Modification to the Phase II Attainment Plan for the Baltimore and Cecil County Nonattainment Areas: Revising the Mobile Source Emission Budgets using Mobile 6

SIP Revision 03-04

(Proposed)

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Prepared for:

U.S. Environmental Protection Agency

Prepared by:

Maryland Department of the Environment

Executive Summary

The purpose of this modification to the Attainment Plan for the Baltimore Region and Cecil County is to update the motor vehicle emission budgets using the MOBILE6 emissions model. EPA required this revision as a condition of the attainment plan approval for these two ozone nonattainment areas. This SIP revision reaffirms Maryland's commitment to address the problem of ground level ozone pollution.

Ground level ozone is a colorless odorless gas that is formed when emissions of volatile organic chemicals (VOCs) and nitrogen oxides (NOx) bake in sunlight. Ground level ozone can cause serious health problems and is of particular concern to young children, the elderly and individuals with pre-existing lung problems. Pollutants that cause ozone are also significant contributors to pollution of the Chesapeake Bay.

Under the 1990 Clean Air Act Amendments, both the Baltimore Region and Cecil County were classified as severe nonattainment areas with respect to the National Ambient Air Quality Standard for 1-hour ozone. The Clean Air Act requires that severe ozone nonattainment areas submit an attainment plan that demonstrates the area will comply with the federal ozone standard by 2005.

On April 28, 1998, Maryland submitted an attainment plan for the Baltimore Nonattainment Area and Cecil County entitled *Phase II Attainment Plan for the Baltimore Region and Cecil County* (The Plan). The Plan identified a number of traditional and innovative control strategies designed to reduce local emissions. The Plan also included local and regional modeling and weight of evidence demonstrations showing that, by implementing this suite of reduction measures, the Baltimore region and Cecil County would be likely to achieve compliance with the federal ozone standard if pollution transported from areas outside these nonattainment areas was reduced.

On October 29, 2001, EPA approved the attainment plan for these areas contingent upon Maryland’s fulfillment of several conditions. One of those conditions was to develop mobile source emission budgets using EPA’s new mobile source emission model, MOBILE6. EPA allowed states one year after the official release of the model to complete the revision of the budgets. This state implementation plan (SIP) revision fulfills that requirement. Other approval conditions are addressed in other SIP revisions.

The 2005 mobile source emission budgets for the Baltimore Region Nonattainment Area (Attainment Budget) are 55.3 tons/day VOC and 146.9 tons/day NOx. The 2005 mobile source emission budgets (Attainment Budget) for Cecil County are 3.0 tons/day VOC and 11.3 tons/day NOx.

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I. Background

The purpose of this modification to the Attainment Plan for the Baltimore Region and Cecil County is to update the motor vehicle emission budgets using the MOBILE6 emissions model. EPA required this revision as a condition of the attainment plan approval for these two ozone nonattainment areas. This SIP revision reaffirms Maryland's commitment to address the problem of ground level ozone pollution.

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Motor vehicle emissions budgets must be established for the attainment year, 2005, and reflect all control programs used in the attainment demonstration. Motor vehicle emission budgets will be used to determine whether transportation plans and transportation improvement programs conform to the Attainment Plan.

II. MOBILE 6 Modeling Processes

The latest version of EPA's mobile emission factor model, MOBILE6, is a major revision based on new test and field data and accounts for changes in vehicle technology. The model also provides the capability to analyze the benefits of a number of new regulations. In addition, the model includes an improved understanding of in-use emission levels and the factors that influence them, resulting in the need for significantly more detailed input data.

As compared to MOBILE5b, the model previously used to estimate mobile emissions, MOBILE6 has a significant impact on the emission factors, benefits of available control strategies, effects of new regulations and corrections to basic emission rates. Consequently, the emission rates are different and it is difficult to compare the results directly to previous runs conducted with MOBILE5b. For this reason, 1990 emission totals are reanalyzed using MOBILE6 and its features to process data collected earlier in the development of the emission estimates for previous SIPs.

Baltimore Region

The Baltimore Region uses a cooperative process to develop mobile source emission estimates and projections that are used in formulating mobile source emission budgets. The following agencies are involved in the process: the Maryland Department of the Environment, the Maryland Department of Transportation and the Baltimore Regional Transportation Board (BRTB) and their staff, the Transportation Planning Division of the Baltimore Metropolitan Council (BMC).

The process develops activity levels for vehicles through modeling that simulates travel patterns in the region. Estimates for the number of vehicle miles traveled and the number of vehicle trips are key outputs from this type of modeling. These outputs combine with other data inputs such as the age of the vehicles, the speed of travel, and other vehicle descriptives in the MOBILE models to produce emission factors that are tabulated and used appropriately based on activity levels to produce the final emission estimate. The BMC staff has made significant changes to the regional travel demand model during the past three years, which have provided a more reliable model for future year projections. The main enhancements to the model were an enhanced zonal structure and highway networks, and new trip attraction rates.

Appendix A (BMC Memorandum) documents the technical process and local assumptions used in the estimation of mobile source emissions in the Baltimore nonattainment area which includes Anne Arundel, Baltimore, Carroll, Harford, and Howard counties and Baltimore City. Briefly, the major steps in the emission estimation process are:

- Highway Performance Monitoring System (HPMS) adjusted simulated Vehicle Miles of Travel (VMT) from a traditional 4-step travel demand model and hourly travel speed estimation using a modification to the standard Bureau Public Roads (BPR) equation
- Locally derived estimation of vehicle mix and hourly volume distribution from classified and hourly counts
- Vehicle fleet class and age distribution from a July 1, 2002 database provided by the Maryland Motor Vehicle Administration (MVA)
- Environmental conditions such as temperature from regional metrological data
- National and local emission control programs such as heavy duty diesel engine rule and I/M program
- EPA's MOBILE6 emission model

A commercially available software package is used for the general flow, creating MOBLE input scripts, and then applying the above assumptions in estimating mobile source emissions for the Baltimore region.

The emission estimation process is conducted using the steps below, which are also further described in both Appendix A and Appendix B:

- Output travel demand model estimates of daily, am and peak period link total and truck volumes
- Convert Travel Demand Model estimates of daily link total and truck volume to seasonal HPMS adjusted hourly estimates
- Estimate link volume by vehicle class (motorcycle, 2 axel, Bus, and 2 axel 6 tire and 3+ axels).
- Calculate new travel speed
- Prepare MOBILE6 transportation related files
- Prepare MOBILE6 input scripts including transportation assumptions, environmental assumptions, control program specification files, and MOBILE6 operating parameters
- Execute MOBILE6 estimating mobile gram per mile composite emissions for three pollutants and VMT fractional shares for 28 vehicle types
- Apply MOBILE6 VMT fractional shares for 28 vehicle types by accumulated facility type VMT summaries multiplied by composite gram per mile emission factors
- Summaries estimated MOBILE source emission by 28 vehicle types for each pollutant and convert to tons per day

Cecil County

Cecil County also utilizes a cooperative process to develop mobile source emission estimates and projections that are used in formulating mobile source emission budgets. The following agencies are involved in the process: the Maryland Department of the Environment, the Maryland Department of Transportation and the Wilmington Area Planning Council (WILMAPCO).

The Wilmington Area Planning Council (WILMAPCO) is the Metropolitan Planning Organization (MPO) for both Cecil County, Maryland and New Castle County, Delaware. Both of these counties are technically part of the Philadelphia severe Ozone Nonattainment Area that also includes parts of Pennsylvania and New Jersey under the MPO leadership of the Delaware Valley Regional Planning Commission (DVRPC). Due to the size of the nonattainment area, and the multi-state implications, a sub-regional mobile emissions budget process has been adopted. In other words, separate mobile budgets are established for both Cecil County and New Castle County by their respective state air agencies for use in the WILMAPCO transportation planning process.   Sub-regional budgets are developed for Pennsylvania and New Jersey for the DVRPC activities.

The mobile source emission budgets for Cecil County are prepared in conjunction with the Maryland Department of Transportation. The projected traffic volumes developed for

Cecil County are based on the Upper Eastern Shore MINUTP transportation planning model. This model, developed by the Maryland State Highway Administration uses data from Cecil, Kent and Queen Anne's Counties in Maryland and New Castle County in Delaware to estimate traffic information.

The MINUTP model develops traffic volumes through a four-step process. Following a review of the model inputs, the outputs are input into a d-base program to produce network and trip ends data for use in the MOBILE 6 model. Emission factors are then developed using MOBILE 6. The emission factors developed include the following federal control programs: Federal Motor Vehicle Control Program (FMVCP) including Tier 1 and 2 vehicle standards, reformulated gasoline (RFG) Phase I and II, enhanced I/M, National Low Emissions Vehicle Program (NLEV), and heavy duty diesel engine 2 gram standard (HDDE2g) and were based on 2002 vehicle fleet characteristics.

The actual emission factor estimation method and post-processing method for Cecil County follows closely the process identified above for Baltimore. After the preparation of Mobile6 based transportation files, the model is run and all 28-vehicle classes are represented.

Land use inputs to the modeling process were provided by WILMAPCO. These land use inputs are 2002 based (with assistance from the 2000 Federal Census) and are synchronized with the land use assumptions used by WILMAPCO in their short term and long term transportation planning process.

In summary, calculating the Cecil County mobile emissions budget is very similar in process to calculating the Baltimore budget. The size of the county and the traffic volumes represented in the county make the calculations simpler in scale. Additional modeling information can be found in Appendix C of this document.

III. Motor Vehicle Emission Budgets for the Phase II Attainment Plan

The budgets in this SIP revision include the following control programs: the Federal Motor Vehicle Control Program including Tier 1 and 2 vehicle standards, RFG Phase I and II, enhanced inspection/maintenance program, NLEV program, and HDDE2g.

Table 1 summarizes the 2005 vehicle highway emissions budgets for the Baltimore 1-hour Ozone Nonattainment Area:

Table 1. 2005 MOBILE6 Budgets – Baltimore Region

Pollutant	**1990 Baseline (MOBILE5)**	**1990 Baseline (MOBILE6)**	**Existing 2005 Budget (MOBILE5)**	**Proposed 2005 Budget (MOBILE6)**
VOC (t/d)	134.2	165.14	45.5	55.3
NOx (t/d)	159.5	228.21	96.9	146.9

Table 2 summarizes the 2005 vehicle highway emissions budgets for Cecil County:

Table 2. Proposed 2005 MOBILE6 Budgets – Cecil County

Pollutant	**1990 Baseline (MOBILE5)**	**1990 Baseline (MOBILE6)**	**Existing 2005 Budget (MOBILE5)**	**Proposed 2005 Budget (MOBILE6)**
VOC (t/d)	7.2	8.6	2.6	3.0
NOx (t/d)	9.3	17.3	9.6	11.3

IV. Consultation Process for Conformity

The conformity rule requires air quality planning agencies to develop a consultation process with state departments of transportation and local officials. This process fosters understanding of the development process for air quality plans and transportation plans between the agencies. The Maryland Department of the Environment (MDE) adopted regulations, COMAR 26.11.26, governing consultation between the Maryland Departments of Transportation and the Environment, the Baltimore Region Transportation Board, and the Wilmington Area Planning Council (WILMAPCO) with respect to the development of air quality plans and transportation plans. This modification to the Phase II Attainment Plan and the motor vehicle emission budgets in it were developed in accordance with the consultation rule.

Appendix A: Travel Demand Documentation from BMC

Baltimore Metropolitan Council

DOCUMENTATION OF EMISSION ESTIMATION PROCESS AND ASSUMPTIONS IN FORECASTING MOBILE6 1990 AND 2005 MOBILE SOURCE EMISSIONS FOR THE BALTIMORE REGION

Task Report 03-3

March 2003

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DOCUMENTATION OF EMISSION ESTIMATION PROCESS AND ASSUMPTIONS IN FORECASTING MOBILE6 1990 AND 2005 MOBILE SOURCE EMISSIONS FOR THE BALTIMORE REGION

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I. Introduction

This report documents the technical process and local assumptions used in the estimation of mobile source emissions in the Baltimore non-attainment area (Cities of Baltimore and Annapolis, Anne Arundel, Baltimore, Carroll, Harford, and Howard counties). The process culminated in a vast amount of BMC staff time spent in determining the "best" technical approach to use in applying the MOBILE6 model. This was accomplished by sharing information with a Technical Workgroup created by the Interagency Consultation Group (ICG) for the Baltimore region. [The ICG's consist of three members – The Maryland Departments of Transportation and Environment and the Baltimore Regional Transportation Board. Staff of the Baltimore Metropolitan Council provide technical and administrative support to the ICG. The main purpose of the ICG is to coordinate the air quality/transportation planning process in the Baltimore non-attainment area.]

As an overview, the emission estimation process uses:

- Highway Performance Monitoring System (HPMS) adjusted simulated Vehicle Miles of Travel (VMT) from a traditional 4-step travel demand model and hourly travel speed estimation using a modification to the standard Bureau Public Roads (BPR) equation
- Locally derived estimation of vehicle mix and hourly volume distribution from classified and hourly counts
- Vehicle fleet class and age distribution from a July 1, 2002 database provided by the Maryland Motor Vehicle Administration (MVA)
- Environmental conditions such as temperature from regional metrological data
- National and local emission control programs such as heavy duty diesel engine rule and I/M program
- EPA's MOBILE6 emission model

A commercially available software package is used for the generally flow, creating MOBILE input scripts, and then applying the above assumptions in estimating mobile source emissions for the Baltimore region.

The emission estimation process is conducted using the steps outlined below, which are given expanded explanation later in the documentation:

- Output travel demand model estimates of daily, am and peak period link total and truck volumes
- Convert Travel Demand Model estimates of daily link total and truck volume to seasonal HPMS adjusted hourly estimates
- Estimate link volume by vehicle class (motorcycle, 2 axle, bus, and 2 axle 6 tire and 3+ axles).
- Calculate new travel speed
- Prepare MOBILE6 transportation related files
- Prepare MOBILE6 input scripts including transportation assumptions, environmental assumptions, control program specification files, and MOBILE6 operating parameters
- Execute MOBILE6 estimating mobile gram per mile composite emissions for three pollutants and VMT fractional shares for 28 vehicle types

- Apply MOBILE6 VMT fractional shares for 28 vehicle types by accumulated facility type VMT summaries multiplied by composite gram per mile emission factors
- Summaries showing estimated MOBILE source emissions by 28 vehicle types for each pollutant and converted to tons per day

II. Converting Travel Demand Model Link Volume

The Baltimore region maintains a traditional 4-step Travel Demand Model. The model most recently has been updated to a base year of 2000 and incorporates a revision in the estimation of medium and heavy truck trips and commercial vehicles based on a adaptive assignment method. The adaptive assignment method uses observed traffic counts to estimate a trip table that was used to adjust the generation of medium, heavy and commercial vehicle trips. The travel demand model is used to estimate travel demand on a link for a daily, am and pm peak period based on the estimates of socioeconomic data and existing and an envisioned transportation network. These estimates of demand are based on models calibrated with observations made from the 1993 Household Travel Survey and 1996 On-Board Transit Survey. Future demand is predicted based on changes in the underlying transportation system and location of demographic data of households and employment.

The estimates of mobile source emissions used in the MOBILE6 SIP are based on the 2000 travel model and the Round 6 socio economic data. The highway and transit networks include all proposed improvements contained in the current conforming TIP (02-06) and the 2001 Long Range Transportation Plan and any additional project that was identified by the sponsoring agency brought to the attention of the BMC staff. Sponsoring agencies identified transportation projects that could be in operation in the year 2005 for consideration in the MOBILE6 SIP for the 2005 attainment year.

The travel model network estimates of daily, am and pm total volume and truck (medium and heavy truck) volume along with link characteristics of functional type, distance, free flow speed, maximum capacity (service level "E"), urban area, travel lanes for am, pm and off peak, link density code, and VMT area (jurisdiction urban/rural) are converted to common database format. This database is the input into the commercially available air quality post processor.

III. Convert Travel Demand Model Estimates in Preparation for MOBILE

Travel models provide estimates of volume that are in the range of observed values on the upper functional class highway system. In order to capture all potential mobile source emissions, EPA requires that travel model estimates of volume be corrected with observed counts (HPMS) and that estimates of VMT not simulated within the travel model (local facilities) be made. It is suggested that MDOT HPMS estimates of average weekday VMT be the region's estimate of travel and the travel model outputs be adjusted to match these totals.

BMC staff contacted and received from MDOT the estimates of annual VMT for 1990 and 2000 summarized by the Federal Urban Aid (FUA) System (urban/rural and functional type). Annual estimated HPMS VMT was converted to average weekday through a conversion factor developed from daily traffic counts for the year 2000. A unique conversion factor for facility was developed that converts average daily to average weekday. The reported MDOT HPMS annual VMT was first divided by 366 (number of days in year 2000) and factored by the average daily to weekday factor for each FUA within each Baltimore jurisdiction.

An HPMS average weekday factor is developed dividing the total simulated VMT from the travel model by the observed HPMS estimated VMT at the FUA level within each jurisdiction. Factors derived from the analysis of 2000 are applied to future travel networks in the estimation of mobile source emissions.

For VMT estimates on the local network not contained in the travel model, BMC calculated the share of local 2000 HPMS VMT compared to non-local 2000 HPMS VMT for each jurisdiction within urban and rural areas. This ratio is the estimate of needed local VMT that would be required to obtain the estimates of network VMT. The travel model network VMT is first adjusted to HPMS totals and then the local VMT ratio is applied. The resulting calculation (local VMT) is placed on local links that are added to the travel model network database for air quality consideration. The same ratio of local to non-local calculations using 2000 data is applied to future horizon years. As future estimates of simulated non-local network VMT increase, local VMT would increase.

The highest concentration of ozone occurs during the summer months. Using the MDOT permanent count station database, which estimates the Average Annual Daily Traffic (AADT) along with calculated monthly adjustment factors, BMC staff estimated a seasonal AADT and a yearly AADT summed for all locations in the database with useable data. A comparison of summer months AADT to yearly AADT was calculated yielding a difference of 1.04. The permanent count stations indicate that summer travel is 4% greater than the yearly average. This factor is then applied to the HPMS average weekday VMT, resulting in average summertime weekday VMT.

The EPA MOBILE6 emission model requires the hourly estimate of VMT. The travel model estimated HPMS adjusted summertime weekday VMT for 3 time periods (daily, am, and pm) using both total and truck volume for each directional link is factored to hourly volumes based on MDOT 1999-2001 hourly count database. Observed hourly counts were totaled grouping by hour and FUA (functional type and urban/rural). Dividing each hourly estimate of observed volume by daily volume yields an hourly share for each FUA facility type. These shares are then used as the hourly pattern file (Appendix A) in the post processing software. Each directional travel model total volume and truck volume link is apportioned to each hour based on the observed data.

The travel model estimate of daily, am, and pm volume is directionally specific. Example being that am peak period volume is greater than the pm peak period volume on facilities heading into downtown and the opposite in the pm period. No attempt to distinguish the peaking direction in the MDOT hourly observed volume was made. The pattern files are generic estimating equal am and pm peak period concentrations. Directional link orientation is captured in the air quality post processing software by controlling the hourly pattern file distribution for the peak period hours back to the am and pm simulated HPMS weekday link volume. The supplied hourly pattern files are adjusted internally within the air quality post processing software to match the directional link peaking characteristics estimated using the travel demand model.

IV. Convert Travel Demand Model Hourly Estimates into 4 Vehicle Types

One of the biggest changes in MOBILE emission modeling is the number of vehicle classes (weight and fuel type) that emission estimation is sensitive to. Gram per mile emission factors increase with engine size or Gross Vehicle Weight (GVW) and gasoline vehicles have greater VOC emissions, while diesel vehicles have greater NOx emissions for a gram per mile. MOBILE6 has the ability to estimate emissions for 28 vehicle types. The BMC staff spent time researching and developing methods in converting hourly class count estimates into the various MOBILE vehicle classes. In addition to a conversion of hourly volume into vehicle classes, BMC staff also wanted to capture future changes in SUV usage compared to sedan and the predicted increasing heavy truck VMT estimated in MOBILE defaults and projected for the Baltimore region based on trends and changing demographics. Capturing the future effects of these changes in VMT shares would lesson the possibility that future modification to the VMT mix would result in emissions over SIP budgets, since the region would already be planning for vehicle mix changes in the SIP.

In order to best use the observed local mix and provide changes in mix over time, a process was developed that blends observed data, future simulated truck VMT and MOBILE national defaults. MDOT provided hourly functional classified counts (federal F-13 scheme) for the years 1999 - 2002. In addition to the goals established for estimating VMT mix, the error that exist in the tube counts lead us to the selected method. Under the F-13 scheme, class 2 and class 3 volumes are supposable 2 axle vehicles with class 3 being light trucks (SUVs). The class counters contain significantly greater number of class 2 volume over that of class 3. This difference is contrary to what one would expect based on Baltimore region vehicle registration data and MOBILE6 defaults. It was clear that the tube counts, attempting to classify 2 axle vehicles based on distance between axles, over estimates class 2 volume.

Converting class tube counts based on number of axles for the 2 axle six tire and 3 plus axle observations with that of the MOBILE6 heavy vehicle classification was investigated. One suggestion was to use a combination of Weigh in Motion (WIM) and classified counters. MDOT/MdTA was contacted for the availability of such data. At present time, only the truck weighing station on I-95 Southbound at the Susquehanna River has such a combination, but the information is not recorded in a database. The data is used to inform the scale attendant of potential trucks exceeding the allowable weight limits and requiring a more precise weight using the static scale. In addition to a lack of a database and limitation to one location, the WIM data would provide loaded vehicle weight and not GVW as classified in MOBILE. Attempts to map the various classes to MOBILE GVW using assumptions and MOBILE 5b mapping schemes were initiated. Concern was raised with dump trucks and cement mixers that have 3 and 4 axles, but are some of the heaviest vehicles in operation. What share of 3 axle vehicles would be 60,000 GVW?

The final selected methodology groups the observed classified counts into 4 vehicle types of 1) motorcycle, 2) 2 axle, 3) bus, and 4) 2 axle 6 tire and 3 plus axle vehicles. The 4 vehicle type groupings are estimated for each hour and FUA facility type using the MDOT provided database for the years 1999 – 2002. The 2 axle count by facility type is further subdivided into Light Duty Vehicle (LDV), Light Duty Truck 1 (LDVT1), LDVT2, LDVT3, and LDVT4 using the National Average Vehicle Miles Traveled Fractions By Vehicle Class Using MOBILE6 (Table 4.1.4 contained in the *Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation)*. The same table is used for mapping the heavy trucks into the MOBILE6 classes of Heavy Duty Vehicle 2B (HDV2b), HDV3, HDV4, HDV5, HDV6, HDV7, HDV8A, and HDV8B and to map bus VMT into Heavy Duty Bus School (HDBS) and Heavy Duty Bus Transit (HDBT). The motorcycle share estimated from the class counts is used for the MOBILE input of motorcycle.

Using the observed classified counts grouped into 4 vehicle types and the national defaults yields an estimate of VMT for 16 vehicle types. The VMT shares for the 16 vehicle types is used in MOBILE6 scripts using the VMT FRACTIONS command. Internally within MOBILE6 using diesel sales fractions, vehicle registration, and annual mileage accumulation for 16 vehicle types for 25 years, the split between gas and diesel for common vehicle types (example LDV is LDGasV and LDDeiselV) is estimated for VMT and estimating emission differences for fuel.

The selected shares to allocate the 4 vehicle type groups to the detailed MOBILE6 classes are selected based on the horizon year of analysis from table 4.1.4. The EPA national database contains estimates from 1952/1972 to 2020/2050. Using this methodology, the 2 axle vehicles will increasingly be allocated to the LDT classes in future years based on the assumptions contained in MOBILE6. The predicted increasing share of HDV estimated for the Baltimore region will be captured using the update to the region's medium and heavy truck model. The Baltimore region recently adopted a truck model that uses an adaptive assignment technique where both trip generation rates and a trip matrix are developed and factored to estimate the best trip matrix to match observed traffic counts. This calibrated truck model is then used to estimate future truck activity based on projections of demographic data (mainly employment). The medium and heavy truck VMT is summarized for horizon years 2000 and 2005 at the FUA class system. The growth in estimated medium and heavy trucks for each functional type is applied to the observed HDV classified traffic count database for each FUA and hour. New shares for each FUA and hour for the 4 vehicle types is recalculated. The share for HDV will be increasing based on the growth estimated in the travel model with the remainder being proportioned to the remaining classes based on the existing observations. The pattern file estimated for 2000 and 2005 is displayed in Appendix B for the 4 vehicle types.

The estimate of the 4 vehicle types for the year 2000 are derived from a analysis of MDOT and BMC conducted directional classified counts. Each year's database was screened eliminating weekend observations. Within each year multiple weekday counts at the same location were averaged. A few permanent count stations have the ability to record class. Averaging the year's worth of data prevents the estimate for the final estimate of vehicle class for that particular FUA to be dominated by the permanent count station. The weekday average for each location and each year is averaged grouping by hour and FUA. This yields an average estimate of vehicle class for each hour on all FUAs considering all weekday observations recorded from 1999 thru 2002.

There were only a few observations on roadways classified as local roads, since MDOT is responsible for the state system, which is mostly the upper class facilities. Local jurisdictions were contacted for the availability of providing hourly classified counts on local roadways. No local jurisdiction was able to provide such a database. Using profession judgment including conversations with local engineers, HDV on local roadways was estimated to be 3.9% of the total volume. BMC has begun the planning for local roadway data collection in upcoming fiscal years.

With development of the pattern files complete, the commercial software provided two options in applying the vehicle mix pattern files. In the simplest form, link hourly volume would be indexed by FUA and multiplied by the 4 vehicle type mix for the corresponding FUA. Once all links were completed and summed by FUA, the share of the 4 vehicle types both observed and simulated would match at a regional level. Each link within a FUA would get the same share of HDV. BMC staff felt some of the details within the truck model would be lost, such as the difference in truck VMT on identical facilities with one roadway connecting the Port of Baltimore to the network and the other located in a rural community.

Under the other option, pattern files are used but internally adjusted based on daily, am, and pm volume for all vehicles and trucks. With this option HPMS seasonal adjusted travel model volume for trucks is maintained on each link. Adjusted pattern files are applied using the summed link travel model volume for 4 vehicle types and when summed at the regional level, the simulated relatively equals that of the observed. This is due to the development of the BMC truck model which uses an adaptive assignment method where a trip table is estimated using the classified counts that were used to create the pattern file. Generation and distribution was calibrated along with a delta table to recreate the count adapted trip table. Using the truck model, heavy truck routes are distinguished from that produced using the pattern file. Ultimately, this difference has a impact on travel speed, since Passenger Car Equivalence (PCE) is considered in the volume to capacity calculation.

Both scenarios were evaluated and tested yielding similar results with respect to VMT distribution. Emissions were greater using the truck model adjusted pattern file. This is a result of assigning more accurate truck volumes at the link level resulting in different distribution of speeds. It was felt that the truck model could be more precise and potentially estimating emissions correctly.

V. Estimate Hourly Link Travel Speed

To prevent the need for emission speed lookup tables as completed in the MOBILE5b analysis, EPA incorporated VMT on freeways and arterials within the emission estimation process. Hourly speed is included in the MOBILE6 scripts using the command SPEED VMT, which references an input file containing shares of hourly speed on freeways and arterials grouped into 14 speed bins. The shares are calculated from accumulating hourly link VMT for speeds estimated using an update to the BPR curve. Two separate equations, one for interstates/freeways and one for non- interstates/freeways is used. The equation are as follows:

$$traveltime = speed * \left(1 + 0.2 * \left(\frac{v}{c} \right)^{10} \right)$$ for interstates/freeways

$$traveltime = speed * \left(1 + 0.05 * \left(\frac{v}{c} \right)^{10} \right)$$ for non-interstates/freeways

Each link's hourly HPMS adjusted summertime weekday volume is compared to the link's maximum (service level "E") hourly capacity in estimating a hourly travel speed. The vehicle types of bus and HDV are assumed to use more capacity than other vehicles based on defaults provided in the commercial software derived from the Highway Capacity Manual. In previous analysis, BMC has been criticized for failure to recognize peak spreading. The selected commercially available software package used to manage the process, has a built in sub-routine to accomplish estimates of peak spreading. The sub-routine requires the input at what point will peak spreading occur and how many hours before and after the peak will be effected. In the development of the MOBILE6 SIP, assumptions that spreading will occur when a link's hourly capacity is exceeded by 30% and that the excess volume will be distributed 3 hours before and after, was selected.

Exactly how travelers in the Baltimore region react or will react to over capacity situation is not known. Various levels (from no peak spreading thru 50% over capacity) of when peak spreading would occur were tested for the horizon year of 2005 measuring the difference in emission estimation. The maximum range was a difference in .27 tons of VOC and .14 tons of NOx. Although the exact inputs for peak spreading are not known, it was felt that assuming some effects of peak spreading would move the analysis in the correct direction and not severely over or understate emissions.

After hourly link speed is estimated assuming peak spreading, link VMT is accumulated in one of 14 speed bins (bin 1 is idle and the other 13 average speeds range from 5 mph to 65 mph in 5 mph increments) for the FUA functional classes of interstate and freeway, which are allocated to the MOBILE6 class of freeway, and principal and minor arterial, which is allocated to the MOBILE6 class of arterial. The travel model representation of collectors and locals is allocated to the MOBILE6 class of local and all travel model representation of ramps are allocated to MOBILE6 class of ramp. MOBILE6 assumes a set speed for the collector and ramp functional type. The commercial software allows for the development of the MOBILE6 speed file using either a simple or harmonic method. Under the simple method all VMT on a link with a hourly speed between 50 and 54.9 would be allocated to the 50 mph bin. Using the harmonic method, link VMT is distributed between two speed bins in the correct portions so the weight between the two speed bins would equal the estimate speed on the link. This method is similar to the AVERAGE SPEED command in MOBILE6. The harmonic method was chosen to allow for emissions to be sensitive to less than 5 mph speed changes.

VI. Preparing MOBILE6 Transportation Inputs

Although possible to estimate emissions from only one run of MOBILE6, the selected commercial software allows for the ease of estimating emissions using area type and functional type. Using a disaggregation also allows for ease in developing needed transportation files. For the Baltimore analysis four transportation related files are being provided using the following MOBILE6 commands:

> VMT FRACTIONS is the estimate of VMT by 16 vehicle types. This estimation is explained above. Observed data divided in 4 vehicle types and applied against adjusted travel model volume. Then using MOBILE6 national defaults, VMT is allocated to individual vehicle types within a group. Group vehicles of 2 axle is allocated to LDV, LDT1, LDT2, LDT3, and LDT4.
>
> VMT BY FACILITY is the estimated VMT by 28 vehicle types for each hour of the day on one of 4 facility types (freeway, arterial, local, and ramp).
>
> VMT BY HOUR is the share of total VMT for each hour of the day.
>
> SPEED VMT is the share of VMT on freeways and arterials for each hour of the day for 14 speed bins.

In the Baltimore analysis, MOBILE6 scripts are developed for each jurisdiction, area type (urban/rural), and each facility type (interstate, freeway, principal arterial, minor arterial, collector, 5 ramp types, and locals) for a maximum of 132 MOBILE6 runs. After the transportation network is analyzed developing hourly link volumes, speeds, and vehicle type, links are indexed by the above mentioned groupings to begin the estimating of the needed transportation files.

The VMT FRACTION file is simply the sum of VMT for each 16 vehicle types indexing by jurisdiction, urban/rural, and FUA divided by the total VMT for that index. For the VMT BY FACILITY file, the file is developed with 100 percent of the VMT occurring on one facility for each hour of the day for each of the 28 vehicle types. This is possible since we are indexing on facility type and only analyzing that particular facility. When principal arterials are selected, all of the VMT is occurring on the MOBILE6 functional class of arterial and the MOBILE6 functional class is set to 100 percent. The VMT BY HOUR is the sum of all VMT for each hour divided by the daily total for each index. The final file of SPEED VMT is created for each index using the harmonic mean as described above. Since we are indexing on facility type, only the freeway section is used when travel model functional class of interstate and freeway are used and arterial when travel model functional class of principal and minor arterial are used. Other functional types have an assumed speed built into MOBILE6.

VII. Preparing MOBILE6 Input Scripts

In addition to transportation data, MOBILE6 requires both environmental conditions and control strategies. For environmental conditions, a minimum temperature of 67.9 and a maximum temperature of 96.5 is used. The sunrise is at 6 am and the sunset is at 8 pm. The evaluation month is 7 (July) and season is 1 (summer). For other environmental conditions, the national defaults are being used.

For control strategies for years 2005 and later, a value of 7 is used for RVP, which is a measure of fuel volatility. Anti-Tampering Program is used with the following values 89 77 50 22222 21111111 1 12 96. 12211112. Appendix C lists a table with a description of switches for the Anti-Tampering Program. The various I/M programs, a total of 7 for 2005 and later, are used in MOBILE and described in Appendix D. The Light Duty Gasoline Vehicle Standards command using the national default penetration fractions is also being used.
MOBILE6 also allows for the input of regional specific registration data along with diesel sales fractions. The 2005 analysis is using registration data developed from the Maryland Motor Vehicle Administration (MVA) from a July 1, 2002 database. The vehicle registration file can be found in Appendix E. The share of each model year by vehicle type that is diesel is found in Appendix F. The heavy duty vehicles are using the national defaults for diesel sales fractions.

VIII. Execute MOBILE6

With transportation data estimated, control program specified, environmental conditions expected, and vehicle fleet data provided, MOBILE6 is executed for each facility type within urban/rural areas for each jurisdiction. MOBILE6 has two output reports. The first being a REPORT FILE, which list various assumptions used in the header and then gram per mile emissions for the various vehicle types. The other being DATABASE OUTPUT, which is more useful due to fixed format and containing only one header line followed by the various MOBILE6 data. Both reports are generated, but only the database is used in estimating regional mobile source emissions.

The POLLUTANTS of hydrocarbons (HC), which are expressed as volatile organic compounds (VOC), carbon monoxide (CO), and oxides of nitrogen (NOx) are estimated for exhaust and evaporative emissions (Exhaust emission of Running, Start and Hot Soak, Evaporative emissions of Diurnal, Resting Loss, Running Loss and Crankcase). Refueling emissions are not estimated, since refueling is accounted for in the SIP as stationary and not mobile. For the database file, gram per mile emission factors use the AGGREGATED OUTPUT command. This command reduces gram per mile emission factors for a daily estimate considering exhaust and non-exhaust (minus refueling) emissions for each 28 vehicle type. The composite emission factor is weighted considering the following:

- VMT per facility - no effect in the Baltimore analysis since facility type is an index

- Age (25) of the vehicle within vehicle type – the weight is based on the registration data for Baltimore and annual miles accumulated by vehicle type and age from the national database.
- Hour of the day – daily VMT share per hour based on MDOT hourly counts applied to travel model output is provided and used as the hourly weight
- Emission factors for exhaust and non-exhaust

The daily gram per mile database emission factor contains the following variables:

- FILE – MOBILE6 has the ability to batch input files together. File is just the numerical identifier of input file.
- RUN/ SCEN – MOBILE6 scripts are divided into two parts (RUN and SCENario). The RUN section contains data such as control program and registration data, while the SCENario section contains information on transportation data. One can have several SCENarios for one RUN. For Baltimore RUN information is at the jurisdiction and urban/rural level and scenario are the various facility types within. FILE, RUN, and SCEN are indexes for the output database.
- CAL_YEAR – The calendar year that the emissions are based on.
- POL – The pollutant (3) being estimated.
- VTYPE – The vehicle type (28) that the emission are estimate for.
- GM_MILE – The estimated gram per mile emission factor.
- GM_DAY – The daily estimate of emission expressed as gram per mile. Daily is estimated as the gram per mile multiplied by the daily miles travel for that vehicle type.
- STARTS – The estimated number of vehicle starts per day for each vehicle type based on the national defaults.
- ENDS – The estimated number of vehicle ends per day that exceeded the soak time based on the national defaults.
- MILES – The estimated daily miles accumulated based on national defaults.
- MPG – The miles per gallon of gasoline using the national database.
- VMT – The weight for individual vehicle types for each pollutant. A single emission factor can be created for each pollutant by summing the gram per mile multiplied VMT.

Appendix G contains an excerpt 2005 MOBILE6 script for all FUAs in the urbanized area of Baltimore County. Other jurisdiction and urban/rural scripts are similar and are available upon request.

IX. Apply MOBILE6 Output to Travel Model Estimates of VMT

Only select fields are used from the output database. The index fields are used to select the emission factor and VMT (weight) for each jurisdiction, urban/rural area, and functional type. The commercial software used during the transportation file preparation for MOBILE6 summarizes the daily VMT for each index (jurisdiction, urban/rural area, and functional type). The daily VMT is then multiplied by the MOBILE6 output estimate of VMT (weight) for each vehicle type yielding the estimated daily VMT for 28 vehicle types. Individual vehicle types daily VMT is multiplied by the composite gram per mile emission factor to estimate mobile source emissions for each vehicle type for each index.

A new database is created with the index fields of jurisdiction, urban/rural area, and functional type along with estimates of VMT and emission for each of the 28 vehicle types and three pollutants of VOC, CO, and NOx.

X. Summarizing Estimates of Mobile Source Emissions

Using the created database by applying VMT summaries with MOBILE6 outputs, the selected commercial software prepares various reports that summaries VMT and emissions. Reports are developed summarizing emissions by vehicle type, time period, jurisdiction and urban/areas, and facility type. A regional report showing the cumulative total for the region summarized by four vehicle types (Auto/MC, Lt. Truck, Hvy. Truck, and Bus) is prepared listing VMT, and pollutants of VOC, CO, and NOx.

This estimate represents the expected emissions for a horizon year based on the supplied planning assumptions.

XI. Conclusion

The commercial software both used for travel forecasting and air quality modeling has been setup with various batch files for easy of executions and replication. The time consuming work of file preparation and analysis has been completed for the various steps. Both processes, travel forecasting and air quality modeling, allow for the estimate of reasonably expected mobile source emissions with the adoption of different planning assumptions.

Appendix A – BMC Memo
Hourly Pattern Files

* SHA Urban Area HPMS FC BMC FC
* 1,11 Interstate 1,6,7,8,9
* 12 Other Freeway & Expressway 2
* 2,14 Other Principal Art. 3
* 6,16 Minor Arterial 4,10
* 7,8,17 Collector 5
* 9,19 Local 11
* Rural (2), but in model code (0)

* Urban (1)/	FC	PATT	Range		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	1	1	0.0	99999	1.405	0.964	0.798	0.728	1.013	2.361	4.549	6.075	5.880	5.067	5.019	5.288	5.524	5.592	6.054	6.664	6.962	6.956	5.955	4.719	3.873	3.471	2.904	2.178
1	2	1	0.0	99999	1.087	0.627	0.470	0.410	0.781	2.479	5.289	6.955	6.493	4.734	4.346	4.678	5.074	5.132	5.811	6.919	7.803	8.243	6.458	4.767	3.764	3.260	2.573	1.847
1	3	1	0.0	99999	0.820	0.498	0.360	0.304	0.477	1.256	3.136	5.408	5.595	5.039	5.438	6.192	6.931	6.761	6.716	7.101	7.607	7.845	6.410	4.938	4.187	3.346	2.187	1.447
1	4	1	0.0	99999	0.621	0.360	0.256	0.251	0.477	1.423	3.979	6.674	6.568	5.364	5.152	5.780	6.362	6.037	6.159	7.145	8.148	8.587	6.832	4.334	3.659	2.854	1.835	1.143
1	5	1	0.0	99999	0.593	0.346	0.269	0.236	0.483	1.500	3.576	5.917	6.439	5.508	4.956	5.612	6.196	5.908	5.952	7.197	8.104	8.559	6.908	5.214	4.278	3.154	1.932	1.163
1	6	1	0.0	99999	1.405	0.964	0.798	0.728	1.013	2.361	4.549	6.075	5.880	5.067	5.019	5.288	5.524	5.592	6.054	6.664	6.962	6.956	5.955	4.719	3.873	3.471	2.904	2.178
1	7	1	0.0	99999	1.405	0.964	0.798	0.728	1.013	2.361	4.549	6.075	5.880	5.067	5.019	5.288	5.524	5.592	6.054	6.664	6.962	6.956	5.955	4.719	3.873	3.471	2.904	2.178
1	8	1	0.0	99999	1.405	0.964	0.798	0.728	1.013	2.361	4.549	6.075	5.880	5.067	5.019	5.288	5.524	5.592	6.054	6.664	6.962	6.956	5.955	4.719	3.873	3.471	2.904	2.178
1	9	1	0.0	99999	1.405	0.964	0.798	0.728	1.013	2.361	4.549	6.075	5.880	5.067	5.019	5.288	5.524	5.592	6.054	6.664	6.962	6.956	5.955	4.719	3.873	3.471	2.904	2.178
1	10	1	0.0	99999	0.621	0.360	0.256	0.251	0.477	1.423	3.979	6.674	6.568	5.364	5.152	5.780	6.362	6.037	6.159	7.145	8.148	8.587	6.832	4.334	3.659	2.854	1.835	1.143
1	15	1	0.0	99999	0.342	0.169	0.141	0.195	0.269	0.982	3.956	6.626	7.031	6.279	5.772	6.409	6.988	6.687	6.823	7.571	8.247	9.129	7.907	2.622	2.212	1.660	1.187	0.795
2	1	1	0.0	99999	1.087	0.726	0.598	0.624	0.963	2.669	5.078	6.374	5.999	5.101	4.972	5.103	5.199	5.359	5.888	6.723	7.416	7.550	6.368	4.769	3.843	3.316	2.521	1.755
2	2	1	0.0	99999	1.087	0.627	0.470	0.410	0.781	2.479	5.289	6.955	6.493	4.734	4.346	4.678	5.074	5.132	5.811	6.919	7.803	8.243	6.458	4.767	3.764	3.260	2.573	1.847
2	3	1	0.0	99999	0.604	0.376	0.318	0.350	0.792	2.459	6.174	7.960	7.279	5.751	4.774	4.975	5.042	5.043	5.789	7.302	8.213	8.587	6.890	3.556	2.621	2.247	1.770	1.128
2	4	1	0.0	99999	0.649	0.360	0.229	0.197	0.372	1.238	3.509	5.738	5.790	5.248	5.580	6.092	6.466	6.414	6.585	7.114	7.866	8.207	6.618	4.956	4.260	3.267	1.978	1.267
2	5	1	0.0	99999	0.575	0.317	0.291	0.341	0.667	2.137	5.452	7.564	6.400	4.816	4.678	4.990	5.310	5.314	5.834	7.084	8.528	9.392	7.148	4.299	3.543	2.638	1.664	1.018
2	6	1	0.0	99999	1.087	0.726	0.598	0.624	0.963	2.669	5.078	6.374	5.999	5.101	4.972	5.103	5.199	5.359	5.888	6.723	7.416	7.550	6.368	4.769	3.843	3.316	2.521	1.755
2	7	1	0.0	99999	1.087	0.726	0.598	0.624	0.963	2.669	5.078	6.374	5.999	5.101	4.972	5.103	5.199	5.359	5.888	6.723	7.416	7.550	6.368	4.769	3.843	3.316	2.521	1.755
2	8	1	0.0	99999	1.087	0.726	0.598	0.624	0.963	2.669	5.078	6.374	5.999	5.101	4.972	5.103	5.199	5.359	5.888	6.723	7.416	7.550	6.368	4.769	3.843	3.316	2.521	1.755
2	9	1	0.0	99999	1.087	0.726	0.598	0.624	0.963	2.669	5.078	6.374	5.999	5.101	4.972	5.103	5.199	5.359	5.888	6.723	7.416	7.550	6.368	4.769	3.843	3.316	2.521	1.755
2	10	1	0.0	99999	0.649	0.360	0.229	0.197	0.372	1.238	3.509	5.738	5.790	5.248	5.580	6.092	6.466	6.414	6.585	7.114	7.866	8.207	6.618	4.956	4.260	3.267	1.978	1.267
2	15	1	0.0	99999	0.374	0.258	0.267	0.401	0.677	1.799	3.223	5.129	4.737	4.951	5.298	5.155	5.939	5.609	6.429	7.586	7.782	8.868	7.978	6.402	4.719	3.811	1.986	0.623

Appendix B – BMC Memo
2000 Vehicle Mix Files

* Vehicle Types: 4 vtypes 1 MC, 2 2 axle, 3 Bus, 4 HDV
* Data supplied for 2 area types (urban/rural) 11 facility types by 24 time periods - Does not vary by county
* ramp types 6,7,8,9 has the same mix as ft 1 Interstate
* ramp type 10 has the same mix as ft 3 Principal Arterial
* ---
*

