

## **EMFAC Modeling Change Technical Memo**

**SUBJECT:** UPDATING VEHICLE MILES TRAVELED AND  
SPEED DISTRIBUTIONS IN EMFAC 2007

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### **SUMMARY**

This Technical Memo documents the final revisions to the motor vehicle activity data used in the motor vehicle emissions model, EMFAC 2007. Vehicle miles traveled (VMT) and speed distributions were submitted by local transportation planning agencies (TPAs) in August and early September 2006 for four areas: South Coast region, the San Francisco Bay Area region, San Diego County, and Santa Barbara County. In addition to discussing the most recent activity data submitted by the TPAs, the memo recaps key information and issues from staff's review of TPA activity data submitted in 2005 and early 2006. The emission impacts from the most recent updates are also quantified.

Statewide, the VMT updates in EMFAC 2007 caused an increase in emissions of roughly 2% for ROG, 8% for NOx, and 10% for PM10 in calendar year (CY) 2002. In the same year the updated speed distributions caused a decrease in ROG, an increase in NOx, and a decrease in PM10, each by less than 1%.

### **BACKGROUND**

The quality assurance (QA) process for updating EMFAC 2007 represents three rounds of data review and coordination with TPAs and air districts during 2005 and 2006. Although it is not possible to capture all these efforts in a single memorandum, highlights from the past two years are captured in this report. Additional details on issues and TPA responses for each area are recorded in the following documents:

#### **Technical Memos on Activity Data Updates:**

Updating Estimates of Vehicle Miles Traveled and Speed Distributions in EMFAC Working Draft 1 (#592)  
Updating Estimates of Vehicle Miles Traveled and Speed Distributions in EMFAC Working Draft 2 (#610)

#### **Activity Related Assessments:**

#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)

These documents are available on request or can be downloaded at  
<http://www.arb.ca.gov/msei/msei.htm>.

In some areas of the state, the VMT and speed distributions contained in EMFAC 2007 were carried forward from earlier working drafts of EMFAC. The earliest Technical Memo on activity data relevant to EMFAC 2007 discusses updates made in 2005 to the first working draft of EMFAC 2007 known as Working Draft 1 (WD1). In 2005 all major urban areas in California submitted revised VMT and speed distributions.

The second Technical Memo documents updates made in June 2006 to the next version of EMFAC known as the Working Draft 2 (WD2). Working Draft 2 included VMT updates for three areas: the South Coast region, the Sacramento Nonattainment Area, and Santa Barbara County, as well as speed distribution updates for the South Coast region only.

As mentioned in the summary, the final model version, EMFAC 2007, includes updated VMT and speeds received from local TPAs in August and early September 2006. These four areas are the South Coast region, the San Francisco Bay Area region, San Diego County, and Santa Barbara County.

EMFAC 2007 includes an update to vehicle populations. Because vehicle populations and mileage accrual are used in the VMT matching algorithm in EMFAC, the VMT estimates included in the earlier working drafts had to be re-matched in EMFAC 2007. The net effect of the matching was that the VMT in EMFAC matched the most recent submittal from the TPAs for all areas. The speeds distributions in EMFAC 2007 reflect the most recent submitted for all areas.

Other kinds of technical revisions were made to EMFAC 2007 in addition to VMT and speeds. All revisions are discussed in technical memos available at <http://www.arb.ca.gov/msei/msei.htm>.

## **VMT DATA UPDATED**

The years of VMT data provided by local TPAs are summarized in Table 1. ARB processed base year vehicle population data from the California Department of Motor Vehicles (DMV) for years 1999 through 2005. The model can match VMT data for one of these base years. Some local areas provided data for two of the base year choices. In these cases, ARB staff selected one year to be the base year. For example, if a local agency provided data for years 2000 and 2005, ARB would select either 2000 or 2005 data to serve as the base year. The base years selected are listed in the table below. Data for calendar year 2040 was extrapolated.

**Table 1: VMT Updated by Area**

AGENCY	COUNTY	AREA	BASE YEARS	CALENDAR YEARS								RECEIVED		
AMBAG	Monterey	16	2000	2010	2020	2030	2040							Nov 04
	San Benito	17	2000	2010	2020	2030	2040							
	Santa Cruz	18	2000	2010	2020	2030	2040							
BCAG	Butte	27	2000	2010	2015	2020	2025	2030	2040					2004
MTC	Alameda	39	2000	2006	2007	2015	2025	2030	2040					Aug 06 (Adjusted)
	Contra Costa	40	2000	2006	2007	2015	2025	2030	2040					
	Marin	41	2000	2006	2007	2015	2025	2030	2040					
	Napa	42	2000	2006	2007	2015	2025	2030	2040					
	San Francisco	43	2000	2006	2007	2015	2025	2030	2040					
	San Mateo	44	2000	2006	2007	2015	2025	2030	2040					
	Santa Clara	45	2000	2006	2007	2015	2025	2030	2040					
	So. Solano (SF)	46	2000	2006	2007	2015	2025	2030	2040					
	So. Sonoma (SF)	47	2000	2006	2007	2015	2025	2030	2040					
	No. Sonoma (NC)	22	2000	2006	2007	2015	2025	2030	2040					
No. Solano (SV)	33	2000	2006	2007	2015	2025	2030	2040						
SACOG	EIDorado (MC)	9	2000	2006	2010	2015	2020	2025	2030	2035	2040		Matched to E 2002	
	Placer (SV)	30	2000	2006	2010	2015	2020	2025	2030	2035	2040			
	Placer (MC)	12	2000	2006	2010	2015	2020	2025	2030	2035	2040			
	Sacramento	31	2000	2006	2010	2015	2020	2025	2030	2035	2040			
	Sutter	34	2000	2006	2010	2015	2020	2025	2030	2035	2040			
	Yolo	36	2000	2006	2010	2015	2020	2025	2030	2035	2040			
Yuba	37	2000	2006	2010	2015	2020	2025	2030	2035	2040				
SANDAG	San Diego	38	2000	2010	2020	2030	2040						Aug 06	
FRESNO COG	Fresno	48	2000	2008	2010	2020	2030	2040					Feb 05 thru Mar 05	
KERN COG	Kern (SJV)	49	2000	2008	2010	2015	2020	2030	2040					
KINGS CAG	Kings	50	2000	2008	2010	2020	2030	2040						
MADERA CTC	Madera	51	2000	2008	2010	2020	2030	2040						
MERCED CAG	Merced	52	2000	2008	2010	2020	2030	2040						
SJCOG	San Joaquin	53	2000	2008	2010	2020	2030	2040						
STANISLAUS COG	Stanislaus	54	2000	2008	2010	2020	2030	2040						
TULARE CAG	Tulare	55	2003	2008	2010	2020	2030	2040						
KERN COG	Kern (MD)	65	2000	2008	2010	2015	2020	2030	2040					
SBCAG	Santa Barbara	57	2000	2010	2020	2030	2040							Sept 06 (Corrected Oct 06)
SCAG	Los Angeles	59	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040	Sept 06	
	Orange	60	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040		
	Riverside with Banning	61	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040		
	San Bernardino	62	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040		
	Los Angeles (Antelope Valley)	68	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040		
	San Bernardino (VV + MV)	69	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040		
	Riverside (Coachella Valley)	64	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040		
Ventura	58	2002	2007	2010	2013	2015	2020	2023	2030	2035	2040			

## **SPEED DATA UPDATED**

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. The exception is the South Coast region. Since the Southern California Association of Governments (SCAG) maintains a heavy-duty truck model for the South Coast region, SCAG heavy-duty truck speeds are used in the EMFAC model.

Table 2 summarizes the years 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. Santa Barbara County Association of Governments (SBCAG) provided specific instructions as to what speeds would be applied to specific calendar years. For Santa Barbara, the speed distribution for 2000 is applied to calendar years 2000 – 2009; the 2010 speed distribution is for 2010 – 2014; the 2020 speed distribution is for 2015 – 2025; and the 2030 speed distribution is for 2026 – 2040. Speed distributions included in EMFAC 2007 are summarized in Table 2.

