EMFAC Modeling Change Technical Memo

SUBJECT: Modification of Mileage Accrual Rates

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SUMMARY

The mileage accrual rate is an estimate of the miles per year traveled. The mileage accrual rates estimated in EMFAC are based on analyses of odometer data recorded in the Smog Check Program. These estimates are area, age, and vehicle class specific.

The EMFAC model maintains an internal relationship between mileage accrual rates, vehicle population, and vehicle miles of travel (VMT). Essentially, the VMT of a specific age and class of vehicles can be calculated as the product of the population and the corresponding mileage accrual rate.

This update will use data from the Bureau of Automotive Repair (BAR) Smog Check data base to determine the accrual rates for the following gasoline-powered vehicle classes:

DESCRIPTION		WEIGHT CLASS
PASSENGER CARS	(PC)	ALL
LIGHT-DUTY TRUCKS	(T1)	0- 3750
LIGHT-DUTY TRUCKS	(T2)	3751- 5750
MEDIUM-DUTY TRUCKS	(T3)	5751- 8500
LIGHT-HEAVY DUTY TRUCKS	(T4)	8501-10000
LIGHT-HEAVY DUTY TRUCKS	(T5)	10001-14000
MOTOR HOMES	(MH)	ALL

Only gasoline-powered vehicles are included in the Smog Check program, so it will be assumed that diesel and electric-powered vehicles will have the same accrual rates as gasoline-powered vehicles of the same class. Therefore, this update will include gasoline, diesel, and electric vehicles for vehicle classes PC-MH. These results are summarized in Tables 1 and 2.

Table 1
Summary of Emissions Changes due to Mileage Accrual Rates
Calendar Year 2002

Air Basin	Emission Changes by Pollutant, tons per day				
	ROG	CO	NOx	CO2	PM10
Statewide	-16.62	-514.48	-71.12	-22663.70	-2.33
South Coast Air Basin	-5.85	-94.85	-11.67	539.90	0.07
San Joaquin Valley AB	-3.72	-112.84	-14.46	-5010.40	-0.52
Sacramento Valley AB	1.21	27.38	1.29	742.30	0.10
San Diego Air Basin	-3.07	-85.47	-10.87	-4336.58	-0.46
San Francisco Bay Area	3.06	23.16	-1.96	-2275.52	-0.21

Table 2
Summary of Emissions Changes due to Mileage Accrual Rates
Calendar Year 2015

Air Basin	Emission Changes by Pollutant, tons per day				
	ROG	CO	NOx	CO2	PM10
Statewide	-1.31	-186.76	-25.07	-32397.90	-3.36
South Coast Air Basin	-2.62	-35.23	-4.67	-743.90	-0.03
San Joaquin Valley AB	-0.23	-42.54	-5.48	-6966.48	-0.72
Sacramento Valley AB	-0.15	9.98	0.06	910.92	0.14
San Diego Air Basin	-0.27	-31.85	-3.54	-5031.62	-0.58
San Francisco Bay Area	1.86	24.65	1.15	-2058.20	-0.13

AFFECTED SOURCE CODE

ACCR_*.f90

NEED FOR REVISION

The mileage accrual rates were last updated in 1999 as part of the EMFAC2000 release. Additionally, because of limits on data availability, only Smog Check data from calendar years 1991-1995 were used. This update utilizes more recent data (2001-2003).

METHODOLOGY

The mileage accrual rate is an estimate of the miles per year traveled. The mileage accrual rates are based on analyses of odometer data recorded in the Smog Check Program. These estimates are area, age, and vehicle class specific. The general approach is to capture corresponding odometer readings in calendar years 2001 and 2003, and determine the mileage accrued over that span of time (nominally two years).

The EMFAC model maintains an internal relationship between mileage accrual rates, vehicle population, and vehicle miles of travel (VMT). Essentially, the VMT of a specific age and class of vehicles can be calculated as the product of the population and the corresponding mileage accrual rate. The VMTs for most areas of the State are provided by either Councils of Government (COGs) or Metropolitan Planning Organizations (MPOs). In those instances where the vehicle population is known yet calculated and reported VMTs do not agree, the mileage accrual rates are adjusted until the target VMTs are achieved.

For this analysis, staff extracted approximately 10 million vehicle records from the BAR 2001 database and were able to locate 6 million matching vehicles in the BAR 2003 database. The matched data were then sorted by county, vehicle class, and model year (MY).

Rollover

Vehicles built before 1990 often have only 5 digits available for the odometer. After 99,999 miles, the odometer returns to 00,000 miles. This is referred to as odometer rollover. Without adjusting for this phenomenon, the average odometer would be biased low. Staff can sense that rollovers have occurred when the odometer reading of the first test year is greater than in subsequent test years. These rollovers were converted by establishing a cutoff of 100,000 as the maximum reasonable difference allowed between consecutive test year odometer readings. For those vehicles that do demonstrate a rollover condition, the odometer difference was determined by the following equation:

$$ODODIFF = (100{,}000 - ODO2001) + ODO2003$$

Otherwise, the odometer difference was calculated by a straight subtraction:

$$ODODIFF = ODO2003 - ODO2001$$

where:

ODO2003 = odometer reading for 2003
ODO2001 = odometer reading for 2001
ODODIFF = difference between odometer readings

Calculation of Accrual Rate

The data were first sorted by vehicle identification number (VIN), then conditions were set to screen out erroneous records such as zero odometer readings, zero odometer differences, and zero age values. The age of the vehicle is defined as the difference between the second test date of the vehicle and the model year of the vehicle. In this way, the age of the vehicle at the time of the second test is determined. A zero age value therefore would be indicative of an erroneous input during testing. The miles traveled between smog checks were then determined and converted to average miles traveled per year using the following equations.

