Appendix I

Sequoia National Park, California

Sustainable Communities Strategy:
Reference Materials

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Appendix I Item 1: Fresno COG 2050 Projections Report

May 4, 2017

Fresno County 2050 Growth Projections

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Fresno County Council of Governments

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SUMMARY

This report provides growth projections for Fresno County and the spheres of influence of each of its cities between 2015 and 2050. The report was commissioned by the Fresno County Council of Governments (FCOG) to assist with updating the Regional Transportation Plan (RTP) as well as the Sustainable Communities Plan (SCP). Table 1 summarizes ADE's topline population and employment projections for the Fresno County region. The population projection is lower than both the existing Department of Finance (DOF) projections and the prior Fresno COG projections for 2050. However, it should be noted that both of those projections significantly over estimated recent population growth and were 9,400 and 38,000 above the actual 2015 population reported by DOF more recently, respectively. In general, DOF projects the San Joaquin Valley to increase this share of statewide population growth, although the counties with greatest growth acceleration are anticipated to be those closest to the Bay Area and the Southern California metropolitan regions. Fresno will share in some of this additional growth, particularly after 2025 when the High Speed Rail improves accessibility to the Bay Area.

In terms of total job growth, ADE projects the county will add 133,900 wage and salary jobs between 2015 and 2050. This equates to an average annual growth rate of about 3,825 jobs over 35 years. For comparison, EDD indicates the County added an average 3,600 jobs per year over the past 25 years, since 1990.

In addition to the population and employment projections, the report includes projections of demographic characteristics and housing demand, including the following:

- Households
- Housing
- Age Distribution
- Average Household Size
- Group Quarters Population
- Average Income
- Household Type
- Race/Ethnicity
- School Enrollment

Table 1 – Population and Employment Projections by Jurisdiction Sphere of Influence

Jurisdiction	2015	2020	2025	2030	2035	2040	2045	2050
Total Population								
County	**972,300**	**1,047,440**	**1,122,840**	**1,191,850**	**1,258,860**	**1,323,070**	**1,383,690**	**1,447,090**
Clovis SOI	114,770	126,850	136,350	145,050	153,490	161,580	169,220	177,210
Coalinga SOI	16,530	17,350	18,170	18,920	19,650	20,350	21,010	21,700
Firebaugh SOI	7,780	8,370	8,880	9,340	9,790	10,220	10,630	11,060
Fowler SOI	6,580	7,240	7,890	8,490	9,070	9,630	10,160	10,710
Fresno SOI	574,590	624,040	676,820	725,120	772,030	816,980	859,410	903,790
Huron SOI	6,820	7,430	7,600	7,750	7,900	8,050	8,180	8,330
Kerman SOI	14,880	15,900	16,930	17,860	18,770	19,650	20,470	21,330
Kingsburg SOI	12,750	13,670	14,590	15,440	16,260	17,050	17,790	18,570
Mendota SOI	11,210	11,920	12,630	13,280	13,920	14,520	15,090	15,690
Orange Cove SOI	9,360	9,540	9,710	9,880	10,030	10,190	10,330	10,480
Parlier SOI	15,100	15,870	16,640	17,350	18,040	18,700	19,330	19,980
Reedley SOI	25,570	27,150	28,740	30,200	31,610	32,960	34,240	35,580
Sanger SOI	26,310	27,860	29,410	30,840	32,220	33,540	34,790	36,100
San Joaquin SOI	4,040	4,310	4,580	4,830	5,070	5,310	5,520	5,750
Selma SOI	26,680	28,250	29,810	31,250	32,640	33,980	35,240	36,550
Balance of County	99,330	101,710	104,080	106,250	108,350	110,370	112,280	114,270
Total Jobs								
County	**372,400**	**398,100**	**422,000**	**441,200**	**460,100**	**476,800**	**491,300**	**506,300**
Clovis	32,400	34,680	36,640	38,560	40,460	42,270	43,970	45,740
Coalinga	2,820	3,050	3,160	3,290	3,420	3,540	3,660	3,780
Firebaugh	1,140	1,260	1,280	1,340	1,410	1,470	1,520	1,580
Fowler	2,400	2,770	2,890	3,030	3,170	3,300	3,420	3,540
Fresno	231,560	248,500	266,150	278,370	291,470	303,650	314,730	326,450
Huron	730	840	840	860	870	890	900	910
Kerman	2,680	2,890	3,130	3,290	3,440	3,580	3,720	3,860
Kingsburg	3,540	3,970	4,190	4,390	4,600	4,790	4,960	5,150
Mendota	890	900	910	950	990	1,030	1,060	1,100
Orange Cove	540	630	660	670	690	700	710	720
Parlier	2,230	2,380	2,530	2,630	2,720	2,810	2,890	2,970
Reedley	5,770	7,010	7,570	7,940	8,310	8,660	8,990	9,330
Sanger SOI	5,490	5,940	6,260	6,520	6,770	7,010	7,220	7,450
San Joaquin SOI	500	520	560	590	610	640	660	690
Selma	5,550	6,330	6,620	6,920	7,210	7,460	7,680	7,910
Balance of County	74,160	76,380	78,610	81,840	83,970	85,010	85,210	85,120

Source: ADE. Note: Totals may not add due to rounding.

2050 GROWTH PROJECTIONS

INTRODUCTION

This report presents projections for employment, population, housing and demographic characteristics for the Fresno County region. The projections reflect regional economic trends as well as land use plans for each of the jurisdictions in the county. In addition, the study team has compiled information about currently planned development projects that will drive growth in the short term. The study process included outreach to all of the jurisdictions in the county to review local planning policies and development trends. In addition, a technical advisory committee, convened by the Fresno COG, reviewed substantive elements of the analysis at several stages during the development of the projections.

The report begins with a review of regional economic trends and existing projections from state agencies and other economic forecast sources. This chapter then reviews the countywide projections and highlights of the city-level data, followed by a chapter describing the methodology for the analysis. Finally, the detailed jurisdictional projections are presented in the last chapter of the report.

EXISTING REGIONAL TRENDS AND PROJECTIONS

Fresno County is part of the San Joaquin Valley (SJV) regional economy in California and is affected not only by regional trends but also state and national economic conditions. We have included a review of projections from Woods and Poole Economics (W&P) because they provide a perspective on how SJV and Fresno County fit into the broader economic picture. Viewing the long term employment data from W&P, it is clear that California had an increasing share of US employment for the 20 years between 1970 and 1990, but then declined during the recessions in the mid 1990's and 2000's (Table 3). W&P projects California to regain its national share of employment but at a slower rate over the next 35 years that it had done earlier. The San Joaquin Valley (SJV) has fluctuated as a share of California state employment in the past and W&P forecasts the Valley to stabilize close to its current share of 8.2 to 8.3 percent of statewide employment. Fresno County is projected to maintain a fairly constant share of SJV jobs at about 26 percent.

However, in terms of population, W&P projects SJV to increase its share to 10.7 percent in 2010 to 11.3 percent by 2045 (Table 4). W&P also forecasts Fresno County to slightly increase its share of SJV population, from 23.4 percent in 2010 to 24.3 percent in 2050. The State Department of Finance (DOF) has a more aggressive scenario for SJV but not so for Fresno County. DOF projects SJV to increase its share of statewide population from 10.7 percent in 2010 to 13.4 percent in 2050 (Table 5). Under this scenario, Fresno County would reduce its share of regional population from 23.4 percent in 2010 to 21.9 percent of 2050. According to DOF the additional SJV growth would be concentrated in Kern County, with smaller increases in share going to San Joaquin, Merced and Madera Counties. DOF projects a higher population for Fresno County in 2050, at 1,464,413, than does W&P, at 1,445,076, but DOF projects the counties at the north and south ends of the Valley to grow more rapidly.

Caltrans has contracted with the California Economic Forecast to prepare state and county projections as well. These projections have lower population projections than either of the other two sources, reaching 1.25 million in Fresno County in 2040, compared to 1.3 million for both DOF and W&P. This reflects a slight decline in share for Fresno County from 23.6 percent in 2015 to 23.2 percent in 2040. SJV is projected to gain in statewide share of population from 10.7 percent in 2010 to 11.3 percent in 2040, similar to the W&P projection. Caltrans also projects SJV to maintain, but not increase, its statewide share of employment but Caltrans projects Fresno County to reduce its share of SJV jobs from 27.2 percent in 2010 to 25.8 percent in 2040. Kern and Madera Counties are projected to see slight increases in their SJV employment share.

In summary, these sources see the San Joaquin Valley continuing to provide a steady share of the state's economic activity, but potentially an increasing share of its population base. Much of the population and some of the employment growth, however, is driven by spillover effects from the Bay Area and the Southern California region. The interior counties of Fresno, Tulare and Kings are projected to see declining shares of growth. Madera County is a small market for growth but this may change with the recent plans to connect the High Speed Rail (HSR) with San Jose. Madera County has already entitled large residential developments poised to provide housing for workers employed in Fresno. Silicon Valley employers were quick to point out the HSR may extend their commute range to Madera County as well.

Table 2 – Comparison of Existing Population and Employment Projections

Projection Source	2010	2015	2020	2025	2030	2035	2040	2045	2050
Population									
DOF	932,969	981,681	1,055,106	1,130,406	1,200,666	1,269,714	1,332,913	1,396,837	1,464,413
Caltrans	932,392	978,775	1,037,791	1,093,696	1,147,330	1,200,659	1,254,509		
W&P	932,642	977,464	1,040,809	1,107,606	1,176,815	1,245,580	1,312,700	1,378,790	1,445,076
Prior Projections	929,758	1,010,080	1,082,097	1,154,741	1,227,649	1,300,597	1,373,679	1,447,198	1,521,496
Employment									
EDD	336,600	371,800	388,260	423,203					
EMSI	329,942	371,800	395,967	421,705					
Caltrans	334,170	372,308	402,438	417,765	434,471	452,465	468,817		
W&P	425,816	476,888	515,573	553,863	591,658	628,451	664,506	699,927	734,721
Prior FCOG Projections	326,900	348,282	369,665	391,047	412,430	433,812	455,195	476,577	497,960
GROWTH RATES (CAGR)									
Population									
DOF		1.0%	1.5%	1.4%	1.2%	1.1%	1.0%	0.9%	0.9%
Caltrans		1.0%	1.2%	1.1%	1.0%	0.9%	0.9%		
W&P		0.9%	1.3%	1.3%	1.2%	1.1%	1.1%	1.0%	0.9%
Prior Projections		1.7%	1.4%	1.3%	1.2%	1.2%	1.1%	1.0%	1.0%
Employment									
EDD*		2.0%	0.9%	1.7%					
EMSI		2.4%	1.3%	1.3%					
Caltrans		2.2%	1.6%	0.8%	0.8%	0.8%	0.7%		
W&P		2.3%	1.6%	1.4%	1.3%	1.2%	1.1%	1.0%	1.0%
Prior FCOG Projections		1.3%	1.2%	1.1%	1.1%	1.0%	1.0%	0.9%	0.9%

Source: ADE, Inc.

**Extrapolated by ADE from EDD's 2012-2022 projections.*

Table 3 – Woods and Poole Historical and Projected Employment

Jurisdiction	1970	1975	1980	1985	1990	1995	2000	2005
UNITED STATES	91,277,573	98,900,540	113,983,152	123,796,761	138,330,928	147,915,852	165,370,857	172,557,332
California	9,056,899	10,286,335	12,761,968	14,284,993	16,834,529	16,939,788	19,280,927	20,255,745
San Joaquin Valley	700,411	845,295	1,012,577	1,087,013	1,275,542	1,381,857	1,529,907	1,660,142
Fresno,	180,331	222,294	275,119	292,648	342,583	377,757	401,005	428,516
Kern	138,871	170,338	202,904	223,570	253,757	278,215	311,129	345,020
Kings	28,533	32,738	35,017	36,261	40,087	45,163	49,602	55,661
Madera	16,486	21,108	27,856	30,234	35,425	44,780	51,583	58,244
Merced	45,454	56,335	64,044	66,196	76,728	77,042	83,240	88,255
San Joaquin	125,641	141,775	165,176	181,853	214,261	224,935	255,095	282,627
Stanislaus, CA	83,871	100,774	123,135	134,090	171,838	177,970	205,739	222,238
Tulare	81,224	99,933	119,326	122,161	140,863	155,995	172,514	179,581
Percent of Region								
Fresno	25.7%	26.3%	27.2%	26.9%	26.9%	27.3%	26.2%	25.8%
Kern	19.8%	20.2%	20.0%	20.6%	19.9%	20.1%	20.3%	20.8%
Kings	4.1%	3.9%	3.5%	3.3%	3.1%	3.3%	3.2%	3.4%
Madera	2.4%	2.5%	2.8%	2.8%	2.8%	3.2%	3.4%	3.5%
Merced	6.5%	6.7%	6.3%	6.1%	6.0%	5.6%	5.4%	5.3%
San Joaquin	17.9%	16.8%	16.3%	16.7%	16.8%	16.3%	16.7%	17.0%
Stanislaus	12.0%	11.9%	12.2%	12.3%	13.5%	12.9%	13.4%	13.4%
Tulare	11.6%	11.8%	11.8%	11.2%	11.0%	11.3%	11.3%	10.8%
SJV Percent of CA	7.7%	8.2%	7.9%	7.6%	7.6%	8.2%	7.9%	8.2%
CA Percent of US	9.9%	10.4%	11.2%	11.5%	12.2%	11.5%	11.7%	11.7%

Source: Woods and Poole

Table 3 – Woods and Poole Historical and Projected Employment (continued)

Location	2010	2015	2020	2025	2030	2035	2040	2045	2050
UNITED STATES	173,034,656	188,866,185	203,418,448	217,670,718	231,564,124	244,922,886	257,978,399	270,917,653	283,809,443
California	19,803,747	22,417,830	24,234,541	26,041,591	27,829,986	29,575,295	31,298,839	33,014,464	34,728,292
San Joaquin Valley	1,646,676	1,852,895	2,001,479	2,147,651	2,291,044	2,430,034	2,566,009	2,699,675	2,831,098
Fresno	425,816	476,888	515,573	553,863	591,658	628,451	664,506	699,927	734,721
Kern	353,907	419,702	456,024	492,282	528,104	563,248	598,102	632,830	667,326
Kings	54,991	59,340	63,376	67,217	70,900	74,377	77,700	80,898	83,969
Madera	57,226	64,323	69,212	73,947	78,514	82,850	86,992	90,946	94,712
Merced	90,680	102,122	109,975	117,625	125,151	132,501	139,758	146,984	154,209
San Joaquin	268,849	299,853	324,798	349,563	374,061	397,919	421,294	444,322	467,105
Stanislaus	209,191	231,869	250,247	268,181	285,772	302,803	319,511	336,011	352,339
Tulare	186,016	198,798	212,274	224,973	236,884	247,885	258,146	267,757	276,717
Percent of Region									
Fresno	25.9%	25.7%	25.8%	25.8%	25.8%	25.9%	25.9%	25.9%	26.0%
Kern	21.5%	22.7%	22.8%	22.9%	23.1%	23.2%	23.3%	23.4%	23.6%
Kings	3.3%	3.2%	3.2%	3.1%	3.1%	3.1%	3.0%	3.0%	3.0%
Madera	3.5%	3.5%	3.5%	3.4%	3.4%	3.4%	3.4%	3.4%	3.3%
Merced	5.5%	5.5%	5.5%	5.5%	5.5%	5.5%	5.4%	5.4%	5.4%
San Joaquin	16.3%	16.2%	16.2%	16.3%	16.3%	16.4%	16.4%	16.5%	16.5%
Stanislaus	12.7%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	12.4%	12.4%
Tulare	11.3%	10.7%	10.6%	10.5%	10.3%	10.2%	10.1%	9.9%	9.8%
SJV Percent of CA	8.3%	8.3%	8.3%	8.2%	8.2%	8.2%	8.2%	8.2%	8.2%
CA Percent of US	11.4%	11.9%	11.9%	12.0%	12.0%	12.1%	12.1%	12.2%	12.2%

Source: Woods and Poole

Table 4 – Woods and Poole Population Projections for California and the San Joaquin Valley Counties, 2010-2050

Jurisdiction	Estimates 2010	Projections 2015	2020	2025	2030	2035	2040	2045	2050
California	37,336,011	39,155,924	41,124,667	43,170,810	45,250,597	47,253,843	49,138,037	50,930,191	52,678,078
Fresno	932,642	977,464	1,040,809	1,107,606	1,176,815	1,245,580	1,312,700	1,378,790	1,445,076
Kern	841,762	885,474	945,171	1,007,841	1,072,459	1,136,332	1,198,261	1,258,708	1,318,690
Kings	152,418	151,342	157,400	163,604	169,781	175,520	180,674	185,354	189,745
Madera	151,154	156,123	164,848	173,958	183,280	192,364	201,032	209,384	217,612
Merced	256,731	269,194	284,894	301,321	318,174	334,674	350,503	365,832	380,990
San Joaquin	687,513	723,300	765,865	810,424	856,176	901,022	944,104	985,882	1,027,237
Stanislaus	515,283	537,458	567,680	599,225	631,489	662,925	692,906	721,780	750,199
Tulare	443,292	462,456	486,127	510,710	535,681	559,731	582,348	603,844	624,780
SJV	3,980,795	4,162,811	4,412,794	4,674,689	4,943,855	5,208,148	5,462,528	5,709,574	5,954,329
Percent Share of Regional Total									
Fresno	23.4%	23.5%	23.6%	23.7%	23.8%	23.9%	24.0%	24.1%	24.3%
Kern	21.1%	21.3%	21.4%	21.6%	21.7%	21.8%	21.9%	22.0%	22.1%
Kings	3.8%	3.6%	3.6%	3.5%	3.4%	3.4%	3.3%	3.2%	3.2%
Madera	3.8%	3.8%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%
Merced	6.4%	6.5%	6.5%	6.4%	6.4%	6.4%	6.4%	6.4%	6.4%
San Joaquin	17.3%	17.4%	17.4%	17.3%	17.3%	17.3%	17.3%	17.3%	17.3%
Stanislaus	12.9%	12.9%	12.9%	12.8%	12.8%	12.7%	12.7%	12.6%	12.6%
Tulare	11.1%	11.1%	11.0%	10.9%	10.8%	10.7%	10.7%	10.6%	10.5%
SJV share of California	10.7%	10.6%	10.7%	10.8%	10.9%	11.0%	11.1%	11.2%	11.3%

Source: Woods and Poole Economics, 2016 State Profile for California.

Table 5 – Department of Finance Population Projections for California and the San Joaquin Valley Counties, 2010-2050

Jurisdiction	Estimates	Projections							
	2010	2015	2020	2025	2030	2035	2040	2045	2050
California	37,341,978	38,896,969	40,619,346	42,373,301	44,085,600	45,747,645	47,233,240	48,574,095	49,779,362
Fresno	932,969	981,681	1,055,106	1,130,406	1,200,666	1,269,714	1,332,913	1,396,837	1,464,413
Kern	846,568	894,492	989,815	1,088,711	1,189,004	1,291,947	1,396,314	1,501,874	1,604,371
Kings	154,276	155,122	167,465	180,355	192,562	205,206	218,394	230,218	240,599
Madera	151,466	157,722	173,146	189,267	204,993	221,824	238,514	255,073	272,384
Merced	256,800	269,572	288,991	313,082	337,798	364,348	389,934	414,895	439,075
San Joaquin	687,095	723,506	766,644	822,755	893,354	966,889	1,037,761	1,104,903	1,171,439
Stanislaus	515,459	538,689	573,794	611,376	648,076	681,703	714,910	748,324	783,005
Tulare	443,487	467,170	498,559	537,015	578,858	616,547	650,819	683,533	715,722
SJV	3,988,120	4,187,954	4,513,520	4,872,967	5,245,311	5,618,178	5,979,559	6,335,657	6,691,008
Percent Share of Regional Total									
Jurisdiction	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Fresno	23.4%	23.4%	23.4%	23.2%	22.9%	22.6%	22.3%	22.0%	21.9%
Kern	21.2%	21.4%	21.9%	22.3%	22.7%	23.0%	23.4%	23.7%	24.0%
Kings	3.9%	3.7%	3.7%	3.7%	3.7%	3.7%	3.7%	3.6%	3.6%
Madera	3.8%	3.8%	3.8%	3.9%	3.9%	3.9%	4.0%	4.0%	4.1%
Merced	6.4%	6.43%	6.4%	6.4%	6.4%	6.5%	6.5%	6.5%	6.6%
San Joaquin	17.2%	17.3%	17.0%	16.9%	17.0%	17.2%	17.4%	17.4%	17.5%
Stanislaus	12.9%	12.9%	12.7%	12.5%	12.4%	12.1%	12.0%	11.8%	11.7%
Tulare	11.1%	11.2%	11.0%	11.0%	11.0%	11.0%	10.9%	10.8%	10.7%
SJV share of California	10.7%	10.8%	11.1%	11.5%	11.9%	12.3%	12.7%	13.0%	13.4%

Source: California Department of Finance.

Table 6 – Caltrans Population Projections for California and the San Joaquin Valley Counties, 2010-2040

Jurisdiction	Estimate	Projections					
	2010	2015	2020	2025	2030	2035	2040
California	37,310,000	38,870,000	40,810,000	42,780,000	44,520,000	46,030,000	47,780,000
Fresno	932,392	978,775	1,037,791	1,093,696	1,147,330	1,200,659	1,254,509
Kern	841,189	882,480	954,191	1,031,474	1,106,477	1,176,052	1,240,496
Kings	152,696	150,746	157,713	165,965	174,888	183,006	190,192
Madera	151,329	156,002	165,177	174,057	183,697	194,350	206,028
Merced	255,897	268,002	284,431	303,043	321,705	340,039	356,585
San Joaquin	686,585	721,120	757,607	790,921	826,222	858,192	886,319
Stanislaus	515,194	534,605	559,097	585,812	612,925	637,626	658,010
Tulare	443,111	463,927	495,937	528,226	557,117	584,304	610,413
SJV	3,978,393	4,155,656	4,411,944	4,673,195	4,930,359	5,174,227	5,402,552
Percent Share of Regional Total							
Fresno	23.4%	23.6%	23.5%	23.4%	23.3%	23.2%	23.2%
Kern	21.1%	21.2%	21.6%	22.1%	22.4%	22.7%	23.0%
Kings	3.8%	3.6%	3.6%	3.6%	3.5%	3.5%	3.5%
Madera	3.8%	3.8%	3.7%	3.7%	3.7%	3.8%	3.8%
Merced	6.4%	6.4%	6.4%	6.5%	6.5%	6.6%	6.6%
San Joaquin	17.3%	17.4%	17.2%	16.9%	16.8%	16.6%	16.4%
Stanislaus	12.9%	12.9%	12.7%	12.5%	12.4%	12.3%	12.2%
Tulare	11.1%	11.2%	11.2%	11.3%	11.3%	11.3%	11.3%
SJV share of California	10.7%	10.7%	10.8%	10.9%	11.1%	11.2%	11.3%

Source: The California Economic Forecast, California County-Level Economic Forecast 2015-2040. Caltrans. September 2015.

Table 7 – Caltrans Employment Projections

Jurisdiction	Estimates			Projections					
	2000	2005	2010	2015	2020	2025	2030	2035	2040
California	14,998,000	15,390,000	14,599,000	16,468,000	17,588,000	18,388,000	19,235,000	20,062,000	20,896,000
Fresno	331,260	348,320	334,170	372,308	402,438	417,765	434,471	452,465	468,817
Kern	244,130	269,240	274,010	325,574	349,389	365,123	381,976	399,987	416,315
Kings	38,310	42,120	42,850	44,634	47,864	50,125	52,538	54,832	57,070
Madera	39,700	44,600	43,600	50,528	55,086	58,107	61,594	65,544	69,608
Merced	64,350	69,840	68,620	77,817	81,728	84,416	87,310	90,647	93,653
San Joaquin	203,610	223,790	206,960	231,235	248,265	258,115	270,680	282,851	295,113
Stanislaus	161,130	175,190	162,700	180,897	194,270	201,929	210,401	219,458	227,710
Tulare	134,140	141,690	144,760	152,678	163,251	168,584	174,310	180,571	187,047
SJV	1,216,630	1,314,790	1,277,670	1,435,671	1,542,291	1,604,162	1,673,281	1,746,355	1,815,334
Percent Share of Region									
Fresno	27.2%	26.5%	26.2%	25.9%	26.1%	26.0%	26.0%	25.9%	25.8%
Kern	20.1%	20.5%	21.4%	22.7%	22.7%	22.8%	22.8%	22.9%	22.9%
Kings	3.1%	3.2%	3.4%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
Madera	3.3%	3.4%	3.4%	3.5%	3.6%	3.6%	3.7%	3.8%	3.8%
Merced	5.3%	5.3%	5.4%	5.4%	5.3%	5.3%	5.2%	5.2%	5.2%
San Joaquin	16.7%	17.0%	16.2%	16.1%	16.1%	16.1%	16.2%	16.2%	16.3%
Stanislaus	13.2%	13.3%	12.7%	12.6%	12.6%	12.6%	12.6%	12.6%	12.5%
Tulare	11.0%	10.8%	11.3%	10.6%	10.6%	10.5%	10.4%	10.3%	10.3%
SJV percent of CA	8.1%	8.5%	8.8%	8.7%	8.8%	8.7%	8.7%	8.7%	8.7%

Source: Caltrans

POPULATION AND DEMOGRAPHIC PROJECTIONS FOR FRESNO COUNTY

According to the most-current population estimate issued by the California Department of Finance, there are 972,297 persons in Fresno County (Table 8). At 574,600 persons, the City of Fresno and its surrounding Sphere of Influence (Fresno SOI) account for almost 60 percent of the county population. There are 114,800 persons (11.8 percent of the county) in Clovis and its SOI (Clovis SOI), making this the next largest area, followed by the Selma SOI area at 26,700 persons (1.2 percent). Between 2015 and 2050, total population in Fresno County is projected to grow by 474,800 persons, or by 48.8 percent over the 35 year period. The Fresno SOI area is projected to grow by 57.3 percent over the 35-year 2015-2050 period, or by 329,200 persons.

Table 8 – ADE Population Projections by Jurisdiction

Jurisdiction	2015	2050	Change	Percent Change
Fresno County	**972,300**	**1,447,090**	**474,790**	**48.8%**
Clovis SOI	114,770	177,210	62,440	54.4%
Coalinga SOI	16,530	21,700	5,170	31.3%
Firebaugh SOI	7,780	11,060	3,280	42.2%
Fowler SOI	6,580	10,710	4,130	62.8%
Fresno SOI	574,590	903,790	329,200	57.3%
Huron SOI	6,820	8,330	1,510	22.1%
Kerman SOI	14,880	21,330	6,450	43.3%
Kingsburg SOI	12,750	18,570	5,830	45.7%
Mendota SOI	11,210	15,690	4,480	40.0%
Orange Cove SOI	9,360	10,480	1,120	12.0%
Parlier SOI	15,100	19,980	4,880	32.3%
Reedley SOI	25,570	35,580	10,010	39.1%
Sanger SOI	26,310	36,100	9,780	37.2%
San Joaquin SOI	4,040	5,750	1,710	42.3%
Selma SOI	26,680	36,550	9,870	37.0%
Balance of County	99,330	114,270	14,940	15.0%

Source: ADE. Note: Totals may not add due to rounding.

The vast majority of persons reside in households. Of the 972,300 persons in Fresno County in 2015, 954,500 (98.1 percent) are in households, versus 17,800 (1.9 percent) who are in group quarters (Table 9). The number of persons in group quarters is projected to increase to 26,150 persons in 2050. However, at 1.8 percent of total population, the share of persons in group quarter in 2050 is similar to the current share. The average household size for the county is projected to fluctuate slightly over the next ten years, hovering around 3.19 and 3.13, but then increase gradually to 3.35 by 2050.

Table 9 –Projections of Household and Group Quarters Populations

Year	Total Number of Persons	Persons in Households	Persons in Group Quarters	Number of Households	Average Household Size
2015	972,300	954,410	17,890	299,450	3.19
2020	1,047,440	1,028,750	18,690	328,300	3.13
2025	1,122,840	1,102,610	20,230	348,120	3.17
2030	1,191,850	1,170,080	21,770	362,860	3.22
2035	1,258,860	1,236,110	22,750	375,290	3.29
2040	1,323,070	1,299,170	23,900	388,930	3.34
2045	1,383,690	1,358,690	25,000	405,260	3.35
2050	1,447,090	1,420,940	26,150	424,480	3.35
15-50 Chng	**474,790**	**466,530**	**8,260**	**125,030**	
15-50 CAGR	1.14%	1.14%	1.09%	1.00%	

Source: ADE (note: CAGR = compound annual growth rate)

There are 299,450 households in Fresno County, according to the California Department of Finance (Table 10). The number of households in the County is projected to grow by 125,030, up to a total of 424,480 in 2050. Households in the Fresno SOI area are projected to grow by 86,420 between 2015 and 2050, going from 181,800 to 268,260. Areas such as Clovis SOI are projected to grow considerably as well, adding 18,210 households on top of the 2015 base of 40,700 households.

Table 10 - ADE Projections of Households

Jurisdiction	2015	2050	Change	Percent Change
Fresno County	**299,450**	**424,480**	**125,030**	**41.8%**
Clovis SOI	40,660	58,870	18,210	44.8%
Coalinga SOI	4,000	4,960	960	23.9%
Firebaugh SOI	2,000	2,670	670	33.3%
Fowler SOI	2,060	3,150	1,090	52.6%
Fresno SOI	181,830	268,260	86,420	47.5%
Huron SOI	1,570	1,790	230	14.5%
Kerman SOI	4,110	5,530	1,410	34.4%
Kingsburg SOI	4,340	5,930	1,590	36.6%
Mendota SOI	2,500	3,280	780	31.2%
Orange Cove SOI	2,160	2,270	110	5.0%
Parlier SOI	3,480	4,320	840	24.1%
Reedley SOI	7,020	9,160	2,140	30.5%
Sanger SOI	7,320	9,410	2,100	28.6%
San Joaquin SOI	900	1,200	300	33.5%
Selma SOI	7,470	9,600	2,130	28.5%
Uninc. Area excl. SOIs	28,000	34,070	6,060	21.7%

Source: ADE, Inc. Note: Totals may not add due to rounding.

Average household incomes are projected to increase in real dollar terms during the projection period. In the short term this will be driven by implementation of the State's minimum wage law. Over the longer term, incomes will increase with the shift in employment from agriculture to professional services and health care types of jobs. Table 11 projects the distribution of households by income category ($2015).

Table 11 – Fresno County Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	23,980	23,360	21,700	19,310	18,290	17,430	16,770	16,510
$10,000 to $24,999	59,340	57,820	53,700	47,780	45,260	43,140	41,510	40,860
$25,000 to $34,999	34,700	33,810	31,400	27,940	26,460	25,220	24,270	23,890
$35,000 to $49,999	40,030	45,060	42,340	38,270	36,250	34,550	33,240	32,730
$50,000 to $74,999	52,750	62,760	74,230	85,630	82,330	81,160	82,030	80,760
$75,000 to $99,999	33,420	39,760	47,030	54,250	62,840	70,650	78,190	85,730
$100,000 to $149,999	33,700	40,090	47,420	54,700	63,360	71,240	78,840	87,840
$150,000 or more	21,540	25,630	30,320	34,970	40,510	45,540	50,400	56,150
Total	**299,450**	**328,300**	**348,120**	**362,860**	**375,290**	**388,930**	**405,260**	**424,480**
Mean Income	**$63,920**	**$67,590**	**$72,490**	**$77,540**	**$82,120**	**$85,850**	**$88,890**	**$91,790**
CAGR		**1.1%**	**1.4%**	**1.4%**	**1.2%**	**0.9%**	**0.7%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

The following tables present county-level projections for various demographic attributes. As indicated in the table below, while the population as a whole is projected to grow annually by 1.1 percent between 2015 and 2050, certain age cohorts are projected to grow at a faster rate. The number of persons between 65 and 74 is expected to grow annually by 1.9 percent, while the number of those 75 and over will grow by 3.0 percent a year (Table 12). As a percentage of total population, persons 65 and over will comprise 17.7 percent of the total population in 2050, versus their current 11.5 percent share. While the median age will go from 31 to 35, the age of persons at the 80th percentile is projected to go from 55 to 62.

Of the 972,300 persons in Fresno County, Latinos are the largest racial\ethnic category at 506,800 (52.1 percent of the total), with Whites-Not Latinos second at 301,300 (31.0 percent)(Table 13). The number of Latinos is projected to grow to 919,300 (63.5 percent) in 2050, or by 412,500 persons between 2015 and 2050. Whites are projected to grow over the next ten years but then gradually decrease to 299,600, slightly below their current level.

Table 12 - Trends and Projections in Total Number of Persons in Fresno County by Age

Age Group	2015	2050	15-50 Change	15-50 CAGR*	'15 Share	'50 Share
Fresno County	972,300	1,447,100	474,800	1.1%	100.0%	100.0%
5 and below	91,400	131,900	39,100	1.0%	9.5%	9.1%
6 to 14	137,200	182,800	48,600	0.9%	14.1%	12.8%
15 to 19	74,700	96,300	24,000	0.8%	7.7%	6.8%
20 to 24	80,500	95,300	16,500	0.5%	8.3%	6.7%
25 to 34	144,200	183,800	41,800	0.7%	14.8%	12.8%
35 to 44	118,300	171,100	52,500	1.1%	12.2%	11.8%
45 to 54	113,300	162,500	47,400	1.0%	11.6%	11.1%
55 to 64	101,300	162,400	59,300	1.3%	10.4%	11.1%
65 to 74	63,900	125,400	59,900	1.9%	6.6%	8.5%
75 and above	47,600	135,500	85,600	3.0%	4.9%	9.2%
20th percentile age	*12*	*13*				
Median age	*31*	*35*				
80th percentile age	*55*	*62*				

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 13 – Projection of Total Population by Race\Ethnicity, Fresno County: 2015 – 2050

	All	White	Latino	Asian	Black	Other
2015	972,300	301,300	506,800	92,300	46,200	25,700
2020	1,047,400	306,800	563,700	100,300	49,200	27,500
2025	1,122,800	310,400	622,700	108,300	52,200	29,300
2030	1,191,800	309,900	681,200	115,100	54,600	31,100
2035	1,258,900	307,100	741,500	121,000	56,500	32,700
2040	1,323,100	302,500	802,600	126,100	57,900	34,000
2045	1,383,700	300,400	860,000	130,000	58,600	34,800
2050	1,447,000	299,600	919,300	134,000	59,000	35,300
2015-2050	474,700	-1,700	412,500	41,700	12,800	9,600

Source: ADE

Of the 972,300 persons in Fresno County in 2015, 212,100 (21.8 percent) are ages 5 to 18 (Table 14). The California Department of Finance (DOF) projects the number of K-12 public school students through 2025 based on their own demographic projections, which are higher than the ADE population projections. The DOF trend shows a slightly declining share of school age children actually enrolled in school, a trend that is corroborated by State Department of Education studies of recent past trends. ADE projected this trend forward using our own demographic projections for Fresno County as shown in Table 14. We project K-12 public school enrollment to increase to 256,100 in 2050, or 59,100 more than the 2015 figure of 197,000.

Table 14 - Fresno County Public School Enrollment of School-Age Children

Year	Total School-Age Youth (5 to 18)	ADE Projections K-12 Enr. Projections	Participation Rate
2015	212,100	197,000	92.9%
2020	219,400	203,100	92.6%
2025	229,900	212,000	92.2%
2030	240,600	221,100	91.9%
2035	252,800	231,500	91.6%
2040	261,500	238,500	91.2%
2045	268,700	244,300	90.9%
2050	282,800	256,100	90.6%
2015-2050 chg	70,700	59,100	
15-50 CAGR*	0.8%	0.8%	

Source: ADE, Inc., based on DOF, California Public K–12 Graded Enrollment and High School Graduate Projections by County — 2015 Series and ADE population projections.

Taking into account population projections, household projections, vacant stock, and other factors such as healthy vacancy rates and residential replacement units, we project a need for 129,180 new residential units over the 35-year 2015 to 2050 period. Based on previous five years-worth of building permits data for each city in Fresno County and California DOF E5 reports, we estimate that, of the 129,180 required units, 97,900 (75.8 percent) will be single-family units, with the balance of 31,280 (24.2 percent) as multi-family (Table 15).

EMPLOYMENT PROJECTIONS

Total jobs in Fresno County are projected to increase by 133,900 jobs, from 372,400 in 2015 to 506,300 in 2050. This reflects a 0.9 percent compound annual growth rate (CAGR) over the entire period, but as shown at the bottom of Table 16, the growth rates are higher in the early years and are lower further into the future. Health care shows the highest growth rate, followed by non-manufacturing industrial sectors, retail, and education. Office and Hospitality jobs grow faster on average than total employment. Despite anticipated growth in certain food processing and durable manufacturing sectors, overall growth in manufacturing is flat during most of the projection period and begins to decline slightly after 2035. Agriculture jobs grow in the early years but then stabilize after 2045. Please see the Methodology Chapter for discussion of the economic trends affecting these projections.

Table 15 - New Units Required Over 35-Year 2015-2050 Period by Unit Building Type

JURISDICTION	NEW UNITS REQUIRED 2015-2050	SFU	MFU
Fresno County	129,180	97,900	31,280
Clovis SOI	18,770	13,800	4,970
Coalinga SOI	990	300	690
Firebaugh SOI	690	500	190
Fowler SOI	1,120	800	320
Fresno SOI	89,370	69,370	20,000
Huron SOI	240	100	140
Kerman SOI	1,460	500	960
Kingsburg SOI	1,640	1,400	240
Mendota SOI	810	500	310
Orange Cove SOI	110	100	10
Parlier SOI	870	600	270
Reedley SOI	2,210	600	1,610
Sanger SOI	2,160	1,600	560
San Joaquin SOI	310	200	110
Selma SOI	2,190	1,800	390
Uninc. excl. SOIs	6,240	5,740	500

Source: ADE, based on US Census Construction Building Permits database (2010-2015) and Calif. DOF E5.

Table 16 – Fresno County Employment Projections by Sector, 2015-2050

JOB SECTOR	2015	2020	2025	2030	2035	2040	2045	2050	CAGR
Agriculture	47,500	48,000	48,500	49,400	50,000	50,400	50,500	50,400	0.2%
Mfg./Mining	26,000	26,000	26,000	26,000	26,000	25,800	25,600	25,400	-0.1%
Other Industrial	52,200	56,500	60,400	64,000	67,700	71,300	74,300	77,500	1.1%
Retail	36,100	40,750	42,200	44,400	46,900	49,000	50,800	52,800	1.1%
Office	46,000	49,600	53,600	56,400	58,800	61,200	63,300	65,200	1.0%
Education	40,000	42,200	44,500	47,100	51,000	53,600	55,800	58,200	1.1%
Health Services	59,000	66,300	74,500	78,100	81,500	85,000	88,600	92,300	1.3%
Hospitality	32,700	35,400	38,500	41,400	43,500	44,800	45,700	46,500	1.0%
Government	32,900	33,300	33,800	34,400	34,700	35,700	36,700	38,000	0.4%
Total	**372,400**	**398,050**	**422,000**	**441,200**	**460,100**	**476,800**	**491,300**	**506,300**	**0.9%**
Total CAGR		1.3%	1.2%	0.9%	0.8%	0.7%	0.6%	0.6%	

Source: ADE Inc. (note: CAGR = compound annual growth rate)

Table 17 shows the total jobs projections for the Spheres of Influence (SOI) for each of the cities plus the unincorporated county area. As discussed further in the Methodology Chapter below, the city projections reflect recent trends in the share of basic sector employment for each of the cities plus future projected population growth that affects local-serving sectors such as retail, education and government jobs. It is anticipated that the metropolitan area of the county will continue to see the bulk of job growth and both Clovis and Fresno will increase their shares of county employment over the course of the projection period. However, the projections also reflect current development projects in each of the smaller cities as well. The last chapter of the report provides historical employment trends for each of the cities plus detailed job projections by industry.

Table 17 - ADE Employment Projections by City, 2015-2050

Jurisdiction	2015	2020	2025	2030	2035	2040	2045	2050	2015 Dstrbtn	2050 Dstrbtn
County	**372,400**	**398,100**	**422,000**	**441,200**	**460,100**	**476,800**	**491,300**	**506,300**	**100.0%**	**100.0%**
Clovis	32,400	34,680	36,640	38,560	40,460	42,270	43,970	45,740	8.7%	9.0%
Coalinga	2,820	3,050	3,160	3,290	3,420	3,540	3,660	3,780	0.8%	0.7%
Firebaugh	1,140	1,260	1,280	1,340	1,410	1,470	1,520	1,580	0.3%	0.3%
Fowler	2,400	2,770	2,890	3,030	3,170	3,300	3,420	3,540	0.6%	0.7%
Fresno	231,560	248,500	266,150	278,370	291,470	303,650	314,730	326,450	62.2%	64.5%
Huron	730	840	840	860	870	890	900	910	0.2%	0.2%
Kerman	2,680	2,890	3,130	3,290	3,440	3,580	3,720	3,860	0.7%	0.8%
Kingsburg	3,540	3,970	4,190	4,390	4,600	4,790	4,960	5,150	1.0%	1.0%
Mendota	890	900	910	950	990	1,030	1,060	1,100	0.2%	0.2%
Orange Cove	540	630	660	670	690	700	710	720	0.1%	0.1%
Parlier	2,230	2,380	2,530	2,630	2,720	2,810	2,890	2,970	0.6%	0.6%
Reedley	5,770	7,010	7,570	7,940	8,310	8,660	8,990	9,330	1.5%	1.8%
Sanger SOI	5,490	5,940	6,260	6,520	6,770	7,010	7,220	7,450	1.5%	1.5%
San Joaquin SOI	500	520	560	590	610	640	660	690	0.1%	0.1%
Selma	5,550	6,330	6,620	6,920	7,210	7,460	7,680	7,910	1.5%	1.6%
Incorporated	298,240	321,670	343,390	359,350	376,140	391,800	406,090	421,180	80.1%	83.2%
Balance	74,160	76,380	78,610	81,840	83,970	85,010	85,210	85,120	19.9%	16.8%

Source: ADE

METHODOLOGY

The study process began by developing a range of total population and employment projections for the county as a whole, reflecting varying assumptions about Fresno County's future share of regional growth as well as trends in industry growth. The employment projection methodology used an economic base approach, forecasting export industry sectors, while local serving business sectors follow growth in the economic base and in the population.

ADE consulted a variety of data sources on employment, population and demographic data. A brief description of these sources is provided below.

CA Employment Development Department (EDD). Data includes historical labor force and wage and salary jobs by industry from 1990 to 2015 actual from the Census of Employment and Wages (CEW) and 2012 to 2022 projected. ADE used the 2015 figures as the baseline for our employment projections and extrapolated the projections to the 2015 to 2025 time frame to align with other projection data.

CA Department of Finance (DOF). ADE used the 2015 total population estimate as the baseline for the population projections. DOF provides population projections in five year increments from 2010 to the year 2060, including age cohort, gender and race/ethnicity. DOF also provides data on birth and death rates and net migration through the year 2023. The fertility and mortality rates are estimated by the CA Department of Health.

The California Economic Forecast (Caltrans). Caltrans has commissioned Dr. Mark Schneipp at the California Economic Forecast to produce projections for the state and all 58 counties. The projections published in 2015 extend to 2040 and provide a wide range of indicators including employment by major industry group, population, housing and economic output.

Wood and Poole (W&P). W&P is an independent economic forecasting firm who provides projections for all counties in the US based on an econometric model that forecasts US economic conditions and creates state, regional and county forecasts based on changing conditions. The 2016 projections were just released in April 2016 and extend to 2050, including population, employment by major industry and a number of other indicators. W&P uses the US Bureau of Economic Analysis (BEA) definition of employment which includes self-employed and other non-employer jobs. The job figures therefore are always higher than wage and salary employment but the growth rates provide a good projected economic growth in the county.

Economic Modeling Specialists Institute (EMSI). A private data vendor that uses EDD data but provides estimates of current employment without the time lag from EDD data releases, and also at a much greater level of industry detail. EMSI provides projections for the 2015 to 20I5 period as well as detailed occupational demand projections. The EMSI employment projections are very similar to the most recent EDD projections for Fresno County.

IMPLAN Input-Output Model. IMPLAN provides I-O models for all counties and down to the zip code level. The model provides employment, output and labor income multipliers for more than 500 industry categories.

California Department of Public Health. An important input into the population cohort survival model we developed to project future population was data birth- and death-rate data by race, gender, and age. Since the state of the economy influences births and birth rates, we generated race- and age-specific birth rates based on birth data covering nine years (2001-2009), particularly to control for possible effects of the Great Recession on the number of births in and birth rates for 2008 and 2009. In generating age-, gender-, and race-specific death rates, we again use detailed morbidity data from California Department of Public Health. With regard to race, we devised death-rates for eight racial\ethnic categories that correspond to the eight racial categories for which we gathered 2010 US Census Decennial 2010 city-level population data (Hispanic, White-Not Hispanic, Asian-Not Hispanic, Black-Not Hispanic, Native American-Not Hispanic, Pacific islander-Not Hispanic, Two-or-More-Not Hispanic, and Other-Not Hispanic). Our birth data was similarly organized with regard to race\ethnicity.

Public Use Micro Data (PUMS). PUMS provides the raw responses to the census surveys collected through the American Community Survey (ACS). ADE used the 3-year 2012-2014 data sample for Fresno County to run crosstabs of demographic, housing and income data by employment sector. The total figures shown in the tables in the report correspond to the total labor force data published in the ACS.

COUNTYWIDE EMPLOYMENT PROJECTIONS

In preparing the initial draft projections ADE sought to identify the range of potential population and employment growth levels based on state and regional economic trends. For both population and employment, the Caltrans projections allocate the lowest level of growth to Fresno County. Although the Caltrans statewide population figure for 2040 is higher than the DOF figure, the Caltrans projections for both SJV and Fresno County are lower. The DOF projections represent the high end of the population growth spectrum, mainly due to higher growth rates over the next ten years. After 2025 the DOF population growth rates are very similar to those from W&P. To construct the population projections, ADE began with the 2015 DOF population estimate, which is about 9,000 people lower than DOF's projection series had estimated, and then applied the annual growth rates for both Caltrans and DOF to create a low and a high projection trend.

For employment, the state Employment Development Department (EDD) projections show more substantial growth in the short term, while W&P projects higher growth rates than Caltrans beyond 2020. The ADE employment projections were constructed in several steps. We first analyzed projected employment growth in the economic base sectors for Fresno County, which include farm jobs and agricultural services, natural resources and mining, manufacturing, which is mainly food processing but also includes some durable goods manufacturing, and the logistics sectors of transportation, warehousing and wholesale. Tables 18 and 19 show the EDD and Caltrans projections for these sectors. ADE began with the EDD 2015 Census of Employment and Wages (CEW) figures as the baseline and applied the growth rates from the EDD and Caltrans projections shown above in Table 2. Subsequently, as discussed below for the city-level projections, ADE calibrated the base year 2014 employment figures to the COG GIS estimates, which are slightly higher than the EDD figures.

The high projections mainly reflected higher growth rates in agriculture related employment, including agricultural services and in distribution sectors (transportation, warehousing, wholesale). However, the low projections actually have higher growth in the non-durable manufacturing sector, which is food processing. Each of these trends has some validity, based on research ADE has conducted for the regional Workforce Investment Boards. While farm labor is declining, agricultural services jobs are increasing, even beyond farm labor contracting. These trends are due to worsening labor economics in the farm sector, leading to continuing increased mechanization in agricultural production. However with the increased mechanization, comes increased demand for more skilled labor to maintain and operate the machines and also to provide specialized crop services. In the food processing sector, continued consumer demand is driving growth in a number of sectors, particularly poultry, cheese and dairy products, and nuts. However, other manufacturing sectors are showing declines, leading to flat net growth in manufacturing.

Table 18 - Employment Development Department Economic Base Job Estimates and Projections

Industry	2000	2005	2010	2015	2020	2025
Total Farm	**55,600**	**46,400**	**46,000**	**47,300**	**52,052**	**55,294**
Mining and Logging	400	200	200	300	235	181
Durable Goods	12,300	10,300	8,000	8,300	8,300	8,501
Nondurable Goods	15,300	16,800	16,100	17,200	18,298	19,705
Transportation, Warehousing	7,600	7,800	9,000	10,000	10,600	11,200
Wholesale Trade	12,200	12,700	11,500	13,800	13,658	13,846
Total Economic Base	**103,400**	**94,200**	**90,800**	**96,900**	**103,143**	**108,727**

Source: California Employment Development Department, extrapolated by ADE from the 2012-2022 projections.

Table 19 – Caltrans Estimates and Projections of Fresno County Economic Base Industries

Industry	2000	2005	2010	2015	2020	2025	2030	2035	2040
Farm	**55,580**	**46,380**	**46,010**	**48,629**	**50,518**	**50,841**	**51,096**	**51,348**	**51,601**
Natural Resources and Mining	360	200	200	303	323	298	298	302	306
Durable Manufacturing	12,330	10,330	8,030	7,972	8,127	8,360	8,569	8,750	8,897
Non-Durable Manufacturing	15,270	16,850	16,100	15,811	16,081	16,321	16,570	16,805	17,025
Trans, Warehousing, Util	9,060	9,410	10,830	12,120	13,112	14,105	15,061	16,027	17,021
Wholesale Trade	12,160	12,660	11,510	14,148	14,508	14,636	14,768	14,903	15,041
Total Economic Base	**104,760**	**95,830**	**92,680**	**98,982**	**102,669**	**104,562**	**106,362**	**108,136**	**109,891**

Source: Caltrans

ADE projected local-serving employment sectors in two stages. In the first stage, we obtained business to business employment multipliers from the IMPLAN input-output model for Fresno County. These "indirect" multipliers provided data on demand for local serving goods and services by the basic employment sectors. Secondly, ADE developed a set of population based multipliers to generate business employment from residential demand. ADE reviewed 25 years of history from the EDD dataset to capture trends in population related demand for service sectors. Interestingly, there is a trend toward fewer jobs in the retail and other local-serving sectors, due to increased business consolidation, increasing scale in stores and increased internet sales. For health care, ADE used the recent projection from Economic Modeling Specialists Institute (EMSI), which captures the changing nature of health care delivery and the increasing demand from the aging baby boomer demographic.

Following review of the initial range of projections by the Technical Advisory Committee, the study team reached out to each of the city and county jurisdictions to review local planning policies and growth projections based on existing general plans and other plans. In addition, most jurisdictions provided information about projects currently planned or under construction. This provided the basis for determining the most likely growth trajectory for the county in the short to medium time frames. The most recent city general plans (Clovis and Fresno) extend to 2035.

NOTES ON REGIONAL COMMUTE PATTERNS

In order to more fully account for potential job growth factors, ADE analyzed the regional commute patterns and the degree to which Fresno County jobs are held by workers from outside of the county. In general, Fresno County has a very high proportion of local workers filling jobs within the county, with over 91 percent of the local labor force working at jobs inside Fresno County (Table 20). In addition, the total jobs (361,500 positions in 2014) match very closely with the size of the labor force (365,305 workers aged 16 years and over).[1] [2] In 2014, about 39,515 jobs in Fresno County were held by workers commuting in from the surrounding region. The counties with the largest number of in-commuters were Madera and Tulare counties, each of which had over 10,000 workers commute into Fresno County.

The commute pattern data came from a variety of different sources. The estimated number of workers in the Fresno County labor force (and surrounding counties) came from the Census Bureau's American Community Survey (ACS), 2010-2014 five-year sample data. The ACS data also identified the number of workers that worked inside of the county of residence. The 2010-2014 ACS data showed a total of 321,984 workers that both lived and worked in Fresno County.

While the ACS data focuses on the labor force, the total job count came from the California Employment Development Department (EDD), Labor Market Information Division (LMID). The total in-commute into Fresno County was estimated by subtracting the total jobs from the total number of Fresno County residents that also worked in the county.

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[1] Job count comes from the California Employment Development Department, Labor Market Information Division.
[2] Labor force data comes from the Census Bureau, American Community Survey, 2006-2010 and 2010-2014 five-year sample.

In order to identify where the in-commuters came from, the analysis used the Inflow-Outflow data from the U.S. Census Bureau, Longitudinal Employer-Household Dynamics (LEHD) database. For each of the counties surrounding Fresno County, in addition to San Joaquin and Stanislaus counties, ADE identified the percentage of out-commuting workers in the LEHD database that commute to Fresno County. This percentage was applied to the total number of workers that work outside of each surrounding county, as identified in the ACS labor force data.

Table 20 – Regional Commute Patterns: 2010 and 2014

2010 - Data Source and Indicator	Fresno	Kern	Kings	Madera	Merced	Monterey	San Benito	San Joaquin	Stanislaus	Tulare
ACS Workers 16 years and over	351,673	304,506	56,356	46,267	91,438	176,845	23,907	262,119	201,003	161,697
ACS Percent Working in County of Residence	92.4%	92.7%	79.8%	66.6%	74.9%	89.6%	51.1%	73.9%	78.1%	86.9%
ACS Workers Working in County of Residence	324,946	282,277	44,972	30,814	68,487	158,453	12,216	193,706	156,983	140,515
ACS Workers Working Outside County of Residence	26,727	22,229	11,384	15,453	22,951	18,392	11,691	68,413	44,020	21,182
ACS Calculated Workers Working in Fresno County		**1,277**	**3,513**	**7,307**	**2,253**	**691**	**280**	**1,492**	**1,792**	**5,468**
LEHD Workers Working in Fresno County	**234,356**	**4,626**	**6,719**	**11,527**	**4,067**	**1,743**	**296**	**2,501**	**3,129**	**13,659**
LEHD Percent of Out commuters Working in Fresno County		5.7%	30.9%	47.3%	9.8%	3.8%	2.4%	2.2%	4.1%	25.8%
LEHD Total All Jobs		266,286	43,529	44,521	80,921	144,765	19,422	233,190	177,638	145,621
LEHD Workers Working in County of Residence		185,787	21,755	20,143	39,489	98,363	7,050	118,483	100,777	92,705
LEHD Out commute		80,499	21,774	24,378	41,432	46,402	12,372	114,707	76,861	52,916
EDD Total Jobs	336,600									
EDD Jobs Held by Workers Outside Fresno County	**11,654**	**618**	**1,701**	**3,538**	**1,091**	**334**	**135**	**722**	**868**	**2,647**

2014 - Data Source and Indicator	Fresno	Kern	Kings	Madera	Merced	Monterey	San Benito	San Joaquin	Stanislaus	Tulare
ACS Workers 16 years and over	352,667	312,996	53,699	42,533	92,426	177,092	24,447	266,476	199,368	165,479
ACS Percent Working in County of Residence	91.3%	93.9%	77.3%	68.9%	73.7%	88.7%	49.0%	73.1%	77.5%	85.3%
ACS Workers Working in County of Residence	321,985	293,903	41,509	29,305	68,118	157,081	11,979	194,794	154,510	141,154
ACS Workers Working Outside County of Residence	30,682	19,093	12,190	13,228	24,308	20,011	12,468	71,682	44,858	24,325
ACS Calculated Workers Working in Fresno County		**1,124**	**3,608**	**6,161**	**2,302**	**768**	**323**	**1,362**	**1,694**	**6,937**
LEHD Workers Working in Fresno County	**243,014**	**4,787**	**7,341**	**13,111**	**4,437**	**2,041**	**362**	**2,502**	**3,230**	**15,874**
LEHD Percent of Out commuters Working in Fresno County		5.9%	29.6%	46.6%	9.5%	3.8%	2.6%	1.9%	3.8%	28.5%
LEHD Total All Jobs	343,773	288,501	46,313	49,526	88,408	156,639	21,570	257,794	192,245	151,054
LEHD Workers Working in County of Residence		207,173	21,512	21,377	41,563	103,461	7,618	126,074	106,730	95,389
LEHD Out commute		81,328	24,801	28,149	46,845	53,178	13,952	131,720	85,515	55,665
EDD Total Jobs	361,500									
EDD Jobs Held by Workers Outside Fresno County	**39,515**	**1,829**	**5,872**	**10,027**	**3,747**	**1,250**	**526**	**2,216**	**2,758**	**11,290**

Source: American Community Survey, CA Employment Development Department, Longitudinal Employer Household Dynamics.

Notes: ACS data for 2010 is based on the 2006-2010 five-year sample, while the 2014 data is based on the 2010-2014 five-year sample.

COUNTYWIDE AND CITY-LEVEL POPULATION PROJECTIONS

This section of the report presents our findings with regard to city- and county-level population projections. We begin first by discussing the model we developed to project population in Fresno County. Then, we present our findings with regard to each city's population projections to the year 2050, including the number of new housing units needed to support future population increases.

POPULATION COHORT SURVIVAL MODEL

The City population and household projections are derived via a population cohort survival model developed by Applied Development Economics. ADE began the model by first obtaining Decennial 2010 Census total population data for each city in Fresno County and for the County as a whole. Specifically, we utilized 2010 Census "PCT 12H" through "PCT 12O," which identifies persons by age, gender, and race-and-ethnicity.[3] As we were seeking to track population trends and projections at the city and Sphere of Influence (SOI) levels, we adjusted each city's Census 2010 data to account for their respective SOI, making sure to reduce 2010 population estimates for unincorporated Fresno County in a corresponding manner. We then applied age- and race-adjusted birth-rate and death rate factors to project the 2010 Census data forward to 2015, in an effort to estimate the natural change in population from 2010 to 2015. We further compared the 2015 natural change population to California DOF "E5" 2015 city and county population estimates, attributing city- and County-level differences between the two data sets to in-migration or, as the case may be, out-migration. The 2015 natural change population for each city and SOI was then adjusted to the DOF 2015 population estimate (which was also SOI-adjusted), meaning that persons by specific age, race-ethnicity, and gender categories in the 2015 natural change output were adjusted on a pro-rata basis with the DOF city-SOI 2015 estimate.

We then applied the population cohort survival method to the 2015 data for each subsequent year out to 2050. The city and SOI-level natural change population, along with the 2020 natural change population for the unincorporated areas excluding SOIs, was summed and that sum was then compared to a county-wide 2020 total population projection obtained separately. Outside of the population cohort survival method, ADE arrived at the overall County-level 2020 population projection by growing the DOF's 2015 "E5" Fresno County population estimate in accordance with Fresno County-specific growth rates (2015-2020) obtained from another DOF data series ("P3") on population projections. ADE attributed the difference between its 2020 natural change County-level projection and the DOF 2020 P3-based County-level projection to either in-migration or out-migration (as the case warrants), and applied the County-level migration rates to each cities' 2020 natural change

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[3]Using the "PCT12" data series from the US Census Decennial 2010 population count, we were able to separate persons by over 100 age categories (i.e. "1", "2", "3",…) and, most importantly, by eight mutually-exclusive racial\ethnic categories. These are: "Hispanic", "White-Not Hispanic," "Black-Not Hispanic", "Asian-Not Hispanic", "Pacific Islander-Not Hispanic", "Native American-Not Hispanic", "Other-Not Hispanic," and "Two or More-Not Hispanic."

population, so that the sum of the cities (and SOIs), along with the unincorporated area, equals ADE's County-level P3-based projection. City total population figures were also adjusted to reflect historical growth between 2002 and 2014 as well as the long term development capacity from the general plans. ADE then continued projecting each city's total population in the manner described here for each succeeding year to 2050.

Having established baseline total population estimates and projections for each city-and-SOI and for unincorporated Fresno County (excluding SOIs), ADE then adjusted the total population in an effort to track persons in households. To this end, ADE utilized persons in household and group quarters estimates and projections issued by the California DOF for Fresno County for the years 2015 through 2030. Once ADE projected number of persons in households for each area, we then obtained Fresno County-specific current and future persons-per-household estimates generated by three separate sources (i.e. Woods and Poole, US Census American Community Survey, and California Department of Finance), dividing the total number of persons in households by current and future average household sizes to project the number of future households for each city-SOI area and unincorporated Fresno County. Taking into account existing stock of vacant units in each city (as reported in the California DOF E5 data series), city-specific healthy vacancy rates, and a uniform housing unit replacement factor of 0.58 percent, we then converted the projected number of households into housing units needed by each city between 2015 and 2050, to accommodate projected household growth over the same period.

CITY-LEVEL POPULATION PROJECTIONS

There are currently 972,300 people in Fresno County, according to the California DOF. We project Fresno County's to grow to 1,447,100 persons in the year 2050 (Table 20). In other words, the County will grow by 474,900 persons over the next 35 years, for annual growth rate of 1.1 percent. At 574,600, the City of Fresno and its SOI (Fresno SOI) contains 59.1 percent of the county's population, with the share projected to increase slightly to 60.6 percent in 2050. In terms of sheer numbers, the Fresno SOI is expected to grow by 329,200 people over the 35-year 2015-2050 period. Clovis SOI is projected to add 62,440 persons over the 2015-2050 period, based on this area's demographic attributes that influence birth rates and death rates, as well as anticipated migration patterns. There are 114,800 persons in the Clovis SOI right now, which is projected to increase to 177,210 by 2050 (Table 21). We project the number of households in the County as a whole to grow to 424,480 in 2050, up by 125,030 between 2015 and 2050 (Table 22). Currently, there are 299,300 households in the County, with the bulk of households at 181,800 (60.7 percent) in the Fresno SOI area.

Table 21 – Projection of Total Population: Fresno County and Local Jurisdictions: 2015 – 2050

Jurisdiction	2015	2020	2025	2030	2035	2040	2045	2050	15-50 Change	15-50 CAGR*
Fresno County	**972,300**	**1,047,440**	**1,122,840**	**1,191,850**	**1,258,860**	**1,323,070**	**1,383,690**	**1,447,090**	**474,790**	**1.1%**
Clovis SOI	114,770	126,850	136,350	145,050	153,490	161,580	169,220	177,210	62,440	1.2%
Coalinga SOI	16,530	17,350	18,170	18,920	19,650	20,350	21,010	21,700	5,170	0.8%
Firebaugh SOI	7,780	8,370	8,880	9,340	9,790	10,220	10,630	11,060	3,280	1.0%
Fowler SOI	6,580	7,240	7,890	8,490	9,070	9,630	10,160	10,710	4,130	1.4%
Fresno SOI	574,590	624,040	676,820	725,120	772,030	816,980	859,410	903,790	329,200	1.3%
Huron SOI	6,820	7,430	7,600	7,750	7,900	8,050	8,180	8,330	1,510	0.6%
Kerman SOI	14,880	15,900	16,930	17,860	18,770	19,650	20,470	21,330	6,450	1.0%
Kingsburg SOI	12,750	13,670	14,590	15,440	16,260	17,050	17,790	18,570	5,830	1.1%
Mendota SOI	11,210	11,920	12,630	13,280	13,920	14,520	15,090	15,690	4,480	1.0%
Orange Cove SOI	9,360	9,540	9,710	9,880	10,030	10,190	10,330	10,480	1,120	0.3%
Parlier SOI	15,100	15,870	16,640	17,350	18,040	18,700	19,330	19,980	4,880	0.8%
Reedley SOI	25,570	27,150	28,740	30,200	31,610	32,960	34,240	35,580	10,010	0.9%
Sanger SOI	26,310	27,860	29,410	30,840	32,220	33,540	34,790	36,100	9,780	0.9%
San Joaquin SOI	4,040	4,310	4,580	4,830	5,070	5,310	5,520	5,750	1,710	1.0%
Selma SOI	26,680	28,250	29,810	31,250	32,640	33,980	35,240	36,550	9,870	0.9%
Uninc. exc. SOIs	99,330	101,710	104,080	106,250	108,350	110,370	112,280	114,270	14,940	0.4%

Source: ADE

Table 22 – ADE Projections of Households

Jurisdiction	2015	2020	2025	2030	2035	2040	2045	2050	15-50 Change	15-50 CAGR*
Fresno County	**299,450**	**328,300**	**348,120**	**362,860**	**375,290**	**388,930**	**405,260**	**424,480**	**125,030**	**1.0%**
Clovis SOI	40,660	45,140	47,970	50,090	51,880	53,830	56,150	58,870	18,210	1.1%
Coalinga SOI	4,000	4,270	4,400	4,480	4,570	4,670	4,800	4,960	960	0.6%
Firebaugh SOI	2,000	2,170	2,270	2,350	2,410	2,480	2,570	2,670	670	0.8%
Fowler SOI	2,060	2,280	2,460	2,600	2,720	2,840	2,980	3,150	1,090	1.2%
Fresno SOI	181,830	198,420	212,740	223,700	233,120	243,160	254,770	268,260	86,420	1.1%
Huron SOI	1,570	1,710	1,730	1,740	1,730	1,740	1,760	1,790	230	0.4%
Kerman SOI	4,110	4,410	4,640	4,810	4,950	5,100	5,300	5,530	1,410	0.9%
Kingsburg SOI	4,340	4,670	4,930	5,120	5,280	5,460	5,670	5,930	1,590	0.9%
Mendota SOI	2,500	2,670	2,800	2,890	2,960	3,040	3,150	3,280	780	0.8%
Orange Cove SOI	2,160	2,210	2,230	2,220	2,210	2,210	2,230	2,270	110	0.1%
Parlier SOI	3,480	3,670	3,810	3,900	3,970	4,050	4,170	4,320	840	0.6%
Reedley SOI	7,020	7,490	7,840	8,080	8,280	8,510	8,810	9,160	2,140	0.8%
Sanger SOI	7,320	7,780	8,120	8,360	8,550	8,770	9,060	9,410	2,100	0.7%
San Joaquin SOI	900	970	1,020	1,050	1,080	1,110	1,160	1,200	300	0.8%
Selma SOI	7,470	7,950	8,290	8,530	8,720	8,950	9,240	9,600	2,130	0.7%
Uninc. excl. SOIs	28,000	32,480	32,860	32,930	32,860	33,000	33,430	34,070	6,060	0.6%

Source: ADE

PROJECTING HOUSING UNITS BASED ON HOUSEHOLD PROJECTIONS, VACANT STOCK, AND VACANCY RATES

In conducting the analysis of housing demand, we used both vacancy rates and replacement unit rates to project the total number of future units, not just the units needed to accommodate projected households. In preparing the table below, we created city-specific weighted average healthy vacancy rates that we then applied to each city's household projections. We utilized standard benchmarks for healthy vacancy rates (i.e. 1.5 percent for owner occupied units and 4.0 percent for rent-occupied units), then, using each city's census-based homeownership and rentership rates, we then generated each city's overall weighted average healthy vacancy rate. In addition, we employed a replacement factor of 0.58 percent. Finally, we took into account vacant stock already in place in the year 2015, assuming that increases in new households would generally first occupy vacant units. In several communities there were considerable amount of vacant stock in 2015 as a result of the Great Recession. However, despite high vacancy rates, a number of cities are processing applications for new housing development, as shown in Table 26 below. Therefore, to account for this development activity, we phased the absorption of "excess" vacant units over a ten year period. Table 22 below shows our projections on a city-by-city basis, with projections presented as new housing unit increases over given time periods.

We also compare our findings against future housing units observed in other documents such as the Regional Housing Needs Allocation (RHNA) for Fresno County (Table 24). For example, the City of Clovis RHNA allocation is 6,300. At the rate Clovis SOI is growing – and given its existing vacant stock and healthy vacancy rate – it will take this area 12 years (2027) to absorb the 6,300 allocation. In Table 24, we include estimates for how long it will take cities in Fresno County to absorb their respective RHNA allocation.

We also compare our projections against city-level data on development capacity of vacant sites in cities across Fresno County (Table 25). Reedley, for example, can build an estimated 1,667 units on vacant lots in the city. Assuming any new housing units are built first on vacant lots within the city, at the rate Reedley is growing, it will take another 21 years (2036) to fully build 1,667 units on the vacant lots within Reedley's city limits. In Table 26 we summarize projects that are already in the development pipeline in each city in Fresno County.

Table 23 – Projected Required New Housing Units Based on Projected Household Increases, Vacancy Rates, Vacant Stock, and Replacement Allowances: 2015-2050

Jurisdiction	Tot. Units	Required New Housing Units By Period							Increase In Households by Period						
	2015	15-20	15-25	15-30	15-35	15-40	15-45	15-50	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Fresno Co.	**324,941**	**21,100**	**38,820**	**64,740**	**78,380**	**92,450**	**109,320**	**129,180**	**28,850**	**48,670**	**63,410**	**75,840**	**89,480**	**105,810**	**125,030**
Clovis SOI	41,832	4,080	6,470	9,720	11,560	13,570	15,960	18,770	4,480	7,310	9,430	11,220	13,170	15,490	18,210
Coalinga SOI	4,353	90	300	490	590	680	820	990	270	400	480	570	670	800	960
Firebaugh SOI	2,135	100	150	350	420	490	580	690	170	270	350	410	480	570	670
Fowler SOI	2,153	180	330	550	670	800	950	1,120	220	400	540	660	780	920	1,090
Fresno SOI	195,429	13,360	24,380	43,300	53,040	63,410	75,420	89,370	16,590	30,910	41,870	51,290	61,330	72,940	86,430
Huron SOI	1,598	150	170	180	180	190	200	240	140	160	170	160	170	190	220
Kerman SOI	4,243	250	430	720	860	1,020	1,220	1,460	300	530	700	840	990	1,190	1,420
Kingsburg SOI	4,504	270	450	810	970	1,150	1,370	1,640	330	590	780	940	1,120	1,330	1,590
Mendota SOI	2,571	150	250	400	480	560	680	810	170	300	390	460	540	650	780
Orange Cv SOI	2,273	20	40	60	70	70	80	110	50	70	60	50	50	70	110
Parlier SOI	3,596	150	240	430	500	590	720	870	190	330	420	490	570	690	840
Reedley SOI	7,157	420	710	1,100	1,300	1,540	1,840	2,210	470	820	1,060	1,260	1,490	1,790	2,140
Sanger SOI	7,269	340	560	1,070	1,270	1,500	1,800	2,160	460	800	1,040	1,230	1,450	1,740	2,090
San J'quin SOI	976	50	90	150	180	220	260	310	70	120	150	180	210	260	300
Selma SOI	7,738	360	610	1,090	1,290	1,520	1,830	2,190	480	820	1,060	1,250	1,480	1,770	2,130
Uninc.	37,114	1,130	3,640	4,320	5,000	5,140	5,590	6,240	4,480	4,860	4,930	4,860	5,000	5,430	6,070

Table 24 – Number of Years to Fulfill RHNA Obligations via Future Housing Units Based on Household Projections

Jurisdiction	Total RHNA	Cumulative Change in Housing Units Beyond 2015							Number of Years To Absorb	Year
		15-20	15-25	15-30	15-35	15-40	15-45	15-50		
Fresno County	**41,440**	**21,100**	**38,820**	**64,740**	**78,380**	**92,450**	**109,320**	**129,180**	**11**	**2026**
Clovis SOI	6,328	4,080	6,470	9,720	11,560	13,570	15,960	18,770	12	2027
Coalinga SOI	589	90	300	490	590	680	820	990	21	2036
Firebaugh SOI	712	100	150	350	420	490	580	690	35+	2050+
Fowler SOI	524	180	330	550	670	800	950	1,120	16	2031
Fresno SOI	23,565	13,360	24,380	43,300	53,040	63,410	75,420	89,370	9	2024
Huron SOI	424	150	170	180	180	190	200	240	35+	2050+
Kerman SOI	909	250	430	720	860	1,020	1,220	1,460	22	2037
Kingsburg SOI	374	270	450	810	970	1,150	1,370	1,640	8	2023
Mendota SOI	554	150	250	400	480	560	680	810	24	2039
Orange Cove SOI	669	20	40	60	70	70	80	110	35+	2050+
Parlier SOI	558	150	240	430	500	590	720	870	23	2038
Reedley SOI	1,311	420	710	1,100	1,300	1,540	1,840	2,210	21	2036
Sanger SOI	1,218	340	560	1,070	1,270	1,500	1,800	2,160	19	2034
San Joaquin SOI	378	50	90	150	180	220	260	310	35+	2050+
Selma SOI	605	360	610	1,090	1,290	1,520	1,830	2,190	10	2025
Uninc., excl. SOIs	2,722	1,130	3,640	4,320	5,000	5,140	5,590	6,240	15	2030

Source: ADE

Table 25 – Number of Years to Fulfill Development Potential of Vacant Sites via Future Housing Units Based on Household Projections

Jurisdiction	Within-City Housing Capacity	Cumulative Change in Housing Units Beyond 2015							Number of Years To Absorb	Year
		2015-2020	2015-2025	2015-2030	2015-2035	2015-2040	2015-2045	2015-2050		
Fresno County	**61,916**	**21,100**	**38,820**	**64,740**	**78,380**	**92,450**	**109,320**	**129,180**	**17**	**2032**
Clovis SOI	9,840	4,080	6,470	9,720	11,560	13,570	15,960	18,770	18	2033
Coalinga SOI	2,080	90	300	490	590	680	820	990	35+	2050+
Firebaugh SOI	712	100	150	350	420	490	580	690	35+	2050+
Fowler SOI	1,331	180	330	550	670	800	950	1,120	35+	2050+
Fresno SOI	139,555	13,360	24,380	43,300	53,040	63,410	75,420	89,370	35+	2050+
Huron SOI	2,253	150	170	180	180	190	200	240	35+	2050+
Kerman SOI	1,274	250	430	720	860	1,020	1,220	1,460	31	2046
Kingsburg SOI	1,215	270	450	810	970	1,150	1,370	1,640	26	2041
Mendota SOI	971	150	250	400	480	560	680	810	35+	2050+
Orange Cove SOI	na	20	40	60	70	70	80	110		
Parlier SOI	592	150	240	430	500	590	720	870	24	2039
Reedley SOI	1,667	420	710	1,100	1,300	1,540	1,840	2,210	26	2041
Sanger SOI	1,101	340	560	1,070	1,270	1,500	1,800	2,160	18	2033
San Joaquin SOI	410	50	90	150	180	220	260	310	35+	2050+
Selma SOI	1,533	360	610	1,090	1,290	1,520	1,830	2,190	24	2039
Uninc., excl. SOI	13,438	1,130	3,640	4,320	5,000	5,140	5,590	6,240	35+	2050+

Source: ADE, based on Fresno COG Excel file "FCOG_HE_Capacity_2016-07-20.xlsx" (Note: no data on development capacity of vacant lots in City of Fresno)

Table 26 – Residential Projects in the Development Pipeline by City

Project Name	Single-Family Units	Multi-Family Units	Status	Projected Completion Date
Clovis				
1515 Escalon		10 Unit MFR	Approved	
Regal Dakota		144 Unit MFR	Approved 10/7/14	
Innovative Living		48 bed senior	Approved	
Ashwood		133 Unit MFR	Approved	
Land Value		216 Unit MFR	Approved	
32 Tract maps are summarized by project status below				
Under Construction	958			
Recorded	179			
Approved	1,119			
Applied	2,557			
Total:	4,813	551		
Coalinga				
Summer Glen Estates	417		Submitted, tentative map approved 9/1/2014	
Golf Course Development	869		Submitted, tentative map approved 5/6/2010	
Canyon Creek Estates	43		Approved 1/7/2010	
Promontory Point	44		Finished Lots That Are Available	
Warthan Meadows	351		March 5, 2005, Final Map 6/7/2007	
Total:	1,724			
Firebaugh				
Adam & Nagi Saleh		40	Project approved but not commenced	None at this time
Lake Joallan	122			
El Sendero Ranch	579			

Project Name	Single-Family Units	Multi-Family Units	Status	Projected Completion Date
Fresno County Housing		30	Permit Issued	12/31/2016
Total:	701	70		
Fresno: The City provided data on 99 approved tract maps. These are summarized by expiration date below.				
	724		Expire 2017	
	5,985		Expire 2018	
	4,558		Expire 2019	
	829		Expire 2020	
Total:	12,096			
Fowler				
TTM 5292 - RJ Hill - APN 345-100-19s	171		Tentative Tract Map	2021
TTM 5834 - RJ Hill - APN 343-040-68	57		Final Map	2020
TTM 5834 Phase 2	75		Final Map	2023
TTM 5090 Phase 2	55		In construction	2017
TTM 5090 Phase 3	55		Final Map	2019
TTM 5623	53		Tentative Tract Map	2030
TTM 5785	57		Tentative Tract Map	2030
Site Plan Review 15-05		6	In construction	2017
Site Plan Review 15-01 Housing Authority		40	Site Plan Approved - LIHTC project by the Housing Authority - 60 units (includes removal of 20 existing units for a net increase of 40 units)	2019
Total:	523	46		
Huron				
Palmer Villas Apartments (phase 2)		57	Approved, permitted	Jan-17
APN 075-032-78S (Phase 2)	88		Approved, permitted	Jan-18
American Community Apartments		64	Approved 3/10/2016	Nov-17
Total:	88	121		
Kerman				

PROJECT NAME	SINGLE-FAMILY UNITS	MULTI-FAMILY UNITS	STATUS	PROJECTED COMPLETION DATE
Tract 5928 Phase 1	19		Approved 7/7/2008	Unknown
Tract 5928 Phase 2	131		Approved 7/7/2008	Unknown
Tract 5831	48		Approved 12/20/2006	Unknown
Infill-custom residential lot	1		Issued Building Permit	Estimated 2017
Gateway Villa Apartments		61	Approved 5/18/2016	Estimated 1-2 years
Tract 5636 (Bordeau II) (submitted P/C)	67		Approved 5/11/2006	Estimated 1-2 years
Tract 5832	106		Not recorded yet/map check	Estimated 1-2 years
Infill-custom residential lot (C st)	1		In Plan Check	Estimated 2017
Total:	373	61		
Kingsburg				
TM 5609 (Kings Crossing)	46		Permits Pulled	2017
TM 6094 (APN 39408001) (Lennar)	34		Construction Started	2017
TM 5073 (Ghuman)	39		Approved TM, Annexation expired	
TM 6141 (Gianetti)	47		Site Plan Review Initiated	
SPR 2016-02 1236 Marion Street (triplex)	3		Site Plan Review-Initiated	
SPR 2014-04 1235 Cardinal Lane		12	Under Construction	2016-17
SPR 2015-14 1200 Marion Street (Fourplex)		4	Site Plan Review-Approved	2017
SPR 2016-05, 6 units on two lots (triplex)		6	Site Plan Review-Approved	
SPR 2016-04 Senior Housing		48	Site Plan Review-Approved, seeking Tax Credit Funding	2018
West Star Construction	147	18	Allocations and SPR process underway	2017 and beyond
TM 6151 (Erickson)	94		Allocations only at this time	2017 and beyond
TM 6122 (Nelson)	60		Allocations only at this time	2017 and beyond
Total:	470	88		
Mendota				
VTTM No. 5483 Final Map (012-190-40 &		200	Approved tentative map March 22,	

PROJECT NAME	SINGLE-FAMILY UNITS	MULTI-FAMILY UNITS	STATUS	PROJECTED COMPLETION DATE
41)			2005	
Ochoca Apartments		11	Approved December 10, 2013	
Total:		211		
Orange Cove				
Century/Builders - Monte Vista Estates	157		9 homes under construction - 17 vacant lots	09.01.17
Joe Serna Homes	47		2 homes under construction - 2 vacant lots	09.01.17
Total:	204			
Parlier				
Balance of Avila Site		18	A balance of 18 additional units could be constructed on site. The site has already been annexed into the City.	
Tentative Tract 6038		148	Approved by City on 4/16/2014. This site has already been annexed into the City.	
Tentative Tract Map 5615	169		Prezoning to R-1 approved by City in 2006. Annexation application was submitted and withdrawn due to market conditions.	
Tentative Tract Map 6041	5		This site is within City limits.	
Tentative Tract 5495	68		TTM 5495 was approved for 158 single family lots and TTM 5607 was approved for 133 single family lots. To date, an estimated 90 homes have been constructed in TTM 5495 and 50 homes on TTM 5607.	
Tentative Tract Map 5607	83			
Oak Grove		31	Project will submit for a LIHTC in March 2016 for review by the Tax Allocation Committee in June 2016. If successful, construction can begin in late 2016.	
Total:	325	197		
Reedley				

Project Name	Single-Family Units	Multi-Family Units	Status	Projected Completion Date
Reedley Family Apartments Phase 2		32	Approved on March 9, 2010.	
Kings River Village - Residential Component	64	190	Approved by City Council on April 28, 2015; pending building permits	
Trailside Terrace - Residential Component	57	104	Under construction	2017
Total:	121	326		
Sanger				
Royal Wood	187		Approved 12/04	100 units remaining - 2017-2018
Sanger Crossing Phase 1		45	Approved 05/13	Has been completed
Sanger Crossing Phase 2		36	Approved 05/13	Waiting for Tax Credit approval
Memorial Village (Fresno Housing Authority)		46 (demo and rebuild 33 existing add 13 new)	Approved 06/16	2017-2018
Total:	187	127		
San Joaquin				
TTM 5645	305		Tentative Tract Map	
Total:	305			
Selma				
Bratton I	220		Approved	Unknown
Emmett	96		Application Submitted	Unknown
Canales	153		Under construction	40 units near completion 2nd phase starting
Shockley Terrace County Housing Authority		48	Approved	Under construction completion March 2017
Synergy	87		Approved	Unknown
Country View III	23		Approved project in the Planning Area	Unknown

PROJECT NAME	SINGLE-FAMILY UNITS	MULTI-FAMILY UNITS	STATUS	PROJECTED COMPLETION DATE
Country Rose Estates	33		Approved project in the Planning Area	Unknown
Casa Bella	33		Under annexation and Planning	Map 5361 Unknown
Selma Heritage	40		Under annexation and Planning	Map 5563 Unknown
Total:	685	48		

CITY-LEVEL EMPLOYMENT PROJECTIONS

The Fresno COG has developed detailed job estimates by Traffic Analysis Zone (TAZ) for 2014. These estimates are based on detailed files provided by EDD supplemented by business data provided by Info USA (Table 28). ADE used these data as the base year for the projection analysis. The data reflect mid-year job numbers for 2014 and therefore are slightly different than EDD's annual averages for the same year. Table 27defines the detailed industry sectors that are grouped into the categories in Table 28.

In order to allocate the countywide employment projections to the cities and unincorporated area, ADE reviewed the historical trend data from the Longitudinal Employer-Household Dynamics (LEHD) data for each city and the county as a whole (Table 29).[4] While this data source provides relatively detailed jobs data for local areas and census geography, it is fairly new and not yet fully calibrated to either the American Community Survey (ACS) worker data or the Bureau of Labor Statistics (BLS) jobs-in-place data. In 2002, the LEHD undercounted the EDD countywide total jobs by 17 percent; however, by 2014 this discrepancy had been reduced to 5 percent. Viewing the data sector by sector, certain industries accounted for nearly all the deviation: Agriculture, health care, education, government and other services. Based on the nature of these differences, ADE was able to calibrate the data to match EDD total jobs for the county in each year (Table 30). In addition, ADE estimated 2015 jobs for each city based on recent growth trends.

Our analysis indicates that while the County as a whole had a 1.4 percent growth rate in jobs between 2010 and 2014, Clovis had a higher rate at 2.5 percent while the City of Fresno had a slower rate of 1.3 percent per year (Table 31). Fresno had strong job growth prior to the recession but seems to have had a very sluggish recovery more recently. The unincorporated area had a relatively strong growth of 2.4 percent per year during this period due to sustained growth in the farm sector. Several of the smaller cities had substantial swings in employment both positive and negative.

Given the volatility of the city growth rates both before and after the recession, it is difficult to rely on those trends directly for the future projections. ADE took the approach that cities would maintain the broad trend of their share of total county employment. The formulas for future jobs growth by city account for the shifts in the share of total county employment between 2002 and 2014. However, for the unincorporated area, a separate jobs projection was done to reflect the overall county projection for change in farm employment. While farm jobs have continued to grow in recent years, future growth rates are projected to diminish due to several reasons including increasing mechanization driven by increasing labor costs. In contrast, given its available land supply for non-residential development, the City of Fresno is anticipated to accelerate jobs growth and regain its historical share of countywide jobs. Local serving jobs for all cities are projected based on their projected increase in population and the countywide ratios between population growth and local-serving job sector growth. Finally, most of the cities provided data on currently approved but unbuilt non-residential projects (Table 32). ADE estimated the jobs for these projects and allocated them to the early 2017-2020

[4] This is cooperative data program with the Bureau of the Census and the Bureau of labor Statistics. Data may be obtained from www.OnTheMap.com.

period based on available information about the construction schedule for the projects. If no schedule was provided, the projects were allocated to the 2019-2020 period.