**Table 2: Speed Distributions Updated 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			Aug 06		
	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 (SF)	San Francisco	46	2000	2006	2007	2015	2025	2030					
	So. Sonoma (SF)	San Francisco	47	2000	2006	2007	2015	2025	2030					
	No. Solano (SV)	Sacramento Valley	33	2000	2006	2007	2015	2025	2030					
	No. Sonoma (NC)	North Coast	22	2000	2006	2007	2015	2025	2030					
SACOG	EIDorado (MC)	Mountain Counties	9	2000	2005	2008	2013	2020	2027			Dec 04		
	Placer (SV)	Sacramento Valley	30	2000	2005	2008	2013	2020	2027			- Mar 05		
	Placer (MC)	Mountain Counties	12	2000	2005	2008	2013	2020	2027					
	Sacramento	Sacramento Valley	31	2000	2005	2008	2013	2020	2027					
	Sutter	Sacramento Valley	34	2000	2005	2008	2013	2020	2027					
	Yolo	Sacramento Valley	36	2000	2005	2008	2013	2020	2027					
	Yuba	Sacramento Valley	37	2000	2005	2008	2013	2020	2027					
SANDAG	San Diego	San Diego	38	2000	2010	2020	2030				Aug 06			
FRESNO COG	Fresno	San Joaquin Valley	48	2000	2002	2005	2008	2010	2020	2030	Feb 05			
KERN COG	Kern (SJV)	San Joaquin Valley	49	2000	2005	2008	2010	2015	2020	2030	- Mar 05			
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 (MD)	Mojave Desert	65	2000	2005	2008	2010	2015	2020	2030				
SBCAG	Santa Barbara	South Central Coast	57	2000	2010	2020	2030				Sept 06 (Corrected Oct 06)			
SCAG	Los Angeles	South Coast	59	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	Sept 06
	Orange	South Coast	60	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	
	Riverside with Banning	South Coast	61	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	
	San Bernardino	South Coast	62	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	
	Los Angeles (Antelope Valley)	Mojave Desert	68	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	
	San Bernardino (VV + MV)	Mojave Desert	69	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	
	Riverside (Coachella Valley)	Salton Sea	64	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	
	Ventura	South Central Coast	58	2002	2005	2007	2010	2013	2015	2020	2023	2030	2035	
TRPA	EI Dorado (LT)	Lake Tahoe	5	2003	2010	2018 (all years have the same speed distribution)							2004	
	Placer (LT)	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 DISTRIBUTIONS	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
27	<b>BCAG</b> Butte	DAILY	SV/BUT						
16 17 18	<b>AMBAG</b> Monterey San Benito Santa Cruz	AMPK, PMPK, OFFPK	NCC/MBU NCC/MBU NCC/MBU	Hours 0-5 " "	6,7,8 " "	9,10,11 " "	12,13,14 " "	15, 16, 17 " "	18-23 " "
39 40 41 42 43 44 45 46 33 47 22	<b>MTC</b> Alameda Contra Costa Marin Napa San Francisco San Mateo Santa Clara Solano (SF) Solano (SV) Sonoma (SF) Sonoma (NC)	PK (Per. 2, 5), OFFPK (Per. 1,3,4,6)	SF/BA SF/BA SF/BA SF/BA SF/BA SF/BA SF/BA SV/YS SF/BA NC/NS	Hours 0-5 " " " " " " " " " "	6,7,8 " " " " " " " " " "	9,10,11 " " " " " " " " " "	12,13,14 " " " " " " " " " "	15, 16, 17 " " " " " " " " " "	18-23 " " " " " " " " " "
9 30 12 31 34 36 37	<b>SACOG</b> El Dorado (MC) Placer (SV) Placer (MC) Sacramento Sutter Yolo Yuba	AM, MID, PM, EVENING	MC/ED SV/PLA MC/PLA SV/SAC SV/FR SV/YS SV/FR	Hours 0-5 " " " " " "	6,7,8 " " " " " "	9,10,11 " " " " " "	12,13,14 " " " " " "	15, 16, 17 " " " " " "	18-23 " " " " " "
38	<b>SANDAG</b> San Diego	PERIODS 1 - 6	SD/SD	Hours 0-5	6,7,8	9,10,11	12,13,14	15, 16, 17	18-23
59 68 60 61 64 67 66 62 69 58	<b>SCAG</b> Los Angeles Los Angeles (Antelope Valley) Orange Riverside (Banning) Riverside (Coachella Valley) Riverside Riverside San Bernardino San Bernardino (Victor Valley and Mojave Valley) Ventura	AMPK, PMPK, MIDDAY, NIGHT	SC/SC MD/AV SC/SC SC/SC SS/SC MD/SC MD/MOJ SC/SC MD/MOJ SCC/VEN	Hours 0-5 " " " " " " " " "	6,7,8 " " " " " " " " "	9,10,11 " " " " " " " " "	12,13,14 " " " " " " " " "	15,16,17,18 " " " " " " " " "	19-23 " " " " " " " " "
48 49 65 50 51 52 53 54 55	<b>SJV TPAs</b> Fresno Kern Kern Kings Madera Merced San Joaquin Stanislaus Tulare	AMPK, PMPK, OFFPK AM, PM, MD, OFF AM, PM, MD, OFF DAILY DAILY DAILY DAILY DAILY AM, PM, OFF	SJV/SJU SJV/SJVU MD/KER SJV/SJU SJV/SJU SJV/SJU SJV/SJU SJV/SJU SJV/SJU	Hours 0-5 Hours 0-6 Hours 0-6 " " " " Hours 0-5	6,7,8 7,8 7,8 " " " " 6,7,8	9,10,11 9,10,11 9,10,11 " " " " 9,10,11	12,13,14 12,13,14 12,13,14 " " " " 12,13,14	15, 16, 17 15, 16, 17 15, 16, 17 " " " " 15, 16, 17	18-23 18-23 18-23 " " " " 18-23
5 6	<b>TRPA (Lake Tahoe)</b> El Dorado Placer	DAILY	LT/ED LT/PLA						
57	<b>SBCAG</b> Santa Barbara	AMPK, PMPK, OFFPK VARIES BY YEAR	SCC CY 2000 CY 2010 CY 2020 CY 2030	Hours 0-6 Hours 0-5 Hours 0-5 Hours 0-5	7-8 6-8 6-9 6-9	9-11 9-11 10-11 10-11	12-15 12-14 12-14 12-14	16,17 15-17 15-18 15-18	18-23 18-23 19-23 19-23

## SOUTH COAST

The Southern California Association of Governments (SCAG) submitted VMT and speed distributions to ARB in September 2006. The data were generated from SCAG's travel demand model and also from SCAG's truck model. Table 4 summarizes the details of the submittal and how ARB processed the data.

**Table 4: SCAG Submittal**

<b>Traffic Model Citation:</b>	<b>Draft 2007 AQMP with complete 5-loop feedback convergence using the Interim Model (September 2006)</b> SCAG developed an Interim Travel Demand Model for EMFAC and the 2007 AQMP/SIP. The Interim Travel Demand Model is based on the current Regional Travel Demand Model with the following improvements: revised socio-economic data, new trip rates, new port trips, new Heavy Duty Truck External Model, and revised volume delay curves.
<b>Submittal Date</b>	September 18, 2006
<b>Data Years for VMT and Speeds:</b>	CYs 2002, 2005, 2007, 2010, 2013, 2015, 2020, 2023, 2030, 2035
<b>VMT Vehicle Classes:</b>	VMT totals for light- and medium-duty vehicles and motorcycles combined. VMT totals for heavy-duty trucks combined. (No data for buses or motor homes.)  <b>Light-duty:</b> ARB matched SCAG VMT totals for light- and medium-duty vehicles plus motorcycles by sub-area and distributed VMT by vehicle class based on updated DMV/BAR data. ARB added VMT for buses and motor homes using DMV/BAR data.  <b>Heavy-duty:</b> Using SCAG's Truck Model data, ARB matched SCAG VMT totals for heavy-duty trucks and distributed VMT by vehicle class based on updated DMV data and ARB's heavy heavy-duty vehicle distribution developed in 2005.
<b>Speed Vehicle Classes:</b>	Speed distributions were provided for the combined light- and medium-duty fleet including motorcycles. Separate speed distributions were provided for heavy-duty trucks combined (LHDT1, LHDT2, MHDT, and HHDT) derived from SCAG's truck model.
<b>Speed Distributions By Periods:</b>	Speed distributions were provided for AM Peak (hours 6-8), PM Peak (15-18), Midday (9-14), Night (0-5 and 19-23), and Daily.

ARB staff reviewed the VMT and speeds data for anomalies, compared VMT trends to past submittals and other independent sources of data, and configured the data submitted into appropriate format for the EMFAC model. During the QA process, ARB compared SCAG's VMT trends (Sept 06) by county, CYs 2000 through 2030, in 5-year increments to several data sources:

SCAG Activity Data Submitted to ARB (May 06)  
South Coast State Implementation Plan (SIP) 2003  
EMFAC 2002, Version 2.2 (Apr03)

EMFAC WD2B (reflects SCAG May 2006 Submittal and adjustments per  
Heavy-Duty Truck VMT Agreement)  
California Motor Vehicle Stock, Travel and Fuel Forecast, Dec 2005 (MVSTAFF Dec05)

VMT growth rates were also compared to human population growth rates from State of California, Department of Finance (DOF), Demographic Research Unit, "Population Projections by Race/Ethnicity for California and Its Counties 2000-2050, Sacramento, California, August 2006 (Human Pop Aug06). The results for the South Coast region are shown in Chart 1.

The speeds analysis of the SCAG data included calculations of mean speeds by county, year, period, and vehicle classes. ARB reviewed mean speed trends over time and also examined VMT assignments to each of the 13 speed bins. Charts 2 and 3 show PM Peak and average daily weighted mean speeds for light-duty vehicles. Charts 4 and 5 show the similar data for heavy-duty trucks.

Two questions raised during the QA process were (a) why mean average trucks speeds increase over time and (b) why mean average truck speeds are faster than light-duty vehicles. SCAG attributed these trends to the provision of truck lanes in future years and also to the fact that a larger portion of light-duty travel occurs on slower local streets than for trucks. Since the QA questions for the final EMFAC update followed previous questions raised during the review of May 2006 data, Appendix A, attached to this memorandum, provides the written QA questions and answers provided during the processing of the May 2006 data and update of the working draft.

In the working drafts of EMFAC, ARB, SCAG, and the South Coast Air Quality Management District (SCAQMD) agreed to adjust the heavy-duty truck VMT from SCAG's truck model to better reflect ARB's 2005 heavy-duty truck VMT redistribution. However, there was no adjustment to the September 2006 data from SCAG's truck model since that data matched the VMT in WD2B within one percent for years beyond 2005.

In June 2006, ARB raised a new issue related to SCAG's transportation demand modeling procedures. Caltrans District 7 staff had determined that the SCAG model was not being executed to the point of "convergence" or reasonable agreement with VMT in successive loops. It was thought that the absence of convergence lead to too-high estimates of speed and too-low estimates of VMT in future years. SCAG agreed to rerun their travel demand model using the complete 5-loop feedback convergence procedure. The 5-loop data was used in EMFAC 2007.