Duration = testdate2003 – testdate2001 (in days)

Miles traveled per year = 365.25 * ODODIFF/Duration.

Results

Staff regressed Mean Accrual Rate as a function of Age. The resulting equations and coefficients are given in Table 3.

For some counties, insufficient data existed to perform adequate regression analyses. For such areas, nearby county equations were utilized. Table 4 gives the county substitution list. For truck categories T3-T5 and Motor Homes, there were only sufficient data for establishing statewide average accrual rates.

Table 3: Mileage Accrual Rates by Area

ACCR = A*ln(Age)+B

AREA	COUNTY	COUNTY ABB	CNTY CODE	AB	REG Eq. For PCs		REG Eq. For T1 and T2s		REG Eq. For T3s		REG Eq. For T4s		REG Eq. For T5s		REG Eq. For MHs	
					B	A	B	A	B	A	B	A	B	A	B	A
1	ALPINE	ALP	2	**GBV**	23857	-5587.5739	20153	-3757.7532	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
2	INYO	INY	14	**GBV**	20999	-4113.6866	21057	-3797.8048	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
3	MONO	MON	26	**GBV**	23857	-5587.5739	20153	-3757.7532	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
4	LAKE	LAK	17	**LC**	20860	-4538.2302	24442	-5756.7041	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
5	EL DORADO	ELD	9	**LT**	23857	-5587.5739	20153	-3757.7532	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
6	PLACER	PLA	31	**LT**	18378	-3578.1710	20175	-4062.3192	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
7	AMADOR	AMA	3	**MC**	19236	-3963.2123	20222	-4142.2297	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
8	CALAVERAS	CAL	5	**MC**	20889	-4565.3957	21272	-4473.1766	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
9	EL DORADO	ELD	31	**MC**	23857	-5587.5739	20153	-3757.7532	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
10	MARIPOSA	MPA	22	**MC**	21047	-4299.1185	21690	-4545.2619	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
11	NEVADA	NEV	29	**MC**	17589	-3196.2661	21625	-4651.9562	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
12	PLACER	PLA	31	**MC**	18378	-3578.1710	20175	-4062.3192	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
13	PLUMAS	PLU	32	**MC**	17589	-3196.2661	21625	-4651.9562	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
14	SIERRA	SIE	46	**MC**	17589	-3196.2661	21625	-4651.9562	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
15	TUOLUMNE	TUO	55	**MC**	20889	-4565.3957	21272	-4473.1766	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
16	MONTEREY	MON	27	**NCC**	18217	-3423.4017	16873	-2351.7561	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
17	SAN BENITO	SBT	35	**NCC**	19384	-3707.0678	23748	-4936.9827	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
18	SANTA CRUZ	SCR	44	**NCC**	18097	-3496.6127	17823	-3093.6232	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
19	DEL NORTE	DN	8	**NC**	20886	-4183.9866	20655	-4017.9952	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
20	HUMBOLDT	HUM	12	**NC**	20886	-4183.9866	20655	-4017.9952	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
21	MENDOCINO	MEN	23	**NC**	20886	-4183.9866	20655	-4017.9952	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
22	SONOMA	SON	49	**NC**	16240	-2774.3246	17709	-3027.4853	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
23	TRINITY	TRI	53	**NC**	20886	-4183.9866	20655	-4017.9952	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
24	LASSEN	LAS	18	**NEP**	19730	-4111.5478	20099	-4066.0348	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
25	MODOC	MOD	25	**NEP**	19730	-4111.5478	20099	-4066.0348	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
26	SISKIYOU	SIS	47	**NEP**	19730	-4111.5478	20099	-4066.0348	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
27	BUTTE	BUT	4	**SV**	17708	-3234.9115	19628	-3660.0493	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
28	COLUSA	COL	6	**SV**	19146	-3607.2561	19175	-3633.8893	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
29	GLENN	GLE	11	**SV**	25574	-6253.9375	25680	-6136.5578	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
30	PLACER	PLA	31	**SV**	18378	-3578.1710	20175	-4062.3192	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
31	SACRAMENT	SAC	34	**SV**	19236	-3963.2123	20222	-4142.2297	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
32	SHASTA	SHA	45	**SV**	19730	-4111.5478	20099	-4066.0348	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
33	SOLANO	SOL	48	**SV**	19973	-4095.6720	20978	-4281.2114	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
34	SUTTER	SUT	51	**SV**	17674	-3077.4870	19338	-3486.1812	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
35	TEHAMA	TEHA	52	**SV**	19438	-3897.1192	21350	-4520.9244	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
36	YOLO	YOL	57	**SV**	19146	-3607.2561	19175	-3633.8893	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
37	YUBA	YUB	58	**SV**	21155	-4259.9000	22697	-4798.3009	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345

Table 3: Mileage Accrual Rates by Area (continued)