For the 2015-2020 period, the city projections are affected by the change in share of countywide growth between 2002 and 2014. Beyond 2025, the economic base projections for each city are influenced by the county share of employment each city is expected to have in 2025. The final jobs projections are shown in five year increments in Table 17.

Table 27 – Industry Sectors by Land Use Category

AGRICULTURE, FORESTRY, FISHING AND HUNTING
MANUFACTURING / MINING
OTHER INDUSTRY
Utilities
Construction
Wholesale Trade
Transportation and Warehousing
Other Services (excluding Public Administration)
RETAIL TRADE
OFFICE
Information
Finance and Insurance
Real Estate and Rental and Leasing
Professional, Scientific, and Technical Services
Management of Companies and Enterprises
Administration & Support, Waste Management
EDUCATIONAL SERVICES
HEALTH CARE AND SOCIAL ASSISTANCE
HOSPITALITY
Arts, Entertainment, and Recreation
Accommodation and Food Services
GOVERNMENT

Source: Fresno COG

Table 28 – Jobs by Jurisdiction SOI and Sector, 2014

SOI	Education	Hospitality	Government	Other Industry	Health care	Office	Retail	Mfg./Mining	Agriculture	Total
Clovis	3,019	4,571	810	4,022	4,825	3,400	5,891	3,351	344	30,233
Coalinga	968	319	319	155	334	177	290	28	76	2,666
Firebaugh	236	71	46	434	102	51	85	16	113	1,154
Fowler	252	118	28	527	157	139	159	554	175	2,110
Fresno	25,956	21,088	26,448	33,412	42,001	38,212	23,226	12,594	1,368	224,305
Huron	118	22	78	12	38	2	29	0	441	740
Kerman	388	243	169	238	326	312	501	162	92	2,431
Kingsburg	272	324	74	1,155	311	231	401	494	77	3,339
Mendota	161	92	44	97	189	14	136	1	157	891
Orange Cove	152	1	54	46	184	19	56	8	23	543
Parlier	718	92	123	272	326	49	150	371	67	2,168
Reedley	1,267	434	217	1,025	1,469	278	595	254	84	5,624
Sanger	920	376	438	615	739	147	710	644	453	5,041
San Joaquin	297	5	62	26	7	5	10	0	75	488
Selma	599	963	188	712	516	367	1,436	414	350	5,545
Unincorporated	2,851	3,154	3,301	7,710	3,597	2,252	1,316	5,640	45,204	75,025
TOTAL	38,176	31,873	32,399	50,458	55,121	45,655	34,991	24,531	49,099	362,303

Source: Fresno COG GIS

Table 29 - LEHD Base Data

Jurisdiction	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
County	286,830	292,388	299,874	308,293	310,553	319,358	320,871	310,683	324,568	324,450	320,437	336,297	343,773
Clovis	23,948	24,416	25,466	25,936	28,188	28,870	29,214	28,017	26,734	26,988	27,397	28,580	30,453
Coalinga	3,883	3,946	3,953	3,797	3,000	2,822	2,726	2,561	2,581	3,966	5,539	5,610	5,757
Firebaugh	1,813	1,794	1,678	1,257	1,147	906	1,021	986	1,319	1,337	1,281	1,195	1,111
Fowler	2,068	2,008	2,077	2,150	2,087	2,083	2,283	2,146	2,102	2,347	2,366	2,343	2,468
Fresno	177,945	181,866	185,508	190,173	194,332	197,093	198,360	193,733	203,101	197,040	198,015	207,285	210,383
Huron	986	968	1,065	974	951	786	782	2,225	1,667	1,228	419	447	579
Kerman	1,868	1,905	3,512	4,157	3,410	3,873	4,083	2,771	3,982	4,793	5,031	5,468	6,977
Kingsburg	3,953	4,619	4,691	4,435	4,721	4,610	4,471	4,428	4,220	4,477	4,412	4,545	4,878
Mendota	874	1,003	903	891	1,048	888	882	1,305	1,259	1,252	1,348	1,337	1,363
Orange Cove	1,043	1,209	1,240	1,009	1,049	888	1,031	926	838	828	774	778	607
Parlier	1,895	1,838	2,281	1,537	1,347	1,407	1,520	1,509	1,789	2,191	2,094	2,334	2,545
Reedley	6,361	6,398	6,158	7,046	7,362	7,677	8,133	7,924	8,011	8,384	7,312	7,793	7,830
Sanger	5,186	5,130	5,112	5,946	5,103	6,304	6,631	6,644	5,791	6,275	5,938	7,009	7,814
San Joaquin	375	340	359	345	484	397	358	165	446	617	767	769	990
Selma	5,694	5,704	5,787	6,188	5,596	6,023	6,029	5,496	5,638	4,959	4,674	5,159	5,104
Incorporated	237,892	243,144	249,790	255,841	259,825	264,627	267,524	260,836	269,478	266,682	267,367	280,652	288,859
Balance	48,938	49,244	50,084	52,452	50,728	54,731	53,347	49,847	55,090	57,768	53,070	55,645	54,914

Source: www.OnTheMap.com

Table 30 – Estimated Historical Growth Trends by Industry Sector – Fresno County 2002 - 2014

Industry Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2010-2014 CAGR
Agriculture	46,600	46,200	46,000	46,400	46,500	48,100	48,900	45,100	46,000	47,900	48,900	49,200	49,009	0.4%	1.6%
Mfg./Mining	27,309	27,188	27,763	27,307	27,799	28,216	27,188	25,429	24,223	23,954	23,891	23,300	24,531	-0.9%	0.3%
Other Industrial	51,303	51,543	53,141	54,378	56,675	57,726	53,876	47,488	44,550	46,562	48,007	50,712	50,458	-0.1%	3.2%
Retail	34,371	34,983	36,181	36,853	37,494	37,052	36,662	34,229	31,776	32,655	33,516	34,737	34,991	0.1%	2.4%
Office	40,096	40,757	41,374	43,705	44,996	44,814	44,896	41,359	40,518	39,125	39,943	42,595	45,768	1.1%	3.1%
Education	37,500	36,800	36,300	36,300	36,800	38,300	39,000	38,200	37,200	37,700	37,100	36,600	38,176	0.1%	0.6%
Health Services	37,300	39,000	41,200	42,400	43,200	44,700	46,300	46,900	46,700	46,900	48,000	50,700	55,121	3.3%	4.2%
Hospitality	26,316	25,926	25,886	26,973	29,399	30,047	29,085	28,068	28,392	30,381	29,746	30,848	31,873	1.6%	2.9%
Government	34,800	34,200	33,800	34,100	34,400	34,800	35,200	35,000	34,700	33,200	32,200	32,200	32,399	-0.6%	-1.7%
Total	335,594	336,596	341,644	348,417	357,263	363,754	361,105	341,772	334,059	338,376	341,304	350,892	362,326	0.6%	2.1%

Table 31 – Estimated Historical Employment Growth Trends by City SOI

Jurisdiction	2002	2015 (Est.)	2002 Share	2015 Share	2002-2007 Change	2002-2007 CAGR	2010-2014 Change	2010-2014 CAGR
County	335,594	371,800	100.0%	100.0%	28,160	1.4%	28,267	1.4%
Clovis	25,152	31,586	7.5%	8.5%	4,941	3.0%	4,221	2.5%
Coalinga	3,489	2,776	1.0%	0.7%	-1,014	-5.6%	662	4.9%
Firebaugh	1,726	1,154	0.5%	0.3%	-772	-9.4%	-142	-1.9%
Fowler	1,520	2,306	0.5%	0.6%	178	1.9%	635	6.2%
Fresno	209,504	230,433	62.4%	62.0%	18,927	1.5%	16,497	1.3%
Huron	1,194	882	0.4%	0.2%	-241	-3.7%	-1,328	-15.7%
Kerman	2,063	2,641	0.6%	0.7%	199	1.5%	592	4.8%
Kingsburg	3,723	3,494	1.1%	0.9%	2,597	9.2%	-2,800	-9.7%
Mendota	638	890	0.2%	0.2%	58	1.5%	44	0.9%
Orange Cove	661	543	0.2%	0.1%	61	1.5%	-233	-5.8%
Parlier	1,271	2,212	0.4%	0.6%	-112	-1.5%	700	6.7%
Reedley	4,935	5,722	1.5%	1.5%	648	2.1%	-250	-0.7%
Sanger	4,386	5,382	1.3%	1.4%	258	1.0%	1,034	3.9%
San Joaquin	191	487	0.1%	0.1%	-17	-1.6%	26	0.9%
Selma	6,693	5,545	2.0%	1.5%	699	1.7%	-1,518	-4.0%
Incorporated	267,146	296,052	79.6%	79.6%	26,408	1.6%	18,141	1.1%
Balance	68,447	75,616	20.4%	20.3%	1,752	0.4%	10,126	2.4%

Source: ADE

Note: CAGR = Compound Annual Growth Rate.

Table 32 – Non-Residential Projects in the Development Pipeline by City

Project Name	Type	Square Footage	Status	Projected Completion Date	Estimated Jobs
Clovis					
Civic Center North	Senior Center, Transit, Health Clinic and County Library		Applied		10
CCMC	Phase C (Bed Tower, and Expansion)		Approved SPR		500
Black Bear	Restaurant		Approved SPR		65
All Tech	Auto Repair Facility		Approved SPR		10
Peloton	Construction office	9,000	Approved SPR		20
Falls	Event center	17,000	Approved SPR		10
DDYS	Specialty medical	10,800	Approved SPR		35
Townplace	114 Room Hotel		Approved SPR		35
Stock Five	Office/retail	11,000	Approved SPR		5
Budget Blinds	Industrial	4,000	Approved SPR		5
Herndon Temperance	Medical Office	18,600	Pending SPR approval		65
Lucido	Retail	6,000	Pending SPR Approval		45
Bond	Professional office	6,200	Pending SPR Approval		15
Taylor	Professional office	4,600	Pending SPR Approval		15
Choppin Block	Industrial Auto	11,500	Under Constrcution		5
CCMC	Cancer Center	97,000	Under Construction		400
Centennial Plaza North	Retail/office	14,400	Under Construction		40
Peterson Centennial South	Retail/office	24,000	Under Construction		60
Beal	Conv. Store Fule Sales		Under Construction		10
Thomason	Retail	20,000	Under Construction		100
CHSU	Office/school	9,400	Under Construction		5
Patel	79 Room Hotel		Under Construction		35

Project Name	Type	Square Footage	Status	Projected Completion Date	Estimated Jobs
Coalinga					
Best Western Hotel	Hotel	44,000	Under Construction	Summer 2017	38
Subway	Retail	4,985	Building Plans Approved, awaiting Building Permit to be pulled	TBD	9
Medical Marijuana Cultivation, Testing and Manufacturing Facility	Industrial	Various (75,000) SF Facilities	Applications to be submitted in the next month	2017	50
Firebaugh					
Valley Health Team	Medical Clinic	10,280	Project approved but not commenced	None at this time	54
Dollar General	Store	9,100	Project approved but not commenced	None at this time	17
Fowler					
Site Plan Review 16-01	Fowler Medical Plaza (Medical Clinic)	50,000	Site Plan and Parcel Map in review	2018	260
Huron					
Adventist Health	Pharmacy/Medical Facility	2,000	Approved 3/10/2016	Nov-17	10
United Health Care	Medical Facility	10,000	Approved 7/17/2016	June-17	52
Amigo Market	Supermarket	6,000	Permitted	Jan-17	12
City of Huron Abuse Shelter	Spousal Abuse Center	36,000	Planning CDBG Grant Approved	Jan-18	6
Kingsburg					
Alves Warehouse expansion	warehouse	210,041	Permits pulled	2016	140
SPR (2016-05(A)	office, lab	20,408	Completed Site Plan Review, project not finalized		68
SPR (2014-05) Amparan Flooring	Warehouse/retail	11,332	Permits pulled	2016-17	11
Orange Cove					
Capital Rivers - NWC of Park and Anchor	Auto Zone	7,458	Site Plan Review Application Submitted	03.01.18	27
Capital Rivers - NWC of Park and Anchor	Dollar Tree	10,000	Site Plan Review Application Submitted	03.01.18	18

Project Name	Type	Square Footage	Status	Projected Completion Date	Estimated Jobs
Capital Rivers - NWC of Park and Anchor	McDonalds	3,042	Site Plan Review Application Submitted	03.01.18	16
Mini Storage Facility - NWC of 12th & Park	Self-Storage Buildings	10,000	Under Construction	09.01.17	1
Mini Storage Facility - NWC of 12th & Park	Managers Office	1,000	Under Construction	09.01.17	1
Reedley					
Trailside Terrace - Commercial Component	70,000 SF Commercial, 34,000 SF Office & 32,000 SF/205 unit Mini Storage	136,000	Under construction	2017	241
Kings River Village - Commercial Component	106,900 medical/office space & 48,130 SF Commercial	155,030	Approved by City Council on April 28, 2015; pending building permits		524
Dopkins Funeral Chapel	14,553 SF chapel, crematory & 4,000 SF gathering/event center	18,553	Entitled in 2015; pending building permits	Estimated Construction Completion Date 2018	19
Sanger					
United Health	Medical office	15,000	Approved	late 2017	78
Cossette	Commercial	8,000	Approved	late 2016	15
Selma					
Medical	Medical Clinic	10,000	In planning stage	unknown	52
Hyundai	Auto Sales	46,700	under construction	2017	47
Toyota	Auto Sales	6,500	Under construction	2017	7
Selma Grove	Commercial Center	360,000	Approved in Planning	Unknown	655
Fitness Evolution	Gym	5,000	Under construction	2017	16
V5 Mini Storage	Storage	124,021	Under review in Planning	unknown	1
Dinuba Shopping Center	Retail	83,332	Under review in Planning	unknown	152
Ford center remodel	Auto	10,000	Tenant improvement	2016	2

Project Name	Type	Square Footage	Status	Projected Completion Date	Estimated Jobs
American Tire	Tire sales	5,000	approved	unknown	18
Floral shopping Center	Commercial Center	19,000	Under construction	2017	35
Summary by Land Use					
Other Industrial					192
Retail					1,838
Health Services					1,134
Hospitality					47

DETAILED PROJECTIONS

The following sections provide the detailed projections for each jurisdiction. All data reflect the sphere of influence (SOI) for each jurisdiction.

CLOVIS

Table 33 – Estimate of Past Job Trends: Clovis SOI

Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 rate	2002 Share	2014 Share
Agriculture	78	63	80	75	72	109	235	244	222	193	128	102	344	13.1%	0.2%	0.7%
Mfg./Mining	4,443	4,469	4,612	4,085	4,675	4,649	4,985	4,767	4,186	4,018	3,360	3,284	3,351	-2.3%	16.3%	13.7%
Other Industrial	4,003	4,027	4,122	4,550	5,299	5,303	4,728	3,445	2,757	2,825	3,020	3,286	4,022	0.0%	7.8%	8.0%
Retail	5,069	5,423	5,840	5,815	6,049	5,694	5,775	5,153	5,038	5,412	5,345	5,763	5,891	1.3%	14.7%	16.8%
Office	2,450	2,561	2,599	2,897	3,163	3,325	3,331	3,006	2,878	3,086	3,389	3,590	3,400	2.8%	6.1%	7.4%
Education	3,285	3,066	2,993	3,027	3,086	3,369	3,273	3,364	3,229	2,820	2,982	2,802	3,019	-0.7%	8.8%	7.9%
Health Services	2,709	2,864	3,239	3,220	3,378	3,608	3,736	3,915	3,603	3,754	4,285	4,280	4,825	4.9%	7.3%	8.8%
Hospitality	2,557	2,500	2,527	2,658	3,257	3,351	3,098	3,309	3,366	3,738	4,053	4,414	4,571	5.0%	9.7%	14.3%
Government	558	558	613	636	659	685	707	629	733	833	826	834	810	3.2%	1.6%	2.5%
Total	25,152	25,531	26,625	26,962	29,639	30,093	29,870	27,831	26,012	26,679	27,387	28,355	30,233	1.5%	7.5%	8.3%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 34 – Job Projections for Clovis SOI by Sector, 2015-2050

Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	320	320	320	330	330	330	330	330
Mfg./Mining	3,680	3,680	3,680	3,680	3,680	3,650	3,620	3,600
Other Industrial	4,240	4,610	4,950	5,250	5,550	5,840	6,090	6,350
Retail	6,200	6,820	7,070	7,520	7,960	8,380	8,770	9,190
Office	3,420	3,720	4,050	4,310	4,560	4,800	5,030	5,260
Education	3,250	3,450	3,640	3,870	4,100	4,310	4,520	4,730
Health Services	5,700	6,050	6,400	6,810	7,200	7,580	7,940	8,320
Hospitality	4,760	5,200	5,700	5,920	6,150	6,380	6,630	6,880
Government	830	830	830	880	930	980	1,030	1,080
Total	**32,400**	**34,680**	**36,640**	**38,560**	**40,460**	**42,270**	**43,970**	**45,740**

Source: ADE, Inc.

Table 35 – Populations Projections for City of Clovis SOI: 2015-2050

Population Variable	Year								2015-2050	
	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	114,770	126,850	136,350	145,050	153,490	161,580	169,220	177,210	62,440	1.2%
Tot. Nos. of Persons in Group Qtrs.	430	460	500	540	560	590	620	650	220	1.2%
Tot. Nos. of Persons in HHs	114,340	126,390	135,850	144,510	152,930	160,990	168,600	176,560	62,220	1.2%
Tot. Nos. of HHs	40,660	45,140	47,970	50,090	51,880	53,830	56,150	58,870	18,210	1.1%
Persons Per Households	2.81	2.80	2.83	2.88	2.95	2.99	3.00	3.00		

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 36 – Periodic Housing Unit Requirement Projections: Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates, Clovis SOI

Households and Housing Units	Cumulative Yearly Increments						
	2015-20	2015-25	2015-30	2015-35	2015-40	2015-45	2015-50
Total Number of New Households By Period	4,480	7,310	9,430	11,220	13,170	15,490	18,210
Total Number of New Units Required By Period	4,080	6,470	9,720	11,560	13,570	15,960	18,770

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 37 – Projections of Total Number of Persons in City of Clovis by Age

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
City of Clovis SOI	114,800	126,800	136,400	145,000	153,500	161,600	169,200	177,200	62,400	1.2%	100.0%	100.0%
5 and below	9,300	10,400	11,200	11,800	12,100	12,500	14,100	15,000	5,700	1.4%	8.1%	8.5%
6 to 14	15,100	15,100	15,900	17,100	18,200	18,900	19,300	20,800	5,700	0.9%	13.2%	11.7%
15 to 19	9,000	9,200	8,800	9,000	9,700	10,400	10,800	11,100	2,100	0.6%	7.8%	6.3%
20 to 24	8,700	9,600	9,500	9,000	9,300	10,000	10,600	11,100	2,400	0.7%	7.6%	6.3%
25 to 34	15,000	17,400	19,400	20,000	19,400	19,200	20,100	21,400	6,400	1.0%	13.1%	12.1%
35 to 44	14,500	15,300	16,500	18,500	20,600	21,200	20,500	20,200	5,700	0.9%	12.6%	11.4%
45 to 54	15,300	15,600	15,800	16,100	17,300	19,500	21,500	22,000	6,700	1.1%	13.3%	12.4%
55 to 64	13,500	15,700	16,100	16,000	16,100	16,500	17,600	19,700	6,200	1.1%	11.8%	11.1%
65 to 74	8,500	11,300	13,400	15,200	15,500	15,500	15,500	15,700	7,200	1.8%	7.4%	8.9%
75 and above	5,900	7,300	9,700	12,400	15,400	18,000	19,300	20,100	14,200	3.6%	5.1%	11.3%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 38 – Projections of Total Number of Persons in Clovis by Race and Ethnicity, Clovis SOI

Race/Ethnic Group	Year 2015	2020	2025	2030	2035	2040	2045	2050	2015-2050 Change	CAGR*	2015 Share	2050 Share
Clovis SOI	**114,800**	**126,800**	**136,400**	**145,000**	**153,500**	**161,600**	**169,200**	**177,200**	**62,400**	**1.2%**	**100.0%**	**100.0%**
White	65,100	70,100	73,300	75,800	77,800	79,300	81,000	82,700	17,600	0.7%	56.7%	46.7%
Latino	31,200	36,200	40,800	45,400	50,200	55,300	60,200	65,400	34,200	2.1%	27.2%	36.9%
Black	2,600	2,900	3,100	3,200	3,400	3,500	3,500	3,600	1,000	0.9%	2.3%	2.0%
Asian	11,300	12,600	13,700	14,700	15,800	16,800	17,600	18,300	7,000	1.4%	9.8%	10.3%
Pacific Islander	200	300	300	300	300	300	300	400	200	2.0%	0.2%	0.2%
Native American	900	1,000	1,000	1,000	1,000	1,000	1,000	1,000	100	0.3%	0.8%	0.6%
Other	200	200	200	200	200	200	200	200	0	0.0%	0.2%	0.1%
Two or more	3,300	3,700	4,000	4,400	4,800	5,100	5,400	5,600	2,300	1.5%	2.9%	3.2%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 39 – Clovis Household Income Projections

Income Category	Number of Households 2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	1,990	1,940	1,800	1,600	1,520	1,450	1,390	1,370
$10,000 to $24,999	5,390	5,250	4,880	4,340	4,110	3,920	3,770	3,710
$25,000 to $34,999	3,520	3,430	3,190	2,840	2,690	2,560	2,460	2,430
$35,000 to $49,999	4,430	4,990	4,680	4,230	4,010	3,820	3,680	3,620
$50,000 to $74,999	7,150	7,890	7,830	7,560	7,270	7,170	7,250	7,130
$75,000 to $99,999	5,940	7,070	8,360	9,640	9,260	9,030	8,960	8,700
$100,000 to $149,999	7,240	8,610	10,180	11,750	13,600	15,300	16,930	18,860
$150,000 or more	5,010	5,960	7,040	8,130	9,410	10,580	11,710	13,050
Total	**40,660**	**45,140**	**47,970**	**50,090**	**51,880**	**53,830**	**56,150**	**58,870**
Mean Income	**$83,270**	**$87,140**	**$92,860**	**$98,750**	**$104,010**	**$108,240**	**$111,650**	**$115,070**
CAGR		**0.9%**	**1.3%**	**1.2%**	**1.0%**	**0.8%**	**0.6%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

COALINGA

Table 40 – Estimate of Past Job Trends: Coalinga SOI

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	586	311	345	304	325	250	49	63	48	47	2	89	76	-15.7%	1.3%	0.2%
Mfg./Mining	12	525	533	500	25	22	22	18	20	19	19	26	28	7.7%	0.0%	0.1%
Other Industrial	412	421	392	382	462	230	187	191	140	123	144	130	155	-7.8%	0.8%	0.3%
Retail	351	355	401	407	361	408	372	299	277	227	270	257	290	-1.6%	1.0%	0.8%
Office	155	154	179	148	204	151	149	168	151	170	232	165	177	1.1%	0.4%	0.4%
Education	883	851	798	838	880	979	1,092	942	1,045	1,042	942	920	968	0.8%	2.4%	2.5%
Health Services	36	35	24	21	23	34	34	36	38	45	349	293	334	20.4%	0.1%	0.6%
Hospitality	999	807	834	806	335	350	300	259	223	223	229	299	319	-9.1%	3.8%	1.0%
Government	56	50	53	46	39	50	51	53	61	381	346	334	319	15.7%	0.2%	1.0%
Total	3,489	3,509	3,559	3,452	2,654	2,474	2,256	2,028	2,004	2,276	2,534	2,513	2,666	-2.2%	1.0%	0.7%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 41 – Job Projections for Coalinga SOI by Sector, 2015-2050

	Year							
Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	70	70	70	70	70	70	70	70
Mfg./Mining	30	30	30	30	30	30	30	30
Other Industrial	160	220	220	230	250	260	270	280
Retail	300	330	330	340	360	370	380	390
Office	180	180	180	190	190	200	210	210
Education	1,040	1,090	1,140	1,190	1,230	1,280	1,320	1,360
Health Services	380	430	480	500	520	540	560	570
Hospitality	330	370	380	390	410	430	440	460
Government	330	330	330	340	360	370	380	390
Total	**2,820**	**3,050**	**3,160**	**3,290**	**3,420**	**3,540**	**3,660**	**3,780**

Source: ADE, Inc.

Table 42 – Population Projections: 2015-2050: City of Coalinga SOI

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	16,530	17,350	18,170	18,920	19,650	20,350	21,010	21,700	5,170	0.8%
Tot. Nos. of Persons in Group Qtrs.	4,610	4,700	4,970	5,240	5,380	5,580	5,760	5,950	1,340	0.7%
Tot. Nos. of Persons in HHs	11,920	12,650	13,200	13,680	14,270	14,770	15,250	15,750	3,830	0.8%
Tot. Nos. of HHs	4,000	4,270	4,400	4,480	4,570	4,670	4,800	4,960	960	0.6%
Persons Per Households	2.98	2.96	3.00	3.05	3.12	3.16	3.18	2.16		

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 43 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates, Coalinga SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	270	400	480	570	670	800	960
Total Number of New Units Required By Period	90	300	490	590	680	820	990

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 44 – Projections of Total Number of Persons by Age: Coalinga SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Coalinga SOI	**16,500**	**17,300**	**18,200**	**18,900**	**19,600**	**20,300**	**21,000**	**21,700**	**5,200**	**0.8%**	**100.0%**	**100.0%**
5 and below	1,400	1,500	1,600	1,700	1,700	1,700	1,900	2,000	500	0.8%	9.1%	9.2%
6 to 14	2,200	2,200	2,200	2,400	2,500	2,500	2,600	2,700	600	0.7%	13.3%	12.9%
15 to 19	1,200	1,200	1,300	1,200	1,300	1,400	1,400	1,400	300	0.6%	7.3%	6.9%
20 to 24	1,300	1,200	1,200	1,300	1,200	1,300	1,400	1,400	100	0.2%	7.9%	6.5%
25 to 34	2,400	2,600	2,600	2,400	2,400	2,400	2,500	2,700	300	0.3%	14.5%	12.4%
35 to 44	2,200	2,200	2,400	2,600	2,500	2,400	2,400	2,500	300	0.4%	13.3%	11.5%
45 to 54	2,100	2,100	2,100	2,100	2,400	2,600	2,500	2,400	200	0.3%	12.7%	10.6%
55 to 64	2,000	2,300	2,000	2,000	2,000	2,100	2,300	2,500	500	0.6%	12.1%	11.5%
65 to 74	1,000	1,400	1,800	2,000	1,800	1,800	1,900	1,900	800	1.7%	6.1%	8.3%
75 and above	600	800	1,000	1,400	1,800	2,100	2,200	2,300	1,600	3.8%	3.6%	10.1%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 45 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Coalinga SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Coalinga SOI	**16,500**	**17,300**	**18,200**	**18,900**	**19,600**	**20,300**	**21,000**	**21,700**	**5,200**	**0.8%**	**100.0%**	**100.0%**
White	5,900	5,900	5,900	5,800	5,600	5,400	5,300	5,100	-800	-0.4%	35.8%	23.5%
Latino	9,200	10,000	10,900	11,700	12,600	13,600	14,400	15,300	6,100	1.5%	55.8%	70.5%
Black	600	600	600	500	500	500	400	400	-200	-1.2%	3.6%	1.8%
Asian	500	500	500	600	600	600	600	600	100	0.5%	3.0%	2.8%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	100	100	100	100	100	100	100	100	0	0.0%	0.6%	0.5%
Other	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Two or more	200	200	200	200	200	200	200	200	0	0.0%	1.2%	0.9%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 46 – Coalinga Household Income Projections

	Number of Households							
Income Category	2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	390	380	350	310	300	280	270	270
$10,000 to $24,999	650	630	590	520	500	470	460	450
$25,000 to $34,999	390	380	350	310	300	280	270	270
$35,000 to $49,999	560	630	590	530	510	480	460	460
$50,000 to $74,999	750	740	740	740	710	700	710	700
$75,000 to $99,999	360	430	510	590	570	540	520	470
$100,000 to $149,999	640	770	910	1,050	1,210	1,360	1,510	1,680
$150,000 or more	260	310	360	420	480	540	600	670
Total	**4,000**	**4,270**	**4,400**	**4,480**	**4,570**	**4,670**	**4,800**	**4,960**
Mean Income	**$66,320**	**$70,170**	**$75,600**	**$81,440**	**$86,250**	**$90,290**	**$93,690**	**$97,000**
CAGR		**1.1%**	**1.5%**	**1.5%**	**1.2%**	**0.9%**	**0.7%**	**0.7%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

FIREBAUGH

Table 47 – Estimate of Past Job Trends: Firebaugh SOI

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	252	248	196	178	131	57	62	56	176	178	175	155	113	-6.5%	0.5%	0.2%
Mfg./Mining	393	360	371	6	11	7	11	6	41	43	12	8	16	-23.4%	1.4%	0.1%
Other Industrial	373	415	404	397	413	310	445	453	518	472	510	420	434	1.3%	0.7%	0.9%
Retail	133	125	139	131	128	123	118	109	111	105	104	98	85	-3.6%	0.4%	0.2%
Office	45	50	59	56	53	54	58	54	46	48	49	39	51	1.0%	0.1%	0.1%
Education	307	311	293	292	302	284	273	234	225	222	223	222	236	-2.2%	0.8%	0.6%
Health Services	51	54	46	42	46	22	62	76	52	73	50	100	102	5.9%	0.1%	0.2%
Hospitality	133	122	118	78	71	65	52	72	82	75	84	87	71	-5.1%	0.5%	0.2%
Government	38	32	27	23	23	33	39	34	46	47	43	43	46	1.5%	0.1%	0.1%
Total	1,726	1,716	1,653	1,203	1,179	954	1,121	1,093	1,296	1,263	1,249	1,172	1,154	-3.3%	0.5%	0.3%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 48 – Job Projections for Firebaugh SOI by Sector, 2015-2050

Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
	Year							
Agriculture	110	110	110	110	110	110	110	110
Mfg./Mining	20	20	20	20	20	20	20	20
Other Industrial	430	460	470	500	530	550	580	600
Retail	80	100	100	110	110	120	120	120
Office	50	50	50	50	60	60	60	60
Education	230	230	230	240	250	260	280	290
Health Services	100	170	180	190	200	210	220	220
Hospitality	70	70	70	70	80	80	80	80
Government	50	50	50	50	60	60	60	60
Total	**1,140**	**1,260**	**1,280**	**1,340**	**1,410**	**1,470**	**1,520**	**1,580**

Source: ADE, Inc

Table 49 – Populations Trends and Projections: 2015-2050: Firebaugh SOI

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	7,780	8,370	8,880	9,340	9,790	10,220	10,630	11,060	3,280	1.0%
Tot. Nos. of Persons in Group Qtrs.	10	10	20	10	10	10	20	20	10	2.0%
Tot. Nos. of Persons in HHs	7,770	8,360	8,860	9,330	9,780	10,210	10,610	11,040	3,270	1.0%
Tot. Nos. of HHs	2,000	2,170	2,270	2,350	2,410	2,480	2,570	2,670	670	0.8%
Persons Per Households	3.89	3.85	3.90	3.97	4.07	4.11	4.14	4.13		

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 50 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Firebaugh SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	170	270	350	410	480	570	670
Total Number of New Units Required By Period	100	150	350	420	490	580	690

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 51 – Trends and Projections in Total Number of Persons by Age: Firebaugh SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Firebaugh SOI	**7,800**	**8,400**	**8,900**	**9,300**	**9,800**	**10,200**	**10,600**	**11,100**	**3,300**	**1.0%**	**100.0%**	**100.0%**
5 and below	800	900	1,000	1,000	1,000	1,000	1,000	1,100	300	0.9%	10.3%	9.9%
6 to 14	1,200	1,200	1,300	1,400	1,400	1,400	1,500	1,500	300	0.6%	15.4%	13.5%
15 to 19	700	700	700	700	700	800	800	800	100	0.3%	9.0%	7.2%
20 to 24	800	700	700	700	600	700	800	800	0	0.0%	10.3%	7.2%
25 to 34	1,000	1,400	1,500	1,400	1,300	1,300	1,300	1,500	500	1.0%	12.8%	13.5%
35 to 44	900	900	1,000	1,300	1,400	1,300	1,300	1,300	400	1.0%	11.5%	11.7%
45 to 54	900	900	900	900	1,000	1,300	1,400	1,300	400	0.9%	11.5%	11.7%
55 to 64	700	900	900	900	800	800	900	1,200	500	1.4%	9.0%	10.8%
65 to 74	400	500	700	800	800	800	700	700	300	2.1%	5.1%	6.3%
75 and above	300	300	400	500	700	800	900	900	600	3.7%	3.8%	8.1%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 52 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Firebaugh SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
Firebaugh SOI	**7,800**	**8,400**	**8,900**	**9,300**	**9,800**	**10,200**	**10,600**	**11,100**	**3,300**	**1.0%**	**100.0%**	**100.0%**
White	500	500	500	500	500	500	500	500	0	0.0%	6.4%	4.5%
Latino	7,170	7,770	8,290	8,760	9,230	9,680	10,090	10,530	3,360	1.1%	91.9%	94.9%
Black	20	20	20	20	20	20	10	10	-10	-2.0%	0.3%	0.1%
Asian	30	30	30	30	30	30	20	20	-10	-1.2%	0.4%	0.2%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	20	20	20	20	10	10	10	10	-10	-2.0%	0.3%	0.1%
Other	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Two or more	0	0	0	0	0	0	0	0	0		0.0%	0.0%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 53 – Firebaugh Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	240	230	220	190	180	170	170	170
$10,000 to $24,999	510	500	470	410	390	370	360	350
$25,000 to $34,999	310	310	280	250	240	230	220	220
$35,000 to $49,999	280	320	300	270	260	250	240	230
$50,000 to $74,999	470	580	740	910	880	860	870	860
$75,000 to $99,999	30	40	40	50	160	260	340	440
$100,000 to $149,999	130	160	190	210	250	280	310	340
$150,000 or more	20	30	30	40	50	50	60	60
Total	**2,000**	**2,170**	**2,270**	**2,350**	**2,410**	**2,480**	**2,570**	**2,670**
Mean Income	**$42,580**	**$45,420**	**$49,050**	**$52,920**	**$56,600**	**$59,660**	**$62,200**	**$64,510**
CAGR		**1.3%**	**1.5%**	**1.5%**	**1.4%**	**1.1%**	**0.8%**	**0.7%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

FOWLER

Table 54 – Estimate of Past Job Trends: Fowler SOI

	Year															
Job Sector	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2002-2014 CAGR**	**2002 Share of County**	**2014 Share of County**
Agriculture	198	190	192	193	181	157	193	172	176	175	175	180	175	-1.0%	0.4%	0.4%
Mfg./Mining	342	274	292	385	320	333	293	234	201	381	461	369	554	4.1%	1.3%	2.3%
Other Industrial	247	280	289	300	342	393	328	297	303	482	453	434	527	6.5%	0.5%	1.0%
Retail	132	125	123	144	164	164	137	192	132	79	116	130	159	1.6%	0.4%	0.5%
Office	227	231	145	166	172	206	246	227	166	230	214	232	139	-4.0%	0.6%	0.3%
Education	232	228	286	258	263	278	287	255	250	243	256	229	252	0.7%	0.6%	0.7%
Health Services	118	128	100	99	92	92	103	102	114	112	105	143	157	2.4%	0.3%	0.3%
Hospitality	10	5	8	10	10	54	82	93	102	124	107	110	118	23.1%	0.0%	0.4%
Government	15	15	17	19	20	20	24	28	29	29	24	25	28	5.5%	0.0%	0.1%
Total	1,520	1,476	1,450	1,573	1,564	1,697	1,693	1,601	1,474	1,856	1,910	1,853	2,109	2.8%	0.5%	0.6%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 55 – Job Projections for Fowler SOI by Sector, 2015-2050

	Year							
Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	160	160	160	160	160	170	170	170
Mfg./Mining	680	680	680	680	680	670	670	660
Other Industrial	590	640	690	730	770	810	850	890
Retail	180	190	190	200	220	230	240	260
Office	140	140	140	150	160	170	180	190
Education	290	300	310	330	360	380	400	420
Health Services	200	500	560	600	640	680	720	760
Hospitality	130	130	130	140	140	150	150	160
Government	30	30	30	30	30	40	40	40
Total	**2,400**	**2,770**	**2,890**	**3,030**	**3,170**	**3,300**	**3,420**	**3,540**

Source: ADE, Inc.

Table 56 – Populations Trends and Projections: 2015-2050: Fowler SOI

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	6,580	7,240	7,890	8,490	9,070	9,630	10,160	10,710	4,130	1.4%
Tot. Nos. of Persons in Group Qtrs.	50	60	60	60	70	70	80	80	30	1.4%
Tot. Nos. of Persons in HHs	6,530	7,180	7,830	8,430	9,000	9,560	10,080	10,630	4,100	1.4%
Tot. Nos. of HHs	2,060	2,280	2,460	2,600	2,720	2,840	2,980	3,150	1,090	1.2%
Persons Per Household	3.17	3.15	3.18	3.24	3.31	3.37	3.38	3.37		

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 57 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Fowler SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	220	400	540	660	780	920	1,090
Total Number of New Units Required By Period	180	330	550	670	800	950	1,120

*Source: Applied Development Economics. (*Note: CAGR = compound annual growth rate)*

Table 58 – Trends and Projections in Total Number of Persons by Age: Fowler SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Fowler SOI	**6,600**	**7,200**	**7,900**	**8,500**	**9,100**	**9,600**	**10,200**	**10,700**	**4,100**	**1.4%**	**100.0%**	**100.0%**
5 and below	600	700	700	800	800	900	900	1,000	300	1.0%	10.6%	9.3%
6 to 14	900	1,000	1,100	1,100	1,200	1,200	1,300	1,400	500	1.3%	13.6%	13.1%
15 to 19	500	500	500	600	600	700	700	700	200	1.0%	7.6%	6.5%
20 to 24	500	500	600	500	600	700	700	700	200	1.0%	7.6%	6.5%
25 to 34	900	1,000	1,100	1,200	1,200	1,200	1,300	1,400	500	1.3%	13.6%	13.1%
35 to 44	900	900	1,000	1,100	1,200	1,200	1,200	1,200	300	0.8%	13.6%	11.2%
45 to 54	800	900	900	1,000	1,000	1,100	1,200	1,200	400	1.2%	12.1%	11.2%
55 to 64	700	800	900	900	900	1,000	1,000	1,100	400	1.3%	10.6%	10.3%
65 to 74	400	500	700	800	800	800	900	900	500	2.3%	6.1%	8.4%
75 and above	300	400	500	600	800	900	1,000	1,100	800	3.8%	4.5%	10.3%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 59 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Fowler SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
Fowler SOI	**6,580**	**7,240**	**7,890**	**8,490**	**9,070**	**9,630**	**10,160**	**10,710**	**4,130**	**1.4%**	**100.0%**	**100.0%**
White	1,300	1,300	1,300	1,300	1,400	1,400	1,400	1,400	100	0.2%	19.8%	13.1%
Latino	4,500	5,100	5,700	6,200	6,800	7,300	7,800	8,400	3,900	1.8%	68.4%	78.4%
Black	80	80	80	80	70	60	60	50	-30	-1.3%	1.2%	0.5%
Asian	600	640	670	710	740	760	780	790	190	0.8%	9.1%	7.4%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	30	30	30	30	30	20	20	20	-10	-1.2%	0.5%	0.2%
Other	10	10	10	0	0	0	0	0	-10		0.2%	0.0%
Two or more	80	80	90	90	90	80	80	80	0	0.0%	1.2%	0.7%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 60 – Fowler Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	100	100	90	80	80	70	70	70
$10,000 to $24,999	570	550	520	460	430	410	400	390
$25,000 to $34,999	180	180	160	150	140	130	130	120
$35,000 to $49,999	270	310	290	260	250	240	230	220
$50,000 to $74,999	260	330	440	540	520	510	520	510
$75,000 to $99,999	290	340	410	470	560	640	720	800
$100,000 to $149,999	230	270	320	370	430	480	530	590
$150,000 or more	170	200	240	270	320	350	390	440
Total	**2,060**	**2,280**	**2,460**	**2,600**	**2,720**	**2,840**	**2,980**	**3,150**
Mean Income	**$65,190**	**$69,080**	**$74,080**	**$79,140**	**$83,800**	**$87,520**	**$90,510**	**$93,310**
CAGR		**1.2%**	**1.4%**	**1.3%**	**1.2%**	**0.9%**	**0.7%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

FRESNO

Table 61 – Estimate of Past Job Trends: Fresno SOI

	Year															
Job Sector	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2002-2014 CAGR**	**2002 Share of County**	**2014 Share of County**
Agriculture	1,363	1,168	1,159	926	1,064	1,056	982	931	792	734	815	1,213	1,368	0.0%	2.9%	2.8%
Mfg./Mining	14,674	14,557	13,995	14,221	14,529	14,958	14,358	12,946	12,292	12,408	12,585	12,494	12,594	-1.3%	53.7%	51.3%
Other Industrial	36,181	35,536	36,934	37,190	38,197	39,228	36,432	32,589	31,117	31,689	31,515	33,171	33,412	-0.7%	70.5%	66.2%
Retail	22,665	22,970	23,680	24,376	24,960	24,645	24,127	22,989	20,881	21,678	22,561	23,233	23,226	0.2%	65.9%	66.4%
Office	30,612	31,943	33,161	34,568	35,393	35,386	35,255	33,887	33,603	31,038	31,982	34,787	38,212	1.9%	76.3%	83.5%
Education	23,875	23,846	23,672	23,444	23,834	24,178	25,166	24,691	23,736	22,333	24,896	25,101	25,956	0.7%	63.7%	68.0%
Health Services	30,501	32,005	33,883	35,105	36,057	37,155	38,200	38,958	37,541	36,230	37,225	38,668	42,001	2.7%	81.8%	76.2%
Hospitality	17,903	17,793	17,598	18,333	19,669	20,273	19,741	18,858	18,073	19,424	19,914	20,385	21,088	1.4%	68.0%	66.2%
Government	31,729	31,250	30,471	30,982	31,540	31,551	31,731	31,481	29,774	27,595	26,447	26,532	26,448	-1.5%	91.2%	81.6%
Total	209,504	211,068	214,552	219,145	225,244	228,431	225,992	217,331	207,809	203,129	207,940	215,583	224,305	0.6%	62.4%	61.9%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 62 – Job Projections for Fresno SOI by Sector, 2015-2050

Job Sector	Year							
	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	1,330	1,330	1,330	1,350	1,370	1,380	1,380	1,380
Mfg./Mining	13,350	13,350	13,350	13,350	13,350	13,250	13,140	13,040
Other Industrial	34,520	37,220	39,770	42,140	44,580	46,950	48,920	51,030
Retail	23,860	26,340	27,260	28,660	30,380	31,730	32,820	34,090
Office	38,380	41,340	44,700	47,070	49,060	51,070	52,790	54,300
Education	27,170	28,750	30,330	32,290	35,570	37,580	39,220	41,030
Health Services	44,490	49,530	56,320	59,040	61,590	64,280	67,110	70,000
Hospitality	21,610	23,440	25,490	26,470	27,490	28,550	29,650	30,790
Government	26,850	27,200	27,600	27,990	28,080	28,880	29,690	30,790
Total	**231,560**	**248,500**	**266,150**	**278,370**	**291,470**	**303,650**	**314,730**	**326,450**

Source: ADE, Inc.

Table 63 – Populations Trends and Projections: 2015-2050: Fresno SOI

Population Variable	Year								2015-2050	
	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	574,590	624,040	676,820	725,120	772,030	816,980	859,410	903,790	329,200	1.3%
Tot. Nos. of Persons in Group Qtrs.	10,530	11,090	12,150	13,190	13,890	14,700	15,460	16,260	5,730	1.2%
Tot. Nos. of Persons in HHs	564,060	612,950	664,670	711,930	758,140	802,280	843,950	887,530	323,470	1.3%
Tot. Nos. of HHs	181,830	198,420	212,740	223,700	233,120	243,160	254,770	268,260	86,430	1.1%
Persons Per Household	3.10	3.09	3.12	3.18	3.25	3.30	3.31	3.31		

Source: ADE

Table 64 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Fresno SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	16,590	30,910	41,870	51,290	61,330	72,940	86,430
Total Number of New Units Required By Period	13,360	24,380	43,300	53,040	63,410	75,420	89,370

Source: ADE

Table 65 – Trends and Projections in Total Number of Persons by Age: Fresno SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Fresno SOI	**574,600**	**624,000**	**676,800**	**725,100**	**772,000**	**817,000**	**859,400**	**903,800**	**329,200**	**1.3%**	**100.0%**	**100.0%**
5 and below	57,100	61,200	64,100	65,700	67,700	71,000	77,500	82,200	25,100	1.0%	9.9%	9.1%
6 to 14	82,400	88,000	92,100	97,600	100,600	103,200	106,400	113,900	31,500	0.9%	14.3%	12.6%
15 to 19	43,300	45,000	50,800	51,200	55,100	57,000	57,900	59,400	16,100	0.9%	7.5%	6.6%
20 to 24	47,800	44,400	46,300	51,900	52,300	56,100	57,700	58,700	10,900	0.6%	8.3%	6.5%
25 to 34	92,800	97,900	95,800	93,800	101,200	107,200	110,700	116,100	23,300	0.6%	16.2%	12.8%
35 to 44	70,700	84,200	97,200	102,400	99,500	97,200	104,000	109,700	39,000	1.3%	12.3%	12.1%
45 to 54	63,900	65,800	73,300	87,100	99,900	105,000	101,200	98,400	34,500	1.2%	11.1%	10.9%
55 to 64	55,800	61,900	64,600	66,400	73,600	87,200	99,300	103,700	47,900	1.8%	9.7%	11.5%
65 to 74	35,000	45,200	53,300	58,900	61,100	62,800	69,100	81,600	46,600	2.5%	6.1%	9.0%
75 and above	26,000	30,500	39,400	50,200	61,000	70,200	75,500	80,100	54,100	3.3%	4.5%	8.9%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 66 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Fresno SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Fresno SOI	**574,600**	**624,000**	**676,800**	**725,100**	**772,000**	**817,000**	**859,400**	**903,800**	**329,200**	**1.3%**	**100.0%**	**100.0%**
White	166,700	171,400	175,600	177,000	176,700	175,500	175,900	177,000	10,300	0.2%	29.0%	19.6%
Latino	284,800	319,300	357,000	394,700	433,800	473,400	510,600	549,300	264,500	1.9%	49.6%	60.8%
Black	39,800	42,400	45,100	47,200	49,000	50,200	50,800	51,200	11,400	0.7%	6.9%	5.7%
Asian	65,600	71,900	78,700	84,600	89,600	94,000	97,600	101,300	35,700	1.2%	11.4%	11.2%
Pacific Islander	800	900	900	1,000	1,100	1,100	1,200	1,300	500	1.4%	0.1%	0.1%
Native American	3,600	3,700	3,800	3,800	3,800	3,800	3,600	3,500	-100	-0.1%	0.6%	0.4%
Other	1,100	1,200	1,300	1,400	1,500	1,500	1,600	1,600	500	1.1%	0.2%	0.2%
Two or more	12,200	13,200	14,400	15,500	16,600	17,500	18,200	18,700	6,500	1.2%	2.1%	2.1%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 67 – Fresno Household Income Projections

	Number of Households							
Income Category	2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	17,270	16,830	15,630	13,910	13,170	12,560	12,080	11,890
$10,000 to $24,999	39,760	38,740	35,980	32,020	30,330	28,900	27,810	27,380
$25,000 to $34,999	21,500	20,950	19,450	17,310	16,400	15,630	15,040	14,800
$35,000 to $49,999	24,860	27,990	26,290	23,770	22,510	21,460	20,640	20,330
$50,000 to $74,999	31,050	37,540	48,700	59,770	57,470	56,650	57,260	56,370
$75,000 to $99,999	18,720	22,270	26,340	30,390	39,340	47,350	54,850	62,740
$100,000 to $149,999	17,490	20,810	24,610	28,390	32,890	36,980	40,920	45,590
$150,000 or more	11,180	13,300	15,730	18,150	21,020	23,630	26,160	29,140
Total	**181,830**	**198,420**	**212,740**	**223,700**	**233,120**	**243,160**	**254,770**	**268,260**
Mean Income	**$59,080**	**$62,710**	**$67,430**	**$72,210**	**$76,700**	**$80,310**	**$83,240**	**$85,970**
CAGR		**1.2%**	**1.5%**	**1.4%**	**1.2%**	**0.9%**	**0.7%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

HURON

Table 68 – Estimate of Past Job Trends: Huron SOI

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	994	979	1,073	920	855	832	828	2,752	1,675	1,027	211	200	441	-6.5%	2.1%	0.9%
Mfg./Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	0.0%	0.0%
Other Industrial	27	22	38	26	121	61	85	55	110	196	28	15	12	-6.5%	0.1%	0.0%
Retail	115	91	92	100	25	12	16	9	46	58	57	52	29	-10.8%	0.3%	0.1%
Office	2	3	3	2	3	0	0	1	4	0	1	1	2	-1.1%	0.0%	0.0%
Education	0	0	0	0	0	20	12	26	107	108	101	108	118	NA	0.0%	0.3%
Health Services	17	21	23	29	31	21	26	20	16	24	22	44	38	6.7%	0.0%	0.1%
Hospitality	28	37	43	41	41	7	10	21	35	58	38	48	22	-1.9%	0.1%	0.1%
Government	12	0	12	6	3	0	9	9	75	57	75	108	78	16.9%	0.0%	0.2%
Total	1,194	1,152	1,285	1,124	1,079	953	986	2,893	2,068	1,528	533	577	740	-3.9%	0.4%	0.2%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 69 – Job Projections for Huron SOI by Sector, 2015-2050

Job Sector	Year							
	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	350	350	350	360	360	360	360	360
Mfg./Mining	0	0	0	0	0	0	0	0
Other Industrial	10	10	10	10	10	10	10	10
Retail	30	40	40	40	40	40	40	40
Office	0	0	0	0	0	0	0	0
Education	160	160	160	160	170	170	170	180
Health Services	60	160	160	160	170	170	170	180
Hospitality	30	30	30	30	30	30	30	40
Government	90	90	90	90	90	100	100	100
Total	**730**	**840**	**840**	**860**	**870**	**890**	**900**	**910**

Source: ADE, Inc.

Table 70 – Populations Trends and Projections: 2015-2050: Huron SOI

Population Variable	Year								2015-2050	
	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	6,820	7,430	7,600	7,750	7,900	8,050	8,180	8,330	1,510	0.6%
Tot. Nos. of Persons in Group Qtrs.	0	0	0	0	0	0	0	0	0	
Tot. Nos. of Persons in HHs	6,820	7,430	7,600	7,750	7,900	8,050	8,180	8,330	1,510	0.6%
Tot. Nos. of HHs	1,570	1,710	1,730	1,740	1,730	1,740	1,760	1,790	220	0.4%
Persons Per Household	4.34	4.34	4.39	4.46	4.55	4.64	4.63	4.64		

Source: ADE

Table 71 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Huron SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	140	160	170	160	170	190	220
Total Number of New Units Required By Period	150	170	180	180	190	200	240

Source: ADE

Table 72 – Trends and Projections in Total Number of Persons by Age: Huron SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Huron SOI	**6,800**	**7,400**	**7,600**	**7,800**	**7,900**	**8,000**	**8,200**	**8,300**	**1,500**	**0.6%**	**100.0%**	**100.0%**
5 and below	770	800	810	820	830	830	830	830	60	0.2%	11.3%	10.0%
6 to 14	1,190	1,220	1,100	1,120	1,130	1,160	1,170	1,170	-20	0.0%	17.5%	14.1%
15 to 19	600	630	680	560	580	590	600	620	20	0.1%	8.8%	7.5%
20 to 24	630	600	600	650	540	550	560	580	-50	-0.2%	9.3%	7.0%
25 to 34	1,120	1,220	1,170	1,100	1,150	1,100	1,020	1,050	-70	-0.2%	16.5%	12.7%
35 to 44	880	1,000	1,060	1,090	1,050	1,000	1,050	1,010	130	0.4%	12.9%	12.2%
45 to 54	660	770	830	890	950	980	950	910	250	0.9%	9.7%	11.0%
55 to 64	550	630	600	670	720	780	840	870	320	1.3%	8.1%	10.5%
65 to 74	240	340	480	520	500	560	610	660	420	2.9%	3.5%	8.0%
75 and above	170	220	270	330	460	510	560	620	440	3.7%	2.5%	7.5%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 73 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Huron SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
Huron SOI	**6,800**	**7,400**	**7,600**	**7,800**	**7,900**	**8,000**	**8,200**	**8,300**	**1,500**	**0.6%**	**100.0%**	**100.0%**
White	100	110	110	100	90	90	90	100	0	0.0%	1.5%	1.2%
Latino	6,640	7,240	7,420	7,590	7,760	7,900	8,040	8,190	1,550	0.6%	97.6%	98.7%
Black	30	30	30	30	20	20	20	20	-10	-1.2%	0.4%	0.2%
Asian	40	40	30	30	30	20	20	20	-20	-2.0%	0.6%	0.2%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	10	10	10	10	10	10	0	0	-10		0.1%	0.0%
Other	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Two or more	0	0	0	0	0	0	0	0	0		0.0%	0.0%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 74 – Huron Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	200	200	180	160	150	150	140	140
$10,000 to $24,999	470	460	420	380	360	340	330	320
$25,000 to $34,999	210	210	190	170	160	150	150	150
$35,000 to $49,999	330	370	350	320	300	290	270	270
$50,000 to $74,999	220	320	400	490	480	470	470	470
$75,000 to $99,999	80	90	110	130	180	230	270	310
$100,000 to $149,999	40	50	50	60	70	80	90	100
$150,000 or more	20	20	20	30	30	40	40	40
Total	**1,570**	**1,710**	**1,730**	**1,740**	**1,730**	**1,740**	**1,760**	**1,790**
Mean Income	**$37,560**	**$40,590**	**$43,560**	**$47,130**	**$49,810**	**$52,170**	**$54,270**	**$56,010**
CAGR		**1.6%**	**1.4%**	**1.6%**	**1.1%**	**0.9%**	**0.8%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

KERMAN

Table 75 – Estimate of Past Job Trends: Kerman SOI

	Year															
Job Sector	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2002-2014 CAGR**	**2002 Share of County**	**2014 Share of County**
Agriculture	2	3	37	44	30	37	41	16	41	57	58	66	92	39.5%	0.0%	0.2%
Mfg./Mining	114	115	9	126	108	9	8	15	13	10	47	42	162	3.0%	0.4%	0.7%
Other Industrial	109	124	149	166	138	199	234	182	196	190	223	281	238	6.8%	0.2%	0.5%
Retail	667	675	653	669	669	746	622	498	439	478	481	457	501	-2.4%	1.9%	1.4%
Office	184	179	167	258	275	286	288	313	304	259	338	242	312	4.5%	0.5%	0.7%
Education	419	402	391	385	394	400	394	370	412	385	386	382	388	-0.6%	1.1%	1.0%
Health Services	94	90	69	92	87	113	133	143	121	152	146	301	326	10.9%	0.3%	0.6%
Hospitality	214	172	177	204	230	218	218	228	220	201	252	222	243	1.1%	0.8%	0.8%
Government	259	256	236	271	242	254	200	277	94	143	164	162	169	-3.5%	0.7%	0.5%
Total	2,063	2,015	1,888	2,215	2,173	2,262	2,139	2,042	1,839	1,876	2,095	2,155	2,431	1.4%	0.6%	0.7%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 76 – Job Projections for Kerman SOI by Sector, 2015-2050

	Year							
Job Sector	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Agriculture	80	80	80	80	80	80	80	80
Mfg./Mining	190	190	190	190	190	190	190	190
Other Industrial	260	280	310	330	350	370	380	400
Retail	550	610	630	660	700	730	760	790
Office	320	360	400	420	440	460	480	500
Education	440	460	500	530	550	580	600	630
Health Services	400	450	520	550	580	600	630	660
Food Services	260	280	320	330	350	360	370	390
Government	180	180	180	190	200	210	220	230
Total	**2,680**	**2,890**	**3,130**	**3,290**	**3,440**	**3,580**	**3,720**	**3,860**

Source: ADE, Inc.

Table 77 – Populations Trends and Projections: 2015-2050: Kerman SOI

	Year								2015-2050	
Population Variable	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***
Tot. Nos. of Persons	14,880	15,900	16,930	17,860	18,770	19,650	20,470	21,330	6,450	1.0%
Tot. Nos. of Persons in Group Qtrs.	10	0	10	0	0	10	10	10	0	0.0%
Tot. Nos. of Persons in HHs	14,870	15,900	16,920	17,860	18,770	19,640	20,460	21,320	6,450	1.0%
Tot. Nos. of HHs	4,110	4,410	4,640	4,810	4,950	5,100	5,300	5,530	1,420	0.9%
Persons Per Household	3.62	3.61	3.65	3.71	3.79	3.85	3.86	3.86		

Source: ADE

Table 78 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Kerman SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	300	530	700	840	990	1,190	1,420
Total Number of New Units Required By Period	250	430	720	860	1,020	1,220	1,460

Source: ADE

Table 79 – Trends and Projections in Total Number of Persons by Age: Kerman SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Kerman SOI	**14,900**	**15,900**	**16,900**	**17,900**	**18,800**	**19,600**	**20,500**	**21,300**	**6,400**	**1.0%**	**100.0%**	**100.0%**
5 and below	1,600	1,600	1,700	1,800	1,800	1,900	2,000	2,100	500	0.8%	10.7%	9.9%
6 to 14	2,500	2,500	2,400	2,500	2,600	2,700	2,800	2,900	500	0.5%	16.8%	14.1%
15 to 19	1,200	1,300	1,400	1,300	1,300	1,400	1,500	1,500	400	0.8%	8.1%	7.5%
20 to 24	1,200	1,200	1,300	1,400	1,300	1,300	1,400	1,500	300	0.6%	8.1%	7.0%
25 to 34	2,100	2,200	2,400	2,500	2,700	2,700	2,600	2,700	600	0.7%	14.1%	12.7%
35 to 44	2,000	2,200	2,100	2,200	2,400	2,500	2,700	2,600	600	0.8%	13.4%	12.2%
45 to 54	1,600	1,700	2,000	2,100	2,000	2,200	2,300	2,400	800	1.2%	10.7%	11.3%
55 to 64	1,300	1,400	1,500	1,600	1,900	2,000	1,900	2,100	700	1.2%	8.7%	9.4%
65 to 74	800	1,000	1,200	1,300	1,400	1,500	1,700	1,800	1,000	2.3%	5.4%	8.5%
75 and above	500	700	900	1,100	1,300	1,500	1,600	1,800	1,300	3.7%	3.4%	8.5%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 80 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Kerman SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Kerman SOI	**14,900**	**15,900**	**16,900**	**17,900**	**18,800**	**19,600**	**20,500**	**21,300**	**6,400**	**1.0%**	**100.0%**	**100.0%**
White	2,560	2,550	2,530	2,480	2,440	2,380	2,350	2,320	-240	-0.3%	17.2%	10.9%
Latino	10,900	11,880	12,890	13,860	14,820	15,750	16,610	17,510	6,610	1.4%	73.2%	82.2%
Black	40	40	40	40	30	30	30	30	-10	-0.8%	0.3%	0.1%
Asian	1,120	1,160	1,200	1,210	1,210	1,220	1,210	1,210	90	0.2%	7.5%	5.7%
Pacific Islander	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%
Native American	60	50	50	50	40	40	30	30	-30	-2.0%	0.4%	0.1%
Other	40	40	30	30	30	30	30	30	-10	-0.8%	0.3%	0.1%
Two or more	170	170	180	190	190	200	200	200	30	0.5%	1.1%	0.9%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 81 – Kerman Household Income Projections

	Number of Households							
Income Category	2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	270	260	240	210	200	190	190	180
$10,000 to $24,999	830	800	750	670	630	600	580	570
$25,000 to $34,999	700	680	630	560	540	510	490	480
$35,000 to $49,999	560	630	590	530	500	480	460	450
$50,000 to $74,999	820	910	1,100	1,300	1,250	1,230	1,250	1,230
$75,000 to $99,999	350	420	500	580	710	840	950	1,070
$100,000 to $149,999	460	540	640	740	860	970	1,070	1,190
$150,000 or more	130	160	190	220	250	280	310	350
Total	**4,110**	**4,410**	**4,640**	**4,810**	**4,950**	**5,100**	**5,300**	**5,530**
Mean Income	**$55,860**	**$58,970**	**$63,200**	**$67,620**	**$71,540**	**$74,790**	**$77,470**	**$79,980**
CAGR		**1.1%**	**1.4%**	**1.4%**	**1.1%**	**0.9%**	**0.7%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

KINGSBURG

Table 82 – Estimate of Past Job Trends: Kingsburg SOI

	Year															
Job Sector	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2002-2014 CAGR**	**2002 Share of County**	**2014 Share of County**
Agriculture	39	60	74	57	57	66	59	52	54	61	58	66	77	5.8%	0.1%	0.2%
Mfg./Mining	1,589	1,780	4,693	4,540	4,668	4,243	4,191	4,120	4,492	1,471	736	412	494	-9.3%	5.8%	2.0%
Other Industrial	294	363	341	338	363	324	347	272	204	1,092	1,124	1,125	1,155	12.1%	0.6%	2.3%
Retail	335	312	351	441	452	325	332	351	315	395	344	352	401	1.5%	1.0%	1.1%
Office	534	538	227	230	247	236	234	219	209	224	236	242	231	-6.7%	1.3%	0.5%
Education	241	229	209	295	283	308	320	310	298	298	270	269	272	1.0%	0.6%	0.7%
Health Services	458	518	392	428	409	450	403	394	307	301	323	322	311	-3.2%	1.2%	0.6%
Hospitality	204	208	225	242	463	344	274	229	230	222	231	261	324	3.9%	0.8%	1.0%
Government	29	66	53	1	1	22	26	87	30	30	75	75	74	8.1%	0.1%	0.2%
Total	3,723	4,073	6,566	6,572	6,942	6,320	6,186	6,034	6,138	4,095	3,397	3,124	3,339	-0.9%	1.1%	0.9%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 83 – Job Projections for Kingsburg SOI by Sector, 2015-2050

	Year							
Job Sector	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Agriculture	70	70	70	70	70	70	70	70
Mfg./Mining	540	540	540	540	540	540	530	530
Other Industrial	1,230	1,480	1,580	1,670	1,770	1,870	1,940	2,030
Retail	420	460	480	510	530	560	590	610
Office	230	230	230	240	260	270	280	290
Education	290	290	290	310	320	340	350	370
Health Services	340	450	500	530	560	580	610	640
Hospitality	340	370	420	440	450	470	490	510
Government	80	80	80	80	90	90	100	100
Total	3,540	3,970	4,190	4,390	4,600	4,790	4,960	5,150

Source: ADE, Inc.

Table 84 – Populations Trends and Projections: 2015-2050: Kingsburg SOI

	Year								2015-2050	
Population Variable	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***
Tot. Nos. of Persons	12,750	13,670	14,590	15,440	16,260	17,050	17,790	18,570	5,820	1.1%
Tot. Nos. of Persons in Group Qtrs.	90	100	100	110	110	120	120	130	40	1.1%
Tot. Nos. of Persons in HHs	12,660	13,570	14,490	15,330	16,150	16,930	17,670	18,440	5,780	1.1%
Tot. Nos. of HHs	4,340	4,670	4,930	5,120	5,280	5,460	5,670	5,930	1,590	0.9%
Persons Per Household	2.92	2.91	2.94	2.99	3.06	3.10	3.12	3.11		

Source: ADE

Table 85 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Kingsburg SOI

	Period						
Households and Housing Units	**15-20**	**15-25**	**15-30**	**15-35**	**15-40**	**15-45**	**15-50**
Total Number of New Households By Period	330	590	780	940	1,120	1,330	1,590
Total Number of New Units Required By Period	270	450	810	970	1,150	1,370	1,640

Source: ADE

Table 86 – Trends and Projections in Total Number of Persons by Age: Kingsburg SOI

	Year								2015-2050		2015	2050
Age Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
Kingsburg SOI	**12,700**	**13,700**	**14,600**	**15,400**	**16,300**	**17,000**	**17,800**	**18,600**	**5,800**	**1.1%**	**100.0%**	**100.0%**
5 and below	1,100	1,200	1,300	1,400	1,400	1,500	1,600	1,700	500	1.1%	8.7%	8.6%
6 to 14	1,800	1,700	1,700	1,900	2,100	2,200	2,200	2,300	500	0.7%	14.2%	12.4%
15 to 19	1,000	1,000	1,000	1,000	1,000	1,100	1,200	1,300	300	0.8%	7.9%	7.0%
20 to 24	1,000	1,100	1,100	1,100	1,000	1,100	1,200	1,200	300	0.8%	7.9%	7.0%
25 to 34	1,500	1,800	2,100	2,200	2,200	2,100	2,100	2,300	800	1.2%	11.8%	12.4%
35 to 44	1,500	1,600	1,600	1,900	2,200	2,200	2,200	2,100	600	1.0%	11.8%	11.4%
45 to 54	1,700	1,600	1,600	1,600	1,600	1,900	2,200	2,300	600	0.9%	13.4%	12.4%
55 to 64	1,400	1,600	1,700	1,600	1,600	1,600	1,600	1,900	500	0.9%	11.0%	10.3%
65 to 74	900	1,100	1,300	1,500	1,600	1,500	1,500	1,500	600	1.5%	7.1%	8.1%
75 and above	800	900	1,100	1,300	1,500	1,800	1,900	1,900	1,100	2.5%	6.3%	10.3%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 87 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Kingsburg SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
Kingsburg SOI	**12,700**	**13,700**	**14,600**	**15,400**	**16,300**	**17,000**	**17,800**	**18,600**	**5,900**	**1.1%**	**100.0%**	**100.0%**
White	6,250	6,440	6,580	6,670	6,720	6,730	6,760	6,800	550	0.2%	49.2%	36.6%
Latino	5,740	6,420	7,150	7,870	8,610	9,360	10,060	10,790	5,050	1.8%	45.2%	58.0%
Black	40	40	40	30	30	30	30	20	-20	-2.0%	0.3%	0.1%
Asian	380	410	440	460	480	490	500	500	120	0.8%	3.0%	2.7%
Pacific Islander	10	10	10	10	10	10	10	10	0	0.0%	0.1%	0.1%
Native American	60	60	60	60	60	50	50	40	-20	-1.2%	0.5%	0.2%
Other	20	20	20	20	20	20	20	20	0	0.0%	0.2%	0.1%
Two or more	250	270	300	320	340	360	380	380	130	1.2%	2.0%	2.0%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 88 – Kingsburg Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	210	210	190	170	160	150	150	150
$10,000 to $24,999	720	700	650	580	550	530	510	500
$25,000 to $34,999	310	300	280	250	240	230	220	210
$35,000 to $49,999	480	540	510	460	440	420	400	390
$50,000 to $74,999	850	820	810	800	770	750	760	750
$75,000 to $99,999	840	1,000	1,180	1,360	1,380	1,420	1,470	1,510
$100,000 to $149,999	440	520	620	710	830	930	1,030	1,150
$150,000 or more	490	580	690	790	920	1,030	1,140	1,270
Total	**4,340**	**4,670**	**4,930**	**5,120**	**5,280**	**5,460**	**5,670**	**5,930**
Mean Income	**$76,870**	**$81,040**	**$86,560**	**$92,270**	**$97,190**	**$101,200**	**$104,480**	**$107,720**
CAGR		**1.1%**	**1.3%**	**1.3%**	**1.0%**	**0.8%**	**0.6%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

MENDOTA

Table 89 – Estimate of Past Job Trends: Mendota SOI

	Year															
Job Sector	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2002-2014 CAGR**	**2002 Share of County**	**2014 Share of County**
Agriculture	138	189	151	122	178	63	43	239	219	195	206	202	157	1.1%	0.3%	0.3%
Mfg./Mining	1	3	4	2	2	3	1	2	1	0	2	1	0	NA	0.0%	0.0%
Other Industrial	103	104	99	112	122	157	151	143	123	120	125	90	97	-0.5%	0.2%	0.2%
Retail	138	134	112	145	170	145	143	136	166	199	195	153	136	-0.1%	0.4%	0.4%
Office	3	3	3	4	1	2	3	2	5	4	11	11	14	12.4%	0.0%	0.0%
Education	158	162	156	158	158	160	159	157	153	146	155	156	161	0.2%	0.4%	0.4%
Health Services	51	60	69	81	101	97	105	103	69	94	103	188	189	11.6%	0.1%	0.3%
Hospitality	39	43	38	40	44	60	71	95	97	102	118	125	92	7.4%	0.1%	0.3%
Government	8	7	6	5	7	9	8	10	12	13	14	13	44	15.9%	0.0%	0.1%
Total	638	706	638	669	784	696	683	887	846	872	929	940	890	2.8%	0.2%	0.2%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 90 – Job Projections for Mendota SOI by Sector, 2015-2050

	Year							
Job Sector	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Agriculture	160	160	160	160	160	170	170	170
Mfg./Mining	0	0	0	0	0	0	0	0
Other Industrial	100	100	100	110	110	120	120	130
Retail	140	140	140	150	150	160	170	170
Office	10	10	10	10	10	10	10	10
Education	160	160	160	170	180	180	190	200
Health Services	190	200	210	220	230	240	250	260
Hospitality	90	90	90	90	100	100	100	110
Government	40	40	40	40	40	50	50	50
Total	**890**	**900**	**910**	**950**	**990**	**1,030**	**1,060**	**1,100**

Source: ADE, Inc.

Table 91 – Populations Trends and Projections: 2015-2050: Mendota SOI

	Year								2015-2050	
Population Variable	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***
Tot. Nos. of Persons	11,210	11,920	12,630	13,280	13,920	14,520	15,090	15,690	4,480	1.0%
Tot. Nos. of Persons in Group Qtrs.	0	0	0	0	0	0	0	0	0	
Tot. Nos. of Persons in HHs	11,210	11,920	12,630	13,280	13,920	14,520	15,090	15,690	4,480	1.0%
Tot. Nos. of HHs	2,500	2,670	2,800	2,890	2,960	3,040	3,150	3,280	780	0.8%
Persons Per Household	4.48	4.47	4.51	4.60	4.70	4.77	4.79	4.78		

Source: ADE

Table 92 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Mendota SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	170	300	390	460	540	650	780
Total Number of New Units Required By Period	150	250	400	480	560	680	810

Source: ADE

Table 93 – Trends and Projections in Total Number of Persons by Age: Mendota SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Mendota SOI	**11,200**	**11,900**	**12,600**	**13,300**	**13,900**	**14,500**	**15,100**	**15,700**	**4,500**	**1.0%**	**100.0%**	**100.0%**
5 and below	1,200	1,200	1,300	1,300	1,400	1,400	1,500	1,500	300	0.6%	10.7%	9.6%
6 to 14	1,800	1,900	1,800	1,800	1,900	2,000	2,100	2,200	400	0.4%	16.1%	14.0%
15 to 19	900	900	1,100	1,000	1,000	1,000	1,100	1,100	200	0.8%	8.0%	7.0%
20 to 24	900	800	900	1,100	900	1,000	1,000	1,100	200	0.3%	8.0%	7.0%
25 to 34	2,000	1,900	1,800	1,700	2,000	2,000	1,900	1,900	-100	-0.2%	17.9%	12.1%
35 to 44	1,600	1,900	2,000	1,900	1,700	1,600	1,900	1,900	300	0.6%	14.3%	12.1%
45 to 54	1,200	1,300	1,500	1,800	1,900	1,800	1,600	1,600	400	0.9%	10.7%	10.2%
55 to 64	900	1,000	1,100	1,200	1,400	1,700	1,800	1,700	800	1.9%	8.0%	10.8%
65 to 74	400	600	800	900	1,000	1,100	1,300	1,500	1,100	3.7%	3.6%	9.6%
75 and above	300	300	400	600	800	1,000	1,100	1,200	900	4.6%	2.7%	7.6%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 94 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Mendota SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
Mendota SOI	**11,200**	**11,900**	**12,600**	**13,300**	**13,900**	**14,500**	**15,100**	**15,700**	**4,500**	**1.0%**	**100.0%**	**100.0%**
White	230	220	220	220	230	230	230	230	0	0.0%	2.1%	1.5%
Latino	10,870	11,590	12,300	12,960	13,590	14,210	14,780	15,390	4,520	1.0%	97.1%	98.0%
Black	30	20	20	20	20	20	20	20	-10	-1.2%	0.3%	0.1%
Asian	40	40	40	30	30	30	20	20	-20	-2.0%	0.4%	0.1%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	20	20	20	20	20	20	10	10	-10	-2.0%	0.2%	0.1%
Other	20	20	20	20	20	20	20	20	0	0.0%	0.2%	0.1%
Two or more	10	10	10	10	10	10	10	10	0	0.0%	0.1%	0.1%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 95 – Mendota Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	320	310	290	260	250	230	230	220
$10,000 to $24,999	1,010	980	910	810	770	730	700	690
$25,000 to $34,999	360	350	320	290	270	260	250	250
$35,000 to $49,999	320	430	570	720	640	590	580	570
$50,000 to $74,999	370	440	530	610	600	600	600	680
$75,000 to $99,999	70	80	100	110	320	500	660	730
$100,000 to $149,999	50	60	80	90	100	110	130	140
$150,000 or more	0	0	0	0	0	0	0	10
Total	**2,500**	**2,670**	**2,800**	**2,890**	**2,960**	**3,040**	**3,150**	**3,280**
Mean Income	**$31,850**	**$34,150**	**$36,760**	**$39,530**	**$43,790**	**$47,280**	**$50,110**	**$51,690**
CAGR		**1.4%**	**1.5%**	**1.5%**	**2.1%**	**1.5%**	**1.2%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

ORANGE COVE

Table 96 – Estimate of Past Job Trends: Orange Cove SOI

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	133	165	172	90	96	56	69	65	40	46	38	31	23	-13.6%	0.3%	0.0%
Mfg./Mining	4	4	4	3	4	4	3	3	8	5	7	5	8	6.8%	0.0%	0.0%
Other Industrial	74	74	70	87	77	96	95	83	86	67	92	63	46	-3.9%	0.1%	0.1%
Retail	70	78	77	91	89	92	102	102	104	88	96	85	56	-1.9%	0.2%	0.2%
Office	31	32	35	159	193	185	200	30	29	55	30	40	19	-4.1%	0.1%	0.0%
Education	151	154	149	156	165	210	207	219	222	199	179	176	152	0.0%	0.4%	0.4%
Health Services	85	90	95	109	108	70	85	78	90	106	76	166	184	6.6%	0.2%	0.3%
Hospitality	3	3	0	11	12	9	6	10	4	1	7	2	1	-9.1%	0.0%	0.0%
Government	108	104	116	108	96	0	116	201	193	208	220	270	54	-5.6%	0.3%	0.2%
Total	661	704	719	816	841	722	884	790	776	774	746	839	543	-1.6%	0.2%	0.1%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 97 – Job Projections for Orange Cove SOI by Sector, 2015-2050

	Year							
Job Sector	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Agriculture	20	20	20	20	20	20	20	20
Mfg./Mining	10	10	10	10	10	10	10	10
Other Industrial	50	50	50	50	60	60	60	60
Retail	60	120	120	120	120	130	130	130
Office	20	20	20	20	20	20	20	20
Education	150	150	150	150	150	160	160	160
Health Services	180	210	240	240	250	250	260	260
Hospitality	0	0	0	0	0	0	0	0
Government	50	50	50	50	50	50	50	50
Total	**540**	**630**	**660**	**670**	**690**	**700**	**710**	**720**

Source: ADE, Inc.

Table 98 – Populations Trends and Projections: 2015-2050: Orange Cove SOI

	Year								2015-2050	
Population Variable	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***
Tot. Nos. of Persons	9,360	9,540	9,710	9,880	10,030	10,190	10,330	10,480	1,120	0.3%
Tot. Nos. of Persons in Group Qtrs.	0	0	0	0	0	0	0	0	0	
Tot. Nos. of Persons in HHs	9,360	9,540	9,710	9,880	10,030	10,190	10,330	10,480	1,120	0.3%
Tot. Nos. of HHs	2,160	2,210	2,230	2,220	2,210	2,210	2,230	2,270	110	0.1%
Persons Per Household	4.33	4.32	4.35	4.45	4.54	4.61	4.63	4.62		

Source: ADE

Table 99 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Orange Cove SOI

Households and Housing Units	Period						
	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	50	70	60	50	50	70	110
Total Number of New Units Required By Period	20	40	60	70	70	80	110

Source: ADE

Table 100 – Trends and Projections in Total Number of Persons by Age: Orange Cove SOI

Age Group	Year								2015-2050		2015	2050
	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Orange Cove SOI	**9,400**	**9,500**	**9,700**	**9,900**	**10,000**	**10,200**	**10,300**	**10,500**	**1,100**	**0.3%**	**100.0%**	**100.0%**
5 and below	1,080	1,090	1,110	1,120	1,100	1,070	1,060	1,070	0	0.0%	11.9%	10.7%
6 to 14	1,800	1,650	1,450	1,500	1,540	1,540	1,510	1,490	-250	-0.4%	19.1%	14.8%
15 to 19	860	880	940	720	760	790	810	800	-50	-0.2%	9.1%	7.7%
20 to 24	880	800	830	880	680	720	750	770	-100	-0.3%	9.4%	7.4%
25 to 34	1,370	1,500	1,530	1,480	1,570	1,440	1,310	1,380	20	0.0%	14.6%	13.2%
35 to 44	1,130	1,160	1,200	1,310	1,350	1,330	1,410	1,310	170	0.4%	11.9%	12.3%
45 to 54	910	940	970	1,010	1,050	1,160	1,210	1,190	240	0.7%	9.7%	11.0%
55 to 64	670	720	770	800	830	880	920	1,020	320	1.1%	7.1%	9.4%
65 to 74	400	480	540	580	630	660	690	730	300	1.6%	4.3%	6.7%
75 and above	250	310	370	460	530	600	660	720	440	2.9%	2.7%	6.6%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 101 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Orange Cove SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Orange Cove SOI	9,400	9,500	9,700	9,900	10,000	10,200	10,300	10,500	1,100	0.3%	100.0%	100.0%
White	430	390	360	340	320	300	280	270	-160	-1.3%	4.6%	2.6%
Latino	8,730	8,950	9,180	9,380	9,580	9,760	9,930	10,100	1,370	0.4%	92.9%	96.2%
Black	20	20	20	20	10	10	10	10	-10	-2.0%	0.2%	0.1%
Asian	90	80	70	70	60	50	50	40	-50	-2.3%	1.0%	0.4%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	30	20	20	20	20	10	10	10	-20	-3.1%	0.3%	0.1%
Other	20	20	10	10	10	10	10	10	-10	-2.0%	0.2%	0.1%
Two or more	50	50	40	40	40	40	30	30	-20	-1.4%	0.5%	0.3%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 102 – Orange Cove Household Income Projections

Income Category	Number of Households							
	2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	320	310	290	260	250	230	230	220
$10,000 to $24,999	640	630	580	520	490	470	450	440
$25,000 to $34,999	490	480	440	390	370	350	340	340
$35,000 to $49,999	120	130	130	110	110	100	100	100
$50,000 to $74,999	330	360	430	520	500	500	500	490
$75,000 to $99,999	180	210	250	290	340	390	430	470
$100,000 to $149,999	50	60	80	90	100	110	130	140
$150,000 or more	20	30	30	40	40	50	50	60
Total	**2,160**	**2,210**	**2,230**	**2,220**	**2,210**	**2,210**	**2,230**	**2,270**
Mean Income	**$37,370**	**$39,530**	**$42,870**	**$46,920**	**$49,560**	**$51,930**	**$54,050**	**$55,770**
CAGR		**1.1%**	**1.6%**	**1.8%**	**1.1%**	**0.9%**	**0.8%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

PARLIER

Table 103 – Estimate of Past Job Trends: Parlier SOI

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	81	75	108	49	41	43	47	44	48	46	34	47	67	-1.6%	0.2%	0.1%
Mfg./Mining	0	3	1	4	2	2	6	0	53	236	273	301	371	NA	0.0%	1.5%
Other Industrial	56	63	74	64	53	126	117	159	296	299	336	287	272	14.0%	0.1%	0.5%
Retail	88	88	104	115	92	94	93	74	72	140	149	155	150	4.6%	0.3%	0.4%
Office	54	54	62	59	72	51	58	52	83	109	79	71	49	-0.9%	0.1%	0.1%
Education	622	615	614	617	533	470	491	430	446	597	645	655	718	1.2%	1.7%	1.9%
Health Services	184	185	181	188	168	151	163	200	220	235	261	317	326	4.9%	0.5%	0.6%
Hospitality	50	60	48	53	60	76	73	65	68	118	90	101	92	5.2%	0.2%	0.3%
Government	135	140	142	128	142	147	147	171	183	176	169	171	123	-0.8%	0.4%	0.4%
Total	1,271	1,282	1,335	1,278	1,163	1,160	1,196	1,197	1,468	1,956	2,036	2,104	2,168	4.5%	0.4%	0.6%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 104 – Job Projections for Parlier SOI by Sector, 2015-2050

	Year							
Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	70	70	70	70	70	70	70	70
Mfg./Mining	390	390	390	390	390	390	380	380
Other Industrial	280	320	370	390	410	440	460	470
Retail	150	160	160	170	170	180	190	190
Office	50	50	50	50	50	60	60	60
Education	740	790	840	880	910	940	980	1,010
Health Services	340	390	440	460	480	490	510	530
Hospitality	90	90	90	90	100	100	100	110
Government	120	120	120	130	130	130	140	140
Total	**2,230**	**2,380**	**2,530**	**2,630**	**2,720**	**2,810**	**2,890**	**2,970**

Source: ADE, Inc.