* Urban /rural	FT	VT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
*urban																										
1	1	1	0.29	0.41	0.48	0.57	0.4	0.24	0.17	0.17	0.2	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.17	0.17	0.17	0.19	0.2	0.2	0.23	0.23
1	1	2	84.01	77.5	71.89	67.14	73.07	84.82	89.68	92.17	90.87	88.08	86.82	87.02	87.69	87.87	89.17	90.86	92.76	93.93	93.89	93.25	92.77	92.7	91.41	89.28
1	1	3	0.85	1.07	1.46	1.75	1.63	1	0.79	0.66	0.79	1.09	1.09	1.05	0.99	1.05	0.93	0.76	0.61	0.5	0.5	0.52	0.51	0.47	0.53	0.59
1	1	4	14.84	21.02	26.17	30.54	24.9	13.94	9.36	7	8.14	10.64	11.91	11.75	11.14	10.89	9.73	8.21	6.46	5.39	5.44	6.05	6.52	6.63	7.84	9.89
1	2	1	0.35	0.44	0.5	0.56	0.43	0.3	0.19	0.14	0.13	0.17	0.2	0.2	0.2	0.2	0.21	0.19	0.18	0.17	0.18	0.21	0.22	0.22	0.24	0.26
1	2	2	90.55	84.4	80.11	75.68	82.5	90.05	92.54	93.79	92.9	90.51	89.43	89.81	90.77	90.8	91.56	92.97	94.34	95.56	95.69	95.56	95.48	95.46	94.93	93.43
1	2	3	0.56	0.91	1.08	1.23	1.03	0.68	0.62	0.51	0.56	0.82	0.82	0.76	0.7	0.82	0.74	0.52	0.41	0.27	0.29	0.28	0.26	0.23	0.27	0.33
1	2	4	8.54	14.25	18.31	22.54	16.04	8.97	6.65	5.56	6.4	8.5	9.55	9.24	8.34	8.18	7.49	6.32	5.07	4	3.84	3.95	4.04	4.09	4.56	5.98
1	3	1	0.23	0.26	0.31	0.39	0.33	0.22	0.16	0.12	0.12	0.14	0.15	0.14	0.15	0.15	0.15	0.14	0.13	0.13	0.15	0.16	0.15	0.15	0.18	0.21
1	3	2	94.22	92.38	90.84	87.08	88.06	91.17	92.69	93.42	92.67	91.79	91.76	92.22	92.68	92.56	92.73	93.42	94.45	95.37	95.66	95.79	96.05	96.13	96	95.48
1	3	3	0.98	1.1	0.83	1.22	1.51	1.06	1.01	0.97	1.01	1	0.89	0.81	0.75	0.79	0.89	0.82	0.69	0.53	0.5	0.47	0.44	0.47	0.53	0.66
1	3	4	4.57	6.26	8.02	11.31	10.09	7.56	6.14	5.49	6.2	7.07	7.2	6.83	6.42	6.5	6.24	5.62	4.73	3.97	3.69	3.58	3.36	3.26	3.29	3.64
1	4	1	0.33	0.31	0.65	0.55	0.51	0.34	0.25	0.2	0.21	0.22	0.26	0.23	0.24	0.27	0.23	0.21	0.21	0.2	0.23	0.25	0.24	0.24	0.23	0.3
1	4	2	94.22	91.88	89.86	85.8	88.5	91.38	92.69	93.63	92.99	91.74	91.49	92.26	92.66	92.64	92.72	93.36	94.49	95.33	95.84	95.73	96.29	96.16	96.13	95.46
1	4	3	0.66	0.85	0.89	1.26	1.2	0.97	1.03	1.11	1.1	0.98	0.77	0.79	0.81	0.82	0.96	0.99	0.7	0.61	0.48	0.39	0.33	0.37	0.41	0.51
1	4	4	4.79	6.97	8.61	12.39	9.79	7.31	6.03	5.06	5.7	7.05	7.48	6.73	6.28	6.27	6.1	5.44	4.6	3.86	3.46	3.63	3.14	3.23	3.23	3.74
1	5	1	0.61	0.49	0.43	0.69	0.63	0.32	0.26	0.18	0.18	0.23	0.27	0.23	0.28	0.31	0.25	0.32	0.26	0.28	0.32	0.37	0.4	0.35	0.34	0.41
1	5	2	90.34	86.62	84.84	79.56	81.41	87.96	90.18	91.67	91.59	90.7	90.6	91.68	92.24	92.05	92.08	92.4	94.1	95.05	95.35	95.01	95.11	95.28	94.64	92.97
1	5	3	1.41	1.55	1.31	1.46	1.92	1.23	1.06	1.23	1.23	1.05	0.97	0.84	0.79	0.82	1.01	1.01	0.69	0.5	0.49	0.53	0.58	0.5	0.78	0.9
1	5	4	7.64	11.33	13.42	18.29	16.04	10.49	8.5	6.92	7	8.03	8.16	7.25	6.69	6.82	6.66	6.27	4.95	4.17	3.84	4.09	3.92	3.86	4.24	5.72
1	6	1	0.29	0.41	0.48	0.57	0.4	0.24	0.17	0.17	0.2	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.17	0.17	0.17	0.19	0.2	0.2	0.23	0.23
1	6	2	84.01	77.5	71.89	67.14	73.07	84.82	89.68	92.17	90.87	88.08	86.82	87.02	87.69	87.87	89.17	90.86	92.76	93.93	93.89	93.25	92.77	92.7	91.41	89.28
1	6	3	0.85	1.07	1.46	1.75	1.63	1	0.79	0.66	0.79	1.09	1.09	1.05	0.99	1.05	0.93	0.76	0.61	0.5	0.5	0.52	0.51	0.47	0.53	0.59
1	6	4	14.84	21.02	26.17	30.54	24.9	13.94	9.36	7	8.14	10.64	11.91	11.75	11.14	10.89	9.73	8.21	6.46	5.39	5.44	6.05	6.52	6.63	7.84	9.89
1	7	1	0.29	0.41	0.48	0.57	0.4	0.24	0.17	0.17	0.2	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.17	0.17	0.17	0.19	0.2	0.2	0.23	0.23
1	7	2	84.01	77.5	71.89	67.14	73.07	84.82	89.68	92.17	90.87	88.08	86.82	87.02	87.69	87.87	89.17	90.86	92.76	93.93	93.89	93.25	92.77	92.7	91.41	89.28
1	7	3	0.85	1.07	1.46	1.75	1.63	1	0.79	0.66	0.79	1.09	1.09	1.05	0.99	1.05	0.93	0.76	0.61	0.5	0.5	0.52	0.51	0.47	0.53	0.59
1	7	4	14.84	21.02	26.17	30.54	24.9	13.94	9.36	7	8.14	10.64	11.91	11.75	11.14	10.89	9.73	8.21	6.46	5.39	5.44	6.05	6.52	6.63	7.84	9.89

Appendix B – BMC Memo
2000 Vehicle Mix Files

1	8	1	0.29	0.41	0.48	0.57	0.4	0.24	0.17	0.17	0.2	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.17	0.17	0.17	0.19	0.2	0.2	0.23	0.23
1	8	2	84.01	77.5	71.89	67.14	73.07	84.82	89.68	92.17	90.87	88.08	86.82	87.02	87.69	87.87	89.17	90.86	92.76	93.93	93.89	93.25	92.77	92.7	91.41	89.28
1	8	3	0.85	1.07	1.46	1.75	1.63	1	0.79	0.66	0.79	1.09	1.09	1.05	0.99	1.05	0.93	0.76	0.61	0.5	0.5	0.52	0.51	0.47	0.53	0.59
1	8	4	14.84	21.02	26.17	30.54	24.9	13.94	9.36	7	8.14	10.64	11.91	11.75	11.14	10.89	9.73	8.21	6.46	5.39	5.44	6.05	6.52	6.63	7.84	9.89
1	9	1	0.29	0.41	0.48	0.57	0.4	0.24	0.17	0.17	0.2	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.17	0.17	0.17	0.19	0.2	0.2	0.23	0.23
1	9	2	84.01	77.5	71.89	67.14	73.07	84.82	89.68	92.17	90.87	88.08	86.82	87.02	87.69	87.87	89.17	90.86	92.76	93.93	93.89	93.25	92.77	92.7	91.41	89.28
1	9	3	0.85	1.07	1.46	1.75	1.63	1	0.79	0.66	0.79	1.09	1.09	1.05	0.99	1.05	0.93	0.76	0.61	0.5	0.5	0.52	0.51	0.47	0.53	0.59
1	9	4	14.84	21.02	26.17	30.54	24.9	13.94	9.36	7	8.14	10.64	11.91	11.75	11.14	10.89	9.73	8.21	6.46	5.39	5.44	6.05	6.52	6.63	7.84	9.89
1	10	1	0.23	0.26	0.31	0.39	0.33	0.22	0.16	0.12	0.12	0.14	0.15	0.14	0.15	0.15	0.15	0.14	0.13	0.13	0.15	0.16	0.15	0.15	0.18	0.21
1	10	2	94.22	92.38	90.84	87.08	88.06	91.17	92.69	93.42	92.67	91.79	91.76	92.22	92.68	92.56	92.73	93.42	94.45	95.37	95.66	95.79	96.05	96.13	96	95.48
1	10	3	0.98	1.1	0.83	1.22	1.51	1.06	1.01	0.97	1.01	1	0.89	0.81	0.75	0.79	0.89	0.82	0.69	0.53	0.5	0.47	0.44	0.47	0.53	0.66
1	10	4	4.57	6.26	8.02	11.31	10.09	7.56	6.14	5.49	6.2	7.07	7.2	6.83	6.42	6.5	6.24	5.62	4.73	3.97	3.69	3.58	3.36	3.26	3.29	3.64
1	15	1	0.65	1.22	0.38	0.73	0.72	0.41	0.28	0.3	0.33	0.31	0.34	0.3	0.25	0.21	0.32	0.37	0.2	0.18	0.33	0.37	0.38	0.35	0.55	0.56
1	15	2	95.2	91.07	88.04	85.91	87.39	93.4	94.79	94.63	93.8	92.72	92.96	93.65	94.2	93.9	94.59	94.64	95.23	94.84	96.41	97.05	97.44	97.66	97.65	96.2
1	15	3	0.92	1.04	2.49	2.38	3.69	2	1.42	1.27	1.5	1.86	1.3	1.22	1.17	1.18	1.04	0.89	0.79	0.57	0.73	0.46	0.44	0.37	0.22	0.47
1	15	4	3.23	6.67	9.09	10.97	8.2	4.19	3.5	3.79	4.37	5.1	5.41	4.83	4.38	4.71	4.05	4.1	3.78	4.41	2.53	2.11	1.74	1.62	1.58	2.77

*rural

2	1	1	0.35	0.38	0.56	0.56	0.41	0.26	0.16	0.14	0.12	0.16	0.19	0.18	0.16	0.15	0.16	0.15	0.14	0.16	0.17	0.23	0.2	0.19	0.21	0.25
2	1	2	65.03	52.69	45.41	42.58	56.84	75.87	86.03	89.44	87.35	82.59	80.52	81.11	81.78	82.82	84.84	87.81	90.73	92.5	91.71	88.38	87.64	86.29	82.43	77.27
2	1	3	1.29	1.69	1.99	2.11	1.77	1.2	0.79	0.68	0.97	1.23	1.25	0.99	0.97	1.07	0.96	0.75	0.63	0.45	0.49	0.78	0.68	0.56	0.64	0.77
2	1	4	33.33	45.24	52.04	54.76	40.98	22.68	13.02	9.74	11.56	16.02	18.04	17.71	17.09	15.96	14.05	11.29	8.5	6.89	7.62	10.6	11.48	12.97	16.71	21.71
2	2	1	0.35	0.44	0.5	0.56	0.43	0.3	0.19	0.14	0.13	0.17	0.2	0.2	0.2	0.2	0.21	0.19	0.18	0.17	0.18	0.21	0.22	0.22	0.24	0.26
2	2	2	90.55	84.4	80.11	75.68	82.5	90.05	92.54	93.79	92.9	90.51	89.43	89.81	90.77	90.8	91.56	92.97	94.34	95.56	95.69	95.56	95.48	95.46	94.93	93.43
2	2	3	0.56	0.91	1.08	1.23	1.03	0.68	0.62	0.51	0.56	0.82	0.82	0.76	0.7	0.82	0.74	0.52	0.41	0.27	0.29	0.28	0.26	0.23	0.27	0.33
2	2	4	8.54	14.25	18.31	22.54	16.04	8.97	6.65	5.56	6.4	8.5	9.55	9.24	8.34	8.18	7.49	6.32	5.07	4	3.84	3.95	4.04	4.09	4.56	5.98
2	3	1	0.16	0.16	0.1	0.19	0.12	0.09	0.12	0.11	0.11	0.14	0.16	0.15	0.16	0.18	0.17	0.21	0.15	0.21	0.2	0.23	0.21	0.17	0.23	0.19
2	3	2	91.15	87.3	82.36	77.59	84.48	89.8	91.92	92.98	91.82	89.37	88.65	88.92	89.08	89.19	90.47	92.41	94.16	95.61	96.07	95.89	96.18	96.33	95.89	95.14
2	3	3	0.52	0.94	1.31	1.25	0.65	0.49	0.61	0.65	0.69	0.89	0.72	0.71	0.74	0.83	0.83	0.65	0.42	0.25	0.2	0.22	0.26	0.21	0.26	0.25
2	3	4	8.16	11.61	16.23	20.97	14.76	9.62	7.35	6.26	7.38	9.6	10.47	10.21	10.02	9.8	8.53	6.73	5.27	3.94	3.53	3.65	3.35	3.29	3.62	4.42
2	4	1	0.6	0.82	0.78	0.63	0.72	0.67	0.62	0.51	0.59	0.74	0.83	0.88	0.81	0.85	0.91	0.79	0.77	0.66	0.83	1.17	1.02	0.89	0.74	0.67
2	4	2	91.97	89.08	85.77	83.66	86.55	89.62	90.6	89.82	88.37	86.05	85.51	86.01	86.54	86.45	87.37	89.3	91.31	93.02	93.1	93.74	94.3	94.53	94.47	94
2	4	3	0.47	0.69	0.69	0.7	0.58	0.46	0.64	2.05	1.86	1.88	1.79	1.96	1.92	2.04	1.98	1.67	1.3	1.12	1.25	0.29	0.28	0.28	0.19	0.3
2	4	4	6.96	9.41	12.76	15.01	12.14	9.25	8.14	7.62	9.18	11.33	11.88	11.15	10.73	10.67	9.73	8.24	6.62	5.21	4.82	4.81	4.4	4.31	4.6	5.03
2	5	1	0.79	0.63	1.18	0.96	0.80	0.57	0.20	0.20	0.17	0.28	0.34	0.39	0.31	0.32	0.39	0.28	0.24	0.24	0.39	0.31	0.43	0.29	0.38	0.39
2	5	2	89.68	85.38	79.06	74.93	82.09	88.40	90.74	91.49	90.21	88.08	87.75	88.07	89.14	88.95	88.97	91.00	92.96	94.93	95.04	94.83	95.11	95.64	94.69	93.55
2	5	3	0.85	0.96	1.30	1.72	1.23	0.74	0.99	1.19	1.19	1.04	0.82	1.03	0.83	1.01	1.66	1.18	0.62	0.21	0.24	0.21	0.16	0.14	0.23	0.44
2	5	4	8.68	13.03	18.46	22.38	15.88	10.29	8.08	7.12	8.42	10.59	11.10	10.51	9.73	9.72	8.98	7.54	6.18	4.62	4.33	4.65	4.29	3.94	4.71	5.63

2000 Vehicle Mix Files

2	6	1	0.35	0.38	0.56	0.56	0.41	0.26	0.16	0.14	0.12	0.16	0.19	0.18	0.16	0.15	0.16	0.15	0.14	0.16	0.17	0.23	0.2	0.19	0.21	0.25
2	6	2	65.03	52.69	45.41	42.58	56.84	75.87	86.03	89.44	87.35	82.59	80.52	81.11	81.78	82.82	84.84	87.81	90.73	92.5	91.71	88.38	87.64	86.29	82.43	77.27
2	6	3	1.29	1.69	1.99	2.11	1.77	1.2	0.79	0.68	0.97	1.23	1.25	0.99	0.97	1.07	0.96	0.75	0.63	0.45	0.49	0.78	0.68	0.56	0.64	0.77
2	6	4	33.33	45.24	52.04	54.76	40.98	22.68	13.02	9.74	11.56	16.02	18.04	17.71	17.09	15.96	14.05	11.29	8.5	6.89	7.62	10.6	11.48	12.97	16.71	21.71
2	7	1	0.35	0.38	0.56	0.56	0.41	0.26	0.16	0.14	0.12	0.16	0.19	0.18	0.16	0.15	0.16	0.15	0.14	0.16	0.17	0.23	0.2	0.19	0.21	0.25
2	7	2	65.03	52.69	45.41	42.58	56.84	75.87	86.03	89.44	87.35	82.59	80.52	81.11	81.78	82.82	84.84	87.81	90.73	92.5	91.71	88.38	87.64	86.29	82.43	77.27
2	7	3	1.29	1.69	1.99	2.11	1.77	1.2	0.79	0.68	0.97	1.23	1.25	0.99	0.97	1.07	0.96	0.75	0.63	0.45	0.49	0.78	0.68	0.56	0.64	0.77
2	7	4	33.33	45.24	52.04	54.76	40.98	22.68	13.02	9.74	11.56	16.02	18.04	17.71	17.09	15.96	14.05	11.29	8.5	6.89	7.62	10.6	11.48	12.97	16.71	21.71
2	8	1	0.35	0.38	0.56	0.56	0.41	0.26	0.16	0.14	0.12	0.16	0.19	0.18	0.16	0.15	0.16	0.15	0.14	0.16	0.17	0.23	0.2	0.19	0.21	0.25
2	8	2	65.03	52.69	45.41	42.58	56.84	75.87	86.03	89.44	87.35	82.59	80.52	81.11	81.78	82.82	84.84	87.81	90.73	92.5	91.71	88.38	87.64	86.29	82.43	77.27
2	8	3	1.29	1.69	1.99	2.11	1.77	1.2	0.79	0.68	0.97	1.23	1.25	0.99	0.97	1.07	0.96	0.75	0.63	0.45	0.49	0.78	0.68	0.56	0.64	0.77
2	8	4	33.33	45.24	52.04	54.76	40.98	22.68	13.02	9.74	11.56	16.02	18.04	17.71	17.09	15.96	14.05	11.29	8.5	6.89	7.62	10.6	11.48	12.97	16.71	21.71
2	9	1	0.35	0.38	0.56	0.56	0.41	0.26	0.16	0.14	0.12	0.16	0.19	0.18	0.16	0.15	0.16	0.15	0.14	0.16	0.17	0.23	0.2	0.19	0.21	0.25
2	9	2	65.03	52.69	45.41	42.58	56.84	75.87	86.03	89.44	87.35	82.59	80.52	81.11	81.78	82.82	84.84	87.81	90.73	92.5	91.71	88.38	87.64	86.29	82.43	77.27
2	9	3	1.29	1.69	1.99	2.11	1.77	1.2	0.79	0.68	0.97	1.23	1.25	0.99	0.97	1.07	0.96	0.75	0.63	0.45	0.49	0.78	0.68	0.56	0.64	0.77
2	9	4	33.33	45.24	52.04	54.76	40.98	22.68	13.02	9.74	11.56	16.02	18.04	17.71	17.09	15.96	14.05	11.29	8.5	6.89	7.62	10.6	11.48	12.97	16.71	21.71
2	10	1	0.16	0.16	0.1	0.19	0.12	0.09	0.12	0.11	0.11	0.14	0.16	0.15	0.16	0.18	0.17	0.21	0.15	0.21	0.2	0.23	0.21	0.17	0.23	0.19
2	10	2	91.15	87.3	82.36	77.59	84.48	89.8	91.92	92.98	91.82	89.37	88.65	88.92	89.08	89.19	90.47	92.41	94.16	95.61	96.07	95.89	96.18	96.33	95.89	95.14
2	10	3	0.52	0.94	1.31	1.25	0.65	0.49	0.61	0.65	0.69	0.89	0.72	0.71	0.74	0.83	0.83	0.65	0.42	0.25	0.2	0.22	0.26	0.21	0.26	0.25
2	10	4	8.16	11.61	16.23	20.97	14.76	9.62	7.35	6.26	7.38	9.6	10.47	10.21	10.02	9.8	8.53	6.73	5.27	3.94	3.53	3.65	3.35	3.29	3.62	4.42
2	15	1	0	0	0	0	0	0.44	0.6	0.39	0.24	0.58	0.88	0.33	0.41	0.54	0.26	0.57	0.71	0.63	1.08	1.24	0.27	1.72	0.71	1.34
2	15	2	98.69	94.62	88.39	89.04	94.56	91.41	94.73	94.49	93.53	94.92	92.07	94.98	94.23	94.37	94.83	94.84	94.24	96.63	96.1	95.31	96.53	94.38	97.55	92.7
2	15	3	0	0	0	0	0	0.44	0.75	1.66	0.83	0	0	0.66	1.1	0.54	0.39	1.33	1.74	0.56	0.22	0	0.27	0	0	0
2	15	4	1.31	5.38	11.61	10.96	5.44	7.72	3.92	3.46	5.4	4.5	7.05	4.04	4.26	4.56	4.51	3.26	3.31	2.18	2.6	3.45	2.93	3.9	1.74	5.95

Appendix B – BMC Memo
2005 Vehicle Mix Files

* Vehicle Types: 4 vtypes 1 MC, 2 2 axle, 3 Bus, 4 HDV
* Data supplied for 2 area types (urban/rural) 11 facility types by 24 time periods - Does not vary by county
* ramp types 6,7,8,9 has the same mix as ft 1 Interstate
* ramp type 10 has the same mix as ft 3 Principal Arterial
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*

* Urban /rural	FT	VT	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
*urban																										
1	1	1	0.29	0.41	0.47	0.56	0.39	0.24	0.17	0.17	0.19	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.16	0.17	0.17	0.19	0.20	0.20	0.23	0.23
1	1	2	83.47	76.79	71.07	66.26	72.28	84.31	89.32	91.89	90.55	87.67	86.37	86.57	87.26	87.45	88.79	90.53	92.50	93.71	93.67	93.00	92.51	92.43	91.09	88.89
1	1	3	0.85	1.06	1.44	1.73	1.62	0.99	0.79	0.66	0.78	1.09	1.08	1.04	0.98	1.05	0.93	0.76	0.61	0.50	0.49	0.52	0.51	0.47	0.52	0.59
1	1	4	15.39	21.74	27.01	31.46	25.71	14.47	9.73	7.28	8.47	11.05	12.37	12.20	11.58	11.31	10.11	8.54	6.73	5.62	5.67	6.30	6.78	6.90	8.15	10.28
1	2	1	0.35	0.43	0.49	0.55	0.43	0.30	0.19	0.14	0.13	0.17	0.19	0.20	0.20	0.20	0.21	0.19	0.18	0.17	0.18	0.21	0.21	0.21	0.24	0.26
1	2	2	89.99	83.54	79.06	74.46	81.55	89.46	92.10	93.41	92.47	89.96	88.82	89.21	90.23	90.26	91.07	92.55	94.00	95.28	95.43	95.29	95.20	95.18	94.62	93.02
1	2	3	0.56	0.90	1.07	1.21	1.01	0.68	0.62	0.51	0.56	0.81	0.82	0.75	0.69	0.81	0.74	0.52	0.40	0.27	0.29	0.28	0.26	0.23	0.27	0.33
1	2	4	9.10	15.13	19.38	23.78	17.00	9.56	7.10	5.93	6.83	9.06	10.17	9.84	8.89	8.72	7.99	6.74	5.41	4.28	4.11	4.23	4.32	4.37	4.87	6.38
1	3	1	0.23	0.26	0.31	0.39	0.33	0.22	0.16	0.12	0.12	0.14	0.15	0.14	0.15	0.15	0.15	0.14	0.13	0.13	0.15	0.16	0.15	0.15	0.18	0.21
1	3	2	94.20	92.36	90.81	87.04	88.03	91.14	92.67	93.40	92.64	91.76	91.73	92.19	92.66	92.54	92.71	93.40	94.43	95.35	95.65	95.78	96.04	96.11	95.99	95.47
1	3	3	0.98	1.10	0.83	1.22	1.51	1.06	1.01	0.97	1.01	1.00	0.89	0.81	0.75	0.79	0.89	0.82	0.69	0.53	0.50	0.47	0.44	0.47	0.53	0.66
1	3	4	4.59	6.28	8.05	11.35	10.13	7.58	6.16	5.51	6.23	7.10	7.23	6.86	6.44	6.52	6.26	5.64	4.75	3.98	3.70	3.59	3.38	3.27	3.30	3.65
1	4	1	0.33	0.31	0.65	0.55	0.51	0.35	0.25	0.20	0.21	0.22	0.26	0.23	0.25	0.27	0.23	0.21	0.21	0.20	0.23	0.25	0.25	0.24	0.23	0.30
1	4	2	94.43	92.18	90.22	86.30	88.91	91.69	92.95	93.85	93.24	92.04	91.81	92.55	92.93	92.91	92.98	93.60	94.69	95.50	95.99	95.89	96.43	96.31	96.28	95.62
1	4	3	0.66	0.85	0.89	1.27	1.20	0.97	1.03	1.11	1.10	0.99	0.78	0.79	0.82	0.82	0.96	0.99	0.70	0.61	0.48	0.39	0.33	0.37	0.41	0.51
1	4	4	4.57	6.67	8.24	11.88	9.38	6.99	5.76	4.84	5.45	6.75	7.15	6.43	6.01	6.00	5.83	5.20	4.40	3.69	3.30	3.46	3.00	3.08	3.09	3.57
1	5	1	0.61	0.50	0.43	0.69	0.64	0.32	0.26	0.18	0.18	0.23	0.28	0.23	0.28	0.31	0.25	0.32	0.26	0.28	0.32	0.37	0.40	0.35	0.34	0.41
1	5	2	90.64	87.04	85.33	80.18	81.97	88.35	90.50	91.94	91.86	91.01	90.91	91.97	92.51	92.32	92.34	92.64	94.30	95.21	95.51	95.18	95.27	95.44	94.81	93.20
1	5	3	1.42	1.56	1.32	1.47	1.93	1.23	1.07	1.23	1.24	1.05	0.98	0.85	0.79	0.82	1.01	1.01	0.69	0.50	0.49	0.53	0.58	0.50	0.78	0.90
1	5	4	7.34	10.90	12.92	17.65	15.46	10.09	8.17	6.65	6.72	7.72	7.84	6.96	6.42	6.54	6.39	6.02	4.75	4.00	3.68	3.92	3.76	3.71	4.07	5.49
1	6	1	0.29	0.41	0.47	0.56	0.39	0.24	0.17	0.17	0.19	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.16	0.17	0.17	0.19	0.20	0.20	0.23	0.23
1	6	2	83.47	76.79	71.07	66.26	72.28	84.31	89.32	91.89	90.55	87.67	86.37	86.57	87.26	87.45	88.79	90.53	92.50	93.71	93.67	93.00	92.51	92.43	91.09	88.89
1	6	3	0.85	1.06	1.44	1.73	1.62	0.99	0.79	0.66	0.78	1.09	1.08	1.04	0.98	1.05	0.93	0.76	0.61	0.50	0.49	0.52	0.51	0.47	0.52	0.59
1	6	4	15.39	21.74	27.01	31.46	25.71	14.47	9.73	7.28	8.47	11.05	12.37	12.20	11.58	11.31	10.11	8.54	6.73	5.62	5.67	6.30	6.78	6.90	8.15	10.28
1	7	1	0.29	0.41	0.47	0.56	0.39	0.24	0.17	0.17	0.19	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.16	0.17	0.17	0.19	0.20	0.20	0.23	0.23
1	7	2	83.47	76.79	71.07	66.26	72.28	84.31	89.32	91.89	90.55	87.67	86.37	86.57	87.26	87.45	88.79	90.53	92.50	93.71	93.67	93.00	92.51	92.43	91.09	88.89
1	7	3	0.85	1.06	1.44	1.73	1.62	0.99	0.79	0.66	0.78	1.09	1.08	1.04	0.98	1.05	0.93	0.76	0.61	0.50	0.49	0.52	0.51	0.47	0.52	0.59
1	7	4	15.39	21.74	27.01	31.46	25.71	14.47	9.73	7.28	8.47	11.05	12.37	12.20	11.58	11.31	10.11	8.54	6.73	5.62	5.67	6.30	6.78	6.90	8.15	10.28
1	8	1	0.29	0.41	0.47	0.56	0.39	0.24	0.17	0.17	0.19	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.16	0.17	0.17	0.19	0.20	0.20	0.23	0.23
1	8	2	83.47	76.79	71.07	66.26	72.28	84.31	89.32	91.89	90.55	87.67	86.37	86.57	87.26	87.45	88.79	90.53	92.50	93.71	93.67	93.00	92.51	92.43	91.09	88.89
1	8	3	0.85	1.06	1.44	1.73	1.62	0.99	0.79	0.66	0.78	1.09	1.08	1.04	0.98	1.05	0.93	0.76	0.61	0.50	0.49	0.52	0.51	0.47	0.52	0.59

1	8	4	15.39	21.74	27.01	31.46	25.71	14.47	9.73	7.28	8.47	11.05	12.37	12.20	11.58	11.31	10.11	8.54	6.73	5.62	5.67	6.30	6.78	6.90	8.15	10.28

1	9	1	0.29	0.41	0.47	0.56	0.39	0.24	0.17	0.17	0.19	0.19	0.18	0.18	0.18	0.19	0.17	0.17	0.16	0.17	0.17	0.19	0.20	0.20	0.23	0.23
1	9	2	83.47	76.79	71.07	66.26	72.28	84.31	89.32	91.89	90.55	87.67	86.37	86.57	87.26	87.45	88.79	90.53	92.50	93.71	93.67	93.00	92.51	92.43	91.09	88.89
1	9	3	0.85	1.06	1.44	1.73	1.62	0.99	0.79	0.66	0.78	1.09	1.08	1.04	0.98	1.05	0.93	0.76	0.61	0.50	0.49	0.52	0.51	0.47	0.52	0.59
1	9	4	15.39	21.74	27.01	31.46	25.71	14.47	9.73	7.28	8.47	11.05	12.37	12.20	11.58	11.31	10.11	8.54	6.73	5.62	5.67	6.30	6.78	6.90	8.15	10.28
1	10	1	0.23	0.26	0.31	0.39	0.33	0.22	0.16	0.12	0.12	0.14	0.15	0.14	0.15	0.15	0.15	0.14	0.13	0.13	0.15	0.16	0.15	0.15	0.18	0.21
1	10	2	94.20	92.36	90.81	87.04	88.03	91.14	92.67	93.40	92.64	91.76	91.73	92.19	92.66	92.54	92.71	93.40	94.43	95.35	95.65	95.78	96.04	96.11	95.99	95.47
1	10	3	0.98	1.10	0.83	1.22	1.51	1.06	1.01	0.97	1.01	1.00	0.89	0.81	0.75	0.79	0.89	0.82	0.69	0.53	0.50	0.47	0.44	0.47	0.53	0.66
1	10	4	4.59	6.28	8.05	11.35	10.13	7.58	6.16	5.51	6.23	7.10	7.23	6.86	6.44	6.52	6.26	5.64	4.75	3.98	3.70	3.59	3.38	3.27	3.30	3.65
1	15	1	0.65	1.22	0.38	0.73	0.72	0.41	0.28	0.30	0.33	0.31	0.34	0.30	0.25	0.21	0.32	0.37	0.20	0.18	0.33	0.37	0.38	0.35	0.55	0.56
1	15	2	95.20	91.07	88.04	85.91	87.39	93.40	94.79	94.63	93.80	92.72	92.96	93.65	94.20	93.90	94.59	94.64	95.23	94.84	96.41	97.05	97.44	97.66	97.65	96.20
1	15	3	0.92	1.04	2.49	2.38	3.69	2.00	1.42	1.27	1.50	1.86	1.30	1.22	1.17	1.18	1.04	0.89	0.79	0.57	0.73	0.46	0.44	0.37	0.22	0.47
1	15	4	3.23	6.67	9.09	10.97	8.20	4.19	3.50	3.79	4.37	5.10	5.41	4.83	4.38	4.71	4.05	4.10	3.78	4.41	2.53	2.11	1.74	1.62	1.58	2.77

*rural

2	1	1	0.33	0.34	0.51	0.50	0.38	0.25	0.15	0.14	0.12	0.15	0.18	0.18	0.16	0.15	0.15	0.15	0.14	0.15	0.17	0.23	0.20	0.18	0.21	0.24
2	1	2	60.98	48.33	41.15	38.39	52.55	72.59	83.85	87.74	85.38	80.04	77.73	78.35	79.08	80.27	82.53	85.88	89.22	91.24	90.33	86.55	85.68	84.11	79.77	74.07
2	1	3	1.21	1.55	1.80	1.90	1.64	1.15	0.77	0.67	0.95	1.19	1.20	0.96	0.93	1.04	0.93	0.74	0.62	0.45	0.49	0.77	0.66	0.54	0.62	0.73
2	1	4	37.49	49.77	56.55	59.21	45.43	26.02	15.22	11.46	13.56	18.62	20.89	20.52	19.82	18.55	16.39	13.24	10.02	8.15	9.01	12.45	13.46	15.16	19.40	24.96
2	2	1	0.35	0.43	0.49	0.55	0.43	0.30	0.19	0.14	0.13	0.17	0.19	0.20	0.20	0.20	0.21	0.19	0.18	0.17	0.18	0.21	0.21	0.21	0.24	0.26
2	2	2	89.99	83.54	79.06	74.46	81.55	89.46	92.10	93.41	92.47	89.96	88.82	89.21	90.23	90.26	91.07	92.55	94.00	95.28	95.43	95.29	95.20	95.18	94.62	93.02
2	2	3	0.56	0.90	1.07	1.21	1.01	0.68	0.62	0.51	0.56	0.81	0.82	0.75	0.69	0.81	0.74	0.52	0.40	0.27	0.29	0.28	0.26	0.23	0.27	0.33
2	2	4	9.10	15.13	19.38	23.78	17.00	9.56	7.10	5.93	6.83	9.06	10.17	9.84	8.89	8.72	7.99	6.74	5.41	4.28	4.11	4.23	4.32	4.37	4.87	6.38
2	3	1	0.16	0.15	0.10	0.17	0.11	0.09	0.11	0.11	0.11	0.13	0.15	0.15	0.16	0.17	0.17	0.21	0.14	0.20	0.19	0.23	0.21	0.17	0.22	0.19
2	3	2	88.34	83.52	77.46	71.73	79.88	86.55	89.36	90.76	89.25	86.14	85.17	85.52	85.73	85.91	87.55	90.05	92.26	94.16	94.77	94.54	94.95	95.11	94.56	93.53
2	3	3	0.51	0.90	1.23	1.16	0.61	0.48	0.60	0.63	0.67	0.86	0.70	0.69	0.71	0.80	0.81	0.63	0.41	0.24	0.20	0.22	0.26	0.21	0.25	0.24
2	3	4	10.99	15.43	21.21	26.94	19.40	12.88	9.93	8.49	9.97	12.86	13.98	13.64	13.41	13.12	11.47	9.11	7.18	5.39	4.84	5.01	4.59	4.51	4.97	6.04
2	4	1	0.59	0.80	0.75	0.61	0.70	0.66	0.61	0.50	0.58	0.72	0.80	0.86	0.79	0.83	0.89	0.78	0.75	0.65	0.82	1.15	1.01	0.88	0.73	0.67
2	4	2	90.38	87.01	83.09	80.61	83.98	87.57	88.77	88.12	86.36	83.65	83.02	83.65	84.26	84.18	85.28	87.48	89.81	91.81	91.98	92.61	93.26	93.51	93.39	92.82
2	4	3	0.46	0.68	0.66	0.68	0.57	0.45	0.63	2.01	1.82	1.83	1.74	1.91	1.87	1.98	1.94	1.64	1.28	1.10	1.23	0.28	0.28	0.27	0.19	0.29
2	4	4	8.57	11.51	15.49	18.11	14.75	11.32	9.99	9.37	11.24	13.80	14.44	13.58	13.08	13.01	11.89	10.11	8.16	6.44	5.96	5.95	5.45	5.34	5.69	6.22
2	5	1	0.47	0.70	0.54	0.68	0.44	0.21	0.17	0.18	0.15	0.20	0.22	0.27	0.25	0.27	0.31	0.21	0.18	0.21	0.29	0.32	0.34	0.25	0.27	0.37
2	5	2	92.21	87.14	81.31	76.35	81.21	87.80	89.58	90.65	89.18	86.72	86.00	86.40	87.22	87.11	87.72	89.52	91.76	93.94	94.49	94.39	94.97	95.47	95.13	94.13
2	5	3	0.34	0.39	0.59	0.71	0.76	0.49	0.76	0.85	0.84	0.81	0.63	0.84	0.73	0.75	0.85	0.87	0.46	0.19	0.17	0.11	0.12	0.08	0.14	0.22
2	5	4	6.98	11.77	17.56	22.26	17.60	11.50	9.49	8.32	9.84	12.28	13.15	12.49	11.80	11.87	11.12	9.40	7.60	5.66	5.06	5.18	4.57	4.20	4.46	5.29
2	6	1	0.33	0.34	0.51	0.50	0.38	0.25	0.15	0.14	0.12	0.15	0.18	0.18	0.16	0.15	0.15	0.15	0.14	0.15	0.17	0.23	0.20	0.18	0.21	0.24
2	6	2	60.98	48.33	41.15	38.39	52.55	72.59	83.85	87.74	85.38	80.04	77.73	78.35	79.08	80.27	82.53	85.88	89.22	91.24	90.33	86.55	85.68	84.11	79.77	74.07

2	6	3	1.21	1.55	1.80	1.90	1.64	1.15	0.77	0.67	0.95	1.19	1.20	0.96	0.93	1.04	0.93	0.74	0.62	0.45	0.49	0.77	0.66	0.54	0.62	0.73
2	6	4	37.49	49.77	56.55	59.21	45.43	26.02	15.22	11.46	13.56	18.62	20.89	20.52	19.82	18.55	16.39	13.24	10.02	8.15	9.01	12.45	13.46	15.16	19.40	24.96

Appendix B – BMC Memo
2005 Vehicle Mix Files

2	7	1	0.33	0.34	0.51	0.50	0.38	0.25	0.15	0.14	0.12	0.15	0.18	0.18	0.16	0.15	0.15	0.15	0.14	0.15	0.17	0.23	0.20	0.18	0.21	0.24
2	7	2	60.98	48.33	41.15	38.39	52.55	72.59	83.85	87.74	85.38	80.04	77.73	78.35	79.08	80.27	82.53	85.88	89.22	91.24	90.33	86.55	85.68	84.11	79.77	74.07
2	7	3	1.21	1.55	1.80	1.90	1.64	1.15	0.77	0.67	0.95	1.19	1.20	0.96	0.93	1.04	0.93	0.74	0.62	0.45	0.49	0.77	0.66	0.54	0.62	0.73
2	7	4	37.49	49.77	56.55	59.21	45.43	26.02	15.22	11.46	13.56	18.62	20.89	20.52	19.82	18.55	16.39	13.24	10.02	8.15	9.01	12.45	13.46	15.16	19.40	24.96
2	8	1	0.33	0.34	0.51	0.50	0.38	0.25	0.15	0.14	0.12	0.15	0.18	0.18	0.16	0.15	0.15	0.15	0.14	0.15	0.17	0.23	0.20	0.18	0.21	0.24
2	8	2	60.98	48.33	41.15	38.39	52.55	72.59	83.85	87.74	85.38	80.04	77.73	78.35	79.08	80.27	82.53	85.88	89.22	91.24	90.33	86.55	85.68	84.11	79.77	74.07
2	8	3	1.21	1.55	1.80	1.90	1.64	1.15	0.77	0.67	0.95	1.19	1.20	0.96	0.93	1.04	0.93	0.74	0.62	0.45	0.49	0.77	0.66	0.54	0.62	0.73
2	8	4	37.49	49.77	56.55	59.21	45.43	26.02	15.22	11.46	13.56	18.62	20.89	20.52	19.82	18.55	16.39	13.24	10.02	8.15	9.01	12.45	13.46	15.16	19.40	24.96
2	9	1	0.33	0.34	0.51	0.50	0.38	0.25	0.15	0.14	0.12	0.15	0.18	0.18	0.16	0.15	0.15	0.15	0.14	0.15	0.17	0.23	0.20	0.18	0.21	0.24
2	9	2	60.98	48.33	41.15	38.39	52.55	72.59	83.85	87.74	85.38	80.04	77.73	78.35	79.08	80.27	82.53	85.88	89.22	91.24	90.33	86.55	85.68	84.11	79.77	74.07
2	9	3	1.21	1.55	1.80	1.90	1.64	1.15	0.77	0.67	0.95	1.19	1.20	0.96	0.93	1.04	0.93	0.74	0.62	0.45	0.49	0.77	0.66	0.54	0.62	0.73
2	9	4	37.49	49.77	56.55	59.21	45.43	26.02	15.22	11.46	13.56	18.62	20.89	20.52	19.82	18.55	16.39	13.24	10.02	8.15	9.01	12.45	13.46	15.16	19.40	24.96
2	10	1	0.16	0.15	0.10	0.17	0.11	0.09	0.11	0.11	0.11	0.13	0.15	0.15	0.16	0.17	0.17	0.21	0.14	0.20	0.19	0.23	0.21	0.17	0.22	0.19
2	10	2	88.34	83.52	77.46	71.73	79.88	86.55	89.36	90.76	89.25	86.14	85.17	85.52	85.73	85.91	87.55	90.05	92.26	94.16	94.77	94.54	94.95	95.11	94.56	93.53
2	10	3	0.51	0.90	1.23	1.16	0.61	0.48	0.60	0.63	0.67	0.86	0.70	0.69	0.71	0.80	0.81	0.63	0.41	0.24	0.20	0.22	0.26	0.21	0.25	0.24
2	10	4	10.99	15.43	21.21	26.94	19.40	12.88	9.93	8.49	9.97	12.86	13.98	13.64	13.41	13.12	11.47	9.11	7.18	5.39	4.84	5.01	4.59	4.51	4.97	6.04
2	15	1	0.00	0.00	0.00	0.00	0.00	0.44	0.60	0.39	0.24	0.58	0.88	0.33	0.41	0.54	0.26	0.57	0.71	0.63	1.08	1.24	0.27	1.72	0.71	1.34
2	15	2	98.69	94.62	88.39	89.04	94.56	91.41	94.73	94.49	93.53	94.92	92.07	94.98	94.23	94.37	94.83	94.84	94.24	96.63	96.10	95.31	96.53	94.38	97.55	92.70
2	15	3	0.00	0.00	0.00	0.00	0.00	0.44	0.75	1.66	0.83	0.00	0.00	0.66	1.10	0.54	0.39	1.33	1.74	0.56	0.22	0.00	0.27	0.00	0.00	0.00
2	15	4	1.31	5.38	11.61	10.96	5.44	7.72	3.92	3.46	5.40	4.50	7.05	4.04	4.26	4.56	4.51	3.26	3.31	2.18	2.60	3.45	2.93	3.90	1.74	5.95

Appendix C – BMC Memo
Anti-Tampering Program

Program Element	Baltimore
Program Start Year	1989
First Model Year	1977
Last Model Year	2050
LDGV	Yes
LDGT1	Yes
LDGT2	Yes
LDGT3	Yes
LDGT4	Yes
HDGV2B	Yes
HDGV3	No
HDGV4	No
HDGV5	No
HDGV6	No
HDGV7	No
HDGV8A	No
HDGV8B	No
GAS BUS	No
Program Type	Test Only
Inspection Frequency	Biennial
Compliance Rate (%)	96
Vehicle Types	
Inspections Performed	
Air pump system disablement	No
Catalyst removal	Yes
Fuel inlet restrictor disablement	Yes
Tailpipe lead deposit test	Yes
EGR disablement	No
Evaporative system disablement	No
PCV system disablement	No
Missing gas cap	Yes

Appendix D – BMC Memo
Baltimore I/M Program

Program Parameters	1	2	3	4	5	6	7
Program Name	Idle older LDGV, LDGT	Idle HDGT	IM240	OBD	Gas Cap for older LDGV, LDGT	Gas Cap for HDGT	Gas Cap for OBD Vehicles
Test Type	Test Only	Test Only	Test Only	Test Only	Test Only	Test Only	Test Only
I/M Program Years	1984 - 2050	1984 - 2050	1984 - 2050	2003 - 2050	2003 - 2050	2003 - 2050	2003 - 2050
Test Frequency	Biennial	Biennial	Biennial	Biennial	Biennial	Biennial	Biennial
Program Type	Idle	Idle	IM240	OBD I/M	GC	GC	EVAP OBD & GC
Model Years	77-83	77-83	84-95	96-50	77-95	77-50	96-50
Stringency Rate (%)	20	20	20	20	N/A	N/A	N/A
Compliance Rate (%)	96	96	96	96	96	96	96
Waiver Rate (%)	3	3	3	3	3	3	3
Grace Period	2	2	2	2	2	2	2
Vehicle Types							
LDGV	Yes	No	Yes	Yes	Yes	No	Yes
LDGT1	Yes	No	Yes	Yes	Yes	No	Yes
LDGT2	Yes	No	Yes	Yes	Yes	No	Yes
LDGT3	Yes	No	Yes	Yes	Yes	No	Yes
LDGT4	Yes	No	Yes	Yes	Yes	No	Yes
HDGV2B	No	Yes	No	No	No	Yes	No
HDGV3	No	Yes	No	No	No	Yes	No
HDGV4	No	Yes	No	No	No	Yes	No
HDGV5	No	Yes	No	No	No	Yes	No
HDGV6	No	Yes	No	No	No	Yes	No
HDGV7	No	No	No	No	No	No	No
HDGV8A	No	No	No	No	No	No	No
HDGV8B	No	No	No	No	No	No	No
GAS BUS	No	No	No	No	No	No	No

