (San Diego County)							
18-29	28	13	8	37	66	42	194
30-39	10	16	7	30	64	71	198
40-49	16	7	7	25	64	76	195
50-64	58	46	37	53	123	189	506
65 and over	67	95	55	16	24	38	295
Total	179	177	114	161	341	416	1,388
MTC Region (San Francisco Bay Area)							
18-29	41	21	13	47	65	68	255
30-39	20	8	13	28	69	148	286
40-49	23	17	13	33	73	189	348
50-64	84	66	76	74	181	300	781
65 and over	82	111	103	29	54	76	455
Total	250	223	218	211	442	781	2,125
SCAG Region (Southern California)							
18-29	94	43	32	131	171	128	599
30-39	54	41	19	75	171	203	563
40-49	53	31	25	76	173	247	605
50-64	157	159	141	149	318	547	1,471
65 and over	204	200	174	47	66	118	809
Total	562	474	391	478	899	1,243	4,047
Remainder of California							
18-29	125	37	15	141	114	58	490
30-39	60	31	13	84	130	99	417
40-49	89	30	7	82	136	137	481
50-64	256	170	91	180	305	321	1,323
65 and over	232	191	101	40	49	47	660
Total	762	459	227	527	734	662	3,371
California Total							
18-29	312	128	71	396	454	318	1,679
30-39	159	107	63	238	471	563	1,601
40-49	195	94	54	238	482	717	1,780
50-64	602	491	390	497	1,020	1,479	4,479
65 and over	654	667	478	139	211	298	2,447
Total	1,922	1,487	1,056	1,508	2,638	3,375	11,986

Table 5. Observed Surveys by Four-Dimensional Cross-Classification - Enhanced Dataset

	Household Income Range						
	Non-workers			Workers			
Region/Age Range	< $45k	$45k-$90k	>$90k	< $45k	$45k-$90k	>$90k	Total
SACOG Region (Sacramento)							
18-29	27	23	9	45	49	26	179
30-39	17	14	13	24	40	51	159
40-49	16	10	4	28	43	84	185
50-64	49	66	59	52	110	145	481
65 and over	81	83	67	8	21	25	285
Total	190	196	152	157	263	331	1,289
SANDAG Region (San Diego County)							
18-29	36	19	13	45	77	57	247
30-39	10	18	10	40	75	83	236
40-49	19	8	10	33	75	97	242
50-64	68	56	57	60	143	221	605
65 and over	85	114	71	19	31	43	363
Total	218	215	161	197	401	501	1,693
MTC Region (San Francisco Bay Area)							
18-29	45	27	24	52	77	92	317
30-39	22	12	15	35	79	166	329
40-49	24	21	18	46	91	213	413
50-64	93	81	101	104	210	364	953
65 and over	107	144	139	36	62	88	576
Total	291	285	297	273	519	923	2,588
SCAG Region (Southern California)							
18-29	107	58	51	147	193	156	712
30-39	57	47	25	87	186	224	626
40-49	63	39	32	93	197	287	711
50-64	176	188	175	186	374	632	1,731
65 and over	237	242	228	59	79	139	984
Total	640	574	511	572	1,029	1,438	4,764
Remainder of California							
18-29	140	55	28	165	142	77	607
30-39	65	39	21	97	152	119	493
40-49	94	38	7	94	158	169	560
50-64	282	203	141	212	360	414	1,612
65 and over	255	223	142	45	66	61	792
Total	836	558	339	613	878	840	4,064
California Total							
18-29	355	182	125	454	538	408	2,062
30-39	171	130	84	283	532	643	1,843
40-49	216	116	71	294	564	850	2,111
50-64	668	594	533	614	1,197	1,776	5,382
65 and over	765	806	647	167	259	356	3,000
Total	2,175	1,828	1,460	1,812	3,090	4,033	14,398

Table 6. 2008 Adult Population by Four-Dimensional Cross-Classification

	Household Income Range						
	Non-workers			Workers			
Age Range	< $45k	$45k-$90k	>$90k	< $45k	$45k-$90k	>$90k	Total
SACOG Region (Sacramento)							
18-29	65,688	30,871	14,127	108,667	98,132	44,655	362,141
30-39	39,433	24,032	9,696	75,771	105,319	52,723	306,974
40-49	37,465	20,150	12,252	63,236	99,463	75,663	308,230
50-64	65,301	40,254	23,925	54,404	84,683	78,643	347,209
65 +	123,738	54,991	27,793	11,755	9,910	8,483	236,670
Total	331,626	170,298	87,794	313,833	397,507	260,166	1,561,224
SANDAG Region (San Diego County)							
18-29	88,328	44,062	27,228	150,422	128,392	74,919	513,350
30-39	53,881	30,646	20,326	109,921	141,427	93,541	449,742
40-49	45,791	32,141	23,173	91,180	146,668	128,318	467,273
50-64	75,987	49,417	40,586	75,679	110,480	123,144	475,293
65 +	158,623	78,059	55,534	14,644	14,483	12,304	333,647
Total	422,611	234,325	166,847	441,847	541,449	432,226	2,239,305
MTC Region (San Francisco Bay Area)							
18-29	133,545	91,326	114,645	198,178	264,306	304,982	1,106,982
30-39	89,147	75,244	72,725	166,382	290,863	334,690	1,029,050
40-49	97,704	62,983	78,531	175,359	316,685	433,655	1,164,916
50-64	177,661	122,253	122,579	176,039	292,058	417,574	1,308,163
65 +	382,517	175,258	146,872	40,914	38,134	39,556	823,249
Total	880,573	527,063	535,351	756,871	1,202,046	1,530,456	5,432,360
SCAG Region (Southern California)							
18-29	578,364	346,420	201,221	830,993	838,082	547,257	3,342,336
30-39	392,206	235,210	131,322	704,543	777,848	523,121	2,764,249
40-49	365,342	208,318	125,763	651,996	821,869	690,406	2,863,693
50-64	518,761	294,442	201,452	537,400	688,813	698,230	2,939,097
65 +	977,991	398,314	252,142	119,016	100,264	92,241	1,939,968
Total	2,832,663	1,482,703	911,899	2,843,948	3,226,876	2,551,254	13,849,344
Remainder of California							
18-29	267,253	120,345	43,383	351,845	247,008	107,561	1,137,395
30-39	167,333	71,680	25,329	253,764	246,445	103,509	868,059
40-49	142,684	65,703	26,783	213,137	275,560	161,070	884,937
50-64	242,461	110,948	56,098	191,490	230,201	166,715	997,913
65 +	421,001	129,099	59,402	41,069	29,555	18,608	698,734
Total	1,240,732	497,776	210,994	1,051,305	1,028,768	557,464	4,587,039
California Total							
18-29	1,133,178	633,024	400,603	1,640,105	1,575,919	1,079,374	6,462,203
30-39	742,000	436,812	259,398	1,310,381	1,561,902	1,107,583	5,418,076
40-49	688,986	389,295	266,502	1,194,909	1,660,245	1,489,112	5,689,049
50-64	1,080,171	617,313	444,640	1,035,011	1,406,235	1,484,305	6,067,675
65 +	2,063,870	835,721	541,742	227,398	192,345	171,192	4,032,268
Total	5,708,205	2,912,165	1,912,885	5,407,804	6,396,646	5,331,566	27,669,272

Expansion Factor Calculation

We estimated expansion factors for each cell of the household cross-classification by dividing the synthesized adult population by the number of survey respondents. Thus, in effect, we have used trip making characteristics from 2011 to represent medium and long distance trip making in 2008. The results are summarized in Table 7 and 8, for the enhanced and reduced datasets, respectively. For reference purpose, the average expansion factors are approximately 2,300 for the enhanced dataset and approximately 1,900 for the reduced dataset. As with Tables 4 and 5, these tables also include boxes drawn around groups of cells representing the aggregations of cells necessary to maintain minimum observations (target=20) for expansion purposes.

Table 7. Expansion Factors by Four-Dimensional Cross-Classification – Enhanced Dataset

	Household Income Range					
	Non-workers			Workers		
Region/Age Range	< $45k	$45k-$90k	>$90k	< $45k	$45k-$90k	>$90k
SACOG Region (Sacramento)						
18-29	2,433	1,342	1,388	2,415	2,003	1,717
30-39	2,330	1,841	1,388	3,157	2,633	1,034
40-49	2,330	1,841	1,388	2,258	2,313	901
50-64	1,333	610	406	1,103	770	542
65 +	1,528	663	415	1,103	472	339
SANDAG Region (San Diego County)						
18-29	2,454	2,319	2,143	3,343	1,667	1,314
30-39	3,437	2,512	2,143	2,748	1,861	1,127
40-49	3,437	2,512	2,143	2,763	1,956	1,323
50-64	1,117	882	712	1,261	773	557
65 +	1,888	685	782	732	467	286
MTC Region (San Francisco Bay Area)						
18-29	2,968	3,382	4,777	3,811	3,433	3,315
30-39	4,052	4,189	4,584	4,754	3,682	2,016
40-49	4,071	4,189	4,584	3,812	3,480	2,036
50-64	1,910	1,509	1,214	1,693	1,391	1,147
65 +	3,575	1,217	1,057	1,136	615	449
SCAG Region (Southern California)						
18-29	5,456	5,973	3,946	5,615	4,342	3,508
30-39	6,881	5,004	5,253	8,098	4,182	2,335
40-49	5,799	5,341	3,930	7,011	4,172	2,406
50-64	2,948	1,566	1,151	2,889	1,842	1,105
65 +	4,127	1,646	1,106	2,017	1,269	664
Remainder of California						
18-29	1,909	2,271	1,549	2,132	1,715	1,397
30-39	2,574	1,886	1,861	2,616	1,611	870
40-49	1,518	1,729	1,861	2,267	1,744	953
50-64	860	547	398	903	639	403
65 +	1,651	579	418	913	448	305

Table 8. Expansion Factors by Four-Dimensional Cross-Classification – Reduced Dataset

	Household Income Range					
	Non-workers			Workers		
Region/Age Range	< $45k	$45k-$90k	>$90k	< $45k	$45k-$90k	>$90k
SACOG Region (Sacramento)						
18-29	2,737	2,207	2,255	2,717	2,582	2,030
30-39	2,652	2,207	2,255	3,608	2,846	1,255
40-49	2,652	2,207	2,255	2,874	2,763	1,113
50-64	1,389	805	532	1,378	911	645
65 +	1,793	786	618	1,378	551	446
SANDAG Region (San Diego County)						
18-29	3,155	2,968	3,215	4,065	1,945	1,784
30-39	3,834	2,968	3,215	3,664	2,210	1,317
40-49	3,834	2,968	3,215	3,647	2,292	1,688
50-64	1,310	1,074	1,097	1,428	898	652
65 +	2,368	822	1,010	915	603	324
MTC Region (San Francisco Bay Area)						
18-29	3,257	4,349	6,818	4,217	4,066	4,485
30-39	4,457	5,529	6,818	5,942	4,215	2,261
40-49	4,248	5,529	6,818	5,314	4,338	2,294
50-64	2,115	1,852	1,613	2,379	1,614	1,392
65 +	4,665	1,579	1,426	1,411	706	520
SCAG Region (Southern California)						
18-29	6,153	8,056	6,288	6,343	4,901	4,275
30-39	7,263	5,737	6,912	9,394	4,549	2,577
40-49	6,893	6,720	5,031	8,579	4,751	2,795
50-64	3,304	1,852	1,429	3,607	2,166	1,276
65 +	4,794	1,992	1,449	2,532	1,519	782
Remainder of California						
18-29	2,138	3,253	2,728	2,495	2,167	1,855
30-39	2,789	2,312	2,728	3,021	1,896	1,046
40-49	1,603	2,190	2,728	2,599	2,026	1,176
50-64	947	653	616	1,064	755	519
65 +	1,815	676	588	1,027	603	396

Examination of the expansion factors shows a large variation in the values of the expansion factors. For example, with the reduced dataset, the calculated expansion factors vary from less than 400 to more than 9,000. This wide variation demonstrates the value of calculating and applying expansion factors by the various strata in order to reduce the bias that would be introduced by heavily over-sampled markets.

These ranges required for the expansion factor resulted from several factors, including typical characteristics of the survey panelists employed by Harris Interactive and intentional sampling to achieve minimum quotas in certain geographical regions. We found that the panelists employed by Harris are typically older and wealthier than the population at large. This is probably due to factors such as access to technology and the relative amount of free time available to different population groups. The intentional oversampling of smaller regions resulted in smaller expansion factors being calculated for the smaller regions, especially in comparison to the two largest regions in the state: SCAG and MTC.

Note that children under age 18 weren't surveyed directly. Their trip-making characteristics were derived from the group size characteristics reported by adults in households. As such, the children trip-makers were not subject to estimation using expansion factors. Adjustments to account for children trip-makers are described in the following section.

Survey Results

Summaries of Expanded Survey Data

Results from the 2011/2008 Trip Frequency Survey, expanded to match the 2008 population as described above, are summarized below. In sub-section a, summaries are presented for total medium and long distance trip making, including intraregional trips, in order to provide a level ground to compare trip-making in all regions of the state. In sub-section b, the summaries are restricted to interregional medium and long distance trips so that the data can be compared and contrasted to data from the 2000 CAHSR R&R Model calibration and validation and to other data, as available.

a. Medium and Long Distance Trip Making within California

Table 9 summarizes expanded trips for all medium and long distance trips in the state, including interregional and intraregional trips, for both the reduced and enhanced datasets. The trips in this table are calculated by multiplying the number of trips reported by respondents during the two month reporting period by the expansion factor for the corresponding population group (worker status, income, age, and geographic region) and by six to convert the expanded trips to annual trips. The resulting annual expanded trips were divided by 365 to convert to daily trips.

The expanded numbers of trips are virtually identical for the two expansion processes. This fact indicates that deleting 2,412 surveys from the enhanced dataset to create the reduced dataset has little impact on the overall trip rates. In fact, the most significant difference between the expanded trips for the two datasets is for commute trips; 296,400 for the reduced dataset versus 277,300 for the enhanced dataset. Since the expansion of commute trips in the enhanced dataset relies on the imputation of the worker status variable, the values obtained from the reduced dataset may be considered more reliable than the values obtained using the enhanced dataset. Therefore, the survey analyses in the remainder of this memo are based on the reduced dataset.

Table 9. Total Medium and Long Distance Trips in California (Daily Adult Person Trips)

Trip Length	Reduced Dataset Medium (50-99 Mi.)	Reduced Dataset Long (100+ Mi.)	Reduced Dataset Total (50+ Mi.)	Enhanced Dataset Medium (50-99 Mi.)	Enhanced Dataset Long (100+ Mi.)	Enhanced Dataset Total (50+ Mi.)
Geographic Region						
SACOG	63,400	26,000	89,400	68,100	25,900	94,000
SANDAG	76,000	39,700	115,700	90,000	39,200	129,200
MTC	182,800	112,600	295,400	175,900	109,700	285,600
SCAG	598,700	252,100	850,800	581,000	249,400	830,400
Remainder of CA	256,300	140,400	396,700	244,500	143,800	388,300
Trip Purpose (Total for All Regions in California)						
Business	157,400	72,800	230,200	158,800	72,000	230,800
Commute	254,600	41,800	296,400	235,000	42,300	277,300
Recreation	241,400	165,500	406,900	245,100	162,100	407,200
Other	523,800	290,700	814,500	520,600	291,600	812,200
Total	1,177,200	570,800	1,748,000	1,159,500	568,000	1,727,500

Medium and long distance trip rates are estimated by dividing the number of trips in the expanded trip database by the number of adults in the corresponding geographic region. Table 10 summarizes trip rates for the major regions in California and for the rest of the state. The overall medium and long distance trip rates (50 miles or more) for the major regions are distributed over a relatively narrow range, between 0.052 and 0.061 trips per person per day. The overall trip rates for the remainder of the state are significantly higher, which can be attributed to the greater travel distances required to meet certain needs in less populated areas.

Table 10. Total Medium and Long Distance Trip Rates in California (Daily Adult Person Trips per Person)

Region	Medium (50-99 Mi.) Trips	Medium (50-99 Mi.) Trip Rate	Long (100+ Mi.) Trips	Long (100+ Mi.) Trip Rate	Total (50+ Mi.) Trips	Total (50+ Mi.) Trip Rate
SACOG	63,400	0.041	26,000	0.017	89,400	0.057
SANDAG	76,000	0.034	39,700	0.018	115,700	0.052
MTC	182,800	0.034	112,600	0.021	295,400	0.054
SCAG	598,700	0.043	252,100	0.018	850,800	0.061
Remainder of CA	256,300	0.056	140,400	0.031	396,700	0.086
Total	1,177,200	0.043	570,800	0.021	1,748,000	0.063

b. Adjustment for Trips Made by Children

The 2011/2008 Trip Frequency Survey collected trip records for adult residents (age 18 and over) only. The HSR R&R Model was validated using data collected in the 2000-2001 California Statewide Travel Survey, which includes trips made by all residents age 5 and over. Therefore, the results of the 2011/2008 Trip Frequency Survey must be adjusted to account for children age 5-17.

The 2011/2008 survey collected data for additional household members who accompanied adult trip-makers. These data suggest that the trip frequency for children accompanying adult household members on recreational and other trips is 67 percent of the overall trip rates for adult residents. As would be expected, the data also indicate that children do not accompany adult household members on most commute and business trips.

The adjustment for trips made by children is applied as follows:

- calculate the total number of medium and long distance trips made by adults for the *recreational* and *other* trip purposes from the expanded survey data, separately for each geographic region;

- divide these medium and long distance trip totals by the total adult population of the geographic region to calculate the overall trip rate for adults;

- multiply the overall adult trip rates by 0.67 to calculate the medium and long distance trip rates for children for the *recreational* and *other* trip purposes;

- extract the population of children aged 5 to 17 for each region from the population synthesis;

- multiply the child trip rates by the number of children aged 5 to 17 to calculate the number of child medium and long distance trips for the *recreational* and *other* trip purposes;

- add the child trips to the adult trips to calculate the total trips by region and trip purpose;

- no child adjustment is made for the *commute* and *business* trip purposes.

Table 11 summarizes the estimated medium and long distance trips after adjusting for trip-making by children. The adjustment for children increases the overall number of trips in the expanded trip tables by approximately ten percent, from 1,748,000 to 1,925,700.

As a reasonableness check we reviewed *Highlights of the 2001 National Household Travel Survey*, which reported that 25.7 percent of long distance trips are made by persons under 25 years of age. When we expanded our survey data and applied the adjustment for child trip-making for all children age 17 and younger the result was that persons under 25 years of age made 25.5 percent of total statewide medium and long distance trips.

Table 11. Medium and Long Distance Trips with Child Adjustment by Region and by Trip Purpose

Region	2011/2008 Estimate of Trips in 50-99 Mile Distance Range				
	Business	Commute	Recreation	Other	Total
SACOG	5,300	12,700	20,400	31,300	69,700
SANDAG	6,700	15,300	23,900	37,800	83,700
MTC	20,200	37,600	46,000	94,300	198,100
SCAG	98,900	129,100	128,800	297,800	654,600
Remainder of CA	26,300	59,900	57,400	139,000	282,600
Total	157,400	254,600	276,500	600,200	1,288,700
	2011/2008 Estimate of Trips in 100+ Mile Distance Range				
Region	Business	Commute	Recreation	Other	Total
SACOG	4,000	1,500	8,800	14,600	28,900
SANDAG	5,700	2,000	12,900	23,700	44,300
MTC	11,700	5,100	40,400	67,200	124,400
SCAG	31,600	29,600	84,800	134,900	280,900
Remainder of CA	19,800	3,600	42,500	92,600	158,500
Total	72,800	41,800	189,400	333,000	637,000

The 1,925,000 daily trips described above include only medium and long distance trips to or from locations within the State of California. Preliminary examination of the raw survey data show that approximately 80 percent of the unweighted trips (before survey cleaning and expansion) reported were to locations within the State of California. The remaining 20 percent of trip records indicate that between 450,000 and 500,000 additional daily long distance trips were made by California residents to or from interstate or international locations.

c. Interregional Trip Making

Medium and long distance interregional trips are estimated by deleting the intraregional trips from the expanded trip tables. Table 12 summarizes the total medium and long distance interregional trip making for the four major regions in California (MTC, SCAG, Sacramento, and San Diego) and for the rest of California as a whole.

Table 12. Medium and Long Distance Interregional Trips

Region	Medium (50-99 Mi.)			Long (100+ Mi.)		
	All Trips	Interregional	Intraregionals Removed	All Trips	Interregional	Intraregionals Removed
SACOG	69,700	49,000	30%	28,900	28,400	2%
SANDAG	83,700	59,000	30%	44,300	44,100	0%
MTC	198,100	78,200	61%	124,400	96,400	23%
SCAG	654,600	119,200	82%	280,900	202,500	28%
Remainder of CA	282,600	173,000	39%	158,500	155,200	2%
Total	1,288,700	478,400	63%	637,000	526,600	17%

The comparison in Table 12 shows that deleting intraregional trips removes 63 percent of the medium distance trips from the expanded trip tables, and removes 17 percent of the long distance trips from the expanded trip tables. Most of the intraregional trips are removed from the two largest regions, SCAG and MTC.

Table 13 summarizes the total medium distance interregional trip making by trip purpose for the four major metropolitan regions in California and for the rest of California as a whole as estimated for 2008 from the 2011/2008 Trip Frequency Survey. This table also shows data from the 2000 CAHSR R&R Model calibration / validation. Note that there is a definitional difference for the two different years[3]:

- For 2011/2008, medium distance interregional trips are defined narrowly to include only those trips made to locations 50 – 99 miles from respondents' homes and traveling between any two of the fourteen modeling regions defined for the CAHSR R&R Model,

Table 13. Medium Distance Interregional Trips by Major Region

Region	2011/2008 Estimate of Interregional Trips in 50-99 Mile Distance Range (1)				
	Business	Commute	Recreation	Other	Total
SACOG	3,200	3,300	15,300	27,200	49,000
SANDAG	6,100	6,800	17,600	28,500	59,000
MTC	8,500	3,800	17,600	48,300	78,200
SCAG	21,500	13,300	37,400	47,000	119,200
Remainder of CA	10,400	32,200	45,200	85,200	173,000
Total	49,700	59,400	133,100	236,200	478,400
Region	2000 Validation Data for Interregional Trips Less Than 100 Miles				
	Business	Commute	Recreation	Other	Total
SACOG (2,3)	–	–	–	–	83,100
SANDAG (2,3)	–	–	–	–	58,800
MTC (2,3)	–	–	–	–	98,900
SCAG (2,3)	–	–	–	–	140,400
Remainder of CA (2,3)	–	–	–	–	627,500
Total (2,3)	–	–	–	–	1,008,700
Total in 50-99 Mile Distance Range (4)	82,800	353,600	146,300	169,300	752,000

Notes: (1) Source: 2011 California Long Distance Survey data expanded to 2008 to match 2008 population.
(2) Source: *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study – Statewide Model Validation*, prepared for the Metropolitan Transportation Commission and the California High-Speed Rail Authority, prepared by Cambridge Systematics, Inc. with Mark Bradley Research and Consulting, July 2007, Table 3.1.
(3) Validation of frequency model was to total trips by region.
(4) Results summarized from modeled trip tables produced for the 2000 validation.

