Appendix C

Mobile Source Emissions Modeling for Atlanta Ozone Reasonable Further Progress State Implementation Plan

Overview

The Georgia Environmental Protection Division (EPD) worked with the Atlanta Regional Commission (ARC) to develop mobile[1] source emissions inventories for the purpose of establishing motor vehicle emission budgets (MVEB) for the Atlanta 8-Hour Ozone Reasonable Further Progress (RFP) State Implementation Plan (SIP) revision, hereinafter called the Ozone RFP Plan. These inventories reflect the most recent planning assumptions and emission factor model[2] available, and the use of updated travel demand and emissions calculation models. The ARC's travel demand and emissions estimation modeling process was employed to estimate on-road mobile source emissions. The mobile source emission inventories for the Ozone RFP Plan MVEB were calculated in a manner consistent with federal regulations for performing regional emissions analyses used in transportation conformity determinations. The alignment of methodologies for mobile source inventories and transportation conformity emissions analyses prevents spurious differences between motor vehicle emission budgets (i.e., the SIP's estimate of future mobile source emissions) and transportation conformity analyses that must conform to those budgets.

The 20-county Atlanta ozone nonattainment area was originally classified as a "marginal" nonattainment area. With an attainment year of 2007, marginal 8-hour ozone areas were required to attain the National Ambient Air Quality Standards (NAAQS) by the 2006 ozone season. Because monitoring data from the 2006 ozone season indicated that Atlanta had not attained the NAAQS, the area was reclassified[3] to "moderate." In ozone nonattainment areas with air quality classified as moderate or worse, a reasonable further progress demonstration, per Section 182(b) of the Clean Air Act (CAA), requires emission reductions equaling 15% within six years of the base year (i.e., by the end of 2008 for the 8-hour ozone NAAQS).

The initial 15% reduction must be in emissions of volatile organic compounds (VOC). Per 40 CFR Part 51.910(a)(1)(iii), Requirements for Preparation, Adoption, and Submittal of Implementation Plans, moderate areas of which a portion has an approved 1-hour ozone 15% VOC Plan can choose to treat the nonattainment area as two parts, each with a separate RFP target, and may substitute reductions in nitrogen oxides (NOx) for VOC in the sub-area with the approved 15% Plan. The 15% reduction for the sub-area without an approved 15% VOC Plan must still be entirely VOC. Because photochemical air quality modeling indicates that NOx reductions are more effective than VOC reductions in reducing ozone concentrations in the region,[4] Georgia has chosen to rely solely on NOx emission reductions in the 13-county part of the Atlanta ozone nonattainment area with an approved 15% VOC Plan.

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[1] The term "mobile" is used to describe emissions from on-road motor vehicles.
[2] MOBILE6.2.03 (http://www.epa.gov/otaq/m6.htm#m60)
[3] 73 Federal Register 12013, March 6, 2008
[4] See Appendix A, Sensitivity of ozone concentrations in Atlanta to NOx and VOC controls inside and outside the nonattainment area (http://www.gaepd.org/Files_PDF/plans/sip/app_a_nox_substitution_and_out_of_area_benefits.pdf)

For use in making transportation conformity determinations for the Atlanta 8-hour ozone nonattainment area, the Ozone RFP Plan will establish MVEB for the year 2008. In contrast with previous EPA guidance and with Georgia's approved Post-1996 9% Plan and Post-1999 ROP[5] Plan, this Ozone RFP Plan does not rely on any emission reductions outside the nonattainment area. As determined through interagency consultation, the emission factors used reflect an assumption that ethanol-blend gasoline had 100 percent market share in summer 2008. Modeling assumptions were distributed to the interagency consultation partners on October 28, 2008.

