# EMFAC Modeling Change Technical Memo

**SUBJECT:** CODING MODIFICATIONS TO CORRECT ERRORS IN EMFAC2002

**LEAD:** DILIP PATEL

## SUMMARY

Since the official release of EMFAC2001[1], staff has noted several coding errors. This document only details errors that have an impact on emissions, and quantifies the impact on emissions from fixing **all** these errors simultaneously. The following changes will be incorporated into the release of the working draft version of EMFAC2007:

a) Corrected how the Mexican vehicle population is backcasted and forecasted from the base year (1999). This impacts the vehicle populations in San Diego and Imperial counties;
b) Corrected how the population of new vehicles is calculated in the first forecast year (2000) to ensure that it is based on the gas to diesel ratio in calendar year 2000, instead of 1999;
c) Changed code that limited the forecasted sales of new heavy heavy-duty vehicles;
d) Removed a portion of the code that capped the PM rates above a certain mileage for **all** heavy-duty trucks;
e) Changed the precision with which the model determines if vehicles in a given hour are experiencing a resting loss event or a diurnal event;
f) Corrected the code so that a user selection for adding motorcycles to Inspection and Maintenance (I&M) programs is retained; and
g) Corrected an error in how temperature is referenced in calculating diurnal evaporative emissions in the EMFAC mode.

These coding modifications were made to the internal working draft of EMFAC2007 ver. 2.213. Table 1 shows the incremental difference (ver. 2.213 – ver. 2.212[2]) in **summer episodic** inventories for calendar year 2002. Table 1 shows that including these coding modifications will change statewide ROG, CO, NOx, and PM10 emissions from **all** on-road motor vehicles in 2002 calendar year by -0.49, -7.31, 7.74, and 3.96 tons per day, respectively. To put this in perspective, this will change statewide ROG, CO, NOx, and PM10 on-road motor vehicle emissions in 2002 by -0.06%, -0.08%, 0.46%, and 8.41%, respectively. Similarly, Table 2 shows that in 2015 the statewide summer ROG, CO, NOx, and PM10 emissions from **all** on-road motor vehicles will change by -1.19, -9.24,

[1] EMFAC2002 April 23, version 2.206 posted on ARB's web site.
[2] Internal working draft of EMFAC2007 version 2.212 that has been updated with new fuel corrections factors and I&M changes.

-0.18, and 2.39 tons per day, respectively. This is equivalent to a -0.32%, -0.26%, 0.03%, and 4.73% change to the total on-road motor vehicle emissions inventory, respectively.

**Table 1 Summary of Emissions Changes from Coding Modifications Calendar Year 2002**

| Area | Emission Changes by Pollutant (tons/day) | | | | |
|---|---|---|---|---|---|
| | ROG | CO | NOx | CO2 | PM10 |
| Statewide | -0.49 | -7.31 | 7.74 | 1867.80 | 3.96 |
| South Coast Air Basin | -0.28 | -3.72 | 3.01 | 689.90 | 1.17 |
| San Joaquin Valley AB | -0.12 | -1.59 | 1.16 | 339.65 | 0.86 |
| Sacramento Valley AB | -0.05 | -0.67 | 0.39 | 111.85 | 0.35 |
| San Diego Air Basin | 0.16 | 1.59 | 1.26 | 209.77 | 0.34 |
| San Francisco Bay Area | -0.13 | -1.66 | 1.01 | 299.15 | 0.70 |

**Table 2 Summary of Emissions Changes from Coding Modifications Calendar Year 2015**

| Area | Emission Changes by Pollutant (tons/day) | | | | |
|---|---|---|---|---|---|
| | ROG | CO | NOx | CO2 | PM10 |
| Statewide | -1.19 | -9.24 | -0.18 | 1218.80 | 2.39 |
| South Coast | -0.48 | -3.14 | 1.18 | 35.40 | 0.69 |
| San Joaquin Valley AB | -0.24 | -1.80 | -0.98 | 420.38 | 0.52 |
| Sacramento Region AB | -0.10 | -0.80 | -0.11 | 109.19 | 0.18 |
| San Diego Air Basin | 0.14 | 1.24 | 0.40 | 301.44 | 0.20 |
| San Francisco Bay Area | -0.15 | -1.16 | 0.28 | 20.40 | 0.43 |

## NEED FOR REVISION

The upcoming SIP process requires that the model reflect regulations or measures that have been adopted since the last update. Consistent with this policy, known errors in the model should be fixed to allow for more accurate assessment of emissions inventory in each area.

## AFFECTED SOURCE CODE/VERSION

Get_Pop.for
Calc_BER_CF.for
UpdateTG.f90
Modules.for
Commons.for
Utilities90.f90
EmfacResrc.rc

## METHODOLOGY

This document details coding modifications to each of the following subsections: Mexican Vehicle Population Forecast and Backcast; Forecasting Gas to Diesel Vehicles; Forecasting Heavy Heavy-Duty Vehicles; Removing Caps on PM Deterioration from Heavy-Duty Vehicles; The "Is-Rest" Check; and Motorcycle I&M.

### Mexican Vehicle Population Forecast and Backcast

The model contains populations of Mexican[3] passenger cars and heavy heavy-duty diesel trucks that cross into San Diego and Imperial counties. These populations are for the base year, which is 1999. For the base year, these populations are simply added to the population estimates of San Diego and Imperial counties. To determine the population of Mexican vehicles in other calendar years, the model has to either forecast (for 2000 and newer calendar years) or backcast (for 1998 and prior years) the vehicle population from the base year.

The baseline total population is the sum of the registered population (with corrections for out-of-state heavy-duty vehicles) plus the chronically-unregistered population plus the Mexican cross-border population.

In forecasting and backcasting, the model first calculates the registered vehicle population, and then calculates the chronically-unregistered and Mexican populations. In previous model versions, the code for backcasting the Mexican population included an error that affected the first backcast year. In the first backcast year, the Mexican vehicle population was adjusted with survival rates but was not adjusted with the population growth rates (which are negative for backcasts).

