Mobile Source Emissions Modeling for Floyd County PM2.5 Maintenance Plan Motor Vehicle Emissions Budget

(updated February 27, 2012)

1.0 Overview

The Georgia Environmental Protection Division (EPD) worked with the Georgia Department of Transportation (GDOT) and the Floyd-Rome Urban Transportation Study (FRUTS), the Metropolitan Planning Organization (MPO) for Rome, to develop mobile[1] source emissions inventories for the purpose of establishing motor vehicle emissions budgets (MVEB) for the 2023 maintenance year for the Rome PM2.5 Maintenance State Implementation Plan (SIP) revision, hereinafter called the Rome PM2.5 Maintenance Plan. The 2023 mobile emissions were developed consistent with the single-run, annual-average-conditions approach described in EPA's August 9, 2005, *Guidance for Creating Annual On-Road Mobile Source Emission Inventories for PM2.5 Nonattainment Areas for Use in SIPs and Conformity*.[2] Consistent with this guidance, once this budget is found adequate or approved by EPA, subsequent emissions analyses for transportation conformity will also use the same annual-average-conditions approach used to establish the MVEB. These inventories reflect the most recent planning assumptions and emission factor model available, and the use of an updated travel demand model. The GDOT travel demand and emissions estimation modeling process was employed to estimate mobile source emission inventories to establish the MVEB for the Rome PM2.5 Maintenance Plan in a manner consistent with federal regulations for performing regional emissions analyses used in transportation conformity determinations. The alignment of methodologies for MVEB and transportation conformity emissions analyses reduces the possibility of spurious differences between motor vehicle emission budgets and transportation conformity analyses that must conform to those budgets.

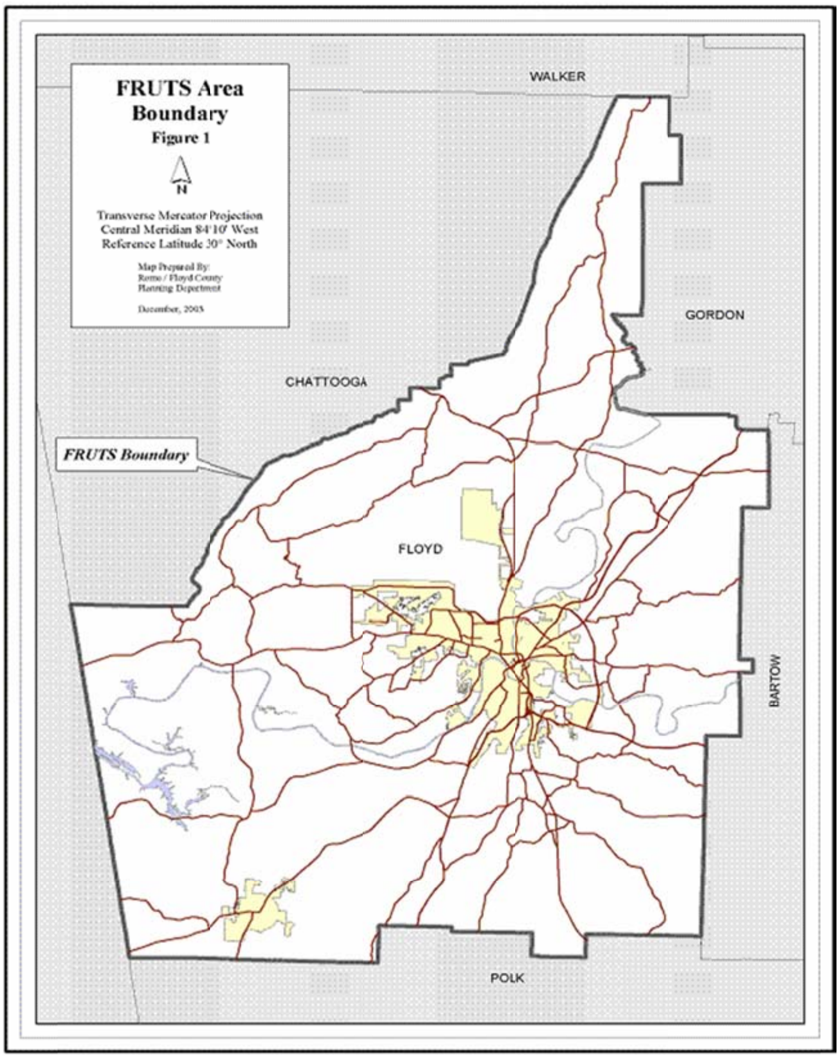
Effective April 5, 2005, the U.S. Environmental Protection Agency (EPA) designated Floyd County as nonattainment for the annual fine particulate (PM2.5) National Ambient Air Quality Standard. The PM2.5 standard is subject to Subpart 1 of the Clean Air Act., the more general nonattainment area planning and control requirements of the Act. The designation also defined the year 2010 as the deadline for the Rome area to attain the PM2.5 standard. Based on quality-assured and certified monitoring data for the 2007–2009 monitoring period, EPA determined that the Rome Area attained the 1997 annual PM2.5 NAAQS by the applicable attainment date of April 5, 2010 on April 5, 2011.

[1] The term "mobile" is used to describe emissions from on-road motor vehicles.
[2] http://epa.gov/otaq/stateresources/transconf/policy/420b05008.pdf

1.1 Planning Boundaries

As the MPO for the Rome urbanized area, FRUTS is responsible for the continuing, cooperative, and comprehensive metropolitan planning process required by Title 23 U.S.C. 134. Based on the 2010 Census, the Rome MPO defined their planning boundary as all of Floyd County; which is consistent with the PM2.5 nonattainment boundary. Figure 1.1-1 illustrates the effective boundary.

Figure 1.1-1
Rome-Floyd County and Nonattainment Area



1.2 Emissions Analysis – Models and Assumptions

In accordance with Section 93.105(b) of the Transportation Conformity Rule and Sections 106(g) and 106(h) of Georgia's transportation conformity SIP, all of which require interagency consultation for SIP development, a detailed listing of the procedures and planning assumptions used for the regional emissions analysis supporting development of the MVEB was distributed to the interagency consultation committee for review on September 15, 2011. The assumptions used to develop Rome's conforming Long Range Transportation Plan and Transportation Improvement Program were also used to develop the network and emissions for the Rome PM2.5 Maintenance Plan MVEB, which required emissions for the year 2023.

The MOVES input files reflect all federal and state motor vehicle emission control programs. In addition, the input files were customized to reflect the specific weather conditions and vehicle registration data for the Rome nonattainment area.

2.0 Travel Demand Modeling Procedures

Georgia DOT is responsible for the development and application of the travel demand models for the urban areas outside of Atlanta. This section summarizes the Rome model's key travel demand modeling attributes, listed below, as they relate to the most important factors in estimating emissions.

1. Socio-economic data based on best available information
2. Consistency between transportation alternatives and land use scenarios
3. Modeled volumes validated against observed counts
4. Reasonable agreement between travel times used for trip-distribution and trip assignment
5. Reasonable sensitivity to time, cost and other factors affecting travel choices
6. Capacity-sensitive traffic assignment methodology

Model Attributes 1 & 2 (Socio-Economic Data)

The primary data inputs to travel demand models are socio-economic data, such as population and employment, and transportation networks. Modeling attributes one and two deal specifically with the socio-economic data inputs to the travel demand modeling process.

The first modeling attribute is that the socio-economic data be based on the best available information. In Georgia, each MPO has the responsibility of preparing socio-economic data. Georgia DOT reviews the socio-economic data for reasonableness and accuracy. The data development process and accuracy checks rely on the best available information, such as US Census data, aerial photography, land use maps, knowledge of proposed new developments and site visits (local knowledge). Other reasonableness and logic checks are made for data at the traffic zone level, such as calculating statistics including population per household, population density and employment density. The MPOs and GDOT work cooperatively, using the best available data, to insure that the data inputs to travel demand models are accurate and reasonable.

The second modeling attribute is that socio-economic data reflect the transportation alternatives being considered. This relates to the fact that improved transportation accessibility can alter land use patterns. However, it is generally accepted that significant improvements in transportation accessibility are necessary to bring about relatively small changes in land use. Due to their complexity, land use models are generally utilized in only a few large metropolitan areas in the United States. Georgia's MPOs, with the exception of Atlanta, do not use land use models. Instead, usually a single forecast for future socio-economic data is made that takes into consideration planned major transportation improvements. Future forecasts are generally made by first developing regional control totals for expected growth. Allocation of expected growth is then done using known development patterns and proposals as the basis, taking into consideration planned infrastructure improvements (new highways, sewer extensions, etc.). If unanticipated major projects are evaluated during the plan update process, a revised forecast may be developed with guidance from the MPO's Technical Coordinating Committee. The population and employment forecasts for the FRUTS area are listed in Table 2.0-1.

Table 2.0-1
Population and Employment Forecasts for FRUTS Area
2007 and 2023

	2007	2023
Total Population	94,743	104,224
Number of Households	35,939	38,352
Employment	41,774	47,188

<u>Model Attribute 3 (Model Validation)</u>

The next attribute involves the validation of travel demand models against observed traffic counts. Model validation is the process of insuring travel models produce results that reasonably replicate observed travel patterns. Properly validated models not only replicate observed conditions, but they also use accurate inputs and apply reasonable calculations to do so.