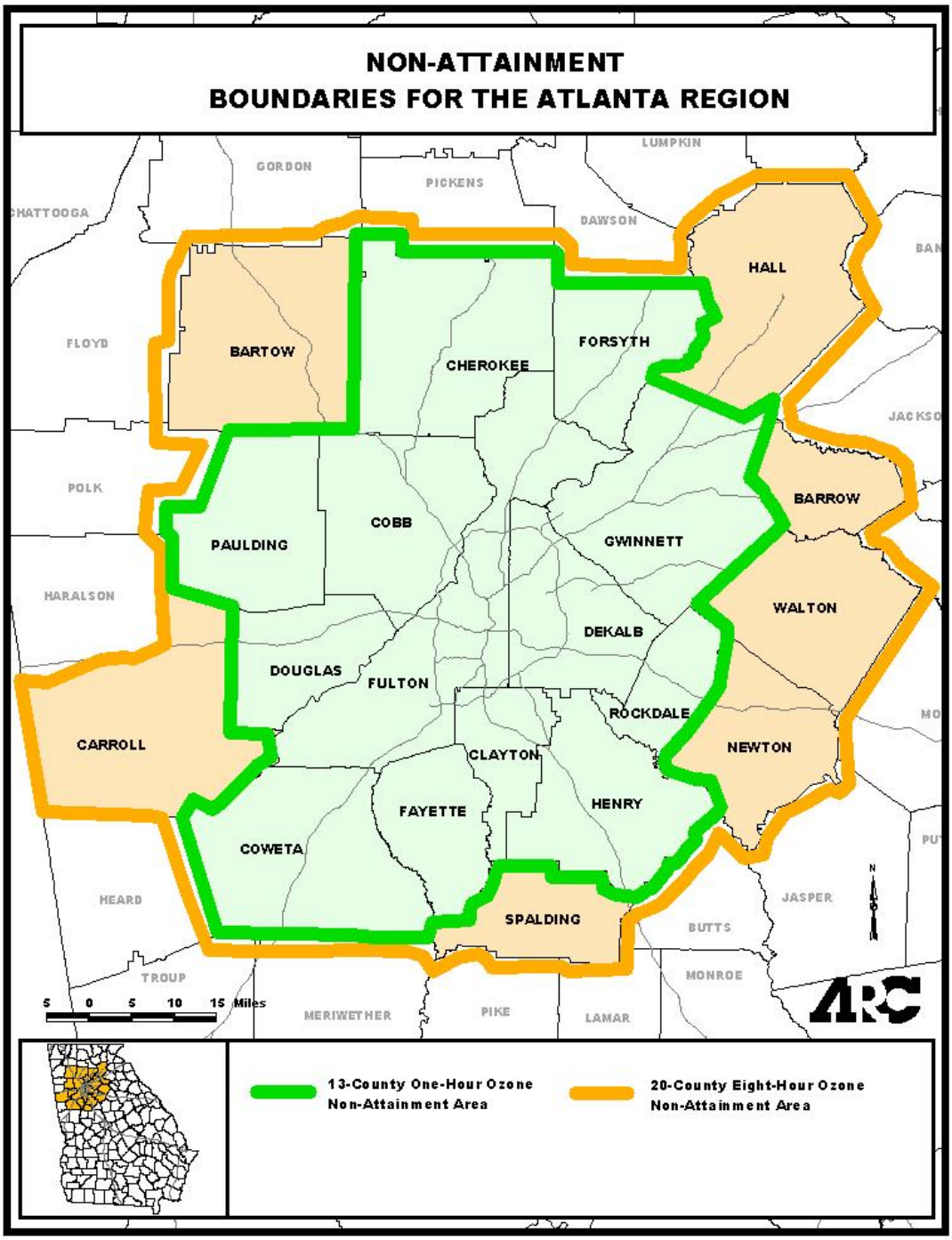
Mobile Source Emissions Inventory

In order to develop the Ozone RFP Plan MVEB, 2002 Base Year and 2008 budget year VOC and NOx emission inventories for the 20-county eight-hour ozone nonattainment area were produced. Reference Figure C-1 for a map of the nonattainment area. The Base Year inventories were adjusted by removing VOC and NOx already scheduled for control by previous federal regulations on motor vehicles and gasoline volatility as required by Section 182(b)(1) of the CAA.

According to the EPA's MOBILE6 policy guidance,[6] "If SIPs are revised..., base year...motor vehicle emission inventories will need to be recalculated with the latest available planning assumptions... Base year...inventories should use the best data available for those years." The motor vehicle emissions inventories for years 2002 and 2008 for the 20 counties that comprise the 8-hour ozone nonattainment area reflect the latest travel demand and emissions modeling processes used for transportation conformity purposes by the ARC, and latest available planning assumptions as documented in Appendix C, Exhibits 3 and 4.

[5] The terminology EPA uses for progress towards attainment has been codified at 40 CFR Part 51.900: "reasonable further progress" (RFP) is used for the 8-hour ozone NAAQS, "rate of progress" (ROP) is used for the former 1-hour NAAQS.
[6] http://www.epa.gov/otaq/models/mobile6/m6policy.pdf

Figure C-1
Atlanta Ozone Nonattainment Area



Emissions Inventory - 20 County Eight-Hour Ozone Nonattainment Area

In support of Ozone RFP Plan MVEB development, the ARC produced nonattainment area mobile emissions inventories for the 2002 Base Year, the 2002 Adjusted Base Year, and the 2008 RFP budget year. The travel demand and emissions modeling process and the planning assumptions used for the Ozone RFP Plan are summarized below and in Appendix C, Exhibits 3 and 4.

