CALIFORNIA HIGH-SPEED TRAIN PROJECT

RIDERSHIP AND REVENUE FORECASTS

PREPARED BY

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SYSTRA

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I.

INTRODUCTION

This paper presents forecasts of riders and revenue for various phases and segments of the full high-speed train system and explains how these forecasts were developed. The high-speed line and stations are shown in the map below, along with 14 regions into which the state was divided for purposes of the forecast model.

II.

DEVELOPING THE FORECASTS

Forecasts of riders and revenue for the high-speed train were developed from 2005 to 2008 by Cambridge Systematics (CS), a national leader in transportation economics and modeling, with extensive current experience in transportation issues throughout California.

CS developed a detailed 4,667-zone model for the entire state to forecast travel between regions. The economic and household characteristics were forecast for each zone in the year 2030 based on data and forecasts from state, regional, and local government agencies.

A detailed description of system capacity, speeds, service levels, cost, and traffic congestion for the highway and local transit networks was developed for 2030 from the fiscally constrained long-range transportation plans of each regional planning agency.

Finally, future air and intercity conventional rail service reflecting current service levels and planned investments were incorporated.

The high-speed train line and stations were added using fares, travel times between stations, and time between trains, provided by the California High-Speed Rail Authority (Authority) and validated by an independent peer review panel.

In 2005, data on travel conditions and patterns were collected from California agencies and 3,170 state-of-the-art surveys were taken of air, auto and intercity rail travelers who had recently made an intercity trip in California.

The data were used to develop sensitivities for each of over 1,200 separate types of traveler and trip, involving combinations of:

- Purpose of the trip (business, commute, recreation, and other)
- Trip distance and size of metro area (more than 100 miles; less than 100 miles and from large metro area; less than 100 miles and from small areas)
- Household characteristics
  - size (1 person, 2, 3, and 4 or more)
  - income (low, medium, and high)
  - autos owned (none, 1, and 2 or more)
  - number of workers (0, 1, and 2 or more)
- Travel party size (alone, and with others)

For all travelers, cost, trip time, and frequency of departure are the more important variables, and reliability is a smaller, but significant, influence on the mode chosen to make a trip.

For forecasting high-speed train travel within the greater Los Angeles basin and the San Francisco Bay Area, the existing urban transportation models for each of the regions were updated in 2008 and high-speed train service was added as an option. Travel within San Diego County was forecast using an extrapolation methodology because of the relatively low number of expected high-speed train trips.

A peer review panel of local, national, and international travel model and high-speed train experts reviewed and commented on the modeling assumptions, methodologies, and results during each stage of model development. The panel concurred with the approach and reasonableness of results.

Two different services were modeled in detail based on train service patterns, fares, and running times provided by the Authority's Program Management Team:

- the full system as shown in blue on the first map;
- a Phase 1 from San Francisco to Anaheim and Merced.

The forecast results are outlined after the discussion of growth, travel conditions, and costs.

III.

GROWTH AND TRAVEL CONDITIONS IN CALIFORNIA IN THE YEAR 2030

In the year 2000, more than half a billion trips were made among California's regions, 95% by car, 4% by air, and 1% by intercity conventional rail, (San Joaquins, ACE, Capital Corridor and Pacific Surfliner). Between 2000 and 2030, population is forecast to grow by 42% to 48 million, and employment will grow by about 51%. This growth will increase total interregional travel by 65% to 911 billion trips a year, with auto keeping its lion's share, but with a nearly five-fold increase in conventional rail trips.

The forecast population and economic growth will also increase travel within the three major metropolitan areas that have several high-speed train stations. Within the Los Angeles/Orange region, over 20 billion auto trips will be made in 2030, 34% more than in the year 2000, and conventional rail trips will grow five-fold. In 2030, the Bay Area will see over seven billion auto trips and the San Diego region over eight billion trips. Conventional rail traffic will grow much faster than auto trips but from a much smaller base.