ACCR = A*ln(Age)+B

AREA	COUNTY	COUNTY ABB	CNTY CODE	AB	REG Eq. For PCs		REG Eq. For T1 and T2s		REG Eq. For T3s		REG Eq. For T4s		REG Eq. For T5s		REG Eq. For MHs	
					B	A	B	A	B	A	B	A	B	A	B	A
38	SAN DIEGO	SD	37	**SD**	18435	-3610.2934	19269	-3593.4936	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
39	ALAMEDA	ALA	1	**SF**	16733	-2838.2411	17697	-2785.4432	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
40	CONTRA COS	CC	7	**SF**	17443	-3139.7194	17511	-2655.4673	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
41	MARIN	MRN	21	**SF**	15455	-2849.4007	17179	-2988.9095	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
42	NAPA	NAP	28	**SF**	16552	-2718.7270	14166	-1302.6843	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
43	SAN FRANCI	SF	38	**SF**	16586	-3132.8673	16522	-2809.6827	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
44	SAN MATEO	SM	41	**SF**	15843	-2566.1965	15188	-1551.8456	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
45	SANTA CLA	SCL	43	**SF**	16531	-2904.2370	16850	-2575.7987	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
46	SOLANO	SOL	48	**SF**	19973	-4095.6720	20978	-4281.2114	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
47	SONOMA	SON	49	**SF**	16240	-2774.32	17709	-3027.49	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
48	FRESNO	FRE	10	**SJV**	20437	-4140.5216	20337	-3862.2833	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
49	KERN	KER	15	**SJV**	18931	-3740.7885	19975	-3922.4174	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
50	KINGS	KIN	16	**SJV**	21221	-4333.9810	18946	-3135.5157	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
51	MADERA	MAD	20	**SJV**	19207	-3684.7658	23851	-5337.1010	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
52	MERCED	MER	24	**SJV**	21047	-4299.1185	21690	-4545.2619	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
53	SAN JOAQUI	SJV	39	**SJV**	20637	-4245.8115	20952	-4075.6750	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
54	STANISLAUS	STA	50	**SJV**	20889	-4565.3957	21272	-4473.1766	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
55	TULARE	TUL	54	**SJV**	19194	-3473.3921	19325	-3225.2960	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
56	SAN LUIS OB	SLO	40	**SCC**	18376	-3252.2969	17901	-2744.9581	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
57	SANTA BARI	SB	42	**SCC**	18052	-3392.7055	15824	-2083.4114	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
58	VENTURA	VEN	56	**SCC**	19610	-4152.1572	19030	-3442.9417	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
59	LOS ANGELE	LA	19	**SC**	18360	-3447.5471	17715	-2605.8978	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
60	ORANGE	ORA	30	**SC**	18944	-3954.1572	19853	-3822.9323	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
61	RIVERSIDE	RIV	33	**SC**	20580	-4215.0735	20888	-3775.6287	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
62	SAN BERNA	SBD	36	**SC**	20999	-4113.6866	21057	-3797.8048	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
63	IMPERIAL	IMP	13	**SS**	19279	-3525.2097	21671	-4605.1981	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
64	RIVERSIDE	RIV	33	**SS**	20580	-4215.0735	20888	-3775.6287	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
65	KERN	KER	15	**MD**	18931	-3740.7885	19975	-3922.4174	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
66	RIVERSIDE	RIV	33	**MD**	20580	-4215.0735	20888	-3775.6287	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
67	RIVERSIDE	RIV	33	**MD**	20580	-4215.0735	20888	-3775.6287	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
68	LOS ANGELE	LA	19	**MD**	18360	-3447.5471	17715	-2605.8978	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345
69	SAN BERNA	SBD	36	**MD**	20999	-4113.6866	21057	-3797.8048	19513	-3451.4256	19957	-3580.6494	20023	-3747.9552	5218	-632.5345

Table 4: Counties Requiring Accrual Rate Substitution

County	Replaced with	County	Replaced with
ALPINE	EL DORADO	AMADOR	SACRAMENTO
MONO	EL DORADO	INYO	SAN BERNARDINO
DEL NORTE	MENDOCINO	LASSEN	SHASTA
HUMBOLDT	MENDOCINO	MODOC	SHASTA
TRINITY	MENDOCINO	SISKIYOU	SHASTA
MARIPOSA	MERCED	CALAVERAS	STANISLAUS
PLUMAS	NEVADA	TUOLUMNE	STANISLAUS
SIERRA	NEVADA	COLUSA	YOLO

Figures 1 and 2 illustrate how well the accrual rate equations fit the data. Using the Statewide regression results, Figure 1 overlays the Predicted Accrual Rates onto the Actual Mean Accrual Rates for PCs. Figure 2 illustrates the regression fit for T1/T2 vehicles.