The previous forecast method did not use the same method for the Mexican population as for the registered and chronically unregistered populations in San Diego and Imperial counties. The previous forecast method applied the population growth rates in San Diego and Imperial counties directly, without applying survival and sales adjustments. This provided the correct population for Mexican vehicles, but it did not allow for the same gradual changes in age distribution that were applied to the rest of the population.

The population calculations were modified so that registered, unregistered, and Mexican populations are treated identically in forecasting and backcasting.

### Forecasting Gas to Diesel Vehicles

In forecasting new vehicle sales, the model looks at the model year technology fractions, which detail the breakdown of new vehicle sales among various

[3] Section 12.0 of EMFAC2000 Technical Support Documentation

technologies. In a given model year, the percentage of the cars that are gasoline (LEV, ULEV, SULEV, etc.) or diesel fueled is based on the technology fractions for cars sold in that model year. For example, the population of 2000 model year gasoline and diesel cars is based on the 2000 model year technology fractions for cars. However, the model was looking up the technology fractions for 1999 rather than those for 2000. This index was essentially off by one year.

The "Get_Pop" algorithm was modified to reflect the correct model year in assessing the gasoline to diesel fuel split.

Forecasting Heavy Heavy-Duty Vehicles

The impact of this coding change is dependent on the population growth of heavy heavy-duty vehicles (HHDV). In forecasting, the sales of new vehicles are capped so that they do not exceed the previous year's new vehicle sales by more than 10%. In the development of EMFAC2000, staff assumed that, if new vehicle sales increased by more than 10%, a lot of older vehicles had been scrapped from the fleet. This potentially implied a dynamic change to the survival rates. In the final release of the EMFAC2000 model, the code for dynamically changing the vehicle survival rates was not implemented. However, the flag which limits new vehicle sales was retained. If the sales limit is exceeded, the additional vehicles are added in proportion to the existing population distribution. This sales limit is not reached for any vehicle class except for HHDV, which are also adjusted by the out-of-state HHDV fraction to account for the total fleet. This adjustment factor accounts for out-of-state HHDV traveling in California.

In reviewing this code, staff noted that, for HHDV, the previous year's sales were not adjusted by the out-of-state HHDV fraction. This meant that the new HHDV sales were capped by the 10% sales limit because the previous year's sales had not been adjusted by the out-of-state HHDV fraction and were lower by 33%. This was fixed by calculating previous year sales based on the registered vehicle population and the out-of-state fraction.

Prior to this fix, with the current values for population-growth factors, the new-vehicle sales limit for HHDV was being reached in most areas of the state, and for most of the calendar years from 2000 to 2010. This meant that additional HHDV were added to the fleet in proportion to the existing population distribution thus skewing the distribution towards older vehicles. Older HHDV accrue fewer miles per day than newer vehicles, hence the calculated VMT for HHDV was lower. Therefore, this change will not have a significant impact on total population of HHDV, but it will change the forecasted population distribution, which will have a large impact on VMT and emissions.

With the fix in place, the number of new vehicles added to the fleet each year increases by nearly 30% in the first forecast year; smaller, but substantial, increases occur over the next 10 forecast years.

Removing Caps on PM Deterioration from Heavy-Duty Vehicles

Dr. Carol Wong, from Hong Kong EPD[4], noticed a portion of the code where the text implied a change to the light-heavy duty trucks (vehicle classes 5 and 6) but the code was incorrectly written as applying to vehicle classes 4 (medium-duty trucks) and 5 (light heavy-duty trucks). The portion of the code is shown below.

```
> c     PM exhaust rates for heavy duty vehicles require special treatment;
> c     their deterioration factors switch to zero after specified mileages:
> c
> c        120K for light heavy duty vehicles (IVEH = 4, 5)
> c        185K for medium heavy duty vehicles (IVEH = 7, 12, 13)
> c        290K for heavy-heavy duty vehicles (IVEH =  8, 9)
> c
>          IF  (IPOL == PM$ .AND. IMODE <= 5) THEN
>             IF (IVEH == 4 .OR. IVEH == 5) THEN
>                ODOMETER = MIN(12.0,CUMMIL(AGEYR,IFUEL,IVEH))
>             ELSEIF (IVEH == 7 .OR. IVEH == 12 .OR. IVEH == 13) THEN
>                ODOMETER = MIN(18.5,CUMMIL(AGEYR,IFUEL,IVEH))
>             ELSEIF (IVEH == 8 .OR. IVEH == 9) THEN
>                ODOMETER = MIN(29.0,CUMMIL(AGEYR,IFUEL,IVEH))
>             ELSE
>                ODOMETER = CUMMIL(AGEYR,IFUEL,IVEH)
>             ENDIF
>          ELSE
>             ODOMETER = CUMMIL(AGEYR,IFUEL,IVEH)
>          ENDIF
```

Staff examined this code and noted two errors. Dr. Wong was correct about the first error in that light heavy-duty vehicles refer to vehicle classes 5 and 6 and not 4. The second is more of a legacy error. This portion of the code also limits the mileage (through odometer) used in calculating PM emissions from heavy-duty vehicles. This portion of the code is/was valid when the emissions data was based on engine tests (EMFAC7G / EMFAC2000). Since the new data on heavy-duty vehicles are based on chassis testing, these limits on PM should have been removed.

This portion of the code was removed from the CALC_BER_CF.for file.

The "Is-Rest" Check- *Resting Loss and Diurnal Temperature Checks*

After the release of EMFAC2002 ver 2.206, staff noted that the number of hours experiencing resting loss were different than those calculated in a previous version of EMFAC2002. These differences occurred even though both models were using the same temperature profile.

[4] Hong Kong Environmental Protection Department

The differences arose because of numerical roundoff in calculating average temperatures for annual and area-average cases combined with a simplistic test for temperature change. This is demonstrated in the table below.