Highway, transit and air capacity are not projected to keep pace with the expected increase in trip making, leading to increases in driving times within and between regions. In particular, peak period travel within and through major urban areas will take longer. Airplanes and trains are likely to become more crowded, and air travel times may continue to slow as airport congestion grows.

With high-speed trains in service in 2030, air travel will take about the same amount of time and be as frequent as in 2005. Air travelers will also continue to arrive at the terminal the same time (~75 minutes) before the scheduled closing of the airplane cabin doors as indicated in the 2005 air traveler surveys. Flight reliability will also remain at 2005 levels, with about 95% of flights arriving within an hour of schedule.

In 2030, Amtrak and other conventional rail trips between regions will take the same time and have as many trips as in 2005. The wait time for trains will be in line with the current 15 minutes, with no airport-style security measures. For rail service within regions, future running times and frequencies will be improved to the levels in each region's long-range transportation plan.

IV.

YEAR 2030 COSTS OF TRAVEL — AIR, AUTO, CONVENTIONAL RAIL AND HIGH-SPEED TRAINS

The ***baseline year 2030*** air, auto, and conventional rail costs were developed based on the relative competitive situation of 2005, and assumptions about future trends as described below. A baseline high-speed train fare structure was set by the Authority and reviewed for reasonableness by an independent peer review panel.

- The cost of driving is assumed to increase in line with general inflation, but to remain at 2005/6 levels in real terms, or 22 cents per mile for each auto traveler (2005$$). Based on MTC methodology, gasoline at $2.93 per gallon in 2006 constitutes about half of this cost. Similarly, bridge tolls were assumed to remain at 2005 real levels. Auto trips were assumed to pay market based parking charges ranging from $0 to $35 per trip, depending on employment density at the destination. These driving and parking costs also apply to air, conventional rail and high-speed train travelers who drive a private vehicle or rental car from the station to/from their final destination.

- Air fares were obtained for 2005 from the Federal Aviation Administration 10% sample of collected tickets for each of the airport pairs in California. Parking costs at airports were assumed to remain at their 2005 levels in real terms.

- Conventional rail fares for the baseline in 2030 were assumed to be equal to the per-ride cost of a current multi-ride ticket, except for the Amtrak San Joaquin and Pacific Surfliner Routes, for which full one-way ticket costs were assumed. Parking costs at stations were assumed to be similar to 2005, in real terms.

- Baseline high-speed train fares for trips between regions were set so that the Los Angeles to San Francisco fare would be half of the average air fare from the SCAG airports to Bay Area airports, or $55 in 2005$$. Fares for other trips between regions were then calculated using a formula derived from this fare, with a fixed boarding charge of $15 plus a per-mile cost of 9 cents. For trips wholly within the Los Angeles Basin, San Diego County, or Bay Area, a lower fare was set with a $7 boarding fee plus 6 cents per mile. Parking costs for interregional travelers were set from $12 for the smaller, less urban stations to $18 for San Jose, Anaheim, Burbank, and LA Union Station, to $32 for SF Transbay Terminal. For intraregional travel, parking was set at $3.

The sensitivity of riders and revenue to different levels of high-speed train fare and automobile and air costs was tested with 13 alternative scenarios. From these, three scenarios were developed for the business plan:

- baseline assumptions for air, auto, and conventional rail;

- an 8% differential increase over inflation in driving cost and air fares, reflecting the real increases from 2005 to 2008; and

- a 50% real increase in auto and air costs.

Results, which are shown below after the section of service patterns, have been inflated to 2008 levels, a 13.3% increase from 2005 based on the consumer price index.

V.

HIGH-SPEED TRAIN SERVICE PATTERNS — YEAR 2030 PHASE 1

The design of the high-speed train line is flexible, allowing many different mixes of express and semi-express trains, depending on the evolution of travel demand. The operational pattern used in this business plan is the first step in developing a final pattern that optimizes ridership, benefits, and revenue from the users.