[3] There is also a difference in the method for estimating trip distances. Detailed address information was not requested in the 2011 CAHSRA Long Distance Survey. Instead, city and zip code information was used to estimate straight line distances for each trip reported by a survey respondent. For the 2000 validation result summaries, distances were based on TAZ to TAZ roadway network distances. As a result, the distances estimated for the 2011 survey data are slightly shorter than the the 2000 distances. This should only be a minor concern for comparing the 2000 and 2011data sources. This shouldn't impact future efforts to validate the CAHSR R&R Model, since the validation effort can be based on consistent definitions of trips distance, i.e. crow's flight.

- For 2000, medium distance interregional trips are defined more broadly to include all trips less than 100 miles made between any two of the fourteen modeling regions defined for the CAHSR R&R Model—including those less than 50 miles.

As shown in Table 13, and as should be expected, the 2000 validation data show substantially more medium distance interregional trips since interregional trips in the 0 to 50 mile range are included. Table 13 also shows the modeled 2000 trips by trip purpose in the 50 to 99 mile distance range. The total interregional trips in the 50 to 99 mile range for 2008 estimated from the expanded survey results are 36 percent lower than the modeled trips for 2000.

The geographic distribution of medium distance interregional trips changes dramatically between the two data sets. In the year 2000 data the four major metropolitan regions account for fewer than 40 percent of total medium distance interregional trips, in spite of the fact that these metropolitan regions account for more than 80 percent of the state's population. In the year 2011/2008 data the four major metropolitan regions account for 64 percent of total medium distance interregional trips, which is more in line with the distribution of the total population.

The distributions of medium distance interregional trips by purpose for the two years are substantially different. That issue will be covered in *e. Distribution of Trips by Trip Purpose*.

Table 14 summarizes the estimated interregional trips greater than or equal to 100 miles for 2011/2008 and 2000.

Table 14. Long Distance Interregional Trips by Major Region

Region	2011/2008 Estimate of Interregional Trips in 100+ Mile Distance Range (1)				
	Business	Commute	Recreation	Other	Total
SACOG	4,000	1,500	8,400	14,500	28,400
SANDAG	5,600	2,000	12,800	23,700	44,100
MTC	9,700	400	36,700	49,600	96,400
SCAG	25,700	17,600	60,200	99,000	202,500
Remainder of CA	19,700	2,500	41,900	91,100	155,200
Total	64,700	24,000	160,000	277,900	526,600
Region	**2000 Validation Data for Interregional Trips in the 100+ Mile Distance Range**				
	Business	Commute	Recreation	Other	Total
SACOG (2,3)	–	–	–	–	44,300
SANDAG (2,3)	–	–	–	–	55,700
MTC (2,3)	–	–	–	–	132,100
SCAG (2,3)	–	–	–	–	140,800
Remainder of CA (2,3)	–	–	–	–	131,900
Total (2,3)	–	–	–	–	504,800
Modeled Results in the 100+ Mile Range (4)	63,400	187,300	203,500	45,200	499,400

Notes: (1) Source: 2011 California Long Distance Survey data expanded to 2008 to match 2008 population.
(2) Source: *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study – Statewide Model Validation*, prepared for the Metropolitan Transportation Commission and the California High-Speed Rail Authority, prepared by Cambridge Systematics, Inc. with Mark Bradley Research and Consulting, July 2007, Table 3.2.
(3) Validation of frequency model was to total trips by region.
(4) Results summarized from modeled trip tables produced for the 2000 validation.

The definitions for the distance ranges between the 2011 California Long Distance Survey and the 2000 validation are consistent with the summaries shown in this table. Overall, the 2011/2008 estimate of long distance interregional trips is five percent higher than the 2000 estimate used for model validation.

The geographic distribution of long distance interregional trips changes between the two data sets. In the year 2000 data the SCAG region accounted for only 28 percent of total long distance interregional trips, in spite of the fact that this metropolitan region accounted for approximately half of the state's population. In the year 2011/2008 data the SCAG region accounted for 38 percent of total long distance interregional trips, which was more in line with the total population.

As with the medium distance interregional trips, the 2011/2008 and 2000 distributions of long distance interregional trips by trip purpose are substantially different.

d. Trip Rates

Tables 15 and 16 summarize our estimate of medium and long distance interregional person trips per household for 2008 and 2000. The trip rates use the household unit in order to allow direct comparison to trip rates reported for the CAHSR R&R Model. The trip rates are expressed as *person trips per household* to clarify that the household unit is used to generate person trips (not household trips).

Table 15. Medium Distance Interregional Person Trip Rates per Household by Major Region

Region	2011/2008 Estimate of Interregional Trips in 50-99 Mile Distance Range (1)				
	Business	Commute	Recreation	Other	Total
SACOG	0.004	0.004	0.020	0.035	0.063
SANDAG	0.006	0.006	0.016	0.026	0.053
MTC	0.003	0.001	0.007	0.019	0.030
SCAG	0.003	0.002	0.006	0.008	0.019
Remainder of CA	0.005	0.015	0.021	0.039	0.079
Total	0.004	0.005	0.010	0.018	0.037
Region	**2000 Validation Data for Interregional Trips Less Than 100 Miles**				
	Business	Commute	Recreation	Other	Total
SACOG (2,3)	–	–	–	–	0.145
SANDAG (2,3)	–	–	–	–	0.060
MTC (2,3)	–	–	–	–	0.040
SCAG (2,3)	–	–	–	–	0.025
Remainder of CA (2,3)	–	–	–	–	0.326
Total (2,3)	–	–	–	–	0.088
Total in 50-99 Mile Distance Range (4)	0.007	0.031	0.013	0.015	0.065

Notes: (1) Source: 2011 California Long Distance Survey data expanded to match 2008 population and 2008 household estimates.
(2) Source: CS from *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study – Statewide Model Validation*, Table 3.1, and 2000 households estimates by region.
(3) Validation of frequency model was to total trips by region.
(4) Results summarized from modeled trip tables produced for the 2000 validation.

The 2000 rates have been estimated from the model output summarized in *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study – Statewide Model Validation*, Table 3.2 along with summaries of 2000 households for each of the regions used as input to the model. The 2008 rates have been estimated using the expanded survey data, adjusted to account for children age 5-17, and the households by region for 2008 as estimated from the California Statewide Travel Demand Model (CSTDM) Synthetic Population Database developed by the University of California-Davis.

Table 16. Long Distance Interregional Person Trip Rates per Household by Major Region

Region	2011/2008 Estimate of Interregional Trips in 100+ Mile Distance Range (1)				
	Business	Commute	Recreation	Other	Total
SACOG	0.005	0.002	0.011	0.019	0.037
SANDAG	0.005	0.002	0.012	0.021	0.040
MTC	0.004	0.0002	0.014	0.019	0.037
SCAG	0.004	0.003	0.010	0.016	0.033
Remainder of CA	0.009	0.001	0.019	0.042	0.071
Total	0.005	0.002	0.012	0.022	0.041
Region	**2000 Validation Data for Interregional Trips in the 100+ Mile Distance Range**				
	Business	Commute	Recreation	Other	Total
SACOG (2,3)	–	–	–	–	0.077
SANDAG (2,3)	–	–	–	–	0.057
MTC (2,3)	–	–	–	–	0.054
SCAG (2,3)	–	–	–	–	0.025
Remainder of CA (2,3)	–	–	–	–	0.069
Total (2,3)	–	–	–	–	0.044
Modeled Long Distance (4)	0.006	0.016	0.018	0.004	0.044

Notes: (1) Source: 2011 California Long Distance Survey data expanded to match 2008 population and 2008 household estimates
(2) Source: CS from *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study – Statewide Model Validation*, Table 3.2, and 2000 households estimates by region.
(3) Validation of frequency model was to total trips by region.
(4) Results summarized from modeled trip tables produced for the 2000 validation.

The comparison of trip rates, rather than total trips, changes the perspective of the differences in long distance interregional trip making for each of the regions. Thus, while the total medium distance interregional trips for 2011/2008 (including the adjustment for children trip-makers) are about 35 percent lower than the number of interregional trips for the same distance range from the 2000 model data (Table 13), the overall medium distance interregional trip rate for 2011/2008 (0.037 medium distance interregional trips per household) is 43 percent lower than the 2000 rate. Likewise, while the total long distance interregional trips for 2011/2008 exceeds the number of long distance interregional trips for 2000 model validation (Table 14), the overall long distance interregional trip rate for 2011/2008 (0.041 long distance interregional trips per household) is seven percent lower than the 2000 rate (0.044 long distance interregional trips per household).

The geographic distribution of the interregional trip rates indicates that the areas with the lowest population densities exhibit the highest rates of medium and, especially, long distance trip making. This is understandable given the greater distances required to reach basic necessities in sparsely populated areas. The lower trip rates calculated for the SCAG and MTC regions are also impacted by the exclusion of intraregional trips. In the SCAG region, especially, there were significant numbers of intraregional trips reported in the 50-99 mile range.

The distributions of trip rates by trip purpose for the two years are substantially different – we provide a more detailed assessment in *Section e. Distribution of Trips by Trip Purpose*.

Estimates of average annual long distance interregional round trips per capita (rather than per household) resulting from an application of the existing CAHSR R&R Model were summarized in a June 8, 2011 memorandum to the Peer Review Panel[4]. Long distance round trip journeys are calculated as half the number of long distance one-way trips. Table 17 summarizes those results from the 2000 model validation, for 2011/2008, and for a recent 2030 travel forecast using the existing HSR R&R Model.

In the May 2-3, 2011 Peer Review Panel meeting, the overall 2000 and 2030 annual per capita long distance trip rates were deemed acceptable, albeit possibly at the high end of the acceptable range. The estimated 2011/2008 per capita rate for all trips is six percent lower than the per capita rates from the 2000 model validation.

Table 17. Average Annual Long Distance (100+ Miles) Interregional Round Trip Journeys per Capita

Year	Business	Commute	Recreation	Other	Total
2000 Validation	0.38	1.11	1.21	0.27	2.96
2011/2008 Long Distance	0.34	0.13	0.84	1.46	2.77
2030 Model	0.39	1.19	1.34	0.32	3.23

The analysis above only accounts for long distance interregional trips within the State of California. Long distance intraregional trips increase the estimated number to 3.35 annual long distance round trip journeys per capita within the State of California.

The additional trip records for trips to locations outside of the State of California indicate that California residents make between 450,000 and 500,000 trips per day to or from interstate and international locations. These trips account for an additional 2.3-2.6 round trip journeys per capita per year, almost all of which qualify as long distance (over 100 miles). The total annual long distance trip rate can be estimated at between 5.7 and 6.0 long distance round trip journeys per capita.

e. Distribution of Trips by Trip Purpose

As has been discussed in the previous two sections, the distribution of trips by trip purpose estimated for 2011/2008 are substantially different from the distribution resulting from the 2000

[4] "Information Requested in 'Section 3.2 Validation and Documentation' of the Independent Peer Review of the California High Speed Rail Ridership and Revenue Forecasting Process, 2005-10, Draft Report for Internal Review (February 7, 2011)."

model calibration and validation, especially for the long distance interregional trips. In particular, the long distance commute and recreation trips and trip rates estimated for 2008 are substantially lower than the 2000 trips and trip rates, while the 2008 other trips and trip rates are substantially higher.

The distribution of trips by trip purpose used for the 2000 model calibration and validation were compiled from a number of sources including the 1995 American Travel Survey (1995 ATS), the 2001 California Statewide Household Travel Survey (2001 SHTS), and the 2000 Census Transportation Planning Package (2000 CTPP) data. The 1995 ATS was designed to collect information regarding long distance travel while the 2001 SHTS was a typical household travel survey focused on collecting household travel information for an assigned travel day. While the 2001 SHTS did collect long distance travel, long distance travel is a rare phenomenon (in comparison to routine daily trip-making) typically resulting in too few observations to draw meaningful summaries. The 2000 CTPP provided information on "the place where the person normally worked" the previous week and linked that information with the household location of the person. Table 18 shows the surveys used to estimate medium and long distance interregional trips for the 2000 model calibration.

Table 18. Surveys Used to Estimate Trips by Purpose for 2000 Model Calibration

Survey	Medium Distance				Long Distance			
	Business	Commute	Recreation	Other	Business	Commute	Recreation	Other
1995 ATS					X		X	X
2001 SHTS	X		X	X				
2000 CTPP		X				X		

The 2011/2008 Trip Frequency Survey, like the 1995 ATS, was designed to collect information specifically on long distance travel. Data on long distance trips made during a two month time period were collected from each respondent in order to compensate for the issues associated with finding sufficient numbers of long distance trips with a normal, one day travel survey. The survey design, however, introduced some uncertainty into the results. Specifically, the survey collected information from only one respondent from each household contacted and the sample was selected from an internet panel. To the extent possible, the impacts of the survey design issues were mitigated through the expansion factoring process.

f. Comparison to Other Data Sources

Table 19 summarizes the percentages of trips by trip purpose from the 2000 calibrated model results and from the 2011/2008 Trip Frequency Survey factored to match the 2008 population. Results from the 2001 National Household Travel Survey (2001 NHTS) and the 2009 NHTS are also summarized in Table 19 for comparison. Key points from the comparison:

- The 2001 NHTS specifically asked long distance travel questions for trips over 50 miles in length. Travel was summarized into the following purposes: Business, Commute, Pleasure, Personal Business, and Other.

- The 2009 NHTS did not include long distance travel questions. However, since over 100,000 households were included in the survey, reasonable numbers of long distance trips were captured in the survey.
- The 2009 NHTS summarized trips into the following trip purposes: home-based work, home-based social, home-based other, business, and non-home-based. For the purposes of comparison, business trips were assumed to be the same as business in a long distance travel survey, home-based work trips were assumed to be commute, and home-based social, home-based other, and non-home-based trips were combined into a combined recreation/other trip purpose.
- The CA HSR R&R Model and 2011/2008 Trip Frequency Survey are limited to interregional trips within the State of California, while the NHTS data include long distance trips to all locations.

Economic conditions should be considered in analyzing the trips by purpose summarized in Table 19. The 2000 data were based on the observation of conditions at the height of the "dot.com" boom. In California, there was substantial commuting and temporary relocations by workers with residences in the San Joaquin Valley, the Monterey Bay area and Central Coast, and, even, the Los Angeles region, who and worked in San Francisco and the Silicon Valley. In contrast, the 2009 NHTS and the 2011 Long Distance survey were collected either during the "great recession" or during the slow recovery afterwards, where such long distance commuting became less prevalent.

Table 19. Percentages of Trips by Trip Purpose

Survey / Source	Distance Range Summarized	Business	Commute	Business / Commute	Recreation / Other
2000 CA HSR Model Results	50+ Miles	12%	43%	55%	45%
2011/2008 Long Distance Survey	50+ Miles	11%	8%	20%	80%
2001 NHTS	50+ Miles	16%	13%	29%	71%
2009 NHTS	50-500 Miles	9%	9%	18%	82%
2000 CA HSR Model Results	100+ Miles	13%	38%	50%	50%
2011/2008 Long Distance Survey	100+ Miles	12%	5%	17%	83%
2009 NHTS	100-500 Miles	10%	3%	13%	87%

The trips reported in the 2011/2008 Trip Frequency Survey indicate that California residents make trips to approximately 1.2 million medium and long distance destinations per day (including intraregional and out-of-state locations), or 0.093 round trip journeys per household per day. The 2001 National Household Travel Survey (*BTS National Household Travel Survey - Long Distance Travel Quick Facts*) reports that Americans made approximately 2.6 billion long distance trips in 2001, or 0.067 trips per household per day, which indicates that California's long distance trip rate observed from the 2011/2008 Trip Frequency Survey is approximately 40 percent greater than the national statistic. However, a recent long distance travel survey completed in the State of Colorado (*Surveying and Modeling Long Distance Trips* presented at the

13th National TRB Transportation Applications Conference, May 11, 2011) reported an average trip rate similar to the California data: 0.097 trips over 50 miles per household per day.[5]

g. Trip Distribution

Table 20 compares long distance interregional trip distribution results from the 2011/2008 Trip Frequency Survey, factored to match 2008 population and adjusted to account for children age 5-17, to 2000 CAHSR R&R Model calibration targets. The 2000 HSR R&R Model calibration targets were defined for major region to region pairs that could be readily summarized from 1995 ATS data and 2000 CTPP data. **Table 20. Average Daily Long Distance Interregional Trips**

Market	Business	Commute	Recreation	Other	Total
2011/2008 Estimate of Interregional Trips in 100+ Mile Distance Range					
LA to Sacramento	5,600	100	4,800	11,200	21,700
LA to San Diego	7,500	10,400	29,800	42,800	90,500
LA to SF	17,300	400	22,000	40,700	80,400
Sacramento to SF	1,900	1,400	12,300	12,300	27,900
Sacramento to San Diego	700	-	900	1,200	2,800
San Diego to SF	2,300	-	3,600	7,300	13,200
LA/SF to SJV	8,700	9,000	21,600	57,900	97,200
Other to SJV	6,500	400	2,600	9,300	18,800
To/from Monterey/Central Coast	15,000	6,000	40,300	62,800	124,100
To/from Far North	6,100	500	12,200	22,600	41,400
To/from W. Sierra Nevada	1,400	300	11,300	4,700	17,700
Total	73,000	28,500	161,400	272,800	535,700
2000 Validation Data for Interregional Trips in 100+ Mile Distance Range (1)					
LA to Sacramento	5,200	5,100	7,100	1,500	18,900
LA to San Diego	10,300	29,700	61,800	13,600	115,400
LA to SF	17,400	22,100	44,100	6,800	90,400
Sacramento to SF	5,600	17,000	21,400	7,300	51,300
Sacramento to San Diego	1,200	900	1,200	200	3,500
San Diego to SF	6,000	4,800	16,400	2,300	29,500
LA/SF to SJV	4,400	53,700	19,800	5,700	83,600
Other to SJV	12,500	11,000	12,900	4,700	41,100
To/from Monterey/Central Coast	8,300	28,800	19,800	6,800	63,700
To/from Far North	3,100	17,000	12,400	2,400	34,900
To/from W. Sierra Nevada	500	9,700	7,500	1,500	19,200
Total	74,500	199,800	224,400	52,800	551,500

Notes: (1) Source: *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study – Final Report*, prepared for the Metropolitan Transportation Commission and the California High-Speed Rail Authority, prepared by Cambridge Systematics, Inc., July 2007, Table 3.3.

[5] The Colorado survey data is preliminary and not yet weighted to correct for observed biases. The difference in the trip rates reported for the national (NHTS) and statewide (California and Colorado) surveys is most likely due to the different survey mechanisms employed. The NHTS survey employed a daily diary while the California and Colorado surveys employed longer term survey mechanisms to capture long distance travel over a longer time frame – 14 days for Colorado and two months for California. The Colorado long distance survey was conducted in conjunction with a household travel survey that employed a daily diary, which resulted in an underestimate of long distance travel similar to the NHTS result: 0.68 trips per household per day.

Table 20 provides information about the absolute levels of interregional trip making for the 2000 model calibration and based on the 2011/2008 estimate of interregional trips. While this table provides information on the absolute numbers of trips, the differences in the numbers of trips by purpose obscure the relative differences in the distributions. To provide information on the relative similarities and differences in the trip distributions, Table 21 shows the percentages of trips for each interchange market for each trip purpose.

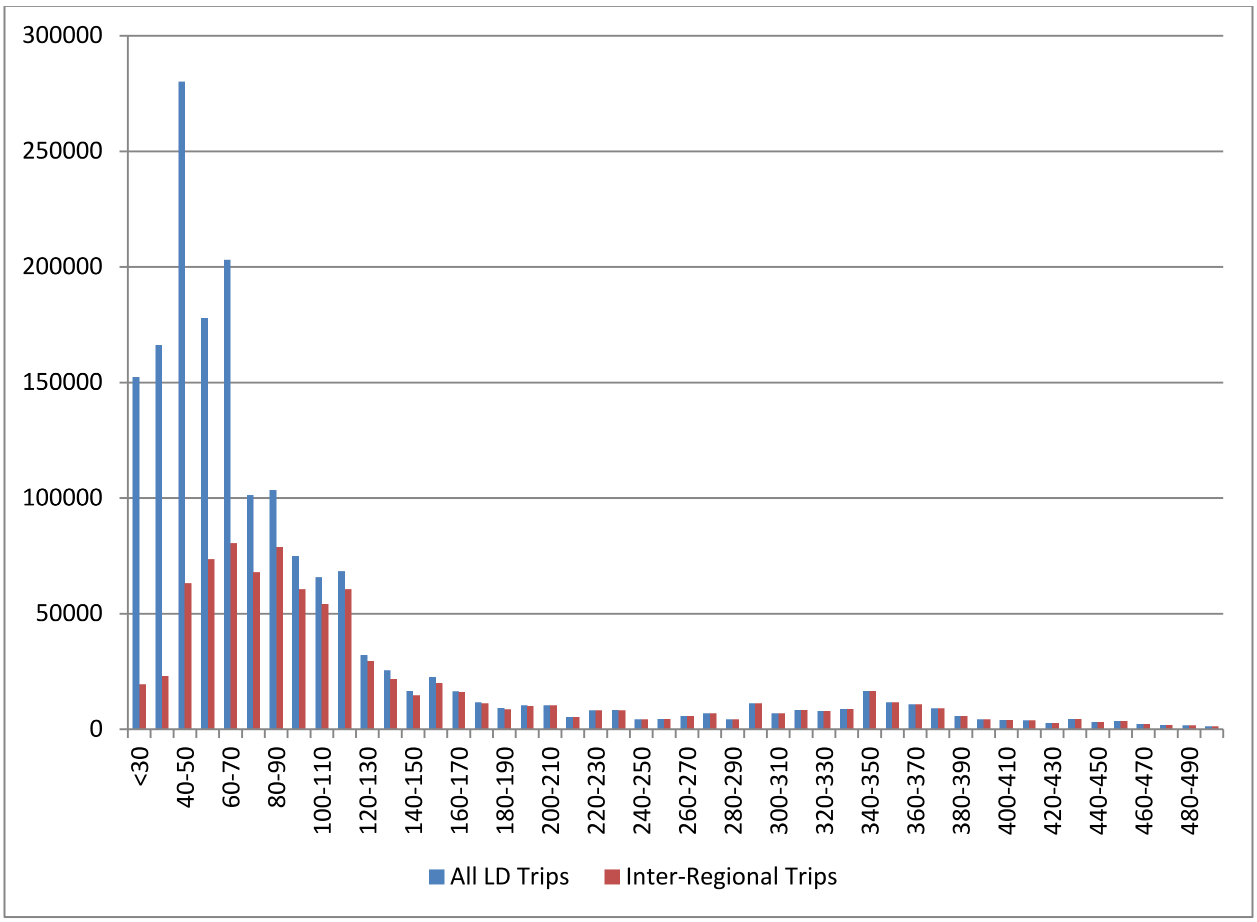
Table 21. Percent of Daily Long Distance Interregional Trips by Trip Purpose and Major Market Pairs

Market	Business		Commute		Recreation		Other		Total	
	2000	2008	2000	2008	2000	2008	2000	2008	2000	2008
LA to Sacramento	7%	8%	3%	0%	3%	3%	3%	4%	3%	4%
LA to San Diego	14%	10%	15%	36%	28%	18%	26%	16%	21%	17%
LA to SF	23%	24%	11%	1%	20%	14%	13%	15%	16%	15%
Sacramento to SF	8%	3%	9%	5%	10%	8%	14%	5%	9%	5%
Sacramento to San Diego	2%	1%	0%	0%	1%	1%	0%	0%	1%	1%
San Diego to SF	8%	3%	2%	0%	7%	2%	4%	3%	5%	2%
LA/SF to SJV	6%	12%	27%	32%	9%	13%	11%	21%	15%	18%
Other to SJV	17%	9%	6%	1%	6%	2%	9%	3%	7%	4%
To/from Monterey/Central Coast	11%	21%	14%	21%	9%	25%	13%	23%	12%	23%
To/from Far North	4%	8%	9%	2%	6%	8%	5%	8%	6%	8%
To/from W. Sierra Nevada	1%	2%	5%	1%	3%	7%	3%	2%	3%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

The trip length frequency distributions for medium and long distance trips within California are displayed in Exhibit 1. This graphic displays the number of daily trips by California adults stratified by 10-mile trip length ranges. The trip length distributions are displayed for both interregional trips and for all trips within the state (including intraregional trips).

