EMFAC Modeling Change Technical Memo

SUBJECT: UPDATING ESTIMATES OF VEHICLE MILES TRAVELED AND SPEED DISTRIBUTIONS IN EMFAC WORKING DRAFT 1

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SUMMARY

From November 2004 through May 2005, transportation planning agencies (TPAs) submitted motor vehicle activity data to the Air Resources Board (ARB) to be used in the 2005 update to the first draft working version EMFAC2007 model known as Working Draft 1. The TPAs represented the major urban areas of California. The activity data included vehicle miles traveled (VMT) and the distribution of VMT by speed and, in some cases, by time period. Statewide, the VMT update caused a 3% decrease in ROG emissions and a 6% decrease in NOx emissions in 2002 relative to VMT calculated with vehicle registration and Smog Check data. The update to speeds caused a 2% decrease in ROG emissions and a 1% decrease in NOx. This memorandum summarizes the TPA data submitted, the quality assurance data review process, and emissions impacts of VMT and speeds updates to the motor vehicle emissions inventory in more detail.

DATA REVIEW

ARB reviewed the TPA data for anomalies and compared VMT and speed trends to past submittals and to other independent sources of data. Staff prepared individual assessments for each area of the state that submitted data. These assessments describe in detail the data submitted, major issues identified during the quality assurance process, and how these issues were resolved. The assessments included quality assurance questions presented to the TPAs and the answers provided by the TPAs. Also, ARB provided supporting files with VMT and speeds trend charts and data files formatted for the EMFAC model.

ARB posted the assessments to ARB's website and sent letters to the TPAs requesting their final review of the information. ARB revised the data as appropriate following TPA input. The updated assessments are listed here and are available with supporting documents at www.arb.ca.gov/planning/sip/emfacact05/emfacact05.htm.

#520 Southern California Association of Governments (SCAG)
#526 Metropolitan Transportation Commission (MTC)
#546 Sacramento Area Council of Governments (SACOG)
#556 San Diego Association of Governments (SANDAG)
#557 Santa Barbara County Association of Governments (SBCAG)
#558 San Joaquin Valley Transportation Planning Agencies (SJV TPAs)
#559 Association of Monterey Bay Area Governments (AMBAG)
#575 Butte County Association of Governments (BCAG) and Tahoe Regional Planning Agency (TRPA)

When the quality assurance process was completed, ARB processed the data into a format compatible with the EMFAC model.

DATA SUBMITTED

In general, the TPAs provided VMT estimates for the total vehicles in the fleet. There were instances where TPAs provided VMT data in more detail by vehicle type; however, after consultations with the TPAs, ARB used updated DMV data (2000 through 2003) to distribute total VMT to the 13 vehicle classes. In particular, heavy-duty truck VMT was assigned according to ARB's recent heavy-duty trucks statewide VMT redistribution. A technical memo documenting the heavy-duty trucks VMT redistribution is available at http://www.arb.ca.gov/msei/msei.htm.

The TPAs provided speed distributions for light-duty vehicles, medium-duty vehicles, and motorcycles. In some cases, they provided speeds for heavy-duty vehicles as well. After consultation, ARB updated the light- and medium-duty fleet using the TPA speed distributions, but left heavy-duty speeds unchanged in the model. The heavy-duty speeds were not changed largely because the heavy-duty statewide VMT redistribution occurred after the travel demand model speeds had been developed. Since in most cases the heavy-duty speeds currently in the EMFAC model reflect instrumented vehicle studies, it was thought better to leave the speeds unchanged for now. There will be opportunity to revisit heavy-duty speeds in future updates.

In the coming year, the TPAs will be improving their travel demand models and updating special truck and transit models. In addition, ARB has agreed to work with TPAs to resolve discrepancies between ARB VMT estimates and travel demand model VMT estimates. The area-specific assessments discuss all of these issues in more detail.

VMT Updates

Table 1 summarizes the calendar years (CYs) of VMT data received from the TPAs. Only one base year among CYs 2000, 2001, 2002, and 2003 could be used to populate the EMFAC model. Some areas provided data for more than one base year. The ones selected for the model are shown in Table 1.

CY 2040 appears for all areas. If an area did not provide 2040 data, ARB extrapolated VMT data to 2040 by compounding the TPA growth rates provided for the nearest prior time period.

SACOG (and MTC for Solano County) provided data for CY 2000; however, due to the VMT adjustments agreed upon by SACOG, the Sacramento Metropolitan Air Quality Management District, and ARB, CY 2003 was selected for the base year. The 2003 data was taken from the Caltrans report, California Motor Vehicle Stock, Travel and Fuel Forecast, Nov 2003, and used in combination with SACOG VMT growth rates to populate EMFAC. Assessment # 546 has a detailed explanation of the agreement and calculations.

The VMT provided by the TPAs was entered into the EMFAC model using a VMT matching algorithm. The Appendix to this memorandum describes how the VMT matching algorithm operates to match TPA VMT data in the EMFAC model.

Table 1: VMT Data Provided by Area

AGENCY	COUNTY	AIR BASIN	AREA	BASE YEARS	CALENDAR YEARS							RECEIVED
AMBAG	Monterey	North Central Coast	16	2000	2010	2020	2030	2040				Nov 04
	San Benito	North Central Coast	17	2000	2010	2020	2030	2040				
	Santa Cruz	North Central Coast	18	2000	2010	2020	2030	2040				
BCAG	Butte	Sacramento Valley	27	2000	2010	2015	2020	2025	2040			2004
MTC	Alameda	San Francisco	39	2000	2006	2007	2015	2025	2030	2040		Dec 04 - May 05
	Contra Costa	San Francisco	40	2000	2006	2007	2015	2025	2030	2040		
	Marin	San Francisco	41	2000	2006	2007	2015	2025	2030	2040		
	Napa	San Francisco	42	2000	2006	2007	2015	2025	2030	2040		
	San Francisco	San Francisco	43	2000	2006	2007	2015	2025	2030	2040		
	San Mateo	San Francisco	44	2000	2006	2007	2015	2025	2030	2040		
	Santa Clara	San Francisco	45	2000	2006	2007	2015	2025	2030	2040		
	So. Solano (subarea)	San Francisco	46	2000		2007	2015	2025	2030	2040		
	So. Sonoma (subarea)	San Francisco	47	2000		2007	2015	2025	2030	2040		
	No. Sonoma (subarea)	North Coast	22	2000		2007	2015	2025	2030	2040		
SACOG	ElDorado (subarea)	Mountain Counties	9	2003	2005	2008	2013	2020	2027	2040		Dec 04 - Mar 05
	Placer (subarea)	Sacramento	30	2003	2005	2008	2013	2020	2027	2040		
	Placer (subarea)	Mountain Counties	12	2003	2005	2008	2013	2020	2027	2040		
	Sacramento	Sacramento	31	2003	2005	2008	2013	2020	2027	2040		
	Sutter	Sacramento	34	2003	2005	2008	2013	2020	2027	2040		
	Yolo	Sacramento	36	2003	2005	2008	2013	2020	2027	2040		
	Yuba	Sacramento	37	2003	2005	2008	2013	2020	2027	2040		
MTC	Solano (subarea)	Sacramento	33	2003		2007	2015	2025	2030	2040		
SANDAG	San Diego	San Diego	38	2002	2008	2009	2010	2014	2020	2030	2040	Dec 04 - Mar 05
FRESNO COG	Fresno	San Joaquin Valley	48	2000	2005	2008	2010	2020	2030	2040		Feb 05 - Mar 05
KERN COG	Kern (subarea)	San Joaquin Valley	49	2000	2005	2008	2010	2015	2020	2030	2040	
KINGS CAG	Kings	San Joaquin Valley	50	2000	2005	2008	2010	2020	2030	2040		
MADERA CTC	Madera	San Joaquin Valley	51	2000	2005	2008	2010	2020	2030	2040		
MERCED CAG	Merced	San Joaquin Valley	52	2000	2005	2008	2010	2020	2030	2040		
SJCOG	San Joaquin	San Joaquin Valley	53	2000	2005	2008	2010	2020	2030	2040		
STANISLAUS COG	Stanislaus	San Joaquin Valley	54	2000	2005	2008	2010	2020	2030	2040		
TULARE CAG	Tulare	San Joaquin Valley	55	2003	2005	2008	2010	2020	2030	2040		
KERN COG	Kern (subarea)	Mojave Desert	65	2000	2005	2008	2010	2015	2020	2030	2040	
SBCAG	Santa Barbara	South Central Coast	57	2000	2005	2010	2015	2020	2030	2040		Feb 05
SCAG	Los Angeles	South Coast	59	2000	2005	2010	2015	2020	2025	2030	2040	Jan 05 - Apr 05
SCAG	Orange	South Coast	60	2000	2005	2010	2015	2020	2025	2030	2040	
SCAG	Riverside with Banning	South Coast	61	2000	2005	2010	2015	2020	2025	2030	2040	
SCAG	San Bernardino	South Coast	62	2000	2005	2010	2015	2020	2025	2030	2040	
SCAG	Los Angeles (Antelope Valley)	Mojave Desert	68	2000	2005	2010	2015	2020	2025	2030	2040	
SCAG	San Bernardino (VV + MV)	Mojave Desert	69	2000	2005	2010	2015	2020	2025	2030	2040	
SCAG	Riverside (Coachella Valley)	Salton Sea	64	2000	2005	2010	2015	2020	2025	2030	2040	
SCAG	Ventura	South Central Coast	58	2000	2005	2010	2015	2020	2025	2030	2040	

Speed Updates

The TPAs provided speeds for the light-duty fleet (passenger cars, light-duty trucks, medium-duty vehicles, and motorcycles). Typically, ARB default speed distributions based on instrumented vehicle studies are used for heavy-duty vehicles.

Table 2 summarizes the CYs of speed distributions provided by the TPAs. ARB did not interpolate or extrapolate speed distributions, but applied the speed distribution for the next future year to interim years. For example, if speeds were provided for CYs 2000, 2005, and 2020, then the 2005 speeds were applied to CYs 2001 through 2005. Likewise, 2020 speeds were applied to CYs 2006 through 2020. In this example, since no speeds were provided for out-years, the 2020 speeds would be applied through 2040.

Santa Barbara was the only exception to the typical approach. SBCAG provided specific instructions as to what speeds would be applied to specific CYs. (See Assessment #557 for details.)

Table 2: Speeds Data Provided by Area

AGENCY	COUNTY	AIR BASIN	AREA	CALENDAR YEARS									RECEIVED
AMBAG	Monterey	North Central Coast	16		2010	2020	2025	2030					Nov 04
	San Benito	North Central Coast	17		2010	2020	2025	2030					
	Santa Cruz	North Central Coast	18		2010	2020	2025	2030					
BCAG	Butte	Sacramento Valley	27	2000	2010	2015	2020	2025					2004
MTC	Alameda	San Francisco	39	2000	2006	2007	2015	2025	2030				Dec 04 - May 05
	Contra Costa	San Francisco	40	2000	2006	2007	2015	2025	2030				
	Marin	San Francisco	41	2000	2006	2007	2015	2025	2030				
	Napa	San Francisco	42	2000	2006	2007	2015	2025	2030				
	San Francisco	San Francisco	43	2000	2006	2007	2015	2025	2030				
	San Mateo	San Francisco	44	2000	2006	2007	2015	2025	2030				
	Santa Clara	San Francisco	45	2000	2006	2007	2015	2025	2030				
	So. Solano (subarea)	San Francisco	46	2000		2007	2015	2025	2030				
	So. Sonoma (subarea)	San Francisco	47	2000		2007	2015	2025	2030				
	No. Sonoma (subarea)	North Coast	22	2000		2007	2015	2025	2030				
SACOG	ElDorado (subarea)	Mountain Counties	9	2000	2005	2008	2013	2020	2027				Dec 04 - Mar 05
	Placer (subarea)	Sacramento	30	2000	2005	2008	2013	2020	2027				
	Placer (subarea)	Mountain Counties	12	2000	2005	2008	2013	2020	2027				
	Sacramento	Sacramento	31	2000	2005	2008	2013	2020	2027				
	Sutter	Sacramento	34	2000	2005	2008	2013	2020	2027				
	Yolo	Sacramento	36	2000	2005	2008	2013	2020	2027				
	Yuba	Sacramento	37	2000	2005	2008	2013	2020	2027				
MTC	Solano (subarea)	Sacramento	33	2000		2007	2015	2025	2030				
SANDAG	San Diego	San Diego	38	2002	2008	2009	2010	2014	2020	2030			Dec 04 - Mar 05
FRESNO COG	Fresno	San Joaquin Valley	48	2000	2002	2005	2008	2010	2020	2030			Feb 05 - Mar 05
KERN COG	Kern (subarea)	San Joaquin Valley	49	2000	2005	2008	2010	2015	2020	2030			
KINGS CAG	Kings	San Joaquin Valley	50	2000	2002	2005	2008	2010	2020	2030			
MADERA CTC	Madera	San Joaquin Valley	51	2000	2005	2008	2010	2020	2030				
MERCED CAG	Merced	San Joaquin Valley	52	2000	2002	2005	2008	2010	2020	2030			
SJCOG	San Joaquin	San Joaquin Valley	53	2000	2005	2008	2010	2020	2030				
STANISLAUS COG	Stanislaus	San Joaquin Valley	54	2000	2005	2008	2010	2020	2030				
TULARE CAG	Tulare	San Joaquin Valley	55	2003	2005	2008	2010	2020	2030				
KERN COG	Kern (subarea)	Mojave Desert	65	2000	2005	2008	2010	2015	2020	2030			
SBCAG	Santa Barbara	South Central Coast	57	2000	2005	2010	2015	2020	2030				Feb 05
SCAG	Los Angeles	South Coast	59	2000	2002	2005	2010	2015	2020	2025	2030	2040	Jan 05 - Apr 05
	Orange	South Coast	60	2000	2002	2005	2010	2015	2020	2025	2030	2040	
	Riverside with Banning	South Coast	61	2000	2002	2005	2010	2015	2020	2025	2030	2040	
	San Bernardino	South Coast	62	2000	2002	2005	2010	2015	2020	2025	2030	2040	
	Los Angeles (Antelope Valley)	Mojave Desert	68	2000	2002	2005	2010	2015	2020	2025	2030	2040	
	San Bernardino (VV + MV)	Mojave Desert	69	2000	2002	2005	2010	2015	2020	2025	2030	2040	
	Riverside (Coachella Valley)	Salton Sea	64	2000	2002	2005	2010	2015	2020	2025	2030	2040	
	Ventura	South Central Coast	58	2000	2002	2005	2010	2015	2020	2025	2030	2040	
TRPA	El Dorado (subarea)	Lake Tahoe	5	2003	2010	2018	(all years have the same speed distribution)						2004
	Placer (subarea)	Lake Tahoe	6	2003	2010	2018	(all years have the same speed distribution)						2004

Time Period Definition Updates

Part of the speed submittals is the period definitions. The period definitions are the time-of-day periods associated with each speed distribution provided by the TPAs. Table 3 summarizes the period definitions by area.