Table 1 Average AREATEMP Values for Annual Case for San Diego County

| Model | Period | AREATEMP | IS_REST | IS_DIURNAL |
|---|---|---|---|---|
| 2.2 rls | 4 | 60.799995 | | |
| 2.2 rls | 5 | 59.900002 | TRUE | FALSE |
| 2.2 rls | 6 | 59.900005 | FALSE | TRUE |
| 2.206 rls | 4 | 60.799999 | | |
| 2.206 rls | 5 | 59.900002 | TRUE | FALSE |
| 2.206 rls | 6 | 59.899998 | TRUE | FALSE |

In periods 5 and 6, the averaged temperature (AREATEMP) is 59.9 degrees for both time periods. The exact calculated values differ very slightly in the two different model versions, but the differences are not meaningful. The differences are artifacts due to rounding.

Resting losses occur in hours where the ambient temperature is constant or decreasing. Diurnal losses occur in hours where the ambient temperature is increasing.

The model checks the temperature change between two hours to determine if vehicles in a particular hour are experiencing resting loss events. The code used a simple inequality test to determine whether the temperature increased. This test did not account for values being “approximately” equal. Using the AREATEMP values above for version 2.200, without allowing for roundoff, the code would assign period 6 to diurnal emissions. When using the values for version 2.206, the same period would be assigned to resting emissions.

The inequality test was replaced with a call to a new function, IsIncreasing. The function evaluates to “true” only if the relative increase from one period to the next is greater than 1.E-5.

When using the IsIncreasing function, the resting-loss test evaluates to “true” for both sets of AREATEMP values above and the diurnal-loss test evaluates to “false.”

Motorcycle I&M

Staff were doing an assessment to determine the emission benefits from adding motorcycles to the statewide Inspection and Maintenance (I&M) program in 2005 calendar year. When comparing results, users noted inconsistent results from adding motorcycles to the I&M program.

Upon examination of the input files, staff noted that I&M flags were correctly set in the input files but they weren't read in correctly. This problem has been corrected; the vehicle flags that are written out and read in from the input file now match the program's internal flags.

Temperature Reference in EMFAC Mode Diurnal Emissions

In the evaporative subroutine used in calculating diurnal emissions for the EMFAC mode, the code was selecting the wrong coefficient for temperature dependence when the ambient temperature was below 65 degrees. This was due to a simple error in array subscripts.

The code was corrected to select the correct temperature coefficient. This change will not affect the tons per day emissions from Burden since its code was correctly coded.

## INVENTORY EFFECTS

Table 3 shows summaries of the statewide summer episodic on-road motor vehicle inventories calculated using internal working draft EMFAC2007 version 2.213, which contains the coding fixes noted in this document. These inventories were calculated by running the model for **summer** on an area-average basis to determine the impact of coding changes on a statewide basis. Table 3 shows that including coding modifications will change statewide emissions of ROG, CO, NOx, and PM10 for **all** on-road motor vehicles in the 2002 calendar year by -0.49, -7.31, 7.74, and 3.96 tons per day, respectively. To put this in perspective, this will change statewide ROG, CO, NOx, and PM10 on-road motor vehicle emissions in 2002 by -0.06%, -0.08%, 0.46%, and 8.41%, respectively. Similarly, Table 3 shows that in 2015 the statewide on-road motor vehicle inventory of ROG, CO, NOx, and PM10 will change by -1.19, -9.24, -0.18, and 2.39 tons per day, respectively. This is equivalent to a -0.32%, -0.26%, -0.03%, and 4.73% change to the on-road motor vehicle emissions inventory.

Tables 4 through 8 show the impact of these changes on summer episodic inventories from Sacramento, San Diego, San Francisco, San Joaquin and the South Coast Air Basin, respectively.

Table 3 shows significant changes, more than anticipated, to the daily estimates of vehicle miles traveled (VMT) and to emissions in general from incorporating these coding fixes. Table 9 shows the changes to the statewide activity and emission estimates, by vehicle class, in calendar year 2005. This table indicates that fixing the error that limited the sales of HHDV caused the VMT to increase by approximately 1.4 million miles per day. The HHDV VMT increase resulted from changes to the forecasted HHDV population (see Figure 1). The average age of a HHDV dropped from 13.05 to 12.40 years. In general, newer vehicles travel more miles per day; hence, changing the age distribution with more newer

vehicles will increase the daily VMT. Figure 2 shows the changes to the forecasted VMT from HHDV.

Table 3 Impact of Coding Fixes on Statewide Inventories

Statewide Summer Episodic Emissions From **All** On-Road Motor Vehicles
(Calculated Using EMFAC2007 draft ver 2.212)

| Cal. Year | Population | VMT*(1000) | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 12044256 | 389110750 | 3297.08 | 29464.92 | 2315.25 | 262391.60 | 43.71 |
| 1990 | 18550046 | 677172610 | 2098.44 | 21947.55 | 2593.12 | 425584.10 | 66.67 |
| 2000 | 22223344 | 796074180 | 1023.79 | 10593.18 | 1837.73 | 465220.80 | 47.06 |
| 2002 | 23188446 | 825020420 | 861.18 | 8840.74 | 1671.41 | 479467.40 | 47.14 |
| 2005 | 24697722 | 872884100 | 695.70 | 7080.65 | 1416.67 | 505232.30 | 47.93 |
| 2010 | 27266632 | 957360640 | 507.12 | 5021.08 | 1050.07 | 561716.70 | 49.10 |
| 2015 | 29638630 | 1032914500 | 377.27 | 3498.82 | 703.86 | 612130.60 | 50.58 |
| 2020 | 32084134 | 1109514100 | 296.22 | 2501.54 | 488.57 | 656076.20 | 52.62 |