Table 105 – Populations Trends and Projections: 2015-2050: Parlier SOI

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	15,100	15,870	16,640	17,350	18,040	18,700	19,330	19,980	4,880	0.8%
Tot. Nos. of Persons in Group Qtrs.	10	0	0	0	0	0	10	0	-10	
Tot. Nos. of Persons in HHs	15,090	15,870	16,640	17,350	18,040	18,700	19,320	19,980	4,890	0.8%
Tot. Nos. of HHs	3,480	3,670	3,810	3,900	3,970	4,050	4,170	4,320	840	0.6%
Persons Per Household	4.34	4.32	4.36	4.45	4.55	4.62	4.63	4.63		

Source: ADE

Table 106 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Parlier SOI

Households and Housing Units	Period						
	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	190	330	420	490	570	690	840
Total Number of New Units Required By Period	150	240	430	500	590	720	870

Source: ADE

Table 107 – Trends and Projections in Total Number of Persons by Age: Parlier SOI

Age Group	Year								2015-2050		2015	2050
	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Parlier SOI	**15,100**	**15,900**	**16,600**	**17,400**	**18,000**	**18,700**	**19,300**	**20,000**	**4,900**	**0.8%**	**100.0%**	**100.0%**
5 and below	1,800	1,800	1,800	1,900	1,900	1,900	2,000	2,000	200	0.4%	11.9%	10.0%
6 to 14	2,700	2,700	2,500	2,600	2,700	2,700	2,800	2,800	100	0.2%	17.9%	14.0%
15 to 19	1,300	1,300	1,500	1,300	1,400	1,400	1,500	1,500	200	0.4%	8.6%	7.5%
20 to 24	1,400	1,200	1,300	1,500	1,300	1,300	1,400	1,400	0	0.1%	9.3%	7.0%
25 to 34	2,300	2,500	2,500	2,400	2,600	2,600	2,500	2,600	300	0.3%	15.2%	13.0%
35 to 44	2,000	2,100	2,200	2,300	2,300	2,300	2,500	2,500	500	0.6%	13.2%	12.5%
45 to 54	1,600	1,600	1,800	1,900	2,000	2,200	2,200	2,100	500	0.8%	10.6%	10.5%
55 to 64	1,100	1,300	1,400	1,500	1,700	1,800	1,800	2,000	900	1.7%	7.3%	10.0%
65 to 74	600	800	900	1,100	1,200	1,300	1,400	1,500	900	2.6%	4.0%	7.5%
75 and above	400	500	600	800	1,000	1,200	1,300	1,500	1,100	3.9%	2.6%	7.5%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 108 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Parlier SOI

Race/Ethnic Group	Year 2015	2020	2025	2030	2035	2040	2045	2050	2015-2050 Change	CAGR*	2015 Share	2050 Share
Parlier SOI	**15,100**	**15,900**	**16,600**	**17,400**	**18,000**	**18,700**	**19,300**	**20,000**	**4,900**	**0.8%**	**100.0%**	**100.0%**
White	240	230	220	210	210	200	190	180	-60	-0.8%	1.6%	0.9%
Latino	14,760	15,540	16,330	17,060	17,760	18,440	19,070	19,740	4,980	0.8%	97.7%	98.7%
Black	10	10	10	10	10	10	10	10	0	0.0%	0.1%	0.1%
Asian	40	40	30	30	20	20	20	20	-20	-2.0%	0.3%	0.1%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	10	10	10	10	10	10	10	10	0	0.0%	0.1%	0.1%
Other	20	10	10	10	10	10	10	10	-10	-2.0%	0.1%	0.1%
Two or more	20	20	20	20	10	10	10	10	-10	-2.0%	0.1%	0.1%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 109 – Parlier Household Income Projections

Income Category	Number of Households 2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	340	330	310	270	260	250	240	230
$10,000 to $24,999	930	900	840	750	710	680	650	640
$25,000 to $34,999	610	590	550	490	460	440	420	420
$35,000 to $49,999	720	820	770	690	660	630	600	590
$50,000 to $74,999	440	500	720	980	940	930	940	920
$75,000 to $99,999	130	150	180	210	350	470	580	690
$100,000 to $149,999	280	340	400	460	530	600	660	730
$150,000 or more	30	40	50	50	60	70	80	90
Total	**3,480**	**3,670**	**3,810**	**3,900**	**3,970**	**4,050**	**4,170**	**4,320**
Mean Income	**$42,590**	**$45,060**	**$48,920**	**$53,130**	**$56,720**	**$59,800**	**$62,440**	**$64,730**
CAGR		**1.1%**	**1.7%**	**1.7%**	**1.3%**	**1.1%**	**0.9%**	**0.7%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

REEDLEY

Table 110 – Estimate of Past Job Trends: Reedley SOI

	Year															
Job Sector	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2002-2014 CAGR**	**2002 Share of County**	**2014 Share of County**
Agriculture	60	61	45	76	81	89	94	82	76	84	77	85	84	2.9%	0.1%	0.2%
Mfg./Mining	188	211	228	226	180	153	74	178	200	204	184	189	254	2.5%	0.7%	1.0%
Other Industrial	660	654	671	699	701	697	669	845	852	1,081	982	1,102	1,025	3.7%	1.3%	2.0%
Retail	710	673	642	705	665	702	734	685	690	636	585	592	595	-1.5%	2.1%	1.7%
Office	248	231	247	323	312	277	485	315	581	604	205	256	278	0.9%	0.6%	0.6%
Education	1,459	1,432	1,452	1,362	1,453	1,433	1,401	1,336	1,297	1,143	1,152	1,190	1,267	-1.2%	3.9%	3.3%
Health Services	1,165	1,147	1,250	1,199	1,310	1,475	1,442	1,520	1,351	1,579	1,492	1,419	1,469	2.0%	3.1%	2.7%
Hospitality	303	331	335	412	574	598	694	658	625	614	478	443	434	3.0%	1.2%	1.4%
Government	142	140	139	134	143	158	179	158	200	229	228	206	217	3.6%	0.4%	0.7%
Total	4,935	4,880	5,009	5,136	5,419	5,583	5,773	5,777	5,873	6,173	5,383	5,481	5,623	1.1%	1.5%	1.6%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 111 – Job Projections for Reedley SOI by Sector, 2015-2050

	Year							
Job Sector	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Agriculture	80	80	80	80	80	80	80	80
Mfg./Mining	260	260	260	260	260	260	260	250
Other Industrial	1,050	1,140	1,230	1,300	1,380	1,450	1,510	1,580
Retail	610	870	900	950	990	1,030	1,070	1,110
Office	280	410	460	480	510	530	550	570
Education	1,300	1,370	1,440	1,510	1,580	1,650	1,720	1,780
Health Services	1,530	2,170	2,440	2,560	2,680	2,800	2,910	3,020
Hospitality	440	490	540	560	580	600	630	650
Government	220	220	220	230	240	250	260	270
Total	**5,770**	**7,010**	**7,570**	**7,940**	**8,310**	**8,660**	**8,990**	**9,330**

Source: ADE, Inc.

Table 112 – Populations Trends and Projections: 2015-2050: Reedley SOI

	Year								2015-2050	
Population Variable	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***
Tot. Nos. of Persons	25,570	27,150	28,740	30,200	31,610	32,960	34,240	35,580	10,010	0.9%
Tot. Nos. of Persons in Group Qtrs.	310	320	340	360	370	390	400	420	110	0.9%
Tot. Nos. of Persons in HHs	25,260	26,830	28,400	29,840	31,240	32,570	33,840	35,160	9,900	0.9%
Tot. Nos. of HHs	7,020	7,490	7,840	8,080	8,280	8,510	8,810	9,160	2,140	0.8%
Persons Per Household	3.60	3.58	3.62	3.69	3.77	3.83	3.84	3.84		

Source: ADE

Table 113 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Reedley SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	470	820	1,060	1,260	1,490	1,790	2,140
Total Number of New Units Required By Period	420	710	1,100	1,300	1,540	1,840	2,210

Source: ADE

Table 114 – Trends and Projections in Total Number of Persons by Age: Reedley SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Reedley SOI	**25,600**	**27,200**	**28,700**	**30,200**	**31,600**	**33,000**	**34,200**	**35,600**	**10,000**	**0.9%**	**100.0%**	**100.0%**
5 and below	2,600	2,700	2,900	3,000	3,100	3,100	3,300	3,500	900	0.9%	10.2%	9.8%
6 to 14	3,900	3,900	3,900	4,200	4,400	4,500	4,600	4,700	800	0.5%	15.2%	13.2%
15 to 19	2,100	2,200	2,200	2,100	2,200	2,400	2,500	2,500	400	0.5%	8.2%	7.0%
20 to 24	2,200	2,100	2,200	2,200	2,100	2,200	2,400	2,500	300	0.3%	8.6%	7.0%
25 to 34	3,600	4,100	4,400	4,300	4,300	4,200	4,200	4,500	900	0.7%	14.1%	12.6%
35 to 44	3,200	3,400	3,500	4,000	4,300	4,200	4,200	4,100	900	0.7%	12.5%	11.5%
45 to 54	3,000	3,100	3,200	3,300	3,400	3,900	4,100	4,100	1,100	0.9%	11.7%	11.5%
55 to 64	2,300	2,600	2,900	3,000	3,000	3,100	3,300	3,700	1,400	1.4%	9.0%	10.4%
65 to 74	1,400	1,700	2,100	2,400	2,600	2,700	2,700	2,800	1,400	2.1%	5.5%	7.9%
75 and above	1,300	1,300	1,600	1,900	2,300	2,600	3,000	3,200	1,900	2.7%	5.1%	9.0%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 115 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Reedley SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Reedley SOI	**25,600**	**27,200**	**28,700**	**30,200**	**31,600**	**33,000**	**34,200**	**35,600**	**10,000**	**0.9%**	**100.0%**	**100.0%**
White	4,450	4,330	4,200	4,060	3,910	3,760	3,650	3,570	-880	-0.6%	17.4%	10.0%
Latino	19,990	21,700	23,420	25,030	26,620	28,160	29,580	31,040	11,050	1.3%	78.1%	87.2%
Black	90	100	110	120	120	120	120	130	40	1.1%	0.4%	0.4%
Asian	720	700	690	670	640	610	570	540	-180	-0.8%	2.8%	1.5%
Pacific Islander	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%
Native American	60	50	50	50	40	40	40	30	-30	-2.0%	0.2%	0.1%
Other	40	40	40	40	40	40	40	40	0	0.0%	0.2%	0.1%
Two or more	200	210	220	220	230	230	230	230	30	0.4%	0.8%	0.6%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 116 – Reedley Household Income Projections

	Number of Households							
Income Category	2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	290	280	260	230	220	210	200	200
$10,000 to $24,999	1,490	1,450	1,350	1,200	1,140	1,080	1,040	1,030
$25,000 to $34,999	890	860	800	710	680	640	620	610
$35,000 to $49,999	1,240	1,400	1,310	1,190	1,120	1,070	1,030	1,010
$50,000 to $74,999	1,150	1,160	1,350	1,560	1,500	1,480	1,500	1,470
$75,000 to $99,999	910	1,080	1,280	1,480	1,640	1,790	1,950	2,090
$100,000 to $149,999	750	900	1,060	1,220	1,420	1,590	1,760	1,960
$150,000 or more	300	360	430	490	570	640	710	790
Total	**7,020**	**7,490**	**7,840**	**8,080**	**8,280**	**8,510**	**8,810**	**9,160**
Mean Income	**$59,870**	**$63,010**	**$67,480**	**$72,200**	**$76,160**	**$79,470**	**$82,240**	**$84,810**
CAGR		**1.0%**	**1.4%**	**1.4%**	**1.1%**	**0.9%**	**0.7%**	**0.6%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

SANGER

Table 117 – Estimate of Past Job Trends: Sanger SOI

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	206	251	262	361	202	381	415	443	308	369	308	384	453	6.8%	0.4%	0.9%
Mfg./Mining	339	259	228	230	242	235	247	213	199	223	259	420	644	5.5%	1.2%	2.6%
Other Industrial	648	587	554	671	763	636	547	475	619	645	606	601	615	-0.4%	1.3%	1.2%
Retail	754	664	627	627	653	673	699	717	589	600	676	706	710	-0.5%	2.2%	2.0%
Office	104	106	113	119	152	129	127	116	133	140	144	137	148	3.0%	0.3%	0.3%
Education	787	804	785	789	818	882	873	866	865	860	896	851	920	1.3%	2.1%	2.4%
Health Services	472	359	367	355	333	376	396	391	374	434	462	671	739	3.8%	1.3%	1.3%
Hospitality	343	330	338	408	456	460	462	427	412	345	305	333	376	0.8%	1.3%	1.2%
Government	731	740	765	804	804	872	850	578	510	549	472	485	438	-4.2%	2.1%	1.4%
Total	4,386	4,102	4,039	4,365	4,423	4,644	4,616	4,227	4,009	4,166	4,127	4,588	5,043	1.2%	1.3%	1.4%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 118 – Job Projections for Sanger SOI by Sector, 2015-2050

Job Sector	Year 2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	420	420	420	430	430	440	440	440
Mfg./Mining	750	750	750	750	750	740	740	730
Other Industrial	660	710	760	810	850	900	930	980
Retail	760	850	880	920	960	1,000	1,040	1,080
Office	150	150	150	160	160	170	180	180
Education	1,030	1,090	1,140	1,200	1,250	1,300	1,350	1,400
Health Services	870	1,070	1,210	1,270	1,330	1,380	1,430	1,480
Hospitality	400	450	500	520	540	560	580	600
Government	450	450	450	470	490	510	530	550
Total	**5,490**	**5,940**	**6,260**	**6,520**	**6,770**	**7,010**	**7,220**	**7,450**

Source: ADE, Inc.

Table 119 – Populations Trends and Projections: 2015-2050: Sanger SOI

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	26,310	27,860	29,410	30,840	32,220	33,540	34,790	36,100	9,790	0.9%
Tot. Nos. of Persons in Group Qtrs.	140	140	150	170	170	180	180	190	50	0.9%
Tot. Nos. of Persons in HHs	26,170	27,720	29,260	30,670	32,050	33,360	34,610	35,910	9,740	0.9%
Tot. Nos. of HHs	7,320	7,780	8,120	8,360	8,550	8,770	9,060	9,410	2,090	0.7%
Persons Per Household	3.58	3.56	3.60	3.67	3.75	3.80	3.82	3.81		

Source: ADE

Table 120 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Sanger SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	460	800	1,040	1,230	1,450	1,740	2,090
Total Number of New Units Required By Period	340	560	1,070	1,270	1,500	1,800	2,160

Source: ADE

Table 121 – Trends and Projections in Total Number of Persons by Age: Sanger SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Sanger SOI	**26,300**	**27,900**	**29,400**	**30,800**	**32,200**	**33,500**	**34,800**	**36,100**	**9,800**	**0.9%**	**100.0%**	**100.0%**
5 and below	2,700	2,900	3,100	3,200	3,200	3,300	3,400	3,600	900	0.8%	10.3%	10.0%
6 to 14	4,100	4,100	4,100	4,400	4,600	4,700	4,800	4,900	800	0.5%	15.6%	13.6%
15 to 19	2,300	2,200	2,300	2,200	2,400	2,500	2,600	2,600	300	0.3%	8.7%	7.2%
20 to 24	2,200	2,300	2,200	2,300	2,200	2,300	2,500	2,500	300	0.3%	8.4%	6.9%
25 to 34	3,500	3,900	4,500	4,400	4,400	4,400	4,400	4,700	1,200	0.9%	13.3%	13.0%
35 to 44	3,500	3,500	3,400	3,800	4,300	4,300	4,200	4,200	700	0.5%	13.3%	11.6%
45 to 54	3,000	3,200	3,400	3,300	3,300	3,700	4,200	4,100	1,100	0.9%	11.4%	11.4%
55 to 64	2,300	2,600	2,800	3,000	3,200	3,200	3,100	3,500	1,200	1.2%	8.7%	9.7%
65 to 74	1,500	1,700	2,100	2,300	2,500	2,700	2,800	2,800	1,300	1.9%	5.7%	7.8%
75 and above	1,200	1,400	1,600	1,900	2,300	2,600	2,900	3,200	2,000	2.7%	4.6%	8.9%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 122 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Sanger SOI

Race/Ethnic Group	Year 2015	2020	2025	2030	2035	2040	2045	2050	2015-2050 Change	CAGR*	2015 Share	2050 Share
Sanger SOI	**26,300**	**27,900**	**29,400**	**30,800**	**32,200**	**33,500**	**34,800**	**36,100**	**9,800**	**0.9%**	**100.0%**	**100.0%**
White	3,590	3,520	3,430	3,340	3,260	3,180	3,130	3,090	-500	-0.4%	13.7%	8.6%
Latino	21,520	23,110	24,730	26,220	27,670	29,070	30,370	31,720	10,200	1.1%	81.8%	87.9%
Black	120	130	130	130	130	130	130	130	10	0.2%	0.5%	0.4%
Asian	720	740	760	770	790	800	810	810	90	0.3%	2.7%	2.2%
Pacific Islander	30	20	20	20	20	20	20	20	-10	-1.2%	0.1%	0.1%
Native American	100	100	90	90	80	70	70	60	-40	-1.4%	0.4%	0.2%
Other	20	20	20	20	20	20	20	20	0	0.0%	0.1%	0.1%
Two or more	220	220	230	240	250	250	250	250	30	0.4%	0.8%	0.7%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 123 – Sanger Household Income Projections

Income Category	Number of Households 2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	360	350	330	290	280	260	250	250
$10,000 to $24,999	1,630	1,590	1,480	1,320	1,250	1,190	1,140	1,130
$25,000 to $34,999	1,100	1,080	1,000	890	840	800	770	760
$35,000 to $49,999	1,010	1,140	1,070	970	910	870	840	830
$50,000 to $74,999	1,420	1,500	1,730	1,990	1,920	1,890	1,910	1,880
$75,000 to $99,999	710	850	1,000	1,160	1,330	1,480	1,630	1,770
$100,000 to $149,999	820	970	1,150	1,330	1,540	1,730	1,920	2,130
$150,000 or more	260	310	360	420	490	550	610	670
Total	7,320	7,780	8,120	8,360	8,550	8,770	9,060	9,410
Mean Income	$57,060	$60,180	$64,520	$69,120	$73,020	$76,290	$79,030	$81,590
CAGR		1.1%	1.4%	1.4%	1.1%	0.9%	0.7%	0.6%

*Source: ADE (*note: CAGR = compound annual growth rate)*

SAN JOAQUIN

Table 124 – Estimate of Past Job Trends: San Joaquin SOI

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	2	2	2	3	5	12	13	4	7	24	24	23	75	38.0%	0.0%	0.2%
Mfg./Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	0.0%	0.0%
Other Industrial	11	91	8	13	104	91	70	44	58	75	126	119	26	7.8%	0.0%	0.1%
Retail	9	11	14	13	16	14	13	3	13	17	14	22	10	1.0%	0.0%	0.0%
Office	1	1	1	0	0	2	2	0	3	2	3	5	5	18.1%	0.0%	0.0%
Education	113	120	118	134	101	0	0	2	296	380	320	291	297	8.4%	0.3%	0.8%
Health Services	2	2	3	3	2	0	0	1	1	0	6	6	7	9.2%	0.0%	0.0%
Hospitality	5	3	7	6	5	6	6	6	5	5	10	5	5	-0.4%	0.0%	0.0%
Government	49	31	53	44	40	49	58	40	80	4	62	49	62	2.0%	0.1%	0.2%
Total	191	261	206	216	274	174	161	99	462	506	565	520	487	8.1%	0.1%	0.1%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 125 – Job Projections for San Joaquin SOI by Sector, 2015-2050

	Year							
Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	70	70	70	70	70	70	70	70
Mfg./Mining	0	0	0	0	0	0	0	0
Other Industrial	30	30	30	30	30	40	40	40
Retail	10	10	10	10	10	10	10	10
Office	10	10	10	10	10	10	10	10
Education	300	320	360	380	400	420	430	450
Health Services	10	10	10	10	10	10	10	10
Hospitality	10	10	10	10	10	10	10	10
Government	60	60	60	60	70	70	70	80
Total	**500**	**520**	**560**	**590**	**610**	**640**	**660**	**690**

Source: ADE, Inc.

Table 126 – Populations Trends and Projections: 2015-2050: San Joaquin SOI

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	4,040	4,310	4,580	4,830	5,070	5,310	5,520	5,750	1,710	1.0%
Tot. Nos. of Persons in Group Qtrs.	0	0	0	0	0	0	0	0	0	
Tot. Nos. of Persons in HHs	4,040	4,310	4,580	4,830	5,070	5,310	5,520	5,750	1,710	1.0%
Tot. Nos. of HHs	900	970	1,020	1,050	1,080	1,110	1,160	1,200	300	0.8%
Persons Per Household	4.49	4.44	4.49	4.60	4.69	4.78	4.76	4.79		

Source: ADE

Table 127 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: San Joaquin SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	70	120	150	180	210	260	300
Total Number of New Units Required By Period	50	90	150	180	220	260	310

Source: ADE

Table 128 – Trends and Projections in Total Number of Persons by Age: San Joaquin SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
San Joaquin SOI	**4,000**	**4,300**	**4,600**	**4,800**	**5,100**	**5,300**	**5,500**	**5,800**	**1,800**	**1.0%**	**100.0%**	**100.0%**
5 and below	400	500	500	600	600	600	600	600	200	0.8%	10.0%	10.3%
6 to 14	800	700	700	700	800	800	800	800	0	0.1%	20.0%	13.8%
15 to 19	400	400	400	300	400	400	400	400	0	0.3%	10.0%	6.9%
20 to 24	400	400	400	400	300	400	400	400	0	0.4%	10.0%	6.9%
25 to 34	500	600	700	800	800	700	700	700	200	0.9%	12.5%	12.1%
35 to 44	500	500	500	600	700	700	800	700	200	0.6%	12.5%	12.1%
45 to 54	400	500	500	500	500	600	700	700	300	1.6%	10.0%	12.1%
55 to 64	300	300	400	400	500	500	400	500	200	1.5%	7.5%	8.6%
65 to 74	200	200	300	300	300	400	400	400	200	2.6%	5.0%	6.9%
75 and above	100	100	200	200	300	300	400	400	300	4.9%	2.5%	6.9%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 129 – Trends and Projections in Total Number of Persons by Race and Ethnicity: San Joaquin SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
San Joaquin SOI	**4,000**	**4,300**	**4,600**	**4,800**	**5,100**	**5,300**	**5,500**	**5,800**	**1,800**	**1.1%**	**100.0%**	**100.0%**
White	110	110	110	100	90	90	90	90	-20	-0.6%	2.8%	1.6%
Latino	3,890	4,160	4,430	4,690	4,950	5,190	5,410	5,640	1,750	1.1%	97.3%	97.2%
Black	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%
Asian	30	30	30	30	30	20	20	20	-10	-1.2%	0.8%	0.3%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	10	10	10	10	10	10	10	0	-10		0.3%	0.0%
Other	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Two or more	0	0	0	0	0	0	0	0	0		0.0%	0.0%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 130 – San Joaquin Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	190	180	170	150	140	140	130	130
$10,000 to $24,999	250	240	220	200	190	180	170	170
$25,000 to $34,999	210	210	190	170	160	160	150	150
$35,000 to $49,999	90	140	200	270	250	250	240	240
$50,000 to $74,999	100	120	140	160	150	150	150	150
$75,000 to $99,999	60	70	80	90	170	230	290	350
$100,000 to $149,999	0	0	0	0	0	0	0	10
$150,000 or more	0	0	10	10	10	10	10	10
Total	**900**	**970**	**1,020**	**1,050**	**1,080**	**1,110**	**1,160**	**1,200**
Mean Income	**$30,680**	**$33,120**	**$35,820**	**$38,680**	**$42,560**	**$45,810**	**$48,540**	**$50,880**
CAGR		**1.5%**	**1.6%**	**1.5%**	**1.9%**	**1.5%**	**1.2%**	**0.9%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

SELMA

Table 131 – Estimate of Past Job Trends: Selma SOI

	Year															
Job Sector	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2002-2014 CAGR**	**2002 Share of County**	**2014 Share of County**
Agriculture	354	339	321	432	333	424	454	411	463	232	195	308	350	-0.1%	0.8%	0.7%
Mfg./Mining	1,440	1,374	1,587	1,570	1,441	1,825	1,658	1,352	1,824	1,587	1,945	1,925	414	-9.9%	5.3%	1.7%
Other Industrial	945	1,003	1,100	1,126	1,077	1,022	903	788	647	682	603	616	712	-2.3%	1.8%	1.4%
Retail	1,664	1,838	1,893	1,884	1,814	1,928	2,029	1,738	1,806	1,550	1,314	1,443	1,436	-1.2%	4.8%	4.1%
Office	726	495	348	458	620	643	520	436	399	375	383	378	367	-5.5%	1.8%	0.8%
Education	294	286	270	269	268	285	287	588	619	604	606	580	599	6.1%	0.8%	1.6%
Health Services	292	317	359	356	179	187	198	387	338	388	356	466	516	4.9%	0.8%	0.9%
Hospitality	792	809	832	827	853	863	864	766	729	799	873	943	963	1.6%	3.0%	3.0%
Government	186	162	170	239	226	216	222	202	237	232	228	212	188	0.1%	0.5%	0.6%
Total	6,693	6,623	6,880	7,161	6,811	7,392	7,137	6,668	7,063	6,450	6,503	6,870	5,545	-1.6%	2.0%	1.5%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 132 – Job Projections for Selma SOI by Sector, 2015-2050

	Year							
Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	350	350	350	360	360	360	360	360
Mfg./Mining	410	410	410	410	410	410	400	400
Other Industrial	710	760	810	860	910	960	1,000	1,040
Retail	1,430	2,470	2,550	2,670	2,790	2,910	3,010	3,130
Office	370	390	420	440	460	480	500	510
Education	600	80	80	80	90	90	90	100
Health Services	530	640	690	720	760	790	820	850
Hospitality	960	1,040	1,120	1,180	1,220	1,250	1,270	1,290
Government	190	190	190	200	210	220	220	230
Total	**5,550**	**6,330**	**6,620**	**6,920**	**7,210**	**7,460**	**7,680**	**7,910**

Source: ADE, Inc.

Table 133 – Populations Trends and Projections: 2015-2050: Selma SOI

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	26,680	28,250	29,810	31,250	32,640	33,980	35,240	36,550	9,870	0.9%
Tot. Nos. of Persons in Group Qtrs.	180	190	200	220	220	230	240	240	60	0.8%
Tot. Nos. of Persons in HHs	26,500	28,060	29,610	31,030	32,420	33,750	35,000	36,310	9,810	0.9%
Tot. Nos. of HHs	7,470	7,950	8,290	8,530	8,720	8,950	9,240	9,600	2,130	0.7%
Persons Per Household	3.55	3.53	3.57	3.64	3.72	3.77	3.78	3.78		

Source: ADE

Table 134 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Selma SOI

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	480	820	1,060	1,250	1,480	1,770	2,130
Total Number of New Units Required By Period	360	610	1,090	1,290	1,520	1,830	2,190

Source: ADE

Table 135 – Trends and Projections in Total Number of Persons by Age: Selma SOI

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Selma SOI	**26,700**	**28,200**	**29,800**	**31,200**	**32,600**	**34,000**	**35,200**	**36,600**	**9,900**	**0.9%**	**100.0%**	**100.0%**
5 and below	2,700	2,900	3,100	3,200	3,200	3,300	3,400	3,600	900	0.8%	10.1%	9.8%
6 to 14	4,000	4,000	4,100	4,400	4,600	4,700	4,800	4,900	900	0.6%	15.0%	13.4%
15 to 19	2,200	2,200	2,200	2,200	2,400	2,500	2,600	2,600	400	0.4%	8.2%	7.1%
20 to 24	2,300	2,200	2,200	2,100	2,200	2,300	2,500	2,600	300	0.3%	8.6%	7.1%
25 to 34	3,700	4,300	4,500	4,300	4,200	4,300	4,400	4,800	1,100	0.7%	13.9%	13.1%
35 to 44	3,500	3,500	3,600	4,200	4,400	4,200	4,100	4,200	700	0.5%	13.1%	11.5%
45 to 54	3,000	3,200	3,400	3,400	3,500	4,000	4,300	4,100	1,100	0.9%	11.2%	11.2%
55 to 64	2,400	2,600	2,900	3,000	3,200	3,200	3,300	3,800	1,400	1.4%	9.0%	10.4%
65 to 74	1,600	1,900	2,100	2,400	2,600	2,700	2,800	2,900	1,300	1.7%	6.0%	7.9%
75 and above	1,300	1,500	1,800	2,100	2,400	2,700	3,000	3,200	1,900	2.6%	4.9%	8.7%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 136 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Selma SOI

	Year								2015-2050		2015	2050
Race/Ethnic Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Selma SOI	**26,700**	**28,200**	**29,800**	**31,200**	**32,600**	**34,000**	**35,200**	**36,600**	**9,900**	**0.9%**	**100.0%**	**100.0%**
White	3,820	3,640	3,460	3,260	3,070	2,890	2,750	2,650	-1,170	-1.0%	14.3%	7.2%
Latino	21,280	22,990	24,720	26,330	27,910	29,440	30,870	32,310	11,030	1.2%	79.7%	88.3%
Black	160	160	160	160	160	160	160	160	0	0.0%	0.6%	0.4%
Asian	990	1,010	1,040	1,060	1,060	1,060	1,040	1,030	40	0.1%	3.7%	2.8%
Pacific Islander	0	0	0	0	0	0	0	0	0		0.0%	0.0%
Native American	120	120	110	100	90	80	70	60	-60	-2.0%	0.4%	0.2%
Other	60	70	80	90	100	100	110	120	60	2.0%	0.2%	0.3%
Two or more	240	250	250	250	250	250	240	240	0	0.0%	0.9%	0.7%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 137 – Selma Household Income Projections

	Number of Households							
Income Category	2015	2020	2025	2030	2035	2040	2045	2050
Less than $10,000	370	360	330	300	280	270	260	250
$10,000 to $24,999	1,620	1,570	1,460	1,300	1,230	1,170	1,130	1,110
$25,000 to $34,999	1,210	1,170	1,090	970	920	880	840	830
$35,000 to $49,999	1,170	1,310	1,230	1,110	1,060	1,010	970	950
$50,000 to $74,999	1,400	1,480	1,750	2,060	1,980	1,950	1,970	1,940
$75,000 to $99,999	880	1,040	1,240	1,430	1,670	1,890	2,100	2,320
$100,000 to $149,999	700	830	980	1,130	1,310	1,470	1,630	1,810
$150,000 or more	150	170	210	240	280	310	340	380
Total	7,470	7,950	8,290	8,530	8,720	8,950	9,240	9,600
Mean Income	$53,500	$56,230	$60,130	$64,280	$67,710	$70,590	$73,020	$75,230
CAGR		1.0%	1.4%	1.3%	1.0%	0.8%	0.7%	0.6%

*Source: ADE (*note: CAGR = compound annual growth rate)*

FRESNO COUNTY (UNINCORPORATED)

Table 138 – Estimate of Past Job Trends: Unincorporated County

	Year															
Job Sector	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2002-2014 CAGR	2002 Share of County	2014 Share of County
Agriculture	42,113	42,095	41,782	42,571	42,850	44,469	45,314	39,527	41,655	44,432	46,396	46,049	45,114	0.6%	90.4%	92.1%
Mfg./Mining	3,770	3,252	1,206	1,408	1,591	1,773	1,327	1,575	694	3,349	4,001	3,824	5,641	3.4%	13.8%	23.0%
Other Industrial	7,162	7,781	7,894	8,256	8,443	8,854	8,536	7,467	6,523	6,525	8,120	8,973	7,710	0.6%	14.0%	15.3%
Retail	1,471	1,421	1,435	1,191	1,188	1,285	1,350	1,172	1,097	993	1,208	1,240	1,316	-0.9%	4.3%	3.8%
Office	4,718	4,176	4,025	4,256	4,136	3,881	3,941	2,533	1,926	2,782	2,645	2,399	2,364	-5.6%	11.8%	5.2%
Education	4,673	4,294	4,114	4,276	4,262	5,043	4,763	4,410	3,999	6,320	3,093	2,668	2,853	-4.0%	12.5%	7.5%
Health Services	1,064	1,124	1,101	1,073	874	849	1,215	576	2,467	3,371	2,741	3,316	3,597	10.7%	2.9%	6.5%
Hospitality	2,732	2,703	2,757	2,844	3,316	3,312	3,133	2,972	4,120	4,333	2,957	3,072	3,154	1.2%	10.4%	9.9%
Government	744	650	927	655	412	732	834	1,041	2,443	2,672	2,807	2,680	3,301	13.2%	2.1%	10.2%
Total	68,447	67,497	65,242	66,530	67,073	70,200	70,413	61,273	64,924	74,777	73,968	74,221	75,050	0.8%	20.4%	20.7%

Source: ADE, Inc., based on 2014 data provided by Fresno County COG and 2002-2014 data from LEHD.

Table 139 – Job Projections for Unincorporated Fresno County by Sector, 2015-2050

	Year							
Job Sector	2015	2020	2025	2030	2035	2040	2045	2050
Agriculture	43,840	44,340	44,840	45,670	46,230	46,600	46,690	46,600
Mfg./Mining	5,690	5,690	5,690	5,690	5,690	5,650	5,600	5,560
Other Industrial	7,880	8,470	9,050	9,590	10,140	10,680	11,130	11,610
Retail	1,320	1,240	1,340	1,370	1,400	1,420	1,450	1,470
Office	2,390	2,540	2,730	2,790	2,840	2,900	2,950	3,000
Education	2,850	3,510	3,730	3,810	3,880	3,960	4,020	4,100
Health Services	3,680	3,870	4,140	4,230	4,310	4,390	4,470	4,550
Hospitality	3,180	3,340	3,610	5,150	5,860	5,730	5,150	4,430
Government	3,330	3,380	3,480	3,550	3,620	3,690	3,750	3,820
Total	**74,160**	**76,380**	**78,610**	**81,840**	**83,970**	**85,010**	**85,210**	**85,120**

Source: ADE, Inc.

Table 140 – Populations Trends and Projections: 2015-2050: Unincorporated County

	Year								2015-2050	
Population Variable	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*
Tot. Nos. of Persons	99,330	101,710	104,080	106,250	108,350	110,370	112,280	114,270	14,940	0.4%
Tot. Nos. of Persons in Group Qtrs.	1,520	1,520	1,570	1,630	1,630	1,670	1,700	1,730	210	0.4%
Tot. Nos. of Persons in HHs	97,810	100,190	102,510	104,620	106,720	108,700	110,580	112,540	14,730	0.4%
Tot. Nos. of HHs	28,000	32,480	32,860	32,930	32,860	33,000	33,430	34,070	6,070	0.6%
Persons Per Household	3.49	3.08	3.12	3.18	3.25	3.29	3.31	3.30		

Source: ADE

Table 141 – Periodic Housing Unit Requirement Projections Net of Adjustments for Existing Vacant Stock, Healthy Vacancy Rates, and Replacement Rates: Unincorporated County

	Period						
Households and Housing Units	15-20	15-25	15-30	15-35	15-40	15-45	15-50
Total Number of New Households By Period	4,480	4,860	4,930	4,860	5,000	5,430	6,070
Total Number of New Units Required By Period	1,130	3,640	4,320	5,000	5,140	5,590	6,240

Source: ADE

Table 142 – Trends and Projections in Total Number of Persons by Age: Unincorporated County

	Year								2015-2050		2015	2050
Age Group	2015	2020	2025	2030	2035	2040	2045	2050	Change	CAGR*	Share	Share
Uninc. Area excl. SOIs	**99,300**	**101,700**	**104,100**	**106,200**	**108,400**	**110,400**	**112,300**	**114,300**	**15,000**	**0.4%**	**100.0%**	**100.0%**
5 and below	6,200	7,300	8,400	9,100	9,200	9,100	9,600	10,300	4,100	1.4%	6.2%	9.0%
6 to 14	10,800	9,900	10,300	12,000	13,500	14,200	14,100	14,200	3,400	0.8%	10.9%	12.4%
15 to 19	7,000	6,300	5,800	5,400	6,400	7,400	8,000	8,000	1,000	0.4%	7.0%	7.0%
20 to 24	8,100	7,100	6,400	5,900	5,400	6,500	7,500	8,100	0	0.0%	8.2%	7.1%
25 to 34	10,200	13,700	15,500	13,600	12,500	11,500	12,000	14,100	3,900	0.9%	10.3%	12.3%
35 to 44	9,300	9,300	10,200	13,700	15,600	13,800	12,700	11,600	2,300	0.6%	9.4%	10.1%
45 to 54	13,300	10,700	9,300	9,100	9,900	13,600	15,600	13,700	400	0.1%	13.4%	12.0%
55 to 64	15,400	15,100	12,800	10,300	8,900	8,800	9,500	13,200	-2,200	-0.4%	15.5%	11.5%
65 to 74	10,700	12,600	13,900	13,600	11,500	9,300	8,100	7,900	-2,800	-0.9%	10.8%	6.9%
75 and above	8,200	9,700	11,500	13,600	15,400	16,000	15,000	13,300	5,100	1.4%	8.3%	11.6%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 143 – Trends and Projections in Total Number of Persons by Race and Ethnicity: Unincorporated County

	Year								2015-2050		2015	2050
Race/Ethnic Group	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**	**Change**	**CAGR***	**Share**	**Share**
Uninc. Area excl. SOIs	**99,300**	**101,700**	**104,100**	**106,300**	**108,400**	**110,400**	**112,300**	**114,300**	**14,900**	**0.4%**	**100.0%**	**100.0%**
White	39,960	35,990	32,470	28,760	24,810	20,630	16,900	13,520	-26,440	-3.0%	40.2%	11.8%
Latino	45,620	51,720	57,500	63,390	69,600	76,070	82,090	87,920	42,300	1.9%	45.9%	76.9%
Black	2,520	2,680	2,850	2,990	3,100	3,180	3,210	3,240	720	0.7%	2.5%	2.8%
Asian	9,070	9,060	8,920	8,690	8,360	7,970	7,560	7,070	-2,000	-0.7%	9.1%	6.2%
Pacific Islander	70	70	70	70	70	70	70	70	0	0.0%	0.1%	0.1%
Native American	940	940	930	920	890	840	800	760	-180	-0.6%	0.9%	0.7%
Other	220	230	240	250	260	270	260	260	40	0.5%	0.2%	0.2%
Two or more	930	1,010	1,100	1,180	1,270	1,340	1,390	1,430	500	1.2%	0.9%	1.3%

*Source: ADE (*note: CAGR = compound annual growth rate)*

Table 144 – Fresno County Unincorporated Household Income Projections

	Number of Households							
Income Category	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**	**2045**	**2050**
Less than $10,000	1,120	1,090	1,010	900	850	810	780	770
$10,000 to $24,999	2,870	2,800	2,600	2,310	2,190	2,090	2,010	1,980
$25,000 to $34,999	2,710	2,640	2,450	2,180	2,070	1,970	1,890	1,870
$35,000 to $49,999	3,580	3,920	3,450	2,830	2,720	2,610	2,500	2,460
$50,000 to $74,999	5,970	8,060	6,820	5,630	5,390	5,310	5,370	5,200
$75,000 to $99,999	3,870	4,610	5,450	6,290	4,840	3,570	2,460	1,280
$100,000 to $149,999	4,370	5,200	6,150	7,100	8,220	9,240	10,230	11,400
$150,000 or more	3,500	4,160	4,920	5,680	6,580	7,390	8,180	9,120
Total	**28,000**	**32,480**	**32,860**	**32,930**	**32,860**	**33,000**	**33,430**	**34,070**
Mean Income	**$83,180**	**$85,780**	**$92,550**	**$99,840**	**$105,770**	**$110,930**	**$115,400**	**$120,190**
CAGR		**0.6%**	**1.5%**	**1.5%**	**1.2%**	**1.0%**	**0.8%**	**0.8%**

*Source: ADE (*note: CAGR = compound annual growth rate)*

Appendix I Item 2:
2017 DOF Population Projections

MEMO

TO: Seth Scott
Kristina Cai

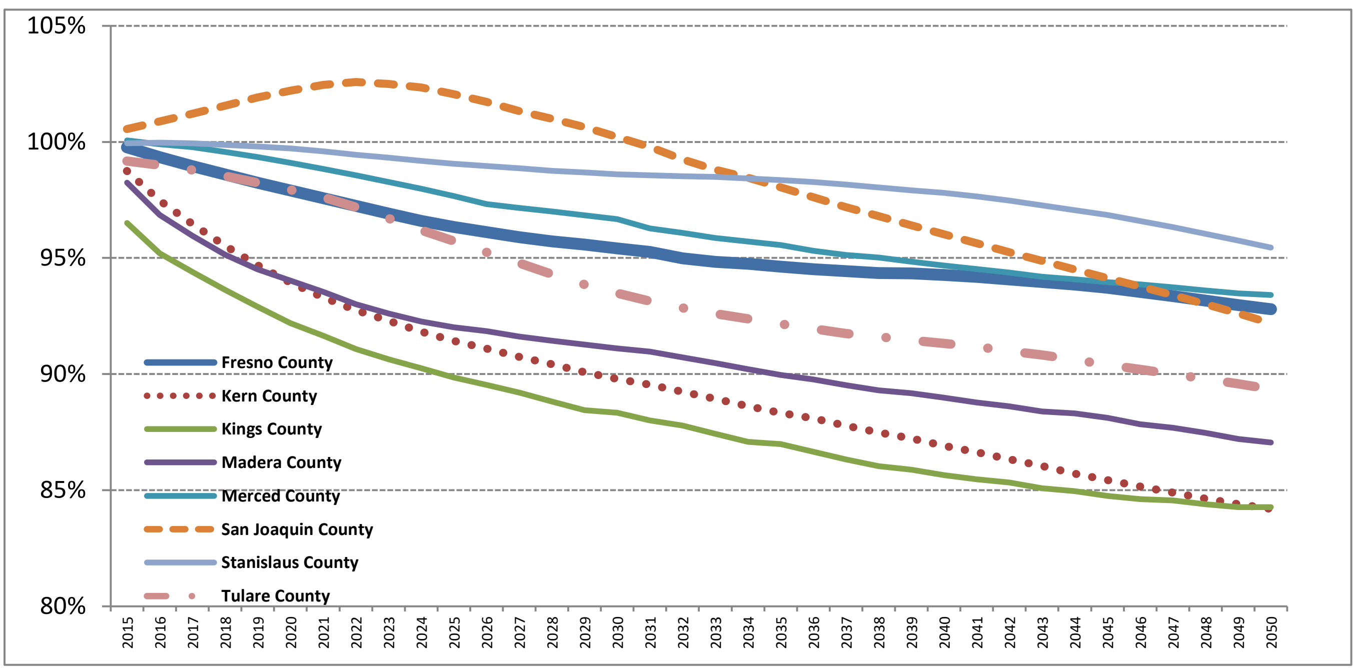
FROM: Tony Daysog
Doug Svensson

DATE: June 23, 2017

SUBJECT: **2017 DOF Population Projections**

In preparing growth projections for the Fresno Council of Governments RTP process, Applied Development Economics relied on population projections issued by the California Department of Finance (DOF), particularly the December 15, 2014 edition of "Report P-1: State and County Population Projections (July 1, 2010-2060)." In February 2017, the DOF issued new population projections for all counties in California. In its new projections, the DOF revised downward population projections for nearly all counties in the San Joaquin Valley, including Fresno County (see Figure 1).

Figure 1. Comparison of New DOF Projections-to-Initial Projections: <100% Means Projections Lowered



Source: ADE, Inc. based on California Dept. of Finance P-1 Population Projection Report (Dec. 2014 and Feb. 2017)

In an e-mail correspondence to ADE, Ethan Sharygin of the DOF explained that the DOF revised the projections based on recent history of the three components of population change: births, deaths, and migration. Migration was only slightly downgraded, based on slower-than-expected increases in net in-migration to Fresno since 2010. Whereas in the past the DOF projected 5,000 annual net migrants in 2020 and 4,000-5,000 per year thereafter, the DOF's latest projections stay closer to an average 4,000 net annual gain. Mr. Sharygan added that the change in net migration has a relatively minor downward effect on the projections. The DOF also projected deaths at nearly the same levels as the December 2014 projection, although slightly higher in during 2010-2020 and lower after 2040.

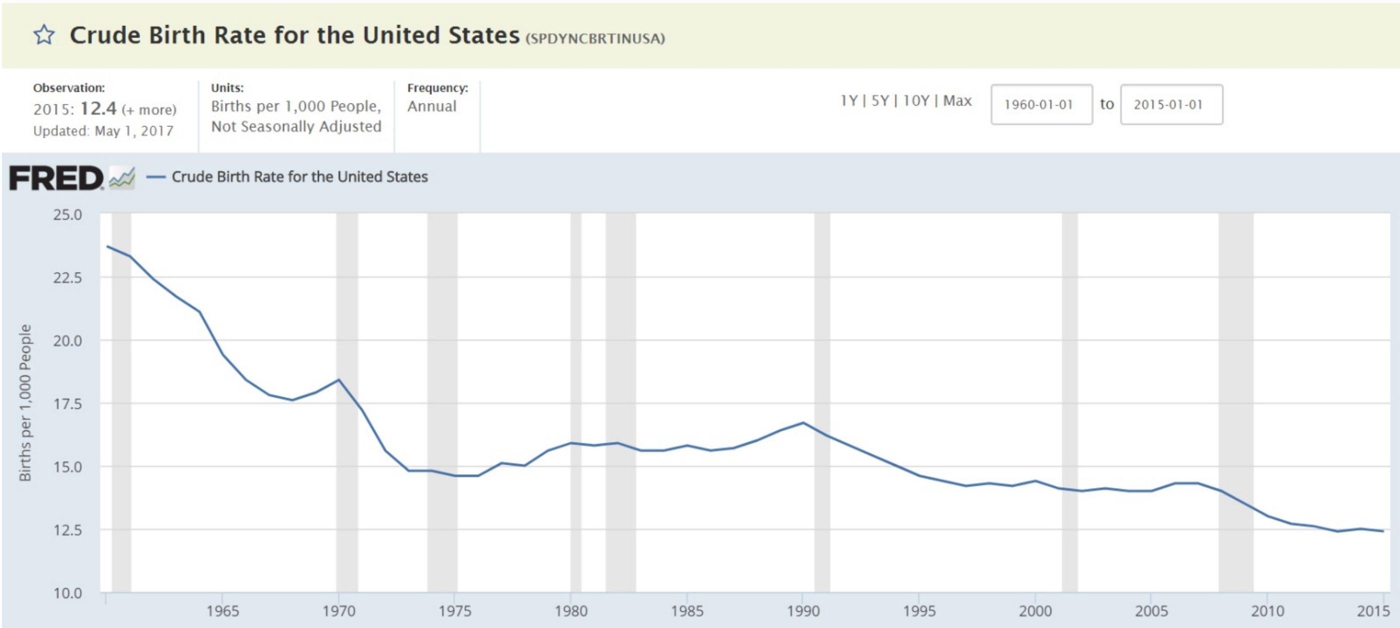
According to Mr. Sharygin, the most important change occurred with respect to fertility. Sharygin explained that the last few years have seen unexpectedly large drops in births in Fresno County, which means a permanent deficit despite a similar trajectory. In the 2013 baseline projections, DOF projected about 16,000 births in 2010 to grow to 21,000 annual births in 2060. Actual 2015 births were closer to 15,000, down from 2010. The DOF projects births to begin increasing again, from 15,000 in 2015 to 19,000 annually in 2060.

ADE's birth projections are between the previous DOF birth projections and the updated February 2017 birth projections, although not precisely between the two and somewhat closer to the higher, previous DOF birth projections. While it is true that the actual number of births in Fresno County declined during and immediately after the 2009-2011 Great Recession, whether this is permanent is open to question. "Demographers have been trying to determine whether the economy forced women to merely delay childbirth or forego starting a family altogether. The latest numbers, while preliminary, suggest that women may just have been delaying" (http://time.com/3924237/us-birth-rates-increase/ http://archive.is/0I6lQ). In addition, "From research on 27 European countries, we know that people with troubled family financial situations are more likely to say they are unsure whether they will meet their stated childbearing goals – that is, economic uncertainty doesn't change their familial aims but may increase uncertainty in whether they will be met" (http://theconversation.com/fewer-births-and-divorces-more-violence-how-the-recession-affected-the-american-family-34272 http://archive.is/1rsMu).

The chart below from the Federal Reserve's FRED Database correlates births per 1,000 persons over time, including periods when the US was in recession (grey-shaded areas)(Figure 2). The chart underscores the point that going into and through recessions, birth rates decline, although, as depicted in the years after 1975, 1982, and 2001, births per 1,000 persons pick up. ADE's annual births per 1,000 persons projections beyond 2015 are one to two points higher than the revised DOF's births per 1,000 projections for Fresno County (Figure 3), which we conclude is somewhat too conservative in light of the FRED Database historic data and basic research referenced above on births rates after recessionary periods.

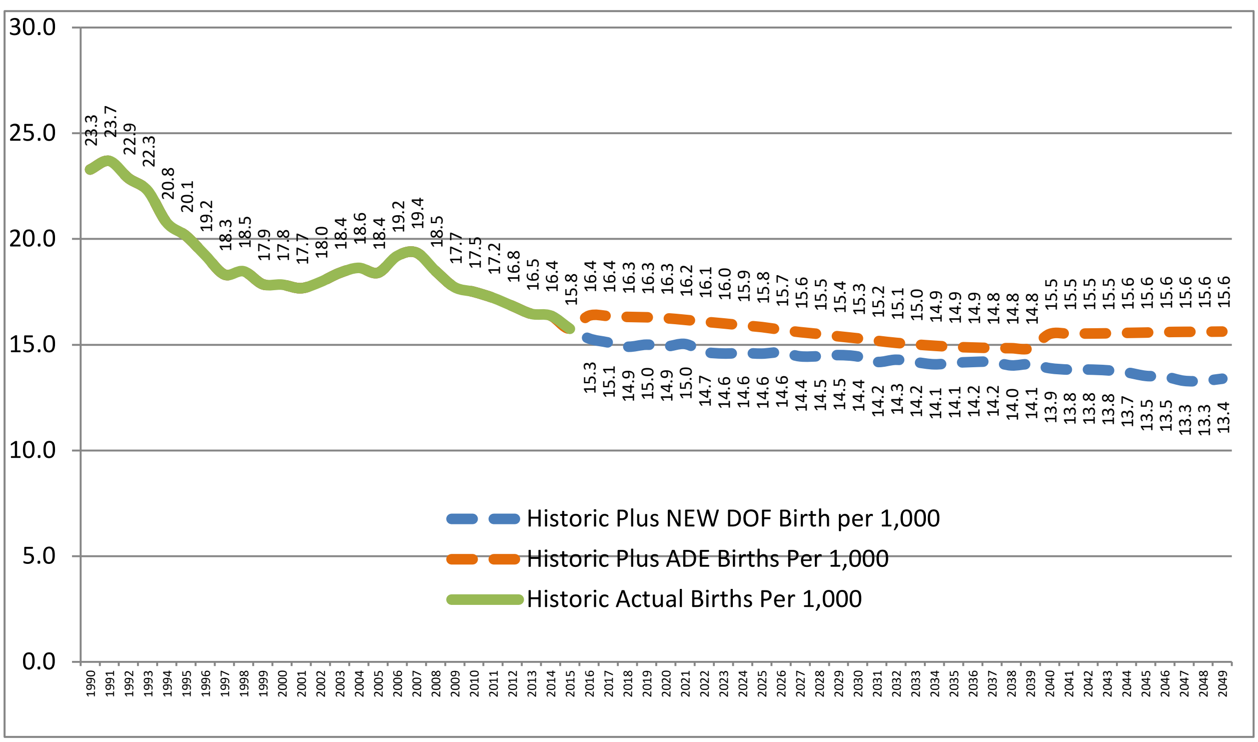
We recommend further monitoring population trends and birth rates over the next several years to see of population growth recovers as has occurred in prior economic downturns.

Figure 2. Historic Lives Births Per 1,000 Persons By Year, Including Recessionary Periods



Source: Applied Development Economics, based on US Federal Reserve: St. Louis Reserve FRED Database

Figure 3. Comparison of Historic Fresno County Child Births per 1,000 Persons, ADE's Projected Child Birth per 1,000 Persons, and New DOF Child Births Per 1,000 Persons



Source: ADE, Inc., based on California Dept. of Finance and ADE Population Co-Hort Survival Model

Appendix I Item 3:
Fresno COG 2018 RTP/SCS
Technical Methodology

Fresno Council of Governments
2035 Tulare St., Ste. 201 tel 559-233-4148
Fresno, California 93721 fax 559-233-9645
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February 6, 2018

Mary Nichols
Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95812

SUBJECT: Fresno COG Greenhouse Gas Emissions Technical Quantification Methodology for the Development of Sustainable Communities Strategy as part of the 2018 Regional Transportation Plan

Ms. Nichols:

Based on the comments received from the ARB staff, please find enclosed the revised technical methodology that Fresno COG intends to use for estimating greenhouse gas (GHG) emissions for the Sustainable Communities Strategy (SCS), and if necessary, the Alternative Planning Strategy (APS), in compliance with the requirements of the Senate Bill 375 (SB 375).

Fresno COG intends to adopt a Regional Transportation Plan (RTP) with an SCS in the summer of 2018 that will meet the established per capita GHG emission reduction targets set by the California Air Resources Board (ARB).

Attachment 1 (Fresno COG Technical Methodology) presents an overview of the SCS development process, including public participation and input, underlying data development, and technical modeling and approach used to estimate GHG emissions reductions resulting from the anticipated adoption of SCS by Fresno COG.

Please contact Kristine Cai at kcai@fresnocog.org should you have any questions on the technical methodology presented in this document.

Sincerely,

Tony Boren

Tony Boren

Executive Director

Fresno COG TECHNICAL METHODOLOGY

SB 375 requires that the Metropolitan Planning Organization (MPO) submit to the Air Resources Board a description of the technological methodology that it intends to apply in the SCS, or APS if applicable.

The technical methodology described in this document satisfies the requirements of SB 375 and is consistent with the original Regional Targets Advisory Committee (RTAC) target setting process. For the 2018 RTP/SCS, Fresno COG will be modeling 2005 as the base analysis year and 2020 and 2035 as the target analysis years for the purposes of SB 375. The 2018 RTP/SCS covers projects from 2018 to 2042.

SB 375 TARGETS:

Current applicable SB 375 targets for each MPO in the San Joaquin Valley are a 5 percent per capita reduction in GHG emissions by the year 2020, and a 10 percent per capita reduction in GHG emissions by the year 2035. The Valley MPOs (along with other MPOs across the state) have been working with ARB staff to update these targets. However, new targets have yet to be finalized. In a December 2016 report to ARB, the Valley MPOs outlined the various SCS achievements that went beyond existing SCS commitments, as well outlined various challenges to GHG reductions that lie beyond an MPO's control (such as economic recovery and reduction in automobile operating costs). At the December 14, 2017 ARB Board meeting, ARB staff highlighted those challenges, and stated that their intention is to refocus the SB 375 process only towards those elements that an SCS can address. Per the ARB staff presentation, workshops are to be held in early 2018 to reshape SB 375 target setting and SCS evaluation. However, given the timing of 2018 RTP/SCS development, the Valley MPOs must proceed with the current applicable targets of 5 percent per capita reduction in GHG emissions by the year 2020, and a 10 percent per capita reduction in GHG emissions by the year 2035. The Valley MPOs are excited to be working with ARB staff on a refocusing of target setting and SCS evaluation, and will work directly with ARB staff to strive for success under SB 375 as the updates are finalized.

SCS DEVELOPMENT SUMMARY:

Over the past three years, Fresno COG in collaboration with the other San Joaquin Valley MPOs, local jurisdictions and interested stakeholders, has been developing an RTP/SCS that seeks to meet SB 375 targets. The process began with updating the necessary modeling tools and developing underlying data and assumptions that would later become part of the scenario evaluation process. Consistent with Fresno COG's public participation plan, a rigorous public participation process was initiated to solicit input from stakeholders on potential GHG emission reduction strategies and scenario performance metrics. Fresno COG Board selected the "preferred" scenario in November 2017. The 2018 RTP/SCS will be adopted by Fresno COG Policy Board in the summer of 2018.

Scenario Modeling

The technical methodology to quantify GHG emissions for the 2018 RTP/SCS is based on Fresno COG Valley Model Improvement Program 2 (VMIP2) model, ARB's EMFAC2014 emission factor model, and off-model adjustments, as necessary, for certain strategies that VMIP2 model does not capture.

In response to ARB feedback received during the technical evaluation of the Valley's first round of SCSs, SJV MPOs have contracted with Fehr & Peers to update their travel models originally developed through the Model Improvement Program (MIP) funded by Proposition 84 funds. The updated model will be used to estimate vehicle miles travelled (VMT) resulting from implementation of the SCS scenario and the alternatives.

In addition, Fresno COG staff, in coordination with the other SJV MPOs, has developed a consistent CO_2 emission modeling methodology using ARB's emission modeling software EMFAC2014 to complete all of the SB 375-related emissions analyses.

Based on ARB's recommended GHG calculation methodology, 2005 base year assumption is kept consistent with the assumption made when 2014 RTP/SCS was developed.

Public Participation

The technical methodology as well as all other elements of the Fresno COG SCS will be subject to Fresno COG public participation plan and outreach requirements including a minimum 55-day review process when the draft RTP/SCS is released in the first quarter of 2018.

Most recent version of the public participation plan was adopted by the Fresno COG Policy Board on July 28, 2016. The full text of the public participation plan is available on Fresno COG website at: http://www.fresnocog.org/sites/default/files/publications/Public_Participation/2016_Fresno_COG_Public_Participation_Plan_Final_Approved.pdf. The information about the public participation activities for the 2018 RTP/SCS is available at: http://www.fresnocog.org/2018-regional-transportation-plan-public-outreach.

Scenario Selection

Fresno COG created four scenarios with the assistance of the RTP Roundtable, an advisory committee that consists of member agencies staff, and representatives from transit agencies, Caltrans, the Air District, BIA, water agency, public health, social equity, environmental group, education, agriculture industry, and other public at large. The scenario concepts were also taken to the general public at a workshop in April 2017. Ten indicators were selected to compare the performance and impacts of the scenarios. Eight of these indicators (GHG reduction, criterial pollutant emission, TOD, density, housing mix, important farmland consumed, VMT, and active transportation and transit trips) were selected from the ten indicators used in the 2014 SCS, which were chosen based on input from stakeholders and the public through focus group meetings, each representing one of six community interests: transportation, environment, health, business, social equity, and natural resources. The remaining two indicators not chosen for comparative scenario analysis in the 2018 SCS (compact development and land consumption) were omitted to make room for the two new indicators discussed below. These two indicators were selected for omission based on their close relationship with other indicators, specifically: compact development is already addressed in the density indicator, and land consumption was determined to be similar in scope to the important farmland consumption indicator.

The two indicators added to the 2018 SCS process were premature deaths prevented and access to resources for EJ population. The former was made possible for consideration due to the use of the Integrated Transport and Health Impact Modeling Tool (ITHIM), which was calibrated for use in the Fresno County in 2016. The latter was the result of Fresno COG's desire to have an EJ-related indicator, and was chosen by the EJ Subcommittee.

Additionally, eight funding priorities were determined for the scenario development process. These priorities were: road maintenance, capacity increase, transit, active transportation, public safety, air quality, congestion, and disadvantaged populations. Each scenario analyzed in the 2018 SCS was given a set of values corresponding to these priorities, indicating which priorities were emphasized for each scenario. To develop constrained project lists for each scenario, a tool was created in Excel to transpose each project's scores according to each scenario's suite of funding priorities, giving each project a new modified total score specific to the priorities defined for each scenario. The tool then ranked the transportation projects based on these new scores and applied projected funding from applicable sources to the highest-ranked projects. Four project lists were created for the four scenarios using this methodology.

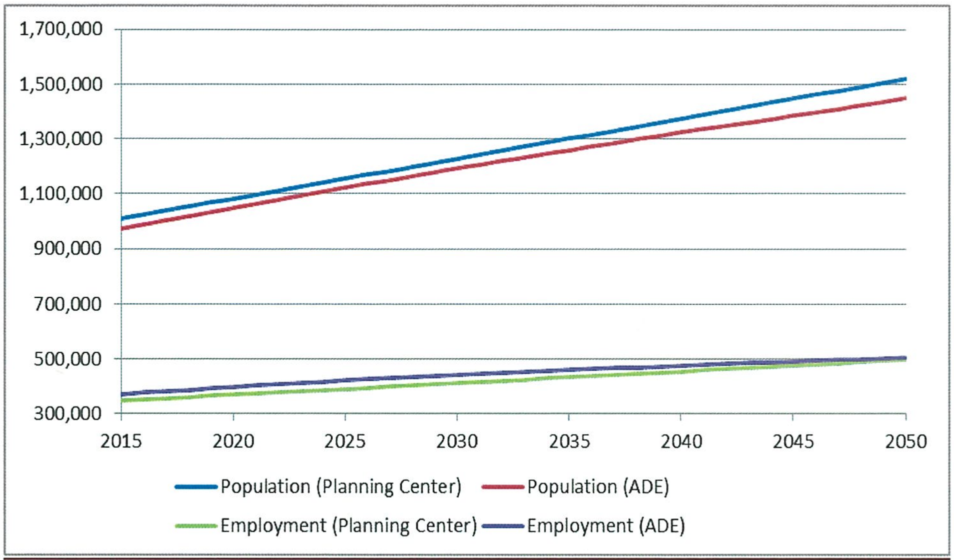
When the indicator results were produced for the four scenarios, the scenarios were taken to the public for their input. More than 1300 people were reached out to during October 2017 through 11 presentations and 20 pop-up events, which were assisted by 6 mini-grant groups funded by Fresno COG. The participants were asked to select a preferred scenario, and their demographic information such as household income, ethnicity, zip code, age, etc. were collected during the outreach events. The survey results were reported to the RTP Roundtable on October 25, and the Transportation Technical Committee (TTC) and the Policy Advisory Committee (PAC) on November 3rd, and the Policy Board on November 16th. The recommendations of the Roundtable, TTC and PAC were also reported to the Policy Board. The Policy Board selected Scenario D as the preferred SCS scenario at the November 16th meeting.

Additional information regarding Fresno COG's RTP/SCS planning process can be located at the following link http://www.fresnocog.org/rtp.

SOCIOECONOMIC DATA:

Fresno COG commissioned a growth forecast study in 2016 to reflect the impacts of the recession on the population and employment growth in the region. The study provides growth projections for Fresno County and the sphere of influence of each of its cities between 2015 and 2050. The study also includes projections of demographic characteristics and housing demand such as households, housing, age distribution average household size, group quarters, average income, household type, race/ethnicity and school enrollment.

Compared to the demographic study used in the 2014 RTP/SCS (*San Joaquin Valley Demographic Forecasts 2010 to 2050* by The Planning Center, 2012), the recent study concluded from the latest observed data that the Fresno region recovered faster from the recession in employment but is experiencing slower population growth than foreseen by the last growth forecast. The finding was reported to ARB in the target recommendation letter on May 17, 2017. The difference between the forecasts for countywide total population and employment can be seen in the following graph:



The report of the 2017 growth forecast can be found at: http://www.fresnocog.org/sites/default/files/publications/RTP/2018_RTP/Fresno_COG_2050_Projections_Final_Report_050417.pdf.

MODELS AND TOOLS:

The Fresno COG will utilize the following tools to estimate GHG emissions for the 2018 RTP/SCS, each of which are described in more detail below:

(1) Scenario Planning/Land Use Model;

(2) MIP Travel Model;

(3) EMFAC 2014 Emissions Factor Model.

(4) Off-Model Adjustments/

Scenario Planning/ Land Use Model

Scenario modeling allows evaluation of the impacts of the RTP/SCS policies on regional land use. In particular, the scenario planning approach is a way to explore what it would take to achieve the revised SB 375 per capita GHG emissions reduction targets. Scenario modeling tools use building blocks that describe the different types of land uses that exist within the metropolitan area or are planned for the future. The output of the scenario modeling tools forms the fundamental input to the MIP transportation model.

Fresno COG employed two land use modeling tools: Cube Land, and Envision Tomorrow.

Cube Land

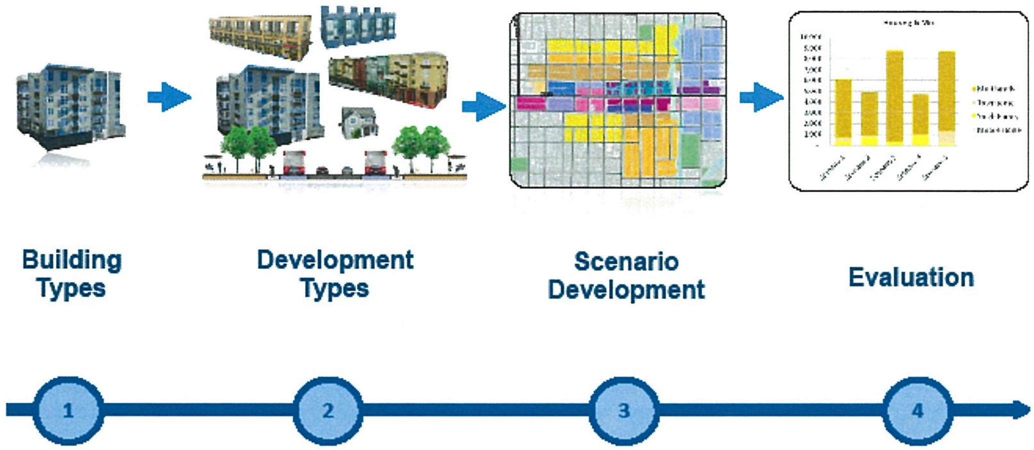
Fresno COG added Cube Land to its land-use modeling methodology for the 2018 SCS in order to add a predictive, economically-driven element to land-use forecasting. Cube Land takes demographic and economic characteristics of the target year and pairs that with zoning and policy characteristics to create a virtual marketplace where households and employers can essentially bid against each other for land on which to reside and work. This creates a land-use development pattern that mirrors the economics of real estate while considering the political climate and land-use planning assumptions of the region.

Cube Land was used to create development patterns for future years that, when compared to base year calibrated runs, provide sound patterns for new residential and commercial growth at the zone level. Using demographic forecast data from the Applied Development Economics (ADE) growth forecast, Fresno COG consulted with The Manhan Group to develop and run the Cube Land model for the 2014 base year calibrated run and for the 2035 forecast run for the Fresno County region. The results from these runs were compared to create delta growth values for housing units and employment at the traffic analysis zone (TAZ) level.

These zonal characteristics for new growth (discounted to 90% in order to allow some flexibility to model the impacts of policies and strategies that might affect future growth patterns) were treated as control totals for the Envision Tomorrow tool, which produces development characteristics at the parcel level, which is a much finer scale. In short, Cube Land is used to determine an economically-driven growth pattern, but produces results at the large-grain TAZ level; then, Envision Tomorrow takes those zonal results and refines them to produce parcel-level growth assumptions.

Envision Tomorrow

Figure 1 – Envision Tomorrow



Envision Tomorrow is a suite of scenario planning tools that tests different land use and transportation options. It consists of two primary tools: a Prototype Builder and a Scenario Builder, which work in unison to develop scenarios.

The Prototype Builder is a "return on investment" (ROI) spreadsheet tool that can be used to determine the physical and financial feasibility of development. This tool allows the user to examine land use regulations in relation to the current development market and consider the impact of various factors, such as parking, height requirements, construction costs, rents and subsidies. The Prototype Builder also considers inputs such as physical building characteristics, parking layout and costs, and other development costs such as landscaping, site acquisition, etc. Stakeholder input is utilized to create building types and development types so that the scenarios reflect existing conditions as well as possible future conditions. Building and development types can be created to represent the development aspirations of the community.

The Scenario Builder is a Geographic Information Systems (GIS) based application that lets the user "paint the landscape" by allocating various, created development types across a study area to create unique land use scenarios. The tool then allows real-time evaluation of each scenario through a set of user-defined indicators. The indicators measure such things as the scenario's impact on land use, housing, sustainability, transportation and economic conditions. General plans, specific plans, community plans, zoning maps, Assessor's parcel data information, and environmental constraints, if any, are all inputs into the Scenario

Builder tool. The growth forecast is allocated—by the user— to locations as desired in this tool.

Once the coordinated land use/transportation scenario is developed the output of that process will be converted into transportation model inputs and run through the MPO MIP travel demand model to estimate vehicle miles traveled attributable to the MPO scenarios.

It is important to note that the output of the scenario planning tool does not yield VMT estimates. As described in the MIP Travel Model section below, the MIP process created standardized land use input categories across all eight San Joaquin Valley MPOs. These standardized categories ensure consistent transportation modeling of household and employment types across all eight MPOs that yields a consistent process to estimate vehicle miles traveled (VMT).

<u>Model Improvement Program (MIP) Travel Model:</u>

Model Development

Beginning in 2010, the eight MPOs began a joint process to improve their travel demand modeling capabilities to help meet SB 375 requirements. This process, known as the San Joaquin Valley Model Improvement Program (MIP) was funded by a $2.5 million Strategic Growth Council Proposition 84 grant. Between 2010 and 2012, staff from each of the eight MPOs participated in monthly meetings with a team of technical consultants to upgrade the models and modeling processes. To enhance coordination efforts, staff from the Air Resources Board and the University of California Berkeley listened in on the monthly MIP meetings of the MPOs and technical consultants.

The MIP effort resulted in the delivery of substantially upgraded and standardized travel demand models to the MPOs in the summer of 2012. The new travel models are designed to better evaluate the types of land use and transportation policies likely to be considered in the RTP/SCSs. Sensitivity to changes in land use and travel estimates was enhanced compared to previous models by – (i) refining each models' traffic analysis zone (TAZ) system to better capture mixed-use and transit oriented development; (ii) incorporating additional socioeconomic variables such as housing units by building type, household income, housing density, employee by detailed sector, and employment density; and (iii) adding a vehicle ownership component and improved sensitivity to travel characteristics.

In addition, the MIP resulted in the standardization of model software, inputs, and methodologies between the eight MPOs. The new models employ a common software package called CUBE, which will enhance the MPOs' ability to share data and resources with each other, as well as coordinate on model improvement and training efforts.

Improvements made to the model input data and each of the key components of the travel demand models (see Figure 2) include: vehicle ownership, trip generation, trip distribution, mode choice, and trip assignment, are discussed in more detail in the following section.

Then in 2014, a minor update to the models was developed, known as VMIP 2. VMIP2 takes advantage of the 2010 Census, the most recent American Community Survey, and 2012-2013 California Household Travel Survey data, and enhances the model structure developed as part of the VMIP1. In addition to the updated data, VMIP2 implements changes to the model structure based on ARB feedback received. Model improvements made to address ARB's comments include the following:

- Auto ownership was updated to accounts for land use accessibility (auto, transit, walk, bike) and commute cost as a percentage of household income.

- Trip generation rates were revised to be by area type, which includes the accessibility of land uses. Area type is recalculated with each model run to account for land use changes between scenarios

- Trip distribution was updated to include correlation between household income and job salary for home-work trips.

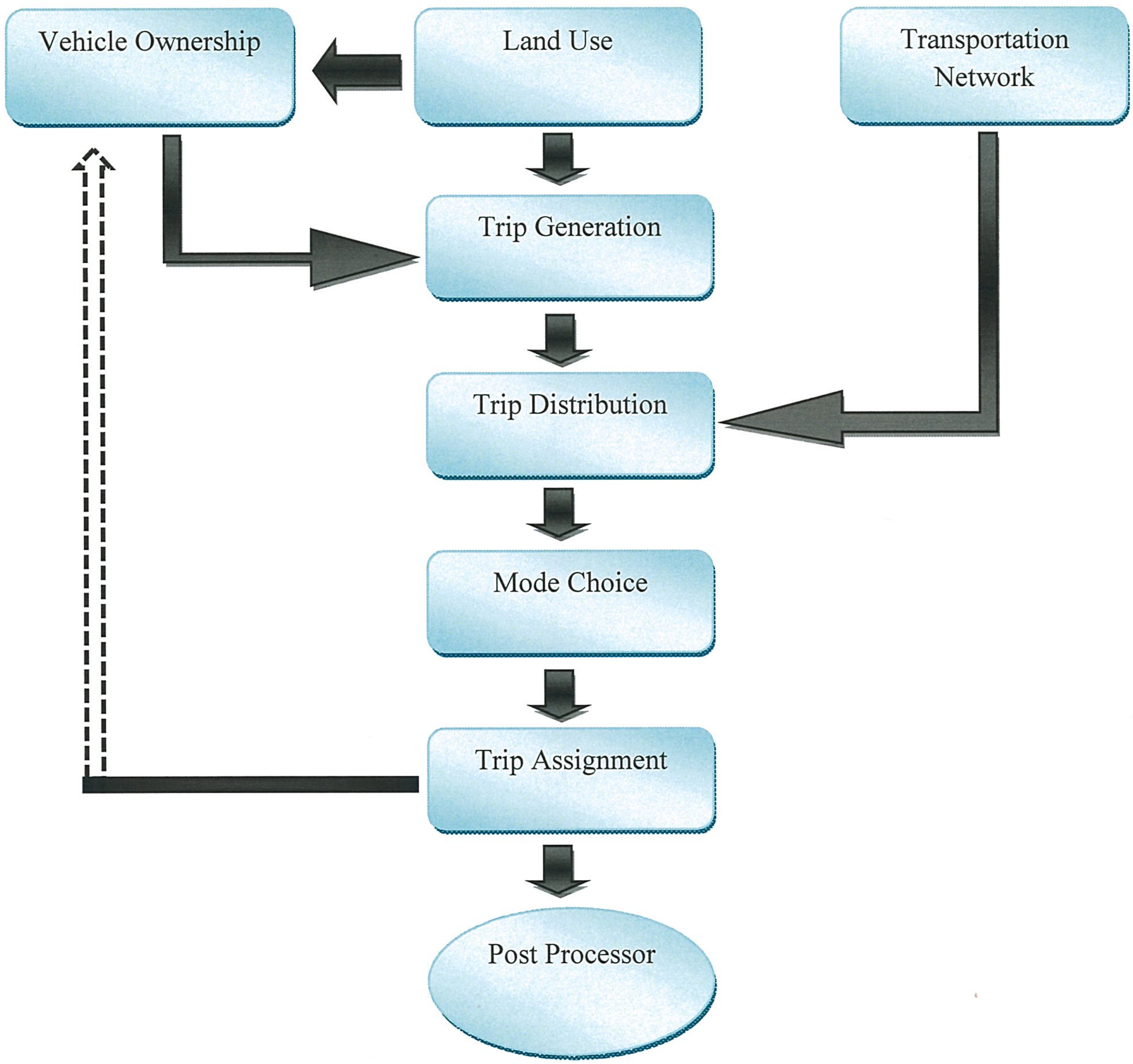
- The mode choice was updated based on the latest household survey and includes demographics (household size, income, autos owned) and incorporates average vehicle occupancy by purpose.

- In addition to counts and VMT, the model peak period congested locations was compared to observed NPMRDS data provided by FHWA

Other key enhancements to model sensitivity and usability include:

- Land Use: simplified residential and employment categories
- Interregional Travel: updated based on the newly released California Statewide Transportation Demand Model, and based on place and purpose, rather than having internal and interregional travel combined and distributed based on time\cost of travel
- Modified Assumptions: adjustments to employment density, intersection density, and access to jobs and houses

Figure 2 – San Joaquin Valley Model Improvement Program: Model Components



Data Input: The MIP models feature improved TAZ systems, socioeconomic data, land use and travel network characteristics. Improvements to the TAZ systems are designed to help capture more detailed travel movements throughout the region, which allows for more precise analysis of land use and smart growth effects. An updated version of the trip based Caltrans statewide traffic model was developed to help forecast interregional and intraregional trips. Improvements to socioeconomic, land use and transportation network data in the models better account for differences in vehicle ownership and trip generation factors, as well as standardize categories across the eight SJV MPOs.

Vehicle Ownership: The MIP model calculates the number of motor vehicles in a region based on demographic characteristics, auto operating cost, and accessibility. The output of this component is a critical input to the trip generation step, helping to capture the economic characteristics of each household. For VMIP 2, the vehicle operating cost was updated to include maintenance and operations costs based on feedback from ARB.

Trip Generation: The trip generation component estimates the number of person-trips for each activity, such as traveling to-and-from work, school, shops, and social/recreational events. The new models estimate person trips based on demographic and employment characteristics, increasing their capability to analyze the effect of socioeconomic factors on trip rates. Further, the new models increase the number of trip purposes from the typical three or five to eleven[1]. This change allows to distinguish the potential for alternative modes such as school and college trips. The new models also improve the trip generation step by allowing trip rates to vary by income, household size, the number of workers in a household, drivers, and vehicle ownership. This provides better information about regional travel patterns. For VMIP2, trip generation factors were updated to reflect the built environment and area type factors, and home-work trips were grouped by income range.

Trip Distribution: Trip distribution estimates the number of trips from one travel zone to each of the other travel zones in the county. The new models improve the sensitivity of changes to land use on trip distribution by better reflecting the attributes that influence a person's decision to travel. The MIP model provides the capability to consider additional factors such as trip purpose, person travel time by all modes, travel cost, congestion, and

[1]The additional trip purposes includes home-based K-12, home-based college, highway commercial, trucks-small, trucks-medium, and truck-heavy.

vehicle ownership. For VMIP2, trip distribution was updated to match household income and job salary and to better reflect interregional travel at a local scale.

Mode Choice: The Fresno COG MIP has an inbuilt mode choice model. This component is used to predict the probability of selecting a travel mode (e.g., auto, transit, bike and walk) for each trip in the region based on the income of the trip maker, the travel cost, time and accessibility of other modes, and improves the travel models' responsiveness to socioeconomic characteristics, land use, pricing and parking strategies. The mode choice model includes seven travel modes with a separate mode choice for walk and bike.

Trip Assignment: The trip assignment component estimates traffic volumes and travel times for each roadway in the network. The new models enhance the trip assignment component by including a new feedback mechanism between the trip assignment and the number of autos to enhance the ability to address induced travel demand. The feedback mechanism inputs congested travel times into the model, which helps to account for travelers who change their travel route and mode in response to congestion.

Model Calibration and Validation: A calibration and validation report for the MIP travel model will be part of Fresno COG's final RTP/SCS submittal to ARB in the summer of 2018.

In model calibration, each component of the model is calibrated to ensure that it produces accurate forecasts. Calibration is an iterative process where model settings are adjusted so the output of the model matches observed travel patterns.

Static validation is that process where the model is tested to ensure that the model output matches available traffic counts and roadway speeds. As part of the static validation process, elements of trip generation, trip distribution and traffic assignment modules may be adjusted.

Dynamic model validation tests the model to determine how well it responds to change. Dynamic testing includes testing the changes to the following:

- Household location, density, diversity and other household attributes
- Employment location
- Roadway network
- Transit service

The MPOs performed calibration for each component of the model following the Federal Highway Administration and Caltrans guidelines, to ensure that the models produce reasonable forecasts. Model validation, a critical step in the development of any regional travel demand model, establishes the credibility of the model to predict future travel behavior. The MPOs performed both static and dynamic validation on the new models as recommended by Federal Highway Administration guidelines. Static validation includes – (i) trip generation rates, (ii) trip length frequency by purpose, (iii) average travel time by purpose, (iv) mode split by purpose, (v) traffic assignment by facility, and (vi) transit ridership. Dynamic validation included changing socioeconomic (household size, income, age distribution), land use (density, household location) and travel cost (auto operating cost and parking price) inputs.

<u>Modeling Interregional trips</u>

The California Statewide Travel Demand Model (Statewide Model) was designed to capture the interactions of land use plans all across the State as they affect interregional travel. The model operates at a scale coarser than the SJV-MIP models. Its value is in placing local and regional travel in the context of total statewide activity. For the VMIP 2 update, interregional travel was updated to reflect the 2010 Statewide Model version. However, due to timing of the Statewide Model update, it contains pre-2014 RTP/SCS land use.

For the VMIP2, AirSage data was used to evaluate county-to-county magnitudes for the 8 MPOs within the San Joaquin Valley and aggregated counties outside of the San Joaquin Valley and focused exclusively on long distance trips. The statewide model was used to compare the magnitude of county-to-county flows to AirSage. Once the magnitudes were determined to be comparable, the statewide model was used to develop through trips (i.e. XX) and station weights by purpose for each gateway. A process of interpolating\extrapolating was implemented using the base and future year from the statewide model for multiple years. The statewide model was also used to determine the weighted average trip distance for external gateways to represent travel beyond the model area.

For the purpose of preparing the GHG emissions analysis for the 2018 RTP/SCSs, all emissions from through trips (trips without an origin and a destination in the MPO region) are excluded. In addition, the portion of VMT attributable to trips that either begin or end within the region but travel to/from neighboring regions (IX/XI) has been included for all portions of the trip within the MPO region.

Accounting for interregional travel, or travel that crosses MPO boundaries, continues to be a key issue for SB-375 implementation across the state. The issue is especially important when considering the area covered by SJV MPOs, which in aggregate experience a higher proportion of through traffic relative to other regions (as a percent of total vehicle miles traveled). Statewide discussions to determine how to account for interregional travel across the state should continue.

It is vitally important that the next update to the Caltrans statewide model be fully completed in order for interregional trips to continue statewide conversations regarding interregional travel statewide. In addition, incorporation of SJV long-term transportation planning elements into the Statewide model is highly desired for the next update.

Emissions Modeling

Fresno COG is using the latest version of ARB's emissions modeling software EMFAC2014 to complete GHG emissions estimates for the SCS scenario and the alternatives.

The latest EMFAC update includes an "SB 375 Emission Analysis" mode that estimates and reports CO2 emissions in tons per day from appropriate light-duty vehicle classes (LDA, LDT1, LDT2 and MDV). In order to ensure a coordinated approach and reduce potential for user errors, EMFAC2014 modeling instructions and EMFAC output post-processing worksheet have been developed for the San Joaquin Valley MPOs in consultation with ARB. The approach uses Transportation Data Templates that convert VMIP2 travel model output into EMFAC2014 inputs including VMT and speed distributions specific to the region. Per RTAC recommendation, the VMT modeled for SB 375 purposes does not include through trips.

In addition, the 2018 RTP/SCS emissions modeling approach incorporates ARB's "Methodology to Calculate CO_2 Adjustment to EMFAC Output for SB 375 Target Demonstration." The emissions methodology assumes the same 2005 base year CO_2 per capita estimate as for the 2014 RTP, and adjusts 2020 and 2035 target performance downward to account for fleet mix and emission factor updates between EMFAC2011 used for the 2014 RTP/SCS and EMFAC2014. The EMFAC output post-processing worksheet calculates per capita CO_2 reductions from 2005 base year for 2020, 2035, and RTP horizon year 2042 using CO_2 emissions modeled with EMFAC2014 and the latest population projections for the region. The spreadsheet also incorporates the ARB CO_2 Adjustment Methodology by applying the difference between CO_2 per capita reductions modeled with EMFAC2011 and EMFAC2014 using 2014 RTP activity data to reductions achieved by the 2018 RTP/SCS using EMFAC2014. Although this approach results in per capita CO_2

reductions that are generally lower than otherwise modeled with EMFAC2014 alone, ARB has indicated that this target demonstration approach is separate from the SB 375 target setting methodology and is not directly comparable to the target recommendations Fresno COG provided to ARB.

<u>Off-Model Adjustments</u>

Similar to other traditional four-step travel demand models, the Fresno COG model is not sensitive to the impacts of Transportation Demand Management/Transportation Systems Management (TDM/TSM) projects such as Intelligent Transportation Systems (ITS), bike and pedestrian projects, and rideshare programs, nor electrical vehicle penetration. In these instances, Fresno COG relies on "off-model" adjustments using methodologies commonly used in literature, previously approved or cited by ARB, and consistent with the other MPOs.

Fresno COG considers the following strategies that are quantified "off-model":

1. Regional electric vehicle (EV) charging infrastructure programs
2. Active transportation projects
3. Vanpool program expansion
4. Rideshare programs
5. Rule 9410 Employer Trip Reductions
6. ITS and other TSM projects

Regional efforts to enhance EV charging infrastructure come from both public and private sectors. A good example of the effort is the Fresno Rural Transit Agency secured funding to install publicly accessible solar powered charging stations at all municipal yards of the small cities that it serviced throughout the Fresno COG region. PG&E recently announced that it will significantly expand access to EV charging stations throughout Northern and Central California over the next three years. Up to 7,500 EV charging stations will be installed at apartment, condominium complexes and workplaces. Electrify America, a subsidiary of Volkswagen, plans to invest $800 million in Zero Emission Vehicle infrastructure and education over the next 10 years in California as part of Volkswagen's court settlement with U.S. regulators over excessive diesel emission. Fresno Metropolitan Statistical Area

(MSA) is included as one of the six metro areas selected for the investment. A methodology created by SANDAG will be adapted and applied to quantify the additional electric VMT not accounted for in the EMFAC model because of the additional regional efforts in building EV infrastructure. The SANDAG methodology was modified to accommodate Fresno COG's 2018 RTP/SCS modeling conditions, a different horizon year from SANDAG for example. Parameters and assumptions were updated to reflect Fresno COG's regional conditions. Vehicle fleet and VMT numbers were updated using EMFAC2014 output. The numbers of Regional Residents ZEVs are scaled from San Diego EMFAC MY percentages. However, the percentage of eVMT increase due to regional charger program is assumed to be 5% (6% lower than the SANDAG assumption), to account for regional differences between San Diego and Fresno regions.

Fresno COG uses Moving Cooler, An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emission, to account for the reduction in VMT from the active transportation, ITS and other TSM projects. Specifically, Table 4.2 in Moving Cooler identifies the GHG reduction that can be expected from different strategies at varying level of deployment. For 2018 RTP/SCS Fresno COG assumes an Aggressive level of deployment of Combined Pedestrian and Combined Bicycle strategies in 2020, 2035 and 2042.

CalVans provides vanpool services to farmworkers and commuters in the rural counties in California. The agency reports Passenger Lane Miles (PLM) Reduced by van service by county. CalVans received $3 million in 2015/2016 from the AHSC program for the Vanpool Expansion project and expects to have rapid growth in its fleet size. Fresno COG will project the VMT savings from the vanpool program based on the historical PLM and the growth projection from CalVans.