The ARC currently maintains a travel model for 20 counties that correspond to the eight-hour ozone nonattainment area. The ARC travel demand model is designed to, at minimum, represent the state of the practice in travel demand modeling and to meet all modeling requirements specified in the federal Transportation Conformity Rule (40 CFR Parts 51 and 93). The Transportation Conformity Rule establishes a regulatory requirement that includes minimum specifications for travel models used to forecast vehicle activity for regional emission analyses in certain nonattainment and maintenance areas. These minimum specifications (see 40 CFR Section 93.122(b)) apply to metropolitan planning areas with an urbanized area population over 200,000 that are also serious, severe, or extreme ozone; or serious carbon monoxide; nonattainment areas. Atlanta met those conditions under the one-hour ozone standard, for which the area had been classified as serious (effective January 6, 1992) and severe (effective January 1, 2004), before being redesignated to attainment of the one-hour ozone standard (effective June 14, 2005). Because travel model VMT are adjusted to count-based estimates before being used for emissions calculations, the biggest remaining difference between network-model-based activity and activity estimated using other "appropriate methods [40 CFR Section 93.122(d)]" is the level of speed averaging. Despite the fact that Atlanta's current ozone nonattainment classification (moderate) would not otherwise subject it to the modeling requirements of 93.122(b), EPA regulations[7] require the continued use of activity from network-based travel models for transportation conformity emissions estimates in Georgia.

A full consultation process, including national peer review, and the ARC strategic travel demand model enhancement program guide all modifications to the travel demand model. As a result, all elements of the travel demand model are designed to support all technical and policy decisions that are required in developing a comprehensive, multimodal transportation plan and program in accordance with the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), the 1990 Clean Air Act Amendments, and the Transportation Conformity Rule.

The previously most recent emissions inventories developed using ARC's travel demand and emissions modeling process were completed as part of the transportation conformity

[7] "In all areas not otherwise subject to paragraph (b) of this section, regional emissions analyses must use those procedures described in paragraph (b) of this section if the use of those procedures has been the previous practice of the MPO [40 CFR Section 93.122(d)]."

analysis for ARC's Envision6 2030 Regional Transportation Plan (RTP) and associated FY 2008-2013 Transportation Improvement Program (TIP); and the Gainesville-Hall MPO's 2030 RTP and associated 2008-2013 TIP; approved by the U.S. Department of Transportation (USDOT), in consultation with the EPA, on October 10, 2007. A number of enhancements to the travel demand model, described below, are reflected in those inventories and in the inventories developed for the Ozone RFP Plan MVEB. Some changes to the travel model were a result of a significant model recalibration initiated after the expansion of the modeling platform from a 13-county to a 20-county geography. Enhancements include updated population and employment estimates that reflect the expanded modeling platform, as well as structural changes within the model needed to recalibrate to its base year, 2000, including the following:

- Mode choice model updated to improve performance of suburban intra-county trips,
- Attraction share model incorporated into four-step modeling process, and
- New commercial vehicle and truck model developed to improve traffic assignment for both passenger vehicles and truck traffic.

The ARC's emissions model has also been updated to reflect all travel model improvements resulting from expansion to the 20-county geography and subsequent 2000 base year recalibration. The emissions modeling procedure requires input of travel model networks for the specific scenario years, in this case 2002 and 2008. External files that specify VMT adjustment factors and MOBILE6 emission factors are also required. Changes to these networks and external files include the following:

- Network files reflect expansion of model system to cover the 20-county eight-hour ozone nonattainment area (2002 and 2008 travel model network years),
- Highway Performance Monitoring System (HPMS) adjustment factors[8] updated to reflect the latest 20-county travel model recalibration for year 2000,
- Updated seasonal adjustment factors, and
- Latest MOBILE6 emission factors.

Travel Model Networks

To prepare the mobile source emissions inventories for establishing the Ozone RFP Plan MVEB, it was necessary to create a 2002 transportation network that accurately reflected the transportation system in place during the 2002 base year, as well as a transportation network for 2008. The year 2002 network needed for the baseline inventory was derived from the base year 2000 travel model network; no regionally significant projects were opened to traffic between 2000 and 2002. Year 2002 population and employment data was interpolated from the latest regional control demographic forecasts documented in Appendix C, Exhibit 4 (http://www.gaepd.org/Files_PDF/plans/sip/exhibit_4_PopEmp_PlanAssumptions_042208.pdf).

[8] The VMT from the travel demand model are adjusted based on the VMT estimates that Georgia DOT develops for HPMS.

The year 2008 network needed for the 2008 RFP MVEB inventories was derived from the 2010 travel model network. Year 2008 population and employment data were interpolated from the latest regional control demographic forecasts documented in Appendix C, Exhibit 4.