Period definitions are typically the same for a given area for all forecasted years in the EMFAC model. For the first time, Santa Barbara provided period definitions that change over time to show a spreading of peak travel due to increases in traffic congestion. In the future, ARB expects that other areas will begin to show peak spreading by varying period definitions over time.

Table 3: Time Period Definitions for EMFAC 2007

Area	TPA County	SPEED DISTRIBTUTIONS	Air Basin/ District	Period 1 Off Peak	Period 2 AM Peak	Period 3 Mid Day	Period 4 Mid Day	Period 5 PM Peak	Period 6 Off Peak
	BCAG	DAILY							
27	Butte		SV/BUT						
	AMBAG	AMPK, PMPK, OFFPK							
16	Monterey		NCC/MBU	Hours 0-5	6,7,8	9,10,11	12,13,14	15, 16, 17	18-23
17	San Benito		NCC/MBU	"	"	"	"	"	"
18	Santa Cruz		NCC/MBU	"	"	"	"	"	"
	MTC	PK (Per. 2, 5), OFFPK (Per. 1,3,4,6)							
39	Alameda		SF/BA	Hours 0-5	6,7,8	9,10,11	12,13,14	15, 16, 17	18-23
40	Contra Costa		SF/BA	"	"	"	"	"	"
41	Marin		SF/BA	"	"	"	"	"	"
42	Napa		SF/BA	"	"	"	"	"	"
43	San Francisco		SF/BA	"	"	"	"	"	"
44	San Mateo		SF/BA	"	"	"	"	"	"
45	Santa Clara		SF/BA	"	"	"	"	"	"
46	Solano (SF)		SF/BA	"	"	"	"	"	"
33	Solano (SV)		SV/YS	"	"	"	"	"	"
47	Sonoma (SF)		SF/BA	"	"	"	"	"	"
22	Sonoma (NC)		NC/NS	"	"	"	"	"	"
	SACOG	AM, MID, PM, EVENING							
9	El Dorado (MC)		MC/ED	Hours 0-5	6,7,8	9,10,11	12,13,14	15, 16, 17	18-23
30	Placer (SV)		SV/PLA	"	"	"	"	"	"
12	Placer (MC)		MC/PLA	"	"	"	"	"	"
31	Sacramento		SV/SAC	"	"	"	"	"	"
34	Sutter		SV/FR	"	"	"	"	"	"
36	Yolo		SV/YS	"	"	"	"	"	"
37	Yuba		SV/FR	"	"	"	"	"	"
	SANDAG	PERIODS 1 - 6							
38	San Diego		SD/SD	Hours 0-5	6,7,8	9,10,11	12,13,14	15, 16, 17	18-23
	SCAG	AMPK, PMPK, MIDDAY, NIGHT							
59	Los Angeles		SC/SC	Hours 0-5	6,7,8	9,10,11	12,13,14	15,16,17,18	19-23
68	Los Angeles (Antelope Valley)		MD/AV	"	"	"	"	"	"
60	Orange		SC/SC	"	"	"	"	"	"
61	Riverside (Banning)		SC/SC	"	"	"	"	"	"
64	Riverside (Coachella Valley)		SS/SC	"	"	"	"	"	"
67	Riverside		MD/SC	"	"	"	"	"	"
66	Riverside		MD/MOJ	"	"	"	"	"	"
62	San Bernardino		SC/SC	"	"	"	"	"	"
69	San Bernardino (Victor Valley and Mojave Valley)		MD/MOJ	"	"	"	"	"	"
58	Ventura		SCC/VEN	"	"	"	"	"	"
	SJV TPAs								
48	Fresno	AMPK, PMPK, OFFPK	SJV/SJU	Hours 0-5	6,7,8	9,10,11	12,13,14	15, 16, 17	18-23
49	Kern	AM, PM, MD, OFF	SJV/SJVU	Hours 0-6	7,8	9,10,11	12,13,14	15, 16, 17	18-23
65	Kern	AM, PM, MD, OFF	MD/KER	Hours 0-6	7,8	9,10,11	12,13,14	15, 16, 17	18-23
50	Kings	DAILY	SJV/SJU						
51	Madera	DAILY	SJV/SJU						
52	Merced	DAILY	SJV/SJU						
53	San Joaquin	DAILY	SJV/SJU						
54	Stanislaus	DAILY	SJV/SJU						
55	Tulare	AM, PM, OFF	SJV/SJU	Hours 0-5	6,7,8	9,10,11	12,13,14	15, 16, 17	18-23
	TRPA (Lake Tahoe)	DAILY							
5	El Dorado		LT/ED						
6	Placer		LT/PLA						
	SBCAG	AMPK, PMPK, OFFPK							
57	Santa Barbara	VARIES BY YEAR	SCC						
			CY 2000	Hours 0-6	7-8	9-11	12-15	16,17	18-23
			CY 2005	Hours 0-6	7-8	9-11	12-15	16,17	18-23
			CY 2010	Hours 0-5	6-8	9-11	12-14	15-17	18-23
			CY 2015	Hours 0-5	6-9	10-11	12-14	15-18	19-23
			CY 2020	Hours 0-5	6-9	10-11	12-14	15-18	19-23
			CY 2030	Hours 0-5	6-9	10-11	12-14	15-18	19-23

Activity Data Issues

During the QA process, ARB staff raised questions with each of the TPAs regarding the activity data submittals. Details on the VMT and speeds issues are provided in the assessments for each area; however, there were two issues of particular interest—the slowing of growth rates compared to previous submittals and baseline VMT estimates that were noticeably less than Caltrans HPMS and ARB's odometer-based estimates.

Slower VMT growth was reported by SCAG, MTC, SAGOG, and AMBAG. The TPAs offered their updated socioeconomic (i.e., population and job growth) estimates as the reason for the slower VMT growth rates.

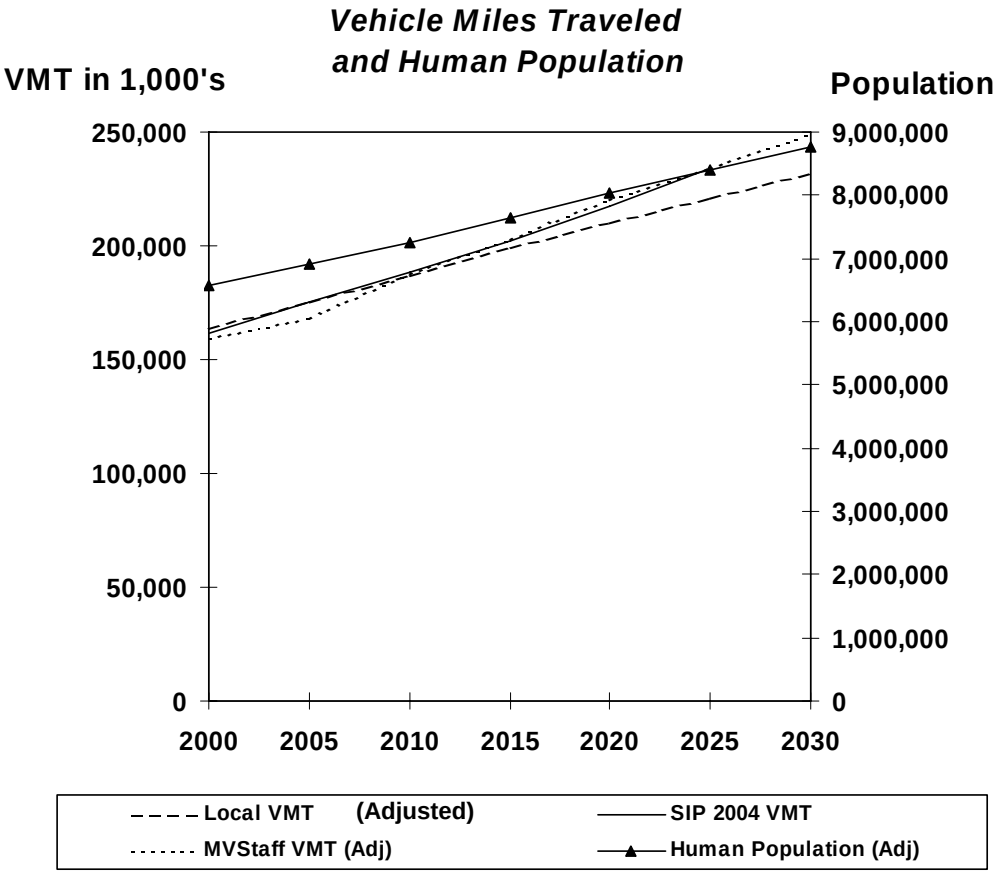
The VMT baselines submitted for SCAG, MTC, SACOG, and the San Joaquin Valley region were less than both MVSTAFF and DMV/Smog Check estimates. In the case of MTC and SACOG, the discrepancies were significant enough that ARB made adjustments to the TPA VMT baselines, as was noted earlier in this document, before entering the data into the 2005 update of the EMFAC model. These adjustments are considered temporary and were the result of agreements reached with the TPAs and air districts. ARB and the TPAs do not know the reasons for the discrepancies and have agreed to try to resolve these issues before EMFAC is finalized in November 2006.

Figures 1 through 7 were taken from the assessments developed during the QA process. They compare the VMT trends and growth rates from several sources of data. The data sources typically included:

> TPA VMT forecasts as submitted to ARB from November 2004 to March 2005 ***(Local VMT)***
>
> TPA VMT forecasts previously submitted to ARB usually represented in EMFAC2002, Version 2.2 ***(EMFAC2002, V2.2 (Apr03))***
>
> The most recently adopted State Implementation Plan for the area *(SIP VMT)*
>
> Caltrans VMT forecasts from the California Motor Vehicle Stock, Travel and Fuel Forecast, Nov 2003 ***(MVSTAFF VMT)***
>
> Human population trends taken from the State of California, Department of Finance, Demographic Research Unit, "Population Projections by Race/Ethnicity for California and Its Counties 2000-2050, Sacramento, California, May 2004. ***(Human Population)***

If a data source was missing an interim year, ARB straight-line interpolated to complete the VMT trend. The comparisons were based on whole county VMT estimates and are not necessarily limited to air basin boundaries. The county level comparisons along with questions/issues raised during the QA process are available at www.arb.ca.gov/planning/sip/emfacact05/emfacact05.htm.