Georgia DOT applied multiple validation checks to each of the major steps in the Rome travel demand modeling process. In addition to socio-economic data checks, both the inputs to and outputs from the models were checked for accuracy and reasonableness during each step of the process. These inputs and outputs include transportation network attributes, trip generation parameters and results, trip distribution parameters and average trip lengths by purpose, auto occupancy rates, and speed-volume relationships.

Highway Networks – Air Quality Attributes

Georgia DOT develops and maintains highway networks with FRUTS review and assistance. Highway network attributes are reviewed for accuracy using the state roadway characteristics database, aerial photography and site visits / local knowledge. Network link attributes include the HPMS functional classification, so that modeled and observed Vehicle Miles Traveled (VMT) can be compared by county. Networks also include GDOT traffic count station numbers, so counts for the base year model can be included in output networks for validation purposes.

Highway Networks - Speed

Since speeds are important for mobile emissions estimation, GDOT uses reasonable inputs and validates each of the factors that influence speed estimation; particularly the following:

- Roadway capacities
- Free-flow speeds
- Modeled volumes
- Speed-volume relationships

Link Capacities

Georgia DOT's link capacities were developed using the latest Highway Capacity Manual Software with typical parameters for various roadway classes and area types. The density of population and employment is used to classify the intensity of development patterns throughout the study area. The Rome model uses the following seven area types to classify land use.

- (1) - Central Business District (CBD) / High Density Urban
- (2) - Urban Commercial
- (3) - Urban Residential
- (4) - Suburban Commercial
- (5) - Suburban Residential
- (6) - Exurban
- (7) - Rural

Table 2.0-2 displays the hourly capacities per lane utilized in the Rome travel demand model.

Table 2.0-2
Rome Model Hourly Per Lane Capacity Matrix

Facility Type	Area Type						
	1	2	3	4	5	6	7
Interstate	1900	1950	2000	2050	2100	2060	2020
Freeway	1600	1660	1730	1790	1850	1820	1780
Expressway	1300	1380	1450	1530	1600	1570	1540
Parkway	1170	1240	1310	1370	1440	1410	1380
Freeway to Freeway Ramp	1400	1530	1650	1780	1900	1860	1820
Freeway Entrance Ramp	900	1030	1150	1280	1400	1370	1340
Freeway Exit Ramp	800	810	810	820	820	810	790
Principal Arterial – Class I	1000	1030	1050	1080	1100	1080	1060
Principal Arterial – Class II	900	900	900	900	900	880	860
Minor Arterial – Class I	800	810	810	820	820	810	790
Minor Arterial – Class II	630	630	640	640	640	630	610
One Way Arterial	760	760	770	770	770	760	740
Major Collector	520	530	540	550	560	550	540
Minor Collector	380	390	390	400	400	390	380
One Way Collector	460	470	470	480	480	470	460
Local Road	340	350	360	370	380	370	360
Centroid Connector	0	0	0	0	0	0	0

Free-flow Speeds

Assumed free-flow speeds are approximately 5 mph faster than typical speed limits for the various roadway classes and area types, taking into consideration control for delay (i.e., traffic signals) if applicable. Peak and off-peak free-flow speeds were evaluated using observed speeds obtained from a travel time study conducted in the Augusta area. An analysis of the Augusta data indicated that Augusta's characteristics and data results are appropriate for use as a base in the Rome model since the travel dynamics for these urban areas are very similar. Through the process of model calibration and validation, the speeds were revised slightly for a couple of facilities to more accurately represent travel conditions in the Rome area. Table 2.0-3 displays the free-flow speeds utilized in the Rome travel demand model.

Table 2.0-3
Rome Model Free-flow Speed Matrix

Facility Type	**Area Type**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Interstate	55	60	60	60	60	70	70
Freeway	50	55	55	55	55	60	60
Expressway	50	50	50	50	55	55	55
Parkway	45	50	50	50	50	55	55
Freeway to Freeway Ramp	55	55	55	55	55	55	55
Freeway Entrance Ramp	45	50	50	50	50	55	55
Freeway Exit Ramp	22	23	30	31	34	40	48
Principal Arterial – Class I	25	28	33	34	37	47	52
Principal Arterial – Class II	23	26	31	32	35	45	49
Minor Arterial – Class I	22	23	30	31	34	40	47
Minor Arterial – Class II	21	22	27	30	32	38	45
One Way Arterial	23	26	30	32	35	42	48
Major Collector	17	18	21	27	29	34	42
Minor Collector	14	15	18	24	26	30	40
One Way Collector	17	18	21	27	29	34	42
Local Road	14	14	17	18	22	28	35
Centroid Connector	14	14	17	18	22	28	35

<u>Modeled Volumes</u>
Output modeled volumes are validated against traffic counts at several levels – regional, corridors and link-by-link. Regional evaluations include VMT, Root Mean Squared Error and R-Squared calculations. Corridor evaluations are primarily screenline and cutline comparisons. Nationally recognized maximum desirable deviation standards are applied to analyze model performance at the link level.

Base year external station volumes are based directly on observed traffic counts at each location. Future year external station volumes are estimated from historical trends in traffic counts at each location. Extrapolated future external station volumes are refined to insure use of reasonable annual compounded growth rates.

<u>Speed-Volume Relationships</u>
Georgia DOT uses speed-volume relationships that are different for various roadway types and area types. The speed-volume curves are calibrated to accurately reflect observed traffic volumes, while retaining sensible shapes to insure reasonable congested speeds. Peak-period

speed data obtained from the GDOT travel time study was used as a reasonableness check in calibrating GDOT speed-volume curves.

Trip Generation

The GDOT trip generation process primarily uses parameters from the Augusta household survey, the Quick Response Freight Manual and US Census data. Minor adjustments are made to GDOT standard procedures to reflect unique characteristics in each area being modeled (e.g., port, military bases, etc.). Various validation checks are made to insure that trip generation results are reasonable. National data sources are used as reasonableness checks for trip generation results.

Trip Distribution

Trip distribution parameters are calibrated to produce reasonable average trip lengths. Expected average trip lengths are estimated from Census Journey-to-Work data and the population and geographic size of the modeled area. Travel times from trip assignment are used as input to trip distribution (i.e., feedback), which strengthens the validity of the modeled trip lengths.

Model Attribute 4 (Feedback of Travel Times)

The Rome model insures that there is reasonable agreement between travel times used for trip distribution and trip assignment by implementing a feedback loop. Within the feedback loop, all model steps from trip distribution to trip assignment are repeated until trip tables and link volumes change very little from one loop to the next. The Rome model includes a closure criterion for determining whether there is "reasonable agreement" in travel times for trip distribution and trip assignment. Closure is obtained if the following criterion is met:

- Maximum link volume change =< 500

The Method of Successive Averages is used to insure that the model reaches stable conditions.

Model Attribute 5 (Mode Choice)

The fifth modeling attribute calls for mode choice models to be reasonably sensitive to changes in travel times and costs. The Rome travel demand model utilizes a trip-end based procedure that determines transit-oriented person trips before the region's person trips are converted to vehicle trips. This trip-end model estimates transit patronage based on socio-economic characteristics such as income or auto-ownership, rather than transportation system characteristics.

Model Attribute 6 (Traffic Assignment)

The sixth modeling attribute calls for the use of capacity sensitive assignment procedures. The Rome model uses a 24-hour equilibrium assignment algorithm. The traffic assignment algorithm is iterative, running through successive applications until equilibrium occurs. Equilibrium occurs when no trip can be made by an alternate path without increasing the total travel time of all trips in the network. The equilibrium assignment is an iterative process that reflects travel demand assigned to minimum time paths as well as the effects of congestion. In each assignment iteration, traffic volumes are loaded onto network links and travel times are adjusted in response to the volume to capacity relationships. Final assigned volumes are derived by summing a percentage of the loadings from each iteration. The percentages reflect congested conditions that usually influence motorists' path selection for a portion of the day, not the entire day.

Georgia DOT requires multiple validation checks to each of the major steps in the travel demand modeling process. Output modeled volumes are validated against traffic counts at several levels – regional, corridors (screenlines) and link-by-link. Regional evaluations include VMT, Root Mean Squared Error and R-Squared calculations for volume-count matching. Corridor evaluations are primarily screenline comparisons. Nationally recognized maximum desirable deviation standards are applied to analyze model performance at the link level. These include FHWA's "*Calibration & Adjustment of System Planning Models*", 1990, and the NCHRP Report 365: "*Travel Estimation Techniques for Urban Planning*", 1998. The Rome model was also validated using 24-hour counts and modeled volumes. Documentation on the development of the Rome Model is in Appendix A.

2.1 Travel Demand Modeling Post-Processing Procedures

The Rome regional travel demand model produces daily estimates of travel and vehicle hours traveled (VHT) and a peak hour speed for each link in the highway network. The links from the daily highway assignment contain a variety of attributes such as the number of distance, lanes, speed, capacities and daily volumes. The daily VMT is determined by multiplying the daily volume by the distance for each link. In order to account for travel conditions throughout the day, VMT estimates, times and speeds by hour were produced. Other refinements to the network link data, discussed below, were performed to produce the files needed for MOVES. The procedures used in estimating emissions for the Rome model area are consistent with the procedures used for emissions modeling (including conformity analyses) in the other nonattainment areas in Georgia.