Fresno County Measure C carpool program is funded by Fresno County's ½ cent sales tax, Measure C. It provides incentives to commuters who carpool. The program reported 58,527 daily commute carpool VMT in year 2015/16. It is assumed that the level of participation in this program will continue into the future at the same rate as the reported year, with the assumption that Measure C will be renewed again in 2026.

San Joaquin Valley Air Pollution Control District Rule 9410 implements Employer Based Trip Reduction through eTRIP program. The eTRIP Rule (Rule 9410, Employer Based Trip Reduction), was adopted by the Air District in 2009. The rule requires larger employers to establish an Employer Trip Reduction Implementation Plan (eTRIP) to encourage employees to reduce single-occupancy vehicle trips, thus reducing pollutant emissions associated with work commutes. The VMT reduction of work commutes was estimated based on model reported average home-based work trip length, countywide worksite numbers, and average number of employees per worksite by tier. The VMT reduction was applied to the total VMT by scenario before it was fed to EMFAC emission model, where GHG and criteria pollutant emissions were calculated.

A detailed documentation of the quantification methodology of the above off-model strategies will be provided as part of the RTP/SCS document.

Appendix I Item 4:
Land-Use Modeling

Developing Land Use Scenarios

Fresno COG employed a two-step approach to developing land-use scenarios:

1. For new growth from 2014 to 2035, determine regional land-use patterns using Cube Land, with jurisdiction-specific control totals from the demographic forecast; and
2. Determine parcel-level development for new growth utilizing Envision Tomorrow, using the zone-level outputs from Cube Land as a guide.

Cube Land

Fresno COG added Cube Land to its land-use modeling methodology for the 2018 SCS in order to add a predictive, economically-driven element to land-use forecasting. Cube Land takes demographic and economic characteristics of the target year and pairs that with zoning and policy characteristics to create a virtual marketplace where households and employers can essentially bid against each other for land on which to reside and work. This creates a land-use development pattern that mirrors the economics of real estate while considering the political climate and land-use planning assumptions of the region.

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Once the coordinated land use/transportation scenario is developed the output of that process will be converted into transportation model inputs and run through the MPO MIP travel demand model to estimate vehicle miles traveled attributable to the MPO scenarios.

It is important to note that the output of the scenario planning tool does not yield VMT estimates. As described in the MIP Travel Model section below, the MIP process created standardized land use input categories across all eight San Joaquin Valley MPOs. These standardized categories ensure consistent transportation modeling of household and employment types across all eight MPOs that yields a consistent process to estimate vehicle miles traveled (VMT).

~~Envision Tomorrow is a land-use scenario planning tool that uses development types to model possible future development patterns. In any given land-use scenario, parcel-level planning areas expected to acquire new development are assigned a development type, which determines the number and types of housing and employment projected to develop in that area. The aggregation of these areas, controlled to reflect Countywide targets for population and employment, reflects one particular SCS scenario for the Fresno County region.~~

Determining Development Patterns

Fresno COG developed a tool to flag parcels for development within the Envision Tomorrow tool, based on an aggregate score depending on several factors. The calculation of a given parcel's score can be generally represented as follows:

$$S = K(S_I + S_R + S_C + S_D + S_S)$$

Where:

S = total development score
K = adjustment factor (adjusts to favor planned development and calibrate infill ratios)
S_I = infill score (considers distance to city centers, highways, and major roads)
S_R = redevelopment score (considers development/redevelopment potential)
S_C = conservation score (prioritizes development in lands with no natural resources)
S_D = density score (used to calibrate regional residential density)
S_S = single-family score (used to calibrate housing mixes)

The Envision Tomorrow land-use allocation process then followed two steps:

1. Determine TAZ-level targets for housing and employment growth based on 90% confidence in the Cube Land model output, adjusting for jurisdiction-level control totals from the demographic forecast. For each TAZ, sort parcels in descending order according to their total development scores and develop parcels within that TAZ until the targets for housing and employment are met.
2. Aggregate housing and employment growth from the developed parcels and determine the difference to be developed to meet totals determined for each jurisdiction, based on the demographic forecast. Repeat the development process for undeveloped parcels, this time aggregating to the jurisdiction level rather than the TAZ level, until the growth targets are met.

The elements that comprise the total development scores were adjusted to calibrate land-use development to mirror (where appropriate) the 2014 SCS development pattern, as well as model alternate development patterns based on scenario-specific parameters.

Development Types

Each parcel with potential for development was assigned three development types based on the parcel's land-use designation in the relevant agency's general or specific plan. These development types represented a spectrum of potential development—including low intensity, medium intensity, and high intensity—all consistent with the range of development allowed by the agency for that area. For some scenarios, parcels with high development scores were developed at a higher intensity to reflect the trade-off strategies outlined in the scenario's description.

The following development types were used in the preferred RTP-SCS scenario for the Fresno County region:

Development Types	Vacant Gross Density		Redev Gross Density		Housing Mix					Employment Mix		
					Housing Unit Percent by Type					Employee Percent by Type		
	Housing Units / Gross Acre	Jobs / Gross Acre	Housing Units / Gross Acre	Jobs / Gross Acre	Multi-Family	Town Home	Single Family	Small Lot Single Family	Large Lot Single Family	Retail	Office	Industrial
Town Center	19.75	50.00	16.79	42.50	100.00%	-	-	-	-	27.32%	72.68%	-
Neighborhood Center	13.34	19.31	10.01	14.48	89.08%	10.92%	-	-	-	50.58%	49.42%	-
Town Neighborhood	11.69	2.42	5.85	1.21	55.64%	13.65%	30.72%	20.28%	10.44%	72.51%	27.49%	-
Mixed-Use Corridor	14.27	37.51	9.27	24.38	100.00%	-	-	-	-	29.28%	70.72%	-
Main Street	6.27	32.04	3.14	16.02	100.00%	-	-	-	-	57.81%	42.19%	-
Office Park	-	33.84	-	8.46	-	-	-	-	-	9.69%	80.93%	9.38%
Suburban Office	-	19.14	-	3.83	-	-	-	-	-	4.88%	79.49%	15.63%
Activity Center	-	19.05	-	4.76	-	-	-	-	-	58.12%	39.35%	2.53%
Arterial Commercial	-	12.94	-	1.94	-	-	-	-	-	100.00%	-	-
Regional Retail	-	10.56	-	2.11	-	-	-	-	-	100.00%	-	-
Educational	-	2.98	-	2.98	-	-	-	-	-	-	100.00%	-
Institutional	-	2.56	-	1.54	-	-	-	-	-	2.86%	97.14%	-
Industrial	-	9.53	-	2.38	-	-	-	-	-	0.30%	21.08%	78.63%
Urban Multifamily	38.99	-	-	-	100.00%	-	-	-	-	-	-	-
Suburban Multifamily	22.48	-	11.24	-	100.00%	-	-	-	-	-	-	-
Compact Neighborhood High	14.00	-	3.50	-	46.27%	31.14%	22.60%	22.60%	-	-	-	-
Compact Neighborhood	8.60	-	3.01	-	-	15.86%	84.14%	76.52%	7.62%	-	-	-
Suburban Residential	3.86	-	-	-	-	-	100.00%	11.81%	88.19%	-	-	-
Large Lot Residential	2.08	-	-	-	-	-	100.00%	-	100.00%	-	-	-
Rural Residential	0.49	-	-	-	-	-	100.00%	-	100.00%	-	-	-

Town Center
(Avg. Density: 16-19 HU/acre, 42-50 jobs/acre)

Town Centers are the highest-intensity development type used in the SCS for the Fresno County region. The best examples of this development type would be central Downtown Fresno. They are employment centric, though they also provide multi-family housing opportunities located very close to jobs and services. Buildings are typically 5 stories or less. Such communities are highly walkable and benefit from high-capacity transit and bus facilities.

Neighborhood Center
(Avg. Density: 10-14 HU/acre, 14-20 jobs/acre)

Neighborhood Center serves as a walkable center for small community or neighborhood services including retail and offices. Buildings are about two to three stories tall and can include mixed uses, including live-work developments. This development type also includes residential development such as duplexes and townhouses.

Town Neighborhood
(Avg. Density: 5-12 HU/acre, 1-3 jobs/acre)

Downtown Neighborhoods include areas with apartments, condos, and townhouses. There may be some mixed use buildings with retail on the ground floor. Street connectivity is relatively favorable, allowing for a walkable environment and transit options.

Mixed Use Corridor

(Avg. Density: 9-15 HU/acre, 24-38 jobs/acre)

Mixed Use Corridor refers to a mix of new and older development in a linear fashion along corridors that are often served by transit. They are usually pedestrian-oriented with a mix of housing, retail and office amenities.

Main Street

(Avg. Density: 3-7 HU/acre, 16-33 jobs/acre)

Main Streets include a mix of uses and interconnected street network. Main Streets primarily function as service destinations rather than centers of employment. Buildings typically stand one to three stories tall and include townhouses or apartments above storefronts.

Office Park

(Avg. Density: 8-34 jobs/acre)

Office Parks are comprised of low to medium density office buildings surrounded by surface parking. Generally located near highways for easy auto-access, transit and walking options are limited. Office parks lack residential or retail uses.

Suburban Office

(Avg. Density: 3-20 jobs/acre)

Suburban Office complexes generally contain low-density, single-story office buildings, and can be found in suburban areas. The development type is on average about half the density of Office Park.

Activity Center

(Avg. Density: 4-20 jobs/acre)

Activity centers include an agglomeration of large-scale retail buildings, office buildings and multifamily housing. Land uses are separated from each other by parking areas, freeways or arterials. Activity centers are usually positioned at intersections of highways or arterials, sometimes along major transit corridors.

Arterial Commercial

(Avg. Density: 1-13 jobs/acre)

Arterial commercial development takes a linear form along both sides of a major road or highway. Connections in this development type consist mostly of highways and frontage roads.

Regional Retail
(Avg. Density: 2-11 jobs/acre)

Regional Retail development is generally characterized by low-density commercial such as pharmacies, grocery stores, and large format retail. It lacks any residential use.

Educational
(Avg. Density: 2-3 jobs/acre)

Educational development refers to schools, universities, and other learning institutions. Such campuses generally contain significant amounts of open space or parks for recreational use.

Institutional
(Avg. Density: 1-3 jobs/acre)

The Institutional development type can contain a mix of government and quasi-government uses, such as museums, government facilities, and the like. Such campuses are often low-density office and educational.

Industrial
(Avg. Density: 2-10 jobs/acre)

The Industrial development type is made up of a mix of low and medium density industrial buildings. This type often consists of industrial yards and campuses separate from other uses due to the nature of the industrial use. This development type is often near highways with large surface parking for autos and trucks.

Urban Multifamily
(Avg. Density: up to 39 HU/acre)

Urban Multifamily is characterized by high-density apartment complexes located in central urbanized areas and city centers. Units are generally small, multifamily rental dwellings. Buildings are typically no more than 4 stories.

Suburban Multifamily
(Avg. Density: 11-23 HU/acre)

Suburban Multifamily development refers to medium-high density apartment complexes located in suburban areas. Buildings can be multi-storied but are characterized by single story dwellings. Such development can accommodate on average about half the number of units per acre as Urban Multifamily.

Compact Neighborhood High
(Avg. Density: 3-14 HU/acre)

This development type can contain a mix of residential uses, including single-story multifamily rentals, attached single-family units such as duplexes and townhomes, and small-lot urban single-family units.

Compact Neighborhood

(Avg. Density: 3-9 HU/acre)

Compact Neighborhoods are medium-density residential areas comprised of small lot single-family dwellings, townhomes and duplexes. Street connectivity is relatively favorable, allowing for a walkable environment and transit options.

Suburban Residential

(Avg. Density: less than 4 HU/acre)

Suburban residential includes a mix of single-family, detached homes. Street networks include many cul-de-sacs, which is typical of post-World War II suburbs. Suburban residential areas are designed for automobile travel. Street connectivity and walkability are generally low.

Large-Lot Residential

(Avg. Density: less than 3 HU/acre)

Large-lot residential subdivisions consist entirely of single-family, detached homes. Large-lot subdivisions are typically isolated or far from employment and retail services. With one acre lots and larger, this development type is characterized by very large residences without sidewalks. Travel to and from destinations is usually by automobile.

Rural Residential

(Avg. Density: less than 1 HU/acre)

Such development consists of detached single-family dwellings on large, rural lots. Rural residential lots are on average four times the size of those in Large-Lot Residential, and can be several miles from the nearest town or community center.

Appendix I Item 5:
Fresno COG Off-Model Tools

Appendix J: Fresno COG Off-Model Tools

Similar to other traditional four-step travel demand models, the Fresno COG model is not sensitive to the impacts of Transportation Demand Management/Transportation Systems Management (TDM/TSM) projects such as Intelligent Transportation Systems (ITS), bike and pedestrian projects, and rideshare programs, nor electrical vehicle penetration. In these instances, Fresno COG relies on "off-model" adjustments using methodologies commonly used in literature, previously approved or cited by ARB, and consistent with the other MPOs.

Fresno COG considers the following strategies that are quantified "off-model":

1. Regional electric vehicle (EV) charging infrastructure programs
2. Active transportation projects
3. Vanpool program expansion
4. Rideshare programs
5. Rule 9410 Employer Trip Reductions
6. ITS and other TSM projects

Regional Electric Vehicle (EV) Charging Infrastructure Programs

Regional efforts to enhance EV charging infrastructure come from both public and private sectors. A good example of the effort is the Fresno Rural Transit Agency secured funding to install publicly accessible solar powered charging stations at 13 municipal yards of the small cities that it serviced throughout the Fresno COG region. PG&E recently announced that it will significantly expand access to EV charging stations throughout Northern and Central California over the next three years. Up to 7,500 EV charging stations will be installed at apartment, condominium complexes and workplaces. Electrify America, a subsidiary of Volkswagen, plans to invest $800 million in Zero Emission Vehicle infrastructure and education over the next 10 years in California as part of Volkswagen's court settlement with U.S. regulators over excessive diesel emission. Fresno Metropolitan Statistical Area (MSA) is included as one of the six metro areas selected for the investment.

A methodology created by SANDAG was adapted and applied to quantify the additional eVMT (VMT in electric mode) not accounted for in the EMFAC model because of the additional regional efforts in building EV infrastructure in the Fresno region. The key assumptions of the spreadsheet tool created by SANDAG are that: 1) over the years, ZEV (Zero Emission Vehicle) and TZEV (Transitional ZEV, such as plug-in hybrid vehicles) penetration of the region's vehicle fleet will go up, 2) regional charger program will increase the eVMT of these ZEV and TZEV by 11% (MTC assumption), and 3) GHG reductions come from replacing gasoline consumption with electricity (GHG emission from electricity generation was taken into account). The spreadsheet was modified to suit Fresno COG's 2018 RTP/SCS modeling conditions, i.e., a different horizon year from SANDAG, etc. Parameters and assumptions were updated to reflect Fresno COG's regional conditions. Vehicle fleet and VMT numbers were taken from EMFAC2014 model run output. The numbers of Regional Residents ZEVs and TZEVs are scaled down to reflect Fresno regional fleet size using EMFAC vehicle population projections and MY (vehicle Model Year) percentages from the SANDAG spreadsheet. In addition, Fresno COG assumes a less-aggressive 5% eVMT increase rate due to additional regional charger programs compared to the 11% used in original spreadsheet for the Bay Area and the San Diego region. The off-model calculation was applied after running the EMFAC emission model, where EMFAC model run output was used to determine the GHG reduction for each specific scenario.

Active Transportation Projects

Many efforts have been made in recent years by the Fresno COG region to improve the infrastructure and promote walking and biking, such as building and extending multipurpose trails. Future transportation funding sources are also identified for active transportation facilities in the 2018 RTP/SCS. To properly account for these efforts, Fresno COG uses Moving Cooler, An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emission, to capture the reduction in per capita GHG emission from the active transportation, prepared by Cambridge Systematics and published by Urban Land Institute in 2009. Specifically, Table 4.2 in Moving Cooler identifies the GHG reduction that can be expected from different strategies at varying level of deployment. 2018 RTP/SCS Fresno COG assumes an Aggressive level of deployment of Combined Pedestrian and Combined Bicycle strategies in 2020, 2035 and 2042 because of the region-wide efforts that have gone into the active transportation planning and the significantly increased numbers of active transportation projects proposed in the 2018 RTP/SCS by the cities/County . The off-model calculation was applied after running the EMFAC emission model, where the GHG emissions were reduced by the specific levels indicated in Moving Cooler.

Vanpool Program Expansion

CalVans provides vanpool services to farmworkers and commuters in the rural counties in California. The agency reports Passenger Lane Miles (PLM) Reduced by van service by county. In the most recent FY15-16 report, CalVans reported 23,867,622 weekday PLM recorded in Fresno County in FY15-16, taking into account the 2,244,892 miles traveled by the vans, which translates to 83,164 vanpool VMT savings per weekday. Fresno COG use that data as the basis to forecast future vanpool growth. CalVans received $3 million in 2015/2016 from the AHSC program for the Vanpool Expansion project and expects to have a rapid growth in its fleet size. In the near future (2017-2020), the growth rate is assumed to be 15% per year. Then the annual growth rates were projected to decrease gradually over the years from 12% for the period of 2021-2030, to 8% for the period of 2031-2035, and then to 6% for the period of 2036-2042. The VMT reduction was applied to the total VMT by scenario before it was feed to EMFAC emission model, where GHG and criteria pollutant emissions were calculated.

Rideshare Programs

Fresno County Measure C carpool program is funded by Fresno County's ½ cent sales tax, Measure C. It provides incentives to commuters who carpool. The program reported 58,527 daily commute carpool VMT in year 2015/16. The VMT savings from this program was based on the assumption that the level of participation in this program will continue into the future at the same rate as the reported year, assuming that Measure C will be renewed again in 2026. The VMT reduction was applied to the total VMT by scenario before it was feed to EMFAC emission model, where GHG and criteria pollutant emissions were calculated.

Rule 9410 Employer Trip Reductions

San Joaquin Valley Air Pollution Control District Rule 9410 implements Employer Based Trip Reduction through eTRIP program. The eTRIP Rule (Rule 9410, Employer Based Trip Reduction), was adopted by the Air District in 2009. The rule requires larger employers to establish an Employer Trip Reduction Implementation Plan (eTRIP) to encourage employees to reduce single-occupancy vehicle trips, thus reducing pollutant emissions associated with work commutes.

Per the final (2009) Air District staff report on Rule 9410, Rule 9410 would apply to an estimated 1,883 worksites throughout the Valley, representing a wide range of sectors and accounting for approximately 500,000 commuting employees. This rule distinguishes those facilities into two tiers. Tier One Worksites are those with 100-249 eligible employees and Tier Two Worksites have 250 or more eligible employees. There are an estimated 1,342 Tier One Worksites and 541 Tier Two Worksites. Fresno has nearly 25 % of the Valley population, so it is assumed that Fresno has 25% of the 8-county shares of worksites.

The VMT reduction of work commutes was estimated based on model reported average home-based work trip length, countywide worksite numbers, and average number of employees per worksite by tier. Future growth in workforce was taken into account by scaling the reduction by way of comparing the future workforce to that of 2009. The VMT reduction was applied to the total VMT by scenario before it was feed to EMFAC emission model, where GHG and criteria pollutant emissions were calculated.

ITS and Other TSM Projects

Similar to Active Transportation Projects, ITS and other TSM improvements were not captured by the Fresno COG's four-step travel demand model. To account for these efforts, Fresno COG uses Moving Cooler, An Analysis of Transportation Strategies for Reducing Greenhouse Gas Emission, prepared by Cambridge Systematics and published by Urban Land Institute in 2009. Specifically, Table 4.2 in Moving Cooler was used to estimate GHG reductions from deploying system operations and management strategies, such as ramp metering, variable message signs, signal control management, and traveler information. The level of deployment is assumed to be "aggressive", which is the middling level on step below the maximum deployment offered by Moving Cooler, in 2020, 2035 and 2042. The off-model calculation was applied after running the EMFAC emission model, where the GHG emissions were reduced by the specific levels indicated in Moving Cooler.

Appendix I Item 6:
SCS Alternative Scenarios

Scenario Development Overview

The scenario development process for the 2018 Sustainable Communities Strategy (SCS) began with the establishment of eight **transportation funding priorities** and four **trade-off strategies** that would establish clear and quantifiable guidelines for the formation of unique scenarios. The funding priorities would affect which projects would be considered in the constrained list for each scenario and would be based upon the transportation project scoring criteria. The trade-off strategies dealt primarily with land-use decisions and would influence the growth pattern of each scenario.

The Scenario Development Subcommittee

In April 2017, the RTP Roundtable approved the formation of the Scenario Development Subcommittee comprised of any members of the Roundtable who were interested in influencing the development of the scenarios to be included in the SCS. This subcommittee was responsible for determining transportation funding priorities and establishing trade-off strategies for each scenario, using the 2014 SCS as a foundation. In essence, each priority and strategy could adhere to that of the 2014 plan, or could deviate from it in one of two directions: either more or less investment (in regards to funding priorities), or more or less aggressive (with regard to trade-off strategies).

The four scenarios as developed by the subcommittee are attached.

Transportation Funding Priorities

The eight transportation funding priorities are as follows:

- Maintain and repair existing roads
- Expand roadway capacity
- Enhance and maintain transit service
- Enhance and maintain active transportation
- Improve public safety
- Reduce pollution and greenhouse gas emissions
- Increase operational efficiency and reduce congestion
- Serve disadvantaged populations

These priorities were chosen to allow for both the prioritization of certain transportation modes as a whole (e.g. “Maintain and repair existing roads”), as well as underlying strategies that apply to multiple modes (e.g. “Improve public safety”). These priorities were also heavily influenced by the results of the *2012 Regional Transportation Plan – Valley Blueprint Outreach Survey* by AIS Market Research. The summarized results from that survey are attached.

To implement these priorities in the modeling process, Fresno COG staff developed a tool that applied each scenario’s relative investment values to the scoring criteria, creating constrained project lists that differed among the scenarios. In this tool, relevant criteria scores were given more or less relative weight in their contribution to a project's aggregated total score, the latter of which was used as the sole basis for a project's inclusion in the scenario's financially constrained list.

Trade-Off Strategies

Each trade-off strategy provided a mechanism by which the land-use pattern could be influenced in specific ways and with various degrees of aggressiveness, using the 2014 SCS land-use pattern for reference. The four trade-off strategies are as follows:

- **Mixed-Use Development:** Follow historical trends OR favor mixed-use
- **Residential Density:** Follow historical trends OR favor compact development
- **Urban and Rural Growth Allocation:** Encourage growth in small cities and rural communities OR encourage growth near urban transit services
- **Transit Improvement Strategies:** Add more bus stops OR add more buses*

**Note: Since there was enough projected funding to include all submitted transit improvement projects in the financially constrained list for each scenario, the transit improvement strategy became irrelevant and thus was not implemented in the scenario modeling process.*

These strategies were implemented in the land-use modeling process in the following way:

- **Mixed-use Development and Residential Density:** A certain percentage of the parcels exhibiting the highest potential for development were assigned development types that were more aggressive with respect to the relevant criteria without violating the guidelines specified in the respective agency's land-use planning literature.
- **Urban vs. Rural Growth:** The control totals for new growth by jurisdiction were adjusted to shift regional residential and employment growth either into the Fresno-Clovis Metropolitan Area, or into the smaller cities and unincorporated communities, according to the specifications of each scenario.

Scenario A

Overview

Scenario A was designed to reflect public input as closely as possible, and to refrain from making any land-use assumptions beyond the demographic forecast and the jurisdiction's current plans. Scenario A is typified with high levels of investment in road maintenance, active transportation infrastructure, and equity, with less investment in expanding roadway capacity. This scenario became the template for the other scenarios, assuring that all scenarios would adhere reasonably closely to public input.

Planning Strategy

- **Vision:** Healthy and safe communities combating climate change
- **Strategies:** Provide a range of effective transit options to all our county's residents, with a focus on decreasing emissions and pollution and investment in vulnerable communities
- **Goals:** Reduce pollution and emissions, reduce vehicle travel, invest in disadvantaged communities, and invest in active transportation options

Distinguishing Factors

- Highest investment in road maintenance and active transportation; lower investment in expanded roadway capacity; all transit projects funded
- Assumes balanced Countywide growth
- Moderately aggressive land-use strategies (lowest residential density and multi-family development) - identical to Scenario D
- Significant improvement in farmland conservation (58% less farmland consumed than 2014 RTP)

Scenario B

Overview

Scenario B places a higher emphasis on active transportation and transit-oriented development by favoring high-density and mixed-use development, and by shifting some new growth to the Fresno-Clovis metropolitan area. This shift in housing and employment growth represents 5 percent of the metropolitan area's projected growth share (based on the demographic forecast), translating to about a 21 percent decrease in growth from the smaller cities and from the unincorporated areas.

Planning Strategy

- **Vision:** Clean air and healthy, active communities
- **Strategies:** Invest in bike and pedestrian projects and transit-oriented developments that encourage people to use their cars less
- **Goals:** Increase active transportation, reduce pollution, and improve community health

Distinguishing Factors

- Highest investment in road maintenance and active transportation; lower investment in expanded roadway capacity; all transit projects funded
- Assumes more growth in Fresno-Clovis Metro Area (5% increase by 2035, 21% decrease from rural jurisdictions)
- Most aggressive land-use strategies (highest projections for residential density, multi-family, and mixed-use development)
- Vast improvement in farmland conservation (88% less farmland consumed than 2014 RTP)

Scenario C

Overview

Scenario C envisions a higher share of new growth going to the small cities and unincorporated communities, the same 5 percent from the metropolitan area translating as a 21 percent increase for the rural areas. Furthermore, this scenario shows a slight preference for mixed-use development.

Planning Strategy

- **Vision:** Healthy, safe, robust and thriving communities, with emphasis on investment in disadvantaged communities
- **Strategies:** Encourage economic growth in existing small cities and rural communities
- **Goals:** Reduce vehicle travel from rural areas into the Fresno/Clovis urban area

Distinguishing Factors

- Highest investment in road maintenance and active transportation; lower investment in expanded roadway capacity; all transit projects funded
- Assumes more growth in small incorporated cities and unincorporated rural communities (21% increase by 2035, 5% decrease from metro jurisdictions)
- More aggressive mixed-use and multi-family strategies
- Improvement in farmland conservation (24% less farmland consumed than 2014 RTP)

Scenario D

Overview

Scenario D was designed as a slight variation of Scenario A, one that represented a less extreme divestment from roadway capacity enhancements, resulting in a slight decrease in road maintenance and active transportation investments. The land-use growth pattern in Scenario D is identical to that of Scenario A.

Planning Strategy

- **Vision:** A transportation system that is efficient and in good repair
- **Strategies:** Invest in maintenance, repair, and enhancement of existing streets and roads
- **Goals:** Minimize vehicle delay and congestion, cutting down on emission-heavy idle time on the roads

Distinguishing Factors

- High investment in road maintenance; moderate investment in expanded roadway capacity and active transportation; all transit projects funded
- Assumes balanced Countywide growth
- Moderately aggressive land-use strategies (lowest residential density and multi-family development) - identical to Scenario A
- Significant improvement in farmland conservation (58% less farmland consumed than 2014 RTP)

Appendix I Item 7:
Transportation Spending Priority Survey Results 2012

Final Sample Outcomes: City/Area and Ethnicity Representations

- Clovis 52 7%
- Coalinga 20 2.5%
- Firebaugh 27 3%
- Fowler 33 4%
- Fresno 300 37%
- Huron 25 3%
- Kerman 35 4%
- Kingsburg 35 4%
- Mendota 25 3%
- Orange Cove 25 3%
- Parlier 36 4.5%
- Reedley 51 6%
- San Joaquin 25 3%
- Sanger 45 6%
- Selma 43 5%
- Rural/Unincorporated area of Fresno County …………… 25 3%

- White : *33%* *Target: 33%*
- Hispanic or Latino *49.5%* *Target: 50%*
- African American *5%* *Target: 5%*
- Asian *9%* *Target: 9%*
- { American Indian / Alaska Native } *over 2.5%* *Target 3%*
  { Native Hawaiian / Other Pacific Islander }
  { Other (*Slavic, Arab, Persian, and Central Asian/Middle-Eastern ethnicity, etc.*) }

Source: AIS Market Research, October 2012

RESULTS: Transportation Spending Priority … [highest rated priority listed at the top; rated from: "1" (Very Low Spending Priority) to "10" (Extremely High Spending Priority)]

- 8.1 Repair potholes on city streets and/or rural roads
- 7.5 Improve transportation for the disabled
- 7.4 Improve transportation for the elderly
- 7.3 Resurface city streets and/or rural roads
- 7.1 Resurface highway/s and/or ramps
- 7.1 Reduce traffic congestion on highways and/or ramps
- 7.0 Repair/maintain sidewalks pedestrian walkways, and trails
- 6.9 Reduce traffic congestion on streets/roads
- 6.7 Expand local bus service routes
- 6.7 Improve/increase local bus service
- 6.4 Expand or add new sidewalks pedestrian walkways, and trails
- 6.3 Add more lanes to highway/s and/or ramps
- 6.1 Widen city streets and/or rural roads
- 6.1 Increase number of bike trails, bike paths, and bike lanes
- 5.9 Build more, or extend city streets and/or rural roads
- 5.4 Improve/increase passenger rail service

Source: AIS Market Research, October 2012

Scale: “1” = Very Low Importance, and “10” = Extremely Important in planning sustainable communities in the Fresno Region. RESULTS:

- 8.6 Having a vibrant economy.
- 8.6 Improving public safety.
- 8.6 Nurturing a healthy community (via minimizing the threat of diseases, and environmental contamination/pollution of food, water, and air).
- 8.4 Providing educational choices and opportunities for all demographic and cultural groups
- 7.8 Fostering respect for other individuals and/or groups from different social class, ethnicities, lifestyles, religions, and cultures.
- 7.7 Offering transportation choices including affordable public transit.
- 7.6 Offering adequate housing choices for all demographic and cultural groups.
- 7.6 Cultivating a positive image of The San Joaquin Valley.
- 6.9 Promoting cultural richness via activities and awareness for various cultural, ethnic, religious, and lifestyle groups.
- 6.8 Having aesthetically pleasant landscapes and buildings.

Source: AIS Market Research, October 2012

Appendix I Item 8:
Fresno COG Performance Measures

Sustainable Communities Strategy Performance Measures

	Performance Measure/Indicator	Definition	Analysis		Scenario A	Scenario B	Scenario C	Scenario D	No Project	2014 RTP/SCS
Land Use (Location Efficiency)	Transit-oriented development	Share of the region's growth in households and employment within half-mile of Bus Rapid Transit (BRT)	Using GIS, identify the planning areas intersecting a half-mile buffer around the scenario's BRT lines; compare total housing units and jobs against their respective scenario countywide totals.		24% housing 36% jobs	25% housing 37% jobs	23% housing 34% jobs	24% housing 36% jobs		21% housing 37% jobs
	Residential density	Average residential density for new growth	Divide total new housing units by the sum acres of the scenario's planning areas that have non-zero residential growth.		7.4 du/acre	7.7 du/acre	7.4 du/acre	7.4 du/acre		7.4 du/acre
	Housing mix	Percent of housing by types (SF/TH/MF)	The results for this indicator were provided by Envision Tomorrow.		55% SF/6% TH 6% TH 39% MF	53% SF 6% TH 41% MF	54% SF 6% TH 40% MF	55% SF 6% TH 39% MF		53% SF 9% TH 38% MF
	Compact development	Growth in population compared with acres developed	Divide total population growth by the sum acres of the scenario's planning areas that have non-zero residential or employment growth.					26.4 ppl/acre		21.1 ppl/acre
	Access to transit line	New housing development within half-mile of transit stops	Using GIS, identify planning areas that intersect a half-mile buffer around existing and planned transit stop locations throughout Fresno County. (Sources: FAX bus stops, Clovis Transit stops, FCRTA stops, proposed BRT stops)					34,000 HU (41.7%)		34,036 HU (35.5%)
Transportation (Mobility, Accessibility, and Reliability)	Travel time distribution for work and non-work trips	Travel time distribution for work and non-work trips	Travel time distribution by trip purpose (work-based and non-work-based) provided by the traffic model.					HBW: 20.4 min / HBO: 12.5 min / NHB: 14.3 min (more details in distribution curves)		HBW: 16.6 min / HBO: 21.1 min / NHB: 16.4 min (more details in distribution curves)
	Average distance for work or non-work trips in miles	The average distance traveled for work or non-work trips separately	Average trip lengths for work-based and non-work-based trips based on the trip length distribution provided by the traffic model.					HBW: 14.6 mi / HBO: 8.4 mi / NHB: 9.9 mi		HBW: 8.9 mi / HBO: 11.6 mi / NHB: 8.3 mi
	Average work trip travel time	In minutes	Average trip length in time (minutes) for work-based trips, estimated by the traffic model.					20.4 min		16.6 min
	Average work trip speed by mode	In mph by mode	Average speed in mph for work-based trips made in auto modes (drive alone, carpool), estimated by the traffic model.					Drive Alone: 39.5 mph / Carpool: 38.4 mph		Drive Alone: 31.3 mph / Carpool: 31.9 mph
	Percent of work trips accessible in 30 minutes	In peak periods by mode (drive alone, carpool, and transit)	Percentage of work-based trips that are shorter than 30 minutes, estimated by mode by the traffic model.					Drive alone:82%/Carpool: 86%/Transit: 35%/Walk:27%/Bike:45 %		Drive alone:94%/Carpool: 91%/Transit: 42%/Walk:35%/Bike:55%
	Percent of non-work trips accessible in 15 minutes	By mode (drive alone, carpool, and transit)	Percentage of non-work-based trips that are shorter than 15 minutes, estimated by mode by the traffic model.					Drive alone: 76%/Carpol 77%/Transit:8%/Walk:16 %/Bike:31%		Drive alone: 47%/Carpol 45%/Transit:7%/Walk:12 %/Bike:28%
	Percent of work trips less than 3 miles	Share of total work trips which are fewer than 3 miles	Percentage of work-based trips that are less than 3 miles long out of total work-based trips based on work trip length distribution provided by the traffic model.					7%		17%
	Work trip length distribution	Statistical distribution of work trip length in the region	Work-based trips length distribution provided by the traffic model.					14.6 miles on average (more details in distribution curves)		8.9 miles on average (more details in distribution curves)
	Vehicle Miles Traveled (VMT)	Total VMT and per capita VMT, per capita VMT reduction against 2005	Per capita VMT are calculated by dividing total daily VMT, provided by the traffic model excluding through traffic VMT, by the total population of the analysis year. Year 2005 value was back-casted to serve as a reference point for per capita VMT reduction.	Total Per Capita Reduction against 2005	23,554,891 18.7 -9.07%	23,287,246 18.5 -10.10%	23,731,765 18.9 -8.39%	23,511,221 18.7 -9.24%	24,116,782 19.2 -6.90%	23,766,798 18.3 -11.20%
	Congested Vehicle Miles Traveled (VMT)	Congested VMT total and per capita, percentage of total auto/transit travel in congested conditions (peaks, all day)	Congested travel when V/C is greater than 0.75, summarized in total congested VMT, per capita congested VMT, and percentage of congested VMT in total VMT. Data was estimated by the traffic model by facility by different time periods (a.m. peak hour, p.m. peak hour, daily, etc.)					Daily Freeway: 2,143,266 / Daily Local: 985,449 (other time of day available)		Daily Freeway: 3,762,593 / Daily Local: 2,804,821 (other time of day available)
	Commute travel (work trip) mode share	Weekday commute trips by mode, commute mode share	Mode share (drive alone, carpool, transit, bike and walk) among home-based work trips, estimated by the traffic model.					Drive Alone 78.2% / Carpool 11.9% / Transit 2.8% / Walk 5.5% / Bike 1.6%		Drive Alone 81.9% / Carpool 13.4% / Transit 1.5% / Walk 2.5% / Bike 0.7%
	Non-Commute travel (non-work trip) mode share	Weekday non-commute trips by mode, non-commute mode share	Mode share (drive alone, carpool, transit, bike and walk) among all trips other than home-based work trips, estimated by the traffic model.					Drive Alone 28.6% / Carpool 47.5% / Transit 4.8% / Walk 15.1% / Bike 2.5%		Drive Alone 28.4% / Carpool 62.3% / Transit 1.6% / Walk 5.7% / Bike 2.0%
Healthy Environment	Criteria pollutants emissions	PM10, PM2.5, and NOx	Criteria pollutants emissions were output from emission model EMFAC2014, which takes input such as facility type, speed profile, and VMT provide by the traffic model.	PM10 PM2.5 NOx	7.9 0.8 12.1	7.6 0.8 12.0	8.0 0.8 12.2	8.0 0.8 12.1	7.6 0.8 12.3	7.9 1.0 11.6
	Greenhouse gas reduction	Per capita greenhouse gas reduction against 2005	Greenhouse gas (GHG) emission was provided by emission model EMFAC2014, which takes input such as facility type, speed profile, and VMT provide by the traffic model. Per capita GHG emission was calculated by dividing total GHG by total population for each analysis year. Year 2005 values were back-casted to serve as a reference point for per capita GHG reduction.		-9.98%	-10.90%	-9.37%	-10.13%	-7.93%	-10.97%
	Fuel Consumption	On-road fuel consumed in gallons per capita	Total fuel (gasoline and diesel) consumption estimated by emission model EMFAC2014, which takes input such as facility type, speed profile, and VMT provide by the traffic model. Per capita fuel consumption was calculated by dividing total fuel in gallons by total population for each analysis year.					0.70 gallon		0.78 gallon
	Transit productivity	Weekday transit trips	Total daily transit trips provided by the traffic model.					109,493		47,186
	Impervious surface	Total acres of impervious surface built from new growth	The results for this indicator were provided by Envision Tomorrow.					6,002 acres		7,867 acres
	Active transportation and transit travel	Weekday person trips by walk, bike and transit modes	Daily personal trips made by active transportation (walking and biking) and transit modes provided by the traffic model.	Walk Trips Bike Trips Transit Trips Total	401,201 79,161 109,550 589,912	403,314 80,028 111,048 594,390	399,357 78,590 109,139 587,086	400,363 79,046 109,493 588,902	392,513 74,642 101,433 568,588	176,199 56,212 47,186 279,597
	Near-roadway exposures	Percent of new housing within 1,000 feet of freeway or major roadway	Using GIS, identify the planning areas intersecting a 1,000-ft. buffer around existing state highways and interstates; compare total housing units against countywide total.					11,087 HU (13.6%)		78,505 HU (81.9%)
	Percent investment in active transportation	Investment in active transportation (sidewalks, bike lanes, etc.) as compared to total plan	Percentage of investment in planned transportation projects devoted to active transportation (biking and walking) as compared to total investments based on RTP financial plan.					12.6%		2.52%
	Premature deaths prevented	Number of premature deaths prevented through promoting active transportation	The results for this indicator were provided by ITHIM model.		17	21	16	17		n/a
Social Equity	Accessibility and Mobility	Ability to move throughout the region, and the time it takes to reach desired destinations	Accessibility: average A.M. peak trip time reaching defined areas of interest by mode by Non-Environmental Justice (EJ) and EJ Traffic Analysis Zones (TAZ) in 2042		Drive Alone 23(19) / Carpool 20(17) / Transit 33(30)	Drive Alone 22(19) / Carpool 20(17) / Transit 33(30)	Drive Alone 23(19) / Carpool 20(17) / Transit 33(30)	Drive Alone 22(19) / Carpool 20(17) / Transit 32(30)	Drive Alone 23(19) / Carpool 20(17) / Transit 35(32)	Drive Alone 19(15) / Carpool 18(17) / Transit 29(29)
			Mobility: average P.M. peak trip time returning from the defined areas of interest by mode , by Non-EJ and EJ TAZ in 2042		Drive Alone 30(22) / Carpool 25(19) / Transit 33(30)	Drive Alone 29(22) / Carpool 24(19) / Transit 33(30)	Drive Alone 30(22) / Carpool 25(19) / Transit 33(30)	Drive Alone 29(22) / Carpool 24(19) / Transit 33(30)	Drive Alone 30(22) / Carpool 26(19) / Transit 35(32)	Drive Alone 20(17) / Carpool 20(19) / Transit 31(30)
	Reliability	Percent of VMT operating at level of service E or worse on links inside EJ and non EJ TAZ	Numbers designated as countywide Non-EJ TAZs (EJ TAZs) in 2042					5.84(6.51)		33.27(9.80)
	Transit Investment Effectiveness	Average Additional Daily Transit Passenger Miles Traveled (PMT) per $1,000 Investment	The percentage of the newly added average number of daily passenger miles traveled (PMT) served by RTP transit projects in 2042 compared to 2014					30(31)		40.38(45.6)
	Distribution of Investments	Equitable distribution of transit investment	Measured by comparing the total transit person miles traveled (PMT) by the total transit investment in Non-EJ TAZs and EJ TAZs in 2042					372,472/$3.16(295,682/ $3.98)		132,498/$12.01(152,161/ $10.46)
	Housing Product Mix	More diverse housing mix which helps to assure that individuals and families at all income levels can find safe and affordable housing	The amount of multifamily housing options (SF% TH% MF%) in the Non-EJ communities compared to EJ areas in 2042					67.30% 3.70% 29.10% (49.90% 5.80% 44.40%)		n/a
	Air Contaminant Exposure	CDC's methodology adopted for measuring Air Contaminant Exposure capturing the impacts of increased traffic volumes	The number of household units within the impacted area of 150 meters or approximately 500 feet from Major highways (Class 1) or as other freeways and expressways (Class 2) in the Non-EJ areas compared to EJ areas in 2042					23,889 8.45% (13,227 13.83%)		n/a
Resource Conservation	Land consumption	Acres of land consumed due to new development	Sum of vacant acres in planning areas with nonzero residential or employment growth.					11,207 acres		14,675 acres
	Important farmland	Total acres of important farmland (prime, unique and state-wide importance) consumed due to new growth	Using GIS, sum acres of the intersection of planning areas with nonzero residential or employment growth overlaid with applicable important farmland features. (Source: FMMP 2010)		38.2 acres	10.5 acres	68.0 acres	38.2 acres		91.9 acres
	Environmental resource land	Total acres of resource areas (CNDDB, critical habitat, FEMA, habitat connectivity, riparian forest, vernal pool & wetland, or input to be determined by Greenprint Committee)	Using GIS, sum acres of the intersection of planning areas with nonzero residential or employment growth overlaid with applicable features from the following datasets: CNDDB, Critical Habitat, FEMA floodzones, Habitat Connectivity, Riparian Forests, Vernal Pools, and Wetlands. (Sources: CA Dept. of Fish and Game, NOAA Fisheries, FEMA, USDA)					CNDDB 6,487 acres, CritHab 43.1 acres, FEMA 642 acres, HabConn 739 acres, RipFor 6.65 acres, VrnlPool 240 acres, Wetland 113 acres		CNDDB 5,550 acres, CritHab 434 acres, FEMA 2,810 acres, HabConn 1,067 acres, RipFor 12.4 acres, VrnlPool 41.4 acres, Wetland 31.7 acres
	Water consumption	Daily water consumption by new housing development based on national average rates	The results for this indicator were provided by Envision Tomorrow.					28,730,000 Gal/day		30,950,000 Gal/day

Appendix I Item 9:
MIP2 Model Documentation

Final Fresno COG VMIP 2
Model Development Report

Prepared for:
Fresno COG

November 2017

WC16-3370

FEHR PEERS

Table of Contents

OVERVIEW

The San Joaquin Valley Model Improvement Plan (VMIP 1) began in 2010 and resulted in substantial enhancements to the modeling capabilities of the Metropolitan Planning Organizations (MPOs) within the San Joaquin Valley (SJV). Due to the timing of the original VMIP 1, many data sources pertinent to understanding travel behavior and developing travel forecasting models were not available. As such, older sources were used to supplement data for the base year, making calibration and validation difficult due to the economic downturn relative to the 2001/2003 California Household Travel Survey (CHTS) and 2000 Census which were collected before calibration efforts commenced. VMIP 2 not only takes advantage of the most recent Census and CHTS data and the model structure enhancements developed as part of the VMIP 1, but also new Big Data.

This document provides guidance on the model specifications and data used in developing the components for the San Joaquin Valley Model Improvement Plan, Phase 2 (VMIP 2). The objective of this document is to provide an overview and full technical details of the VMIP 2 models: this includes aspects common to all VMIP 2 models as well as specific calibration and model validation for the Fresno Council of Governments (Fresno COG) model. Changes between the original VMIP 1 models and the VMIP 2 models receive special emphasis.

In addition to the updated data, VMIP 2 implemented changes to the model structure are based on feedback from the Air Resources Board (ARB) provided during the Regional Transportation Plan (RTP) and Sustainable Communities Strategy (SCS) review process, and MPO staff who applied the models over the last several years. Key enhancements to model sensitivity and usability include:

- Land Use: Simplified residential and employment categories and addition of group quarters population
- Socio-economic: Employee salary and household income relationship for home-work trips
- Inter-regional Travel: Improved control over scenario evaluation of inter-regional assumptions
- Updated Scenario Development: Created single scenario spreadsheets and clear documentation
- Sensitivity to the "Ds:" Used GIS centerline network and included accessibility variables
- Refined Post-Processors: Added flexibility to summary processes including select link assignment

Listed below are recommendations for updating the model, data, or usability beyond VMIP 2.

- Refine trip generation such that person trips and vehicle trips account for under-reporting of travel in the CHTS, and assigned traffic volumes reflect roadway counts.
- Refine economic factors at a more specific geography and calibrate the land use allocation model using the refined data.
- Continue to collect traffic count and transit ridership data, land use development (residential, school, and employees) to perform near-term forecasts.
- Review and update the highway and transit networks for future years, creating a link between the RTP projects and the model.
- Coordinate with other MPOs and update the inter-regional travel components as needed.
- Track demographics, economics, and related Ds variables over time to inform future scenario development.
- Evaluate shifts in future assumptions such as autonomous vehicles, demographics, fuel price, and land use development patterns.

The following sections describe the data collected for model estimation, calibration, and validation.

DATA ACQUISITION, REVIEW, AND SUMMARY

This section describes the data collection, review processes, and provides a summary of the data used in the estimation, calibration, and validation of the VMIP 2 models.

2010 CENSUS/2012 ACS

Updated land use cross-classification tables used 2012 ACS Census data and the finest available geography. Most required data were available at the level of census block group or census tract, but a few multi-dimension tables were only available at the Public Use Microdata Areas (PUMA) level. These cross-classification tables are in a percentage format. Each MPO/County provides the control totals for demographic variables including total population, total numbers of households, and total number of residential units at transportation analysis zone (TAZ) level. The base year for most models is 2008, although some MPOs/Counties have opted to update model base years to 2014 under separate contracts. ACS 2012 cross-classified tables represent demographic characteristic of each TAZ regardless of the model base year. The control total can easily be updated to a new base year after each MPO/County provides recent demographic data at the TAZ level.

2012 CHTS

The original VMIP 1, completed before 2012 CHTS data were available, used the 2001/2003 CHTS for validation of household variables. VMIP 2 used newer data from the 2012 CHTS to re-estimate most model components.

PREPARATION AND CLEANING OF CHTS DATA

The publically available version of the 2012 CHTS required a substantial amount of preparation, including re-weighting, before it was suitable for model development. Details of the data preparation are in Appendix A: Preparation of California Household Travel Survey Data. Data dictionaries for the cleaned and prepared CHTS data, including households, trips, and persons files, are in Appendix B: California Household Travel Survey Data Dictionary.

The following pages describe portions of the CHTS data preparation most relevant to VMIP 2; for full details please see the appendices.

Identification of Trip Purposes

The 2012 CHTS data does not describe trip purposes directly; instead, it contains a "place" file whose attributes include a listing of up to three activities the respondent participated in at that place. A small list of place purposes was distilled from this activity information: HOME, WORK, COLLEGE, K12, SHOP, or OTHER.

Once the purpose for each place has been determined, assigning a purpose to each trip is straightforward.

- If one end of the trip is "HOME" and the other is "WORK," the trip is home-based work ("HBW").
- If one end of the trip is "HOME" and the other is "K12," the trip is home-based K-12 ("HBK").
- If one end of the trip is "HOME" and the other is "COLLEGE," the trip is home-based college ("HBC").
- If one end of the trip is "HOME" and the other is "SHOP," the trip is home-based shop ("HBS").
- If one end of the trip is "HOME" and the other is either "OTHER" or "HOME," the trip is home-based other ("HBO").
- If one end of the trip is "WORK" and the other end is anything but "HOME," the trip is work-based other ("WBO").
- In all other cases, the trip is non-home-based ("NHB").

Identification and Consolidation of Transit Trip Chains

In recording transit trips, the CHTS treats each portion of the transit trip chain as a separate trip. For example, a trip in which the traveler drives to a rail station, takes the train to a second rail station, and then walks to a workplace is listed in the survey as three separate consecutive trips, with three separate modes. This method of record-keeping makes it possible to track the mode of access and egress for a transit trip, but for most travel behavior analyses it is preferable to consider these three trips as a single unit or linked trip. Thus, a necessary step of data preparation is identification and consolidation of chains which make up a single linked transit trip. Details of this process are in Appendix A: Preparation of California Household Travel Survey Data.

Estimation of Survey Weights

Surveys capture the characteristics of an entire population by randomly sampling a small proportion of the population. Often, a perfectly random sample is hard to achieve — some groups are difficult to survey and are under-represented, other groups are over-represented. To balance this bias, estimated sample weights "reshape" the sample. Fehr & Peers estimated household sample weights for the CHTS to balance the survey sample to match county-level percentages for several variables as reported in the 2012 ACS 5-year estimates. Listed below are variables used as controls for the re-weighting.

- Household size (one to seven or more).
- Household income (nine income categories).
- Number of workers per household (zero to three or more).
- Number of vehicles owned per household (zero to four or more).
- Household residential unit type (three categories).
- Household size (one to five or more) cross-classified by household income (five categories).
- Household size (one to five or more) cross-classified by number of vehicles per household (zero to four or more).
- Household size (one to five or more) cross-classified by number of workers per household (zero to three or more).

Details of the survey weight estimation are in Appendix A: Preparation of California Household Travel Survey Data.

Census Designated Places

Census Designated Places (CDPs) are a useful identification that includes cities as well as unincorporated but named places. The fact that publically-available CHTS data is geo-coded only by census tract made the process of identifying a CDP for each location slightly more complex. Because the boundaries of CDPs do not neatly match census tracts, each census tract may have multiple CDPs associated with them. In cases where multiple CDPs make up a single census tract, the CDP with the largest population in the tract (as identified at the census block level) is used. The CDP is identified as an unincorporated portion of the relevant county if the largest population in the tract is outside all named CDPs.

Place Type

In addition to locating households and trip ends using census tracts, CDPs, and counties, each household location and trip end is assigned a place type category. The place type is based on the number of jobs and the working-age population accessible from the household or trip end. These accessibility metrics are available as part of the EPA Smart Location Database (http://www2.epa.gov/smartgrowth/smart-location-mapping#SLD), and are weighted so nearby jobs and population are more influential than distant jobs and population. The resulting sum of accessible jobs and potential workers are categorized into the following place types.

1. Under 40,000 jobs + workers.
2. 40,000 – 100,000 jobs + workers.
3. 100,000 – 200,000 jobs + workers.
4. 200,000 – 450,000 jobs + workers.
5. Over 450,000 jobs + workers.

"Work" Trips Made by Non-Workers

The CHTS collects both employment data for each participant and trip purpose data for all trips undertaken. However, the survey does not ensure these values are in agreement with one another. There are a small number of persons whose employment status is either not reported (or reported as "retired" or "unemployed") whose trips are categorized as work trips. Because this is not optimal for modeling purposes, any work trips made by a non-employed person is re-categorized; HBW trips are re-assigned as HBO trips, and WBO trips are re-assigned as OBO trips.

ESTIMATION DATASET

The estimation dataset for VMIP 2 consists of a portion of the statewide CHTS data. Only CHTS records which satisfy the following criteria were used.

- For household-level variables, only residents of the eight SJV counties and the six Sacramento Area Council of Governments (SACOG) counties are included. The six SACOG counties had to be included to ensure an adequate sample size.
- Only weekday trips are included.
- Trips are included from the full year of the CHTS, including winter and summer.
- Trips with both trip ends outside the 14-county SJV + SACOG region are excluded.

Table 1 shows the distribution of CHTS households in the estimation counties, the households reported in the ACS, and percentage of samples in the estimation set. Note the table shows the (unweighted) number of households in the estimation set and the full CHTS, while the value in the final column represents the percentage of the overall samples by county.

TABLE 1: GEOGRAPHIC SCALE FOR NEW TAZ VARIABLES

County	Households in Estimation Set	Total households in CHTS	Total households in County (2012 ACS)	Percentage of Estimation Set
Fresno	718	1,115	287,082	14%
Kern	961	1,544	253,178	12%
Kings	199	293	40,767	2%
Madera	205	311	42,063	2%
Merced	297	474	74,496	3%
San Joaquin	468	629	213,632	12%
Stanislaus	383	552	165,999	8%
Tulare	537	799	129,996	6%
Sacramento	567	825	512,496	25%
El Dorado	151	208	67,846	2%
Placer	290	385	131,775	7%
Sutter	130	168	31,635	2%
Yuba	137	205	24,133	1%
Yolo	186	246	70,090	4%
Total	**5,229**	**7,754**	**512,496**	**100%**

CHTS SUMMARIES

Several broad summaries of CHTS data were produced and are suitable both for model development and for general information. Separate summaries were produced for the 14-county estimation region, the eight-county SJV region, the three-county Three County Model region, and each of the eight SJV counties individually. The "simple" and "flat" summaries contain one record per geography, and is suitable for joining to GIS. The "simple" summary contains a smaller number of metrics, while the "flat" summary contains many more details. The "filterable" summary contains many records per geography, and is viewable in Excel. Details and data dictionaries for these summaries are in Appendix C: Simple Summaries of CHTS Data, Appendix D: Flat Summaries of CHTS Data, and Appendix E: Filterable Summaries of CHTS Data.

CHTS SIMPLIFIED DATA

In addition to being useful for model estimation, calibration, and validation, the CHTS data is useful for a wide range of other purposes. To that end, we have provided simplified versions of CHTS data together with instructions for processing that data in Excel. The format is designed to be flexible, easy to use, and able to produce a variety of commonly-requested summaries such as mode shares, trip lengths and origin/destination tables. More information about the simplified data and instructions for using it in Excel is in Appendix F: Simplified CHTS Data.

HOUSING AFFORDABILITY, EMPLOYMENT AND JOBS/HOUSING BALANCE

Demographic and employment data are critical components to any land use, transportation, or integrated land use-transportation modeling effort. An appropriately detailed description of the people who live and work in each geographic zone is essential to understanding their travel behavior and in predicting the region's evolution over time, especially the relationship between the locations of employers paying a given range of wages and the residence locations of workers with similar income levels. There are many sources for this data, necessitating a data merge and verifying its compatibility with other datasets. CoStar led this effort. They used surveyors to call and visit residential, office, and commercial buildings and combined multiple demographic and transportation databases into a single web-accessible dashboard. CoStar continuously updates the data and keeps the historic data so changes in rents, vacancies, and other relevant variables can be evaluated. This data were used to calibrate the bid/rent functions of the land use allocation/disaggregation model, and to assist in the estimation and calibration of trip generation and distribution, allowing additional functionality to better match jobs and household income. The income of households and job salaries are described later in the calibration step.

REFINE MODEL INPUT DATA

TRANSPORTATION ANALYSIS ZONES

The TAZ system for each model is largely unchanged from the original VMIP 1. New TAZ attributes were developed to refine the model's trip distribution, including the matching of jobs to workers by income level and the distribution of trips entering and leaving the model area. In addition, the VMIP 2 models include both accessibility pre-processors and in-model accessibility calculations at the TAZ level, described below.

TAZ ATTRIBUTES

New attributes in the TAZ-level input data are listed below.

- Total acreage of the TAZ (including undeveloped land).
- Percentage of trips produced by the TAZ which enter or leave the model area, by trip purpose.
- Percentage of trips attracted to the TAZ which enter or leave the model area, by trip purpose.
- Percentage of jobs in the TAZ which are high-, medium-, and low-income, by employment category.

Table 2 below describes the geographic scale at which the trips produced/attracted and employment income variables are implemented in the model. The model user can change variables to apply at a different scale if desired, as described in the table.

TABLE 2: GEOGRAPHIC SCALE FOR NEW TAZ VARIABLES

Variables	Description	Scale of current implementation	Scale of potential implementation
HBWH_ix, HBWH_xi, HBWM_ix, HBWM_xi, etc.	Percentages of trips produced & attracted to TAZ, by trip purpose	CDP	TAZ
EMP_EDUH, EMP_EDUM, EMP_EDUL, etc.	Percentages of employment that are high, medium, and low income, by job sector	County	TAZ

The full data dictionary for TAZ-level inputs is in Appendix G: Data dictionary for TAZ data inputs.

ACCESSIBILITY

The VMIP 2 models include two accessibility pre-processors. These are Python scripts, operating on the input TAZ and network shapefiles to produce accessibility metrics.

- Intersections.py produces a count of the number of intersections per TAZ.
- RoadwayMiles.py produces the sum of walkable network miles.

These script outputs, in data base format (DBF), are used during the model input preparation stage to calculate a variety of accessibility metrics at the TAZ level.

A third input file, VMTseed, contains an estimate of the average commuting VMT generated per worker in the TAZ. The starting estimates can be approximate because this estimate is updated throughout the model process.

During the input preparation phase of the model, TAZ-level accessibility metrics and built environment ("D variable") metrics are produced. These metrics are updated as the model runs through its feedback loops. Some of the accessibility metrics are implemented later in the model; others are provided as model outputs. **Table 3** below shows the accessibility metrics used later in the model.

TABLE 3: ACCESSIBILITY METRICS USED IN VMIP 2 MODELS

Metric	Description	Where used
EMP_30AUT	Jobs within 30 minutes by auto	Place Type calculation
WRK_30AUT	Working-age population within 30 minutes by auto	Place Type Calculation
ATYPE	Place Type categorization of job+worker to five categories. (See Table 4 below).	Trip Generation
LOG_EMPD	Log of employment density (jobs per developed acre)	Auto Ownership, Mode Choice
INTDEN	Intersection density (intersections per square mile)	Auto Ownership, Mode Choice
EMP_30TRN	Jobs within 30 minutes by transit	Auto Ownership, Mode Choice
COMMUTECOST	Average annual commute cost	Auto Ownership

Place type is calculated from the sum of jobs within 30 minutes by auto- and working-age population within 30 minutes by auto, and categorized into the five categories listed in **Table 4** below.

TABLE 4: PLACE TYPES

Place Type Category	Alternate Name	Description
1	POP1	Under 40,000 jobs + working-age population within 30 minutes by auto
2	POP2	Between 40,000 and 100,000 jobs + working-age population within 30 minutes by auto
3	POP3	Between 100,000 and 200,000 jobs + working-age population within 30 minutes by auto
4	POP4	Between 200,000 and 450,000 jobs + working-age population within 30 minutes by auto
5	POP5	Over 450,000 jobs + working-age population within 30 minutes by auto

A full data dictionary of the accessibility metrics calculated in the model is in Appendix H: Accessibility Variables.

LAND USE INPUTS

During the original VMIP 1, Census 2000 land use data were used in combination with the CHTS 2001/03 to estimate and calibrate the trip generation rates. After Census 2000, the Census Bureau not only developed continuous sampling and reporting via the American Community Survey, but they also changed the format, variables, and detail of reported data. In 2012 it was discovered all of the variables used in the MIP models are not available at the same cross-classification detailed level as was reported in 2000. As such, we have updated the residential demographic variables at the same time we re-estimated trip generation equations.

In addition to the availability of data provided by the ACS and Census, updating the land use inputs at the same time trip information is estimated and calibrated allowed the opportunity to expand the capabilities to take advantage of the job salary and household mortgage/expense data. While the Census and ACS provide the information for the base year recalibration, the VMIP 2 models can now also use Cube Land to disaggregate the base year land use to reflect the validation conditions, allowing future forecasts of residential demographics to vary based on land use and transportation system changes.

Although the land use data and Cube Land model were implemented for each model, the application of Cube Land is not required. It can be used to disaggregate land use while keeping the totals by zone nearly identical, test brand new scenarios by allocating the control total for each land use type, or a middle scenario where some areas do not change and others can be allocated based on Cube Land.

Table 5 below describes the land use variables used as model inputs:

TABLE 5: LAND USE INPUT VARIABLES

Type	Attribute	Description	Units
Geographic	TAZ	Transportation Analysis Zone ID	
	STATE	State	
	COUNTY	County	
	PUMA	Census Public Use Microdata Area	
	CITY	City	
	TRACT	Census tract ID	
	BLOCK	Census block ID	
	MODEL	Model ID	
	PLACETYPE [1]	Placetype category	
Residential	TOTHH	Total Households	Households
	RU1, RU2, … RU10 [2]	Households by Residential Unit Type	Households
	RUG1, RUG2, RUG3 [2]	Households by Residential Unit Type Groups	Households
	RUG1SPARE, … RUG7SPARE	Unused in current model but available for expanding grouping of residential unit types.	
Non-residential[3]	TOTEMP	Total employees	Employees
	EMPEDU	Educational Services (61-63)	Employees
	EMPFOO	Accommodations (721), Food Services (722), Arts, Entertainment and Recreation (71)	Employees
	EMPGOV	Public Administration (92)	Employees
	EMPIND	Utilities (22), Construction (23), Other Services Except Public Administration (81), Wholesale Trade (42), Transportation and Warehousing (48-49)	Employees
	EMPMED	Health Care and Social Assistance (62)	Employees
	EMPOFC	Information (51), Finance and Insurance (52), Real Estate, Rental and Leasing (53), Professional, Scientific, and Technical Services (54), Management of Companies and Enterprises (55), Administrative/Support, Waste Management & Remediation (56)	Employees
	EMPOTH	Mining, Quarrying, Oil and Gas Extraction (21), Manufacturing (31-33)	Employees

TABLE 5: LAND USE INPUT VARIABLES

Type	Attribute	Description	Units
	EMPRET	Retail Trade (44-45)	Employees
	EMPAGR	Agriculture, Forestry, Fishing and Hunting (11)	Employees
	EMPSPARE1, … EMPSPARE8	Unused in current model but available for expanding employment categories	
	POPDORM	Group Quarters population: School (Dormitory, Fraternity, Sorority)	People
	POPASSIST	Group Quarters Population: Medical (Assisted living, retirement home)	People
	POPMILITARY	Group Quarters Population: Military (Military base if not special generator)	People
	POPINST	Group Quarters Population: Institutionalized population (prison, mental health, etc.)	People
	ELEM	Elementary and middle school enrollment	Student Enrollment
	HS	High school enrollment	Student Enrollment
	COLLEGE	College enrollment	Student Enrollment
Scenario	YEAR	Scenario year	
	SCEN	Scenario name	
	MPO	MPO	
	Comments	Scenario comments	

Notes:

1. See Table 4 for place type categories.
2. See Table 8 for residential unit type categories.
3. Non-residential description contains NAICS sector number(s).

The land use inputs above are combined with the Census cross-classification rates to create the SE Detail file, described in **Table 6** below.

TABLE 6: SOCIO-ECONOMIC DETAIL

Type	Attribute	Description	Units
Geographic	TAZ	Transportation Analysis Zone ID	
	STATE	State	
	COUNTY	County	
	PUMA	Census Public Use Microdata Area	

TABLE 6: SOCIO-ECONOMIC DETAIL

Type	Attribute	Description	Units
Residential	CITY	City	
	TRACT	Census tract ID	
	BLOCK	Census block ID	
	MODEL	Model ID	
	PLACETYPE [1]	Placetype category	
	TOTHH	Total Households	Households
	RUG1, RUG2, RUG3 [2]	Households by Residential Unit Type Groups	Households
	RUG1SPARE, … RUG7SPARE	Unused in current model but available for expanding grouping of residential unit types.	
	RU1_HHPOP, RU3_HHPOP, RU6_HHPOP [2]	Population in households by residential unit type	People
	RUSPARE1, … RUSPARE7	Unused in current model but available for expanding grouping of residential unit types	
	RU1_HHSIZE1_INC1, RU9_HHSIZE5_INC5 [2,3,4]	Households cross-classified by Residential Unit Type, Household Size, and Household Income	Households
	RU1_AGE1524, … RU9AGE75 [2,5]	Households cross-classified by Residential Unit Type and Household Age category.	Households
	POP0005, … , POP75 [6]	Population by age range	People
Non-residential [7]	TOTEMP	Total employees	Employees
	EMPEDU	Educational Services (61-63)	Employees
	EMPFOO	Accommodations (721), Food Services (722), Arts, Entertainment and Recreation (71)	Employees
	EMPGOV	Public Administration (92)	Employees
	EMPIND	Utilities (22), Construction (23), Other Services Except Public Administration (81), Wholesale Trade (42), Transportation and Warehousing (48-49)	Employees
	EMPMED	Health Care and Social Assistance (62)	Employees

TABLE 6: SOCIO-ECONOMIC DETAIL

Type	Attribute	Description	Units
	EMPOFC	Information (51), Finance and Insurance (52), Real Estate, Rental and Leasing (53), Professional, Scientific, and Technical Services (54), Management of Companies and Enterprises (55), Administrative/Support, Waste Management & Remediation (56)	Employees
	EMPOTH	Mining, Quarrying, Oil and Gas Extraction (21), Manufacturing (31-33)	Employees
	EMPRET	Retail Trade (44-45)	Employees
	EMPAGR	Agriculture, Forestry, Fishing and Hunting (11)	Employees
	EMPSPARE1, … EMPSPARE8	Unused in current model but available for expanding employment categories	
	POPDORM	Group Quarters population: School (Dormitory, Fraternity, Sorority)	People
	POPASSIST	Group Quarters Population: Medical (Assisted living, retirement home)	People
	POPMILITARY	Group Quarters Population: Military (Military base if not special generator)	People
	POPINST	Group Quarters Population: Institutionalized population (prison, mental health, etc.)	People
	ELEM	Elementary and middle school enrollment	Student Enrollment
	HS	High school enrollment	Student Enrollment
	COLLEGE	College enrollment	Student Enrollment
Scenario	YEAR	Scenario year	
	SCEN	Scenario name	
	MPO	MPO	
	Comments	Scenario comments	

Notes:
1. See Table 7 for place type categories.
2. See Table 8 for residential unit type categories.
3. See Table 9 for household size categories.
4. See Table 10 for household annual income categories.
5. See Table 11 for household age categories.
6. See Table 12 for population distribution by age range categories.
7. Non-residential description contains NAICS sector number(s).

If desired, preliminary place type descriptions may be included in the land use input. Within the VMIP 2 models, place type is re-calculated as part of the accessibility module described in Accessibility / D Variables.

TABLE 7: PLACE TYPES

Place Type Category	Alternate Name	Description
1	POP1	Under 40,000 jobs + working-age population within 30 minutes by auto
2	POP2	Between 40,000 and 100,000 jobs + working-age population within 30 minutes by auto
3	POP3	Between 100,000 and 200,000 jobs + working-age population within 30 minutes by auto
4	POP4	Between 200,000 and 450,000 jobs + working-age population within 30 minutes by auto
5	POP5	Over 450,000 jobs + working-age population within 30 minutes by auto

TABLE 8: RESIDENTIAL UNIT TYPE

Name	Grouping	Alternate Grouping Name	Description
RU1	RUG1 (SF)	RU1	1, detached
RU2			1, attached
RU3	RUG2 (MF)	RU3	2 units
RU4			3 to 4 units
RU5			5 to 9 units
RU6			10 to 19 units
RU7			20 to 49 units
RU8			50+ units
RU9	RUG3 (Other)	RU9	Mobile home
RU10			Boat, RV, van, etc.

Data sources:
Model input: MPO land use inputs
Estimation: CHTS
Calibration: Census

TABLE 9: HOUSEHOLD SIZE

Category	Description
HHSIZE1	1 person household
HHSIZE2	2 person household
HHSIZE3	3 person household
HHSIZE4	4 person household
HHSIZE5	5 or more person household

Source:
Model Input: MPO land use inputs + census cross-classification percentages
Estimation: CHTS
Calibration: Census

TABLE 10: HOUSEHOLD ANNUAL INCOME

High-med-low grouping	5-category grouping	10-category grouping	Description
LOWINC	INCG1	INC1	Less than $10,000
		INC2	$10,000 to $24,999
	INCG2	INC3	$25,000 to $34,999
		INC4	$35,000 to $49,999
MEDINC	INCG3	INC5	$50,000 to $74,999
	INCG4	INC6	$75,000 to $99,999
HIGHINC	INCG5	INC7	$100,000 to $149,999
		INC8	$150,000 to $199,999
		INC9	$200,00 or more
		INC10	SPARE -- unused

Data sources:
Model Input: MPO land use inputs + census cross-classification percentages
Estimation: CHTS
Calibration: Census

TABLE 11: HOUSEHOLD AGE

Category	Description
Age1524	No household member over age 25 but at least one household member age 15-24.
Age2564	Household has at least one member age 25-64
Age6574	Household has no member age 25-64 but at least one member age 65-74.
Age75	Household has no member age 25-74 but at least one member age 75 or older.

Data sources:
Model Input: MPO land use inputs + census cross-classification percentages
Estimation: CHTS
Calibration: Census

TABLE 12: POPULATION BY AGE RANGE

Category	Description
POP0005	People 0 to 5 years
POP0514	People 5 to 14 years
POP1517	People 15 to 17 years
POP1824	People 18 to 24 years
POP2554	People 25 to 54 years
POP5564	People 55 to 64 years
POP6574	People 65 to 74 years
POP75	People 75 years and over

Source:
Model Input: MPO land use inputs + census cross-classification percentages
Estimation: CHTS
Calibration: Census

Appendix I: Comparison of land use categories shows the residential land use data elements and how the VMIP 2 grouping compares to other data sources including the CHTS, ACS, and VMIP 1 categorization.

NETWORK UPDATE

As part of the VMIP 1, integration of GIS for each of the models took a substantial step forward by utilizing a geodatabase for background data and for storing model outputs. However, the highway and transit networks remained simplistic link and node representations of the actual networks. As part of VMIP 2, the highway network was based on a true shape centerline file in a geodatabase and updated variables to reflect the master network from the RTP/SCS. The transit lines were also updated to match the more detailed highway network and are contained in the geodatabase. The benefits of this are more accurate mapping and distances, easy linkage and comparisons to speed data, and inclusion of local streets for sub-TAZ level analysis. In addition, the GIS network contains many variables to complement those already part of the travel model network, including auto, HOV, transit, truck, bike, and walk accessibility designations. Advanced models such as Activity Based Models (ABMs) and Dynamic Traffic Assignment (DTA) also greatly benefit from the network accuracy and detail.

TABLE 13: STANDARD MASTER HIGHWAY NETWORK VARIABLES

Attribute	Description
Nodes	
X	X-coordinate of node in Nad 83
Y	Y-coordinate of node in Nad 83
N	Node number
TAZ	Traffic Analysis Zone Number
DISTRICT	Super district number used for aggregation
SOI	Sphere of influence used to number TAZs alphabetically
STDID	Study location number used to record turning movements when non-zero
COUNTY	County where node is located
JURISDICTION	Political jurisdiction where node is located
COMMUNITY	Community/district name
Links	
A	A node
B	B node
DISTANCE	Distance in miles
NAME	Local street name
ROUTE	Numerical state route number
TERRAIN	Terrain (F=Flat , R=Rolling, M=Mountain)
JURISDICTION	Political jurisdiction where link is located location
SCREENLINE	Screenline by direction (See Figures 3-1.1 through 3.1.10)
XXXX_PRJID [1]	RTP Project ID number
XXXX_PRJYR [1]	RTP Project Opening Year
XXXX_FACTYP [1]	Facility type by year [2]
XXXX_AREATYP [1]	Area type by year [2]
XXXX_LANES [1]	Number of directional through travel lanes by year [2]
XXXX_AUX [1]	Auxiliary lane (0=no, 1=yes)
XXXX_SPEED [1]	Free-flow speed in miles-per hour by year [3]

TABLE 13: STANDARD MASTER HIGHWAY NETWORK VARIABLES

Attribute	Description
XXXX_CAPCLASS [1]	Capacity class by year (derived from Terrain, Facility type, and Area Type) [2]
XXXX_CAPACITY [1]	Vehicle per hour (calculated based on Lanes and CapClass) [4]
XXXX_USE [1]	Identifies vehicle prohibitions by year [5]
XXXX_TOLL [1]	Code used for cost on toll facilities by year [3]

Notes:

1. XXXX represents BASE (calibration/validation year), IMP1 (status after first improvement), and IMP2 (status after second improvement). In addition to calibration/validation year which varies by MPO, the years required to be covered by improvement are 05, 20, 35, and 40.
2. See Table 14 for details on CapClass by Terrain, Facility Type, and Area Type.
3. See Table 15 for Speed ranges by Terrain, Facility Type, and Area Type.
4. See Table 16 for details on Capacity by Terrain, Facility Type, and Area Type.
5. 0 or 1=facility open to all ("general purpose") ; 2=Carpool 2; 3=Carpool 3+; 4=Combination trucks prohibited; 5=Walk or bike only

TABLE 14: CAPACITY CLASS BY TERRAIN, FACILITY TYPE, AND AREA TYPE

Facility Type	Area Type				
	Rural (R)	Suburban (SU)	Urban (U)	Fringe (F)	Central Business District (CBD)
Flat					
Freeway	1	11	21	31	41
Highway	2	12	22	32	42
Expressway	3	13	23	33	43
Arterial	4	14	24	34	44
Collector	5	15	25	35	45
Local	6	16	26	36	46
Ramp: Freeway-Freeway	7	17	27	37	47
Ramp: Slip	8	18	28	38	48
Ramp: Loop	9	19	29	39	49
Connector: Dist. ≤ 0.25	10	N/A	N/A	N/A	N/A
Connector: Dist. > 0.25	20	N/A	N/A	N/A	N/A

TABLE 14: CAPACITY CLASS BY TERRAIN, FACILITY TYPE, AND AREA TYPE

Facility Type	Area Type				
	Rural (R)	Suburban (SU)	Urban (U)	Fringe (F)	Central Business District (CBD)
Rolling					
Freeway	51	61	71	81	91
Highway	52	62	72	82	92
Expressway	53	63	73	83	93
Arterial	54	64	74	84	94
Collector	55	65	75	85	95
Local	56	66	76	86	96
Ramp: Freeway-Freeway	57	67	77	87	97
Ramp: Slip	58	68	78	88	98
Ramp: Loop	59	69	79	89	99
Connector: Dist. ≤ 0.25	60	N/A	N/A	N/A	N/A
Connector: Dist. > 0.25	70	N/A	N/A	N/A	N/A
Mountain					
Freeway	101	111	121	131	141
Highway	102	112	122	132	142
Expressway	103	113	123	133	143
Arterial	104	114	124	134	144
Collector	105	115	125	135	145
Local	106	116	126	136	146
Ramp: Freeway-Freeway	107	117	127	137	147
Ramp: Slip	108	118	128	138	148
Ramp: Loop	109	119	129	139	149
Connector: Dist. ≤ 0.25	110	N/A	N/A	N/A	N/A
Connector: Dist. > 0.25	120	N/A	N/A	N/A	N/A

TABLE 15: TYPICAL SPEEDS BY TERRAIN, FACILITY TYPE, AND AREA TYPE

Facility Type	Area Type				
	Rural (R)	Suburban (SU)	Urban (U)	Fringe (F)	Central Business District (CBD)
Flat					
Freeway	70	65-70	55-65	55-65	55-65
Highway	40-45	40-45	40-45	40-45	40-45
Expressway	55	45-55	45-55	45-55	40-45
Arterial	40-45	30-45	25-45	30-45	25-45
Collector	50	50	35-40	35-40	35-40
Local	25-40	25-40	25-40	25-40	25-40
Ramp: Freeway-Freeway	50	50	50	50	50
Ramp: Slip	50	50	50	50	50
Ramp: Loop	45	45	45	45	45
Connector: Dist. ≤ 0.25	35	35	35	35	35
Connector: Dist. > 0.25	15	15	15	15	15
Rolling					
Freeway	65-70	65-70	65-70	65-70	65-70
Highway	40-45	40-45	40-45	40-45	40-45
Expressway	50-65	50-65	50-65	50-65	50-65
Arterial	30-45	30-45	30-45	30-45	30-45
Collector	50	50	50	50	50
Local	50	50	50	50	50
Ramp: Freeway-Freeway	50	50	50	50	50
Ramp: Slip	50	50	50	50	50
Ramp: Loop	45	45	45	45	45
Connector: Dist. ≤ 0.25	35	35	35	35	35
Connector: Dist. > 0.25	15	15	15	15	15
Mountain					

TABLE 15: TYPICAL SPEEDS BY TERRAIN, FACILITY TYPE, AND AREA TYPE

Facility Type	Area Type				
	Rural (R)	Suburban (SU)	Urban (U)	Fringe (F)	Central Business District (CBD)
Freeway	65	65	65	65	65
Highway	40-45	40-45	40-45	40-45	40-45
Expressway	40-55	40-55	40-55	40-55	40-55
Arterial	30-45	30-45	30-45	30-45	30-45
Collector	25-40	25-40	25-40	25-40	25-40
Local	25-40	25-40	25-40	25-40	25-40
Ramp: Freeway-Freeway	50	50	50	50	50
Ramp: Slip	45	45	45	45	45
Ramp: Loop	35	35	35	35	35
Connector: Dist. ≤ 0.25	15	15	15	15	15
Connector: Dist. > 0.25	25	25	25	25	25

Note: Speed shown as miles per hour (MPH)

TABLE 16: DEFAULT CAPACITY BY TERRAIN, FACILITY TYPE, AND AREA TYPE

Facility Type	Area Type				
	Rural (R)	Suburban (SU)	Urban (U)	Fringe (F)	Central Business District (CBD)
Flat					
1. Freeway	2,000	2,000	1,800	1,750	1,750
2. Highway	1,800	1,800	1,600	1,500	1,300
3. Expressway	1,100	1,100	1,000	900	800
4. Arterial	900	900	900	800	750
5. Collector	700	700	800	800	700
6. Local	600	600	700	700	600

TABLE 16: DEFAULT CAPACITY BY TERRAIN, FACILITY TYPE, AND AREA TYPE

Facility Type	Area Type				
	Rural (R)	Suburban (SU)	Urban (U)	Fringe (F)	Central Business District (CBD)
7. Ramp: Freeway-Freeway	1,800	1,800	1,800	1,800	1,800
8. Ramp: Slip	1,500	1,500	1,500	1,500	1,500
9. Ramp: Loop	1,250	1,250	1,250	1,250	1,250
10. Connector: Internal	N/A	N/A	N/A	N/A	N/A
Rolling					
20. Connector: External (except major gateways)	N/A	N/A	N/A	N/A	N/A
21. Freeway	1,800	1,800	1,620	1,580	1,580
22. Highway	1,460	1,460	1,300	1,220	1,060
23. Expressway	890	890	810	730	650
24. Arterial	730	730	730	650	610
25. Collector	570	570	650	650	570
26. Local	550	550	640	640	550
27. Ramp: Freeway-Freeway	1,800	1,800	1,800	1,800	1,800
28. Ramp: Slip	1,500	1,500	1,500	1,500	1,500
29. Ramp: Loop	1,250	1,250	1,250	1,250	1,250
Mountain					
31. Freeway	1,500	1,500	1,350	1,310	1,310
32. Highway	790	790	700	660	570
33. Expressway	480	480	440	390	350
34. Arterial	390	390	390	350	330
35. Collector	310	310	350	350	310
36. Local	330	330	380	380	330

TABLE 16: DEFAULT CAPACITY BY TERRAIN, FACILITY TYPE, AND AREA TYPE

Facility Type	Area Type				
	Rural (R)	Suburban (SU)	Urban (U)	Fringe (F)	Central Business District (CBD)
37. Ramp: Freeway-Freeway	1,800	1,800	1,800	1,800	1,800
38. Ramp: Slip	1,500	1,500	1,500	1,500	1,500
39. Ramp: Loop	1,250	1,250	1,250	1,250	1,250

Note: Capacity shown as vehicles per hour per lane (VPHPL)

ESTIMATION, CALIBRATION, AND VALIDATION

This section covers the model estimation with the enhancements of integrating D variables within the sub-models and a revised inter-regional process to capture the interaction between household income and job salary. Values presented in this section are those estimated based on the entire survey data set, and **Appendix L** contains the resulting calibrated values.

ECONOMIC LAND USE FORECASTING

VMIP 1 developed and implemented an integrated transportation and standard socioeconomic land use forecasting model structure by expanding the pilot project for Kern COG. This system supports the travel demand models by allocating study area forecast control totals of households and jobs by type to zones within the study area based upon bid-rent economic principles. This approach to land use forecasting provides a way of recognizing the important effects that linkages between spatial distributions of housing costs, household incomes, and job industries have on intra- and inter-regional travel. It also provides a way to automate the otherwise tedious and error-prone process of disaggregating land use assumptions developed through scenario visioning exercises into more detailed household and job type stratifications for travel modeling.

TRAVEL MODEL ESTIMATION

VMIP 2 re-estimated the trip generation, auto availability, and mode choice model components using data from the 2012 CHTS. The fairly limited sample size, particularly for transit and non-motorized trips, precluded the estimation of county-specific mode choice model coefficients. Instead, models were estimated using data from all eight San Joaquin Valley counties, together with the six SACOG counties. Each model was then calibrated to fit local conditions using CHTS data for its county/counties alone. Calibration values are in Appendix L: Calibrated Parameters.

The table below shows the re-estimated model components for VMIP 2, including a description of the model structure and a list of variables used. Detailed descriptions of each model component and its estimation are in the following sections.

TABLE 17: RE-ESTIMATED MODEL COMPONENTS

	Vehicle Availability	Trip Generation	Mode Choice
Model Structure	Disaggregate: multinomial logit	Aggregate: 4-dimensional cross-class models or regression models. Stratified by productions vs attractions and trip purpose.	Disaggregate: multinomial logit. Stratified by trip purpose and vehicle availability + household size.
Household Size	HH1, HH2, HH3, HH4, HH5	HH1, HH2, HH3, HH4, HH5	
Household Income	INCG1, INCG2, INCG3, INCG4, INCG5	INCG1, INCG2, INCG3, INCG4, INCG5	
Housing Type	RUG1, RUG3, RUG6	RUG1, RUG3, RUG6	
Accessibility / D variables	Intersection density, transit accessibility to jobs, employment density	Place Types based on auto accessibility to jobs and workers: pop1, pop2, pop3, pop4, pop5	Intersection density, transit accessibility to jobs, employment density
Age of population		POP0005, POP0514, POP1517, POP1824, POP2554, POP5564, POP75	
Employment		EMPEDU, EMPFOO, EMPGOV, EMPIND, EMPMED, EMPOFC, EMPRET, EMPOTH, EMPAGR	
School Enrollment		ELEM, HS, COLLEGE	
In-vehicle travel time			Applies to all modes. Transit amenities, if any, can be discounted here.
Out of vehicle time			Access/egress/transfer walk and waiting time for transit, parking time for drive-to-transit, and passenger pickup for shared ride.
Cost	Commute cost proportion of household income		Transit fare, plus toll and parking costs as well as auto operating costs for drive modes.

ACCESSIBILITY / D VARIABLES

All three of the re-estimated model components make use of built environment ("D variables"), particularly the inclusion of accessibility. The table below describes the variables used.

TABLE 18: ACCESSIBILITY METRICS USED IN VMIP 2 MODELS

Metric	Description	Where used
EMP_30AUT	Jobs within 30 minutes by auto	Place Type calculation
WRK_30AUT	Working-age population within 30 minutes by auto	Place Type Calculation
ATYPE	Place Type categorization of job+worker to five categories. (See table 19 below).	Trip Generation
LOG_EMPD	Log of employment density (jobs per developed acre)	Auto Ownership, Mode Choice
INTDEN	Intersection density (intersections per square mile)	Auto Ownership, Mode Choice
EMP_30TRN	Jobs within 30 minutes by transit	Auto Ownership, Mode Choice
COMMUTECOST	Average annual commute cost	Auto Ownership

Place type is calculated from the sum of jobs within 30 minutes by auto and working-age population within 30 minutes by auto, and categorized into the five categories listed below.