Statewide Summer Episodic On-Road Motor Vehicle Inventories With Coding Fixes
(Calculated Using EMFAC2007 draft ver 2.213)

| 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 | 46.60 |
| 1990 | 18546378 | 677009980 | 2097.65 | 21943.77 | 2591.55 | 425411.20 | 72.91 |
| 2000 | 22223088 | 796323710 | 1023.66 | 10590.63 | 1840.57 | 465847.60 | 51.03 |
| 2002 | 23187272 | 825735810 | 860.69 | 8833.43 | 1679.15 | 481335.20 | 51.11 |
| 2005 | 24695158 | 874319490 | 694.49 | 7066.71 | 1420.40 | 508798.20 | 51.75 |
| 2010 | 27261810 | 958940800 | 505.40 | 5005.88 | 1047.25 | 565548.90 | 52.07 |
| 2015 | 29633200 | 1033439800 | 376.08 | 3489.59 | 703.67 | 613349.40 | 52.98 |
| 2020 | 32078400 | 1109706600 | 295.46 | 2498.19 | 489.54 | 656449.10 | 54.73 |

Difference (Ver. 2.213 - Ver. 2.212) 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 | -2376 | 55330 | -1.57 | -3.32 | -0.42 | 34.20 | 2.89 |
| 1990 | -3668 | -162630 | -0.79 | -3.78 | -1.58 | -172.90 | 6.24 |
| 2000 | -256 | 249530 | -0.13 | -2.55 | 2.84 | 626.80 | 3.97 |
| 2002 | -1174 | 715390 | -0.49 | -7.31 | 7.74 | 1867.80 | 3.96 |
| 2005 | -2564 | 1435390 | -1.21 | -13.93 | 3.73 | 3565.90 | 3.82 |
| 2010 | -4822 | 1580160 | -1.72 | -15.20 | -2.82 | 3832.20 | 2.97 |
| 2015 | -5430 | 525300 | -1.19 | -9.24 | -0.18 | 1218.80 | 2.39 |
| 2020 | -5734 | 192500 | -0.76 | -3.35 | 0.97 | 372.90 | 2.11 |

Percentage Change in Statewide Emission Inventories (relative to Ver. 2.212)

| Cal. Year | Population | VMT | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | -0.02% | 0.01% | -0.05% | -0.01% | -0.02% | 0.01% | 6.61% |
| 1990 | -0.02% | -0.02% | -0.04% | -0.02% | -0.06% | -0.04% | 9.36% |
| 2000 | 0.00% | 0.03% | -0.01% | -0.02% | 0.15% | 0.13% | 8.44% |
| 2002 | -0.01% | 0.09% | -0.06% | -0.08% | 0.46% | 0.39% | 8.41% |
| 2005 | -0.01% | 0.16% | -0.17% | -0.20% | 0.26% | 0.71% | 7.98% |
| 2010 | -0.02% | 0.17% | -0.34% | -0.30% | -0.27% | 0.68% | 6.05% |
| 2015 | -0.02% | 0.05% | -0.32% | -0.26% | -0.03% | 0.20% | 4.73% |
| 2020 | -0.02% | 0.02% | -0.26% | -0.13% | 0.20% | 0.06% | 4.01% |

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 4 Impact of Coding Fixes on Sacramento Valley Air Basin Inventories

Sacramento Summer Episodic Emissions From **All** On-Road Motor Vehicles
(Calculated Using EMFAC2007 draft ver 2.212)

| Cal. Year | Population | VMT*(1000) | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 928448 | 27881342 | 253.93 | 2286.53 | 178.17 | 19083.41 | 3.63 |
| 1990 | 1390476 | 47539696 | 167.37 | 1708.18 | 201.06 | 30649.06 | 5.50 |
| 2000 | 1639920 | 54680392 | 81.28 | 791.49 | 141.62 | 33668.76 | 3.63 |
| 2002 | 1750373 | 57784508 | 70.51 | 671.91 | 130.23 | 35241.25 | 3.59 |
| 2005 | 1907740 | 62629400 | 58.21 | 540.80 | 109.02 | 37766.85 | 3.59 |
| 2010 | 2145240 | 70184448 | 42.24 | 373.66 | 77.58 | 41776.20 | 3.55 |
| 2015 | 2397775 | 77831144 | 31.11 | 253.08 | 50.72 | 45752.51 | 3.60 |
| 2020 | 2633766 | 84078712 | 24.42 | 178.25 | 34.24 | 49480.40 | 3.76 |

Sacramento Summer Episodic On-Road Motor Vehicle Inventories With Coding Fixes
(Calculated Using EMFAC2007 draft ver 2.213)

| 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 | 3.95 |
| 1990 | 1390293 | 47535384 | 167.31 | 1708.06 | 201.06 | 30646.95 | 6.10 |
| 2000 | 1639895 | 54699356 | 81.26 | 791.12 | 141.78 | 33715.70 | 3.99 |
| 2002 | 1750264 | 57828772 | 70.46 | 671.24 | 130.62 | 35353.10 | 3.93 |
| 2005 | 1907510 | 62704904 | 58.13 | 539.85 | 109.17 | 37957.99 | 3.91 |
| 2010 | 2144810 | 70267144 | 42.13 | 372.56 | 77.41 | 41986.34 | 3.79 |
| 2015 | 2397312 | 77873800 | 31.01 | 252.29 | 50.61 | 45861.70 | 3.78 |
| 2020 | 2633298 | 84091224 | 24.36 | 177.94 | 34.21 | 49513.31 | 3.91 |

Difference (Ver. 2.213 - Ver. 2.212) 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 | 90 | 18350 | -0.02 | 0.90 | 0.07 | 15.76 | 0.32 |
| 1990 | -183 | -4312 | -0.05 | -0.12 | -0.01 | -2.11 | 0.60 |
| 2000 | -25 | 18964 | -0.02 | -0.37 | 0.15 | 46.94 | 0.36 |
| 2002 | -109 | 44264 | -0.05 | -0.67 | 0.39 | 111.85 | 0.35 |
| 2005 | -230 | 75504 | -0.08 | -0.95 | 0.15 | 191.14 | 0.32 |
| 2010 | -430 | 82696 | -0.11 | -1.10 | -0.17 | 210.14 | 0.24 |
| 2015 | -463 | 42656 | -0.10 | -0.80 | -0.11 | 109.19 | 0.18 |
| 2020 | -468 | 12512 | -0.06 | -0.32 | -0.02 | 32.91 | 0.15 |