Chart 1: South Coast Region

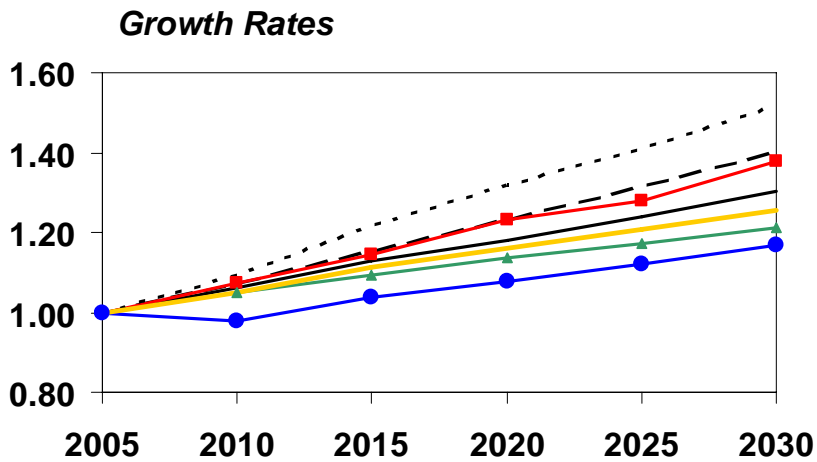
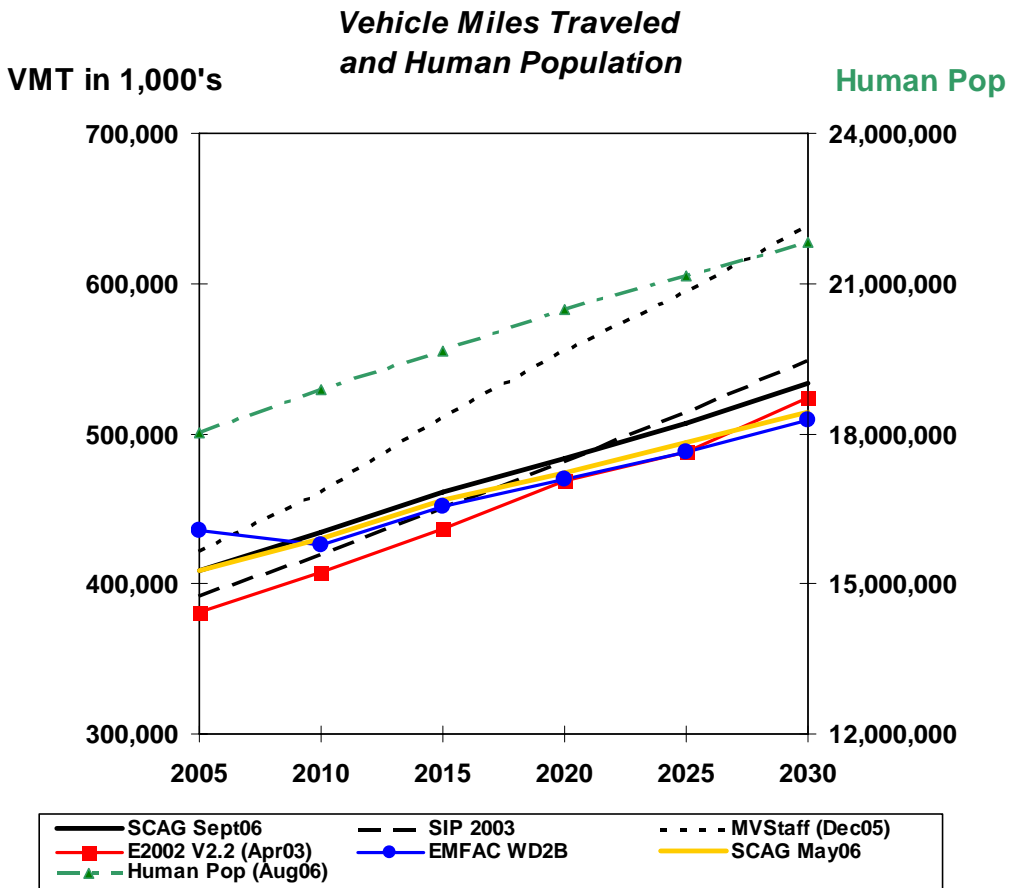


Chart 2

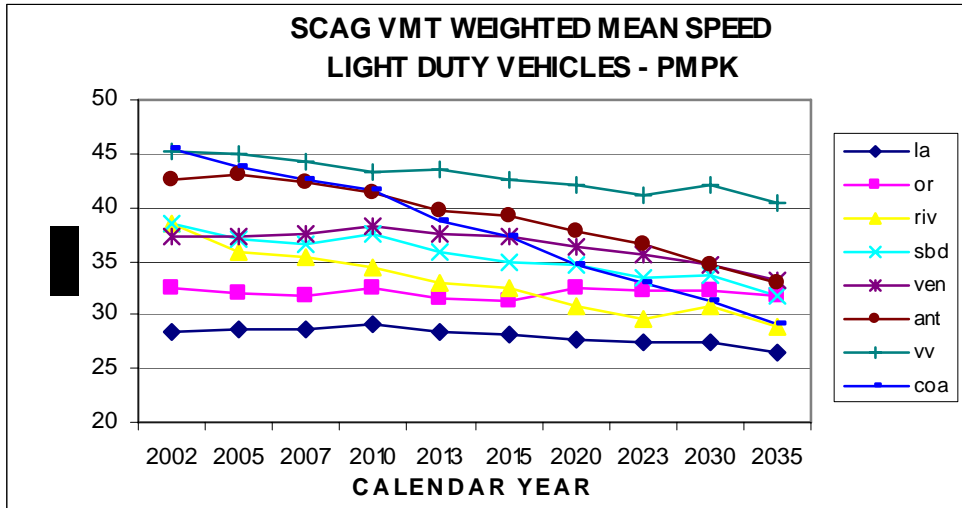
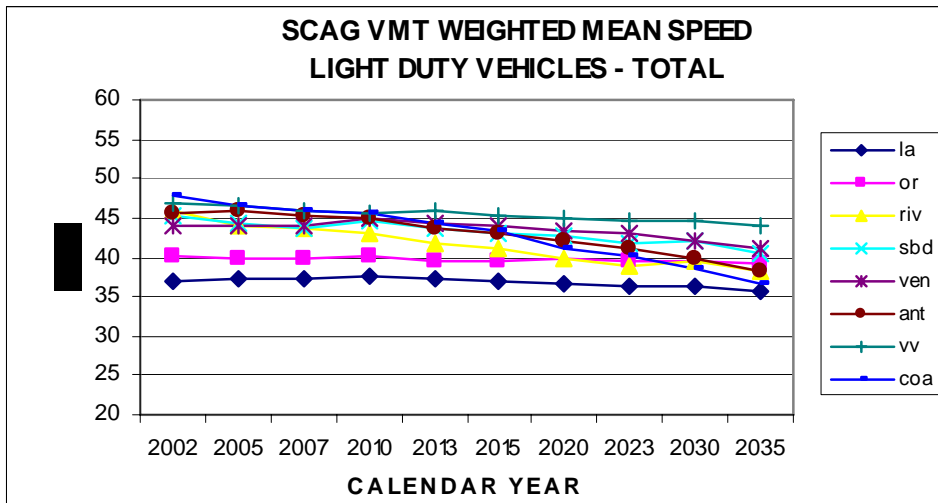
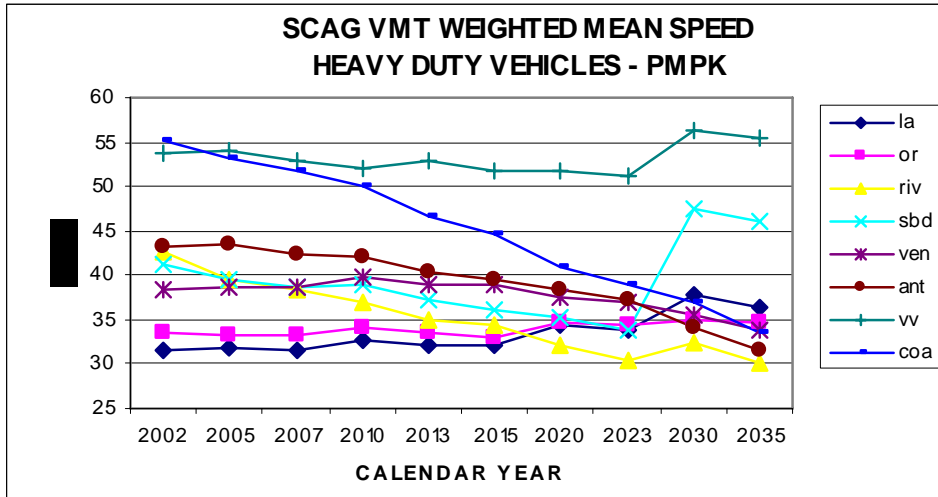


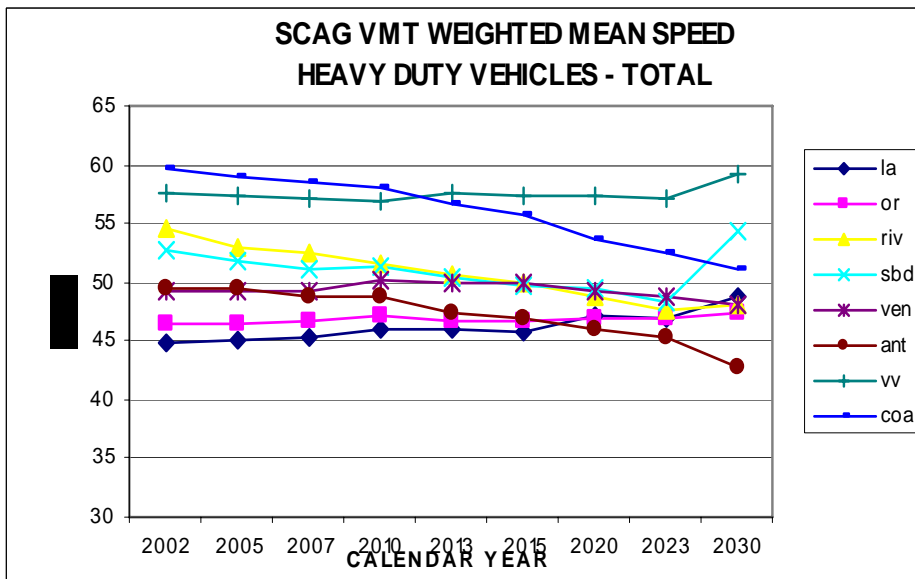
Chart 3



**Chart 4**



**Chart 5**



## **SAN DIEGO COUNTY**

The San Diego Association of Governments (SANDAG) submitted vehicle activity data in August 2006. Table 5 provides details on the SANDAG submittal.

**Table 5: SANDAG Submittal**

<b>Traffic Model Citation:</b>	2030 Cities/County Growth Forecast, 2030 Revenue Constrained Regional Transportation Plan: 2006 Update Network. August 2006, TransCAD Model.
<b>Date of Submittal:</b>	August 2006
<b>Years Provided:</b>	2000, 2010, 2020, and 2030
<b>VMT Vehicle Classes:</b>	VMT totals represent all vehicle classes. SANDAG provided VMT by vehicle class and by period; however, EMFAC 2007 reflects VMT distribution over the vehicle classes based on DMV data.
<b>Speed Vehicle Classes:</b>	Speed distributions were provided by vehicle class; however, ARB default speeds were used for heavy-duty vehicles

Similar to the South Coast data review, ARB staff reviewed the activity data received from SANDAG and compared VMT trends for CYs 2000 through 2030 in 5-year increments to other data sources:

SANDAG Activity Data Submitted to ARB (March 2005)  
EMFAC 2002, Version 2.2 (Apr03)  
EMFAC WD2B  
California Motor Vehicle Stock, Travel and Fuel Forecast, Dec 2005 (MVSTAFF Dec05)  
DOF Human Population (Human Pop Aug06).