Figure 1: San Francisco Bay Area



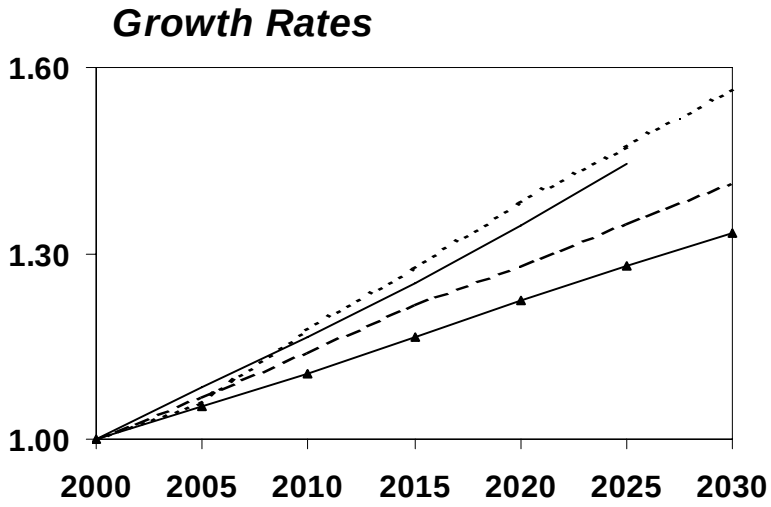
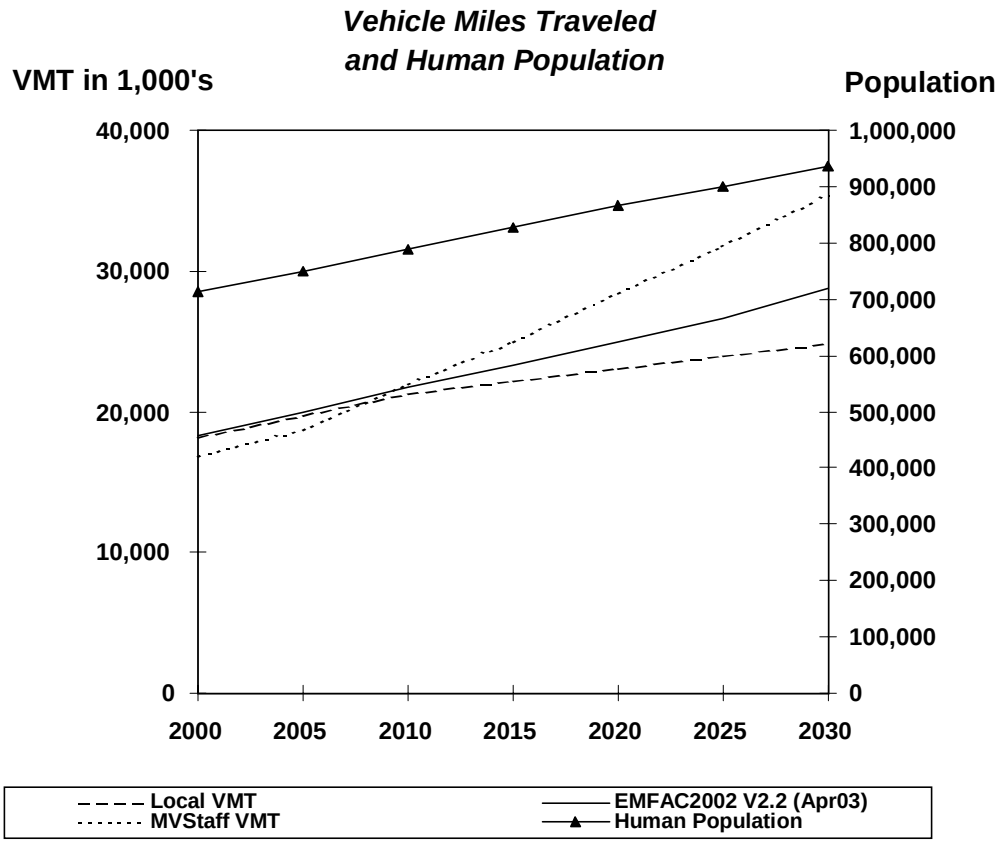


Figure 2: Monterey Bay Area



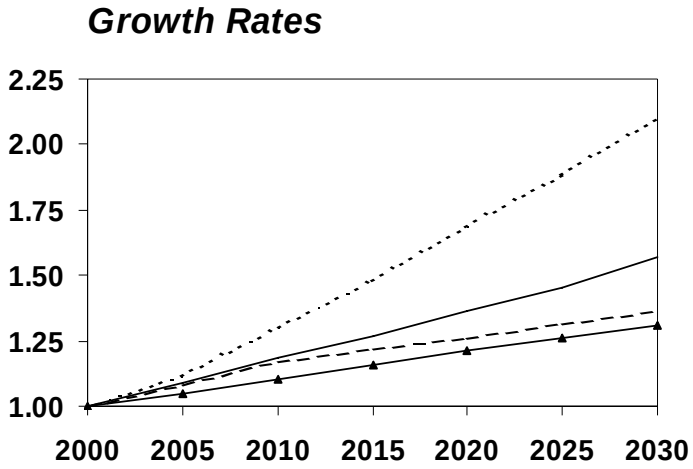
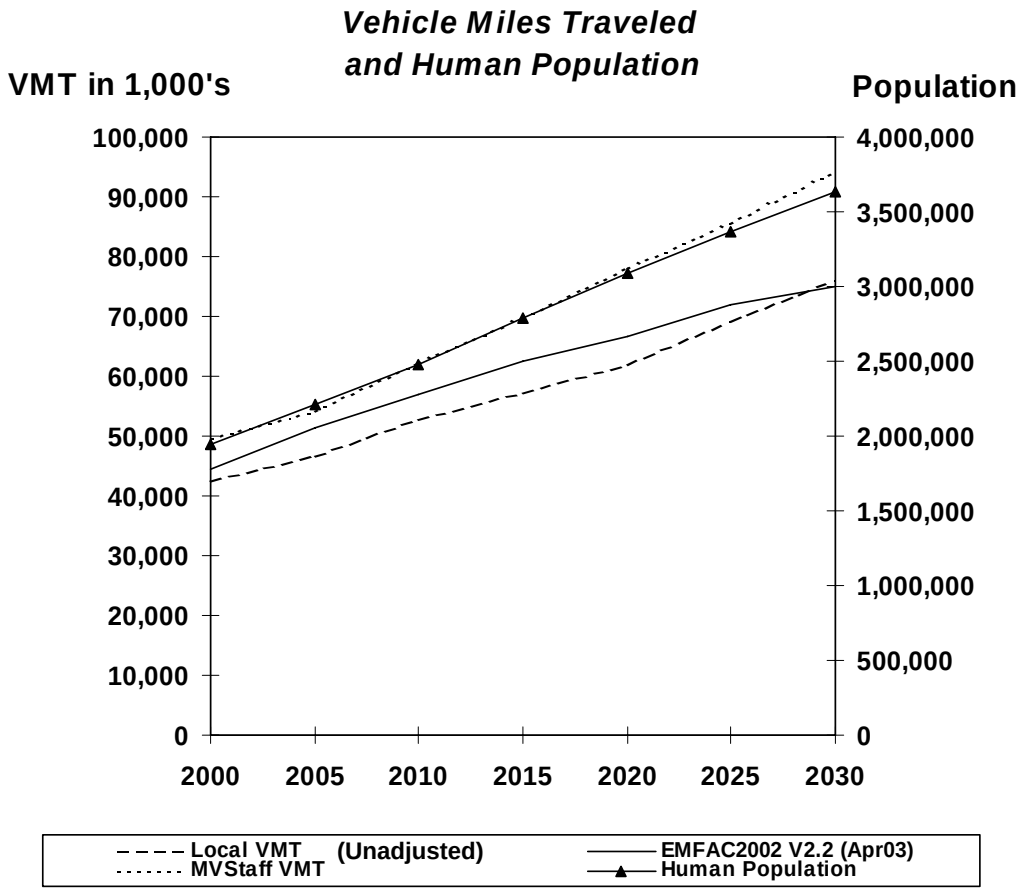


Figure 3: Sacramento Planning Area



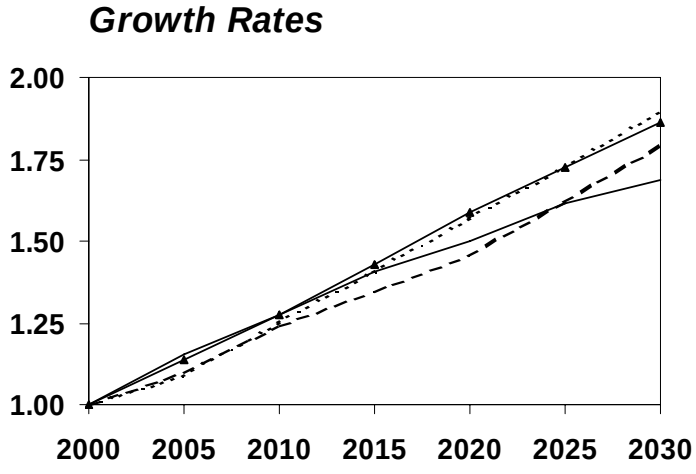
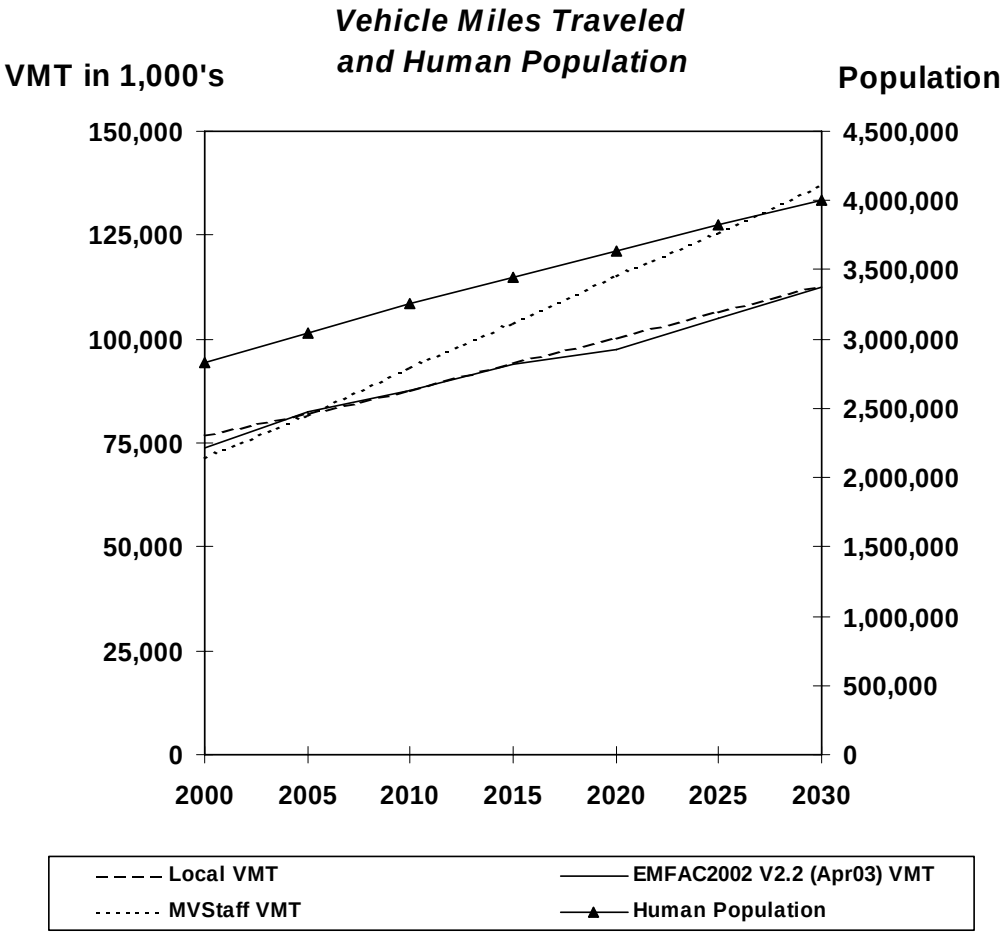


Figure 4: San Diego County



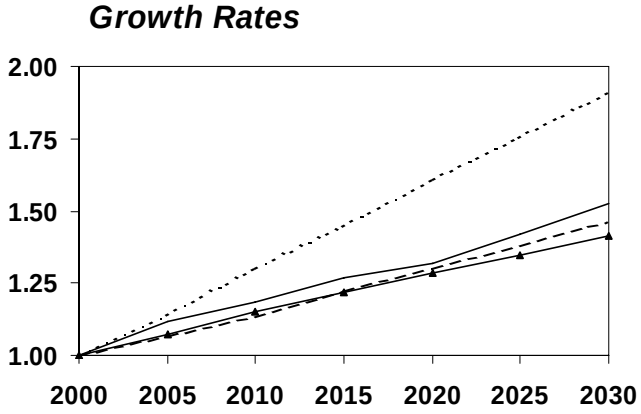
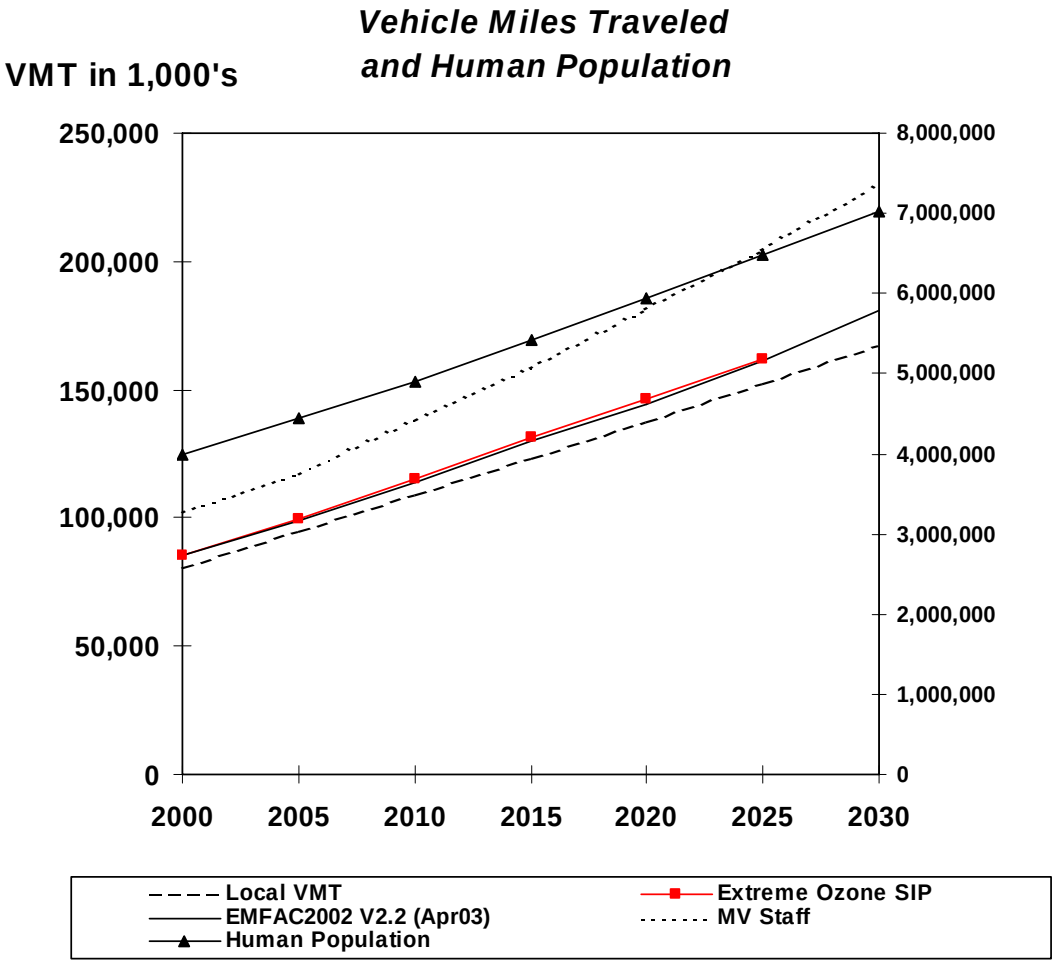