Percentage Change in Sacramento Emission Inventories (relative to Ver. 2.212)

| Cal. Year | Population | VMT | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 0.01% | 0.07% | -0.01% | 0.04% | 0.04% | 0.08% | 8.85% |
| 1990 | -0.01% | -0.01% | -0.03% | -0.01% | 0.00% | -0.01% | 10.90% |
| 2000 | 0.00% | 0.03% | -0.03% | -0.05% | 0.11% | 0.14% | 9.80% |
| 2002 | -0.01% | 0.08% | -0.07% | -0.10% | 0.30% | 0.32% | 9.65% |
| 2005 | -0.01% | 0.12% | -0.14% | -0.18% | 0.14% | 0.51% | 8.97% |
| 2010 | -0.02% | 0.12% | -0.26% | -0.29% | -0.22% | 0.50% | 6.88% |
| 2015 | -0.02% | 0.05% | -0.31% | -0.32% | -0.22% | 0.24% | 5.13% |
| 2020 | -0.02% | 0.01% | -0.26% | -0.18% | -0.07% | 0.07% | 4.04% |

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 5 Impact of Coding Fixes on San Diego Valley Air Basin Inventories

San Diego Summer Episodic Emissions From **All** On-Road Motor Vehicles
(Calculated Using EMFAC2007 draft ver 2.212)

| Cal. Year | Population | VMT*(1000) | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 934571 | 31707434 | 295.64 | 2698.84 | 169.32 | 22069.36 | 2.82 |
| 1990 | 1606621 | 63591472 | 189.30 | 2053.63 | 211.27 | 40894.99 | 5.30 |
| 2000 | 1899124 | 73909272 | 85.77 | 930.96 | 149.28 | 42961.61 | 4.18 |
| 2002 | 1996742 | 77007520 | 71.98 | 783.75 | 135.66 | 44597.09 | 4.26 |
| 2005 | 2164502 | 82659608 | 58.52 | 639.04 | 115.91 | 47704.58 | 4.44 |
| 2010 | 2336487 | 87480560 | 42.47 | 450.03 | 85.44 | 50692.60 | 4.48 |
| 2015 | 2531560 | 93885768 | 31.91 | 314.19 | 58.82 | 54266.88 | 4.58 |
| 2020 | 2669319 | 97541648 | 25.60 | 229.45 | 42.09 | 56283.64 | 4.69 |

San Diego Summer Episodic On-Road Motor Vehicle Inventories With Coding Fixes
(Calculated Using EMFAC2007 draft ver 2.213)

| 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 | 188.84 | 2051.17 | 209.98 | 40770.53 | 5.72 |
| 2000 | 1899099 | 73953032 | 85.87 | 931.92 | 150.18 | 43069.26 | 4.54 |
| 2002 | 1996641 | 77082128 | 72.13 | 785.33 | 136.92 | 44806.86 | 4.60 |
| 2005 | 2164267 | 82851496 | 58.58 | 639.34 | 116.57 | 48116.35 | 4.76 |
| 2010 | 2335998 | 87707944 | 42.52 | 450.87 | 85.63 | 51139.89 | 4.73 |
| 2015 | 2530983 | 94056240 | 32.06 | 315.43 | 59.23 | 54568.32 | 4.78 |
| 2020 | 2668675 | 97693344 | 25.89 | 232.21 | 42.72 | 56550.75 | 4.87 |

Difference (Ver. 2.213 - Ver. 2.212) 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 | -1005 | -29096 | -0.53 | -2.92 | -0.50 | -36.96 | 0.14 |
| 1990 | -1561 | -89508 | -0.45 | -2.45 | -1.28 | -124.46 | 0.41 |
| 2000 | -25 | 43760 | 0.10 | 0.96 | 0.90 | 107.65 | 0.35 |
| 2002 | -101 | 74608 | 0.16 | 1.59 | 1.26 | 209.77 | 0.34 |
| 2005 | -235 | 191888 | 0.06 | 0.30 | 0.67 | 411.77 | 0.32 |
| 2010 | -489 | 227384 | 0.05 | 0.83 | 0.19 | 447.29 | 0.24 |
| 2015 | -577 | 170472 | 0.14 | 1.24 | 0.40 | 301.44 | 0.20 |
| 2020 | -644 | 151696 | 0.29 | 2.76 | 0.63 | 267.11 | 0.18 |

Percentage Change in San Diego Emission Inventories (relative to Ver. 2.212)

| Cal. Year | Population | VMT | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | -0.11% | -0.09% | -0.18% | -0.11% | -0.30% | -0.17% | 5.03% |
| 1990 | -0.10% | -0.14% | -0.24% | -0.12% | -0.61% | -0.30% | 7.82% |
| 2000 | 0.00% | 0.06% | 0.11% | 0.10% | 0.60% | 0.25% | 8.48% |
| 2002 | -0.01% | 0.10% | 0.22% | 0.20% | 0.93% | 0.47% | 8.04% |
| 2005 | -0.01% | 0.23% | 0.10% | 0.05% | 0.57% | 0.86% | 7.22% |
| 2010 | -0.02% | 0.26% | 0.11% | 0.19% | 0.23% | 0.88% | 5.42% |
| 2015 | -0.02% | 0.18% | 0.45% | 0.39% | 0.68% | 0.56% | 4.33% |
| 2020 | -0.02% | 0.16% | 1.15% | 1.20% | 1.49% | 0.47% | 3.85% |

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 of Coding Fixes on San Francisco Valley Air Basin Inventories