TABLE 19: PLACE TYPES

Place Type Category	Alternate Name	Description
1	POP1	Under 40,000 jobs + working-age population within 30 minutes by auto
2	POP2	Between 40,000 and 100,000 jobs + working-age population within 30 minutes by auto
3	POP3	Between 100,000 and 200,000 jobs + working-age population within 30 minutes by auto
4	POP4	Between 200,000 and 450,000 jobs + working-age population within 30 minutes by auto
5	POP5	Over 450,000 jobs + working-age population within 30 minutes by auto

A full data dictionary of the accessibility metrics calculated in the model is in Appendix H: Accessibility Variables.

VEHICLE AVAILABILITY AND TRIP GENERATION

The original VMIP 1 resulted in all models generating person trips by vehicle availability from a very consistent set of land uses. Household trips were generated for eight different purposes, and truck trips were generated for light, medium, and heavy trucks. With the new CHTS data we have re-estimated the vehicle availability and trip generation rates. In addition to the cross-classifications currently used in the models we have added place classifications that relate jobs/housing, income and long distance commuting, and other factors that were not available in previous data sets. To better link jobs and housing, the HBW trip purpose was split into three purposes corresponding to high, medium, and low income households and jobs.

Auto Operating Cost

Auto operating costs were determined using the methodology outlined in the memo prepared by MTC, SCAG, SACOG, and SANDAG in October 2014 titled *Automobile Operating Cost for the Second Round of Sustainable Communities Strategies*. The method uses county specific base year fuel prices, fleet mix and fuel efficiency from EMFAC, and a consistent growth factor for fuel and non-fuel maintenance and operating costs. See Appendix K: Memo on Auto Operating Cost for the full memo and methodology. The resulting values for years ranging from 2005 to 20420 for each MPO is in Appendix L: Calibrated Parameters.

Vehicle Availability

The vehicle availability model is a disaggregate multinomial logit model which predicts the probability of a household owning 0, 1, 2, or 3, or 4+ vehicles based on the following variables:

TABLE 20: VARIABLES IN VMIP 2 VEHICLE AVAILABILITY MODEL

Category	Variable	Description
Cost Variable	Commute Cost Ratio	Average annual commute cost divided by household income
Accessibility Variables	Intersection Density	Intersections per square mile
	Transit Accessibility	Jobs within 30 minutes via transit
	Employment Density	Log of (jobs per developed acre)
Household Demographic Variables	Household Size	See size categories in Table 9
	Household Income	See income categories in Table 10
	Household Residential Unit Type	See residential unit type groups in Table 11

The commute cost ratio variable is an estimate of the proportion of a household's income required to own vehicles. It is derived from a county-level estimate of per-mile auto ownership costs, tract-level estimates of commuting VMT derived from the EPA's Smart Location Calculator, an annualization factor of 250 working days per year, and the household income. The variable is applied on a per-vehicle basis, so that owning no vehicles incurs no cost, owning two vehicles incurs twice the cost of owning one vehicle, and so on.

The table below provides the coefficients of the auto ownership model. In its draft form the model was estimated without alternative-specific constants. These constants were set for each model individually during model calibration.

TABLE 21: VMIP 2 AUTO OWNERSHIP MODEL COEFFICIENTS

	0 Vehicles	1 Vehicle	2 Vehicles	3 Vehicles	4+ Vehicles
Alternative-Specific Constant					
CommuteCostRatio	7.51	3.95	0.00	0.00	0.00
PedOrIntDens	0.009	0	0	-0.004	-0.004
TransitAccessibility (x1000)	0.009	0.010	0	-0.051	-0.112
LogEmpDensity	0.39	0.24	0	0.00	-0.19
RUGroup=RU1	0	0	0	0	0
RUGroup=RU3	1.27	0.53	0	-1.53	-1.53
RUGroup=RU6	0.27	-.27	0	0	0
HH_size=1	-1.16	1.5	0	-3.15	-4.94
HH_size=2	-3.03	-0.42	0	-2.26	-4.19
HH_size=3	-3.37	-0.24	0	-1.34	-3.40
HH_size=4	-4.02	-0.66	0	-1.61	-3.13
HH_size=5+	-3.50	-0.89	0	-1.32	-2.44
HH_inc=IncG1	0	0	0	0	0
HH_inc=IncG2	-1.33	-0.28	0	0.86	0.98
HH_inc=IncG3	-3.87	-0.93	0	1.2	2.35
HH_inc=IncG4	-2.98	-1.55	0	1.55	2.35
HH_inc=IncG5	-4.23	-1.96	0	1.44	2.87

Note the model uses owning two vehicles as its base, and calculates the relative probability of owning fewer or greater vehicles; thus the model coefficients describe relative probabilities as in the example below:

$$\ln\left(\frac{Prob(0\ vehicles)}{Prob(2\ vehicles)}\right) = 7.51(CommuteCostRatio) + 0.0093(PedOrIntDensity) + \ \ldots$$

The coefficients for this model are generally intuitive in direction and scale.

- Higher commuting cost increases the probability of owning 0 or 1 vehicles, and decreases the probability of owning 3 or 4 vehicles, as compared to the baseline of 2 vehicles.
- Higher scores for the three accessibility variables, indicating generally better accessibility by non-auto modes, increase the probability of owning 0 vehicles (and sometimes also 1 vehicle) relative to owning 2; and decrease the probability of owning 3 or 4.
- Household income is the demographic variable which has the largest influence in auto ownership. Generally as incomes go up, probabilities of owning 0 or 1 vehicles go down, and probabilities of owning 3 or 4 vehicles go up.
- Household size behaves in the expected way, with probability of owning 0 or 1 vehicles going down as household size increases and probability of owning 3 or 4 vehicles going up.
- Multi-family unit types are more likely to own 0 or 1 vehicles, and less likely to own 3 or 4 vehicles, than single family. There weren't enough records in the RUG6 "other" category (RV, mobile home, etc.) to distinguish them from single family, and they were generally more similar to single family than multi-family uses, so they share the same coefficients as single family.

An important consideration for future model development is that car sharing and transportation network companies (i.e., UBER, LYFT, etc.) are changing auto availability dynamics and potentially long-term auto ownership. As more data becomes available it may be appropriate to modify the auto ownership model to recognize these changes and focus more on auto availability across multiple sub modes and costs per mile.

Trip Generation

The VMIP 2 models generate person-trips from a consistent set of land uses, using cross-classified residential data, for a number of purposes including non-home-based purposes, K-12 and college trip purposes, and generate small, medium, and heavy truck trips. We have re-estimated trip generation rates, excluding truck rates, with the new CHTS data. The most significant changes in trip generation as compared to original VMIP 1 are listed below.

- Trip generation considers accessibility using the place type variable described in
- Accessibility / D Variables.

- Non-home based trip generation is based on the new categorization of employment.
- HBW trips are expanded into three new categories: HBW-High, HBW-Medium, and HBW-Low. These categories are based on household income on the production side and proportions of worker incomes for each employment category on the attraction side.
- Trips are classified as internal to internal (II), internal to external (IX), or external to internal (XI) based on percentages calculated from CHTS data. These percentages are calculated by trip purpose and by CDP.

Home-Based Productions: Cross-Classification Models

Three of the home-based trip productions (HBW, HBS, and HBO) were estimated using cross-classification models. These models are applied to socio-economic-demographic (SED) data which has been cross-classified by four variables: household size, household income, residential unit type, and place type (as described in section Accessibility / D Variables.

Estimation of trip rates using cross-classification models must ensure all cross-classification groups have large enough sample sizes to produce sufficient variability to obtain a stable average trip rate. Because not all cross-classifications of the variables above do in fact have a large enough sample size, some cross-classifications were estimated in aggregate, resulting in identical trip rates being estimated for some cross-classification combinations.

Variables were added to the cross-classification model sequentially, and with each added variable existing groups were only subdivided if there was sufficient sample size (generally at least 40 households) to support a split. The order in which variables were added to the cross-classification models was as follows.

- Household size
- Household income
- Place Type
- Residential unit type

Although the model is coded to allow for five income categories and five place types, the data available did not allow for distinctions to be determined this finely either because of a lack of sufficient amount of data, or differences which weren't statistically significant, or both. In effect, this means the estimated trip rates differ only among three income categories: low (under $50,000), medium ($50,000 - $100,000), and high (over $100,000); and only between two groups of place types: types 1 and 2 (with fewer than 100,000 workers+jobs within a 30-minute auto trip); and types 3, 4, and 5 (with more than 100,000 workers+jobs within a 30-minute auto trip). In addition, only a few combinations of household size, household income, and place type yielded different trip rates by residential unit type.

The tables below provide the resulting person-trip production rates:

TABLE 22: HBW HOUSEHOLD PERSON TRIP PRODUCTION RATES (DAILY TRIPS PER HOUSEHOLD)

	1-person HH	2-person HH	3-person HH	4-person HH	5+-person HH
Low Income; Place Types 1 and 2	0.42 (SF) 0.24 (MF)	0.62 (SF) 0.45 (MF)	0.87	1.28	1.50
Low Income; Place Types 3, 4, 5	0.55 (SF) 0.43 (MF)	0.80 (SF) 0.92 (MF)	1.35	1.27	1.49
Medium Income; Place Types 1 and 2	0.79	1.13	1.57	1.72	2.40
Medium Income; Place Types 3, 4, 5	0.68	1.17	1.62	1.47	2.25
High Income; Place Types 1 and 2	0.61	1.42	1.63	1.75	1.84
High Income; Place Types 3, 4, 5	0.61	1.26	2.04	1.62	1.84

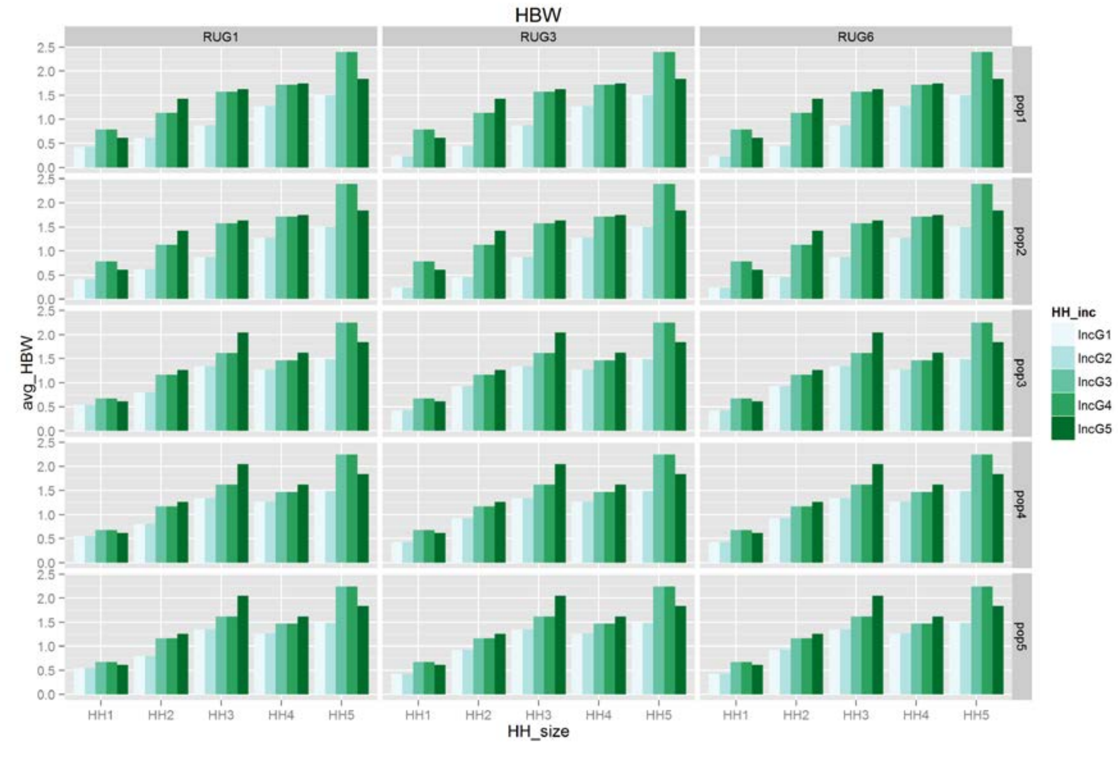
TABLE 23: HBS HOUSEHOLD PERSON TRIP PRODUCTION RATES (DAILY TRIPS PER HOUSEHOLD)

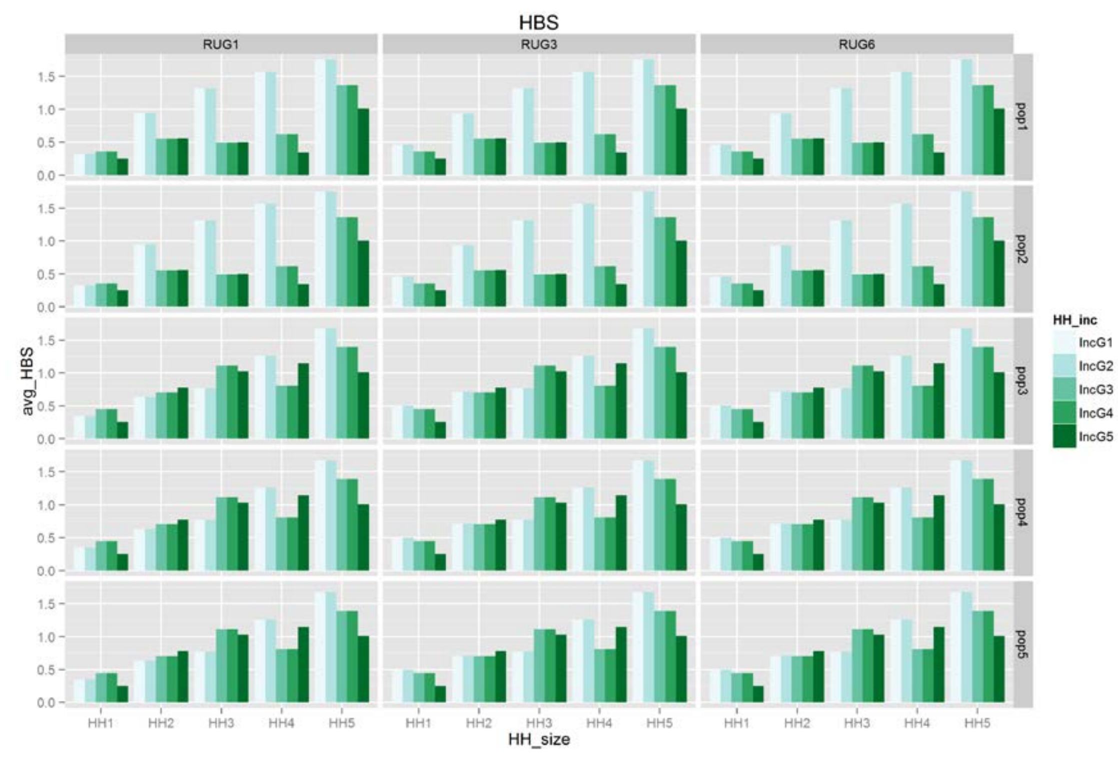
	1-person HH	2-person HH	3-person HH	4-person HH	5+-person HH
Low Income; Place Types 1 and 2	0.32 (SF) 0.46 (MF)	0.95 (SF) 0.93 (MF)	1.32	1.57	1.75
Low Income; Place Types 3, 4, 5	0.34 (SF) 0.50 (MF)	0.63 (SF) 0.71 (MF)	0.77	1.26	1.67
Medium Income; Place Types 1 and 2	0.36	0.55	0.49	0.62	1.37
Medium Income; Place Types 3, 4, 5	0.45	0.70	1.11	0.81	1.39
High Income; Place Types 1 and 2	0.25	0.56	0.50	0.34	1.01
High Income; Place Types 3, 4, 5	0.25	0.78	1.03	1.14	1.01

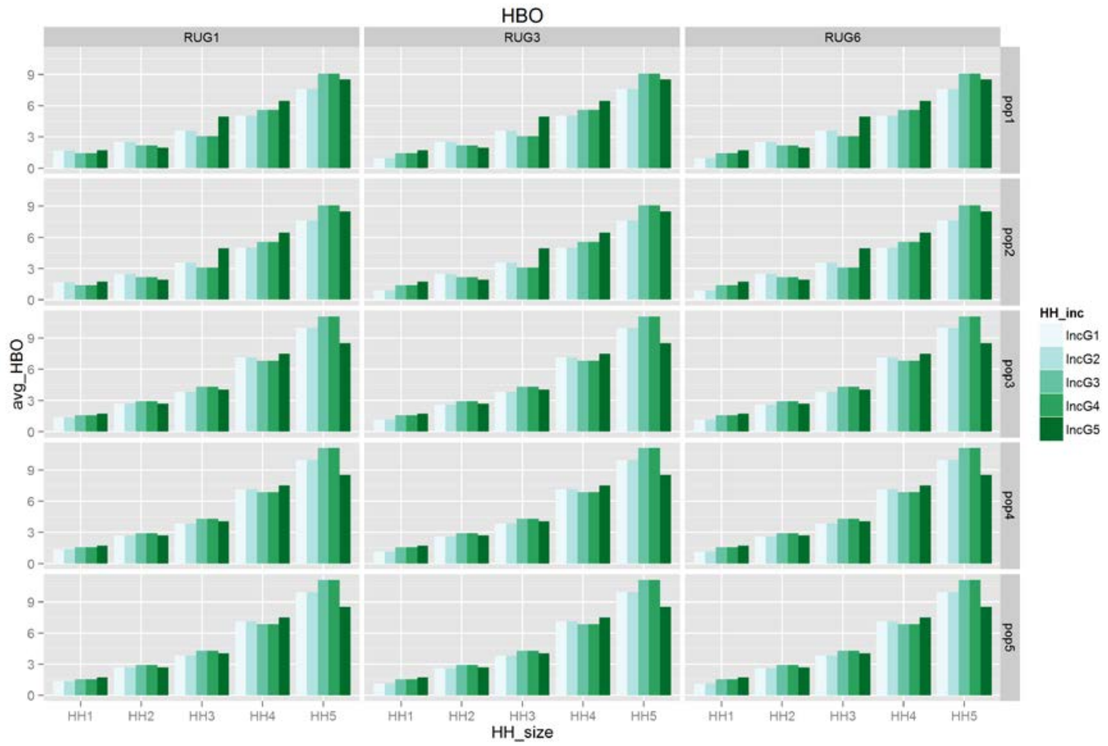
TABLE 24: HBO HOUSEHOLD PERSON TRIP PRODUCTION RATES (DAILY TRIPS PER HOUSEHOLD)

	1-person HH	2-person HH	3-person HH	4-person HH	5+-person HH
Low Income; Place Types 1 and 2	1.68 (SF) 0.92 (MF)	2.50	3.57	5.02	7.61
Low Income; Place Types 3, 4, 5	1.35 (SF) 1.14 (MF)	2.69 (SF) 2.59 (MF)	3.83	7.13	9.94
Medium Income; Place Types 1 and 2	1.44	2.17	3.09	5.59	9.06
Medium Income; Place Types 3, 4, 5	1.57	2.92	4.30	6.84	11.10
High Income; Place Types 1 and 2	1.73	1.94	4.94	6.45	8.51
High Income; Place Types 3, 4, 5	1.73	2.69	4.04	7.50	8.51

The graphs below show the cross-classified trip production rates.







Home-Based Productions: School Purposes

The remaining home-based trip productions, HBK and HBC, were estimated using regression models. The units of analysis for these models were households, and the explanatory variables were the numbers of household members in various age categories: Age 0-4, Age 5-14, Age 15-17, Age 18-24, and Age 25-54.

Two separate models were estimated for each trip purpose, one for households in place types 1 and 2 (with fewer than 100,000 workers+jobs within a 30-minute auto trip); and one for households in place types 3, 4, and 5 (with more than 100,000 workers+jobs within a 30-minute auto trip).

The table below lists the resulting trip production rates per person in the age ranges specified. Note that while one might reasonably expect each child to make two school trips per day (to and from), the actual trip rates are somewhat lower: the survey includes days when individual children don't go to school due to school holidays or illness. Furthermore, if children make intermediate stops between school and home, the resulting trips will not appear as HBK trips in the household survey but rather as multiple trips (e.g., OBO and HBO).

TABLE 25: HBK AND HBC TRIP RATES (PER PERSON)

	HBK (Place Types 1 and 2)	HBK (Place Types 3 and 4)	HBC (Place Types 1 and 2)	HBC (Place Types 3 and 4)
Age 0-4	0.15	0.24		
Age 5-14	1.18	1.07		
Age 15-17	0.93	1.06		0.06
Age 18-24	0.07	0.11	0.23	0.24
Age 25-54			0.02	0.02

Attractions and Non-Home-Based Productions

Trip attractions, along with trip productions for non-home-based trips, were estimated using either ordinary linear regression models or partial linear regression models. Unlike ordinary linear regression, partial linear regression can be used even when explanatory variables are strongly correlated with one another. Because the VMIP 2 models include a large number of employment categories highly correlated with one another this model form resulted in more reasonable models than ordinary linear regression for some trip purposes.

Units of analysis for both kinds of regression models were groups of census tracts; the techniques used to group census tracts are described below. The explanatory variables for these models were the total number of jobs in each of the nine employment categories, school enrollment totals at the K-12 and university levels, and the total number of households. The table below lists the nine employment categories used:

TABLE 26: EMPLOYMENT CATEGORIES FOR VMIP 2 MODELS

Category	Description and NAICS code(s)
EMPEDU	Educational Services (61)
EMPFOO	Accommodation and Food Service (72), Art, Entertainment, and Recreation (71),
EMPAGR	Agriculture, Forestry, Fishing and Hunting (11)
EMPOTH	Mining (21), and Manufacturing (31-33)
EMPMED	Health Care and Social Assistance (62)
EMPIND	Utilities (22), Construction (23), Wholesale Trade (42), Transportation and Warehousing (48-49), Other Services (81)
EMPRET	Retail Trade (44-45)

TABLE 26: EMPLOYMENT CATEGORIES FOR VMIP 2 MODELS

Category	Description and NAICS code(s)
EMPOFC	Information (51), Finance and Insurance (52), Real Estate Rental and Leasing (53), Professional, Scientific, and Technical Services (54), Management of Companies and Enterprises (55), and Administrative and Support and Waste Management and Remediation Services (56)
EMPGOV	Public Administration (92)

The units of analysis for these regression models were defined using a combination of geography (census tracts, census designated places, or counties) and place type (as measured by jobs+workers within a 30-minute auto trip). A “rolling up” process was used where the smallest possible analytic units with sufficient sample size were used. Where census tracts attracted at least 50 trips of a given purpose, they were used as analytic units; otherwise census places or full counties, grouped by place type, were used instead.

Data for school enrollments was only available at the full county level. For the home-based school and home-based college trip purposes, this data was used with analytic units equal to counties, despite the fact that this resulted in models with very few analytic units. However, for other trip purposes which used school enrollments as explanatory variables, school enrollments were distributed among those census tracts which had HBK or HBC trip attractions. The countywide total of school enrollments was kept constant, with each tract receiving a portion commensurate with its HBK or HBC trip attractions. The result, while not as accurate as using enrollment data at the tract level, allows trip purposes such as HBO and WBO to have a larger number of analytic units and nevertheless use the school enrollment data.

The table below summarizes the number of analytic units used for each regression model, by trip purpose and attraction (A) versus production (P). For example, the 61 analytic units used for the HBW attractions model includes 6 individual census tracts (with sufficiently many work trips attracted to each), 34 subsets of census places with the same Place Type (e.g., Fresno, type 4; Stockton, type 3; Hanford type 2; Unincorporated Tulare County type 2), and 21 subsets of counties grouped by Place Type (e.g., Sacramento County, types 2 and 3 or San Joaquin County, type 2).

TABLE 27: GEOGRAPHIC UNITS USED IN MODEL ESTIMATION

Trip Purpose	Census Tracts	Census Places by Place Type	Counties by Place Type	Total
HBW (A)	6	34	21	61
HBK (A)	0	0	14	14
HBC (A)	0	0	0	14
HBS (A)	0	24	18	42
HBO (A)	32	78	14	124
WBO (P)	2	21	19	42
WBO (A)	1	20	18	39
OBO (P)	9	43	21	73
OBO (A)	10	47	18	75

Employment data used for model estimation was obtained from the EPA's Smart Location Database (SLD). The employment categories in the SLD do not fully match those in the model, so the model's Construction, Agricultural, and Industrial categories are combined; the resulting trip rate for the combined category is then applied to each of the three model categories. Additional explanatory variables tested include the number of households per tract, and the school enrollment per tract. School enrollment data was obtained from the California Department of Education (K12, public school enrollments only) and from the California Postsecondary Education Commission (college, public and private 2- and 4-year institutions).

All of the regression models estimated were either simple linear regressions with no intercept, or partial linear regressions with no intercept. In the case of non-home-based trips (WBO and OBO), the same variables were used for the production and the attraction models. **Table 28** lists the person trip rates estimated for each model. As an example of interpreting these models, the home-based other attraction model states that each retail, service, and public sector job will attract roughly 2 HBO trips, each K-12 school enrollment will attract roughly 1.5 HBO trips, and each household will attract roughly 1.1 HBO trips.

TABLE 28: ESTIMATED ATTRACTION AND NON-HOME BASED PRODUCTION MODELS

	HBW-A	HBS-A	HBK-A	HBC-A	HBO-A	WBO-P	WBO-A	OBO-P	OBO-A
AGR employment	1.17				0.34				
EDU employment	1.17								
FOO employment	1.17	2.15			1.25	0.12	0.12	8.19	7.66
GOV employment	1.17					0.07	0.09	0.16	0.22
IND employment	1.17				0.34				
MED employment	1.17				3.45	0.18	0.18	0.16	0.22
OFC employment	1.17				5.16	0.33	0.41	0.16	0.22
OTH employment	1.17				0.34				
RET employment	1.17	5.76			1.2	0.15	0.16	8.19	7.66
ELEM enrollment			1.1		0.66	0.8	0.76	0.14	0.05
HS enrollment			1.1		0.66	0.8	0.76	0.14	0.05
COLLEGE enrollment				0.35					
Total households					0.95				

HBW Segmentation by Household Income

Following trip generation, HBW trips were further segmented by household income. On the production side, this segmentation was already achieved by virtue of the fact that household income was one of the variables present in cross-classification. On the attraction side, HBW trip attractions for each employment category were separated into high, medium, and low income based on the percentages in the table below.

Proportion of II, IX, and XI Trips

Once the base trip production and attraction rates were established, trip productions for each TAZ were further segmented into II and IX trips, while trip attractions were further segmented into II and XI trips. This segmentation was calculated separately for each trip purpose and each CDP as described below. Note this segmentation simply describes the proportion of trips which enter or leave the county from each listed CDP; it does not govern the location of those trips, which is still determined by the trip distribution model.

First, all CHTS trip ends and households were associated with a CDP or were determined to fall in unincorporated areas. This process was made more complicated by the fact that the publicly-available version of the CHTS has all locations geocoded by census tract; however, census tract boundaries may not align with CDP boundaries, and each census tract may have multiple CDPs associated with it. In cases where multiple CDPs are associated with a single census tract, the CDP with the largest population in the tract (identified at the census block level) is used. If the largest population in the tract is outside all named CDPs, the tract is identified as an unincorporated portion of the relevant county. Note that some named CDPs are not the largest population center in any census tract, and thus do not appear in the summaries of CHTS data, having been aggregated into either neighboring CDPs or the unincorporated portion of the county.

Next, trip productions for each CDP and trip purpose were segmented into II and IX trips; while trip attractions were segmented into II and XI trips. In cases where the CHTS contains fewer than 30 trips for the place/purpose combination, the county-wide average II versus IX or II versus XI percentage was substituted.

TRIP DISTRIBUTION

The current gravity model trip distribution process and factors for each existing MPO model was mostly maintained for consistency. The required revisions are:

- Add friction factors for additional trip purposes resulting in the jobs housing relationship – segmenting by income level as well as by IX and XI parameters.
- Ensure friction factors for non-work trips do not screen out short trips which are likely candidates for non-motorized travel, particularly in models which have only used vehicle trip generation.

For models without mode choice components, the composite travel time will be estimated using walk time based on distance and an average of walk and drive time for origin-destination pairs where walk is competitive with auto. In addition, the sub-TAZ level of detail available in the GIS network will be used in combination with TAZ size.

The required revisions are listed below.

- Add friction factors for additional trip purposes and income group for home-work.
- Revise friction factors to be continuous and better match survey data.
- Adjust impedance inputs to be based on a composite of person travel times by all modes as well as travel costs, instead of just travel time by auto.

MODE CHOICE

In general, the mode choice functionality is the same as the VMIP 1 model. The primary changes to the mode choice model are listed below.

- The number of transit sub-modes in the model has been expanded from two to four. The prior Transit-Walk and Transit-Drive submodes have been replace with the following modes,
    - Transit-Walk-Bus
    - Transit-Walk-Rail (including the possibility of rail access via bus)
    - Transit-Drive-Bus
    - Transit-Drive-Rail (including the possibility of rail access via bus)
- In the current implementation, Transit-Walk-Bus and Transit-Walk-Rail are combined into a single mode prior to assignment; as are Transit-Drive-Bus and Transit-Drive Rail. This report recommends future model updates assign these modes separately, with the Rail submodes requiring the presence of at least one rail leg.
- Accessibility and built environment variables have been incorporated into the mode choice model.

The VMIP 2 mode choice model is segmented by trip purpose and vehicle availability, using three vehicle availability categories as described in the table below:

TABLE 29: VEHICLE AVAILABILITY SEGMENTS IN VMIP 2 MODE CHOICE MODELS

Name	Description
0veh	Households which own no vehicles
1veh	Households which have one vehicle but more than one person
Others	Households with either one vehicle and one person, or more than one vehicle

The table below lists the modes available in the VMIP 2 models.

TABLE 30: MODES AVAILABLE IN VMIP 2 MODE CHOICE MODELS

Category	Name	Segments Available	Trip Purposes	Description
Auto	da	1Veh, Other	All	Drive alone
	s2	All	All	Shared ride, 2 persons
	s3	All	All	Shared ride, 3+ persons
Transit	twb	All	All	Transit, walk-access, bus
	tdb	All	All	Transit, drive-access, bus
	twr	All	All but HBK, HBC	Transit, walk-access, rail
	tdr	All	All but HBK, HBC	Transit, drive-access, rail
	sb	All	HBK only	School bus
Active	walk	All	All	Walk
	bike	All	All	Bike

The variables used in each of the mode choice model segments are listed in the table below. Not all variables are used in all trip purposes models. For the accessibility and built environment variables, the table notes whether the variable is measured at the trip production (P) or trip attraction (A). Note that value of time is a direct consequence of the relationship between in-vehicle time and cost. As such, it is not estimated directly but is instead a consequence of the in-vehicle time (IVT) and cost coefficients. For model implementation purposes, only value of time (VOT) is used in the mode choice utility equation; for clarity, both are reported in the tables below.

TABLE 31: VARIABLES IN VMIP 2 MODE CHOICE MODELS

Variable	Purposes	Description
(Constants)	All	Alternative-specific constants
IVT	All	In-vehicle time
OVT	All	Out-of-vehicle time (access, transfer, egress, and waiting times)
Cost	All	Total cost, including auto operating cost, parking cost and tolls, and transit fares.
VOT	All	Value of time (conversion between cost variables and time variables)
TransitAccess	HBW, WBO, OBO	Jobs available within 30 minutes via transit, decay-weighted (P)
LogEmpDensity	HBW, HBS, HBO	Log (employment density of block group) (A)
IntDensity	HBK, HBC	Pedestrian-oriented intersection density (A)

The form of the VMIP 2 mode choice models is multinomial logit. A nested logit form might have been preferred for theoretical reasons, given the strong relationships among drive, transit, and active modes. However, no satisfactory nested logit models were estimated, likely because of severe constraints on the amount of transit data available. Multinomial logit models produced generally more sensible results and were used instead. Even the multinomial logit models produced some un-intuitive results. Rather than use un-intuitive coefficients, these were replaced by results from VMIP 1 mode choice models, pooled models involving multiple segments or multiple trip purposes, or were omitted altogether.

Home-Based Work

The table below lists model coefficients for HBW segments. Drive-alone was used as a reference mode for all segments, including the 0-vehicle segment where this mode is not permitted. In this segment, utility calculations were carried out without the drive alone mode.

TABLE 32: HBW MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
Constant	da	x	0	0
	s2	0.710	-1.839	-2.340
	s3	-0.229	-2.587	-2.936

TABLE 32: HBW MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
	twb	-1.900	-1.602	-2.754
	tdb	-1.900	-1.602	0.000
	twr	-1.900	-4.173	-5.937
	tdr	-1.900	-0.444	-5.432
	bike	-2.438	-2.898	-3.763
	walk	1.477	0.030	-1.075
IVT	All	-0.035	-0.040	-0.040
OVT	All	-0.070	-0.080	-0.080
OVT/IVT	All	2	2	2
Cost	All	-0.003	-0.002	-0.001
VOT	All	6	10.055	18
LogEmpDensity	da	x	0	0
	s2	0.828	0.329	0.506
	s3	0.458	0.408	0.506
	twb	1.873	0.586	1.066
	tdb	1.873	0.586	1.066
	twr	1.202	0.850	1.202
	tdr	1.066	0.189	1.202
	bike	2.147	0.765	0.506
	walk	1.025	0.178	0.005
TransitAccess	da	0	0	0
	s2	0.013	0.013	0.005
	s3	0.013	0.013	0.005
	twb	0.158	0.027	0.032
	tdb	0.158	0.027	0.032
	twr	0.158	0.027	0.032

TABLE 32: HBW MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
	tdr	0.158	0.027	0.032
	bike	0.136	0.031	0.062
	walk	0.136	0.031	0.062

Home-Based Shop

The table below lists model coefficients for HBS segments. Drive-alone was used as a reference mode for the 1-vehicle and 2-vehicle segments, while walk was used as a reference mode for the 0-vehicle segment.

TABLE 33: HBS MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
Constant	da	x	0	0
	s2	-3.420	-0.495	-0.889
	s3	-4.269	-0.380	-1.009
	twb	-2.439	-3.542	-5.834
	tdb	-2.439	-3.542	-5.834
	twr	-2.439	-3.542	-5.834
	tdr	-2.439	-3.542	-6.961
	bike	-5.341	-3.756	-2.972
	walk	0	2.191	-0.684
IVT	All	-0.025	-0.025	-0.025
OVT	All	-0.050	-0.050	-0.050
OVT/IVT	All	2	2	2
Cost	All	-0.005	-0.003	-0.002
VOT	All	3	6	6.319
LogEmpDensity	da	x	0	0

TABLE 33: HBS MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
	s2	-0.040	0.297	0.161
	s3	0.957	0.026	0.161
	twb	0.732	0.916	1.141
	tdb	0.732	0.916	1.141
	twr	0.866	0.866	0.750
	tdr	0.866	0.866	0.750
	bike	1.274	1.171	0.594
	walk	0	0.190	0.458

Home-Based School (K-12)

The table below lists model coefficients for HBK segments. The reference mode for the 0- and 1-vehicle segments is walk; the reference mode for the 2-vehicle segment is shared-ride 3.

TABLE 34: HBK MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
Constant	da	x	-4.874	-2.110
	s2	-3.560	-1.710	-0.703
	s3	-3.115	-1.540	0
	twb	-0.887	-7.657	0.316
	tdb	-0.887	-7.657	0.316
	bike	-4.456	-4.456	-2.876
	walk	0	0	0.273
	sb	-1.198	-1.346	0.449
IVT	All	-0.025	-0.025	-0.025
OVT	All	-0.050	-0.050	-0.050

TABLE 34: HBK MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
OVT/IVT	All	2	2	2
Cost	All	-0.005	-0.003	-0.002
VOT	All	3	6	9
IntDensity	da	x	-0.004	0
	s2	0	-0.004	0.004
	s3	0	-0.004	-0.019
	twb	-0.019	0.003	0.004
	tdb	0	0	0
	bike	0.003	0.009	0.005
	walk	-0.008	0.000	0.005
	sb	-0.012	-0.004	-0.003

Home-Based College

The table below lists model coefficients for HBC segments. Because of the very small number of HBC trips in the household survey data, all vehicle ownership segments were pooled for model estimation purposes, with distinctions between segments left for adjustment during model calibration. Drive-alone was used as a reference mode. In the 0-vehicle segment, utility calculations were carried out without the drive alone mode.

TABLE 35: HBC MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
Constant	da	x	0	0
	s2	-2.230	-2.230	-2.230
	s3	-2.396	-2.396	-2.396
	twb	-0.521	-0.521	-0.521
	tdb	-0.521	-0.521	-0.521

TABLE 35: HBC MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
	bike	-3.848	-3.848	-3.848
	walk	-1.126	-1.126	-1.126
IVT	All	-0.025	-0.025	-0.025
OVT	All	-0.050	-0.050	-0.050
OVT/IVT	All	2	2	2
Cost	All	-0.005	-0.003	-0.002
VOT	All	3	6	9
IntDensity	da	x	0	0
	s2	-0.004	0.004	0.004
	s3	-0.004	-0.019	-0.019
	twb	0.003	0.004	0.004
	tdb	0	0	0
	bike	0.009	0.005	0.005
	walk	0	0.005	0.005

Home-Based Other

The table below lists model coefficients for HBO segments. Drive-alone was used as a reference mode for the 2-vehicle segment, while walk was used as a reference mode for the 0- and 1-vehicle segments.

TABLE 36: HBO MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
Constant	da	x	-1.538	0
	s2	-3.032	-1.086	-0.151
	s3	-3.354	-1.250	0.014
	twb	-4.518	-3.406	-3.174

TABLE 36: HBO MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
	tdb	-8.953	-5.947	-3.341
	twr	-6.684	-6.405	-7.221
	tdr	-6.684	-6.405	-7.221
	bike	-3.368	-3.596	-1.963
	walk	0	0	0.561
IVT	All	-0.025	-0.025	-0.025
OVT	All	-0.050	-0.050	-0.050
OVT/IVT	All	2	2	2
Cost	All	-0.005	-0.003	-0.002
VOT	All	3	6	9
	da	x	-0.455	0
	s2	-0.455	-0.455	0
	s3	-0.614	-0.614	0
	twb	0.387	0.277	0.315
LogEmpDensity	tdb	0.924	0.277	0.315
	twr	-0.407	0.277	0.363
	tdr	-0.407	0.277	0.363
	bike	-0.143	0.559	0.455
	walk	0	0	0.455

Work-Based Other

The table below lists model coefficients for WBO segments. Because of the small number of WBO, 0-vehicle household trips in the household survey data, the 0-vehicle and 1-vehicle segments were pooled for model estimation purposes, with distinctions between them left for adjustment during model calibration. Drive-alone was used as a reference mode. In the 0-vehicle segment, utility calculations were carried out without the drive alone mode.

TABLE 37: WBO MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
Constant	da	x	0	0
	s2	-1.226	-1.226	-1.308
	s3	-1.857	-1.857	-1.969
	twb	0.000	0.000	-2.453
	tdb	-4.305	-4.305	-2.453
	twr	-3.518	-3.518	-3.285
	tdr	-3.518	-3.518	-2.497
	bike	-3.424	-3.424	-5.431
	walk	-2.108	-2.108	-2.153
IVT	All	-0.035	-0.035	-0.030
OVT	All	-0.089	-0.089	-0.076
OVT/IVT	All	2.515	2.515	2.515
Cost	All	-0.004	-0.001	-0.001
VOT	All	6.076	16.618	18
TransitAccess	da	0	0	0
	s2	0	0	0
	s3	0	0	0
	twb	0.084	0.084	0.023
	tdb	0.084	0.084	0.023
	twr	0.144	0.144	0.062
	tdr	0.144	0.144	0.078
	bike	0.063	0.063	0.045
	walk	0.063	0.063	0.072

Other-Based Other

The table below lists model coefficients for OBO segments. Walk was used as a reference mode for the 0- and 1-vehicle segments; drive-alone was used as a reference mode for the 2-vehicle segment.

TABLE 38: OBO MODE CHOICE MODEL COEFFICIENTS

Variable	Mode	0-Vehicle	1-Vehicle, 2+ person HH	All Others
Constant	da	x	-0.732	0
	s2	-1.975	-0.223	-0.228
	s3	-2.353	-0.732	-0.388
	twb	-2.764	-3.899	-4.442
	tdb	-2.764	-3.899	-4.442
	twr	-4.017	-3.899	-5.409
	tdr	-4.017	-3.899	-5.409
	bike	-3.036	-4.219	-3.627
	walk	0	0	-0.444
IVT	All	-0.030	-0.030	-0.074
OVT	All	-0.061	-0.061	-0.147
OVT/IVT	All	2	2	2
Cost	All	-0.004	-0.003	-0.005
VOT	All	5.191	6	9
TransitAccess	da	x	-0.200	0
	s2	-0.200	-0.200	0
	s3	-0.369	-0.369	0
	twb	0.027	0.097	0.025
	tdb	0.027	0.097	0.025
	twr	0.027	0.097	0.025
	tdr	0.027	0.097	0.025
	bike	0.043	0.150	0.039
	walk	0	0	0.039

PRICING

The auto operating cost was updated based on the Big 4 MPO methodology. The change includes the non-fuel pricing, fuel cost and vehicle fleet determined for each individual county, and a constant price increase for fuel and non-fuel costs applied to forecast the future. More details are found in the memo from the Big 4 in Appendix K: Memo on Auto Operating Cost.

The household income and commute cost was also included in the model for the auto ownership. More details on this are included in the estimation section.

TRIP ASSIGNMENT

Trip assignment includes traffic and transit assignments.

Traffic Assignment

The traffic assignment process in each model was reviewed. During implementation of VMIP 1 it was noticed the addition of distance to the path assignment resulted in routes that did not reflect traffic counts or local knowledge. For VMIP 2, the traffic assignment method was modified to include congested travel time and link or node costs, removing distance.

To allow for a different value of time, traffic assignments by vehicle availability was implemented for a multi-class assignment which separately evaluates and reports the following five vehicle types:

- Drive Alone
- Drive Alone Toll
- Shared Ride 2
- Shared Ride 3+
- Truck

Traffic assignment was modified to remove distance from the path cost function, leaving time and pricing (converted to time using the value of time).

Transit Assignment

The transit assignment has not changed from VMIP 1 and includes the following variables:

- Transit networks, real or synthetic
- Transit attributes (mode, operator, vehicle type)

- Transit access links (coded into network? How does this work)
- Fares
- User classes (this needs to reflect types of MPO questions, such as sensitivity to fares or value of time)
- Transfer and wait rules

FEEDBACK LOOP

The feedback loop ensures the travel times used as input to trip distribution are consistent with the travel times on the final reported congested road network, as required for air quality conformity analysis. No changes were made during VMIP 2.

INTER-REGIONAL COORDINATION

In VMIP 1, each of the eight SJV counties used its own estimates of travel growth at the county boundaries and the proportions of through traffic. These forecasts of growth and through trips may be very different, even for adjacent counties, making it difficult to consistently identify inter-regional travel and possibly consolidate travel forecasts from multiple MPOs. The basis of the inter-regional coordination in VMIP 2 is the California Statewide Travel Demand Model (CSTDM), which provides a baseline distribution of passenger vehicle trips entering, leaving, or passing through each model area. The statewide model may not need to be re-run for every scenario run in a VMIP 2 model; the process illustrated and described below shows the decision process for whether the statewide model needs to be re-run.

Interregional Process

- First, trips internal to the model (ii trips) should be balanced to one another.
- Next, inter-regional trips produced and attracted to the model are compared to the number of IX and XI trips passing through model gateways. If balance can be achieved by re-distributing IX and XI trips among gateways, then there is no need to re-run the statewide model.
- However, if the number of IX trips produced by the model varies significantly from the number of IX trips attracted to gateways, or the number of XI trips attracted by the model is too different from the number of XI trips produced from gateways, then the statewide model must be re-run to account for land use changes which have changed inter-regional travel patterns.

The process outlined above was only partly implemented during VMIP 2 since the CSTDM has not been updated recently and does not include the land use developed for the RTP/SCS for any of the MPOs in the SJV. This report recommends that once the CSTDM (passenger) and California Statewide Freight Forecasting Model (CSFFM) are updated, new through trip tables are implemented in the model.

MODEL CALIBRATION

Calibration is an iterative process where model settings are adjusted so the output of the model matches observed travel patterns. Model calibration helps overcome issues of data quality, sample size, or aggregation bias and results in model outcomes tailored to local travel characteristics.

CALIBRATION TARGETS

The first calibration step is to verify the model is producing reasonable travel behavior across household dimensions:

- Household size
- Household income

A cross-classification comparison of the model outcomes and validation behavior for each of the household dimensions is prepared. The model is calibrated in an iterative method by reducing or increasing the 2012 ACS values until the household cross-classification totals from the model match the validation data source totals.

Model-Specific Calibration Targets

To verify that acceptable levels of calibration have been achieved, the model output for each step or submodel is compared to observed data. This comparison is referred to as validation.

- Vehicle availability was validated using census vehicle ownership cross-classified by household size and income.
- Trip generation was validated for trip productions, attractions, and trip balancing.
    - Trip production: A comparison of model total trips by purpose and observed totals from the expanded 2012 CHTS data. A secondary comparison, if needed, can be HBW trips from more aggregate sources such as the CTPP or NHTS. These sources are used with caution since they report “usual” workplace locations and are not directly comparable to model generated workplace locations. Convert person trip rates to ITE rates using Ave Veh Occ by purpose.
    - Trip attraction: Compare HBW attractions to total jobs in zone, range of 1.2-1.5 HBW attractions per employee in zone (source TFResource.org).
    - Trip balancing: PA totals, within +-10% of totals and totals by purpose.

- The trip distribution gravity model and any associated friction factors (k-factors) were calibrated iteratively to match average trip lengths by purpose and trip length frequencies by purpose are compared with the CHTS.
- The mode choice model was validated against CHTS mode shares.

The calibrated parameters used in the model are reported in Appendix L: Calibrated Parameters and summarized in the 1_Inputs\Support\ VMIP2_FresnoCOG_Parameters.xlsx.

MODEL STATIC VALIDATION

In the static validation tests, we ran the model to ensure the model output matches available traffic counts and ridership counts, and assessed the model's ability to replicate roadway speeds. This process starts with measuring the model traffic volume flows across screenlines composed of several roadways to ensure overall traffic flows in specific directions are accurately captured. Then, model volumes on individual links are compared to traffic counts. As part of the static validation procedure, elements of the trip generation, trip distribution, and traffic assignment modules were adjusted. Validation results are in the 0_Documents\Validation directory included with the model.

TRIP GENERATION

Trip generation validation consisted of the total production to attraction ratio (P/A) by purpose and the total trips generated per household. As we can see from the table, the P/A ratios are quite close to 1 for all the trip purposes and well within the 10% guideline. When applying the model for future years or land use scenarios, the P/A ratio should be reviewed along with the trips per household to ensure the model results reasonably reflect the scenario. The User Guide contains additional detail on checking the land use, trip balancing, and adjusting the inter-regional factors if needed.

TABLE 39: TRIP GENERATION – PRODUCTION (P)/ATTRACTION (A) BALANCE

Trip Purpose	Evaluation Criterion	Productions	Attractions	P/A Ratio	Difference	Percent Difference
HBW	+/- 10%	207,845	204,054	1.02	-3,790	-1.8%
HBS	+/- 10%	472,158	462,414	1.02	-9,744	-2.1%
HBO	+/- 10%	1,306,831	1,246,216	1.05	-60,615	-4.6%
NHB	+/- 10%	706,722	722,447	0.98	15,725	2.2%

The person trips per household are lower than the CHTS. As directed by Fresno COG staff, trip generation rates were reduced to have VMT and other validation criteria closer to the guidelines. Subarea validation should be performed prior to using the model for applications other than regional performance metrics.

TABLE 40: WEEKDAY PERSON TRIPS PER HOUSEHOLD

CHTS	Model
11.0	9.6

Notes: 2012 California Household Travel Survey, Weekday Trips, re-weighted by F&P

VEHICLE AVAILABILITY

Next, we checked weekday person trips per household as shown in the table below. Again, the model output matches closely with the data from the 2012 CHTS. Similarly, vehicle availability from the model as shown in the table below matches with the CHTS data.

TABLE 41: VEHICLE AVAILABILITY

0		1		2		3+	
CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model
9%	14%	35%	34%	37%	39%	30%	13%

Notes: 2012 California Household Travel Survey, Weekday Trips, re-weighted by F&P

MODE SPLIT

When it comes to mode split by purpose, including modes such as drive alone, shared ride 2, transit and walking as well as purposes such as home based work (HBW) and non-home based work (NHB), outputs from the model are once again very close to the CHTS data.

TABLE 42: MODE SPLIT BY PURPOSE

Purpose	Total		Drove Alone		Shared Ride 2		Shared Ride 3+		Transit		Walk		Bike		Other	
	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model
HBW	13%	8%	81%	81%	8%	8%	4%	4%	1.7%	1.7%	4%	4%	1%	1%	0%	0%
HBO	59%	66%	27%	25%	28%	26%	24%	19%	2.2%	3.0%	13%	24%	3%	3%	3%	1%
NHB	28%	27%	46%	45%	26%	29%	21%	19%	0.5%	0.6%	5%	5%	2%	2%	0%	0%
Total	100%	100%	40%	34%	25%	26%	20%	17%	1.7%	2.3%	10%	17%	2%	2%	1%	1%

Notes: 2012 California Household Travel Survey, Weekday Trips, re-weighted by F&P. Includes only internal-to-internal, weekday person trips for all modes. School bus trips are categorized as Other.

Model output for trip purposes by mode also falls close to the survey results as clearly shown in the table below.

TABLE 43: PURPOSE BY MODE

Purpose	Total		Drove Alone		Shared Ride 2		Shared Ride 3+		Transit		Walk		Bike	
	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model
HBW	13%	8%	27%	18%	4%	2%	2%	2%	14%	6%	6%	2%	7%	4%
HBO	59%	66%	41%	47%	67%	67%	69%	70%	78%	88%	81%	90%	71%	72%
NHB	28%	27%	32%	35%	29%	30%	29%	29%	8%	7%	14%	8%	22%	24%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Notes: 2012 California Household Travel Survey, Weekday Trips, re-weighted by F&P. Includes only internal-to-internal, weekday person trips for all modes. School bus trips are categorized as Other.

DISTRIBUTION – TRAVEL TIME

During the model estimation process the individual household survey records were evaluated. In many cases the reported travel time, level of congestion in the area, and travel distance were inconsistent for a given trip. Rather than using trip distance, the model uses travel time for distribution so future congestion or changes in travel time between modes influences overall travel. The results of the average travel time from the model are close to those observed, with the model being slightly lower than CHTS average times for home-based trips.

TABLE 44: TRIP ASSIGNMENT – AVERAGE TRAVEL TIME (IN MINUTES) BY TRIP PURPOSE

Trip Purpose					
HBW		HBO		NHB	
CHTS	Model	CHTS	Model	CHTS	Model
20.8	20.0	14.0	12.6	13.0	13.6

Notes: 2012 California Household Travel Survey, Weekday Trips, re-weighted by F&P. Includes only internal-to-internal, weekday person trips for all modes.

VEHICLE MILES TRAVELED

Data from Highway Performance Management System (HPMS) were used as a benchmark for comparison of Vehicle Miles Traveled (VMT) within the model area. Although HPMS is an estimate of VMT based on sampled count data throughout the county, it is a standard method and a point of comparison often referenced especially for air quality analysis. The model is within the recommended deviation compared to HPMS. Based upon VMT being within the estimate from HPMS combined with the travel time distribution and the lack of significant congestion within the region, the distribution portion of the model seems reasonable.

TABLE 45: TRIP ASSIGNMENT – VMT

Evaluation Criterion	HPMS	Model	% Deviation
+-3%	22,574,620	23,053,713	+2.1%

Notes: Daily Vehicle Miles Traveled. Highway Performance Management System – 2014 California Public Road Data, Table 6.

DISTRIBUTION – INTER-REGIONAL TRAVEL

We also looked at model trip distribution and compared it with CHTS survey data. As shown in the table below, the model is close to the survey data for each trip type.

TABLE 46: TRIP DISTRIBUTION – BY PURPOSE (ALL MODES)

Trip Type	Trip Purpose							
	Total		HBW		HBO		NHB	
	CHTS	Model	CHTS	Model	CHTS	Model	CHTS	Model
II	93%	94%	88%	91%	95%	95%	93%	94%
IX	3%	3%	4%	3%	3%	3%	4%	3%
XI	3%	3%	8%	6%	3%	3%	3%	2%

Notes: 2012 California Household Travel Survey, Weekday Trips, re-weighted by F&P. Includes only internal-to-internal, weekday person trips for all modes.

ROADWAY ASSIGNMENT – TRAFFIC VOLUMES

For the Fresno COG model, weekday traffic counts were compared to the model assigned volume for total vehicle trips. Fresno COG collected a large number of counts on county roads and city streets, and these counts were supplemented by count data collected by Caltrans as part of the Highway Performance Management System (HPMS) reporting. Count data ranged from 2014 to 2016, with the model land use reflecting 2014. **Table 47** summarizes the static validation tests for both sets of counts. The Assignment Validation Dashboard on the following page.

TABLE 47: SUMMARY OF TRAFFIC ASSIGNMENT VALIDATION – DAILY CONDITIONS

Evaluation Criterion	Guidelines(1)	Model
Number of count locations	N/A	793
Model/Count Ratio	+/- 10%	0.94
Percent within Caltrans Deviation	>75%	79%
Percent Root Mean Square Error	< 40%	54%
Correlation Coefficient	> 0.88	95%
Screenlines within Caltrans Deviation	100%	92%

Notes: (1) *2017 Regional Transportation Plan Guidelines for Metropolitan Planning Organizations*, California Transportation Commission, January 18, 2017 and *Travel Forecasting Guidelines*, State of California Department of Transportation, 1992.

The VMIP 2 model does not pass all of the static validation, with the %RMSE being slightly high and some of the screenlines not passing. The model meeting most of the criteria but local area model validation and calibration is recommended for project application.

The model validation results demonstrate the model performs acceptably at a regional scale especially for key metrics such as VMT and higher volume roadways. At a local scale or specific times of day, sub-area refinements and validation should be performed before using the model for project applications. Refinements may include adding zonal or network detail to the model along with modifications to centroid loadings, network inputs (i.e., speeds), land use inputs, and demographic inputs. As described in the Fresno COG forecasting guidelines, any applications forecasts should also use an appropriate forecasting approach as described by National Cooperative Highway Research Program (NCHRP) Report 255 or 716 rather than using model forecast volumes directly.

San Joaquin Valley Model Improvement Project (San Joaquin Valley MIP)
One-Way Volume Model Validation Results
Fresno County Model

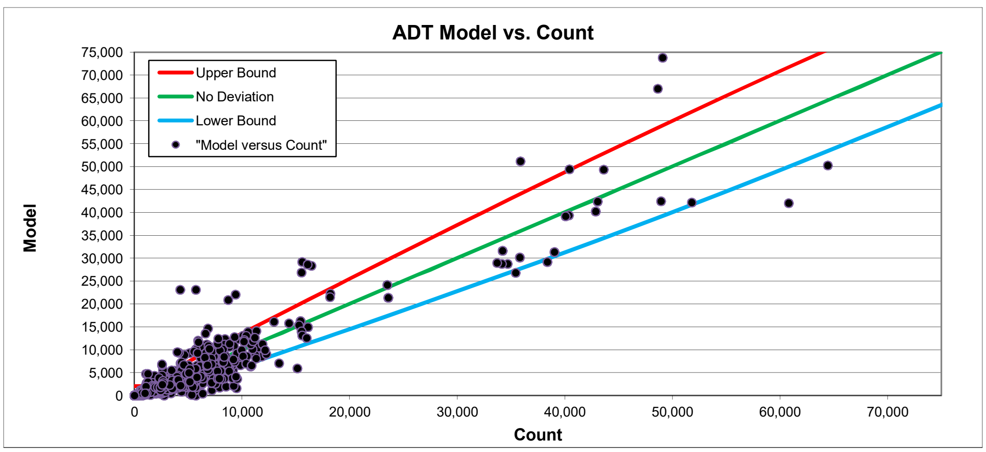
August 1, 2017

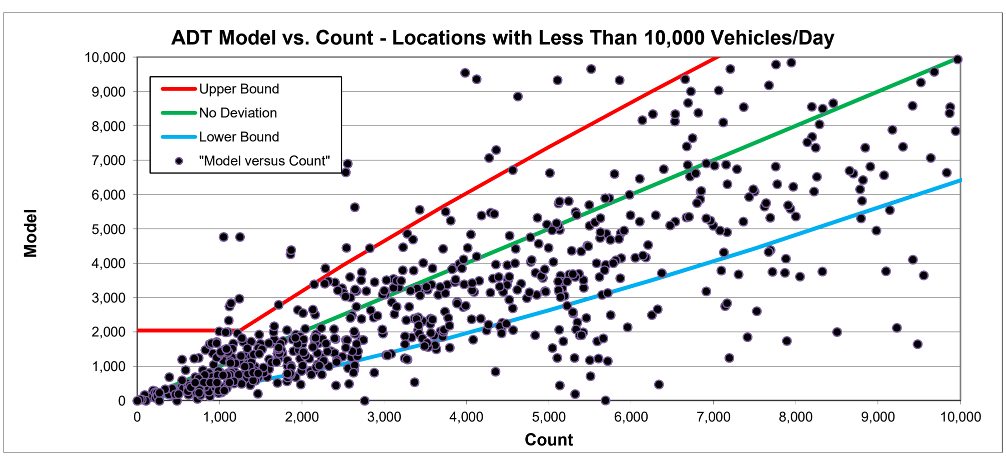
DAILY Assignment		
Model/Count Ratio =	**0.94**	
Percent Within Caltrans Maximum Deviation =	**79%**	> 75%
Percent Root Mean Square Error =	**54%**	<40
Correlation Coefficient =	**95%**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**92%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	793	
Link Within Deviation	623	
Link Outside Deviation	170	
	Remaining	Total Needed
	-28	595

Model/Count by ADT Volume Groups		
Link Volume	**M/C**	**Counts**
> 50,000	**1.09**	
25,000 - 49,999	**0.98**	
10,000 - 24,999	**1.02**	
5,000 - 9,999	**0.87**	
2,500 - 4,999	**0.88**	
1,000 - 2,499	**0.85**	
< 1,000	**0.82**	

RMSE by ADT Volume Groups		
Link Volume	**%RMSE**	**FHWA**
> 50,000	**28%**	< 21%
25,000 - 49,999	**21%**	< 22%
10,000 - 24,999	**32%**	< 25%
5,000 - 9,999	**48%**	< 29%
2,500 - 4,999	**56%**	< 36%
1,000 - 2,499	**52%**	< 47%
< 1,000	**60%**	< 60%

ADT Model/Count by Functional Class		
Functional Class	**M/C**	**Counts**
Freeway	**1.04**	**54**
Highway	**1.26**	**17**
Expressway	**1.25**	**26**
Arterial	**0.79**	**339**
Collector	**0.82**	**368**





Note: Detailed validation results can be found in Appendix M.

TRANSIT ASSIGNMENT – SYSTEM RIDERSHIP

As shown in the table below, the total transit system ridership is slightly high compared to the observed ridership. With transit mode share reported in CHTS for transit less than 2%, minor differences in mode share result in a noticeable difference in transit riders.

TABLE 48: DAILY TRANSIT ASSIGNMENT

Validation Statistic	Evaluation Criterion	Observed Ridership	Model Ridership	Percentage
Difference between actual ridership to model results for entire system	+/- 20%	61,324	77,545	+26%

Notes: Observed Ridership includes FAX, Clovis Transit, FCRTA average weekday unlinked trips for 2014

THROUGH TRIPS

In addition to the through trips beeing updated, enhancements to travel behavior within the model include more reasonable internal trip rates and estimates consistent with the 2012 CHTS. As discussed in the inter-regional coordination section, the CSTDM has not been updated to reflect the SJV MPO current RTPs. As such, the XX trips, derived from the CSTDM, were based on the CSTDM but calibrated to better match counts on the freeways near gateways. Also, XX truck trips in VMIP 2 were converted from passenger car equivalents (PCEs) to vehicles since the assignment accounts for PCEs and the counts (passenger vehicles plus trucks) are also in terms of vehicles. It is recommended that the through trips for the base year and future scenarios be updated when the CSTDM is updated to reflect the SJV MPO RTP/SCS.

MODEL DYNAMIC VALIDATION

The model was tested to evaluate the sensitivity of auto operating cost and the results were compared to published research. Since the test was implemented for the base year, the results were compared to the short-term elasticities. The internal-external, household demographics, and all other factors remained constant so only internal-internal VMT was compared to reduce the influence of interregional travel. Research on the elasticity of fuel price on vehicle miles traveled summarized by ARB indicate ranges of -.026 to -0.195. The model sensitivity to an increase and decrease in auto operating cost in the same magnitude but not as sensitive as published research suggests. Given the high dependence on auto travel for the county as a whole and the fuel price being a smaller component of auto operating cost when the maintenance and other fixed prices are include, the model is sensitive for relative scenario comparisons.

TABLE 49: AUTO OPERATING COST AND VMT

Test	Change in Cost	VMT	% Change in VMT	Elasticity
Increase Auto Operating Cost	+ 3%	16,355,828	-0.05%	-0.017
Decrease Auto Operating Cost	- 3%	16,370,611	0.04%	-0.013

Notes: Base year internal VMT= 16,364,286

APPENDIX A:

PREPARATION OF CALIFORNIA HOUSEHOLD TRAVEL SURVEY DATA

MEMORANDUM

Date: June 23, 2015

To: Users of CHTS data prepared by Fehr & Peers

From: Jennifer Ziebarth

Subject: Cleaning and Weighting of California Household Travel Survey Data

WC14-3115

The purpose of this memo is to document the steps undertaken to prepare the 2012 California Household Travel Survey (CHTS) for use in the Valley Model Improvement Program, Phase 2 (VMIP 2) project.

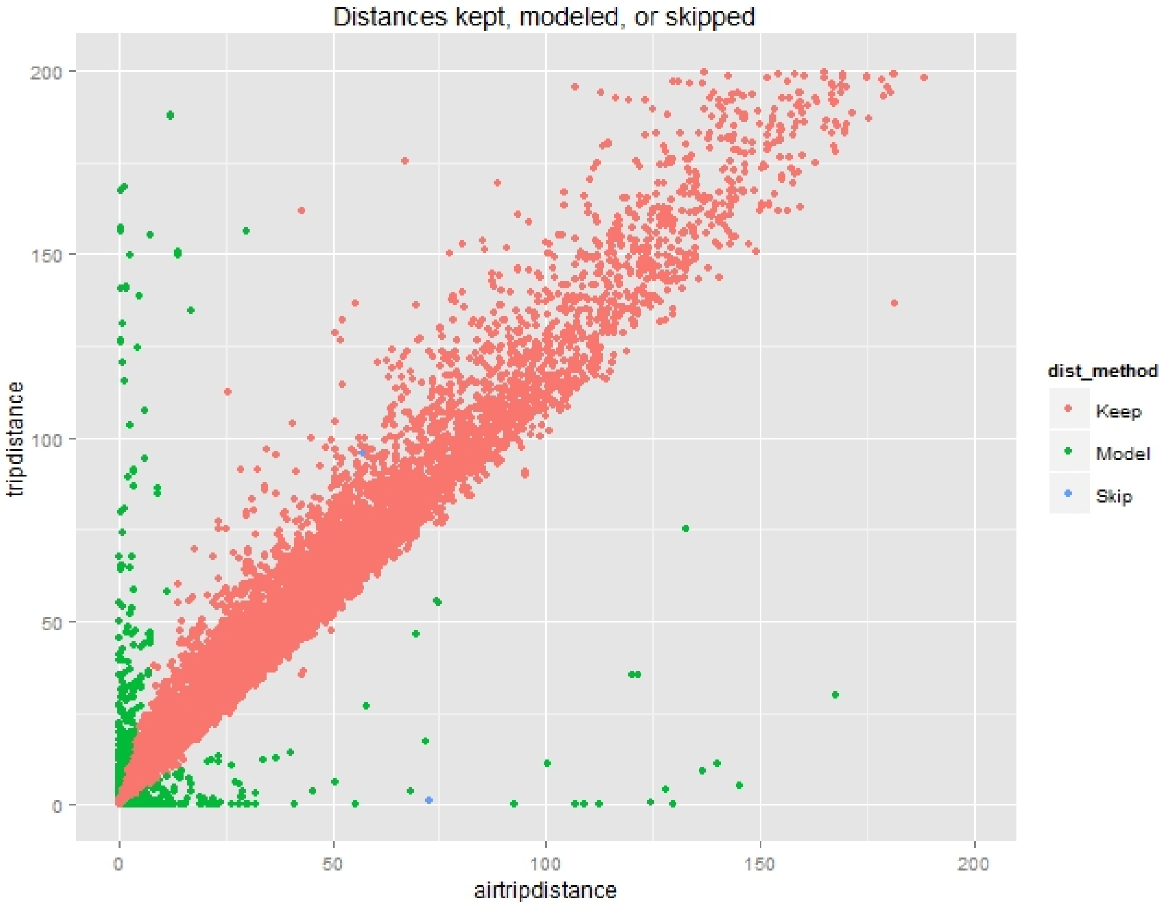
The 2012 CHTS is a statewide dataset of multi-modal travel behavior and household demographics. The survey includes data from a total of 42,431 households, collected using telephone surveys and GPS devices from all counties in California. The dataset includes travel patterns, including activity purpose, duration, travel distance, travel time, and mode choice. Demographics include household size, income, vehicle availability, and the additional characteristics of the individuals within the household.

Data preparation included the following steps:

1. Identify and repair unreasonable or missing trip distances.
2. Identify and consolidate transit trip chains.
3. Identify trip purposes.
4. Impute missing household income data.
5. Calculate a set of household-level weights to replace those provided with the CHTS.
6. Recode certain variables
7. Attach MPO and Census Designated Place information to trip and household records
8. Aggregate information about persons in the household to the household record
9. Attach person-level data to the trip records

TRIP DISTANCE CLEANING

The California Household Travel Survey provides trip distances in two formats: an "as-traveled" distance intended to be the actual distance traveled, and an "air distance" reflecting the straight-line distance between the trip's origin and destination. However, the as-traveled distance was missing from some trip records and was unreasonable in others. The graph below shows the relationship between air distance and as-traveled distance for all non-airplane trips in the CHTS. Trips whose as-traveled distance deviate too much from their air distance are candidates for providing a "cleaned" distance.



To provide "cleaned" trip distances, a simple linear regression was performed separately for each travel mode based only on the data where the as-traveled distance is deemed reasonable.

IDENTIFY TRIP PURPOSES

To identify trip purposes, both the activity purpose from the CHTS activities file and the place name from the CHTS places file were used. The activity codes provided in the CHTS data are as follows:

1. PERSONAL ACTIVITIES (SLEEPING, PERSONAL CARE, LEISURE, CHORES)
2. PREPARING MEALS/EATING
3. HOSTING VISITORS/ENTERTAINING GUESTS
4. EXERCISE (WITH OR WITHOUT EQUIPMENT)/PLAYING SPORTS
5. STUDY / SCHOOLWORK
6. WORK FOR PAY AT HOME USING TELECOMMUNICATIONS EQUIPMENT
7. USING COMPUTER/TELEPHONE/CELL OR SMART PHONE OR OTHER COMMUNICATIONS DEVICE FOR PERSONAL ACTIVITIES
8. ALL OTHER ACTIVITIES AT MY HOME
9. WORK/JOB DUTIES
10. TRAINING
11. MEALS AT WORK
12. WORK-SPONSORED SOCIAL ACTIVITIES (HOLIDAY OR BIRTHDAY CELEBRATIONS, ETC)
13. NON-WORK RELATED ACTIVITIES (SOCIAL CLUBS, ETC)
14. EXERCISE/SPORTS
15. VOLUNTEER WORK/ACTIVITIES
16. ALL OTHER WORK-RELATED ACTIVITIES AT MY WORK
17. IN SCHOOL/CLASSROOM/LABORATORY
18. MEALS AT SCHOOL/COLLEGE
19. AFTER SCHOOL OR NON-CLASS-RELATED SPORTS/PHYSICAL ACTIVITY
20. ALL OTHER AFTER SCHOOL OR NON-CLASS RELATED ACTIVITIES (LIBRARY, BAND REHEARSAL, CLUBS, ETC)
21. CHANGE TYPE OF TRANSPORTATION/TRANSFER (WALK TO BUS, WALK TO/FROM PARKED CAR)
22. PICKUP/DROP OFF PASSENGER(S)

23. DRIVE THROUGH MEALS (SNACKS, COFFEE, ETC.) [SHOW IF PTYPE <> 1 (HOME)]
24. DRIVE THROUGH OTHER (ATM, BANK) [SHOW IF PTYPE <> 1]
25. WORK-RELATED (MEETING, SALES CALL, DELIVERY)
26. SERVICE PRIVATE VEHICLE (GAS, OIL, LUBE, REPAIRS)
27. ROUTINE SHOPPING (GROCERIES, CLOTHING, CONVENIENCE STORE, HH MAINTENANCE)
28. SHOPPING FOR MAJOR PURCHASES OR SPECIALTY ITEMS (APPLIANCE, ELECTRONICS, NEW VEHICLE, MAJOR HH REPAIRS)
29. HOUSEHOLD ERRANDS (BANK, DRY CLEANING, ETC.)
30. PERSONAL BUSINESS (VISIT GOVERNMENT OFFICE, ATTORNEY, ACCOUNTANT)
31. EAT MEAL AT RESTAURANT/DINER
32. HEALTH CARE (DOCTOR, DENTIST, EYE CARE, HIROPRACTOR, VETERINARIAN)
33. CIVIC/RELIGIOUS ACTIVITIES
34. OUTDOOR EXERCISE (PLAYING SPORTS/JOGGING, BICYCLING, WALKING, WALKING THE DOG, ETC.)
35. INDOOR EXERCISE (GYM, YOGA, ETC.)
36. ENTERTAINMENT (MOVIES, WATCH SPORTS, ETC)
37. SOCIAL/VISIT FRIENDS/RELATIVES
38. OTHER (SPECIFY) [NOTE: LISTED ON DIARY] (O_APURP)
39. LOOP TRIP (FOR INTERVIEWER ONLY-NOT LISTED ON DIARY)
99. DONT KNOW/REFUSED

Each place visited was assigned a place based on the following criteria:

- If the place name is "HOME," then the place is "HOME," regardless of the activity purposes.
- If the place includes an activity with purpose code between 9 and 16, the place is "WORK."
- If the place includes an activity with purpose code between 17 and 20, then:
  - If the place name includes identifying strings such as "COLLEGE," "UNIV," "UCLA," or "USC," the place is "COLLEGE."
  - If the place name includes "PRESCHOOL" or "DAYCARE," the place is "OTHER".

  - Otherwise the place is "K12."

- If the place includes an activity with purpose code 27 or 28, then the place is "SHOP."
- Otherwise, the place is "OTHER."

Once the purpose for each place has been determined, assigning a purpose to each trip is straightforward. For non-transit trips, the purpose at the trip origin is the purpose of the immediately preceding place record, and the purpose at the trip destination is the purpose of the place record itself. Then:

- If one end of the trip is "HOME" and the other is "WORK," the trip is home-based work ("HBW").
- If one end of the trip is "HOME" and the other is "K12," the trip is home-based K-12 ("HBK").
- If one end of the trip is "HOME" and the other is "COLLEGE," the trip is home-based college ("HBC").
- If one end of the trip is "HOME" and the other is "SHOP," the trip is home-based shop ("HBS").
- If one end of the trip is "HOME" and the other is either "OTHER" or "HOME," the trip is home-based other ("HBO").
- If one end of the trip is "WORK" and the other end is anything but "HOME," the trip is work-based other ("WBO").
- In all other cases, the trip is non-home-based ("NHB").

In some cases it is useful to consolidate these trips into a simpler scheme:

- Home-based work ("HBW") is the same as above.
- Home-based other ("HBO") includes "HBO," "HBK," "HBC," and "HBS" above.
- Non-home-based ("NHB") includes "WBO" and "NHB" above.

For transit trips, the purpose identification is slightly more complex and first requires identification of chains of transit trips (see below).

JOINT TRAVEL AMONG HOUSEHOLD MEMBERS

When multiple household members travel together in a single vehicle, the trip is considered a joint trip. Such trips are identified using arrival and departure times as well as person codes for household members on the trip. If the only purpose of the trip is to drop off or pick up household members, the trip is flagged as an escort trip.

This coding allows flexibility in how escort trips are counted when CHTS records are summarized. To avoid losing potentially important information, no trip purposes are changed.

IDENTIFY AND CONSOLIDATE TRANSIT TRIP CHAINS

In recording transit trips, the California Household Travel Survey treats each portion of the transit trip chain as a separate trip. For example, a trip in which the traveler drives to a rail station, takes the train to a second rail station, and then walks to a workplace is listed in the survey as three separate, consecutive trips, with three separate modes. This method of record-keeping makes it possible to track the mode of access and egress for a transit trip, but for most travel behavior analyses it is preferable to consider these three trips as a single unit. . Thus, a necessary step of data preparation is identification and consolidation of chains which make up a single linked transit trip.

To identify chains of transit trips, trips are flagged as transit access, transit egress, or transit transfer using the following criteria. A transit access trip is one which:

- Immediately precedes a trip whose mode is a transit mode,
- Does not itself use a transit mode, and either
  - Has an activity of "change to type of transportation / transfer" coded, or
  - Has an activity duration less than 30 minutes and a location whose name contains a keyword suggesting a transit stop, such as "station," "bus," "subway," etc.
- Does not end at the traveler's home.

A transit egress trip is one which:

- Immediately follows a trip whose mode is a transit mode,
- Does not itself use a transit mode, and either
  - Has an activity of "change to type of transportation / transfer" coded, or
  - Has an activity duration less than 30 minutes and a location whose name contains a keyword suggesting a transit stop, such as "station," "bus," "subway," etc.
- Does not depart from the traveler's home.

A trip which fits both sets of criteria, appearing to be both transit access and transit egress, is considered a transit transfer.

Once potential access, transfer, and egress trips have been identified, the first and last legs of transit trip chains are identified according to the following criteria. The first leg of a transit trip chain is one which:

- Is flagged as a transit access trip, or
- Is a transit trip whose preceding trip is not transit and does not have an activity of "change to type of transportation" coded, and whose previous activity duration is greater than 30 minutes.

The last leg of a transit trip chain is one which:

- Is flagged as a transit egress trip, or
- Is a transit trip which does not have an activity of "change to type of transportation" coded, whose following trip is not transit and whose activity duration is greater than 30 minutes.

Note the actual criteria are slightly more involved; for details see the R code. For validation of this process, it was confirmed no person has a different number of trips flagged as the first in a transit chain than flagged as the last in a transit chain.

Once transit trip chains have been identified, a trip purpose can be assigned to the chain as a whole. The chain origin is the origin for the first trip in the chain, that is, the purpose of the immediately preceding place. The chain destination is the destination for the final trip in the chain. The same categorization of trip purposes is used as described in the previous section.

COMPARISON OF TRIP MODES

The modes reported in the cleaned CHTS data are slightly simplified from those reported in the original CHTS data. In addition, mode categories in the cleaned CHTS data reflect vehicle occupancy of drive modes and mode of access for transit modes. The comparison between the original mode reported in the CHTS and the simplified mode in the cleaned data is as follows:

Simplified mode	Original modes
Walk	Walk; Wheelchair / Mobility Scooter Other Non-Motorized
Bike	Bike

Simplified mode	Original modes
Drive Alone	Auto / Van / Truck Driver Auto / Van / Truck Passenger Carpool / Vanpool Motorcycle / Scooter / Moped Rental Car / Vehicle
Drive Shared 2	Auto / Van / Truck Driver Auto / Van / Truck Passenger Carpool / Vanpool Motorcycle / Scooter / Moped Rental Car / Vehicle
Drive Shared 3	Auto / Van / Truck Driver Auto / Van / Truck Passenger Carpool / Vanpool Motorcycle / Scooter / Moped Rental Car / Vehicle
Drive Shared 4+	Auto / Van / Truck Driver Auto / Van / Truck Passenger Carpool / Vanpool Motorcycle / Scooter / Moped Rental Car / Vehicle
Taxi	Taxi / Hired Car / Limo
Shuttle	Private shuttle (SuperShuttle, employer, hotel, etc.) Other Private Transit
Walk to Bus	Greyhound Bus Local Bus, Rapid Bus Express Bus / Commuter Bus (AC Transbay, Golden Gate Transit, etc.) Premium Bus (Metro Orange / Silver Line) Public Transit Shuttle (DASH, Emery Go Round, etc.) AirBART / LAX FlyAway Amtrak Bus Other Bus
Drive to Bus	Greyhound Bus Local Bus, Rapid Bus Express Bus / Commuter Bus (AC Transbay, Golden Gate Transit, etc.) Premium Bus (Metro Orange / Silver Line) Public Transit Shuttle (DASH, Emery Go Round, etc.) AirBART / LAX FlyAway Amtrak Bus Other Bus

Simplified mode	Original modes
Walk to Rail	BART, Metro Red / Purple Line ACE, Amtrak, Caltrain, Coaster, Metrolink Metro Blue / Green / Gold Line, Muni Metro, Sacramento Light Rail, San Diego Sprinter / Trolley / Orange/Blue/Green, VTA Light Rail Street Car / Cable Car Other Rail
Drive to Rail	BART, Metro Red / Purple Line ACE, Amtrak, Caltrain, Coaster, Metrolink Metro Blue / Green / Gold Line, Muni Metro, Sacramento Light Rail, San Diego Sprinter / Trolley / Orange/Blue/Green, VTA Light Rail Street Car / Cable Car Other Rail
Walk to Ferry	Ferry / Boat
Drive to Ferry	Ferry / Boat
School Bus	School Bus
Paratransit	Dial-a-Ride / Paratransit (Access Services, etc.)
(removed from cleaned data)	Plane
NA	RF

IMPUTATION OF MISSING DATA

Although the household records are largely complete, certain key variables are missing for a small number of records. Variables used to estimate household weights (see next section) are imputed if they are missing. Additional variables were created to flag households whose data is imputed rather than reported in the original survey. The imputation process for these variables is described below.

HOUSEHOLD INCOME

Household income was not reported for 3,642 (8.6%) of households. For these households, the most likely income was calculated by comparing households of the same size, number of vehicles owned, and tenure type (own versus rent). The imputed household income is the average income category of the comparable households. For cases where fewer than ten households were considered comparable, households were grouped to provide a larger sample.

HOUSEHOLD RESIDENTIAL TYPE

The residential unit type was not available for 69 households (0.2% of the full CHTS). Residential unit type was imputed for these households by examining the residential unit types of households with the same size, number of vehicles owned, and household income category. The imputed residential unit type (single family, multi-family, or other) is set to be the most common residential unit type for matching households.

AGE OF HEAD OF HOUSEHOLD

Age of the head of household could not be determined for one household. This household was assumed to have a head in the age 25-64 category.

ESTIMATION OF SURVEY WEIGHTS

Surveys are meant to capture the characteristics of an entire population by randomly sampling a small proportion of the population. Often, a perfectly random sample is hard to achieve — some groups are difficult to survey and are under-represented, other groups are over-represented. To balance this bias, sample weights are estimated to "reshape" the sample. Fehr & Peers estimated household sample weights for the CHTS to balance the survey sample to match county-level percentages for several variables as reported in the 2012 American Community Survey 5-year estimates. Variables used as controls for the re-weighting are:

- Household size (one to seven or more)
- Household income (nine income categories)
- Number of workers per household (zero to three or more)
- Number of vehicles owned per household (zero to four or more)
- Household residential unit type (three categories)
- Household size (one to five or more) cross-classified by household income (five categories)
- Household size (one to five or more) cross-classified by number of vehicles per household (zero to four or more)
- Household size (one to five or more) cross-classified by number of workers per household (zero to three or more)

Counties were weighted either individually or, in the case of counties with fewer CHTS households, in groups of at most four adjacent counties weighted as a single unit. The multi-county groups used for weighting where single-county sample sizes were insufficient were:

- Lake and Mendocino Counties
- Del Norte, Siskiyou, Lassen, Modoc, Plumas, Sierra, and Nevada Counties
- Shasta, Tehama, Trinity, Glenn, and Colusa Counties
- Yolo, Yuba, and Sutter Counties
- Alpine, Amador, Calaveras, Mariposa, Tuolomne, Inyo, and Mono Counties
- Monterey and San Benito Counties

Expansion weights, suitable for expanding CHTS data to represent the full population of a county, were calculated for each county individually. Separate expansion weights exist for all households, and for households whose travel day is a weekday.

Weighting reports for each of the eight San Joaquin Valley counties is in the appendix to this memo.

ATTACH MPO AND CENSUS DESIGNATED PLACE INFORMATION

Fields are added to the household record listing the MPO and the Census Designated Place (CDP) of the household location; fields are added to the trip record listing the MPO and CDP of the trip origin and destination. Many MPOs in California are a single county; in this case, the MPO code is identical to the county FIP code. Multi-county MPOs are coded as follows:

1. AMBAG: Santa Cruz, Monterey, and San Benito Counties
2. MTC: Alameda, Contra Costa, Solano, Napa, Sonoma, Marin, San Francisco, San Mateo, and Santa Clara Counties
3. SACOG: Sacramento, Yolo, Yuba, Sutter, and portions of El Dorado and Placer counties
4. SCAG: Los Angeles, Ventura, Orange, Riverside, Imperial, and San Bernardino counties
5. TMPO: Portions of El Dorado and Placer counties

El Dorado and Placer counties are divided between two MPOs: the Tahoe Basin area lies in TMPO while the remainder of the counties are part of SACOG. Records are coded into the proper MPO using their census tract.

ATTACH PERSON DATA

A limited amount of data from the raw CHTS person file is attached to the final household and trip records. Demographic information such as the traveler's age, racial identity, worker, and student status is attached to the trip record. Fields indicating the number of household members in various age categories are added to the household record, along with a field indicating the age category of the head of household. The age categories used are:

- Age 0-2
- Age 3-4
- Age 5-14
- Age 15-17
- Age 18-24
- Age 25-34
- Age 35-44
- Age 45-54
- Age 55-64
- Age 65-74
- Age 75 and up

APPENDIX B:

CALIFORNIA HOUSEHOLD TRAVEL SURVEY DATA DICTIONARY

MEMORANDUM

Date: April 21, 2015

To: File

From: Jennifer Ziebarth

Subject: Instructions for using CHTS cleaned data

WC14-3115

The purpose of this memo is to provide instructions for using the cleaned and re-weighted California Household Travel Survey data. It includes data dictionaries for both the household and trip files, and important instructions regarding the use of household and trip weights.

JOINING THE HOUSEHOLD AND TRIP FILES

The "sampno" variable is a household ID code which can be used to join the household and trip files.

USING THE WEIGHTS

Please note that the CHTS data comes with survey weights which must be correctly applied to yield accurate summaries.

There are three types of weights included with the cleaned CHTS data:

- Household-level weights (hhweight and hhexpweight)
- Trip-level weights (tripweight and tripexpweight)
- Trip correction factor (tcf)

In order to use CHTS data accurately, one or more of these weights must be applied. The following instructions describe when to use each type of weight, and explain and give examples of using the weights.