Figure 1

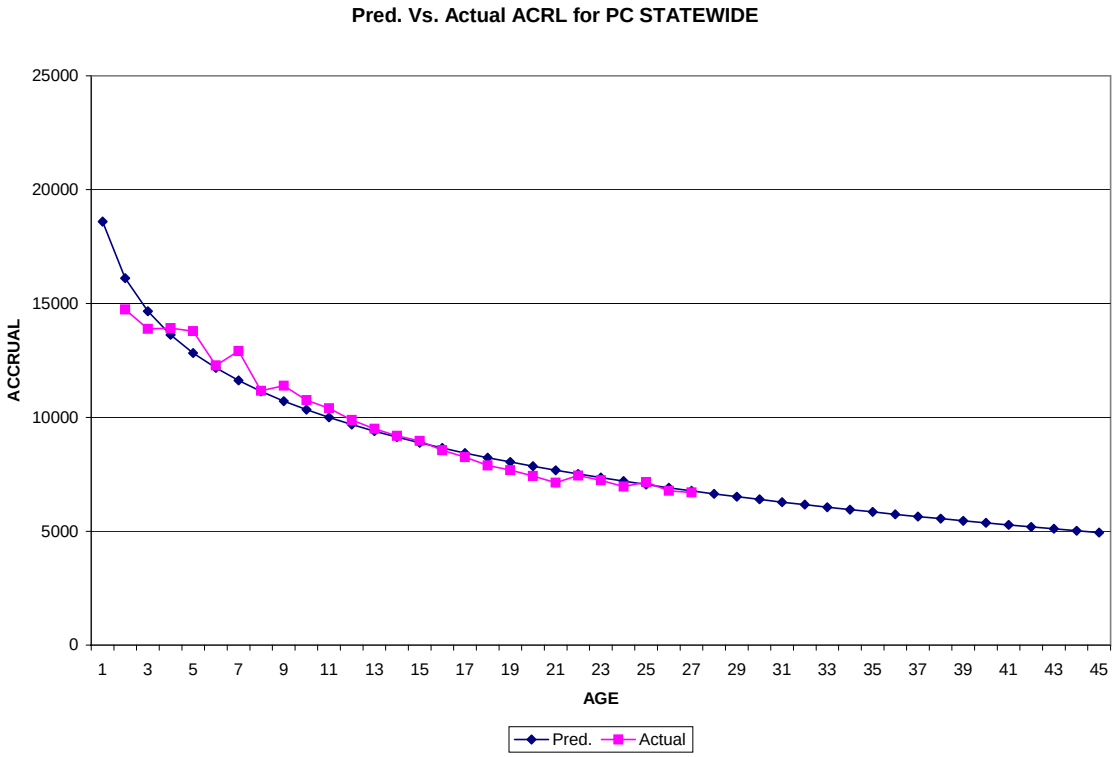
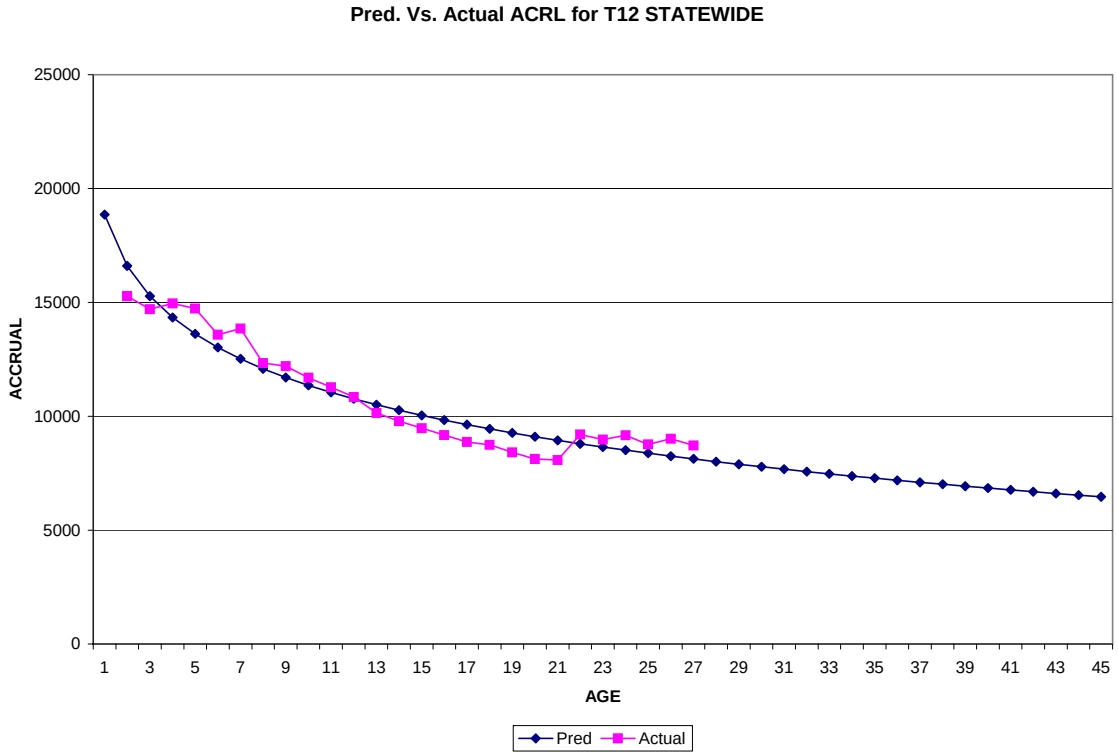


Figure 2



EMISSIONS IMPACT

The emissions impacts were estimated by substituting the new mileage accrual rates into the ACCR_*.f90 files in the EMFAC model. The impact on the fleet is displayed in the following tables. It should be noted that the estimates below are made by updating the accrual rates without specifying the VMT. In the final model, the VMT will be specified by the local planning agencies, and the accrual rates will be decreased or increased accordingly.