San Francisco Summer Episodic Emissions From **All** On-Road Motor Vehicles
(Calculated Using EMFAC2007 draft ver 2.212)

| Cal. Year | Population | VMT*(1000) | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 2884329 | 90067376 | 765.22 | 6931.23 | 544.07 | 58677.01 | 8.97 |
| 1990 | 3779228 | 133990550 | 389.90 | 4063.57 | 502.35 | 81356.07 | 12.29 |
| 2000 | 4587554 | 159271550 | 193.84 | 1939.47 | 348.93 | 91969.98 | 9.15 |
| 2002 | 4767934 | 164169900 | 171.61 | 1729.38 | 330.02 | 94262.83 | 9.15 |
| 2005 | 5059512 | 172580900 | 133.10 | 1324.72 | 271.52 | 98481.00 | 9.31 |
| 2010 | 5719370 | 193298350 | 98.24 | 958.53 | 201.14 | 117230.00 | 10.08 |
| 2015 | 6104228 | 202212820 | 71.68 | 661.67 | 134.01 | 123899.80 | 10.26 |
| 2020 | 6540161 | 213899180 | 55.38 | 467.58 | 92.53 | 130414.00 | 10.55 |

San Francisco Summer Episodic On-Road Motor Vehicle Inventories With Coding Fixes
(Calculated Using EMFAC2007 draft ver 2.213)

| 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 | 9.47 |
| 1990 | 3778902 | 133980700 | 389.83 | 4063.51 | 502.35 | 81353.11 | 13.33 |
| 2000 | 4587510 | 159313810 | 193.79 | 1938.75 | 349.26 | 92075.27 | 9.83 |
| 2002 | 4767732 | 164287710 | 171.48 | 1727.73 | 331.03 | 94561.98 | 9.85 |
| 2005 | 5059078 | 172769280 | 132.89 | 1322.51 | 271.93 | 98961.19 | 10.00 |
| 2010 | 5718522 | 193409790 | 98.03 | 956.64 | 201.14 | 117529.40 | 10.63 |
| 2015 | 6103198 | 202209840 | 71.53 | 660.51 | 134.29 | 123920.20 | 10.69 |
| 2020 | 6539036 | 213873180 | 55.28 | 466.99 | 92.75 | 130374.10 | 10.91 |

Difference (Ver. 2.213 - Ver. 2.212) 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 | -432 | 14448 | -0.30 | -1.07 | 0.02 | 11.83 | 0.51 |
| 1990 | -326 | -9850 | -0.07 | -0.06 | 0.00 | -2.96 | 1.04 |
| 2000 | -44 | 42260 | -0.05 | -0.72 | 0.33 | 105.29 | 0.68 |
| 2002 | -202 | 117810 | -0.13 | -1.66 | 1.01 | 299.15 | 0.70 |
| 2005 | -434 | 188380 | -0.20 | -2.21 | 0.41 | 480.19 | 0.69 |
| 2010 | -848 | 111440 | -0.21 | -1.89 | -0.01 | 299.40 | 0.55 |
| 2015 | -1030 | -2980 | -0.15 | -1.16 | 0.28 | 20.40 | 0.43 |
| 2020 | -1125 | -26000 | -0.10 | -0.59 | 0.22 | -39.90 | 0.36 |

Percentage Change in San Francisco Emission Inventories (relative to Ver. 2.212)

| Cal. Year | Population | VMT | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | -0.01% | 0.02% | -0.04% | -0.02% | 0.00% | 0.02% | 5.65% |
| 1990 | -0.01% | -0.01% | -0.02% | 0.00% | 0.00% | 0.00% | 8.42% |
| 2000 | 0.00% | 0.03% | -0.03% | -0.04% | 0.09% | 0.11% | 7.42% |
| 2002 | 0.00% | 0.07% | -0.07% | -0.10% | 0.31% | 0.32% | 7.60% |
| 2005 | -0.01% | 0.11% | -0.15% | -0.17% | 0.15% | 0.49% | 7.43% |
| 2010 | -0.01% | 0.06% | -0.21% | -0.20% | 0.00% | 0.26% | 5.45% |
| 2015 | -0.02% | 0.00% | -0.20% | -0.17% | 0.21% | 0.02% | 4.20% |
| 2020 | -0.02% | -0.01% | -0.19% | -0.13% | 0.24% | -0.03% | 3.46% |

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 of Coding Fixes on San Joaquin Valley Air Basin Inventories

San Joaquin Summer Episodic Emissions From **All** On-Road Motor Vehicles
(Calculated Using EMFAC2007 draft ver 2.212)

| Cal. Year | Population | VMT*(1000) | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 881059 | 32884974 | 272.99 | 2786.85 | 232.28 | 23758.31 | 5.57 |
| 1990 | 1451839 | 60357364 | 207.39 | 2315.18 | 296.41 | 41542.37 | 8.78 |
| 2000 | 1991960 | 81054320 | 113.55 | 1231.07 | 230.19 | 51171.07 | 5.92 |
| 2002 | 2123866 | 85988360 | 96.61 | 1041.13 | 215.97 | 54065.73 | 5.94 |
| 2005 | 2324908 | 94207944 | 78.70 | 840.91 | 188.56 | 58998.68 | 6.05 |
| 2010 | 2643519 | 107741370 | 56.37 | 583.84 | 140.88 | 67279.58 | 6.05 |
| 2015 | 2998433 | 122270790 | 41.61 | 402.53 | 94.36 | 76628.91 | 6.22 |
| 2020 | 3351177 | 135617100 | 32.81 | 290.86 | 65.52 | 85445.91 | 6.61 |

San Joaquin Summer Episodic On-Road Motor Vehicle Inventories With Coding Fixes
(Calculated Using EMFAC2007 draft ver 2.213)

| 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 | 6.21 |
| 1990 | 1451709 | 60353564 | 207.35 | 2315.06 | 296.40 | 41540.45 | 10.19 |
| 2000 | 1991935 | 81094664 | 113.50 | 1230.42 | 230.47 | 51269.70 | 6.77 |
| 2002 | 2123753 | 86125608 | 96.49 | 1039.54 | 217.13 | 54405.38 | 6.80 |
| 2005 | 2324699 | 94471192 | 78.51 | 838.70 | 189.19 | 59647.63 | 6.89 |
| 2010 | 2643156 | 108103830 | 56.08 | 581.25 | 139.66 | 68168.80 | 6.70 |
| 2015 | 2998074 | 122441730 | 41.37 | 400.73 | 93.39 | 77049.29 | 6.74 |
| 2020 | 3350822 | 135666620 | 32.65 | 289.95 | 65.20 | 85565.63 | 7.08 |