In Phase 1 high-speed trains run from San Francisco to Los Angeles Union Station and Anaheim, and from Merced to Anaheim and San Francisco. The tables below show the mix of express and stopping trains that provides frequent service to all stations as well as fast runs between major markets. In the peak hours (6 am to 9 am, and 4 pm to 7 pm) trains operate, on average, every 9 minutes in each direction between San Francisco and the Los Angeles Basin, every 20 minutes from Merced, and every 15 minutes between Anaheim and Los Angeles. In the off-peak (5am to 6am, 9am to 4pm, and 4pm to midnight) departures are less frequent: 11 minutes apart between Los Angeles and San Francisco, every

33 minutes between Merced and Los Angeles or San Francisco, and 26 minutes apart between Anaheim and Los Angeles. Phase 1 includes a total of 57 trains in each direction during the peak periods, and 71 trains per direction during the remaining 10 hours of off-peak service, for a total of 256 trains daily.

Phase 1 train patterns at 6 peak hours, one-way

Pattern#	1	2	3	4	5	6	7	8
Frequency of service (mins)	120	60	120	30	30	120	40	40
	Run times from start in minutes							
San Francisco	0	0	0	0	0	0	0	
Milbrae	|	|	13	13	|	|	13	
Redwood City / Palo Alto	20	|	23	|	20	20	23	
San Jose	34	30	38	34	34	34	38	
Gilroy	51	|	55	|	51	|	55	
Merced	|	|	|	|	|	|	89	0
Fresno	|	|	95	86	|	|		21
Bakersfield	|	|	133	124	|	|		59
Palmdale	|	|	|	|	147	139		92
Sylmar	|	|	|	171	|	159		112
Burbank	|	|	|	|	171	168		121
Los Angeles Union Station	170	161	188	185	181	177		130
Norwalk	182	|	201			189		143
Anaheim	195	183	213			202		155
# of trains	3	6	3	12	12	3	9	9

Stopping time at stations = 90 seconds, except LA and San Jose at 2 minutes

Phase 1 train patterns for 10 off-peak hours, one-way

Pattern#	1	9	3	4	5	7	8
Frequency of service (mins)	120	120	120	30	30	75	75
	Run times from start in minutes						
San Francisco	0	0	0	0	0	0	
Milbrae	|	13	13	13	|	13	
Redwood City / Palo Alto	20	23	23	|	20	23	
San Jose	34	38	38	34	34	38	
Gilroy	51	55	55	|	51	55	
Merced	|	|	|	|	|	89	0
Fresno	|	95	95	86	|		21
Bakersfield	|	132	133	124	|		59
Palmdale	|	165	|	|	147		92
Sylmar	|	185	|	171	|		112
Burbank	|	194	|	|	171		121
Los Angeles Union Station	170	203	188	185	181		130
Norwalk	182	215	201				143
Anaheim	195	228	213				155
# of trains	5	5	5	20	20	8	8

VI.

RESULTS OF FORECASTS FOR PHASE 1 — OVERVIEW

Riders and revenues are shown in the table below for 12 Phase 1 scenarios ranging from a high of 71 million riders with the highest air and auto costs and low high-speed train fares, to a low of 33 million riders with 2005 level air and auto costs and high fares for high-speed trains. Revenues increase as high-speed train fares are raised, in all scenarios of air and auto costs.

FUTURE SCENARIOS TESTED		YEAR 2030 (MILLIONS)	
#	Phase 1, Air & Auto Baseline Cost 2005/6 Levels	Riders	2008 $$
1	HST fares 50% of air	55.1	$2,202
2	HST fares 66% of air	46.3	$2,369
3	HST fares 83% of air	38.8	$2,490
4	HST fares 83% of air & $25 minimum	33.5	$2,542
#	Phase 1, Air & Auto 2008 Cost, +8% over 2005/6 Levels		
5	HST fares 50% of air	54.6	$2,355
6	HST fares 62% of air	47.7	$2,437
7	HST fares 77% of air	39.9	$2,562
8	HST fares 77% of air & $25 minimum	34.4	$2,615
#	Phase 1, Air & Auto Cost, +50% over 2005/6 Levels		
9	HST fares 33% of air	71.0	$2,978
10	HST fares 44% of air	57.8	$3,075
11	HST fares 55% of air	48.5	$3,638
12	HST fares 55% of air & $25 minimum	42.4	$3,713

SOURCE: High-Speed Rail Authority Program Management Team, 2008

VII.

