Memorandum

TO: Nick Brand

FROM: George Mazur, David Kurth, Rachel Copperman, Michael Snavely

DATE: June 10, 2009 (revised August 14, 2009)

RE: 2030 and 2035 Ridership and Revenue Forecasts, May 2009 Scenario

---

This technical report summarizes Cambridge Systematics' (CS) technical work completed from February 2009 through May 2009 under contract with the California High-Speed Rail (HSR) Program Management Team (PMT). Technical work completed by CS included a revised ridership and revenue analysis of system phasing options for the 2030 forecast year, and the development of an expansion factor procedure for obtaining initial 2035 forecasts based on the 2030 summary results.

2030 Ridership and Revenue Forecasts

CS conducted two runs of the year 2030 ridership and revenue model to test alternate operating scenarios. One run was conducted for Phase 1: Anaheim to San Francisco operating plan, and the second run was conducted on the Full System operating plan. These two runs, known as the May 2009 runs, used the version of the ridership and revenue model as completed in August 2008, competing mode information in the August 2008 model, updated air fare and HST fare structures, and updated auto operating costs. These two additional runs included tests of travel time and station and operating plan sensitivity.

New Operating Plans

The operating plans were revised from the August 2008 run for both the Phase 1 System and the Full System. Table 1 shows the new operating plan for Phase 1 for both the peak and off-peak periods heading Southbound. Northbound is a reverse of the southbound plan. There are several significant changes from the August 2008 plan which include:

- The conversion of one limited multi-stop train per hour in the peak periods to a non-stop train between San Francisco Transbay and Los Angeles Union Station. This provides faster service for these major markets, while reducing by one the number of stops at Redwood City, San Jose, Gilroy, Palmdale, and Burbank.

- The addition of one train per hour in the off-peak from Anaheim to San Francisco Transbay, slightly increasing frequency of service to these endpoints and Norwalk, Los Angeles Union Station, Bakersfield, Fresno, and all stations from Gilroy north.

- The slowing of run times by several minutes for many line segments.

Table 2 shows the new operating plan for the Full System for both the peak and off-peak periods heading Southbound. Northbound is a reverse of the southbound plan. The new Full System operating plan is significantly different from the August 2008 plan which was developed during the Bay Area – Central Valley Programmatic EIR/EIS work. The new plan incorporates features of the Phase 1 operating plan, which improved service and generated greater ridership, as well as patterns of operation emerging from the development of a detailed operating schedule. Major changes include:

- A regular "clock-face" hourly schedule, in which each train type leaves at the same time each hour.
- More than three times the number of trains to Norwalk and Anaheim in the off-peak, and nearly twice as many in the peak.
- Addition in the peak of two Los Angeles Union Station – San Diego trains per hour per direction to handle the volume of ridership, especially between Los Angeles and Riverside.
- Conversion of one limited stop train per hour to non-stop between San Francisco Transbay – Los Angeles Union Station, Norwalk, and Anaheim, resulting in faster running times for this major market.
- In all, an increase of nine trains per direction in the six-hour peak period to 90 trains.
- An increase of 43 trains per direction in the ten hour off-peak period, to 80, increasing service for all stations.
- Run times slowed by several minutes for many line segments.
- No service to the Irvine and Morgan Hill stations.

Compared to the Phase 1 service, the full system shows some operating plan differences that help explain detailed differences in the forecasts:

- Decreased frequency of service during the peak period for most stations.
- Increased frequency of service for some station-to-station pairs, decrease of frequency of service for other pairs.
- Decreased frequency of service between Bakersfield and Southern California stations.

Table 1. Phase 1 Operating Plan for May 2009 Run

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

Pattern#	0	1	2	3	4	5	6	7	8	
Frequency of service (mins)	60	120	60	120	30	60	120	40	40	
	Run times from start in minutes									
San Francisco	0	0	0	0	0	0	0	0		
Milbrae	|	|	|	15	15	|	|	15		
Redwood City / Palo Alto	|	20	|	25	|	20	20	25		
San Jose	|	35	30	40	35	35	35	40		
Gilroy	|	51	|	56	|	51	|	56		
Merced								91	0	
Fresno	|	|	|	97	87	|	|		22	
Bakersfield	|	|	|	136	126	|	|		61	
Palmdale	|	|	|	|	|	151	145		95	
Sylmar	|	|	|	|	175	|	167		117	
Burbank	|	|	|	|	|	179	176		126	
Los Angeles Union Station	160	175	163	194	189	188	185		135	
Norwalk		188	|	207			198		148	
Anaheim		200	184	219			210		160	
# of trains	6	3	6	3	12	6	3	9	9	57