Figure 5: San Joaquin Valley



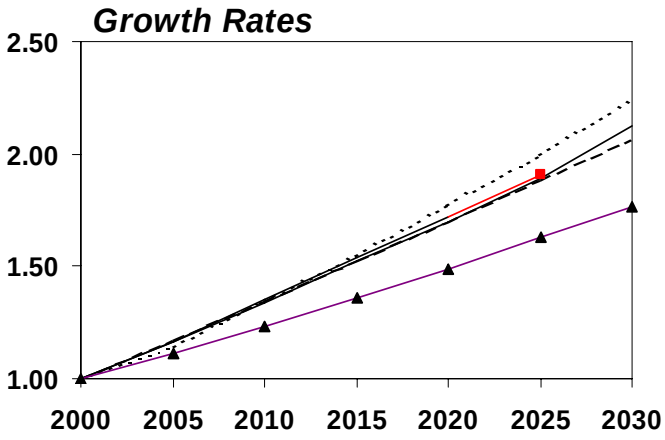
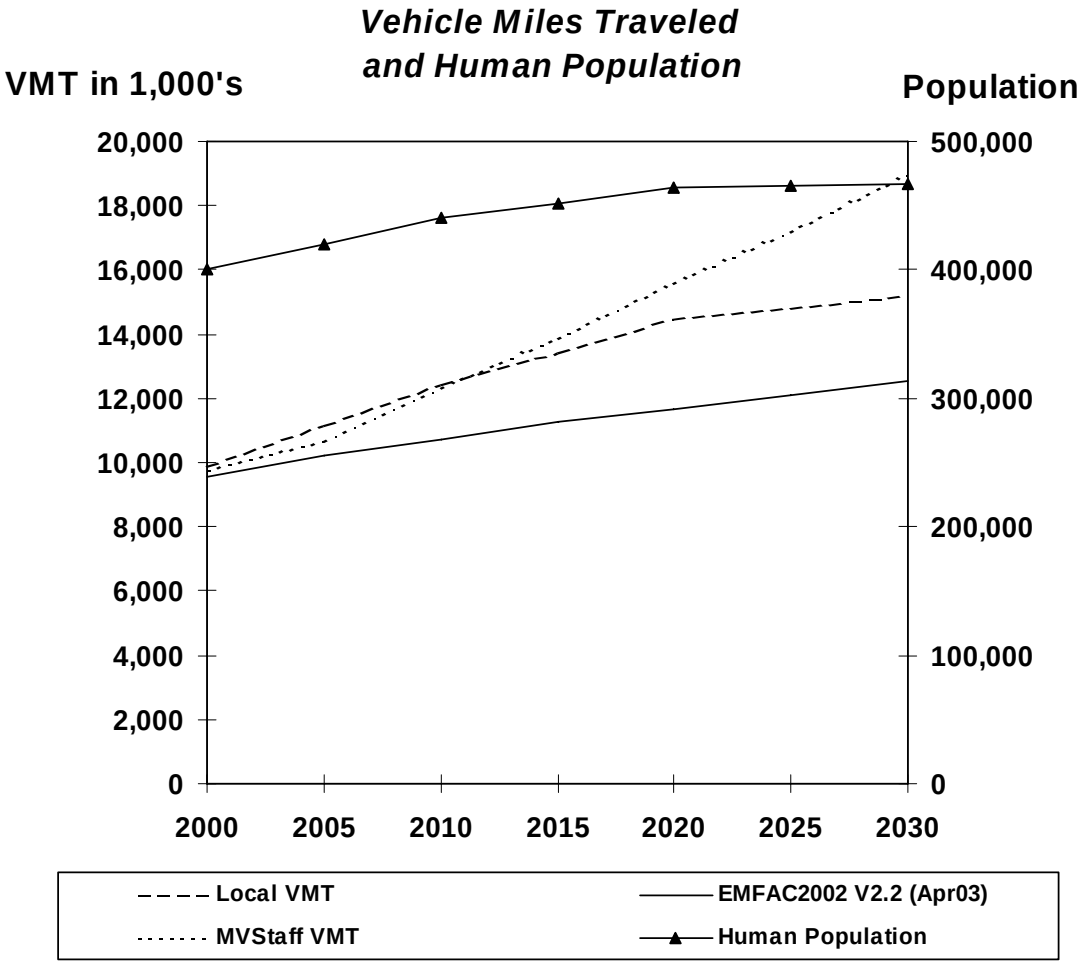


Figure 6: Santa Barbara County



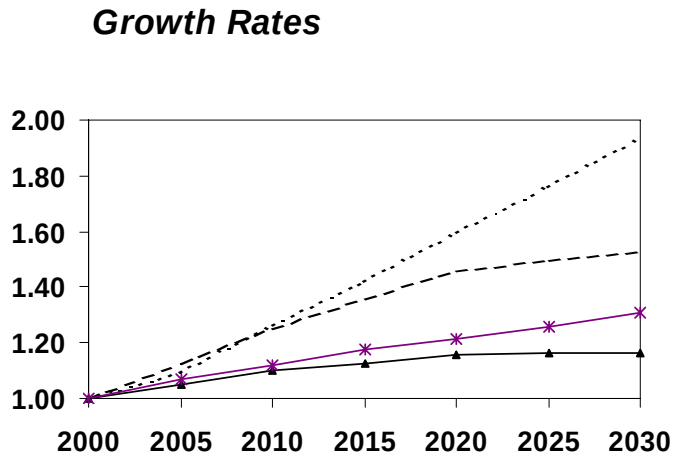
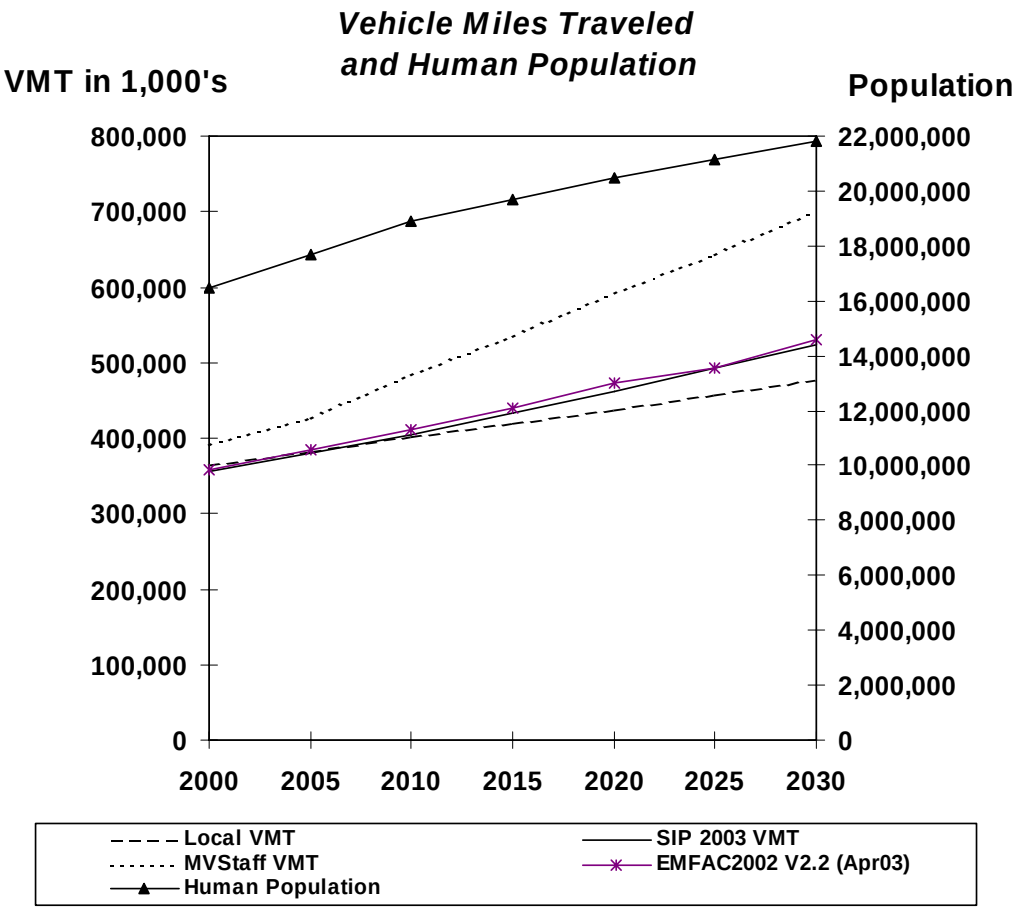
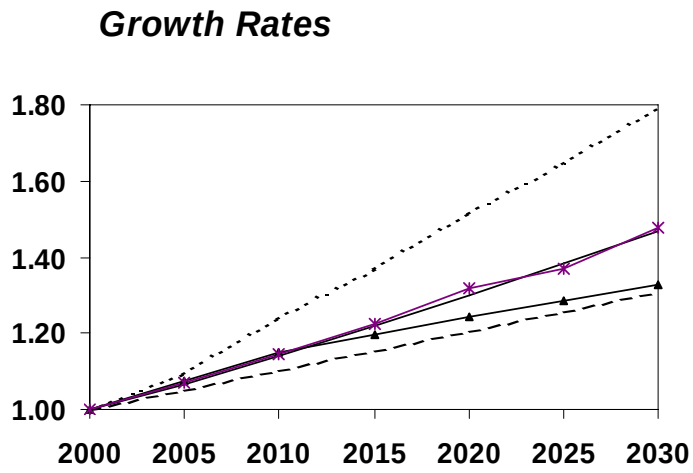


Figure 7: South Coast Region





Emission Impacts from New VMT (Relative to EMFAC 2002)

In order to compare emissions associated with the new Working Draft activity data to emissions associated with prior activity data, staff ran the new EMFAC, Version 2.22.8.51209 model in two ways: (1) using activity defaults (the new activity data) and (2) using activity data from EMFAC2002, Version 2.2 (Apr03).

Table A shows the difference when the summer season WIS enabled (prior activity) model runs are subtracted from the default (new activity) model runs. Negative numbers indicate that the new values are lower than the prior values. Thus, statewide, there was an increase in VMT and corresponding emissions resulting from the new data. In 2002, the increase was 70 tons per day of ROG, 111 tons per day of NOx, and 5 tons per day of PM10.

In the base year 2002, the San Joaquin Valley Air Basin shows a decrease in VMT and emissions. South Coast, San Joaquin Valley, and San Francisco Air Basins show less VMT and emissions for out years 2015 and 2020. In the South Coast, the new activity data decreased ROG by 10 tons per day, NOx by 14 tons per day, and PM10 by 1 ton per day in 2015 with a slightly bigger decrease in 2020.

Table B shows the percent change in emissions, vehicle population, and VMT. Emission changes range from 7 percent decrease to 6 percent increase depending on the calendar year and area.

Table A

Changes in Emissions

Draft EMFAC 2007 VMT Compared to E07 with E02 VMT

			Tons/Day			Vehicles	Miles/Day
	ROG	CO	NOx	CO2	PM10	Pop	VMT in 1,000's
CY2002							
Statewide	70	625	111	32	5	1,716,700	53,521
South Coast Air Basin	24	204	31	11	1	618,600	18,310
San Joaquin Valley Air Basin	-4	-33	-9	-2	0	-73,780	-2,477
San Diego Air Basin	2	21	3	1	0	61,150	2,036
San Francisco Air Basin	7	62	9	3	0	172,450	5,174
CY2015							
Statewide	4	28	6	4	0	244,300	7,450
South Coast Air Basin	-10	-68	-14	-11	-1	-655,600	-18,746
San Joaquin Valley Air Basin	-4	-24	-8	-4	0	-183,830	-6,155
San Diego Air Basin	0	1	0	0	0	6,680	212
San Francisco Air Basin	-1	-9	-2	-1	0	-89,050	-2,598
CY2020							
Statewide	0	3	1	1	0	40,500	1,240
South Coast Air Basin	-12	-73	-15	-18	-2	-1,049,300	-29,974
San Joaquin Valley Air Basin	-2	-15	-5	-4	0	-180,570	-6,134
San Diego Air Basin	1	7	1	2	0	89,170	2,816
San Francisco Air Basin	-1	-10	-2	-3	0	-147,960	-4,305

Source: EMFAC Working Draft, Version 2.22.8.51209, default compared to WIS enabled, summer.
Vehicle populations were adjusted in order to change VMT.