HPMS Adjustment of VMT

In order to develop the information necessary to perform emissions modeling, post-processing of the output from the travel demand model was required. First, intra-zonal VMT is normally not reflected in the daily network assignment. A procedure was used that multiplied the number of intra-zonal vehicle trips from the vehicle trip table by the zone centroid distance to calculate the intra-zonal VMT. This VMT was then added to the network in a new link and summarized in the model VMT summaries.

Next, the daily VMT from the travel demand model was adjusted based on the VMT estimates that GDOT develops for the Highway Performance Monitoring System (HPMS). According to Section 3.4.2.4 of EPA's "Volume IV" guidance,[3] "[T]he detailed VMT estimates produced by the transportation planning process should be made consistent in the aggregate with HPMS." Consistent with this long-standing SIP guidance, Section 93.122(b)(3) of the Transportation Conformity Rule, Procedures for Determining Regional Transportation Related Emissions, says:

"Highway Performance Monitoring System (HPMS) estimates of vehicle miles

[3] *Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources*, EPA-420-R-92-009, US EPA, Office of Air and Radiation, Office of Mobile Sources, 1992, http://www.epa.gov/otaq/invntory/r92009.pdf.

traveled (VMT) shall be considered the primary measure of VMT within the portion of the nonattainment or maintenance area and for the functional classes of roadways included in HPMS.... For areas with network-based travel models, a factor (or factors) may be developed to reconcile and calibrate the network-based travel model estimates of VMT in the base year of its validation to the HPMS estimates for the same period. These factors may then be applied to model estimates of future VMT."

The EPA guidance issued in August 2005, *Guidance for Creating Annual On-Road Mobile Source Emission Inventories for PM2.5 Nonattainment Areas for Use in SIPs and Conformity*, identified several approaches for preparing PM2.5 emissions. The guidance also specified that the interagency consultation process should be used to determine which approach is most appropriate for the area. The Rome interagency consultation group agreed to the *Single-Run Approach* recommended by EPD and GDOT for establishing the MVEB and performing subsequent conformity analyses. This methodology involves a single set of modeling runs using MOVES for each scenario year and annual average VMT.

HPMS adjustment factors were developed based on the average annual daily HPMS VMT for the model calibration year. In the case of Rome there are two model calibration years, 2006[4] and 2009[5]. The current Rome model that was used to perform the last conformity determination was calibrated and validated for the year 2006. A new Rome model has been developed that was calibrated and validated for the year 2009. The 2009 model will be used to perform future conformity determinations.

The HPMS adjustment reconciles the travel demand model link-based VMT to the average annual daily travel conditions at the aggregate functional class level. The aggregate functional classification level was used since FHWA eliminated the urban/rural area type distinction from HPMS functional classifications beginning with the 2009 data, reported in 2010. (*Guidance for the Functional Classification of Highways (updated), Federal Highway Administration, October 14, 2008.)*

To determine the "2006 HPMS VMT" adjustment factors, the average annual daily Floyd County VMT for the year 2006 was summarized by the HPMS functional classifications from the Georgia Department of Transportation's Office of Transportation Data "445 Report." The data was summarized for the Rome MPO area which consists of all of Floyd County. The 445 Report summarizes the mileage and VMT by function classification by county.

The following equation was used to calculate the 2006 HPMS adjustment factors:

$$\textit{HPMS Adjustment Factor}_i = (\textit{2006 HPMS VMT}_i / \textit{2006 Model VMT}_i)$$

where $_i$*=HPMS functional class)*

The 2006 factors were applied to the VMT on each link in the highway network based on the

[4] (the base year of validation for the current version of the regional travel model)
[5] (the base year of validation for the updated version of the regional travel model)

aggregate functional classification for the year 2006. These factors were applied to the model application for 2007. A separate set of HPMS adjustment factors were developed for 2009 using the same method. The 2009 factors were applied to the model application for the year 2023 and will be applied for future conformity determinations. Table 2.1-1 lists the adjustment factors based on the comparison between the HPMS VMT and the VMT from the regional travel demand model for both years 2006 and 2009.

Table 2.1-1
HPMS VMT Adjustment Factors for Rome MPO Area
(from the FRUTS travel demand model)

Functional Class Name	Functional Class No.	2006 HPMS VMT	2006 Model VMT	2006 Adjust-ment Factors	2009 HPMS VMT	2009 Model VMT	2009 Adjust-ment Factors
Interstate	1,11,12	27,444	31,841	0.86	30,000	26,804	1.12
Principal Arterials	2,14	1,152,782	1,114,318	1.03	1,117,000	1,005,323	1.11
Minor Arterials	6,16	647,805	700,058	0.93	598,000	630,480	0.95
Collectors	7,8,17	443,918	442,352	1.00	398,000	397,978	1.00
Local	9,19	726,665	351,531	2.07	816,000	374,461	2.18
Total		2,998,614	2,640,100	1.14	2,959,000	2,425,846	1.22

Table 2.1-2 shows the adjusted average annual daily modeled VMT for Floyd County used in the emissions modeling procedures for the years 2007 and 2023.

Table 2.1-2
Average Annual Daily Modeled VMT for Floyd County
(As adjusted per Table 2.1-1)

Year	VMT
2007	3,045,053
2023	3,518,199

VMT Estimation by Hour

Factors derived using the methodology described in the report *Speed and Delay Prediction Models for Planning Applications* were used to develop VMT estimates by hour from the daily estimates. The methodology is a simplified queuing-based model (QSIM) which incorporates several key features such as the use of temporal distribution as a basis for developing hourly traffic estimates and the estimation of "peak spreading" for both arterials and freeways. Because most analytical methods consider only the effects of peak hour congestion (such as V/C ratio), a new measurement of daily congestion was used: the Average Annual Daily Traffic-to-Capacity (AADT/C) ratio, where capacity is the two-way capacity. Hourly factors were developed based on the AADT/C ratio and are listed in Table 2.1-3. These factors were applied to the daily traffic assignment to develop hourly volumes and VMT by link. Conical volume-delay curves were then used to develop hourly times and speeds by link.

Roadtype Classification

The network link data was also classified by MOVES roadtype based on functional classification. The mapping of FHWA highway functional system classifications to the appropriate MOVES roadtypes used for this modeling is listed in Table 2.1-4. Interstate and freeway ramps are functionally classified as local facilities in Georgia. Since these facilities operate with restricted access, the facility type definition variable (a unique variable in the highway network that defines the highway facilities based on their operation) was used to classify ramps as either rural or urban restricted facilities. Off-network activity is calculated within the MOVES process based on the source type (vehicle) population and is not an input from the travel demand model data.

Table 2.1-4
Listing of FHWA Highway Functional Classifications
Mapped to MOVES Road Types

FHWA Highway Functional System	MOVES Road Type	MOVES Value
Rural interstate	Rural restricted access	2
Rural other principal arterial	Rural restricted access	2
Rural minor arterial	Rural unrestricted access	3
Rural major collector	Rural unrestricted access	3
Rural minor collector	Rural unrestricted access	3
Rural local	Rural unrestricted access	3
Urban interstate	Urban restricted access	4
Urban other freeways	Urban restricted access	4
Urban other principal arterial	Urban unrestricted access	5
Urban minor arterial	Urban unrestricted access	5
Urban collector	Urban unrestricted access	5
Urban local	Urban unrestricted access	5

Table 2.1-3
Hourly Distribution of Daily Vehicle Miles Travelled (VMT)