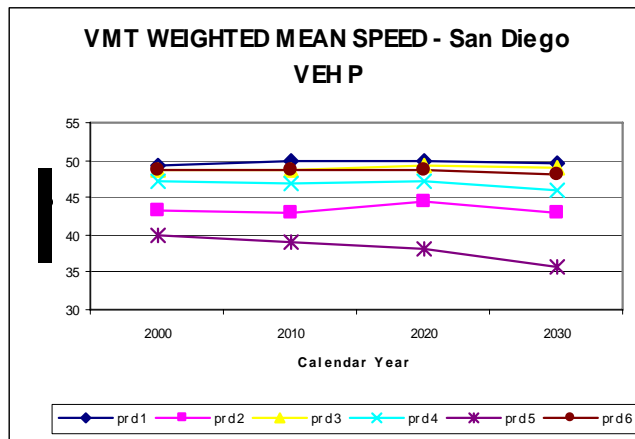
The San Diego VMT comparison and growth rates are shown in Chart 6.

SANDAG provided speed distributions by vehicle class. ARB calculated mean speeds by vehicle class and examined mean speed trends over time. Chart 7 shows the mean speeds associated with passenger cars.

SANDAG provided VMT and speeds by vehicle class; however, because of ARB's recent efforts to update vehicle population and redistribute statewide VMT for heavy-duty trucks, ARB preferred to use SANDAG total VMT for the fleet on whole but with ARB VMT distributions by vehicle class. The heavy heavy-duty truck VMT was updated to agree with ARB's redistribution. Similarly, SANDAG agreed to use ARB default speed distributions for heavy-duty vehicles. EMFAC 2007 reflects SANDAG speed distributions for light-duty cars and trucks plus motorcycles.



**Chart 7**



**SAN FRANCISCO BAY AREA**

The Metropolitan Transportation Commission (MTC) provided updated activity data in August 2006. Table 6 describes the VMT and speed distribution data submitted by MTC.

**Table 6: MTC Submittal**

<b>Traffic Model Citation:</b>	MTC Travel Demand Model (BAYCAST, 2000) based on ABAG’s Projections 2005 series of demographic / economic / land use forecasts. Projections 2005 reflects regional “Smart Growth” land use assumptions. These planning assumptions are reflected in the 2007 TIP Conformity Analysis (July 2006).
<b>Date of Submittal:</b>	August 2006
<b>Years Provided:</b>	2000, 2006, 2007, 2015, 2025, 2030
<b>VMT Vehicle Classes:</b>	VMT totals represent all vehicle classes.
<b>Speed Vehicle Classes:</b>	Apply to light-duty cars and trucks, medium-duty vehicles, and motorcycles. ARB default speeds to be used for all heavy-duty vehicles. Speeds were provided on whole county basis only.
<b>Speed Distributions and Periods:</b>	Two speed distributions -- Peak (periods 2 and 5) and Off-Peak (periods 1, 3, 4, and 6)

Similarly to the South Coast QA process, ARB staff reviewed MTC’s VMT and speed distributions. ARB compared MTC’s VMT and growth rates (August 06) by county, CYs 2000 through 2030, in 5-year increments to the following data sources:

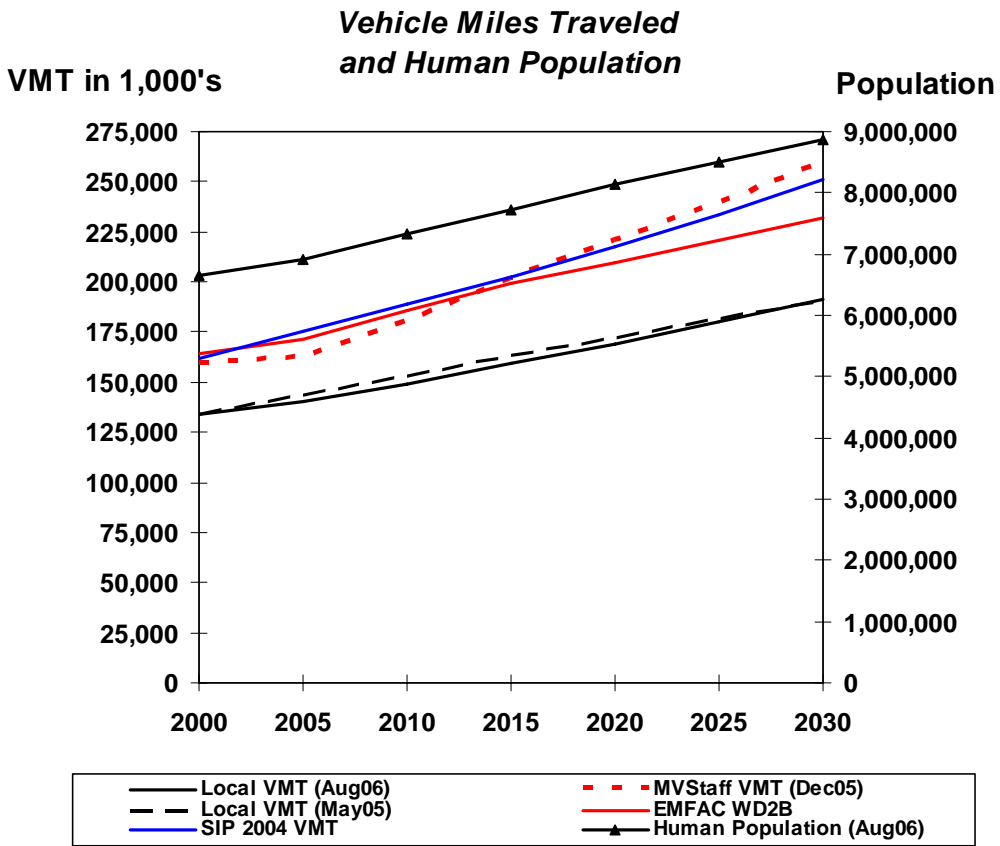
- MTC Activity Data Submitted to ARB (May 2005)
- State Implementation Plan (SIP) 2004
- EMFAC WD2B
- California Motor Vehicle Stock, Travel and Fuel Forecast, Dec 2005 (MVSTAFF Dec05)
- DOF human population growth rates (Human Pop Aug06)

The VMT comparison and growth rates for the San Francisco Air Basin are shown in Chart 8. The speeds analysis of MTC data included calculations of mean speeds for the peak and off-peak periods by county and by year. These are displayed in Charts 9 and 10.

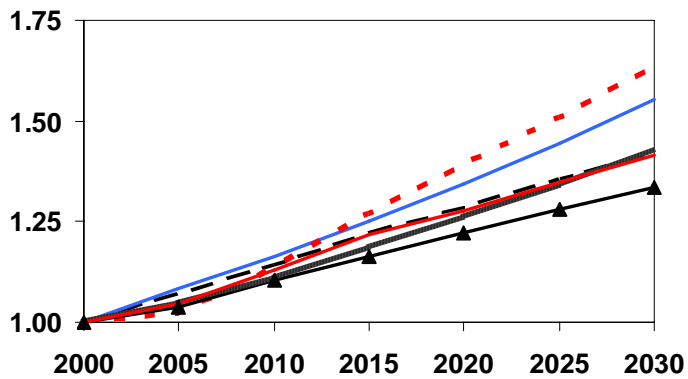
One important issue discussed during the QA process on MTC's data was VMT estimates for base year 2000. Prior investigations as well as the current analysis by ARB showed that MTC VMT estimates were significantly lower than those based on the DMV vehicle populations plus mileage accrual rates determined from California's SMOG Check Program. In an effort to be fully protective of air quality, ARB, MTC, and the Bay Area Air Quality Management District (BAAQMD) determined that it would be better to have VMT forecasts that err on the side of being too high rather than too low. Therefore, these agencies agreed to adjust Bay Area VMT before using it in air quality plans or in the EMFAC model pending future efforts to determine the reasons for VMT discrepancies among independent sources of data.

For EMFAC 2007 ARB adjusted VMT using the DMV population and SMOG Check accrual rates to calculate base year VMT. The ARB calculated methodology provided VMT estimates in between MTC estimates and MVSTAFF estimates. MTC VMT growth rates were then applied to base year VMT to estimate future years.