Stopping time at stations included per operating plan and 3.5% recovery time

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

Pattern#	1	9	3	4	5	7	8	
Frequency of service (mins)	60	60	30	0	30	60	60	
	Run times from start in minutes							
San Francisco	0	0	0	0	0	0		
Milbrae	|	15	15	15	|	15		
Redwood City / Palo Alto	20	25	25	|	20	25		
San Jose	35	40	40	35	35	40		
Gilroy	51	56	56	|	51	56		
Merced						91	0	
Fresno	|	97	97	87	|		22	
Bakersfield	|	136	136	126	|		61	
Palmdale	|	170	|	|	151		95	
Sylmar	|	192	|	175	|		117	
Burbank	|	201	|	|	179		126	
Los Angeles Union Station	175	210	194	189	188		135	
Norwalk	188	223	207				148	
Anaheim	200	235	219				160	
# of trains	10	10	20	0	20	10	10	80

Stopping time at stations included per operating plan and 3.5% recovery time

Table 2. Full System Operating Plan for May 2009 Run

Pattern#	0	1	2	29	28	4	20	41	42	14	39	25	15	35
Frequency of service (mins)	60	30	60	60	60	60	60	60	60	60	60	60	60	60
	Run times from start in minutes													
San Francisco	0	0	0	0	0	0	0			0	0			
Milbrae	|	|	|	|	15	15	15			15	|			
Redwood City / Palo Alto	|	20	|	20	25	25	25			25	20			
San Jose	|	35	30	35	40	40	40			40	35			
Gilroy	|	51	|	51	56	56	|			56	|			
Merced										91	|			
Modesto										108	|			
Stockton										124	104			
Sacramento										146	126	0	0	0
Stockton												22	22	22
Modesto												|	38	|
Merced												|	55	|
Fresno	|	|	|	|	97	97	93					68	78	68
Bakersfield	|	|	|	|	|	138	134					|	119	|
Palmdale	|	|	|	151	164	172	|				135	153	|
Sylmar	|	|	|	173	|	194	183					157	175	|
Burbank	|	|	|	|	|	203	|					166	184	|
Los Angeles Union Station	160	175	163	188	198	213	198	0	0			176	194	154
City of Industry		|		208	218	|		19	|					174
Ontario		203		220	230	241		31	|					186
Riverside		216		233	243	254		44	35					199
Murrieta		|		250	260	|		61	|					216
Escondido		|		268	278	|		79	|					234
University City		258		283	293	296		94	|					249
San Diego		270		295	305	308		106	85					261
Norwalk	173		176				211					189	207	
Anaheim	184		187				222					200	218	
# of trains	6	12	6	6	6	6	6	6	6	6	6	6	6	6

Includes dwell and 3.5% recovery time
Where timetable shows separate arrival and departure times, midpoint of dwell shown
"0" pattern replaces "21" pattern

Full System train patterns for 10 off-peak hours, one-way

Pattern#	1	27	26	15	17	4	16	14
Frequency of service (mins)	60	60	60	60	60	60	60	60
	Run times from start in minutes							
San Francisco	0	0	0		0	0	0	0
Milbrae	|	|	15		|	15	15	15
Redwood City / Palo Alto	20	20	25		20	25	25	25
San Jose	35	35	40		35	40	40	40
Gilroy	51	51	56		51	56	56	56
Merced								91
Modesto								108
Stockton								124
Sacramento				0				146
Stockton				22				
Modesto				38				
Merced				55				
Fresno	|	|	97	78	|	97	97	
Bakersfield	|	|	138	119	|	138	138	
Palmdale	|	151	|	153	151	172	|	
Sylmar	|	173	|	175	173	194	|	
Burbank	|	182	|	184	182	203	|	
Los Angeles Union Station	175	192	194	194	192	213	194	
City of Industry	|	212	214			|		
Ontario	203	224	226			241		
Riverside	216	237	239			254		
Murrieta	|	254	256			|		
Escondido	|	272	274			|		
University City	258	287	289			296		
San Diego	270	299	301			308		
Norwalk				207	205		207	
Anaheim				218	216		218	
# of trains	10	10	10	10	10	10	10	10

Updated Costs and Fares

Several changes were made from the August 2008 run regarding costs and fares. Air fares and high-speed rail fares were increased by eight percent. Auto operating costs were increased from 22 to 24 cents per mile (in 2005 dollars). No changes were made to conventional rail fares, or parking costs at airports, high-speed rail, and conventional rail stations.

Results – Phase 1

The Phase 1 results show a total high speed rail annual ridership of 55.8 million in the year 2030 (see Table 3), an increase of 1.6 million, or three percent, from the August 2008 plan. While the eight percent higher travel costs and the slightly slower segment run times tend to reduce ridership, the operating changes provide a much stronger net increase.

The faster Los Angeles – San Francisco Transbay express train and the higher off-peak frequency to Anaheim result in a net increase of 1.3 million trips between the LA Basin and the San Francisco Bay Area, and increased the trips between San Diego and Orange Counties and Los Angeles by 0.4 million. The additional off-peak train contributes to increases in other markets served – intra Bay Area, San Joaquin Valley to Los Angeles and the Bay Area. On the down side, the intra-North Los Angeles traffic drops by 0.5 million largely because the peak-period Los Angeles – San Francisco Bay Area express train replaces one that provided local service to Palmdale and Burbank, and the additional off-peak train does not stop at these stations.