The distribution curve for interregional trips is relatively flat between 50 miles and 120 miles, drops quickly between 120 and 200 miles, and exhibits a very long tail that includes a distinct peak at the 350 mile range. This distribution pattern is directly attributable to the geography and demographics of the State of California, with the two largest metropolitan centers (SCAG and MTC) being separated by approximately 350 miles. The large numbers of trips in the range up to 120 miles are due to the proximity of the adjacent metropolitan regions, such as SCAG and SANDAG or MTC and SACOG.

Exhibit 1. Trip Length Frequency Distribution for Medium and Long Distance Trips in California



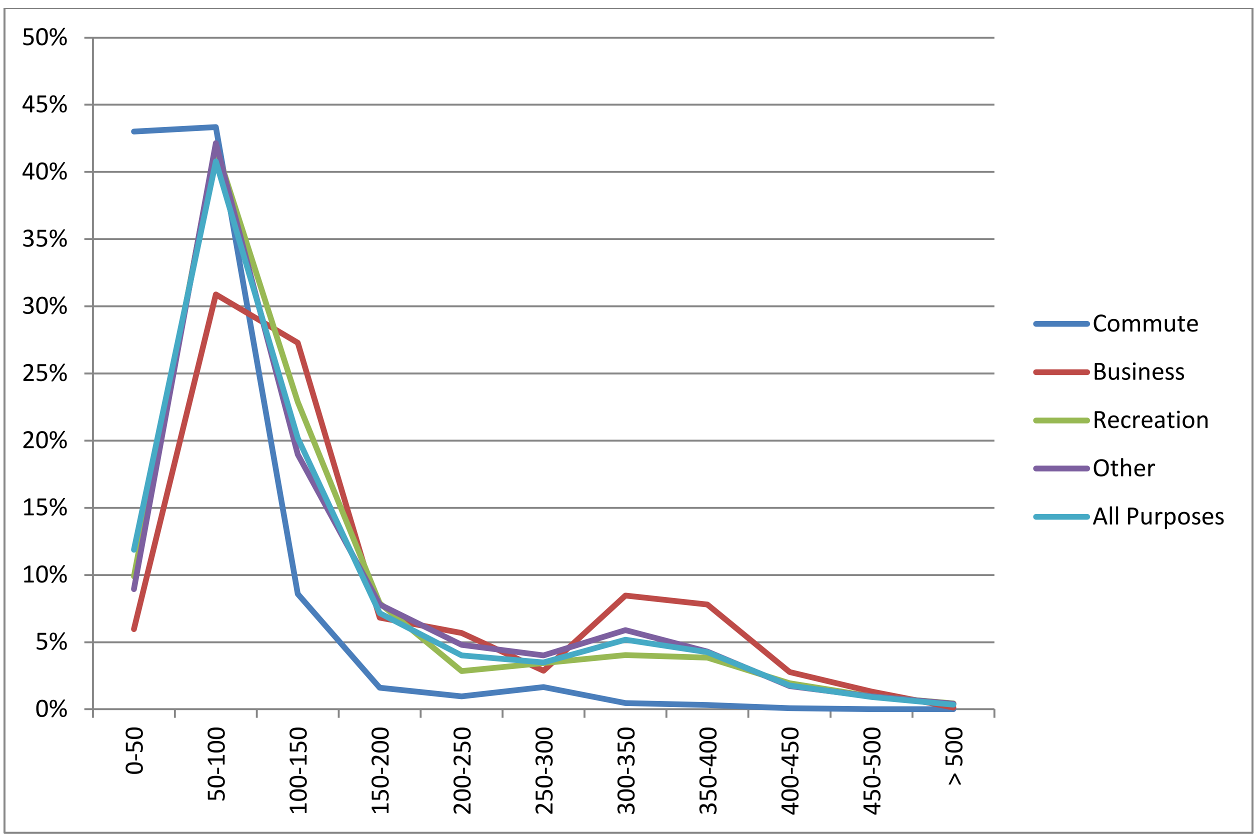
The trip distribution appears to include many trips that are less than the 50-mile threshold required for the trips to qualify as a medium or long distance trip. This is a result of the GIS-based methodology used to estimate trip lengths: straight line distance between polygon centroids for zip codes and cities, and doesn't reflect the impacts of geographic barriers and highway path choices. Most of the shorter trips are intraregional in nature, and therefore not a concern for the purposes of the validation of the CA HSR R&R Model.

The trip length frequency distributions for medium and long distance interregional trips are displayed for the various trip purposes in Exhibit 2. This graphic, which aggregates the trips into 50-mile ranges, shows that the trip length distributions for the commute and business trip purposes are very different from the distributions for the recreational and other trip purposes.

The trip distribution for the commute trips is weighted heavily to the shorter trip lengths, with fewer than five percent of the medium and long distance commute trips being over 150 miles in length.

The trip length distribution for the business trip purpose includes a significant share of trips of very long trip length, including approximately 20 percent of the medium and long distance business trips being over 300 miles in length. This is due to the large amount of business travel between the major metropolitan regions of the state.

Exhibit 2. Trip Length Frequency Distribution for Medium and Long Distance Interregional Trips by Trip Purpose



h. Mode Shares

Table 22 summarizes the medium and long interregional main travel mode shares by trip purpose from the 2000 CAHSR R&R Model validation results and the mode shares estimated from the 2011/2008 Trip Frequency Survey, factored to match the 2008 population synthesis data and adjusted to account for children age 5-17. Year 2000 model validation results have been summarized rather than the 2000 model validation targets. In this way, medium distance interregional trips (in the 50 to 99 mile distance range) could be estimated. The 2000 model validation targets for interregional trips less than 100 miles included trips in the 0 to 50 mile range.

The 2008 mode shares for medium distance interregional trips reflect higher mode use of rail and bus for the travel. The increase in the medium distance commute, rail mode share between 2000 and 2008 may be reflective of real increases in interregional commuter rail use, especially the Amtrak services (Capitol Corridor and San Joaquins in northern California and the San Joaquin Valley, and the Surfliner in southern California).

For long distance travel, the air mode shares for 2008 are substantially higher than for 2000 for business and commute trips, and slightly lower for recreation/other trips. Due to the differences in trips by purpose, overall air travel estimated for 2008 is almost identical to that for 2000, even though the business and commute mode shares are higher. The average daily long distance air travel for 2000 was estimated to be 55,100 trips and for 2008 was estimated to be 55,200 trips. The 55,200 estimate for 2008 compares to 36,900 daily intrastate air trips by California residents estimated by Geoff Gosling.[6] Gosling's estimate included only travel between the Bay Area and Southern California and between Sacramento and Southern California with the smaller markets excluded.

Table 22. Percent of Daily Long Distance Interregional Trips by Trip Purpose and Mode

Mode	Business		Commute		Business / Commute		Recreation / Other		Total	
	2000	2011/ 2008	2000	2011/ 2008	2000	2011/ 2008	2000	2011/ 2008	2000	2011 2008
Medium Distance (50-99 Miles)										
Auto	99%	97%	99%	96%	99%	96%	100%	97%	99%	97%
Air	0%	1%	0%	0%	0%	1%	0%	0%	0%	0%
Rail	1%	1%	1%	3%	1%	2%	0%	1%	1%	2%
Other, including bus	–	1%	–	0%	–	0%	–	2%	–	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Long Distance (100+ Miles)										
Auto	86%	61%	89%	79%	88%	64%	88%	88%	88%	84%
Air	13%	35%	11%	21%	11%	33%	11%	8%	11%	12%
Rail	0%	1%	0%	0%	0%	1%	1%	2%	1%	2%
Other, including bus	–	2%	–	0%	–	2%	–	2%	–	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

[6] *Potential Airline Response to High-Speed Rail Service in California*, prepared for Cambridge Systematics by Aviation System Consulting, LLC, April 29, 2011, Tables 1 and 2.

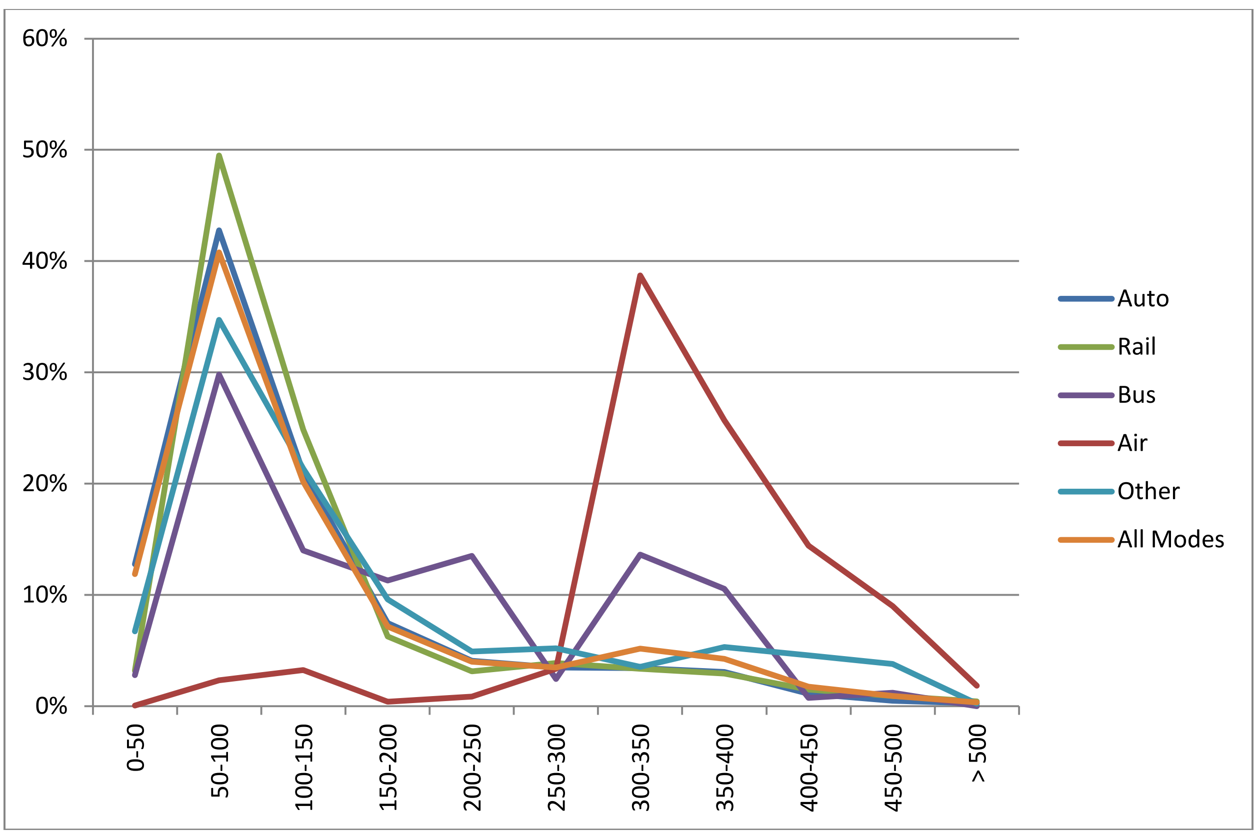
The trip length frequency distributions for medium and long distance interregional trips are displayed for the various main travel modes in Exhibit 3. This graphic, which aggregates the trips into 50-mile ranges, shows that the trip length distributions for the auto and rail travel modes are quite different from the distributions for the air and bus modes.

The trip length frequency curves for the auto and rail modes both exhibit a steep drop from the shorter trip lengths until approximately 250 miles, and then the frequencies stabilize until approximately 400 miles.

The trip length frequency curves for the bus mode shows relatively few trips in the shorter trip lengths (as compared to the auto and rail modes) and higher percentages of trips in the trip lengths over 200 miles.

The trip length frequency curves for the air mode is dramatically different from all other modes, as there are very few trips in the shorter trip lengths (below 300 miles) and significant percentages of trips in the trip lengths over 300 miles. This graphic shows that almost two-thirds of all air trips in California are between 300 and 400 miles in length.

Exhibit 3. Trip Length Frequency Distribution for Medium and Long Distance Interregional Trips by Main Travel Mode



The total number of daily trips estimated for each travel mode are displayed in stacked bar format in Exhibit 4. This exhibit shows that virtually all of the trips less than 300 miles are made using auto mode and the air mode becomes significant for trips over 300 miles in length.

Exhibit 4. Travel Modes by Trip Length for Medium and Long Distance Interregional Trips

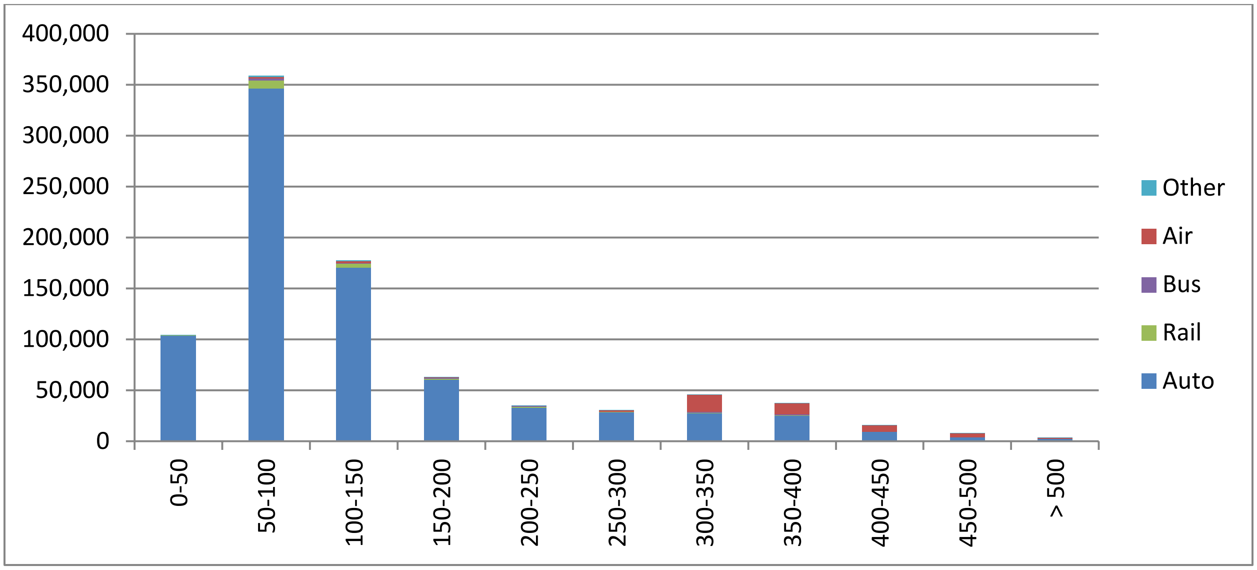
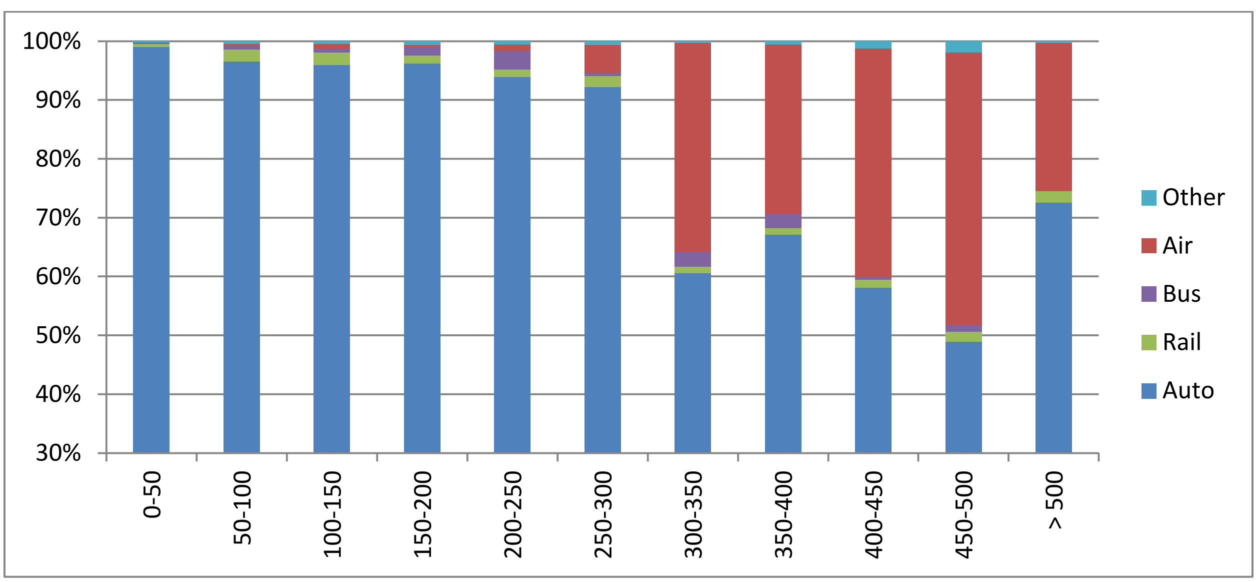


Exhibit 5 provides a more readable way to show the mode shares of medium and long distances travel in California for different trip distances. The modal shares of daily trips estimated for each travel mode are displayed in stacked bar format. This exhibit shows dramatically how the air mode becomes significant for trips over 300 miles in length. This exhibit also shows that the rail modal share remains virtually constant (near two percent) for most trip lengths.

Exhibit 5. Travel Mode Shares by Trip Length for Medium and Long Distance Interregional Trips



Some Considerations Regarding Survey Results

Several issues regarding the state of the economy in 2000 and 2011 should be considered in interpreting the results reported above:

- The 2000 data were based on the observation of conditions at the height of the "dot.com" boom. In California, there was substantial commuting by workers living in the San Joaquin Valley, the Monterey Bay area and Central Coast, and, even, the Los Angeles region and the Silicon Valley.
- In contrast, the 2009 NHTS and the 2011 Long Distance survey were collected either during the "great recession" or during the slow recovery afterwards, where such long distance commuting became less prevalent.
- The 2008 population synthesis data used for the survey expansion are based on underlying population characteristics from the 2000 Census and are, in essence, pre-great recession data.
- If the 2011 CAHSRA Long Distance Survey data were expanded to reflect the California population for 2010/2011, different results might be obtained. There are about one million more unemployed workers for 2010/2011 than in 2008.

Appendix 1 – Final Survey Mechanism

BASE: ALL RESPONDENTS
Q75 (QV7) PRELOAD – SAMPLE SUPPLIER
1 HPOL
5 Partner 2
36 Partner

BASE: ALL RESPONDENTS
Q5 (QV8) PRELOAD – INCENTIVE TYPE
[NUMERIC 5 DIGIT]
|_|_|_|_|_|

Q610 Welcome and thank you for agreeing to take part in our survey! Your time and opinions are greatly valued!

First, we would like to start by asking you some classification questions so that we can customize the survey for you.

Are you…?

1 Male
2 Female

Q615 In what year were you born? Please enter as a four-digit number, for example, 1963.

|__|__|__|__| [RANGE: 1890-2000]

Q620 [BEHIND THE SCENES: AGE COMPUTE THAT RECODES THE DATA AT Q615]

1 Under 13 [IMMEDIATELY TERMINATE TO "UNDER 13" PAGE]
2 13-17 [ASK Q624-Q630, THEN TERMINATE TO Q98]
3 18-29
4 30-39
5 40-49
6 50-64
7 65 and older

[BASE:ALL RESPONDENTS]
Q264 In what country or region do you currently reside?
[DROP DOWN MENU —SEE STANDARD RESPONSES FOR SHORT LIST]

[ASK IF Q264/244]
Q625 In what state or territory do you currently reside?
[DROP DOWN MENU WITH CHOICES LISTED-SEE STANDARD RESPONSES]

Q800
Q18. In what city do you live?

1. City ______________________

[BASE:ALL US RESPONDENTS]
Q630 What is your zip code? Please enter only the first five digits.
|_|_|_|_|_| [ALLOW ONLY A 5 DIGIT, NUMERIC CODE]

[TERMINATE IF NOT FROM CA (CODE 105)]

Q635 [DMA ASSIGNMENT – USE ZIP CODE TO ASSIGN DMA]
1. Los Angeles, CA = DMA 803 [QMS=99999]
2. San Francisco-Oakland-San Jose, CA = DMA 807 [QMS=99999]
3. Sacramento-Stockton-Modesto, CA = DMA 862 [QMS=99999]
4. San Diego, CA = DMA 825 [QMS=99999]
5. Fresno-Visalia, CA = DMA 866 [QMS=99999]
6. Santa Barbara-Santa Maria-San Luis Obispo, CA = DMA 855 [QMS=99999]
7. Monterey-Salinas, CA = DMA 828 [QMS=99999]
8. Bakersfield, CA = DMA 800 [QMS=99999]
9. Anywhere else in the state of CA [QMS=11,000]

Q640 [DMA ASSIGNMENT BY SAMPLE SOURCE]
1. HPOL Los Angeles, CA = DMA 803 (Q75/1 AND Q635/1) [QMS=99999]
2. HPOL San Francisco-Oakland-San Jose, CA = DMA 807 (Q75/1 AND Q635/2) [QMS=99999]
3. HPOL Sacramento-Stockton-Modesto, CA = DMA 862 (Q75/1 AND Q635/3) [QMS=99999]
4. HPOL San Diego, CA = DMA 825 (Q75/1 AND Q635/4) [QMS=99999]
5. HPOL Fresno-Visalia, CA = DMA 866 (Q75/1 AND Q635/5) [QMS=99999]
6. HPOL Santa Barbara-Santa Maria-San Luis Obispo, CA = DMA 855 (Q75/1 AND Q635/6) [QMS=99999]
7. HPOL Monterey-Salinas, CA = DMA 828 (Q75/1 AND Q635/7) [QMS=99999]
8. HPOL Bakersfield, CA = DMA 800 (Q75/1 AND Q635/8) [QMS=99999]
9. HPOL Anywhere else in the state of CA (Q75/1 AND Q635/9) [QMS=99999]
10. Partner Los Angeles, CA = DMA 803 (Q75/36 AND Q635/1) [QMS=99999]
11. Partner San Francisco-Oakland-San Jose, CA = DMA 807 (Q75/36 AND Q635/2) [QMS=99999]
12. Partner Sacramento-Stockton-Modesto, CA = DMA 862 (Q75/36 AND Q635/3) [QMS=99999]
13. Partner San Diego, CA = DMA 825 (Q75/36 AND Q635/4) [QMS=99999]
14. Partner Fresno-Visalia, CA = DMA 866 (Q75/36 AND Q635/5) [QMS=99999]
15. Partner Santa Barbara-Santa Maria-San Luis Obispo, CA = DMA 855 (Q75/36 AND Q635/6) [QMS=99999]
16. Partner Monterey-Salinas, CA = DMA 828 (Q75/36 AND Q635/7) [QMS=99999]
17. Partner Bakersfield, CA = DMA 800 (Q75/36 AND Q635/8) [QMS=99999]
18. Partner Anywhere else in the state of CA (Q75/36 AND Q635/9) [QMS=99999]
19. Partner 2 Los Angeles, CA = DMA 803 (Q75/5 AND Q635/1) [QMS=99999]

20. Partner 2 San Francisco-Oakland-San Jose, CA = DMA 807 (Q75/5 AND Q635/2) [QMS=99999]
21. Partner 2 Sacramento-Stockton-Modesto, CA = DMA 862 (Q75/5 AND Q635/3) [QMS=99999]
22. Partner 2 San Diego, CA = DMA 825 (Q75/5 AND Q635/4) [QMS=99999]
23. Partner 2 Fresno-Visalia, CA = DMA 866 (Q75/5 AND Q635/5) [QMS=99999]
24. Partner 2 Santa Barbara-Santa Maria-San Luis Obispo, CA = DMA 855 (Q75/5 AND Q635/6) [QMS=99999]
25. Partner 2 Monterey-Salinas, CA = DMA 828 (Q75/5 AND Q635/7)[QMS=99999]
26. Partner 2 Bakersfield, CA = DMA 800 (Q75/5 AND Q635/8) [QMS=99999]
27. Partner 2 Anywhere else in the state of CA (Q75/5 AND Q635/9) [QMS=99999]

Q695 Initially Qualified

1 Qualified (Q620/3-7 AND Q264/244 AND Q625/105) [QMS = 15,020]
2 Not Qualified [TERMINATE]

Q98 Screener Termination
Not 18+ (Q620/1-2)
Not from the US (Q264/NE 244)
Not from CA (Q625/NE 105)
Not initially qualified (Q695/2)

Q99 Screener Qualified
Must be 18+ (Q620/3-7)
Must be from the US (Q264/244)
Must be from CA (Q625/105)
Must be initially qualified (Q695/1)

Section A: Travel Information
Q700
We are gathering information on long distance travel made by California residents. We define long distance trips as a trip to a location 50 or more miles from your home. We will ask you to provide separate information about your outbound long distance trip (from your home) and your long distance trip to return home.