Chart 8: San Francisco Air Basin

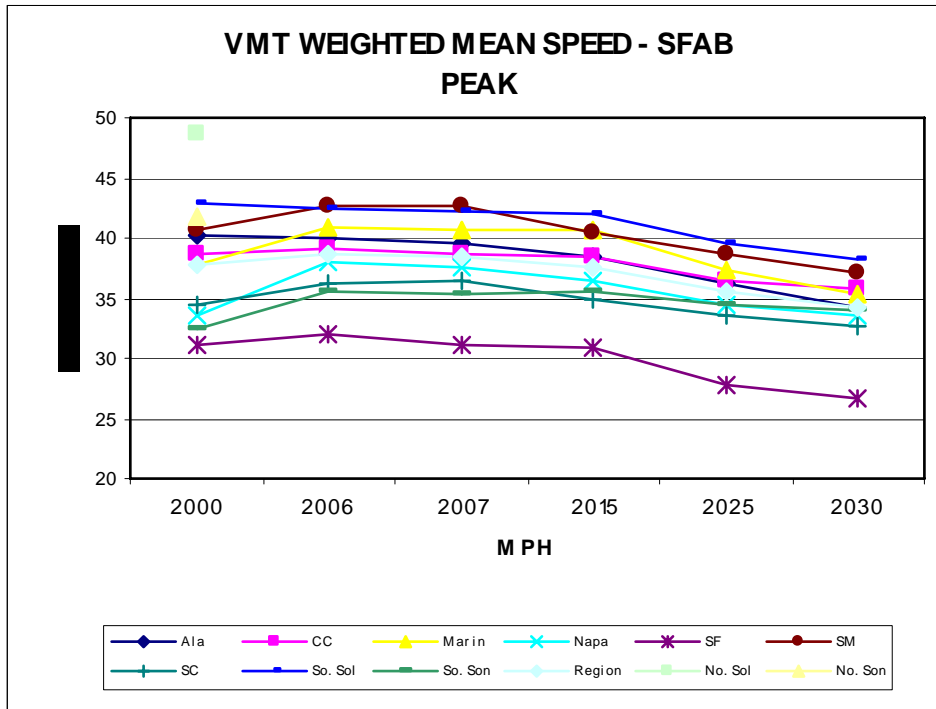


Growth Rates

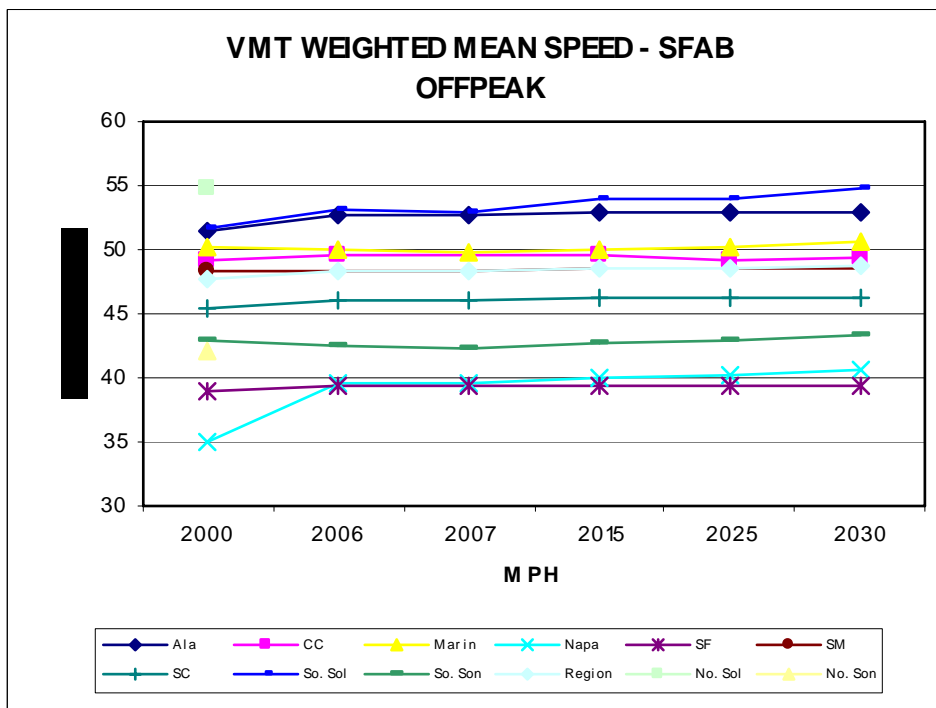




**Chart 9**



**Chart 10**



## **SACRAMENTO METROPOLITAN AREA**

Sacramento Area Council of Governments (SACOG) provided ARB with VMT and speed distributions in 2005 and again in late September 2006. Unfortunately, the timelines for updating EMFAC prevented ARB from assessing and including SACOG 2006 data.

During prior QA processes on SACOG data, staff found that SACOG VMT was significantly lower in the base year than MVSTAFF data or ARB's calculated VMT based on DMV vehicle populations and SMOG Check accrual rates. In 2005 ARB, SACOG, the Sacramento Metropolitan Air Quality Management District (SMAQMD) consulted on what VMT estimates should be used in WD1. At that time MVSTAFF base year VMT estimates were lower than ARB calculated VMT and higher than SACOG modeled VMT. Hence, MVSTAFF VMT estimates for 2003 were used as a "compromise" base year along with SACOG VMT growth rates to determine future years. The adjusted VMT estimates were put into WD1.

In May 2006, ARB, SACOG, the SMAQMD consulted again on VMT. There were no updated VMT estimates yet available from SACOG; however, the three agencies agreed that because VMT estimates anticipated from SACOG in the fall of 2006 were expected to more closely match VMT in EMFAC2002, Version 2.2 (Apr03) than the 2005 VMT agreement, the Sacramento Metropolitan Area VMT was re-matched to EMFAC 2002.

The Northern Solano County is an exception to this approach. Staff inadvertently referred back to the 2005 agreement and used MVSTAFF data for that county's base year VMT. MTC growth rates (August 2006) were used to calculate future years. Although the method is inconsistent with the 2006 agreement with SACOG, at least the VMT does err on the higher, more conservative side. EMFAC VMT for all counties in the Sacramento Metropolitan Area will need to be updated at the first opportunity to better reflect the latest data available.

The speed distributions used in EMFAC 2007 for the region are SACOG's 2005 data, unadjusted. Northern Solano County speeds were provided by MTC in August 2006.

Although ARB was unable to include the 2006 activity from SACOG in EMFAC 2007, this data, once reviewed, will be included in future activity updates to EMFAC. In the mean time, the "what if scenario" features of EMFAC can be used to update VMT and speeds for planning purposes. The VMT data currently included in EMFAC 2007 is summarized in Table 7.

**Table 7: EMFAC 2007 VMT for the Sacramento Metropolitan Area**

County	Area	2000	2006	2015	2025	2030
EIDorado (MC)	9	2,874	3,454	4,156	4,743	4,973
Placer (SV)	30	6,034	7,598	9,461	10,860	11,216
Placer (MC)	12	746	937	1,169	1,343	1,400
Sacramento	31	27,090	31,010	35,567	39,608	40,685
Sutter	34	1,921	2,443	3,534	4,963	5,860
Yolo	36	4,577	5,314	6,535	7,662	7,692
Yuba	37	1,278	1,573	2,157	2,849	3,249
No. Solano (SV) (MVSTAFF)	33	4,731	5,316	7,425	8,622	10,508

(VMT in thousands)

**SANTA BARBARA COUNTY**

Santa Barbara County Association of Governments (SBCAG) provided total VMT estimates for light-duty vehicles in September 2006. The submittal is summarized in Table 8.

**Table 8: SBCAG Submittal**

<b>Traffic Model Citation:</b>	Draft 2006 Regional Transportation Plan and Draft 2007 Clean Air Plan, SBCAG, September/October 2006
<b>Date of Submittal:</b>	September 2006 Corrections submitted in October 2006
<b>Years Provided:</b>	2000, 2010, 2020, 2030
<b>VMT Vehicle Classes:</b>	VMT for the light and medium-duty fleet were generated from SBCAG's model and distributed by vehicle class by ARB. VMT estimates for heavy-duty vehicles are based on ARB calculations from DMV updates.
<b>Speeds Vehicle Classes:</b>	Apply to light- and medium-duty vehicles plus motorcycles. ARB default speeds to be used for heavy-duty vehicles.
<b>Speed Distributions by Period:</b>	SBCAG provided 3 unique speeds (AM-Peak, PM-Peak, and Off-Peak) spread over 5 periods. ARB split the Off-Peak period into 4 periods with the same speed distribution to populate the 6 periods in EMFAC. Thus periods 1, 3, 4, and 6 will be assigned the same Off-Peak speed distribution. SBCAG's period definitions change over time to accommodate peak spreading.

During the QA process the data was compared to:

EMFAC 2002, Version 2.2 (Apr03)

EMFAC WD2B

California Motor Vehicle Stock, Travel and Fuel Forecast, Dec 2005 (MVSTAFF Dec05)

DOF human population growth rates (Human Pop Aug06)

The VMT comparison and growth rates for Santa Barbara are shown in Chart 11. Mean speeds by period and by year are shown in Chart 12.

**Chart 11: Santa Barbara County**

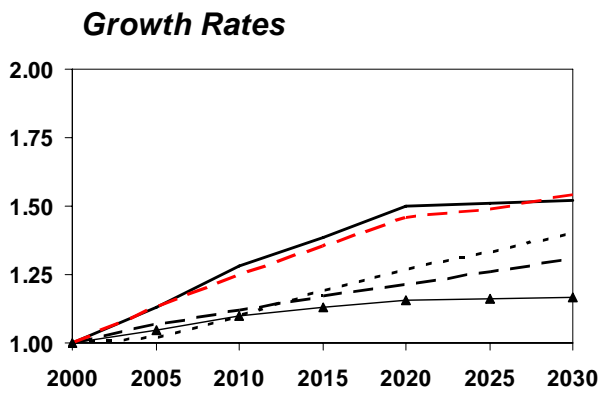
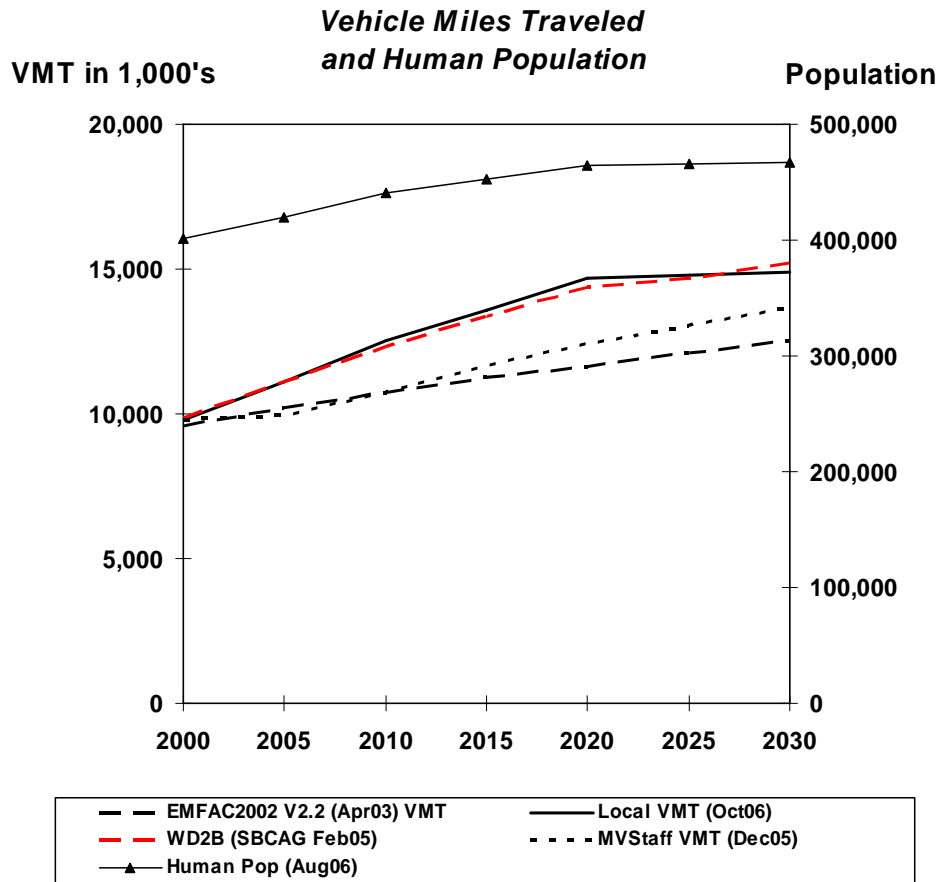
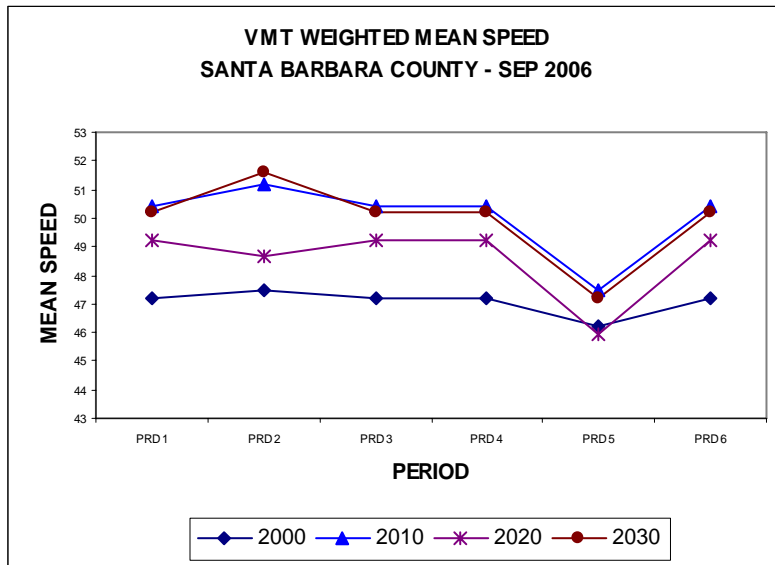