The eight percent increase in high speed rail fares coupled with the three percent growth in ridership resulted in a revenue increase of approximately 12 percent over the August 2008 forecast. Table 4 shows the estimated daily average boardings at each high speed rail station. Boardings increased compared to the August 2008 plan for all stations except Bakersfield, Palmdale, Sylmar, and Burbank, which had boarding decreases between one percent (Bakersfield) and nine percent (Burbank) for the operations plan reasons described above. Boardings increased as expected in Redwood City, Millbrae, Anaheim, and San Francisco Transbay Terminal.

Station to station segment volumes (shown in Table 5) increased for all segments as expected.

Table 3. Phase 1 Annual Region to Region Ridership and Revenue – Year 2030

Market	May 2009				August 2008			
	Ridership (millions)	Mode Share	Average Fare (2008$$)	HSR Revenue (2008$$ in millions)	Ridership (millions)	Mode Share	Average Fare (2008$$)	HSR Revenue (2008$$ in millions)
LA Basin – Sacramento	1.9	25%	$68	$125	1.8	25%	$63	$116
LA Basin – San Diego	0.2	0%	$14	$2	0.1	0%	$13	$2
LA Basin – Bay Area	11.9	57%	$67	$790	10.6	51%	$62	$650
Sacramento – Bay Area	0.0	0%	$11	$0	0.0	0%	$11	$0
San Diego- Sacramento	0.0	2%	$69	$2	0.0	1%	$63	$2
San Diego- Bay Area	3.2	36%	$69	$221	3.2	35%	$64	$201
Bay Area – San Joaquin Valley	7.6	11%	$46	$346	7.4	10%	$43	$318
San Joaquin Valley – LA Basin	8.5	12%	$42	$352	8.3	12%	$39	$322
Sacramento – San Joaquin Valley	0.6	3%	$52	$29	0.6	3%	$49	$29
San Diego – San Joaquin Valley	0.1	25%	$46	$3	0.1	24%	$43	$3
Within Bay Area Peninsula	5.1	0.1%	$11	$57	4.8	0.1%	$10	$50
Within North LA Basin	4.3	0.0%	$12	$52	4.8	0.1%	$11	$53
Within South LA Basin	1.6	0.0%	$10	$16	1.3	0.0%	$9	$12
North LA – South LA	3.8	0.1%	$11	$42	3.9	0.1%	$10	$40
Within San Diego region	0.0	0.0%	$0	$0	0.0	0.0%	$0	$0
Within San Joaquin Valley	1.0	0.0%	$31	$30	0.9	0.0%	$29	$27
Other	6.2	0.1%	$47	$293	6.4	0.1%	$44	$284
Total	**55.8**	**0%**	**$42**	**$2,362**	**54.2**	**0%**	**$39**	**$2,108**
Within San Diego region	0.0	0.0%	$0	$0	0.0	0.0%	$0	$0
Within entire LA Basin	9.7	0.0%	$11	$110	9.9	0.0%	$11	$106
Within entire MTC	5.1	0.1%	$11	$57	4.8	0.1%	$10	$50
Total between regions	**41.1**	**0%**	**$53**	**$2,195**	**39.5**	**0%**	**$49**	**$1,953**

Table 4. Phase 1 Average Daily HSR Station Boardings – Year 2030

Origin Station	May 2009	August 2008
San Francisco (Transbay)	33,900	32,900
Millbrae	3,100	2,800
Redwood City	5,400	4,600
San Jose	10,800	10,500
Gilroy	6,400	6,100
Merced	7,500	7,400
Fresno	6,500	6,300
Bakersfield	7,500	7,600
Palmdale	16,300	17,100
Sylmar	7,300	7,800
Burbank	3,800	4,200
Los Angeles Union Station	17,500	17,200
Norwalk	5,900	5,600
Anaheim	31,300	29,000
TOTAL DAILY	**163,200**	**159,100**

Table 5. Phase 1 Daily High-Speed Rail Trips on each Station to Station Segment (Southbound) – Year 2030

Origin Station	Destination Station	May 2009	August 2008
San Francisco (Transbay)	Millbrae	33,900	32,900
Millbrae	Redwood City	35,300	34,000
Redwood City	San Jose	37,500	36,000
San Jose	Gilroy	40,400	38,400
Gilroy	Merced	2,400	2,300
Gilroy	Fresno	43,500	41,800
Merced	Fresno	5,100	5,100
Fresno	Bakersfield	44,300	42,700
Bakersfield	Palmdale	41,300	39,800
Palmdale	Sylmar	48,500	47,700
Sylmar	Burbank	43,200	42,500
Burbank	Los Angeles Union Station	39,400	38,300
Los Angeles Union Station	Norwalk	35,300	33,000
Norwalk	Anaheim	31,200	29,000

Results – Full System

The Full System travel forecast for 2030 resulted in a predicted annual high speed rail ridership of 98.3 million (see Table 6). This represents an increase of 6.9 million, or 7.5 percent, over the August 2008 plan. The increase in train frequency for both the peak and off-peak periods, especially for the Norwalk and Anaheim stations, increased ridership between San Joaquin Valley and the Los Angeles basin by 2.8 million riders. The increased service to all stations also increased ridership within the Bay Area by 1.7 million riders. The faster Los Angeles – San Francisco express train and increased service to the LA Basin and Bay Area stations contributed to an increase of three million riders between the LA Basin and the Bay Area.