Difference (Ver. 2.213 - Ver. 2.212) 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 | -24 | 9946 | -0.01 | 0.43 | 0.04 | 9.37 | 0.64 |
| 1990 | -130 | -3800 | -0.05 | -0.11 | 0.00 | -1.92 | 1.41 |
| 2000 | -25 | 40344 | -0.05 | -0.64 | 0.28 | 98.63 | 0.85 |
| 2002 | -113 | 137248 | -0.12 | -1.59 | 1.16 | 339.65 | 0.86 |
| 2005 | -209 | 263248 | -0.19 | -2.21 | 0.63 | 648.95 | 0.84 |
| 2010 | -363 | 362460 | -0.30 | -2.59 | -1.23 | 889.22 | 0.65 |
| 2015 | -359 | 170940 | -0.24 | -1.80 | -0.98 | 420.38 | 0.52 |
| 2020 | -355 | 49520 | -0.16 | -0.91 | -0.33 | 119.72 | 0.47 |

Percentage Change in San Joaquin Emission Inventories (relative to Ver. 2.212)

| Cal. Year | Population | VMT | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 0.00% | 0.03% | 0.00% | 0.02% | 0.02% | 0.04% | 11.50% |
| 1990 | -0.01% | -0.01% | -0.02% | 0.00% | 0.00% | 0.00% | 16.01% |
| 2000 | 0.00% | 0.05% | -0.04% | -0.05% | 0.12% | 0.19% | 14.34% |
| 2002 | -0.01% | 0.16% | -0.12% | -0.15% | 0.54% | 0.63% | 14.49% |
| 2005 | -0.01% | 0.28% | -0.24% | -0.26% | 0.33% | 1.10% | 13.91% |
| 2010 | -0.01% | 0.34% | -0.53% | -0.44% | -0.87% | 1.32% | 10.69% |
| 2015 | -0.01% | 0.14% | -0.57% | -0.45% | -1.04% | 0.55% | 8.31% |
| 2020 | -0.01% | 0.04% | -0.50% | -0.31% | -0.50% | 0.14% | 7.10% |

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 of Coding Fixes on South Coast Air Basin Inventories

South Coast Summer Episodic Emissions From **All** On-Road Motor Vehicles
(Calculated Using EMFAC2007 draft ver 2.212)

| Cal. Year | Population | VMT*(1000) | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | 4873676 | 158731810 | 1323.61 | 11305.46 | 892.91 | 107732.60 | 17.33 |
| 1990 | 7641506 | 275902500 | 835.47 | 8528.15 | 1000.43 | 173727.80 | 25.50 |
| 2000 | 8971597 | 317873060 | 394.71 | 4106.39 | 703.82 | 183389.80 | 17.69 |
| 2002 | 9243115 | 325196700 | 328.19 | 3382.39 | 631.77 | 186380.60 | 17.61 |
| 2005 | 9672629 | 337082460 | 262.58 | 2681.61 | 529.86 | 192682.50 | 17.77 |
| 2010 | 10409606 | 358938080 | 189.30 | 1880.47 | 388.18 | 205882.80 | 17.89 |
| 2015 | 11147240 | 381397660 | 142.18 | 1328.27 | 256.43 | 223509.10 | 18.55 |
| 2020 | 11940293 | 406621660 | 111.16 | 947.84 | 175.91 | 237434.10 | 19.17 |

South Coast Summer Episodic On-Road Motor Vehicle Inventories With Coding Fixes
(Calculated Using EMFAC2007 draft ver 2.213)

| 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 | 18.25 |
| 1990 | 7640950 | 275887420 | 835.29 | 8528.05 | 1000.45 | 173724.40 | 27.39 |
| 2000 | 8971487 | 317953860 | 394.61 | 4104.93 | 704.68 | 183587.10 | 18.87 |
| 2002 | 9242592 | 325466590 | 327.91 | 3378.67 | 634.78 | 187070.50 | 18.79 |
| 2005 | 9671430 | 337630750 | 262.02 | 2675.81 | 531.34 | 194087.40 | 18.88 |
| 2010 | 10407354 | 359493570 | 188.57 | 1874.55 | 387.35 | 207340.60 | 18.74 |
| 2015 | 11144674 | 381367780 | 141.70 | 1325.12 | 257.62 | 223544.50 | 19.24 |
| 2020 | 11937573 | 406502500 | 110.80 | 945.97 | 176.97 | 237236.80 | 19.78 |

Difference (Ver. 2.213 - Ver. 2.212) 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 | -868 | 20010 | -0.80 | -3.48 | -0.03 | 14.80 | 0.92 |
| 1990 | -556 | -15080 | -0.18 | -0.10 | 0.02 | -3.40 | 1.89 |
| 2000 | -110 | 80800 | -0.10 | -1.45 | 0.86 | 197.30 | 1.18 |
| 2002 | -523 | 269890 | -0.28 | -3.72 | 3.01 | 689.90 | 1.17 |
| 2005 | -1199 | 548290 | -0.55 | -5.80 | 1.47 | 1404.90 | 1.12 |
| 2010 | -2252 | 555490 | -0.73 | -5.92 | -0.83 | 1457.80 | 0.85 |
| 2015 | -2566 | -29880 | -0.48 | -3.14 | 1.18 | 35.40 | 0.69 |
| 2020 | -2720 | -119160 | -0.36 | -1.88 | 1.06 | -197.30 | 0.61 |