Appendix E – BMC Memo
Baltimore Region Motor Vehicle Registration File

```
* LDV
 1 0.0646 0.0842 0.0867 0.0750 0.0732 0.0740 0.0664 0.0726 0.0600 0.0530
   0.0451 0.0401 0.0381 0.0329 0.0281 0.0232 0.0174 0.0116 0.0080 0.0044
   0.0026 0.0021 0.0019 0.0024 0.0324
* LDT1
 2 0.0909 0.1057 0.1137 0.1007 0.0968 0.0874 0.0735 0.0687 0.0538 0.0408
   0.0307 0.0246 0.0229 0.0224 0.0191 0.0145 0.0095 0.0071 0.0049 0.0026
   0.0015 0.0010 0.0009 0.0019 0.0046
* LDT2
 3 0.0909 0.1057 0.1137 0.1007 0.0968 0.0874 0.0735 0.0687 0.0538 0.0408
   0.0307 0.0246 0.0229 0.0224 0.0191 0.0145 0.0095 0.0071 0.0049 0.0026
   0.0015 0.0010 0.0009 0.0019 0.0046
* LDT3
 4 0.0560 0.0815 0.0826 0.0707 0.0654 0.0702 0.0574 0.0628 0.0628 0.0418
   0.0353 0.0340 0.0367 0.0414 0.0406 0.0361 0.0343 0.0204 0.0167 0.0095
   0.0066 0.0053 0.0043 0.0077 0.0201
* LDT4
 5 0.0560 0.0815 0.0826 0.0707 0.0654 0.0702 0.0574 0.0628 0.0628 0.0418
   0.0353 0.0340 0.0367 0.0414 0.0406 0.0361 0.0343 0.0204 0.0167 0.0095
   0.0066 0.0053 0.0043 0.0077 0.0201
* HDV2B
 6 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV3
 7 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV4
 8 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV5
 9 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV6
10 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV7
11 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV8a
12 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV8b
13 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDBS
14 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDBT
15 0.0255 0.0410 0.0624 0.1022 0.0548 0.0826 0.0626 0.0911 0.0484 0.0434
   0.0363 0.0392 0.0476 0.0481 0.0440 0.0429 0.0355 0.0269 0.0152 0.0097
   0.0097 0.0063 0.0064 0.0068 0.0115
* Motorcycles
16 0.0852 0.1120 0.0907 0.0738 0.0526 0.0448 0.0457 0.0373 0.0309 0.0334
   0.0243 0.3692 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
   0.0000 0.0000 0.0000 0.0000 0.0000
```

Appendix F – BMC Memo
Baltimore Region Motor Diesel Sales Fractions

```
* LDV
0.0001 0.0002 0.0006 0.0022 0.0014 0.0015 0.0020 0.0014 0.0015 0.0012
0.0017 0.0032 0.0013 0.0010 0.0005 0.0107 0.0078 0.0361 0.0508 0.0766
0.1184 0.1215 0.0962 0.0370 0.0046
* LDT1
0.0010 0.0010 0.0032 0.0136 0.0048 0.0172 0.0165 0.0153 0.0106 0.0151
0.0163 0.0169 0.0175 0.0250 0.0183 0.0256 0.0553 0.0651 0.0748 0.0877
0.2434 0.1723 0.1120 0.0614 0.0160
* LDT2
0.0010 0.0010 0.0032 0.0136 0.0048 0.0172 0.0165 0.0153 0.0106 0.0151
0.0163 0.0169 0.0175 0.0250 0.0183 0.0256 0.0553 0.0651 0.0748 0.0877
0.2434 0.1723 0.1120 0.0614 0.0160
* LDT3
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
* LDT4
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
* HDV2B
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.2578 0.2515 0.3263
0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726 0.2743 0.3004 0.2918
0.2859 0.0138 0.0000 0.0000 0.0000
* HDV3
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.7715 0.7910 0.8105
0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842 0.6145 0.5139 0.5032
0.4277 0.0079 0.0000 0.0000 0.0001
* HDV4
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8473 0.8048 0.8331
0.7901 0.7316 0.7275 0.7158 0.5647 0.3178 0.2207 0.1968 0.1570 0.0738
0.0341 0.0414 0.0003 0.0000 0.0000
* HDV5
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4384 0.3670 0.4125
0.3462 0.2771 0.2730 0.2616 0.1543 0.0615 0.0383 0.0333 0.0255 0.0111
0.0049 0.0060 0.0000 0.0000 0.0000
* HDV6
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6078 0.5246 0.5767
0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705 0.4525 0.4310 0.3569
0.3690 0.4413 0.3094 0.1679 0.1390
* HDV7
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8443 0.7943 0.8266
0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567 0.7431 0.7261 0.6602
0.6717 0.7344 0.6107 0.4140 0.3610
* HDV8A
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9989 0.9987 0.9989
0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980 0.9979 0.9976 0.9969
0.9978 0.9982 0.9974 0.9965 0.9964
* HDV8B
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
* MC
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.8857 0.8525 0.8795
0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733 0.5155 0.3845 0.3238
0.3260 0.2639 0.0594 0.0460 0.0291
```

Baltimore County MOBILE6 Script

```
MOBILE6 INPUT FILE
REPORT FILE        :  C:\pptemp\m6output.out       REPLACE
DATABASE OUTPUT    :
WITH FIELDNAMES    :
EMISSIONS TABLE    :  C:\BALTAQ\run\m6data\M6OUTPUT.TB1    REPLACE
POLLUTANTS         :  HC CO NOX
AGGREGATED OUTPUT  :
MIN/MAX TEMPERATURE: 67.9 96.5
FUEL RVP           : 7.0
EXPRESS HC AS VOC  :
EXPAND EXHAUST     :
EXPAND EVAPORATIVE :
NO REFUELING       :
ANTI-TAMP PROGRAM  :
89 77 50 22222 21111111 1 12  96. 12211112
I/M DESC FILE      : C:\BALTAQ\M6_Data\im2005.d
94+ LDG IMP        : C:\BALTAQ\M6_Data\nlevne.d
REG DISTRIBUTION   : C:\BALTAQ\M6_Data\regdat02.bal
DIESEL FRACTIONS   :
0.0001 0.0002 0.0006 0.0022 0.0014 0.0015 0.0020 0.0014 0.0015 0.0012
0.0017 0.0032 0.0013 0.0010 0.0005 0.0107 0.0078 0.0361 0.0508 0.0766
0.1184 0.1215 0.0962 0.0370 0.0046
0.0010 0.0010 0.0032 0.0136 0.0048 0.0172 0.0165 0.0153 0.0106 0.0151
0.0163 0.0169 0.0175 0.0250 0.0183 0.0256 0.0553 0.0651 0.0748 0.0877
0.2434 0.1723 0.1120 0.0614 0.0160
0.0010 0.0010 0.0032 0.0136 0.0048 0.0172 0.0165 0.0153 0.0106 0.0151
0.0163 0.0169 0.0175 0.0250 0.0183 0.0256 0.0553 0.0651 0.0748 0.0877
0.2434 0.1723 0.1120 0.0614 0.0160
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.2578 0.2515 0.3263
0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726 0.2743 0.3004 0.2918
0.2859 0.0138 0.0000 0.0000 0.0000
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.7715 0.7910 0.8105
0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842 0.6145 0.5139 0.5032
0.4277 0.0079 0.0000 0.0000 0.0001
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8473 0.8048 0.8331
0.7901 0.7316 0.7275 0.7158 0.5647 0.3178 0.2207 0.1968 0.1570 0.0738
0.0341 0.0414 0.0003 0.0000 0.0000
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4384 0.3670 0.4125
0.3462 0.2771 0.2730 0.2616 0.1543 0.0615 0.0383 0.0333 0.0255 0.0111
0.0049 0.0060 0.0000 0.0000 0.0000
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6078 0.5246 0.5767
0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705 0.4525 0.4310 0.3569
0.3690 0.4413 0.3094 0.1679 0.1390
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8443 0.7943 0.8266
0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567 0.7431 0.7261 0.6602
0.6717 0.7344 0.6107 0.4140 0.3610
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9989 0.9987 0.9989
0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980 0.9979 0.9976 0.9969
0.9978 0.9982 0.9974 0.9965 0.9964
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.8857 0.8525 0.8795
0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733 0.5155 0.3845 0.3238
0.3260 0.2639 0.0594 0.0460 0.0291


SCENARIO RECORD    :[01 0031]  1
CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
```

```
SEASON              : 1
SUNRISE/SUNSET      : 6 8
CLOUD COVER         : 0.35
*VMT TOTALS          12054790
*                     5138853  940708 3130030  964066  443810  431572   42385   34536
*                       25641   95890  113813  123755  440599   73394   33020   22718
VMT FRACTIONS       :
                      .426291 .078036 .259650 .079974 .036816 .035801 .003516 .002865
                      .002127 .007955 .009441 .010266 .036550 .006088 .002739 .001885
VMT BY FACILITY     :V003101F.def
VMT BY HOUR         :V003101H.def
SPEED VMT           :V003101S.def

SCENARIO RECORD     :[02 0031]  2
CALENDAR YEAR       :2005
EVALUATION MONTH    : 7
ABSOLUTE HUMIDITY   : 69.
FUEL PROGRAM        : 2 S
SEASON              : 1
SUNRISE/SUNSET      : 6 8
CLOUD COVER         : 0.35
*VMT TOTALS           1986636
*                      877240  160586  534318  164573   75762   52285    5135    4184
*                        3106   11617   13788   14993   53379    8128    3657    3885
VMT FRACTIONS       :
                      .441571 .080833 .268956 .082840 .038136 .026318 .002585 .002106
                      .001563 .005848 .006940 .007547 .026869 .004091 .001841 .001956
VMT BY FACILITY     :V003102F.def
VMT BY HOUR         :V003102H.def
SPEED VMT           :V003102S.def


SCENARIO RECORD     :[03 0031]  3
CALENDAR YEAR       :2005
EVALUATION MONTH    : 7
ABSOLUTE HUMIDITY   : 69.
FUEL PROGRAM        : 2 S
SEASON              : 1
SUNRISE/SUNSET      : 6 8
CLOUD COVER         : 0.35
*VMT TOTALS           4506553
*                     2041041  373629 1243180  382906  176272   82047    8058    6566
*                        4875   18230   21637   23527   83764   23398   10527    6896
VMT FRACTIONS       :
                      .452904 .082908 .275861 .084967 .039115 .018206 .001788 .001457
                      .001082 .004045 .004801 .005221 .018587 .005192 .002336 .001530
VMT BY FACILITY     :V003103F.def
VMT BY HOUR         :V003103H.def
SPEED VMT           :V003103S.def


SCENARIO RECORD     :[04 0031]  4
CALENDAR YEAR       :2005
EVALUATION MONTH    : 7
ABSOLUTE HUMIDITY   : 69.
FUEL PROGRAM        : 2 S
SEASON              : 1
SUNRISE/SUNSET      : 6 8
CLOUD COVER         : 0.35
*VMT TOTALS           4315538
*                     1973280  361224 1201907  370194  170420   65451    6428    5238
*                        3889   14542   17260   18768   66820   19970    8985   11162
VMT FRACTIONS       :
                      .457249 .083703 .278507 .085782 .039490 .015166 .001490 .001214
                      .000901 .003370 .004000 .004349 .015484 .004627 .002082 .002586
VMT BY FACILITY     :V003104F.def
VMT BY HOUR         :V003104H.def
SPEED VMT           :V003104S.def


SCENARIO RECORD     :[05 0031]  5
```

```
CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          1764718
*                     803119  147017  489172  150668   69360   29094    2857    2328
*                       1729    6464    7673    8343   29703    7856    3535    5800
VMT FRACTIONS      :
                     .455096 .083309 .277196 .085378 .039304 .016486 .001619 .001319
                     .000980 .003663 .004348 .004728 .016832 .004452 .002003 .003287
VMT BY FACILITY    :V003105F.def
VMT BY HOUR        :V003105H.def
SPEED VMT          :V003105S.def


SCENARIO RECORD    :[06 0031]  6
CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS           555387
*                     240185   43967  146293   45059   20743   17926    1761    1435
*                       1065    3983    4727    5140   18301    2551    1148    1103
VMT FRACTIONS      :
                     .432462 .079165 .263407 .081131 .037349 .032277 .003171 .002584
                     .001918 .007172 .008511 .009255 .032952 .004593 .002067 .001986
VMT BY FACILITY    :V003106F.def
VMT BY HOUR        :V003106H.def
SPEED VMT          :V003106S.def


SCENARIO RECORD    :[07 0031]  7
CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS           336559
*                     147396   26982   89777   27652   12730    9572     940     766
*                        569    2127    2524    2745    9772    1573     708     726
VMT FRACTIONS      :
                     .437950 .080170 .266749 .082161 .037824 .028441 .002793 .002276
                     .001691 .006320 .007499 .008156 .029035 .004674 .002104 .002157
VMT BY FACILITY    :V003107F.def
VMT BY HOUR        :V003107H.def
SPEED VMT          :V003107S.def


SCENARIO RECORD    :[08 0031]  8

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS            56496
*                      25572    4681   15575    4797    2208    1085     107      87
*                         64     241     286     311    1108     166      75     133
VMT FRACTIONS      :
                     .452630 .082856 .275685 .084909 .039083 .019205 .001894 .001540
```

```
                   .001133 .004266 .005062 .005505 .019612 .002938 .001328 .002354
VMT BY FACILITY    :V003108F.def
VMT BY HOUR        :V003108H.def
SPEED VMT          :V003108S.def


SCENARIO RECORD    :[09 0031]  9
CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS           21973
*                      9757    1786    5942    1830     842     542      53      43
*                        32     120     143     155     554      89      40      45
VMT FRACTIONS      :
                   .444039 .081283 .270427 .083285 .038320 .024667 .002412 .001957
                   .001456 .005461 .006508 .007054 .025213 .004050 .001820 .002048
VMT BY FACILITY    :V003109F.def
VMT BY HOUR        :V003109H.def
SPEED VMT          :V003109S.def


SCENARIO RECORD    :[10 0031] 10
CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS            7629
*                      3313     606    2018     621     286     225      22      18
*                        13      50      59      65     230      61      27      15
VMT FRACTIONS      :
                   .434282 .079431 .264509 .081397 .037487 .029492 .002884 .002359
                   .001704 .006554 .007733 .008520 .030147 .007996 .003539 .001966
VMT BY FACILITY    :V003110F.def
VMT BY HOUR        :V003110H.def
SPEED VMT          :V003110S.def


SCENARIO RECORD    :[11 0031] 15
CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
ABSOLUTE HUMIDITY  : 69.
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS         1579960
*                    732534  134096  446180  137426   63264   16571    1627    1326
*                       985    3682    4370    4752   16917    7849    3531    4850
VMT FRACTIONS      :
                   .463640 .084873 .282400 .086981 .040042 .010488 .001030 .000839
                   .000623 .002330 .002766 .003008 .010707 .004968 .002235 .003070
VMT BY FACILITY    :V003111F.def
VMT BY HOUR        :V003111H.def
SPEED VMT          :V003111S.def


END OF RUN         :
```

<u>Appendix B: MOBILE6 Documentation from Baker for Baltimore Region</u>

The Baltimore Ozone Non-Attainment Area

An Explanation of Methodology for Developing Mobile Source Emissions Budgets using MOBILE6

Prepared for:

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April 2003

The Baltimore Ozone Non-Attainment Area
State Implementation Plan Revision Using MOBILE6
An Explanation of Methodology
April 2003

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OVERVIEW

This document reflects the highway mobile sources emission estimations for 2005 Baltimore Ozone Non-Attainment Area using EPA's recently approved MOBILE6 emission model that will revise the interim MOBILE5-based (Tier 2) motor vehicle emissions budget. The latest version of MOBILE is a major revision based on new test data and accounts for changes in vehicle technology and regulations. In addition, the model includes an improved understanding of in-use emission levels and the factors that influence them resulting in significantly more detailed input data. The revised motor vehicle emissions budgets using MOBILE6 are presented in the following table.

Table 1 Baltimore Area MOBILE6 Motor Vehicle Emissions Summary

Year	VOC (tons per day)	NO_x (tons per day)
2005	55.3	146.9

As compared to previous MOBILE versions, MOBILE6 has a significant impact on the emission factors, benefits of available control strategies, effects of new regulations and corrections to basic emission rates. As a result, the emissions rates are different and it is difficult to compare the results directly to previous runs conducted with MOBILE5. For this reason, 1990 emission totals are reanalyzed using MOBILE6 and its available input parameters.

Guidance documents from EPA were used to develop the inventory for the Baltimore Non-Attainment area. They include:

- *Policy Guidance on the Use of MOBILE6 for SIP Development and Transportation Conformity,* US EPA Office of Air and Radiation, dated January 18, 2002.
- *Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation,* US EPA Office of Air and Radiation, and Office of Transportation and Air Quality, dated January 2002.
- *User's Guide to MOBILE6.0, Mobile Source Emission Factor Model*, EPA420-R-02-001, dated January 2002.

The methodologies used to produce the MOBILE6 emission results conform to the recommendations provided in EPA's Technical Guidance. A mix of local data and national default input data (internal to MOBILE6) has been used for this submission. Local data has been used for the primary data items that have a significant impact on emissions. This includes VMT, speeds, vehicle mixes, age distributions, diesel sales fractions, hourly distributions, temperatures, and inspection/maintenance and fuel program characteristics.

Some of the planning assumptions and modeling tools have been updated for this inventory effort. The key elements to the modeling protocol which have been updated are outlined below:

Baltimore Regional Travel Demand Model

The roadway data input to the emissions calculations for the Baltimore (5-counties and Baltimore City) ozone non-attainment region is based on the Baltimore Metropolitan Council's (BMC's) latest travel demand model upgrade. The new model utilizes the TP+ software platform and incorporates the following:

- Produces volumes by 5 time periods.
- Calibrated/validated to year 2000 traffic count data. The travel model is validated to 2000, but it was calibrated on 1993 HTS and 1996 transit survey. Truck model was calibrated with 2000 data.
- Contains a truck model calibrated to State Highway Administration (SHA) 2002 vehicle class counts.
- Utilizes BMC's latest land use assumptions and forecasts, Round 6.
- Contains mode choice and transit components to represent the impacts of the region's bus and rail networks.

PPSUITE Post Processor

PPSUITE was used for the first time in Maryland for this SIP. PPSUITE represents an enhanced version of the Post Processor for Air Quality (PPAQ) software system that has been used for previous inventory and conformity submissions in Pennsylvania, Virginia, New Jersey, and the New York City Metropolitan Area. The software has gone through a significant revision to ensure consistency with the MOBILE6 emissions model. PPSUITE is used to process the outputs from the regional travel demand model runs for 1990 and 2005 including the development of roadway speed estimates, which are supplied as input to the MOBILE6 model. The software is also used to prepare and run the MOBILE6 input files and to process the MOBILE6 outputs.

Baltimore Regional Inspection/Maintenance Program

The 1990 analysis runs assume an idle test on post-1977 gas vehicles up to 26,000 pounds. In addition, an anti-tampering program is included which includes 2 inspections applied to all subject vehicles. The 2005 analysis runs assume a more robust inspection program including the following key elements:

- An OBDII computer check for 1996 and newer model year gas vehicles up to 8,500 pounds.
- An IM240 tail pipe test for 1984 to 1995 gas vehicles and trucks up to 10,000 pounds.
- An Idle test for 1977 to 1983 vehicles up to 10,000 pounds and all gas trucks 10,000 to 26,000 pounds.
- A gas cap test for all vehicles tested.
- An anti-tampering program with 3 inspections for all vehicles receiving an idle test.

I. Regional Fuel Program

For 2005, the Baltimore ozone non-attainment region is required to have federal reformulated gasoline (RFG). Like conventional gasoline, RFG must meet fuel volatility requirements that vary by geographic region. The Baltimore region was modeled using the RFG requirements of the Southern region in summer time. Based on EPA's guidance and using the monthly fuel laboratory data (Source: Motor Fuel Tax Division, Office of the Comptroller), the 1990 analysis year runs for the Baltimore region utilized a computed Reid Vapor Pressure (RVP) value of 8.2.

Vehicle Age/Diesel Sales Distributions

Vehicle age distributions are input to MOBILE for the region based on registered vehicles that reflect July 1 summer conditions. These distributions reflect the percentage of vehicles in the fleet up to 25 years old and are listed by the 16 MOBILE6 vehicle types. As in previous SIP submissions, 1990 information is used in the development of the data input for the 1990 analysis year based on Maryland Motor Vehicle Administration's (MVA's) vehicle registration database download. Updated 2002 vehicle age distributions have been downloaded from the registration database and are used for the 2005 analysis year run. The analysis utilizes light-duty diesel sales fraction data acquired from state registration data for both 1990 and 2002.

Vehicle Mix Patterns

Vehicle mix patterns were developed from a combination of sources. Truck totals for 2005 were determined from the Baltimore regional truck model, which was calibrated against 2002 local count data. 1990 truck estimates were adjusted to reflect regional toll data from the Maryland Transportation Authority (MDTA). Regional vehicle mix patterns, developed by facility type from local count data, were used to split the autos into light-duty vehicles and motorcycles; and the trucks into heavy-duty trucks and buses. MOBILE6 defaults were then used to split the above 4 vehicle categories into the required 16 MOBILE6 vehicle classes. Defaults were used specific to the year being analyzed (1990, 2005). Thus, more sport utility vehicles are assumed in the year 2005 as compared to 1990.

Weather Data

Minimum and maximum daily temperatures were developed following USEPA guidance using information collected from the National Weather's Service BWI monitoring station. The 1990 temperatures used are the same that were used and documented in the official 1990 inventory for the Baltimore area. The 2005 temperatures are those used and documented in the 1999 inventory for the Baltimore area.

Federal Program: Low Emission Vehicle (NLEV), Tier 2/Low Sulfur Fuel, and 2004 Heavy Duty Engine (HDE) Rule

Federal new vehicle emissions control and fuel programs that were modeled separately using MOBILE5 are now incorporated into MOBILE6. The NLEV program had a three-year phase-in starting with 1999 model years. The Tier 2 / Low Sulfur Fuel Program takes effect in 2004 and provides benefit for subsequent years.

Other Changes incorporated into MOBILE6

In addition to the new regulations, a number of improvements (corrections) were incorporated into MOBILE6 that have a significant impact on emission calculations, in particular NO_x emissions. These changes may increase or decrease emissions depending on the pollutant, calendar year, fuel program and locally specified speeds and facility class driving activities. As a result, a MOBILE6 comparison to MOBILE5 emission estimates will be significantly different.

Below is a list of the most important quantitative changes to emissions incorporated into MOBILE6:

- Basic Emission Rates (BER) for light-duty cars and trucks are lower from late 1980s and early 1990 model year vehicles due to new data that shows pollution control devices are more durable than expected. This change generally lowers emissions from vehicles of model years in the late 1980's and early 1990's.
- Real world driving factors that influence emissions like air conditioning and high acceleration effects.
- Fuel content corrections to account for damage inflicted by high levels of sulfur in gasoline in vehicles with advanced catalysts. This leads to increased emissions in the late 1990s and early 2000s. This effect declines as the Tier 2 regulations phase in lower sulfur fuel.
- Speed data shows that vehicle emissions are generally less sensitive to speed changes than previously thought. This has a variable effect on emissions.
- For heavy-duty trucks, MOBILE6 includes lower base-rate emissions, but excess NO_x emissions under steady state driving conditions can occur due to pollution control defeat devices included in these vehicles in the 1990's. MOBILE6 includes, though, a reduction in these NO_x emissions expected in future years as the result of a consent decree with engine manufacturers. Thus, MOBILE6 heavy-duty truck emissions are significantly higher than MOBILE5 for some model years and pollutants and significantly lower for others.
- Heavy-duty diesel vehicle NO_x off-cycle emissions effects are incorporated into MOBILE6. These effects include the Defeat Device, NO_x Pull Ahead, Rebuild Mitigation Program, and Rebuild program effectiveness.
- MOBILE6 includes new data for evaporative emissions because this data has indicated a small fraction of older vehicles with leaks in their fuel systems contribute a large quantity of evaporative emissions. MOBILE6 also accounts for the new tests and new regulations that require lower emissions and more durable fuel systems. This has a variable effect on emissions.

INTRODUCTION

The purpose of this document is to explain how Baltimore estimates emissions from highway vehicles for inclusion in its emission inventories and State Implementation Plan.

Highway vehicles contribute significantly to air pollution, particularly to ground-level ozone. Ozone is not created directly but formed in sunlight from VOCs and NO_x. Both VOCs and NO_x are emitted from highway vehicles. Baltimore's ozone-related emission inventory efforts have been focused on these pollutants.

In order to estimate both the rate at which emissions are being generated and to calculate vehicle miles traveled (activity level), Baltimore examines its road network and fleet to estimate vehicle activity. For ozone-related inventories, this is done for a typical summer (July) weekday. Not only must this be done for a baseline year, but it must also be projected into the future. This process involves a large quantity of data and is extremely complex.

Computer models have been developed to perform these calculations by simulating the travel of vehicles on the region's roadway system. These models then generate emission rates (also called emission factors) for different vehicle types for area-specific conditions and then combine them in summary form. The "area-specific conditions" include vehicle and highway data, plus control measure characteristics and future year projections of all variables.

MOBILE. The heart of the highway vehicle emission calculation procedure is EPA's highway vehicle emission factor model, MOBILE. This is a FORTRAN program that calculates **average** in-use fleet emission factors for ozone precursors for each of twenty-eight categories of vehicles under various conditions affecting in-use emission levels (e.g., ambient temperatures, average traffic speeds, gasoline volatility) as specified by the model user. MOBILE produces the "emission rates" referred to in the previous section.

The model was first developed as MOBILE1 in the late 1970s, and has been periodically updated to reflect the collection and analysis of additional emission factor data over the years, as well as changes in vehicle, engine and emission control system technologies, changes in applicable regulations, emission standards and test procedures, and improved understanding of in-use emission levels and the factors that influence them. For this inventory effort, Baltimore utilizes MOBILE6 as approved by EPA.

PPSUITE. The Baltimore region is now using a post processor named PPSUITE (formerly named PPAQ - Post Processor for Air Quality), which consists of a set of programs that perform the following functions:

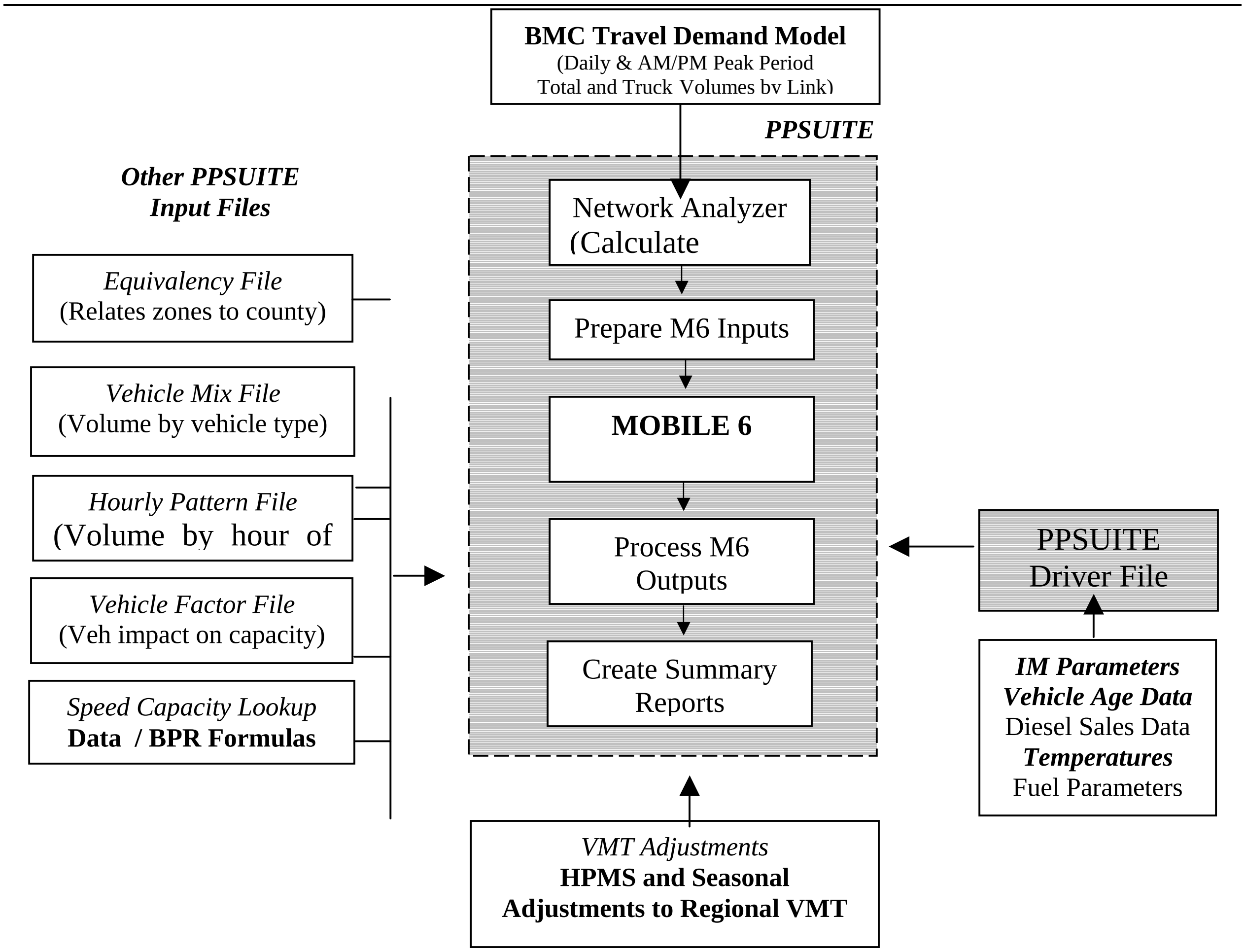
- Analyzes highway operating conditions
- Calculates highway speeds
- Compiles vehicle miles of travel (VMT) and vehicle type mix data
- Prepares MOBILE6 runs
- Calculates emissions from output MOBILE6 emission rates and accumulated highway VMT.

PPSUITE has become a widely used and accepted tool for estimating speeds and processing MOBILE emission rates. It is currently being used throughout Pennsylvania, for the New York City region, for the north and south New Jersey regions, and in other states including Louisiana, Virginia, and Indiana. The software is based upon accepted transportation engineering methodologies. For example, PPSUITE utilizes speed and delay estimation procedures based on planning methods provided in the 2000 Highway

Capacity Manual, a report prepared by the Transportation Research Board (TRB) summarizing current knowledge and analysis techniques for capacity and level-of-service analyses of the transportation system.

These two computer programs interact as shown in Exhibit 1. PPSUITE replaces the prior MDE-developed post processor, which could not accommodate MOBILE6 requirements without significant revision. In addition, PPSUITE enhances and adds new capabilities regarding the calculation of speed, the preparation of those speeds for input to MOBILE6, and allows for an organized input data storage format.

Exhibit 1 Emission Calculation Process for the Baltimore Region

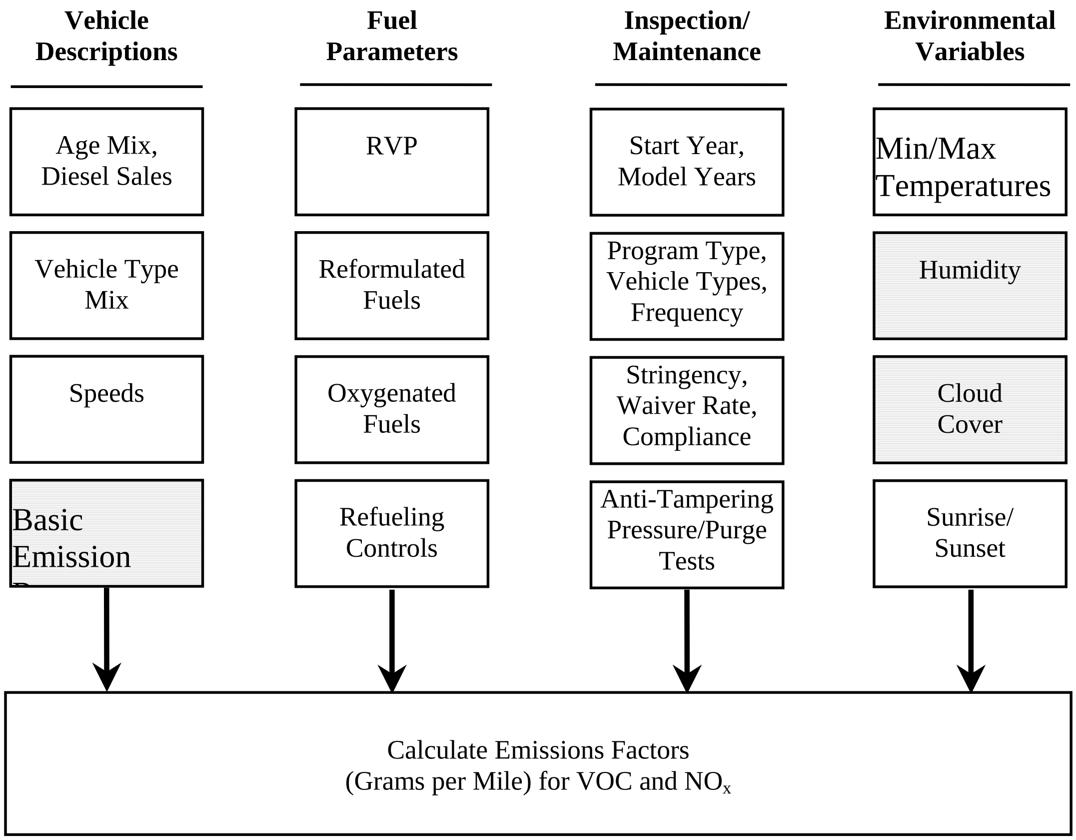


OVERVIEW OF INPUT DATA

Data Inputs to MOBILE

A large number of inputs to MOBILE are needed to fully account for the numerous vehicle and environmental parameters that affect emissions including traffic flow characteristics, vehicle descriptions, fuel parameters, inspection/maintenance program parameters, and environmental variables as shown in Exhibit 2. With some input parameters, MOBILE allows the user to choose default values, while others require area-specific inputs.

Exhibit 2 MOBILE Inputs



For an emissions inventory, area specific inputs are used for all of the items shown in Exhibit 2 except for the basic emission rates, humidity and cloud cover, which are MOBILE defaults. In addition, Baltimore uses the MOBILE6 default starts-per-day data and soak distributions that are used to calculate the number of starts in cold and hot start modes. EPA requires that the number of starts occurring per vehicle be determined from instrumented vehicle counts. Since such local data is not available, the MOBILE6 national defaults are used for the Baltimore region analyses. A vehicle will generate more emissions when it is first operated (cold start). It generates emissions at a different rate when it is stopped and then started again within a short period of time (hot start). Soak distributions are used to determine the time between when an engine is turned off to the next time it is restarted.

Vehicle Descriptions. Vehicle age distributions are input to MOBILE representing the distribution for the MOBILE6 16-vehicle types in the Baltimore region. This data is based on registered vehicles from the Maryland Motor Vehicle Administration's vehicle registration database reflecting July 1 summer conditions. As in previous SIP submissions, 1990 information is used in the development of the data input for the 1990 analysis year for non-trucks. Updated 2002 age data has been prepared and used for the forecast 2005 analysis year.

Vehicle Type Mix is calculated from algorithms using a combination of BMC travel demand model truck assignments, collected 1999-2002 State Highway Administration vehicle class counts, and MOBILE6 default percentages. (See also the discussion of Vehicle Type Pattern Data in the next section.) Speeds are discussed extensively in the next section.

Significant changes have occurred in the MOBILE6 model as compared to previous releases. Some of the information previously applied by post processor routines can now be input directly to the MOBILE6 model run. This includes information on the hourly distribution of VMT and the hourly speeds that occur during the day. Another important change in MOBILE6 is the influence of facility type on output emission factors. For example, MOBILE6 assumes that an average speed on a freeway results in a different emission factor than the same speed on an arterial roadway. Thus MOBILE6 is indirectly accounting for the accelerations and decelerations that typically occur on such roadways. MOBILE6 has four distinct facility types: Freeway, Arterial, Local, and Ramp. For any emission run, the input functional classes analyzed must be mapped to the above facility types. The following mapping scheme is used for the Baltimore runs:

BMC Model Facility Types	***MOBILE6 Facility Type***
1,2 (Interstate/Freeways)	Freeway
3,4 (Major/Minor Arterial)	Arterial
5,11 (Collector/Locals)	Local
6-10 (Ramps)	Ramp

Since ramps are directly represented within the travel demand model, they are mapped directly to the MOBILE6 Ramp category. Since the travel model does not contain all collector and local roadways, the volumes carried by such roadways may not represent the actual travel conditions. As a result, these facilities are mapped to the MOBILE6 Local category, which has a set speed used for all hours of the day. The above assumptions are consistent with the recommendations provided in EPA's Technical Guidance on the Use of MOBILE6 for Emissions Inventory Preparation.

Fuel Parameters. The same vehicle will produce different emissions using a different type of gasoline. Fuel control strategies can be powerful emission reduction mechanisms. An important variable in fuels for VOC emissions is its evaporability, measured by Reid Vapor Pressure.

MOBILE allows the user to choose among conventional, federal reformulated (used in the Baltimore region), oxygenated and low Reid Vapor Pressure (RVP) gasoline. Baltimore chooses the MOBILE inputs appropriate to the year and control strategy for the area being modeled. For 2005 Baltimore region uses Southern region summertime reformulated gasoline, and for 1990 conventional gasoline with an RVP of 8.2.

MOBILE also allows users to calculate refueling emissions - the emissions created when vehicles are refueled at service stations. Baltimore includes refueling emissions in its area source inventory and not in its highway vehicle inventory.

Vehicle Emission Inspection/Maintenance (I/M) Parameters. MOBILE allows users to vary inputs depending on the I/M program in place for the particular analysis year. For the Baltimore Region, the following tables describe the I/M program and anti-tampering program in place for the 1990 and 2005 analysis years.

Table 2 Baltimore Region I/M Program Parameters

Program Parameters	**1990**	**2005**						
Program Name	Idle Test	Idle older LDGV, LDGT	Idle HDGT	IM240	OBD	Gas Cap for older LDGV, LDGT	Gas Cap for HDGT	Gas Cap for OBD Vehicles
Test Type	Test Only	Test Only	Test Only	Test Only	Test Only	Test Only	Test Only	Test Only
I/M Program Start Year	1984	1984	1984	1984	2003	2003	2003	2003
Test Frequency	Biennial	Biennial	Biennial	Biennial	Biennial	Biennial	Biennial	Biennial
Program Type	Idle	Idle	Idle	IM240	OBD I/M	GC	GC	EVAP OBD & GC
Model Years	77-50	77-83	77-83	84-95	96-50	77-95	77-50	96-50
Stringency Rate (%)	23	20	20	20	20	N/A	N/A	N/A
Compliance Rate (%)	96	96	96	96	96	96	96	96
Waiver Rate (%)	21 / 23	3	3	3	3	3	3	3
Grace Period	0	2	2	2	2	2	2	2
Vehicle Types								
LDGV	Yes	Yes	No	Yes	Yes	Yes	No	Yes
LDGT1	Yes	Yes	No	Yes	Yes	Yes	No	Yes
LDGT2	Yes	Yes	No	Yes	Yes	Yes	No	Yes
LDGT3	Yes	Yes	No	Yes	Yes	Yes	No	Yes
LDGT4	Yes	Yes	No	Yes	Yes	Yes	No	Yes
HDGV2B	Yes	No	Yes	No	No	No	Yes	No
HDGV3	Yes	No	Yes	No	No	No	Yes	No
HDGV4	Yes	No	Yes	No	No	No	Yes	No
HDGV5	Yes	No	Yes	No	No	No	Yes	No
HDGV6	Yes	No	Yes	No	No	No	Yes	No
HDGV7	No	No	No	No	No	No	No	No
HDGV8A	No	No	No	No	No	No	No	No
HDGV8B	No	No	No	No	No	No	No	No
GAS BUS	No	No	No	No	No	No	No	No

Table 3 Baltimore Region Anti-tampering Program Parameters

Program Element	**Baltimore Region**	
Analysis Year	**1990**	**2005**
Program Start Year	1989	1989
First Model Year	1977	1977
Last Model Year	2050	2050
LDGV	Yes	Yes
LDGT1	Yes	Yes
LDGT2	Yes	Yes
LDGT3	Yes	Yes
LDGT4	Yes	Yes
HDGV2B	Yes	Yes
HDGV3	Yes	No
HDGV4	Yes	No
HDGV5	Yes	No
HDGV6	Yes	No
HDGV7	No	No
HDGV8A	No	No
HDGV8B	No	No
GAS BUS	No	No
Program Type	Test Only	Test Only
Inspection Frequency	Biennial	Biennial
Compliance Rate (%)	96	96
Inspections Performed		
Air pump system disablement	No	No
Catalyst removal	Yes	Yes
Fuel inlet restrictor disablement	Yes	Yes
Tailpipe lead deposit test	No	No
EGR disablement	No	No
Evaporative system disablement	No	No
PCV system disablement	No	No
Missing gas cap	No	Yes

Weather Data. Minimum and maximum daily temperatures were developed following USEPA guidance using information collected from the National Weather's Service BWI monitoring station. The 1990 temperatures used are the same that were used and documented in the official 1990 inventory for the Baltimore area. The 2005 temperatures are those used and documented in the 1999 inventory for the Baltimore area.

Emission and Speed Relationships

Of all the user-supplied input parameters, perhaps the most important is vehicle speed (except for local and ramp roadway types where a constant MOBILE6 speed is assumed).

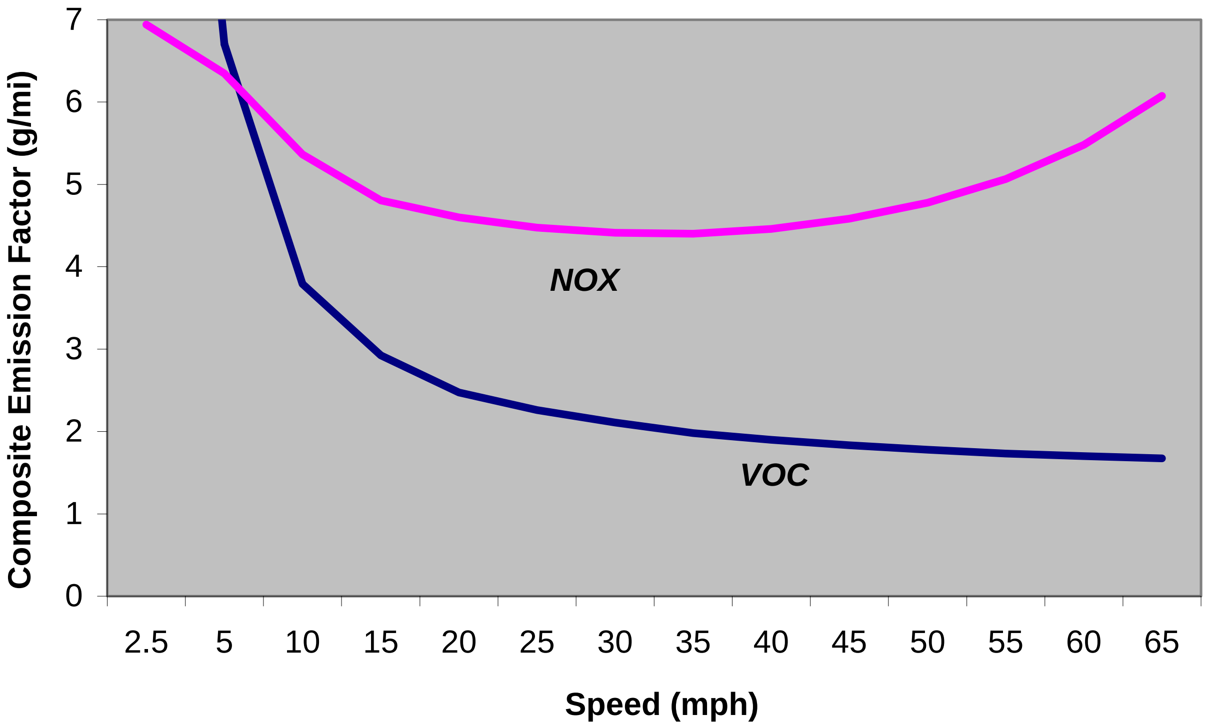
To obtain the best estimate of vehicle speeds, Baltimore uses the PPSUITE set of programs, whose primary function is to calculate speeds and to organize and simplify the handling of large amounts of data needed for calculating speeds and for preparing MOBILE input files. MOBILE6 uses hourly speeds that are grouped into 14 speed bins. The shares are calculated from accumulating hourly link VMT for speeds estimated using an update to the BPR curve. Two separate equations, one for interstates/freeways and non- interstates/freeways are used. The equations are as follows:

$$traveltime = speed * \left(1 + 0.2 * \left(\frac{v}{c}\right)^{10}\right) \text{ for interstates/freeways}$$

$$traveltime = speed * \left(1 + 0.05 * \left(\frac{v}{c}\right)^{10}\right) \text{ for non-interstates/freeways}$$

Emissions of both VOC and NO_x vary significantly with speed, but the relationships are not linear, as shown in Exhibit 3. While VOCs generally decrease as speed increases, NO_x decreases only at the low speed range and increases steeply at higher speeds.