Table 5 - Impact on Statewide Inventories

Statewide Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.214)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	12041880	389166080	3295.50	29461.60	2314.83	262425.80	46.80
1990	18546378	677009980	2097.20	21939.43	2591.43	425411.20	73.41
2000	22223088	796323710	1016.44	10481.32	1824.34	465847.60	51.46
2002	23187272	825735810	851.72	8692.24	1659.83	481335.20	51.55
2005	24695158	874319490	683.90	6893.00	1398.91	508798.20	52.24
2010	27261810	958940800	494.61	4824.73	1026.19	565548.90	52.62
2015	29633200	1033439800	367.01	3333.40	686.44	613349.40	53.57
2020	32078400	1109706600	288.22	2370.51	475.91	656449.10	55.36

Statewide Summer Episodic On-Road Motor Vehicle Inventories With Accrual Rate Changes
(Calculated Using EMFAC2007 draft ver 2.215)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	12041880	371778530	3166.93	27748.40	2212.04	252027.40	45.75
1990	18546378	650153280	2029.51	20763.27	2490.03	410858.00	71.61
2000	22223088	753438720	989.63	9853.05	1741.83	445422.70	49.34
2002	23187272	778395070	835.10	8177.76	1588.71	458671.50	49.22
2005	24695158	821862590	675.27	6486.76	1342.41	483639.70	49.64
2010	27261810	898401730	491.06	4536.77	986.47	536614.10	49.63
2015	29633200	965580930	365.70	3146.64	661.37	580951.50	50.21
2020	32078400	1035436800	288.77	2256.71	460.21	621132.40	51.68

Difference (Ver. 2.215 - Ver. 2.214) 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	-17387550	-128.57	-1713.20	-102.79	-10398.40	-1.06
1990	0	-26856700	-67.69	-1176.16	-101.40	-14553.20	-1.80
2000	0	-42884990	-26.81	-628.27	-82.51	-20424.90	-2.12
2002	0	-47340740	-16.62	-514.48	-71.12	-22663.70	-2.33
2005	0	-52456900	-8.63	-406.24	-56.50	-25158.50	-2.59
2010	0	-60539070	-3.55	-287.96	-39.73	-28934.80	-2.99
2015	0	-67858870	-1.31	-186.76	-25.07	-32397.90	-3.36
2020	0	-74269800	0.55	-113.80	-15.70	-35316.70	-3.68

Percentage Change in Statewide Emission Inventories (relative to Ver. 2.214)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-4.47%	-3.90%	-5.82%	-4.44%	-3.96%	-2.26%
1990	0.00%	-3.97%	-3.23%	-5.36%	-3.91%	-3.42%	-2.45%
2000	0.00%	-5.39%	-2.64%	-5.99%	-4.52%	-4.38%	-4.12%
2002	0.00%	-5.73%	-1.95%	-5.92%	-4.28%	-4.71%	-4.51%
2005	0.00%	-6.00%	-1.26%	-5.89%	-4.04%	-4.94%	-4.96%
2010	0.00%	-6.31%	-0.72%	-5.97%	-3.87%	-5.12%	-5.67%
2015	0.00%	-6.57%	-0.36%	-5.60%	-3.65%	-5.28%	-6.28%
2020	0.00%	-6.69%	0.19%	-4.80%	-3.30%	-5.38%	-6.65%

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 6 - Impact on Sacramento Valley Air Basin Inventories

Sacramento Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.214)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	928538	27899692	253.91	2287.43	178.23	19099.17	3.97
1990	1390293	47535384	167.29	1707.78	201.05	30646.95	6.14
2000	1639895	54699356	80.77	783.52	140.67	33715.70	4.03
2002	1750264	57828772	69.84	661.23	129.28	35353.10	3.98
2005	1907510	62704904	57.39	527.42	107.66	37957.99	3.96
2010	2144810	70267144	41.40	359.83	75.94	41986.34	3.83
2015	2397312	77873800	30.40	241.36	49.42	45861.70	3.83
2020	2633298	84091224	23.86	168.82	33.25	49513.31	3.95

Sacramento Summer Episodic On-Road Motor Vehicle Inventories With Accrual Rate Changes
(Calculated Using EMFAC2007 draft ver 2.215)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	928538	28698772	257.78	2339.44	181.59	19497.75	4.01
1990	1390293	49487920	171.29	1778.72	205.25	31572.85	6.21
2000	1639895	56256872	82.54	817.15	142.64	34472.57	4.12
2002	1750264	59454992	71.05	688.61	130.57	36095.40	4.07
2005	1907510	64613468	58.13	548.84	108.40	38789.95	4.06
2010	2144810	72296712	41.57	373.61	76.15	42866.40	3.96
2015	2397312	80002296	30.25	251.34	49.47	46772.62	3.97
2020	2633298	86301176	23.62	178.08	33.26	50413.86	4.11

Difference (Ver. 2.215 - Ver. 2.214) 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	799080	3.87	52.01	3.35	398.58	0.04
1990	0	1952536	4.01	70.94	4.20	925.90	0.07
2000	0	1557516	1.78	33.63	1.97	756.87	0.09
2002	0	1626220	1.21	27.38	1.29	742.30	0.10
2005	0	1908564	0.74	21.42	0.74	831.96	0.11
2010	0	2029568	0.17	13.79	0.21	880.06	0.12
2015	0	2128496	-0.15	9.98	0.06	910.92	0.14
2020	0	2209952	-0.24	9.26	0.00	900.55	0.16

Percentage Change in Sacramento Emission Inventories (relative to Ver. 2.214)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	2.86%	1.52%	2.27%	1.88%	2.09%	1.00%
1990	0.00%	4.11%	2.39%	4.15%	2.09%	3.02%	1.19%
2000	0.00%	2.85%	2.20%	4.29%	1.40%	2.24%	2.28%
2002	0.00%	2.81%	1.73%	4.14%	1.00%	2.10%	2.42%
2005	0.00%	3.04%	1.28%	4.06%	0.69%	2.19%	2.74%
2010	0.00%	2.89%	0.41%	3.83%	0.27%	2.10%	3.23%
2015	0.00%	2.73%	-0.48%	4.14%	0.11%	1.99%	3.63%
2020	0.00%	2.63%	-1.02%	5.49%	0.00%	1.82%	3.94%