	Hour of Day																							
AADT/C Ratio	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
<= 7	1.00	0.60	0.48	0.45	0.67	1.85	5.01	7.73	6.13	4.82	4.79	5.12	5.36	5.47	6.05	7.27	8.28	8.27	5.89	4.18	3.32	3.03	2.44	1.77
8	1.01	0.61	0.48	0.43	0.64	1.82	5.04	7.67	6.42	4.97	4.82	5.19	5.41	5.53	6.07	7.14	7.97	7.90	5.87	4.21	3.33	3.10	2.53	1.84
9	1.01	0.61	0.48	0.42	0.63	1.81	5.06	7.64	6.56	5.05	4.84	5.22	5.43	5.56	6.08	7.08	7.81	7.71	5.86	4.22	3.33	3.13	2.58	1.88
10	1.01	0.60	0.47	0.40	0.61	1.80	5.05	7.49	6.61	5.19	4.95	5.29	5.46	5.60	6.09	6.99	7.58	7.50	5.92	4.31	3.38	3.18	2.63	1.91
11	1.01	0.60	0.45	0.38	0.58	1.79	5.05	7.33	6.65	5.33	5.06	5.35	5.50	5.64	6.11	6.90	7.34	7.28	5.98	4.39	3.43	3.23	2.68	1.93
12	1.01	0.59	0.44	0.36	0.56	1.78	5.04	7.17	6.70	5.47	5.17	5.42	5.53	5.68	6.12	6.81	7.10	7.06	6.04	4.48	3.48	3.28	2.73	1.96
13	1.27	0.89	0.75	0.68	0.86	1.98	4.97	6.92	6.49	5.36	5.09	5.32	5.42	5.55	5.96	6.59	6.86	6.82	5.88	4.45	3.54	3.35	2.85	2.14
14	1.54	1.19	1.06	0.99	1.16	2.18	4.90	6.67	6.28	5.25	5.00	5.21	5.30	5.43	5.80	6.37	6.61	6.58	5.73	4.43	3.60	3.43	2.97	2.33
15	1.80	1.48	1.37	1.31	1.46	2.38	4.82	6.42	6.07	5.14	4.92	5.11	5.19	5.30	5.63	6.15	6.37	6.34	5.57	4.40	3.65	3.50	3.09	2.51
16	2.06	1.78	1.68	1.63	1.76	2.58	4.75	6.17	5.86	5.04	4.84	5.00	5.08	5.18	5.47	5.93	6.12	6.10	5.42	4.38	3.71	3.58	3.21	2.70
17	2.33	2.08	1.99	1.95	2.06	2.77	4.68	5.92	5.65	4.93	4.75	4.90	4.96	5.05	5.31	5.71	5.88	5.86	5.26	4.35	3.77	3.65	3.33	2.88
18	2.59	2.38	2.30	2.26	2.36	2.97	4.60	5.67	5.43	4.82	4.67	4.79	4.85	4.92	5.14	5.49	5.63	5.61	5.10	4.32	3.82	3.72	3.45	3.06
19	2.85	2.68	2.61	2.58	2.66	3.17	4.53	5.42	5.22	4.71	4.59	4.69	4.74	4.80	4.98	5.27	5.39	5.37	4.95	4.30	3.88	3.80	3.57	3.25
20	3.11	2.97	2.92	2.90	2.96	3.37	4.46	5.17	5.01	4.60	4.50	4.58	4.62	4.67	4.82	5.05	5.14	5.13	4.79	4.27	3.94	3.87	3.69	3.43
21	3.38	3.27	3.24	3.22	3.27	3.57	4.39	4.92	4.80	4.49	4.42	4.48	4.51	4.55	4.66	4.83	4.90	4.89	4.64	4.25	4.00	3.95	3.81	3.62
22	3.64	3.57	3.55	3.53	3.57	3.77	4.31	4.67	4.59	4.38	4.33	4.38	4.39	4.42	4.49	4.61	4.66	4.65	4.48	4.22	4.05	4.02	3.93	3.80
23	3.90	3.87	3.86	3.85	3.87	3.97	4.24	4.42	4.38	4.28	4.25	4.27	4.28	4.29	4.33	4.39	4.41	4.41	4.32	4.19	4.11	4.09	4.05	3.98
24	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17	4.17

Source: Speed and Delay Prediction Models for Planning Applications

Speed Bin Classification
The network link hourly data was also stratified by speed bin. As previously mentioned, conical volume-delay curves were used to develop hourly times and speed by link. MOVES defines 16 "speed bins" which describe the average driving speed on a roadtype or highway network link. Table 2.1-5 lists the speed bins and ranges that were assigned to the network link data by hour.

Table 2.1-5
Listing of MOVES Speed Bins

Speed Bin	Lower Range	Upper Range
1	<=	2.4
2	2.5	7.4
3	7.5	12.4
4	12.5	17.4
5	17.5	22.4
6	22.5	27.4
7	27.5	32.4
8	32.5	37.4
9	37.5	42.4
10	42.5	47.4
11	47.5	52.4
12	52.5	57.4
13	57.5	62.4
14	62.5	67.4
15	67.5	72.4
16	=>	72.5

2.2 Development of MOVES Input Files

The mobile source emissions used for the Rome analysis reflect all federal and state mobile source control rules, including federal tailpipe standards and gasoline sulfur and volatility limits.

Interagency Consultation
To prevent transportation conformity problems, the emissions used in preparation of emission inventories for SIP MVEB development and transportation conformity analysis must be consistent. Interagency consultation helps to assure consistency between the two procedures. The MOVES input parameters for the Rome PM2.5 Maintenance Plan mobile source emissions modeling were established through interagency consultation and are listed below:

1) Emission Factor Model: MOVES2010a - Database: MOVES20100830

a. Emission Process - using MOVES in Inventory mode for a July day, which was annualized for 2007 and 2023 Maintenance Plan Inventories, and as the basis for 2023 motor vehicle emissions budgets

2) MOVES Inputs –
    a. Temperature and relative humidity
        i. 2007 data from National Mobile Inventory Model's (NMIM) default database (NCD20090531)
    b. Fuel
        i. Floyd County MOVES defaults for July
    c. Use MOVES defaults for a July weekday for budgets
    d. 2002 Regional Fleet Age Distribution
        i. Derived from R.L. Polk & Co. registration data for Floyd county
        ii. Default for HDDV Class 8B
    e. Regional Vehicle Population
        i. Started with 2002 R.L. Polk & Co. registration data for Floyd county, as well as the Georgia Dept. of Revenue's registration data for 2003 and 2007
        ii. Vehicles by type were grown from 2002 to 2007 using different growth factors by vehicle type based on either Census person population estimates or Georgia 2007 registration data. Methodology developed by EPD for inputs to the SMOKE-MOVES Integration Tool.
        iii. 2023 data grown from 2007 based on estimated MPO population growth
        iv. Vehicle population for MOVES source type 62 revised using MOVES default VMT/VPOP ratios and VMT for HPMS type 60 data
    f. MOVES Default VMT fractions by source type, adjusted using GDOT count data

<u>MOVES</u>

MOVES20100830 is the latest database version for EPA's motor vehicle emissions model. MOVES requires a variety of input files. The MOVES input data files associated with travel behavior have been developed using the Rome travel demand model data, Georgia vehicle classification counts, and MOVES national defaults. Other data sources were used to develop the source type population data, meteorology data, and fuel specifications. These data files were developed through Interagency Consultation.

<u>MOVES Parameters</u>

MOVES was run for 2007 and 2023 using the following parameters listed in Table 2.2-1. The RunSpecs are shown in Exhibit 1 and 3.

Table 2.2-1
MOVES Input Parameters

Parameters	Input Values		
Scale	Domain: County	Calculation Type: Inventory Mode	
Time Spans	Time Aggregation: Weekday – 24 hours	Month: July	Year: 2007 or 2023
Geographical Boundary	Floyd County		
Vehicles Equipment	Fuels: • Diesel Fuel • Gasoline	Source Use Types: • Combination Long-haul Truck • Combination Short-haul Truck • Intercity Bus • Light Commercial Truck • Motor Home • Motorcycle • Passenger Car • Passenger Truck • Refuse Truck • School Bus • Single Unit Long-haul Truck • Single Unit Short-haul Truck • Transit Bus	Selections: • Diesel Fuel - Combination Long-haul Truck • Diesel Fuel - Combination Short-haul Truck • Diesel Fuel - Intercity Bus • Diesel Fuel - Light Commercial Truck • Diesel Fuel - Motor Home • Diesel Fuel - Passenger Car • Diesel Fuel - Passenger Truck • Diesel Fuel - Refuse Truck • Diesel Fuel - School Bus • Diesel Fuel - Single Unit Long-haul Truck • Diesel Fuel - Single Unit Short-haul Truck • Diesel Fuel - Transit Bus • Gasoline - Combination Short-haul Truck • Gasoline - Light Commercial Truck • Gasoline - Motor Home • Gasoline - Motorcycle • Gasoline - Passenger Car • Gasoline - Passenger Truck • Gasoline - Refuse Truck • Gasoline - School Bus • Gasoline - Single Unit Long-haul Truck • Gasoline - Single Unit Short-haul Truck • Gasoline - Transit Bus

Parameters	Input Values		
RoadType	Types: 1-5	• Off-Network • Rural Restricted Access • Rural Unrestricted Access • Urban Restricted Access • Urban Unrestricted Access	
Pollutants and Processes	PM2.5	Primary Exhaust PM2.5 – Total	• Running Exhaust • Start Exhaust • Crankcase Running Exhaust • Crankcase Start Exhaust • Crankcase Extended Idle Exhaust • Extended Idle Exhaust
		Primary PM2.5 – Organic Carbon	• Running Exhaust • Start Exhaust • Crankcase Running Exhaust • Crankcase Start Exhaust • Crankcase Extended Idle Exhaust • Extended Idle Exhaust
		Primary PM2.5 – Elemental Carbon	• Running Exhaust • Start Exhaust • Crankcase Running Exhaust • Crankcase Start Exhaust • Crankcase Extended Idle Exhaust • Extended Idle Exhaust
		Primary PM 2.5 Sulfate Particulate	• Running Exhaust • Start Exhaust • Crankcase Running Exhaust • Crankcase Start Exhaust • Crankcase Extended Idle Exhaust • Extended Idle Exhaust
		Primary PM2.5 – Brakewear	• Breakwear

Parameters	Input Values		
		Particulate	
		Primary PM2.5 – Tirewear Particulate	• Tirewear
		Total Energy Consumption	• Running Exhaust • Start Exhaust
	NOx	Oxides of Nitrogen (NOx)	• Running Exhaust • Start Exhaust • Crankcase Running Exhaust • Crankcase Start Exhaust • Crankcase Extended Idle Exhaust • Extended Idle Exhaust
Output	General Output	Units: • Units: Grams • Energy Units: Joules • Distance Units: Miles	Activity: • Distance Traveled • Population

Methodology to Develop MOVES Input Data

The data files to run MOVES are entered via the County Data Importer. The methodologies to prepare the data files are described in Table 2.2-2 with their associated Excel Workbook and Worksheet names. The input data are shown in Exhibits 1-4 for the years 2007 and 2023.