Percentage Change in South Coast Emission Inventories (relative to Ver. 2.212)

| Cal. Year | Population | VMT | ROG_Tot[1] | CO_Tot | NOx_Tot | CO2_Tot | PM10_Tot[2] |
|---|---|---|---|---|---|---|---|
| 1980 | -0.02% | 0.01% | -0.06% | -0.03% | 0.00% | 0.01% | 5.29% |
| 1990 | -0.01% | -0.01% | -0.02% | 0.00% | 0.00% | 0.00% | 7.41% |
| 2000 | 0.00% | 0.03% | -0.03% | -0.04% | 0.12% | 0.11% | 6.69% |
| 2002 | -0.01% | 0.08% | -0.09% | -0.11% | 0.48% | 0.37% | 6.67% |
| 2005 | -0.01% | 0.16% | -0.21% | -0.22% | 0.28% | 0.73% | 6.30% |
| 2010 | -0.02% | 0.15% | -0.39% | -0.31% | -0.21% | 0.71% | 4.76% |
| 2015 | -0.02% | -0.01% | -0.34% | -0.24% | 0.46% | 0.02% | 3.73% |
| 2020 | -0.02% | -0.03% | -0.33% | -0.20% | 0.60% | -0.08% | 3.19% |

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 9 Changes to 2005 Activity and Emission Estimates

| Calendar Year 2005 | Population Ver. 2212 | Population Ver. 2213 | diff (2213-2212) | VMT Ver. 2212 | VMT Ver. 2213 | diff (2213-2212) | Difference to ROG (tpd) | Difference to CO (tpd) | Difference to NOx (tpd) | Difference to CO2 (tpd) | Difference to PM10 (tpd) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LDA | 13908834 | 13906842 | -1992 | 481507420 | 481510620 | 3200 | 0.04 | -0.33 | -0.03 | -1.90 | 0.00 |
| LDT1 | 3747020 | 3746784 | -236 | 127606570 | 127602910 | -3660 | -0.01 | -0.13 | -0.02 | -1.24 | 0.00 |
| LDT2 | 3801961 | 3801792 | -169 | 134516210 | 134512290 | -3920 | -0.03 | -0.57 | 0.11 | -19.20 | 0.00 |
| MDV | 1676825 | 1676592 | -233 | 58278592 | 58273568 | -5024 | -0.02 | -0.13 | -0.02 | -3.55 | 0.00 |
| LHD1 | 257517 | 257559 | 41.4 | 14464286 | 14466499 | 2213 | 0.00 | 0.01 | 0.01 | 2.03 | 0.01 |
| LHD2 | 84389 | 84380 | -8.27 | 4345560 | 4345350 | -210 | 0.00 | -0.01 | 0.00 | -0.16 | 0.00 |
| MHD | 249840 | 249837 | -3.4 | 12865034 | 12865528 | 494 | 0.00 | 0.00 | 0.00 | 0.81 | 0.38 |
| HHD | 204812 | 204787 | -25.7 | 27636096 | 29077814 | **1441718** | -1.19 | -12.81 | 3.68 | 3589.22 | 3.39 |
| LHV | 0 | 0 | 0 | 0 | 0 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UBUS | 28186 | 28186 | 0.02 | 3344800 | 3344803 | 3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| MCY | 397680 | 397744 | 64.6 | 3012986 | 3013609 | 623 | 0.00 | 0.03 | 0.00 | 0.09 | 0.00 |
| SBUS | 26850 | 26849 | -1.17 | 1092497 | 1092453 | -44 | 0.00 | 0.00 | 0.00 | -0.07 | 0.05 |
| MH | 313806 | 313806 | 0 | 4214100 | 4214094 | -6 | 0.00 | 0.00 | 0.00 | -0.02 | 0.00 |
| Total | 24697720 | 24695158 | -2563 | 872884151 | 874319538 | 1435387 | -1.21 | -13.93 | 3.73 | 3566.02 | 3.82 |

Figure 1 Changes To Forecasted Heavy Heavy-Duty Populations in 2005

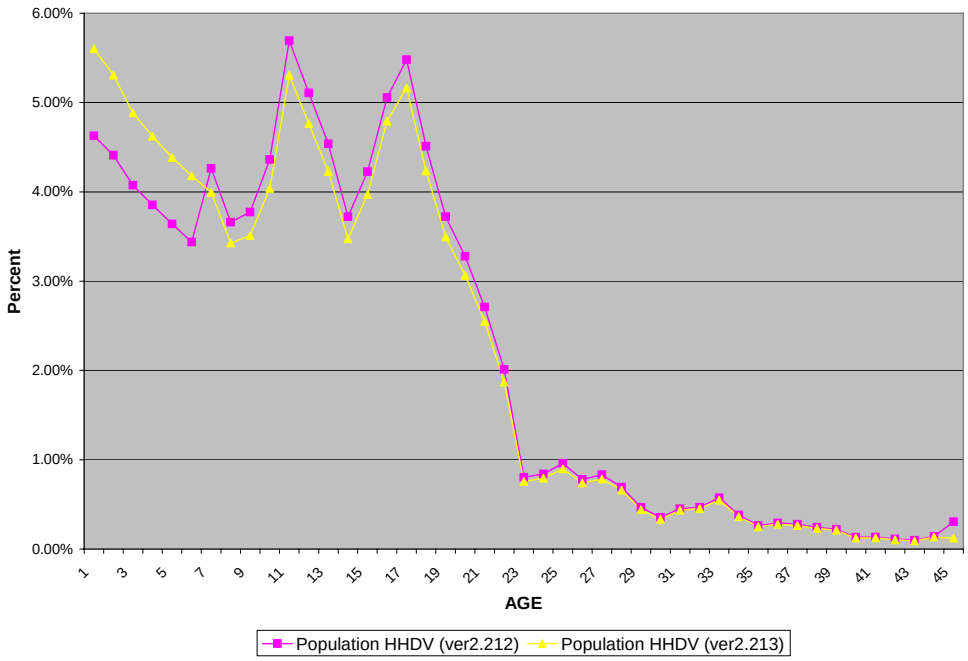


Figure 2 Changes To Forecasted 2005 VMT Distribution For Heavy Heavy-Duty Vehicles