Exhibit 3 MOBILE6 VOC and NO_x Speed vs. Emissions



Roadway Data

The roadway data input to the emissions calculations for the Baltimore ozone non-attainment region is based on the Baltimore Metropolitan Council's (BMC's) latest travel demand model upgrade. The new model utilizes the TP+ software platform and incorporates the following:

- Produces volumes by 5 time periods.
- Calibrated/validated to year 2000 traffic count data. The travel model is validated to 2000, but was calibrated on 1993 HTS and 1996 transit survey. Truck model was calibrated with 2000 data.
- Contains a truck model calibrated to State Highway Administration (SHA) 2002 vehicle class counts.
- Utilizes BMC's latest land use assumptions and forecasts (Round6).
- Contains mode choice and transit components to represent the impacts of the region's bus and rail networks.

The travel model contains all state highways and arterials, most of the major collectors, and some minor collector and local roadways divided into links of varying lengths. Each of these link segments contains descriptive data that is used in the calculation of the congested speeds input to the MOBILE emissions model. The PPSUITE post processor calculates the congested speeds based on the following model network fields:

- Number of Lanes

- Distances
- Daily, AM/PM Peak Period Volumes
- Daily, AM/PM Peak Period Truck Volumes
- Facility Type
- Area Type (Urban/Rural)
- Link capacity which includes impact of signals and other intersection controls
- Link free-flow speeds
- Zones to relate each link to the county in which it belongs

The model volumes and distances are used in calculating highway VMT totals for each county. As discussed in the next section, adjustments are needed to convert the volumes to an average July weekday. Lane and capacity values are an important input for determining the congestion and speeds for individual highway segments. Truck volumes are used in the speed determination process and are used to split volumes to the individual vehicle types used by the MOBILE software.

The travel demand model classifies its road segments by function, in addition to whether it is located in an urban or rural area, as indicated below in Exhibit 4. The facility types are important indicators of the type and function of each roadway segment. The variables provide insights into other characteristics not contained in the model network fields that are used for speed and emission calculations. In addition, VMT and emission quantities are aggregated and reported using both facility types and urban/rural codes.

Exhibit 4 Baltimore Model Classification Scheme: Urban/Rural and Facility Type Codes

Urban/Rural Code	1 = Urban	
	2 = Rural	
Facility Type Class	1 = Interstate	7 = Ramp 2
	2 = Freeway	8 = Ramp 3
	3 = Primary Arterial	9 = Ramp 4
	4 = Minor Arterial	10 = Ramp5
	5 = Collector	11 = Local
	6 = Ramp 1	

Additions and Adjustments to Roadway Data

Before the travel model data can be used by PPSUITE for speed and emission calculations, several adjustments and additions must be made to the roadway data.

HPMS Adjustments. According to EPA guidance, baseline inventory VMT computed from the travel demand model must be adjusted to be consistent with Highway Performance Monitoring System (HPMS) VMT totals. Although it has some limitations, the HPMS system is currently in use in all 50 states and is being improved under FHWA direction.

A transportation model must be validated against real world observations to be an accurate predictor of total area VMT. Since the USEPA has designated HPMS as the “official” VMT estimation methodology for air quality purposes, the Baltimore regional travel model outputs were compared to 1990 and 2000 HPMS totals.

Adjustment factors are calculated which adjust the 1990 Model VMT to be consistent with 1990 HPMS totals. In addition, the travel model is also run for the 2000 analysis year and compared to 2000 HPMS reported VMT totals. 2000 HPMS adjustments are calculated as factors and are carried forward to the 2005 analysis year run. These factors are developed for each county, urban/rural code, and facility group combination. “Lower” classes (e.g. local roads) require greater adjustment since a large part of the local system is not contained within the travel demand model. Local roadways require no adjustments since they are not in the travel model. HPMS data is used to estimate the amount of local VMT, which is added to the travel model database.

Seasonal Adjustments to Volumes. The Baltimore travel demand model produces volumes that represent an average weekday. An ozone emission analysis, however, is based on a typical July weekday. Therefore, those volumes must be seasonally adjusted. A seasonal factor of 1.04 was developed from SHA count data and is applied to all link volumes in the network before the calculation of speeds for 2005. The 1990 factor was estimated at 1.05.

24-hour Pattern Data. Speeds and emissions vary considerably depending on the time of day (because of temperature) and congestion. Therefore, it is important to estimate the pattern by which roadway volume varies by hour of the day. The 24-hour pattern data provides PPSUITE with information used to split the daily roadway segment volumes to each of the 24 hours in a day. Pattern data is in the form of a percentage of the daily volumes for each hour. Distributions are provided for each county and functional class grouping. This data was developed from SHA 24-hour count data between 1999 and 2002.

Vehicle Type Pattern Data. Basic emission rates may differ by vehicle type. These types are listed below in Exhibit 5.

Exhibit 5 MOBILE6 Input Composite Vehicle Classes

1. LDV - Light-Duty Vehicles (Passenger Cars)
2. LDT1 - Light-Duty Trucks 1 (<6,000 lbs)
3. LDT2 - Light-Duty Trucks 2 (<6,000 lbs, LVW=3,751-5,750)
4. LDT3 - Light-Duty Trucks 3 (6,001-8,500 lbs)
5. LDT4 - Light-Duty Trucks 4 (6,001-8,500 lbs, LVW>5,751)
6. HDV2B - Class 2b Heavy Duty Vehicles
7. HDV3 - Class 3 Heavy Duty Vehicles
8. HDV4 - Class 4 Heavy Duty Vehicles
9. HDV5 - Class 5 Heavy Duty Vehicles
10. HDV6 - Class 6 Heavy Duty Vehicles
11. HDV7 - Class 7 Heavy Duty Vehicles
12. HDV8A - Class 8a Heavy Duty Vehicles
13. HDV8B - Class 8b Heavy Duty Vehicles
14. HDBS - School Buses
15. HDBT - Transit and Urban Buses
16. MC - Motorcycles

MOBILE summary reports by vehicle type are also useful in knowing what kinds of vehicles generate emissions. The vehicle type pattern data is supplied to MOBILE for each run (county, urban/rural combination) and scenario (facility type) within the MOBILE6 input file. The data is generated by PPSUITE based on the following sources:

- Vehicle Mix Patterns for light-duty vehicles, heavy-duty vehicles, buses, and motorcycles based on SHA vehicle class counts taken between 1999 and 2002.
- Baltimore travel demand truck model results for 2005
- MOBILE6 default vehicle type breakdowns for the analysis year
- MDTA Statement of Annual Traffic Volume and Toll Income and Resulting Percentages 1990 through 2000 data.

The vehicle type pattern percentages are developed for each county and functional class combination and are input to MOBILE using the VMT FRACTIONS keyword. First, the travel model truck volumes are used to divide individual link volumes to auto and truck categories. PPSUITE uses the input vehicle mix pattern data based on SHA counts to calculate the number of motorcycles and buses within each of those categories. Finally, MOBILE6 defaults, specific to the analysis year being run, are used to divide the 4 vehicle groupings into the 16 MOBILE6 vehicle types. PPSUITE then aggregates this link specific information to the area, facility scenario groupings input to the MOBILE model. Note that the MOBILE6 defaults used vary by analysis year; as a result, each forecast year utilizes a unique vehicle mix distribution. The VMT mixes used for 1990 and 2005 are provided in Tables 4 and 5.

Vehicle Type Capacity Analysis Factors. Vehicle type percentages are provided to the capacity analysis section of PPSUITE to adjust the speeds in response to trucks. That is, a given number of larger trucks take up more roadway space than a given number of cars, and this must be accounted for in the model. Capacity is adjusted based on the factors provided in this data. Values are developed from information in the 2000 Highway Capacity Manual and are specific to the various facility types.

Table 4 2005 Vehicle Mix Inputs to MOBILE6

Run Area	Facility Scenario	*MOBILE6 VEHICLE TYPES* LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
Baltimore City	Interstate	41.98%	7.69%	25.57%	7.88%	3.63%	4.03%	0.40%	0.32%	0.24%	0.89%	1.06%	1.15%	4.11%	0.60%	0.27%	0.19%
(Urban)	Freeway	43.51%	7.96%	26.50%	8.16%	3.76%	3.05%	0.30%	0.24%	0.18%	0.68%	0.81%	0.88%	3.12%	0.46%	0.20%	0.19%
	Principal Arterial	44.57%	8.16%	27.15%	8.36%	3.85%	2.27%	0.22%	0.18%	0.14%	0.51%	0.60%	0.65%	2.32%	0.59%	0.27%	0.16%
	Minor Arterial	44.49%	8.14%	27.10%	8.35%	3.84%	2.25%	0.22%	0.18%	0.13%	0.50%	0.59%	0.64%	2.30%	0.70%	0.31%	0.25%
	Collector	44.34%	8.12%	27.01%	8.32%	3.83%	2.35%	0.23%	0.19%	0.14%	0.52%	0.62%	0.67%	2.40%	0.67%	0.30%	0.29%
	Ramp 1	43.30%	7.93%	26.37%	8.12%	3.74%	3.19%	0.31%	0.25%	0.19%	0.71%	0.84%	0.91%	3.25%	0.47%	0.21%	0.20%
	Ramp 2	43.11%	7.89%	26.26%	8.09%	3.72%	3.31%	0.32%	0.26%	0.20%	0.73%	0.87%	0.95%	3.38%	0.47%	0.21%	0.22%
	Ramp 3	41.71%	7.64%	25.40%	7.82%	3.60%	4.20%	0.41%	0.34%	0.25%	0.93%	1.11%	1.20%	4.29%	0.61%	0.27%	0.21%
	Ramp 4	42.48%	7.77%	25.85%	7.96%	3.66%	3.74%	0.37%	0.29%	0.21%	0.83%	0.99%	1.07%	3.82%	0.48%	0.21%	0.27%
	Ramp 5	42.98%	7.86%	26.19%	8.07%	3.69%	3.21%	0.32%	0.27%	0.21%	0.69%	0.86%	0.91%	3.31%	0.80%	0.37%	0.27%
	Local	46.36%	8.49%	28.24%	8.70%	4.00%	1.02%	0.10%	0.08%	0.06%	0.23%	0.27%	0.29%	1.04%	0.56%	0.25%	0.31%
Anne Arundel County	Interstate	42.35%	7.75%	25.80%	7.95%	3.66%	3.79%	0.37%	0.30%	0.23%	0.84%	1.00%	1.09%	3.87%	0.57%	0.26%	0.19%
(Urban)	Freeway	44.73%	8.19%	27.25%	8.39%	3.86%	2.27%	0.22%	0.18%	0.14%	0.50%	0.60%	0.65%	2.32%	0.34%	0.15%	0.20%
	Principal Arterial	44.80%	8.20%	27.29%	8.40%	3.87%	2.13%	0.21%	0.17%	0.13%	0.47%	0.56%	0.61%	2.18%	0.56%	0.25%	0.15%
	Minor Arterial	45.40%	8.31%	27.65%	8.52%	3.92%	1.70%	0.17%	0.14%	0.10%	0.38%	0.45%	0.49%	1.73%	0.55%	0.25%	0.26%
	Collector	45.77%	8.38%	27.88%	8.59%	3.95%	1.47%	0.14%	0.12%	0.09%	0.33%	0.39%	0.42%	1.51%	0.44%	0.20%	0.33%
	Ramp 1	42.91%	7.85%	26.13%	8.05%	3.71%	3.44%	0.34%	0.28%	0.20%	0.76%	0.91%	0.99%	3.51%	0.50%	0.22%	0.20%
	Ramp 2	44.61%	8.17%	27.17%	8.37%	3.85%	2.35%	0.23%	0.19%	0.14%	0.52%	0.62%	0.67%	2.40%	0.32%	0.15%	0.24%
	Ramp 3	44.57%	8.16%	27.15%	8.36%	3.85%	2.38%	0.23%	0.19%	0.14%	0.53%	0.63%	0.68%	2.43%	0.32%	0.15%	0.24%
	Ramp 4	45.94%	8.41%	27.99%	8.62%	3.97%	1.50%	0.15%	0.12%	0.09%	0.33%	0.39%	0.43%	1.53%	0.20%	0.09%	0.24%
	Ramp 5	45.31%	8.29%	27.59%	8.50%	3.91%	1.83%	0.18%	0.15%	0.11%	0.41%	0.48%	0.52%	1.87%	0.45%	0.20%	0.18%
	Local	46.36%	8.49%	28.24%	8.70%	4.00%	1.02%	0.10%	0.08%	0.06%	0.23%	0.27%	0.29%	1.04%	0.56%	0.25%	0.31%
Anne Arundel County	Interstate	41.93%	7.67%	25.54%	7.87%	3.62%	4.11%	0.40%	0.33%	0.24%	0.91%	1.08%	1.18%	4.20%	0.50%	0.23%	0.18%
(Rural)	Principal Arterial	43.02%	7.88%	26.20%	8.07%	3.72%	3.42%	0.34%	0.27%	0.20%	0.76%	0.90%	0.98%	3.49%	0.39%	0.18%	0.16%
	Minor Arterial	43.06%	7.88%	26.23%	8.08%	3.72%	2.91%	0.29%	0.23%	0.17%	0.65%	0.77%	0.84%	2.97%	0.97%	0.44%	0.80%

Run Area	Facility Scenario	LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
		MOBILE6 VEHICLE TYPES															
	Collector	44.97%	8.23%	27.39%	8.44%	3.88%	2.11%	0.21%	0.17%	0.13%	0.47%	0.56%	0.60%	2.15%	0.29%	0.13%	0.28%
	Ramp 1	43.52%	7.97%	26.51%	8.17%	3.76%	3.11%	0.30%	0.25%	0.19%	0.69%	0.82%	0.89%	3.17%	0.32%	0.15%	0.20%
	Ramp 2	43.61%	7.98%	26.56%	8.18%	3.77%	3.03%	0.30%	0.24%	0.18%	0.67%	0.80%	0.87%	3.10%	0.35%	0.16%	0.19%
	Ramp 4	41.81%	7.67%	25.36%	7.78%	3.62%	4.26%	0.43%	0.32%	0.21%	0.96%	1.17%	1.17%	4.37%	0.43%	0.21%	0.21%
	Ramp 5	45.28%	8.28%	27.56%	8.50%	3.92%	1.96%	0.19%	0.16%	0.13%	0.44%	0.51%	0.57%	2.02%	0.19%	0.09%	0.19%
	Local	46.21%	8.46%	28.14%	8.67%	3.99%	1.09%	0.11%	0.09%	0.06%	0.24%	0.29%	0.31%	1.11%	0.41%	0.18%	0.63%
Baltimore County (Urban)	Interstate	42.63%	7.80%	25.96%	8.00%	3.68%	3.61%	0.35%	0.29%	0.21%	0.80%	0.95%	1.04%	3.69%	0.54%	0.24%	0.19%
	Freeway	44.16%	8.08%	26.90%	8.28%	3.81%	2.64%	0.26%	0.21%	0.16%	0.59%	0.70%	0.76%	2.70%	0.39%	0.18%	0.20%
	Principal Arterial	45.29%	8.29%	27.59%	8.50%	3.91%	1.84%	0.18%	0.15%	0.11%	0.41%	0.48%	0.53%	1.88%	0.48%	0.22%	0.16%
	Minor Arterial	45.72%	8.37%	27.85%	8.58%	3.95%	1.50%	0.15%	0.12%	0.09%	0.33%	0.40%	0.43%	1.54%	0.49%	0.22%	0.27%
	Collector	45.50%	8.33%	27.71%	8.54%	3.93%	1.63%	0.16%	0.13%	0.10%	0.36%	0.43%	0.47%	1.66%	0.48%	0.22%	0.35%
	Ramp 1	43.24%	7.92%	26.34%	8.11%	3.73%	3.22%	0.32%	0.26%	0.19%	0.72%	0.85%	0.92%	3.29%	0.47%	0.21%	0.21%
	Ramp 2	43.79%	8.02%	26.67%	8.21%	3.78%	2.88%	0.28%	0.23%	0.17%	0.64%	0.76%	0.82%	2.93%	0.40%	0.18%	0.23%
	Ramp 3	45.27%	8.29%	27.57%	8.49%	3.91%	1.94%	0.19%	0.15%	0.11%	0.43%	0.51%	0.56%	1.98%	0.25%	0.11%	0.24%
	Ramp 4	44.38%	8.12%	27.03%	8.32%	3.83%	2.50%	0.24%	0.20%	0.15%	0.56%	0.66%	0.72%	2.55%	0.34%	0.15%	0.24%
	Ramp 5	43.40%	7.95%	26.45%	8.14%	3.75%	2.98%	0.30%	0.25%	0.18%	0.67%	0.79%	0.86%	3.05%	0.72%	0.32%	0.19%
	Local	46.36%	8.49%	28.24%	8.70%	4.00%	1.02%	0.10%	0.08%	0.06%	0.23%	0.27%	0.29%	1.04%	0.56%	0.25%	0.30%
Baltimore County (Rural)	Interstate	42.30%	7.74%	25.76%	7.94%	3.65%	3.89%	0.38%	0.31%	0.23%	0.86%	1.02%	1.11%	3.97%	0.44%	0.20%	0.19%
	Principal Arterial	43.26%	7.92%	26.35%	8.12%	3.74%	3.27%	0.32%	0.26%	0.19%	0.73%	0.86%	0.94%	3.34%	0.37%	0.17%	0.17%
	Minor Arterial	43.85%	8.03%	26.71%	8.23%	3.79%	2.45%	0.24%	0.20%	0.15%	0.54%	0.65%	0.70%	2.50%	0.81%	0.36%	0.81%
	Collector	44.49%	8.14%	27.10%	8.35%	3.84%	2.40%	0.24%	0.19%	0.14%	0.53%	0.63%	0.69%	2.45%	0.32%	0.15%	0.33%
	Ramp 1	42.26%	7.74%	25.75%	7.93%	3.65%	3.89%	0.38%	0.31%	0.23%	0.87%	1.03%	1.12%	3.98%	0.47%	0.21%	0.18%
	Ramp 2	42.80%	7.83%	26.06%	8.03%	3.70%	3.56%	0.34%	0.28%	0.22%	0.80%	0.94%	1.02%	3.64%	0.34%	0.16%	0.28%
	Ramp 3	43.87%	8.02%	26.71%	8.22%	3.79%	2.88%	0.28%	0.23%	0.17%	0.64%	0.76%	0.83%	2.94%	0.25%	0.11%	0.30%
	Local	46.21%	8.46%	28.15%	8.67%	3.99%	1.09%	0.11%	0.09%	0.06%	0.24%	0.29%	0.31%	1.12%	0.40%	0.18%	0.63%
Carroll County	Principal Arterial	43.90%	8.04%	26.74%	8.24%	3.79%	2.68%	0.26%	0.21%	0.16%	0.60%	0.71%	0.77%	2.74%	0.70%	0.31%	0.15%

Run Area	Facility Scenario	MOBILE6 VEHICLE TYPES															
		LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
(Urban)	Minor Arterial	44.60%	8.16%	27.16%	8.37%	3.85%	2.17%	0.21%	0.17%	0.13%	0.48%	0.57%	0.62%	2.21%	0.71%	0.32%	0.25%
	Collector	44.60%	8.16%	27.17%	8.37%	3.85%	2.16%	0.21%	0.17%	0.13%	0.48%	0.57%	0.62%	2.21%	0.63%	0.28%	0.38%
	Ramp 2	44.40%	8.13%	26.90%	8.25%	3.83%	2.63%	0.24%	0.24%	0.12%	0.60%	0.72%	0.72%	2.63%	0.36%	0.12%	0.12%
	Ramp 5	43.12%	7.89%	26.27%	8.09%	3.73%	3.15%	0.32%	0.25%	0.19%	0.70%	0.84%	0.91%	3.22%	0.80%	0.36%	0.18%
	Local	46.36%	8.48%	28.24%	8.70%	4.00%	1.04%	0.10%	0.08%	0.06%	0.23%	0.28%	0.30%	1.06%	0.52%	0.23%	0.32%
Carroll County	Interstate	38.64%	7.07%	23.53%	7.25%	3.34%	6.22%	0.61%	0.50%	0.37%	1.38%	1.64%	1.79%	6.35%	0.78%	0.35%	0.17%
(Rural)	Principal Arterial	41.52%	7.60%	25.29%	7.79%	3.59%	4.39%	0.43%	0.35%	0.26%	0.98%	1.16%	1.26%	4.49%	0.49%	0.22%	0.17%
	Minor Arterial	43.54%	7.97%	26.52%	8.17%	3.76%	2.63%	0.26%	0.21%	0.16%	0.58%	0.69%	0.75%	2.68%	0.88%	0.40%	0.81%
	Collector	43.95%	8.05%	26.77%	8.25%	3.80%	2.75%	0.27%	0.22%	0.16%	0.61%	0.72%	0.79%	2.80%	0.32%	0.14%	0.40%
	Ramp 2	43.12%	7.89%	26.24%	8.07%	3.72%	3.37%	0.33%	0.27%	0.21%	0.74%	0.89%	0.95%	3.42%	0.36%	0.15%	0.27%
	Ramp 5	44.74%	8.32%	27.33%	8.32%	3.86%	2.08%	0.30%	0.30%	0.00%	0.59%	0.59%	0.59%	2.08%	0.00%	0.00%	0.89%
	Local	46.21%	8.46%	28.14%	8.67%	3.99%	1.09%	0.11%	0.09%	0.06%	0.24%	0.29%	0.31%	1.11%	0.41%	0.19%	0.64%
Harford County	Interstate	40.79%	7.47%	24.85%	7.65%	3.52%	4.78%	0.47%	0.38%	0.28%	1.06%	1.26%	1.37%	4.88%	0.72%	0.32%	0.19%
(Urban)	Freeway	44.42%	8.13%	27.06%	8.33%	3.84%	2.48%	0.24%	0.20%	0.15%	0.55%	0.65%	0.71%	2.53%	0.36%	0.16%	0.20%
	Principal Arterial	43.82%	8.02%	26.69%	8.22%	3.78%	2.73%	0.27%	0.22%	0.16%	0.61%	0.72%	0.78%	2.79%	0.71%	0.32%	0.16%
	Minor Arterial	44.40%	8.13%	27.04%	8.33%	3.83%	2.28%	0.22%	0.18%	0.14%	0.51%	0.60%	0.65%	2.33%	0.75%	0.34%	0.26%
	Collector	45.15%	8.27%	27.50%	8.47%	3.90%	1.83%	0.18%	0.15%	0.11%	0.41%	0.48%	0.53%	1.87%	0.55%	0.25%	0.35%
	Ramp 2	43.26%	7.92%	26.35%	8.11%	3.74%	3.21%	0.32%	0.26%	0.19%	0.71%	0.85%	0.92%	3.28%	0.48%	0.21%	0.20%
	Ramp 3	42.57%	7.74%	25.97%	7.98%	3.69%	3.69%	0.36%	0.24%	0.24%	0.83%	0.95%	1.07%	3.69%	0.48%	0.24%	0.24%
	Ramp 4	43.87%	8.04%	26.74%	8.24%	3.79%	2.79%	0.28%	0.23%	0.16%	0.63%	0.74%	0.81%	2.85%	0.31%	0.15%	0.36%
	Ramp 5	52.11%	7.98%	27.94%	7.98%	3.99%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Local	46.36%	8.49%	28.24%	8.70%	4.00%	1.02%	0.10%	0.08%	0.06%	0.23%	0.27%	0.29%	1.04%	0.56%	0.25%	0.32%
Harford County	Interstate	40.75%	7.46%	24.82%	7.64%	3.52%	4.87%	0.48%	0.39%	0.29%	1.08%	1.28%	1.40%	4.97%	0.60%	0.27%	0.18%
(Rural)	Principal Arterial	44.00%	8.05%	26.80%	8.25%	3.80%	2.79%	0.27%	0.22%	0.17%	0.62%	0.74%	0.80%	2.85%	0.30%	0.14%	0.19%
	Minor Arterial	43.15%	7.90%	26.28%	8.10%	3.73%	2.86%	0.28%	0.23%	0.17%	0.63%	0.75%	0.82%	2.92%	0.96%	0.43%	0.79%
	Collector	43.55%	7.97%	26.53%	8.17%	3.76%	3.00%	0.29%	0.24%	0.18%	0.67%	0.79%	0.86%	3.06%	0.42%	0.19%	0.33%

Run Area	Facility Scenario	LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
		MOBILE6 VEHICLE TYPES															
	Ramp 2	42.33%	7.76%	25.79%	7.94%	3.66%	3.84%	0.38%	0.31%	0.24%	0.86%	1.02%	1.11%	3.93%	0.46%	0.20%	0.16%
	Ramp 3	41.43%	7.59%	25.24%	7.77%	3.58%	4.44%	0.44%	0.36%	0.26%	0.98%	1.17%	1.27%	4.53%	0.51%	0.23%	0.20%
	Local	46.20%	8.46%	28.14%	8.67%	3.99%	1.09%	0.11%	0.09%	0.06%	0.24%	0.29%	0.31%	1.11%	0.41%	0.18%	0.65%
Howard County	Interstate	40.10%	7.34%	24.42%	7.52%	3.46%	5.23%	0.51%	0.42%	0.31%	1.16%	1.38%	1.50%	5.34%	0.78%	0.35%	0.18%
(Urban)	Freeway	44.64%	8.17%	27.19%	8.38%	3.86%	2.33%	0.23%	0.19%	0.14%	0.52%	0.61%	0.67%	2.38%	0.35%	0.16%	0.19%
	Principal Arterial	43.12%	7.89%	26.26%	8.09%	3.72%	3.15%	0.31%	0.25%	0.19%	0.70%	0.83%	0.90%	3.22%	0.84%	0.38%	0.15%
	Minor Arterial	45.87%	8.40%	27.94%	8.61%	3.96%	1.41%	0.14%	0.11%	0.08%	0.31%	0.37%	0.41%	1.44%	0.47%	0.21%	0.26%
	Collector	45.46%	8.32%	27.69%	8.53%	3.93%	1.65%	0.16%	0.13%	0.10%	0.37%	0.44%	0.47%	1.69%	0.48%	0.22%	0.38%
	Ramp 1	44.10%	8.07%	26.86%	8.27%	3.81%	2.67%	0.26%	0.21%	0.16%	0.59%	0.70%	0.77%	2.73%	0.39%	0.17%	0.21%
	Ramp 2	44.41%	8.13%	27.05%	8.33%	3.84%	2.48%	0.24%	0.20%	0.15%	0.55%	0.65%	0.71%	2.53%	0.34%	0.15%	0.24%
	Ramp 3	45.19%	8.27%	27.53%	8.48%	3.90%	1.99%	0.19%	0.16%	0.12%	0.44%	0.52%	0.57%	2.03%	0.25%	0.12%	0.24%
	Ramp 4	44.27%	8.10%	26.97%	8.31%	3.83%	2.56%	0.25%	0.20%	0.15%	0.57%	0.68%	0.73%	2.61%	0.36%	0.16%	0.25%
	Ramp 5	45.68%	8.36%	27.83%	8.57%	3.94%	1.60%	0.16%	0.13%	0.09%	0.35%	0.42%	0.46%	1.64%	0.40%	0.18%	0.19%
	Local	46.36%	8.49%	28.24%	8.70%	4.00%	1.02%	0.10%	0.08%	0.06%	0.23%	0.27%	0.29%	1.04%	0.56%	0.25%	0.30%
Howard County	Interstate	39.50%	7.23%	24.06%	7.41%	3.41%	5.67%	0.56%	0.45%	0.34%	1.26%	1.50%	1.63%	5.79%	0.71%	0.32%	0.17%
(Rural)	Principal Arterial	44.06%	8.06%	26.83%	8.26%	3.80%	2.77%	0.27%	0.22%	0.16%	0.61%	0.73%	0.79%	2.82%	0.29%	0.13%	0.18%
	Minor Arterial	44.02%	8.06%	26.82%	8.26%	3.80%	2.34%	0.23%	0.19%	0.14%	0.52%	0.62%	0.67%	2.38%	0.79%	0.36%	0.81%
	Collector	44.98%	8.23%	27.40%	8.44%	3.88%	2.09%	0.21%	0.17%	0.12%	0.46%	0.55%	0.60%	2.13%	0.28%	0.13%	0.32%
	Ramp 1	44.27%	8.11%	26.97%	8.30%	3.83%	2.58%	0.25%	0.21%	0.15%	0.57%	0.68%	0.74%	2.63%	0.30%	0.13%	0.27%
	Ramp 2	44.64%	8.18%	27.20%	8.38%	3.86%	2.38%	0.23%	0.18%	0.14%	0.53%	0.62%	0.68%	2.42%	0.21%	0.08%	0.27%
	Ramp 3	44.16%	8.08%	26.90%	8.28%	3.82%	2.67%	0.27%	0.21%	0.16%	0.59%	0.70%	0.76%	2.72%	0.29%	0.13%	0.27%
	Ramp 4	44.12%	8.14%	27.01%	8.33%	3.89%	2.41%	0.19%	0.19%	0.19%	0.56%	0.74%	0.74%	2.59%	0.19%	0.00%	0.74%
	Local	46.22%	8.46%	28.15%	8.67%	3.99%	1.09%	0.11%	0.09%	0.06%	0.24%	0.29%	0.31%	1.11%	0.41%	0.19%	0.62%

Table 5 1990 Vehicle Mix Inputs to MOBILE6

		MOBILE6 VEHICLE TYPES															
Run Area	**Facility Scenario**	**LDV**	**LDT1**	**LDT2**	**LDT3**	**LDT4**	**HDV2B**	**HDV3**	**HDV4**	**HDV5**	**HDV6**	**HDV7**	**HDV8A**	**HDV8B**	**HDBS**	**HDBT**	**MC**
Baltimore City	Interstate	60.81%	4.07%	13.52%	5.48%	2.51%	4.19%	0.43%	0.25%	0.20%	0.81%	1.00%	1.19%	4.25%	0.77%	0.36%	0.17%
(Urban)	Freeway	63.10%	4.22%	14.03%	5.68%	2.61%	3.18%	0.33%	0.19%	0.15%	0.61%	0.76%	0.90%	3.22%	0.55%	0.26%	0.21%
	Principal Arterial	64.53%	4.32%	14.35%	5.81%	2.67%	2.44%	0.25%	0.15%	0.12%	0.47%	0.58%	0.69%	2.48%	0.70%	0.33%	0.11%
	Minor Arterial	64.79%	4.34%	14.40%	5.84%	2.68%	2.29%	0.23%	0.14%	0.11%	0.44%	0.54%	0.65%	2.33%	0.67%	0.32%	0.24%
	Collector	64.41%	4.31%	14.32%	5.80%	2.66%	2.48%	0.25%	0.15%	0.12%	0.48%	0.59%	0.70%	2.52%	0.64%	0.30%	0.25%
	Ramp 1	62.87%	4.21%	13.98%	5.66%	2.60%	3.26%	0.33%	0.20%	0.16%	0.63%	0.78%	0.92%	3.31%	0.61%	0.29%	0.19%
	Ramp 2	62.53%	4.18%	13.90%	5.63%	2.59%	3.41%	0.35%	0.20%	0.17%	0.66%	0.81%	0.97%	3.46%	0.60%	0.28%	0.25%
	Ramp 3	62.19%	4.16%	13.82%	5.60%	2.57%	3.57%	0.36%	0.21%	0.17%	0.69%	0.85%	1.01%	3.62%	0.62%	0.29%	0.25%
	Ramp 4	61.55%	4.15%	13.72%	5.53%	2.57%	3.80%	0.39%	0.25%	0.20%	0.74%	0.89%	1.09%	3.85%	0.49%	0.25%	0.54%
	Ramp 5	62.43%	4.16%	13.86%	5.68%	2.63%	3.33%	0.28%	0.14%	0.14%	0.69%	0.83%	0.97%	3.33%	0.83%	0.42%	0.28%
	Local	67.22%	4.50%	14.95%	6.05%	2.78%	1.16%	0.12%	0.07%	0.06%	0.22%	0.28%	0.33%	1.18%	0.55%	0.26%	0.27%
Anne Arundel County	Interstate	61.35%	4.10%	13.64%	5.53%	2.54%	3.95%	0.40%	0.24%	0.19%	0.76%	0.94%	1.12%	4.01%	0.72%	0.34%	0.17%
(Urban)	Freeway	63.79%	4.27%	14.18%	5.75%	2.64%	2.87%	0.29%	0.17%	0.14%	0.55%	0.68%	0.81%	2.91%	0.51%	0.24%	0.19%
	Principal Arterial	64.95%	4.35%	14.44%	5.85%	2.69%	2.26%	0.23%	0.14%	0.11%	0.44%	0.54%	0.64%	2.29%	0.66%	0.31%	0.11%
	Minor Arterial	65.69%	4.40%	14.61%	5.92%	2.72%	1.91%	0.20%	0.11%	0.09%	0.37%	0.45%	0.54%	1.94%	0.56%	0.27%	0.24%
	Collector	66.03%	4.42%	14.68%	5.95%	2.73%	1.77%	0.18%	0.11%	0.09%	0.34%	0.42%	0.50%	1.80%	0.46%	0.22%	0.31%
	Ramp 1	61.95%	4.15%	13.77%	5.58%	2.56%	3.67%	0.38%	0.22%	0.18%	0.71%	0.87%	1.04%	3.73%	0.69%	0.32%	0.18%
	Ramp 2	64.66%	4.33%	14.38%	5.82%	2.67%	2.48%	0.25%	0.15%	0.12%	0.48%	0.59%	0.70%	2.52%	0.44%	0.21%	0.21%
	Ramp 3	64.63%	4.33%	14.37%	5.82%	2.67%	2.48%	0.26%	0.15%	0.12%	0.48%	0.59%	0.70%	2.52%	0.44%	0.21%	0.23%
	Ramp 4	65.29%	4.37%	14.52%	5.88%	2.70%	2.19%	0.23%	0.13%	0.11%	0.42%	0.52%	0.62%	2.23%	0.27%	0.13%	0.38%
	Ramp 5	65.15%	4.36%	14.49%	5.87%	2.69%	2.18%	0.22%	0.13%	0.11%	0.42%	0.52%	0.62%	2.22%	0.55%	0.25%	0.23%
	Local	67.22%	4.50%	14.95%	6.05%	2.78%	1.16%	0.12%	0.07%	0.06%	0.22%	0.28%	0.33%	1.18%	0.55%	0.26%	0.27%
Anne Arundel County	Interstate	60.76%	4.07%	13.51%	5.47%	2.51%	4.31%	0.44%	0.26%	0.21%	0.83%	1.03%	1.22%	4.38%	0.58%	0.27%	0.14%
(Rural)	Principal Arterial	62.38%	4.17%	13.87%	5.62%	2.58%	3.54%	0.36%	0.21%	0.17%	0.68%	0.84%	1.00%	3.59%	0.58%	0.27%	0.13%
	Minor Arterial	62.53%	4.18%	13.90%	5.63%	2.59%	3.01%	0.31%	0.18%	0.15%	0.58%	0.72%	0.85%	3.06%	1.10%	0.52%	0.69%
	Collector	65.11%	4.36%	14.48%	5.86%	2.69%	2.21%	0.23%	0.13%	0.11%	0.43%	0.53%	0.63%	2.25%	0.47%	0.22%	0.30%
	Ramp 1	63.08%	4.22%	14.02%	5.68%	2.60%	3.27%	0.33%	0.20%	0.16%	0.63%	0.78%	0.92%	3.32%	0.41%	0.19%	0.19%

Run Area	Facility Scenario	*MOBILE6 VEHICLE TYPES*															
		LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
	Ramp 2	63.14%	4.23%	14.04%	5.69%	2.61%	3.25%	0.33%	0.19%	0.16%	0.63%	0.77%	0.92%	3.29%	0.40%	0.19%	0.17%
	Ramp 4	60.25%	4.05%	13.42%	5.44%	2.53%	4.43%	0.51%	0.25%	0.25%	0.89%	1.01%	1.27%	4.56%	0.63%	0.25%	0.25%
	Ramp 5	65.72%	4.40%	14.57%	5.89%	2.70%	2.08%	0.21%	0.12%	0.08%	0.42%	0.50%	0.58%	2.12%	0.29%	0.12%	0.21%
	Local	67.02%	4.48%	14.90%	6.04%	2.77%	1.24%	0.13%	0.07%	0.06%	0.24%	0.29%	0.35%	1.25%	0.40%	0.19%	0.56%
Baltimore County	Interstate	61.81%	4.14%	13.74%	5.57%	2.56%	3.75%	0.38%	0.23%	0.18%	0.72%	0.89%	1.06%	3.80%	0.68%	0.32%	0.17%
(Urban)	Freeway	63.90%	4.28%	14.21%	5.76%	2.64%	2.83%	0.29%	0.17%	0.14%	0.54%	0.67%	0.80%	2.87%	0.49%	0.23%	0.20%
	Principal Arterial	65.56%	4.39%	14.58%	5.90%	2.71%	2.01%	0.21%	0.12%	0.10%	0.39%	0.48%	0.57%	2.04%	0.58%	0.27%	0.11%
	Minor Arterial	66.08%	4.42%	14.69%	5.95%	2.73%	1.74%	0.18%	0.11%	0.08%	0.34%	0.41%	0.49%	1.77%	0.50%	0.24%	0.26%
	Collector	66.13%	4.42%	14.70%	5.96%	2.73%	1.73%	0.18%	0.10%	0.08%	0.33%	0.41%	0.49%	1.76%	0.46%	0.22%	0.30%
	Ramp 1	62.68%	4.19%	13.94%	5.65%	2.59%	3.35%	0.34%	0.20%	0.16%	0.65%	0.80%	0.95%	3.40%	0.62%	0.29%	0.19%
	Ramp 2	63.44%	4.24%	14.10%	5.71%	2.62%	3.02%	0.31%	0.18%	0.15%	0.58%	0.72%	0.85%	3.06%	0.53%	0.25%	0.22%
	Ramp 3	65.52%	4.38%	14.57%	5.90%	2.71%	2.10%	0.22%	0.13%	0.10%	0.40%	0.50%	0.59%	2.13%	0.35%	0.17%	0.24%
	Ramp 4	64.22%	4.30%	14.28%	5.79%	2.65%	2.68%	0.28%	0.16%	0.13%	0.52%	0.63%	0.76%	2.72%	0.47%	0.22%	0.20%
	Ramp 5	61.30%	4.08%	13.61%	5.52%	2.51%	3.83%	0.38%	0.25%	0.19%	0.75%	0.88%	1.07%	3.83%	0.88%	0.44%	0.50%
	Local	67.22%	4.50%	14.95%	6.05%	2.78%	1.16%	0.12%	0.07%	0.06%	0.22%	0.28%	0.33%	1.18%	0.55%	0.26%	0.27%
Baltimore County	Interstate	61.27%	4.10%	13.62%	5.52%	2.53%	4.09%	0.42%	0.25%	0.20%	0.79%	0.97%	1.16%	4.15%	0.53%	0.25%	0.16%
(Rural)	Principal Arterial	62.82%	4.20%	13.97%	5.66%	2.60%	3.33%	0.34%	0.20%	0.16%	0.64%	0.79%	0.94%	3.38%	0.56%	0.26%	0.15%
	Minor Arterial	63.56%	4.25%	14.13%	5.72%	2.63%	2.59%	0.26%	0.16%	0.12%	0.50%	0.62%	0.73%	2.62%	0.95%	0.45%	0.70%
	Collector	64.44%	4.31%	14.33%	5.80%	2.66%	2.51%	0.26%	0.15%	0.12%	0.48%	0.60%	0.71%	2.54%	0.47%	0.22%	0.39%
	Ramp 1	61.28%	4.10%	13.62%	5.51%	2.53%	4.09%	0.42%	0.24%	0.20%	0.79%	0.98%	1.16%	4.15%	0.53%	0.25%	0.16%
	Ramp 2	61.74%	4.13%	13.74%	5.57%	2.56%	3.86%	0.40%	0.24%	0.18%	0.75%	0.91%	1.10%	3.91%	0.44%	0.20%	0.26%
	Ramp 3	63.70%	4.26%	14.17%	5.74%	2.64%	2.98%	0.31%	0.18%	0.15%	0.57%	0.71%	0.84%	3.03%	0.28%	0.14%	0.32%
	Local	67.06%	4.49%	14.91%	6.04%	2.77%	1.24%	0.13%	0.07%	0.06%	0.24%	0.29%	0.35%	1.26%	0.40%	0.19%	0.51%
Carroll County	Principal Arterial	63.57%	4.25%	14.13%	5.73%	2.63%	2.84%	0.29%	0.17%	0.14%	0.55%	0.68%	0.80%	2.89%	0.82%	0.39%	0.13%
(Urban)	Minor Arterial	64.52%	4.32%	14.34%	5.81%	2.67%	2.39%	0.24%	0.14%	0.12%	0.46%	0.57%	0.68%	2.43%	0.70%	0.33%	0.29%
	Collector	65.04%	4.35%	14.46%	5.86%	2.69%	2.18%	0.22%	0.13%	0.11%	0.42%	0.52%	0.62%	2.21%	0.43%	0.20%	0.57%
	Ramp 2	64.06%	4.24%	14.32%	5.84%	2.63%	2.78%	0.29%	0.15%	0.15%	0.58%	0.58%	0.73%	2.78%	0.58%	0.29%	0.00%
	Ramp 5	62.43%	4.17%	13.87%	5.63%	2.59%	3.33%	0.35%	0.20%	0.15%	0.63%	0.78%	0.94%	3.37%	0.96%	0.46%	0.15%
	Local	67.16%	4.49%	14.93%	6.05%	2.78%	1.18%	0.12%	0.07%	0.06%	0.23%	0.28%	0.34%	1.20%	0.51%	0.24%	0.36%
Carroll County	Interstate	55.97%	3.75%	12.44%	5.04%	2.31%	6.49%	0.66%	0.39%	0.31%	1.25%	1.54%	1.84%	6.59%	0.88%	0.41%	0.13%