(Please note that brief stops for gas, rest, food, picking up passengers or changing vehicles are considered parts of the long distance trip, and are not considered separate trips. For example, imagine that you drove from your home in Sacramento to Fresno with a stop along the way for gas. This would be considered one long distance trip – from Sacramento to Fresno. Your return home to Sacramento would be another long distance trip – from Fresno to Sacramento.)

Q1. Did you make any trips to a location 50 miles or more from your home (a "long distance trip") during the past two months?

1. Yes

2. No

Q705, Q706, Q707

Q2. When did you make your most recent outbound (away from home) long distance trip? (Please respond even if this trip occurred more than two months ago.)

Enter date that you started this trip (i.e. mm/dd/yy): ________

Q708 Enter day of week: _____ [INSERT DROP DOWN WITH DAYS OF THE WEEK]

[FORCE RESPONDENT TO ENTER THE DAY OF THE TRIP (Q706) OR THE DAY OF THE WEEK (Q708). ERROR MESSAGE: If you don't remember the exact date of this long distance trip, please enter the year, month, and day of the week that you made this trip (to the best of your recollection).]

Q710

Q3. Where were you when you actually started this trip?

1. Your home [Skip to Q720 (Q5)]

2. Work

3. School

4. Somewhere else (please specify): Q711 ______________________

Q715, Q716, Q717, Q718 [ASK IF Q710/2-4]

Q4. Where was this place located (where you started this long distance trip)?

1. City: _______________________ [MANDATORY TEXT BOX]

2. Country: ______________________ [DROP DOWN WITH SHORT LIST, ANCHOR US AT THE TOP]

3. State: ______________________ [DROP DOWN WITH STATES ONLY IF Q716 IS US, ANCHOR CA AT THE TOP]

4. Zip Code (if known): _________________ [NON-MANDATORY]

Q720

Q5. What was the primary purpose for this long distance trip? Please select only one response. [RANDOMIZE]

1. Commuting to or from my place of work

2. Business (work-related, but to a location other than your usual workplace)

3. School or school-related activity

4. Visit friends, family, or relatives

5. Medical

6. Vacation, recreation, or entertainment

7. Other (specify): Q721 ___________________________

[DISPLAY Q725, Q726, Q727, Q728 AND Q775 ON THE SAME SCREEN]
Q725, Q726, Q727, Q728

Q6. Where was the primary destination for this trip?

1. City: ________________________ [MANDATORY TEXT BOX]

2. Country: ______________________ [DROP DOWN WITH SHORT LIST, ANCHOR US AT THE TOP]

3. State: _______________________ [DROP DOWN WITH STATES ONLY IF Q726 IS US, ANCHOR CA AT THE TOP]

4. Zip Code (if known): _________________ [NON-MANDATORY]

Q775 [ASK IF Q700/1]

Q16. How many times have you traveled to this same destination for the same reason during the past two months?

□ Just this one time

More than once (Record number): _____ [RANGE=2-999]

[DISPLAY Q730 AND Q735 ON THE SAME SCREEN]
Q730

Q7. Now, thinking back to the last time you made this trip, how many people traveled with you on this trip (not including yourself)?

Record Number: _____ [RANGE=0-999]

Q735

Q8. How many of these people were members of your household (not including yourself)?

Record Number: _____ [RANGE=0-999] [MUST BE LESS THAN OR EQUAL TO Q730]

Q740

Q9. How did you travel? Please select your primary travel mode. [SINGLE] [RANDOMIZE]

1. Car, truck, van, or motorcycle (either owned or rented by you or a traveling companion) [Skip to Q765 (Q14)]

2. Commercial airline (e.g. Southwest, United, Alaska Air…)

3. Train (e.g. Amtrak)

4. Bus (e.g. Greyhound, Amtrak Thruway Motorcoach)

5. Other (specify): Q741 ____

Q745 [ASK IF Q740/2-5]

Q10. What is the name or location of the airport, train or bus station you used for your departure?

[NON-MANDATORY TEXT BOX]

Q750 [ASK IF Q740/2-5]

Q11. How did you travel to your departure airport, train, or bus station? [RANDOMIZE AND KEEP CODES 1-3 TOGETHER]

1. Drove a personal vehicle directly to airport or train station parking lot

2. Drove a personal vehicle to a remote parking lot

3. Drove a rental car

4. Got a ride from a friend or relative

5. Took a taxi

6. Used public transit

7. Used a hotel van, private van, limousine

8. Walked or bicycled

9. Other (specify): Q751______________________

Q755 [ASK IF Q740/2-5]

Q12. What is the name or location of the airport, train or bus station you used at your destination?

[NON-MANDATORY TEXT BOX]

Q760 [ASK IF Q740/2-5]

Q13. How did you travel from your destination airport, train or bus station to your final destination? [RANDOMIZE IN SAME ORDER AS Q750]

1. Drove a personal vehicle directly from airport, train or bus station parking lot

2. Drove a personal vehicle from a remote parking lot

3. Drove a rental car

4. Got a ride from a friend or relative

5. Took a taxi

6. Used public transit

7. Used a hotel van, private van, limousine

8. Walked or bicycled

9. Other (specify): Q761________________________

Q765

Q14. Did you return the same day?

1. Yes [Skip to Q1109]

2. No, this trip included an overnight stay of one or more nights.

Q770 [ASK IF Q765/2]

Q15. How many nights were you gone before returning home?

Record number: _____ [RANGE=1-999]

Q1105, Q1106, Q1107 [ASK IF Q765/2]

Thank you for providing that information about your most recent outbound long distance trip. We will now ask you to provide similar information for the long distance trip you made when you returned home after that outbound trip.

Q17. When did you make the return trip?

Enter date that you started this trip (i.e. mm/dd/yy): ________

Q1108 Enter day of week: ______ [INSERT DROP DOWN WITH DAYS OF THE WEEK]

[FORCE RESPONDENT TO ENTER THE DAY OF THE TRIP (Q1106) OR THE DAY OF THE WEEK (Q1108). ERROR MESSAGE: If you don't remember the exact date of this long distance trip, please enter the year, month, and day of the week that you made this trip (to the best of your recollection).]

Q1109 [BASE: ALL QUALIFIED RESPONDENTS]

[DISPLAY IF Q765/1: Thank you for providing that information about your most recent outbound long distance trip. We will now ask you to provide similar information for the long distance trip you made when you returned home after that outbound trip.]

Did you return home from the same location (which you described earlier as your primary destination)?

1. Yes [SKIP TO Q1130]

2. No, I made an intermediate trip to another location before returning home

Q1115, Q1116, Q1117, Q1118 [ASK IF Q1109/2]
Q18. Where were you when you started this return trip?

1. City: ______________________ [MANDATORY TEXT BOX]

2. Country: _____________________ [DROP DOWN WITH SHORT LIST, ANCHOR US AT THE TOP]

3. State: _____________________ [DROP DOWN WITH STATES ONLY IF Q1116 IS US, ANCHOR CA AT THE TOP]

4. Zip Code (if known): ________________ [NON-MANDATORY]

[DISPLAY Q1130 AND Q1135 ON THE SAME SCREEN]
Q1130
Q19. How many people traveled with you on this return trip (not including yourself)?

Record Number: _____ [RANGE=0-999]

Q1135
Q20. How many of these people were members of your household (not including yourself)?

Record Number: _____ [RANGE=0-999] [MUST BE LESS THAN OR EQUAL TO Q1130]

Q1140
Q21. How did you travel? Please select your primary travel mode. [SINGLE] [RANDOMIZE (same order as before)]

1. Car, truck, van, or motorcycle (either owned or rented by you or a traveling companion) [Skip to Q1110 (Q26)]

2. Commercial airline (e.g. Southwest, United, Alaska Air…)

3. Train (e.g. Amtrak)

4. Bus (e.g. Greyhound, Amtrak Thruway Motorcoach)

5. Other (specify): Q941 ____

Q1145 [ASK IF Q1140/2-5]
Q22. What is the name or location of the airport, train or bus station you used for your departure?

[NON-MANDATORY TEXT BOX]

Q1150 [ASK IF Q1140/2-5]
Q23. How did you travel to your departure airport, train, or bus station? [RANDOMIZE IN SAME ORDER AS Q750 AND KEEP CODES 1-3 TOGETHER]

1. Drove a personal vehicle directly to airport or train station parking lot

2. Drove a personal vehicle to a remote parking lot

3. Drove a rental car

4. Got a ride from a friend or relative

5. Took a taxi

6. Used public transit

7. Used a hotel van, private van, limousine

8. Walked or bicycled

9. Other (specify): Q1151________________________

Q1155 [ASK IF Q1140/2-5]
Q24. What is the name or location of the airport, train or bus station you used at your destination?

[NON-MANDATORY TEXT BOX]

Q1160 [ASK IF Q1140/2-5]
Q25. How did you travel from your destination airport, train or bus station to your final destination? [RANDOMIZE IN SAME ORDER AS Q750]

1. Drove a personal vehicle directly from airport, train or bus station parking lot

2. Drove a personal vehicle from a remote parking lot

3. Drove a rental car

4. Got a ride from a friend or relative

5. Took a taxi

6. Used public transit

7. Used a hotel van, private van, limousine

8. Walked or bicycled

9. Other (specify): Q761________________________

Q1110
Q26. Where were you when you actually ended this trip?

1. Your home

2. Work

3. School

4. Somewhere else (please specify): Q1111 ______________________

Q779 [DISPLAY IF Q700/1]
Thank you for providing information about your most recent outbound and return long distance trips. We would now like you to summarize (in much less detail than before) the other long distance trips you have made from your home in the past two months.

CAMBRIDGE SYSTEMATICS

Q780 [ASK IF Q700/1]

Q27. Please summarize all long distance trips to a location 50 miles or more from your home during the past two months. Please use separate lines to record long distance trips made to the same destination for different reasons (for example: if you made one trip to San Francisco for a business meeting, and two trips to San Francisco to visit family, please fill in two lines in the table below).

Please scroll to the right to view the entire row. Please use only as many lines as you need to document trips made in the past two months and leave other lines blank.

When you have finished entering information for locations visited in the past two months, please proceed to the next screen.

Trip Number	Q925, Q927 Traveled to City: : Traveled to State (or Foreign Country):	Q920 Reason for Travel	Q921 How did you travel?	Q922 Did this trip include an overnight stay?	Q975 How many times did you make a trip to this destination for the same reason during the past two months?
1	[INSERT Q725 AND Q727]	[INSERT Q720]	[INSERT Q740 USING SHORTENED LIST BELOW]	[INSERT "No" IF Q765/1, INSERT "Yes" IF Q765/2]]	[INSERT Q775]
2	[TEXT BOX FOR CITY AND DROP DOWN FOR STATE]	Drop down menu from Q720 (Q5)	[DROPDOWN] 1. Private auto, truck, etc. 2. Commercial airline 3. Train 4. Bus 5. Other	[Yes/No DROPDOWN]	RANGE=0-999]
…8					

[DISPLAY Q28a AND Q28b ON THE SAME SCREEN]
Q980 (28a) [ASK IF RESPONDENT FILLED OUT ALL ROWS IN Q780]
How many other long distance trips did you make to locations 50 miles or more from your home during the past two months (not including the trips summarized previously)?
|_|_|_| [RANGE=0-999]

Q985 (28b) [ASK IF RESPONDENT FILLED OUT ALL ROWS IN Q780]
How many of these long distance trips were to locations in the State of California?
|_|_|_| [RANGE=0-999]

Section B: Demographic Information

[DISPLAY Q805 AND Q810 ON THE SAME SCREEN]
Q805 We now have some questions about your household.

Q29. How many people live in your household (including yourself)?

Record Number _____ [RANGE=1-20]

Q810 [ASK IF AGE 18+]
Q30. How many people in your household are aged 18 or above?

Record Number _____ [RANGE=1-20]

Q815
Q31. How many operational vehicles (autos, trucks, vans, and motorcycles) are owned, leased, or generally available for regular use by people who live in your household?

Record Number _____ [RANGE=1-20]

Q820, Q821, Q822
Q32. How many members of your household? (The numbers of household members entered below should add up to the total number of people living in your household, including yourself. If someone works at both a full-time and a part-time job, include that person only under full-time.) [ALLOW BLANK ENTRIES, TOTAL SHOULD NOT EXCEED Q805]

1. Work full-time for pay _____ [RANGE=0-20]

2. Work part-time for pay _____ [RANGE=0-20]

3. Do not work at a paid job ____ [RANGE=0-20]

Q825
Q33. Approximately, what is the total annual income (year 2010) of all individuals who reside in your household?

1. Under $10,000

2. Between $10,000 and $29,999
3. Between $30,000 and $44,999
4. Between $45,000 and $59,999
5. Between $60,000 and $74,999
6. Between $75,000 and $89,999
7. Between $90,000 and $104,999
8. Between $105,000 and $119,999
9. Between $120,000 and $134,999
10. Between $135,000 and $174,999
11. $175,000 or more
12. Decline to answer

Q59 Screener Termination
Not 18+ (Q620/1-2)
Not from the US (Q264/NE 244)
Not from CA (Q625/NE 105)
Not initially qualified (Q695/2)

Q60 Screener Qualified
Must be 18+ (Q620/3-7)
Must be from the US (Q264/244)
Must be from CA (Q625/105)
Must be initially qualified (Q695/1)

Appendix 2 – CSTDM Synthetic Population Database

Cali.sqlite is the CSTDM synthetic population database; it is a SQLite database contained in a single file. A SQLite database does not need a server to be run; the file can be accessed by a number of techniques. The CSTDM uses Python code and the standard sqlite3 library. A Firefox plugin, available at https://addons.mozilla.org/en-US/firefox/addon/sqlite-manager/ can be used to view the database in an interactive window environment. The database contains a number of tables, along with associated views and indices for ease of use and speed.

The three key tables needed to do a run are the pums_hh, pums_per and one or more synthpop_XX tables where _XX is the scenario name; currently _00 for 2000 and _08 for 2008, but other scenarios can be created with a suffix, such as 15 for a 2015 base scenario and 15a for an alternate 2015 scenario. These _XX scenario names are specified in the paths.py file created by Cube using the YearShort key. (This will be called the "scenario key" in this document.)

The pums_hh table is the 2000 Census 5% Public Use Microdata Sample for California housing units. Each row contains one housing unit, with a large number of columns containing their properties. The majority of these columns - the first 112 - are imported directly from the PUMS dataset, and the Census documentation at http://www.census.gov/prod/cen2000/doc/pums.pdf describes these fields in detail. The additional fields added for use in the CSTDM are:

- hhtype: the household type using the California PECAS typology. The first character indicates the number of persons in the household, with 3=3 or 4, 5=5+ persons and S being an all-senior household. The final character is the income group: 1=<$15K, 2=$15-50K, 3=$50-100K, 4=$100-150K, 5=$150K+
- num_workers: the number of workers in the household
- num_students: the number of students in the household
- hhtype_expan: a numerical code categorizing households in groups for the expansion process (see the documentation on travel behaviour surveys for a detailed schematic of the groups)
- num_lic: the number of licensed drivers in the household derived from a base license model (since deprecated; the SDPTM calculates driver's license status for each person on each run)
- hhtype_hsr: the household type for the LDPTM model (groupings described in detail in the LDPTM documentation)
- unic: unit income (the household income for records representing Census households, the individual person's income for records representing Group Quarters residents -- the base PUMS income fields have 0 income for GQ residents, as they are not households)
- p03, p15, p16: the number of persons under 3, 15 and 16 years of age respectively.

The pums_per table is the 2000 Census 5% Public Use Microdata Sample for California persons. Each row contains one person, with a large number of columns describing their properties. The first 162 of these are described in the same Census PUMS document described above. The additional columns added for use in the CSTDM are:

- state: the FIPS code for the state of the records
- pertype: the person type, as used in SDPTM the day pattern model, and described in detail in part 2 of the SDPTM documentation
- occCode5: the person's occupation, coded into a set of 5 occupation groups originally used to develop targets for the population synthesis process, but not used in the CSTDM for active running of the model
- occGroup: the person's occupation, coded into the 8 occupation groups used to run the SDPTM, with the detailed groups described in the Zonal Properties documentation. This field is blank for persons who are not workers.
- licutil: the "base" utility of holding a driver's license, from the SDPTM driver's license model described in part 1 of that model's documentation. This is the utility for the person from the estimated model in table 1a, excluding the two work logsums (since the same PUMS record will have copies located in multiple zones with different work logsums, due to the population synthesis process.) This does not include the calibration parameters in tables 1b and 1c.
- pertype_base: the person type in 7 base groups; this is the initial part of the pertype code and the groups are described in the SDPTM day pattern documentation (part 2 of the SDPTM documentation).

There are multiple synthpop tables, with suffixes to this name. These describe the different synthetic populations that have been created, one per table. Each row of this table is one synthetic household, and links to one PUMS household and the persons within that PUMS household. (A PUMS household will be represented multiple times in the synthpop table.) The table contains the following fields:

- zoneid: the TAZ the synthetic household lives in
- unitid: the sample ID for the household from the population synthesis process
- puma5: the Public Use Microsample Area the household lives in
- statename and state: the state the household lives in (not important for the CSTDM)
- serialno: the serial number of the PUMS household represented by this synthetic household; this is the unique identifier of each PUMS household, and is also in the PUMS person table identifying the persons in the household.

- uniqueid: a unique identifier for each synthetic population household, which is written out in the CSTDM driver's license and auto ownership output files. This enables the decisions to be traced to a specific instance of a household, and thus to their zone as well as to the associated PUMS records.

In addition to these key tables, there are several views that are used by the CSTDM. A view is a query that joins multiple tables, saved so that the resulting query can be referenced as if it is a table itself. The views, and the SQL statements that create them are:

per_hh: joins the PUMS person and household tables together to create a composite table, where each record is a person but contains their household's properties as well.

```
CREATE VIEW per_hh AS SELECT * FROM pums_per p JOIN pums_hh h
WHERE (h.serialno = p.serialno)
```

synth_hh_XX: joins the synthetic population to the PUMS household table, where _XX is the scenario key.

```
CREATE VIEW synth_hh_08 AS SELECT * FROM synthpop_08 s JOIN
pums_hh h WHERE (s.serialno = h.serialno AND s.state = h.state)
ORDER BY zoneid
```

synth_per_XX: joins the synthetic population to the PUMS person table, where _XX is the scenario key.

```
CREATE VIEW synth_per_08 AS SELECT * FROM synthpop_08 s JOIN
pums_per p WHERE (s.serialno = p.serialno AND s.state = p.state)
ORDER BY zoneid
```

synth_per_hh_XX: joins the synthetic population to the composite per_hh view, where _xx is the scenario key.

```
CREATE VIEW synth_per_hh_08 AS SELECT * FROM synthpop_08 s JOIN
per_hh p WHERE (s.serialno = p.serialno AND s.state = p.state)
ORDER BY zoneid
```

Indexes help speed up database operations. The specific names used are not important; the tables and fields indexed are. The ones used in the CSTDM are:

pums_hh_id and pums_per_id are indexes on the unique identifiers for each PUMS household and person record.

```
CREATE UNIQUE INDEX pums_hh_id ON pums_hh(serialno)

CREATE UNIQUE INDEX pums_per_id ON pums_per(serialno, pnum)
```

synthpop_ser_st_XX indexes the synthpop_XX table, with each record uniquely identified.

```
CREATE INDEX synthpop_ser_st_08 on synthpop_08(serialno, state)
```

zoneID_XX is an index on the synthpop_XX table, identifying each zone, so that all synthetic households of a zone can be rapidly identified.

```
CREATE INDEX zoneID_08 on synthpop_08(zoneid)
```

E. Documentation of HST Fare Assumptions

Appendix E
High-Speed Train Fare Assumptions

This appendix describes the procedure used to calculate fares for high-speed train (HST) service for use in the 2012 Business Plan.

Background

"50 Percent Airfare" Fare Structure – BACV EIR/EIS Forecasts

The "50 percent airfare" fare structure for HSR was originally developed for the BACV EIR/EIS. The fare structure was based on a boarding charge and per mile charge as shown below[1]:

- $15 + $0.09/mile (in 2005 dollars) for interregional fares; and
- $7 + $0.06/mile (in 2005 dollars) for intraregional fares.

To provide for consistency, distance charges were based on auto distances between HSR stations. As a result, HSR fares did not vary based on changes in alignments.

"50 Percent Airfare" Fare Structure – May 2009 Operating Plan

In August 2008, modeled air fares and HSR fares were increased by eight percent[2]. This was accomplished by multiplying existing fare matrices by 1.08. For new stations, the following fare formulae were used:

- $16.20 + $0.0972/mile (in 2005 dollars) for interregional fares; and
- $7.56 + $0.0648/mile (in 2005 dollars) for intraregional fares.

Again, for new stations, distance charges were based on auto distances between HSR stations.

"83 Percent Airfare" Fare Structure

The December 2009 business plan suggested an increase in HSR fares to "83 percent of air fares." Several model runs have been performed since July 1, 2010 using this 83 percent airfare

[1] *Bay Area/California High-Speed Rail Ridership and Revenue Forecasting Study – Final Report*, (R9a Report), prepared by Cambridge Systematics, Inc., prepared for Metropolitan Transportation Commission and the California High-Speed Rail Authority, July 2007, page 6-3.