Table B

Percent Change in Emissions

Draft EMFAC 2007 VMT Compared to E07 with E02 VMT

	ROG	CO	NOx	CO2	PM10	Vehicle Pop	VMT
CY2002							
Statewide	6%	6%	6%	6%	6%	6%	6%
South Coast Air Basin	6%	6%	6%	6%	6%	6%	6%
San Joaquin Valley Air Basin	-3%	-3%	-3%	-3%	-3%	-3%	-3%
San Diego Air Basin	3%	3%	3%	3%	3%	3%	3%
San Francisco Air Basin	3%	3%	3%	3%	3%	3%	3%
CY2015							
Statewide	1%	1%	1%	1%	1%	1%	1%
South Coast Air Basin	-5%	-5%	-5%	-5%	-5%	-5%	-5%
San Joaquin Valley Air Basin	-5%	-5%	-5%	-5%	-5%	-5%	-5%
San Diego Air Basin	0%	0%	0%	0%	0%	0%	0%
San Francisco Air Basin	-1%	-1%	-1%	-1%	-1%	-1%	-1%
CY2020							
Statewide	0%	0%	0%	0%	0%	0%	0%
South Coast Air Basin	-7%	-7%	-7%	-7%	-7%	-7%	-7%
San Joaquin Valley Air Basin	-5%	-5%	-5%	-5%	-5%	-5%	-5%
San Diego Air Basin	3%	3%	3%	3%	3%	3%	3%
San Francisco Air Basin	-2%	-2%	-2%	-2%	-2%	-2%	-2%

Source: EMFAC Working Draft, Version 2.22.8.51209, default compared to WIS enabled, summer.

Vehicle populations were adjusted in order to change VMT.

Emissions Impacts from New VMT (Relative to ARB Calculated VMT)

Another way that ARB estimates the impacts associated with a given change in the EMFAC model is by making one type of change at a time and then comparing the difference in emissions. Version 2.225 of the EMFAC model reflects revisions made up to the point of changing VMT to reflect the TPA VMT submittals. Version 2.226 was updated to reflect the new TPA VMT submittal. Thus, the difference between 2.225 and 2.226 can be attributed to the difference in VMT methodologies.

One point of clarification is that Version 2.225 includes updated DMV/BAR data used to establish base year vehicle populations, accrual rates, and resulting VMT. Also, heavy heavy-duty diesel truck (HHDDT) growth rates were revised during ARB's recent redistribution of statewide HHDDT VMT. Hence, the VMT assignments used as the base case in the following comparisons are different than those in EMFAC 2002, Version 2.2 which contains previous TPA data and will be used in air quality plans and evaluations up to the release of EMFAC 2007.

Given that TPA VMT estimates were less than the VMT in EMFAC Version 2.225 calculated from DMV/BAR data, the emissions associated with the new VMT are also less.

Table 4 shows the differences in emissions, vehicle population, and VMT between Version 2.225 and 2.226. In CY 2002 there was roughly 8% fewer VMT resulting in 3% less ROG, 6% less NOx, and 7% less PM10 statewide. In CY 2020 there was roughly 16% fewer VMT, 6% less ROG, 7% less NOx, and 16% less PM10.

Table 4 also shows that the South Coast had 14% less VMT causing 4% less ROG, 10% less NOx, and 12% less PM10 in CY 2002 when compared to EMFAC Version 2.225. In 2020, the South Coast had 27% less VMT resulting in 10% less ROG, 10% less NOx, and 27% less PM10.

For more detailed information, see Tables 6 through 12 at the end of this memorandum.

Table 4: Changes in Emissions from New Vehicle Population and VMT
EMFAC Version 2.226 Compared to 2.225

	tons/day					*vehicles*	*miles/day*
	ROG	**CO**	**NOx**	**CO2**	**PM10**	**POP**	**VMT**
Year 2002							
Statewide	-29.94	-881.31	-109.91	-39,900	-5.44	0	-79,719,430
South Coast Air Basin	-18.34	-605.75	-60.68	-27,091	-2.93	0	-55,973,630
San Joaquin Valley Air Basin	-3.64	-82.34	-18.40	-3,674	-1.06	0	-6,048,760
Sacramento Valley Air Basin	-0.57	-13.06	-2.17	-454	-0.11	0	-785,352
San Diego Air Basin	-0.45	-10.60	-1.67	-532	-0.08	0	-976,184
San Francisco Air Basin	-7.34	-163.62	-27.25	-7,164	-1.16	0	-13,771,500
Year 2015							
Statewide	-33.96	-600.41	-61.22	-93,303	-9.23	-2,681,268	-178,640,000
South Coast Air Basin	-20.95	-400.39	-27.39	-59,185	-5.76	-1,805,238	-119,369,190
San Joaquin Valley Air Basin	-2.12	-44.03	-14.36	-9,608	-1.03	-147,136	-14,454,850
Sacramento Valley Air Basin	-0.54	-8.22	-1.95	-914	-0.13	-15,385	-1,489,020
San Diego Air Basin	-1.79	-17.53	-3.12	-2,907	-0.29	-123,930	-5,223,240
San Francisco Air Basin	-6.16	-108.73	-16.53	-15,885	-1.77	-351,758	-27,441,740
Year 2020							
Statewide	-27.96	-454.64	-50.16	-109,511	-10.59	-3,396,152	-207,707,000
South Coast Air Basin	-17.26	-300.62	-21.20	-68,318	-6.66	-2,278,627	-137,600,320
San Joaquin Valley Air Basin	-1.89	-35.51	-12.10	-11,678	-1.09	-212,650	-17,355,760
Sacramento Valley Air Basin	-0.26	-5.14	-1.20	-864	-0.11	-8,654	-1,402,300
San Diego Air Basin	-1.31	-11.04	-1.74	-1,582	-0.20	-71,119	-2,773,400
San Francisco Air Basin	-4.75	-78.94	-11.85	-19,356	-1.94	-479,906	-33,627,130

ROG includes total exhaust plus evaporative emissions.
PM10 includes total exhaust plus tire/brake wear emissions.

Emissions Impacts from New Speeds

Speed distributions are entered directly into the EMFAC model. To find the emissions impacts from the new TPA speeds, staff compared Version 2.226 to Version 2.227. Version 2.227 is identical to 2.226 except that the new TPA speeds were added to the model.

The speeds in EMFAC Version 2.226 were carried forward from EMFAC 2002, Version 2.2. The change in emissions is the result of updating the light- and medium-duty vehicle fleet speed distributions with the new TPA speeds. Sometimes the new speeds were slower than past submittals showing the effects of congestion. Other times, the speeds were faster than past submittals, showing the impact from new transportation projects built or planned. The emission impacts varied by area, but statewide emissions increased as a result of the new speeds.

Table 5 shows that statewide, the new TPA speeds caused a 2% increase in ROG emissions, less than 1% increase in NOx, and 1% increase in PM10 in CY 2002. CY 2020 showed an increase of less than 1% for ROG and NOx and roughly 1% increase in PM10 statewide.

For the South Coast, new speeds caused a 3% increase in ROG, less than 1% increase in NOx, and 2% increase in PM10 in CY 2002. In CY 2020 there was less than 1% increase in ROG and NOx and roughly 3% increase in PM10.

Tables 13 through 19 found at the end of this memorandum provide additional details on emission impacts from the new speeds by area.

Table 5: Changes in Emissions from New Speeds
EMFAC Version 2.227 Compared to Version 2.226

	tons/day				
	ROG	**CO**	**NOx**	**CO2**	**PM10**
Year 2002					
Statewide	21.32	207.26	10.59	17,176	0.89
South Coast Air Basin	10.86	91.12	3.94	8,667	0.49
San Joaquin Valley Air Basin	0.99	11.46	0.22	681	0.01
Sacramento Valley Air Basin	0.69	10.07	0.84	656	0.02
San Diego Air Basin	0.52	5.36	0.32	462	0.03
San Francisco Bay Area	6.83	76.21	5.43	5,752	0.24
Year 2015					
Statewide	2.66	14.55	4.18	7,658	0.64
South Coast Air Basin	1.23	13.91	1.31	5,877	0.39
San Joaquin Valley Air Basin	0.57	8.88	0.16	1,672	0.12
Sacramento Valley Air Basin	0.09	-0.34	0.17	385	0.00
San Diego Air Basin	0.28	4.02	0.14	914	0.09
San Francisco Bay Area	-0.77	-15.56	0.01	-1,880	-0.23
Year 2020					
Statewide	2.02	10.93	2.77	9,873	0.69
South Coast Air Basin	0.89	12.33	0.92	6,881	0.51
San Joaquin Valley Air Basin	0.35	5.51	0.11	1,569	0.11
Sacramento Valley Air Basin	-0.01	-2.67	0.05	-17	-0.03
San Diego Air Basin	0.15	2.66	0.10	792	0.08
San Francisco Bay Area	-0.24	-10.58	0.10	-600	-0.15

ROG includes total exhaust plus evaporative emissions.

PM10 includes total exhaust plus tire/brake wear emissions.

Table 6: Statewide New VMT and Emission Impacts

Statewide Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.225)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	14,817,640	497,419,840	3605.04	33282.71	2589.22	329154.60	73.55
1990	22,515,974	786,020,420	2546.91	26510.16	2792.00	477633.40	119.32
2000	26,785,744	897,559,680	1407.16	13580.21	2117.27	513539.40	84.29
2002	28,178,674	958,260,290	1155.76	10937.50	1927.04	545244.80	79.16
2005	30,910,260	1,034,734,700	1019.65	9097.96	1795.05	591358.10	81.38
2010	33,960,136	1,121,785,100	767.72	6507.64	1342.03	641240.60	72.04
2015	36,789,816	1,219,000,600	580.58	4510.23	937.79	709149.40	68.31
2020	39,667,496	1,318,458,400	454.89	3198.95	670.13	773355.50	67.53

Statewide Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG VMTs
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	14,820,197	452,361,020	3389.44	30319.66	2381.83	303119.60	69.76
1990	22,523,984	719,014,210	2423.96	24275.23	2599.22	442908.70	113.57
2000	26,785,744	822,458,560	1357.07	12461.46	1981.11	475853.90	78.81
2002	28,178,674	878,540,860	1125.82	10056.19	1817.13	505344.80	73.71
2005	29,135,822	895,088,450	948.51	7941.62	1640.20	519362.50	72.54
2010	31,854,958	967,485,630	723.74	5688.66	1263.26	563602.40	64.29
2015	34,108,548	1,040,360,600	546.62	3909.82	876.57	615846.90	59.08
2020	36,271,344	1,110,751,400	426.93	2744.30	619.97	663844.10	56.94

Difference (Ver. 2.226 - Ver. 2.225) in Statewide Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	2,557	-45,058,820	-215.60	-2963.05	-207.39	-26035.00	-3.79
1990	8,010	-67,006,210	-122.95	-2234.93	-192.78	-34724.70	-5.75
2000	0	-75,101,120	-50.08	-1118.75	-136.16	-37685.50	-5.48
2002	0	-79,719,430	-29.94	-881.31	-109.91	-39900.00	-5.44
2005	-1,774,438	-139,646,250	-71.14	-1156.34	-154.85	-71995.60	-8.84
2010	-2,105,178	-154,299,470	-43.98	-818.98	-78.78	-77638.20	-7.75
2015	-2,681,268	-178,640,000	-33.96	-600.41	-61.22	-93302.50	-9.23
2020	-3,396,152	-207,707,000	-27.96	-454.64	-50.16	-109511.40	-10.59

Percentage Change in Statewide Emission Inventories (relative to Ver. 2.225)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.02%	-9.06%	-5.98%	-8.90%	-8.01%	-7.91%	-5.15%
1990	0.04%	-8.52%	-4.83%	-8.43%	-6.90%	-7.27%	-4.82%
2000	0.00%	-8.37%	-3.56%	-8.24%	-6.43%	-7.34%	-6.50%
2002	0.00%	-8.32%	-2.59%	-8.06%	-5.70%	-7.32%	-6.88%
2005	-5.74%	-13.50%	-6.98%	-12.71%	-8.63%	-12.17%	-10.86%
2010	-6.20%	-13.75%	-5.73%	-12.58%	-5.87%	-12.11%	-10.76%
2015	-7.29%	-14.65%	-5.85%	-13.31%	-6.53%	-13.16%	-13.51%
2020	-8.56%	-15.75%	-6.15%	-14.21%	-7.48%	-14.16%	-15.68%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 7: Sacramento Valley Air Basin New VMT and Emission Impacts

Sacramento Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.225)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1189906	39432972	303.10	2854.83	213.30	25924.68	6.37
1990	1761329	61722380	208.55	2171.95	232.02	37811.89	10.91
2000	2069264	67513488	119.25	1125.49	180.22	40118.05	7.17
2002	2254476	74678744	101.78	937.45	168.17	43740.23	6.74
2005	2566627	82908240	94.73	805.89	161.63	48876.33	7.00
2010	2862687	91412848	73.65	584.40	120.75	53269.45	6.11
2015	3173468	103683800	54.92	397.14	83.15	60338.51	5.72
2020	3454848	113224960	42.33	277.45	57.98	66815.88	5.63

Sacramento Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG VMT
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1189906	38993796	300.72	2820.04	210.89	25655.24	6.27
1990	1761329	61012160	206.77	2141.71	229.12	37393.59	10.73
2000	2069264	66786188	118.45	1109.86	177.85	39694.47	7.05
2002	2254476	73893392	101.21	924.39	166.00	43286.40	6.62
2005	2564842	82002616	94.15	793.90	159.23	48335.57	6.87
2010	2858330	90350352	73.18	574.63	118.59	52628.00	5.98
2015	3158083	102194780	54.38	388.92	81.21	59424.96	5.59
2020	3446194	111822660	42.07	272.31	56.78	65951.75	5.52

Difference (Ver. 2.226 - Ver. 2.225) in Sacramento Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	-439176	-2.37	-34.79	-2.41	-269.44	-0.10
1990	0	-710220	-1.78	-30.23	-2.91	-418.30	-0.18
2000	0	-727300	-0.79	-15.63	-2.37	-423.58	-0.12
2002	0	-785352	-0.57	-13.06	-2.17	-453.83	-0.11
2005	-1785	-905624	-0.57	-12.00	-2.40	-540.76	-0.13
2010	-4357	-1062496	-0.47	-9.76	-2.16	-641.45	-0.13
2015	-15385	-1489020	-0.54	-8.22	-1.95	-913.55	-0.13
2020	-8654	-1402300	-0.26	-5.14	-1.20	-864.13	-0.11