Run Area	Facility Scenario	*MOBILE6 VEHICLE TYPES* LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
(Rural)	Principal Arterial	60.25%	4.03%	13.40%	5.43%	2.49%	4.48%	0.46%	0.27%	0.22%	0.86%	1.07%	1.27%	4.55%	0.61%	0.29%	0.33%
	Minor Arterial	63.27%	4.23%	14.07%	5.70%	2.62%	2.70%	0.28%	0.16%	0.13%	0.52%	0.64%	0.77%	2.74%	1.00%	0.47%	0.69%
	Collector	63.69%	4.26%	14.16%	5.74%	2.63%	2.84%	0.29%	0.17%	0.14%	0.55%	0.67%	0.80%	2.88%	0.48%	0.23%	0.48%
	Ramp 2	62.62%	4.19%	13.96%	5.68%	2.59%	3.39%	0.40%	0.20%	0.20%	0.70%	0.80%	1.00%	3.49%	0.30%	0.10%	0.40%
	Ramp 5	66.22%	4.05%	14.19%	6.08%	2.70%	2.03%	0.00%	0.00%	0.00%	0.68%	0.68%	0.68%	2.03%	0.00%	0.00%	0.68%
	Local	67.06%	4.49%	14.91%	6.04%	2.77%	1.23%	0.13%	0.07%	0.06%	0.24%	0.29%	0.35%	1.25%	0.41%	0.19%	0.51%
Harford County	Interstate	59.10%	3.96%	13.14%	5.32%	2.44%	4.95%	0.51%	0.30%	0.24%	0.95%	1.18%	1.40%	5.02%	0.90%	0.43%	0.17%
(Urban)	Freeway	65.00%	4.35%	14.45%	5.85%	2.69%	2.33%	0.24%	0.14%	0.11%	0.45%	0.56%	0.66%	2.37%	0.41%	0.19%	0.19%
	Principal Arterial	63.29%	4.24%	14.07%	5.70%	2.62%	2.96%	0.30%	0.18%	0.14%	0.57%	0.70%	0.84%	3.00%	0.87%	0.41%	0.11%
	Minor Arterial	64.42%	4.31%	14.32%	5.80%	2.66%	2.44%	0.25%	0.15%	0.12%	0.47%	0.58%	0.69%	2.48%	0.71%	0.34%	0.26%
	Collector	65.33%	4.37%	14.52%	5.88%	2.70%	2.07%	0.21%	0.12%	0.10%	0.40%	0.49%	0.59%	2.10%	0.54%	0.25%	0.31%
	Ramp 2	62.96%	4.21%	14.00%	5.67%	2.60%	3.22%	0.33%	0.19%	0.15%	0.62%	0.77%	0.91%	3.27%	0.59%	0.28%	0.21%
	Ramp 3	61.63%	4.18%	13.73%	5.52%	2.54%	3.73%	0.45%	0.30%	0.15%	0.75%	0.90%	1.05%	3.88%	0.60%	0.30%	0.30%
	Ramp 4	63.55%	4.26%	14.13%	5.73%	2.62%	2.96%	0.31%	0.18%	0.14%	0.57%	0.70%	0.84%	3.01%	0.49%	0.23%	0.27%
	Ramp 5	62.72%	4.66%	13.98%	4.66%	4.66%	4.66%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.66%	0.00%	0.00%	0.00%
	Local	67.19%	4.50%	14.94%	6.05%	2.78%	1.16%	0.12%	0.07%	0.06%	0.22%	0.28%	0.33%	1.18%	0.56%	0.26%	0.32%
Harford County	Interstate	59.10%	3.95%	13.14%	5.32%	2.44%	5.06%	0.52%	0.31%	0.24%	0.98%	1.20%	1.43%	5.14%	0.68%	0.32%	0.14%
(Rural)	Principal Arterial	63.81%	4.27%	14.19%	5.75%	2.64%	2.89%	0.30%	0.17%	0.14%	0.56%	0.69%	0.82%	2.93%	0.49%	0.23%	0.15%
	Minor Arterial	62.48%	4.18%	13.89%	5.63%	2.58%	3.03%	0.31%	0.18%	0.15%	0.58%	0.72%	0.86%	3.07%	1.11%	0.52%	0.71%
	Collector	63.06%	4.22%	14.02%	5.68%	2.61%	3.11%	0.32%	0.19%	0.15%	0.60%	0.74%	0.88%	3.15%	0.62%	0.29%	0.37%
	Ramp 2	61.34%	4.10%	13.63%	5.52%	2.54%	4.05%	0.42%	0.25%	0.20%	0.78%	0.96%	1.16%	4.12%	0.51%	0.25%	0.18%
	Ramp 3	60.11%	4.02%	13.36%	5.41%	2.49%	4.61%	0.47%	0.28%	0.22%	0.89%	1.10%	1.31%	4.68%	0.59%	0.28%	0.18%
	Local	67.05%	4.49%	14.91%	6.04%	2.77%	1.24%	0.13%	0.07%	0.06%	0.24%	0.29%	0.35%	1.25%	0.40%	0.19%	0.51%
Howard County	Interstate	58.10%	3.89%	12.92%	5.23%	2.40%	5.39%	0.55%	0.33%	0.26%	1.04%	1.28%	1.53%	5.47%	0.98%	0.46%	0.16%
(Urban)	Freeway	64.88%	4.34%	14.42%	5.84%	2.68%	2.39%	0.24%	0.14%	0.12%	0.46%	0.57%	0.68%	2.42%	0.42%	0.20%	0.19%
	Principal Arterial	63.27%	4.23%	14.07%	5.70%	2.62%	2.97%	0.30%	0.18%	0.14%	0.57%	0.71%	0.84%	3.01%	0.88%	0.41%	0.10%
	Minor Arterial	66.68%	4.46%	14.83%	6.01%	2.76%	1.49%	0.15%	0.09%	0.07%	0.29%	0.36%	0.42%	1.52%	0.44%	0.21%	0.23%
	Collector	65.90%	4.41%	14.65%	5.94%	2.72%	1.81%	0.19%	0.11%	0.09%	0.35%	0.43%	0.51%	1.83%	0.36%	0.17%	0.53%
	Ramp 1	63.95%	4.28%	14.22%	5.76%	2.64%	2.79%	0.28%	0.17%	0.13%	0.54%	0.67%	0.79%	2.84%	0.50%	0.24%	0.21%

Run Area	Facility Scenario	MOBILE6 VEHICLE TYPES															
		LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
	Ramp 2	64.18%	4.29%	14.27%	5.78%	2.65%	2.69%	0.28%	0.16%	0.13%	0.52%	0.64%	0.76%	2.73%	0.45%	0.21%	0.25%
	Ramp 3	64.91%	4.34%	14.43%	5.85%	2.68%	2.38%	0.24%	0.14%	0.11%	0.46%	0.56%	0.67%	2.41%	0.40%	0.19%	0.23%
	Ramp 4	63.87%	4.27%	14.19%	5.76%	2.65%	2.81%	0.30%	0.16%	0.14%	0.55%	0.66%	0.80%	2.86%	0.41%	0.18%	0.39%
	Ramp 5	66.24%	4.43%	14.75%	5.98%	2.75%	1.72%	0.17%	0.09%	0.09%	0.34%	0.39%	0.47%	1.72%	0.43%	0.22%	0.22%
	Local	67.20%	4.50%	14.94%	6.05%	2.78%	1.16%	0.12%	0.07%	0.06%	0.22%	0.28%	0.33%	1.18%	0.56%	0.26%	0.30%
Howard County (Rural)	Interstate	57.17%	3.83%	12.71%	5.15%	2.36%	5.94%	0.61%	0.36%	0.29%	1.15%	1.41%	1.68%	6.03%	0.81%	0.38%	0.14%
	Principal Arterial	63.85%	4.27%	14.20%	5.75%	2.64%	2.86%	0.29%	0.17%	0.14%	0.55%	0.68%	0.81%	2.90%	0.48%	0.22%	0.17%
	Minor Arterial	63.45%	4.25%	14.11%	5.71%	2.62%	2.62%	0.27%	0.16%	0.13%	0.51%	0.62%	0.74%	2.66%	0.96%	0.45%	0.73%
	Collector	65.15%	4.36%	14.49%	5.87%	2.69%	2.18%	0.22%	0.13%	0.11%	0.42%	0.52%	0.62%	2.22%	0.40%	0.19%	0.42%
	Ramp 1	64.23%	4.31%	14.29%	5.79%	2.67%	2.71%	0.28%	0.16%	0.12%	0.52%	0.64%	0.76%	2.75%	0.36%	0.16%	0.26%
	Ramp 2	64.67%	4.31%	14.39%	5.81%	2.66%	2.59%	0.26%	0.15%	0.11%	0.49%	0.60%	0.75%	2.62%	0.22%	0.11%	0.26%
	Ramp 3	63.60%	4.26%	14.15%	5.74%	2.63%	3.03%	0.30%	0.18%	0.14%	0.59%	0.73%	0.85%	3.07%	0.32%	0.16%	0.24%
	Local	67.04%	4.49%	14.90%	6.04%	2.77%	1.24%	0.13%	0.07%	0.06%	0.24%	0.29%	0.35%	1.25%	0.40%	0.19%	0.55%

SPEED/EMISSION ESTIMATION PROCEDURE

The previous sections have summarized the input data used for computing speeds and emission rates for the Baltimore Non-Attainment region. This section explains how PPSUITE and MOBILE use that input data to produce emission estimates. Exhibit 6 on the following page summarizes PPSUITE's analysis procedure used for each of the nearly 15,000 roadway links contained in the travel demand model.

Producing an emissions inventory with PPSUITE requires a process of disaggregation and aggregation. Data is available and used on a very small scale - individual ½ mile roadway segments 24 hours of the day. This data needs to first be aggregated into categories so that a reasonable number of MOBILE scenarios can be run, and then further aggregated and/or re-sorted into summary information that is useful for emission inventory reporting.

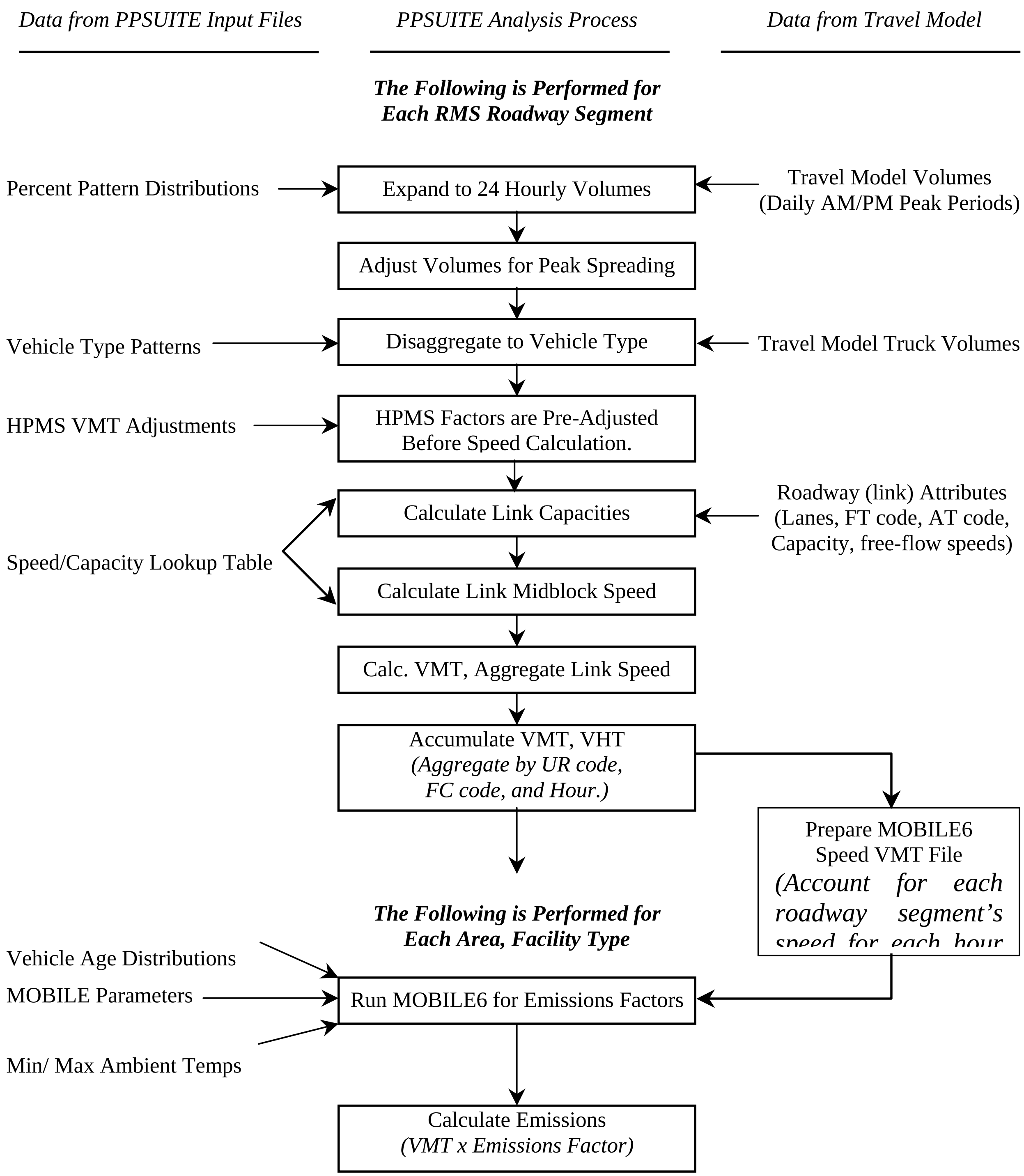
One of the major enhancements of MOBILE6 is the increased detail of traffic speed data that can be input to the emissions model. The PPSUITE post processor calculates hourly speeds for each roadway segment. Since previous versions of MOBILE only allowed one average speed as input for each scenario, a lookup table was created for speeds from 2.5 to 65 MPH in 0.1 MPH increments. MOBILE6 allows for direct input of the 24 hourly speeds as well as options to account for each link's speed separately. These added features utilize the full extent of the information output from the speed processing programs and provide for more accurate emission estimates of the available traffic data.

Volume/VMT Development

Before speeds can be calculated and MOBILE run, volumes acquired from the travel demand model must be adjusted and disaggregated. Such adjustments include factoring to HPMS VMT, seasonal adjustments, and disaggregating daily volumes to each hour of the day and to each of the sixteen MOBILE6 vehicle types.

Future Year Volumes. Future year volumes are based on projected land use files that the Baltimore Regional Transportation Board (BRTB) endorse and expected changes to the future transportation network. The model is run using the future year inputs and assigned volumes are produced for each roadway link contained within the model network.

Exhibit 6 PPSUITE Speed/Emission Estimation Procedure



Seasonal Adjustments. PPSUITE takes the 24 hr model volumes from the travel demand model, which represents an average annual weekday that has been adjusted for seasonal variance to represent an average summer weekday. A comprehensive adjustment factor of 1.04 is applied to the entire region. Using the adjusted weekday volumes, VMT is calculated for each model link.

Example:

Assume a sample Baltimore Arterial link: The average annual weekday traffic for this link in 2005 is 13,355 vehicles/day.

A seasonal factor of 1.04 is then applied.
Average Weekday summer Volume = 13,355 x 1.04 = 13,889 vehicles/day

Total VMT (daily) for this link is calculated as volume x distance. The distance of this link as obtained from the model is 0.296 miles.

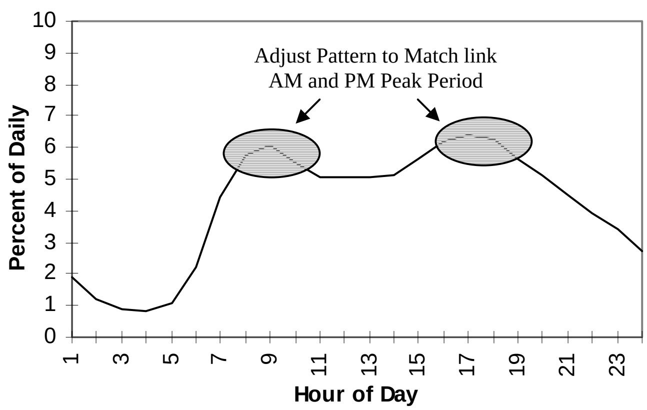
2005 VMT = 13,889 vehicles/day x 0.286 miles = 4,111 vehicle-miles / day

---

Disaggregation to 24 Hours. After seasonally adjusting the link volume, the volume is split to each hour of the day. This allows for more accurate speed calculations (effects of congested hours) and allows PPSUITE to prepare the hourly VMT and speeds for input to the MOBILE6 model.

Example:

To support speed calculations and emission estimates by time of day, the summer weekday volume is disaggregated to 24 hourly volumes. Temporal patterns by facility type were previously developed from SHA 1999-2001 count data and input to PPSUITE. A sample distribution is illustrated below and can be applied to the daily link volume to produce hourly volumes. Additional features within PPSUITE allow for the input pattern to be adjusted ensuring peak period volumes for the AM and PM are consistent with values supplied for each link.



Using the sample link, the resulting typical hourly volumes include:

8-9 a.m.	6.0 % x	(4,111 vehicle miles/ 0.296mi.)	= 833 vehicles/hour (vph)
12-1 p.m.	5.0 % x	(4,111 vehicle miles/ 0.296mi.)	= 694 vph
5-6 p.m.	6.3 % x	(4,111 vehicle miles/ 0.296mi.)	= 875 vph

After dividing the daily volumes to each hour of the day, PPSUITE identifies hours that are unreasonably congested. For those hours, PPSUITE then spreads a portion of the volume to other hours within the same peak period, thereby approximating the “peak spreading” that normally occurs in such over-capacity conditions.

Disaggregation to Vehicle Type. EPA requires VMT estimates to be prepared by vehicle type, reflecting specific local characteristics. As a result, for Baltimore’s emission inventory runs, the hourly volumes are disaggregated to the sixteen MOBILE6 vehicle types based on a combination of model truck volume assignments, SHA count pattern data, and MOBILE6 defaults.

Example:

Disaggregation of the total sample link volume (by hour) to the various vehicle types would include the following:

Total Model Volume 8-9 am = 833 vph; Model Truck Volume 8-9 am = 90 vph
From above, Auto Volume 8-9 am = 833-90 = 743 vph

From the SHA counts for hour 8-9am (Based on Facility Type):

Light-duty vehicles (LDV)	= 89.52%
Motorcycles (MC)	= 00.17%
Heavy-duty vehicles (HDV)	= 09.52%
Bus	= 00.79%

The above is renormalized into Auto and Truck groupings:

AUTO:	LDV = 99.8%,	MC = 0.2%
TRUCK:	HDV = 92.3%,	Bus = 7.7%

Using the above information, the following vehicle type volumes are calculated for 8-9 am:

LDV	=	743 x 99.8%	=	741 vph
MC	=	743 x 00.2%	=	2 vph
HDV	=	90 x 92.3%	=	83 vph
BUS	=	90 x 7.7%	=	7 vph

Finally, MOBILE6 defaults are used to break the above categories into the 16 input vehicle types. Defaults vary by the analysis year being run. For example, the following factors have been developed from 2005 MOBILE6 defaults:

LDV	0.4840 of LDV Group	=	359 vph
LDT1	0.0885 of LDV Group	=	66 vph
LDT2	0.2948 of LDV Group	=	218 vph
LDT3	0.0908 of LDV Group	=	67 vph
LDT4	0.0418 of LDV Group	=	31 vph
HDV2B	0.3299 of HDV Group	=	27 vph
HDV3	0.0324 of HDV Group	=	3 vph
HDV4	0.0264 of HDV Group	=	2 vph
HDV5	0.0196 of HDV Group	=	2 vph
HDV6	0.0733 of HDV Group	=	6 vph
HDV7	0.0870 of HDV Group	=	7 vph
HDV8A	0.0946 of HDV Group	=	8 vph
HDV8B	0.3367 of HDV Group	=	28 vph
HDBS	0.6897 of BUS Group	=	5 vph
HDBT	0.3103 of BUS Group	=	2 vph
MC	1.0000 of MC Group	=	2 vph

Speed/Delay Determination

EPA recognizes that the estimation of vehicle speeds is a difficult and complex process. Because emissions are so sensitive to speeds, it recommends special attention be given to developing reasonable and consistent speed estimates; it also recommends that VMT be disaggregated into subsets that have roughly equal speed, with separate emission factors for each subset. At a minimum, speeds should be estimated separately according to roadway facility class.

The computational framework used for this analysis meets and exceeds that recommendation. Speeds are individually calculated for each roadway segment and hour based on the physical characteristics of the roadway and the assigned capacities to each model link. Rather than accumulating the roadway segments into area/functional groupings and calculating an average speed, each individual link hourly speed is represented in the MOBILE6 speed VMT file. This represents a significant enhancement in the MOBILE model since past versions only allowed input of one average speed for each scenario. MOBILE6 allows the input of a distribution of hourly speeds. For example, if 5% of a county's arterial VMT operate at 5 mph during the AM peak hour and the remaining 95% operate at 65mph, this can be represented in the MOBILE6 speed input file. For the Baltimore runs, distributions of speeds are input to MOBILE6 for separate scenarios representing county/area and facility type groupings; VMT is accumulated by the same groupings for the application of the emission factors to produce resulting emission totals.

To calculate speeds, PPSUITE first obtains initial capacities (how much volume the roadway can serve before heavy congestion) and free-flow speeds (speeds assuming no congestion) from the travel demand model data. Other data needed for the speed calculations including the BPR parameters (speed – congestion relationships) are obtained from a lookup table input to PPSUITE. This lookup data contains default roadway information indexed by the urban/rural code and facility type.

Example:

For the sample arterial link, the free-flow speeds and capacity is obtained from the travel demand model:

free flow speed = 65 mph
capacity = 1800 vph per lane

This information is used along with the physical characteristics of the roadway to calculate the delay (including congestion) to travel this link during each hour of the day:

For example: The sample link is calculated to have a travel time, including delay of 17.76 seconds for the 8-9am hour

Total travel time, in vehicle hours, for the 8-9am hour is calculated as:

VHT (8-9am) = 17.76 seconds x 833vph / 3600 sec/hr = 4.12 vehicle hours

---

The result of this process is an estimated average travel time for each hour of the day for each highway segment. The average time multiplied by the volume produces vehicle hours of travel (VHT).

HPMS and VMT Adjustments

Link volumes from the traffic model assignment must also be adjusted to account for differences with the HPMS VMT totals, as described previously. VMT adjustment factors are provided as input to PPSUITE, and are applied to each of the roadway segment volumes. These factors were developed from 1990 and 2000 HPMS data; however, the 2000 factors are also applied to any future year runs. The VMT added or subtracted to the travel model links are applied before the calculation of speeds. Therefore, the final congested speed that is used by MOBILE6 accounts for the HPMS VMT adjustments. However, for "local" facility, a constant speed is assumed within MOBILE6 for the calculation of emission factors and the HPMS adjustments will not impact its speeds.

Example:

Assuming the sample arterial link example is in Harford County, the daily assigned volume is adjusted to account for reconciliation with the HPMS VMT. HPMS VMT for Harford County urban arterials is 721,411 vehicle miles in 1990. The total VMT for all urban arterial model links in Harford County is 744,471 vehicle miles. A factor is developed by dividing the HPMS VMT by the travel model link VMT:

HPMS adjustment factor = 721,411 / 744,471 = 0.969

This factor is applied in the 1990 run. Separate factors are calculated for the year 2000 and carried forward to all future years.

Thus for the sample link:

VMT (8-9am) = 833 vph x 0.296 miles x 0.969 = 239 vehicle miles

VMT and Speed Aggregation

As discussed in previous sections, MOBILE6's ability to handle input distributions of hourly speeds has eliminated the need to aggregate speed data. For the Baltimore runs, PPSUITE has been set up to automatically accumulate VMT and VHT by geographic areas and highway facility type. The speed files input to MOBILE6 for each scenario contain the actual distribution of roadway speeds for that aggregation group. Exhibit 7 illustrates the scenario aggregation scheme used with MOBILE6.

Exhibit 7 VMT/VHT Aggregation Scheme

County -	1 = Baltimore City 3 = Baltimore County 5 = Harford County	2 = Anne Arundel County 4 = Carroll County 6 = Howard County	6 entries
Urban/Rural Code -	1=Urban 2=Rural		2 entries
Facility Type -	1 = Interstate 2 = Freeway 3 = Principal Arterial 4 = Minor Arterial	5 = Collector 6-10 = Ramps 11= Local	11 entries
			132 potential combinations

Geographic aggregation is performed according to urban and rural areas of each county. Facility class aggregation is according to the facility types contained in the travel demand model. For an individual county, this creates a potential for 22 possible combinations, each of which becomes an input MOBILE6 scenario. This allows each MOBILE6 scenario to represent the actual VMT mix and speed for that geographic/highway combination. Altogether then, there are potentially 132 combinations for which speeds and VMT are computed and emissions are calculated with MOBILE.

MOBILE Emissions Run

After computing speeds and aggregating VMT and VHT, PPSUITE prepares input files to be run in EPA's MOBILE6 program, which is used to produce VOC and NO_x emission factors in grams of pollutant per vehicle mile.

The MOBILE input file prepared by PPSUITE contains the following:

- MOBILE template containing appropriate parameters and program flags
- Temperature data specific to the Baltimore region.
- Vehicle age and diesel sales fraction data for the Baltimore region.
- Scenario data - contains VMT mix, speed distributions specific to scenario as produced by PPSUITE

Example:

A MOBILE input file is created by PPSUITE for each county in the Baltimore region. This file contains separate scenarios for each urban/rural code, facility type. A scenario represents a separate MOBILE run with different emission factors calculated and output for each run.

For this example, Harford County arterials will be run as a scenario with a specific VMT mix file and a speed distribution file accounting for all the roadway speeds within the grouping.

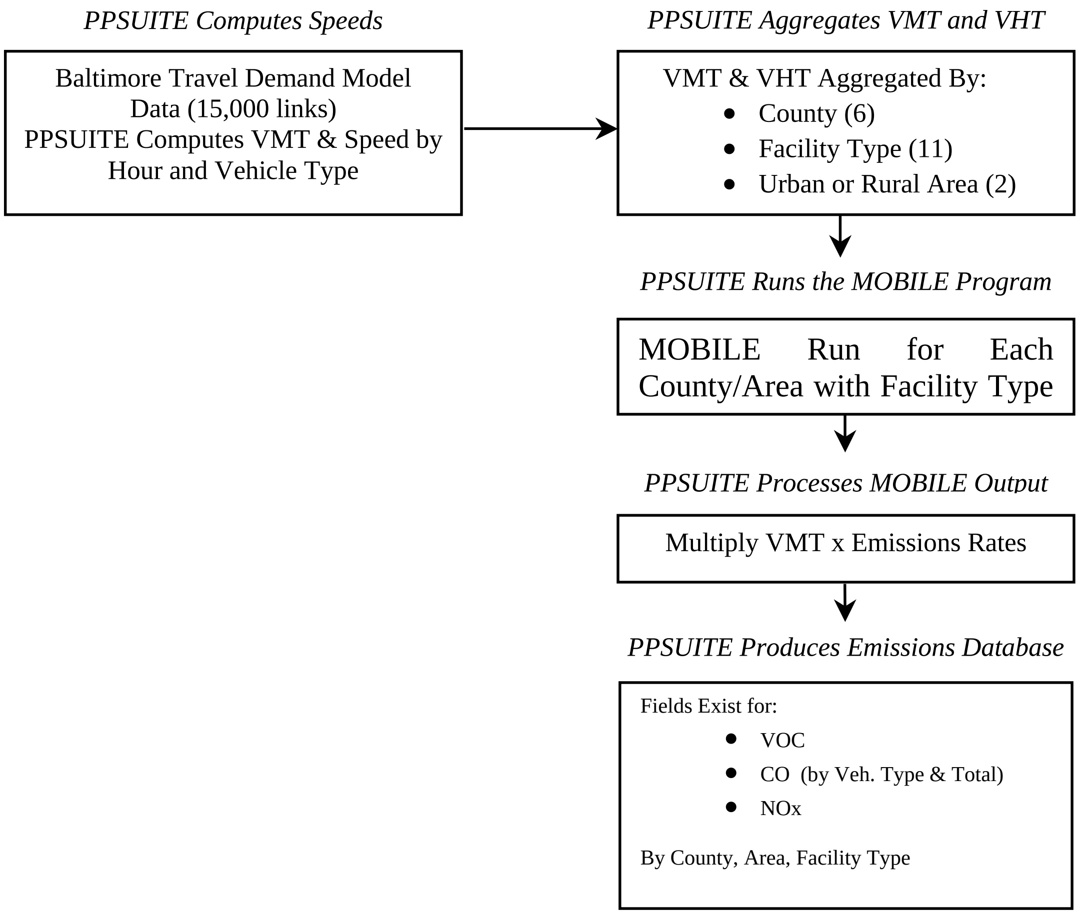
Time of Day Emissions

Unlike in the past using MOBILE5, VMT and speeds are no longer aggregated as separate scenarios representing time periods. This was done in the past to account for the unique speeds encountered during each time period in the day. Diurnal emissions were estimated on a daily period. Since MOBILE6 allows for hourly roadway speeds to be represented in the speed VMT file, such a process is no longer needed. MOBILE6 will internally account for the emissions during each hour in the day and make the necessary calculations.

MOBILE Output Post-Processing

After MOBILE has been run, PPSUITE processes the MOBILE output files and compiles the emission factors for each scenario. Using the MOBILE emission factors, PPSUITE calculates emission quantities by multiplying the emission factors by the aggregated VMT totals. PPSUITE then produces an emissions database summarizing VMT, VHT, VOC, and NO_x emissions as shown in Exhibit 8.

Exhibit 8 Summary of PPSUITE's Methodology in Producing Emissions Summary



Example:

Harford County urban arterials were run as a scenario in MOBILE. Based on the input information, MOBILE6 outputs emission factors by vehicle type for this scenario as shown below:

Composite Emission Factors (grams/mile) from MOBILE6 output

Vehicle Type:	LDGV	LDGT1	LDGT2	LDGT3	LDGT4	HDDV	For all 28 M6 types
VOC:	1.22	1.86	2.42	3.68	0.36	1.13	
NO_X:	2.41	3.16	3.66	7.14	1.84	5.84	

PPSUITE reads these emission factors from the MOBILE6 output file and multiplies them by the Harford County urban arterial VMT to obtain emission totals for this scenario. (Note: emissions shown in kg/day, which is converted to tons/day in SIP narratives)

PPSUITE computes emissions as follows for this scenario:

			Emission Factors (g/mi)			**Emissions (kg/day)**	
Veh Type	**VMT**		**VOC**	**NOX**		**VOC**	**NOX**
LDGV	84,344	x	1.22	2.41	=	102.9	203.3
LDGT1	30,713	x	1.86	3.16	=	57.1	97.1
LDGT2	21,515	x	2.42	3.66	=	52.1	78.7
LDGT3	4,209	x	3.68	7.14	=	15.5	30.1
LDGT4	3,586	x	0.36	1.84	=	1.3	6.6
HDDV7	7,483	x	1.13	5.84	=	8.5	43.7
….. Repeated for all 28 MOBILE6 vehicle types							
Total	155,903					244.6	482.0

The emissions for this scenario are reported and stored in an output database file that contains a record for each scenario with fields containing VMT, VHT, VOC emissions, and NO_x emissions. Fields exist for each vehicle type and for the total of all vehicle types as shown below.

Reported by Vehicle Type 1-28 and Total **---** *Repeated for VHT,HC,NOX*

Cnty	**UR**	**FC**	**VMT1**	**VMT2**	**VMT3**	**VMT4**	**VMT5**	**VMT6**	**VMT7**	**VMT8**	**VMT28**
Harf	1	3	84,344	30,713	21,515	4,209	3,586	2,806	7,483	1,248	
			VHT1	**VHT2**	**VHT3**	**VHT4**	**VHT5**	**VHT6**	**VHT7**	**VHT8**	**VHT28**
			1,298	473	331	65	55	43	115	19	
			VOC1	**VOC2**	**VOC3**	**VOC4**	**VOC5**	**VOC6**	**VOC7**	**VOC8**	**VOC28**
			102.9	57.1	52.1	15.5	1.3	1.5	8.5	5.7	
			NO_x1	**NO_x2**	**NO_x3**	**NO_x4**	**NO_x5**	**NO_x6**	**NO_x7**	**NO_x8**	**NO_x28**
			203.3	97.1	78.7	30.1	6.6	11.6	43.7	10.9	

RESOURCES

MOBILE Model

EPA – OTAQ - Modeling and Inventories. Feb. 12, 2003. U. S. Environmental Protection Agency. April 3, 2003. <http://www.epa.gov/omswww/models.htm>

This site contains a downloadable model, MOBILE users guide, and other information.

U.S. Environmental Protection Agency. *User's Guide to MOBILE6.0 (Mobile Source Emission Factor Model)*. Office of Mobile Sources. January 2002.

U.S. Environmental Protection Agency. *Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation.* Office of Transportation and Air Quality. January 2002.

U.S. Environmental Protection Agency. *Policy Guidance on the Use of MOBILE6 for Emission Inventory Preparation.* Office of Air and Radiation. January 18, 2002.

Traffic Engineering

Transportation Research Board. *2000 Highway Capacity Manual.* Committee on Highway Capacity and Quality of Service. 2000.

This manual presents current knowledge and techniques for analyzing the transportation system.

Appendix A – BMC Memorandum – included as Appendix A of SIP Revision

Appendix B – Baker – Baltimore Mobile6 Input Files

```
2005 MOBILE6 INPUT File Script for the Baltimore Region

MOBILE6 INPUT FILE

REPORT FILE         :  C:\pptemp\m6output.out       REPLACE
DATABASE OUTPUT     :
WITH FIELDNAMES     :
EMISSIONS TABLE     :  d:\BALTAQ\RUN\m6data\M6OUTPUT.TB1    REPLACE
POLLUTANTS          :  HC CO NOX
AGGREGATED OUTPUT   :
RUN DATA            : 0011

MIN/MAX TEMPERATURE: 67.9 96.5
FUEL RVP            : 7.0
EXPRESS HC AS VOC   :
EXPAND EXHAUST      :
EXPAND EVAPORATIVE :
NO REFUELING        :
ANTI-TAMP PROGRAM   :
89 77 50 22222 21111111 1 12  96. 12211112
I/M DESC FILE       : d:\BALTAQ\M6_Data\im2005.d
94+ LDG IMP         : d:\BALTAQ\M6_Data\nlevne.d
REG DISTRIBUTION    : d:\BALTAQ\M6_Data\regdat02.bal
DIESEL FRACTIONS    :
0.0001 0.0002 0.0006 0.0022 0.0014 0.0015 0.0020 0.0014 0.0015 0.0012
0.0017 0.0032 0.0013 0.0010 0.0005 0.0107 0.0078 0.0361 0.0508 0.0766
0.1184 0.1215 0.0962 0.0370 0.0046
0.0010 0.0010 0.0032 0.0136 0.0048 0.0172 0.0165 0.0153 0.0106 0.0151
0.0163 0.0169 0.0175 0.0250 0.0183 0.0256 0.0553 0.0651 0.0748 0.0877
0.2434 0.1723 0.1120 0.0614 0.0160
0.0010 0.0010 0.0032 0.0136 0.0048 0.0172 0.0165 0.0153 0.0106 0.0151
0.0163 0.0169 0.0175 0.0250 0.0183 0.0256 0.0553 0.0651 0.0748 0.0877
0.2434 0.1723 0.1120 0.0614 0.0160
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.2578 0.2515 0.3263
0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726 0.2743 0.3004 0.2918
0.2859 0.0138 0.0000 0.0000 0.0000
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.7715 0.7910 0.8105
0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842 0.6145 0.5139 0.5032
0.4277 0.0079 0.0000 0.0000 0.0001
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8473 0.8048 0.8331
0.7901 0.7316 0.7275 0.7158 0.5647 0.3178 0.2207 0.1968 0.1570 0.0738
0.0341 0.0414 0.0003 0.0000 0.0000
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4384 0.3670 0.4125
0.3462 0.2771 0.2730 0.2616 0.1543 0.0615 0.0383 0.0333 0.0255 0.0111
0.0049 0.0060 0.0000 0.0000 0.0000
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6078 0.5246 0.5767
0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705 0.4525 0.4310 0.3569
0.3690 0.4413 0.3094 0.1679 0.1390
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8443 0.7943 0.8266
0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567 0.7431 0.7261 0.6602
0.6717 0.7344 0.6107 0.4140 0.3610
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9989 0.9987 0.9989
0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980 0.9979 0.9976 0.9969
0.9978 0.9982 0.9974 0.9965 0.9964
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.8857 0.8525 0.8795
0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733 0.5155 0.3845 0.3238
0.3260 0.2639 0.0594 0.0460 0.0291
```

```
SCENARIO RECORD    :[01 0011]  1

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          2581303
*                    1083679  198376  660060  203302   93591  103898   10204    8314
*                       6173   23085   27400   29793  106071   15544    6993    4820
VMT FRACTIONS      :
                     .419820 .076851 .255708 .078759 .036257 .040250 .003953 .003221
                     .002391 .008943 .010615 .011542 .041092 .006022 .002709 .001867
VMT BY FACILITY    :V001101F.def
VMT BY HOUR        :V001101H.def
SPEED VMT          :V001101S.def


SCENARIO RECORD    :[02 0011]  2

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS           430271
*                     187190   34267  114016   35118   16167   13142    1291    1052
*                        781    2920    3466    3768   13416    1959     881     837
VMT FRACTIONS      :
                     .435054 .079640 .264986 .081618 .037574 .030544 .003000 .002445
                     .001815 .006786 .008055 .008757 .031180 .004553 .002048 .001945
VMT BY FACILITY    :V001102F.def
VMT BY HOUR        :V001102H.def
SPEED VMT          :V001102S.def


SCENARIO RECORD    :[03 0011]  3

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          3471070
*                    1547152  283219  942357  290251  133618   78916    7751    6315
*                       4689   17534   20812   22630   80567   20570    9255    5434
VMT FRACTIONS      :
                     .445728 .081594 .271489 .083620 .038495 .022735 .002233 .001819
                     .001351 .005051 .005996 .006520 .023211 .005926 .002666 .001566
VMT BY FACILITY    :V001103F.def
VMT BY HOUR        :V001103H.def
SPEED VMT          :V001103S.def


SCENARIO RECORD    :[04 0011]  4

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          2387720
*                    1062297  194462  647035  199290   91744   53675    5271    4295
*                       3189   11926   14155   15391   54797   16677    7503    6013
VMT FRACTIONS      :
                     .444899 .081443 .270984 .083465 .038423 .022480 .002208 .001799
```

```
                   .001336 .004995 .005928 .006446 .022950 .006984 .003142 .002518
VMT BY FACILITY    :V001104F.def
VMT BY HOUR        :V001104H.def
SPEED VMT          :V001104S.def


SCENARIO RECORD    :[05 0011]  5

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          684233
*                    303369   55534  184779   56913   26200   16104    1582    1289
*                       957    3578    4247    4618   16441    4563    2053    2007
VMT FRACTIONS      :
                   .443370 .081162 .270053 .083178 .038291 .023536 .002312 .001884
                   .001399 .005229 .006207 .006749 .024028 .006669 .003000 .002933
VMT BY FACILITY    :V001105F.def
VMT BY HOUR        :V001105H.def
SPEED VMT          :V001105S.def


SCENARIO RECORD    :[06 0011]  6

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          215347
*                     93241   17068   56792   17492    8053    6865     674     549
*                       408    1525    1811    1969    7009    1003     451     437
VMT FRACTIONS      :
                   .432981 .079258 .263723 .081227 .037395 .031879 .003130 .002549
                   .001895 .007082 .008410 .009143 .032547 .004658 .002094 .002029
VMT BY FACILITY    :V001106F.def
VMT BY HOUR        :V001106H.def
SPEED VMT          :V001106S.def


SCENARIO RECORD    :[07 0011]  7

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS           85325
*                     36781    6734   22405    6901    3177    2821     277     226
*                       168     627     744     809    2880     403     181     191
VMT FRACTIONS      :
                   .431070 .078922 .262584 .080879 .037234 .033062 .003246 .002649
                   .001969 .007348 .008720 .009481 .033753 .004723 .002121 .002239
VMT BY FACILITY    :V001107F.def
VMT BY HOUR        :V001107H.def
SPEED VMT          :V001107S.def


SCENARIO RECORD    :[08 0011]  8

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
```

```
*VMT TOTALS            42277
*                      17634     3228    10740     3308     1523     1776      174      142
*                        105      395      468      509     1813      257      115       90
VMT FRACTIONS      :
                     .417103 .076354 .254040 .078246 .036024 .042009 .004116 .003359
                     .002484 .009343 .011070 .012040 .042884 .006079 .002720 .002129
VMT BY FACILITY    :V001108F.def
VMT BY HOUR        :V001108H.def
SPEED VMT          :V001108S.def


SCENARIO RECORD    :[09 0011]  9

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS             3745
*                       1591      291      968      298      137      140       14       11
*                          8       31       37       40      143       18        8       10
VMT FRACTIONS      :
                     .424769 .077712 .258507 .079582 .036586 .037387 .003739 .002938
                     .002136 .008279 .009881 .010682 .038188 .004807 .002136 .002671
VMT BY FACILITY    :V001109F.def
VMT BY HOUR        :V001109H.def
SPEED VMT          :V001109S.def


SCENARIO RECORD    :[10 0011] 10

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS             1871
*                        804      147      490      151       69       60        6        5
*                          4       13       16       17       62       15        7        5
VMT FRACTIONS      :
                     .429799 .078556 .261854 .080694 .036873 .032064 .003206 .002672
                     .002138 .006947 .008550 .009085 .033133 .008016 .003741 .002672
VMT BY FACILITY    :V001110F.def
VMT BY HOUR        :V001110H.def
SPEED VMT          :V001110S.def


SCENARIO RECORD    :[11 0011] 15

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
FUEL PROGRAM       : 2 S
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          1076490
*                     499105    91365   304001    93634    43105    10969     1077      878
*                        652     2437     2893     3145    11199     6021     2709     3300
VMT FRACTIONS      :
                     .463640 .084873 .282400 .086981 .040042 .010190 .001000 .000816
                     .000606 .002264 .002687 .002922 .010403 .005593 .002517 .003066
VMT BY FACILITY    :V001111F.def
VMT BY HOUR        :V001111H.def
SPEED VMT          :V001111S.def


END OF RUN         : 0021
```

INPUT SCRIPTS CONTINUE FOR EVERY COUNTY AREA TYPE COMBINATION………

Attachment 1 to Appendix C

2005 I/M Input File to MOBILE6 for the Baltimore Region

```
*IM Program 2005.  Idle, IM240, and OBD.
*IM240  Final Cutpoints.
*HDGT1 receives IM240, but is modeled as idle test to allow single run.
*Describes IM emissions program beginning Summer 2004.
*Includes gas cap testing, which will be advisory until summer 2003, and
*should become pass/fail then.
*Waiver rates are based on the assumption that a $450 waiver expenditure will
*result in a  3% waiver rate.
*Gas Cap for OBD Vehicles
*
I/M PROGRAM        : 7 2003 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 7 1996 2050
I/M VEHICLES       : 7 22222 11111111 1
I/M COMPLIANCE     : 7 96.0
I/M WAIVER RATES   : 7  3.0  3.0
I/M GRACE PERIOD   : 7 2
*Gas Cap for HDGT
I/M PROGRAM        : 6 2003 2050 2 T/O GC
I/M MODEL YEARS    : 6 1977 2050
I/M VEHICLES       : 6 11111 22222111 1
I/M COMPLIANCE     : 6 96.0
I/M WAIVER RATES   : 6  3.0  3.0
I/M GRACE PERIOD   : 6 2
*Gas Cap for older LDGV, LDGT
I/M PROGRAM        : 5 2003 2050 2 T/O GC
I/M MODEL YEARS    : 5 1977 1995
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 96.0
I/M WAIVER RATES   : 5  3.0  3.0
I/M GRACE PERIOD   : 5 2
*OBD
I/M PROGRAM        : 4 2003 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 20.0
I/M COMPLIANCE     : 4 96.0
I/M WAIVER RATES   : 4  3.0  3.0
I/M GRACE PERIOD   : 4 2
*IM240
I/M PROGRAM        : 3 1984 2050 2 T/O IM240
I/M MODEL YEARS    : 3 1984 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M STRINGENCY     : 3 20.0
I/M COMPLIANCE     : 3 96.0
I/M WAIVER RATES   : 3  3.0  3.0
I/M CUTPOINTS      : 3 d:\BALTAQ\M6_Data\cutpnt05.d
I/M GRACE PERIOD   : 3 2
*Idle HDGT
I/M PROGRAM        : 2 1984 2050 2 T/O Idle
I/M MODEL YEARS    : 2 1977 2050
I/M VEHICLES       : 2 11111 22222111 1
I/M STRINGENCY     : 2 20.0
I/M COMPLIANCE     : 2 96.0
I/M WAIVER RATES   : 2  3.0  3.0
I/M GRACE PERIOD   : 2 2
*Idle older LDGV, LDGT
I/M PROGRAM        : 1 1984 2050 2 T/O Idle
I/M MODEL YEARS    : 1 1977 1983
I/M VEHICLES       : 1 22222 11111111 1
I/M STRINGENCY     : 1 20.0
I/M COMPLIANCE     : 1 96.0
```

```
I/M WAIVER RATES   : 1  3.0  3.0
I/M GRACE PERIOD   : 1 2
```