DETERMINING WHICH WEIGHTS TO USE

To determine which weights to use, consider the following criteria:

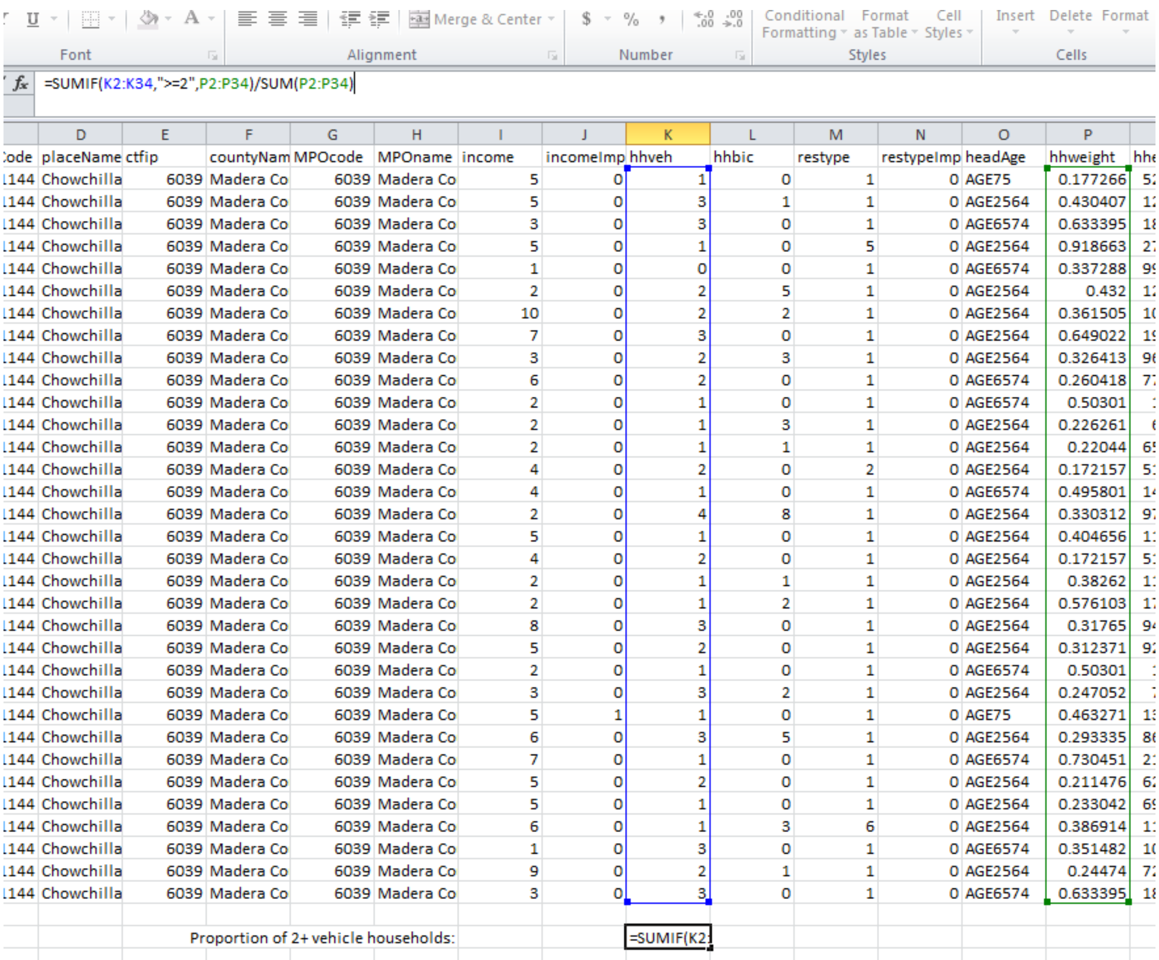
- When summing or averaging values that pertain to households, use the household weights *hhweight* or *hhexpweight*. Examples include calculating the percentage of 0-vehicle households in a region, calculating the average number of licensed drivers per household, or calculating the number of households in a region with school-aged children. The *hhweight* weighting factor will weight households relative to one another and is useful for computing percentages, while the *hhexpweight* factor will also provide estimates of the total number of households.
- When summing or averaging values that pertain to trips from different households, use the trip weights *tripweight* or *tripexpweight*. Examples include calculating the average distance per vehicle trip, calculating mode shares, or calculating the distribution of travel times. As with the household weights, *tripweight* will weight trips relative to one another and is useful for computing percentages, while the *tripexpweight* factor will also provide estimates of the total number of trips.
- When summing or averaging values that pertain to trips within a single household, use the trip correction factor *tcf*. Often this is not done on its own but as the first of a two-step process; an example is calculating average VMT per household: first sum the VMT per household using the *tcf* weight, then average each household's VMT using either the *hhweight* or the *hhexpweight* weight. Similar two-step processes should be used to calculate the number of person-trips per household and the number of vehicle-trips per household.
- When in doubt about which weight to use, please contact Jennifer Ziebarth. I'm more than happy to help or to double-check that you've chosen the right weighting factor for your situation.

EXAMPLE 1: PROPORTION OF 2-OR-MORE VEHICLE HOUSEHOLDS

To calculate the proportion of households with two or more vehicles, sum the weights of households with two or more vehicles, then divide by the sum of all household weights. In equation form:

$$Proportion\ of\ 2 - vehicle\ households = \frac{\sum_{2\ or\ more\ vehicle\ households}(household\ weight)}{\sum_{all\ households}(household\ weight)}$$

To do this in Excel, use the SUMIF and SUM functions:



	D	E	F	G	H	I	J	K	L	M	N	O	P	
ode	placeName	ctfip	countyNam	MPOcode	MPOname	income	incomeImp	hhveh	hhbic	restype	restypeImp	headAge	hhweight	hhe
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	0	1	0	1	0	AGE75	0.177266	52
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	0	3	1	1	0	AGE2564	0.430407	12
144	Chowchilla	6039	Madera Co	6039	Madera Co	3	0	3	0	1	0	AGE6574	0.633395	18
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	0	1	0	5	0	AGE2564	0.918663	27
144	Chowchilla	6039	Madera Co	6039	Madera Co	1	0	0	0	1	0	AGE6574	0.337288	99
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	2	5	1	0	AGE2564	0.432	12
144	Chowchilla	6039	Madera Co	6039	Madera Co	10	0	2	2	1	0	AGE2564	0.361505	10
144	Chowchilla	6039	Madera Co	6039	Madera Co	7	0	3	0	1	0	AGE2564	0.649022	19
144	Chowchilla	6039	Madera Co	6039	Madera Co	3	0	2	3	1	0	AGE2564	0.326413	96
144	Chowchilla	6039	Madera Co	6039	Madera Co	6	0	2	0	1	0	AGE6574	0.260418	77
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	1	0	1	0	AGE6574	0.50301	
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	1	3	1	0	AGE2564	0.226261	6
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	1	1	1	0	AGE2564	0.22044	65
144	Chowchilla	6039	Madera Co	6039	Madera Co	4	0	2	0	2	0	AGE2564	0.172157	51
144	Chowchilla	6039	Madera Co	6039	Madera Co	4	0	1	0	1	0	AGE6574	0.495801	14
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	4	8	1	0	AGE2564	0.330312	97
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	0	1	0	1	0	AGE2564	0.404656	11
144	Chowchilla	6039	Madera Co	6039	Madera Co	4	0	2	0	1	0	AGE2564	0.172157	51
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	1	1	1	0	AGE2564	0.38262	11
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	1	2	1	0	AGE2564	0.576103	17
144	Chowchilla	6039	Madera Co	6039	Madera Co	8	0	3	0	1	0	AGE2564	0.31765	94
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	0	2	0	1	0	AGE2564	0.312371	92
144	Chowchilla	6039	Madera Co	6039	Madera Co	2	0	1	0	1	0	AGE6574	0.50301	
144	Chowchilla	6039	Madera Co	6039	Madera Co	3	0	3	2	1	0	AGE2564	0.247052	7
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	1	1	0	1	0	AGE75	0.463271	13
144	Chowchilla	6039	Madera Co	6039	Madera Co	6	0	3	5	1	0	AGE2564	0.293335	86
144	Chowchilla	6039	Madera Co	6039	Madera Co	7	0	1	0	1	0	AGE6574	0.730451	21
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	0	2	0	1	0	AGE2564	0.211476	62
144	Chowchilla	6039	Madera Co	6039	Madera Co	5	0	1	0	1	0	AGE2564	0.233042	69
144	Chowchilla	6039	Madera Co	6039	Madera Co	6	0	1	3	6	0	AGE2564	0.386914	11
144	Chowchilla	6039	Madera Co	6039	Madera Co	1	0	3	0	1	0	AGE6574	0.351482	10
144	Chowchilla	6039	Madera Co	6039	Madera Co	9	0	2	1	1	0	AGE2564	0.24474	72
144	Chowchilla	6039	Madera Co	6039	Madera Co	3	0	3	0	1	0	AGE6574	0.633395	18
		Proportion of 2+ vehicle households:						=SUMIF(K2						

To do this in R, use the sum function, identifying the subset of households with at least two vehicles in the numerator and all households in the denominator.

```
> prop_2plus <- sum(chowchilla$hhweight[chowchilla$hhveh>=2]) / sum(chowchilla$hhweight)
> prop_2plus
[1] 0.4930628
> |
```

EXAMPLE 2: AVERAGE TRIP DISTANCE

To calculate average trip distance for a collection of trips, sum the products of each trip distance multiplied by the trip weight, then divide by the sum of all trip weights. In equation form:

$$Average\ trip\ distance = \frac{\sum_{trips}(trip\ distance) * (trip\ weight)}{\sum_{trips}(trip\ weight)}$$

To do this in Excel, use the SUMPRODUCT and SUM functions:

Font | Alignment | Number | Styles | Cells

=sumproduct(R2:R94,BA2:BA94)/sum(BA2:BA94)

	D	E	F	G	H	Q	R	AB	AO	AZ	BA	BB	BC
	dTract	oPlace	oPlaceNam	dPlace	dPlaceNam	tripPurp	totalDist	modeString	age	tcf	tripweight	tripexpweight	
01	300	1144	Chowchilla	1144	Chowchilla	NHB	5.664943	Drive Alone	62	1.085538	0.186883	67.43078	
00	300	1144	Chowchilla	1144	Chowchilla	HBO	0.664659	Drive Alone	62	1.331198	0.229175	82.69053	
00	300	1144	Chowchilla	1144	Chowchilla	HBO	0.926246	Drive Shared 2	62	1.331198	0.229175	82.69053	
00	300	1144	Chowchilla	1144	Chowchilla	HBO	0.872687	Drive Alone	63	1.08895	0.187471	67.64272	
00	300	1144	Chowchilla	1144	Chowchilla	HBO	0.872687	Drive Alone	63	1.08895	0.187471	67.64272	
00	300	1144	Chowchilla	1144	Chowchilla	HBO	0.926246	Drive Shared 2	63	1.331198	0.229175	82.69053	
00	300	1144	Chowchilla	1144	Chowchilla	HBS	0.64899	Drive Shared 2	60	2.174432	0.83198	300.1934	
00	300	1144	Chowchilla	1144	Chowchilla	HBS	0.644164	Drive Shared 2	60	2.174432	0.83198	300.1934	
00	300	1144	Chowchilla	1144	Chowchilla	HBS	0.64899	Drive Shared 2	58	2.174432	0.83198	300.1934	
00	300	1144	Chowchilla	1144	Chowchilla	HBS	0.64899	Drive Shared 2	58	2.174432	0.83198	300.1934	
00	202	1144	Chowchilla	1144	Chowchilla	HBO	2.994741	Walk	18	0.696995	0.401541	144.8832	
02	300	1144	Chowchilla	1144	Chowchilla	HBO	2.994741	Drive Shared 2	18	0.988271	0.569346	205.4302	
02	300	1144	Chowchilla	1144	Chowchilla	HBO	5.840582	Drive Alone	77	1.188906	0.377656	136.265	
00	300	1144	Chowchilla	1144	Chowchilla	NHB	0.913314	Drive Shared 3	27	1.331198	0.328875	118.6639	
00	300	1144	Chowchilla	1144	Chowchilla	HBO	1.999179	Drive Alone	27	1.331198	0.328875	118.6639	
02	300	1144	Chowchilla	1144	Chowchilla	HBO	0.644646	Drive Alone	37	1.08895	0.319427	115.255	
00	202	1144	Chowchilla	1144	Chowchilla	HBO	0.642672	Drive Shared 3	37	1.08895	0.319427	115.255	
02	300	1144	Chowchilla	1144	Chowchilla	HBO	1.388131	Drive Shared 2	37	1.331198	0.390487	140.8946	
00	202	1144	Chowchilla	1144	Chowchilla	HBO	1.388131	Drive Alone	37	1.331198	0.390487	140.8946	
02	300	1144	Chowchilla	1144	Chowchilla	HBO	0.644646	Drive Shared 3	31	1.331198	0.390487	140.8946	
00	300	1144	Chowchilla	1144	Chowchilla	NHB	2.387291	Drive Alone	31	1.331198	0.390487	140.8946	
00	300	1144	Chowchilla	1144	Chowchilla	NHB	1.514051	Drive Alone	31	1.331198	0.390487	140.8946	
00	202	1144	Chowchilla	1144	Chowchilla	HBO	1.388131	Drive Shared 2	31	1.331198	0.390487	140.8946	
02	201	1144	Chowchilla	1144	Chowchilla	HBK	6.436982	School Bus	10	1.365993	0.400693	144.5773	
01	300	1144	Chowchilla	1144	Chowchilla	NHB	5.901662	School Bus	10	0.988271	0.289894	104.5991	
00	202	1144	Chowchilla	1144	Chowchilla	HBO	0.642672	Drive Shared 3	10	1.188906	0.348748	125.8344	
02	202	1144	Chowchilla	1144	Chowchilla	HBK	2.771092	School Bus	8	1.208368	0.354457	127.8942	
02	202	1144	Chowchilla	1144	Chowchilla	HBK	2.773391	School Bus	8	1.173979	0.344369	124.2544	
02	300	1144	Chowchilla	1144	Chowchilla	HBO	1.388131	Drive Shared 2	8	1.08895	0.319427	115.255	
00	202	1144	Chowchilla	1144	Chowchilla	HBO	1.388131	Drive Shared 2	8	1.08895	0.319427	115.255	
02	300	1144	Chowchilla	1144	Chowchilla	HBW	2.674768	Drive Alone	65	1.079488	0.228286	82.3697	
00	300	1144	Chowchilla	1144	Chowchilla	WBO	0.242534	Drive Alone	65	1.273109	0.269232	97.14383	
00	202	1144	Chowchilla	1144	Chowchilla	HBS	2.490271	Drive Alone	65	1.273109	0.269232	97.14383	
02	300	1144	Chowchilla	1144	Chowchilla	HBW	2.674768	Drive Alone	65	1.079488	0.228286	82.3697	
00	202	1144	Chowchilla	1144	Chowchilla	HBW	3.015911	Drive Alone	65	1.079488	0.228286	82.3697	
02	201	1144	Chowchilla	1144	Chowchilla	HBW	6.905395	Drive Alone	59	0.988271	0.208996	75.40944	
01	202	1144	Chowchilla	1144	Chowchilla	HBW	6.905395	Drive Alone	59	1.188906	0.251425	90.71877	
					Average trip distance		=sumproduct(R2:R94,BA2:BA94)/sum(BA2:BA94)						

To do this in R, use the weighted.mean function:

```
> weighted.mean(chowchilla_ii_trips$totalDist,chowchilla_ii_trips$tripweight)
[1] 2.282369
> 
```

EXAMPLE 3: VMT PER HOUSEHOLD

To calculate the average VMT per household requires working with both the trips and households data, and using two different weights at different steps of the process. Note the "sampno" variable is a household ID which can be used to join the household and trip data to each other.

The first step in calculating VMT per household is to find the sum of all vehicle trip distances for each household, using the trip correction factor as a weight. Note that to select vehicle trips you can select trips for which autoDriver=1; this will select each vehicle trip exactly once. The total VMT per household is the sum $VMT = \sum_{vehicle\ trips}(trip\ distance) * (tcf)$.

The second step in calculating VMT per household is to find the weighted average of all of the household VMTs just calculated. Because we're working per household, we need to use the household weights:

$$Average\ VMT\ per\ household = \frac{\sum_{households}(household\ VMT) * (household\ weight)}{\sum_{households}(household\ weight)}$$

DATA DICTIONARY: HOUSEHOLDS

The following table documents the variables in the cleaned household data file.

HOUSEHOLDS FILE DATA DICTIONARY

Variable	Description
sampno	Household ID
hctract	Census tract of household residence. A 10-digit ID which includes the county FIP as well as the census tract.
placeCode, placeName	Census Designated Place of household residence
ctfip,countyName	County of household residence
MPOcode, MPOname	MPO of household residence. Same as county for 1-county MPOs.
servicepop	Service population: Jobs + workers within 45 minutes by auto (time-decay-weighted)
income, incomeImputed	Household income category, flag for imputed data 1 = Less than \$10,000 2 = \$10,000 - \$24,999 3 = \$25,000 - \$34,999 4 = \$35,000 - \$49,999 5 = \$50,000 - \$74,999 6 = \$75,000 - \$99,999 7 = \$100,000 - \$149,999 8 = \$150,000 - \$199,999 9 = \$200,000 or more
hhsize	Number of household residents
hhemp, hhstu, hhlic	Number of household workers, students, driver's license holders
hhveh, hhbic	Number of vehicles and number of bicycles owned by household
restype, restypeImputed	Residential unit type, flag for imputed data

HOUSEHOLDS FILE DATA DICTIONARY

Variable	Description
headAge, headAgeImputed	Age category of HH head, flag for imputed data
tripMonth	Month of travel day
tripDay	Day of week for travel day
householdTrips	Total number of person-trips taken by household members on the travel day
Age0002, Age0304, Age0514, Age1517, Age1824, Age2534, Age3544, Age4554, Age5564, Age6574, Age75	The number of household residents in each age category
hhweight	Household weight
hhexpweight, hhexpweight_weekday	Household expansion weight for all households and for weekday subset of households

Data sources: 2012 CHTS household and person files, as cleaned and prepared by F&P; for details see the CHTS data preparation memo.

DATA DICTIONARY: TRIPS

The following table documents the variables in the cleaned trips data file.

TRIPS FILE DATA DICTIONARY

Variable	Description
sampno, perno	Household ID, person ID
chainno, numLegs	Trip chain ID, number of legs in trip chain
dep_hr, dep_min, arr_hr, arr_min	Time of trip departure & arrival (hour, minute)
tripPurp	Trip purpose (7 categories)
modeString	Trip mode (16 categories)
totalDist, totalTime	Total trip distance (miles) and time (minutes)
oTract, dTract	Census tract of trip origin and destination. (10-digit number, includes county FIP code)
pTract, aTract	Census tract of trip production and attraction
oPlace, oPlaceName, dPlace, dPlaceName	Census Designated Place of trip origin and destination
pPlace, pPlaceName, aPlace, aPlaceName	Census Designated Place of trip production and attraction

TRIPS FILE DATA DICTIONARY

Variable	Description
oFIP, oCountyName, dFIP, dCountyName	County of trip origin and destination
pFIP, pCountyName, aFIP, aCountyName	County of trip production and attraction
oMPO, oMPOname, dMPO, dMPOname	MPO of trip origin & destination (same as county for one-county MPOs)
pMPO, pMPOname, aMPO, aMPOname	MPO of trip production and attraction
oServicePop, dServicePop	Service population (jobs + workers within 45 minutes by auto, time-decay-weighted) at trip origin and destination
opurp, dpurp	Purpose recorded at trip origin and destination
opurp1,opurp2,opurp3,dpurp1,dpurp2,dpurp3	Detailed activity purpose codes at trip origin and destination
totalDist	Total trip distance (including transit access/egress)
accessDist, xferDist, egressDist	Transit access, transfer , egress distances
IVT, accessTime, xferTime, egressTime, waitTime	In-vehicle time, transit access, transfer, egress, and wait times
dwellTime	Time spent at trip destination
autoDriver	Flag for driver of auto trips
nonHHDriver	Flag for trips where the respondent is a passenger on a trip where a non-HH member is the driver
hhmem, nonhhmem	Count of HH and non-HH passengers on trip (not including the driver)
escortFlag	Flag for trip whose only discernable purpose is to escort another person
accMode, egrMode	Transit access and egress modes
accOcc, egrOcc	Vehicle occupancy of access and egress modes
age	Age of trip-maker
gender,ntvty, hisp,race,disab	Gender, nativity, Hispanic & racial identity, disability status of trip-maker
worker,student, schoolType	Worker & student status, and school type of trip-maker
license, transPass	Driver's license, transit pass status of trip-maker
tcf, tripweight	Trip correction factor , trip weight

Data sources: Data sources: 2012 CHTS person, place, and activity files, as cleaned and prepared by F&P; for details see the CHTS data preparation memo.

APPENDIX C:

SIMPLE SUMMARIES OF CHTS DATA

MEMORANDUM

Date: December 29, 2015

To: File

From: Jennifer Ziebarth

Subject: Data dictionary for CHTS simple summaries

WC14-3115

The purpose of this memo is to provide a data dictionary for the "simple" summaries of CHTS data. These summaries come in both Excel (.xlsx) and csv (.csv) formats. The summaries have one record for each geographic unit and are suitable for joining to a shapefile for visualization in GIS. The data summarized here includes the most commonly requested data from the CHTS including mode shares, trip purposes, trip distance, and trip time.

DATA DICTIONARY: CHTS SIMPLE SUMMARIES

Grouping	Variable	Description
Geography	geogCode, geogName, geogType, lookup	Code, name, and type of geography (e.g., state, county, MPO, or "place" (city or named place recognized by census). The lookup field is useful for creating VLOOKUPs in Excel, and helps to distinguish between cities and counties with the same name (e.g., Alameda_place is the city of Alameda; Alameda_county is the county.)
Households, Trips, and Sample Sizes	HHsampleSize, PTsampleSize,VTsampleSize	Number of household, person-trip, and vehicle-trip records in the CHTS for this geography. CAUTION: If there are fewer than 100 households or trips for a geography, then the corresponding summaries should be used with caution. If there are fewer than 30 households for a given geography, it is excluded from this summary. Consult Jennifer Ziebarth for advice on how to proceed.

DATA DICTIONARY: CHTS SIMPLE SUMMARIES

Grouping	Variable	Description
Households, Trips, and Sample Sizes	numHH, numPersonTrips, numVehTrips	The total number of households, person-trips, and vehicle trips represented by the CHTS for this geography.
Person-Trips per Household	PersonTrips_per_HH, PersonTrips_per_HH_HBW, PersonTrips_per_HH_HBO, PersonTrips_per_HH_NHB	The average number of person-trips per household, total and by trip purpose. Includes all travel modes, and all trips regardless of o/d.
Person-Trips per Household	PMT_per_HH, PMT_per_HH_HBW, PMT_per_HH_HBO, PMT_per_HH_NHB	The average number of person-miles traveled per household, total and by trip purpose. Includes all travel modes, and all trips regardless of o/d.
Person-Trips per Household	PHT_per_HH, PHT_per_HH_HBW, PHT_per_HH_HBO, PHT_per_HH_NHB	The average number of person-hours traveled per household, total and by trip purpose. Includes all travel modes, and all trips regardless of o/d.
Vehicle-Trips per Household	VehicleTrips_per_HH, VehicleTrips_per_HH_HBW, VehicleTrips_per_HH_HBO, VehicleTrips_per_HH_NHB	The average number of vehicle-trips per household, total and by trip purpose. Includes all trips regardless of o/d.
Vehicle-Trips per Household	VMT_per_HH, VMT_per_HH_HBW, VMT_per_HH_HBO, VMT_per_HH_NHB	The average number of vehicle-miles traveled per household, total and by trip purpose. Includes all trips regardless of o/d.
Vehicle-Trips per Household	VHT_per_HH, VHT_per_HH_HBW, VHT_per_HH_HBO, VHT_per_HH_NHB	The average number of vehicle-hours traveled per household, total and by trip purpose. Includes all trips regardless of o/d.
Person-Trips per Household (ii only)	PersonTrips_per_HH_ii, PersonTrips_per_HH_HBW_ii, PersonTrips_per_HH_HBO_ii, PersonTrips_per_HH_NHB_ii	The average number of person-trips per household, total and by trip purpose. Includes all travel modes, but only trips *within the named geography.*
Person-Trips per Household (ii only)	PMT_per_HH_ii, PMT_per_HH_HBW_ii, PMT_per_HH_HBO_ii, PMT_per_HH_NHB_ii	The average number of person-miles traveled per household, total and by trip purpose. Includes all travel modes, but only trips *within the named geography.*
Person-Trips per Household (ii only)	PHT_per_HH_ii, PHT_per_HH_HBW_ii, PHT_per_HH_HBO_ii, PHT_per_HH_NHB_ii	The average number of person-hours traveled per household, total and by trip purpose. Includes all travel modes, but only trips *within the named geography.*

DATA DICTIONARY: CHTS SIMPLE SUMMARIES

Grouping	Variable	Description
Vehicle-Trips per Household (ii only)	VehicleTrips_per_HH_ii, VehicleTrips_per_HH_HBW_ii, VehicleTrips_per_HH_HBO_ii, VehicleTrips_per_HH_NHB_ii	The average number of vehicle-trips per household, total and by trip purpose. Includes only trips *within the named geography*.
Vehicle-Trips per Household (ii only)	VMT_per_HH_ii, VMT_per_HH_HBW_ii, VMT_per_HH_HBO_ii, VMT_per_HH_NHB_ii	The average number of vehicle-miles traveled per household, total and by trip purpose. Includes only trips *within the named geography*.
Vehicle-Trips per Household (ii only)	VHT_per_HH_ii, VHT_per_HH_HBW_ii, VHT_per_HH_HBO_ii, VHT_per_HH_NHB_ii	The average number of vehicle-hours traveled per household, total and by trip purpose**.** Includes only trips *within the named geography*.
Person-Trip Distance by mode & purpose	PersonTrip_Avg_Distance_*mode-_purpose*	Average person-trip distance (miles) for each combination of mode and purpose. Includes ii trips (trips internal to the named geography) only.
Person-Trip Time by mode & purpose	PersonTrip_Avg_Time_*mode_purpose*	Average person-trip time (minutes) for each combination of mode and purpose. Includes ii trips (trips internal to the named geography) only.
Daily mode shares	modeShare_*mode_purpose*	Average daily mode share for the listed mode within all trips of the listed purpose. If no purpose is listed, mode share is for trips of all purposes. Includes ii trips (trips internal to the named geography) only.
Peak period mode shares	modeShare_*mode_purpose*_peak	Average peak period mode share for the listed mode within all trips of the listed purpose. For purposes of this summary, peak period is defined as 6-9 AM and 4-7 PM. If no purpose is listed, mode share is for trips of all purposes. Includes ii trips (trips internal to the named geography) only.
Daily purpose shares	purpShare_*mode_purpose*	Average daily purpose share for the listed purpose within all trips of the listed mode. Includes ii trips (trips internal to the named geography) only.
Peak period purpose shares	purpShare_*mode_purpose*_peak	Average peak period purpose share for the listed purpose within all trips of the listed mode. For purposes of this summary, peak period is defined as 6-9 AM and 4-7 PM. Includes ii trips (trips internal to the named geography) only.
Direction Share	dirShare_*direction_purpose*	Average daily share of trips by direction: internal (ii), outgoing (ix), and incoming (xi), within all trips of the given purpose. If no purpose is listed, then share of trips by direction for all purposes combined.

Data sources: 2012 CHTS household, person, place, and activity files, with F&P modifications
Summarized using script MasterCHTSSummaries.R

APPENDIX D:

FLAT SUMMARIES OF CHTS DATA

MEMORANDUM

Date: April 22, 2015

To: File

From: Jennifer Ziebarth

Subject: Data dictionary for CHTS flat summaries

WC14-3115

The purpose of this memo is to provide a data dictionary for the "flat" summaries of CHTS data. These summaries come in both Excel (.xlsx) and csv (.csv) formats. The summaries have one record for each geographic unit and are suitable for joining to a shapefile for visualization in GIS.

DATA DICTIONARY: CHTS FLAT SUMMARIES

Grouping	Variable	Description
Geography	geogCode, geogName, geogType	Code, name, and type of geography (e.g., state, county, MPO, or "place" (city or named place recognized by census)
Number of Households and Trips	numHH, HHsampleSize, HH_Warning	Number of households represented by the CHTS for this geography, CHTS household sample size for this geography, and warning indicating whether data should be used with caution (*, 100 households or fewer) or used only when aggregated to include more households (**, 30 households or fewer).
Number of Households and Trips	numVehTrips, VTsampleSize, vehTripWarning	Number of vehicle trips represented by the CHTS for this geography, CHTS vehicle trip sample size for this geography, and warning indicating whether data should be used with caution (*, 100 vehicle trips or fewer) or used only when aggregated to include more vehicle trips (**, 30 vehicle trips or fewer).

DATA DICTIONARY: CHTS FLAT SUMMARIES

Grouping	Variable	Description
Number of Households and Trips	numPersonTrips, PTsampleSize, personTripWarning	Number of person trips represented by the CHTS for this geography, CHTS person trip sample size for this geography, and warning indicating whether data should be used with caution (*, 100 person trips or fewer) or used only when aggregated to include more person trips (**, 30 person trips or fewer).
Demographics	HH1, HH2, HH3, HH4, HH5, hhsize	Percentage of households with 1, 2, 3, 4, or 5+ members; average number of persons per household
Demographics	Veh0,Veh1,Veh2,Veh3,Veh4; hhveh	Percentage of households with 0,1,2,3, or 4+ autos; average number of vehicles per household
Demographics	Inc1, Inc2, Inc3, Inc4, Inc5, Inc6, Inc7, Inc8, Inc9	Percentage of households in each income category: 1. Less than $10,000 2. $10,000 to $24,999 3. $25,000 to $34,999 4. $35,000 to $49,999 5. $50,000 to $74,999 6. $75,000 to $99,999 7. $100,000 to $149,999 8. $150,000 to $199,999 9. $200,000 or more
Demographics	RUG1, RUG3, RUG6	Percentage of households by residential type. RUG1 = Single family; RUG3=Multi-family; RUG6 = Other (e.g., Mobile home, RV, boat)
Demographics	Age1824,Age2564,Age6574, Age75	Percentage of households by age category of household head
Demographics	Pop0005, Pop0514, Pop1517, Pop1824, Pop2554, Pop5564, Pop6574, Pop75	Average number of residents per HH in each category
Household Summaries	VMT_per_HH_*purpose_mode*	Average VMT per Household by purpose and mode.
Household Summaries	VehicleTrips_per_HH_*purpose_mode*	Average Vehicle Trips per Household by purpose and mode
Household Summaries	PersonTrips_per_HH_*purpose_mode*	Average Person Trips per Household by purpose and Mode
Vehicle Trip Summaries	numVehTrips_*purpose_mode_distribution*	Total number of vehicle trips represented for each combination of purpose, mode, distribution

DATA DICTIONARY: CHTS FLAT SUMMARIES

Grouping	Variable	Description
Vehicle Trip Summaries	vehDist_*purpose_mode_distribution*	Average vehicle trip distance for each combination of purpose, mode, distribution
Vehicle Trip Summaries	vehTime_*purpose_mode_distribution*	Average vehicle trip time for each combination of purpose, mode, distribution
Vehicle Trip Summaries	vehOcc_*purpose_mode_distribution*	Average vehicle occupancy for each combination of purpose, mode, distribution
Person Trip Summaries	numPersonTrips_*purpose_mode_distribution*	Total number of person trips represented for each combination of purpose, mode, distribution
Person Trip Summaries	PersDist_*purpose_mode_distribution*	Average person trip distance for each combination of purpose, mode, distribution
Person Trip Summaries	PersTime_*purpose_mode_distribution*	Average person trip time for each combination of purpose, mode, distribution

Data sources: 2012 CHTS household and person files, with F&P modifications
Summarized using script MasterCHTSSummaries.R

APPENDIX E:

FILTERABLE SUMMARIES OF CHTS DATA

MEMORANDUM

Date: December 29, 2015

To: File

From: Jennifer Ziebarth

Subject: Data dictionary for CHTS filterable summaries

WC14-3115

The purpose of this memo is to provide instructions for using the “filterable” summaries of CHTS data. Unlike the “flat” summaries, which are comparatively small in size, the “filterable” summaries allow for filtering based on multiple criteria, and as such they are quite large files. To simplify the summaries and allow for somewhat smaller file sizes, the filterable summaries are separated into two files, household summaries and trip summaries, which are described below.

INSTRUCTIONS AND HINTS

The filterable summaries allow CHTS data to be viewed by geography as well as selecting households or trips with certain demographic or travel profiles, such as households with two or more vehicles owned, or trips internal to the geography.

In most cases it is possible to select any combination of filter variables and see a summary of the relevant CHTS data. However, note that for some combinations the sample size of CHTS households, vehicle trips, or person trips may be quite small. Warning fields indicate whether the data can be used on its own, should be viewed with caution, or used only when aggregated with other data.

	Large enough sample size for confident reporting.
*	Use with caution: sample size may be not be large enough for statistical confidence.
**	Do not use in isolation. Sample size is too small for this result to stand on its own.

OTHER TIPS

- Non-vehicle modes such as bike, walk, or transit always have 0 vehicle trips per household in the household summaries, and 0 vehicle trips in the trip summaries, because these modes do not generate vehicle trips.
- Mode shares (and other “share” variables) are measured relative to mode= “All,” with all other filters identical.
- Note that in some cases cities and counties share a name, so you may need to filter on both geogName and geogType to get the result you’re looking for.

EXAMPLES

The examples below shows some of the tips above:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Geography			Filter variables						Summaries per Household								
2	geogCode	geogName	geogType	HH size	HH vehicles	HH income	Trip purpose	Mode	Peak	HH total	HH sample size	HH Warning	Vehicle Trips per HH Mea	VMT per HH Mean	VHT per HH Mean	Person Trips per HH Mea	PMT per HH Mean	PHT per HH Mean
345	1797	Tulare	place	All	All	All	All	Bike	All	10,739	57	*	0.0	0.0	0.0	0.0	0.0	0.0
346	6107	Tulare	county	All	All	All	All	Bike	All	113,379	464		0.0	0.0	0.0	0.1	0.1	0.0
347	1797	Tulare	place	All	All	All	All	DriveAlon	All	10,739	57	*	4.4	25.5	1.1	4.4	25.5	1.1
40726	6107	Tulare	county	All	All	All	All	DriveAlon	All	113,379	464		4.9	35.4	1.2	4.9	35.5	1.2
40727	1797	Tulare	place	All	All	All	All	DriveShar	All	10,739	57	*	2.0	6.3	0.4	3.6	12.6	0.6
40728	6107	Tulare	county	All	All	All	All	DriveShar	All	113,379	464		1.8	11.2	0.4	3.3	20.9	0.8
86763	1797	Tulare	place	All	All	All	All	DriveShar	All	10,739	57	*	0.5	0.9	0.1	2.4	3.4	0.2
86764	6107	Tulare	county	All	All	All	All	DriveShar	All	113,379	464		0.9	5.1	0.2	3.0	14.5	0.7
86765	1797	Tulare	place	All	All	All	All	Other	All	10,739	57	*	0.0	0.0	0.0	0.3	0.7	0.1
86766	6107	Tulare	county	All	All	All	All	Other	All	113,379	464		0.0	0.0	0.0	0.3	1.7	0.1
127407	1797	Tulare	place	All	All	All	All	Transit	All	10,739	57	*	0.0	0.0	0.0	0.0	0.3	0.0
127408	6107	Tulare	county	All	All	All	All	Transit	All	113,379	464		0.0	0.0	0.0	0.1	1.8	0.1
127409	1797	Tulare	place	All	All	All	All	Walk	All	10,739	57	*	0.0	0.0	0.0	0.9	0.5	0.1
127410	6107	Tulare	county	All	All	All	All	Walk	All	113,379	464		0.0	0.0	0.0	1.5	0.8	0.3

- The summary shows both the city of Tulare and the county of Tulare; the CHTS has 464 households in the county, but only 57 households in the city. Thus, summaries for the city should be used with caution.
- Vehicle trips, VMT, and VHT per household are 0 for all modes except the drive modes.

	Geography			Filter variables								Summaries per person-trip								
	geogCode	geogName	geogType	HH size	HH vehicles	HH income	Trip purpose	Mode	Resident	Direction	Peak	Total Number of Person Trips	Person-trip Sample Size	Person Trip Warning	Person-trip Mode Share	Person-trip Purpose Share	Person-trip Resident Share	Person-trip Direction Share	Person-trip Distance Mean	Person-trip Time Mean
54	1797	Tulare	place	All	All	All	All	All	Res	ii	All	101,614	312		100%	100%	94%	83%	1.4	8.1
86	1797	Tulare	place	All	All	All	All	Bike	Res	ii	All	98	1	**	0%	100%	100%	100%	2.4	24.0
98	1797	Tulare	place	All	All	All	All	DriveAlon	Res	ii	All	34,581	132		34%	100%	90%	74%	1.7	9.0
33	1797	Tulare	place	All	All	All	All	DriveShar	Res	ii	All	31,815	80	*	31%	100%	100%	86%	1.4	8.0
65	1797	Tulare	place	All	All	All	All	DriveShar	Res	ii	All	21,865	56	*	22%	100%	93%	89%	1.2	5.4
94	1797	Tulare	place	All	All	All	All	Other	Res	ii	All	3,537	10	**	3%	100%	100%	100%	2.0	14.9
37	1797	Tulare	place	All	All	All	All	Walk	Res	ii	All	9,718	33	*	10%	100%	100%	99%	0.6	9.0
45	6107	Tulare	county	All	All	All	All	All	Res	ii	All	1,378,601	3,986		100%	100%	99%	96%	3.8	12.5
77	6107	Tulare	county	All	All	All	All	Bike	Res	ii	All	7,461	38	*	1%	100%	100%	100%	1.1	17.7
93	6107	Tulare	county	All	All	All	All	DriveAlon	Res	ii	All	513,362	1,729		37%	100%	99%	94%	4.8	12.8
29	6107	Tulare	county	All	All	All	All	DriveShar	Res	ii	All	337,192	1,042		24%	100%	99%	95%	4.2	11.5
65	6107	Tulare	county	All	All	All	All	DriveShar	Res	ii	All	325,740	734		24%	100%	100%	97%	3.3	11.3
98	6107	Tulare	county	All	All	All	All	Other	Res	ii	All	30,612	79	*	2%	100%	100%	95%	4.5	24.8
25	6107	Tulare	county	All	All	All	All	Transit	Res	ii	All	6,100	29	**	0%	100%	100%	86%	4.4	37.4
47	6107	Tulare	county	All	All	All	All	Walk	Res	ii	All	158,133	335		11%	100%	100%	100%	0.5	12.4

- All visible entries for "purpose share" are 100%, because trip purpose has been filtered to show all trip purposes combined ("All").
- Mode shares for rows where mode= "All" are 100%, while mode shares in other rows are smaller than 100%. The 34% mode share in the third row indicates that that row's mode ("Drive Alone") represents 34% of all person trips with the selected characteristics: In the city of Tulare, all household sizes, vehicles, and incomes, trips by residents only ("Res"), and only trips within Tulare ("ii").
- In many cases shown the number of households or trips is too small to draw any conclusions with the visible data. For example, the second row indicates the CHTS has only one weekday person trip, made by a resident of the city of Tulare, within that city, by bike. The red highlight serves as a warning that this single trip is not enough to draw wider conclusions.

DATA DICTIONARIES

DATA DICTIONARY: CHTS HOUSEHOLD FILTERABLE SUMMARIES

Type	Variable	Description
Geography	geogCode, geogName, geogType	Code, name, and type of geography (e.g., state, county, region/MPO, or "place" (city or named place recognized by census)
Filter	HH size	Household size : HH1=1, HH2=2, HH3=3, HH4=4, HH5=5 or more, HH4+ = 4 or more,
	HH vehicles	Number of vehicles owned by household: Veh0=0, Veh1=1, Veh2=2, Veh3=3, Veh4=4 or more, Veh2+ = 2 or more

DATA DICTIONARY: CHTS HOUSEHOLD FILTERABLE SUMMARIES

Type	Variable	Description
	HH income	Household income by category: Low = $0 - $49,999; Med = $50,000 - $99,999; High = $100,000 or more
	Trip purpose	Trip purpose, 3 categories (HBW, HBO, NHB). "HB" includes both HBW and NHB.
	Mode	Mode (Active, Drive Alone, Drive Shared 2, Drive Shared 3+, Transit, Other)
	Peak	All = All trips; Peak = 6-9am or 4-7pm; Offpeak = all other times
Summaries Per Household	HH total	Total number of households
	HH sample size	Number of CHTS household records
	HH Warning	Warning indicating whether data should be used with caution (*, 100 households or fewer) or used only when aggregated to include more households (**, 30 households or fewer).
	Person Trips per HH Mean	Average number of person trips per household
	PMT per HH Mean	Average Person Miles Traveled per household
	PHT per HH Mean	Average Person Hours Traveled per household
	Vehicle Trips per HH Mean	Average number of vehicle trips per household
	VMT per HH Mean	Average Vehicle Miles Traveled per household
	VHT per HH Mean	Average Vehicle Hours Traveled per household

Data sources: 2012 CHTS, as cleaned and summarized by Fehr & Peers

DATA DICTIONARY: CHTS TRIP FILTERABLE SUMMARIES

Type	Variable	Description
Geography	geogCode, geogName, geogType	Code, name, and type of geography (e.g., state, county, MPO, or "place" (city or named place recognized by census)
Filter	HH size	Household size : HH1=1, HH2=2, HH3=3, HH4=4, HH5=5 or more, HH4+ = 4 or more,

DATA DICTIONARY: CHTS TRIP FILTERABLE SUMMARIES

Type	Variable	Description
	HH vehicles	Number of vehicles owned by household: Veh0=0, Veh1=1, Veh2=2, Veh3=3, Veh4=4 or more, Veh2+ = 2 or more
	HH income	Household income by category: Low = $0 - $49,999; Med = $50,000 - $99,999; High = $100,000 or more
	Trip purpose	Trip purpose, 3 categories (HBW, HBO, NHB). "HB" includes both HBW and NHB.
	Mode	Mode (Active, Drive Alone, Drive Shared 2, Drive Shared 3+, Transit, Other)
	Resident	Restrict to residents of the listed geography? Res= Only residents; Non= Only non-residents; All = Both residents and non-residents
	Direction	Direction of trip, relative to the listed geography. ii =internal trip within the geography. ix = outgoing trip which starts inside and ends outside the geography. xi = incoming trip which begins outside and ends inside the geography.
	Peak	All = All trips; Peak = 6-9am or 4-7pm; Offpeak = all other times
Summaries per Vehicle Trip	Total Number of Vehicle Trips	Total number of vehicle trips
	Vehicle trip sample size	Number of CHTS vehicle trip records
	Vehicle Trip Warning	Warning indicating whether data should be used with caution (*, 100 vehicle trips or fewer) or used only when aggregated to include more vehicle trips (**, 30 vehicle trips or fewer).
	Vehicle Trip Mode Share, Vehicle Trip Purpose Share, Vehicle Trip Resident Share, Vehicle Trip Direction Share	Percent of vehicle trips with the current mode , purpose, residence status, or direction
	Vehicle Trip Distance Mean	Average vehicle trip distance
	Vehicle Trip Time Mean	Average vehicle trip time
	Vehicle Occupancy Mean	Average vehicle occupancy per vehicle trip
	Total Number of Person Trips	Total number of person trips
	Person Trip Sample Size	Number of CHTS person trip records

DATA DICTIONARY: CHTS TRIP FILTERABLE SUMMARIES

Type	Variable	Description
Summaries per Person Trip	Person Trip Warning	Warning indicating whether data should be used with caution (*, 100 person trips or fewer) or used only when aggregated to include more vehicle trips (**, 30 person trips or fewer).
	Person Trip Mode Share, Person Trip Purpose Share, Person Trip Resident Share, Person Trip Direction Share	Percent of person trips with the current mode , purpose, residence status, or direction
	Person Trip Distance Mean	Average person trip distance
	Person Trip Time Mean	Average person trip time

Data sources: 2012 CHTS, as cleaned and summarized by Fehr & Peers

APPENDIX F:
SIMPLIFIED CHTS DATA

MEMORANDUM

Date: October 7, 2015

To: File

From: Jennifer Ziebarth

Subject: How to use simplified CHTS data

WC14-3115

The purpose of this memo is to provide a data dictionary and instructions for using the simplified CHTS data (also known as "pivot summaries"). This data comes in .csv format and is intended to be further processed in Excel.

DATA DICTIONARY

The table below lists the variables present in the simplified CHTS data.

DATA DICTIONARY: SIMPLIFIED CHTS DATA

Grouping	Variables	Description
Location	oTract, dTract, homeTract, workTract	Census tract for trip origin, destination, home location, and (for respondents with a work trip on survey date) work location. Census tracts are listed as 10-digit state+county+tract FIPS code.
Location	oPlace, dPlace, homePlace, workPlace	Census Designated Place (e.g., city or other named place) for trip origin, destination, home location, and (for respondents with a work trip on survey date) work location.
Location	oFIP, dFIP, homeFIP, workFIP; oCounty, dCounty, homeCounty, workCounty	County (both FIPS code and name) for trip origin, destination, home location, and (for respondents with a work trip on survey date) work location.

DATA DICTIONARY: SIMPLIFIED CHTS DATA

Grouping	Variables	Description
Location	oRegion, dRegion, homeRegion, workRegion	Region for trip origin, destination, home location, and (for respondents with a work trip on survey date) work location. Regions are multi-county MPOs or other multi-county regions as listed below: • AMBAG: Monterey, San Benito, and Santa Cruz Counties • MTC: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma Counties • SACOG: El Dorado*, Placer*, Sacramento, Sutter, Yolo, and Yuba Counties, excluding Tahoe Basin area of El Dorado and Placer counties • SCAG: Imperial, Los Angeles, Orange, Riverside, San Bernardino, Ventura Counties • TMPO: Tahoe Basin area of El Dorado and Placer Counties • SJV: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare Counties • North: Butte, Colusa, Del Norte, Glenn, Humboldt, Lake, Lassen, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Tehama, and Trinity Counties • Central Mountains: Alpine, Amador, Calaveras, Inyo, Mariposa, Mono, and Tuolumne Counties • S Central Coast: San Luis Obispo and Santa Barbara Counties • SANDAG: San Diego County
Mode	Mode	One of the following travel modes: • DriveAlone, DriveShared • Bus, Rail, Ferry • Walk, Bike • Other (e.g., taxi, school bus, paratransit, …)
Purpose	Purpose	One of the following trip purposes: • HBW (home-based work) • HBO (home-based other) • NHB (non-home-based)
Distance	Distance	Total trip distance, rounded to the nearest mile. (Trips under half a mile are reported as distance 0). Note that trip distances in the survey are calculated from respondent's origin and destination, and the route used may not match the respondent's actual route.

DATA DICTIONARY: SIMPLIFIED CHTS DATA

Grouping	Variables	Description
Time	Time	Total trip time (including transit access/egress and waiting), rounded to the nearest 5 minutes. (Trips under 2.5 minutes are reported as time 0.) Note that trip times are self-reported by survey respondents.
Person-Trips	numPersTrips	Weighted and expanded number of person-trips for the given origin, destination, home, work, purpose, mode, distance, and time.
Person-Trips	rawPersTrips	Survey sample size for person-trips with the given origin, destination, home, work, purpose, mode, distance, and time.
Vehicle-Trips	numVehTrips	Weighted and expanded number of vehicle-trips for the given origin, destination, home, work, purpose, mode, distance, and time.
Vehicle-Trips	rawVehTrips	Survey sample size for vehicle-trips with the given origin, destination, home, work, purpose, mode, distance, and time.

Data sources: 2012 CHTS household and person files, with F&P modifications
Summarized using script ModeDistTime_PurposeDistrib.R

ON SURVEY WEIGHTING AND EXPANSION

The variables representing the number of person-trips and vehicle-trips are weighted and expanded to represent the total number of household-related trips of the listed type. While the survey is weighted to match household demographics (such as household size, household income, etc.) on a per-county basis, some limitations of the survey should be kept in mind when using the expanded number of trips.

- Because the CHTS is a **household** travel survey, it only measures travel related to (California) households. It does not measure commercial trips, trips made by visitors, or trips made by California residents who are not classified by the census as belonging to households – e.g., residents of group living quarters such as college dormitories, military bases, medical facilities, or correctional facilities.
- The survey weights supplied with the CHTS were judged to be insufficient for Fehr & Peers' purposes and we have therefore re-calculated weights in-house. For more information, see the CHTS data preparation memo or contact Jennifer Ziebarth.

USING THE SIMPLIFIED DATA

The simplified CHTS data is designed to be a flexible format which can produce the most commonly-requested summaries of CHTS data. Within Excel, this data can be filtered, summed, averaged, or brought into pivot tables and pivot charts to create a variety of summaries. Several common examples are detailed below. Two general comments may help you get started:

1. Because the CHTS is a weighted survey, you'll want to use the weighted variables numPersTrips and numVehTrips to count person-trips or vehicle-trips for almost any summary.
2. It's important to always confirm your summary is based on a large enough sample to provide reasonable representation of the population. For this reason, the sample sizes rawPersTrips and rawVehTrips are also provided. In general, caution should be used when summaries are based on less than 100 total (person- or vehicle-) trips; summaries based on a sample of less than 30 total trips should not be used alone, but should rather be pooled with additional data.

EXAMPLES OF COMMONLY REQUESTED SUMMARIES

MODE SHARE BY TRIP PURPOSE

To create a table of mode shares by trip purpose, start by confirming the CHTS has enough records to summarize the characteristics of interest. Create a pivot table with modes as rows, trip purposes as columns, and raw person-trips as values. In the Value Field Settings dialog, summarize values by Sum. Add filters to the pivot table to select other characteristics of interest such as residence or work location, origin, destination, etc. In the example below, we've selected records for respondents who live in Oakland and work in Walnut Creek.

homePlace	Oakland			
workPlace	Walnut Creek			
Sum of rawPersTrips	**Column Labels**			
Row Labels	**HBO**	**HBW**	**NHB**	**Grand Total**
DriveAlone	8	12	7	27
Rail		1	1	2
Walk	3		1	4
Grand Total	**11**	**13**	**9**	**33**

Unsurprisingly, there aren't very many trips in the CHTS with these characteristics, so we should expand our criteria. A good guideline for mode share summaries is at least 100 trips total, and at least 30 trips for each trip purpose.

Once we've confirmed the CHTS has enough responses with the characteristics of interest, create a second pivot table with the same rows, columns, and filters, and with number of person-trips as values. In the Value Field Settings dialog, summarize values by Sum, and show the values as percentage of column total.

homePlace	Oakland			
workCounty	Contra Costa			
Sum of numPersTrips	**Column Labels**			
Row Labels	**HBO**	**HBW**	**NHB**	**Grand Total**
DriveAlone	59%	84%	68%	70%
DriveShared	29%	0%	15%	14%
Rail	0%	16%	1%	5%
Walk	12%	0%	16%	11%
Grand Total	**100%**	**100%**	**100%**	**100%**

AVERAGE VEHICLE TRIP LENGTH

To estimate average vehicle-trip length, again start by confirming the CHTS has enough trips with the desired characteristics. Create a pivot table with raw vehicle trips (summarized by sum) in the value field, and any other desired characteristics in filters, rows and columns. Here, we see there are sufficient records for residents of all three AMBAG counties to allow summarizing vehicle trip length.

homeRegion	AMBAG			
Sum of rawVehTrips	**Column Labels**			
Row Labels	**HBO**	**HBW**	**NHB**	**Grand Total**
Monterey	1,597	827	997	3,421
San Benito	429	225	279	933
Santa Cruz	1,170	521	849	2,540
Grand Total	**3,196**	**1,573**	**2,125**	**6,894**

To determine average vehicle trip length by trip purpose, it's easier not to use a pivot table but to work with the relevant portion of the data directly. Set filters for the desired characteristics, and create a new column multiplying trip distance by the number of vehicle trips.

L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
homeRegic	workTr	workPl	workCc	workRe	mode	purpos	distanc	time	numPe	rawPer	numVe	rawVeh	numVT*distance	
AMBAG	NA	NA	NA	NA	DriveAlon	HBO	109	150	0.09	1	0.09	1	=W817*S817	
AMBAG	6E+09	San Leand	Alameda	MTC	DriveShar	HBW	92	170	1.07	1	1.07	1		
AMBAG	6E+09	Fremont	Alameda	MTC	DriveAlon	HBW	90	115	0.1	1	0.1	1		
AMBAG	NA	NA	NA	NA	DriveShar	NHB	111	270	0.19	2	0.09	1		
AMBAG	NA	NA	NA	NA	DriveAlon	HBO	333	340	0.06	1	0.06	1		
AMBAG	NA	NA	NA	NA	DriveShar	NHB	84	110	0.18	1	0.18	1		
AMBAG	NA	NA	NA	NA	DriveAlon	HBO	55	55	0.11	1	0.11	1		
AMBAG	6.05E+09	Los Banos	Merced	SJV	DriveShar	NHB	2	5	1.36	2	0.67	1		
AMBAG	6.05E+09	Los Banos	Merced	SJV	DriveShar	HBO	71	70	1.06	2	0.53	1		

Then, create sums for both the number of vehicle trips and vehicle trips * distance. Because we want to calculate average vehicle trip length for residents of the three AMBAG counties separately, SUMIF statements will help to sum only the values we're interested in.

=SUMIF($K1:$K195510,K$195618,$W1:$W195510)

J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y
homeP	homeC	homeRegio	workTr	workPl	workCo	workRe	mode	purpos	distanc	time	numPe	rawPer	numVe	rawVel	numVT*dist
Unincorpo	Santa Cru:	AMBAG	NA	NA	NA	NA	DriveShar	NHB	87	170	1.01	2	0.52	1	45.24
Santa Cru:	Santa Cru:	AMBAG	NA	NA	NA	NA	DriveAlon	NHB	90	120	0.05	1	0.05	1	4.5
Soquel	Santa Cru:	AMBAG	NA	NA	NA	NA	DriveShar	NHB	41	70	0.66	2	0.33	1	13.53
Santa Cru:	Santa Cru:	AMBAG	NA	NA	NA	NA	DriveShar	NHB	168	360	0.02	2	0.01	1	1.68
Felton	Santa Cru:	AMBAG	NA	NA	NA	NA	DriveShar	NHB	88	30	0.91	1	0.91	1	80.08
Felton	Santa Cru:	AMBAG	6.8E+09	Other US	Other US	Other US	DriveShar	NHB	1	15	0.86	1	0.86	1	0.86
Felton	Santa Cru:	AMBAG	6.8E+09	Other US	Other US	Other US	DriveShar	NHB	1	30	0.69	1	0.69	1	0.69
Rio del M:	Santa Cru:	AMBAG	NA	NA	NA	NA	DriveShar	NHB	163	240	0.91	4	0.25	1	40.75
Total	Monterey												=SUMIF($I		
Total	San Benito														
Total	Santa Cruz														
Total	AMBAG														

Finally, divide the sum of vehicle trips * distance by the sum of vehicle trips, and you have the average vehicle trip distance. Note that this process is creating a weighted average of the trip distance, using the number of vehicle trips as a weight.

	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
	homeP	homeC												numVe	rawVel	numVT*distance	
7	Felton	Santa Cru:	A	N	N	N	N	D	N	#	#	1	1	0.91	1	80.08	
8	Felton	Santa Cru:	A	#	O	O	O	D	N	1	#	1	1	0.86	1	0.86	
9	Felton	Santa Cru:	A	#	O	O	O	D	N	1	#	1	1	0.69	1	0.69	
0	Rio del M:	Santa Cru:	A	N	N	N	N	D	N	#	#	1	4	0.25	1	40.75	
7																	Average Vehicle Trip Distance
8	Total	Monterey												1685.18		13083.81	7.76
9	Total	San Benito												250.92		2686.28	10.71
0	Total	Santa Cruz												1287.31		9913.47	7.70
1	Total	AMBAG												3223.41		25683.56	7.97
2																	

O/D TABLE

To create an O/D table for a set of geographies, again start by setting up a pivot table with the desired filters, with origins as rows, destinations as columns, and raw trips (either person- or vehicle-trips) as value; this will help you to confirm whether sample sizes are sufficient.

oRegion	SJV								
dRegion	SJV								
Sum of rawVehTrips	**Column Labels**								
Row Labels	**Fresno**	**Kern**	**Kings**	**Madera**	**Merced**	**San Joaquin**	**Stanislaus**	**Tulare**	**Grand Total**
Fresno	3,576	8	51	107	20	1	3	100	3,866
Kern	11	4,024	1		1	1	1	38	4,077
Kings	55	2	798	1				43	899
Madera	110	1	1	633	18	-	6		769
Merced	17	1		19	1,354	6	85	1	1,483
San Joaquin	2			2	7	2,076	104		2,191
Stanislaus	2	1		4	84	104	1,602	2	1,799
Tulare	99	33	46	4		1	1	2,519	2,703
Grand Total	**3,872**	**4,070**	**897**	**770**	**1,484**	**2,189**	**1,802**	**2,703**	**17,787**

In this example, overall we have plenty of vehicle trips to summarize, but for the pairs with a small number of survey records we shouldn't draw any conclusions beyond the obvious one that these pairs don't experience as much interaction as other pairs.

Create a second pivot table with the same rows, columns, and filters, and with number of trips as values. To help distinguish cells with enough sample size to draw conclusions, cells with sufficient sample size are highlighted in green in the example below.

oRegion	SJV								
dRegion	SJV								
Sum of numVehTrips	**Column Labels**								
Row Labels	**Fresno**	**Kern**	**Kings**	**Madera**	**Merced**	**San Joaquin**	**Stanislaus**	**Tulare**	**Grand Total**
Fresno	1,716,778	1,962	13,634	18,028	8,853	266	1,077	22,169	1,782,766
Kern	2,265	1,439,497	162		448	162	211	9,538	1,452,284
Kings	14,181	470	215,434	269				8,006	238,360
Madera	20,314	330	269	165,030	3,725	-	1,463		191,130
Merced	9,487	583		3,981	372,138	716	25,554	121	412,581
San Joaquin	247			1,378	833	1,157,843	37,287		1,197,587
Stanislaus	556	621		1,120	25,876	36,474	793,667	500	858,813
Tulare	21,272	7,294	8,705	1,693		264	410	795,079	834,717
Grand Total	**1,785,099**	**1,450,758**	**238,204**	**191,498**	**411,873**	**1,195,725**	**859,669**	**835,413**	**6,968,238**

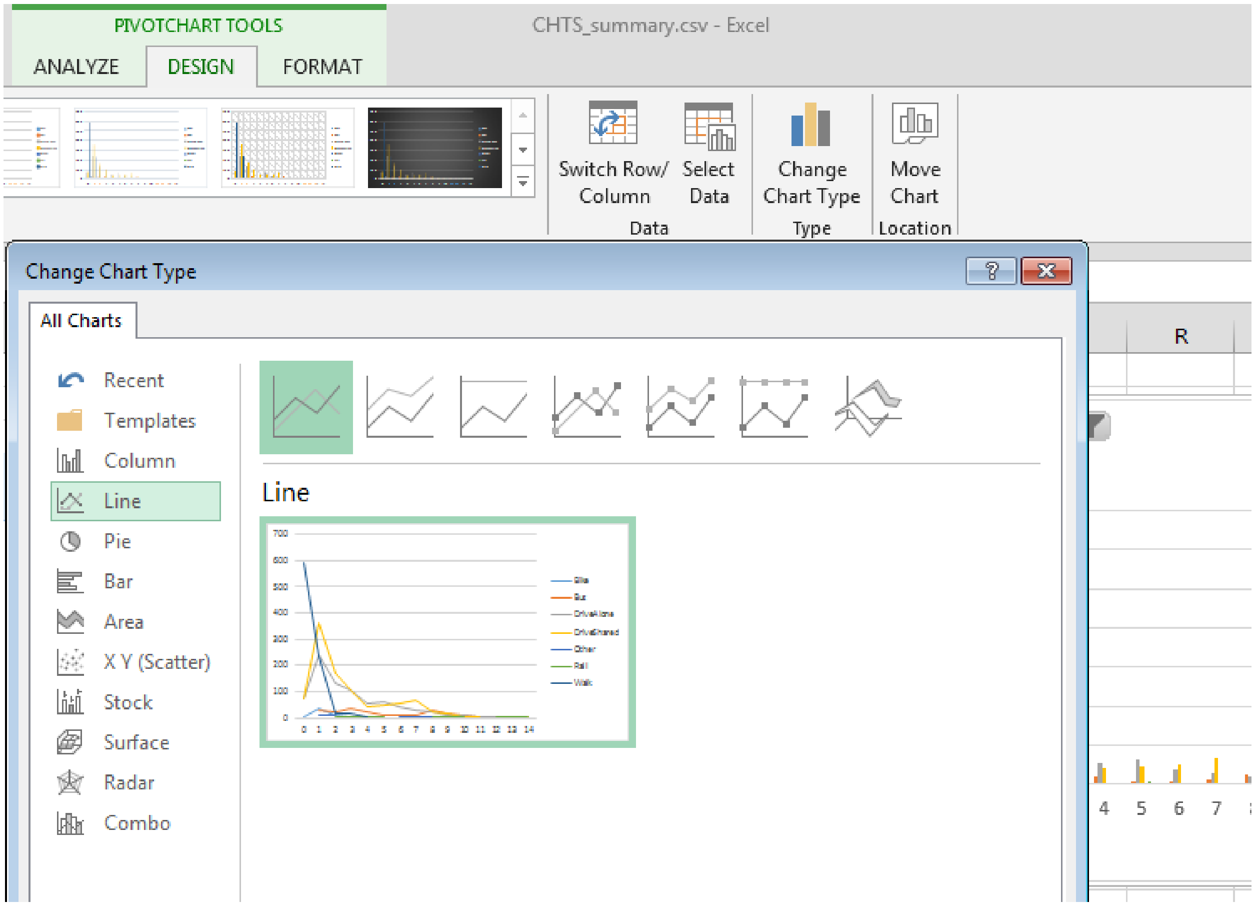
GRAPH OF TRIP DISTANCE BY MODE

Excel can create pivot tables and pivot charts which appear side-by-side with the same data. As before, confirm there are enough trips in the CHTS to summarize by creating a pivot table with mode as columns, distance as rows, raw person-trips as values (summarized by sum), and any desired filters. In this example, we certainly have enough trips for most modes, but should be cautious about drawing conclusions about

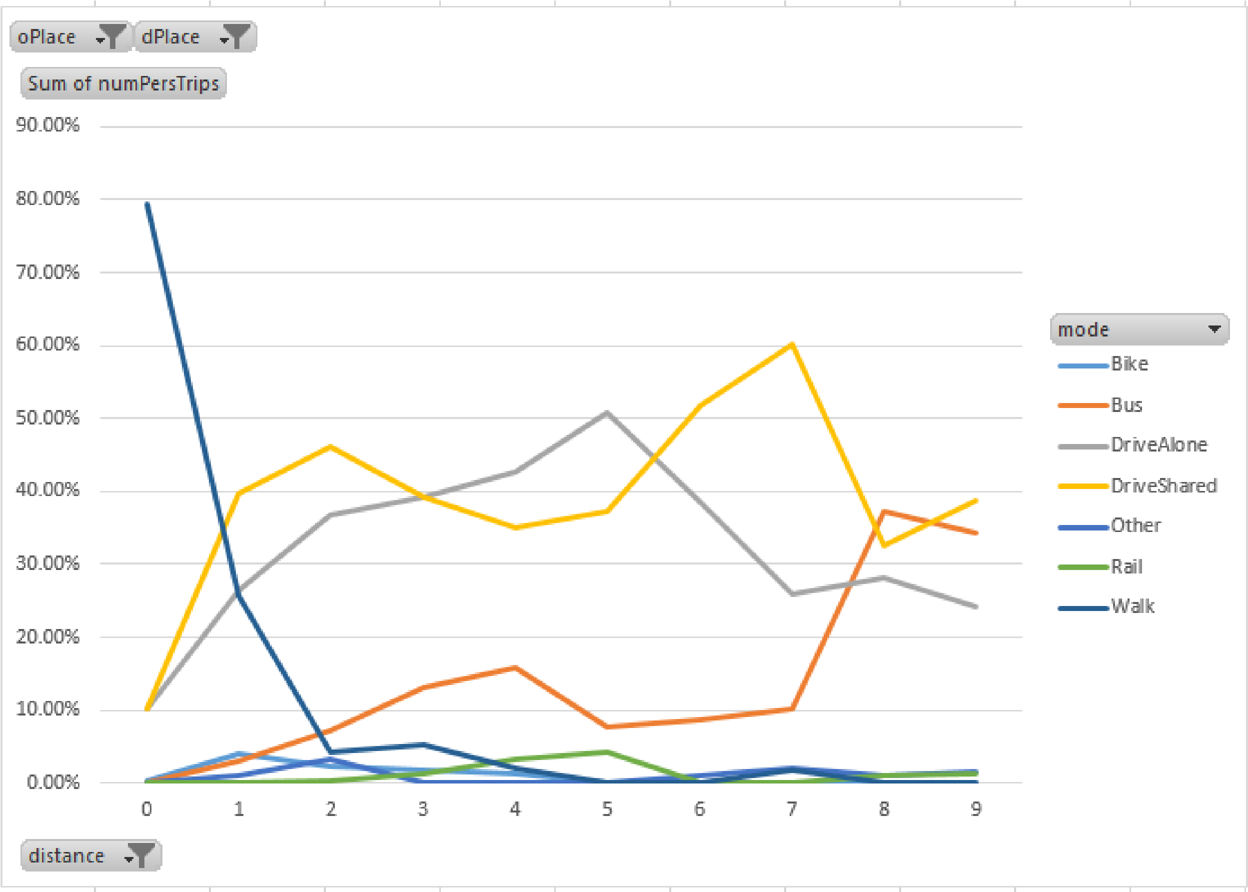
Rail or Other modes. Also, trips of 10 miles or longer are few enough that they should be considered as an aggregate rather than mile-by-mile.

oPlace	Oakland							
dPlace	Oakland							
Sum of rawPersTrips	**Column Labels**							
Row Labels	**Bike**	**Bus**	**DriveAlone**	**DriveShared**	**Other**	**Rail**	**Walk**	**Grand Total**
0	4		58	60			384	506
1	31	16	162	245	10		149	613
2	9	14	110	122	11	1	10	277
3	4	22	85	84		3	4	202
4	1	13	42	38		2	4	100
5		5	53	43		6		107
6		6	36	33	1			76
7		3	20	24	2		1	50
8		7	18	17	1	1		44
9		7	13	12	1	1		34
10		4	6	3		4		17
11		2	5	3				10
12		1	2			1		4
13			1	7		1		9
14				2		1		3
Grand Total	**49**	**100**	**611**	**693**	**26**	**21**	**552**	**2052**

To create the graph, change the value field from raw person trips to number of person trips (still summarized by sum). While the default pivot-chart bar chart format conveys some information, it's probably clearer to see if we change the chart type to a line chart:



If we'd rather look at mode share for each distance, we can show the values as a percentage of the row total – remembering that trips of 10 miles are longer may show unreasonable variability because there are so few of them in the survey.


oPlace
dPlace
Sum of numPersTrips
90.00%
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
0
1
2
3
4
5
6
7
8
9
distance
mode
Bike
Bus
DriveAlone
DriveShared
Other
Rail
Walk

APPENDIX G:

DATA DICTIONARY FOR TAZ DATA INPUTS

The table below is a data dictionary for the elements of the TAZdata.csv model input.

DATA DICTIONARY FOR TAZDATA.CSV

Name	Description
TAZ	Traffic Analysis Zone ID
AIRBASIN	For counties containing multiple air basins,
MID_BNDRY	Middle school boundary
HIGH_BNDRY	High school boundary
GENPARKCOST	Parking cost, general public
EMPCOST	Parking cost, employees
INTDEN	Intersection density (No longer used, replaced by Python script)
WALKPERC	Percentage of TAZ lane miles that are walkable (No longer used, replaced by Python script)
MHHINC	Median household income
AREA_AC	Total area of the TAZ, in acres, including undeveloped land
RESACRE	Total developed area of TAZ devoted to residential uses
EMPACRE	Total developed area of TAZ devoted to non-residential uses
HWYCOM	Percentage of commercial that is highway focused
PTERM	Additional out-of-vehicle time required for drive trip productions to reach vehicle
ATERM	Additional out-of-vehicle time required for drive trip attractions to reach vehicle
PKFREQ	Frequency of peak-period transit service (used for synthetic transit)
OPFREQ	Frequency of off-peak transit service (used for synthetic transit)
EJ	Environmental Justice code
HBWH_ix	Percentage of home-based work (high income) trips produced which leave the model
HBWH_xi	Percentage of home-based work (high income) trips attracted from outside the model
HBWM_ix	Percentage of home-based work (medium income) trips produced which leave the model

DATA DICTIONARY FOR TAZDATA.CSV

Name	Description
HBWM_xi	Percentage of home-based work (medium income) trips attracted from outside the model
HBWL_ix	Percentage of home-based work (low income) trips produced which leave the model
HBWL_xi	Percentage of home-based work (low income) trips attracted from outside the model
HBS_ix	Percentage of home-based shop trips produced which leave the model
HBS_xi	Percentage of home-based shop trips attracted from outside the model
HBK_ix	Percentage of home-based school (K-12) trips produced which leave the model **(NOT used in the model: all HBK trips are assumed to be internal to the model.)**
HBK_xi	Percentage of home-based school (K-12) trips attracted from outside the model **(NOT used in the model: all HBK trips are assumed to be internal to the model.)**
HBC_ix	Percentage of home-based college trips produced which leave the model
HBC_xi	Percentage of home-based college trips attracted from outside the model
HBO_ix	Percentage of home-based other trips produced which leave the model
HBO_xi	Percentage of home-based other trips attracted from outside the model
WBO_ix	Percentage of work-based other trips produced which leave the model
WBO_xi	Percentage of work-based other trips attracted from outside the model
OBO_ix	Percentage of other-based other trips produced which leave the model
OBO_xi	Percentage of other-based other trips attracted from outside the model
EMP_EDUH	Percentage of educational employment that is high-income
EMP_EDUM	Percentage of educational employment that is medium-income
EMP_EDUL	Percentage of educational employment that is low-income
EMP_FOOH	Percentage of food/entertainment employment that is high-income
EMP_FOOM	Percentage of food/entertainment employment that is medium-income
EMP_FOOL	Percentage of food/entertainment employment that is low-income
EMP_GOVH	Percentage of government employment that is high-income
EMP_GOVM	Percentage of government employment that is medium-income
EMP_GOVL	Percentage of government employment that is low-income
EMP_INDH	Percentage of industrial employment that is high-income

DATA DICTIONARY FOR TAZDATA.CSV

Name	Description
EMP_INDM	Percentage of industrial employment that is medium-income
EMP_INDL	Percentage of industrial employment that is low-income
EMP_MEDH	Percentage of medical employment that is high-income
EMP_MEDM	Percentage of medical employment that is medium-income
EMP_MEDL	Percentage of medical employment that is low-income
EMP_OFCH	Percentage of office employment that is high-income
EMP_OFCM	Percentage of office employment that is medium-income
EMP_OFCL	Percentage of office employment that is low-income
EMP_RETH	Percentage of retail employment that is high-income
EMP_RETM	Percentage of retail employment that is medium-income
EMP_RETL	Percentage of retail employment that is low-income
EMP_OTHH	Percentage of mining/manufacturing employment that is high-income
EMP_OTHM	Percentage of mining/manufacturing employment that is medium-income
EMP_OTHL	Percentage of mining/manufacturing employment that is low-income
EMP_AGRH	Percentage of agricultural employment that is high-income
EMP_AGRM	Percentage of agricultural employment that is medium-income
EMP_AGRL	Percentage of agricultural employment that is low-income

APPENDIX H:
ACCESSIBILITY VARIABLES

The table below lists all of the accessibility and D-variables calculated during the Accessibility portions of the model. Note that the accessibility metrics are calculated during the Input Preparation phase of the model, and updated as the model runs through each iteration.

TABLE H-1: DATA DICTIONARY FOR TAZ-LEVEL ACCESSIBILITY VARIABLES

Variable	Description
ATYPE	Place type, calculated from EMP_30AUT + WRK_30AUT
TOTHH_SF	Total households in single-family residential units
HHPOP_SF	Total household population in single-family residential units
TOTHH_MF	Total households in multi-family residential units
HHPOP_MF	Total household population in multi-family residential units.
WRKPOP	Total working-age population.
INTDEN	Intersection density (intersections per square mile, including undeveloped area)
DIRECT	Not currently used; placeholder for measure of directness
WALK_MI	Miles of walkable roadway links
WALKPERC	Percentage of TAZ which is walkable
RESACRE	Developed acres for residential purposes
EMPACRE	Developed acres for non-residential purposes
HH_05TRN	Households within half-mile of transit
WRK_05TRN	Working-age population within half-mile of transit
EMP_05TRN	Jobs within half-mile of transit
EMP_30TRN	Jobs within 30 minutes by transit
WRK_30TRN	Working-age population within 30 minutes by transit
EMP_1WALK	Jobs within 1-mile walk
WRK_1WALK	Working-age population within 1-mile walk
EMP_3BIKE	Jobs within 3-mile bike ride

TABLE H-1: DATA DICTIONARY FOR TAZ-LEVEL ACCESSIBILITY VARIABLES

Variable	Description
WRK_3BIKE	Working-age population within 3-mile bike ride
EMP_30AUT	Jobs within 30 minutes by auto
WRK_30AUT	Working-age population within 30 minutes by auto
ACT_30AUT	Activity (jobs + working-age population) within 30 minutes by auto
ACT_30TRN	Activity (jobs + working-age population) within 30 minutes by transit
COMMUTECOST	Average annual cost of commuting by auto

APPENDIX I:

COMPARISON OF LAND USE CATEGORIES

The table below shows the residential land use data elements and how the VMIP 2 grouping compares to other data sources including the CHTS, ACS, and VMIP 1 categorization.

**TABLE 3.2-8:
RESIDENTIAL AGGREGATION STRUCTURE FOR VMIP 2**

	VMIP 2 (grouped)	VMIP 2	2012 CHTS	2012 ACS 5 Year	VMIP 1		CTPP 2010
Residence Type			*resty*	*B25024 (BG)*			
		RUG1 (SF)	01 1, detached	RU1	RU1	1, detached	SF detached (RU1)
			02 1, attached	RU2	RU2	1, attached	SF attached (RU2)
		RUG2 (MF)	04 2-4 units	RU3 RU4	RU3 RU4	2 3 or 4	MF 2-4 (RU3 + RU4)
			05 5-19 units	RU5 RU6	RU5 RU6	5 to 9 10 to 19	MF 5-19 (RU5 + RU6)
			06 20+ units	RU7 RU8	RU7 RU8	20 to 49 50 or more	MF 20-49 (RU7) MF 50+ (RU8)
		RUG3 (OTH)	03 Mobile home 07 Boat, RV, van, etc.	RU9 RU10	RU9 RU10	Mobile home Boat, RV, van, etc.	MH (RU9) Other (RU10)
Household Size			*hhsize*	*B25009 (BG)*			
		HH1	Range is 1-15	1-person	HH1	HOUSEHOLD SIZE 1	1-person
		HH2		2-person	HH2	HOUSEHOLD SIZE 2	2-person
		HH3		3-person	HH3	HOUSEHOLD SIZE 3	3-person
		HH4		4-person	HH4	HOUSEHOLD SIZE 4	4-or-more-person
		HH5		5-person	HH5	HOUSEHOLD SIZE 5	
				6-person	HH6	HOUSEHOLD SIZE 6	
				7-or-more-person	HH7	HOUSEHOLD SIZE 7 or more	
				Total Households	TOTHH	TOTAL HOUSEHOLD	
Household Vehicles			*hhveh*	*B25044 (BG)*			
		Veh0	Range is 0-15	No vehicle available	Veh0	No vehicle available	0 cars
		Veh1		1 vehicle available	Veh1	1 vehicle available	1 car
		Veh2		2 vehicles available	Veh2	2 vehicles available	2 cars

TABLE 3.2-8:
RESIDENTIAL AGGREGATION STRUCTURE FOR VMIP 2

	VMIP 2 (grouped)	VMIP 2	2012 CHTS	2012 ACS 5 Year	VMIP 1		CTPP 2010
		Veh3		3 vehicles available	Veh3	3 vehicles available	3 cars
		Veh4		4 vehicles available	Veh4	4 vehicles available	4-or-more-cars
				5 or more vehicles available	Veh5	5 or more vehicles available	
Household Income			*incom*	*S1901 (BG)*			
	INCLOW	INC1	1 Less than $10,000	Less than $10,000	INC1	Less than $10,000	Less than $15,000
			2 $10,000 - $24,999	$10,000 to $14,999	INC2	$10,000 to $14,999	
				$15,000 to $19,999	INC3	$15,000 to $24,999	$15,000-$24,999
				$20,000 to $24,999			
		INC2	3 $25,000 - $34,999	$25,000 to $29,999	INC4	$25,000 to $34,999	$25,000-$34,999
				$30,000 to $34,999			
			4 $35,000 - $49,999	$35,000 to $39,999	INC5	$35,000 to $49,999	$35,000-$49,999
				$40,000 to $44,999			
				$45,000 to $49,999			
	INCMED	INC3	5 $50,000 - $74,999	$50,000 to $59,999	INC6	$50,000 to $74,999	$50,000-$74,999
				$60,000 to $74,999			
		INC4	6 $75,000 - $99,999	$75,000 to $99,999	INC7	$75,000 to $99,999	$75,000-$99,999
	INCHIGH	INC5	7 $100,000 - $149,999	$100,000 to $124,999	INC8	$100,000 to $149,999	$100,000-$149,999
				$125,000 to $149,999			
			8 $150,000 - $199,999	$150,000 to $199,999	INC9	$150,000 to $199,999	$150,000 or more
			9 $200,000 - $249,999	$200,000 or more	INC10	$200,000 or more	
			10 $250,000 or more				
				Total, household income	TOTINC	TOTAL HH INCOME	Total, household income
Population by Age			*age*	*B01001 (BG)*	AGE		
		POP0005	*Range is 0-98, 99 for 99+*	Under 5 years		People 0 to 5 years	
		POP0514		5 to 9 years		People 5 to 14 years	
				10 to 14 years			
		POP1517		15 to 17 years		People 15 to 17 years	
		POP1824		18 and 19 years		People 18 to 24 years	
				20 years			
				21 years			
				22 to 24 years			

TABLE 3.2-8:
RESIDENTIAL AGGREGATION STRUCTURE FOR VMIP 2

	VMIP 2 (grouped)	VMIP 2	2012 CHTS	2012 ACS 5 Year	VMIP 1		CTPP 2010
		POP2554		25 to 29 years 30 to 34 years 35 to 39 years 40 to 44 years 45 to 49 years 50 to 54 years		People 25 to 54 years	
		POP5564		55 to 59 years 60 and 61 years 62 to 64 years		People 55 to 64 years	
		POP6574		65 and 66 years 67 to 69 years 70 to 74 years		People 65 to 74 years	
		POP75		75 to 79 years 80 to 84 years 85 years and over		People 75 years and over	
Age of head of household			*age*	*SF1-2010 H17 (ACS B19037 has fewer categories)*			
		AGE1524	*Not a separate variable but does have ages of all household members to use for calculation of this variable*	Householder 15 to 24 years	Hage1	Householder 15 to 24 years	Householder 15 to 17 years
		AGE2564		Householder 25 to 34 years	Hage2	Householder 25 to 34 years	Householder 18 to 24 years
				Householder 35 to 44 years	Hage3	Householder 35 to 44 years	Householder 25 to 44 years
				Householder 45 to 54 years	Hage4	Householder 45 to 54 years	Householder 45 to 59 years
				Householder 55 to 59 years	Hage5	Householder 55 to 59 years	Householder 60 to 64 years
				Householder 60 to 64 years	Hage6	Householder 60 to 64 years	Householder 65 to 74 years
		AGE6574		Householder 65 to 74 years	Hage7	Householder 65 to 74 years	Householder 75 years and over
		AGE75		Householder 75 to 84 years	Hage8	Householder 75 to 84 years	
				Householder 85 years and over	Hage9	Householder 85 years and over	
work trip Travel time			*totalTime (F&P created)*				
			All travel times are measured in minutes; for transit trips totalTime is a sum of IVT, waitTime, accessTime, xferTime,egressTime		TT1	Less than 10 minutes	Less than 5
					TT2	10 to 14 minutes	5 to 9 minutes
					TT3	15 to 19 minutes	15 to 19 minutes
					TT4	20 to 24 minutes	20 to 20 minutes
					TT5	25 to 29 minutes	30 to 44 minutes
					TT6	30 to 34 minutes	45 to 59 minutes
					TT7	35 to 44 minutes	60 to 74 minutes
					TT8	45 to 59 minutes	75 to 89 minutes

TABLE 3.2-8:
RESIDENTIAL AGGREGATION STRUCTURE FOR VMIP 2

	VMIP 2 (grouped)	VMIP 2	2012 CHTS	2012 ACS 5 Year		VMIP 1	CTPP 2010
				*same as VMIP 1	TT9	60 or more minutes *is available as same in CTPP *still looking for place of work by census tract	90 minutes or more **aggregate option

TABLE 3-2.9: NON-RESIDENTIAL LAND USE CATEGORY AGGREGATION STRUCTURE					
VMIP 2	**VMIP 1**	**Description**	**NAICS**	**CTPP**	**CSTDM**
EMPEDU	EDUCATION	Educational Services (Schools, Junior Colleges, Colleges, Universities, Professional Schools	61	Edu / Health	Education and health
EMPFOO	ACCOMODTNS	Accommodation	721	Arts/Rec/Accom/Food	Leisure and hospitality
	FOOD	Food Services	722	Arts/Rec/Accom/Food	Leisure and hospitality
	ENT_REC	Arts, Entertainment, and Recreation	71	Arts/Rec/Accom/Food	Leisure and hospitality
EMPGOV	PUBLIC	Public Administration	92	Government	Office
EMPIND	CONSTRUCTN	Construction	23	Construction	Primary and Secondary
	UTILITIES	Utilities	22	Trans / Util.	Trans / Util.
	SVC_OTHER	Other Services (except Public Administration)	81	Other Service	Other Service
	WHOLESALE	Wholesale Trade	42	Wholesale	Wholesale
	WAREHOUSE	Transportation and Warehousing	48-49	Trans / Util.	Trans / Util.
EMPMED	HEALTH	Health Care and Social Assistance	62	Edu / Health	Education and health

TABLE 3-2.9: NON-RESIDENTIAL LAND USE CATEGORY AGGREGATION STRUCTURE					
VMIP 2	**VMIP 1**	**Description**	**NAICS**	**CTPP**	**CSTDM**
EMPOFC	INFORMATN	Information	51	Information	Office
	FINAN_INSR	Finance and Insurance	52	FIRE	Office
	REALESTATE	Real Estate and Rental and Leasing	53	FIRE	Office
	SVC_PROF	Professional, Scientific, and Technical Services	54	Prof Sci, Admin	Office
	SVC_MNGMNT	Management of Companies and Enterprises	55	Prof Sci, Admin	Office
	SVC_ADMIN	Administrative and Support and Waste Management and Remediation Services	56	Prof Sci, Admin	Office
EMPRET	RETAIL	Retail Trade	44-45	Retail	Retail
EMPOTH	MANUFACTUR	Manufacturing	31-33	Manufacturing	Primary and Secondary
	MINING	Mining, Quarrying, and Oil and Gas Extraction	21	Ag_Mining	Primary and Secondary
EMPAGR	AGRICULTUR	Agriculture, Forestry, Fishing and Hunting	11	Ag_Mining	Primary and Secondary

APPENDIX J:
GUIDANCE ON STATIC VALIDATION

TABLE A-1:
DRAFT SUMMARY OF MODEL PERFORMANCE – STATIC VALIDATION

Model Component	Validation Statistic	Evaluation Criterion	Source	Notes, further guidance[1]	Documentation
Static Validation					
Transit Assignment	1. Difference between actual ridership to model results for entire system	+/- 20%	2010 RTP Guidelines Daily	Source of actual daily ridership: http://www.ntdprogram.gov/ntdprogram/archives.htm (National transit database for base year, typically 2008) 2010 RTP Guidelines specify difference between actual ridership to model results for a given year by route group (i.e., Local Bus, Express Bus, etc.). However, National transit database only specifies transit ridership for entire system. Valley Transit operators do not use consistent route groups.	Table
Traffic Assignment	2. % of Links within Caltrans Deviation Allowance	At Least 75%	2010 RTP Guidelines *Travel Forecasting Guidelines*, Caltrans, 1992	Source of traffic data: Vehicle count database for each County for comparison Daily, non-directional	Table, Figure of location and deviation color (valid, +1, +2, -1, -2). Graph (model validation scatter plot).
	3. % of Screenlines within Caltrans Deviation Allowance	100%	2010 RTP Guidelines *Travel Forecasting Guidelines*, Caltrans, 1992	Daily, non-directional	Table

[1] Potential solutions to unexpected results may vary-: TMIP Guidelines are the standard reference for troubleshooting and solutions: http://tmip.fhwa.dot.gov/resources/clearinghouse/docs/FHWA-HEP-10-042/FHWA-HEP-10-042.pdf

TABLE A-1:
DRAFT SUMMARY OF MODEL PERFORMANCE – STATIC VALIDATION

Model Component	Validation Statistic	Evaluation Criterion	Source	Notes, further guidance[1]	Documentation
	4. Correlation Coefficient	At Least 0.88	3.2010 RTP Guidelines *Travel Forecasting Guidelines*, Caltrans, 1992	Daily, non-directional	Table
	5. Percent Root Mean Squared Error (RMSE) (model-wide)	Below 40%	2010 RTP Guidelines	Daily, non-directional	Table
	6. Percent Root Mean Squared Error (RMSE) (functional classification)	Below 40%		No specific criteria available Daily, non-directional Functional Class: Freeway Highway Expressway Arterial Collector	Table
	7. Percent Root Mean Squared Error (RMSE) (volume range)	0-4,999 – <116% 5,000 to 9,999 – <43% 10,000 to 19,999 – <28% 20,000 to 39,999 – < 25% 40,000 to 59,000 – < 30% 60,000 to 89,999 – <-19%	Harvey, G., et al. A Manual of Regional Transportation Modeling Practice for Air Quality Analysis for the Natural Association of Regional Councils, Washington, D.C. July 1993	Is there a minimum number of counts in a volume range or functional class range that we want to consider?	Table

TABLE A-1:
DRAFT SUMMARY OF MODEL PERFORMANCE – STATIC VALIDATION

Model Component	Validation Statistic	Evaluation Criterion	Source	Notes, further guidance[1]	Documentation
	8. Model Volume to Count Ratio (model-wide)	General relationship (i.e., high or low) between model volumes and counts	2010 RTP Guidelines	Daily, non-directional *Minimum Travel Demand Model Calibration and Validation Guidelines for State of Tennessee*. FHWA - identifies that model volumes should be within 5-10% of observed traffic volumes on the highway network. This is the range reference in TMIP, *Model Validation and Reasonableness Checking Manual*, 1997 for screenlines	Table
	9. Model Volume to Count Ratio (roadway functional classification)	Freeway – +/- 7% Major Arterial – 10% Minor Arterial – 15% Collector – 25%	TMIP, *Model Validation and Reasonableness Checking Manual*, 1997	Daily, non-directional Percent difference targets for daily traffic volumes by facility type.	Table
	XX. Distribution of Class by Time of Day	Comparison to collected count data		Total vehicles trips stratified by class and time of day.	Table
	XX. Distribution of Time of Day by Class	Comparison to collected count data		Total vehicles trips stratified by time of day and class.	Table

**TABLE A-1:
DRAFT SUMMARY OF MODEL PERFORMANCE – STATIC VALIDATION**

Model Component	Validation Statistic	Evaluation Criterion	Source	Notes, further guidance[1]	Documentation
	10. Model Volume to Count Ratio (volume range)	<1,000 < 60% 1,000-2,500 < 47% 2,500-5,000 – <36% 5,000-10,000 – <29% 10,000-25,000 – <25% 25,000-50,000 – <22% >50,000 – <21%	TMIP, *Model Validation and Reasonableness Checking Manual*, 1997	Percent difference targets for daily traffic volumes for individual links.	Table
Reasonableness Checks					
Highway and Transit Networks	11. General roadway network and transit line coding	Reasonableness Check	TDF Model	Centerline	
Trip Generation	12. PA Balance	+/- 10% by purpose and overall	TDF Model	after including IX/XI trips	Table or bar chart comparing balance before and after adjustment
Trip Distribution	13. Zonal Trip Distribution		TDF Model	Select link assignment for gateways, TAZ near gateway, and TAZ central to model network.	Network bandwidth plots.