Percentage Change in Sacramento Emission Inventories (relative to Ver. 2.225)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-1.11%	-0.78%	-1.22%	-1.13%	-1.04%	-1.56%
1990	0.00%	-1.15%	-0.85%	-1.39%	-1.25%	-1.11%	-1.69%
2000	0.00%	-1.08%	-0.66%	-1.39%	-1.32%	-1.06%	-1.72%
2002	0.00%	-1.05%	-0.56%	-1.39%	-1.29%	-1.04%	-1.67%
2005	-0.07%	-1.09%	-0.60%	-1.49%	-1.48%	-1.11%	-1.88%
2010	-0.15%	-1.16%	-0.64%	-1.67%	-1.79%	-1.20%	-2.06%
2015	-0.48%	-1.44%	-0.98%	-2.07%	-2.34%	-1.51%	-2.25%
2020	-0.25%	-1.24%	-0.61%	-1.85%	-2.08%	-1.29%	-1.90%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 8: San Diego Air Basin New VMT and Emission Impacts

San Diego Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.225)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1097560	33909908	299.80	2720.07	172.04	23744.43	3.60
1990	1874269	65479136	203.76	2153.91	198.10	40895.29	6.30
2000	2227749	74069576	105.04	1029.44	140.46	41771.38	5.00
2002	2373918	80020584	87.65	846.07	125.67	45127.00	4.99
2005	2654406	87498144	78.65	724.04	114.59	49545.58	5.32
2010	2859402	92355784	58.93	506.80	87.12	51998.42	5.13
2015	3090088	99320864	45.71	352.70	63.24	56011.39	5.10
2020	3248809	103131030	37.60	259.02	47.85	58635.43	5.17

San Diego Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG VMTs
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1097560	33496236	297.15	2685.02	169.93	23470.72	3.55
1990	1874269	64680348	202.07	2126.32	195.56	40414.38	6.20
2000	2227749	73166000	104.39	1016.39	138.54	41279.64	4.91
2002	2373918	79044400	87.20	835.47	124.00	44595.10	4.90
2005	2571104	83761520	75.88	692.42	109.90	47455.96	5.08
2010	2748386	87558408	56.67	482.32	82.72	49319.84	4.84
2015	2966158	94097624	43.91	335.17	60.13	53104.29	4.81
2020	3177690	100357630	36.28	247.97	46.11	57053.48	4.97

Difference (Ver. 2.226 - Ver. 2.225) in San Diego Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	-413672	-2.65	-35.05	-2.11	-273.71	-0.05
1990	0	-798788	-1.69	-27.59	-2.54	-480.91	-0.10
2000	0	-903576	-0.65	-13.05	-1.92	-491.74	-0.08
2002	0	-976184	-0.45	-10.60	-1.67	-531.90	-0.08
2005	-83302	-3736624	-2.77	-31.62	-4.69	-2089.62	-0.24
2010	-111016	-4797376	-2.27	-24.47	-4.39	-2678.58	-0.29
2015	-123930	-5223240	-1.79	-17.53	-3.12	-2907.10	-0.29
2020	-71119	-2773400	-1.31	-11.04	-1.74	-1581.95	-0.20

Percentage Change in San Diego Emission Inventories (relative to Ver. 2.225)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-1.22%	-0.88%	-1.29%	-1.22%	-1.15%	-1.42%
1990	0.00%	-1.22%	-0.83%	-1.28%	-1.28%	-1.18%	-1.59%
2000	0.00%	-1.22%	-0.62%	-1.27%	-1.37%	-1.18%	-1.70%
2002	0.00%	-1.22%	-0.52%	-1.25%	-1.33%	-1.18%	-1.69%
2005	-3.14%	-4.27%	-3.52%	-4.37%	-4.10%	-4.22%	-4.52%
2010	-3.88%	-5.19%	-3.84%	-4.83%	-5.04%	-5.15%	-5.70%
2015	-4.01%	-5.26%	-3.92%	-4.97%	-4.93%	-5.19%	-5.69%
2020	-2.19%	-2.69%	-3.49%	-4.26%	-3.63%	-2.70%	-3.93%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 9: San Francisco Air Basin New VMT and Emission Impacts

San Francisco Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.225)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	3577805	113122960	853.62	7929.08	590.98	70074.33	10.93
1990	4628184	152582580	481.28	5057.39	503.60	85561.60	15.02
2000	5519282	177297100	261.09	2515.25	340.34	94893.51	11.27
2002	5644236	183115630	220.05	2128.45	313.85	98220.21	10.87
2005	6003726	191004560	183.13	1674.32	267.53	102661.90	11.30
2010	6757176	213706530	141.05	1242.50	202.47	122057.50	11.82
2015	7193950	227056940	102.96	849.52	139.09	132051.80	11.87
2020	7683764	243221500	77.72	587.99	98.14	141849.50	12.14

San Francisco Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG VMTs
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	3577805	104633350	811.63	7313.42	546.00	65112.39	9.87
1990	4628184	140980770	459.30	4660.59	463.01	79310.57	13.42
2000	5519282	164071820	251.76	2326.24	311.13	88033.75	10.06
2002	5644236	169344130	212.71	1964.83	286.59	91055.96	9.72
2005	5964264	175417250	177.12	1532.31	242.99	94489.30	10.01
2010	6401483	186231760	132.16	1089.44	178.65	106644.50	10.07
2015	6842192	199615200	96.80	740.79	122.56	116166.60	10.10
2020	7203858	209594370	72.97	509.05	86.28	122493.60	10.20

Difference (Ver. 2.226 - Ver. 2.225) in San Francisco Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	-8489610	-42.00	-615.66	-44.99	-4961.94	-1.06
1990	0	-11601810	-21.97	-396.80	-40.59	-6251.03	-1.59
2000	0	-13225280	-9.33	-189.01	-29.21	-6859.76	-1.21
2002	0	-13771500	-7.34	-163.62	-27.25	-7164.25	-1.16
2005	-39462	-15587310	-6.01	-142.01	-24.54	-8172.60	-1.28
2010	-355693	-27474770	-8.90	-153.06	-23.83	-15413.00	-1.75
2015	-351758	-27441740	-6.16	-108.73	-16.53	-15885.20	-1.77
2020	-479906	-33627130	-4.75	-78.94	-11.85	-19355.90	-1.94

Percentage Change in San Francisco Emission Inventories (relative to Ver. 2.225)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-7.50%	-4.92%	-7.76%	-7.61%	-7.08%	-9.72%
1990	0.00%	-7.60%	-4.57%	-7.85%	-8.06%	-7.31%	-10.62%
2000	0.00%	-7.46%	-3.57%	-7.51%	-8.58%	-7.23%	-10.72%
2002	0.00%	-7.52%	-3.33%	-7.69%	-8.68%	-7.29%	-10.63%
2005	-0.66%	-8.16%	-3.28%	-8.48%	-9.17%	-7.96%	-11.35%
2010	-5.26%	-12.86%	-6.31%	-12.32%	-11.77%	-12.63%	-14.81%
2015	-4.89%	-12.09%	-5.99%	-12.80%	-11.88%	-12.03%	-14.91%
2020	-6.25%	-13.83%	-6.11%	-13.43%	-12.08%	-13.65%	-15.99%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 10: San Joaquin Valley Air Basin New VMT and Emission Impacts

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.225)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1023520	38087232	271.20	2730.16	256.65	29347.22	14.49
1990	1679639	63364384	231.95	2423.36	337.54	46353.51	24.66
2000	2330556	82586816	154.83	1464.79	329.20	57045.61	16.00
2002	2487499	89559584	129.28	1186.23	315.67	60746.58	14.20
2005	2830626	99974768	121.26	1023.58	316.77	68100.70	14.12
2010	3199563	112108190	92.83	728.81	236.88	74139.71	10.75
2015	3615226	130570590	69.66	495.88	166.60	86958.69	9.21
2020	4024302	146839180	54.26	350.59	119.07	99459.26	8.57

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG VMTs
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1023520	35562160	258.74	2540.86	241.26	27640.65	13.54
1990	1679639	59095444	221.82	2254.52	317.67	43622.46	23.06
2000	2330556	77028680	149.58	1362.70	309.37	53628.51	14.82
2002	2487499	83510824	125.65	1103.89	297.27	57072.38	13.14
2005	2729342	89859968	114.61	921.78	288.39	61565.61	12.60
2010	3159172	103175800	90.84	675.24	222.08	68293.25	9.88
2015	3468090	116115740	67.54	451.85	152.23	77351.02	8.18
2020	3811652	129483420	52.37	315.08	106.97	87781.16	7.48

Difference (Ver. 2.226 - Ver. 2.225) in San Joaquin Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	-2525072	-12.45	-189.30	-15.39	-1706.57	-0.95
1990	0	-4268940	-10.13	-168.85	-19.87	-2731.05	-1.60
2000	0	-5558136	-5.26	-102.09	-19.83	-3417.10	-1.18
2002	0	-6048760	-3.64	-82.34	-18.40	-3674.20	-1.06
2005	-101284	-10114800	-6.65	-101.80	-28.38	-6535.09	-1.51
2010	-40391	-8932390	-1.98	-53.57	-14.79	-5846.46	-0.87
2015	-147136	-14454850	-2.12	-44.03	-14.36	-9607.67	-1.03
2020	-212650	-17355760	-1.89	-35.51	-12.10	-11678.10	-1.09

Percentage Change in San Joaquin Emission Inventories (relative to Ver. 2.225)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-6.63%	-4.59%	-6.93%	-6.00%	-5.82%	-6.55%
1990	0.00%	-6.74%	-4.37%	-6.97%	-5.89%	-5.89%	-6.50%
2000	0.00%	-6.73%	-3.40%	-6.97%	-6.02%	-5.99%	-7.36%
2002	0.00%	-6.75%	-2.81%	-6.94%	-5.83%	-6.05%	-7.46%
2005	-3.58%	-10.12%	-5.48%	-9.95%	-8.96%	-9.60%	-10.70%
2010	-1.26%	-7.97%	-2.14%	-7.35%	-6.25%	-7.89%	-8.09%
2015	-4.07%	-11.07%	-3.05%	-8.88%	-8.62%	-11.05%	-11.14%
2020	-5.28%	-11.82%	-3.48%	-10.13%	-10.16%	-11.74%	-12.76%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table11: South Coast Air Basin New VMT and Emission Impacts

South Coast Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.225)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	6132212	212274690	1444.87	13076.57	974.36	138027.20	21.90
1990	9485851	332536610	1055.82	10900.81	1024.42	196327.50	32.95
2000	11074958	374707840	563.05	5478.85	721.29	205289.90	25.70
2002	11606219	399479680	452.53	4345.55	632.13	217598.10	24.81
2005	12648746	431110880	387.47	3528.80	562.43	235094.50	26.21
2010	13569852	455681220	279.78	2424.07	415.72	246294.50	24.96
2015	14488933	482021250	212.99	1694.85	287.62	266581.40	24.80
2020	15463265	514247580	168.23	1209.94	204.30	285327.50	25.04

South Coast Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG VMTs
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	6132212	180033150	1293.57	11068.61	836.95	119653.70	20.28
1990	9485851	284595070	970.75	9331.86	902.00	172100.40	30.65
2000	11074958	321947740	530.31	4701.98	641.59	179635.30	22.91
2002	11606219	343506050	434.20	3739.80	571.44	190507.20	21.88
2005	11270981	329753600	336.91	2705.51	475.15	184343.70	21.02
2010	12119336	350421920	250.49	1868.12	371.71	195277.20	20.02
2015	12683695	362652060	192.04	1294.47	260.23	207396.40	19.04
2020	13184638	376647260	150.97	909.32	183.10	217009.20	18.38

Difference (Ver. 2.226 - Ver. 2.225) in South Coast Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	-32241540	-151.30	-2007.96	-137.41	-18373.50	-1.63
1990	0	-47941540	-85.07	-1568.95	-122.42	-24227.10	-2.30
2000	0	-52760100	-32.74	-776.87	-79.71	-25654.60	-2.79
2002	0	-55973630	-18.34	-605.75	-60.68	-27090.90	-2.93
2005	-1377765	-101357280	-50.57	-823.29	-87.28	-50750.80	-5.19
2010	-1450516	-105259300	-29.29	-555.95	-44.01	-51017.30	-4.94
2015	-1805238	-119369190	-20.95	-400.39	-27.39	-59185.00	-5.76
2020	-2278627	-137600320	-17.26	-300.62	-21.20	-68318.30	-6.66

Percentage Change in South Coast Emission Inventories (relative to Ver. 2.225)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-15.19%	-10.47%	-15.36%	-14.10%	-13.31%	-7.43%
1990	0.00%	-14.42%	-8.06%	-14.39%	-11.95%	-12.34%	-6.97%
2000	0.00%	-14.08%	-5.82%	-14.18%	-11.05%	-12.50%	-10.86%
2002	0.00%	-14.01%	-4.05%	-13.94%	-9.60%	-12.45%	-11.80%
2005	-10.89%	-23.51%	-13.05%	-23.33%	-15.52%	-21.59%	-19.80%
2010	-10.69%	-23.10%	-10.47%	-22.93%	-10.59%	-20.71%	-19.79%
2015	-12.46%	-24.76%	-9.84%	-23.62%	-9.52%	-22.20%	-23.23%
2020	-14.74%	-26.76%	-10.26%	-24.85%	-10.38%	-23.94%	-26.61%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 12: Statewide Emissions Impacts from New Speeds