On the down side, similar to the Phase 1 results, ridership between the LA Basin stations drops by a total of 3.3 million largely because of the decrease of service between these stations. Ridership also decreased between Sacramento and the Bay Area, attributable to decreased level of service between these areas.

The eight percent increase in high speed rail fares, 7.5 percent growth in ridership, and a relative increase in longer distance, higher fare trips produce a revenue increase of approximately 20 percent over the revenue forecast for the August 2008 run.

Table 7 shows the average daily boardings at each high speed rail station. Percentage increases in boardings and absolute increases in boardings in comparison to the August 2008 plan were highest at Norwalk and Anaheim, due to the increased frequency of service to these stations. Station boardings decreased in Bakersfield, Palmdale, and Burbank, due to the conversion of the limited-stop train between Los Angeles Union Station and San Francisco Transbay to a non-stop train, which eliminated service to these stations. In addition, station boardings decreased at the Temecula, Escondido, and University City due to decreased frequency of service to these stations.

In comparison to the Phase 1 results, Full System station boardings decrease in San Francisco, Merced, and Anaheim. The decreases in boardings are due to the shifts of riders from San Francisco Transbay Terminal and Merced to high speed rail stations in Sacramento and Stockton. In particular, almost all of the high speed rail users from Yolo and Sacramento Counties switch to the Sacramento station, and about half of the Solano County riders do the same. In addition, about ten percent of the Contra Costa high speed rail riders switch to the Stockton station. The decrease in ridership at the Anaheim station is due to the new line to the San Diego region which adds seven stations between Los Angeles Union Station and San Diego. The final five stations on that line, Riverside, Temecula/Murrieta, Escondido, University City, and San Diego all primarily accessed Anaheim for Phase 1.

Station to station segment volumes (shown in Table 8) had the largest absolute volume increases on the Fresno to Bakersfield and Bakersfield to Palmdale segments. Most segment volumes increased as expected. However, there were some decreases on some segments such as Sacramento to Stockton, Gilroy to Merced, and City of Industry through Riverside. These decreases are relatively small and due to changes in operating plans, fares, and mode shifts.

Table 6. Full System Annual Region to Region Ridership and Revenue – Year 2030

Market	May 2009				August 2008			
	Ridership (millions)	Mode Share	Average Fare (2008$$)	HSR Revenue (2008$$ in millions)	Ridership (millions)	Mode Share	Average Fare (2008$$)	HSR Revenue (2008$$ in millions)
LA Basin – Sacramento	3.8	51%	$66	$254	3.2	43%	$62	$198
LA Basin – San Diego	21.4	15%	$31	$659	21.0	15%	$29	$601
LA Basin- Bay Area	12.3	59%	$68	$836	9.3	45%	$63	$586
Sacramento – Bay Area	3.0	4%	$45	$132	3.3	5%	$42	$138
San Diego- Sacramento	0.1	5%	$78	$7	0.1	5%	$72	$7
San Diego- Bay Area	3.5	39%	$81	$280	3.6	41%	$75	$271
Bay Area – San Joaquin Valley	8.0	11%	$45	$359	7.2	10%	$42	$302
San Joaquin Valley – LA Basin	8.4	12%	$44	$367	5.6	8%	$41	$228
Sacramento – San Joaquin Valley	2.1	9%	$42	$87	2.3	10%	$40	$93
San Diego – San Joaquin Valley	0.1	26%	$55	$4	0.1	32%	$52	$5
Within Bay Area Peninsula	6.2	0.1%	$11	$68	4.5	0.1%	$10	$45
Within North LA Basin	6.0	0.1%	$12	$75	6.7	0.1%	$12	$79
Within South LA Basin	3.5	0.0%	$10	$36	4.1	0.0%	$10	$41
North LA – South LA	6.8	0.2%	$11	$76	8.8	0.3%	$14	$128
Within San Diego region	0.4	0.0%	$11	$4	0.4	0.0%	$10	$4
Within San Joaquin Valley	2.3	0.0%	$29	$65	2.0	0.0%	$28	$57
Other	10.5	0.1%	$53	$554	9.1	0.1%	$48	$435
Total	**98.3**	**0%**	**$39**	**$3,863**	**91.4**	**0%**	**$35**	**$3,218**
Within San Diego region	0.4	0.0%	$11	$4	0.4	0.0%	$10	$4
Within Entire LA Basin	16.3	0.1%	$11	$187	19.6	0.1%	$13	$248
Within entire MTC	6.2	0.1%	$11	$68	4.5	0.1%	$10	$45
Total between regions	**75.3**	**1%**	**$48**	**$3,608**	**66.9**	**0%**	**$44**	**$2,925**