RESULTS OF FORECASTS FOR PHASE 1 BY MARKET

More detailed results are presented below for two of the 12 scenarios. In both, the 2008 levels of air and auto cost (8% higher than 2005/6) are used. In the first, high-speed train fares are based on 50% of air fare, and on 77% of air fare in the second. The table below shows the riders and revenues by market for Phase 1, in order of the market's contribution to total high-speed train revenue.

The market from the Los Angeles Basin to the Bay Area, including intermediate markets, provides over one-half of ridership and just over 70% of the revenue. The specific market between the Bay Area and Los Angeles Basin has the largest ridership and about 30% of the total revenue. Travelers between the San Joaquin Valley and the Los Angeles Basin/Bay Area make up the next two largest markets, and with travelers within the Valley, contribute another 31-33% of the revenue. Travelers from Monterey, Central

Coast, Northern California, and the Western Sierras contribute another 12% of ridership and 13% of revenue.

PHASE 1 YEAR 2030 2008 AUTO & AIR COST	FARES 50% OF AIR (MILLIONS, 2008$)		FARES 77% OF AIR (MILLIONS, 2008$)	
Market Pairs (Ultimate trip ends)	**Riders**	**$$**	**Riders**	**$$**
LA Basin – Bay Area, with intermediate markets	**31.6**	**$1,679**	**22.6**	**$1,842**
LA Basin – Bay Area	*10.8*	*$735*	*7.3*	*$762*
San Joaquin Valley – LA Basin	*8.3*	*$355*	*6.1*	*$418*
Bay Area – San Joaquin Valley	*7.3*	*$346*	*5.5*	*$399*
Monterey Bay /Central Coast – LA Basin	*1.9*	*$114*	*1.5*	*$130*
Monterey Bay/Central Coast – Bay Area	*2.4*	*$100*	*1.7*	*$106*
Within San Joaquin Valley	*0.9*	*$29*	*0.5*	*$27*
San Diego region – Bay Area	3.3	$234	2.0	$219
LA Basin – Sacramento region	1.9	$132	1.3	$135
Other Interregional	1.4	$64	1.0	$69
North & Sierras regions – LA Basin	0.7	$36	0.5	$40
Sacramento region – San Joaquin Valley	0.6	$32	0.5	$39
San Diego region - San Joaquin Valley	0.1	$3	0.1	$4
LA Basin – San Diego region	0.1	$2	0.1	$2
San Diego region – Sacramento region	<0.1	$2	<0.1	$1
Interregional subtotal	*39.8*	*$2,184*	*27.9*	*$2,351*
within North LA Basin	4.7	$58	3.7	$69
within Bay Area Peninsula	4.8	$54	3.7	$65
North LA – South LA	3.8	$43	3.2	$55
within South LA Basin	1.5	$16	1.4	$22
Local within-region subtotal	*14.8*	*$171*	*12.0*	*$211*
Total Phase 1	**54.6**	**$2,355**	**39.9**	**$2,562**

SOURCE: High-Speed Rail Authority Program Management Team, 2008

Travelers to and from the San Diego and Sacramento regions to other parts of the state use stations at Anaheim, San Francisco and Merced to access the high-speed train. These 10% of the riders contribute 15% of the revenue because the trips they make are considerably longer than the average.

Short-distance trips wholly within the Los Angeles/Orange Basin or the Bay Area constitute the remaining riders, relatively numerous at 30% of the total, but because of their short trips and less expensive fares, contribute only 8% of the revenue.

In most markets, the higher fares for high-speed trains generate more revenue. The exceptions are the longest markets involving San Diego, where air is a strong competitor on time, and within the San Joaquin Valley, where the automobile competes well.

VIII.