Table 2.2-2
Methodology to Prepare MOVES Input Data Files
For the County Data Importer

Input Data from Travel Demand Model

County Data Manager Inputs	Worksheet	Methodology
AverageSpeed Distribution	avgSpeedDistribution	The weekday link hourly vehicle hours travelled (VHT) is summarized by road type and speed bin. The MOVES defaults for the 13 source types by year are used to allocate to vehicle type. The fraction of time in each speed bin for each hour based on vehicle type, road type, and average speed is calculated where the fractions sum to one for each combination of vehicle type and road type by hour.
Ramp Fraction	RoadType	The weekday link VMT is summarized for interstate/freeway and ramp facilities by urban versus rural area type classifications. The percent of ramp VMT of the total interstate/freeway and ramp VMT is calculated by area type.
RoadTypeDistribution	roadTypeDistribution	The weekday link hourly VMT is summarized by roadtype. The MOVES defaults for the 13 source types by year are used to allocate to vehicle type. The fraction of VMT by road type and vehicle type is calculated where the fractions sum to one for each vehicle type.
Vehicle Type VMT	HPMSVtypeYear	The weekday VMT is summarized by MOVES roadtype and then weighted by the vehicle classification counts[6] for the Georgia area outside of the Atlanta 20 county area by the 6 HPMS vehicle types. The fractions for vehicle type 20 and 30 are then re-distributed based on the MOVES source vehicle defaults for the year. This is because the vehicle classification counts are collected using counters which count vehicles by the number of axles and as a result, the counts do not accurately reflect the difference between passenger cars and SUVs. The daily VMT is annualized using the EPA AADVMT Calculator Excel workbook.

[6] (A summary of the vehicle classification counts and description of the methodology used is in Exhibit 5)

County Data Manager Inputs	Worksheet	Methodology
	MonthVMTFraction	MOVES National Defaults
	DayVMTFraction	MOVES National Defaults
	HourVMTFraction	The weekday link hourly VMT is summarized by roadtype and hour. The MOVES defaults for the 13 source types by year are used to allocate to vehicle type. The fraction of VMT by road type and vehicle type is calculated where the fractions sum to one for each vehicle type by roadtype. The hourVMTFraction must sum to 1 for each source type-road type-type of day combination.
Input Data from Other Sources		
County Data Manager Inputs	**Worksheet**	**Methodology**
Source Type Population	sourceTypeYear	Vehicle population by source types was developed using 2002 R.L. Polk & Co. registration data. The 2002 data were grown to 2007 using either census person population estimates or Georgia annual vehicle registration data. Vehicle population for source type 62 (long-haul trucks) was recalculated using corresponding VMT for HPMS type 60 data from the HPMSVtypeYear worksheet and national default ratios of VMT and vehicle population in order to account for activity from trucks not registered but run locally. MPO population projection was used to calculate 2023 vehicle population.
I/M Programs	IMCoverage	No I/M Program
Fuel Supply	Fuel Supply	MOVES Defaults for Floyd County
	Fuel Formulation	MOVES Defaults for Floyd County
Meteorology Data	ZoneMonthHour	NCD20090531- 2007 data for Floyd County
Age Distribution	sourceTypeAgeDistribution	Age distributions in MOBILE6 format were derived from 2002 R.L. Polk & Co. registration data for all vehicle types, except for HDDV Class 8B where MOBILE6 defaults were used. They were converted into MOVES format using EPA converter.

2.4 Nonattainment Area Emissions Analysis Summary

A factor was developed to annualize the weekday emissions to include weekend activity. The factor was based on the MOVES defaults for DayVMTFractions which is being used as part of the MOVES inputs. The following formula was used:

Number of weekday equivalents in a year = 365*(5/7)+365*(2/7)*MOVES Urban Weekend Adjustment Factor(.7793) = 341.9809 (rounded to 342)

This is shown in cell D34 of tab "Import HPMS AADVMT and Factors" in the EPA AADVMTCalculator Excel workbook. The daily emissions are produced in grams and are converted to tons by dividing by 907,184.74. The daily emissions in tons are then multiplied by 342 to get annual emissions. Table 2.4-1 lists the results from the regional emissions analysis produced using the travel demand model in daily grams while Table 2.4-2 lists the emissions in annual tons.

Table 2.4-1
Summary of Mobile Source Emissions for Rome Nonattainment Area
(in Daily Grams)

	PM2.5			Nox		
Year	**Running**	**Non-running**	**Total**	**Running**	**Non-running**	**Total**
2007	289,662.78	21,369.56	311,032.33	7,670,499.78	1,290,807.42	8,961,307.20
2023	76,927.03	7,531.20	84,458.23	1,596,478.25	650,232.98	2,246,711.23

Table 2.4-2
Summary of Mobile Source Emissions for Rome Nonattainment Area
(in Annual Tons)

	PM2.5			Nox		
Year	**Running**	**Non-running**	**Total**	**Running**	**Non-running**	**Total**
2007	109.2001	8.0561	117.2562	2,891.7053	486.6221	3,378.3274
2023	29.0008	2.8392	31.8400	601.8571	245.1316	846.9887

A series of sensitivity tests were performed for the future years 2023, 2035 and 2040. These tests assumed different growth scenarios in the nonattainment area and were used to develop safety margins. The last major Regional Transportation Plan was developed in 2008. The update of the Regional Transportation Plan for 2040 is underway and is due April 29, 2012. The estimated growth rate between 2023 and 2040 is less than 10%. An alternative scenario was tested where the growth doubled between 2023 and 2040 to account for uncertainty in the future growth projections and transportation improvements.

Exhibit 1: 2007 RunSpec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Run#5 - Used revised HDveh Pop 62 - revised src pop
Run 6 - Revised vmtvehicletype using MOVES lookups for 2007  for veh type 20 & 30-Revised avg spd dstrb file to use moves lookups for 2007-Revised weather to average for year  - 082611
Run#7 Used Revised Cube script for roadtypedistribution
Run#8 Revise Ramp Fraction]]></description>
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Exhibit 2: MOVES Input Data for Floyd County Emissions for PM2.5 SIP Budget – 2007

Source Type Population

yearID	sourceTypeID	sourceTypePopulation
2007	11	2545
2007	21	40909
2007	31	27051
2007	32	8683
2007	41	10
2007	42	6
2007	43	273
2007	51	25
2007	52	963
2007	53	68
2007	54	110
2007	61	400
2007	62	404

Ramp Fraction

roadTypeID	RampFraction
2	0
4	0.3601

Sample Average Speed Distribution

sourceTypeid	roadTypeID	hourDayID	AvgSpeedBinID	AvgSpeedFraction
11	3	115	8	0.29629
21	3	115	8	0.29629
31	3	115	8	0.29629
32	3	115	8	0.29629
41	3	115	8	0.29629
42	3	115	8	0.29629
43	3	115	8	0.29629
51	3	115	8	0.29629
52	3	115	8	0.29629
53	3	115	8	0.29629
54	3	115	8	0.29629
61	3	115	8	0.29629
62	3	115	8	0.29629
11	3	115	9	0.26695
21	3	115	9	0.26695
31	3	115	9	0.26695

sourceTypeid	roadTypeID	hourDayID	AvgSpeedBinID	AvgSpeedFraction
32	3	115	9	0.26695
41	3	115	9	0.26695
42	3	115	9	0.26695
43	3	115	9	0.26695
51	3	115	9	0.26695
52	3	115	9	0.26695
53	3	115	9	0.26695
54	3	115	9	0.26695
61	3	115	9	0.26695
62	3	115	9	0.26695
11	3	115	10	0.17178
21	3	115	10	0.17178
31	3	115	10	0.17178
32	3	115	10	0.17178
41	3	115	10	0.17178
42	3	115	10	0.17178
43	3	115	10	0.17178
51	3	115	10	0.17178
52	3	115	10	0.17178
53	3	115	10	0.17178
54	3	115	10	0.17178
61	3	115	10	0.17178
62	3	115	10	0.17178

Note: File contains19,969 records and is available on request

Road Type Distribution

sourceTypeid	roadTypeID	RoadTypeVMTFraction
11	1	0
11	2	0
11	3	0.348028
11	4	0.014664
11	5	0.637308
21	1	0
21	2	0
21	3	0.348028
21	4	0.014664
21	5	0.637308
31	1	0
31	2	0
31	3	0.348028

sourceTypeid	roadTypeID	RoadTypeVMTFraction
31	4	0.014664
31	5	0.637308
32	1	0
32	2	0
32	3	0.348028
32	4	0.014664
32	5	0.637308
41	1	0
41	2	0
41	3	0.348027
41	4	0.014663
41	5	0.637310
42	1	0
42	2	0
42	3	0.348025
42	4	0.014661
42	5	0.637314
43	1	0
43	2	0
43	3	0.348029
43	4	0.014663
43	5	0.637309
51	1	0
51	2	0
51	3	0.348028
51	4	0.014663
51	5	0.637309
52	1	0
52	2	0
52	3	0.348028
52	4	0.014664
52	5	0.637308
53	1	0
53	2	0
53	3	0.348028
53	4	0.014665
53	5	0.637308
54	1	0
54	2	0
54	3	0.348028

sourceTypeid	roadTypeID	RoadTypeVMTFraction
54	4	0.014664

Vehicle Type VMT – HPMSVtypeYear Worksheet

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2007	3,190,897.45	0
20	2007	573,623,546.46	0
30	2007	381,547,677.11	0
40	2007	4,716,005.83	0
50	2007	34,749,741.64	0
60	2007	43,522,253.35	0