Table 7. Full System Average Daily HSR Station Boardings – Year 2030

Origin Station	May 2009	August 2008
San Francisco (Transbay)	31,100	26,500
Millbrae	4,000	2,900
Redwood City	7,700	4,600
San Jose	13,300	11,800
Gilroy	6,400	4,800
Sacramento	18,500	18,700
Stockton	6,500	5,100
Modesto/SP Downtown	4,500	3,700
Merced	2,500	1,600
Fresno	8,200	6,800
Bakersfield	8,300	8,700
Palmdale	18,300	19,600
Sylmar	13,700	13,000
Burbank	4,600	7,400
Los Angeles Union Station	32,700	31,400
Norwalk	7,600	3,500
Anaheim	23,700	12,500
City of Industry	6,900	9,200
Ontario	11,600	10,600
Riverside	14,400	14,000
Temecula / Murrieta	7,400	7,600
Escondido	7,800	9,000
University City	5,800	5,800
San Diego	20,000	19,000
TOTAL DAILY	**285,500**	**269,700**

Table 8. Full System Daily High-Speed Rail Trips on Each Station to Station Segment (Southbound) – Year 2030

Origin Station	Destination Station	May 2009	August 2008
San Francisco (Transbay)	Millbrae	31,100	26,500
Millbrae	Redwood City	32,200	27,500
Redwood City	San Jose	35,100	29,600
San Jose	Morgan Hill*	39,800	35,000
Morgan Hill*	Gilroy	39,800	34,600
Gilroy	Merced	6,200	6,600
Gilroy	Fresno	34,200	27,600
Sacramento	Stockton	18,500	18,700
Stockton	Modesto/SP Downtown	24,200	23,100
Modesto/SP Downtown	Merced	27,200	25,500
Merced	Fresno	22,600	19,700
Fresno	Bakersfield	53,700	44,600
Bakersfield	Palmdale	49,800	39,900
Palmdale	Sylmar	58,400	51,000
Sylmar	Burbank	55,800	51,000
Burbank	Los Angeles Union Station	54,100	49,800
Los Angeles Union Station	Norwalk	27,100	21,000
Norwalk	Anaheim	23,700	20,200
Los Angeles Union Station	City of Industry	39,500	41,000
City of Industry	Ontario	41,900	42,700
Ontario	Riverside	41,300	42,100
Riverside	Temecula / Murrieta	37,500	37,200
Temecula / Murrieta	Escondido	33,000	32,600
Escondido	University City	25,500	24,400
University City	San Diego	19,800	18,900

*Morgan Hill not in the May 2009 operating pattern

Initial 2035 Ridership and Revenue Forecasts

CS developed an expansion factoring process for developing initial 2035 forecasts based on the results of the 2030 forecasts described for the Phase 1 and Full System plans. The expansion factor process was based on:

- Assembling projected changes in population and employment between 2030 and 2035 for each of the 14 regions identified for the high-speed rail ridership and revenue model;
- Developing trip production and attraction growth factors for each of the regions;
- Applying an iterative proportional fitting (IPF) growth factor process to the 2030 region to region high-speed rail ridership forecasts described above to produce initial forecasts of 2035 high-speed rail region-to-region; and
- Allocating the changes in region to region high-speed rail trips to the 2030 station boardings and segment ridership results to produce initial estimates of 2035 station boardings, segment volumes, and revenues.

Growth Factors Based on 2035 Population and Employment Forecasts

In order to produce the initial ridership forecasts, projected changes (or percent changes) in population and employment between 2030 and 2035 were assembled for each of the 14 regions defined in the model: AMBAG, Central Coast, Far North, Fresno/Madera, Kern, South SJ Valley, Merced, SACOG, SANDAG, San Joaquin, Stanislaus, W. Sierra Nevada, MTC, and SCAG.

Table 9 shows the population and employment forecasts for 2030 and 2035, along with the percent growth from 2030 to 2035 for each of the 14 regions. For AMBAG, MTC, Kern, and SCAG, forecasts of regional population, total employment, and households were obtained from the respective MPOs. Since 2035 MPO forecasts had either not been produced or adopted for the remaining regions, 2035 regional forecasts for those regions were developed using information from Woods and Poole Economics, Inc.[1]

[1] While SACOG adopted year 2035 growth projections in 2008 as part of its Metropolitan Transportation Plan, these new projections did not include updated forecasts for year 2030. Therefore, it was not possible to calculate a 2030 to 2035 growth estimate using the new SACOG growth forecasts.