[2] Memorandum to Nick Brand from George Mazur, David Kurth, Rachel Copperman, Michael Snavely dated June 10, 2009, re: 2030 and 2035 Ridership and Revenue Forecasts, page 5.

HSR fare structure. The fare matrices were obtained by multiplying the 50 percent airfare fare matrices by 1.66.

Business Plan Fare Structure

"83 Percent Airfare" Fare Structure

The 83 percent airfare fare structure will be used for the 2012 Business Plan model runs. However, the procedures used to development of the previous 83 percent fare matrix introduced some inconsistencies due to different rounding procedures. Specifically, the original eight percent increase in fares was applied to an original fare matrix rounded to the nearest dollar while fares for new station pairs were estimated using the more precise formulae and then rounded to the nearest dime. In addition, some fares for new station pairs may have been estimated by interpolating between existing stations. Thus, a new 83 percent fare matrix has been estimated based on multiplying the 50 percent airfare fare structure formulae for the May 2009 Operating Plan as documented above by 1.66. In addition, in order to reduce the short peak of traffic between Palmdale and LA Union Station, which requires 10 percent more capacity than at the peak of long-distance travel in the Central Valley, intraregional fares in the LA Basin have been assumed to be half way between the interregional and intraregional fares.

- $26.89 + $0.1614/mile (in 2005 dollars) for interregional fares;
- $19.72 + $0.1345/mile (in 2005 dollars) for intraregional fares for SCAG region; and
- $12.55 + $0.1076/mile (in 2005 dollars) for intraregional fares for MTC and SANDAG regions.

Distance charges were based on 2030 peak period auto skims between HSR stations.

"83 Percent Airfare" Fare Structure – Results

Table 1 shows the resulting station to station fares. Station pairs are shown only from the north to the south. Symmetrical fares should be assumed. For example, the fare from Anaheim to Millbrae is the same as Millbrae to Anaheim.

Table 1 HSR Station-to-Station Fares for 2012 Business Plan

Origin Station	Destination Station	Peak Auto Distance in Miles	Fare (2005 Dollars)
San Francisco (Transbay)	San Francisco (4th & King)	1.44	12.70
San Francisco (Transbay)	Millbrae	14.19	14.10
San Francisco (Transbay)	Redwood City	26.30	15.40
San Francisco (Transbay)	San Jose	49.60	17.90
San Francisco (Transbay)	Gilroy	71.22	20.20
San Francisco (Transbay)	Merced	131.01	48.00
San Francisco (Transbay)	Fresno	189.12	57.40
San Francisco (Transbay)	Visalia	225.35	63.30
San Francisco (Transbay)	Bakersfield	295.86	74.60
San Francisco (Transbay)	Palmdale	376.35	87.60
San Francisco (Transbay)	San Fernando Valley	376.55	87.60
San Francisco (Transbay)	Los Angeles Union Station	394.18	90.50
San Francisco (Transbay)	Norwalk	407.45	92.60
San Francisco (Transbay)	Anaheim	421.65	94.90
San Francisco (4th & King)	Millbrae	13.12	14.00
San Francisco (4th & King)	Redwood City	25.23	15.30
San Francisco (4th & King)	San Jose	48.53	17.80
San Francisco (4th & King)	Gilroy	70.55	20.10
San Francisco (4th & King)	Merced	131.50	48.10
San Francisco (4th & King)	Fresno	189.60	57.50
San Francisco (4th & King)	Visalia	225.83	63.30
San Francisco (4th & King)	Bakersfield	295.20	74.50
San Francisco (4th & King)	Palmdale	375.69	87.50
San Francisco (4th & King)	San Fernando Valley	375.89	87.50
San Francisco (4th & King)	Los Angeles Union Station	393.52	90.40
San Francisco (4th & King)	Norwalk	406.79	92.50
San Francisco (4th & King)	Anaheim	420.99	94.80
Millbrae	Redwood City	12.28	13.90
Millbrae	San Jose	35.57	16.40
Millbrae	Gilroy	57.60	18.70
Millbrae	Merced	131.91	48.20
Millbrae	Fresno	185.83	56.90
Millbrae	Visalia	217.11	61.90
Millbrae	Bakersfield	282.24	72.40
Millbrae	Palmdale	362.73	85.40
Millbrae	San Fernando Valley	362.93	85.50
Millbrae	Los Angeles Union Station	380.56	88.30
Millbrae	Norwalk	393.83	90.40
Millbrae	Anaheim	408.03	92.70
Redwood City	San Jose	23.74	15.10
Redwood City	Gilroy	45.89	17.50
Redwood City	Merced	125.76	47.20
Redwood City	Fresno	174.13	55.00
Redwood City	Bakersfield	270.53	70.50
Redwood City	Visalia	205.41	60.00
Redwood City	Palmdale	351.03	83.50
Redwood City	San Fernando Valley	351.23	83.60
Redwood City	Los Angeles Union Station	368.86	86.40
Redwood City	Norwalk	382.13	88.50
Redwood City	Anaheim	396.33	90.80
San Jose	Gilroy	23.08	15.00
San Jose	Merced	112.16	45.00

Origin Station	Destination Station	Peak Auto Distance in Miles	Fare (2005 Dollars)
San Jose	Fresno	151.32	51.30
San Jose	Visalia	182.60	56.40
San Jose	Bakersfield	247.73	66.90
San Jose	Palmdale	328.22	79.90
San Jose	San Fernando Valley	328.42	79.90
San Jose	Los Angeles Union Station	346.05	82.70
San Jose	Norwalk	359.32	84.90
San Jose	Anaheim	373.52	87.20
Gilroy	Merced	90.73	41.50
Gilroy	Fresno	129.89	47.90
Gilroy	Visalia	161.17	52.90
Gilroy	Bakersfield	226.30	63.40
Gilroy	Palmdale	306.79	76.40
Gilroy	San Fernando Valley	306.99	76.40
Gilroy	Los Angeles Union Station	324.62	79.30
Gilroy	Norwalk	337.89	81.40
Gilroy	Anaheim	352.09	83.70
Merced	Fresno	58.95	36.40
Merced	Visalia	95.18	42.20
Merced	Bakersfield	172.83	54.80
Merced	Palmdale	259.03	68.70
Merced	San Fernando Valley	264.70	69.60
Merced	Los Angeles Union Station	282.33	72.40
Merced	Norwalk	295.60	74.60
Merced	Anaheim	309.80	76.90
Fresno	Visalia	36.89	32.80
Fresno	Bakersfield	114.54	45.40
Fresno	Palmdale	200.73	59.30
Fresno	San Fernando Valley	206.40	60.20
Fresno	Los Angeles Union Station	224.03	63.00
Fresno	Norwalk	237.30	65.20
Fresno	Anaheim	251.51	67.50
Visalia	Bakersfield	88.02	41.10
Visalia	Palmdale	174.22	55.00
Visalia	San Fernando Valley	179.02	55.80
Visalia	Los Angeles Union Station	196.65	58.60
Visalia	Norwalk	209.92	60.80
Visalia	Anaheim	224.12	63.10
Bakersfield	Palmdale	86.38	40.80
Bakersfield	San Fernando Valley	93.53	42.00
Bakersfield	Los Angeles Union Station	111.16	44.80
Bakersfield	Norwalk	124.43	47.00
Bakersfield	Anaheim	138.64	49.30
Palmdale	San Fernando Valley	43.66	25.60
Palmdale	Los Angeles Union Station	52.56	26.80
Palmdale	Norwalk	63.24	28.20
Palmdale	Anaheim	77.49	30.10
San Fernando Valley	Los Angeles Union Station	18.98	22.30
San Fernando Valley	Norwalk	32.10	24.00
San Fernando Valley	Anaheim	46.32	25.90
Los Angeles Union Station	Norwalk	13.67	21.60
Los Angeles Union Station	Anaheim	27.87	23.50
Norwalk	Anaheim	15.26	21.80

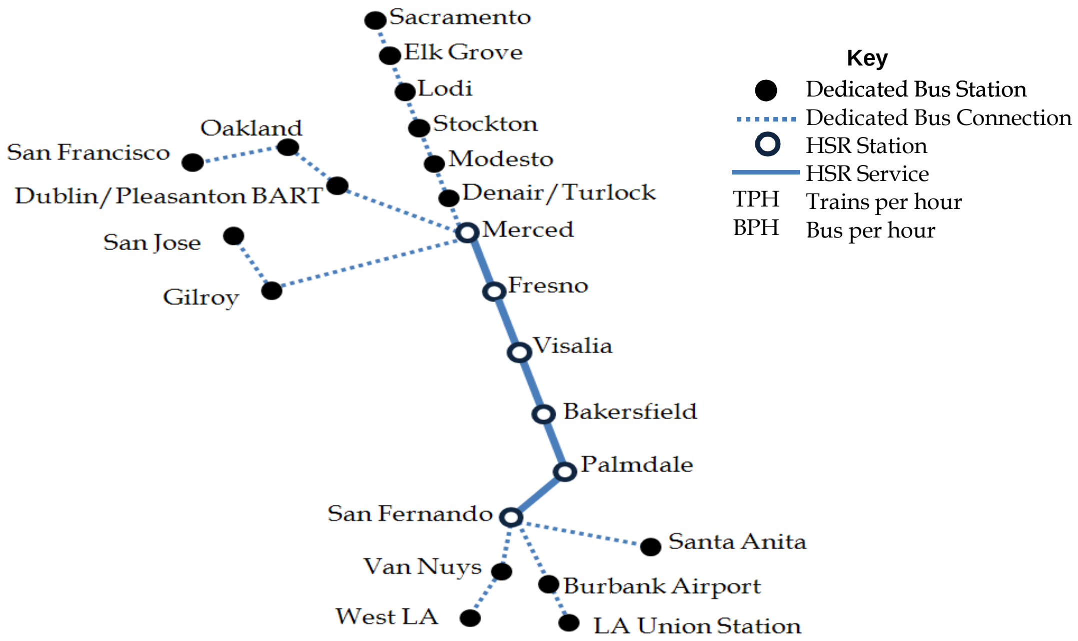
F. Details of Model Run Assumptions and Outcomes

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario:	**12-041d: IOS South (Low) with 20 cents/mi in 2011$ for 2012 Final Business Plan**
Scenario Description:	High Speed Rail (HSR) service between Merced and San Fernando with bus connections to the Bay Area and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)
Phase:	IOS
Year:	2030
HSR Fare Policy:	83% of San Francisco-Los Angeles airfare with lower rates for shorter distances
AIR Fare Policy:	Actual 2009 airfares
CVR Fare Policy:	Actual 2011 fares
Parking Costs:	High (Oct-09)
Motor Fuel:	20 cents/mile (2011$)
Socioeconomic:	Based on 2011 Moody's Analytics Forecast for 2030
Trip Rate:	2011 Survey, by region

Service Summary:
(See next page for details)

- 4 peak TPH from Merced and San Fernando(2 in offpeak)
- 4 peak BPH from Merced to Sacramento(2 in offpeak)
- 4 peak BPH from Merced to San Jose (2 in offpeak)
- 4 peak BPH from Merced to San Francisco (2 in offpeak)
- 4 peak BPH from San Fernando to LA Union Station (2 in offpeak)
- 4 peak BPH from San Fernando to West LA (2 in offpeak)
- 4 peak BPH from San Fernando to Santa Anita (4 in offpeak)



Run Date: 3/20/2012

Disclaimer
The information and results presented in this workbook are estimates and projections that involve subjective judgments, and may differ materially from the actual future ridership and revenue. This workbook is not intended nor shall it be construed to constitute a guarantee, promise or representation of any particular outcome(s) or result(s). Further, the material presented in this workbook is provided for purposes of comparing potential scenarios of the proposed California High Speed Rail project for the 2012 Business Plan.

Scenario 12-041d: IOS South (Low) with 20 cents/mi in 2011$ for 2012 Final Business Plan
High Speed Rail (HSR) service between Merced and San Fernando with bus connections to the Bay Area and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Operating Plan:

Dedicated Bus Connections - North

6 Peak Hours

Pattern#	1	2	3
Frequency of service (mins)	15	15	15
San Francisco	0		
Oakland	40		
Dublin Pleasanton BART	80		
Sacramento		0	
Elk Grove		10	
Lodi		35	
Stockton		60	
Modesto		120	
Denair/Turlock		156	
San Jose			0
Gilroy			40
Merced	200	200	150
# of buses	24	24	24
Transfer Time @ Merced	15	15	15

10 Off Peak Hours

Pattern#	1	2	3
Frequency of service (mins)	30	30	30
San Francisco	0		
Oakland	40		
Dublin Pleasanton BART	80		
Sacramento		0	
Elk Grove		10	
Lodi		35	
Stockton		60	
Modesto		120	
Denair/Turlock		156	
San Jose			0
Gilroy			40
Merced	200	200	150
# of buses	20	20	20
Transfer Time @ Merced	15	15	15

HSR Patterns

6 Peak Hours

	62	70	22	42
Frequency	60	60	60	60
Run times from start in minutes				
Merced	0	0	0	0
Fresno	19	25	25	19
Visalia	38	44	35	29
Bakersfield	69	69	66	60
Palmdale	100	106	97	97
San Fernando	126	132	123	123
# of Trains	6	6	6	6

10 Off Peak Hours

	67	27
Frequency	60	60
Run times from start in minutes		
Merced	0	0
Fresno	25	25
Visalia	44	35
Bakersfield	75	66
Palmdale	112	97
San Fernando	138	123
# of Trains	10	10

Dedicated Bus Connections - South

6 Peak Hours

Pattern#	1	2	3
Transfer Time @ San Fernando	15	15	15
Frequency of service (mins)	15	15	15
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		12	
West Los Angeles (bus)		32	
Santa Anita (bus)			40
# of buses	24	24	24

10 Off Peak Hours

Pattern#	1	2	3
Transfer Time @ San Fernando	15	15	15
Frequency of service (mins)	30	30	15
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		17	
West Los Angeles (bus)		37	
Santa Anita (bus)			40
# of buses	20	20	20

Note: "Frequency" refers to "Headway" in these pattern charts.

Run Date: 3/20/2012

Scenario 12-041d: IOS South (Low) with 20 cents/mi in 2011$ for 2012 Final Business Plan-High Speed Rail (HSR) service between Merced and San Fernando with bus connections to the Bay Area and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	Destination Region	Business/ Commute	Recreation/ Other	Total	Auto	Conv. Rail	Air	Induced	Auto	Conv. Rail	Air	Induced
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	2,000	21,000	23,000	0%	100%	0%	0%	86%	14%	0%	0%
	MTC	535,000	68,000	603,000	53%	0%	45%	2%	55%	0%	44%	1%
	SACOG	109,000	11,000	120,000	84%	0%	14%	2%	74%	0%	26%	0%
	SJV	524,000	1,376,000	1,900,000	90%	0%	9%	1%	94%	0%	4%	2%
	CC/AMBAG	41,000	23,000	65,000	68%	0%	32%	0%	66%	0%	34%	0%
	OTHER	112,000	152,000	264,000	88%	0%	11%	1%	91%	0%	7%	3%
SANDAG	SCAG	2,000	21,000	23,000	0%	100%	0%	0%	86%	14%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	13,000	2,000	14,000	6%	0%	94%	1%	39%	0%	61%	0%
	SACOG	-	-	-	2%	0%	98%	0%	8%	0%	92%	0%
	SJV	3,000	-	3,000	84%	0%	11%	5%	0%	0%	0%	0%
	CC/AMBAG	-	-	-	69%	0%	30%	2%	0%	0%	0%	0%
	OTHER	-	-	-	79%	0%	14%	7%	0%	0%	0%	0%
MTC	SCAG	535,000	68,000	603,000	53%	0%	45%	2%	55%	0%	44%	1%
	SANDAG	13,000	2,000	14,000	6%	0%	94%	1%	39%	0%	61%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	57,000	31,000	88,000	77%	18%	5%	0%	0%	98%	2%	0%
	CC/AMBAG	11,000	10,000	21,000	83%	6%	11%	0%	93%	4%	2%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
SACOG	SCAG	109,000	11,000	120,000	84%	0%	14%	2%	74%	0%	26%	0%
	SANDAG	-	-	-	2%	0%	98%	0%	8%	0%	92%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	15,000	-	15,000	71%	24%	5%	0%	96%	0%	4%	0%
	CC/AMBAG	5,000	-	5,000	90%	5%	5%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
SJV	SCAG	524,000	1,376,000	1,900,000	90%	0%	9%	1%	94%	0%	4%	2%
	SANDAG	3,000	-	3,000	84%	0%	11%	5%	0%	0%	0%	0%
	MTC	57,000	31,000	88,000	77%	18%	5%	0%	0%	98%	2%	0%
	SACOG	15,000	-	15,000	71%	24%	5%	0%	96%	0%	4%	0%
	SJV	80,000	46,000	126,000	0%	99%	1%	0%	81%	19%	0%	0%
	CC/AMBAG	10,000	-	10,000	98%	1%	1%	0%	100%	0%	0%	0%
	OTHER	1,000	-	1,000	0%	78%	7%	15%	100%	0%	0%	0%
CC/AMBAG	SCAG	41,000	23,000	65,000	68%	0%	32%	0%	66%	0%	34%	0%
	SANDAG	-	-	-	69%	0%	30%	2%	0%	0%	0%	0%
	MTC	11,000	10,000	21,000	83%	6%	11%	0%	93%	4%	2%	0%
	SACOG	5,000	-	5,000	90%	5%	5%	0%	100%	0%	0%	0%
	SJV	10,000	-	10,000	98%	1%	1%	0%	100%	0%	0%	0%
	CC/AMBAG	-	-	-	98%	0%	2%	0%	100%	0%	0%	0%
	OTHER	2,000	-	2,000	97%	0%	2%	0%	100%	0%	0%	0%
OTHER	SCAG	112,000	152,000	264,000	88%	0%	11%	1%	91%	0%	7%	3%
	SANDAG	-	-	-	79%	0%	14%	7%	0%	0%	0%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	1,000	-	1,000	0%	78%	7%	15%	100%	0%	0%	0%
	CC/AMBAG	2,000	-	2,000	97%	0%	2%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**2,960,000**	**3,434,000**	**6,394,000**	**71%**	**4%**	**23%**	**1%**	**90%**	**2%**	**6%**	**2%**

Percent of Total Statewide Interregional HSR Trips that are Induced: 1.64%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario: **12-040e: IOS South (High) - For 2012 Final Business Plan**

Scenario Description: High Speed Rail (HSR) service between Merced and San Fernando with dedicated bus connections to the Bay Area and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Phase: IOS

Year: 2030

HSR Fare Policy: 83% of San Francisco-Los Angeles airfare with lower rates for shorter distances

AIR Fare Policy: Actual 2009 airfares

CVR Fare Policy: Actual 2011 fares

Parking Costs: High (Oct-09)

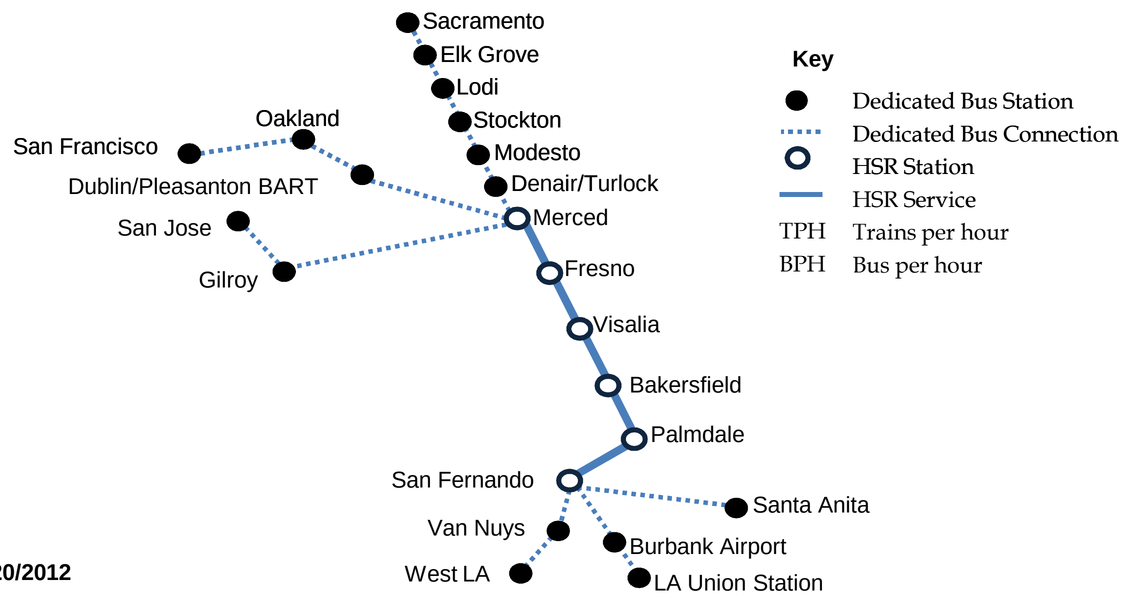
Motor Fuel: 28 cents/mile (2011$)

Socioeconomic: Based on comparison of 2008 to 2011 Woods and Poole Forecast

Trip Rate: 2005 Survey, by region

Service Summary:
(See next page for details)

- 4 peak TPH from Merced and San Fernando(2 in offpeak)
- 4 peak BPH from Merced to Sacramento(2 in offpeak)
- 4 peak BPH from Merced to San Jose (2 in offpeak)
- 4 peak BPH from Merced to San Francisco (2 in offpeak)
- 4 peak BPH from San Fernando to LA Union Station (2 in offpeak)
- 4 peak BPH from San Fernando to West LA (2 in offpeak)
- 4 peak BPH from San Fernando to Santa Anita (4 in offpeak)



Run Date: 3/20/2012

Disclaimer
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Scenario 12-040e: IOS South (High) - For 2012 Final Business Plan

High Speed Rail (HSR) service between Merced and San Fernando with dedicated bus connections to the Bay Area and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Operating Plan:

Dedicated Bus Connections - North

6 Peak Hours

Pattern#	1	2	3
Frequency of service (mins)	15	15	15
San Francisco	0		
Oakland	40		
Dublin Pleasanton BART	80		
Sacramento		0	
Elk Grove		10	
Lodi		35	
Stockton		60	
Modesto		120	
Denair/Turlock		155	
San Jose			0
Gilroy			40
Merced	200	200	150
# of buses	24	24	24
Transfer Time @ Merced	15	15	15

10 Off Peak Hours

Pattern#	1	2	3
Frequency of service (mins)	30	30	30
San Francisco	0		
Oakland	40		
Dublin Pleasanton BART	80		
Sacramento		0	
Elk Grove		10	
Lodi		35	
Stockton		60	
Modesto		120	
Denair/Turlock		155	
San Jose			0
Gilroy			40
Merced	200	200	150
# of buses	20	20	20
Transfer Time @ Merced	15	15	15

HSR Patterns

6 Peak Hours

	62	70	22	42
Frequency	60	60	60	60
Run times from start in minutes				
Merced	0	0	0	0
Fresno	19	25	25	19
Visalia	38	44	35	29
Bakersfield	69	69	66	60
Palmdale	100	106	97	97
San Fernando	126	132	123	123
# of Trains	6	6	6	6

10 Off Peak Hours

	67	27
Frequency	60	60
Run times from start in minutes		
Merced	0	0
Fresno	25	25
Visalia	44	35
Bakersfield	75	66
Palmdale	112	97
San Fernando	138	123
# of Trains	10	10

Dedicated Bus Connections - South

Transfer Time @ San Fernando	15	15	15
Pattern#	1	2	3
Frequency of service (mins)	15	15	15
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		12	
West Los Angeles (bus)		32	
Santa Anita (bus)			40
# of buses	24	24	24

Transfer Time @ San Fernando	15	15	15
Pattern#	1	2	3
Frequency of service (mins)	30	30	15
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		17	
West Los Angeles (bus)		37	
Santa Anita (bus)			40
# of buses	20	20	20

Note: "Frequency refers to "Headway" in these pattern charts.