Statewide Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	14820197	452361020	3389.44	30319.66	2381.83	303119.60	69.76
1990	22523984	719014210	2423.96	24275.23	2599.22	442908.70	113.57
2000	26785744	822458560	1357.07	12461.46	1981.11	475853.90	78.81
2002	28178674	878540860	1125.82	10056.19	1817.13	505344.80	73.71
2005	29135822	895088450	948.51	7941.62	1640.20	519362.50	72.54
2010	31854958	967485630	723.74	5688.66	1263.26	563602.40	64.29
2015	34108548	1040360600	546.62	3909.82	876.57	615846.90	59.08
2020	36271344	1110751400	426.93	2744.30	619.97	663844.10	56.94

Statewide Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG Speeds
(Calculated Using EMFAC2007 draft ver 2.227)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	14820197	452361020	3391.44	30338.42	2381.20	303363.40	69.77
1990	22523984	719014210	2425.25	24292.48	2599.45	443269.30	113.58
2000	26785744	822458560	1384.34	12713.99	1992.36	491034.00	79.62
2002	28178674	878540860	1147.14	10263.45	1827.72	522520.90	74.60
2005	29135822	895088450	963.08	8090.12	1647.95	536017.40	73.46
2010	31854958	967485630	731.12	5749.98	1269.81	575405.80	65.36
2015	34108548	1040360600	549.28	3924.37	880.74	623504.50	59.72
2020	36271344	1110751400	428.95	2755.23	622.75	673717.30	57.64

Difference (Ver. 2.227 - Ver. 2.226) in Statewide Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	0	2.00	18.76	-0.63	243.80	0.02
1990	0	0	1.29	17.25	0.24	360.60	0.02
2000	0	0	27.27	252.53	11.24	15180.10	0.81
2002	0	0	21.32	207.26	10.59	17176.10	0.89
2005	0	0	14.57	148.50	7.75	16654.90	0.92
2010	0	0	7.38	61.32	6.55	11803.40	1.07
2015	0	0	2.66	14.55	4.18	7657.60	0.64
2020	0	0	2.02	10.93	2.77	9873.20	0.69

Percentage Change in Statewide Emission Inventories (relative to Ver. 2.226)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	0.00%	0.06%	0.06%	-0.03%	0.08%	0.02%
1990	0.00%	0.00%	0.05%	0.07%	0.01%	0.08%	0.02%
2000	0.00%	0.00%	2.01%	2.03%	0.57%	3.19%	1.03%
2002	0.00%	0.00%	1.89%	2.06%	0.58%	3.40%	1.20%
2005	0.00%	0.00%	1.54%	1.87%	0.47%	3.21%	1.27%
2010	0.00%	0.00%	1.02%	1.08%	0.52%	2.09%	1.66%
2015	0.00%	0.00%	0.49%	0.37%	0.48%	1.24%	1.08%
2020	0.00%	0.00%	0.47%	0.40%	0.45%	1.49%	1.22%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 13: Sacramento Valley Air Basin Emission Impacts from New Speeds

Sacramento Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1189906	38993796	300.72	2820.04	210.89	25655.24	6.27
1990	1761329	61012160	206.77	2141.71	229.12	37393.59	10.73
2000	2069264	66786188	118.45	1109.86	177.85	39694.47	7.05
2002	2254476	73893392	101.21	924.39	166.00	43286.40	6.62
2005	2564842	82002616	94.15	793.90	159.23	48335.57	6.87
2010	2858330	90350352	73.18	574.63	118.59	52628.00	5.98
2015	3158083	102194780	54.38	388.92	81.21	59424.96	5.59
2020	3446194	111822660	42.07	272.31	56.78	65951.75	5.52

Sacramento Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG Speeds
(Calculated Using EMFAC2007 draft ver 2.227)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1189906	38993796	301.11	2835.63	211.14	25699.52	6.27
1990	1761329	61012160	207.01	2150.16	229.46	37479.71	10.73
2000	2069264	66786188	119.02	1118.47	178.61	40099.35	7.06
2002	2254476	73893392	101.91	934.47	166.85	43942.66	6.65
2005	2564842	82002616	94.65	801.24	159.88	48973.60	6.89
2010	2858330	90350352	73.27	575.61	118.89	52912.88	5.98
2015	3158083	102194780	54.47	388.58	81.38	59809.62	5.59
2020	3446194	111822660	42.06	269.64	56.82	65935.05	5.49

Difference (Ver. 2.227 - Ver. 2.226) in Sacramento Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	0	0.39	15.59	0.26	44.28	0.00
1990	0	0	0.25	8.45	0.34	86.12	0.00
2000	0	0	0.56	8.60	0.75	404.88	0.01
2002	0	0	0.69	10.07	0.84	656.26	0.02
2005	0	0	0.50	7.34	0.64	638.03	0.02
2010	0	0	0.09	0.98	0.30	284.88	-0.01
2015	0	0	0.09	-0.34	0.17	384.66	0.00
2020	0	0	-0.01	-2.67	0.05	-16.70	-0.03

Percentage Change in Sacramento Emission Inventories (relative to Ver. 2.226)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	0.00%	0.13%	0.55%	0.12%	0.17%	0.04%
1990	0.00%	0.00%	0.12%	0.39%	0.15%	0.23%	0.02%
2000	0.00%	0.00%	0.48%	0.78%	0.42%	1.02%	0.20%
2002	0.00%	0.00%	0.69%	1.09%	0.51%	1.52%	0.36%
2005	0.00%	0.00%	0.53%	0.92%	0.40%	1.32%	0.31%
2010	0.00%	0.00%	0.12%	0.17%	0.25%	0.54%	-0.11%
2015	0.00%	0.00%	0.16%	-0.09%	0.21%	0.65%	0.01%
2020	0.00%	0.00%	-0.03%	-0.98%	0.08%	-0.03%	-0.63%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 14: San Diego Air Basin Emission Impacts from New Speeds

San Diego Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1097560	33496236	297.15	2685.02	169.93	23470.72	3.55
1990	1874269	64680348	202.07	2126.32	195.56	40414.38	6.20
2000	2227749	73166000	104.39	1016.39	138.54	41279.64	4.91
2002	2373918	79044400	87.20	835.47	124.00	44595.10	4.90
2005	2571104	83761520	75.88	692.42	109.90	47455.96	5.08
2010	2748386	87558408	56.67	482.32	82.72	49319.84	4.84
2015	2966158	94097624	43.91	335.17	60.13	53104.29	4.81
2020	3177690	100357630	36.28	247.97	46.11	57053.48	4.97

San Diego Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG Speeds
(Calculated Using EMFAC2007 draft ver 2.227)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1097560	33496236	297.15	2685.02	169.93	23470.72	3.55
1990	1874269	64680348	202.07	2126.32	195.56	40414.38	6.20
2000	2227749	73166000	104.39	1016.39	138.54	41279.64	4.91
2002	2373918	79044400	87.72	840.83	124.32	45057.07	4.93
2005	2571104	83761520	76.24	696.02	110.10	47881.50	5.11
2010	2748386	87558408	56.81	484.11	82.78	49584.72	4.86
2015	2966158	94097624	44.19	339.19	60.27	54017.91	4.90
2020	3177690	100357630	36.43	250.64	46.21	57845.01	5.04

Difference (Ver. 2.227 - Ver. 2.226) in San Diego Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	0	0.00	0.00	0.00	0.00	0.00
1990	0	0	0.00	0.00	0.00	0.00	0.00
2000	0	0	0.00	0.00	0.00	0.00	0.00
2002	0	0	0.52	5.36	0.32	461.97	0.03
2005	0	0	0.36	3.60	0.21	425.54	0.03
2010	0	0	0.14	1.79	0.06	264.88	0.02
2015	0	0	0.28	4.02	0.14	913.62	0.09
2020	0	0	0.15	2.66	0.10	791.53	0.08

Percentage Change in San Diego Emission Inventories (relative to Ver. 2.226)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1990	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2000	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2002	0.00%	0.00%	0.60%	0.64%	0.26%	1.04%	0.51%
2005	0.00%	0.00%	0.48%	0.52%	0.19%	0.90%	0.52%
2010	0.00%	0.00%	0.25%	0.37%	0.07%	0.54%	0.47%
2015	0.00%	0.00%	0.63%	1.20%	0.24%	1.72%	1.84%
2020	0.00%	0.00%	0.41%	1.07%	0.22%	1.39%	1.56%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 15: San Francisco Air Basin Emission Impacts from New Speeds

San Francisco Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	3577805	104633350	811.63	7313.42	546.00	65112.39	9.87
1990	4628184	140980770	459.30	4660.59	463.01	79310.57	13.42
2000	5519282	164071820	251.76	2326.24	311.13	88033.75	10.06
2002	5644236	169344130	212.71	1964.83	286.59	91055.96	9.72
2005	5964264	175417250	177.12	1532.31	242.99	94489.30	10.01
2010	6401483	186231760	132.16	1089.44	178.65	106644.50	10.07
2015	6842192	199615200	96.80	740.79	122.56	116166.60	10.10
2020	7203858	209594370	72.97	509.05	86.28	122493.60	10.20

San Francisco Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG Speeds
(Calculated Using EMFAC2007 draft ver 2.227)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	3577805	104633350	811.63	7313.42	546.00	65112.39	9.87
1990	4628184	140980770	459.30	4660.59	463.01	79310.57	13.42
2000	5519282	164071820	259.40	2416.68	317.13	93331.35	10.28
2002	5644236	169344130	219.54	2041.04	292.02	96807.51	9.95
2005	5964264	175417250	182.01	1589.66	246.91	100448.90	10.28
2010	6401483	186231760	131.77	1083.81	179.30	106597.10	9.98
2015	6842192	199615200	96.03	725.23	122.57	114287.00	9.86
2020	7203858	209594370	72.73	498.46	86.38	121893.30	10.05

Difference (Ver. 2.227 - Ver. 2.226) in San Francisco Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	0	0.00	0.00	0.00	0.00	0.00
1990	0	0	0.00	0.00	0.00	0.00	0.00
2000	0	0	7.63	90.45	5.99	5297.60	0.22
2002	0	0	6.83	76.21	5.43	5751.55	0.24
2005	0	0	4.89	57.35	3.91	5959.60	0.27
2010	0	0	-0.39	-5.63	0.65	-47.40	-0.09
2015	0	0	-0.77	-15.56	0.01	-1879.60	-0.23
2020	0	0	-0.24	-10.58	0.10	-600.30	-0.15

Percentage Change in San Francisco Emission Inventories (relative to Ver. 2.226)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1990	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2000	0.00%	0.00%	3.03%	3.89%	1.93%	6.02%	2.16%
2002	0.00%	0.00%	3.21%	3.88%	1.89%	6.32%	2.44%
2005	0.00%	0.00%	2.76%	3.74%	1.61%	6.31%	2.67%
2010	0.00%	0.00%	-0.29%	-0.52%	0.37%	-0.04%	-0.91%
2015	0.00%	0.00%	-0.80%	-2.10%	0.01%	-1.62%	-2.32%
2020	0.00%	0.00%	-0.33%	-2.08%	0.11%	-0.49%	-1.51%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 16: San Joaquin Valley Air Basin Emission Impacts from New Speeds

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1023520	35562160	258.74	2540.86	241.26	27640.65	13.54
1990	1679639	59095444	221.82	2254.52	317.67	43622.46	23.06
2000	2330556	77028680	149.58	1362.70	309.37	53628.51	14.82
2002	2487499	83510824	125.65	1103.89	297.27	57072.38	13.14
2005	2729342	89859968	114.61	921.78	288.39	61565.61	12.60
2010	3159172	103175800	90.84	675.24	222.08	68293.25	9.88
2015	3468090	116115740	67.54	451.85	152.23	77351.02	8.18
2020	3811652	129483420	52.37	315.08	106.97	87781.16	7.48

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG Speeds
(Calculated Using EMFAC2007 draft ver 2.227)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	1023520	35562160	258.70	2527.80	240.91	27637.42	13.54
1990	1679639	59095444	221.85	2249.25	317.41	43618.66	23.06
2000	2330556	77028680	150.75	1374.49	309.54	54170.14	14.83
2002	2487499	83510824	126.64	1115.36	297.49	57753.48	13.15
2005	2729342	89859968	115.45	932.66	288.57	62379.82	12.63
2010	3159172	103175800	91.47	684.46	222.24	69335.46	9.94
2015	3468090	116115740	68.11	460.72	152.40	79022.63	8.30
2020	3811652	129483420	52.73	320.60	107.07	89350.41	7.59

Difference (Ver. 2.227 - Ver. 2.226) in San Joaquin Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	0	-0.04	-13.06	-0.34	-3.23	0.00
1990	0	0	0.03	-5.27	-0.25	-3.80	0.00
2000	0	0	1.18	11.80	0.16	541.63	0.01
2002	0	0	0.99	11.46	0.22	681.10	0.01
2005	0	0	0.84	10.89	0.18	814.21	0.02
2010	0	0	0.63	9.22	0.16	1042.21	0.05
2015	0	0	0.57	8.88	0.16	1671.61	0.12
2020	0	0	0.35	5.51	0.11	1569.25	0.11

Percentage Change in San Joaquin Emission Inventories (relative to Ver. 2.226)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	0.00%	-0.02%	-0.51%	-0.14%	-0.01%	0.00%
1990	0.00%	0.00%	0.01%	-0.23%	-0.08%	-0.01%	0.01%
2000	0.00%	0.00%	0.79%	0.87%	0.05%	1.01%	0.04%
2002	0.00%	0.00%	0.79%	1.04%	0.07%	1.19%	0.09%
2005	0.00%	0.00%	0.73%	1.18%	0.06%	1.32%	0.19%
2010	0.00%	0.00%	0.69%	1.37%	0.07%	1.53%	0.53%
2015	0.00%	0.00%	0.85%	1.96%	0.11%	2.16%	1.43%
2020	0.00%	0.00%	0.67%	1.75%	0.10%	1.79%	1.49%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Table 17: South Coast Air Basin Emission Impacts from New Speeds