AVERAGE FARES AND MARKET SHARE FOR PHASE 1 BY MARKET

The fares paid on average by high-speed train and air passengers (where relevant) are shown in the two tables below. Each figure averages all fares over all stations and airport pairs in the region. Parking, driving, or transit costs are not included. The high-speed train share of each market is also shown, along with air and auto shares.

A. PHASE 1 WITH FARES AT 50% OF AIR

The Los Angeles-Bay Area market has the highest high-speed train share of travel at 53% and most of the other longer distance markets have shares from 10-37% even though San Diego, Sacramento and other travelers use high-speed train stations in neighboring regions. The lower high-speed train shares for the longest distance markets are caused by more competitive door-to-door travel times for air and/or a proportionately higher high-speed train fare relative to air.

For shorter interregional trips, high-speed train shares are less than 5% with the automobile continuing as the dominant mode. The relatively low high-speed train fares in the Sacramento to the Bay Area and from San Diego to the Los Angeles Basin markets reflect travel to San Francisco or Anaheim to take high-speed trains locally within the Bay Area or Los Angeles Basin.

PHASE 1 FARES & MARKET SHARE — 2008 AIR & AUTO COST, HST FARES 50% OF AIR

Market Pairs (Ultimate trip ends)	Average fare (2008$$)		Phase 1 share of market		
	HST	Air	HST	Air	Auto
LA Basin – Bay Area	$68	$130	53%	21%	26%
San Diego region – Bay Area	$70	$126	37%	53%	10%
LA basin – Sacramento region	$69	$115	26%	32%	42%
San Diego region – San Joaquin Valley	$46	n.a.	25%	36%	39%
San Joaquin Valley – LA Basin	$43	n.a.	12%	2%	86%
Bay Area – San Joaquin Valley[1]	$47	$168	10%	1%	86%
Sacramento region – San Joaquin Valley	$54	n.a.	3%	2%	95%
San Diego region – Sacramento region	$70	$114	2%	96%	2%
Sacramento region – Bay Area[1]	$12	$186	0%	0%	93%
Interregional in San Joaquin Valley	$32	n.a.	<1%	0%	>99%
Monterey Bay /Central Coast regions – Bay Area	$42	n.a.	4%	<1%	95%
Northern CA & Sierras regions – LA Basin	$51	n.a.	5%	25%	70%
Monterey Bay /Central Coast regions – LA Basin[1]	$60	n.a.	5%	3%	91%
LA basin - San Diego region[1]	$14	$203	<1%	0%	93%
Other interregional markets	$46	n.a.	<1%	<1%	>99%
North LA – South LA	$11	n.a.	<1%	0%	>99%
within North LA Basin	$12	n.a.	<1%	0%	>99%
within Bay Area[1]	$11	n.a.	<1%	0%	>99%
within South LA Basin	$11	n.a.	<1%	0%	>99%
1) Conventional rail carries remainder of market	n.a. = not applicable/available				

SOURCE: HIGH-SPEED RAIL AUTHORITY PROGRAM MANAGEMENT TEAM, 2008.

Forty-eight percent of the interregional high-speed train travel is for business and commuting purposes, and 52% for recreation and personal reasons. High-speed train is more likely to attract business and commute trips than would be suggested by the statewide mix of one-third business/commute trips and two-thirds recreation/personal trips.

Because air traffic is a small proportion of the overall trips, diverted air passengers make up 27% of the statewide Phase 1 interregional high-speed train passengers, auto 71%, and conventional rail 2%. Induced and diverted trips represent less than 1% of high-speed train trips.