Run Date: 3/20/2012

Scenario 12-040e: IOS South (High) - For 2012 Final Business Plan - High Speed Rail (HSR) service between Merced and San Fernando with dedicated bus connections to the Bay Area and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	Destination Region	Business/ Commute	Recreation/ Other	Total	Auto	Conv. Rail	Air	Induced	Auto	Conv. Rail	Air	Induced
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	5,000	5,000	10,000	13%	86%	0%	0%	87%	13%	0%	0%
	MTC	972,000	91,000	1,063,000	50%	0%	48%	2%	44%	0%	53%	3%
	SACOG	310,000	14,000	324,000	84%	0%	12%	4%	75%	0%	26%	0%
	SJV	1,876,000	828,000	2,705,000	90%	0%	8%	2%	89%	0%	8%	3%
	CC/AMBAG	118,000	17,000	134,000	60%	0%	40%	0%	63%	0%	37%	0%
	OTHER	274,000	81,000	355,000	88%	0%	9%	3%	88%	0%	8%	3%
SANDAG	SCAG	5,000	5,000	10,000	13%	86%	0%	0%	87%	13%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	53,000	1,000	53,000	4%	0%	95%	1%	27%	0%	73%	0%
	SACOG	2,000	-	2,000	1%	0%	99%	0%	4%	0%	96%	0%
	SJV	16,000	-	16,000	84%	0%	10%	6%	0%	0%	0%	0%
	CC/AMBAG	1,000	-	1,000	62%	0%	37%	0%	0%	0%	0%	0%
	OTHER	2,000	-	2,000	76%	0%	17%	7%	0%	0%	0%	0%
MTC	SCAG	972,000	91,000	1,063,000	50%	0%	48%	2%	44%	0%	53%	3%
	SANDAG	53,000	1,000	53,000	4%	0%	95%	1%	27%	0%	73%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	379,000	48,000	427,000	75%	16%	8%	0%	0%	97%	3%	0%
	CC/AMBAG	61,000	20,000	80,000	77%	9%	14%	0%	90%	6%	2%	2%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
SACOG	SCAG	310,000	14,000	324,000	84%	0%	12%	4%	75%	0%	26%	0%
	SANDAG	2,000	-	2,000	1%	0%	99%	0%	4%	0%	96%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	152,000	-	152,000	66%	27%	8%	0%	89%	5%	5%	0%
	CC/AMBAG	47,000	-	47,000	87%	7%	6%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
SJV	SCAG	1,876,000	828,000	2,705,000	90%	0%	8%	2%	89%	0%	8%	3%
	SANDAG	16,000	-	16,000	84%	0%	10%	6%	0%	0%	0%	0%
	MTC	379,000	48,000	427,000	75%	16%	8%	0%	0%	97%	3%	0%
	SACOG	152,000	-	152,000	66%	27%	8%	0%	89%	5%	5%	0%
	SJV	1,061,000	118,000	1,179,000	0%	99%	1%	0%	86%	14%	0%	0%
	CC/AMBAG	71,000	-	71,000	97%	2%	2%	0%	100%	0%	0%	0%
	OTHER	16,000	-	16,000	0%	59%	5%	35%	100%	0%	0%	0%
CC/AMBAG	SCAG	118,000	17,000	134,000	60%	0%	40%	0%	63%	0%	37%	0%
	SANDAG	1,000	-	1,000	62%	0%	37%	0%	0%	0%	0%	0%
	MTC	61,000	20,000	80,000	77%	9%	14%	0%	90%	6%	2%	2%
	SACOG	47,000	-	47,000	87%	7%	6%	0%	100%	0%	0%	0%
	SJV	71,000	-	71,000	97%	2%	2%	0%	100%	0%	0%	0%
	CC/AMBAG	2,000	-	2,000	97%	0%	3%	0%	100%	0%	0%	0%
	OTHER	12,000	-	12,000	96%	1%	3%	0%	100%	0%	0%	0%
OTHER	SCAG	274,000	81,000	355,000	88%	0%	9%	3%	88%	0%	8%	3%
	SANDAG	2,000	-	2,000	76%	0%	17%	7%	0%	0%	0%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	16,000	-	16,000	0%	59%	5%	35%	100%	0%	0%	0%
	CC/AMBAG	12,000	-	12,000	96%	1%	3%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**9,797,000**	**2,328,000**	**12,121,000**	**68%**	**13%**	**17%**	**2%**	**81%**	**5%**	**11%**	**3%**

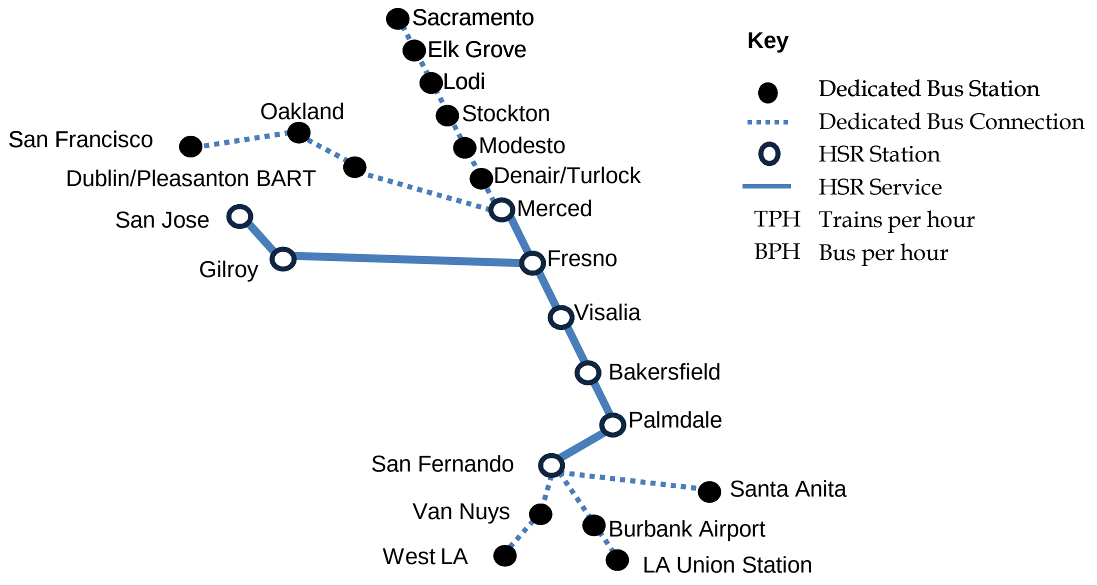
Percent of Total Statewide Interregional HSR Trips that are Induced: 1.90%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario:	**12-045c: Bay to Basin (Low) - For 2012 Final Business Plan**
Scenario Description:	High Speed Rail (HSR) between San Jose and San Fernando with dedicated bus connections to San Francisco and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)
Phase:	Bay to Basin
Year:	2030
HSR Fare Policy:	83% of San Francisco-Los Angeles airfare with lower rates for shorter distances
AIR Fare Policy:	Actual 2009 airfares
CVR Fare Policy:	Actual 2011 fares
Parking Costs:	High (Oct-09)
Motor Fuel:	20 cents/mile (2011$)
Socioeconomic:	Based on 2011 Moody's Analytics Forecast for 2030
Trip Rate:	2011 Survey, by region
Service Summary: **(See next page for details)**	• 4 peak TPH from San Jose to San Fernando (3 in offpeak) • 2 peak TPH from Merced to San Fernando (1 in offpeak) • 2 peak BPH from Merced to San Francisco (1 in offpeak) • 2 peak BPH from Merced to Sacramento (1 in offpeak) • 6 peak BPH from San Fernando to LA Union Station (4 in offpeak) • 6 peak BPH from San Fernando to West LA (4 in offpeak) • 6 peak BPH from San Fernando to Santa Anita (4 in offpeak)



Run Date: <u>3/20/2012</u>

Disclaimer
The information and results presented in this workbook are estimates and projections that involve subjective judgments, and may differ materially from the actual future ridership and revenue. This workbook is not intended nor shall it be construed to constitute a guarantee, promise or representation of any particular outcome(s) or result(s). Further, the material presented in this workbook is provided for purposes of comparing potential scenarios of the proposed California High Speed Rail project for the 2012 Business Plan.

Scenario 12-045c: Bay to Basin (Low) - For 2012 Final Business Plan

High Speed Rail (HSR) between San Jose and San Fernando with dedicated bus connections to San Francisco and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Operating Plan:

Dedicated Bus Connections - North

Peak Period

6 Peak Hours

Pattern#	1	2
Frequency of service (mins)	30	30
San Francisco	0	
Oakland	40	
Dublin Pleasanton BART	80	
Sacramento		0
Elk Grove		10
Lodi		35
Stockton		60
Modesto		120
Denair/Turlock		155
Merced	200	200
# of buses	12	12
Transfer Time @ Merced	15	15

Off-peak

10 Off Peak Hours

Pattern#	1	2
Frequency of service (mins)	60	60
San Francisco	0	
Oakland	40	
Dublin Pleasanton BART	80	
Sacramento		0
Elk Grove		10
Lodi		35
Stockton		60
Modesto		120
Denair/Turlock		155
Merced	200	200
# of buses	10	10
Transfer Time @ Merced	15	15

HSR Patterns

High Speed Rail - Peak

Pattern	30	40	50	60	70	80
Frequency	60	60	60	60	60	60
San Jose	0	0	0	0		
Gilroy	15	18	18	18		
Merced					0	0
Fresno	59	56	62	56	19	25
Visalia	69	72	72	66	29	44
Bakersfield	100	97	97	97	54	75
Palmdale	131	134	134	128	91	106
San Fernando	154	157	157	151	114	129
# of Trains	6	6	6	6	6	6

High Speed Rail - Off-peak

Pattern	25	35	40	85
Frequency	60	60	60	60
San Jose	0	0	0	
Gilroy	15	18	18	
Merced				0
Fresno	59	62	56	25
Visalia	69	72	72	35
Bakersfield	100	103	97	66
Palmdale	137	134	134	103
San Fernando	160	157	157	126
# of Trains	10	10	10	10

Dedicated Bus Connections - South

Pattern#	1	2	3
Transfer Time @ San Fernando	15	15	15
Frequency of service (mins)	10	10	10
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		17	
West Los Angeles (bus)		37	
Santa Anita (bus)			40
# of buses	36	36	36

Pattern#	1	2	3
Transfer Time @ San Fernando	15	15	15
Frequency of service (mins)	15	15	15
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		17	
West Los Angeles (bus)		37	
Santa Anita (bus)			40
# of buses	40	40	40

Note: "Frequency" refers to "Headway" in these pattern charts.

Run Date: 3/20/2012

Scenario 12-045c: Bay to Basin (Low) - For 2012 Final Business Plan-High Speed Rail (HSR) between San Jose and San Fernando with dedicated bus connections to San Francisco and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	Destination Region	Business/ Commute	Recreation/ Other	Total	Auto	Conv. Rail	Air	Induced	Auto	Conv. Rail	Air	Induced
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	2,000	24,000	26,000	0%	100%	0%	0%	89%	11%	0%	0%
	MTC	731,000	1,592,000	2,322,000	54%	0%	43%	3%	55%	0%	42%	3%
	SACOG	88,000	8,000	96,000	85%	0%	14%	0%	72%	0%	28%	0%
	SJV	434,000	1,310,000	1,744,000	91%	0%	9%	0%	95%	0%	4%	2%
	CC/AMBAG	155,000	415,000	570,000	68%	0%	32%	0%	70%	0%	30%	0%
	OTHER	93,000	130,000	223,000	90%	0%	10%	0%	92%	0%	7%	1%
SANDAG	SCAG	2,000	24,000	26,000	0%	100%	0%	0%	89%	11%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	11,000	100,000	112,000	6%	0%	94%	0%	33%	0%	67%	0%
	SACOG	-	-	-	2%	0%	98%	0%	10%	0%	90%	0%
	SJV	2,000	-	2,000	85%	0%	9%	6%	0%	0%	0%	0%
	CC/AMBAG	-	-	-	76%	0%	23%	2%	0%	0%	0%	0%
	OTHER	-	-	-	82%	0%	12%	6%	0%	0%	0%	0%
MTC	SCAG	731,000	1,592,000	2,322,000	54%	0%	43%	3%	55%	0%	42%	3%
	SANDAG	11,000	100,000	112,000	6%	0%	94%	0%	33%	0%	67%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	100%	0%	0%	17%	83%	0%	0%
	SJV	111,000	805,000	916,000	83%	10%	7%	0%	91%	6%	3%	1%
	CC/AMBAG	40,000	201,000	242,000	93%	2%	5%	0%	99%	0%	1%	0%
	OTHER	-	12,000	12,000	95%	5%	0%	0%	98%	1%	1%	0%
SACOG	SCAG	88,000	8,000	96,000	85%	0%	14%	0%	72%	0%	28%	0%
	SANDAG	-	-	-	2%	0%	98%	0%	10%	0%	90%	0%
	MTC	-	-	-	0%	100%	0%	0%	17%	83%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	9,000	-	10,000	60%	35%	4%	0%	96%	0%	4%	0%
	CC/AMBAG	5,000	-	5,000	90%	5%	5%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
SJV	SCAG	434,000	1,310,000	1,744,000	91%	0%	9%	0%	95%	0%	4%	2%
	SANDAG	2,000	-	2,000	85%	0%	9%	6%	0%	0%	0%	0%
	MTC	111,000	805,000	916,000	83%	10%	7%	0%	91%	6%	3%	1%
	SACOG	9,000	-	10,000	60%	35%	4%	0%	96%	0%	4%	0%
	SJV	59,000	35,000	94,000	0%	99%	1%	0%	76%	24%	0%	0%
	CC/AMBAG	16,000	3,000	18,000	97%	1%	2%	0%	100%	0%	0%	0%
	OTHER	1,000	-	1,000	0%	96%	4%	0%	100%	0%	0%	0%
CC/AMBAG	SCAG	155,000	415,000	570,000	68%	0%	32%	0%	70%	0%	30%	0%
	SANDAG	-	-	-	76%	0%	23%	2%	0%	0%	0%	0%
	MTC	40,000	201,000	242,000	93%	2%	5%	0%	99%	0%	1%	0%
	SACOG	5,000	-	5,000	90%	5%	5%	0%	100%	0%	0%	0%
	SJV	16,000	3,000	18,000	97%	1%	2%	0%	100%	0%	0%	0%
	CC/AMBAG	2,000	-	2,000	99%	0%	1%	0%	100%	0%	0%	0%
	OTHER	2,000	-	2,000	97%	0%	2%	0%	100%	0%	0%	0%
OTHER	SCAG	93,000	130,000	223,000	90%	0%	10%	0%	92%	0%	7%	1%
	SANDAG	-	-	-	82%	0%	12%	6%	0%	0%	0%	0%
	MTC	-	12,000	12,000	95%	5%	0%	0%	98%	1%	1%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	1,000	-	1,000	0%	96%	4%	0%	100%	0%	0%	0%
	CC/AMBAG	2,000	-	2,000	97%	0%	2%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**3,461,000**	**9,235,000**	**12,698,000**	**70%**	**3%**	**26%**	**1%**	**77%**	**1%**	**21%**	**2%**

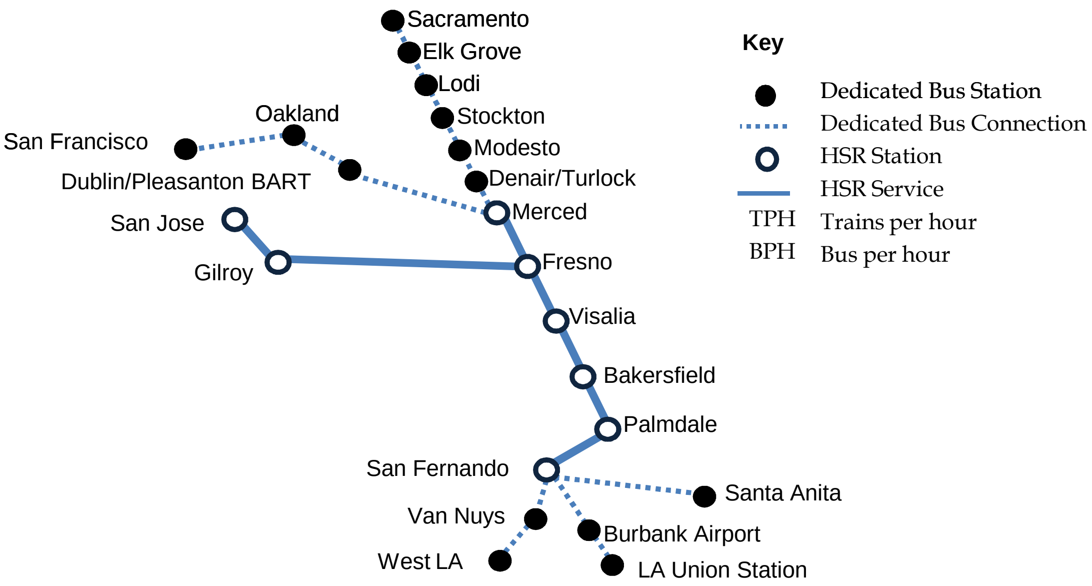
Percent of Total Statewide Interregional HSR Trips that are Induced: 1.66%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario:	**12-044b: Bay to Basin (High) - For 2012 Final Business Plan**
Scenario Description:	High Speed Rail (HSR) between San Jose and San Fernando with dedicated bus connections to San Francisco and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)
Phase:	Bay to Basin
Year:	2030
HSR Fare Policy:	83% of San Francisco-Los Angeles airfare with lower rates for shorter distances
AIR Fare Policy:	Actual 2009 airfares
CVR Fare Policy:	Actual 2011 fares
Parking Costs:	High (Oct-09)
Motor Fuel:	28 cents/mile (2011$)
Socioeconomic:	Based on comparison of 2008 to 2011 Woods and Poole Forecast
Trip Rate:	2005 Survey, by region
Service Summary: **(See next page for details)**	• 4 peak TPH from San Jose to San Fernando (3 in offpeak) • 2 peak TPH from Merced to San Fernando (1 in offpeak) • 2 peak BPH from Merced to San Francisco (1 in offpeak) • 2 peak BPH from Merced to Sacramento (1 in offpeak) • 6 peak BPH from San Fernando to LA Union Station (4 in offpeak) • 6 peak BPH from San Fernando to West LA (4 in offpeak) • 6 peak BPH from San Fernando to Santa Anita (4 in offpeak)



Run Date: 3/20/2012

Scenario 12-044b: Bay to Basin (High) - For 2012 Final Business Plan

High Speed Rail (HSR) between San Jose and San Fernando with dedicated bus connections to San Francisco and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Operating Plan:

Dedicated Bus Connections - North

Peak Period

6 Peak Hours

Pattern#	1	2
Frequency of service (mins)	30	30
San Francisco	0	
Oakland	40	
Dublin Pleasanton BART	80	
Sacramento		0
Elk Grove		10
Lodi		35
Stockton		60
Modesto		120
Denair/Turlock		155
Merced	200	200
# of buses	12	12
Transfer Time @ Merced	15	15

Off-peak

10 Off Peak Hours

Pattern#	1	2
Frequency of service (mins)	60	60
San Francisco	0	
Oakland	40	
Dublin Pleasanton BART	80	
Sacramento		0
Elk Grove		10
Lodi		35
Stockton		60
Modesto		120
Denair/Turlock		155
Merced	200	200
# of buses	10	10
Transfer Time @ Merced	15	15

HSR Patterns

High Speed Rail - Peak

Pattern	30	40	50	60	70	80
Frequency	60	60	60	60	60	60
San Jose	0	0	0	0		
Gilroy	15	18	18	18		
Merced					0	0
Fresno	59	56	62	55	19	25
Visalia	69	72	72	66	29	44
Bakersfield	100	97	97	97	54	75
Palmdale	131	134	134	128	91	106
San Fernando	154	157	157	151	114	129
# of Trains	6	6	6	6	6	6

High Speed Rail - Off-peak

Pattern	25	35	40	85
Frequency	60	60	60	60
San Jose	0	0	0	
Gilroy	15	18	18	
Merced				0
Fresno	59	62	56	25
Visalia	69	72	72	35
Bakersfield	100	103	97	66
Palmdale	137	134	134	103
San Fernando	160	157	157	126
# of Trains	10	10	10	10

Dedicated Bus Connections - South

Pattern#	1	2	3
Transfer Time @ San Fernando	15	15	15
Frequency of service (mins)	10	10	10
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		17	
West Los Angeles (bus)		37	
Santa Anita (bus)			40
# of buses	36	36	36

Pattern#	1	2	3
Transfer Time @ San Fernando	15	15	15
Frequency of service (mins)	15	15	15
San Fernando (bus)	0	0	0
Burbank Airport (bus)	12		
Los Angeles Union Station (bus)	37		
Van Nuys (bus)		17	
West Los Angeles (bus)		37	
Santa Anita (bus)			40
# of buses	40	40	40

Note: "Frequency" refers to "Headway" in these pattern charts.