TABLE A-1:
DRAFT SUMMARY OF MODEL PERFORMANCE – STATIC VALIDATION

Model Component	Validation Statistic	Evaluation Criterion	Source	Notes, further guidance[1]	Documentation
Vehicle Availability	14.		2010 ACS (Surveys from 2006-2010) and CHTS http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/Final2001_StwTravelSurveyWkdayRpt.pdf	County level comparison Compare percent of households (single and multiple) with 0, 1, 2, 3+ autos CHTS includes survey data for Fresno, Kern, Merced, San Joaquin, Stanislaus, and Tulare counties. (Table 4, Pages 26 – 30)	
Feedback Loop	15.			Convergence	
Comparisons					
Land Use	16. Total Population	Within 3% (based on RHNA criteria)	Census	by income group	Bar chart comparing model to census data.
	17. Total Households	Ideally within 3% (RHNA criteria)	Census or Department of Finance	RHNA allocations are not anticipated until mid-2013	Bar chart comparing model to census data.
	18. Total Employment	Note	Department of Finance	Check reasonableness of retail jobs per household and non-retail jobs per household. Job mix?	Bar chart comparing model to census data.
Trip Generation	19. Person trip rates		CHTS, ITE	Convert person trip rates to ITE rates using Ave Veh Occ by purpose	Table
Trip Distribution	20. Average Trip Length by Purpose		CHTS	3-County model also has OD survey	Table
	21. Trip Length Frequency Distribution by Purpose		CHTS	3-County model also has OD survey	Graph for each purpose

TABLE A-1:
DRAFT SUMMARY OF MODEL PERFORMANCE – STATIC VALIDATION

Model Component	Validation Statistic	Evaluation Criterion	Source	Notes, further guidance[1]	Documentation
	XX. Percentage of IX/XI/XX trips for long-distance trips		Cellphone Inter-regional Data	Compare percentage of II/IX/XI trips from model trip tables with percentage of II/IX/XI trips from cellphone inter-regional travel data.	Table and/or Map
Trip Assignment	22. Vehicle class		Count data	Percent by class for each period Percent by time period for each class	Table
	23. VMT	+/- 5%	HPMS http://www.dot.ca.gov/hq/tsip/hpms/hpmslibrary	Compare countywide daily VMT estimate from HPMS (Table 10, Page 80) Reasonableness of comparison should be based on how the model compares to HMPS estimates. In general, The model should be VMT forecasts should be lower than the HPMS estimate, since HPMS VMT is estimated for local streets that are not in the model networks.	Table
	24. Travel Speed by Functional Classification		Existing Data	Compare by functional classification based on observed data. For all classifications, summarize average speed, minimum, and maximum. If observed data is not available, compare relative congested speed by functional class.	Table
	25. Average Travel Time by Trip Purpose		CHTS	Daily CHTS provide travel time for HBW trips and total trips. http://www.dot.ca.gov/hq/tsip/tab/documents/travelsurveys/Final2001_StwTravelSurveyWkdayRpt.pdf	Table
Mode Split	26. Mode split by purpose		CHTS	Daily	Pie chart

Source: Fehr & Peers, 2016

APPENDIX K:

MEMO ON AUTO OPERATING COST

MEMORANDUM

To: Ken Kirkey, MTC; Huasha Liu, SCAG; Gordan Garry, SACOG; Muggs Stoll, SANDAG

From: David Ory, MTC; Guoxiong Huang, SCAG; Bruce Griesenbeck, SACOG; Clint Daniels, SANDAG

Re: Automobile Operating Cost for the Second Round of Sustainable Communities Strategies

Date: October 13, 2014

This memorandum summarizes our collective thinking regarding fuel price assumptions for the second round of sustainable communities strategies (SCSs)[2].

Background

The Regional Targets Advisory Committee (or RTAC) formed by the California Air Resources Board (ARB) recommended that MPOs use "consistent long-range planning assumptions statewide, to the degree practicable, including … existing and forecasted fuel prices and automobile operating costs."[3] For the first round of sustainable communities strategies, we agreed to use the following sets of assumptions:

- Base Year Fuel Price: Region-specific, set during model calibration
- Year 2020 Fuel Price: $4.74 (Year 2009 dollars, $2009);
- Year 2035 Fuel Price: $5.24 ($2009);
- Effective Fleet-wide Fuel Efficiency: Region-specific, derived from ARB's Emission Factor (EMFAC) software;
- Year 2020 Non-fuel-related Operating Cost (if included in region-specific automobile operating cost calculations): $0.09 ($2009);

[2] The first round beginning with SANDAG's 2011 RTP/SCS; the second round beginning with SANDAG's 2015 RTP/SCS.
[3] See page 10 of *Recommendations of the Regional Targets Advisory Committee Pursuant to Senate Bill 375: A Report to the California Air Resources Board*.

- Year 2035 Non-fuel-related Operating Cost (if included in region-specific automobile operating cost calculation): $0.11 ($2009).

This set of assumptions were used to compute the assumed perceived automobile operating cost for each MPO. The resulting values are shown in **Table 50**.

Table 50: Assumed Perceived Automobile Operating Costs ($2009) for First Round of SCSs

MPO	Base Year Cost (year)	Year 2020 Cost	Year 2035 Cost	Avg Annual Growth (Base to 2035)
SCAG	$0.23 (2005)	$0.32	$0.32	1.1%
MTC	$0.18 (2010)	$0.28	$0.28	1.8%
SACOG	$0.21 (2008)	$0.27	$0.29	1.2%
SANDAG	$0.19 (2008)	$0.22	$0.21	0.4%

Using the above assumptions, we achieved consistency in forecast year fuel price as well as the approach to computing perceived automobile operating cost. Unfortunately, we were not able to achieve consistency in base year assumptions. Achieving consistency across MPOs for base year input is more difficult than achieving consistency across forecast year input because base year input is part of the expensive and time consuming model development process.

The result of using consistent forecast year assumptions and inconsistent base year assumptions were uneven changes in the assumed increase in perceived automobile operating cost across MPOs. For example, between 2010 and 2035, MTC assumes a 1.8 percent average annual increase in perceived automobile operating cost; between 2008 and 2035, SANDAG assumes a 0.4 percent average annual increase. It is worth noting that the base year differences may reflect actual base year differences (i.e., fuel prices changing from 2005 to 2010) and do reflect regional differences in the assumed average fleet-wide fuel efficiency. In any case, the differences in growth rates make it difficult to claim that the perceived automobile operating costs were handled in a consistent manner.

Proposed Approach

Our proposed remedy for the above-described problem is *not* to try and achieve consistent base year assumptions. The model calibration process is difficult enough without adding the constraint of a single perceived automobile operating cost introduced at an unknown time in the model development cycle. Rather, we propose using a consistent growth in fuel price between the SB 375 base year of 2005 and the forecast years used in the SCS, specifically the target years 2020, and 2035. In addition, we propose using a consistent non-fuel-related operating cost as well as consistent data sources for effective fleet-wide fuel efficiency and base year gas price.

The following subsections outline the approach. Note that the below assumptions do not account for potential increases in fuel costs from California's Cap-and-Trade program.

Fuel Price Assumptions

The Department of Energy issues an annual forecast of motor vehicle gasoline prices. The 2013 forecast[4] is paired with historical information from 2005 to compute a consistent fuel price ratio that will be used by each MPO. The target value for the calculation is not the midpoint between the low and high forecast, but rather three-quarters of the way between the low and high forecasts, plus 32 cents ($2010) – the 32 cents accounts for gasoline generally being more expensive in California than the rest of the nation. These calculations are shown in **Table 51**.

Table 51: Department of Energy Forecasts and Resulting Growth Ratio (Prices in Year 2010 Dollars)

Year	Low	High	Low plus 75% Diff + 32 cents	Ratio to 2005
2005	---	---	$2.82*	---
2015	$2.70	$3.77	$3.82	1.35
2020	$2.54	$4.17	$4.08	1.45
2025	$2.53	$4.39	$4.25	1.51
2030	$2.52	$4.77	$4.53	1.61
2035	$2.53	$5.18	$4.84	1.72
2040	$2.57	$5.70	$5.24	1.86

* – Historical price taken from http://www.eia.gov/dnav/pet/pet_pri_gnd_a_epm0_pte_dpgal_a.htm, and converted to year 2010 dollars.

To compute an MPO-specific forecast year fuel price, the growth ratios in **Table 51** are paired with base year prices. We propose using base year prices from a consistent source, specifically the retail gasoline price data from the Oil Price Information Service (OPIS); these prices will be introduced during our next round of model development activities. The assumed base year prices are shown in **Table 52** for each of the MPO areas for years 2005 through 2012. These prices will be used in subsequent model development activities[5].

Table 52: Historical Gas Prices per OPIS (All prices in Year 2010 dollars)

Year*	MTC	SCAG	SACOG	SANDAG
2005	$2.83	$2.85	$2.74	$2.84

[4] The data is here: http://www.eia.gov/forecasts/archive/aeo13/source_oil.cfm.
[5] Some MPOs will be recalibrating their models and generating a "new" "forecasts" (or "backcasts") of year 2005. Others will not. Those generating new forecasts will use the fuel prices listed in **Table 56**; those not generating new forecasts will leave their prices as they were set in their model development processes.

2008	$3.68	$3.53	$3.53	$3.35
2010	$3.17	n/a	$3.09	$2.92
2012	$3.87	$3.90	$3.85	$3.64

* - The base year prices are only shown (and, in some cases, only purchased) for 2005 and potential model calibration years. For example, SCAG intends to use a 2012 calibration year, and, as such, did not purchase the year 2010 prices from OPIS.

Non-Fuel-Related Operating Costs

As noted above, the calculation of perceived automobile operating cost is assumed to have two components: fuel costs and non-fuel-related costs. Similar to the base year fuel price, we propose using base year non-fuel-related operating costs from a consistent source, specifically the American Automobile Association (AAA). The assumed non-fuel-related base year prices are shown in **Table 53**; these are national estimates that we'll assume apply to each of the MPO areas. These prices will be used in subsequent model development activities.

Table 53: Non-Fuel-Related Operating Costs (Prices in Year 2010 dollars per mile)

Year	Maintenance	Tires	Maint. + Tires
2005	$0.0437	$0.0062	$0.05
2006	$0.0453	$0.0065	$0.05
2007	$0.0437	$0.0069	$0.05
2008	$0.0452	$0.0076	$0.05
2009	$0.0447	$0.0082	$0.05
2010	$0.0444	$0.0096	$0.05
2011	$0.0461	$0.0103	$0.06
2012	$0.0524	$0.0105	$0.06

The above data can be used to estimate forecast-year non-fuel-related costs. Using a simple linear regression and extrapolation, the forecast year values shown in **Table 54** can be computed. Similar to the gasoline price, the MPOs will use the computed ratio to calculate the forecast year values from whatever values were or are assumed for year 2005.

Table 54: Forecast Year Non-Fuel-Related Operating Costs Ratios (Prices in Year 2010 dollars)

Year	Estimate	Ratio to 2005
2005	$0.050	---
2012	$0.063	1.26
2015	$0.062	1.25
2020	$0.069	1.38
2025	$0.075	1.50
2030	$0.081	1.62
2035	$0.087	1.75
2040	$0.093	1.87

Effective Fleet-wide Fuel Efficiency

The computation of perceived automobile operating cost requires an assumption be made about the effective passenger-vehicle[6] fuel efficiency. ARB's EMFAC software provides two estimates of carbon dioxide (CO_2) emissions. The first estimate is for a hypothetical future in which fuel and vehicle regulations are not enacted; this hypothetical future is used only for computing emissions for SB 375 purposes (method A). The second estimate is for the expected future in which fuel and vehicle regulations are enacted (method B). This future is assumed for all non-SB 375 purposes, including federally-mandated conformity analyses. Unfortunately, the EMFAC software only provides a fuel consumption result for the first set (method A) of CO_2 emissions. The effective fleet-wide fuel efficiency needs to be calculated from the second estimate. Each MPO will use the following equation to compute the effective fleet-wide fuel efficiency:

$$FE = \frac{VMT}{\frac{(CO_2)_B \cdot FLCFS}{(CO_2)_A} \cdot FC_A}$$

where VMT is passenger-vehicle miles traveled, $(CO_2)_A$ is the passenger-vehicle CO_2 estimate from method A, $(CO_2)_B$ is the passenger-vehicle CO_2 estimate from method B, and FC_A is the passenger-vehicle fuel consumption from method A. FLCFS is an adjustment factor to account for Low Carbon Fuel Standards (LCFS) CO_2 reduction factors assumed in EMFAC 2011. LCFS is a fuel standard that requires a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020 (see Table 5-2, http://www.arb.ca.gov/msei/emfac2011-technical-documentation-final-updated-0712-v03.pdf). FLCFS is set at 1.11 to offset this reduction factor in the fuel efficiency calculations as the reduction

[6] Defined as EMFAC vehicle types LDA, LDT1, LDT2, and MDV.

from LCFS is related to carbon content rather than fuel consumption. The calculation assumes a linear relationship between CO_2 emissions and fuel consumption.

Using the effective fuel efficiency derived from EMFAC presents a “chicken or egg” problem, as one cannot generate the fuel-efficiency estimate unless an input assumption about operating cost is made, but the operating cost assumption requires a fuel-efficiency estimate. In practice, each MPO will select a representative fuel efficiency estimate during the SCS development process that will be carried through SCS adoption.

Region-Specific Calculations

Detailed calculations are provided below for each of the MPO regions. The regions differ as to whether they will update the year 2005 simulation results using the prices presented in **Table 52** and **Table 53**; either way, consistent ratios for fuel prices (presented in **Table 51**) and non-fuel-related prices (**Table 54**) are applied to either the updated or non-updated 2005 assumptions.

MTC: Assuming updated Year 2005 Simulation Results

Using the above information, MTC will compute the year 2005, 2020, and 2035 perceived automobile operating cost estimates using the approach detailed in **Table 55**.

Table 55: MTC Region Example Calculations Assuming Updated 2005 Results (Prices in Year 2010 dollars)

Year	Quantity	Value
2005	Region-specific fuel price (Table 52, dollars per mile)	$2.83
	Non-fuel-related price (Table 53, dollars per mile)	$0.05
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	20.09
	Perceived automobile operating cost (cents per mile)	19.1¢
2020	Consistent fuel price ratio (Table 51)	1.45
	Region-specific fuel price (Ratio x 2005 price)	$4.09
	Consistent non-fuel-related price ratio (Table 54)	1.38
	Region-specific non-fuel-related price	$0.07
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	25.15[†]
	Perceived automobile operating cost (cents per mile)	23.1¢
2035	Consistent fuel price ratio (Table 51)	1.72
	Region-specific fuel price (Ratio x 2005 price)	$4.85
	Consistent non-fuel-related price ratio (Table 54)	1.75

	Region-specific non-fuel-related price	$0.09
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	28.85†
	Perceived automobile operating cost (cents per mile)	25.6¢

† - Value may change during the planning process.

SCAG: Assuming Updated Year 2005 Simulation Results

Using the information contained in this memorandum, SCAG will compute the year 2020 and 2035 perceived automobile operating cost estimates using the approach detailed in **Table 57**.

Table 56: SCAG Region Example Calculations (Prices in Year 2010 dollars)

Year	Quantity	Value
2005	Region-specific fuel price (Table 52, dollars per gallon)	$2.85
	Non-fuel-related price (Table 53, dollars per mile)	$0.05
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	18.63
	Perceived automobile operating cost (cents per mile)	20.3¢
2020	Consistent fuel price ratio (Table 51)	1.45
	Region-specific fuel price (Ratio x 2005 price)	$4.12
	Consistent non-fuel-related price ratio (Table 54)	1.38
	Region-specific non-fuel-related price	$0.07
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	23.63†
	Perceived automobile operating cost (cents per mile)	24.3¢
2035	Consistent fuel price ratio (Table 51)	1.72
	Region-specific fuel price (Ratio x 2005 price)	$4.89
	Consistent non-fuel-related price ratio (Table 54)	1.75
	Region-specific non-fuel-related price	$0.09
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	26.40†
	Perceived automobile operating cost (cents per mile)	27.3¢

† - Value may change during the planning process.

SACOG: Assuming Static Year 2005 Simulation Results

Using the information contained in this memorandum, SACOG will compute the year 2020 and 2035 perceived automobile operating cost estimates using the approach detailed in **Table 57**.

Table 57: SACOG Region Example Calculations (Prices in Year 2010 dollars)

Year	Quantity	Value
2005	Region-specific fuel price (Table 3, dollars per gallon)	$2.74
	Non-fuel-related price (Table 4, dollars per mile)	$0.05
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	19.50
	Perceived automobile operating cost (cents per mile)	19.1¢
2020	Consistent fuel price ratio (Table 51)	1.45
	Region-specific fuel price (Ratio x 2005 price)	$3.96
	Consistent non-fuel-related price ratio (Table 54)	1.38
	Region-specific non-fuel-related price	$0.07
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	24.92[†]
	Perceived automobile operating cost (cents per mile)	22.8¢
2035	Consistent fuel price ratio (Table 51)	1.72
	Region-specific fuel price (Ratio x 2005 price)	$4.70
	Consistent non-fuel-related price ratio (Table 54)	1.75
	Region-specific non-fuel-related price	$0.09
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	28.30[†]
	Perceived automobile operating cost (cents per mile)	25.4¢

[†] - Value may change during the planning process.

SANDAG: Assuming Static Year 2005 Simulation Results

Using the information contained in this memorandum, SANDAG will compute the year 2020 and 2035 perceived automobile operating cost estimates using the approach detailed in **Table 58**.

Table 58: SANDAG Region Example Calculations (Prices in Year 2010 dollars)

Year	Quantity	Value
2005	Region-specific fuel price (Table 52, dollars per gallon)	$2.84
	Non-fuel-related price (Table 53, dollars per mile)	$0.05
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	18.89
	Perceived automobile operating cost (cents per mile)	20.0¢
2020	Consistent fuel price ratio (Table 51)	1.45
	Region-specific fuel price (Ratio x 2005 price)	$4.11
	Consistent non-fuel-related price ratio (Table 54)	1.38
	Region-specific non-fuel-related price	$0.07
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	23.98†
	Perceived automobile operating cost (cents per mile)	24.0¢
2035	Consistent fuel price ratio (Table 51)	1.72
	Region-specific fuel price (Ratio x 2005 price)	$4.87
	Consistent non-fuel-related price ratio (Table 54)	1.75
	Region-specific non-fuel-related price	$0.09
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	27.20†
	Perceived automobile operating cost (cents per mile)	26.7¢

† - Value may change during the planning process.

Comparisons across SCS Rounds

Table 59 compares the fuel price and resulting automobile operating cost results across SCS rounds for each MPO *assuming* the effective fleet-wide fuel efficiency number remains unchanged from the first to second round – this number will change during the planning process.

Table 59: Fuel Price and Automobile Operating Cost Comparison across SCS Rounds (Prices in Year 2010 Dollars)

Year	Quantity	MTC		SCAG		SANDAG		SACOG	
		Rnd 1	Rnd 2	Rnd 1	Rnd 2	Rnd 1	Rnd 2	Rnd 1	Rnd 2
2005	Fuel price	$2.79	$2.83	$2.83	$2.85	$2.68	$2.84	$2.70	$2.74
	Auto. Oper. Cost	21.2¢	19.1¢	23.8¢	20.3¢	19.2¢	18.9¢	19.7¢	19.1¢
2020	Fuel price	$4.74	$4.09	$4.74	$4.12	$4.74	$4.11	$4.74	$3.96
	Auto. Oper. cost	28.7¢	23.1¢	31.9¢	24.3¢	22.6¢	24.0¢	27.0¢	22.8¢
2035	Fuel price	$5.24	$4.85	$5.24	$4.89	$5.24	$4.87	$5.24	$4.70
	Auto. Oper. cost	28.6¢	25.6¢	32.3¢	27.3¢	21.7¢	26.7¢	28.9¢	25.4¢
Ratios	2020 to 2005	1.34	1.21	1.34	1.20	1.18	1.20	1.37	1.20
	2035 to 2005	1.33	1.34	1.36	1.34	1.13	1.33	1.47	1.33

Next Steps

This memorandum proposes a consistent approach for computing fuel price for each of our MPOs for the second round of sustainable community strategies. After collecting your feedback and modifying our approach accordingly, we will share this approach with ARB and the other MPOs across the state.

APPENDIX L:

CALIBRATED PARAMETERS

Auto Operating Cost

	Fresno	Kern	Kings	Madera	TCM	Tulare
2005	19.12	20.43	19.13	19.79	19.56	19.48
2006	20.68	20.68	20.68	20.68	20.68	20.68
2007	22.23	22.23	22.23	22.23	22.23	22.23
2008	23.78	25.75	23.82	24.61	24.45	24.86
2009	22.63	22.63	22.63	22.63	22.63	22.63
2010	21.48	22.96	21.50	22.17	22.08	21.99
2011	21.70	21.70	21.70	21.70	21.70	21.70
2012	21.92	21.92	21.92	21.92	21.92	21.92
2013	22.14	22.14	22.14	22.14	22.14	22.14
2014	22.36	22.36	22.36	22.36	22.36	22.36
2015	22.58	22.58	22.58	22.58	22.58	22.58
2016	22.80	22.80	22.80	22.80	22.80	22.80
2017	23.02	23.02	23.02	23.02	23.02	23.02
2018	23.24	23.24	23.24	23.24	23.24	23.24
2019	23.46	23.46	23.46	23.46	23.46	23.46
2020	23.68	24.81	23.22	24.87	24.45	24.35
2021	23.57	23.57	23.57	23.57	23.57	23.57
2022	23.46	23.46	23.46	23.46	23.46	23.46
2023	23.36	23.36	23.36	23.36	23.36	23.36
2024	23.25	23.25	23.25	23.25	23.25	23.25
2025	23.14	23.14	23.14	23.14	23.14	23.14
2026	23.03	23.03	23.03	23.03	23.03	23.03
2027	22.93	22.93	22.93	22.93	22.93	22.93
2028	22.82	22.82	22.82	22.82	22.82	22.82
2029	22.71	22.71	22.71	22.71	22.71	22.71
2030	22.60	22.60	22.60	22.60	22.60	22.60
2031	22.50	22.50	22.50	22.50	22.50	22.50
2032	22.39	22.39	22.39	22.39	22.39	22.39
2033	22.28	22.28	22.28	22.28	22.28	22.28
2034	22.17	22.17	22.17	22.17	22.17	22.17
2035	22.07	23.07	21.84	23.29	22.54	22.47
2036	22.29	22.29	22.29	22.29	22.29	22.29
2037	22.52	22.52	22.52	22.52	22.52	22.52
2038	22.74	22.74	22.74	22.74	22.74	22.74
2039	22.97	22.97	22.97	22.97	22.97	22.97
2040	23.19	24.28	22.96	24.47	23.66	23.58

		Fresno	Kern	Kings	Madera	TCM			Tulare	MTC	SCAG	SACOG	SANDAG
						Merced	San Joaquin	Stanislaus					
2005	Region-specific fuel price[1] (dollars per gallon)	$ 2.81	$ 2.79	$ 2.78	$ 2.82	$ 2.84	$ 2.82	$ 2.84	$ 2.88	2.83	2.85	2.74	2.84
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	19.87	18.09	19.66	19.05	19.47	19.47	19.47	19.2	20.09	18.3	19.5	18.89
	Fuel related automobile operating cost (dollars per mile)	$ 0.14	$ 0.15	$ 0.14	$ 0.15	$ 0.15	$ 0.14	$ 0.15	$ 0.15				
	Non-fuel-related price[2] (dollars per mile)	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05
	Perceived automobile operating cost (cents per mile)	19.12	20.43	19.13	19.79	19.56	19.48	19.58	20.00	19.1	20.3	19.1	20
2008	Region-specific fuel price[1] (dollars per gallon)	$ 3.65	$ 3.63	$ 3.61	$ 3.67	$ 3.69	$ 3.67	$ 3.69	$ 3.75	3.68	3.53	3.53	3.35
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	19.74	17.74	19.49	18.97	19.21	19.21	19.21	19.14				
	Fuel related automobile operating cost (cents per mile)	$ 0.19	$ 0.20	$ 0.19	$ 0.19	$ 0.19	$ 0.19	$ 0.19	$ 0.20				
	Non-fuel-related price[2] (dollars per mile)	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05				
	Perceived automobile operating cost (cents per mile)	23.78	25.75	23.82	24.61	24.49	24.38	24.50	24.86				
2010	Region-specific fuel price[1] (dollars per gallon)	$ 3.15	$ 3.13	$ 3.11	$ 3.16	$ 3.18	$ 3.16	$ 3.18	$ 3.23	3.17	n/a	3.09	2.92
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	19.57	17.81	19.34	18.83	19.05	19.05	19.05	18.95				
	Fuel related automobile operating cost (cents per mile)	$ 0.16	$ 0.18	$ 0.16	$ 0.17	$ 0.17	$ 0.17	$ 0.17	$ 0.17				
	Non-fuel-related price[2] (dollars per mile)	0.054	0.054	0.054	0.054	0.054	0.054	0.054	0.054				
	Perceived automobile operating cost (cents per mile)	21.48	22.96	21.50	22.17	22.08	21.99	22.10	22.44				
2020	Region-specific fuel price[1] (dollars per gallon)	$ 4.06	$ 4.04	$ 4.02	$ 4.07	$ 4.10	$ 4.08	$ 4.10	$ 4.17	4.09	4.12	3.96	4.1
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	24.19	22.53	24.61	22.68	23.37	23.37	23.37	24.17	25.15	23.63	24.92	23.98
	Fuel related automobile operating cost (cents per mile)	$ 0.17	$ 0.18	$ 0.16	$ 0.18	$ 0.18	$ 0.17	$ 0.18	$ 0.17				
	Non-fuel-related price[2] (dollars per mile)	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07	$ 0.07
	Perceived automobile operating cost (cents per mile)	23.68	24.81	23.22	24.87	24.45	24.35	24.46	24.14	23.1	24.3	22.8	24
2035	Region-specific fuel price[1] (dollars per gallon)	$ 4.81	$ 4.79	$ 4.76	$ 4.83	$ 4.86	$ 4.83	$ 4.87	$ 4.94	4.85	4.89	4.7	4.87
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	36.01	33.3	36.24	33.11	35.12	35.12	35.12	36.97	28.85	26.4	28.3	27.2
	Fuel related automobile operating cost (cents per mile)	$ 0.13	$ 0.14	$ 0.13	$ 0.15	$ 0.14	$ 0.14	$ 0.14	$ 0.13				
	Non-fuel-related price[2] (dollars per mile)	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	0.087	0.087	0.087
	Perceived automobile operating cost (cents per mile)	22.07	23.07	21.84	23.29	22.54	22.47	22.56	22.06	25.6	27.3	25.4	26.7
2040	Region-specific fuel price[1] (dollars per gallon)	$ 5.21	$ 5.18	$ 5.15	$ 5.22	$ 5.26	$ 5.23	$ 5.26	$ 5.34				
	Effective passenger vehicle fuel efficiency (EMFAC, miles per gallon)	37.46	34.55	37.7	34.45	36.62	36.62	36.62	38.61				
	Fuel related automobile operating cost (cents per mile)	$ 0.14	$ 0.15	$ 0.14	$ 0.15	$ 0.14	$ 0.14	$ 0.14	$ 0.14				
	Non-fuel-related price[2] (dollars per mile)	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09	$ 0.09				
	Perceived automobile operating cost (cents per mile)	23.19	24.28	22.96	24.47	23.66	23.58	23.67	23.14				

Based on the memo prepared by MTC, SCAG, SACOG, and SANDAG in October 2014 titled Automobile Operating Cost for the Second Round of Sustainable Communities Strategies.

Notes
1. See Table 2 of *Automobile Operating Cost for the Second Round of Sustainable Communities Strategies*
2. See Table 5 of *Automobile Operating Cost for the Second Round of Sustainable Communities Strategies*

;Index	Veh0	Veh1	Veh2	Veh3	Veh4	key
1	0	0	0	0	0	;Alt-specific Constant (set in calibration)
2	7.51	3.95	0	0	0	;commute_cost_ratio
3	0.0093	0	0	-0.0036	-0.0036	;ped-oriented intersection density
4	0.000009	0.00001	0	-5.1E-05	-0.000112	;transit accessibility
5	0.39	0.24	0	0	-0.19	;log employment density
11	0	0	0	0	0	;RU_group=RUG1
12	1.27	0.53	0	-1.53	-1.53	;RU_group=RUG3
13	0.27	0.27	0	0	0	;RU_group=RUG6
21	-1.16	1.5	0	-3.15	-4.94	;HH_size=HH1
22	-3.03	-0.42	0	-2.26	-4.19	;HH_size=HH2
23	-3.37	-0.24	0	-1.34	-3.4	;HH_size=HH3
24	-4.02	-0.66	0	-1.61	-3.13	;HH_size=HH4
25	-3.5	-0.89	0	-1.32	-2.44	;HH_size=HH5
31	0	0	0	0	0	;HH_inc=IncG1
32	-1.33	-0.28	0	0.86	0.98	;HH_inc=IncG2
33	-3.87	-0.93	0	1.2	2.35	;HH_inc=IncG3
34	-2.98	-1.55	0	1.55	2.35	;HH_inc=IncG4
35	-4.23	-1.96	0	1.44	2.87	;HH_inc=IncG5

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
1	1001	TOTHH	0.195	0.17	0	0	0.625	0	0	0	0	0	0	0	0	0	0	0	0
1	1002	HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1003	GQPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1004	RU1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1005	RU3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1006	RU6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1007	RUSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1008	RUSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1009	RUSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1010	RUSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1011	RU1_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1012	RU3_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1013	RU9_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1014	RU7SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1015	RU8SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1016	RU9SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1017	RU10SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1018	RU1_HHSIZE1_INC1	0.483	0.42	0	0	1.582	0	0	0	0	0	0	0	0	0	0	0	0
1	1019	RU1_HHSIZE1_INC2	0.483	0.42	0	0	1.582	0	0	0	0	0	0	0	0	0	0	0	0
1	1020	RU1_HHSIZE1_INC3	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1021	RU1_HHSIZE1_INC4	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1022	RU1_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1023	RU1_HHSIZE2_INC1	0.816	0.71	0	0	2.645	0	0	0	0	0	0	0	0	0	0	0	0
1	1024	RU1_HHSIZE2_INC2	0.816	0.71	0	0	2.645	0	0	0	0	0	0	0	0	0	0	0	0
1	1025	RU1_HHSIZE2_INC3	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
1	1026	RU1_HHSIZE2_INC4	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
1	1027	RU1_HHSIZE2_INC5	0.983	0.76	0	0	2.265	0	0	0	0	0	0	0	0	0	0	0	0
1	1028	RU1_HHSIZE3_INC1	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
1	1029	RU1_HHSIZE3_INC2	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
1	1030	RU1_HHSIZE3_INC3	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
1	1031	RU1_HHSIZE3_INC4	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
1	1032	RU1_HHSIZE3_INC5	1.762	1.37	0	0	4.081	0	0	0	0	0	0	0	0	0	0	0	0
1	1033	RU1_HHSIZE4_INC1	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
1	1034	RU1_HHSIZE4_INC2	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
1	1035	RU1_HHSIZE4_INC3	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
1	1036	RU1_HHSIZE4_INC4	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
1	1037	RU1_HHSIZE4_INC5	2.133	1.65	0	0	4.929	0	0	0	0	0	0	0	0	0	0	0	0
1	1038	RU1_HHSIZE5_INC1	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
1	1039	RU1_HHSIZE5_INC2	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
1	1040	RU1_HHSIZE5_INC3	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
1	1041	RU1_HHSIZE5_INC4	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
1	1042	RU1_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
1	1043	RU3_HHSIZE1_INC1	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0
1	1044	RU3_HHSIZE1_INC2	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0
1	1045	RU3_HHSIZE1_INC3	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1046	RU3_HHSIZE1_INC4	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1047	RU3_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1048	RU3_HHSIZE2_INC1	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
1	1049	RU3_HHSIZE2_INC2	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
1	1050	RU3_HHSIZE2_INC3	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
1	1051	RU3_HHSIZE2_INC4	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
1	1052	RU3_HHSIZE2_INC5	0.983	0.76	0	0	2.265	0	0	0	0	0	0	0	0	0	0	0	0
1	1053	RU3_HHSIZE3_INC1	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
1	1054	RU3_HHSIZE3_INC2	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
1	1055	RU3_HHSIZE3_INC3	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
1	1056	RU3_HHSIZE3_INC4	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
1	1057	RU3_HHSIZE3_INC5	1.762	1.37	0	0	4.081	0	0	0	0	0	0	0	0	0	0	0	0
1	1058	RU3_HHSIZE4_INC1	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
1	1059	RU3_HHSIZE4_INC2	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
1	1060	RU3_HHSIZE4_INC3	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
1	1061	RU3_HHSIZE4_INC4	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
1	1062	RU3_HHSIZE4_INC5	2.133	1.65	0	0	4.929	0	0	0	0	0	0	0	0	0	0	0	0
1	1063	RU3_HHSIZE5_INC1	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
1	1064	RU3_HHSIZE5_INC2	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
1	1065	RU3_HHSIZE5_INC3	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
1	1066	RU3_HHSIZE5_INC4	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
1	1067	RU3_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
1	1068	RU9_HHSIZE1_INC1	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
1	1069	RU9_HHSIZE1_INC2	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0
1	1070	RU9_HHSIZE1_INC3	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1071	RU9_HHSIZE1_INC4	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1072	RU9_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
1	1073	RU9_HHSIZE2_INC1	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
1	1074	RU9_HHSIZE2_INC2	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
1	1075	RU9_HHSIZE2_INC3	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
1	1076	RU9_HHSIZE2_INC4	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
1	1077	RU9_HHSIZE2_INC5	0.983	0.76	0	0	2.265	0	0	0	0	0	0	0	0	0	0	0	0
1	1078	RU9_HHSIZE3_INC1	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
1	1079	RU9_HHSIZE3_INC2	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
1	1080	RU9_HHSIZE3_INC3	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
1	1081	RU9_HHSIZE3_INC4	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
1	1082	RU9_HHSIZE3_INC5	1.762	1.37	0	0	4.081	0	0	0	0	0	0	0	0	0	0	0	0
1	1083	RU9_HHSIZE4_INC1	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
1	1084	RU9_HHSIZE4_INC2	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
1	1085	RU9_HHSIZE4_INC3	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
1	1086	RU9_HHSIZE4_INC4	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
1	1087	RU9_HHSIZE4_INC5	2.133	1.65	0	0	4.929	0	0	0	0	0	0	0	0	0	0	0	0
1	1088	RU9_HHSIZE5_INC1	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
1	1089	RU9_HHSIZE5_INC2	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
1	1090	RU9_HHSIZE5_INC3	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
1	1091	RU9_HHSIZE5_INC4	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
1	1092	RU9_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
1	1093	RU1_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1094	RU1_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1095	RU1_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1096	RU1_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1097	RU3_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1098	RU3_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1099	RU3_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1100	RU3_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1101	RU9_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1102	RU9_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1103	RU9_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1104	RU9_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1105	POP0005	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0.048	0	0.03	0.038
1	1106	POP0514	0	0	0.28	0	0	0	0	0	0	0	0	0	0	0.365	0	0.23	0.26
1	1107	POP1517	0	0	0.09	0.31	0	0	0	0	0	0	0	0	0	0	0.462	0	0
1	1108	POP1824	0	0	0	0.19	0	0	0	0	0	0	0	0	0	0	0.077	0	0
1	1109	POP2554	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0.01	0	0
1	1110	POP5564	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1111	POP6574	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1112	POP75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1113	EMPEDU	0	0	0	0	0	0	0	0	0	0	0	0.933	0	0	0	0	0
1	1114	EMPFOO	0	0	0	0	0	3.324	7.472	0	0	0	0	1.267	6.343	0	0	11.2	2.007
1	1115	EMPGOV	0	0	0	0	0	1.032	0.566	0	0	0	0	2.793	0	0	0	3.98	0.585
1	1116	EMPIND	0	0	0	0	0	0	0	0	0	0	0	1.388	0	0	0	3.27	0
1	1117	EMPMED	0	0	0	0	0	0.496	0.278	0	0	0	0	1.359	0	0	0	1.94	0.278
1	1118	EMPOFC	0	0	0	0	0	0.645	0.358	0	0	0	0	1.783	0	0	0	2.54	0.365
1	1119	EMPOTH	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
1	1120	EMPRET	0	0	0	0	0	2.491	5.607	0	0	0	0	0.948	4.758	0	0	8.43	1.509
1	1121	EMPAGR	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
1	1122	POPDORM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1123	POPASSIST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1124	POPMILITARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1125	EMPSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1126	EMPSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1127	EMPSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1128	EMPSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1129	EMPSPARE5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1130	EMPSPARE6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1131	EMPSPARE7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1132	EMPSPARE8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	1133	ELEM	0	0	0.82	0	0	0	0	0	0	0	0	0	0	1.095	0	0.67	0.778
1	1134	HS	0	0	0.36	1.17	0	0	0	0	0	0	0	0	0	0	1.767	0	0
1	1135	COLLEGE	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0
2	2001	TOTHH	0.195	0.17	0	0	0.625	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
2	2002	HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2003	GQPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2004	RU1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2005	RU3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2006	RU6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2007	RUSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2008	RUSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2009	RUSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2010	RUSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2011	RU1_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2012	RU3_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2013	RU9_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2014	RU7SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2015	RU8SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2016	RU9SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2017	RU10SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2018	RU1_HHSIZE1_INC1	0.483	0.42	0	0	1.582	0	0	0	0	0	0	0	0	0	0	0	0
2	2019	RU1_HHSIZE1_INC2	0.483	0.42	0	0	1.582	0	0	0	0	0	0	0	0	0	0	0	0
2	2020	RU1_HHSIZE1_INC3	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2021	RU1_HHSIZE1_INC4	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2022	RU1_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2023	RU1_HHSIZE2_INC1	0.816	0.71	0	0	2.645	0	0	0	0	0	0	0	0	0	0	0	0
2	2024	RU1_HHSIZE2_INC2	0.816	0.71	0	0	2.645	0	0	0	0	0	0	0	0	0	0	0	0
2	2025	RU1_HHSIZE2_INC3	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
2	2026	RU1_HHSIZE2_INC4	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
2	2027	RU1_HHSIZE2_INC5	0.983	0.76	0	0	2.265	0	0	0	0	0	0	0	0	0	0	0	0
2	2028	RU1_HHSIZE3_INC1	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
2	2029	RU1_HHSIZE3_INC2	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
2	2030	RU1_HHSIZE3_INC3	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
2	2031	RU1_HHSIZE3_INC4	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
2	2032	RU1_HHSIZE3_INC5	1.762	1.37	0	0	4.081	0	0	0	0	0	0	0	0	0	0	0	0
2	2033	RU1_HHSIZE4_INC1	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
2	2034	RU1_HHSIZE4_INC2	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
2	2035	RU1_HHSIZE4_INC3	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
2	2036	RU1_HHSIZE4_INC4	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
2	2037	RU1_HHSIZE4_INC5	2.133	1.65	0	0	4.929	0	0	0	0	0	0	0	0	0	0	0	0
2	2038	RU1_HHSIZE5_INC1	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
2	2039	RU1_HHSIZE5_INC2	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
2	2040	RU1_HHSIZE5_INC3	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
2	2041	RU1_HHSIZE5_INC4	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
2	2042	RU1_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
2	2043	RU3_HHSIZE1_INC1	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0
2	2044	RU3_HHSIZE1_INC2	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0
2	2045	RU3_HHSIZE1_INC3	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2046	RU3_HHSIZE1_INC4	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2047	RU3_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2048	RU3_HHSIZE2_INC1	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
2	2049	RU3_HHSIZE2_INC2	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
2	2050	RU3_HHSIZE2_INC3	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
2	2051	RU3_HHSIZE2_INC4	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
2	2052	RU3_HHSIZE2_INC5	0.983	0.76	0	0	2.265	0	0	0	0	0	0	0	0	0	0	0	0
2	2053	RU3_HHSIZE3_INC1	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
2	2054	RU3_HHSIZE3_INC2	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
2	2055	RU3_HHSIZE3_INC3	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
2	2056	RU3_HHSIZE3_INC4	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
2	2057	RU3_HHSIZE3_INC5	1.762	1.37	0	0	4.081	0	0	0	0	0	0	0	0	0	0	0	0
2	2058	RU3_HHSIZE4_INC1	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
2	2059	RU3_HHSIZE4_INC2	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
2	2060	RU3_HHSIZE4_INC3	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
2	2061	RU3_HHSIZE4_INC4	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
2	2062	RU3_HHSIZE4_INC5	2.133	1.65	0	0	4.929	0	0	0	0	0	0	0	0	0	0	0	0
2	2063	RU3_HHSIZE5_INC1	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
2	2064	RU3_HHSIZE5_INC2	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
2	2065	RU3_HHSIZE5_INC3	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
2	2066	RU3_HHSIZE5_INC4	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
2	2067	RU3_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
2	2068	RU9_HHSIZE1_INC1	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0
2	2069	RU9_HHSIZE1_INC2	0.325	0.29	0	0	1.054	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
2	2070	RU9_HHSIZE1_INC3	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2071	RU9_HHSIZE1_INC4	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2072	RU9_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
2	2073	RU9_HHSIZE2_INC1	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
2	2074	RU9_HHSIZE2_INC2	0.77	0.68	0	0	2.528	0	0	0	0	0	0	0	0	0	0	0	0
2	2075	RU9_HHSIZE2_INC3	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
2	2076	RU9_HHSIZE2_INC4	0.964	0.75	0	0	2.226	0	0	0	0	0	0	0	0	0	0	0	0
2	2077	RU9_HHSIZE2_INC5	0.983	0.76	0	0	2.265	0	0	0	0	0	0	0	0	0	0	0	0
2	2078	RU9_HHSIZE3_INC1	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
2	2079	RU9_HHSIZE3_INC2	1.141	1	0	0	3.749	0	0	0	0	0	0	0	0	0	0	0	0
2	2080	RU9_HHSIZE3_INC3	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
2	2081	RU9_HHSIZE3_INC4	1.28	0.99	0	0	2.977	0	0	0	0	0	0	0	0	0	0	0	0
2	2082	RU9_HHSIZE3_INC5	1.762	1.37	0	0	4.081	0	0	0	0	0	0	0	0	0	0	0	0
2	2083	RU9_HHSIZE4_INC1	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
2	2084	RU9_HHSIZE4_INC2	1.567	1.37	0	0	5.116	0	0	0	0	0	0	0	0	0	0	0	0
2	2085	RU9_HHSIZE4_INC3	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
2	2086	RU9_HHSIZE4_INC4	1.976	1.53	0	0	4.578	0	0	0	0	0	0	0	0	0	0	0	0
2	2087	RU9_HHSIZE4_INC5	2.133	1.65	0	0	4.929	0	0	0	0	0	0	0	0	0	0	0	0
2	2088	RU9_HHSIZE5_INC1	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
2	2089	RU9_HHSIZE5_INC2	2.17	1.9	0	0	7.058	0	0	0	0	0	0	0	0	0	0	0	0
2	2090	RU9_HHSIZE5_INC3	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
2	2091	RU9_HHSIZE5_INC4	3.2	2.49	0	0	7.4	0	0	0	0	0	0	0	0	0	0	0	0
2	2092	RU9_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
2	2093	RU1_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2094	RU1_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2095	RU1_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2096	RU1_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2097	RU3_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2098	RU3_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2099	RU3_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2100	RU3_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2101	RU9_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2102	RU9_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2103	RU9_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2104	RU9_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2105	POP0005	0	0	0.04	0	0	0	0	0	0	0	0	0	0	0.048	0	0.03	0.038
2	2106	POP0514	0	0	0.28	0	0	0	0	0	0	0	0	0	0	0.365	0	0.23	0.26
2	2107	POP1517	0	0	0.09	0.31	0	0	0	0	0	0	0	0	0	0	0.462	0	0
2	2108	POP1824	0	0	0	0.19	0	0	0	0	0	0	0	0	0	0	0.077	0	0
2	2109	POP2554	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0.01	0	0
2	2110	POP5564	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2111	POP6574	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2112	POP75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2113	EMPEDU	0	0	0	0	0	0	0	0	0	0	0	0.933	0	0	0	0	0
2	2114	EMPFOO	0	0	0	0	0	3.324	7.472	0	0	0	0	1.267	6.343	0	0	11.2	2.007
2	2115	EMPGOV	0	0	0	0	0	1.032	0.566	0	0	0	0	2.793	0	0	0	3.98	0.585
2	2116	EMPIND	0	0	0	0	0	0	0	0	0	0	0	1.388	0	0	0	3.27	0
2	2117	EMPMED	0	0	0	0	0	0.496	0.278	0	0	0	0	1.359	0	0	0	1.94	0.278
2	2118	EMPOFC	0	0	0	0	0	0.645	0.358	0	0	0	0	1.783	0	0	0	2.54	0.365
2	2119	EMPOTH	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
2	2120	EMPRET	0	0	0	0	0	2.491	5.607	0	0	0	0	0.948	4.758	0	0	8.43	1.509
2	2121	EMPAGR	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
2	2122	POPDORM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2123	POPASSIST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2124	POPMILITARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2125	EMPSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2126	EMPSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2127	EMPSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2128	EMPSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2129	EMPSPARE5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2130	EMPSPARE6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2131	EMPSPARE7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2132	EMPSPARE8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2133	ELEM	0	0	0.82	0	0	0	0	0	0	0	0	0	0	1.095	0	0.67	0.778
2	2134	HS	0	0	0.36	1.17	0	0	0	0	0	0	0	0	0	0	1.767	0	0
2	2135	COLLEGE	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0
3	3001	TOTHH	0.195	0.17	0	0	0.625	0	0	0	0	0	0	0	0	0	0	0	0
3	3002	HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
3	3003	GQPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3004	RU1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3005	RU3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3006	RU6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3007	RUSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3008	RUSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3009	RUSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3010	RUSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3011	RU1_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3012	RU3_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3013	RU9_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3014	RU7SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3015	RU8SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3016	RU9SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3017	RU10SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3018	RU1_HHSIZE1_INC1	0.455	0.39	0	0	1.465	0	0	0	0	0	0	0	0	0	0	0	0
3	3019	RU1_HHSIZE1_INC2	0.455	0.39	0	0	1.465	0	0	0	0	0	0	0	0	0	0	0	0
3	3020	RU1_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
3	3021	RU1_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
3	3022	RU1_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
3	3023	RU1_HHSIZE2_INC1	0.826	0.71	0	0	2.684	0	0	0	0	0	0	0	0	0	0	0	0
3	3024	RU1_HHSIZE2_INC2	0.826	0.71	0	0	2.684	0	0	0	0	0	0	0	0	0	0	0	0
3	3025	RU1_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
3	3026	RU1_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
3	3027	RU1_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
3	3028	RU1_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
3	3029	RU1_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
3	3030	RU1_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
3	3031	RU1_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
3	3032	RU1_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
3	3033	RU1_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
3	3034	RU1_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
3	3035	RU1_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
3	3036	RU1_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
3	3037	RU1_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
3	3038	RU1_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
3	3039	RU1_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
3	3040	RU1_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
3	3041	RU1_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
3	3042	RU1_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
3	3043	RU3_HHSIZE1_INC1	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
3	3044	RU3_HHSIZE1_INC2	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
3	3045	RU3_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
3	3046	RU3_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
3	3047	RU3_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
3	3048	RU3_HHSIZE2_INC1	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
3	3049	RU3_HHSIZE2_INC2	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
3	3050	RU3_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
3	3051	RU3_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
3	3052	RU3_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
3	3053	RU3_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
3	3054	RU3_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
3	3055	RU3_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
3	3056	RU3_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
3	3057	RU3_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
3	3058	RU3_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
3	3059	RU3_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
3	3060	RU3_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
3	3061	RU3_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
3	3062	RU3_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
3	3063	RU3_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
3	3064	RU3_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
3	3065	RU3_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
3	3066	RU3_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
3	3067	RU3_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
3	3068	RU9_HHSIZE1_INC1	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
3	3069	RU9_HHSIZE1_INC2	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
3	3070	RU9_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
3	3071	RU9_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
3	3072	RU9_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
3	3073	RU9_HHSIZE2_INC1	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
3	3074	RU9_HHSIZE2_INC2	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
3	3075	RU9_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
3	3076	RU9_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
3	3077	RU9_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
3	3078	RU9_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
3	3079	RU9_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
3	3080	RU9_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
3	3081	RU9_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
3	3082	RU9_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
3	3083	RU9_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
3	3084	RU9_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
3	3085	RU9_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
3	3086	RU9_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
3	3087	RU9_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
3	3088	RU9_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
3	3089	RU9_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
3	3090	RU9_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
3	3091	RU9_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
3	3092	RU9_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
3	3093	RU1_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3094	RU1_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3095	RU1_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3096	RU1_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3097	RU3_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3098	RU3_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3099	RU3_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3100	RU3_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3101	RU9_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3102	RU9_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3103	RU9_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3104	RU9_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	3105	POP0005	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0.077	0	0.05	0.048
3	3106	POP0514	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0.337	0	0.2	0.24
3	3107	POP1517	0	0	0.11	0.37	0	0	0	0	0	0	0	0	0	0	0.557	0	0
3	3108	POP1824	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0
3	3109	POP2554	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0.01	0	0
3	3110	POP5564	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3111	POP6574	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3112	POP75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3113	EMPEDU	0	0	0	0	0	0	0	0	0	0	0	0.933	0	0	0	0	0
3	3114	EMPFOO	0	0	0	0	0	3.324	7.472	0	0	0	0	1.267	6.343	0	0	11.2	2.007
3	3115	EMPGOV	0	0	0	0	0	1.032	0.566	0	0	0	0	2.793	0	0	0	3.98	0.585
3	3116	EMPIND	0	0	0	0	0	0	0	0	0	0	0	1.388	0	0	0	3.27	0
3	3117	EMPMED	0	0	0	0	0	0.496	0.278	0	0	0	0	1.359	0	0	0	1.94	0.278
3	3118	EMPOFC	0	0	0	0	0	0.645	0.358	0	0	0	0	1.783	0	0	0	2.54	0.365
3	3119	EMPOTH	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
3	3120	EMPRET	0	0	0	0	0	2.491	5.607	0	0	0	0	0.948	4.758	0	0	8.43	1.509
3	3121	EMPAGR	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
3	3122	POPDORM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3123	POPASSIST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3124	POPMILITARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3125	EMPSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3126	EMPSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3127	EMPSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3128	EMPSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3129	EMPSPARE5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3130	EMPSPARE6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3131	EMPSPARE7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3132	EMPSPARE8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	3133	ELEM	0	0	0.82	0	0	0	0	0	0	0	0	0	0	1.095	0	0.67	0.778
3	3134	HS	0	0	0.36	1.17	0	0	0	0	0	0	0	0	0	0	1.767	0	0
3	3135	COLLEGE	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0
4	4001	TOTHH	0.195	0.17	0	0	0.625	0	0	0	0	0	0	0	0	0	0	0	0
4	4002	HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4003	GQPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
4	4004	RU1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4005	RU3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4006	RU6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4007	RUSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4008	RUSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4009	RUSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4010	RUSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4011	RU1_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4012	RU3_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4013	RU9_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4014	RU7SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4015	RU8SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4016	RU9SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4017	RU10SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4018	RU1_HHSIZE1_INC1	0.455	0.39	0	0	1.465	0	0	0	0	0	0	0	0	0	0	0	0
4	4019	RU1_HHSIZE1_INC2	0.455	0.39	0	0	1.465	0	0	0	0	0	0	0	0	0	0	0	0
4	4020	RU1_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
4	4021	RU1_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
4	4022	RU1_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
4	4023	RU1_HHSIZE2_INC1	0.826	0.71	0	0	2.684	0	0	0	0	0	0	0	0	0	0	0	0
4	4024	RU1_HHSIZE2_INC2	0.826	0.71	0	0	2.684	0	0	0	0	0	0	0	0	0	0	0	0
4	4025	RU1_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
4	4026	RU1_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
4	4027	RU1_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
4	4028	RU1_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
4	4029	RU1_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
4	4030	RU1_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
4	4031	RU1_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
4	4032	RU1_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
4	4033	RU1_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
4	4034	RU1_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
4	4035	RU1_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
4	4036	RU1_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
4	4037	RU1_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
4	4038	RU1_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
4	4039	RU1_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
4	4040	RU1_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
4	4041	RU1_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
4	4042	RU1_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
4	4043	RU3_HHSIZE1_INC1	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
4	4044	RU3_HHSIZE1_INC2	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
4	4045	RU3_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
4	4046	RU3_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
4	4047	RU3_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
4	4048	RU3_HHSIZE2_INC1	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
4	4049	RU3_HHSIZE2_INC2	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
4	4050	RU3_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
4	4051	RU3_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
4	4052	RU3_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
4	4053	RU3_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
4	4054	RU3_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
4	4055	RU3_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
4	4056	RU3_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
4	4057	RU3_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
4	4058	RU3_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
4	4059	RU3_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
4	4060	RU3_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
4	4061	RU3_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
4	4062	RU3_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
4	4063	RU3_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
4	4064	RU3_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
4	4065	RU3_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
4	4066	RU3_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
4	4067	RU3_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
4	4068	RU9_HHSIZE1_INC1	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
4	4069	RU9_HHSIZE1_INC2	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
4	4070	RU9_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
4	4071	RU9_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
4	4072	RU9_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
4	4073	RU9_HHSIZE2_INC1	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
4	4074	RU9_HHSIZE2_INC2	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
4	4075	RU9_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
4	4076	RU9_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
4	4077	RU9_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
4	4078	RU9_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
4	4079	RU9_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
4	4080	RU9_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
4	4081	RU9_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
4	4082	RU9_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
4	4083	RU9_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
4	4084	RU9_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
4	4085	RU9_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
4	4086	RU9_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
4	4087	RU9_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
4	4088	RU9_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
4	4089	RU9_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
4	4090	RU9_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
4	4091	RU9_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
4	4092	RU9_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
4	4093	RU1_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4094	RU1_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4095	RU1_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4096	RU1_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4097	RU3_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4098	RU3_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4099	RU3_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4100	RU3_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4101	RU9_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4102	RU9_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4103	RU9_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4104	RU9_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	4105	POP0005	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0.077	0	0.05	0.048
4	4106	POP0514	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0.337	0	0.2	0.24
4	4107	POP1517	0	0	0.11	0.37	0	0	0	0	0	0	0	0	0	0	0.557	0	0
4	4108	POP1824	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0
4	4109	POP2554	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0.01	0	0
4	4110	POP5564	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4111	POP6574	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4112	POP75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4113	EMPEDU	0	0	0	0	0	0	0	0	0	0	0	0.933	0	0	0	0	0
4	4114	EMPFOO	0	0	0	0	0	3.324	7.472	0	0	0	0	1.267	6.343	0	0	11.2	2.007
4	4115	EMPGOV	0	0	0	0	0	1.032	0.566	0	0	0	0	2.793	0	0	0	3.98	0.585
4	4116	EMPIND	0	0	0	0	0	0	0	0	0	0	0	1.388	0	0	0	3.27	0
4	4117	EMPMED	0	0	0	0	0	0.496	0.278	0	0	0	0	1.359	0	0	0	1.94	0.278
4	4118	EMPOFC	0	0	0	0	0	0.645	0.358	0	0	0	0	1.783	0	0	0	2.54	0.365
4	4119	EMPOTH	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
4	4120	EMPRET	0	0	0	0	0	2.491	5.607	0	0	0	0	0.948	4.758	0	0	8.43	1.509
4	4121	EMPAGR	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
4	4122	POPDORM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4123	POPASSIST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4124	POPMILITARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4125	EMPSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4126	EMPSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4127	EMPSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4128	EMPSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4129	EMPSPARE5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4130	EMPSPARE6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4131	EMPSPARE7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4132	EMPSPARE8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	4133	ELEM	0	0	0.82	0	0	0	0	0	0	0	0	0	0	1.095	0	0.67	0.778
4	4134	HS	0	0	0.36	1.17	0	0	0	0	0	0	0	0	0	0	1.767	0	0
4	4135	COLLEGE	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0
5	5001	TOTHH	0.195	0.17	0	0	0.625	0	0	0	0	0	0	0	0	0	0	0	0
5	5002	HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5003	GQPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5004	RU1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
5	5005	RU3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5006	RU6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5007	RUSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5008	RUSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5009	RUSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5010	RUSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5011	RU1_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5012	RU3_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5013	RU9_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5014	RU7SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5015	RU8SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5016	RU9SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5017	RU10SPARE_HHPOP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5018	RU1_HHSIZE1_INC1	0.455	0.39	0	0	1.465	0	0	0	0	0	0	0	0	0	0	0	0
5	5019	RU1_HHSIZE1_INC2	0.455	0.39	0	0	1.465	0	0	0	0	0	0	0	0	0	0	0	0
5	5020	RU1_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
5	5021	RU1_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
5	5022	RU1_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
5	5023	RU1_HHSIZE2_INC1	0.826	0.71	0	0	2.684	0	0	0	0	0	0	0	0	0	0	0	0
5	5024	RU1_HHSIZE2_INC2	0.826	0.71	0	0	2.684	0	0	0	0	0	0	0	0	0	0	0	0
5	5025	RU1_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
5	5026	RU1_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
5	5027	RU1_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
5	5028	RU1_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
5	5029	RU1_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
5	5030	RU1_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
5	5031	RU1_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
5	5032	RU1_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
5	5033	RU1_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
5	5034	RU1_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
5	5035	RU1_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
5	5036	RU1_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
5	5037	RU1_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
5	5038	RU1_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
5	5039	RU1_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
5	5040	RU1_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
5	5041	RU1_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
5	5042	RU1_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
5	5043	RU3_HHSIZE1_INC1	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
5	5044	RU3_HHSIZE1_INC2	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
5	5045	RU3_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
5	5046	RU3_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
5	5047	RU3_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0
5	5048	RU3_HHSIZE2_INC1	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
5	5049	RU3_HHSIZE2_INC2	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
5	5050	RU3_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
5	5051	RU3_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
5	5052	RU3_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
5	5053	RU3_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
5	5054	RU3_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
5	5055	RU3_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
5	5056	RU3_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
5	5057	RU3_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
5	5058	RU3_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
5	5059	RU3_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
5	5060	RU3_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
5	5061	RU3_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
5	5062	RU3_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
5	5063	RU3_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
5	5064	RU3_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
5	5065	RU3_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
5	5066	RU3_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
5	5067	RU3_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
5	5068	RU9_HHSIZE1_INC1	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
5	5069	RU9_HHSIZE1_INC2	0.417	0.36	0	0	1.348	0	0	0	0	0	0	0	0	0	0	0	0
5	5070	RU9_HHSIZE1_INC3	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
5	5071	RU9_HHSIZE1_INC4	0.677	0.52	0	0	1.561	0	0	0	0	0	0	0	0	0	0	0	0
5	5072	RU9_HHSIZE1_INC5	0.64	0.51	0	0	1.493	0	0	0	0	0	0	0	0	0	0	0	0

/* Area Type	LU Code	LU_Type	HW_P	HS_P	HK_P	HC_P	HO_P	WO_P	OO_P	HY_P	TS_P	TM_P	TH_P	HW_A	HS_A	HK_A	HC_A	HO_A	WO_A
5	5073	RU9_HHSIZE2_INC1	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
5	5074	RU9_HHSIZE2_INC2	0.844	0.73	0	0	2.743	0	0	0	0	0	0	0	0	0	0	0	0
5	5075	RU9_HHSIZE2_INC3	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
5	5076	RU9_HHSIZE2_INC4	1.196	0.93	0	0	2.762	0	0	0	0	0	0	0	0	0	0	0	0
5	5077	RU9_HHSIZE2_INC5	1.178	0.92	0	0	2.724	0	0	0	0	0	0	0	0	0	0	0	0
5	5078	RU9_HHSIZE3_INC1	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
5	5079	RU9_HHSIZE3_INC2	1.187	1.04	0	0	3.866	0	0	0	0	0	0	0	0	0	0	0	0
5	5080	RU9_HHSIZE3_INC3	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
5	5081	RU9_HHSIZE3_INC4	1.753	1.36	0	0	4.061	0	0	0	0	0	0	0	0	0	0	0	0
5	5082	RU9_HHSIZE3_INC5	1.771	1.38	0	0	4.11	0	0	0	0	0	0	0	0	0	0	0	0
5	5083	RU9_HHSIZE4_INC1	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
5	5084	RU9_HHSIZE4_INC2	1.919	1.69	0	0	6.286	0	0	0	0	0	0	0	0	0	0	0	0
5	5085	RU9_HHSIZE4_INC3	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
5	5086	RU9_HHSIZE4_INC4	2.273	1.77	0	0	5.261	0	0	0	0	0	0	0	0	0	0	0	0
5	5087	RU9_HHSIZE4_INC5	2.559	1.99	0	0	5.926	0	0	0	0	0	0	0	0	0	0	0	0
5	5088	RU9_HHSIZE5_INC1	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
5	5089	RU9_HHSIZE5_INC2	2.606	2.28	0	0	8.521	0	0	0	0	0	0	0	0	0	0	0	0
5	5090	RU9_HHSIZE5_INC3	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
5	5091	RU9_HHSIZE5_INC4	3.672	2.86	0	0	8.502	0	0	0	0	0	0	0	0	0	0	0	0
5	5092	RU9_HHSIZE5_INC5	2.837	2.2	0	0	6.56	0	0	0	0	0	0	0	0	0	0	0	0
5	5093	RU1_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5094	RU1_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5095	RU1_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5096	RU1_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5097	RU3_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5098	RU3_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5099	RU3_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5100	RU3_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5101	RU9_AGE1524	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5102	RU9_AGE2564	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5103	RU9_AGE6574	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5104	RU9_AGE75	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	5105	POP0005	0	0	0.06	0	0	0	0	0	0	0	0	0	0	0.077	0	0.05	0.048
5	5106	POP0514	0	0	0.25	0	0	0	0	0	0	0	0	0	0	0.337	0	0.2	0.24
5	5107	POP1517	0	0	0.11	0.37	0	0	0	0	0	0	0	0	0	0	0.557	0	0
5	5108	POP1824	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0
5	5109	POP2554	0	0	0	0.02	0	0	0	0	0	0	0	0	0	0	0.01	0	0
5	5110	POP5564	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5111	POP6574	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5112	POP75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5113	EMPEDU	0	0	0	0	0	0	0	0	0	0	0	0.933	0	0	0	0	0
5	5114	EMPFOO	0	0	0	0	0	3.324	7.472	0	0	0	0	1.267	6.343	0	0	11.2	2.007
5	5115	EMPGOV	0	0	0	0	0	1.032	0.566	0	0	0	0	2.793	0	0	0	3.98	0.585
5	5116	EMPIND	0	0	0	0	0	0	0	0	0	0	0	1.388	0	0	0	3.27	0
5	5117	EMPMED	0	0	0	0	0	0.496	0.278	0	0	0	0	1.359	0	0	0	1.94	0.278
5	5118	EMPOFC	0	0	0	0	0	0.645	0.358	0	0	0	0	1.783	0	0	0	2.54	0.365
5	5119	EMPOTH	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
5	5120	EMPRET	0	0	0	0	0	2.491	5.607	0	0	0	0	0.948	4.758	0	0	8.43	1.509
5	5121	EMPAGR	0	0	0	0	0	0	0	0	0	0	0	0.417	0	0	0	0.99	0
5	5122	POPDORM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5123	POPASSIST	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5124	POPMILITARY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5125	EMPSPARE1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5126	EMPSPARE2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5127	EMPSPARE3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5128	EMPSPARE4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5129	EMPSPARE5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5130	EMPSPARE6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5131	EMPSPARE7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5132	EMPSPARE8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	5133	ELEM	0	0	0.82	0	0	0	0	0	0	0	0	0	0	1.095	0	0.67	0.778
5	5134	HS	0	0	0.36	1.17	0	0	0	0	0	0	0	0	0	0	1.767	0	0
5	5135	COLLEGE	0	0	0	0.23	0	0	0	0	0	0	0	0	0	0	0.087	0	0

/* LU Code	LU_Type	TS_People	TS_Mail	TS_UrbFrt	TS_Const	TS_Service	TM_People	TM_Mail	TM_UrbFrt	TM_Const	TM_Service	TH_People	TH_Mail	TM_UrbFrt	TH_Const	TH_Service */
101	TOTHH	0.0075	0.00167	0.03551	0.03041	0.35243	0.0051	0.00008	0.00719	0.0107	0.09483	0	0.00001	0.00345	0.00394	0.00161
102	TOTEMP	0.0121	0.00167	0	0.03041	0.32839	0.00158	0.00008	0	0.0107	0.0844	0	0.00001	0	0.00394	0.00161
103	RETAIL	0	0	0.12571	0	0	0	0	0.01835	0	0	0	0	0.00592	0	0
104	AG	0	0	0.15714	0	0	0	0	0.02099	0	0	0	0	0.01583	0	0
105	MINING	0	0	0.15714	0	0	0	0	0.02099	0	0	0	0	0.01583	0	0
106	CONSTR	0	0	0.15714	0.03041	0	0	0	0.02099	0.0107	0	0	0	0.01583	0.00394	0
107	MFGPROD	0	0	0.13278	0	0	0	0	0.01758	0	0	0	0	0.00945	0	0
108	MFGEQUIP	0	0	0.13278	0	0	0	0	0.01758	0	0	0	0	0.00945	0	0
109	TRANSP	0	0	0.13278	0	0	0	0	0.01758	0	0	0	0	0.00945	0	0
110	WHLSALE	0	0	0.13278	0	0	0	0	0.01758	0	0	0	0	0.00945	0	0
111	FINANCE	0	0	0.06186	0	0	0	0	0.0049	0	0	0	0	0.00081	0	0
112	EDUGOV	0	0	0.06186	0	0	0	0	0.0049	0	0	0	0	0.00081	0	0

INDEX	A	KEY
1	-999	;INTCAP_HBW_CONSTANT
2	-999	;INTCAP_HBW_MXD_EMP
3	-999	;INTCAP_HBW_MXD_AREA
4	-999	;INTCAP_HBW_DIVERSITY
5	-999	;INTCAP_HBW_INTDEN
6	-999	;INTCAP_HBW_HHSIZE
7	-999	;INTCAP_HBW_VEHOWN
8	-999	;INTCAP_HBO_CONSTANT
9	-999	;INTCAP_HBO_MXD_EMP
10	-999	;INTCAP_HBO_MXD_AREA
11	-999	;INTCAP_HBO_DIVERSITY
12	-999	;INTCAP_HBO_INTDEN
13	-999	;INTCAP_HBO_HHSIZE
14	-999	;INTCAP_HBO_VEHOWN
15	-999	;INTCAP_NHB_CONSTANT
16	-999	;INTCAP_NHB_MXD_EMP
17	-999	;INTCAP_NHB_MXD_AREA
18	-999	;INTCAP_NHB_DIVERSITY
19	-999	;INTCAP_NHB_INTDEN
20	-999	;INTCAP_NHB_HHSIZE
21	-999	;INTCAP_NHB_VEHOWN
22	-999	;EXTWALK_HBW_CONSTANT
23	-999	;EXTWALK_HBW_MXD_AREA
24	-999	;EXTWALK_HBW_DENSITY
25	-999	;EXTWALK_HBW_DIVERSITY
26	-999	;EXTWALK_HBW_RETAIL_DIVERSITY
27	-999	;EXTWALK_HBW_INTDEN
28	-999	;EXTWALK_HBW_EMP_1WALK
29	-999	;EXTWALK_HBW_HHSIZE
30	-999	;EXTWALK_HBW_VEHOWN
31	-999	;EXTWALK_HBO_CONSTANT
32	-999	;EXTWALK_HBO_MXD_AREA
33	-999	;EXTWALK_HBO_DENSITY
34	-999	;EXTWALK_HBO_DIVERSITY
35	-999	;EXTWALK_HBO_RETAIL_DIVERSITY
36	-999	;EXTWALK_HBO_INTDEN
37	-999	;EXTWALK_HBO_EMP_1WALK
38	-999	;EXTWALK_HBO_HHSIZE
39	-999	;EXTWALK_HBO_VEHOWN
40	-999	;EXTWALK_NHB_CONSTANT
41	-999	;EXTWALK_NHB_MXD_AREA
42	-999	;EXTWALK_NHB_DENSITY
43	-999	;EXTWALK_NHB_DIVERSITY
44	-999	;EXTWALK_NHB_RETAIL_DIVERSITY
45	-999	;EXTWALK_NHB_INTDEN
46	-999	;EXTWALK_NHB_EMP_1WALK
47	-999	;EXTWALK_NHB_HHSIZE

INDEX	A	KEY
48	-999	;EXTWALK_NHB_VEHOWN
49	-999	;EXTTRAN_HBW_CONSTANT
50	-999	;EXTTRAN_HBW_MXD_EMP
51	-999	;EXTTRAN_HBW_INTDEN
52	-999	;EXTTRAN_HBW_EMP_30TRN
53	-999	;EXTTRAN_HBW_HHSIZE
54	-999	;EXTTRAN_HBW_VEHOWN
55	-999	;EXTTRAN_HBO_CONSTANT
56	-999	;EXTTRAN_HBO_MXD_EMP
57	-999	;EXTTRAN_HBO_INTDEN
58	-999	;EXTTRAN_HBO_EMP_30TRN
59	-999	;EXTTRAN_HBO_HHSIZE
60	-999	;EXTTRAN_HBO_VEHOWN
61	-999	;EXTTRAN_NHB_CONSTANT
62	-999	;EXTTRAN_NHB_MXD_EMP
63	-999	;EXTTRAN_NHB_INTDEN
64	-999	;EXTTRAN_NHB_EMP_30TRN
65	-999	;EXTTRAN_NHB_HHSIZE
66	-999	;EXTTRAN_NHB_VEHOWN
67	-999	;AVG_MXD_EMP
68	-999	;AVG_MXD_AREA
69	-999	;AVG_DIVERSITY
70	-999	;AVG_INTDEN
71	-999	;AVG_HHSIZE
72	-999	;AVG_VEHOWN
73	-999	;AVG_DENSITY
74	-999	;AVG_RETAIL_DIVERSITY
75	-999	;AVG_EMP_1WALK
76	-999	;AVG_EMP_30TRN

;Mode Choice Coefficients				IVT	OVT/IVT	ParkCostFa	Cost	VOT	Constants										Accessibility variables		
;1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
;INDEX	PURP	SEGMENT	Period	CI_C_TIME	CI_FAC_OV	CI_PKCOST	CI_COST	CI_VOT	CI_C_D1	CI_C_S2	CI_C_S3	CI_C_TWB	CI_C_TWR	CI_C_TDB	CI_C_TDR	CI_C_BK	CI_C_WK	CI_C_SB	CI_LE_D1	CI_LE_S2	CI_LE_S3
11	1	1	PK	-0.035	2	0.25	-0.003	6	0	0.132408	-0.66259	-2.26597	-2.26597	-2.26597	-2.26597	-3.19033	0.934309	0	0	0.506	0.408
12	1	2	PK	-0.04	2	0.25	-0.002	10.06	0	-2.70589	-3.23738	-2.44896	-2.44896	-4.72196	-4.72196	-4.02649	-0.31054	0	0	0.506	0.408
13	1	3	PK	-0.04	2	0.25	-0.001	18	0	-3.49618	-3.80317	-3.41096	-3.41096	-6.59396	-6.08896	-5.26665	-1.68638	0	0	0.506	0.408
21	2	1	OK	-0.025	2	0.25	-0.005	3	0	1.816134	0.607982	2.386232	2.386232	2.386232	2.386232	-0.73225	6.332827	0	0	0.297	0.026
22	2	2	OK	-0.025	2	0.25	-0.003	6	0	-0.0628	-0.48653	-3.72515	-3.72515	-3.72515	-3.72515	-4.26237	3.740741	0	0	0.297	0.026
23	2	3	OK	-0.025	2	0.25	-0.002	6.32	0	-0.31273	-1.15104	-6.06115	-6.06115	-6.06115	-7.18815	-3.64749	1.558654	0	0	0.161	0.161
31	3	1	OK	-0.025	2	0.25	-0.005	3	0	2.656575	2.971383	4.428369	4.428369	-3.24563	-3.24563	1.163276	5.022453	2.440541	0	0	0
32	3	2	OK	-0.025	2	0.25	-0.003	6	0	2.649362	2.623574	-0.15195	-0.15195	-2.36895	-2.36895	1.534913	5.00418	2.478812	0	0	0
33	3	3	OK	-0.025	2	0.25	-0.002	9	0	0.721149	1.162765	0.273053	0.273053	-1.94395	-1.94395	0.723551	4.557907	2.714082	0	0	0
41	4	1	OK	-0.025	2	0.25	-0.005	3	0	-2.07362	-3.06083	-0.42985	-0.42985	-4.90885	-4.90885	-8.29093	-2.38342	0	0	0	0
42	4	2	OK	-0.025	2	0.25	-0.003	6	0	-1.99493	-3.39374	-0.38327	-0.38327	-4.86227	-4.86227	-10.5129	-2.55462	0	0	0	0
43	4	3	OK	-0.025	2	0.25	-0.002	9	0	-1.91723	-3.72666	-0.36327	-0.36327	-4.84227	-4.84227	-12.7349	-3.18283	0	0	0	0
51	5	1	OK	-0.025	2	0.25	-0.005	3	0	0.871384	0.557317	0.099229	-4.33577	-2.06677	-2.06677	0.420012	4.06964	0	0	0	0
52	5	2	OK	-0.025	2	0.25	-0.003	6	0	0.377076	0.225976	-0.87216	-3.41316	-3.87116	-3.87116	-2.20948	1.701959	0	0	0	0
53	5	3	OK	-0.025	2	0.25	-0.002	9	0	-0.08523	-0.06937	-2.13116	-2.29816	-6.17816	-6.17816	-2.29198	0.783279	0	0	0	0
61	6	1	OK	-0.035	2.515	0.25	-0.004	6.08	0	-1.87745	-3.27781	-5.48499	-5.48499	-4.69799	-4.69799	-1.71242	-3.8502	0	0	0	0
62	6	2	OK	-0.035	2.515	0.25	-0.001	16.62	0	-2.20317	-3.98822	-6.07449	-6.07449	-5.28749	-5.28749	-0.85663	-3.7668	0	0	0	0
63	6	3	OK	-0.03	2.515	0.25	-0.001	18	0	-2.61089	-4.81163	-4.36049	-4.36049	-5.19249	-4.40449	-2.00784	-4.6824	0	0	0	0
71	7	1	OK	-0.03	2	0.25	-0.004	5.19	0	2.479688	2.18443	-0.60976	-0.60976	-1.86276	-1.86276	1.821189	4.0766	0	0	0	0
72	7	2	OK	-0.03	2	0.25	-0.003	6	0	1.031532	0.645145	-6.09563	-6.09563	-6.09563	-6.09563	-2.36172	0.920899	0	0	0	0
73	7	3	OK	-0.074	2	0.25	-0.005	9	0	0.468375	0.47186	-7.78663	-7.78663	-8.75363	-8.75363	-2.12662	-0.2698	0	0	0	0
81	8	1	OK	-0.025	2	0.25	-0.003	6	0	-1.978	-1.978	-10	-10	-10	-10	-10	-10	0	0	0	0
82	8	2	OK	-0.025	2	0.25	-0.001	12	0	-0.642	-0.642	-10	-10	-10	-10	-10	-10	0	0	0	0
83	8	3	OK	-0.025	2	0.25	-0.001	18	0	-0.244	-0.244	-10	-10	-10	-10	-10	-10	0	0	0	0

;Mode Choice Coefficients

;1	2	3	4	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
;INDEX	PURP	SEGMENT	Period	CI_LE_TWE	CI_LE_TWF	CI_LE_TDB	CI_LE_TDR	CI_LE_BK	CI_LE_WK	CI_TA_D1	CI_TA_S2	CI_TA_S3	CI_TA_TWI	CI_TA_TWI	CI_TA_TDB	CI_TA_TDR	CI_TA_BK	CI_TA_WK	CI_PID_D1	CI_PID_S2	CI_PID_S3
11	1	1	PK	0.5	0.5	0.5	0.5	0.506	0.5	0	0.013	0.013	0.03	0.03	0.03	0.03	0.03	0.04	0	0	0
12	1	2	PK	0.5	0.5	0.5	0.5	0.506	0.178	0	0.013	0.013	0.027	0.027	0.027	0.027	0.031	0.031	0	0	0
13	1	3	PK	0.5	0.5	0.5	0.5	0.506	0.005	0	0.005	0.005	0.013	0.013	0.013	0.013	0.015	0.015	0	0	0
21	2	1	OK	0.5	0.5	0.5	0.5	0.4	0.19	0	0	0	0	0	0	0	0	0	0	0	0
22	2	2	OK	0.5	0.5	0.5	0.5	0.4	0.19	0	0	0	0	0	0	0	0	0	0	0	0
23	2	3	OK	0.5	0.5	0.5	0.5	0.4	0.19	0	0	0	0	0	0	0	0	0	0	0	0
31	3	1	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.007
32	3	2	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.007
33	3	3	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.007
41	4	1	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.004	-0.019
42	4	2	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.004	-0.019
43	4	3	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	5	1	OK	0.5	0.5	0.048	0.048	0.312	0.455	0	0	0	0	0	0	0	0	0	0	0	0
52	5	2	OK	0.5	0.5	0.363	0.363	0.312	0.455	0	0	0	0	0	0	0	0	0	0	0	0
53	5	3	OK	0.315	0.315	0.363	0.363	0.455	0.455	0	0	0	0	0	0	0	0	0	0	0	0
61	6	1	OK	0	0	0	0	0	0	0	0	0	0.023	0.023	0.023	0.023	0.03	0.04	0	0	0
62	6	2	OK	0	0	0	0	0	0	0	0	0	0.023	0.023	0.023	0.023	0.03	0.04	0	0	0
63	6	3	OK	0	0	0	0	0	0	0	0	0	0.023	0.023	0.023	0.023	0.03	0.04	0	0	0
71	7	1	OK	0	0	0	0	0	0	0	-0.007	-0.01	0.04	0.04	0.04	0.04	0.03	0.039	0	0	0
72	7	2	OK	0	0	0	0	0	0	0	-0.007	-0.01	0.04	0.04	0.04	0.04	0.03	0.039	0	0	0
73	7	3	OK	0	0	0	0	0	0	0	0	0	0.025	0.025	0.025	0.025	0	0.039	0	0	0
81	8	1	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	8	2	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
83	8	3	OK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