B. PHASE 1 WITH FARES AT 77% OF AIR

PHASE 1 FARES & MARKET SHARE – 2008 AIR & AUTO COST, HST FARES 77% OF AIR

Market Pairs (Ultimate trip ends)	Average fare (2008$$)		Phase 1 share of market		
	HST	Air	HST	Air	Auto
LA Basin – Bay Area	$104	$130	35%	31%	34%
San Diego region – Bay Area	$109	$126	22%	64%	14%
LA basin – Sacramento region	$104	$115	16%	36%	48%
San Diego region – San Joaquin Valley	$40	n.a.	21%	39%	40%
San Joaquin Valley – LA Basin	$69	n.a.	9%	3%	88%
Bay Area – San Joaquin Valley	$73	$168	8%	1%	89%
Sacramento region – San Joaquin Valley	$78	n.a.	2%	2%	96%
San Diego region – Sacramento region	$111	$114	5%	93%	2%
Sacramento region – Bay Area	$19	$186	0%	0%	93%
Interregional in San Joaquin Valley	$54	n.a.	<1%	0%	>99%
Monterey Bay /Central Coast regions – Bay Area	$62	n.a.	3%	<1%	96%
Northern CA & Sierras regions – LA Basin	$80	n.a.	4%	24%	71%
Monterey Bay /Central Coast regions – LA Basin	$85	n.a.	2%	4%	93%
LA Basin – San Diego region	$20	$203	<1%	0%	93%
Other interregional markets	$67	n.a.	<1%	<1%	>99%
North LA – South LA	$18	n.a.	<1%	0%	>99%
within North LA Basin	$19	n.a.	<1%	0%	>99%
within Bay Area	$18	n.a.	<1%	0%	>99%
within South LA Basin	$15	n.a.	<1%	0%	>99%
1) Conventional rail carries remainder of market	n.a. = not applicable/available				

SOURCE: High-Speed Rail Authority Program Management Team, 2008

The higher fares for high-speed trains reduce its share in all markets, with a generally larger drop in the longer markets. Longer interregional market shares now range from 8-35%, down 20-60% from the 50% of air fare scenario.

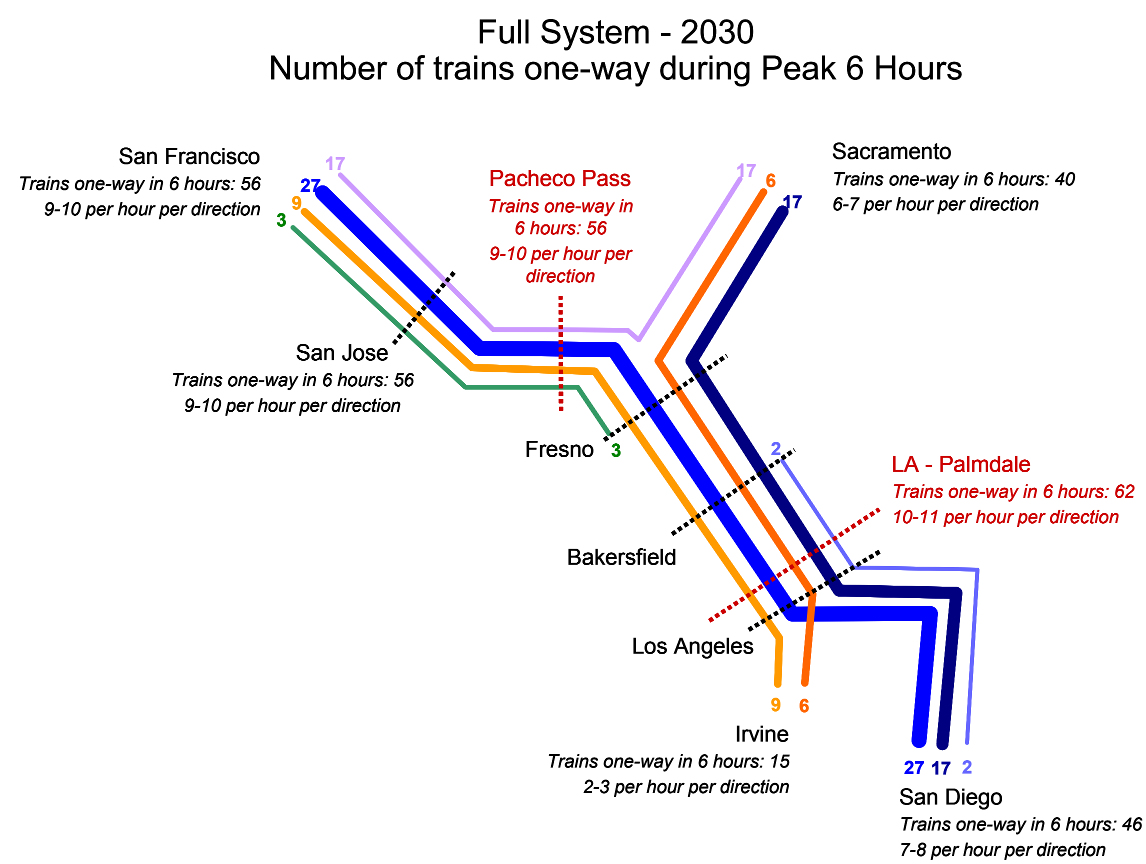
For shorter interregional trips, high-speed train shares are less than 4% with the automobile continuing as the dominant mode.