Vehicle Type VMT – Sample HourVMTFraction

sourceTypeid	roadTypeID	dayID	hourID	HourVMTFraction
11	3	5	1	0.01000
11	3	5	2	0.00600
11	3	5	3	0.00480
11	3	5	4	0.00450
11	3	5	5	0.00670
11	3	5	6	0.01850
11	3	5	7	0.05011
11	3	5	8	0.07731
11	3	5	9	0.06132
11	3	5	10	0.04821
11	3	5	11	0.04791
11	3	5	12	0.05121
11	3	5	13	0.05361
11	3	5	14	0.05471
11	3	5	15	0.06051
11	3	5	16	0.07271
11	3	5	17	0.08281
11	3	5	18	0.08271
11	3	5	19	0.05891
11	3	5	20	0.04181
11	3	5	21	0.03321
11	3	5	22	0.03031
11	3	5	23	0.02441
11	3	5	24	0.01772
11	4	5	1	0.01000
11	4	5	2	0.00600
11	4	5	3	0.00480

sourceTypeid	roadTypeID	dayID	hourID	HourVMTFraction
11	4	5	4	0.00450
11	4	5	5	0.00669
11	4	5	6	0.01849
11	4	5	7	0.05012
11	4	5	8	0.07730
11	4	5	9	0.06140
11	4	5	10	0.04825
11	4	5	11	0.04792
11	4	5	12	0.05123
11	4	5	13	0.05362
11	4	5	14	0.05473
11	4	5	15	0.06052
11	4	5	16	0.07268
11	4	5	17	0.08273
11	4	5	18	0.08261
11	4	5	19	0.05891
11	4	5	20	0.04182
11	4	5	21	0.03321
11	4	5	22	0.03033
11	4	5	23	0.02443
11	4	5	24	0.01771

Note: File contains 1,561 records and is available on request

Meteorology Data

monthID	zoneID	HourID	temperature	relHumidity
7	131150	1	54.5833	75.0083
7	131150	2	53.5083	76.6667
7	131150	3	52.5500	78.0500
7	131150	4	51.6250	79.4583
7	131150	5	50.8417	80.4917
7	131150	6	50.1833	81.2333
7	131150	7	49.8917	81.6917
7	131150	8	51.1583	79.8917
7	131150	9	54.5417	74.8167
7	131150	10	59.2750	67.2333
7	131150	11	63.8167	59.5167
7	131150	12	67.6750	53.2000
7	131150	13	70.6667	48.6583
7	131150	14	72.7500	45.4750
7	131150	15	74.1250	43.3917
7	131150	16	74.7250	42.2667

monthID	zoneID	HourID	temperature	relHumidity
7	131150	17	74.5500	42.1583
7	131150	18	73.1083	43.8750
7	131150	19	69.9583	48.6000
7	131150	20	65.8417	55.3000
7	131150	21	62.0500	61.9583
7	131150	22	59.5083	66.4833
7	131150	23	57.6000	69.9167
7	131150	24	55.9750	72.7167

Age Distribution - Sample

sourceTypeID	yearID	ageID	ageFraction
21	2007	0	0.009402
21	2007	1	0.041008
21	2007	2	0.047009
21	2007	3	0.056111
21	2007	4	0.054511
21	2007	5	0.053411
21	2007	6	0.060812
21	2007	7	0.057812
21	2007	8	0.072314
21	2007	9	0.063913
21	2007	10	0.062212
21	2007	11	0.054211
21	2007	12	0.049310
21	2007	13	0.045609
21	2007	14	0.045309
21	2007	15	0.040608
21	2007	16	0.032907
21	2007	17	0.026605
21	2007	18	0.024405
21	2007	19	0.019004
21	2007	20	0.011402
21	2007	21	0.006201
21	2007	22	0.005601
21	2007	23	0.005501
21	2007	24	0.005403
21	2007	25	0.005306
21	2007	26	0.005212
21	2007	27	0.005119
21	2007	28	0.005027
21	2007	29	0.004937
21	2007	30	0.023807
31	2007	0	0.011666

sourceTypeID	yearID	ageID	ageFraction
31	2007	1	0.037502
31	2007	2	0.048189
31	2007	3	0.043896
31	2007	4	0.045392
31	2007	5	0.053793
31	2007	6	0.072358
31	2007	7	0.026665
31	2007	8	0.038199
31	2007	9	0.044025
31	2007	10	0.044785
31	2007	11	0.039277
31	2007	12	0.033409
31	2007	13	0.049020
31	2007	14	0.058062
31	2007	15	0.054176
31	2007	16	0.038568
31	2007	17	0.054861
31	2007	18	0.056149
31	2007	19	0.050207
31	2007	20	0.031296
31	2007	21	0.025647
31	2007	22	0.035746
31	2007	23	0.000424
31	2007	24	0.000328
31	2007	25	0.000289
31	2007	26	0.000253
31	2007	27	0.000215
31	2007	28	0.000188
31	2007	29	0.000167
31	2007	30	0.005248

Note: File contains 373 records and is available on request

Exhibit 3: 2023 RunSpec

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 - Revised Mode Inputs 070811 using VMT by vehicle group from GDOT HPMS data (in vehicletype.dat) file weighted by model vmt by road type -
Run11 - 091411 - Use new model set with Cube scripts for 2023
Run 12 - 091911 - Ramp Fractions
Run 13 - 101111 - Using HPMS adj factors from 2009 model
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<pollutantprocessassociation pollutantkey="31" pollutantname="Sulfur Dioxide (SO2)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
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	</savedata>

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Exhibit 4: MOVES Input Data for Floyd County Emissions for PM2.5 SIP Budget – 2023

Source Type Population

yearID	sourceTypeID	sourceTypePopulation
2023	11	2790
2023	21	44846
2023	31	29654
2023	32	9518
2023	41	11
2023	42	7
2023	43	299
2023	51	28
2023	52	1055
2023	53	75
2023	54	120
2023	61	439
2023	62	449

Ramp Fraction

roadTypeID	RampFraction
2	0
4	0.4481

Sample Average Speed Distribution

sourceTypeid	roadTypeID	hourDayID	AvgSpeedBinID	AvgSpeedFraction
11	3	15	8	0.33047
21	3	15	8	0.33047
31	3	15	8	0.33047
32	3	15	8	0.33047
41	3	15	8	0.33047
42	3	15	8	0.33047
43	3	15	8	0.33047
51	3	15	8	0.33047
52	3	15	8	0.33047
53	3	15	8	0.33047
54	3	15	8	0.33047
61	3	15	8	0.33047
62	3	15	8	0.33047
11	3	15	9	0.25898
21	3	15	9	0.25898
31	3	15	9	0.25898
32	3	15	9	0.25898

sourceTypeid	roadTypeID	hourDayID	AvgSpeedBinID	AvgSpeedFraction
41	3	15	9	0.25898
42	3	15	9	0.25898
43	3	15	9	0.25898
51	3	15	9	0.25898
52	3	15	9	0.25898
53	3	15	9	0.25898
54	3	15	9	0.25898
61	3	15	9	0.25898
62	3	15	9	0.25898
11	3	15	10	0.19630
21	3	15	10	0.19630
31	3	15	10	0.19630
32	3	15	10	0.19630
41	3	15	10	0.19630
42	3	15	10	0.19630
43	3	15	10	0.19630
51	3	15	10	0.19630
52	3	15	10	0.19630
53	3	15	10	0.19630
54	3	15	10	0.19630
61	3	15	10	0.19630
62	3	15	10	0.19630

Note: File contains19,969 records and is available on request

Road Type Distribution

sourceTypeid	roadTypeID	RoadTypeVMTFraction
11	1	0.00000
11	2	0.00000
11	3	0.34001
11	4	0.01702
11	5	0.64297
21	1	0.00000
21	2	0.00000
21	3	0.34001
21	4	0.01702
21	5	0.64297
31	1	0.00000
31	2	0.00000
31	3	0.34001
31	4	0.01702
31	5	0.64297

sourceTypeid	roadTypeID	RoadTypeVMTFraction
32	1	0.00000
32	2	0.00000
32	3	0.34001
32	4	0.01702
32	5	0.64297
41	1	0.00000
41	2	0.00000
41	3	0.34001
41	4	0.01703
41	5	0.64297
42	1	0.00000
42	2	0.00000
42	3	0.34001
42	4	0.01702
42	5	0.64297
43	1	0.00000
43	2	0.00000
43	3	0.34001
43	4	0.01702
43	5	0.64297
51	1	0.00000
51	2	0.00000
51	3	0.34000
51	4	0.01703
51	5	0.64297
52	1	0.00000
52	2	0.00000
52	3	0.34001
52	4	0.01702
52	5	0.64297
53	1	0.00000
53	2	0.00000
53	3	0.34001
53	4	0.01702
53	5	0.64297
54	1	0.00000
54	2	0.00000
54	3	0.34001
54	4	0.01702
54	5	0.64297

sourceTypeid	roadTypeID	RoadTypeVMTFraction
61	1	0.00000
61	2	0.00000
61	3	0.34001
61	4	0.01702
61	5	0.64297
62	1	0.00000
62	2	0.00000
62	3	0.34001
62	4	0.01702
62	5	0.64297