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 - Impact on San Diego Valley Air Basin Inventories

San Diego Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.214)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	933566	31678338	295.11	2695.92	168.81	22032.40	2.96
1990	1605060	63501964	188.80	2050.80	209.97	40770.53	5.74
2000	1899099	73953032	85.16	921.29	148.59	43069.26	4.57
2002	1996641	77082128	71.24	771.51	135.04	44806.86	4.63
2005	2164267	82851496	57.51	622.11	114.45	48116.35	4.80
2010	2335998	87707944	41.46	433.48	83.62	51139.89	4.77
2015	2530983	94056240	31.19	300.93	57.62	54568.32	4.83
2020	2668675	97693344	25.21	220.64	41.48	56550.75	4.92

San Diego Summer Episodic On-Road Motor Vehicle Inventories With Accrual Rate Changes
(Calculated Using EMFAC2007 draft ver 2.215)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	933566	27771970	265.32	2322.65	148.44	19548.16	2.71
1990	1605060	57427596	174.94	1828.29	191.89	37302.39	5.37
2000	1899099	65550992	80.31	817.22	135.37	38917.64	4.14
2002	1996641	68294352	68.17	686.05	124.17	40470.28	4.17
2005	2164267	73553328	55.74	554.12	106.12	43550.01	4.30
2010	2335998	77681832	40.70	385.86	78.05	46296.98	4.22
2015	2530983	83475768	30.92	269.08	54.08	49536.70	4.25
2020	2668675	86704488	25.15	198.31	39.14	51376.29	4.31

Difference (Ver. 2.215 - Ver. 2.214) 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	-3906368	-29.79	-373.27	-20.37	-2484.24	-0.25
1990	0	-6074368	-13.86	-222.50	-18.08	-3468.14	-0.37
2000	0	-8402040	-4.85	-104.07	-13.22	-4151.62	-0.43
2002	0	-8787776	-3.07	-85.47	-10.87	-4336.58	-0.46
2005	0	-9298168	-1.77	-67.99	-8.34	-4566.34	-0.50
2010	0	-10026112	-0.77	-47.62	-5.57	-4842.91	-0.55
2015	0	-10580472	-0.27	-31.85	-3.54	-5031.62	-0.58
2020	0	-10988856	-0.06	-22.33	-2.35	-5174.46	-0.61

Percentage Change in San Diego Emission Inventories (relative to Ver. 2.214)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-12.33%	-10.10%	-13.85%	-12.07%	-11.28%	-8.48%
1990	0.00%	-9.57%	-7.34%	-10.85%	-8.61%	-8.51%	-6.49%
2000	0.00%	-11.36%	-5.70%	-11.30%	-8.89%	-9.64%	-9.46%
2002	0.00%	-11.40%	-4.32%	-11.08%	-8.05%	-9.68%	-9.96%
2005	0.00%	-11.22%	-3.08%	-10.93%	-7.29%	-9.49%	-10.44%
2010	0.00%	-11.43%	-1.85%	-10.99%	-6.66%	-9.47%	-11.49%
2015	0.00%	-11.25%	-0.85%	-10.59%	-6.15%	-9.22%	-11.99%
2020	0.00%	-11.25%	-0.24%	-10.12%	-5.65%	-9.15%	-12.32%

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 - Impact on San Francisco Valley Air Basin Inventories

San Francisco Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.214)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	2883897	90081824	764.92	6930.17	544.09	58688.84	9.51
1990	3778902	133980700	389.71	4062.33	502.32	81353.11	13.41
2000	4587510	159313810	192.15	1915.04	345.61	92075.27	9.90
2002	4767732	164287710	169.47	1697.71	326.70	94561.98	9.92
2005	5059078	172769280	130.63	1287.10	267.28	98961.19	10.08
2010	5718522	193409790	95.72	919.12	196.60	117529.40	10.72
2015	6103198	202209840	69.68	629.21	130.71	123920.20	10.78
2020	6539036	213873180	53.92	442.22	90.02	130374.10	11.00

San Francisco Summer Episodic On-Road Motor Vehicle Inventories With Accrual Rate Changes
(Calculated Using EMFAC2007 draft ver 2.215)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	2883897	87621144	751.16	6739.95	531.01	57230.79	9.37
1990	3778902	129902490	392.46	4072.65	497.01	79558.21	13.20
2000	4587510	153884500	194.58	1934.77	342.99	89916.48	9.69
2002	4767732	158701250	172.53	1720.88	324.74	92286.46	9.71
2005	5059078	167139140	134.18	1314.16	266.75	96676.55	9.87
2010	5718522	188120260	98.68	944.94	196.94	115365.70	10.55
2015	6103198	197015890	71.54	653.86	131.85	121862.00	10.65
2020	6539036	209265580	54.89	465.67	91.29	128598.60	10.94

Difference (Ver. 2.215 - Ver. 2.214) 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	-2460680	-13.76	-190.21	-13.07	-1458.05	-0.14
1990	0	-4078210	2.75	10.32	-5.31	-1794.90	-0.21
2000	0	-5429310	2.43	19.73	-2.62	-2158.79	-0.20
2002	0	-5586460	3.06	23.16	-1.96	-2275.52	-0.21
2005	0	-5630140	3.55	27.06	-0.53	-2284.64	-0.21
2010	0	-5289530	2.97	25.82	0.35	-2163.70	-0.17
2015	0	-5193950	1.86	24.65	1.15	-2058.20	-0.13
2020	0	-4607600	0.97	23.45	1.28	-1775.50	-0.07