A small portion of the Atlanta Urbanized Area extends into Hall County. In February 2003, the Gainesville-Hall MPO (GHMPO) was designated for the Gainesville Urbanized Area; the planning boundary for the GHMPO covers Hall County in its entirety. Hall County is included in Atlanta's ozone nonattainment area. The ARC, by agreement with the GHMPO, performs the emissions modeling for Hall County. Travel model networks reflect the project listing as approved:

- in ARC's Envision6 2030 RTP and 2008-2013 TIP; adopted by the ARC Board September 26, 2007; and received a positive conformity determination from USDOT October 10, 2007; and
- in the GHMPO's 2030 RTP and 2008-2013 TIP; adopted by the GHMPO Board August 14, 2007; and received a positive conformity determination from USDOT October 10, 2007

Project coding for network years 2002 (based on 2000 network) and 2008 (based on 2010 network) was reviewed by state and local project sponsors in March and April 2007 as part of the development of the Envision6 and GHMPO 2030 RTPs and FY 2008-2013 TIPs. Year 2002 and 2008 networks were run through a full travel model assignment procedure, based on the recalibrated model stream, to produce the VMT and speeds for the respective mobile source emission inventories.

VMT Adjustment Factors

Traffic volumes produced by the travel model are adjusted within the emissions modeling process by applying a VMT adjustment factor, which is a combination of HPMS adjustment factors, used to reconcile travel model VMT to HPMS VMT estimates,[9] and seasonal adjustment factors used to convert the average annual daily traffic produced by the travel model to average summer-time daily traffic for the purposes of ozone precursor emissions modeling.[10]

EPA requires[11] that reasonable methods be used to estimate VMT on off-network (off-model) roadways within the urban transportation planning area. Off-model VMT is travel that is accounted for within HPMS estimates, but not accounted for within the coded transportation network; it typically reflects travel on the local road system. EPA also recommends,[12] for areas with travel demand models in place, that HPMS adjustments be

[9] 40 CFR Sections 93.122(a)(7) and 93.122(b)(3)
[10] Section 3.4.2.6 *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*, EPA420-R-92-009, USEPA Office of Air and Radiation, Office of Mobile Sources, 1992.
[11] 40 CFR Section 93.122(a)(7)
[12] 40 CFR Section 93.122(b)(3)

made based on comparison of base year VMT from the transportation model to base year HPMS VMT estimates. The ARC calculates HPMS adjustment factors by comparing HPMS VMT to travel model VMT by 12 HPMS functional classes for the 2000 calibration year. The resulting factors are then applied to travel model VMT estimates for future analysis years. The following equation was used to calculate the HPMS adjustment factors:

$\text{HPMS Adjustment Factor}_i = \text{2000 HPMS VMT}_i / \text{2000 MODEL VMT}_i$
(where i=HPMS functional class)

To determine the "2000 HPMS VMT," average daily VMT for the year 2000 were grouped by the 12 HPMS functional classes for the 13 counties[13] that correspond to the nonattainment area for the previous 1-hour ozone standard where a 15% VOC Plan is in place, and, separately, for the 7 counties[14] that were not part of the 1-hour ozone nonattainment area, but are nonattainment under the 8-hour ozone standard, where there is not currently a 15% VOC Plan. County-level HPMS data by functional class was taken from the Georgia Department of Transportation's (Georgia DOT) Office of Transportation Data "445 Report." Georgia DOT's 445 Report provides information on mileage and VMT by route type and road system and contains county-specific State Route, County Road and City Street mileage and VMT broken down by functional classification. VMT by county and functional class were aggregated to total VMT by HPMS functional class. "2000 Travel Demand Model VMT" at the HPMS functional class level was derived from the recalibrated 2000 travel model network. HPMS adjustment factors for the 13- and 7- county areas are listed below.

Note that for the HPMS adjustment factors for the 7-county area, urban and rural HPMS VMT were combined by HPMS functional classification prior to comparing with ARC travel model VMT. Travel model network coding for the 7-county area took place in early 2006 and reflects the latest version (from the 2000 Census) of the urbanized area definition. The 2000 HPMS data that is used as the base for calculation of the adjustment factors reflects the 1990 Census urbanized area definition. Georgia DOT did not update to the 2000 Census definitions until calendar year 2005, with their 2004 445 Report. In order to avoid a disconnect between travel model VMT in the 7 counties coded with 2000 Census urban/rural designations and 2000 HPMS VMT that reflects the 1990 definition, the urban and rural VMT were combined by functional class before the factors were calculated. This produced four unique HPMS adjustment factors for the 7-county area, as opposed to 12 unique factors calculated for the 13-county area.