Attachment 2 to Appendix C

2002 Vehicle Age Distribution Inputs to MOBILE6 for the Baltimore Region

```
REG DIST
* This file contains the default MOBILE6 values for the distribution of
* vehicles by age for July of any calendar year.  There are sixteeen (16)
* sets of values representing 16 combined gasoline/diesel vehicle class
* distributions.  These distributions are split for gasoline and diesel
* using the separate input (or default) values for diesel sales fractions.
* Each distribution contains 25 values which represent the fraction of
* all vehicles in that class (gasoline and diesel) of that age in July.
* The first number is for age 1 (calendar year minus model year plus one)
* and the last number is for age 25.  The last age includes all vehicles
* of age 25 or older.  The first number in each distribution is an integer
* which indicates which of the 16 vehicle classes are represented by the
* distribution.  The sixteen vehicle classes are:
*
*  1  LDV    Light-Duty Vehicles (Passenger Cars)
*  2  LDT1   Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
*  3  LDT2   Light Duty Trucks 2 (0-6,001 lbs. GVWR, 3751-5750 lbs. LVW)
*  4  LDT3   Light Duty Trucks 3 (6,001-8500 lbs. GVWR, 0-3750 lbs. LVW)
*  5  LDT4   Light Duty Trucks 4 (6,001-8500 lbs. GVWR, 3751-5750 lbs. LVW)
*  6  HDV2B  Class 2b Heavy Duty Vehicles (8501-10,000 lbs. GVWR)
*  7  HDV3   Class 3 Heavy Duty Vehicles (10,001-14,000 lbs. GVWR)
*  8  HDV4   Class 4 Heavy Duty Vehicles (14,001-16,000 lbs. GVWR)
*  9  HDV5   Class 5 Heavy Duty Vehicles (16,001-19,500 lbs. GVWR)
* 10  HDV6   Class 6 Heavy Duty Vehicles (19,501-26,000 lbs. GVWR)
* 11  HDV7   Class 7 Heavy Duty Vehicles (26,001-33,000 lbs. GVWR)
* 12  HDV8A  Class 8a Heavy Duty Vehicles (33,001-60,000 lbs. GVWR)
* 13  HDV8B  Class 8b Heavy Duty Vehicles (>60,000 lbs. GVWR)
* 14  HDBS   School Busses
* 15  HDBT   Transit and Urban Busses
* 16  MC     Motorcycles (All)
*
* The 25 age values are arranged in two rows of 10 values followed by a row
* with the last 5 values.  Comments (such as this one) are indicated by
* an asterisk in the first column. Empty rows are ignored.  Values are
* read "free format," meaning any number may appear in any row with as
* many characters as needed (including a decimal) as long as 25 values
* follow the initial integer value separated by a space.
*
* If all 28 vehicle classes do not need to be altered from the default
* values, then only the vehicle classes that need to be changed need to
* be included in this file.  The order in which the vehicle classes are
* read does not matter, however each vehicle class set must contain 25
* values and be in the proper age order.
*
* Based on the 2002 MVA Data received during July 2002
* LDV
 1 0.0646 0.0842 0.0867 0.0750 0.0732 0.0740 0.0664 0.0726 0.0600 0.0530
   0.0451 0.0401 0.0381 0.0329 0.0281 0.0232 0.0174 0.0116 0.0080 0.0044
   0.0026 0.0021 0.0019 0.0024 0.0324
* LDT1
 2 0.0909 0.1057 0.1137 0.1007 0.0968 0.0874 0.0735 0.0687 0.0538 0.0408
   0.0307 0.0246 0.0229 0.0224 0.0191 0.0145 0.0095 0.0071 0.0049 0.0026
   0.0015 0.0010 0.0009 0.0019 0.0046
* LDT2
 3 0.0909 0.1057 0.1137 0.1007 0.0968 0.0874 0.0735 0.0687 0.0538 0.0408
   0.0307 0.0246 0.0229 0.0224 0.0191 0.0145 0.0095 0.0071 0.0049 0.0026
   0.0015 0.0010 0.0009 0.0019 0.0046
* LDT3
 4 0.0560 0.0815 0.0826 0.0707 0.0654 0.0702 0.0574 0.0628 0.0628 0.0418
   0.0353 0.0340 0.0367 0.0414 0.0406 0.0361 0.0343 0.0204 0.0167 0.0095
   0.0066 0.0053 0.0043 0.0077 0.0201
* LDT4
 5 0.0560 0.0815 0.0826 0.0707 0.0654 0.0702 0.0574 0.0628 0.0628 0.0418
   0.0353 0.0340 0.0367 0.0414 0.0406 0.0361 0.0343 0.0204 0.0167 0.0095
   0.0066 0.0053 0.0043 0.0077 0.0201
```

```
* HDV2B
 6 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV3
 7 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV4
 8 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV5
 9 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV6
10 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV7
11 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV8a
12 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDV8b
13 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDBS
14 0.0503 0.0815 0.0989 0.0959 0.0546 0.0757 0.0505 0.0712 0.0421 0.0327
   0.0263 0.0293 0.0395 0.0401 0.0381 0.0328 0.0293 0.0222 0.0145 0.0090
   0.0081 0.0064 0.0069 0.0083 0.0360
* HDBT
15 0.0255 0.0410 0.0624 0.1022 0.0548 0.0826 0.0626 0.0911 0.0484 0.0434
   0.0363 0.0392 0.0476 0.0481 0.0440 0.0429 0.0355 0.0269 0.0152 0.0097
   0.0097 0.0063 0.0064 0.0068 0.0115
* Motorcycles
16 0.0852 0.1120 0.0907 0.0738 0.0526 0.0448 0.0457 0.0373 0.0309 0.0334
   0.0243 0.3692 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
   0.0000 0.0000 0.0000 0.0000 0.0000
```

Appendix C – Baker – 1990 Baltimore Mobile6 Input Files

```
1990 MOBILE6 INPUT File Script for the Baltimore Region

MOBILE6 INPUT FILE

REPORT FILE        :  C:\pptemp\m6output.out       REPLACE
DATABASE OUTPUT    :
WITH FIELDNAMES    :
EMISSIONS TABLE    :  d:\SIP1990.M6\RUN90\m6data\M6OUTPUT.TB1    REPLACE
POLLUTANTS         :  HC CO NOX
AGGREGATED OUTPUT  :
RUN DATA           : 0011

MIN/MAX TEMPERATURE: 69.1  98.4
```

FUEL RVP : 8.2

```
EXPRESS HC AS VOC  :
EXPAND EXHAUST     :
EXPAND EVAPORATIVE :
NO CLEAN AIR ACT   :
NO REFUELING       :
ANTI-TAMP PROGRAM  :
89 77 50 22222 22222111 1 12  96. 12211111
I/M DESC FILE      : d:\SIP1990.M6\M6_Data\MDIm1990.d
REG DISTRIBUTION   : d:\SIP1990.M6\M6_Data\MD90.reg
DIESEL FRACTIONS   :
0.0004 0.0005 0.0003 0.0033 0.0043 0.0136 0.0178 0.0206 0.0396 0.0546
0.0479 0.0230 0.0111 0.0078 0.0102 0.0142 0.0067 0.0032 0.0044 0.0014
0.0019 0.0016 0.0003 0.0003 0.0007
0.0022 0.0128 0.0113 0.0150 0.0316 0.0370 0.0637 0.0867 0.2519 0.2094
0.1066 0.0391 0.0181 0.0038 0.0019 0.0023 0.0054 0.0000 0.0017 0.0025
0.0000 0.0000 0.0120 0.0000 0.0209
0.0022 0.0128 0.0113 0.0150 0.0316 0.0370 0.0637 0.0867 0.2519 0.2094
0.1066 0.0391 0.0181 0.0038 0.0019 0.0023 0.0054 0.0000 0.0017 0.0025
0.0000 0.0000 0.0120 0.0000 0.0209
0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013
0.0006 0.0011 0.0001 0.0000 0.0000 0.0000 0.0001 0.0001 0.0001 0.0001
0.0001 0.0001 0.0001 0.0001 0.0001
0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013
0.0006 0.0011 0.0001 0.0000 0.0000 0.0000 0.0001 0.0001 0.0001 0.0001
0.0001 0.0001 0.0001 0.0001 0.0001
0.2384 0.2058 0.1756 0.1958 0.2726 0.2743 0.3004 0.2918 0.2859 0.0138
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.8477 0.7940 0.7488 0.7789 0.7842 0.6145 0.5139 0.5032 0.4277 0.0079
0.0000 0.0000 0.0001 0.0003 0.0010 0.0028 0.0248 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.7275 0.7158 0.5647 0.3178 0.2207 0.1968 0.1570 0.0738 0.0341 0.0414
0.0003 0.0000 0.0000 0.0000 0.0259 0.0078 0.0004 0.0090 0.0112 0.0112
0.0112 0.0112 0.0112 0.0112 0.0112
0.2730 0.2616 0.1543 0.0615 0.0383 0.0333 0.0255 0.0111 0.0049 0.0060
0.0000 0.0000 0.0000 0.0000 0.0037 0.0011 0.0001 0.0013 0.0016 0.0016
0.0016 0.0016 0.0016 0.0016 0.0016
0.5617 0.4537 0.4216 0.4734 0.4705 0.4525 0.4310 0.3569 0.3690 0.4413
0.3094 0.1679 0.1390 0.0808 0.0476 0.0365 0.0288 0.0274 0.0297 0.0297
0.0297 0.0297 0.0297 0.0297 0.0297
0.8177 0.7440 0.7184 0.7588 0.7567 0.7431 0.7261 0.6602 0.6717 0.7344
0.6107 0.4140 0.3610 0.2353 0.1489 0.1170 0.0940 0.0897 0.0966 0.0966
0.0966 0.0966 0.0966 0.0966 0.0966
0.9982 0.9979 0.9969 0.9978 0.9980 0.9979 0.9976 0.9969 0.9978 0.9982
0.9974 0.9965 0.9964 0.9949 0.9920 0.9936 0.9819 0.9812 0.9720 0.9720
0.9720 0.9720 0.9720 0.9720 0.9720
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.8760 0.7710 0.7502 0.7345 0.6733 0.5155 0.3845 0.3238 0.3260 0.2639
0.0594 0.0460 0.0291 0.0240 0.0086 0.0087 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
```

```
SCENARIO RECORD    :[01 0011]  1

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          2185899
*                    1329189   88940  295522  119720   54950   91581    9368    5519
*                       4415   17659   21778   25924   92954   16812    7911    3657
VMT FRACTIONS      :
                     .608074 .040688 .135195 .054769 .025138 .041896 .004286 .002525
                     .002020 .008079 .009963 .011860 .042524 .007691 .003619 .001673
VMT BY FACILITY    :V001101F.def
VMT BY HOUR        :V001101H.def
SPEED VMT          :V001101S.def


SCENARIO RECORD    :[02 0011]  2

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS           160915
*                     101540    6794   22575    9146    4198    5109     523     308
*                        246     985    1215    1446    5185     889     419     337
VMT FRACTIONS      :
                     .631015 .042221 .140292 .056838 .026088 .031750 .003250 .001914
                     .001529 .006121 .007551 .008986 .032222 .005525 .002604 .002094
VMT BY FACILITY    :V001102F.def
VMT BY HOUR        :V001102H.def
SPEED VMT          :V001102S.def


SCENARIO RECORD    :[03 0011]  3

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          3991427
*                    2575687  172347  572660  231991  106482   97473    9971    5874
*                       4699   18796   23179   27592   98934   28068   13208    4466
VMT FRACTIONS      :
                     .645305 .043179 .143472 .058122 .026678 .024421 .002498 .001472
                     .001177 .004709 .005807 .006913 .024787 .007032 .003309 .001119
VMT BY FACILITY    :V001103F.def
VMT BY HOUR        :V001103H.def
SPEED VMT          :V001103S.def


SCENARIO RECORD    :[04 0011]  4

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS          1638649
*                    1061606   71035  236030   95618   43888   37547    3841    2263
*                       1810    7240    8929   10628   38110   11011    5182    3911
VMT FRACTIONS      :
                     .647854 .043350 .144039 .058352 .026783 .022913 .002344 .001381
```

```
                   .001105 .004418 .005449 .006486 .023257 .006720 .003162 .002387
VMT BY FACILITY    :V001104F.def
VMT BY HOUR        :V001104H.def
SPEED VMT          :V001104S.def


SCENARIO RECORD    :[05 0011]  5

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS           652180
*                     420057   28107   93393   37834   17366   16201    1657     976
*                        781    3124    3853    4586   16444    4180    1967    1654
VMT FRACTIONS      :
                   .644080 .043097 .143201 .058012 .026628 .024841 .002541 .001497
                   .001198 .004790 .005908 .007032 .025214 .006409 .003016 .002536
VMT BY FACILITY    :V001105F.def
VMT BY HOUR        :V001105H.def
SPEED VMT          :V001105S.def


SCENARIO RECORD    :[06 0011]  6

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS            83201
*                      52312    3500   11631    4712    2163    2714     278     164
*                        131     523     645     768    2755     508     239     158
VMT FRACTIONS      :
                   .628742 .042067 .139794 .056634 .025997 .032620 .003341 .001971
                   .001574 .006286 .007752 .009231 .033113 .006106 .002873 .001899
VMT BY FACILITY    :V001106F.def
VMT BY HOUR        :V001106H.def
SPEED VMT          :V001106S.def


SCENARIO RECORD    :[07 0011]  7

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS            40538
*                      25350    1696    5636    2283    1048    1383     141      83
*                         67     267     329     392    1404     244     115     100
VMT FRACTIONS      :
                   .625342 .041837 .139029 .056317 .025852 .034116 .003478 .002047
                   .001653 .006586 .008116 .009670 .034634 .006019 .002837 .002467
VMT BY FACILITY    :V001107F.def
VMT BY HOUR        :V001107H.def
SPEED VMT          :V001107S.def


SCENARIO RECORD    :[08 0011]  8

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
```

```
*VMT TOTALS             17317
*                       10769     721    2394     970     445     618      63      37
*                          30     119     147     175     627     108      51      43
VMT FRACTIONS      :
                      .621869 .041636 .138247 .056015 .025698 .035688 .003638 .002137
                      .001732 .006872 .008489 .010106 .036208 .006237 .002945 .002483
VMT BY FACILITY    :V001108F.def
VMT BY HOUR        :V001108H.def
SPEED VMT          :V001108S.def


SCENARIO RECORD    :[09 0011]  9

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS              2026
*                        1247      84     278     112      52      77       8       5
*                           4      15      18      22      78      10       5      11
VMT FRACTIONS      :
                      .615461 .041465 .137230 .055287 .025669 .038010 .003949 .002468
                      .001975 .007404 .008885 .010860 .038503 .004936 .002468 .005430
VMT BY FACILITY    :V001109F.def
VMT BY HOUR        :V001109H.def
SPEED VMT          :V001109S.def


SCENARIO RECORD    :[10 0011] 10

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS               721
*                         450      30     100      41      19      24       2       1
*                           1       5       6       7      24       6       3       2
VMT FRACTIONS      :
                      .624314 .041589 .138629 .056838 .026340 .033271 .002773 .001386
                      .001386 .006931 .008318 .009704 .033271 .008318 .004159 .002773
VMT BY FACILITY    :V001110F.def
VMT BY HOUR        :V001110H.def
SPEED VMT          :V001110S.def


SCENARIO RECORD    :[11 0011] 15

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
FUEL PROGRAM       : 1
SEASON             : 1
SUNRISE/SUNSET     : 6 8
CLOUD COVER        : 0.35
*VMT TOTALS            892600
*                      600005   40148  133401   54042   24805   10380    1062     625
*                         500    2001    2468    2938   10535    4930    2320    2440
VMT FRACTIONS      :
                      .672198 .044979 .149452 .060544 .027790 .011629 .001190 .000700
                      .000560 .002242 .002765 .003292 .011803 .005523 .002599 .002734
VMT BY FACILITY    :V001111F.def
VMT BY HOUR        :V001111H.def
SPEED VMT          :V001111S.def


END OF RUN         : 0021
```

INPUT SCRIPTS CONTINUE FOR EVERY COUNTY AREA TYPE COMBINATION………

Attachment 1 to Appendix D

1990 I/M Input File to MOBILE6 for the Baltimore Region

```
*MD IM Program for 1990.  Idle Test All Vehicles
*Idle for all vehicles
I/M PROGRAM        : 1 1984 2050 2 T/O Idle
I/M MODEL YEARS    : 1 1977 2050
I/M VEHICLES       : 1 22222 22222111 1
I/M STRINGENCY     : 1 23.0
I/M COMPLIANCE     : 1 96.0
I/M WAIVER RATES   : 1 21.0 23.0
```

Attachment 2 to Appendix D

1990 Vehicle Age Distribution Inputs to MOBILE6 for the Baltimore Region

```
REG DIST
*
* This file contains the default MOBILE6 values for the distribution of
* vehicles by age for July of any calendar year.  There are sixteeen (16)
* sets of values representing 16 combined gasoline/diesel vehicle class
* distributions.  These distributions are split for gasoline and diesel
* using the separate input (or default) values for diesel sales fractions.
* Each distribution contains 25 values which represent the fraction of
* all vehicles in that class (gasoline and diesel) of that age in July.
* The first number is for age 1 (calendar year minus model year plus one)
* and the last number is for age 25.  The last age includes all vehicles
* of age 25 or older.  The first number in each distribution is an integer
* which indicates which of the 16 vehicle classes are represented by the
* distribution.  The sixteen vehicle classes are:
*
*  1  LDV    Light-Duty Vehicles (Passenger Cars)
*  2  LDT1   Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
*  3  LDT2   Light Duty Trucks 2 (0-6,001 lbs. GVWR, 3751-5750 lbs. LVW)
*  4  LDT3   Light Duty Trucks 3 (6,001-8500 lbs. GVWR, 0-3750 lbs. LVW)
*  5  LDT4   Light Duty Trucks 4 (6,001-8500 lbs. GVWR, 3751-5750 lbs. LVW)
*  6  HDV2B  Class 2b Heavy Duty Vehicles (8501-10,000 lbs. GVWR)
*  7  HDV3   Class 3 Heavy Duty Vehicles (10,001-14,000 lbs. GVWR)
*  8  HDV4   Class 4 Heavy Duty Vehicles (14,001-16,000 lbs. GVWR)
*  9  HDV5   Class 5 Heavy Duty Vehicles (16,001-19,500 lbs. GVWR)
* 10  HDV6   Class 6 Heavy Duty Vehicles (19,501-26,000 lbs. GVWR)
* 11  HDV7   Class 7 Heavy Duty Vehicles (26,001-33,000 lbs. GVWR)
* 12  HDV8A  Class 8a Heavy Duty Vehicles (33,001-60,000 lbs. GVWR)
* 13  HDV8B  Class 8b Heavy Duty Vehicles (>60,000 lbs. GVWR)
* 14  HDBS   School Busses
* 15  HDBT   Transit and Urban Busses
* 16  MC     Motorcycles (All)
*
* The 25 age values are arranged in two rows of 10 values followed by a row
* with the last 5 values.  Comments (such as this one) are indicated by
* an asterisk in the first column. Empty rows are ignored.  Values are
* read "free format," meaning any number may appear in any row with as
* many characters as needed (including a decimal) as long as 25 values
* follow the initial integer value separated by a space.
*
* If all 28 vehicle classes do not need to be altered from the default
* values, then only the vehicle classes that need to be changed need to
* be included in this file.  The order in which the vehicle classes are
* read does not matter, however each vehicle class set must contain 25
* values and be in the proper age order.
*
* LDV
 1 0.0690 0.0776 0.0771 0.0739 0.0873 0.0747 0.0693 0.0616 0.0586 0.0580
```

```
   0.0544 0.0510 0.0450 0.0356 0.0247 0.0174 0.0098 0.0056 0.0044 0.0037
   0.0044 0.0034 0.0025 0.0018 0.0293
* LDT1
 2 0.0995 0.1223 0.1073 0.0994 0.1017 0.0812 0.0663 0.0504 0.0434 0.0411
   0.0403 0.0363 0.0300 0.0206 0.0168 0.0122 0.0069 0.0041 0.0034 0.0025
   0.0042 0.0031 0.0021 0.0016 0.0035
* LDT2
 3 0.0995 0.1223 0.1073 0.0994 0.1017 0.0812 0.0663 0.0504 0.0434 0.0411
   0.0403 0.0363 0.0300 0.0206 0.0168 0.0122 0.0069 0.0041 0.0034 0.0025
   0.0042 0.0031 0.0021 0.0016 0.0035
* LDT3
 4 0.0626 0.0748 0.0805 0.0688 0.0763 0.0769 0.0522 0.0452 0.0451 0.0477
   0.0559 0.0577 0.0540 0.0528 0.0326 0.0265 0.0156 0.0106 0.0085 0.0073
   0.0127 0.0101 0.0076 0.0044 0.0137
* LDT4
 5 0.0626 0.0748 0.0805 0.0688 0.0763 0.0769 0.0522 0.0452 0.0451 0.0477
   0.0559 0.0577 0.0540 0.0528 0.0326 0.0265 0.0156 0.0106 0.0085 0.0073
   0.0127 0.0101 0.0076 0.0044 0.0137
* HDV2B
 6 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDV3
 7 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDV4
 8 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDV5
 9 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDV6
10 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDV7
11 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDV8a
12 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDV8b
13 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDBS
14 0.0924 0.0690 0.0955 0.0648 0.0969 0.0599 0.0443 0.0318 0.0336 0.0504
   0.0542 0.0550 0.0451 0.0406 0.0327 0.0227 0.0128 0.0104 0.0103 0.0116
   0.0140 0.0097 0.0072 0.0050 0.0305
* HDBT
15 0.0483 0.0434 0.0882 0.0813 0.1221 0.0698 0.0619 0.0404 0.0395 0.0543
   0.0580 0.0602 0.0539 0.0447 0.0361 0.0224 0.0131 0.0106 0.0105 0.0109
   0.0102 0.0059 0.0041 0.0014 0.0087
* Motorcycles
16 0.0799 0.0780 0.0674 0.0638 0.0535 0.0441 0.0414 0.0348 0.0249 0.0235
   0.0267 0.4620 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
   0.0000 0.0000 0.0000 0.0000 0.0000
```

Appendix C: MOBILE6 Documentation from Baker for Cecil County

The Cecil County Ozone Non-Attainment Area

An Explanation of Methodology For Developing Mobile Source Emissions Budgets Using MOBILE6

Prepared for:

Mobile Sources Control Program
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, MD 21230

Prepared by:
Michael Baker, Jr., Inc.

April 2003

The Cecil County Ozone Non-Attainment Area
State Implementation Plan Revision Using MOBILE6
An Explanation of Methodology
April 2003

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Appendix B   1990 Cecil County mobile6 input scripts

OVERVIEW

This document reflects the highway mobile sources emission estimations for the Cecil County 2005 ozone non-attainment area using EPA's recently approved MOBILE6 emission model that will revise the interim MOBILE5-based (Tier 2) motor vehicle emissions budget. The latest version of MOBILE is a major revision based on new test data and accounts for changes in vehicle technology and regulations. In addition, the model includes an improved understanding of in-use emission levels and the factors that influence them resulting in significantly more detailed input data. The revised motor vehicle emissions budgets using MOBILE6 are presented in the following table.

Table 1 Cecil County MOBILE6 Motor Vehicle Emissions Summary

Year	VOC (tons per day)	NO_x (tons per day)
2005	3.0	11.3

As compared to previous MOBILE versions, MOBILE6 has a significant impact on the emission factors, benefits of available control strategies, effects of new regulations and corrections to basic emission rates. As a result, the emissions rates are different and it is difficult to compare the results directly to previous runs conducted with MOBILE5. For this reason, 1990 emission totals are reanalyzed using MOBILE6 and its available input parameters.

Guidance documents from EPA were used to develop the inventory for the Cecil County Non-Attainment area. They include:

- *Policy Guidance on the Use of MOBILE6 for SIP Development and Transportation Conformity,* US EPA Office of Air and Radiation, dated January 18, 2002.
- *Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation,* US EPA Office of Air and Radiation, and Office of Transportation and Air Quality, dated January 2002.
- *User's Guide to MOBILE6.0, Mobile Source Emission Factor Model*, EPA420-R-02-001, dated January 2002.

The methodologies used to produce the MOBILE6 emission results conform to the recommendations provided in EPA's Technical Guidance. A mix of local data and national default input data (internal to MOBILE6) has been used for this submission. Local data has been used for the primary data items that have a significant impact on emissions. This includes VMT, speeds, vehicle mixes, age distributions, diesel sales fractions, hourly distributions, temperatures, and inspection/maintenance and fuel program characteristics.

Some of the planning assumptions and modeling tools have been updated for this inventory effort. The key elements to the modeling protocol which have been updated are outlined below:

Cecil County Travel Demand Model

The roadway data input to the emissions calculations for the Cecil County non-attainment region is based on a travel demand model developed by the Maryland Department of Transportation. The model, which was developed using the MINUTP software platform, incorporates the following:

- Produces daily traffic volumes.
- Follows traditional "4-step" process – Trip generation, Trip Distribution, Mode Split, and Traffic Assignment.
- Calibrated/validated to year 1999 traffic count data.
- Utilizes socioeconomic projections, including employment, households, and population as recommended by the Technical Advisory Committee (TAC) and adopted by the WILMAPCO Council on May 3rd, 2001.
- Networks include the major capacity improvement projects that will be in place and open to service in the year 2005.

PPSUITE Post Processor

PPSUITE was used for the first time for Cecil County inventory submissions. PPSUITE represents an enhanced version of the Post Processor for Air Quality (PPAQ) software system that has been used for previous inventory and conformity submissions in Pennsylvania, Virginia, New Jersey, and the New York City Metropolitan Area. The software has gone through a significant revision to ensure consistency with the MOBILE6 emissions model. PPSUITE is used to process the outputs from the regional travel demand model runs for 1990 and 2005 including the development of roadway speed estimates, which are supplied as input to the MOBILE6 model. The software is also used to prepare and run the MOBILE6 input files and to process the MOBILE6 outputs.

Cecil County Inspection/Maintenance Program

The 1990 analysis run assumes no inspection/maintenance program for the region. The 2005 analysis run assumes an inspection program with the following key elements:

- An OBDII computer check for 1996 and newer model year gas vehicles up to 8,500 pounds.
- An IM240 tail pipe test for 1984 to 1995 gas vehicles and trucks up to 10,000 pounds.
- An Idle test for 1977 to 1983 vehicles up to 10,000 pounds and all gas trucks 10,000 to 26,000 pounds.
- A gas cap test for all vehicles tested.
- An anti-tampering program with 3 inspections for all vehicles receiving an idle test.

Regional Fuel Program

For 2005, the Cecil County ozone non-attainment region is required to have federal reformulated gasoline (RFG). Like conventional gasoline, RFG must meet fuel volatility requirements that vary by geographic region. Cecil County was modeled using the RFG requirements of the Northern region in summer time. Based on EPA's guidance and using the monthly fuel laboratory data (Source: Motor Fuel Tax Division, Office of the Comptroller), the 1990 analysis year runs for Cecil County utilized a computed Reid Vapor Pressure (RVP) value of 8.2.

Vehicle Age/Diesel Sales Distributions

Vehicle age distributions are input to MOBILE for the region based on registered vehicles that reflect July 1 summer conditions. These distributions reflect the percentage of vehicles in the fleet up to 25 years old and are listed by the 16 MOBILE6 vehicle types. As in previous SIP submissions, 1990 information is used in the development of the data input for the 1990 analysis year based on Maryland Motor Vehicle Administration's (MVA's) vehicle registration database download. Updated 2002 vehicle age distributions have been downloaded from the registration database and are used for the 2005 analysis year run. The analysis utilizes light-duty diesel sales fraction data acquired from state registration data for both 1990 and 2002.

Vehicle Mix Patterns

Vehicle mix patterns were developed from a combination of sources. Regional vehicle mix patterns, developed by facility type from SHA 1999-2002 local count data, were used to split the link travel volumes into 4 categories: auto, truck, bus, and motorcycle. 1990 estimates were adjusted to reflect regional toll data from the Maryland Transportation Authority (MDTA). MOBILE6 defaults were then used to split the above 4 vehicle categories into the required 16 MOBILE6 vehicle classes. Defaults were used specific to the year being analyzed (1990, 2005). Thus, more sport utility vehicles are assumed in the year 2005 as compared to 1990.

Weather Data

Minimum and maximum daily temperatures were developed following USEPA guidance using information collected from the National Weather's Service BWI monitoring station. The 1990 temperatures used are the same that were used and documented in the official 1990 inventory for the Baltimore area. The 2005 temperatures are those used and documented in the 1999 inventory for the Baltimore area.

Federal Program: Low Emission Vehicle (NLEV), Tier 2/Low Sulfur Fuel, and 2004 Heavy Duty Engine (HDE) Rule

Federal new vehicle emissions control and fuel programs that were modeled separately using MOBILE5 are now incorporated into MOBILE6. The NLEV program had a three-year phase-in starting with 1999 model years. The Tier 2 / Low Sulfur Fuel Program takes effect in 2004 and provides benefit for subsequent years.

Other Changes incorporated into MOBILE6

In addition to the new regulations, a number of improvements (corrections) were incorporated into MOBILE6 that have a significant impact on emission calculations, in particular NO_x emissions. These changes may increase or decrease emissions depending on the pollutant, calendar year, fuel program and locally specified speeds and facility class driving activities. As a result, a MOBILE6 comparison to MOBILE5 emission estimates will be significantly different.

Below is a list of the most important quantitative changes to emissions incorporated into MOBILE6:

- Basic Emission Rates (BER) for light-duty cars and trucks are lower from late 1980s and early 1990 model year vehicles due to new data that shows pollution control devices are more durable than expected. This change generally lowers emissions from vehicles of model years in the late 1980's and early 1990's.
- Real world driving factors that influence emissions like air conditioning and high acceleration effects.
- Fuel content corrections to account for damage inflicted by high levels of sulfur in gasoline in vehicles with advanced catalysts. This leads to increased emissions in the late 1990s and early 2000s. This effect declines as the Tier 2 regulations phase in lower sulfur fuel.
- Speed data shows that vehicle emissions are generally less sensitive to speed changes than previously thought. This has a variable effect on emissions.
- For heavy-duty trucks, MOBILE6 includes lower base-rate emissions, but excess NO_x emissions under steady state driving conditions can occur due to pollution control defeat devices included in these vehicles in the 1990's. MOBILE6 includes, though, a reduction in these NO_x emissions expected in future years as the result of a consent decree with engine manufacturers. Thus, MOBILE6 heavy-duty truck emissions are significantly higher than MOBILE5 for some model years and pollutants and significantly lower for others.
- Heavy-duty diesel vehicle NO_x off-cycle emissions effects are incorporated into MOBILE6. These effects include the Defeat Device, NO_x Pull Ahead, Rebuild Mitigation Program, and Rebuild program effectiveness.
- MOBILE6 includes new data for evaporative emissions because this data has indicated a small fraction of older vehicles with leaks in their fuel systems contribute a large quantity of evaporative emissions. MOBILE6 also accounts for the new tests and new regulations that require lower emissions and more durable fuel systems. This has a variable effect on emissions.

INTRODUCTION

The purpose of this document is to explain how Cecil County estimates emissions from highway vehicles for inclusion in its emission inventories and State Implementation Plan.

Highway vehicles contribute significantly to air pollution, particularly to ground-level ozone. Ozone is not created directly but formed in sunlight from VOCs and NO_x. Both VOCs and NO_x are emitted from highway vehicles. Cecil County's ozone-related emission inventory efforts have been focused on these pollutants.

In order to estimate both the rate at which emissions are being generated and to calculate vehicle miles traveled (activity level), Cecil County examines its road network and fleet to estimate vehicle activity. For ozone-related inventories, this is done for a typical summer (July) weekday. Not only must this be done for a baseline year, but it must also be projected into the future. This process involves a large quantity of data and is extremely complex.

Computer models have been developed to perform these calculations by simulating the travel of vehicles on the region's roadway system. These models then generate emission rates (also called emission factors) for different vehicle types for area-specific conditions and then combine them in summary form. The "area-specific conditions" include vehicle and highway data, plus control measure characteristics and future year projections of all variables.

MOBILE. The heart of the highway vehicle emission calculation procedure is EPA's highway vehicle emission factor model, MOBILE. This is a FORTRAN program that calculates **average** in-use fleet emission factors for ozone precursors for each of twenty-eight categories of vehicles under various conditions affecting in-use emission levels (e.g., ambient temperatures, average traffic speeds, gasoline volatility) as specified by the model user. MOBILE produces the "emission rates" referred to in the previous section.

The model was first developed as MOBILE1 in the late 1970s, and has been periodically updated to reflect the collection and analysis of additional emission factor data over the years, as well as changes in vehicle, engine and emission control system technologies, changes in applicable regulations, emission standards and test procedures, and improved understanding of in-use emission levels and the factors that influence them. For this inventory effort, Cecil County utilizes MOBILE6 as approved by EPA.

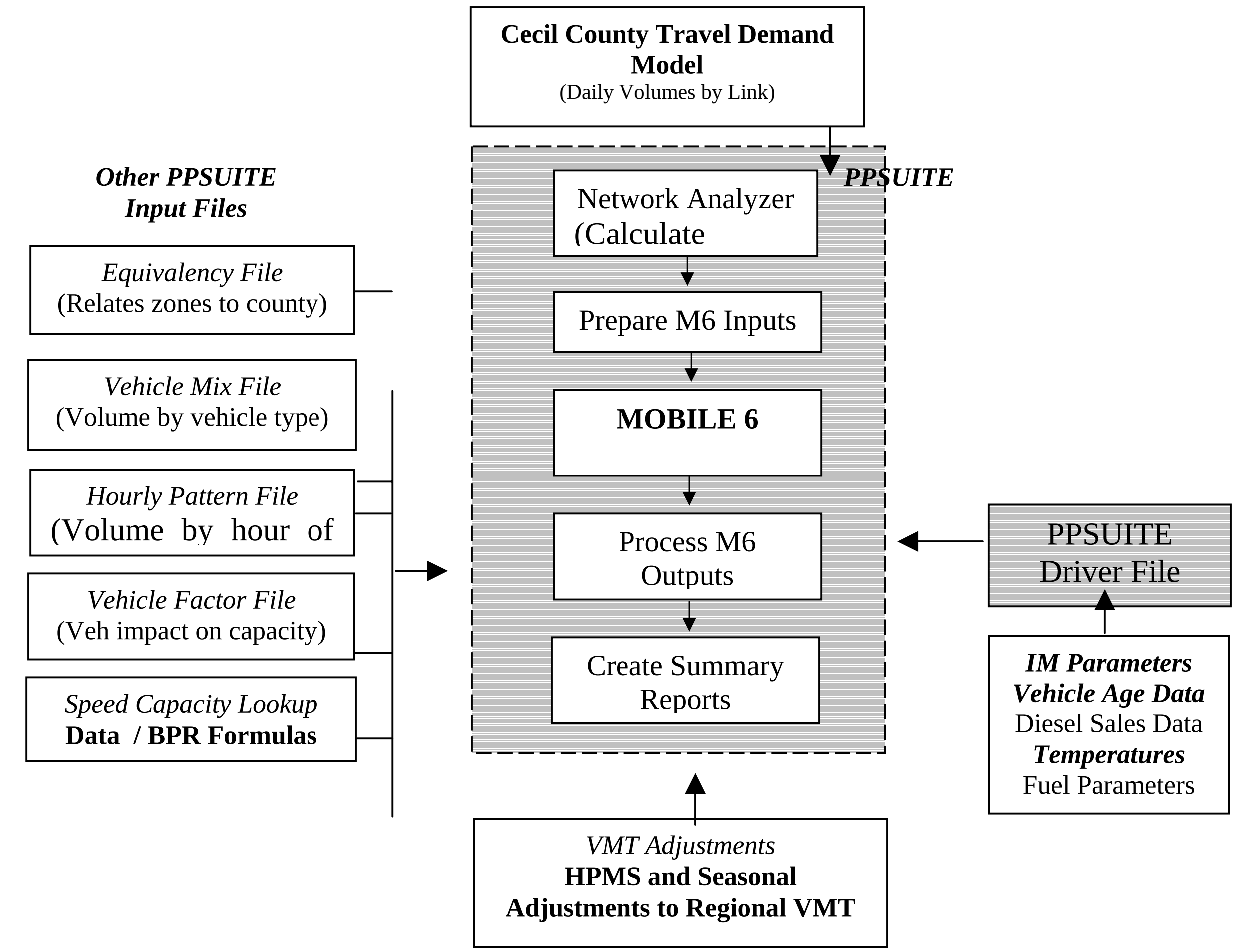
PPSUITE. Cecil County is now using a post processor named PPSUITE (formerly named PPAQ - Post Processor for Air Quality), which consists of a set of programs that perform the following functions:

- Analyzes highway operating conditions
- Calculates highway speeds
- Compiles vehicle miles of travel (VMT) and vehicle type mix data
- Prepares MOBILE6 runs
- Calculates emissions from output MOBILE6 emission rates and accumulated highway VMT.

PPSUITE has become a widely used and accepted tool for estimating speeds and processing MOBILE emission rates. It is currently being used throughout Pennsylvania, for the New York City region, for the north and south New Jersey regions, and in other states including Louisiana, Virginia, and Indiana. The software is based upon accepted transportation engineering methodologies. For example, PPSUITE utilizes speed and delay estimation procedures based on planning methods provided in the 2000 Highway Capacity Manual, a report prepared by the Transportation Research Board (TRB) summarizing current knowledge and analysis techniques for capacity and level-of-service analyses of the transportation system.

These two computer programs interact as shown in Exhibit 1. PPSUITE replaces the prior MDE-developed post processor, which could not accommodate MOBILE6 requirements without significant revision. In addition, PPSUITE enhances and adds new capabilities regarding the calculation of speed, the preparation of those speeds for input to MOBILE6, and allows for an organized input data storage format.

Exhibit 1 Emission Calculation Process for Cecil County

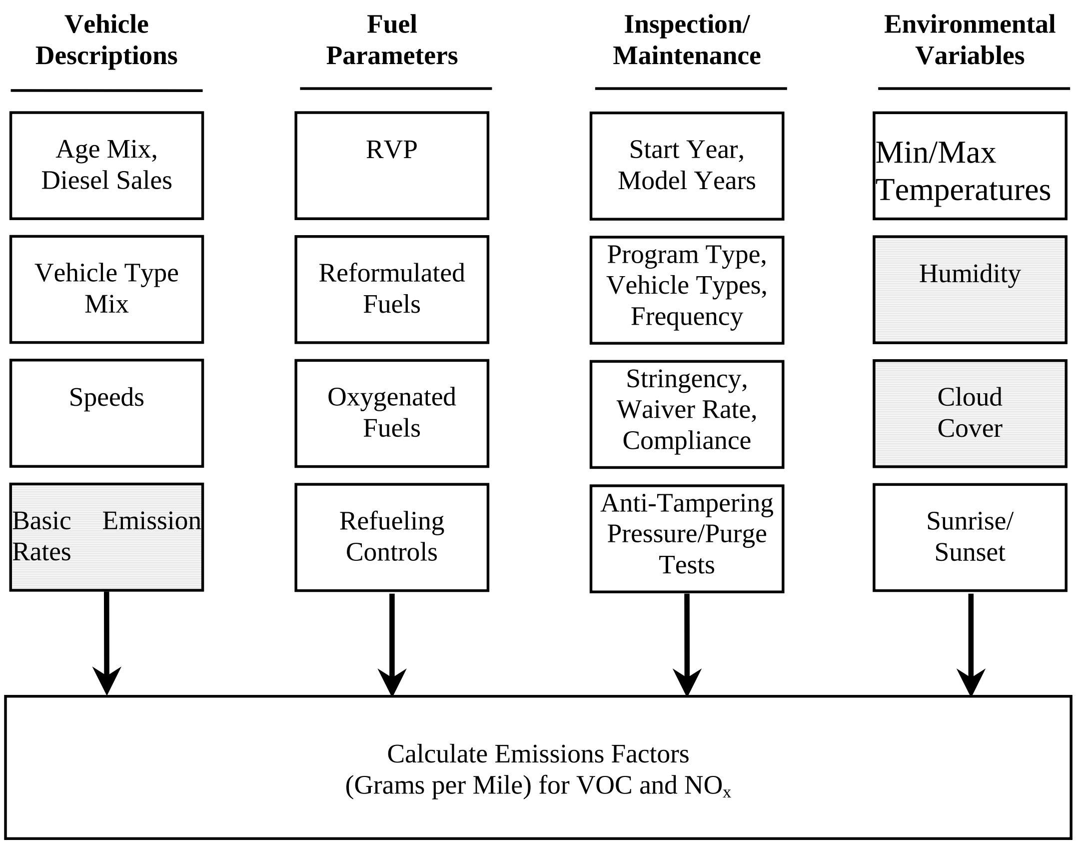


OVERVIEW OF INPUT DATA

Data Inputs to MOBILE

A large number of inputs to MOBILE are needed to fully account for the numerous vehicle and environmental parameters that affect emissions including traffic flow characteristics, vehicle descriptions, fuel parameters, inspection/maintenance program parameters, and environmental variables as shown in Exhibit 2. With some input parameters, MOBILE allows the user to choose default values, while others require area-specific inputs.

Exhibit 2 MOBILE Inputs



For an emissions inventory, area specific inputs are used for all of the items shown in Exhibit 2 except for the basic emission rates, humidity and cloud cover, which are MOBILE defaults. In addition, Cecil County uses the MOBILE6 default starts-per-day data and soak distributions that are used to calculate the number of starts in cold and hot start modes. EPA requires that the number of starts occurring per vehicle be determined from instrumented vehicle counts. Since such local data is not available, the MOBILE6 national defaults are used for the Cecil County analyses. A vehicle will generate more emissions when it is first operated (cold start). It generates emissions at a different rate when it is stopped and then started again within a short period of time (hot start). Soak distributions are used to determine the time between when an engine is turned off to the next time it is restarted.

Vehicle Descriptions. Vehicle age distributions are input to MOBILE representing the distribution for the MOBILE6 16-vehicle types in Cecil County. This data is based on registered vehicles from the Maryland Motor Vehicle Administration's vehicle registration database reflecting July 1 summer conditions. As in previous SIP submissions, 1990 information is used in the development of the data input for the 1990 analysis year for non-trucks. Updated 2002 age data has been prepared and used for the forecast 2005 analysis year.

Vehicle Type Mix is calculated from algorithms using a combination of collected 1999-2002 State Highway Administration vehicle class counts, and MOBILE6 default percentages. (See also the discussion of Vehicle Type Pattern Data in the next section.) Speeds are discussed extensively in the next section.

Significant changes have occurred in the MOBILE6 model as compared to previous releases. Some of the information previously applied by post processor routines can now be input directly to the MOBILE6 model run. This includes information on the hourly distribution of VMT and the hourly speeds that occur during the day. Another important change in MOBILE6 is the influence of facility type on output emission factors. For example, MOBILE6 assumes that an average speed on a freeway results in a different emission factor than the same speed on an arterial roadway. Thus MOBILE6 is indirectly accounting for the accelerations and decelerations that typically occur on such roadways. MOBILE6 has four distinct facility types: Freeway, Arterial, Local, and Ramp. For any emission run, the input functional classes analyzed must be mapped to the above facility types. The following mapping scheme is used for the Cecil County runs:

Cecil Model Facility Types	***MOBILE6 Facility Type***
1,5,6 (Interstate/Freeways)	Freeway
2,3,4 (Major-Minor Arterial/Collector)	Arterial
7 (Locals)	Local

Since ramps are not directly represented within the travel demand model, they are assumed to be 8% of the total interstate/freeway VMT. The above assumptions are consistent with the recommendations provided in EPA's Technical Guidance on the Use of MOBILE6 for Emissions Inventory Preparation.

Fuel Parameters. The same vehicle will produce different emissions using a different type of gasoline. Fuel control strategies can be powerful emission reduction mechanisms. An important variable in fuels for VOC emissions is its evaporability, measured by Reid Vapor Pressure.

MOBILE allows the user to choose among conventional, federal reformulated (used in Cecil County), oxygenated and low Reid Vapor Pressure (RVP) gasoline. Cecil County chooses the MOBILE inputs appropriate to the year and control strategy for the area being modeled. For 2005, Cecil County uses Northern region summertime reformulated gasoline, and for 1990, conventional gasoline with an RVP of 8.2.

MOBILE also allows users to calculate refueling emissions - the emissions created when vehicles are refueled at service stations. Cecil County includes refueling emissions in its area source inventory and not in its highway vehicle inventory.

Vehicle Emission Inspection/Maintenance (I/M) Parameters. MOBILE allows users to vary inputs depending on the I/M program in place for the particular analysis year. For Cecil County, the following tables describe the I/M program and anti-tampering program in place for the 1990 and 2005 analysis years.

Table 2 Cecil County I/M Program Parameters

Program Parameters	**1990**	**2005**						
Program Name	NO IM	Idle older LDGV, LDGT	Idle HDGT	IM240	OBD	Gas Cap for older LDGV, LDGT	Gas Cap for HDGT	Gas Cap for OBD Vehicles
Test Type		Test Only	Test Only	Test Only	Test Only	Test Only	Test Only	Test Only
I/M Program Start Year		1984	1984	1984	2003	2003	2003	2003
Test Frequency		Biennial	Biennial	Biennial	Biennial	Biennial	Biennial	Biennial
Program Type		Idle	Idle	IM240	OBD I/M	GC	GC	EVAP OBD & GC
Model Years		77-83	77-83	84-95	96-50	77-95	77-50	96-50
Stringency Rate (%)		20	20	20	20	N/A	N/A	N/A
Compliance Rate (%)		96	96	96	96	96	96	96
Waiver Rate (%)		3	3	3	3	3	3	3
Grace Period		2	2	2	2	2	2	2
Vehicle Types								
LDGV		Yes	No	Yes	Yes	Yes	No	Yes
LDGT1		Yes	No	Yes	Yes	Yes	No	Yes
LDGT2		Yes	No	Yes	Yes	Yes	No	Yes
LDGT3		Yes	No	Yes	Yes	Yes	No	Yes
LDGT4		Yes	No	Yes	Yes	Yes	No	Yes
HDGV2B		No	Yes	No	No	No	Yes	No
HDGV3		No	Yes	No	No	No	Yes	No
HDGV4		No	Yes	No	No	No	Yes	No
HDGV5		No	Yes	No	No	No	Yes	No
HDGV6		No	Yes	No	No	No	Yes	No
HDGV7		No	No	No	No	No	No	No
HDGV8A		No	No	No	No	No	No	No
HDGV8B		No	No	No	No	No	No	No
GAS BUS		No	No	No	No	No	No	No

Table 3 Cecil County Anti-tampering Program Parameters

Program Element	Cecil County	
Analysis Year	**1990**	**2005**
Program Start Year	No ATP	1989
First Model Year		1977
Last Model Year		2050
LDGV		Yes
LDGT1		Yes
LDGT2		Yes
LDGT3		Yes
LDGT4		Yes
HDGV2B		Yes
HDGV3		No
HDGV4		No
HDGV5		No
HDGV6		No
HDGV7		No
HDGV8A		No
HDGV8B		No
GAS BUS		No
Program Type		Test Only
Inspection Frequency		Biennial
Compliance Rate (%)		96
Air pump system disablement		No
Catalyst removal		Yes
Fuel inlet restrictor disablement		Yes
Tailpipe lead deposit test		No
EGR disablement		No
Evaporative system disablement		No
PCV system disablement		No
Missing gas cap		Yes

Weather Data. Minimum and maximum daily temperatures were developed following USEPA guidance using information collected from the National Weather's Service BWI monitoring station. The 1990 temperatures used are the same that were used and documented in the official 1990 inventory for the Baltimore area. The 2005 temperatures are those used and documented in the 1999 inventory for the Baltimore area.