Percentage Change in San Francisco Emission Inventories (relative to Ver. 2.214)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-2.73%	-1.80%	-2.74%	-2.40%	-2.48%	-1.44%
1990	0.00%	-3.04%	0.70%	0.25%	-1.06%	-2.21%	-1.59%
2000	0.00%	-3.41%	1.27%	1.03%	-0.76%	-2.34%	-2.07%
2002	0.00%	-3.40%	1.80%	1.36%	-0.60%	-2.41%	-2.14%
2005	0.00%	-3.26%	2.72%	2.10%	-0.20%	-2.31%	-2.10%
2010	0.00%	-2.73%	3.10%	2.81%	0.18%	-1.84%	-1.63%
2015	0.00%	-2.57%	2.67%	3.92%	0.88%	-1.66%	-1.18%
2020	0.00%	-2.15%	1.80%	5.30%	1.42%	-1.36%	-0.60%

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 – Impact on San Joaquin Air Basin Inventories

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.214)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	881036	32894920	272.98	2787.27	232.31	23767.68	6.24
1990	1451709	60353564	207.31	2314.65	296.40	41540.45	10.26
2000	1991935	81094664	112.87	1220.07	229.02	51269.70	6.84
2002	2123753	86125608	95.66	1025.43	215.31	54405.38	6.87
2005	2324699	94471192	77.47	820.49	187.07	59647.63	6.97
2010	2643156	108103830	55.03	562.04	137.55	68168.80	6.80
2015	2998074	122441730	40.47	383.85	91.59	77049.29	6.85
2020	3350822	135666620	31.90	275.41	63.69	85565.63	7.20

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories With Accrual Rate Changes
(Calculated Using EMFAC2007 draft ver 2.215)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	881036	29457588	251.66	2452.46	213.75	21756.65	6.04
1990	1451709	54696584	194.02	2077.02	277.14	38447.02	9.91
2000	1991935	72027192	107.20	1085.86	212.13	46583.25	6.36
2002	2123753	76506976	91.94	912.58	200.85	49394.98	6.36
2005	2324699	84188880	75.38	729.43	175.51	54268.18	6.41
2010	2643156	96274624	54.08	497.46	129.26	62039.62	6.17
2015	2998074	108847670	40.25	341.31	86.11	70082.81	6.13
2020	3350822	120507560	32.14	247.19	60.04	77824.43	6.39

Difference (Ver. 2.215 - Ver. 2.214) 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	-3437332	-21.32	-334.81	-18.56	-2011.03	-0.20
1990	0	-5656980	-13.29	-237.63	-19.26	-3093.43	-0.35
2000	0	-9067472	-5.67	-134.21	-16.89	-4686.45	-0.48
2002	0	-9618632	-3.72	-112.84	-14.46	-5010.40	-0.52
2005	0	-10282312	-2.10	-91.05	-11.56	-5379.45	-0.56
2010	0	-11829206	-0.95	-64.58	-8.28	-6129.18	-0.63
2015	0	-13594060	-0.23	-42.54	-5.48	-6966.48	-0.72
2020	0	-15159060	0.23	-28.21	-3.65	-7741.20	-0.81

Percentage Change in San Joaquin Emission Inventories (relative to Ver. 2.214)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-10.45%	-7.81%	-12.01%	-7.99%	-8.46%	-3.17%
1990	0.00%	-9.37%	-6.41%	-10.27%	-6.50%	-7.45%	-3.40%
2000	0.00%	-11.18%	-5.02%	-11.00%	-7.38%	-9.14%	-7.00%
2002	0.00%	-11.17%	-3.89%	-11.00%	-6.72%	-9.21%	-7.50%
2005	0.00%	-10.88%	-2.71%	-11.10%	-6.18%	-9.02%	-8.04%
2010	0.00%	-10.94%	-1.72%	-11.49%	-6.02%	-8.99%	-9.33%
2015	0.00%	-11.10%	-0.56%	-11.08%	-5.98%	-9.04%	-10.50%
2020	0.00%	-11.17%	0.73%	-10.24%	-5.73%	-9.05%	-11.19%

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 – Impact on South Coast Air Basin Inventories

South Coast Summer Episodic On-Road Motor Vehicle Inventories
(Calculated Using EMFAC2007 draft ver 2.214)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	4872808	158751820	1322.81	11301.98	892.87	107747.40	18.32
1990	7640950	275887420	835.13	8526.69	1000.41	173724.40	27.60
2000	8971487	317953860	391.86	4062.16	698.41	183587.10	19.03
2002	9242592	325466590	324.52	3323.92	627.37	187070.50	18.95
2005	9671430	337630750	258.01	2608.94	523.16	194087.40	19.06
2010	10407354	359493570	184.55	1805.18	379.38	207340.60	18.95
2015	11144674	381367780	138.29	1264.82	251.09	223544.50	19.46
2020	11937573	406502500	108.12	897.59	171.89	237236.80	20.01

South Coast Summer Episodic On-Road Motor Vehicle Inventories With Accrual Rate Changes
(Calculated Using EMFAC2007 draft ver 2.215)

Cal. Year	Population	VMT*(1000)	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	4872808	157254530	1292.24	10980.67	874.22	106857.30	18.19
1990	7640950	282656740	825.45	8450.20	995.54	176613.40	27.73
2000	8971487	320077090	385.64	3945.23	686.98	184930.40	19.15
2002	9242592	325838980	318.67	3229.07	615.70	187610.40	19.02
2005	9671430	336634560	253.12	2537.31	512.61	193960.50	19.09
2010	10407354	357359550	181.00	1752.98	371.56	206662.90	18.94
2015	11144674	379058300	135.67	1229.58	246.42	222800.60	19.43
2020	11937573	404549790	106.26	880.22	169.56	236737.10	19.99