[13] (Cherokee, Clayton, Cobb, Coweta, DeKalb, Douglas, Fayette, Forsyth, Fulton, Gwinnett, Henry, Paulding, and Rockdale)
[14] (Barrow, Bartow, Carroll, Hall, Newton, Spalding, and Walton)

Table C-1
HPMS Adjustment Factors – 13 Counties

Functional Class Name	Functional Class Number	HPMS VMT	Model VMT	Factor
Rural Interstate	1	5,470,815	8,583,156	0.64
Rural Principal Arterial	2	3,578,882	3,579,075	1.00
Rural Minor Arterial	6	3,821,128	3,343,871	1.14
Rural Major Collector	7	3,510,608	4,021,609	0.87
Rural Minor Collector	8	1,191,162	1,121,165	1.06
Rural Local	9	3,322,148	5,199,188	0.64
Urban Interstate	11	35,934,531	35,043,828	1.03
Urban Other Freeway	12	5,765,979	2,422,195	2.38
Urban Principal Arterial	14	10,398,680	15,341,281	0.68
Urban Minor Arterial	16	22,101,606	18,118,598	1.22
Urbanized Collector	17	7,540,916	6,098,164	1.24
Urbanized Local	19	15,412,042	15,841,739	0.97

Table C-2
HPMS Adjustment Factors – 7 Counties

Functional Class Name	Functional Class Number	HPMS VMT	Model VMT	Factor
Rural Interstate	1	4,160,787	2,426,269	0.85
Rural Principal Arterial	2	3,912,496	1,299,608	0.97
Rural Minor Arterial	6	3,843,626	1,784,578	0.97
Rural Major Collector	7	2,498,042	1,435,602	1.80
Rural Minor Collector	8	1,019,255	303,600	1.80
Rural Local	9	3,112,673	1,515,043	1.09
Urban Interstate	11	322,200	2,510,593	0.85
Urban Other Freeway	12	0	310,430	0.85
Urban Principal Arterial	14	2,874	1,979,977	0.97
Urban Minor Arterial	16	17,640	2,952,583	0.97
Urbanized Collector	17	0	216,380	1.80
Urbanized Local	19	20,796	1,353,590	1.09

Summer (seasonal) adjustment factors are used to convert from average annual daily VMT to average summer-season daily VMT for the purposes of ozone precursor emissions modeling.[15] Seasonal adjustment factors were the latest factors provided by the Georgia DOT Office of Transportation Data, on August 9, 2006. Summer-adjustment factors for the 13- and 7- county geographies are listed below.

[15] *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources,* Section 3.4.2.6, EPA420-R-92-009, USEPA Office of Air and Radiation, Office of Mobile Sources, 1992.

Table C-3
Summer Adjustment Factors

Functional Class Name	13-County Factor	7-County Factor
Rural Interstate	1.05	1.04
Rural Principal Arterial	1.02	1.02
Rural Minor Arterial	1.01	1.01
Rural Major Collector	1.00	1.00
Rural Minor Collector	1.01	1.01
Rural Local	1.01	1.01
Urban Interstate	1.02	1.00
Urban Other Freeway	1.03	1.00
Urban Principal Arterial	0.99	1.00
Urban Minor Arterial	0.99	0.99
Urbanized Collector	0.97	1.00
Urbanized Local	0.97	0.97

HPMS adjustment factors were multiplied by the seasonal adjustment factors for each HPMS functional classification to produce a set of VMT adjustment factors by HPMS functional classification for 13-county and 7-county portions of the 20-county nonattainment area, separately. VMT adjustment factors are listed below.

Table C-4
VMT Adjustment Factors

Functional Class Name	13-County Factor	7-County Factor
Rural Interstate	0.67	0.89
Rural Principal Arterial	1.02	0.99
Rural Minor Arterial	1.16	0.98
Rural Major Collector	0.88	1.81
Rural Minor Collector	1.07	1.81
Rural Local	0.64	1.10
Urban Interstate	1.05	0.86
Urban Other Freeway	2.44	0.85
Urban Principal Arterial	0.67	0.97
Urban Minor Arterial	1.21	0.96
Urbanized Collector	1.21	1.80
Urbanized Local	0.95	1.06

MOBILE6 Emission Factors

Emission factors were produced for 2.5 miles per hour (mph), then 3 mph to 65 mph, inclusive, in one mile per hour increments for VOC and NOx using EPA's MOBILE6.2.03 model. Mobile source emissions are calculated by multiplying the VMT

for each link[16] in the travel model network by the corresponding VMT adjustment factor (by HPMS class), then by an emission factor that corresponds to the congested flow speed of the link. Link level emissions are then summed to the time of day, and daily level, for reporting purposes.

Emission factors reflect two types of programs, the federally mandated motor vehicle emission control programs and the locally specific parameters for Atlanta.