Trip purposes and sources of trips remain similar to those in the 50% scenario.

IX.
HIGH-SPEED TRAIN OPERATIONS AND RESULTS — YEAR 2030 FULL SYSTEM

The forecast of riders and revenue for the full system has been updated to reflect the higher air and auto costs of 2008, and inflation to $2008. The base with fares at 50% of air fare remains at 93 million, but revenues have now increased to $3.6 billion in 2030. With high-speed train fares at 77% of air, riders drop to 74 million, but revenue increases to $4.3 billion. The table on the following page shows the results by major market.

The full system operating pattern redistributes trains among end points, extends service to Sacramento, and San Diego with additional stops at Modesto, Stockton, City of Industry, Ontario, Riverside, Murrieta, Escondido, and University City. The figure below shows the resulting operations pattern for the peak. In the off-peak hourly frequencies are reduced similarly to the Phase 1 patterns.



RIDERS AND REVENUE FOR HIGH-SPEED TRAIN FULL SYSTEM, YEAR 2030 2008 AIR & AUTO CONDITIONS (+8% OVER 2005/6)				
(figures in millions, 2008$$)	HSR fares at 50% of air fare levels		HSR fares at 77% of air fare levels	
Market Pairs (Ultimate trip ends)	**Riders**	**Revenue**	**Riders**	**Revenue**
LA Basin – Bay Area, with intermediate markets	28.9	$1,503	21.1	$1,678
LA Basin- Bay Area	*9.5*	*$659*	*6.7*	*$720*
Bay Area - San Joaquin Valley	*7.3*	*$339*	*5.6*	*$402*
San Joaquin Valley - LA Basin	*5.7*	*$256*	*4.3*	*$296*
Monterey Bay/Central Coast regions – Bay Area	*2.9*	*$99*	*1.9*	*$105*
Monterey Bay /Central Coast regions – LA Basin	*1.4*	*$86*	*1.4*	*$98*
Within San Joaquin Valley	*2.1*	*$64*	*1.2*	*$57*
LA basin - San Diego region	21.4	$675	19.1	$927
San Diego region – Bay Area	3.7	$305	2.4	$309
LA Basin – Sacramento region	3.3	$222	2.3	$239
Northern CA & Sierras regions – LA Basin	2.7	$182	2.0	$221
Sacramento region – Bay Area	3.4	$155	2.7	$188
Other interregional markets	2.2	$122	1.6	$148
Sacramento region – San Joaquin Valley	2.4	$105	1.9	$132
San Diego – Sacramento region	0.1	$7	0.1	$3
San Diego region – San Joaquin Valley	0.1	$6	0.1	$7
Sub-total interregional	***68.2***	***$3,282***	***53.3***	***$3,852***
North LA Basin – South LA Basin	9.0	$144	7.7	$188
within North LA Basin	6.8	$89	5.4	$109
within Bay Area Peninsula	4.6	$51	3.5	$60
within South LA Basin	4.1	$46	3.7	$64
within San Diego region	0.4	$5	0.4	$6
Sub-total within-region	***24.9***	***$335***	***20.7***	***$427***
Total 2030	**93.1**	**$3,617**	**74.0**	**$4,279**

SOURCE: High-Speed Rail Authority Program Management Team, 2008

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