;Mode Choice Coefficients

;1	2	3	4	41	42	43	44	45	46	47	48	49	50	51	
;INDEX	PURP	SEGMENT	Period	CI_PID_TW	CI_PID_TW	CI_PID_TD	CI_PID_TD	CI_PID_BK	CI_PID_W	CI_PID_SB	TIMEPEN_	TIMEPEN_	TIMEPEN_	DACC_PEN	KEY
11	1	1	PK	0	0	0	0	0	0	0	5	7	0	2	;HW 0 Veh HH
12	1	2	PK	0	0	0	0	0	0	0	5	7	0	2	;HW 1 Veh-2PHH
13	1	3	PK	0	0	0	0	0	0	0	5	7	0	2	;HW All Other HH
21	2	1	OK	0	0	0	0	0	0	0	5	7	0	2	;HS 0 Veh HH
22	2	2	OK	0	0	0	0	0	0	0	5	7	0	2	;HS 1 Veh-2PHH
23	2	3	OK	0	0	0	0	0	0	0	5	7	0	2	;HS All Other HH
31	3	1	OK	0.006	0.006	0	0	0.008	0.004	0	5	7	10	2	;HK 0 Veh HH
32	3	2	OK	0.006	0.006	0	0	0.008	0.004	0	5	7	10	2	;HK 1 Veh-2PHH
33	3	3	OK	0.006	0.006	0	0	0.008	0.004	0	5	7	10	2	;HK All Other HH
41	4	1	OK	0.004	0	0	0	0.005	0.005	0	5	7	0	2	;HC All Other HH
42	4	2	OK	0.004	0	0	0	0.005	0.005	0	5	7	0	2	;HC 1 Veh-2PHH
43	4	3	OK	0	0	0	0	0.005	0.005	0	5	7	0	2	;HC All Other HH
51	5	1	OK	0	0	0	0	0	0	0	5	7	0	2	;HO 0 Veh HH
52	5	2	OK	0	0	0	0	0	0	0	5	7	0	2	;HO 1 Veh-2PHH
53	5	3	OK	0	0	0	0	0	0	0	5	7	0	2	;HO All Other HH
61	6	1	OK	0	0	0	0	0	0	0	5	7	0	2	;WO 0 Veh HH
62	6	2	OK	0	0	0	0	0	0	0	5	7	0	2	;WO 1 Veh-2PHH
63	6	3	OK	0	0	0	0	0	0	0	5	7	0	2	;WO All Other HH
71	7	1	OK	0	0	0	0	0	0	0	5	7	0	2	;OO 0 Veh HH
72	7	2	OK	0	0	0	0	0	0	0	5	7	0	2	;OO 1 Veh-2PHH
73	7	3	OK	0	0	0	0	0	0	0	5	7	0	2	;OO All Other HH
81	8	1	OK	0	0	0	0	0	0	0	5	7	0	2	;HY 0 Veh HH
82	8	2	OK	0	0	0	0	0	0	0	5	7	0	2	;HY 1 Veh-2PHH
83	8	3	OK	0	0	0	0	0	0	0	5	7	0	2	;HY All Other HH

;INDEX	A	B	C	KEY
1	100000	-0.06	0	;HWH
2	100000	-0.06	0	;HWM
3	100000	-0.06	0	;HWL
4	100000	-0.2	0	;HS
5	100000	-0.09	0	;HK
6	100000	-0.06	0	;HC
7	100000	-0.1	0	;HO
8	100000	-0.085	0	;WO
9	100000	-0.09	0	;OO
10	100000	-0.065	0	;HY
11	100000	-0.07	-0.5	;TS
12	100000	-0.07	-0.5	;TM
13	100000	-0.07	-0.5	;TH

; Diurnal factors by mode and purpose

; Drive Alone

; Lookup	D1	Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
101	1	1	0.066	0.035	0	0	0.039	0	0	0	0.0079	0.0059	0.0105	0.0974	0.03	0	0	0.0329	0	0.0034	0.0035	0.0079	0.0059	0.0105	0.002	0
102	1	2	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
103	1	3	0	0.003	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.0009	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.002
104	1	4	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
105	1	5	0.065	0.006	0	0	0.002	0	0	0.004	0.0079	0.0059	0.0105	0.0011	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.022	0.005
106	1	6	0.098	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.0645	0	0	0	0.0052	0	0.0045	0.0079	0.0059	0.0105	0.034	0
107	1	7	0.103	0.014	0.018	0.018	0.018	0.003	0	0.006	0.0374	0.0427	0.0369	0.0067	0	0	0	0.0035	0.0193	0.0031	0	0.0374	0.0427	0.0369	0.092	0.006
108	1	8	0.042	0.041	0.206	0.206	0.095	0.011	0.021	0.017	0.0374	0.0427	0.0369	0.0001	0.0245	0	0	0.0346	0.0883	0.0698	0.0019	0.0374	0.0427	0.0369	0.175	0.018
109	1	9	0.018	0.024	0.052	0.052	0.047	0.016	0.014	0.023	0.0374	0.0427	0.0369	0.0006	0.0156	0	0	0.0385	0.0448	0.0161	0.0167	0.0374	0.0427	0.0369	0.058	0.024
110	1	10	0.009	0.055	0.051	0.051	0.029	0.056	0.016	0.053	0.0214	0.0255	0.0238	0.0004	0.0226	0	0	0.0108	0.029	0.0111	0.0241	0.0214	0.0255	0.0238	0.031	0.055
111	1	11	0.004	0.037	0.024	0.024	0.03	0.054	0.024	0.036	0.0214	0.0255	0.0238	0.0011	0.0172	0.022	0.022	0.0121	0.0308	0.0317	0.0184	0.0214	0.0255	0.0238	0.017	0.038
112	1	12	0.018	0.037	0.017	0.017	0.032	0.057	0.046	0.036	0.0214	0.0255	0.0238	0.0092	0.0199	0.0633	0.0633	0.0278	0.023	0.0439	0.0212	0.0214	0.0255	0.0238	0.015	0.038
113	1	13	0.007	0.027	0.052	0.052	0.011	0.089	0.029	0.026	0.0214	0.0255	0.0238	0.0136	0.0441	0.0376	0.0376	0.0254	0.0492	0.0692	0.0471	0.0214	0.0255	0.0238	0.006	0.027
114	1	14	0.024	0.024	0.039	0.039	0.026	0.035	0.056	0.023	0.0214	0.0255	0.0238	0.0125	0.0316	0.065	0.065	0.023	0.0267	0.052	0.0337	0.0214	0.0255	0.0238	0.02	0.025
115	1	15	0.0092	0.0314	0.0025	0.0025	0.0264	0.0525	0.037	0.0328	0.0214	0.0255	0.0238	0.0274	0.0344	0.0553	0.0553	0.036	0.0268	0.0784	0.0352	0.0214	0.0255	0.0238	0.008	0.033
116	1	16	0.0076	0.0187	0	0	0.0255	0.0677	0.0373	0.0195	0.0214	0.0255	0.0238	0.0694	0.0455	0.0834	0.0834	0.0516	0.0176	0.0731	0.0466	0.0214	0.0255	0.0238	0.006	0.02
117	1	17	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0689	0.0509	0.0189	0.0189	0.0304	0.0024	0.0487	0.0469	0.0505	0.043	0.0359	0.002	0.03
118	1	18	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0778	0.0417	0.0187	0.0187	0.0477	0.006	0.0379	0.0765	0.0505	0.043	0.0359	0.005	0.058
119	1	19	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0309	0.0275	0.0184	0.0184	0.0323	0.0009	0.0343	0.051	0.0505	0.043	0.0359	0.01	0.044
120	1	20	0.001	0.022	0	0	0.009	0.007	0.006	0.044	0.0079	0.0059	0.0105	0.0247	0.0255	0.0243	0.0243	0.0143	0	0.0198	0.0473	0.0079	0.0059	0.0105	0.001	0.045
121	1	21	0.002	0.007	0	0	0.016	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.0114	0.0114	0.0346	0.0346	0.03	0	0.0025	0.0212	0.0079	0.0059	0.0105	0.002	0.014
122	1	22	0.004	0.002	0	0	0.003	0	0.005	0.002	0.0079	0.0059	0.0105	0.0076	0.0085	0.0076	0.0076	0.02	0	0.0111	0.0182	0.0079	0.0059	0.0105	0.003	0.002
123	1	23	0.002	0	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.0147	0	0	0	0.0101	0	0	0	0.0079	0.0059	0.0105	0.002	0
124	1	24	0.001	0.002	0.004	0.004	0.016	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.0142	0	0	0	0.0038	0	0	0	0.0079	0.0059	0.0105	0.001	0.002

; Shared-ride 2

;Lookup	SR2	Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
201	2	1	0.066	0.035	0	0	0.039	0	0	0	0.0079	0.0059	0.0105	0.0974	0.03	0	0	0.0329	0	0.0034	0.0035	0.0079	0.0059	0.0105	0.002	0
202	2	2	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
203	2	3	0	0.003	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.0009	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.002
204	2	4	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
205	2	5	0.065	0.006	0	0	0.002	0	0	0.004	0.0079	0.0059	0.0105	0.0011	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.022	0.005
206	2	6	0.098	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.0645	0	0	0	0.0052	0	0.0045	0.0079	0.0059	0.0105	0.034	0
207	2	7	0.103	0.014	0.018	0.018	0.018	0.003	0	0.006	0.0374	0.0427	0.0369	0.0067	0	0	0	0.0035	0.0193	0.0031	0	0.0374	0.0427	0.0369	0.092	0.006
208	2	8	0.042	0.041	0.206	0.206	0.095	0.011	0.021	0.017	0.0374	0.0427	0.0369	0.0001	0.0245	0	0	0.0346	0.0883	0.0698	0.0019	0.0374	0.0427	0.0369	0.175	0.018
209	2	9	0.018	0.024	0.052	0.052	0.047	0.016	0.014	0.023	0.0374	0.0427	0.0369	0.0006	0.0156	0	0	0.0385	0.0448	0.0161	0.0167	0.0374	0.0427	0.0369	0.058	0.024
210	2	10	0.009	0.055	0.051	0.051	0.029	0.056	0.016	0.053	0.0214	0.0255	0.0238	0.0004	0.0226	0	0	0.0108	0.029	0.0111	0.0241	0.0214	0.0255	0.0238	0.031	0.055
211	2	11	0.004	0.037	0.024	0.024	0.03	0.054	0.024	0.036	0.0214	0.0255	0.0238	0.0011	0.0172	0.022	0.022	0.0121	0.0308	0.0317	0.0184	0.0214	0.0255	0.0238	0.017	0.038
212	2	12	0.018	0.037	0.017	0.017	0.032	0.057	0.046	0.036	0.0214	0.0255	0.0238	0.0092	0.0199	0.0633	0.0633	0.0278	0.023	0.0439	0.0212	0.0214	0.0255	0.0238	0.015	0.038
213	2	13	0.007	0.027	0.052	0.052	0.011	0.089	0.029	0.026	0.0214	0.0255	0.0238	0.0136	0.0441	0.0376	0.0376	0.0254	0.0492	0.0692	0.0471	0.0214	0.0255	0.0238	0.006	0.027
214	2	14	0.024	0.024	0.039	0.039	0.026	0.035	0.056	0.023	0.0214	0.0255	0.0238	0.0125	0.0316	0.065	0.065	0.023	0.0267	0.052	0.0337	0.0214	0.0255	0.0238	0.02	0.025
215	2	15	0.0092	0.0314	0.0025	0.0025	0.0264	0.0525	0.037	0.0328	0.0214	0.0255	0.0238	0.0274	0.0344	0.0553	0.0553	0.036	0.0268	0.0784	0.0352	0.0214	0.0255	0.0238	0.008	0.033
216	2	16	0.0076	0.0187	0	0	0.0255	0.0677	0.0373	0.0195	0.0214	0.0255	0.0238	0.0694	0.0455	0.0834	0.0834	0.0516	0.0176	0.0731	0.0466	0.0214	0.0255	0.0238	0.006	0.02
217	2	17	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0689	0.0509	0.0189	0.0189	0.0304	0.0024	0.0487	0.0469	0.0505	0.043	0.0359	0.002	0.03
218	2	18	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0778	0.0417	0.0187	0.0187	0.0477	0.006	0.0379	0.0765	0.0505	0.043	0.0359	0.005	0.058
219	2	19	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0309	0.0275	0.0184	0.0184	0.0323	0.0009	0.0343	0.051	0.0505	0.043	0.0359	0.01	0.044
220	2	20	0.001	0.022	0	0	0.009	0.007	0.006	0.044	0.0079	0.0059	0.0105	0.0247	0.0255	0.0243	0.0243	0.0143	0	0.0198	0.0473	0.0079	0.0059	0.0105	0.001	0.045
221	2	21	0.002	0.007	0	0	0.016	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.0114	0.0114	0.0346	0.0346	0.03	0	0.0025	0.0212	0.0079	0.0059	0.0105	0.002	0.014
222	2	22	0.004	0.002	0	0	0.003	0	0.005	0.002	0.0079	0.0059	0.0105	0.0076	0.0085	0.0076	0.0076	0.02	0	0.0111	0.0182	0.0079	0.0059	0.0105	0.003	0.002
223	2	23	0.002	0	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.0147	0	0	0	0.0101	0	0	0	0.0079	0.0059	0.0105	0.002	0
224	2	24	0.001	0.002	0.004	0.004	0.016	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.0142	0	0	0	0.0038	0	0	0	0.0079	0.0059	0.0105	0.001	0.002

; Shared-ride 3+

;Lookup	SR3+	Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
301	3	1	0.066	0.035	0	0	0.039	0	0	0	0.0079	0.0059	0.0105	0.0974	0.03	0	0	0.0329	0	0.0034	0.0035	0.0079	0.0059	0.0105	0.002	0
302	3	2	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
303	3	3	0	0.003	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.0009	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.002
304	3	4	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
305	3	5	0.065	0.006	0	0	0.002	0	0	0.004	0.0079	0.0059	0.0105	0.0011	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.022	0.005
306	3	6	0.098	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.0645	0	0	0	0.0052	0	0.0045	0.0079	0.0059	0.0105	0.034	0
307	3	7	0.103	0.014	0.018	0.018	0.018	0.003	0	0.006	0.0374	0.0427	0.0369	0.0067	0	0	0	0.0035	0.0193	0.0031	0	0.0374	0.0427	0.0369	0.092	0.006
308	3	8	0.042	0.041	0.206	0.206	0.095	0.011	0.021	0.017	0.0374	0.0427	0.0369	0.0001	0.0245	0	0	0.0346	0.0883	0.0698	0.0019	0.0374	0.0427	0.0369	0.175	0.018
309	3	9	0.018	0.024	0.052	0.052	0.047	0.016	0.014	0.023	0.0374	0.0427	0.0369	0.0006	0.0156	0	0	0.0385	0.0448	0.0161	0.0167	0.0374	0.0427	0.0369	0.058	0.024
310	3	10	0.009	0.055	0.051	0.051	0.029	0.056	0.016	0.053	0.0214	0.0255	0.0238	0.0004	0.0226	0	0	0.0108	0.029	0.0111	0.0241	0.0214	0.0255	0.0238	0.031	0.055
311	3	11	0.004	0.037	0.024	0.024	0.03	0.054	0.024	0.036	0.0214	0.0255	0.0238	0.0011	0.0172	0.022	0.022	0.0121	0.0308	0.0317	0.0184	0.0214	0.0255	0.0238	0.017	0.038
312	3	12	0.018	0.037	0.017	0.017	0.032	0.057	0.046	0.036	0.0214	0.0255	0.0238	0.0092	0.0199	0.0633	0.0633	0.0278	0.023	0.0439	0.0212	0.0214	0.0255	0.0238	0.015	0.038
313	3	13	0.007	0.027	0.052	0.052	0.011	0.089	0.029	0.026	0.0214	0.0255	0.0238	0.0136	0.0441	0.0376	0.0376	0.0254	0.0492	0.0692	0.0471	0.0214	0.0255	0.0238	0.006	0.027
314	3	14	0.024	0.024	0.039	0.039	0.026	0.035	0.056	0.023	0.0214	0.0255	0.0238	0.0125	0.0316	0.065	0.065	0.023	0.0267	0.052	0.0337	0.0214	0.0255	0.0238	0.02	0.025
315	3	15	0.0092	0.0314	0.0025	0.0025	0.0264	0.0525	0.037	0.0328	0.0214	0.0255	0.0238	0.0274	0.0344	0.0553	0.0553	0.036	0.0268	0.0784	0.0352	0.0214	0.0255	0.0238	0.008	0.033
316	3	16	0.0076	0.0187	0	0	0.0255	0.0677	0.0373	0.0195	0.0214	0.0255	0.0238	0.0694	0.0455	0.0834	0.0834	0.0516	0.0176	0.0731	0.0466	0.0214	0.0255	0.0238	0.006	0.02

; Lookup	D1		Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
	317	3	17	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0689	0.0509	0.0189	0.0189	0.0304	0.0024	0.0487	0.0469	0.0505	0.043	0.0359	0.002	0.03
	318	3	18	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0778	0.0417	0.0187	0.0187	0.0477	0.006	0.0379	0.0765	0.0505	0.043	0.0359	0.005	0.058
	319	3	19	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0309	0.0275	0.0184	0.0184	0.0323	0.0009	0.0343	0.051	0.0505	0.043	0.0359	0.01	0.044
	320	3	20	0.001	0.022	0	0	0.009	0.007	0.006	0.044	0.0079	0.0059	0.0105	0.0247	0.0255	0.0243	0.0243	0.0143	0	0.0198	0.0473	0.0079	0.0059	0.0105	0.001	0.045
	321	3	21	0.002	0.007	0	0	0.016	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.0114	0.0114	0.0346	0.0346	0.03	0	0.0025	0.0212	0.0079	0.0059	0.0105	0.002	0.014
	322	3	22	0.004	0.002	0	0	0.003	0	0.005	0.002	0.0079	0.0059	0.0105	0.0076	0.0085	0.0076	0.0076	0.02	0	0.0111	0.0182	0.0079	0.0059	0.0105	0.003	0.002
	323	3	23	0.002	0	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.0147	0	0	0	0.0101	0	0	0	0.0079	0.0059	0.0105	0.002	0
	324	3	24	0.001	0.002	0.004	0.004	0.016	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.0142	0	0	0	0.0038	0	0	0	0.0079	0.0059	0.0105	0.001	0.002
;	; Transit																										
;Lookup	TRN		Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
	401	4	1	0.066	0.035	0	0	0.039	0	0	0	0.0079	0.0059	0.0105	0.0974	0.03	0	0	0.0329	0	0.0034	0.0035	0.0079	0.0059	0.0105	0.002	0
	402	4	2	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
	403	4	3	0	0.003	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.0009	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.002
	404	4	4	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
	405	4	5	0.065	0.006	0	0	0.002	0	0	0.004	0.0079	0.0059	0.0105	0.0011	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.022	0.005
	406	4	6	0.098	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.0645	0	0	0	0.0052	0	0.0045	0.0079	0.0059	0.0105	0.034	0
	407	4	7	0.103	0.014	0.018	0.018	0.018	0.003	0	0.006	0.0374	0.0427	0.0369	0.0067	0	0	0	0.0035	0.0193	0.0031	0	0.0374	0.0427	0.0369	0.092	0.006
	408	4	8	0.042	0.041	0.206	0.206	0.095	0.011	0.021	0.017	0.0374	0.0427	0.0369	0.0001	0.0245	0	0	0.0346	0.0883	0.0698	0.0019	0.0374	0.0427	0.0369	0.175	0.018
	409	4	9	0.018	0.024	0.052	0.052	0.047	0.016	0.014	0.023	0.0374	0.0427	0.0369	0.0006	0.0156	0	0	0.0385	0.0448	0.0161	0.0167	0.0374	0.0427	0.0369	0.058	0.024
	410	4	10	0.009	0.055	0.051	0.051	0.029	0.056	0.016	0.053	0.0214	0.0255	0.0238	0.0004	0.0226	0	0	0.0108	0.029	0.0111	0.0241	0.0214	0.0255	0.0238	0.031	0.055
	411	4	11	0.004	0.037	0.024	0.024	0.03	0.054	0.024	0.036	0.0214	0.0255	0.0238	0.0011	0.0172	0.022	0.022	0.0121	0.0308	0.0317	0.0184	0.0214	0.0255	0.0238	0.017	0.038
	412	4	12	0.018	0.037	0.017	0.017	0.032	0.057	0.046	0.036	0.0214	0.0255	0.0238	0.0092	0.0199	0.0633	0.0633	0.0278	0.023	0.0439	0.0212	0.0214	0.0255	0.0238	0.015	0.038
	413	4	13	0.007	0.027	0.052	0.052	0.011	0.089	0.029	0.026	0.0214	0.0255	0.0238	0.0136	0.0441	0.0376	0.0376	0.0254	0.0492	0.0692	0.0471	0.0214	0.0255	0.0238	0.006	0.027
	414	4	14	0.024	0.024	0.039	0.039	0.026	0.035	0.056	0.023	0.0214	0.0255	0.0238	0.0125	0.0316	0.065	0.065	0.023	0.0267	0.052	0.0337	0.0214	0.0255	0.0238	0.02	0.025
	415	4	15	0.0092	0.0314	0.0025	0.0025	0.0264	0.0525	0.037	0.0328	0.0214	0.0255	0.0238	0.0274	0.0344	0.0553	0.0553	0.036	0.0268	0.0784	0.0352	0.0214	0.0255	0.0238	0.008	0.033
	416	4	16	0.0076	0.0187	0	0	0.0255	0.0677	0.0373	0.0195	0.0214	0.0255	0.0238	0.0694	0.0455	0.0834	0.0834	0.0516	0.0176	0.0731	0.0466	0.0214	0.0255	0.0238	0.006	0.02
	417	4	17	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0689	0.0509	0.0189	0.0189	0.0304	0.0024	0.0487	0.0469	0.0505	0.043	0.0359	0.002	0.03
	418	4	18	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0778	0.0417	0.0187	0.0187	0.0477	0.006	0.0379	0.0765	0.0505	0.043	0.0359	0.005	0.058
	419	4	19	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0309	0.0275	0.0184	0.0184	0.0323	0.0009	0.0343	0.051	0.0505	0.043	0.0359	0.01	0.044
	420	4	20	0.001	0.022	0	0	0.009	0.007	0.006	0.044	0.0079	0.0059	0.0105	0.0247	0.0255	0.0243	0.0243	0.0143	0	0.0198	0.0473	0.0079	0.0059	0.0105	0.001	0.045
	421	4	21	0.002	0.007	0	0	0.016	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.0114	0.0114	0.0346	0.0346	0.03	0	0.0025	0.0212	0.0079	0.0059	0.0105	0.002	0.014
	422	4	22	0.004	0.002	0	0	0.003	0	0.005	0.002	0.0079	0.0059	0.0105	0.0076	0.0085	0.0076	0.0076	0.02	0	0.0111	0.0182	0.0079	0.0059	0.0105	0.003	0.002
	423	4	23	0.002	0	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.0147	0	0	0	0.0101	0	0	0	0.0079	0.0059	0.0105	0.002	0
	424	4	24	0.001	0.002	0.004	0.004	0.016	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.0142	0	0	0	0.0038	0	0	0	0.0079	0.0059	0.0105	0.001	0.002
; Walk/Bike																											
;Lookup	WLK		Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
	501	5	1	0.066	0.035	0	0	0.039	0	0	0	0.0079	0.0059	0.0105	0.0974	0.03	0	0	0.0329	0	0.0034	0.0035	0.0079	0.0059	0.0105	0.002	0
	502	5	2	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
	503	5	3	0	0.003	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.0009	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.002
	504	5	4	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
	505	5	5	0.065	0.006	0	0	0.002	0	0	0.004	0.0079	0.0059	0.0105	0.0011	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.022	0.005
	506	5	6	0.098	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.0645	0	0	0	0.0052	0	0.0045	0.0079	0.0059	0.0105	0.034	0
	507	5	7	0.103	0.014	0.018	0.018	0.018	0.003	0	0.006	0.0374	0.0427	0.0369	0.0067	0	0	0	0.0035	0.0193	0.0031	0	0.0374	0.0427	0.0369	0.092	0.006
	508	5	8	0.042	0.041	0.206	0.206	0.095	0.011	0.021	0.017	0.0374	0.0427	0.0369	0.0001	0.0245	0	0	0.0346	0.0883	0.0698	0.0019	0.0374	0.0427	0.0369	0.175	0.018
	509	5	9	0.018	0.024	0.052	0.052	0.047	0.016	0.014	0.023	0.0374	0.0427	0.0369	0.0006	0.0156	0	0	0.0385	0.0448	0.0161	0.0167	0.0374	0.0427	0.0369	0.058	0.024
	510	5	10	0.009	0.055	0.051	0.051	0.029	0.056	0.016	0.053	0.0214	0.0255	0.0238	0.0004	0.0226	0	0	0.0108	0.029	0.0111	0.0241	0.0214	0.0255	0.0238	0.031	0.055
	511	5	11	0.004	0.037	0.024	0.024	0.03	0.054	0.024	0.036	0.0214	0.0255	0.0238	0.0011	0.0172	0.022	0.022	0.0121	0.0308	0.0317	0.0184	0.0214	0.0255	0.0238	0.017	0.038
	512	5	12	0.018	0.037	0.017	0.017	0.032	0.057	0.046	0.036	0.0214	0.0255	0.0238	0.0092	0.0199	0.0633	0.0633	0.0278	0.023	0.0439	0.0212	0.0214	0.0255	0.0238	0.015	0.038
	513	5	13	0.007	0.027	0.052	0.052	0.011	0.089	0.029	0.026	0.0214	0.0255	0.0238	0.0136	0.0441	0.0376	0.0376	0.0254	0.0492	0.0692	0.0471	0.0214	0.0255	0.0238	0.006	0.027
	514	5	14	0.024	0.024	0.039	0.039	0.026	0.035	0.056	0.023	0.0214	0.0255	0.0238	0.0125	0.0316	0.065	0.065	0.023	0.0267	0.052	0.0337	0.0214	0.0255	0.0238	0.02	0.025
	515	5	15	0.0092	0.0314	0.0025	0.0025	0.0264	0.0525	0.037	0.0328	0.0214	0.0255	0.0238	0.0274	0.0344	0.0553	0.0553	0.036	0.0268	0.0784	0.0352	0.0214	0.0255	0.0238	0.008	0.033
	516	5	16	0.0076	0.0187	0	0	0.0255	0.0677	0.0373	0.0195	0.0214	0.0255	0.0238	0.0694	0.0455	0.0834	0.0834	0.0516	0.0176	0.0731	0.0466	0.0214	0.0255	0.0238	0.006	0.02
	517	5	17	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0689	0.0509	0.0189	0.0189	0.0304	0.0024	0.0487	0.0469	0.0505	0.043	0.0359	0.002	0.03
	518	5	18	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0778	0.0417	0.0187	0.0187	0.0477	0.006	0.0379	0.0765	0.0505	0.043	0.0359	0.005	0.058
	519	5	19	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0309	0.0275	0.0184	0.0184	0.0323	0.0009	0.0343	0.051	0.0505	0.043	0.0359	0.01	0.044
	520	5	20	0.001	0.022	0	0	0.009	0.007	0.006	0.044	0.0079	0.0059	0.0105	0.0247	0.0255	0.0243	0.0243	0.0143	0	0.0198	0.0473	0.0079	0.0059	0.0105	0.001	0.045
	521	5	21	0.002	0.007	0	0	0.016	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.0114	0.0114	0.0346	0.0346	0.03	0	0.0025	0.0212	0.0079	0.0059	0.0105	0.002	0.014
	522	5	22	0.004	0.002	0	0	0.003	0	0.005	0.002	0.0079	0.0059	0.0105	0.0076	0.0085	0.0076	0.0076	0.02	0	0.0111	0.0182	0.0079	0.0059	0.0105	0.003	0.002
	523	5	23	0.002	0	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.0147	0	0	0	0.0101	0	0	0	0.0079	0.0059	0.0105	0.002	0
	524	5	24	0.001	0.002	0.004	0.004	0.016	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.0142	0	0	0	0.0038	0	0	0	0.0079	0.0059	0.0105	0.001	0.002
;Truck																											
;Lookup	TRK		Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
	601	6	1	0.066	0.035	0	0	0.039	0	0	0	0.0079	0.0059	0.0105	0.0974	0.03	0	0	0.0329	0	0.0034	0.0035	0.0079	0.0059	0.0105	0.002	0
	602	6	2	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
	603	6	3	0	0.003	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.0009	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0	0.002
	604	6	4	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0
	605	6	5	0.065	0.006	0	0	0.002	0	0	0.004	0.0079	0.0059	0.0105	0.0011	0	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.022	0.005
	606	6	6	0.098	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.0645	0	0	0	0.0052	0	0.0045	0.0079	0.0059	0.0105	0.034	0
	607	6	7	0.103	0.014	0.018	0.018	0.018	0.003	0	0.006	0.0374	0.0427	0.0369	0.0067	0	0	0	0.0035	0.0193	0.0031	0	0.0374	0.0427	0.0369	0.092	0.006
	608	6	8	0.042	0.041	0.206	0.206	0.095	0.011	0.021	0.017	0.0374	0.0427	0.0369	0.0001	0.0245	0	0	0.0346	0.0883	0.0698	0.0019	0.0374	0.0427	0.0369	0.175	0.018

; Lookup	D1	Hour	DEP_HW	DEP_HS	DEP_HK	DEP_HC	DEP_HO	DEP_WO	DEP_OO	DEP_HY	DEP_TS	DEP_TM	DEP_TH	RET_HW	RET_HS	RET_HK	RET_HC	RET_HO	RET_WO	RET_OO	RET_HY	RET_TS	RET_TM	RET_TH	DEP_HW_XX	DEP_HS_XX
609	6	9	0.018	0.024	0.052	0.052	0.047	0.016	0.014	0.023	0.0374	0.0427	0.0369	0.0006	0.0156	0	0	0.0385	0.0448	0.0161	0.0167	0.0374	0.0427	0.0369	0.058	0.024
610	6	10	0.009	0.055	0.051	0.051	0.029	0.056	0.016	0.053	0.0214	0.0255	0.0238	0.0004	0.0226	0	0	0.0108	0.029	0.0111	0.0241	0.0214	0.0255	0.0238	0.031	0.055
611	6	11	0.004	0.037	0.024	0.024	0.03	0.054	0.024	0.036	0.0214	0.0255	0.0238	0.0011	0.0172	0.022	0.022	0.0121	0.0308	0.0317	0.0184	0.0214	0.0255	0.0238	0.017	0.038
612	6	12	0.018	0.037	0.017	0.017	0.032	0.057	0.046	0.036	0.0214	0.0255	0.0238	0.0092	0.0199	0.0633	0.0633	0.0278	0.023	0.0439	0.0212	0.0214	0.0255	0.0238	0.015	0.038
613	6	13	0.007	0.027	0.052	0.052	0.011	0.089	0.029	0.026	0.0214	0.0255	0.0238	0.0136	0.0441	0.0376	0.0376	0.0254	0.0492	0.0692	0.0471	0.0214	0.0255	0.0238	0.006	0.027
614	6	14	0.024	0.024	0.039	0.039	0.026	0.035	0.056	0.023	0.0214	0.0255	0.0238	0.0125	0.0316	0.065	0.065	0.023	0.0267	0.052	0.0337	0.0214	0.0255	0.0238	0.02	0.025
615	6	15	0.0092	0.0314	0.0025	0.0025	0.0264	0.0525	0.037	0.0328	0.0214	0.0255	0.0238	0.0274	0.0344	0.0553	0.0553	0.036	0.0268	0.0784	0.0352	0.0214	0.0255	0.0238	0.008	0.033
616	6	16	0.0076	0.0187	0	0	0.0255	0.0677	0.0373	0.0195	0.0214	0.0255	0.0238	0.0694	0.0455	0.0834	0.0834	0.0516	0.0176	0.0731	0.0466	0.0214	0.0255	0.0238	0.006	0.02
617	6	17	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0689	0.0509	0.0189	0.0189	0.0304	0.0024	0.0487	0.0469	0.0505	0.043	0.0359	0.002	0.03
618	6	18	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0778	0.0417	0.0187	0.0187	0.0477	0.006	0.0379	0.0765	0.0505	0.043	0.0359	0.005	0.058
619	6	19	0.00983	0.03253	0.02847	0.02847	0.02843	0.059267	0.02987	0.0479	0.0505	0.043	0.0359	0.0309	0.0275	0.0184	0.0184	0.0323	0.0009	0.0343	0.051	0.0505	0.043	0.0359	0.01	0.044
620	6	20	0.001	0.022	0	0	0.009	0.007	0.006	0.044	0.0079	0.0059	0.0105	0.0247	0.0255	0.0243	0.0243	0.0143	0	0.0198	0.0473	0.0079	0.0059	0.0105	0.001	0.045
621	6	21	0.002	0.007	0	0	0.016	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.0114	0.0114	0.0346	0.0346	0.03	0	0.0025	0.0212	0.0079	0.0059	0.0105	0.002	0.014
622	6	22	0.004	0.002	0	0	0.003	0	0.005	0.002	0.0079	0.0059	0.0105	0.0076	0.0085	0.0076	0.0076	0.02	0	0.0111	0.0182	0.0079	0.0059	0.0105	0.003	0.002
623	6	23	0.002	0	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.0147	0	0	0	0.0101	0	0	0	0.0079	0.0059	0.0105	0.002	0
624	6	24	0.001	0.002	0.004	0.004	0.016	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.0142	0	0	0	0.0038	0	0	0	0.0079	0.0059	0.0105	0.001	0.002

;

ors by mode and

D1		Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
	1	1	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.004	0.004	0	0	0.004	0	0.003	0.004	0.0079	0.0059	0.0105
	1	2	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.003	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	1	3	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0.001	0.002	0	0	0	0	0	0.002	0.0079	0.0059	0.0105
	1	4	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	1	5	0	0	0	0	0	0.005	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	1	6	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.005	0	0	0	0.005	0	0.005	0.0079	0.0059	0.0105
	1	7	0.02	0.02	0.021	0.003	0	0.006	0.0374	0.0427	0.0369	0.006	0	0	0	0.004	0.019	0.003	0	0.0374	0.0427	0.0369
	1	8	0.219	0.219	0.112	0.012	0.023	0.018	0.0374	0.0427	0.0369	0	0.002	0	0	0.037	0.088	0.07	0.002	0.0374	0.0427	0.0369
	1	9	0.052	0.052	0.051	0.016	0.014	0.024	0.0374	0.0427	0.0369	0.002	0.017	0	0	0.039	0.045	0.016	0.017	0.0374	0.0427	0.0369
	1	10	0.054	0.054	0.034	0.059	0.017	0.055	0.0214	0.0255	0.0238	0.002	0.024	0	0	0.011	0.029	0.011	0.024	0.0214	0.0255	0.0238
	1	11	0.026	0.026	0.034	0.057	0.025	0.038	0.0214	0.0255	0.0238	0.005	0.018	0.022	0.022	0.012	0.031	0.032	0.018	0.0214	0.0255	0.0238
	1	12	0.018	0.018	0.037	0.06	0.048	0.038	0.0214	0.0255	0.0238	0.008	0.021	0.063	0.063	0.028	0.023	0.044	0.021	0.0214	0.0255	0.0238
	1	13	0.054	0.054	0.013	0.093	0.031	0.027	0.0214	0.0255	0.0238	0.012	0.047	0.038	0.038	0.026	0.049	0.069	0.047	0.0214	0.0255	0.0238
	1	14	0.042	0.042	0.029	0.037	0.059	0.025	0.0214	0.0255	0.0238	0.011	0.034	0.065	0.065	0.023	0.027	0.052	0.034	0.0214	0.0255	0.0238
	1	15	0.003	0.003	0.036	0.053	0.037	0.033	0.0214	0.0255	0.0238	0.024	0.035	0.055	0.055	0.046	0.027	0.078	0.035	0.0214	0.0255	0.0238
	1	16	0	0	0.035	0.068	0.037	0.02	0.0214	0.0255	0.0238	0.062	0.047	0.083	0.083	0.066	0.018	0.073	0.047	0.0214	0.0255	0.0238
	1	17	0.006	0.006	0.026	0.063	0.03	0.03	0.0505	0.043	0.0359	0.112	0.047	0.019	0.019	0.035	0.002	0.049	0.047	0.0505	0.043	0.0359
	1	18	0.026	0.026	0.023	0.081	0.03	0.058	0.0505	0.043	0.0359	0.126	0.077	0.019	0.019	0.043	0.006	0.038	0.077	0.0505	0.043	0.0359
	1	19	0.029	0.029	0.029	0.016	0.02	0.044	0.0505	0.043	0.0359	0.05	0.051	0.018	0.018	0.029	0.001	0.034	0.051	0.0505	0.043	0.0359
	1	20	0	0	0.01	0.007	0.006	0.045	0.0079	0.0059	0.0105	0.021	0.047	0.024	0.024	0.013	0	0.02	0.047	0.0079	0.0059	0.0105
	1	21	0	0	0.017	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.01	0.021	0.035	0.035	0.027	0	0.003	0.021	0.0079	0.0059	0.0105
	1	22	0	0	0.001	0	0.005	0.002	0.0079	0.0059	0.0105	0.006	0.018	0.008	0.008	0.025	0	0.011	0.018	0.0079	0.0059	0.0105
	1	23	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.012	0	0	0	0.012	0	0	0	0.0079	0.0059	0.0105
	1	24	0.004	0.004	0.003	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.012	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105
2																						
SR2		Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
	2	1	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.004	0.004	0	0	0.004	0	0.003	0.004	0.0079	0.0059	0.0105
	2	2	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.003	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	2	3	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0.001	0.002	0	0	0	0	0	0.002	0.0079	0.0059	0.0105
	2	4	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	2	5	0	0	0	0	0	0.005	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	2	6	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.005	0	0	0	0.005	0	0.005	0.0079	0.0059	0.0105
	2	7	0.02	0.02	0.021	0.003	0	0.006	0.0374	0.0427	0.0369	0.006	0	0	0	0.004	0.019	0.003	0	0.0374	0.0427	0.0369
	2	8	0.219	0.219	0.112	0.012	0.023	0.018	0.0374	0.0427	0.0369	0	0.002	0	0	0.037	0.088	0.07	0.002	0.0374	0.0427	0.0369
	2	9	0.052	0.052	0.051	0.016	0.014	0.024	0.0374	0.0427	0.0369	0.002	0.017	0	0	0.039	0.045	0.016	0.017	0.0374	0.0427	0.0369
	2	10	0.054	0.054	0.034	0.059	0.017	0.055	0.0214	0.0255	0.0238	0.002	0.024	0	0	0.011	0.029	0.011	0.024	0.0214	0.0255	0.0238
	2	11	0.026	0.026	0.034	0.057	0.025	0.038	0.0214	0.0255	0.0238	0.005	0.018	0.022	0.022	0.012	0.031	0.032	0.018	0.0214	0.0255	0.0238
	2	12	0.018	0.018	0.037	0.06	0.048	0.038	0.0214	0.0255	0.0238	0.008	0.021	0.063	0.063	0.028	0.023	0.044	0.021	0.0214	0.0255	0.0238
	2	13	0.054	0.054	0.013	0.093	0.031	0.027	0.0214	0.0255	0.0238	0.012	0.047	0.038	0.038	0.026	0.049	0.069	0.047	0.0214	0.0255	0.0238
	2	14	0.042	0.042	0.029	0.037	0.059	0.025	0.0214	0.0255	0.0238	0.011	0.034	0.065	0.065	0.023	0.027	0.052	0.034	0.0214	0.0255	0.0238
	2	15	0.003	0.003	0.036	0.053	0.037	0.033	0.0214	0.0255	0.0238	0.024	0.035	0.055	0.055	0.046	0.027	0.078	0.035	0.0214	0.0255	0.0238
	2	16	0	0	0.035	0.068	0.037	0.02	0.0214	0.0255	0.0238	0.062	0.047	0.083	0.083	0.066	0.018	0.073	0.047	0.0214	0.0255	0.0238
	2	17	0.006	0.006	0.026	0.063	0.03	0.03	0.0505	0.043	0.0359	0.112	0.047	0.019	0.019	0.035	0.002	0.049	0.047	0.0505	0.043	0.0359
	2	18	0.026	0.026	0.023	0.081	0.03	0.058	0.0505	0.043	0.0359	0.126	0.077	0.019	0.019	0.043	0.006	0.038	0.077	0.0505	0.043	0.0359
	2	19	0.029	0.029	0.029	0.016	0.02	0.044	0.0505	0.043	0.0359	0.05	0.051	0.018	0.018	0.029	0.001	0.034	0.051	0.0505	0.043	0.0359
	2	20	0	0	0.01	0.007	0.006	0.045	0.0079	0.0059	0.0105	0.021	0.047	0.024	0.024	0.013	0	0.02	0.047	0.0079	0.0059	0.0105
	2	21	0	0	0.017	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.01	0.021	0.035	0.035	0.027	0	0.003	0.021	0.0079	0.0059	0.0105
	2	22	0	0	0.001	0	0.005	0.002	0.0079	0.0059	0.0105	0.006	0.018	0.008	0.008	0.025	0	0.011	0.018	0.0079	0.0059	0.0105
	2	23	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.012	0	0	0	0.012	0	0	0	0.0079	0.0059	0.0105
	2	24	0.004	0.004	0.003	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.012	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105
3+																						
SR3+		Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
	3	1	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.004	0.004	0	0	0.004	0	0.003	0.004	0.0079	0.0059	0.0105
	3	2	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.003	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	3	3	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0.001	0.002	0	0	0	0	0	0.002	0.0079	0.0059	0.0105
	3	4	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	3	5	0	0	0	0	0	0.005	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
	3	6	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.005	0	0	0	0.005	0	0.005	0.0079	0.0059	0.0105
	3	7	0.02	0.02	0.021	0.003	0	0.006	0.0374	0.0427	0.0369	0.006	0	0	0	0.004	0.019	0.003	0	0.0374	0.0427	0.0369
	3	8	0.219	0.219	0.112	0.012	0.023	0.018	0.0374	0.0427	0.0369	0	0.002	0	0	0.037	0.088	0.07	0.002	0.0374	0.0427	0.0369
	3	9	0.052	0.052	0.051	0.016	0.014	0.024	0.0374	0.0427	0.0369	0.002	0.017	0	0	0.039	0.045	0.016	0.017	0.0374	0.0427	0.0369
	3	10	0.054	0.054	0.034	0.059	0.017	0.055	0.0214	0.0255	0.0238	0.002	0.024	0	0	0.011	0.029	0.011	0.024	0.0214	0.0255	0.0238
	3	11	0.026	0.026	0.034	0.057	0.025	0.038	0.0214	0.0255	0.0238	0.005	0.018	0.022	0.022	0.012	0.031	0.032	0.018	0.0214	0.0255	0.0238
	3	12	0.018	0.018	0.037	0.06	0.048	0.038	0.0214	0.0255	0.0238	0.008	0.021	0.063	0.063	0.028	0.023	0.044	0.021	0.0214	0.0255	0.0238
	3	13	0.054	0.054	0.013	0.093	0.031	0.027	0.0214	0.0255	0.0238	0.012	0.047	0.038	0.038	0.026	0.049	0.069	0.047	0.0214	0.0255	0.0238
	3	14	0.042	0.042	0.029	0.037	0.059	0.025	0.0214	0.0255	0.0238	0.011	0.034	0.065	0.065	0.023	0.027	0.052	0.034	0.0214	0.0255	0.0238
	3	15	0.003	0.003	0.036	0.053	0.037	0.033	0.0214	0.0255	0.0238	0.024	0.035	0.055	0.055	0.046	0.027	0.078	0.035	0.0214	0.0255	0.0238
	3	16	0	0	0.035	0.068	0.037	0.02	0.0214	0.0255	0.0238	0.062	0.047	0.083	0.083	0.066	0.018	0.073	0.047	0.0214	0.0255	0.0238

D1	Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
3	17	0.006	0.006	0.026	0.063	0.03	0.03	0.0505	0.043	0.0359	0.112	0.047	0.019	0.019	0.035	0.002	0.049	0.047	0.0505	0.043	0.0359
3	18	0.026	0.026	0.023	0.081	0.03	0.058	0.0505	0.043	0.0359	0.126	0.077	0.019	0.019	0.043	0.006	0.038	0.077	0.0505	0.043	0.0359
3	19	0.029	0.029	0.029	0.016	0.02	0.044	0.0505	0.043	0.0359	0.05	0.051	0.018	0.018	0.029	0.001	0.034	0.051	0.0505	0.043	0.0359
3	20	0	0	0.01	0.007	0.006	0.045	0.0079	0.0059	0.0105	0.021	0.047	0.024	0.024	0.013	0	0.02	0.047	0.0079	0.0059	0.0105
3	21	0	0	0.017	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.01	0.021	0.035	0.035	0.027	0	0.003	0.021	0.0079	0.0059	0.0105
3	22	0	0	0.001	0	0.005	0.002	0.0079	0.0059	0.0105	0.006	0.018	0.008	0.008	0.025	0	0.011	0.018	0.0079	0.0059	0.0105
3	23	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.012	0	0	0	0.012	0	0	0	0.0079	0.0059	0.0105
3	24	0.004	0.004	0.003	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.012	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105
; Transit																					
TRN	Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
4	1	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.004	0.004	0	0	0.004	0	0.003	0.004	0.0079	0.0059	0.0105
4	2	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.003	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
4	3	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0.001	0.002	0	0	0	0	0	0.002	0.0079	0.0059	0.0105
4	4	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
4	5	0	0	0	0	0	0.005	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
4	6	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.005	0	0	0	0.005	0	0.005	0.0079	0.0059	0.0105
4	7	0.02	0.02	0.021	0.003	0	0.006	0.0374	0.0427	0.0369	0.006	0	0	0	0.004	0.019	0.003	0	0.0374	0.0427	0.0369
4	8	0.219	0.219	0.112	0.012	0.023	0.018	0.0374	0.0427	0.0369	0	0.002	0	0	0.037	0.088	0.07	0.002	0.0374	0.0427	0.0369
4	9	0.052	0.052	0.051	0.016	0.014	0.024	0.0374	0.0427	0.0369	0.002	0.017	0	0	0.039	0.045	0.016	0.017	0.0374	0.0427	0.0369
4	10	0.054	0.054	0.034	0.059	0.017	0.055	0.0214	0.0255	0.0238	0.002	0.024	0	0	0.011	0.029	0.011	0.024	0.0214	0.0255	0.0238
4	11	0.026	0.026	0.034	0.057	0.025	0.038	0.0214	0.0255	0.0238	0.005	0.018	0.022	0.022	0.012	0.031	0.032	0.018	0.0214	0.0255	0.0238
4	12	0.018	0.018	0.037	0.06	0.048	0.038	0.0214	0.0255	0.0238	0.008	0.021	0.063	0.063	0.028	0.023	0.044	0.021	0.0214	0.0255	0.0238
4	13	0.054	0.054	0.013	0.093	0.031	0.027	0.0214	0.0255	0.0238	0.012	0.047	0.038	0.038	0.026	0.049	0.069	0.047	0.0214	0.0255	0.0238
4	14	0.042	0.042	0.029	0.037	0.059	0.025	0.0214	0.0255	0.0238	0.011	0.034	0.065	0.065	0.023	0.027	0.052	0.034	0.0214	0.0255	0.0238
4	15	0.003	0.003	0.036	0.053	0.037	0.033	0.0214	0.0255	0.0238	0.024	0.035	0.055	0.055	0.046	0.027	0.078	0.035	0.0214	0.0255	0.0238
4	16	0	0	0.035	0.068	0.037	0.02	0.0214	0.0255	0.0238	0.062	0.047	0.083	0.083	0.066	0.018	0.073	0.047	0.0214	0.0255	0.0238
4	17	0.006	0.006	0.026	0.063	0.03	0.03	0.0505	0.043	0.0359	0.112	0.047	0.019	0.019	0.035	0.002	0.049	0.047	0.0505	0.043	0.0359
4	18	0.026	0.026	0.023	0.081	0.03	0.058	0.0505	0.043	0.0359	0.126	0.077	0.019	0.019	0.043	0.006	0.038	0.077	0.0505	0.043	0.0359
4	19	0.029	0.029	0.029	0.016	0.02	0.044	0.0505	0.043	0.0359	0.05	0.051	0.018	0.018	0.029	0.001	0.034	0.051	0.0505	0.043	0.0359
4	20	0	0	0.01	0.007	0.006	0.045	0.0079	0.0059	0.0105	0.021	0.047	0.024	0.024	0.013	0	0.02	0.047	0.0079	0.0059	0.0105
4	21	0	0	0.017	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.01	0.021	0.035	0.035	0.027	0	0.003	0.021	0.0079	0.0059	0.0105
4	22	0	0	0.001	0	0.005	0.002	0.0079	0.0059	0.0105	0.006	0.018	0.008	0.008	0.025	0	0.011	0.018	0.0079	0.0059	0.0105
4	23	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.012	0	0	0	0.012	0	0	0	0.0079	0.0059	0.0105
4	24	0.004	0.004	0.003	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.012	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105
WLK	Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
5	1	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.004	0.004	0	0	0.004	0	0.003	0.004	0.0079	0.0059	0.0105
5	2	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.003	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
5	3	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0.001	0.002	0	0	0	0	0	0.002	0.0079	0.0059	0.0105
5	4	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
5	5	0	0	0	0	0	0.005	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
5	6	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.005	0	0	0	0.005	0	0.005	0.0079	0.0059	0.0105
5	7	0.02	0.02	0.021	0.003	0	0.006	0.0374	0.0427	0.0369	0.006	0	0	0	0.004	0.019	0.003	0	0.0374	0.0427	0.0369
5	8	0.219	0.219	0.112	0.012	0.023	0.018	0.0374	0.0427	0.0369	0	0.002	0	0	0.037	0.088	0.07	0.002	0.0374	0.0427	0.0369
5	9	0.052	0.052	0.051	0.016	0.014	0.024	0.0374	0.0427	0.0369	0.002	0.017	0	0	0.039	0.045	0.016	0.017	0.0374	0.0427	0.0369
5	10	0.054	0.054	0.034	0.059	0.017	0.055	0.0214	0.0255	0.0238	0.002	0.024	0	0	0.011	0.029	0.011	0.024	0.0214	0.0255	0.0238
5	11	0.026	0.026	0.034	0.057	0.025	0.038	0.0214	0.0255	0.0238	0.005	0.018	0.022	0.022	0.012	0.031	0.032	0.018	0.0214	0.0255	0.0238
5	12	0.018	0.018	0.037	0.06	0.048	0.038	0.0214	0.0255	0.0238	0.008	0.021	0.063	0.063	0.028	0.023	0.044	0.021	0.0214	0.0255	0.0238
5	13	0.054	0.054	0.013	0.093	0.031	0.027	0.0214	0.0255	0.0238	0.012	0.047	0.038	0.038	0.026	0.049	0.069	0.047	0.0214	0.0255	0.0238
5	14	0.042	0.042	0.029	0.037	0.059	0.025	0.0214	0.0255	0.0238	0.011	0.034	0.065	0.065	0.023	0.027	0.052	0.034	0.0214	0.0255	0.0238
5	15	0.003	0.003	0.036	0.053	0.037	0.033	0.0214	0.0255	0.0238	0.024	0.035	0.055	0.055	0.046	0.027	0.078	0.035	0.0214	0.0255	0.0238
5	16	0	0	0.035	0.068	0.037	0.02	0.0214	0.0255	0.0238	0.062	0.047	0.083	0.083	0.066	0.018	0.073	0.047	0.0214	0.0255	0.0238
5	17	0.006	0.006	0.026	0.063	0.03	0.03	0.0505	0.043	0.0359	0.112	0.047	0.019	0.019	0.035	0.002	0.049	0.047	0.0505	0.043	0.0359
5	18	0.026	0.026	0.023	0.081	0.03	0.058	0.0505	0.043	0.0359	0.126	0.077	0.019	0.019	0.043	0.006	0.038	0.077	0.0505	0.043	0.0359
5	19	0.029	0.029	0.029	0.016	0.02	0.044	0.0505	0.043	0.0359	0.05	0.051	0.018	0.018	0.029	0.001	0.034	0.051	0.0505	0.043	0.0359
5	20	0	0	0.01	0.007	0.006	0.045	0.0079	0.0059	0.0105	0.021	0.047	0.024	0.024	0.013	0	0.02	0.047	0.0079	0.0059	0.0105
5	21	0	0	0.017	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.01	0.021	0.035	0.035	0.027	0	0.003	0.021	0.0079	0.0059	0.0105
5	22	0	0	0.001	0	0.005	0.002	0.0079	0.0059	0.0105	0.006	0.018	0.008	0.008	0.025	0	0.011	0.018	0.0079	0.0059	0.0105
5	23	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.012	0	0	0	0.012	0	0	0	0.0079	0.0059	0.0105
5	24	0.004	0.004	0.003	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.012	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105
TRK	Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
6	1	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.004	0.004	0	0	0.004	0	0.003	0.004	0.0079	0.0059	0.0105
6	2	0	0	0	0	0	0	0.0079	0.0059	0.0105	0.003	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
6	3	0	0	0	0	0	0.002	0.0079	0.0059	0.0105	0.001	0.002	0	0	0	0	0	0.002	0.0079	0.0059	0.0105
6	4	0	0	0	0	0	0	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
6	5	0	0	0	0	0	0.005	0.0079	0.0059	0.0105	0	0	0	0	0	0	0	0	0.0079	0.0059	0.0105
6	6	0	0	0.005	0	0	0	0.0079	0.0059	0.0105	0	0.005	0	0	0	0.005	0	0.005	0.0079	0.0059	0.0105
6	7	0.02	0.02	0.021	0.003	0	0.006	0.0374	0.0427	0.0369	0.006	0	0	0	0.004	0.019	0.003	0	0.0374	0.0427	0.0369
6	8	0.219	0.219	0.112	0.012	0.023	0.018	0.0374	0.0427	0.0369	0	0.002	0	0	0.037	0.088	0.07	0.002	0.0374	0.0427	0.0369

D1	Hour	DEP_HK_XX	DEP_HC_XX	DEP_HO_XX	DEP_WO_XX	DEP_OO_XX	DEP_HY_XX	DEP_TS_XX	DEP_TM_XX	DEP_TH_XX	RET_HW_XX	RET_HS_XX	RET_HK_XX	RET_HC_XX	RET_HO_XX	RET_WO_XX	RET_OO_XX	RET_HY_XX	RET_TS_XX	RET_TM_XX	RET_TH_XX
6	9	0.052	0.052	0.051	0.016	0.014	0.024	0.0374	0.0427	0.0369	0.002	0.017	0	0	0.039	0.045	0.016	0.017	0.0374	0.0427	0.0369
6	10	0.054	0.054	0.034	0.059	0.017	0.055	0.0214	0.0255	0.0238	0.002	0.024	0	0	0.011	0.029	0.011	0.024	0.0214	0.0255	0.0238
6	11	0.026	0.026	0.034	0.057	0.025	0.038	0.0214	0.0255	0.0238	0.005	0.018	0.022	0.022	0.012	0.031	0.032	0.018	0.0214	0.0255	0.0238
6	12	0.018	0.018	0.037	0.06	0.048	0.038	0.0214	0.0255	0.0238	0.008	0.021	0.063	0.063	0.028	0.023	0.044	0.021	0.0214	0.0255	0.0238
6	13	0.054	0.054	0.013	0.093	0.031	0.027	0.0214	0.0255	0.0238	0.012	0.047	0.038	0.038	0.026	0.049	0.069	0.047	0.0214	0.0255	0.0238
6	14	0.042	0.042	0.029	0.037	0.059	0.025	0.0214	0.0255	0.0238	0.011	0.034	0.065	0.065	0.023	0.027	0.052	0.034	0.0214	0.0255	0.0238
6	15	0.003	0.003	0.036	0.053	0.037	0.033	0.0214	0.0255	0.0238	0.024	0.035	0.055	0.055	0.046	0.027	0.078	0.035	0.0214	0.0255	0.0238
6	16	0	0	0.035	0.068	0.037	0.02	0.0214	0.0255	0.0238	0.062	0.047	0.083	0.083	0.066	0.018	0.073	0.047	0.0214	0.0255	0.0238
6	17	0.006	0.006	0.026	0.063	0.03	0.03	0.0505	0.043	0.0359	0.112	0.047	0.019	0.019	0.035	0.002	0.049	0.047	0.0505	0.043	0.0359
6	18	0.026	0.026	0.023	0.081	0.03	0.058	0.0505	0.043	0.0359	0.126	0.077	0.019	0.019	0.043	0.006	0.038	0.077	0.0505	0.043	0.0359
6	19	0.029	0.029	0.029	0.016	0.02	0.044	0.0505	0.043	0.0359	0.05	0.051	0.018	0.018	0.029	0.001	0.034	0.051	0.0505	0.043	0.0359
6	20	0	0	0.01	0.007	0.006	0.045	0.0079	0.0059	0.0105	0.021	0.047	0.024	0.024	0.013	0	0.02	0.047	0.0079	0.0059	0.0105
6	21	0	0	0.017	0.002	0.004	0.014	0.0079	0.0059	0.0105	0.01	0.021	0.035	0.035	0.027	0	0.003	0.021	0.0079	0.0059	0.0105
6	22	0	0	0.001	0	0.005	0.002	0.0079	0.0059	0.0105	0.006	0.018	0.008	0.008	0.025	0	0.011	0.018	0.0079	0.0059	0.0105
6	23	0	0	0	0	0.007	0	0.0079	0.0059	0.0105	0.012	0	0	0	0.012	0	0	0	0.0079	0.0059	0.0105
6	24	0.004	0.004	0.003	0.002	0.002	0.002	0.0079	0.0059	0.0105	0.012	0	0	0	0.005	0	0	0	0.0079	0.0059	0.0105

; Roadway parameters by facility and typology

; Capacity Class	Terrain	Area Type	Facility Type	Capacity_1	Capacity_2+	Speed Max	Alpha	Beta	OpsCap_1	OpsCap_2+	Description
1	1	1	1	2100	2100	70	0.25	9	2205	2310	Flat, Rural, Freeway
2	1	1	2	1680	2100	45	0.08	6	1680	2200	Flat, Rural, Highway
3	1	1	3	1155	1155	55	0.08	6	1680	2200	Flat, Rural, Expressway
4	1	1	4	945	945	45	0.07	6	1680	1980	Flat, Rural, Arterial
5	1	1	5	735	735	50	0.07	6	1680	1980	Flat, Rural, Collector
6	1	1	6	600	600	40	0.34	4	1155	1870	Flat, Rural, Local
7	1	1	7	1900	1900	50	0.08	6	1890	1980	Flat, Rural, Ramp:Freeway-Freeway
8	1	1	8	1600	1600	50	0.74	5	1575	1650	Flat, Rural, Ramp:Slip
9	1	1	9	1300	1300	45	0.7	5	1313	1375	Flat, Rural, Ramp:Loop
10	1	1	10	0	0	35	0	0	0	0	Flat, Rural, Connector: Internal
11	1	2	1	2000	2000	70	0.25	9	2100	2200	Flat, Suburban, Freeway
12	1	2	2	1600	2000	45	0.08	6	1680	2200	Flat, Suburban, Highway
13	1	2	3	1100	1100	55	0.08	6	1155	1210	Flat, Suburban, Expressway
14	1	2	4	900	900	45	0.38	5	945	990	Flat, Suburban, Arterial
15	1	2	5	700	700	50	0.96	5	735	770	Flat, Suburban, Collector
16	1	2	6	600	600	40	1.11	5	630	660	Flat, Suburban, Local
17	1	2	7	1800	1800	50	0.08	6	1890	1980	Flat, Suburban, Ramp:Freeway-Freeway
18	1	2	8	1500	1500	50	0.74	5	1575	1650	Flat, Suburban, Ramp:Slip
19	1	2	9	1250	1250	45	0.7	5	1313	1375	Flat, Suburban, Ramp:Loop
20	1	2	11	0	0	15	0	0	0	0	Flat, Suburban, Connector: External
21	1	3	1	1900	1900	65	0.25	9	1995	2090	Flat, Urban, Freeway
22	1	3	2	1600	1600	45	0.34	4	1680	1760	Flat, Urban, Highway
23	1	3	3	1000	1000	55	0.74	5	1050	1100	Flat, Urban, Expressway
24	1	3	4	800	800	45	0.7	5	840	880	Flat, Urban, Arterial
25	1	3	5	700	700	40	1	5	735	770	Flat, Urban, Collector
26	1	3	6	600	600	40	1.2	5	630	660	Flat, Urban, Local
27	1	3	7	1800	1800	50	0.08	6	1890	1980	Flat, Urban, Ramp:Freeway-Freeway
28	1	3	8	1500	1500	50	0.74	5	1575	1650	Flat, Urban, Ramp:Slip
29	1	3	9	1250	1250	45	0.7	5	1313	1375	Flat, Urban, Ramp:Loop
30	1	3	0	0	0	0	0	0	0	0	#N/A
31	1	4	1	1800	1800	65	0.18	8.5	1890	1980	Flat, Fringe, Freeway
32	1	4	2	1500	1500	45	0.07	6	1575	1650	Flat, Fringe, Highway
33	1	4	3	900	900	55	0.74	5	945	990	Flat, Fringe, Expressway
34	1	4	4	800	800	45	0.7	5	840	880	Flat, Fringe, Arterial
35	1	4	5	700	700	40	1	5	735	770	Flat, Fringe, Collector
36	1	4	6	600	600	40	1.5	5	630	660	Flat, Fringe, Local
37	1	4	7	1800	1800	50	0.08	6	1890	1980	Flat, Fringe, Ramp:Freeway-Freeway
38	1	4	8	1500	1500	50	0.74	5	1575	1650	Flat, Fringe, Ramp:Slip
39	1	4	9	1250	1250	45	0.7	5	1313	1375	Flat, Fringe, Ramp:Loop
40	1	4	0	0	0	0	0	0	0	0	#N/A
41	1	5	1	1750	1750	65	0.1	10	1838	1925	Flat, CBD, Freeway
42	1	5	2	1300	1300	45	0.07	6	1365	1430	Flat, CBD, Highway
43	1	5	3	800	800	45	1.16	6	840	880	Flat, CBD, Expressway
44	1	5	4	750	750	45	1	5	788	825	Flat, CBD, Arterial
45	1	5	5	700	700	40	1.4	5	735	770	Flat, CBD, Collector
46	1	5	6	600	600	40	1.5	5	630	660	Flat, CBD, Local
47	1	5	7	1800	1800	50	0.08	6	1890	1980	Flat, CBD, Ramp:Freeway-Freeway
48	1	5	8	1500	1500	50	0.74	5	1575	1650	Flat, CBD, Ramp:Slip
49	1	5	9	1250	1250	45	0.7	5	1313	1375	Flat, CBD, Ramp:Loop
50	1	5	0	0	0	0	0	0	0	0	#N/A
51	2	1	1	1800	1800	70	0.25	9	1890	1980	Rolling, Rural, Freeway
52	2	1	2	1300	1800	45	0.08	6	1365	1980	Rolling, Rural, Highway
53	2	1	3	1300	1800	65	0.08	6	1365	1980	Rolling, Rural, Expressway
54	2	1	4	1300	1700	45	0.07	6	1365	1870	Rolling, Rural, Arterial
55	2	1	5	1300	1700	50	0.07	6	1365	1870	Rolling, Rural, Collector
56	2	1	6	1000	1600	50	0.34	4	1050	1760	Rolling, Rural, Local
57	2	1	7	1800	1800	50	0.08	6	1890	1980	Rolling, Rural, Ramp:Freeway-Freeway
58	2	1	8	1500	1500	50	0.74	5	1575	1650	Rolling, Rural, Ramp:Slip
59	2	1	9	1250	1250	45	0.7	5	1313	1375	Rolling, Rural, Ramp:Loop
60	2	1	10	0	0	35	0	0	0	0	Rolling, Rural, Connector: Internal
61	2	2	1	1800	1800	70	0.25	9	1890	1980	Rolling, Suburban, Freeway
62	2	2	2	1300	1800	45	0.08	6	1365	1980	Rolling, Suburban, Highway
63	2	2	3	890	890	65	0.08	6	935	979	Rolling, Suburban, Expressway
64	2	2	4	730	730	45	0.38	5	767	803	Rolling, Suburban, Arterial
65	2	2	5	570	570	50	0.96	5	599	627	Rolling, Suburban, Collector
66	2	2	6	550	550	50	1.11	5	578	605	Rolling, Suburban, Local
67	2	2	7	1800	1800	50	0.08	6	1890	1980	Rolling, Suburban, Ramp:Freeway-Freeway
68	2	2	8	1500	1500	50	0.74	5	1575	1650	Rolling, Suburban, Ramp:Slip
69	2	2	9	1250	1250	45	0.7	5	1313	1375	Rolling, Suburban, Ramp:Loop
70	2	2	11	0	0	15	0	0	0	0	Rolling, Suburban, Connector: External
71	2	3	1	1620	1620	70	0.18	8.5	1701	1782	Rolling, Urban, Freeway
72	2	3	2	1300	1300	45	0.34	4	1365	1430	Rolling, Urban, Highway
73	2	3	3	810	810	65	0.74	5	851	891	Rolling, Urban, Expressway
74	2	3	4	730	730	45	0.7	5	767	803	Rolling, Urban, Arterial
75	2	3	5	650	650	50	1	5	683	715	Rolling, Urban, Collector
76	2	3	6	640	640	50	1.2	5	672	704	Rolling, Urban, Local
77	2	3	7	1500	1500	50	0.08	6	1575	1650	Rolling, Urban, Ramp:Freeway-Freeway
78	2	3	8	1500	1500	50	0.74	5	1575	1650	Rolling, Urban, Ramp:Slip
79	2	3	9	1250	1250	45	0.7	5	1313	1375	Rolling, Urban, Ramp:Loop
80	2	3	0	0	0	0	0	0	0	0	#N/A
81	2	4	1	1580	1580	70	0.18	8.5	1659	1738	Rolling, Fringe, Freeway
82	2	4	2	1220	1220	45	0.07	6	1281	1342	Rolling, Fringe, Highway

; Roadway parameters by facility and typology

; Capacity Class	Terrain	Area Type	Facility Type	Capacity_1	Capacity_2+	Speed Max	Alpha	Beta	OpsCap_1	OpsCap_2+	Description
83	2	4	3	730	730	65	0.74	5	767	803	Rolling, Fringe, Expressway
84	2	4	4	650	650	45	0.7	5	683	715	Rolling, Fringe, Arterial
85	2	4	5	650	650	50	1	5	683	715	Rolling, Fringe, Collector
86	2	4	6	640	640	50	1.5	5	672	704	Rolling, Fringe, Local
87	2	4	7	1500	1500	50	0.08	6	1575	1650	Rolling, Fringe, Ramp:Freeway-Freeway
88	2	4	8	1500	1500	50	0.74	5	1575	1650	Rolling, Fringe, Ramp:Slip
89	2	4	9	1250	1250	45	0.7	5	1313	1375	Rolling, Fringe, Ramp:Loop
90	2	4	0	0	0	0	0	0	0	0	#N/A
91	2	5	1	1580	1580	70	0.1	10	1659	1738	Rolling, CBD, Freeway
92	2	5	2	1060	1060	45	0.07	6	1113	1166	Rolling, CBD, Highway
93	2	5	3	650	650	65	1.16	6	683	715	Rolling, CBD, Expressway
94	2	5	4	610	610	45	1	5	641	671	Rolling, CBD, Arterial
95	2	5	5	570	570	50	1.4	5	599	627	Rolling, CBD, Collector
96	2	5	6	550	550	50	1.5	5	578	605	Rolling, CBD, Local
97	2	5	7	1500	1500	50	0.08	6	1575	1650	Rolling, CBD, Ramp:Freeway-Freeway
98	2	5	8	1500	1500	50	0.74	5	1575	1650	Rolling, CBD, Ramp:Slip
99	2	5	9	1250	1250	45	0.7	5	1313	1375	Rolling, CBD, Ramp:Loop
100	2	5	0	0	0	0	0	0	0	0	#N/A
101	3	1	1	1500	1500	65	0.18	8.5	1575	1650	Mountain, Rural, Freeway
102	3	1	2	700	1400	45	0.08	6	735	1540	Mountain, Rural, Highway
103	3	1	3	700	1400	55	0.08	6	735	1540	Mountain, Rural, Expressway
104	3	1	4	700	1400	45	0.07	6	735	1540	Mountain, Rural, Arterial
105	3	1	5	700	1400	40	0.07	6	735	1540	Mountain, Rural, Collector
106	3	1	6	600	1300	40	0.34	4	630	1430	Mountain, Rural, Local
107	3	1	7	1500	1500	50	0.08	6	1575	1650	Mountain, Rural, Ramp:Freeway-Freeway
108	3	1	8	1500	1500	45	0.74	5	1575	1650	Mountain, Rural, Ramp:Slip
109	3	1	9	1250	1250	35	0.7	5	1313	1375	Mountain, Rural, Ramp:Loop
110	3	1	10	0	0	35	0	0	0	0	Mountain, Rural, Connector: Internal
111	3	2	1	1500	1500	65	0.18	8.5	1575	1650	Mountain, Suburban, Freeway
112	3	2	2	700	1400	45	0.08	6	735	1540	Mountain, Suburban, Highway
113	3	2	3	700	1400	55	0.08	6	735	1540	Mountain, Suburban, Expressway
114	3	2	4	390	390	45	0.38	5	410	429	Mountain, Suburban, Arterial
115	3	2	5	310	310	40	0.96	5	326	341	Mountain, Suburban, Collector
116	3	2	6	330	330	40	1.11	5	347	363	Mountain, Suburban, Local
117	3	2	7	1500	1500	50	0.08	6	1575	1650	Mountain, Suburban, Ramp:Freeway-Freeway
118	3	2	8	1500	1500	45	0.74	5	1575	1650	Mountain, Suburban, Ramp:Slip
119	3	2	9	1250	1250	35	0.7	5	1313	1375	Mountain, Suburban, Ramp:Loop
120	3	2	11	0	0	15	0	0	0	0	Mountain, Suburban, Connector: External
121	3	3	1	1350	1350	65	0.1	10	1418	1485	Mountain, Urban, Freeway
122	3	3	2	700	700	45	0.34	4	735	770	Mountain, Urban, Highway
123	3	3	3	440	440	55	0.74	5	462	484	Mountain, Urban, Expressway
124	3	3	4	390	390	45	0.7	5	410	429	Mountain, Urban, Arterial
125	3	3	5	350	350	40	1	5	368	385	Mountain, Urban, Collector
126	3	3	6	380	380	40	1.2	5	399	418	Mountain, Urban, Local
127	3	3	7	1500	1500	50	0.08	6	1575	1650	Mountain, Urban, Ramp:Freeway-Freeway
128	3	3	8	1500	1500	45	0.74	5	1575	1650	Mountain, Urban, Ramp:Slip
129	3	3	9	1250	1250	35	0.7	5	1313	1375	Mountain, Urban, Ramp:Loop
130	3	3	0	0	0	0	0	0	0	0	#N/A
131	3	4	1	1310	1310	65	0.1	10	1376	1441	Mountain, Fringe, Freeway
132	3	4	2	660	660	45	0.07	6	693	726	Mountain, Fringe, Highway
133	3	4	3	390	390	55	0.74	5	410	429	Mountain, Fringe, Expressway
134	3	4	4	350	350	45	0.7	5	368	385	Mountain, Fringe, Arterial
135	3	4	5	350	350	40	1	5	368	385	Mountain, Fringe, Collector
136	3	4	6	380	380	40	1.5	5	399	418	Mountain, Fringe, Local
137	3	4	7	1500	1500	50	0.08	6	1575	1650	Mountain, Fringe, Ramp:Freeway-Freeway
138	3	4	8	1500	1500	45	0.74	5	1575	1650	Mountain, Fringe, Ramp:Slip
139	3	4	9	1250	1250	35	0.7	5	1313	1375	Mountain, Fringe, Ramp:Loop
140	3	4	0	0	0	0	0	0	0	0	#N/A
141	3	5	1	1310	1310	65	0.1	10	1376	1441	Mountain, CBD, Freeway
142	3	5	2	570	570	45	0.07	6	599	627	Mountain, CBD, Highway
143	3	5	3	350	350	55	1.16	6	368	385	Mountain, CBD, Expressway
144	3	5	4	330	330	45	1	5	347	363	Mountain, CBD, Arterial
145	3	5	5	310	310	40	1.4	5	326	341	Mountain, CBD, Collector
146	3	5	6	330	330	40	1.5	5	347	363	Mountain, CBD, Local
147	3	5	7	1500	1500	50	0.08	6	1575	1650	Mountain, CBD, Ramp:Freeway-Freeway
148	3	5	8	1500	1500	45	0.74	5	1575	1650	Mountain, CBD, Ramp:Slip
149	3	5	9	1250	1250	35	0.7	5	1313	1375	Mountain, CBD, Ramp:Loop
150	3	5	0	0	0	0	0	0	0	0	#N/A

;

District

D 1 = 1-100 ; External
D 2 = 101-320 ; Clovis
D 3 = 321-370 ; Coalinga
D 4 = 371-410 ; Firebaugh
D 5 = 411-470 ; Fowler
D 6 = 471-1540 ; Fresno
D 7 = 1541-1580 ; Huron
D 8 = 1581-1630 ; Kerman
D 9 = 1631-1680 ; Kingsburg
D 10 = 1681-1720 ; Mendota
D 11 = 1721-1750 ; Orange Cove
D 12 = 1751-1790 ; Parlier
D 13 = 1791-1850 ; Reedley
D 14 = 1851-1920 ; Sanger
D 15 = 1921-3000 ; San Joaquin

Lables

1	External
2	Clovis
3	Coalinga
4	Firebaugh
5	Fowler
6	Fresno
7	Huron
8	Kerman
9	Kingsburg
10	Mendota
11	Orange Cove
12	Parlier
13	Reedley
14	Sanger
15	San Joaquin

Note: This file has been transposed for reporting and should not be used directly as formated in the model

; LOS_NO	1	2	3	4	5	6
TEMP01	0	100	590	810	850	999999
U_FWY_G2_2	1270	2110	2940	3580	3980	999999
U_FWY_G2_3	1970	3260	4550	5530	6150	999999
U_FWY_G2_4	2660	4410	6150	7480	8320	999999
U_FWY_G2_5	3360	5560	7760	9440	10480	999999
U_FWY_G2_6	4050	6710	9360	11390	12650	999999
TEMP07	0	100	590	810	850	999999
TEMP08	0	100	590	810	850	999999
TEMP09	0	100	590	810	850	999999
TEMP10	0	100	590	810	850	999999
TEMP11	0	100	590	810	850	999999
U_FWY_L2_2	1130	1840	2660	3440	3910	999999
U_FWY_L2_3	1780	2890	4180	5410	6150	999999
U_FWY_L2_4	2340	3940	5700	7380	8380	999999
U_FWY_L2_5	3080	4990	7220	9340	10620	999999
U_FWY_L2_6	3730	6040	8740	11310	12850	999999
TEMP17	0	100	590	810	850	999999
TEMP18	0	100	590	810	850	999999
TEMP19	0	100	590	810	850	999999
TEMP20	0	100	590	810	850	999999
U_HWY_UI_1	100	340	670	950	1300	999999
U_HWY_UI_2	1060	1720	2500	3230	3670	999999
U_HWY_UI_3	1600	2590	3740	4840	5500	999999
TEMP24	0	100	590	810	850	999999
TEMP25	0	100	590	810	850	999999
TEMP26	0	100	590	810	850	999999
TEMP27	0	100	590	810	850	999999
TEMP28	0	100	590	810	850	999999
TEMP29	0	100	590	810	850	999999
TEMP30	0	100	590	810	850	999999
U_ART_C1_1	0	220	720	860	890	999999
U_ART_C1_2	250	1530	1810	1860	1861	999999
U_ART_C1_3	380	2330	2720	2790	2791	999999
U_ART_C1_4	490	3030	3460	3540	3541	999999
TEMP35	0	100	590	810	850	999999
U_ART_C2_1	0	100	590	810	850	999999
U_ART_C2_2	0	220	1360	1710	1800	999999
U_ART_C2_3	0	340	2110	2570	2710	999999
U_ART_C2_4	0	440	2790	3330	3500	999999
TEMP40	0	100	590	810	850	999999
U_ART_C3_1	0	1	280	660	810	999999
U_ART_C3_2	0	1	650	1510	1720	999999
U_ART_C3_3	0	1	1020	2330	2580	999999
U_ART_C3_4	0	1	1350	3070	3330	999999
TEMP45	0	100	590	810	850	999999
U_ART_C4_1	0	1	270	720	780	999999
U_ART_C4_2	0	1	650	1580	1660	999999
U_ART_C4_3	0	1	1000	2390	2490	999999
U_ART_C4_4	0	1	1350	3130	3250	999999
TEMP50	0	100	590	810	850	999999
U_MAJ_NS_1	0	1	480	760	810	999999
U_MAJ_NS_2	0	1	1120	1620	1720	999999
U_MAJ_NS_3	0	1	1740	2450	2580	999999
TEMP54	0	100	590	810	850	999999
TEMP55	0	100	590	810	850	999999
U_OTH_NS_1	0	1	250	530	660	999999
U_OTH_NS_2	0	1	580	1140	1320	999999
U_OTH_NS_3	0	1	870	1710	1980	999999
TEMP59	0	100	590	810	850	999999
TEMP60	0	100	590	810	850	999999
TEMP61	0	100	590	810	850	999999
TEMP62	0	100	590	810	850	999999
TEMP63	0	100	590	810	850	999999
TEMP64	0	100	590	810	850	999999
TEMP65	0	100	590	810	850	999999
TEMP66	0	100	590	810	850	999999
TEMP67	0	100	590	810	850	999999
TEMP68	0	100	590	810	850	999999
TEMP69	0	100	590	810	850	999999
TEMP70	0	100	590	810	850	999999
TEMP71	0	100	590	810	850	999999
R_FWY_RU_2	1220	2020	2740	3240	3600	999999
R_FWY_RU_3	1890	3110	4230	5000	5560	999999
R_FWY_RU_4	2560	4210	5720	6770	7520	999999
TEMP75	0	100	590	810	850	999999
TEMP76	0	100	590	810	850	999999
TEMP77	0	100	590	810	850	999999
TEMP78	0	100	590	810	850	999999
TEMP79	0	100	590	810	850	999999
TEMP80	0	100	590	810	850	999999
R_HWY_RU_1	120	250	410	650	1060	999999
R_HWY_RU_2	940	1540	2200	2830	3140	999999
R_HWY_RU_3	1410	2310	3330	4240	4710	999999
TEMP84	0	100	590	810	850	999999
TEMP85	0	100	590	810	850	999999
R_HWY_SU_1	120	350	600	820	1120	999999
R_HWY_SU_2	950	1540	2230	2890	3280	999999
R_HWY_SU_3	1430	2310	3350	4330	4920	999999
TEMP89	0	100	590	810	850	999999
TEMP90	0	100	590	810	850	999999
R_ART_SU_1	0	120	590	740	800	999999
R_ART_SU_2	0	290	1360	1570	1660	999999
R_ART_SU_3	0	450	2100	2360	2500	999999
TEMP94	0	100	590	810	850	999999
TEMP95	0	100	590	810	850	999999
R_LOC_SU_1	0	1	100	410	540	999999
TEMP97	0	100	590	810	850	999999
TEMP98	0	100	590	810	850	999999
TEMP99	0	100	590	810	850	999999

APPENDIX M:

ONE-WAY VOLUME MODEL VALIDATION RESULTS

San Joaquin Valley Model Improvement Project (San Joaquin Valley MIP)
One-Way Volume Model Validation Results
Fresno County Model

August 1, 2017

DAILY Assignment		
Model/Count Ratio =	**0.94**	
Percent Within Caltrans Maximum Deviation =	**79%**	> 75%
Percent Root Mean Square Error =	**54%**	<40
Correlation Coefficient =	**95%**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**92%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	793	
Link Within Deviation	623	
Link Outside Deviation	170	
	Remaining	Total Needed
	-28	595

Model/Count by ADT Volume Groups		
Link Volume	M/C	Counts
> 50,000	**1.09**	
25,000 - 49,999	**0.98**	
10,000 - 24,999	**1.02**	
5,000 - 9,999	**0.87**	
2,500 - 4,999	**0.88**	
1,000 - 2,499	**0.85**	
< 1,000	**0.82**	

RMSE by ADT Volume Groups		
Link Volume	%RMSE	FHWA
> 50,000	**28%**	< 21%
25,000 - 49,999	**21%**	< 22%
10,000 - 24,999	**32%**	< 25%
5,000 - 9,999	**48%**	< 29%
2,500 - 4,999	**56%**	< 36%
1,000 - 2,499	**52%**	< 47%
< 1,000	**60%**	< 60%

ADT Model/Count by Functional Class		
Functional Class	M/C	Counts
Freeway	**1.04**	**54**
Highway	**1.26**	**17**
Expressway	**1.25**	**26**
Arterial	**0.79**	**339**
Collector	**0.82**	**368**

AM Peak Period (6 - 9 AM)		
Model/Count Ratio =	**0.84**	
Percent Within Caltrans Maximum Deviation =	**76%**	> 75%
Percent Root Mean Square Error =	**62%**	<40
Correlation Coefficient =	**0.93**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**91%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	793	
Link Within Deviation	606	
Link Outside Deviation	187	
	Remaining	Total Needed
	-11	595

MD Peak Period (10 AM - 2 PM)		
Model/Count Ratio =	**0.93**	
Percent Within Caltrans Maximum Deviation =	**70%**	> 75%
Percent Root Mean Square Error =	**64%**	<40
Correlation Coefficient =	**0.94**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**100%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	793	
Link Within Deviation	552	
Link Outside Deviation	241	
	Remaining	Total Needed
	43	595

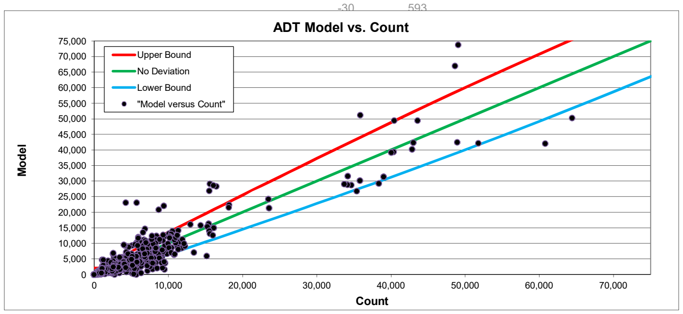
AM Peak Hour (7- 8 AM)		
Model/Count Ratio =	**0.66**	
Percent Within Caltrans Maximum Deviation =	**47%**	> 75%
Percent Root Mean Square Error =	**105%**	<40
Correlation Coefficient =	**0.79**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**58%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	793	
Link Within Deviation	373	
Link Outside Deviation	420	
	Remaining	Total Needed
	222	595

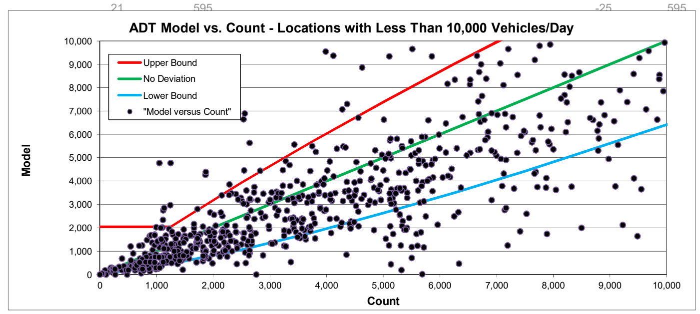
Freeway Traffic vs. Local Traffic	Model/Count	
Time Period Analyzed	Freeway	Streets
DAILY Assignment	1.02	0.88
AM Peak Period (6 - 9 AM)	0.90	0.80
MD Peak Period (10 AM - 2 PM)	1.11	0.82
PM Peak Period (3 - 7 PM)	1.05	0.97
Off Peak Period (8 PM - 5 AM)	0.93	1.00
AM Peak Hour (7- 8 AM)	1.00	0.48
PM Peak Hour (5 - 6 PM)	1.03	0.85

PM Peak Period (3 - 7 PM)		
Model/Count Ratio =	**1.00**	
Percent Within Caltrans Maximum Deviation =	**79%**	> 75%
Percent Root Mean Square Error =	**51%**	<40
Correlation Coefficient =	**0.95**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**100%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	791	
Link Within Deviation	623	
Link Outside Deviation	168	
	Remaining	Total Needed
	-30	593

Off Peak Period (8 PM - 5 AM)		
Model/Count Ratio =	**0.97**	
Percent Within Caltrans Maximum Deviation =	**72%**	> 75%
Percent Root Mean Square Error =	**71%**	<40
Correlation Coefficient =	**0.91**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**100%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	793	
Link Within Deviation	574	
Link Outside Deviation	219	
	Remaining	Total Needed
	21	595

PM Peak Hour (5 - 6 PM)		
Model/Count Ratio =	**0.91**	
Percent Within Caltrans Maximum Deviation =	**78%**	> 75%
Percent Root Mean Square Error =	**157%**	<40
Correlation Coefficient =	**0.64**	> 0.88
%of Screenlines Within Caltrans Standard Dev. =	**92%**	100%
Externals M/C Ratio =		
Externals % RMSE =		
Total Count	793	
Link Within Deviation	620	
Link Outside Deviation	173	
	Remaining	Total Needed
	-25	595





Note: The results reflect the validation status of VMIP 2 Model as of August 1, 2017. Fresno COG and model consultants will continually work on improving the model, including peak hour validations, as the process is a work-in-progress.