Run Date: 3/20/2012

Scenario 12-044b: Bay to Basin (High) - For 2012 Final Business Plan-High Speed Rail (HSR) between San Jose and San Fernando with dedicated bus connections to San Francisco and Sacramento at Merced and to LA Basin at San Fernando (DRAFT)

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	Destination Region	Business/ Commute	Recreation/ Other	Total	Auto	Conv. Rail	Air	Induced	Auto	Conv. Rail	Air	Induced
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	4,000	5,000	9,000	19%	80%	0%	0%	90%	10%	0%	0%
	MTC	1,320,000	2,276,000	3,596,000	50%	0%	46%	4%	44%	0%	52%	4%
	SACOG	262,000	12,000	274,000	86%	0%	11%	3%	73%	0%	27%	0%
	SJV	1,541,000	790,000	2,331,000	91%	0%	8%	1%	90%	0%	7%	3%
	CC/AMBAG	544,000	253,000	797,000	62%	0%	38%	0%	62%	0%	38%	0%
	OTHER	234,000	71,000	305,000	90%	0%	8%	2%	90%	0%	8%	2%
SANDAG	SCAG	4,000	5,000	9,000	19%	80%	0%	0%	90%	10%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	43,000	109,000	152,000	4%	0%	96%	0%	19%	0%	81%	0%
	SACOG	1,000	-	1,000	1%	0%	99%	0%	5%	0%	95%	0%
	SJV	15,000	-	15,000	85%	0%	9%	6%	0%	0%	0%	0%
	CC/AMBAG	2,000	-	2,000	70%	0%	27%	3%	0%	0%	0%	0%
	OTHER	1,000	-	1,000	77%	0%	16%	7%	0%	0%	0%	0%
MTC	SCAG	1,320,000	2,276,000	3,596,000	50%	0%	46%	4%	44%	0%	52%	4%
	SANDAG	43,000	109,000	152,000	4%	0%	96%	0%	19%	0%	81%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	-	-	-	0%	100%	0%	0%	51%	50%	0%	0%
	SJV	746,000	1,535,000	2,281,000	80%	9%	11%	0%	84%	8%	7%	2%
	CC/AMBAG	234,000	418,000	652,000	93%	3%	5%	0%	98%	0%	1%	0%
	OTHER	2,000	16,000	18,000	93%	7%	0%	0%	98%	2%	1%	0%
SACOG	SCAG	262,000	12,000	274,000	86%	0%	11%	3%	73%	0%	27%	0%
	SANDAG	1,000	-	1,000	1%	0%	99%	0%	5%	0%	95%	0%
	MTC	-	-	-	0%	100%	0%	0%	51%	50%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	96,000	-	96,000	54%	39%	7%	0%	89%	6%	6%	0%
	CC/AMBAG	45,000	-	45,000	88%	7%	6%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
SJV	SCAG	1,541,000	790,000	2,331,000	91%	0%	8%	1%	90%	0%	7%	3%
	SANDAG	15,000	-	15,000	85%	0%	9%	6%	0%	0%	0%	0%
	MTC	746,000	1,535,000	2,281,000	80%	9%	11%	0%	84%	8%	7%	2%
	SACOG	96,000	-	96,000	54%	39%	7%	0%	89%	6%	6%	0%
	SJV	778,000	84,000	862,000	0%	99%	1%	0%	81%	19%	0%	0%
	CC/AMBAG	164,000	2,000	167,000	93%	1%	6%	0%	100%	0%	0%	0%
	OTHER	8,000	-	8,000	0%	97%	3%	0%	100%	0%	0%	0%
CC/AMBAG	SCAG	544,000	253,000	797,000	62%	0%	38%	0%	62%	0%	38%	0%
	SANDAG	2,000	-	2,000	70%	0%	27%	3%	0%	0%	0%	0%
	MTC	234,000	418,000	652,000	93%	3%	5%	0%	98%	0%	1%	0%
	SACOG	45,000	-	45,000	88%	7%	6%	0%	100%	0%	0%	0%
	SJV	164,000	2,000	167,000	93%	1%	6%	0%	100%	0%	0%	0%
	CC/AMBAG	14,000	-	14,000	99%	0%	1%	0%	100%	0%	0%	0%
	OTHER	12,000	-	12,000	96%	1%	3%	0%	100%	0%	0%	0%
OTHER	SCAG	234,000	71,000	305,000	90%	0%	8%	2%	90%	0%	8%	2%
	SANDAG	1,000	-	1,000	77%	0%	16%	7%	0%	0%	0%	0%
	MTC	2,000	16,000	18,000	93%	7%	0%	0%	98%	2%	1%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	8,000	-	8,000	0%	97%	3%	0%	100%	0%	0%	0%
	CC/AMBAG	12,000	-	12,000	96%	1%	3%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**11,340,000**	**11,058,000**	**22,400,000**	**69%**	**9%**	**20%**	**1%**	**67%**	**2%**	**28%**	**3%**

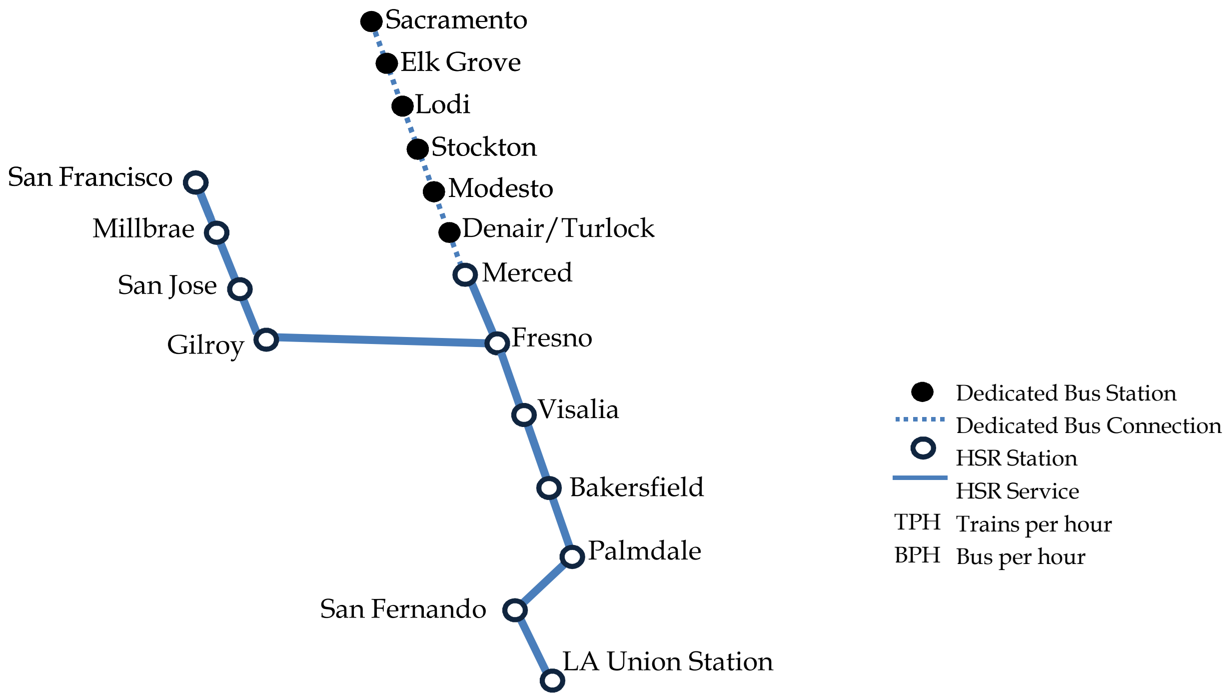
Percent of Total Statewide Interregional HSR Trips that are Induced: 2.04%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario:	**12-043d: Phase 1 Blended Service (Low)**
Scenario Description:	HSR connection between San Francisco and Los Angeles Union Station with bus connections to Sacramento at Merced (DRAFT)
Phase:	Blended Service
Year:	2030
HSR Fare Policy:	83% of actual airfare
AIR Fare Policy:	Actual 2009 airfares
CVR Fare Policy:	Actual 2011 fares
Parking Costs:	High (Oct-09)
Motor Fuel:	20 cents/mile (2011$)
Socioeconomic:	Based on 2011 Moody's Analytics Forecast for 2030
Trip Rate:	2011 Survey, by region
Service Summary: **(See next page for details)**	• 4 peak TPH from San Francisco to LA Union Station (same for offpeak) • 2 peak TPH from San Jose to LA Union Station (0 in offpeak) • 2 peak TPH from Merced to LA Union Station (1 in offpeak) • 2 peak BPH from Merced to Sacramento (1 in offpeak)



Run Date: 3/20/2012

Disclaimer
The information and results presented in this workbook are estimates and projections that involve subjective judgments, and may differ materially from the actual future ridership and revenue. This workbook is not intended nor shall it be construed to constitute a guarantee, promise or representation of any particular outcome(s) or result(s). Further, the material presented in this workbook is provided for purposes of comparing potential scenarios of the proposed California High Speed Rail project for the 2012 Business Plan.

Scenario 12-043d: Phase 1 Blended Service (Low)
HSR connection between San Francisco and Los Angeles Union Station with bus connections to Sacramento at

Operating Plan:

Dedicated Bus Connections - North

Dedicated Coach - Peak Period

Frequency	30
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200
# of buses	12
Transfer Time @ Merced	15

Dedicated Coach - Off-peak Period

Frequency	60
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200
# of buses	10
Transfer Time @ Merced	15

HSR Patterns

High Speed Rail - Peak

Pattern	10	20	30	40	50	60	70	80
Frequency	60	60	60	60	60	60	60	60
San Francisco Transbay	0	0	0	0				
Millbrae	16	16	16	16				
San Jose	42	42	48	48	0	0		
Gilroy	53	57	63	66	18	15		
Merced							0	0
Fresno	89	101	107	104	62	53	19	25
Visalia	98	111	117	120	72	63	29	44
Bakersfield	122	142	148	145	97	94	54	75
Palmdale	151	179	179	182	134	125	91	106
San Fernando	170	199	199	208	154	145	111	132
Los Angeles	180	210	210	219	165	156	122	143
# of Trains	6	6	6	6	6	6	6	6

High Speed Rail - Off-peak

Pattern	10	25	35	40	85
Frequency	60	60	60	60	60
San Francisco Transbay	0	0	0	0	
Millbrae	16	16	16	16	
San Jose	42	48	48	48	
Gilroy	53	63	66	66	
Merced					0
Fresno	89	107	110	104	25
Visalia	98	117	120	120	35
Bakersfield	122	148	151	145	66
Palmdale	151	185	182	182	103
San Fernando	170	205	202	208	129
Los Angeles	180	216	213	219	140
# of Trains	10	10	10	10	10

Note: "Frequency" refers to "Headway" in these pattern charts. Run Date: 3/20/2012

Scenario 12-043d: Phase 1 Blended Service (Low)-HSR connection between San Francisco and Los Angeles Union Station with bus connections to Sacramento at Merced (DRAFT)

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	**Destination Region**	**Business/ Commute**	**Recreation/ Other**	**Total**	**Auto**	**Conv. Rail**	**Air**	**Induced**	**Auto**	**Conv. Rail**	**Air**	**Induced**
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	3,000	216,000	219,000	0%	100%	0%	0%	99%	1%	0%	0%
	MTC	802,000	1,902,000	2,705,000	54%	0%	43%	4%	55%	0%	41%	4%
	SACOG	100,000	63,000	163,000	86%	0%	12%	1%	77%	0%	23%	0%
	SJV	485,000	1,385,000	1,870,000	91%	0%	7%	1%	94%	0%	4%	2%
	CC/AMBAG	107,000	402,000	509,000	70%	0%	30%	0%	69%	0%	31%	0%
	OTHER	66,000	139,000	205,000	90%	0%	10%	0%	92%	0%	7%	1%
SANDAG	SCAG	3,000	216,000	219,000	0%	100%	0%	0%	99%	1%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	39,000	374,000	413,000	9%	0%	89%	2%	41%	0%	58%	1%
	SACOG	-	2,000	2,000	3%	0%	97%	0%	13%	0%	87%	0%
	SJV	4,000	-	4,000	84%	0%	11%	5%	80%	0%	20%	0%
	CC/AMBAG	1,000	-	1,000	73%	0%	25%	3%	50%	0%	50%	0%
	OTHER	1,000	-	1,000	83%	0%	11%	6%	0%	0%	0%	0%
MTC	SCAG	802,000	1,902,000	2,705,000	54%	0%	43%	4%	55%	0%	41%	4%
	SANDAG	39,000	374,000	413,000	9%	0%	89%	2%	41%	0%	58%	1%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	2,000	-	2,000	0%	100%	0%	0%	29%	71%	0%	0%
	SJV	141,000	959,000	1,100,000	85%	8%	6%	0%	91%	5%	3%	1%
	CC/AMBAG	41,000	327,000	368,000	93%	3%	4%	0%	99%	0%	1%	0%
	OTHER	1,000	24,000	25,000	94%	6%	1%	0%	98%	1%	1%	0%
SACOG	SCAG	100,000	63,000	163,000	86%	0%	12%	1%	77%	0%	23%	0%
	SANDAG	-	2,000	2,000	3%	0%	97%	0%	13%	0%	87%	0%
	MTC	2,000	-	2,000	0%	100%	0%	0%	29%	71%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	12,000	-	12,000	66%	29%	5%	0%	98%	0%	2%	0%
	CC/AMBAG	4,000	-	4,000	87%	8%	5%	0%	100%	0%	0%	0%
	OTHER	-	-	-	100%	0%	0%	0%	0%	0%	0%	0%
SJV	SCAG	485,000	1,385,000	1,870,000	91%	0%	7%	1%	94%	0%	4%	2%
	SANDAG	4,000	-	4,000	84%	0%	11%	5%	80%	0%	20%	0%
	MTC	141,000	959,000	1,100,000	85%	8%	6%	0%	91%	5%	3%	1%
	SACOG	12,000	-	12,000	66%	29%	5%	0%	98%	0%	2%	0%
	SJV	60,000	35,000	95,000	0%	99%	1%	0%	75%	25%	0%	0%
	CC/AMBAG	12,000	2,000	14,000	96%	1%	3%	0%	100%	0%	0%	0%
	OTHER	1,000	-	1,000	0%	98%	2%	0%	100%	0%	0%	0%
CC/AMBAG	SCAG	107,000	402,000	509,000	70%	0%	30%	0%	69%	0%	31%	0%
	SANDAG	1,000	-	1,000	73%	0%	25%	3%	50%	0%	50%	0%
	MTC	41,000	327,000	368,000	93%	3%	4%	0%	99%	0%	1%	0%
	SACOG	4,000	-	4,000	87%	8%	5%	0%	100%	0%	0%	0%
	SJV	12,000	2,000	14,000	96%	1%	3%	0%	100%	0%	0%	0%
	CC/AMBAG	1,000	-	1,000	98%	0%	2%	0%	100%	0%	0%	0%
	OTHER	1,000	-	1,000	97%	1%	1%	0%	100%	0%	0%	0%
OTHER	SCAG	66,000	139,000	205,000	90%	0%	10%	0%	92%	0%	7%	1%
	SANDAG	1,000	-	1,000	83%	0%	11%	6%	0%	0%	0%	0%
	MTC	1,000	24,000	25,000	94%	6%	1%	0%	98%	1%	1%	0%
	SACOG	-	-	-	100%	0%	0%	0%	0%	0%	0%	0%
	SJV	1,000	-	1,000	0%	98%	2%	0%	100%	0%	0%	0%
	CC/AMBAG	1,000	-	1,000	97%	1%	1%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**3,707,000**	**11,625,000**	**15,334,000**	**69%**	**3%**	**26%**	**2%**	**76%**	**1%**	**21%**	**2%**

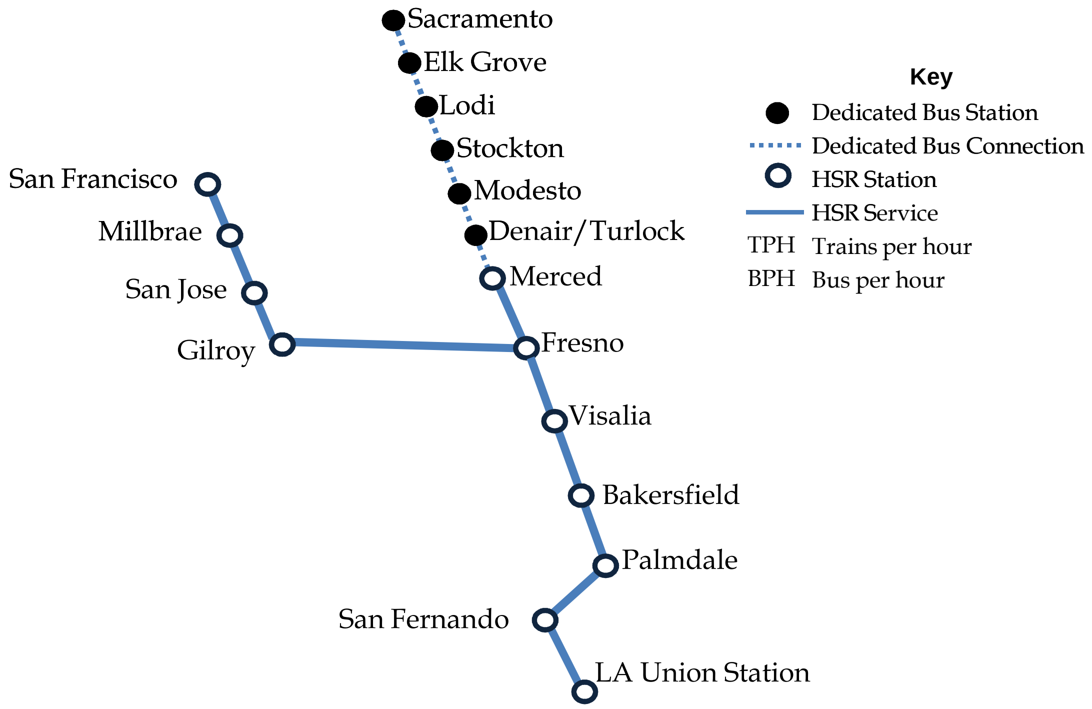
Percent of Total Statewide Interregional HSR Trips that are Induced: 2.05%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario:	**12-042b: Blended Phase 1 (High) - For 2012 Final Business Plan**
Scenario Description:	Blended Service from San Francisco Transbay to Los Angeles Union Station with bus connections to Sacramento at Merced. (DRAFT)
Phase:	Blended Service
Year:	2030
HSR Fare Policy:	83% of San Francisco-Los Angeles airfare with lower fares for shorter distances
AIR Fare Policy:	Actual 2009 airfares
CVR Fare Policy:	Actual 2011 fares
Parking Costs:	High (Oct-09)
Motor Fuel:	28 cents/mile (2011$)
Socioeconomic:	Based on comparison of 2008 to 2011 Woods and Poole Forecast
Trip Rate:	2005 Survey, by region
Service Summary: **(See next page for details)**	• 4 peak TPH from San Francisco to Los Angeles (same for offpeak) • 2 peak TPH from San Jose to Los Angeles (0 in offpeak) • 2 peak TPH from Merced to Los Angeles (1 in offpeak) • 2 peak BPH from Merced to Sacramento (1 in offpeak)



Run Date: 3/16/2012

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Scenario 12-042b: Blended Phase 1 (High) - For 2012 Final Business Plan
Blended Service from San Francisco Transbay to Los Angeles Union Station with bus connections to Sacramento at Merced. (DRAFT)

Operating Plan:

Dedicated Bus Connections - North

Dedicated Coach - Peak Period

Frequency	30
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200
# of buses	12
Transfer Time @ Merced	15

Dedicated Coach - Off-peak Period

Frequency	60
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200
# of buses	10
Transfer Time @ Merced	15

HSR Patterns

High Speed Rail - Peak

Pattern	10	20	30	40	50	60	70	80
Frequency	60	60	60	60	60	60	60	60
San Francisco Transbay	0	0	0	0				
Millbrae	16	16	16	16				
San Jose	42	42	48	48	0	0		
Gilroy	53	57	63	66	18	15		
Merced							0	0
Fresno	89	101	107	104	62	53	19	25
Visalia	98	111	117	120	72	63	29	44
Bakersfield	122	142	148	145	97	94	54	75
Palmdale	151	179	179	182	134	125	91	106
San Fernando	170	199	199	208	154	145	111	132
Los Angeles	180	210	210	219	165	156	122	143
# of Trains	6	6	6	6	6	6	6	6

High Speed Rail - Off-peak

Pattern	10	25	35	40	85
Frequency	60	60	60	60	60
San Francisco Transbay	0	0	0	0	
Millbrae	16	16	16	16	
San Jose	42	48	48	48	
Gilroy	53	63	66	66	
Merced					0
Fresno	89	107	110	104	25
Visalia	98	117	120	120	35
Bakersfield	122	148	151	145	66
Palmdale	151	185	182	182	103
San Fernando	170	205	202	208	129
Los Angeles	180	216	213	219	140
# of Trains	10	10	10	10	10

Note: "Frequency" refers to "Headway" in these pattern charts.

Run Date: 3/16/2012

Scenario 12-042b: Blended Phase 1 (High) - For 2012 Final Business Plan-Blended Service from San Francisco Transbay to Los Angeles Union Station with bus connections to Sacramento at Merced. (DRAFT)

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	**Destination Region**	**Business/ Commute**	**Recreation/ Other**	**Total**	**Auto**	**Conv. Rail**	**Air**	**Induced**	**Auto**	**Conv. Rail**	**Air**	**Induced**
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	8,000	28,000	35,000	31%	69%	0%	0%	96%	4%	0%	0%
	MTC	1,424,000	2,652,000	4,076,000	50%	0%	46%	4%	45%	0%	52%	4%
	SACOG	312,000	97,000	408,000	87%	0%	9%	4%	73%	0%	26%	2%
	SJV	1,701,000	861,000	2,562,000	92%	0%	7%	2%	90%	0%	7%	3%
	CC/AMBAG	374,000	249,000	623,000	65%	0%	35%	0%	62%	0%	38%	0%
	OTHER	192,000	75,000	266,000	92%	0%	8%	1%	90%	0%	9%	1%
SANDAG	SCAG	8,000	28,000	35,000	31%	69%	0%	0%	96%	4%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	172,000	303,000	475,000	7%	0%	91%	2%	25%	0%	75%	0%
	SACOG	2,000	1,000	3,000	1%	0%	99%	0%	6%	0%	94%	0%
	SJV	26,000	-	26,000	85%	0%	9%	6%	100%	0%	0%	0%
	CC/AMBAG	4,000	-	4,000	67%	0%	30%	2%	0%	0%	0%	0%
	OTHER	3,000	-	3,000	80%	0%	14%	6%	0%	0%	0%	0%
MTC	SCAG	1,424,000	2,652,000	4,076,000	50%	0%	46%	4%	45%	0%	52%	4%
	SANDAG	172,000	303,000	475,000	7%	0%	91%	2%	25%	0%	75%	0%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	6,000	1,000	7,000	0%	100%	0%	0%	57%	43%	0%	0%
	SJV	915,000	1,796,000	2,711,000	82%	8%	10%	0%	85%	7%	6%	2%
	CC/AMBAG	276,000	614,000	890,000	94%	3%	3%	0%	99%	0%	1%	0%
	OTHER	5,000	32,000	38,000	92%	7%	1%	0%	97%	1%	1%	0%
SACOG	SCAG	312,000	97,000	408,000	87%	0%	9%	4%	73%	0%	26%	2%
	SANDAG	2,000	1,000	3,000	1%	0%	99%	0%	6%	0%	94%	0%
	MTC	6,000	1,000	7,000	0%	100%	0%	0%	57%	43%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	127,000	-	127,000	62%	31%	8%	0%	95%	1%	4%	0%
	CC/AMBAG	30,000	-	30,000	83%	12%	5%	0%	100%	0%	0%	0%
	OTHER	-	-	-	99%	1%	0%	0%	0%	0%	0%	0%
SJV	SCAG	1,701,000	861,000	2,562,000	92%	0%	7%	2%	90%	0%	7%	3%
	SANDAG	26,000	-	26,000	85%	0%	9%	6%	100%	0%	0%	0%
	MTC	915,000	1,796,000	2,711,000	82%	8%	10%	0%	85%	7%	6%	2%
	SACOG	127,000	-	127,000	62%	31%	8%	0%	95%	1%	4%	0%
	SJV	793,000	84,000	877,000	0%	99%	1%	0%	81%	19%	0%	0%
	CC/AMBAG	134,000	2,000	137,000	91%	1%	7%	0%	100%	0%	0%	0%
	OTHER	9,000	-	9,000	0%	99%	1%	0%	100%	0%	0%	0%
CC/AMBAG	SCAG	374,000	249,000	623,000	65%	0%	35%	0%	62%	0%	38%	0%
	SANDAG	4,000	-	4,000	67%	0%	30%	2%	0%	0%	0%	0%
	MTC	276,000	614,000	890,000	94%	3%	3%	0%	99%	0%	1%	0%
	SACOG	30,000	-	30,000	83%	12%	5%	0%	100%	0%	0%	0%
	SJV	134,000	2,000	137,000	91%	1%	7%	0%	100%	0%	0%	0%
	CC/AMBAG	6,000	-	6,000	98%	0%	2%	0%	100%	0%	0%	0%
	OTHER	5,000	-	5,000	96%	2%	1%	0%	100%	0%	0%	0%
OTHER	SCAG	192,000	75,000	266,000	92%	0%	8%	1%	90%	0%	9%	1%
	SANDAG	3,000	-	3,000	80%	0%	14%	6%	0%	0%	0%	0%
	MTC	5,000	32,000	38,000	92%	7%	1%	0%	97%	1%	1%	0%
	SACOG	-	-	-	99%	1%	0%	0%	0%	0%	0%	0%
	SJV	9,000	-	9,000	0%	99%	1%	0%	100%	0%	0%	0%
	CC/AMBAG	5,000	-	5,000	96%	2%	1%	0%	100%	0%	0%	0%
	OTHER	-	-	-	100%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**12,249,000**	**13,506,000**	**25,753,000**	**70%**	**9%**	**20%**	**2%**	**68%**	**2%**	**28%**	**3%**