Federal Programs	Regional Parameters
National Low Emission Vehicle Standards	Average Fuel Volatility
Heavy-Duty Vehicle Emission Standards	Vehicle Registration Information
Tier 1 Emission Standards	Ambient Weather Conditions
Tier 2 Emission Standards[17]	Inspection & Maintenance Program
	Low-Sulfur Georgia Gasoline[18]

MOBILE6 estimates emissions for four types of "driving cycle" - arterial/collector, freeway, ramp, and local road. It is assumed that all VMT by motor vehicles will occur in one of these four driving cycles. Each driving cycle implies different assumptions about vehicle activity and different emission estimates in MOBILE6. The definitions of the different driving cycles from EPA's *Technical Guidance on the Use of MOBILE6.2 for Emission Inventory Preparation*[19] are given below.

- Freeway Driving Cycle

In MOBILE6, "freeway" VMT refers to driving that occurs on roadways that do not have traffic signals, that usually have limited access (via converging ramps) and have free flow speeds greater than 50 miles per hour. These roadways are usually divided and have more than one lane in each direction. This definition does not include short sections (less than two miles) of a roadway between signals, but could include longer roadway segments that effectively act as freeways.

- Arterial/Collector Driving Cycle

In MOBILE6, "arterial/collector" VMT refers to driving that occurs on roadways that have signalized traffic control. These roadways are not freeways, because they have traffic signals, but they may be divided, multiple lanes, one-way and have high free-flow speeds. However, traffic will be stopped periodically by traffic signals and will be

[16] A link refers to a section of the modeled road network in which none of the describing attributes change (e.g., link "A" is a segment of a highway that has 4 lanes with speed limit of 55; if the number of lanes changes, then a new link should be coded).
[17] (beginning with 2004 models)
[18] when different from federal sulfur levels
[19] http://www.epa.gov/otaq/models/mobile6/420r04013.pdf

further affected by access to the roadway by driveways and un-signalized intersections. Even in free flow, the driving on arterial/collector roadways will be characterized by cruising periods interrupted by traffic signals.

- Local Roadway Driving Cycle

In MOBILE6, "local roadway" VMT refers to driving on roadways that are not normally considered as part of the traffic network. These roadways do not have traffic lights and rarely have more than one lane in each direction. They usually allow vehicle parking on the roadway surface and traffic control is handled via stop/yield signs. Speed limits are normally 30 miles per hour or less. The driving cycle used in MOBILE6 to model local roadways is fixed at an average speed of 12.9 miles per hour. Driving on local roadways is characterized by extremely low speeds and frequent stops at intersections.

- Freeway Ramp

In MOBILE6, "freeway ramp" VMT refers to the access roadways for freeways. It includes both traffic entering the freeway and exiting. Driving on freeway ramps is characterized by rapid acceleration from stop or low speeds to freeway speeds and decelerations from freeway speeds to low speeds or stop. Freeway ramp activity is not included in the MOBILE6 freeway roadway definition. Therefore, all freeway activity must include a corresponding freeway ramp activity to account for acceleration and deceleration to and from freeway speeds.

Many areas do not explicitly account for freeway ramps as a separate roadway type so EPA developed a default ramp fraction (8% of freeway travel) for MOBILE6 users to account for this. This approach is not necessary for Atlanta's nonattainment area freeway emission estimates because freeway ramps have been explicitly defined in the ARC highway network. Freeway ramps have been defined as separate facilities stratified by the type of design and speed, high, medium and low. High-speed ramps represent ramps that connect freeway-to-freeway travel, such as I-285 to I-85N, while the lower speed ramps are for access to a freeway from an arterial or egress from a freeway to an arterial. The high-speed ramps in the ARC model have significantly higher free-flow speeds than the lower speed ramps and are not characterized by rapid acceleration or by deceleration from freeway speeds to low speeds or stops. Based on guidance from EPA, emissions for high-speed freeway ramps are estimated using non-ramp freeway emission factors while emissions for lower speed freeway ramps are estimated using freeway ramp emission factors.

In MOBILE6, only arterial/collector and freeway emissions are speed sensitive. Emission factors were produced for 2.5 miles per hour and, in one mile per hour increments, between 3 mph and 65 mph, inclusive, for these two driving cycles. The all-vehicles composite emission factors were used to develop the mobile source emissions inventories for the MVEB.