South Coast Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.226)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	6132212	180033150	1293.57	11068.61	836.95	119653.70	20.28
1990	9485851	284595070	970.75	9331.86	902.00	172100.40	30.65
2000	11074958	321947740	530.31	4701.98	641.59	179635.30	22.91
2002	11606219	343506050	434.20	3739.80	571.44	190507.20	21.88
2005	11270981	329753600	336.91	2705.51	475.15	184343.70	21.02
2010	12119336	350421920	250.49	1868.12	371.71	195277.20	20.02
2015	12683695	362652060	192.04	1294.47	260.23	207396.40	19.04
2020	13184638	376647260	150.97	909.32	183.10	217009.20	18.38

South Coast Summer Episodic On-Road Motor Vehicle Inventories With Changes to COG Speeds
(Calculated Using EMFAC2007 draft ver 2.227)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	6132212	180033150	1293.57	11068.61	836.95	119653.70	20.28
1990	9485851	284595070	970.75	9331.86	902.00	172100.40	30.65
2000	11074958	321947740	545.89	4824.47	645.58	188003.30	23.41
2002	11606219	343506050	445.05	3830.92	575.38	199174.60	22.37
2005	11270981	329753600	343.60	2762.98	477.88	192241.40	21.50
2010	12119336	350421920	254.92	1912.78	373.64	204573.60	20.64
2015	12683695	362652060	193.27	1308.38	261.55	213273.30	19.43
2020	13184638	376647260	151.86	921.66	184.01	223890.50	18.89

Difference (Ver. 2.227 - Ver. 2.226) in South Coast Emission Inventories (tons per day)

Cal. Year	Population	VMT(miles)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0	0	0.00	0.00	0.00	0.00	0.00
1990	0	0	0.00	0.00	0.00	0.00	0.00
2000	0	0	15.58	122.49	3.99	8368.00	0.49
2002	0	0	10.86	91.12	3.94	8667.40	0.49
2005	0	0	6.70	57.48	2.73	7897.70	0.48
2010	0	0	4.43	44.66	1.92	9296.40	0.62
2015	0	0	1.23	13.91	1.31	5876.90	0.39
2020	0	0	0.89	12.33	0.92	6881.30	0.51

Percentage Change in South Coast Emission Inventories (relative to Ver. 2.226)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
1990	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2000	0.00%	0.00%	2.94%	2.61%	0.62%	4.66%	2.16%
2002	0.00%	0.00%	2.50%	2.44%	0.69%	4.55%	2.23%
2005	0.00%	0.00%	1.99%	2.12%	0.57%	4.28%	2.26%
2010	0.00%	0.00%	1.77%	2.39%	0.52%	4.76%	3.09%
2015	0.00%	0.00%	0.64%	1.07%	0.50%	2.83%	2.07%
2020	0.00%	0.00%	0.59%	1.36%	0.50%	3.17%	2.77%

ROG_Tot[1] - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10_Tot[2] - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

APPENDIX: VMT Matching Algorithm

This Appendix was taken from EMFAC Modeling Change Technical Memo, "Updating Estimates of Vehicle Miles Traveled," July 2002, Appendix 1, pages 31 –36. Minor edits were made to reflect the addition of base years 2000, 2001, 2002, and 2003.

New VMT is updated in the EMFAC model using a VMT matching algorithm. In other words, the VMT in the model is replaced with updated estimates submitted by the TPAs by retaining vehicle populations based on DMV data yet "matching" VMT to the updated TPA data. Key to understanding the VMT matching algorithm is that VMT is the product of the vehicle population, vehicle mileage accrual and weekday adjustment factors.

$$VMT_{cy,a,v,f} = (POP_{cy,a,v,f,age} * ACCRUAL_{a,v,f,age}) * WAF_{v} \quad (1)$$

where:
$VMT_{cy,a,v,f}$ = VMT for a given calendar year, geographic area, vehicle class, and fuel type.
$POP_{cy,a,v,f,age}$ = Population for a given calendar year, geographic area, vehicle class, fuel type, and vehicle age.
$ACCRUAL_{a,v,f,age}$ = Mileage accrual for a given geographic area, vehicle class, fuel type, and vehicle age.
WAF_{v} = Weekday adjustment factors by vehicle class.

The VMT matching algorithm first checks to determine if target VMTs have been supplied for base years 1999, 2000, 2001, 2002, or 2003. This is important in assessing whether accrual rates should be changed or not. This step is described below under the heading "Base year adjustments." Next, the algorithm calculates VMTs for all forecast calendar years. If the base year VMT is changed, the new accrual rates are used in calculating the VMTs for the forecast years. The algorithm then compares the VMTs for the forecast years with target VMTs. If they are different, the vehicle population growth rates are adjusted to match the target VMTs. This step is described in the section titled "Forecast years."

Base year adjustments

In EMFAC 2007 the base years are 1999 through 2003. These years are referred to as base years because the model contains vehicle population data for these calendar years. The vehicle populations for base years are determined from analyzing DMV vehicle registration data. For all other calendar years the vehicle population is calculated using either the back casting (1970-1998) or the forecasting (2004-2040) algorithm. Equation 1 (above) shows that the VMT for the base years (Base_VMT) is calculated from the product of the known vehicle population, vehicle accrual and the weekday adjustment factors.

Base year adjustments to vehicle mileage accrual rates are necessary when the Base_VMT calculated in the EMFAC model using equation 1, is different than the target VMT submitted by the TPA. For example, suppose a TPA, using a transportation model, calculates that the target VMT in 2000 is 1,250,000 miles per day. The EMFAC model must match this estimate along with those for future calendar years. To match the target VMT for CY 2000, only vehicle mileage accrual rates can be changed while maintaining the relationship shown in equation 1.

In the VMT matching algorithm, a ratio of the target versus base VMTs is calculated. This is noted as:

$$Ratio_v = Target\_VMT_v / Base\_VMT_v \quad (2)$$

where:
Subscript "v" refers to vehicle class.

The ratio is then applied to the current accrual rates to calculate new accrual rates.

$$New\_ ACCRUAL_{a,v,f,age} = ACCRUAL_{a,v,f,age} * Ratio_v \quad (3)$$

This calculation is done for each vehicle age, fuel type, and vehicle class and is specific to the geographic area. This is because accrual rates vary by these factors. These new accrual rates are then used in recalculating VMTs for all future years. These new VMTs are then used in subsequent calculation of population growth rates to match future year target VMTs.

Forecast Years

The EMFAC2007 model forecasts vehicle population and VMT estimates for calendar years 2004-2040. VMT for future years is still calculated using equation 1 (above). However, in equation 1 vehicle population is now a function of the base year population (2003), population growth rates and vehicle attrition. For the purposes of explaining this algorithm assume that vehicle attrition is negligible. In this case the vehicle population in 2004 calendar year is simply a product of the known population in 2003 and the population growth rate in 2004. Similarly, the vehicle population in 2005 is a product of the forecasted population in 2004 and the population growth rate for calendar year 2005. If this process is simplified then one arrives at equation 4, which states that the population for a forecast year is simply a product of 2003 calendar year and population growth rates.

$$POP_{2004} = POP_{2003} * (1 + pgr_{2004})$$
$$POP_{2005} = POP_{2004} * (1 + pgr_{2005})$$
..
..
$$POP_{2005} = \{POP_{2003} * (1 + pgr_{2004})\} * (1 + pgr_{2005})$$

$$POP_{cy,a,v,f,age} = POP_{2003} * \{ (1 + pgr_{2004}) * (1 + pgr_{2005}) + \ldots \} \quad (4)$$

where:
POP_{2003} = Vehicle population data from DMV
Pgr_{2004} = Population growth rates for 2004 calendar year
Pgr_{2005} = Population growth rates for 2005 calendar year

Equation 4 shows in a simple way how vehicle populations are forecast. In reality the POP2003 varies by area, vehicle class, and fuel type. Hence, the population growth rates also vary by calendar year, area, vehicle class, and fuel type. The vehicle populations, calculated using equation 4, are then used in equation 1 to calculate VMT for a given calendar year.

From this simple explanation on how VMTs are calculated for future years it is important to grasp that if a TPA submits a target VMTs for a forecast year this VMT can be matched by adjusting the population growth rates. For example, if a TPA supplies a target VMT estimate for 2005 calendar year this target VMT is matched by adjusting the population growth rates for 2004 and 2005 calendar years. It is assumed that the vehicle population grows linearly between the base year (2003) and the forecast year (2005). The linear increase in population growth rates results in a linear increase in VMT. This will become evident in the following example.

The VMT matching algorithm can be explained by the following example where region X has only submitted a target VMT of 2500 miles per day for calendar year 2005. Table A-1 shows the population growth rates for region X. The growth rate for 2003 is 0 since this is a base year. Thereafter, the vehicle population grows by 10% in 2004 and 15% in 2005. In this example, assume that the VMT for 2003 calendar year, calculated as a product of the known vehicle population and vehicle accrual rate, is 1501.97 miles per day. Further, assume that VMT grows at the same rate as population growth rates. Note this is not always the case since shifts in the model year population distribution can result in a different VMT growth hence the need to iterate on the population growth rates by model year.

Table A-1 Example Data for Region X

	2003	2004	2005
Population Growth Rates	0	0.1	0.15
Modeled VMTs	1501.97	1652.17	1900
Target VMT			2500

In this example, the VMT matching algorithm first calculates VMTs for 2004 and 2005. These are shows as "Modeled VMTs" in Table A-1. Using equation 4 the VMT for 2004 is 1501.97 * (1+ 0.1) = 1652.17 miles per day. Similarly, the VMT for 2005 is 1652.17 (1+0.15) = 1900 mile per day.

Having calculated "Modeled VMT" for calendar year 2005, the VMT algorithm notes that this estimate is different than the target VMT estimate.

The VMT matching algorithm then proceeds through the following steps noted S1, S2 and so on.

Begin loop

S1: The model first calculated a ratio based on dividing the target VMT by the Modeled VMT for 2005.

Ratio = $Target\_VMT_{2005}$ / $Modeled\_VMT_{2005}$ = 2500/1900 = 1.3157895

S2: Check for convergence. If the value of (Ratio – 1) is less than 0.00001 then skip further iterations. When this convergence criteria has been met it assumes that the modeled VMT for 2005 matches the target VMT. In this example, the Ratio is 1.3157895 hence proceed to the next step.

S3: Calculate the current compounded growth factor for calendar year 2005. This compounded growth factor for 2005 is: gf = (1)*(1.1)*(1.15) = 1.265.

S4: The compounded growth factor indicates that the VMT increases by 26.5% from 2003 to 2005 calendar year. This compounded growth factor is then used to calculate a linear growth factor (lgf) for calendar years 2004 and 2005. This growth factor assumes a linear and equal growth in VMT in calendar years 2004 and 2005.

The linear growth factor: lgf = EXP(ln(gf) / n) = 1.124722188

In this equation n is number of years, which is 2 in this example. The linear growth factor indicates that the annualized growth rates is 12.5% for 2004 and 2005 calendar years. Note this lgf is for the growth in "Modeled VMT."

S5: The next step is to calculate what the annualized growth rate is for the new target VMT. This is done by calculating what the incremental growth factor is beyond what was calculated in S4. This is done by calculating the incremental growth factor: igf = EXP(ln(Ratio)/n) = 1.14707867. This incremental growth factor is then multiplied by the linear growth factor (lgf) to calculate the new annualized population growth rate.

Calculate new population growth rate: NGR = lgf * graf – 1 = 0.2901448

In this example, the new annualized growth rate is 29% for 2004 and 2005 calendar years. This new growth rate is then used to calculate VMTs for calendar years 2004 and 2005.

S6: Update growth rates and calculate new VMTs. Table A-2 shows the new growth rates for calendar years 2004 and 2005. Note the model assumes equal growth in 2004 and 2005 calendar years. Hence, population and VMT will grow linearly between 2003 and 2005 calendar years. In this example, the VMT for 2004 and 2005 are recalculated using the new population growth rates. Using equation 4, the new VMT for 2004 = 1501.97*(1+0.29) =1937.76. This calculation is then repeated for calendar year 2005.

Table A-2 Calculation of New Population Growth Rates and VMTs

	2003	2004	2005
NGR	0	0.2901448	0.2901448
New VMT	1501.97	1937.76	2499.99

S7: Goes to the top of the loop where additional checks are performed convergence.

End loop

In this example, the TPA submitted a target VMT for 2005. This VMT was matched is by adjusting the population growth rates for both 2004 and 2005 calendar years. These new growth rates were then used in calculating new VMTs for 2004 and 2005 calendar years.

If the TPA had submitted target VMTs for 2005 and 2010 calendar years then the VMT matching algorithm would first match the 2005 VMT by following the steps outlined above.

This would involve recalculating the VMTs for 2004 and 2005 calendar years assuming a linear and equal growth rate. To match the 2010 target VMT, the algorithm would recalculate VMTs for 2006, 2007, 2008, 2009 and 2010 calendar years. Again the algorithm would calculate a linear and equal growth rate for these years. It is important to note that since the VMT algorithm is matching VMTs for individual calendar years (for example 2005 and 2010), the population growth rates for calendar years 2004-2005 may be different than that for calendar years 2006-2010. This reflects different growth assumptions. However, the growth rates within the calendar years is the same.

The VMT matching algorithm then writes out changes to the population growth rate files, vehicle accrual rate files, and new forecasted VMTs for all future calendar years.