Table 9. Population and Employment by Region for 2030 and 2035

Region	Source for 2035 Forecast	2030		2035		Percent Change	
		Population	Total Employment	Population	Total Employment	Population	Total Employment
AMBAG	AMBAG	895,577	387,920	920,713	404,620	2.8%	4.3%
Central Coast	Woods & Poole	799,563	540,392	829,800	569,233	3.8%	5.3%
Far North	Woods & Poole	1,307,895	699,537	1,367,929	742,367	4.6%	6.1%
Fresno/Madera	Woods & Poole	1,359,119	672,339	1,429,346	714,055	5.2%	6.2%
Kern	Kern	1,156,938	426,924	1,264,200	460,385	9.3%	7.8%
Merced	Woods & Poole	331,378	126,061	350,230	134,348	5.7%	6.6%
MTC	MTC	8,712,800	4,921,680	9,031,500	5,247,780	3.7%	6.6%
SACOG	Woods & Poole	2,257,887	1,338,726	2,372,541	1,422,813	5.1%	6.3%
San Joaquin	Woods & Poole	905,658	394,570	957,178	420,428	5.7%	6.6%
SANDAG	Woods & Poole	3,926,855	2,628,192	4,140,035	2,819,077	5.4%	7.3%
SCAG	SCAG	23,255,380	9,913,335	24,057,301	10,287,127	3.4%	3.8%
South SJ Valley	Woods & Poole	713,456	319,386	745,713	335,736	4.5%	5.1%
Stanislaus	Woods & Poole	688,307	298,413	727,194	316,346	5.6%	6.0%
W. Sierra Nevada	Woods & Poole	256,685	134,549	271,280	144,236	5.7%	7.2%

The full model estimates business and commute trip frequency for residents based on accessibility to employment throughout the rest of the state. Recreational and other trip frequency for residents in the full model is based on accessibility to retail and service employment and accessibility to households. Accessibility is based on travel times between resident zones and all other zones via auto, air, conventional rail, and high speed rail. Since the initial 2035 forecasts did not include detailed network analysis, growth factors for regional trip productions for each of the trip purposes were based on the percent changes in population in each of the 14 regions. The growth in business and commute trip attractions was based on the percent changes in employment in each of the 14 regions and the growth in recreational and other trip attractions was based on the percent growth in the sums of households, service employment and retail employment for each of the 14 regions. Note that the growth in households closely paralleled the growth in population in the regions and growth in retail and service employment closely paralleled the growth in total employment.

Table 10 shows the growth factors by production and attraction for each purpose for the 15 regions and sub-regions. As noted above, the SCAG region has been subdivided into SCAG North and SCAG South for ridership summaries. The growth factors estimated for the entire SCAG region were applied to both the SCAG North and SCAG South sub-regions.

Table 10. Growth Factors by Production, Attraction, and Trip Purpose

	Business/Commute		Recreation/Other	
Region	**Production**	**Attraction**	**Production**	**Attraction**
AMBAG	1.028	1.043	1.028	1.040
Central Coast	1.038	1.053	1.038	1.052
Far North	1.046	1.061	1.046	1.054
Fresno/Madera	1.052	1.062	1.052	1.062
Kern	1.093	1.078	1.093	1.086
South SJ Valley	1.045	1.051	1.045	1.054
Merced	1.057	1.066	1.057	1.056
SACOG	1.051	1.063	1.051	1.060
SANDAG	1.054	1.073	1.054	1.065
San Joaquin	1.057	1.066	1.057	1.056
Stanislaus	1.056	1.060	1.056	1.054
W. Sierra Nevada	1.057	1.072	1.057	1.064
MTC	1.037	1.066	1.037	1.056
SCAG-North	1.034	1.038	1.034	1.042
SCAG-South	1.034	1.038	1.034	1.042

Growth Factoring Process for Producing Region-to-Region High-Speed Rail Trips

The factoring approach used for the initial 2035 forecasts includes many implicit assumptions. The operating plans, travel times, fares, station locations, and competing mode information for the initial 2035 forecasts are assumed to be identical to those for the 2030 forecasts described above. Thus, these initial forecasts do not consider changes in competitiveness among the different modes and do not fully account for changes in accessibility among the different regions. Given this factoring process, these initial 2035 forecasts will differ from subsequent forecasts obtained from a full application of the HSR ridership and revenue model using 2035 socioeconomic data.

The growth factoring process developed to forecast 2035 region-to-region high-speed rail trips by purpose used 2030 forecasts of region to region business/commute trips and recreation/ other trips for the Full System and Phase 1 operating plans as input. For each operating plan and trip purpose combination, an Iterative Proportional Fitting (IPF) growth factoring method (also known as the Fratar method) was used. The process ensures that the sums of trip interchanges from or to any region match the estimated trips produced or attracted by the region within a specified tolerance. As shown in Table 10, unique growth factors were used for productions and attractions, and for business/commute and recreation/other purposes.