Chart 12



**EMISSIONS IMPACTS FROM UPDATED VMT  
(Version 2.245 COMPARED TO Version 2.244)**

ARB estimates the impacts associated with a given change in the EMFAC model by making one type of change at a time and then comparing the difference in emissions. Version 2.244 of EMFAC 2007 reflects revisions made up to the point of updating VMT. Version 2.245 includes VMT updates. Thus, the difference between 2.245 and 2.244 can be attributed to the VMT update.

Table 9 shows the statewide differences in emissions, vehicle population, and VMT between Version 2.245 and 2.244. In CY 2002 VMT increased by roughly 4% statewide. ROG emissions increased by roughly 2%, NOx by 8%, and PM10 by 10%. In CY 2020 VMT increased by roughly 3.5%, ROG by less than 1%, NOx by 4%, and PM10 by 5%.

Table 10 shows that in the South Coast Air Basin VMT increased by 3%, ROG by 3%, NOx by 10%, and PM10 by 14% in CY 2002. In 2020 South Coast VMT increased by almost 7% while ROG decreased less than 1%. NOx and PM10 increased 4% and 8%, respectively. For more information on urban areas, see Tables 9 through 14.

**Table 9: Statewide New VMT and Emission Impacts**

Statewide Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.244)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	12149294	391430240	3345.01	30256.78	2224.44	265085.40	59.18
1990	18590314	666071420	2170.90	22341.42	2405.39	412007.70	96.36
2000	22238266	769936900	1151.17	11128.46	1855.60	470065.60	69.03
2002	23522966	827356990	945.24	9074.67	1703.19	509137.20	67.56
2005	25779210	917129220	809.31	7320.39	1819.37	586549.50	81.47
2010	27418770	941118590	572.44	4988.62	1334.92	597391.40	71.00
2015	29607084	1001779800	438.28	3534.80	940.94	647440.10	66.40
2020	31486028	1059602400	354.78	2604.85	663.68	694032.20	62.96
Statewide Summer Episodic On-Road Motor Vehicle Inventories With Revised VMTs (4) (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	12149294	403566500	3419.48	31385.18	2316.33	274994.70	65.64
1990	18590314	691047620	2239.14	23348.06	2549.61	430949.70	107.71
2000	22238266	799847680	1180.16	11606.22	1989.21	490688.00	76.39
2002	23522966	859649340	968.08	9482.31	1832.32	531556.50	74.62
2005	25779210	955231100	831.50	7688.97	1976.44	614643.40	90.40
2010	26819682	955739200	570.81	5132.74	1373.19	604799.80	74.28
2015	29203932	1028757100	437.56	3675.23	965.78	659870.10	69.23
2020	31283970	1096582100	356.91	2762.53	692.09	711353.20	66.12
Difference (Ver. 2.245 - Ver. 2.244) in Statewide Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	12136260	74.47	1128.40	91.90	9909.30	6.46
1990	0	24976200	68.24	1006.64	144.22	18942.00	11.35
2000	0	29910780	28.99	477.76	133.62	20622.40	7.36
2002	0	32292350	22.84	407.63	129.13	22419.30	7.05
2005	0	38101880	22.19	368.58	157.08	28093.90	8.93
2010	-599088	14620610	-1.63	144.12	38.27	7408.40	3.29
2015	-403152	26977300	-0.72	140.43	24.84	12430.00	2.83
2020	-202058	36979700	2.13	157.68	28.42	17321.00	3.16
Percentage Change in Statewide Emission Inventories (relative to Ver. 2.244)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	3.10%	2.23%	3.73%	4.13%	3.74%	10.91%
1990	0.00%	3.75%	3.14%	4.51%	6.00%	4.60%	11.78%
2000	0.00%	3.88%	2.52%	4.29%	7.20%	4.39%	10.66%
2002	0.00%	3.90%	2.42%	4.49%	7.58%	4.40%	10.44%
2005	0.00%	4.15%	2.74%	5.03%	8.63%	4.79%	10.96%
2010	-2.18%	1.55%	-0.29%	2.89%	2.87%	1.24%	4.63%
2015	-1.36%	2.69%	-0.16%	3.97%	2.64%	1.92%	4.27%
2020	-0.64%	3.49%	0.60%	6.05%	4.28%	2.50%	5.02%
ROG_Tot <sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.							
PM10_Tot <sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.							
Fuel <sup>3</sup> - VMT Matching by Fuel Type Using Populations							

**Table 10: South Coast Air Basin New VMT and Emission Impacts**

South Coast Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.244)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	4826178	157146990	1298.27	11254.71	806.82	103864.80	16.74
1990	7547354	273917630	835.75	8598.15	852.76	162724.30	26.36
2000	8884512	313004830	425.21	4211.28	611.51	183001.00	20.81
2002	9438759	337964290	349.39	3490.45	553.66	202214.70	21.64
2005	10519533	380412450	293.72	2821.72	546.59	232403.90	25.78
2010	10495556	365368060	188.08	1755.65	379.49	221014.80	23.10
2015	11173246	377321310	145.54	1257.69	276.40	232865.00	22.96
2020	11647190	388438300	118.58	927.87	193.48	242053.20	22.12
South Coast Summer Episodic On-Road Motor Vehicle Inventories With Revised VMTs (4) (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	4826178	161397680	1324.30	11673.59	841.75	107753.20	19.61
1990	7547354	282561700	864.72	8974.63	914.96	170318.70	31.42
2000	8884512	323009820	435.50	4364.13	668.42	190653.00	23.83
2002	9438759	348730080	358.42	3629.85	610.60	210632.80	24.69
2005	10519533	393766780	302.36	2951.95	617.21	243338.30	29.71
2010	10483311	377734430	188.18	1820.36	391.72	228070.30	24.60
2015	11350811	397695230	145.36	1319.83	282.35	244315.90	24.39
2020	11976029	414266050	118.51	989.38	201.76	256613.90	23.81
Difference (Ver. 2.245 - Ver. 2.244) in South Coast Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	4250690	26.03	418.88	34.93	3888.40	2.87
1990	0	8644070	28.98	376.48	62.20	7594.40	5.05
2000	0	10004990	10.29	152.84	56.91	7652.00	3.02
2002	0	10765790	9.03	139.40	56.94	8418.10	3.05
2005	0	13354330	8.64	130.23	70.63	10934.40	3.93
2010	-12245	12366370	0.11	64.71	12.23	7055.50	1.50
2015	177565	20373920	-0.18	62.14	5.96	11450.90	1.43
2020	328839	25827750	-0.07	61.51	8.28	14560.70	1.69
Percentage Change in South Coast Emission Inventories (relative to Ver. 2.244)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	2.70%	2.00%	3.72%	4.33%	3.74%	17.12%
1990	0.00%	3.16%	3.47%	4.38%	7.29%	4.67%	19.16%
2000	0.00%	3.20%	2.42%	3.63%	9.31%	4.18%	14.50%
2002	0.00%	3.19%	2.58%	3.99%	10.28%	4.16%	14.10%
2005	0.00%	3.51%	2.94%	4.62%	12.92%	4.70%	15.23%
2010	-0.12%	3.38%	0.06%	3.69%	3.22%	3.19%	6.48%
2015	1.59%	5.40%	-0.12%	4.94%	2.16%	4.92%	6.24%
2020	2.82%	6.65%	-0.06%	6.63%	4.28%	6.02%	7.65%
ROG_Tot <sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.							
PM10_Tot <sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.							
Fuel <sup>3</sup> - VMT Matching by Fuel Type Using Populations							

**Table 11: Sacramento Valley Air Basin New VMT and Emission Impacts**

Sacramento Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.244)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	930468	29582826	273.25	2576.02	177.39	20080.16	5.04
1990	1386223	49401012	181.70	1877.40	197.96	31224.69	8.59
2000	1640558	55741092	96.12	917.84	155.27	34840.61	5.83
2002	1774658	61560824	79.78	747.11	143.94	38176.44	5.56
2005	1987329	69618544	70.26	607.34	159.87	45283.35	6.78
2010	2167608	73450904	51.44	421.31	116.45	47186.27	5.73
2015	2371109	79771488	38.55	289.68	78.54	51701.06	5.15
2020	2573026	86390472	30.69	208.40	54.90	56554.10	4.89
Sacramento Summer Episodic On-Road Motor Vehicle Inventories With Revised VMTs (4) (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	930468	30025802	276.24	2629.86	181.80	20472.24	5.40
1990	1386223	50471700	184.28	1924.19	204.11	32015.06	9.13
2000	1640558	57266592	97.28	940.47	161.17	35900.34	6.19
2002	1774658	63236352	80.66	766.01	149.47	39321.32	5.88
2005	1987329	71431648	71.18	624.45	166.65	46618.51	7.19
2010	2119383	73263888	52.04	432.41	123.11	47498.54	6.01
2015	2349824	81618752	39.86	306.19	86.27	53301.73	5.50
2020	2557394	88570064	32.34	227.06	61.40	58491.07	5.20
Difference (Ver. 2.245 - Ver. 2.244) in Sacramento Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	442976	2.99	53.84	4.41	392.08	0.35
1990	0	1070688	2.58	46.79	6.15	790.37	0.53
2000	0	1525500	1.16	22.63	5.91	1059.73	0.36
2002	0	1675528	0.88	18.90	5.53	1144.88	0.32
2005	0	1813104	0.92	17.11	6.78	1335.16	0.40
2010	-48225	-187016	0.61	11.10	6.67	312.27	0.28
2015	-21285	1847264	1.31	16.51	7.74	1600.67	0.35
2020	-15632	2179592	1.65	18.66	6.50	1936.97	0.32
Percentage Change in Sacramento Emission Inventories (relative to Ver. 2.244)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	1.50%	1.09%	2.09%	2.49%	1.95%	7.02%
1990	0.00%	2.17%	1.42%	2.49%	3.11%	2.53%	6.22%
2000	0.00%	2.74%	1.21%	2.47%	3.80%	3.04%	6.10%
2002	0.00%	2.72%	1.10%	2.53%	3.84%	3.00%	5.82%
2005	0.00%	2.60%	1.31%	2.82%	4.24%	2.95%	5.95%
2010	-2.22%	-0.25%	1.18%	2.63%	5.73%	0.66%	4.89%
2015	-0.90%	2.32%	3.39%	5.70%	9.85%	3.10%	6.77%
2020	-0.61%	2.52%	5.38%	8.96%	11.84%	3.42%	6.46%
ROG_Tot <sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.							
PM10_Tot <sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.							
Fuel <sup>3</sup> - VMT Matching by Fuel Type							