Difference (Ver. 2.215 - Ver. 2.214) 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	-1497290	-30.57	-321.31	-18.65	-890.10	-0.14
1990	0	6769320	-9.68	-76.49	-4.87	2889.00	0.13
2000	0	2123230	-6.22	-116.93	-11.43	1343.30	0.12
2002	0	372390	-5.85	-94.85	-11.67	539.90	0.07
2005	0	-996190	-4.89	-71.63	-10.55	-126.90	0.03
2010	0	-2134020	-3.55	-52.19	-7.82	-677.70	-0.01
2015	0	-2309480	-2.62	-35.23	-4.67	-743.90	-0.03
2020	0	-1952710	-1.86	-17.37	-2.34	-499.70	-0.02

Percentage Change in South Coast Emission Inventories (relative to Ver. 2.214)

Cal. Year	Population	VMT	ROG_Tot[1]	CO_Tot	NOx_Tot	CO2_Tot	PM10_Tot[2]
1980	0.00%	-0.94%	-2.31%	-2.84%	-2.09%	-0.83%	-0.75%
1990	0.00%	2.45%	-1.16%	-0.90%	-0.49%	1.66%	0.47%
2000	0.00%	0.67%	-1.59%	-2.88%	-1.64%	0.73%	0.64%
2002	0.00%	0.11%	-1.80%	-2.85%	-1.86%	0.29%	0.39%
2005	0.00%	-0.30%	-1.90%	-2.75%	-2.02%	-0.07%	0.15%
2010	0.00%	-0.59%	-1.92%	-2.89%	-2.06%	-0.33%	-0.04%
2015	0.00%	-0.61%	-1.90%	-2.79%	-1.86%	-0.33%	-0.14%
2020	0.00%	-0.48%	-1.72%	-1.94%	-1.36%	-0.21%	-0.11%

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.

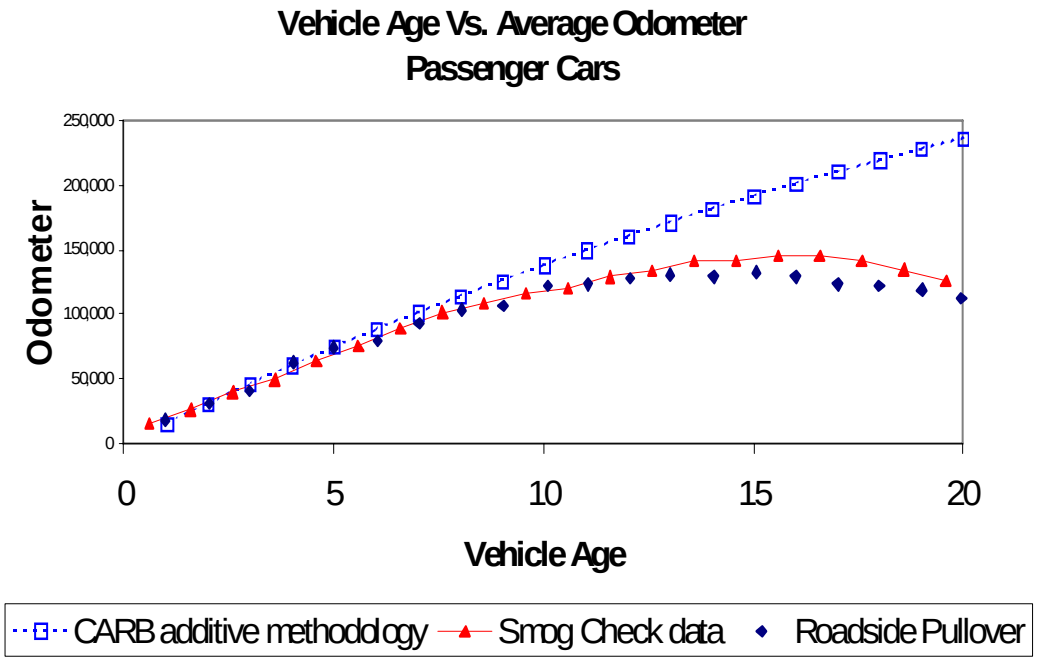
FUTURE WORK

During the AB1493 (Greenhouse Gas) regulatory process, Sierra Research raised an issue regarding how EMFAC determines the odometer value as vehicles age. EMFAC calculates the odometer at a given age as the sum of all the previous years' accrual rates. As noted by Sierra Research, this practice tends to be inflationary in that the odometer estimates would not properly account for vehicles that accrued high mileage and retired early from the fleet. In reality, these vehicles would have no influence on the mean odometer of older vehicles.

In Sierra Research's analysis of this issue, their estimates of cumulative mileage are in reasonable agreement with those of EMFAC for the first ten years of vehicle usage (Figure 3).

Although staff acknowledge that Sierra's claim is legitimate, it is important to note that the impact of this issue is limited to the assumption of emissions deterioration, and only for those vehicles beyond ten years old. Therefore, staff believes that the impact of this issue on the overall inventory is small, but will investigate correcting the problem in subsequent revisions to the model.

Figure 3



Source: Frank Di Genova, Sierra Research, CRC 15th Workshop in San Diego, April 4-6, 2005