Vehicle Type VMT – HPMSVtypeYear Worksheet

HPMSVtypeID	yearID	HPMSBaseYearVMT	baseYearOffNetVMT
10	2023	3,681,075.81	0.00
20	2023	718,351,473.19	0.00
30	2023	385,703,070.19	0.00
40	2023	5,437,626.61	0.00
50	2023	40,045,911.27	0.00
60	2023	49,937,856.49	0.00

Vehicle Type VMT – Sample HourVMTFraction

sourceTypeid	roadTypeID	dayID	hourID	HourVMTFraction
11	3	5	1	0.01000
11	3	5	2	0.00600
11	3	5	3	0.00480
11	3	5	4	0.00449
11	3	5	5	0.00669
11	3	5	6	0.01849
11	3	5	7	0.05012
11	3	5	8	0.07730
11	3	5	9	0.06141
11	3	5	10	0.04826
11	3	5	11	0.04792
11	3	5	12	0.05123
11	3	5	13	0.05363
11	3	5	14	0.05473
11	3	5	15	0.06052
11	3	5	16	0.07267
11	3	5	17	0.08271
11	3	5	18	0.08259

sourceTypeid	roadTypeID	dayID	hourID	HourVMTFraction
11	3	5	19	0.05890
11	3	5	20	0.04182
11	3	5	21	0.03321
11	3	5	22	0.03033
11	3	5	23	0.02444
11	3	5	24	0.01774
11	4	5	1	0.01000
11	4	5	2	0.00600
11	4	5	3	0.00480
11	4	5	4	0.00449
11	4	5	5	0.00669
11	4	5	6	0.01849
11	4	5	7	0.05012
11	4	5	8	0.07728
11	4	5	9	0.06143
11	4	5	10	0.04828
11	4	5	11	0.04793
11	4	5	12	0.05124
11	4	5	13	0.05363
11	4	5	14	0.05474
11	4	5	15	0.06052
11	4	5	16	0.07266
11	4	5	17	0.08268
11	4	5	18	0.08256
11	4	5	19	0.05891
11	4	5	20	0.04182
11	4	5	21	0.03321
11	4	5	22	0.03033
11	4	5	23	0.02444
11	4	5	24	0.01775
11	5	5	1	0.01002
11	5	5	2	0.00601
11	5	5	3	0.00480
11	5	5	4	0.00446

Note: File contains 1,561 records and is available on request

Meteorology Data

monthID	zoneID	HourID	temperature	relHumidity
7	131150	1	54.5833	75.0083
7	131150	2	53.5083	76.6667
7	131150	3	52.5500	78.0500

monthID	zoneID	HourID	temperature	relHumidity
7	131150	4	51.6250	79.4583
7	131150	5	50.8417	80.4917
7	131150	6	50.1833	81.2333
7	131150	7	49.8917	81.6917
7	131150	8	51.1583	79.8917
7	131150	9	54.5417	74.8167
7	131150	10	59.2750	67.2333
7	131150	11	63.8167	59.5167
7	131150	12	67.6750	53.2000
7	131150	13	70.6667	48.6583
7	131150	14	72.7500	45.4750
7	131150	15	74.1250	43.3917
7	131150	16	74.7250	42.2667
7	131150	17	74.5500	42.1583
7	131150	18	73.1083	43.8750
7	131150	19	69.9583	48.6000
7	131150	20	65.8417	55.3000
7	131150	21	62.0500	61.9583
7	131150	22	59.5083	66.4833
7	131150	23	57.6000	69.9167
7	131150	24	55.9750	72.7167

Age Distribution - Sample

sourceTypeID	yearID	ageID	ageFraction
21	2023	0	0.009402
21	2023	1	0.041008
21	2023	2	0.047009
21	2023	3	0.056111
21	2023	4	0.054511
21	2023	5	0.053411
21	2023	6	0.060812
21	2023	7	0.057812
21	2023	8	0.072314
21	2023	9	0.063913
21	2023	10	0.062212
21	2023	11	0.054211
21	2023	12	0.049310
21	2023	13	0.045609
21	2023	14	0.045309
21	2023	15	0.040608
21	2023	16	0.032907
21	2023	17	0.026605
21	2023	18	0.024405

sourceTypeID	yearID	ageID	ageFraction
21	2023	19	0.019004
21	2023	20	0.011402
21	2023	21	0.006201
21	2023	22	0.005601
21	2023	23	0.005501
21	2023	24	0.005403
21	2023	25	0.005306
21	2023	26	0.005212
21	2023	27	0.005119
21	2023	28	0.005027
21	2023	29	0.004937
21	2023	30	0.023807
31	2023	0	0.011666
31	2023	1	0.037502
31	2023	2	0.048189
31	2023	3	0.043896
31	2023	4	0.045392
31	2023	5	0.053793
31	2023	6	0.072358
31	2023	7	0.026665
31	2023	8	0.038199
31	2023	9	0.044025
31	2023	10	0.044785
31	2023	11	0.039277
31	2023	12	0.033409
31	2023	13	0.049020
31	2023	14	0.058062
31	2023	15	0.054176
31	2023	16	0.038568
31	2023	17	0.054861
31	2023	18	0.056149
31	2023	19	0.050207
31	2023	20	0.031296
31	2023	21	0.025647
31	2023	22	0.035746
31	2023	23	0.000424
31	2023	24	0.000328
31	2023	25	0.000289
31	2023	26	0.000253
31	2023	27	0.000215
31	2023	28	0.000188
31	2023	29	0.000167
31	2023	30	0.005248

Note: File contains 373 records and is available on request

Exhibit 5: Vehicle Classification Counts

Weekday vehicle classification counts from GDOT were obtained for the years 2008 through 2010 for the entire state of Georgia. The counts for the 13 county nonattainment Atlanta MPO area were eliminated from the calculations. The vehicle classification counts collected were stratified based on the FHWA vehicle classifications. The counts were then summarized into the 6 HPMS vehicle type categories based the FHWA vehicle classifications. The percent by vehicle type by road type based on functional classification was calculated by year and then averaged for the three years. Table1 list the counts by year. Table 2 lists the final factors of VMT by vehicle type by road type based on the counts. These values were used to weight the VMT from the travel demand model by road type by vehicle type for input into AADVMT worksheet.

Table 1
GDOT Vehicle Classification Counts

2008 Statewide minus ARC 13 County MPO Area

Code	HPMS Vehicle Type	FHWA Veh Class	**Weekday Counts** Rural Restricted Access (FC=1)	Rural Unrestricted Access (FC=2-7)	Urban Restricted Access (FC=11-12)	Urban Unrestricted Access (FC=14-19)	**Percent by Road Type** Rural Restricted Access (FC=1)	Rural Unrestricted Access (FC=2-7)	Urban Restricted Access (FC=11-12)	Urban Unrestricted Access (FC=14-19)
10	Motorcycles	Class 1	415,477	276,557	703,762	273,810	0.3%	0.4%	0.3%	0.3%
20	Passenger Cars	Class 2	78,146,859	45,813,738	134,370,835	70,721,022	55.0%	64.5%	65.4%	74.5%
30	Other 2 axle-4 tire vehicles	Class 3	23,048,320	16,181,222	37,536,241	19,040,830	16.2%	22.8%	18.3%	20.1%
40	Buses	Class 4	1,348,962	412,115	1,464,298	372,563	0.9%	0.6%	0.7%	0.4%
50	Single Unit Trucks	Class 5-7	5,177,758	3,054,596	6,643,091	2,735,728	3.6%	4.3%	3.2%	2.9%
60	Combination Trucks	Class 8-13	33,983,937	5,320,479	24,746,197	1,724,995	23.9%	7.5%	12.0%	1.8%
			142,121,313	71,058,707	205,464,424	94,868,948	100%	100%	100%	100%

2009 Statewide minus ARC 13 County MPO Area

Code	HPMS Vehicle Type	FHWA Veh Class	**Weekday Counts** Rural Restricted Access (FC=1)	Rural Unrestricted Access (FC=2-7)	Urban Restricted Access (FC=11-12)	Urban Unrestricted Access (FC=14-19)	**Percent by Road Type** Rural Restricted Access (FC=1)	Rural Unrestricted Access (FC=2-7)	Urban Restricted Access (FC=11-12)	Urban Unrestricted Access (FC=14-19)
10	Motorcycles	Class 1	543,569	380,461	552,296	334,712	0.3%	0.3%	0.3%	0.3%
20	Passenger Cars	Class 2	99,860,922	74,033,369	123,617,071	92,974,090	57.6%	65.0%	66.5%	73.4%
30	Other 2 axle-4 tire vehicles	Class 3	29,013,174	25,257,242	35,153,989	26,580,997	16.7%	22.2%	18.9%	21.0%
40	Buses	Class 4	1,445,231	636,498	1,260,763	480,718	0.8%	0.6%	0.7%	0.4%
50	Single Unit Trucks	Class 5-7	5,931,816	4,577,695	5,977,298	3,774,967	3.4%	4.0%	3.2%	3.0%
60	Combination Trucks	Class 8-13	36,572,792	9,058,107	19,363,526	2,566,080	21.1%	7.9%	10.4%	2.0%
			173,367,504	113,943,372	185,924,943	126,711,564	100%	100%	100%	100%

Table 1
GDOT Vehicle Classification Counts (continued)