**Table 12: San Francisco Air Basin New VMT and Emission Impacts**

San Francisco Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.244)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	3034318	93108128	819.33	7527.50	518.42	59127.32	8.96
1990	3934765	132557320	424.47	4409.22	436.49	76279.27	12.40
2000	4710429	154959220	225.95	2183.40	303.48	92228.70	9.82
2002	4843978	160981600	189.05	1831.73	275.09	96221.17	9.56
2005	4931736	163790940	146.75	1331.82	244.57	100582.10	10.51
2010	5448062	176046770	106.45	931.24	181.30	108362.10	10.36
2015	5854649	187606480	78.56	640.57	123.38	115824.20	10.18
2020	6160764	196181440	61.65	458.81	87.09	123172.80	10.28

San Francisco Summer Episodic On-Road Motor Vehicle Inventories With Revised VMTs (4) (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	3034318	93108128	819.33	7527.50	518.42	59127.32	8.96
1990	3934765	132557320	424.47	4409.22	436.49	76279.27	12.40
2000	4710429	154959220	225.95	2183.40	303.48	92228.70	9.82
2002	4843978	160981600	189.05	1831.73	275.09	96221.17	9.56
2005	4931736	163790940	146.75	1331.82	244.57	100582.10	10.51
2010	5283268	170180350	104.63	909.18	178.56	104274.80	10.08
2015	5745727	183333070	78.90	637.60	123.20	111751.20	9.93
2020	6136616	193977140	64.19	474.55	88.57	119389.90	10.09

Difference (Ver. 2.245 - Ver. 2.244) in San Francisco Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
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	0.00	0.00	0.00	0.00	0.00
2005	0	0	0.00	0.00	0.00	0.00	0.00
2010	-164794	-5866420	-1.82	-22.05	-2.74	-4087.30	-0.28
2015	-108922	-4273410	0.35	-2.96	-0.18	-4073.00	-0.26
2020	-24148	-2204300	2.54	15.74	1.48	-3782.90	-0.19

Percentage Change in San Francisco Emission Inventories (relative to Ver. 2.244)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
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%	0.00%	0.00%	0.00%	0.00%	0.00%
2005	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2010	-3.02%	-3.33%	-1.71%	-2.37%	-1.51%	-3.77%	-2.73%
2015	-1.86%	-2.28%	0.44%	-0.46%	-0.15%	-3.52%	-2.52%
2020	-0.39%	-1.12%	4.12%	3.43%	1.70%	-3.07%	-1.86%

ROG\_Tot<sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.

PM10\_Tot<sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.

Fuel<sup>3</sup> - VMT Matching by Fuel Type

**Table 13: San Diego Air Basin New VMT and Emission Impacts**

San Diego Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.244)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	943100	28715544	271.64	2419.15	156.19	20320.46	3.15
1990	1617500	57259732	179.10	1872.31	179.23	36119.32	5.38
2000	1930482	65436412	88.07	867.45	126.26	37502.14	4.30
2002	2047831	70645840	72.19	705.44	112.65	40989.52	4.35
2005	2229141	77174632	59.49	562.99	106.17	45682.71	4.88
2010	2407160	79362312	44.54	402.53	81.23	46798.45	4.71
2015	2612149	84857272	35.61	294.04	59.92	50803.77	4.79
2020	2805262	90583536	30.53	227.65	46.82	54481.10	4.93
San Diego Summer Episodic On-Road Motor Vehicle Inventories With Revised VMTs (4) (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	943100	32722436	298.88	2778.65	178.17	22993.51	3.68
1990	1617500	65249684	196.45	2152.81	206.03	40978.79	6.40
2000	1930482	74567344	94.61	995.50	146.64	42556.80	5.17
2002	2047831	80503720	76.80	810.05	130.15	46524.00	5.22
2005	2229141	87943288	63.02	649.74	122.40	51856.64	5.87
2010	2324121	86947920	45.30	453.14	89.51	50801.80	5.43
2015	2476352	91082784	35.65	330.48	65.27	53768.82	5.42
2020	2646354	96987464	30.21	256.12	50.12	57251.29	5.52
Difference (Ver. 2.245 - Ver. 2.244) in San Diego Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	4006892	27.24	359.50	21.99	2673.05	0.53
1990	0	7989952	17.35	280.50	26.80	4859.47	1.02
2000	0	9130932	6.54	128.05	20.39	5054.66	0.87
2002	0	9857880	4.61	104.61	17.50	5534.48	0.87
2005	0	10768656	3.53	86.76	16.23	6173.93	0.98
2010	-83039	7585608	0.76	50.61	8.28	4003.35	0.71
2015	-135797	6225512	0.04	36.44	5.35	2965.05	0.64
2020	-158908	6403928	-0.31	28.47	3.30	2770.19	0.60
Percentage Change in San Diego Emission Inventories (relative to Ver. 2.244)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	13.95%	10.03%	14.86%	14.08%	13.15%	16.76%
1990	0.00%	13.95%	9.69%	14.98%	14.95%	13.45%	18.86%
2000	0.00%	13.95%	7.42%	14.76%	16.15%	13.48%	20.16%
2002	0.00%	13.95%	6.39%	14.83%	15.54%	13.50%	20.12%
2005	0.00%	13.95%	5.93%	15.41%	15.29%	13.51%	20.16%
2010	-3.45%	9.56%	1.71%	12.57%	10.19%	8.55%	15.16%
2015	-5.20%	7.34%	0.11%	12.39%	8.93%	5.84%	13.33%
2020	-5.66%	7.07%	-1.03%	12.51%	7.05%	5.08%	12.10%
ROG_Tot <sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.							
PM10_Tot <sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.							
Fuel <sup>3</sup> - VMT Matching by Fuel Type							

**Table 14: San Joaquin Valley Air Basin New VMT and Emission Impacts**

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.244)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	845708	30491510	258.55	2579.79	232.35	24291.57	11.90
1990	1395276	54288600	206.12	2126.34	307.81	40510.16	19.93
2000	1943266	71829128	129.96	1231.33	304.55	51972.92	13.41
2002	2083564	78362592	107.76	994.69	292.28	55791.09	12.19
2005	2389187	91948456	100.45	838.29	360.92	70270.88	15.42
2010	2795653	104662510	77.63	617.39	274.45	78084.16	12.29
2015	3080186	115625980	58.43	432.79	185.44	88407.03	10.21
2020	3399954	128013220	46.98	321.49	131.91	99194.45	9.18
San Joaquin Summer Episodic On-Road Motor Vehicle Inventories With Revised VMTs (4) (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	845708	32804326	271.98	2791.86	252.69	26215.13	13.63
1990	1395276	58324140	217.20	2295.86	336.08	43726.87	22.84
2000	1943266	77177368	136.03	1328.98	334.76	56056.50	15.36
2002	2083564	84201024	112.47	1075.09	321.58	60163.98	13.94
2005	2389187	98949112	105.34	911.92	398.60	75950.93	17.65
2010	2590992	103175630	78.72	648.00	299.79	77959.70	13.69
2015	2871252	115712810	59.78	461.99	207.29	88871.69	11.36
2020	3181907	129483280	47.87	348.33	146.25	100805.50	9.98
Difference (Ver. 2.245 - Ver. 2.244) in San Joaquin Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0	2312816	13.43	212.07	20.34	1923.56	1.74
1990	0	4035540	11.08	169.52	28.27	3216.71	2.92
2000	0	5348240	6.07	97.65	30.21	4083.58	1.95
2002	0	5838432	4.71	80.39	29.30	4372.89	1.75
2005	0	7000656	4.89	73.62	37.69	5680.05	2.23
2010	-204661	-1486880	1.09	30.61	25.34	-124.46	1.40
2015	-208934	86830	1.35	29.20	21.85	464.66	1.15
2020	-218047	1470060	0.88	26.84	14.34	1611.05	0.80
Percentage Change in San Joaquin Emission Inventories (relative to Ver. 2.244)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	0.00%	7.59%	5.19%	8.22%	8.75%	7.92%	14.59%
1990	0.00%	7.43%	5.38%	7.97%	9.18%	7.94%	14.65%
2000	0.00%	7.45%	4.67%	7.93%	9.92%	7.86%	14.57%
2002	0.00%	7.45%	4.37%	8.08%	10.02%	7.84%	14.35%
2005	0.00%	7.61%	4.87%	8.78%	10.44%	8.08%	14.46%
2010	-7.32%	-1.42%	1.40%	4.96%	9.23%	-0.16%	11.37%
2015	-6.78%	0.08%	2.31%	6.75%	11.78%	0.53%	11.24%
2020	-6.41%	1.15%	1.88%	8.35%	10.87%	1.62%	8.70%
ROG_Tot <sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.							
PM10_Tot <sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.							
Fuel <sup>3</sup> - VMT Matching by Fuel Type							

## **EMISSIONS IMPACTS FROM UPDATED SPEED DISTRIBUTIONS** **(Version 2.246 COMPARED TO Version 2.245)**

Data received as VMT by speed bin are converted into percent distributions. The speed distributions for each area are updated according to calendar years and periods submitted. In order to determine the emissions impacts from speed distribution updates we compare EMFAC version 2.246 to 2.245. As noted earlier in this document, version 2.245 includes VMT updates but not speed revisions. Version 2.246 includes speed revisions as well. Thus, the difference in model run between the two versions can be attributed to the effects of the updated speed distributions.