Emission factors are applied to travel model VMT based on the appropriate driving cycle and congested flow speed. The mapping of MOBILE6 roadway type to both HPMS functional class and ARC roadway facility type[20] used for the MVEB emissions modeling is shown in Tables C-5 and C-6, below. The appropriate MOBILE6 roadway type can be determined by using the facility type definitions in the highway network except for the rural other principal arterial. EPA believes that facilities with the HPMS classification of rural other principal arterial should be modeled using a combination of the freeway and ramp emission factors. EPA has recommended that the freeway emission factors be applied to 92% of the VMT while the ramp emission factors be applied for the remaining 8% of the VMT for these facilities. This is the only case where a combination of emission factors by driving cycle is used for the same functional classification. In the ARC highway networks, facilities with rural other principal arterial HPMS classifications have different facility types, ranging from expressway to different types of arterials. Within the ARC emissions modeling procedure, the HPMS functional classification, facility type, and free-flow speed for each link are checked to determine the appropriate MOBILE6 driving cycle for this category. Only links with a facility type of arterial or collector, an HPMS classification of rural other principal arterial, and a free-flow speed greater than 50 mph, will have the VMT adjusted based on the above criteria. Facilities with a freeway facility type and an HPMS classification of rural other principal arterial will not be adjusted. Table C-5 lists the mapping of HPMS functional classes to MOBILE6 driving cycles and Table C-6 lists the mapping of the ARC facility types to the MOBILE6 driving cycles.

[20] ARC uses a more refined breakdown of roadway types for travel demand modeling to enable a more accurate estimate of roadway volumes and speeds. ARC roadway types are referred to as Facility Types.

Table C-5
HPMS Functional Classifications
Mapped to MOBILE6 Driving Cycles

HPMS Highway Functional System	MOBILE6 Driving Cycle
Rural interstate	Freeway and freeway ramp
Rural other principal arterial	Freeway and freeway ramp
Rural minor arterial	Arterial/collector
Rural major collector	Arterial/collector
Rural minor collector	Arterial/collector
Rural local	Local
Urban interstate	Freeway and freeway ramp
Urban other freeways	Freeway and freeway ramp
Urban other principal arterial	Arterial/collector
Urban minor arterial	Arterial/collector
Urban collector	Arterial/collector
Urban local	Local

Table C-6
Listing of ARC Facility Type Classifications
by MOBILE 6 Driving Cycles

Facility Type Classification	Code	Area Type	MOBILE6 Driving Cycle
Interstate/Freeways	1	Urban/Rural	Freeway
Parkway	2	Urban/Rural	Freeway
HOV Buffer Separated	3	Urban/Rural	Freeway
HOV Barrier Separated	4	Urban/Rural	Freeway
High Speed Ramps/CD Roads	5	Urban/Rural	Freeway
Principal Arterial – Class I*	12	Rural	Arterial/collector or Freeway and Ramp
Principal Arterial – Class I	12	Urban	Arterial/collector
Principal Arterial – Class II*	13	Rural	Arterial/collector or Freeway and Ramp
Principal Arterial – Class II	13	Urban	Arterial/collector
Minor Arterials – Class I	14	Rural	Arterial/collector
Minor Arterials – Class I	14	Urban	Arterial/collector
Minor Arterials – Class II	15	Rural	Arterial/collector
HOV Arterials	16	Urban/Rural	Arterial/collector
Major Collector	17	Urban/Rural	Arterial/collector
Minor Collector	18	Urban/Rural	Arterial/collector
Medium Speed Ramp	6	Urban/Rural	Ramp
Low Speed Ramp	7	Urban/Rural	Ramp
Loop Ramp	8	Urban/Rural	Ramp
Off Ramp w/Intersection	9	Urban/Rural	Ramp
On Ramp w/Intersection	10	Urban/Rural	Ramp
Planned Ramps w/Intersections	19	Urban/Rural	Ramp
Planned Directional Ramps	20	Urban/Rural	Ramp
Centroid Connectors	0	Urban/Rural	Local

**If HPMS classification is Rural Other Principal Arterial and free-flow speed is >50 mph - 92% of VMT allocated to freeway while 8% allocated to ramp*

Specific variables within the MOBILE6 inputs for the MVEB inventories are documented below.

- Ambient Weather Conditions

MOBILE6 allows relative humidity and temperature to be input for each hour of the day, with a single entry for barometric pressure. Hourly humidity and temperature inputs, and daily barometric pressure, were derived from National Weather Service Local Climatological Data from the 10 days with the highest ozone concentrations for the three-year period 2000-2002. The hourly humidities and temperatures were averaged across

the 10 days. The daily average barometric pressures for the 10 days were also averaged. See Exhibit 1 for details.[21]

- Fleet Age

Separate, area-specific registration distributions by age for the 13- and 7-county parts of the Atlanta ozone nonattainment area, developed using registration data obtained from R.L. Polk & Company,[22] were modeled. In keeping with EPA guidance,[23] the MOBILE6 default distribution was used for the heaviest (Class 8B) heavy-duty vehicles.

- Gasoline[24]

The 2002 Base Year and the 2008 RFP budget year mobile source emissions inventories for the Atlanta 8-hour ozone nonattainment area reflect the effects of the low-sulfur and low RVP gasoline required by state rule in and near the nonattainment area. In 2002, sulfur and RVP were 150 parts per million average and 7.0 pounds per square inch, respectively. For the 2008 RFP budget year, Phase 2 Georgia Gas (30 ppm sulfur, 7.0 psi RVP) with 100% market share ethanol blend (10% by volume) and an RVP waiver was assumed. Per Georgia's Gasoline Marketing Rule, 391-3-1-.02(2)(bbb), this waiver allows the RVP of ethanol blend gasoline to rise as high as 8.0 psi.