Annual market-to-market ridership forecasts and mode shares were developed from the forecasted 2035 region-to-region trips for Phase 1 and the Full System (see Tables 11 and 12). Average high-speed rail fares for 2035 were assumed to be equal to the 2030 values for estimations of annual revenues. Between 2030 and 2035, the initial 2035 forecasts show that Phase 1 high-speed rail ridership will increase by approximately 2.4 million riders, or by about 4.3 percent. Revenues increase by $103 million, which is also over a 4 percent increase. The Full System results for 2035 showed similar increases in ridership and revenue over 2030. Ridership increased by 4.1 million riders, and revenue increased by $158 million from 2030 to 2035. For both Phase 1 and the Full System the largest ridership growth occurred between San Diego and the Bay Area and between the Bay Area and San Joaquin Valley.

.Development of 2035 Station Boardings and Segment Volumes

The forecast 2035 region-to-region high speed rail trips were used in conjunction with the forecast 2030 station to station high speed rail trips to produce initial estimates of 2035 station boardings and segment volumes for both Phase 1 and the Full System.

The first step in producing station to station boardings for 2035 was to associate specific stations with specific regions for both Phase 1 and the Full System. For example, for both Phase 1 and the Full System trips originating in the AMBAG accessed either the Gilroy or San Jose stations. On the other hand, for Phase 1, SACOG trips accessed either San Francisco Transbay, Millbrae, Redwood City, San Jose, or Merced stations, while for the Full System all SACOG trips were assigned to the Sacramento station. Allocation percentages were developed for each region to each station. For example, for AMBAG, Gilroy was assigned 79 percent of the trips and San Jose was assigned 21 percent of the trips. These allocation percentages were developed iteratively by using the same procedure for 2030 to approximate the results of the full applications of the HSR ridership and revenue model. The same allocations were used when associating destination regions with stations.

Table 11. 2035 Phase 1 Annual Region to Region Ridership and Revenue*

Market	HSR Ridership (millions)	HSR Mode Share	HSR Average Fare (2008 $$)	Revenue (2008 $$ in millions)
LA Basin – Sacramento	1.9	26%	$68	$131
LA Basin – San Diego	0.2	0%	$14	$2
LA Basin- Bay Area	12.2	47%	$67	$811
Sacramento – Bay Area	0.0	0%	$11	$0
San Diego- Sacramento	0.0	2%	$69	$3
San Diego- Bay Area	3.4	37%	$69	$233
Bay Area – San Joaquin Valley	8.1	9%	$46	$371
San Joaquin Valley – LA Basin	8.9	11%	$42	$371
Sacramento – San Joaquin Valley	0.6	3%	$52	$32
San Diego – San Joaquin Valley	0.1	27%	$46	$4
Within Bay Area Peninsula	5.3	0.1%	$11	$59
Within North LA Basin	4.5	0.0%	$12	$54
Within South LA Basin	1.6	0.0%	$10	$16
North LA – South LA	3.9	0.1%	$11	$43
Within San Diego region	0.0	0.0%	$0	$0
Within San Joaquin Valley	1.1	0.0%	$31	$33
Other	6.5	0.1%	$47	$303
Total	**58.2**	**0%**	**$42**	**$2,465**
Within San Diego region	0.0	0.0%	$0	$0
Within entire LA Basin	9.9	0.0%	$11	$113
Within entire MTC	5.3	0.1%	$11	$59
Total between regions	**43.0**	**0%**	**$53**	**$2,293**

*Note: These initial 2035 forecasts are based on a factoring of the results of the model runs for 2030.

Table 12. 2035 Full System Annual Region to Region Ridership and Revenue*

Market	HSR Ridership (millions)	HSR Mode Share	HSR Average Fare (2008$$)	Revenue (2008$$ in millions)
LA Basin – Sacramento	3.9	50%	$66	$261
LA Basin – San Diego	22.5	14%	$31	$692
LA Basin- Bay Area	12.4	48%	$68	$838
Sacramento – Bay Area	3.1	4%	$45	$140
San Diego- Sacramento	0.1	5%	$78	$8
San Diego- Bay Area	3.8	41%	$81	$304
Bay Area – San Joaquin Valley	8.6	10%	$45	$387
San Joaquin Valley – LA Basin	8.7	11%	$44	$380
Sacramento – San Joaquin Valley	2.2	9%	$42	$94
San Diego – San Joaquin Valley	0.1	27%	$55	$5
Within Bay Area Peninsula	6.5	0.1%	$11	$71
Within North LA Basin	6.3	0.1%	$12	$77
Within South LA Basin	3.6	0.0%	$10	$38
North LA – South LA	7.0	0.2%	$11	$78
Within San Diego region	0.4	0.0%	$9	$3
Within San Joaquin Valley	2.4	0.0%	$29	$70
Other	10.9	0.1%	$53	$576
Total	**102.4**	**0%**	**$39**	**$4,021**
Within San Diego region	0.4	0.0%	$9	$3
Within entire LA Basin	16.9	0.1%	$11	$193
Within entire MTC	6.5	0.1%	$11	$71
Total between regions	**78.7**	**0%**	**$48**	**$3,758**

*Note: These initial 2035 forecasts are based on a factoring of the results of the model runs for 2030.