Emission and Speed Relationships

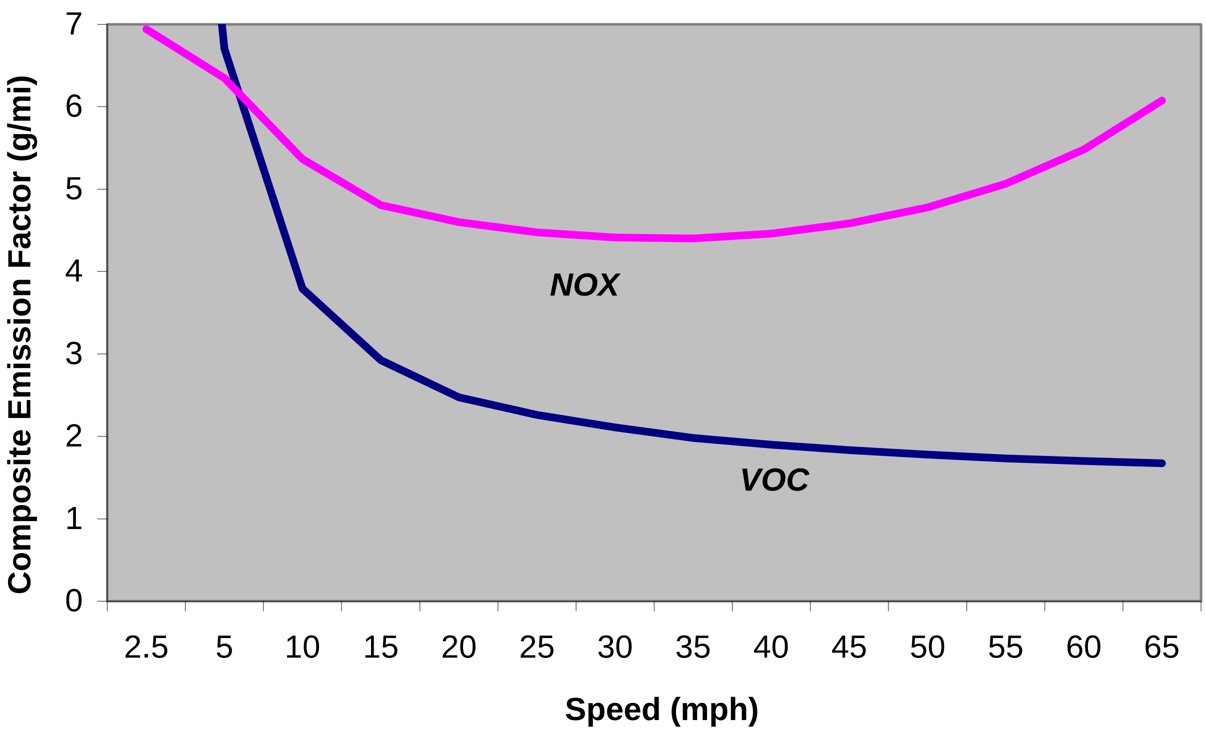
Of all the user-supplied input parameters, perhaps the most important is vehicle speed (except for local and ramp roadway types where a constant MOBILE6 speed is assumed).

To obtain the best estimate of vehicle speeds, Cecil County uses the PPSUITE set of programs, whose primary function is to calculate speeds and to organize and simplify the handling of large amounts of data needed for calculating speeds and for preparing MOBILE input files. MOBILE6 uses hourly speeds that are grouped into 14 speed bins. The shares are calculated from accumulating hourly link VMT for speeds estimated using an update to the BPR curve. Equations, consistent with previous conformity efforts, are used for the analyses. The equation is as follows:

$$traveltime = speed * \left(1 + 0.15 * \left(\frac{v}{c}\right)^4\right) \text{ for all roadway types}$$

Emissions of both VOC and NO_x vary significantly with speed, but the relationships are not linear, as shown in Exhibit 3. While VOCs generally decrease as speed increases, NO_x decreases only at the low speed range and increases steeply at higher speeds.

Exhibit 3 MOBILE6 VOC and NO_x Speed vs. Emissions



Roadway Data

The roadway data input to the emissions calculations for the Cecil County non-attainment region is based on a travel demand model developed by the Maryland Department of Transportation. The model, which was developed using the MINUTP software platform, incorporates the following:

- Produces daily traffic volumes.
- Follows traditional “4-step” process – Trip generation, Trip Distribution, Mode Split, and Traffic Assignment.
- Calibrated/validated to year 1999 traffic count data.
- Utilizes socioeconomic projections, including employment, households, and population as recommended by the Technical Advisory Committee (TAC) and adopted by the WILMAPCO Council on May 3rd, 2001.
- Networks include the major capacity improvement projects that will be in place and open to service in the year 2005.

The travel model contains all state highways and arterials, most of the major collectors, and some minor collector and local roadways divided into links of varying lengths. Each of these link segments contains descriptive data that is used in the calculation of the congested speeds input to the MOBILE emissions model. The PPSUITE post processor calculates the congested speeds based on the following model network fields:

- Number of Lanes
- Distances
- Daily Traffic Volumes
- Facility Type
- Area Type (Urban/Rural)
- Link capacity which includes impact of signals and other intersection controls
- Link free-flow speeds
- Zones to relate each link to the county in which it belongs

The model volumes and distances are used in calculating highway VMT totals for each county. As discussed in the next section, adjustments are needed to convert the volumes to an average July weekday. Lane and capacity values are an important input for determining the congestion and speeds for individual highway segments.

The travel demand model classifies its road segments by function, in addition to whether it is located in an urban or rural area, as indicated below in Exhibit 4. The facility types are important indicators of the type and function of each roadway segment. The variables provide insights into other characteristics not contained in the model network fields that are used for speed and emission calculations. In addition, VMT and emission quantities are aggregated and reported using both urban/rural codes and 5 groupings of the listed facility types.

Exhibit 4 Cecil County Model Classification Scheme: Urban/Rural and Facility Type Codes

Urban/Rural Code	1 = Urban 2 = Rural
Facility Type Class	1 = Interstate 2 = Principal Arterial 3 = Minor Arterial 4 = Collector 5 = Interstate 6 = Interstate 7 = Local

Additions and Adjustments to Roadway Data

Before the travel model data can be used by PPSUITE for speed and emission calculations, several adjustments and additions must be made to the roadway data.

HPMS Adjustments. According to EPA guidance, baseline inventory VMT computed from the travel demand model must be adjusted to be consistent with Highway Performance Monitoring System (HPMS) VMT totals. Although it has some limitations, the HPMS system is currently in use in all 50 states and is being improved under FHWA direction.

A transportation model must be validated against real world observations to be an accurate predictor of total area VMT. Since the USEPA has designated HPMS as the “official” VMT estimation methodology for air quality purposes, the Cecil County regional travel model outputs were compared to 1990 and 1999 HPMS totals.

Adjustment factors are calculated which adjust the 1990 Model VMT to be consistent with 1990 July VMT totals as documented in the 1990 Maryland inventory submission prepared in 1993. In addition, the 2005 travel model run is factored to correspond with more recent 1999 HPMS VMT totals. The factor value of 1.03362 is used for all future year run HPMS adjustments. These factors are applied to all county, urban/rural code, and facility group combinations.

Seasonal Adjustments to Volumes. The Cecil County travel demand model produces volumes that represent an average day. An ozone emission analysis, however, is based on a typical July weekday. Therefore, those volumes must be seasonally adjusted. A seasonal factor of 1.10, consistent with recent conformity analysis runs, is applied to all link volumes in the network before the calculation of speeds for 2005. The 1990 seasonal factor is represented as part of the HPMS adjustments as described above.

24-hour Pattern Data. Speeds and emissions vary considerably depending on the time of day (because of temperature) and congestion. Therefore, it is important to estimate the pattern by which roadway volume varies by hour of the day. The 24-hour pattern data provides PPSUITE with information used to split the daily roadway segment volumes to each of the 24 hours in a day. Pattern data is in the form of a percentage of the daily volumes for each hour. Distributions are provided for each county and facility type grouping. This data was developed from SHA 24-hour count data between 1999 and 2002.

Vehicle Type Pattern Data. Basic emission rates may differ by vehicle type. These types are listed below in Exhibit 5.

Exhibit 5 MOBILE6 Input Composite Vehicle Classes

VI.	LDV	- Light-Duty Vehicles (Passenger Cars)
VII.	LDT1	- Light-Duty Trucks 1 (<6,000 lbs)
VIII.	LDT2	- Light-Duty Trucks 2 (<6,000 lbs, LVW=3,751-5,750)
IX.	LDT3	- Light-Duty Trucks 3 (6,001-8,500 lbs)
X.	LDT4	- Light-Duty Trucks 4 (6,001-8,500 lbs, LVW>5,751)
XI.	HDV2B	- Class 2b Heavy Duty Vehicles
XII.	HDV3	- Class 3 Heavy Duty Vehicles
XIII.	HDV4	- Class 4 Heavy Duty Vehicles
XIV.	HDV5	- Class 5 Heavy Duty Vehicles
XV.	HDV6	- Class 6 Heavy Duty Vehicles
XVI.	HDV7	- Class 7 Heavy Duty Vehicles
XVII.	HDV8A	- Class 8a Heavy Duty Vehicles
XVIII.	HDV8B	- Class 8b Heavy Duty Vehicles
XIX.	HDBS	- School Buses
XX.	HDBT	- Transit and Urban Buses
XXI.	MC	- Motorcycles

MOBILE summary reports by vehicle type are also useful in knowing what kinds of vehicles generate emissions. The vehicle type pattern data is supplied to MOBILE for each run (county, urban/rural combination) and scenario (facility type) within the MOBILE6 input file. The data is generated by PPSUITE based on the following sources:

- Vehicle Mix Patterns for light-duty vehicles, heavy-duty vehicles, buses, and motorcycles based on SHA vehicle class counts taken between 1999 and 2002.
- MOBILE6 default vehicle type breakdowns for the analysis year
- MDTA Statement of Annual Traffic Volume and Toll Income and Resulting Percentages for 1990 through 2000.

The vehicle type pattern percentages are developed for each county and facility type combination and are input to MOBILE using the VMT FRACTIONS keyword. First, PPSUITE uses the input vehicle mix pattern data based on SHA counts to calculate the number of autos, trucks, buses, and motorcycles. Then, MOBILE6 defaults, specific to the analysis year being run, are used to divide the 4 vehicle groupings into the 16 MOBILE6 vehicle types. PPSUITE then aggregates this link specific information to the area, facility scenario groupings input to the MOBILE model. Note that the MOBILE6 defaults used vary by analysis year; as a result, each forecast year utilizes a unique vehicle mix distribution. The VMT mixes used for 1990 and 2005 are provided in Tables 4 and 5.

Table 4 2005 Vehicle Mix Inputs to MOBILE6

Run Area	Facility Grouping Scenario	*MOBILE6 VEHICLE TYPES*															
		LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
Cecil County (Urban)	Interstate	35.49%	6.49%	21.61%	6.66%	3.06%	8.07%	0.79%	0.64%	0.48%	1.79%	2.13%	2.31%	8.24%	1.37%	0.61%	0.27%
	Principal Arterial	45.05%	8.23%	27.43%	8.45%	3.89%	2.07%	0.20%	0.17%	0.12%	0.46%	0.54%	0.59%	2.11%	0.41%	0.18%	0.09%
	Minor Arterial	45.78%	8.37%	27.88%	8.59%	3.95%	1.48%	0.15%	0.12%	0.09%	0.33%	0.39%	0.42%	1.51%	0.37%	0.17%	0.40%
	Collector	44.45%	8.13%	27.06%	8.34%	3.84%	2.48%	0.24%	0.20%	0.15%	0.55%	0.65%	0.71%	2.54%	0.15%	0.06%	0.45%
	Local	46.22%	8.45%	28.15%	8.67%	3.99%	1.20%	0.12%	0.10%	0.07%	0.27%	0.32%	0.35%	1.23%	0.29%	0.13%	0.45%
Cecil County (Rural)	Interstate	36.34%	6.64%	22.13%	6.82%	3.14%	7.43%	0.73%	0.59%	0.44%	1.65%	1.96%	2.13%	7.59%	1.44%	0.65%	0.31%
	Principal Arterial	37.06%	6.77%	22.57%	6.95%	3.20%	7.29%	0.72%	0.58%	0.43%	1.62%	1.92%	2.09%	7.45%	0.60%	0.27%	0.48%
	Minor Arterial	43.30%	7.92%	26.37%	8.12%	3.74%	3.15%	0.31%	0.25%	0.19%	0.70%	0.83%	0.90%	3.22%	0.48%	0.22%	0.31%
	Collector	44.18%	8.08%	26.91%	8.29%	3.81%	2.55%	0.25%	0.20%	0.15%	0.57%	0.67%	0.73%	2.60%	0.50%	0.22%	0.29%
	Local	46.23%	8.45%	28.16%	8.67%	3.99%	1.19%	0.12%	0.10%	0.07%	0.26%	0.31%	0.34%	1.21%	0.29%	0.13%	0.47%

Table 5 1990 Vehicle Mix Inputs to MOBILE6

Run Area	Facility Grouping Scenario	*MOBILE6 VEHICLE TYPES*															
		LDV	LDT1	LDT2	LDT3	LDT4	HDV2B	HDV3	HDV4	HDV5	HDV6	HDV7	HDV8A	HDV8B	HDBS	HDBT	MC
Cecil County (Urban)	Interstate	50.19%	3.36%	11.16%	4.52%	2.07%	9.00%	0.92%	0.54%	0.43%	1.74%	2.14%	2.55%	9.14%	1.35%	0.63%	0.27%
	Principal Arterial	65.50%	4.38%	14.56%	5.90%	2.71%	2.13%	0.22%	0.13%	0.10%	0.41%	0.51%	0.60%	2.16%	0.40%	0.19%	0.11%
	Minor Arterial	66.58%	4.46%	14.80%	6.00%	2.75%	1.52%	0.16%	0.09%	0.07%	0.29%	0.36%	0.43%	1.54%	0.36%	0.17%	0.41%
	Collector	64.63%	4.32%	14.37%	5.82%	2.67%	2.56%	0.26%	0.15%	0.12%	0.49%	0.61%	0.72%	2.60%	0.12%	0.06%	0.48%
	Local	67.20%	4.50%	14.94%	6.05%	2.78%	1.24%	0.13%	0.08%	0.06%	0.24%	0.29%	0.35%	1.26%	0.27%	0.13%	0.49%
Cecil County (Rural)	Interstate	51.43%	3.44%	11.43%	4.63%	2.13%	8.35%	0.85%	0.50%	0.40%	1.61%	1.98%	2.36%	8.47%	1.42%	0.67%	0.31%
	Principal Arterial	53.91%	3.61%	11.99%	4.86%	2.23%	7.52%	0.77%	0.45%	0.36%	1.45%	1.79%	2.13%	7.63%	0.58%	0.27%	0.47%
	Minor Arterial	62.95%	4.21%	13.99%	5.67%	2.60%	3.25%	0.33%	0.20%	0.16%	0.63%	0.77%	0.92%	3.30%	0.48%	0.22%	0.32%
	Collector	64.22%	4.30%	14.28%	5.78%	2.65%	2.63%	0.27%	0.16%	0.13%	0.51%	0.63%	0.75%	2.67%	0.46%	0.21%	0.36%
	Local	67.21%	4.50%	14.94%	6.05%	2.78%	1.22%	0.13%	0.07%	0.06%	0.24%	0.29%	0.35%	1.24%	0.28%	0.13%	0.51%

SPEED/EMISSION ESTIMATION PROCEDURE

The previous sections have summarized the input data used for computing speeds and emission rates for the Cecil County Non-Attainment region. This section explains how PPSUITE and MOBILE use that input data to produce emission estimates. Exhibit 6 on the following page summarizes PPSUITE's analysis procedure used for each of the 705 roadway links contained in the travel demand model.

Producing an emissions inventory with PPSUITE requires a process of disaggregation and aggregation. Data is available and used on a very small scale - individual ½ mile roadway segments 24 hours of the day. This data needs to first be aggregated into categories so that a reasonable number of MOBILE scenarios can be run, and then further aggregated and/or re-sorted into summary information that is useful for emission inventory reporting.

One of the major enhancements of MOBILE6 is the increased detail of traffic speed data that can be input to the emissions model. The PPSUITE post processor calculates hourly speeds for each roadway segment. Since previous versions of MOBILE only allowed one average speed as input for each scenario, a lookup table was created for speeds from 2.5 to 65 MPH in 0.1 MPH increments. MOBILE6 allows for direct input of the 24 hourly speeds as well as options to account for each link's speed separately. These added features utilize the full extent of the information output from the speed processing programs and provide for more accurate emission estimates of the available traffic data.

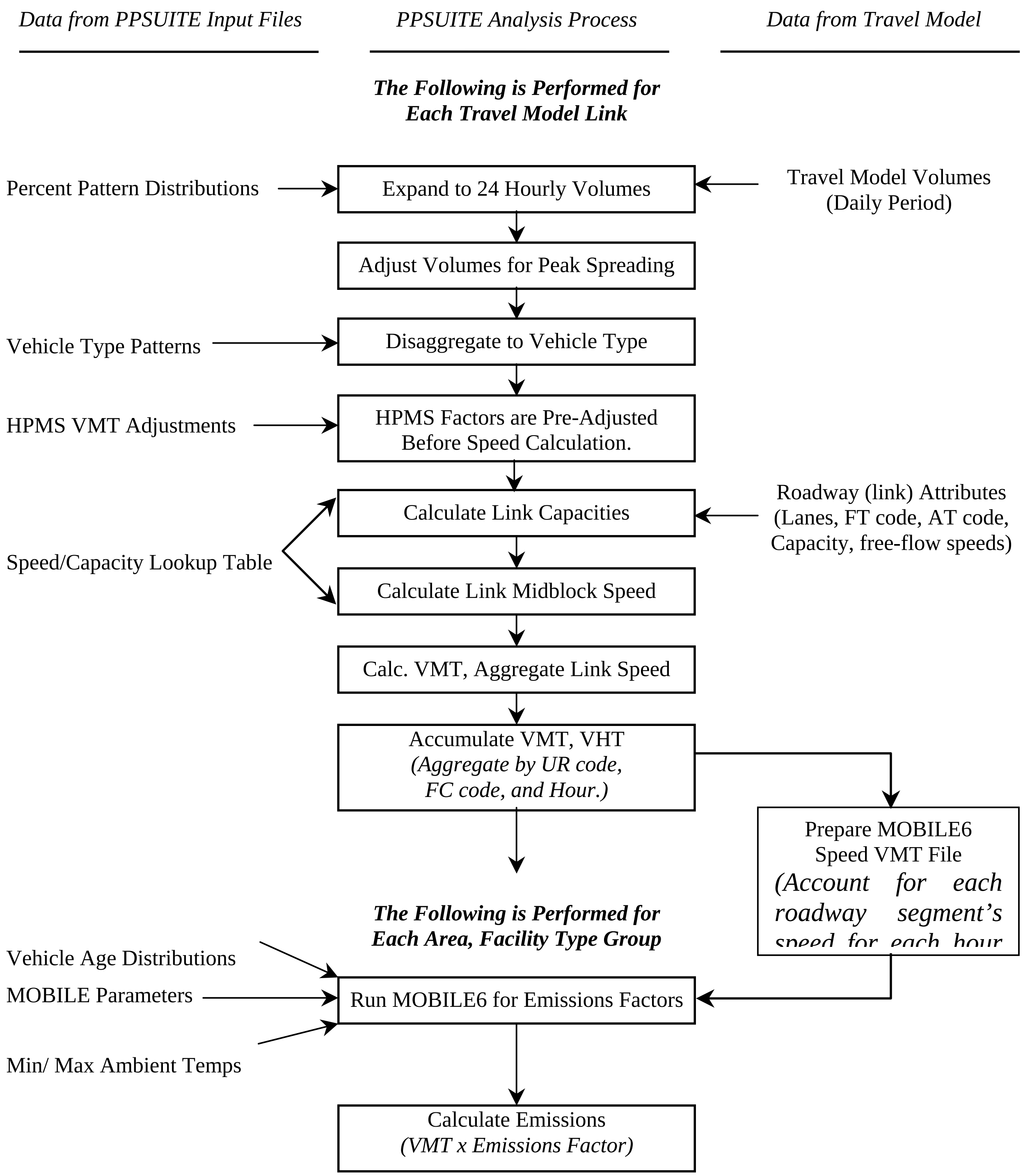
Volume/VMT Development

Before speeds can be calculated and MOBILE run, volumes acquired from the travel demand model must be adjusted and disaggregated. Such adjustments include factoring to HPMS VMT, seasonal adjustments, and disaggregating daily volumes to each hour of the day and to each of the sixteen MOBILE6 vehicle types.

Future Year Volumes

Future year volumes are based on projected land use files that the Technical Advisory Committee (TAC) and WILMAPCO Council endorse and expected changes to the future transportation network. The model is run using the future year inputs and assigned volumes are produced for each roadway link contained within the model network.

Exhibit 6 PPSUITE Speed/Emission Estimation Procedure



Seasonal Adjustments. PPSUITE takes the 24 hr model volumes from the travel demand model, which represents an average annual day. A comprehensive adjustment factor of 1.10 is applied to the entire region. Using the adjusted weekday volumes, VMT is calculated for each model link.

Example:

Assume a sample Cecil County Arterial link: The average annual weekday traffic for this link in 2005 is 12,626 vehicles/day.

A seasonal factor of 1.10 is then applied.
Average Weekday summer Volume = 12,626 x 1.10 = 13,889 vehicles/day

Total VMT (daily) for this link is calculated as volume x distance. The distance of this link as obtained from the model is 0.296 miles.

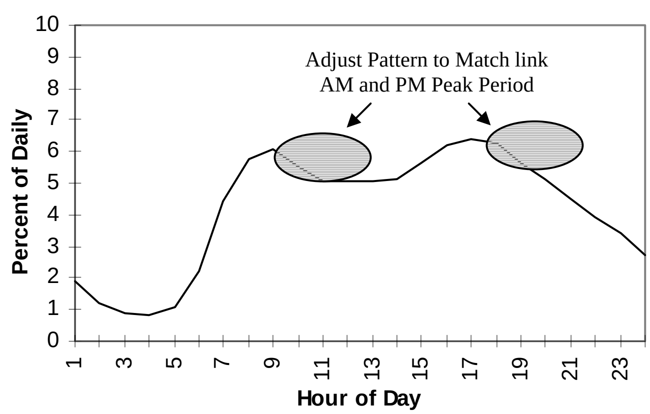
2005 VMT = 13,889 vehicles/day x 0.296 miles = 4,111 vehicle-miles / day

---

Disaggregation to 24 Hours. After seasonally adjusting the link volume, the volume is split to each hour of the day. This allows for more accurate speed calculations (effects of congested hours) and allows PPSUITE to prepare the hourly VMT and speeds for input to the MOBILE6 model.

Example:

To support speed calculations and emission estimates by time of day, the summer weekday volume is disaggregated to 24 hourly volumes. Temporal patterns by facility type were previously developed from SHA 1999-2002 count data and input to PPSUITE. A sample distribution is illustrated below and can be applied to the daily link volume to produce hourly volumes. Additional features within PPSUITE allow for the input pattern to be adjusted ensuring peak period volumes for the AM and PM are consistent with values supplied for each link.



Using the sample link, the resulting typical hourly volumes include:
8-9 a.m. 6.0 % x (4,111 vehicle miles/ 0.296mi.) = 833 vehicles/hour (vph)
12-1 p.m. 5.0 % x (4,111 vehicle miles/ 0.296mi.) = 694 vph
5-6 p.m. 6.3 % x (4,111 vehicle miles/ 0.296mi.) = 875 vph

After dividing the daily volumes to each hour of the day, PPSUITE identifies hours that are unreasonably congested. For those hours, PPSUITE then spreads a portion of the volume to other hours within the same peak period, thereby approximating the "peak spreading" that normally occurs in such over-capacity conditions.

Disaggregation to Vehicle Type. EPA requires VMT estimates to be prepared by vehicle type, reflecting specific local characteristics. As a result, for Cecil County's emission inventory runs, the hourly volumes are disaggregated to the sixteen MOBILE6 vehicle types based on a combination of SHA count pattern data and MOBILE6 defaults.

Example:

Disaggregation of the total sample link volume (by hour) to the various vehicle types would include the following:

Total Model Volume 8-9 am = 833 vph;

From the SHA counts for hour 8-9am (Based on Facility Type):

Light-duty vehicles (LDV)	= 89.52%
Motorcycles (MC)	= 00.17%
Heavy-duty vehicles (HDV)	= 09.52%
Bus	= 00.79%

Using the above information, the following vehicle type volumes are calculated for 8-9 am:

LDV	=	833 x 89.5%	=	746	vph
MC	=	833 x 00.2%	=	1	vph
HDV	=	833 x 09.5%	=	79	vph
BUS	=	833 x 00.8%	=	7	vph

Finally, MOBILE6 defaults are used to break the above categories into the 16 input vehicle types. Defaults vary by the analysis year being run. For example, the following factors have been developed from 2005 MOBILE6 defaults:

LDV	0.4840 of LDV Group	=	361	vph
LDT1	0.0885 of LDV Group	=	66	vph
LDT2	0.2948 of LDV Group	=	220	vph
LDT3	0.0908 of LDV Group	=	68	vph
LDT4	0.0418 of LDV Group	=	31	vph
HDV2B	0.3299 of HDV Group	=	26	vph
HDV3	0.0324 of HDV Group	=	3	vph
HDV4	0.0264 of HDV Group	=	2	vph
HDV5	0.0196 of HDV Group	=	2	vph
HDV6	0.0733 of HDV Group	=	6	vph
HDV7	0.0870 of HDV Group	=	7	vph
HDV8A	0.0946 of HDV Group	=	7	vph
HDV8B	0.3367 of HDV Group	=	26	vph
HDBS	0.6897 of BUS Group	=	5	vph
HDBT	0.3103 of BUS Group	=	2	vph
MC	1.0000 of MC Group	=	1	vph

Speed/Delay Determination

EPA recognizes that the estimation of vehicle speeds is a difficult and complex process. Because emissions are so sensitive to speeds, it recommends special attention be given to developing reasonable and consistent speed estimates; it also recommends that VMT be disaggregated into subsets that have roughly equal speed, with separate emission factors for each subset. At a minimum, speeds should be estimated separately according to roadway facility class.

The computational framework used for this analysis meets and **exceeds** that recommendation. Speeds are individually calculated for each roadway segment and hour based on the physical characteristics of the roadway and the assigned capacities to each model link. Rather than accumulating the roadway segments into area/functional groupings and calculating an average speed, each individual link hourly speed is represented in the MOBILE6 speed VMT file. This represents a significant enhancement in the MOBILE model since past versions only allowed input of one average speed for each scenario. MOBILE6 allows the input of a distribution of hourly speeds. For example, if 5% of a county's arterial VMT operate at 5 mph during the AM peak hour and the remaining 95% operate at 65mph, this can be represented in the MOBILE6 speed input file. For the Cecil County runs, distributions of speeds are input to MOBILE6 for separate scenarios representing county/area and facility type groupings; VMT is accumulated by the same groupings for the application of the emission factors to produce resulting emission totals.

To calculate speeds, PPSUITE first obtains initial capacities (how much volume the roadway can serve before heavy congestion) and free-flow speeds (speeds assuming no congestion) from the travel demand model data. Other data needed for the speed calculations including the BPR parameters (speed – congestion relationships) are obtained from a lookup table input to PPSUITE. This lookup data contains default roadway information indexed by the urban/rural code and facility type.

Example:

For the sample arterial link, the free-flow speeds and capacity is obtained from the travel demand model:

free flow speed = 65 mph
capacity = 1800 vph per lane

This information is used along with the physical characteristics of the roadway to calculate the delay (including congestion) to travel this link during each hour of the day:

For example: The sample link is calculated to have a travel time, including delay of 17.76 seconds for the 8-9am hour

Total travel time, in vehicle hours, for the 8-9am hour is calculated as:

VHT (8-9am) = 17.76 seconds x 833vph / 3600 sec/hr = 4.12 vehicle hours

---

The result of this process is an estimated average travel time for each hour of the day for each highway segment. The average time multiplied by the volume produces vehicle hours of travel (VHT).

HPMS and VMT Adjustments

Link volumes from the traffic model assignment must also be adjusted to account for differences with the HPMS VMT totals, as described previously. VMT adjustment factors are provided as input to PPSUITE, and are applied to each of the roadway segment volumes. These factors were developed from 1990 and 1999 HPMS data; however, the 1999 factors are also applied to any future year runs. The VMT added or subtracted to the travel model links are applied before the calculation of speeds. Therefore, the final congested speed that is used by MOBILE6 accounts for the HPMS VMT adjustments. However, for “local” facility, a constant speed is assumed within MOBILE6 for the calculation of emission factors and the HPMS adjustments will not impact its speeds.

Example:

Assuming the sample arterial link in Cecil County, the daily assigned volume is adjusted to account for reconciliation with the HPMS VMT. A factor of 1.03362 has been developed in the past to account for HPMS differences for all future years.

This factor is applied in the 2005 run.

Thus for the sample link:

VMT (8-9am) = 833 vph x 0.296 miles x 1.03362 = 255 vehicle miles

---

VMT and Speed Aggregation

As discussed in previous sections, MOBILE6’s ability to handle input distributions of hourly speeds has eliminated the need to aggregate speed data. For the Cecil County runs, PPSUITE has been set up to automatically accumulate VMT and VHT by geographic areas and 5 highway facility type groupings. The speed files input to MOBILE6 for each scenario contain the actual distribution of roadway speeds for that aggregation group. Exhibit 7 illustrates the scenario aggregation scheme used with MOBILE6.

Exhibit 7 VMT/VHT Aggregation Scheme

Urban/Rural Code -	1=Urban 2=Rural	2 entries
Facility Type Group -	1 = Interstate 2 = Principal Arterial 3 = Minor Arterial 4 = Collector 5 = Local	5 entries
		10 potential combinations

Geographic aggregation is performed according to urban and rural areas within the county. Facility class aggregation is based on 5 groupings of the facility types contained in the travel demand model. This creates a potential for 10 possible combinations, each of which becomes an input MOBILE6 scenario. This allows each MOBILE6 scenario to represent the actual VMT mix and speed for that geographic/highway combination.

MOBILE Emissions Run

After computing speeds and aggregating VMT and VHT, PPSUITE prepares input files to be run in EPA's MOBILE6 program, which is used to produce VOC and NO_x emission factors in grams of pollutant per vehicle mile.

The MOBILE input file prepared by PPSUITE contains the following:

- MOBILE template containing appropriate parameters and program flags
- Temperature data specific to Cecil County (based on Baltimore data).
- Vehicle age and diesel sales fraction data for Cecil County.
- Scenario data - contains VMT mix, speed distributions specific to scenario as produced by PPSUITE

Example:

A MOBILE input file is created by PPSUITE for Cecil County. This file contains separate scenarios for each urban/rural code, facility type grouping. A scenario represents a separate MOBILE run with different emission factors calculated and output for each run.

For this example, Cecil County arterials will be run as a scenario with a specific VMT mix file and a speed distribution file accounting for all the roadway speeds within the grouping.

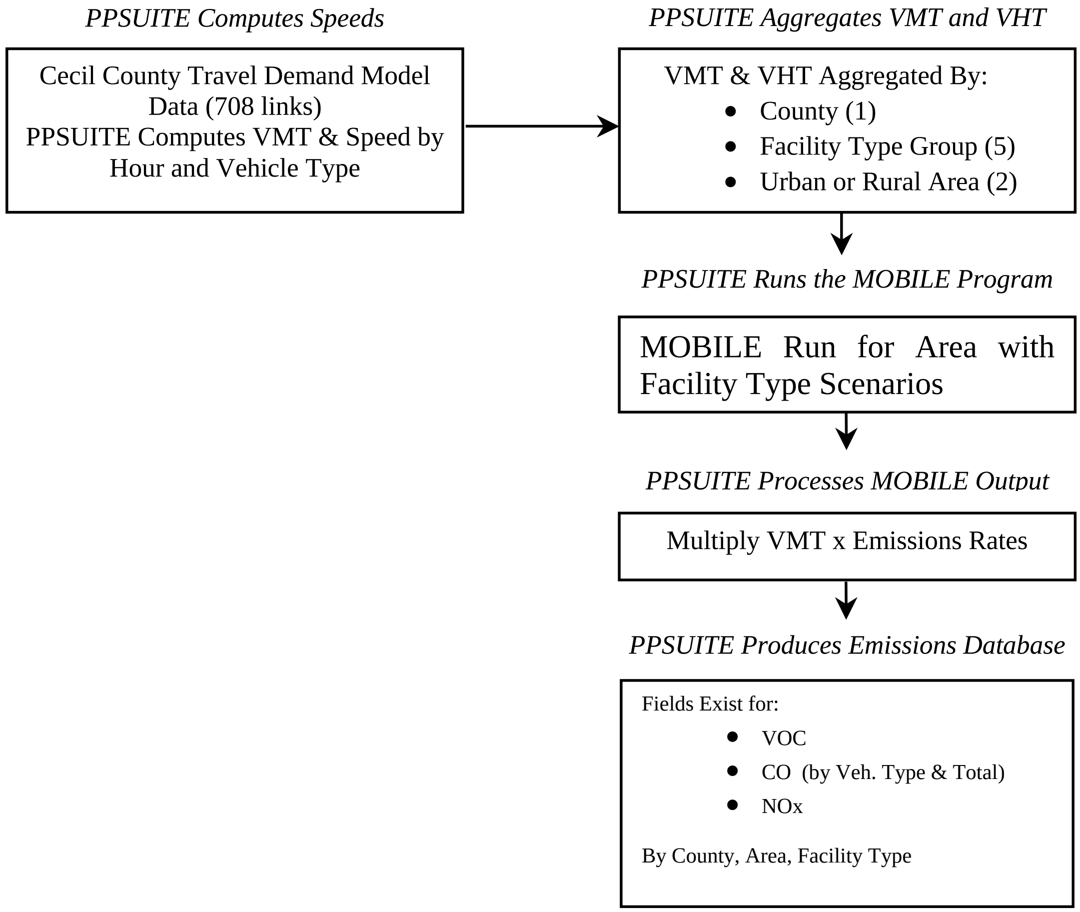
Time of Day Emissions

Unlike in the past using MOBILE5, VMT and speeds are no longer aggregated as separate scenarios representing time periods. This was done in the past to account for the unique speeds encountered during each time period in the day. Diurnal emissions were estimated on a daily period. Since MOBILE6 allows for hourly roadway speeds to be represented in the speed VMT file, such a process is no longer needed. MOBILE6 will internally account for the emissions during each hour in the day and make the necessary calculations.

MOBILE Output Post Processing

After MOBILE has been run, PPSUITE processes the MOBILE output files and compiles the emission factors for each scenario. Using the MOBILE emission factors, PPSUITE calculates emission quantities by multiplying the emission factors by the aggregated VMT totals. PPSUITE then produces an emissions database summarizing VMT, VHT, VOC, and NO_x emissions as shown in Exhibit 8.

Exhibit 8 Summary of PPSUITE's Methodology in Producing Emissions Summary



Example:

Cecil County urban arterials were run as a scenario in MOBILE. Based on the input information, MOBILE6 outputs emission factors by vehicle type for this scenario as shown below:

Composite Emission Factors (grams/mile) from MOBILE6 output

Vehicle Type:	LDGV	LDGT1	LDGT2	LDGT3	LDGT4	HDDV	For all 28 M6 types
VOC:	1.22	1.86	2.42	3.68	0.36	1.13	
NO_X:	2.41	3.16	3.66	7.14	1.84	5.84	

PPSUITE reads these emission factors from the MOBILE6 output file and multiplies them by the Cecil County urban arterial VMT to obtain emission totals for this scenario. (Note: emissions shown in kg/day, which is converted to tons/day in SIP narratives)

PPSUITE computes emissions as follows for this scenario:

			Emission Factors (g/mi)			Emissions (kg/day)	
Veh Type	**VMT**		**VOC**	**NOX**		**VOC**	**NOX**
LDGV	84,344	x	1.22	2.41	=	102.9	203.3
LDGT1	30,713	x	1.86	3.16	=	57.1	97.1
LDGT2	21,515	x	2.42	3.66	=	52.1	78.7
LDGT3	4,209	x	3.68	7.14	=	15.5	30.1
LDGT4	3,586	x	0.36	1.84	=	1.3	6.6
HDDV7	7,483	x	1.13	5.84	=	8.5	43.7
….. Repeated for all 28 MOBILE6 vehicle types							
Total	155,903					244.6	482.0

The emissions for this scenario are reported and stored in an output database file that contains a record for each scenario with fields containing VMT, VHT, VOC emissions, and NO_x emissions. Fields exist for each vehicle type and for the total of all vehicle types as shown below.

Reported by Vehicle Type 1-28 and Total **---** *Repeated for VHT,HC,NOX*

Cnty	**UR**	**FC**	**VMT1**	**VMT2**	**VMT3**	**VMT4**	**VMT5**	**VMT6**	**VMT7**	**VMT8**	**VMT28**
Harf	1	3	84,344	30,713	21,515	4,209	3,586	2,806	7,483	1,248	
			VHT1	**VHT2**	**VHT3**	**VHT4**	**VHT5**	**VHT6**	**VHT7**	**VHT8**	**VHT28**
			1,298	473	331	65	55	43	115	19	
			VOC1	**VOC2**	**VOC3**	**VOC4**	**VOC5**	**VOC6**	**VOC7**	**VOC8**	**VOC28**
			102.9	57.1	52.1	15.5	1.3	1.5	8.5	5.7	
			NO_x1	**NO_x2**	**NO_x3**	**NO_x4**	**NO_x5**	**NO_x6**	**NO_x7**	**NO_x8**	**NO_x28**
			203.3	97.1	78.7	30.1	6.6	11.6	43.7	10.9	

RESOURCES

MOBILE Model

EPA – OTAQ - Modeling and Inventories. Feb. 12, 2003. U. S. Environmental Protection Agency. April 3, 2003. <http://www.epa.gov/omswww/models.htm>

This site contains a downloadable model, MOBILE users guide, and other information.

U.S. Environmental Protection Agency. *User's Guide to MOBILE6.0 (Mobile Source Emission Factor Model).* Office of Mobile Sources. January 2002.

U.S. Environmental Protection Agency. *Technical Guidance on the Use of MOBILE6 for Emission Inventory Preparation.* Office of Transportation and Air Quality. January 2002.

U.S. Environmental Protection Agency. *Policy Guidance on the Use of MOBILE6 for Emission Inventory Preparation.* Office of Air and Radiation. January 18, 2002.

Traffic Engineering

Transportation Research Board. *2000 Highway Capacity Manual.* Committee on Highway Capacity and Quality of Service. 2000.

This manual presents current knowledge and techniques for analyzing the transportation system.