- Vehicle Inspection and Maintenance Program

The vehicle inspection and maintenance (I/M) program in place in 1990 was modeled for the nonattainment area Adjusted Base Year mobile source inventory. This was a decentralized program for 12-years-old-and-newer cars and light trucks in Cobb, DeKalb, Fulton, and Gwinnett counties. That annual program consisted of an idle test and a check for tampering of three items: air pump system, catalytic converter, and fuel inlet restrictor. For 2002 Base Year and 2008 mobile source emissions modeling, the enhanced I/M program[25] in place in the 13-county part of the nonattainment area was modeled. This annual program requires onboard diagnostics system checks on 1996 and newer model year cars and light trucks, 2-mode ASM tests on 25-year-old through 1995

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[21] http://www.gaepd.org/Files_PDF/plans/sip/exhibit_1_hourly_temp_and_humidity.pdf

[22] Registration data was from R. L. Polk & Co.'s National Vehicle Population Profile ® current as of October 2002 and from R. L. Polk & Co.'s TIPNet ® current as of March 2003. See Exhibit 2, http://www.gaepd.org/Files_PDF/plans/sip/exhibit_2_2002_registration_distributions.pdf, for more details on the registration distributions by age.

[23] "EPA encourages and recommends the use of actual locality-specific...registration distributions by age in the development of SIP emission inventories. One exception to this would be areas having relatively few local HDDV registrations, but significant interstate trucking activity within the local area. Such areas may want to retain and use the [MOBILE] national registration distributions." Section 2.2.3.6, *User's Guide to MOBILE5*.

[24] In 1999, Georgia's two-phase gasoline sulfur control program limited average sulfur in gasoline sold in the 13-county Atlanta area and in 12 surrounding counties to 150 parts per million (ppm). In addition, there is a seasonal (June 1 to September 15) 7.0 pounds per square inch (psi) Reid vapor pressure (RVP) cap on gasoline sold in this Phase 1 area. In 2003, Phase 2 of Georgia's gasoline rule reduced average sulfur to 30 ppm and added 20 additional counties outside the 20-county ozone nonattainment area to the sulfur and (seasonal) RVP control program.

[25] See Rules for Enhanced Inspection and Maintenance, Chapter 391-3-20, http://www.gaepd.org/Files_PDF/rules/rules_exist/391-3-20.pdf

model year vehicles; a check for catalytic converter tampering on 25-year-old through 1995 model year vehicles; and a gas cap pressure test on all subject vehicles.

Additional detail related to development of emission factors used for the Ozone RFP Plan emissions inventory is provided in Appendix C, Exhibit 3 (http://www.gaepd.org/Files_PDF/plans/sip/exhibit_3_PlanAssumptions_102808.pdf).

Emission Inventory Files

The MOBILE6 input variables are specified in the input files. Exhibit 5 contains abbreviated versions of the MOBILE6.2 input files used to model link-level, nonattainment area emission factors for the 2002 Base and Adjusted Base Years. There is a separate scenario in each input for each speed, with only the speed varying. To conserve space, most of the speed scenarios are omitted from these inputs:
http://www.gaepd.org/Files_PDF/plans/sip/exhibit_5_base_and_adj_base_inputs_ozone_rfp.pdf

Exhibit 6 contains abbreviated versions of the input files used to calculate emission factors for the 2008 nonattainment area MVEB inventories:
http://www.gaepd.org/Files_PDF/plans/sip/exhibit_6_2008_inputs.pdf

Exhibit 7 is a compressed file containing the complete MOBILE6.2 input files (filename.IN), plus the output (filename.TXT), post-processed output (filename.PRN) and supporting files (filename.D) used in modeling the mobile source emission inventories for the Ozone RFP Plan MVEB (all these files are in ASCII text format):
http://www.gaepd.org/Files_PDF/plans/sip/exhibit_7_mobile_files_ozone_rfp.zip

Loaded network files that list VMT, speeds, FIPS[26] code, facility type code, HPMS functional class code, VOC and NOx, etc., by time of day for each network link are produced by the emissions calculation model. These files were imported into database tables and daily emissions were then summarized. The data tables and the SQL queries used to summarize 2002 and 2008 link-level emissions are contained in a compressed Microsoft Access file available here:
http://www.gaepd.org/Files_PDF/plans/sip/02_and_08_network_database.zip

File size: 27 megabytes compressed, 74 megabytes expanded.

[26] Federal Information Processing Standard, a numerical code indicating state and county.