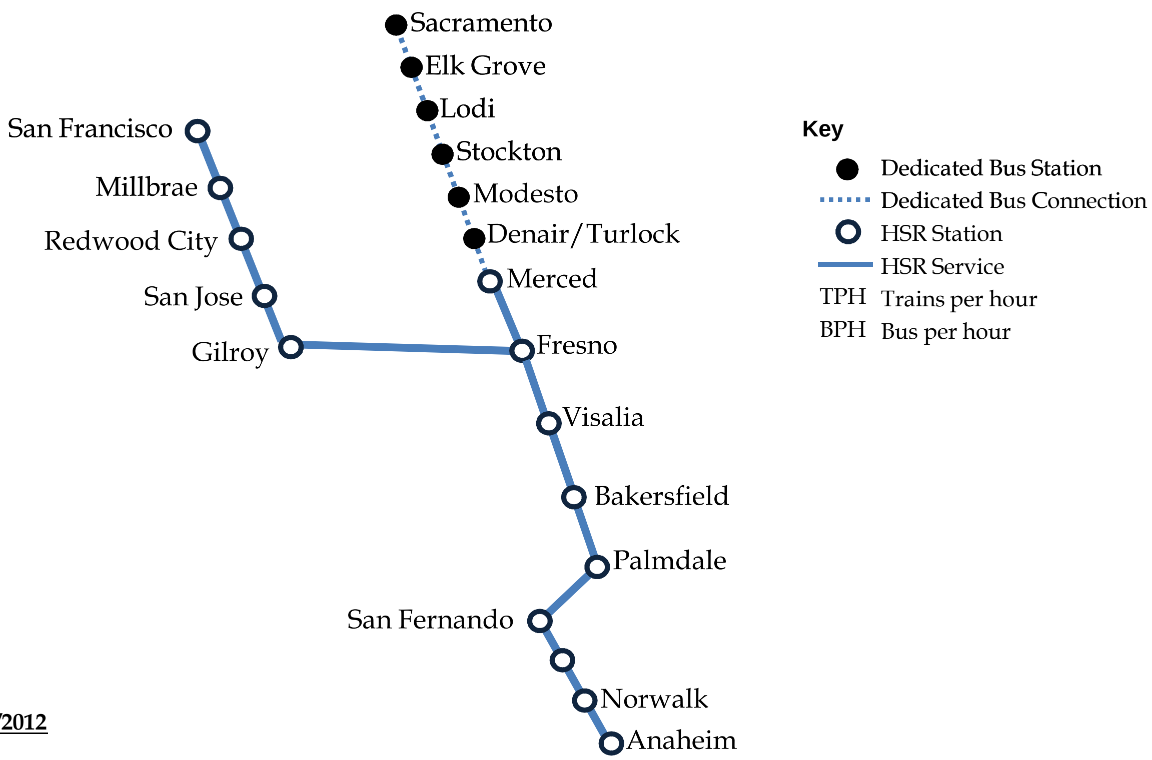
Percent of Total Statewide Interregional HSR Trips that are Induced: 2.18%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario:	**12-047b: Phase 1 (Low) with 20 cents/mile (2011$) Fuel Cost**
Scenario Description:	Phase 1 Business Plan As Is with Amtrak-San Joaquin Truncated at Merced - Low (DRAFT)
Phase:	Phase 1
Year:	2030
HSR Fare Policy:	83% of actual airfare
AIR Fare Policy:	Actual 2009 airfares
CVR Fare Policy:	Actual 2011 fares
Parking Costs:	High (Oct-09)
Motor Fuel:	20 cents/mile (2011$)
Socioeconomic:	Based on 2011 Moody's Analytics Forecast for 2030
Trip Rate:	2011 Survey, by region
Service Summary: **(See next page for details)**	• 3 peak TPH from San Francisco to Anaheim (3 in offpeak) • 2 peak TPH from San Francisco to LA Union Station (1 in offpeak) • 2 peak TPH from San Jose to LA Union Station (1 in offpeak) • 2 peak TPH from Merced to LA Union Station (1 in offpeak) • 2 peak BPH from Sacramento to Merced (1 in offpeak)



Run Date: 3/5/2012

Disclaimer
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Scenario 12-047b: Phase 1 (Low) with 20 cents/mile (2011$) Fuel Cost
Phase 1 Business Plan As Is with Amtrak-San Joaquin Truncated at Merced - Low (DRAFT)

Operating Plan:

Dedicated Bus Connections - North

6 Peak Hours

Pattern#	1
Frequency	30
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200

10 Off-Peak Hours

Pattern#	1
Frequency	60
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200

HSR Patterns

Phase 1 Test train patterns at 6 peak hours, one-way

	10	20	40	50	60	80	90	100	70
Frequency	60	60	60	60	60	60	60	60	60
Run times from start in minutes									
San Francisco	0	0	0	0	0				
Millbrae	10	11	9	18	18				
Redwood City	15	17	21	24	24				
San Jose	25	35	39	42	35	0	0		
Gilroy	36	50	54	63	53	18	15		
Merced								0	0
Fresno	72	94	92	107	91	56	59	19	25
Visalia	81	104	102	117	110	66	69	29	44
Bakersfield	105	135	133	142	141	97	94	60	69
Palmdale	134	166	170	179	172	128	131	91	106
San Fernando	153	186	196	199	198	154	151	117	126
Los Angeles	160	201	211	214	213	169	166	132	141
Norwalk	175			229	228				
Anaheim	188			242	241				
# of Trains	6	6	6	6	6	6			6

Phase 1 Test train patterns for 10 off peak hours, one way

	y	y	y	y	y
	15	25	55	65	75
Frequency	60	60	60	60	60
start in minutes					
San Francisco	0	0	0	0	
Millbrae	11	11	18	11	
Redwood City	17	17	30	17	
San Jose	28	35	48	35	
Gilroy	43	50	66	50	
Merced					0
Fresno	87	94	104	94	25
Visalia	97	104	114	113	35
Bakersfield	128	135	139	144	66
Palmdale	159	166	170	181	103
San Fernando	179	186	190	207	129
Los Angeles	194	201	205	222	144
Norwalk	209		220	237	
Anaheim	222		233	250	
# of Trains	6	6	6	6	6

xxx	No Stop
xxx	Stop

xxx

Note: "Frequency" refers to "Headway" in these pattern charts.

Run Date: 3/5/2012

Scenario 12-047b: Phase 1 (Low) with 20 cents/mile (2011$) Fuel Cost-Phase 1 Business Plan As Is with Amtrak-San Joaquin Truncated at Merced - Low (DRAFT)

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	Destination Region	Business/ Commute	Recreation/ Other	Total	Auto	Conv. Rail	Air	Induced	Auto	Conv. Rail	Air	Induced
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	6,000	585,000	591,000	0%	100%	0%	0%	98%	2%	0%	0%
	MTC	883,000	1,941,000	2,824,000	55%	0%	42%	4%	56%	0%	40%	4%
	SACOG	81,000	99,000	180,000	87%	0%	13%	0%	79%	0%	21%	1%
	SJV	502,000	1,560,000	2,062,000	91%	0%	7%	2%	94%	0%	3%	2%
	CC/AMBAG	141,000	430,000	571,000	70%	0%	30%	0%	70%	0%	30%	0%
	OTHER	106,000	147,000	252,000	90%	0%	10%	1%	92%	0%	7%	1%
SANDAG	SCAG	6,000	585,000	591,000	0%	100%	0%	0%	98%	2%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	48,000	722,000	770,000	9%	0%	89%	2%	38%	0%	59%	3%
	SACOG	1,000	9,000	10,000	2%	0%	98%	0%	11%	0%	89%	0%
	SJV	4,000	-	4,000	85%	0%	9%	5%	86%	0%	14%	0%
	CC/AMBAG	1,000	-	1,000	67%	0%	28%	5%	50%	0%	50%	0%
	OTHER	1,000	-	1,000	81%	0%	13%	6%	0%	0%	0%	0%
MTC	SCAG	883,000	1,941,000	2,824,000	55%	0%	42%	4%	56%	0%	40%	4%
	SANDAG	48,000	722,000	770,000	9%	0%	89%	2%	38%	0%	59%	3%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	1,000	-	2,000	0%	100%	0%	0%	36%	64%	0%	0%
	SJV	150,000	991,000	1,141,000	86%	8%	6%	0%	92%	5%	2%	1%
	CC/AMBAG	60,000	322,000	382,000	94%	2%	4%	0%	99%	0%	1%	0%
	OTHER	1,000	24,000	25,000	93%	6%	1%	0%	98%	1%	1%	0%
SACOG	SCAG	81,000	99,000	180,000	87%	0%	13%	0%	79%	0%	21%	1%
	SANDAG	1,000	9,000	10,000	2%	0%	98%	0%	11%	0%	89%	0%
	MTC	1,000	-	2,000	0%	100%	0%	0%	36%	64%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	9,000	-	9,000	57%	38%	5%	0%	98%	0%	2%	0%
	CC/AMBAG	4,000	-	5,000	89%	7%	4%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	100%	0%	0%	0%	0%
SJV	SCAG	502,000	1,560,000	2,062,000	91%	0%	7%	2%	94%	0%	3%	2%
	SANDAG	4,000	-	4,000	85%	0%	9%	5%	86%	0%	14%	0%
	MTC	150,000	991,000	1,141,000	86%	8%	6%	0%	92%	5%	2%	1%
	SACOG	9,000	-	9,000	57%	38%	5%	0%	98%	0%	2%	0%
	SJV	61,000	41,000	102,000	0%	99%	1%	0%	79%	21%	0%	0%
	CC/AMBAG	15,000	1,000	15,000	96%	1%	2%	0%	100%	0%	0%	0%
	OTHER	1,000	-	1,000	0%	95%	5%	0%	100%	0%	0%	0%
CC/AMBAG	SCAG	141,000	430,000	571,000	70%	0%	30%	0%	70%	0%	30%	0%
	SANDAG	1,000	-	1,000	67%	0%	28%	5%	50%	0%	50%	0%
	MTC	60,000	322,000	382,000	94%	2%	4%	0%	99%	0%	1%	0%
	SACOG	4,000	-	5,000	89%	7%	4%	0%	100%	0%	0%	0%
	SJV	15,000	1,000	15,000	96%	1%	2%	0%	100%	0%	0%	0%
	CC/AMBAG	1,000	-	1,000	99%	0%	1%	0%	100%	0%	0%	0%
	OTHER	1,000	-	1,000	97%	1%	3%	0%	100%	0%	0%	0%
OTHER	SCAG	106,000	147,000	252,000	90%	0%	10%	1%	92%	0%	7%	1%
	SANDAG	1,000	-	1,000	81%	0%	13%	6%	0%	0%	0%	0%
	MTC	1,000	24,000	25,000	93%	6%	1%	0%	98%	1%	1%	0%
	SACOG	-	-	-	0%	0%	0%	100%	0%	0%	0%	0%
	SJV	1,000	-	1,000	0%	95%	5%	0%	100%	0%	0%	0%
	CC/AMBAG	1,000	-	1,000	97%	1%	3%	0%	100%	0%	0%	0%
	OTHER	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**4,094,000**	**13,703,000**	**17,797,000**	**70%**	**3%**	**26%**	**2%**	**76%**	**1%**	**21%**	**2%**

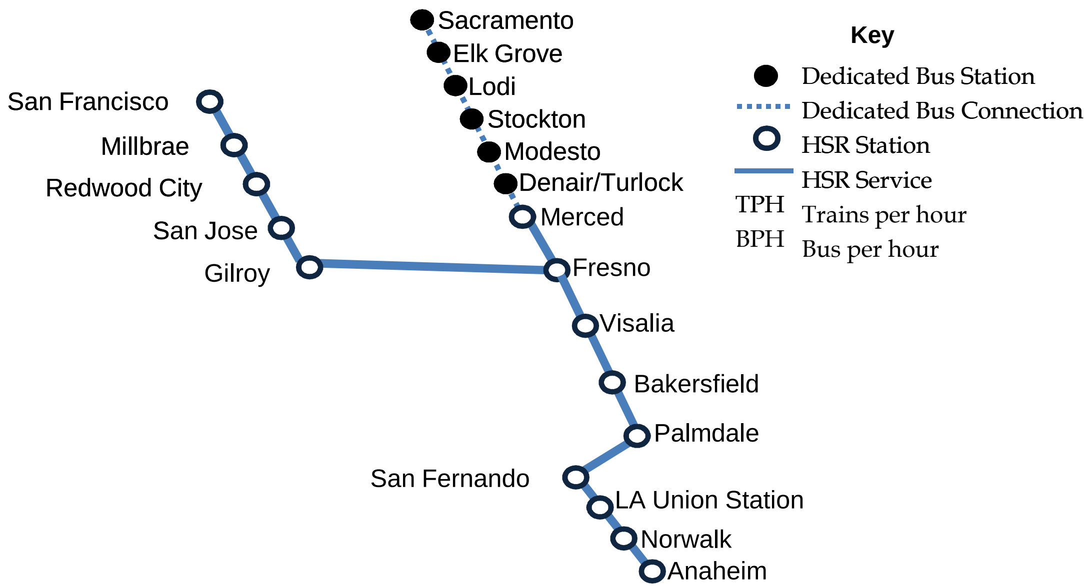
Percent of Total Statewide Interregional HSR Trips that are Induced: 2.14%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments

California High Speed Rail Ridership and Revenue Forecast
Model Run Summary

Scenario:	**12-046: Phase 1 Amtrak to Merced (High) - For 2012 Final Business Plan**
Scenario Description:	Phase 1 Business Plan As Is with Amtrak - San Joaquin Truncated at Merced. (Draft).
Phase:	Phase1
Year:	2030
HSR Fare Policy:	83% of San Francisco-Los Angeles airfare with lower rates for shorter distances
AIR Fare Policy:	Actual 2009 airfares
CVR Fare Policy:	Actual 2011 fares
Parking Costs:	High (Oct-09)
Motor Fuel:	28 cents/mile (2011$)
Socioeconomic:	Based on comparison of 2008 to 2011 Woods and Poole Forecast
Trip Rate:	2005 Survey, by region
Service Summary: **(See next page for details)**	• 3 peak TPH from San Francisco to Anaheim (same in offpeak) • 2 peak TPH from San Francisco to Los Angeles (1 in offpeak) • 2 peak TPH from San Jose to Los Angeles (0 in offpeak) • 2 peak TPH from Merced to Los Angeles (1 in offpeak) • 2 peak BPH from Merced to Sacramento (1 in offpeak)



Run Date: 2/29/2012

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12-046: Phase 1 Amtrak to Merced (High) - For 2012 Final Business Plan
Phase 1 Business Plan As Is with Amtrak - San Joaquin Truncated at Merced. (Draft).

Operating Plan:

Dedicated Bus Connections - North

6 Peak Hours

Pattern#	1
Frequency	30
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200

10 Off-Peak Hours

Pattern#	1
Frequency	60
Sacramento	0
Elk Grove	10
Lodi	35
Stockton	60
Modesto	120
Denair/Turlock	155
Merced	200

HSR Patterns

Phase 1 Test train patterns at 6 peak hours, one-way

	10	20	40	50	60	80	90	100	70
Frequency	60	60	60	60	60	60	60	60	60
Run times from start in minutes									
San Francisco	0	0	0	0	0				
Millbrae	10	11	9	18	18				
Redwood City	15	17	21	24	24				
San Jose	25	35	39	42	35	0	0		
Gilroy	36	50	54	63	53	18	15		
Merced								0	0
Fresno	72	94	92	107	91	56	59	19	25
Visalia	81	104	102	117	110	66	69	29	44
Bakersfield	105	135	133	142	141	97	94	60	69
Palmdale	134	166	170	179	172	128	131	91	106
San Fernando	153	186	196	199	198	154	151	117	126
Los Angeles	160	201	211	214	213	169	166	132	141
Norwalk	175			229	228				
Anaheim	188			242	241				
# of Trains	6	6	6	6	6	6			6

Phase 1 Test train patterns for 10 off-peak hours, one-way

	y 15	y 25	y 55	y 65	y 75
Frequency	60	60	60	60	60
start in minutes					
San Francisco	0	0	0	0	
Millbrae	11	11	18	11	
Redwood City	17	17	30	17	
San Jose	28	35	48	35	
Gilroy	43	50	66	50	
Merced					0
Fresno	87	94	104	94	25
Visalia	97	104	114	113	35
Bakersfield	128	135	139	144	66
Palmdale	159	166	170	181	103
San Fernando	179	186	190	207	129
Los Angeles	194	201	205	222	144
Norwalk	209		220	237	
Anaheim	222		233	250	
# of Trains	6	6	6	6	6

xxx	No Stop
xxx	Stop
xxx	3 min. for overtakes

Note: "Frequency" refers to "Headway" in these pattern charts.

Run Date: 2/29/2012

Scenario 12-046: Phase 1 Amtrak to Merced (High) - For 2012 Final Business Plan - Phase 1 Business Plan As Is with Amtrak - San Joaquin Truncated at Merced. (Draft).

Source of Annual Interregional HSR Trips by Region Pair, Mode and Trip Purpose — Year 2030

		Annual HSR Trips			% Diverted from Each Mode - Business and Commute				% Diverted from Each Mode - Recreation Other			
Origin Region	Destination Region	Business/ Commute	Recreation/ Other	Total	Auto	Conv. Rail	Air	Induced	Auto	Conv. Rail	Air	Induced
SCAG	SCAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SANDAG	13,000	70,000	83,000	34%	65%	0%	0%	96%	4%	0%	0%
	MTC	1,564,000	2,742,000	4,306,000	51%	0%	45%	4%	46%	0%	50%	4%
	SACOG	189,000	163,000	352,000	86%	0%	11%	2%	73%	0%	24%	3%
	SJV	1,749,000	990,000	2,739,000	92%	0%	6%	2%	90%	0%	6%	4%
	CC/AMBAG	483,000	268,000	750,000	65%	0%	35%	0%	63%	0%	37%	0%
	OTHER	266,000	81,000	348,000	89%	0%	8%	3%	89%	0%	9%	2%
SANDAG	SCAG	13,000	70,000	83,000	34%	65%	0%	0%	96%	4%	0%	0%
	SANDAG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	MTC	204,000	761,000	965,000	6%	0%	91%	3%	23%	0%	75%	2%
	SACOG	5,000	10,000	15,000	1%	0%	99%	0%	6%	0%	94%	0%
	SJV	27,000	-	27,000	86%	0%	8%	6%	100%	0%	0%	0%
	CC/AMBAG	6,000	-	6,000	61%	0%	34%	5%	0%	0%	0%	0%
	OTHER	3,000	-	3,000	78%	0%	15%	7%	0%	0%	0%	0%
MTC	SCAG	1,564,000	2,742,000	4,306,000	51%	0%	45%	4%	46%	0%	50%	4%
	SANDAG	204,000	761,000	965,000	6%	0%	91%	3%	23%	0%	75%	2%
	MTC	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SACOG	4,000	1,000	4,000	0%	100%	0%	0%	61%	39%	0%	0%
	SJV	972,000	1,827,000	2,799,000	82%	7%	10%	1%	86%	6%	5%	2%
	CC/AMBAG	387,000	620,000	1,007,000	93%	3%	3%	1%	99%	0%	1%	0%
	OTHER	5,000	33,000	39,000	92%	7%	1%	0%	98%	1%	1%	0%
SACOG	SCAG	189,000	163,000	352,000	86%	0%	11%	2%	73%	0%	24%	3%
	SANDAG	5,000	10,000	15,000	1%	0%	99%	0%	6%	0%	94%	0%
	MTC	4,000	1,000	4,000	0%	100%	0%	0%	61%	39%	0%	0%
	SACOG	-	-	-	0%	0%	0%	0%	0%	0%	0%	0%
	SJV	93,000	-	94,000	51%	42%	7%	0%	95%	1%	3%	0%
	CC/AMBAG	39,000	-	39,000	86%	10%	5%	0%	100%	0%	0%	0%
	OTHER	-	-	-	99%	1%	0%	0%	0%	0%	0%	0%
SJV	SCAG	1,749,000	990,000	2,739,000	92%	0%	6%	2%	90%	0%	6%	4%
	SANDAG	27,000	-	27,000	86%	0%	8%	6%	100%	0%	0%	0%
	MTC	972,000	1,827,000	2,799,000	82%	7%	10%	1%	86%	6%	5%	2%
	SACOG	93,000	-	94,000	51%	42%	7%	0%	95%	1%	3%	0%
	SJV	816,000	102,000	918,000	0%	99%	1%	0%	84%	16%	0%	0%
	CC/AMBAG	156,000	1,000	157,000	93%	1%	6%	0%	100%	0%	0%	0%
	OTHER	14,000	-	14,000	0%	68%	3%	29%	100%	0%	0%	0%
CC/AMBAG	SCAG	483,000	268,000	750,000	65%	0%	35%	0%	63%	0%	37%	0%
	SANDAG	6,000	-	6,000	61%	0%	34%	5%	0%	0%	0%	0%
	MTC	387,000	620,000	1,007,000	93%	3%	3%	1%	99%	0%	1%	0%
	SACOG	39,000	-	39,000	86%	10%	5%	0%	100%	0%	0%	0%
	SJV	156,000	1,000	157,000	93%	1%	6%	0%	100%	0%	0%	0%
	CC/AMBAG	12,000	-	12,000	99%	0%	1%	0%	100%	0%	0%	0%
	OTHER	11,000	-	11,000	95%	1%	3%	0%	100%	0%	0%	0%
OTHER	SCAG	266,000	81,000	348,000	89%	0%	8%	3%	89%	0%	9%	2%
	SANDAG	3,000	-	3,000	78%	0%	15%	7%	0%	0%	0%	0%
	MTC	5,000	33,000	39,000	92%	7%	1%	0%	98%	1%	1%	0%
	SACOG	-	-	-	99%	1%	0%	0%	0%	0%	0%	0%
	SJV	14,000	-	14,000	0%	68%	3%	29%	100%	0%	0%	0%
	CC/AMBAG	11,000	-	11,000	95%	1%	3%	0%	100%	0%	0%	0%
	OTHER	-	-	-	100%	0%	0%	0%	0%	0%	0%	0%
TOTAL		**13,208,000**	**15,236,000**	**28,446,000**	**69%**	**8%**	**20%**	**2%**	**66%**	**2%**	**30%**	**3%**

Percent of Total Statewide Interregional HSR Trips that are Induced: 2.41%

Acronyms List:

SCAG	Southern California Association of Governments
SANDAG	San Diego Association of Governments
MTC	Metropolitan Transportation Commission
SACOG	Sacramento Area Council of Governments
SJV	San Joaquin Valley
CC/AMBAG	Central Coast/Association of Monterey Bay Area Governments