Using a combination of the assigned region to station allocation percentages and the 2030 station-to-station boarding distribution, region-to-region trips were converted to station-to-station boardings and alightings. Tables 13 and 14 show the initial estimates for the 2035 station boardings for Phase 1 and the Full System, respectively. For both Phase 1 and the Full System, station boardings were forecast to increase by about five percent from 2030 to 2035. In accord with the 2030 results, station boardings in the Full System were forecast to decrease compared to Phase 1 station boardings at the San Francisco Transbay, Merced, and Anaheim stations. This occurrence was due to the planned lines running to Sacramento and San Diego in the full system.

Station to station trips for 2035 were estimated for the Phase 1 and the Full Systems in a manner analogous to that used to estimate the 2035 region to region trips. Station to station volumes from the appropriate 2030 forecasts were "Fratared" to match estimated boardings and alightings at stations. This procedure maintained the same underlying station to station movement patterns forecast for 2030 for the Phase 1 and Full Systems while ensuring that total station boardings and alightings matched the appropriate 2035 estimates. The station to station volumes were summarized to estimate segment volumes. This was possible without an assignment of the trips to the high speed rail network since there is only one high speed rail path available between each station pair. Table 15 and Table 16 show the initial estimates of 2035 segment volumes for the Phase 1 and Full Systems. Compared to 2030 segment volumes, Phase 1 segment volumes increased between about four and seven percent. For the Full System, segment volumes increased between about three and five percent over 2030 segment volumes.

Table 13. 2035 Phase 1 Average Daily HSR Stations Boardings*

Origin Station	Total
San Francisco (Transbay)	35,700
Millbrae	3,300
Redwood City	5,600
San Jose	11,000
Gilroy	6,500
Merced	7,900
Fresno	6,800
Bakersfield	7,900
Palmdale	17,400
Sylmar	7,800
Burbank	4,100
Los Angeles Union Station	18,200
Norwalk	6,200
Anaheim	32,900
TOTAL DAILY	**171,300**

*Note: These initial 2035 forecasts are based on a factoring of the results of the model runs for 2030

Table 14. 2035 Full System Average Daily HSR Stations Boardings*

Origin Station	Total
San Francisco (Transbay)	32,700
Millbrae	4,100
Redwood City	7,900
San Jose	13,600
Gilroy	6,600
Sacramento	19,300
Stockton	6,800
Merced	2,600
Modesto/SP Downtown	4,800
Fresno	8,600
Bakersfield	9,000
Palmdale	19,500
Sylmar	14,200
Burbank	4,800
Los Angeles Union Station	34,800
Norwalk	7,900
Anaheim	24,600
City of Industry	7,200
Ontario	12,300
Riverside	15,200
Temecula / Murrieta	8,400
Escondido	8,200
University City	6,200
San Diego	20,400
Daily	**299,700**

*Note: These initial 2035 forecasts are based on a factoring of the results of the model runs for 2030.

Table 15. 2035 Phase 1 Daily High-Speed Rail Trips on Each Station to Station Segment (Southbound)*

Origin Station	Destination Station	Total Trips
San Francisco (Transbay)	Millbrae	35,700
Millbrae	Redwood City	37,300
Redwood City	San Jose	39,700
San Jose	Gilroy	42,600
Gilroy	Merced	2,500
Gilroy	Fresno	46,000
Merced	Fresno	5,400
Fresno	Bakersfield	46,800
Bakersfield	Palmdale	43,500
Palmdale	Sylmar	50,800
Sylmar	Burbank	45,400
Burbank	Los Angeles Union Station	41,500
Los Angeles Union Station	Norwalk	37,700
Norwalk	Anaheim	33,500

*Note: These initial 2035 forecasts are based on a factoring of the results of the model runs for 2030.

Table 16. 2035 Full System Daily High-Speed Rail Trips on Each Station to Station Segment (Southbound)*

Origin Station	Destination Station	Total Trips
San Francisco (Transbay)	Millbrae	32,700
Millbrae	Redwood City	33,800
Redwood City	San Jose	36,900
San Jose	Morgan Hill	41,800
Morgan Hill	Gilroy	41,800
Gilroy	Merced	6,400
Gilroy	Fresno	35,900
Sacramento	Stockton	19,300
Stockton	Modesto/SP Downtown	25,300
Modesto/SP Downtown	Merced	28,400
Merced	Fresno	23,800
Fresno	Bakersfield	56,600
Bakersfield	Palmdale	52,100
Palmdale	Sylmar	60,900
Sylmar	Burbank	58,100
Burbank	Los Angeles Union Station	56,400
Los Angeles Union Station	Norwalk	28,500
Norwalk	Anaheim	24,800
Los Angeles Union Station	City of Industry	41,000
City of Industry	Ontario	43,400
Ontario	Riverside	42,900
Riverside	Temecula / Murrieta	39,000
Temecula / Murrieta	Escondido	34,000
Escondido	University City	26,400
University City	San Diego	20,600

*Note: These initial 2035 forecasts are based on a factoring of the results of the model runs for 2030.