Table 15 shows that in CY 2002 the EMFAC 2007 updates to speed distributions caused a statewide decrease in ROG, an increase in NO<sub>x</sub>, and a decrease in PM<sub>10</sub>, each by less than 1%. In CY 2020 there was a statewide change of less than 1% that increased ROG and NO<sub>x</sub> and decreased PM<sub>10</sub>.

Table 16 shows the effects of updated speeds in the South Coast Air Basin. In CY 2002 there was no detectable change in ROG, NO<sub>x</sub>, or PM<sub>10</sub>. In CY 2020 there was less than 1% increase in ROG, NO<sub>x</sub>, and PM<sub>10</sub>.

**Table 15: Statewide Emission Impacts from New Speed Distributions**

Statewide Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	12149294	403566500	3419.48	31385.18	2316.33	274994.70	65.64
1990	18590314	691047620	2239.14	23348.06	2549.61	430949.70	107.71
2000	22238266	799847680	1180.16	11606.22	1989.21	490688.00	76.39
2002	23522966	859649340	968.08	9482.31	1832.32	531556.50	74.62
2005	25779210	955231100	831.50	7688.97	1976.44	614643.40	90.40
2010	26819682	955739200	570.81	5132.74	1373.19	604799.80	74.28
2015	29203932	1028757100	437.56	3675.23	965.78	659870.10	69.23
2020	31283970	1096582100	356.91	2762.53	692.09	711353.20	66.12
Statewide Summer Episodic On-Road Motor Vehicle Inventories With Revised Speeds (4) (Calculated Using EMFAC2007 draft ver 2.246)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	12149294	403566500	3419.48	31385.18	2316.33	274994.70	65.64
1990	18590314	691047620	2239.14	23348.06	2549.61	430949.70	107.71
2000	22238266	799847680	1181.18	11620.95	1990.48	491503.80	76.42
2002	23522966	859649340	967.44	9478.02	1832.72	531287.60	74.58
2005	25779210	955231100	831.26	7688.09	1976.72	614489.40	90.36
2010	26819682	955739200	571.02	5134.34	1373.13	605052.10	74.29
2015	29203932	1028757100	437.64	3674.17	965.68	659756.80	69.19
2020	31283970	1096582100	357.13	2763.79	692.12	711756.00	66.11
Difference (Ver. 2.246 - Ver. 2.245) in Statewide Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
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	1.01	14.73	1.26	815.80	0.03
2002	0	0	-0.64	-4.29	0.40	-268.90	-0.04
2005	0	0	-0.24	-0.88	0.28	-154.00	-0.04
2010	0	0	0.22	1.60	-0.07	252.30	0.01
2015	0	0	0.08	-1.06	-0.10	-113.30	-0.05
2020	0	0	0.22	1.26	0.03	402.80	-0.01
Percentage Change in Statewide Emission Inventories (relative to Ver. 2.245)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
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%	0.09%	0.13%	0.06%	0.17%	0.04%
2002	0.00%	0.00%	-0.07%	-0.05%	0.02%	-0.05%	-0.05%
2005	0.00%	0.00%	-0.03%	-0.01%	0.01%	-0.03%	-0.04%
2010	0.00%	0.00%	0.04%	0.03%	0.00%	0.04%	0.01%
2015	0.00%	0.00%	0.02%	-0.03%	-0.01%	-0.02%	-0.07%
2020	0.00%	0.00%	0.06%	0.05%	0.00%	0.06%	-0.02%
ROG_Tot <sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.							
PM10_Tot <sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.							
Fuel <sup>3</sup> - VMT Matching by Fuel Type Using Populations							

**Table 16: South Coast Air Basin Emission Impacts from New Speed Distributions**

South Coast Summer Episodic On-Road Motor Vehicle Inventories (Calculated Using EMFAC2007 draft ver 2.245)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	4826178	161397680	1324.30	11673.59	841.75	107753.20	19.61
1990	7547354	282561700	864.72	8974.63	914.96	170318.70	31.42
2000	8884512	323009820	435.50	4364.13	668.42	190653.00	23.83
2002	9438759	348730080	358.42	3629.85	610.60	210632.80	24.69
2005	10519533	393766780	302.36	2951.95	617.21	243338.30	29.71
2010	10483311	377734430	188.18	1820.36	391.72	228070.30	24.60
2015	11350811	397695230	145.36	1319.83	282.35	244315.90	24.39
2020	11976029	414266050	118.51	989.38	201.76	256613.90	23.81
South Coast Summer Episodic On-Road Motor Vehicle Inventories With Revised Speeds (4) (Calculated Using EMFAC2007 draft ver 2.246)							
Cal. Year	Population	VMT*(1000)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
1980	4826178	161397680	1324.30	11673.59	841.75	107753.20	19.61
1990	7547354	282561700	864.72	8974.63	914.96	170318.70	31.42
2000	8884512	323009820	435.50	4364.13	668.42	190653.00	23.83
2002	9438759	348730080	358.42	3629.85	610.60	210632.80	24.69
2005	10519533	393766780	302.36	2951.95	617.21	243338.30	29.71
2010	10483311	377734430	188.47	1823.19	391.61	228494.40	24.64
2015	11350811	397695230	145.55	1322.18	282.34	244824.10	24.44
2020	11976029	414266050	118.76	992.75	201.83	257666.00	23.90
Difference (Ver. 2.246 - Ver. 2.245) in South Coast Emission Inventories (tons per day)							
Cal. Year	Population	VMT(miles)	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
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	0.00	0.00	0.00	0.00	0.00
2005	0	0	0.00	0.00	0.00	0.00	0.00
2010	0	0	0.29	2.83	-0.11	424.10	0.04
2015	0	0	0.19	2.35	-0.02	508.20	0.04
2020	0	0	0.24	3.37	0.07	1052.10	0.09
Percentage Change in South Coast Emission Inventories (relative to Ver. 2.245)							
Cal. Year	Population	VMT	ROG_Tot <sup>1</sup>	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot <sup>2</sup>
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%	0.00%	0.00%	0.00%	0.00%	0.00%
2005	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2010	0.00%	0.00%	0.15%	0.16%	-0.03%	0.19%	0.18%
2015	0.00%	0.00%	0.13%	0.18%	-0.01%	0.21%	0.18%
2020	0.00%	0.00%	0.21%	0.34%	0.03%	0.41%	0.39%
ROG_Tot <sup>1</sup> - This includes running, starting, idle exhaust emissions and emissions from all evaporative processes.							
PM10_Tot <sup>2</sup> - Total emissions from running, starting, idle processes, and from tire wear and brake wear.							
Fuel <sup>3</sup> - VMT Matching by Fuel Type Using Populations							

**APPENDIX A**  
**Southern California VMT and Speeds**  
**for EMFAC WD2 and the 2007 AQMP/SIP**  
**Data Review Questions for SCAG**

**Travel Model Citation**

1. Please provide a citation that will uniquely identify the travel demand model runs that generated the vehicle activity for EMFAC2007 and the 2007 AQMP/SIP.

*SCAG: Draft 2007 AQMP Interim Model Runs - SCAG developed an Interim Travel Demand Model for the draft EMFAC2007 and 2007 AQMP/SIP. The Interim Travel Demand Model is based on the current Regional Travel Demand Model with the following improvements: revised socio-economic data, new trip rates, new Port Trips, new Heavy Duty Truck External Model, and with revised volume delay curves.*

**Average Speeds**

2. Los Angeles and Orange County heavy-duty truck mean speeds increase significantly between 2002 and 2035, particularly for the peak periods. This occurs despite steady increases in truck VMT. How can this best be explained?

*SCAG: It appears data listed for 2030 am peak period in "hd chart" sheet are the same as that of 2020's.*

*The speed increase is attributed to the new truck lane facilities introduced in 04RTP (2030 Plan includes truck lanes from ports to Barstow along I-710, SR-60, and I-15).*

*One of SCAG's concerns is the use of VMT by 5 mile speed range. For example, the average 2030 am peak period heavy-duty truck speed in Orange County is 31.4 mph as estimated by the model. When estimated from VMT by 5 miles range, that speed becomes 35.1 mph.*

3. Can you help us explain some other trends for HDTs?
  - Decreasing speeds in South Coast Riverside and Coachella, Antelope
  - Sharp increase in South Coast San Bernardino 2020-2030 (PM peak and mid-day)

*SCAG: The addition of truck lane facilities will also increase average truck speeds in San Bernardino as well as having other distributional effects.*

4. Heavy-duty truck mean speeds remain greater than light-duty mean speeds in the same period for all periods. Can you provide speed distributions by time period facility type, to help us understand the basis for this? How would we explain faster HDT speeds for the same periods on the same facilities?

*SCAG: Yes, SCAG will provide the data.*

5. To help us better understand the speed trends and differences in speeds by county, can SCAG provide average speeds by facility type and also per-lane capacity assumptions by facility type in terms of vehicles per hour per lane (vphpl) and total lane miles by facility type?

*SCAG: Yes, SCAG will provide the data.*

#### **VMT**

6. We note that VMT estimates are generally higher than those provided in 2005, and that growth rates are faster for HDTs. Is this consistent with SCAG's expectations given latest socioeconomic data and travel model improvements?

*SCAG: Yes, the interim model was validated to 2003 HPMS.*

7. For the areas of San Bernardino and Riverside Counties outside the current SCAG modeling domain, can ARB continue to use our own estimates? We would revisit these estimates when the SCAG domain is extended.

*SCAG: Yes.*

8. We are concerned about possible underestimation of HDT VMT in some areas. Compared to the estimates ARB, SCAG and SCAQMD agreed upon last summer, the April 2006 SCAG estimates are 60-80 percent lower in Coachella Valley, Antelope Valley, South Coast San Bernardino and Ventura County. To avoid undercounting emissions, would it be prudent to continue to use the 2005 ARB numbers--in some or all of those areas--and grow them with the new SCAG growth rates?

*SCAG: Please use the 2005 ARB numbers. SCAG is reviewing external truck model and outputs prepared by Cambridge Systematics, Inc.*

9. Can you tell us if the dip in heavy-duty VMT between 2005 and 2007, in South Coast San Bernardino, Antelope Valley, and Victor Valley, is correct? We note that all other counties show almost flat VMT growth for the same period; is that right? Finally, we see a dip in light and medium-duty VMT between 2007 and 2010 in South Coast Los Angeles and Banning; is this also correct?

*SCAG: SCAG will check the model inputs SEDS.*