Appendix A – Baker – Cecil County Mobile6 Input Files

```
2005 MOBILE6 INPUT File Script for Cecil County

MOBILE6 INPUT FILE

REPORT FILE         :  m6output.out    REPLACE
DATABASE OUTPUT     :
WITH FIELDNAMES     :
EMISSIONS TABLE     :  M6OUTPUT.TB1    REPLACE
POLLUTANTS          :  HC CO NOX
AGGREGATED OUTPUT  :
RUN DATA            : 0001

MIN/MAX TEMPERATURE: 67.9 96.5
FUEL RVP            : 7.0
EXPRESS HC AS VOC  :
EXPAND EXHAUST      :
EXPAND EVAPORATIVE :
NO REFUELING        :
ANTI-TAMP PROGRAM  :
89 77 50 22222 22222111 1 12  96. 12211112
I/M DESC FILE       : IM2005.D
94+ LDG IMP         : nlevne.d
REG DISTRIBUTION    : Reg2002.TRK
DIESEL FRACTIONS    :
0.0013 0.0004 0.0011 0.0029 0.0032 0.0004 0.0018 0.0012 0.0005 0.0005
0.0012 0.0044 0.0014 0.0014 0.0000 0.0086 0.0112 0.0282 0.0203 0.0479
0.1200 0.0918 0.0805 0.0200 0.0047
0.0086 0.0123 0.0112 0.0305 0.0126 0.0355 0.0298 0.0261 0.0105 0.0129
0.0166 0.0184 0.0237 0.0229 0.0164 0.0031 0.0457 0.0390 0.0636 0.0789
0.2143 0.2727 0.1923 0.0233 0.0144
0.0086 0.0123 0.0112 0.0305 0.0126 0.0355 0.0298 0.0261 0.0105 0.0129
0.0166 0.0184 0.0237 0.0229 0.0164 0.0031 0.0457 0.0390 0.0636 0.0789
0.2143 0.2727 0.1923 0.0233 0.0144
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0126 0.0115 0.0111 0.0145
0.0115 0.0129 0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209
0.0256 0.0013 0.0006 0.0011 0.0001
0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.1998 0.2578 0.2515 0.3263
0.2784 0.2963 0.2384 0.2058 0.1756 0.1958 0.2726 0.2743 0.3004 0.2918
0.2859 0.0138 0.0000 0.0000 0.0000
0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.6774 0.7715 0.7910 0.8105
0.8068 0.8280 0.8477 0.7940 0.7488 0.7789 0.7842 0.6145 0.5139 0.5032
0.4277 0.0079 0.0000 0.0000 0.0001
0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8606 0.8473 0.8048 0.8331
0.7901 0.7316 0.7275 0.7158 0.5647 0.3178 0.2207 0.1968 0.1570 0.0738
0.0341 0.0414 0.0003 0.0000 0.0000
0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4647 0.4384 0.3670 0.4125
0.3462 0.2771 0.2730 0.2616 0.1543 0.0615 0.0383 0.0333 0.0255 0.0111
0.0049 0.0060 0.0000 0.0000 0.0000
0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6300 0.6078 0.5246 0.5767
0.5289 0.5788 0.5617 0.4537 0.4216 0.4734 0.4705 0.4525 0.4310 0.3569
0.3690 0.4413 0.3094 0.1679 0.1390
0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8563 0.8443 0.7943 0.8266
0.7972 0.8279 0.8177 0.7440 0.7184 0.7588 0.7567 0.7431 0.7261 0.6602
0.6717 0.7344 0.6107 0.4140 0.3610
0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9992 0.9989 0.9987 0.9989
0.9977 0.9984 0.9982 0.9979 0.9969 0.9978 0.9980 0.9979 0.9976 0.9969
0.9978 0.9982 0.9974 0.9965 0.9964
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.9585 0.8857 0.8525 0.8795
0.9900 0.9105 0.8760 0.7710 0.7502 0.7345 0.6733 0.5155 0.3845 0.3238
0.3260 0.2639 0.0594 0.0460 0.0291
```

```
SCENARIO RECORD    :[01 0001]  1

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
SEASON             : 1
ALTITUDE           : 1
CLOUD COVER        : 0.35
SUNRISE/SUNSET     : 6 8
FUEL PROGRAM       : 2 N
VMT FRACTIONS      :
                     .354851 .064873 .216078 .066555 .030646 .080681 .007915 .006448
                     .004788 .017922 .021265 .023141 .082364 .013673 .006147 .002653
VMT BY FACILITY    :V000101F.def
VMT BY HOUR        :V000101H.def
SPEED VMT          :V000101S.def


SCENARIO RECORD    :[02 0001]  2

CALENDAR YEAR      :2005
EVALUATION MONTH   : 7
SEASON             : 1
ALTITUDE           : 1
CLOUD COVER        : 0.35
SUNRISE/SUNSET     : 6 8
FUEL PROGRAM       : 2 N
VMT FRACTIONS      :
                     .450464 .082348 .274308 .084487 .038892 .020661 .002030 .001653
                     .001228 .004589 .005448 .005925 .021095 .004095 .001844 .000933
VMT BY FACILITY    :V000102F.def
VMT BY HOUR        :V000102H.def
SPEED VMT          :V000102S.def
```

INPUT RUN/SCENARIOS CONTINUE FOR AREA, Facility Group COMBINATION………

Attachment 1 to Appendix B

2005 I/M Input File to MOBILE6 for Cecil County

```
*IM Program 2005.  Idle, IM240, and OBD.
*IM240  Final Cutpoints.
*HDGT1 receives IM240, but is modeled as idle test to allow single run.
*Describes IM emissions program beginning Summer 2004.
*Includes gas cap testing, which will be advisory until summer 2003, and
*should become pass/fail then.
*Waiver rates are based on the assumption that a $450 waiver expenditure will
*result in a  3% waiver rate.
*Gas Cap for OBD Vehicles
*
I/M PROGRAM        : 7 2003 2050 2 T/O EVAP OBD & GC
I/M MODEL YEARS    : 7 1996 2050
I/M VEHICLES       : 7 22222 11111111 1
I/M COMPLIANCE     : 7 96.0
I/M WAIVER RATES   : 7  3.0  3.0
I/M GRACE PERIOD   : 7 2
*Gas Cap for HDGT
I/M PROGRAM        : 6 2003 2050 2 T/O GC
I/M MODEL YEARS    : 6 1977 2050
I/M VEHICLES       : 6 11111 22222111 1
I/M COMPLIANCE     : 6 96.0
I/M WAIVER RATES   : 6  3.0  3.0
I/M GRACE PERIOD   : 6 2
*Gas Cap for older LDGV, LDGT
```

```
I/M PROGRAM        : 5 2003 2050 2 T/O GC
I/M MODEL YEARS    : 5 1977 1995
I/M VEHICLES       : 5 22222 11111111 1
I/M COMPLIANCE     : 5 96.0
I/M WAIVER RATES   : 5  3.0  3.0
I/M GRACE PERIOD   : 5 2
*OBD
I/M PROGRAM        : 4 2003 2050 2 T/O OBD I/M
I/M MODEL YEARS    : 4 1996 2050
I/M VEHICLES       : 4 22222 11111111 1
I/M STRINGENCY     : 4 20.0
I/M COMPLIANCE     : 4 96.0
I/M WAIVER RATES   : 4  3.0  3.0
I/M GRACE PERIOD   : 4 2
*IM240
I/M PROGRAM        : 3 1984 2050 2 T/O IM240
I/M MODEL YEARS    : 3 1984 1995
I/M VEHICLES       : 3 22222 11111111 1
I/M STRINGENCY     : 3 20.0
I/M COMPLIANCE     : 3 96.0
I/M WAIVER RATES   : 3  3.0  3.0
I/M CUTPOINTS      : 3 d:\BALTAQ\M6_Data\cutpnt05.d
I/M GRACE PERIOD   : 3 2
*Idle HDGT
I/M PROGRAM        : 2 1984 2050 2 T/O Idle
I/M MODEL YEARS    : 2 1977 2050
I/M VEHICLES       : 2 11111 22222111 1
I/M STRINGENCY     : 2 20.0
I/M COMPLIANCE     : 2 96.0
I/M WAIVER RATES   : 2  3.0  3.0
I/M GRACE PERIOD   : 2 2
*Idle older LDGV, LDGT
I/M PROGRAM        : 1 1984 2050 2 T/O Idle
I/M MODEL YEARS    : 1 1977 1983
I/M VEHICLES       : 1 22222 11111111 1
I/M STRINGENCY     : 1 20.0
I/M COMPLIANCE     : 1 96.0
I/M WAIVER RATES   : 1  3.0  3.0
I/M GRACE PERIOD   : 1 2
```

Attachment 2 to Appendix B

2002 Vehicle Age Distribution Inputs to MOBILE6 for Cecil County

```
REG DIST
*
*   2002 Registration Mix for the Cecil County of MD
*
* This file contains the default MOBILE6 values for the distribution of
* vehicles by age for July of any calendar year.  There are sixteeen (16)
* sets of values representing 16 combined gasoline/diesel vehicle class
* distributions.  These distributions are split for gasoline and diesel
* using the separate input (or default) values for diesel sales fractions.
* Each distribution contains 25 values which represent the fraction of
* all vehicles in that class (gasoline and diesel) of that age in July.
* The first number is for age 1 (calendar year minus model year plus one)
* and the last number is for age 25.  The last age includes all vehicles
* of age 25 or older.  The first number in each distribution is an integer
* which indicates which of the 16 vehicle classes are represented by the
* distribution.  The sixteen vehicle classes are:
*
*  1  LDV    Light-Duty Vehicles (Passenger Cars)
*  2  LDT1   Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
*  3  LDT2   Light Duty Trucks 2 (0-6,001 lbs. GVWR, 3751-5750 lbs. LVW)
*  4  LDT3   Light Duty Trucks 3 (6,001-8500 lbs. GVWR, 0-3750 lbs. LVW)
*  5  LDT4   Light Duty Trucks 4 (6,001-8500 lbs. GVWR, 3751-5750 lbs. LVW)
*  6  HDV2B  Class 2b Heavy Duty Vehicles (8501-10,000 lbs. GVWR)
*  7  HDV3   Class 3 Heavy Duty Vehicles (10,001-14,000 lbs. GVWR)
*  8  HDV4   Class 4 Heavy Duty Vehicles (14,001-16,000 lbs. GVWR)
*  9  HDV5   Class 5 Heavy Duty Vehicles (16,001-19,500 lbs. GVWR)
* 10  HDV6   Class 6 Heavy Duty Vehicles (19,501-26,000 lbs. GVWR)
* 11  HDV7   Class 7 Heavy Duty Vehicles (26,001-33,000 lbs. GVWR)
```

```
* 12  HDV8A  Class 8a Heavy Duty Vehicles (33,001-60,000 lbs. GVWR)
* 13  HDV8B  Class 8b Heavy Duty Vehicles (>60,000 lbs. GVWR)
* 14  HDBS   School Busses
* 15  HDBT   Transit and Urban Busses
* 16  MC     Motorcycles (All)
*
* The 25 age values are arranged in two rows of 10 values followed by a row
* with the last 5 values.  Comments (such as this one) are indicated by
* an asterisk in the first column. Empty rows are ignored.  Values are
* read "free format," meaning any number may appear in any row with as
* many characters as needed (including a decimal) as long as 25 values
* follow the initial integer value separated by a space.
*
* If all 28 vehicle classes do not need to be altered from the default
* values, then only the vehicle classes that need to be changed need to
* be included in this file.  The order in which the vehicle classes are
* read does not matter, however each vehicle class set must contain 25
* values and be in the proper age order.
*
* Based on the 2002 MVA Data received during July 2002
* Assume Defaults for Trucks
*
* LDV
 1 0.0432 0.0704 0.0795 0.0664 0.0688 0.0724 0.0612 0.0707 0.0604 0.0563
   0.0477 0.0447 0.0399 0.0398 0.0332 0.0259 0.0198 0.0128 0.0110 0.0052
   0.0028 0.0027 0.0024 0.0028 0.0599
* LDT1
 2 0.0736 0.0924 0.0964 0.0955 0.0852 0.0819 0.0765 0.0701 0.0600 0.0442
   0.0342 0.0309 0.0294 0.0304 0.0269 0.0204 0.0139 0.0097 0.0070 0.0048
   0.0027 0.0007 0.0016 0.0027 0.0088
* LDT2
 3 0.0736 0.0924 0.0964 0.0955 0.0852 0.0819 0.0765 0.0701 0.0600 0.0442
   0.0342 0.0309 0.0294 0.0304 0.0269 0.0204 0.0139 0.0097 0.0070 0.0048
   0.0027 0.0007 0.0016 0.0027 0.0088
* LDT3
 4 0.0526 0.0762 0.0708 0.0666 0.0632 0.0691 0.0565 0.0653 0.0624 0.0448
   0.0411 0.0373 0.0422 0.0455 0.0464 0.0367 0.0362 0.0217 0.0163 0.0100
   0.0050 0.0050 0.0039 0.0064 0.0187
* LDT4
 5 0.0526 0.0762 0.0708 0.0666 0.0632 0.0691 0.0565 0.0653 0.0624 0.0448
   0.0411 0.0373 0.0422 0.0455 0.0464 0.0367 0.0362 0.0217 0.0163 0.0100
   0.0050 0.0050 0.0039 0.0064 0.0187
* Motorcycles
16 0.0786 0.1063 0.0772 0.0592 0.0536 0.0407 0.0421 0.0379 0.0282 0.0277
   0.0250 0.4235 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
   0.0000 0.0000 0.0000 0.0000 0.0000
```

Appendix B – Baker – 1990 Cecil County Mobile6 Input Files

```
1990 MOBILE6 INPUT File Script for Cecil County

MOBILE6 INPUT FILE

REPORT FILE        :  m6output.out    REPLACE
DATABASE OUTPUT    :
WITH FIELDNAMES    :
EMISSIONS TABLE    :  M6OUTPUT.TB1    REPLACE
POLLUTANTS         :  HC CO NOX
AGGREGATED OUTPUT  :
RUN DATA           : 0001

MIN/MAX TEMPERATURE: 69.1 98.4
FUEL RVP           : 8.2
EXPRESS HC AS VOC  :
EXPAND EXHAUST     :
EXPAND EVAPORATIVE :
NO REFUELING       :
REG DISTRIBUTION   : Reg1990.CEC
DIESEL FRACTIONS   :
0.0012 0.0007 0.0000 0.0000 0.0048 0.0049 0.0092 0.0065 0.0163 0.0283
0.0188 0.0060 0.0089 0.0045 0.0035 0.0000 0.0105 0.0040 0.0039 0.0053
0.0060 0.0000 0.0075 0.0088 0.0014
0.0050 0.0000 0.0029 0.0033 0.0177 0.0176 0.0348 0.0419 0.1122 0.1940
0.0513 0.0174 0.0313 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.1000
0.0050 0.0000 0.0029 0.0033 0.0177 0.0176 0.0348 0.0419 0.1122 0.1940
0.0513 0.0174 0.0313 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.1000
0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013
0.0006 0.0011 0.0001 0.0000 0.0000 0.0000 0.0001 0.0001 0.0001 0.0001
0.0001 0.0001 0.0001 0.0001 0.0001
0.0096 0.0083 0.0072 0.0082 0.0124 0.0135 0.0169 0.0209 0.0256 0.0013
0.0006 0.0011 0.0001 0.0000 0.0000 0.0000 0.0001 0.0001 0.0001 0.0001
0.0001 0.0001 0.0001 0.0001 0.0001
0.2384 0.2058 0.1756 0.1958 0.2726 0.2743 0.3004 0.2918 0.2859 0.0138
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.8477 0.7940 0.7488 0.7789 0.7842 0.6145 0.5139 0.5032 0.4277 0.0079
0.0000 0.0000 0.0001 0.0003 0.0010 0.0028 0.0248 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000
0.7275 0.7158 0.5647 0.3178 0.2207 0.1968 0.1570 0.0738 0.0341 0.0414
0.0003 0.0000 0.0000 0.0000 0.0259 0.0078 0.0004 0.0090 0.0112 0.0112
0.0112 0.0112 0.0112 0.0112 0.0112
0.2730 0.2616 0.1543 0.0615 0.0383 0.0333 0.0255 0.0111 0.0049 0.0060
0.0000 0.0000 0.0000 0.0000 0.0037 0.0011 0.0001 0.0013 0.0016 0.0016
0.0016 0.0016 0.0016 0.0016 0.0016
0.5617 0.4537 0.4216 0.4734 0.4705 0.4525 0.4310 0.3569 0.3690 0.4413
0.3094 0.1679 0.1390 0.0808 0.0476 0.0365 0.0288 0.0274 0.0297 0.0297
0.0297 0.0297 0.0297 0.0297 0.0297
0.8177 0.7440 0.7184 0.7588 0.7567 0.7431 0.7261 0.6602 0.6717 0.7344
0.6107 0.4140 0.3610 0.2353 0.1489 0.1170 0.0940 0.0897 0.0966 0.0966
0.0966 0.0966 0.0966 0.0966 0.0966
0.9982 0.9979 0.9969 0.9978 0.9980 0.9979 0.9976 0.9969 0.9978 0.9982
0.9974 0.9965 0.9964 0.9949 0.9920 0.9936 0.9819 0.9812 0.9720 0.9720
0.9720 0.9720 0.9720 0.9720 0.9720
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000 1.0000
1.0000 1.0000 1.0000 1.0000 1.0000
0.8760 0.7710 0.7502 0.7345 0.6733 0.5155 0.3845 0.3238 0.3260 0.2639
0.0594 0.0460 0.0291 0.0240 0.0086 0.0087 0.0000 0.0000 0.0000 0.0000
0.0000 0.0000 0.0000 0.0000 0.0000


SCENARIO RECORD    :[01 0001]  1

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
```

```
SEASON             : 1
ALTITUDE           : 1
FUEL PROGRAM       : 1
VMT FRACTIONS      :
                     .501874 .033589 .111564 .045186 .020736 .090000 .009197 .005427
                     .004341 .017366 .021393 .025478 .091371 .013453 .006312 .002713
VMT BY FACILITY    :V000101F.def
VMT BY HOUR        :V000101H.def
SPEED VMT          :V000101S.def


SCENARIO RECORD    :[02 0001]  2

CALENDAR YEAR      :1990
EVALUATION MONTH   : 7
SEASON             : 1
ALTITUDE           : 1
FUEL PROGRAM       : 1
VMT FRACTIONS      :
                     .654981 .043827 .145622 .058991 .027077 .021310 .002177 .001287
                     .001028 .004107 .005066 .006031 .021626 .003952 .001861 .001057
VMT BY FACILITY    :V000102F.def
VMT BY HOUR        :V000102H.def
SPEED VMT          :V000102S.def
```

INPUT RUN/SCENARIOS CONTINUE FOR AREA, Facility Group COMBINATION………

Attachment 1 to Appendix C

1990 Vehicle Age Distribution Inputs to MOBILE6 for Cecil County

```
REG DIST
*
* 1990 Registration Mix for the Cecil County of MD
* This file contains the default MOBILE6 values for the distribution of
* vehicles by age for July of any calendar year.  There are sixteeen (16)
* sets of values representing 16 combined gasoline/diesel vehicle class
* distributions.  These distributions are split for gasoline and diesel
* using the separate input (or default) values for diesel sales fractions.
* Each distribution contains 25 values which represent the fraction of
* all vehicles in that class (gasoline and diesel) of that age in July.
* The first number is for age 1 (calendar year minus model year plus one)
* and the last number is for age 25.  The last age includes all vehicles
* of age 25 or older.  The first number in each distribution is an integer
* which indicates which of the 16 vehicle classes are represented by the
* distribution.  The sixteen vehicle classes are:
*
*  1  LDV    Light-Duty Vehicles (Passenger Cars)
*  2  LDT1   Light-Duty Trucks 1 (0-6,000 lbs. GVWR, 0-3750 lbs. LVW)
*  3  LDT2   Light Duty Trucks 2 (0-6,001 lbs. GVWR, 3751-5750 lbs. LVW)
*  4  LDT3   Light Duty Trucks 3 (6,001-8500 lbs. GVWR, 0-3750 lbs. LVW)
*  5  LDT4   Light Duty Trucks 4 (6,001-8500 lbs. GVWR, 3751-5750 lbs. LVW)
*  6  HDV2B  Class 2b Heavy Duty Vehicles (8501-10,000 lbs. GVWR)
*  7  HDV3   Class 3 Heavy Duty Vehicles (10,001-14,000 lbs. GVWR)
*  8  HDV4   Class 4 Heavy Duty Vehicles (14,001-16,000 lbs. GVWR)
*  9  HDV5   Class 5 Heavy Duty Vehicles (16,001-19,500 lbs. GVWR)
* 10  HDV6   Class 6 Heavy Duty Vehicles (19,501-26,000 lbs. GVWR)
* 11  HDV7   Class 7 Heavy Duty Vehicles (26,001-33,000 lbs. GVWR)
* 12  HDV8A  Class 8a Heavy Duty Vehicles (33,001-60,000 lbs. GVWR)
* 13  HDV8B  Class 8b Heavy Duty Vehicles (>60,000 lbs. GVWR)
* 14  HDBS   School Busses
* 15  HDBT   Transit and Urban Busses
* 16  MC     Motorcycles (All)
*
* The 25 age values are arranged in two rows of 10 values followed by a row
```

```
* with the last 5 values.  Comments (such as this one) are indicated by
* an asterisk in the first column. Empty rows are ignored.  Values are
* read "free format," meaning any number may appear in any row with as
* many characters as needed (including a decimal) as long as 25 values
* follow the initial integer value separated by a space.
*
* If all 28 vehicle classes do not need to be altered from the default
* values, then only the vehicle classes that need to be changed need to
* be included in this file.  The order in which the vehicle classes are
* read does not matter, however each vehicle class set must contain 25
* values and be in the proper age order.
*
* Based on the 1990 MVA Data received during July 1990
*
* LDV
 1 0.0501 0.0884 0.0966 0.0978 0.0964 0.0874 0.0834 0.0564 0.0472 0.0468
   0.0424 0.0459 0.0379 0.0274 0.0178 0.0088 0.0088 0.0077 0.0080 0.0058
   0.0051 0.0047 0.0041 0.0035 0.0216
* LDT1
 2 0.0862 0.1455 0.1468 0.1276 0.1086 0.0849 0.0674 0.0356 0.0209 0.0143
   0.0166 0.0367 0.0273 0.0235 0.0162 0.0092 0.0060 0.0090 0.0053 0.0047
   0.0019 0.0023 0.0006 0.0004 0.0021
* LDT2
 3 0.0862 0.1455 0.1468 0.1276 0.1086 0.0849 0.0674 0.0356 0.0209 0.0143
   0.0166 0.0367 0.0273 0.0235 0.0162 0.0092 0.0060 0.0090 0.0053 0.0047
   0.0019 0.0023 0.0006 0.0004 0.0021
* LDT3
 4 0.0549 0.0924 0.1011 0.0986 0.1037 0.0769 0.0696 0.0522 0.0375 0.0347
   0.0339 0.0475 0.0411 0.0321 0.0237 0.0121 0.0141 0.0124 0.0118 0.0095
   0.0074 0.0085 0.0064 0.0060 0.0117
* LDT4
 5 0.0549 0.0924 0.1011 0.0986 0.1037 0.0769 0.0696 0.0522 0.0375 0.0347
   0.0339 0.0475 0.0411 0.0321 0.0237 0.0121 0.0141 0.0124 0.0118 0.0095
   0.0074 0.0085 0.0064 0.0060 0.0117
* HDV2B
 6 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDV3
 7 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDV4
 8 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDV5
 9 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDV6
10 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDV7
11 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDV8a
12 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDV8b
13 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDBS
14 0.0330 0.0629 0.0748 0.0840 0.0816 0.0727 0.0504 0.0320 0.0402 0.0335
   0.0395 0.0552 0.0513 0.0314 0.0255 0.0170 0.0343 0.0351 0.0192 0.0181
   0.0179 0.0161 0.0134 0.0134 0.0475
* HDBT
```

```
15 0.0426 0.0739 0.0938 0.1165 0.1108 0.0852 0.0568 0.0284 0.0455 0.0426
   0.0625 0.0455 0.0483 0.0227 0.0085 0.0057 0.0313 0.0170 0.0170 0.0114
   0.0170 0.0057 0.0028 0.0028 0.0057
* Motorcycles
16 0.0283 0.0405 0.0489 0.0604 0.1055 0.0680 0.0474 0.0528 0.0956 0.0872
   0.0696 0.2959 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000
```

0.0000 0.0000 0.0000 0.0000 0.0000

Appendix D: MOBILE6 Electronic Files

MOBILE6 ELECTRONIC FILES FOR THE BALTIMORE NONATTAINMENT AREA AND CECIL COUNTY

Electronic files related to this SIP Revision can also be obtained by contacting:

Brian J. Hug, Planner II
Air and Radiation Management Administration
Maryland Department of the Environment
1800 Washington Boulevard
Baltimore, Maryland 21230
(410) 537-4125
bhug@mde.state.md.us

Appendix E: Impact of MOBILE6 Changes on the Attainment Plans

The purpose of this appendix is to examine the mobile source emission budgets prepared using MOBILE6 with respect to the attainment plan for the Baltimore Region and Cecil County to ensure that progress toward attaining the federal 1-hour ozone standard is maintained and that both regions are able to comply with the standard as expeditiously as possible.

In this initial analysis, two indicators are examined to determine whether the purpose of the SIP is met. The first indicator compares the relative reduction achieved between the base year and the 2005 inventory from the original attainment plan to the relative reduction achieved between the revised base year and 2005 inventory which includes the revised mobile source emission estimates. The second indicator examines improvements in recent air quality data against air quality before the attainment plan reductions were implemented.

A more comprehensive assessment of air quality with respect to attainment of the one-hour ozone standard, called the Mid-Course Review, currently is scheduled for December 31, 2004. Maryland committed to complete a Mid-Course Review as part of the conditional approval of the attainment plan. The time frame for completion of the review is consistent with EPA guidance and may allow sufficient time to assess the effects of implementing the NOx SIP Call in areas outside Maryland. If the Mid-Course Review determines that an emission reduction shortfall exists, Maryland will examine strategies that will address such a shortfall during that process.

Relative Reduction Comparison

SIP revisions based on MOBILE6 must demonstrate that the SIP still achieves its purpose (e.g., attainment or maintenance) when the MOBILE5-based motor vehicle emission inventories are replaced with MOBILE6 inventories. An unempirical comparison of the emission estimates from vehicles in the attainment plan and the emission estimates developed with the new model appears to show an increase in emissions. A re-examination of both the overall baseline emissions and the controlled emissions using estimates of vehicle emissions developed using MOBILE6 shows that the new emission limit continues the same rate of emission reductions. This relative reduction concept was outlined in EPA's January 2002 MOBILE6 guidance (Appendix F)[1].

The relative reduction concept is an appropriate technique for determining whether the attainment plan still achieves attainment because Maryland used "weight of evidence" procedures to analyze whether the emission reductions in the attainment plan were sufficient to attain the ozone standard. A weight of evidence analysis uses the results from photochemical grid models to show that the combination of the controls selected is

[1] *Memorandum: Policy Guidance on the Use of MOBILE6 for SIP Development and Transportation Conformity*, John Seitz and Margo Oge, USEPA OAQPS and OTAQ, January 18, 2002.

effective[2] and to estimate how much ozone is reduced using the controls. The predicted reduction is then applied to monitored air quality data to evaluate the effectiveness of the controls in a particular region. This combination of techniques predicts future ozone concentrations from a baseline of actual historic air quality data and the ozone improvement predicted by the photochemical grid model. Both parts of the analysis are needed because air quality models are more accurate at calculating relative improvement in air quality as opposed to predicting an absolute concentration of ozone at a particular place.

Tables 1 and 2 in this section compare the total emission inventories including new mobile source estimates using MOBILE6 with total emission inventories developed using MOBILE5b mobile estimates for each nonattainment area to determine if attainment will still be predicted by the establish attainment date. Inventories for both the base year and the attainment year are needed because using the weight of evidence method, the determination of whether or not attainment is still demonstrated depends on the relative reduction of ozone precursors between the base year and the attainment year. If the relative reductions between the base year and attainment year using MOBILE6 are equal to or greater than the relative reductions between the base year and attainment year using MOBILE5 then attainment continues to be demonstrated. Increases in percent reductions mean that the new inventories predict lower ozone precursor emissions in the attainment year relative to the base year. Similarly, decreases in percent reductions mean that the new inventories predict higher ozone precursor emissions in the attainment year relative to the base year.

Prior to comparisons of the total emission estimates, the baseline and controlled inventories for point, area and nonroad were re-examined to see if any revisions to these inventories were appropriate due to changes in the growth projections, control strategy efficiency or other assumptions. No revisions to the other source sectors were deemed necessary.

The revised VOC inventories for the Baltimore region predict a greater relative reduction in emissions for the attainment year relative to the base year than the inventories from the attainment plan. However, the revised NOx inventories predict a smaller relative reduction in emissions in the attainment year relative to the base year. In this instance more reductions from VOC are available than needed and less NOx reductions are available than required. The combined effect of these reductions is equivalent if the potential of the additional VOC reductions is evaluated against the need for additional NOx reductions using substitution. Section 182 (c)(2)(C) of the Clean Air Act allows for the substitution of VOC emissions reductions with NOx emission reductions and vice versa if it can be demonstrated that such substitution yields equivalent ozone reductions. Maryland made such an equivalency demonstration in the Phase I Ozone SIP. A NOx to VOC substitution ratio of 1.44 was calculated for the area: 1 ton of VOC reductions are

[2]Unlike primary pollutants, such as SO2 and CO, which are emitted directly and can be controlled at their source, ozone is formed in the atmosphere from volatile organic compounds and nitrogen oxides in the presence of intense sunlight. These complex reactions make reducing ozone concentrations a difficult challenge.

equivalent to 1.44 tons of NOx emission reductions in terms of ozone reductions. Using substitution to offset the smaller NOx reduction requires 7.03 tons of VOC reductions. Thus, the larger VOC reduction benefit of 10.12 tons will offset the 5.58-ton NOx increase.

Table 1. Baltimore NAA Attainment Plan Summary

BNAA SIP Inventory (tons/day)					
Pollutant	**Source Category**	**1990**	**2005**	**% Reduction**	**Shortfall (tons/day)**
VOC	Point	42.00	45.68		
	Area	122.40	93.31		
	Nonroad	44.70	36.45		
	Mobile 5	134.20	45.50		
	Total	343.30	220.94	35.64%	
VOC	Point	42.00	45.68		
	Area	122.40	93.31		
	Nonroad	44.70	36.45		
	Mobile 6	165.14	55.30		
	Total	374.24	230.74	38.34%	-10.12
NOX	Point	223.20	118.70		
	Area	13.70	14.79		
	Nonroad	71.50	72.03		
	Mobile 5	159.50	96.90		
	Total	467.90	302.42	35.37%	
NOX	Point	223.20	118.70		
	Area	13.70	14.79		
	Nonroad	71.50	72.03		
	Mobile 6	228.21	146.90		
	Total	536.61	352.42	34.33%	5.58

Table 2. Cecil County Attainment Plan Summary

Cecil SIP Inventory (tons/day)					
Pollutant	**Source Category**	**1990**	**2005**	**% Reduction**	**Shortfall (tons/day)**
VOC	Point	0.56	0.62		
	Area	8.73	4.05		
	Nonroad	2.04	1.67		
	Mobile 5	7.20	2.60		
	Total	18.52	8.94	51.72%	
VOC	Point	0.56	0.62		
	Area	8.73	4.05		
	Nonroad	2.04	1.67		
	Mobile 6	8.59	2.98		
	Total	19.91	9.322	53.19%	-0.29
NOX	Point	0.00	0.00		
	Area	1.78	1.46		
	Nonroad	2.64	2.32		
	Mobile 5	9.30	5.60		
	Total	13.72	9.38	31.69%	
NOX	Point	0.00	0.00		
	Area	1.78	1.46		
	Nonroad	2.64	2.32		
	Mobile 6	17.31	11.33		
	Total	21.73	15.11	30.50%	0.26

Maryland made such an equivalency demonstration in the Phase I Ozone SIP for Cecil County. A VOC to NOx substitution ratio of 1.35 was calculated for the area: 1 ton of VOC reductions are equivalent to 1.35 tons of NOx emission reductions in terms of ozone reductions. Using substitution to offset the smaller NOx reduction requires 0.19 tons of VOC reductions. Thus, the larger VOC reduction benefit of 0.29 tons will offset the 0.26-ton NOx increase.

Based on Maryland's MOBILE6 revision of its on-road mobile emissions, the result of the test of the attainment demonstration for the on-road mobile source sector is that the

Baltimore NAA and Cecil County are still predicted to achieve attainment. Therefore, in accordance with USEPA guidance[3], the two conditions are met that allow Maryland to revise its motor vehicle emissions inventories and budgets using MOBILE6 without revising the entire attainment demonstration SIP or completing additional modeling.

Air Quality Comparison

The Phase II Attainment Plan and this SIP revision address the national ambient air quality standard for ozone based on one hour averaging. The standard is a one hour average of 0.12 parts per million (ppm) not to be exceeded more than three days over a three year period. Therefore, the fourth highest value over a three-year period termed the design value, determines whether or not an area is below the standard. Maryland has made progress in reducing the spatial extent of the area that is above the one-hour ozone standard and in reducing the maximum measured concentrations.

Table E-1 Comparison of Air Quality Data

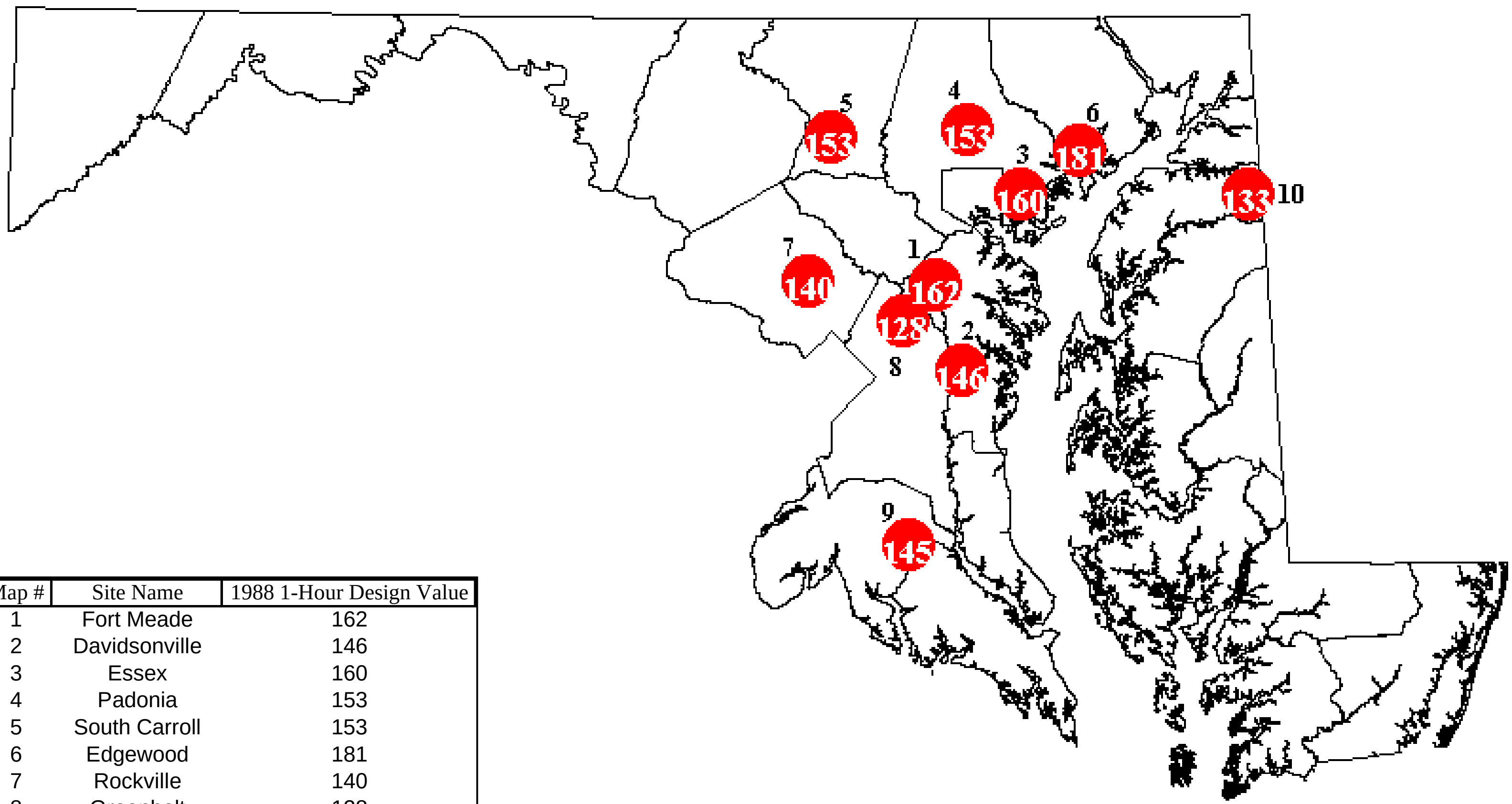
Ozone Monitor	Exceedances /3 Years 1988-1990	Exceedances /3 Years 2000-2002	Design Value 1988* in ppb	Design Value 2002 in ppb
South Carroll	0	0	153	110
Padonia	16	4	153	131
Essex	17	6	160	142
Edgewood	24	16	181	146
Aldino	4 (began in1990)	13	NA	143
Ft. Meade	20	6	162	136
Davidsonville	12	8	146	133
Fairhill	(began in 1992)	11	NA	143

*Severe nonattainment areas were classified based on the 1988 design value under 1990 CAAA.

Table E-1 illustrates significant reductions in the number of monitoring site exceedances between the period directly before passage of the 1990 Clean Air Act Amendments and the last three years of data, 2000 to 2002. The table also shows a notable reduction in design values for monitors in the Baltimore region between the data used to classify the Baltimore region as a severe nonattainment area and current design values. The peak monitors have shown the most dramatic reduction.

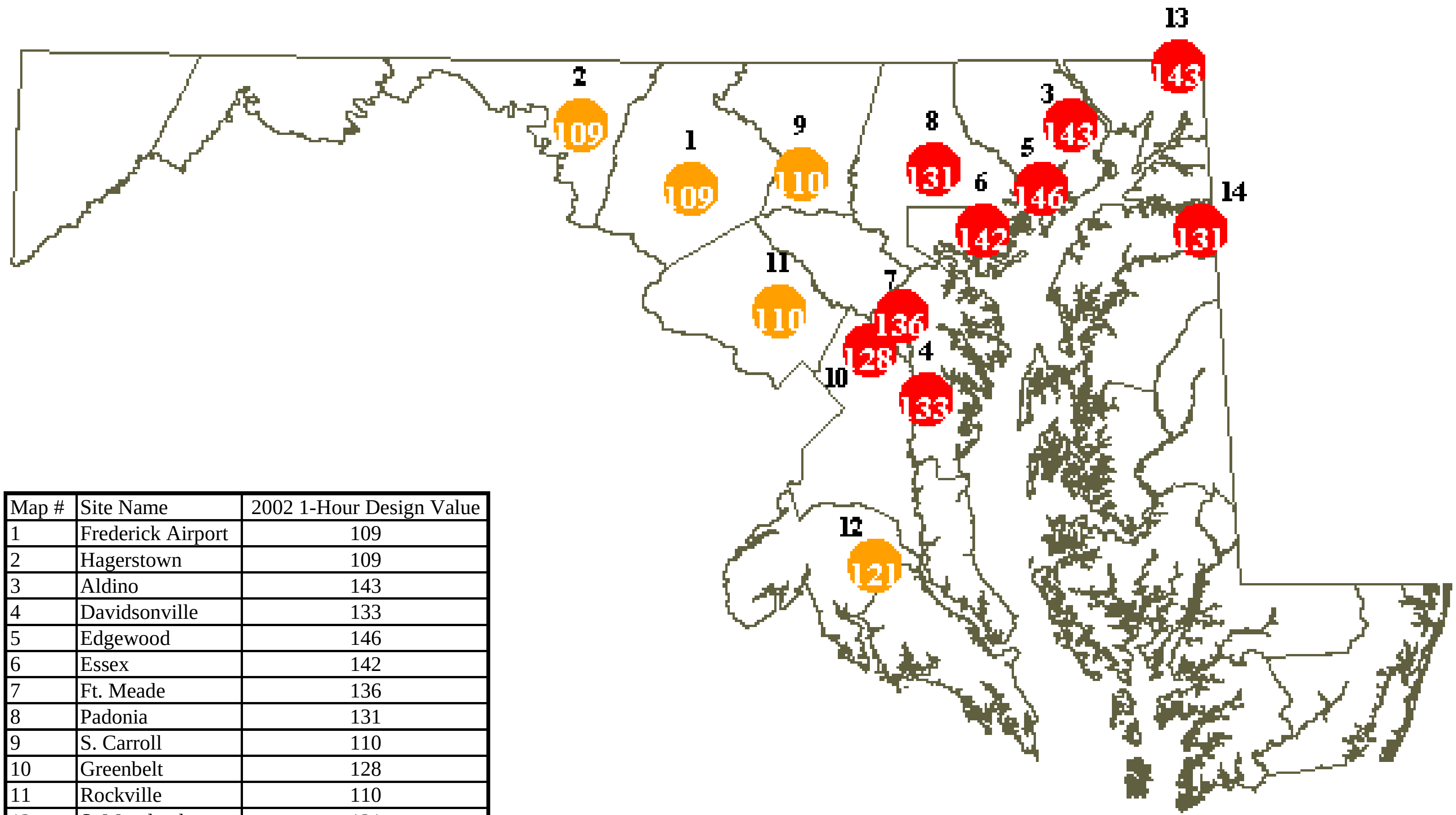
[3] Policy Guidance on the Use of MOBILE6 for SIP Development and Transportation Conformity, USEPA Office of Air and Radiation, January 18, 2002.

Map of 1988 1-Hour Design Values



Map #	Site Name	1988 1-Hour Design Value
1	Fort Meade	162
2	Davidsonville	146
3	Essex	160
4	Padonia	153
5	South Carroll	153
6	Edgewood	181
7	Rockville	140
8	Greenbelt	128
9	South Maryland	145
10	Millington	133

Map of 2002 1-Hour Design Values



Map #	Site Name	2002 1-Hour Design Value
1	Frederick Airport	109
2	Hagerstown	109
3	Aldino	143
4	Davidsonville	133
5	Edgewood	146
6	Essex	142
7	Ft. Meade	136
8	Padonia	131
9	S. Carroll	110
10	Greenbelt	128
11	Rockville	110
12	S. Maryland	121
13	Fair Hill	143
14	Millington	131

Although design values have decreased in the region, values continue above the ozone standard. This is due in part to the fact that not all reduction programs have been fully implemented at this time. Significant reductions within Maryland from the NOx SIP Call will be complete next year. It is also due to ozone precursor emissions and ozone concentrations aloft from outside and upwind of Maryland contributing to ozone concentrations in the State. Additional emission reductions from within Maryland and outside Maryland should result in further improvement in the air quality data in the next years. The air quality data trends will be evaluated fully as part of the Mid-Course Review.

<u>Appendix F: EPA Policy Guidance Memo</u>

Use of MOBILE6 for SIP Development and Transportation Conformity (pages 8-10)

1. <u>When existing attainment and maintenance SIPs and motor vehicle emissions budgets are revised with MOBILE6, what do States need to submit to show that the SIP's purpose continues to be demonstrated?</u>

<u>General policy</u>: EPA will rely on its existing SIP policy and past experience in answering this question. Whenever motor vehicle emissions inventories and budgets in attainment or maintenance SIPs are revised, it is important to ensure that the SIP continues to demonstrate its Clean Air Act purpose (e.g., attainment, maintenance). For example, if a State revises a maintenance plan to add or delete control measures, the State needs to show in its revised SIP that maintenance continues to be demonstrated with the new mix of control measures. EPA has always required under the Clean Air Act that revisions to existing SIPs and budgets continue to demonstrate the purpose of the SIP. Similarly, States that revise existing SIPs with MOBILE6 must show that the SIP continues to support attainment or maintenance with the new level of motor vehicle emissions calculated by the new model.

The transportation conformity rule (40 CFR 93.118(e)(4)(iv)) requires that "the motor vehicle emissions budget(s), when considered together with all other emissions sources, is consistent with applicable requirements for reasonable further progress, attainment, or maintenance (whichever is relevant to the given implementation plan submission)." This criterion must be satisfied before EPA can find submitted budgets adequate for use in the conformity process. The following paragraphs articulate EPA's policy for existing SIPs that are revised with MOBILE6, including ideas for how to streamline these revisions whenever possible. This policy will apply to all SIP revisions completed with MOBILE6, including revisions to SIPs and budgets that relied on interim MOBILE5-based Tier 2 estimates.

<u>Use of latest planning assumptions</u>: If SIPs are revised with MOBILE6, base year and attainment/maintenance year motor vehicle emission inventories will need to be recalculated with the latest available planning assumptions. As required by Clean Air Act §172(c)(3) and EPA's regulation at 40 CFR 51.112(a), states must use the latest planning assumptions available at the time that the SIP is developed, including but not limited to the latest information for vehicle miles traveled (VMT), speeds, fleet mix, and SIP control measures. Base year and historical year inventories should use the best data available for those years. Future year projection inventories must be based on the latest data available. If planning assumptions have not changed since the original SIP was submitted, the State should document this in its new SIP submission.

In addition, States must consider whether growth and control strategy assumptions for non-motor vehicle sources (i.e., point, area and non-road mobile sources) are still accurate at the time that the MOBILE6 SIP revision is developed. Such assumptions include population and economic assumptions and any allowable emissions relied upon for stationary sources. If these assumptions have not changed, the State can simply re-submit the original SIP with the revised motor vehicle emission inventories and budgets. Otherwise, the emissions categories in the SIP that have changed must be brought up to date.

Attainment or maintenance demonstration: As discussed above, SIP revisions based on MOBILE6 must continue to demonstrate that the SIP still demonstrates its purpose (e.g., attainment or maintenance) when the MOBILE5-based motor vehicle emission inventories are replaced with MOBILE6 inventories. The level of effort needed for this demonstration can vary depending upon how MOBILE6 affects the level of motor vehicle emissions and whether non-motor vehicle inventories require updating. The method used in the original demonstration could also be a factor.

Areas can revise their motor vehicle emissions inventories and budgets using MOBILE6 without revising the entire SIP or completing additional modeling if: 1) the SIP continues to demonstrate attainment or maintenance when the MOBILE5-based motor vehicle emission inventories are replaced with MOBILE6 base year and attainment/maintenance year inventories; and, 2) the State can document that the growth and control strategy assumptions for non-motor vehicle sources (i.e., point, area and non-road mobile sources) continue to be valid and any minor updates do not change the overall conclusions of the SIP. For example, consistent with EPA's SIP modeling guidance for various pollutants, if an ozone SIP relied on changes in emissions from the base year to an attainment or maintenance year inventory to estimate relative changes in monitored ozone levels, the first criterion could be satisfied by demonstrating that the relative emission reductions between the base year and the attainment or maintenance year are the same or greater using MOBILE6 than they were using MOBILE5.

Alternatively, if an ozone attainment SIP relied on absolute model predictions for the future attainment year, then the first criterion could be satisfied by demonstrating that the MOBILE6 estimates are equal to or lower than the MOBILE5 estimates for the future attainment year. Or, if a carbon monoxide ©) maintenance plan relied on either a relative or absolute determination, the first criterion could be satisfied by documenting that the relative emissions reductions between the base year and the maintenance year are the same or greater using MOBILE6 as compared to MOBILE5. In any case, if using the latest planning assumptions for emissions estimates results in changes to other emissions categories (e.g., point or area emissions), the demonstration would apply to the entire inventory, rather than just the on-road mobile inventory.

If both of the above criteria are met, the State can simply re-submit the original SIP with the revised MOBILE6 motor vehicle emissions inventories. If either criteria are not met, the emissions categories in the SIP that have changed must be brought up to date. Any changes in mobile or non-mobile control strategies, including stationary source inventories, must be factored in to both base and future year inventories to determine if they would indicate a nonattainment problem. However, a State would not necessarily have to revise a non-mobile emissions inventory category just to account for a regulatory or permit change that *reduces* these emissions in an attainment or maintenance year relative to the existing SIP.

It should be noted that regardless of the technique used for attainment or maintenance demonstrations, a more rigorous reassessment of the SIP's demonstration may be necessary if a State decides to reallocate possible excess emission reductions to the motor vehicle emissions budget as a safety margin. In other words, the State will need to assess how its original attainment demonstration is impacted by using MOBILE6 vs. MOBILE5 before it reallocates any apparent motor vehicle emission reductions resulting from the use of MOBILE6.

<u>States completing mid-course reviews</u>: As described in question 3 of this guidance, if a State that has committed to complete a mid-course review cannot demonstrate that the SIP shows attainment with the revised MPOBOILE6 inventories, the State can submit an enforceable commitment to do one of the following in its mid-course review: 1) submit additional measures needed to fill any emission reduction shortfall (if a shortfall is confirmed in the mid-course review; or 2) document that the mid-course review reflects that there is no emission reduction shortfall. Such a commitment, if needed, would be submitted as part of the MOBILE6 SIP revision, and this commitment is necessary for EPA to find the revised MOBILE6-based motor vehicle emission budgets adequate for conformity purposes.

<u>EPA assistance</u>: States are expected to consult with their EPA Regional Office prior to submitting MOBILE6 SIP revisions. Early consultation can limit delays in EPA's adequacy or approval processes. EPA will work with States on a case-by-case basis to decide what additional documentation, analyses, and for mid-course review areas, other commitments (as described above) that are necessary to show that the SIP revision demonstrates its intended purpose (e.g., attainment or maintenance). For example, EPA is available to discuss whether additional SIP documentation for validating or updating non-motor vehicle emissions inventories or air quality modeling is needed. EPA will consider issuing additional guidance in the future if additional issues and questions arise.