2010 Statewide minus ARC 13 County MPO Area

Code	HPMS Vehicle Type	FHWA Veh Class	Weekday Counts: Rural Restricted Access (FC=1)	Weekday Counts: Rural Unrestricted Access (FC=2-7)	Weekday Counts: Urban Restricted Access (FC=11-12)	Weekday Counts: Urban Unrestricted Access (FC=14-19)	Percent by Road Type: Rural Restricted Access (FC=1)	Percent by Road Type: Rural Unrestricted Access (FC=2-7)	Percent by Road Type: Urban Restricted Access (FC=11-12)	Percent by Road Type: Urban Unrestricted Access (FC=14-19)
10	Motorcycles	Class 1	531,781	465,637	767,240	413,477	0.3%	0.3%	0.3%	0.3%
20	Passenger Cars	Class 2	115,785,383	90,783,273	163,511,794	103,655,999	58.1%	64.4%	68.1%	73.3%
30	Other 2 axle-4 tire vehicles	Class 3	33,029,619	31,077,060	45,607,435	29,985,205	16.6%	22.1%	19.0%	21.2%
40	Buses	Class 4	1,648,242	837,435	1,403,597	520,635	0.8%	0.6%	0.6%	0.4%
50	Single Unit Trucks	Class 5-7	6,527,272	5,527,587	7,477,099	4,162,187	3.3%	3.9%	3.1%	2.9%
60	Combination Trucks	Class 8-13	41,728,831	12,222,357	21,492,738	2,746,397	20.9%	8.7%	8.9%	1.9%
	Total		199,251,128	140,913,349	240,259,903	141,483,900	100%	100%	100%	100%

2008-2010 Statewide minus ARC 13 County MPO Area Summary

Code	HPMS Vehicle Type	FHWA Veh Class	Weekday Counts: Rural Restricted Access (FC=1)	Weekday Counts: Rural Unrestricted Access (FC=2-7)	Weekday Counts: Urban Restricted Access (FC=11-12)	Weekday Counts: Urban Unrestricted Access (FC=14-19)	Percent by Road Type: Rural Restricted Access (FC=1)	Percent by Road Type: Rural Unrestricted Access (FC=2-7)	Percent by Road Type: Urban Restricted Access (FC=11-12)	Percent by Road Type: Urban Unrestricted Access (FC=14-19)
10	Motorcycles	Class 1	1,490,827	1,122,655	2,023,298	1,021,999	0.3%	0.3%	0.2%	0.2%
20	Passenger Cars	Class 2	293,793,164	210,630,380	421,499,700	267,351,111	57.7%	67.7%	73.5%	76.6%
30	Other 2 axle-4 tire vehicles	Class 3	85,091,113	72,515,524	118,297,665	75,607,032	16.7%	20.7%	16.5%	18.6%
40	Buses	Class 4	4,442,435	1,886,048	4,128,658	1,373,916	0.9%	0.6%	0.7%	0.5%
50	Single Unit Trucks	Class 5-7	17,636,846	13,159,878	20,097,488	10,672,882	3.4%	3.8%	3.0%	2.7%
60	Combination Trucks	Class 8-13	112,285,560	26,600,943	65,602,461	7,037,472	21.0%	6.9%	6.2%	1.4%
	Total		514,739,945	325,915,428	631,649,270	363,064,412	100%	100%	100%	100%

Table 2
Final Factors for VMT by Vehicle Type by Road Type

Code	HPMS Vehicle Type	FHWA Veh Class	Rural Restricted Access Factor	Rural Unrestricted Access Factor	Urban Restricted Access Factor	Urban Unrestricted Access Factor
10	Motorcycles	Class 1	0.002909	0.003512	0.003196	0.002817
20	Passenger Cars	Class 2	0.568990	0.646239	0.666475	0.737280
30	Other 2 axle-4 tire vehicles	Class 3	0.165098	0.223307	0.187197	0.207472
40	Buses	Class 4	0.008700	0.005776	0.006583	0.003800
50	Single Unit Trucks	Class 5-7	0.034469	0.040796	0.031867	0.029349
60	Combination Trucks	Class 8-13	0.219834	0.080369	0.104681	0.019282
	Total		1.000000	1.000000	1.000000	1.000000

Since the vehicle classification counts are collected using counters that do not adequately distinguish between passenger cars and SUVs, the MOVES defaults for vehicle types 20 and 30 by road type were used to redistribute the VMT. The MOVES Defaults are listed in Table 3.

Table 3
MOVES Defaults
Percent VMT by Vehicle Type

	Vehicle Type					
Year	**10**	**20**	**30**	**40**	**50**	**60**
1999	0.00390	0.58310	0.33480	0.00280	0.02610	0.04920
2000	0.00380	0.58250	0.33600	0.00280	0.02570	0.04920
2001	0.00340	0.58240	0.33740	0.00250	0.02590	0.04850
2002	0.00330	0.58110	0.33850	0.00240	0.02660	0.04820
2003	0.00330	0.57880	0.34060	0.00230	0.02690	0.04810
2004	0.00340	0.57260	0.34600	0.00220	0.02730	0.04850
2005	0.00360	0.57060	0.34770	0.00220	0.02710	0.04870
2006	0.00400	0.55990	0.35850	0.00220	0.02750	0.04780
2007	0.00450	0.55070	0.36630	0.00220	0.02790	0.04840
2008	0.00510	0.54610	0.36980	0.00230	0.02870	0.04800
2009	0.00530	0.54760	0.37480	0.00210	0.02660	0.04370
2010	0.00530	0.54360	0.37770	0.00220	0.02770	0.04350
2011	0.00530	0.53940	0.37830	0.00240	0.02970	0.04500
2012	0.00530	0.53700	0.37740	0.00250	0.03140	0.04640

	Vehicle Type					
Year	**10**	**20**	**30**	**40**	**50**	**60**
2013	0.00520	0.53640	0.37610	0.00260	0.03240	0.04730
2014	0.00520	0.53780	0.37370	0.00260	0.03310	0.04760
2015	0.00511	0.54185	0.36926	0.00266	0.03358	0.04754
2016	0.00505	0.54655	0.36414	0.00270	0.03413	0.04743
2017	0.00500	0.55148	0.35868	0.00274	0.03465	0.04744
2018	0.00495	0.55719	0.35240	0.00278	0.03509	0.04759
2019	0.00490	0.56346	0.34559	0.00281	0.03548	0.04777
2020	0.00484	0.57033	0.33840	0.00283	0.03581	0.04779
2021	0.00479	0.57743	0.33138	0.00285	0.03599	0.04755
2022	0.00475	0.58459	0.32444	0.00286	0.03613	0.04723
2023	0.00471	0.59142	0.31755	0.00288	0.03639	0.04705
2024	0.00466	0.59782	0.31089	0.00291	0.03674	0.04698
2025	0.00462	0.60374	0.30470	0.00294	0.03709	0.04692
2026	0.00458	0.60921	0.29896	0.00296	0.03745	0.04684
2027	0.00455	0.61410	0.29377	0.00300	0.03784	0.04674
2028	0.00452	0.61852	0.28903	0.00303	0.03828	0.04662
2029	0.00450	0.62265	0.28449	0.00307	0.03876	0.04652
2030	0.00448	0.62625	0.28038	0.00311	0.03930	0.04648
2031	0.00444	0.62984	0.27688	0.00313	0.03959	0.04611
2032	0.00440	0.63303	0.27380	0.00316	0.03987	0.04574
2033	0.00436	0.63573	0.27104	0.00319	0.04023	0.04545
2034	0.00432	0.63812	0.26857	0.00321	0.04058	0.04519
2035	0.00429	0.64015	0.26636	0.00324	0.04096	0.04501
2036	0.00425	0.64184	0.26447	0.00327	0.04134	0.04483
2037	0.00421	0.64323	0.26287	0.00330	0.04173	0.04465
2038	0.00418	0.64417	0.26173	0.00333	0.04211	0.04447
2039	0.00414	0.64476	0.26096	0.00336	0.04249	0.04428
2040	0.00411	0.64532	0.26017	0.00340	0.04289	0.04411
2041	0.00407	0.64586	0.25937	0.00343	0.04331	0.04396
2042	0.00404	0.64630	0.25864	0.00346	0.04374	0.04381
2043	0.00401	0.64666	0.25799	0.00350	0.04418	0.04366
2044	0.00398	0.64693	0.25741	0.00353	0.04462	0.04352
2045	0.00395	0.64711	0.25692	0.00357	0.04507	0.04338
2046	0.00392	0.64719	0.25653	0.00360	0.04552	0.04324
2047	0.00389	0.64720	0.25620	0.00364	0.04598	0.04310
2048	0.00386	0.64715	0.25593	0.00368	0.04643	0.04295
2049	0.00383	0.64704	0.25572	0.00371	0.04690	0.04281
2050	0.00380	0.64689	0.25554	0.00375	0.04736	0.04266

Exhibit 5: Vehicle Registration Data

Georgia's Revised Registration Distribution by Age

Overview

R.L. Polk & Co. (Polk) maintains databases encompassing all registered vehicles in operation by state. Polk acquires the source registration data from the states and then processes and enhances the data. Key data elements Polk used for grouping vehicle registered in Georgia by their appropriate composite (i.e., gasoline and diesel) vehicle types were: vehicle make, vehicle model, engine make, engine model, fuel type, cab type, bed length, wheel configuration, vehicle type, gross vehicle weight rating (GVWR)[7] class, model year, and registration geography (i.e., county).

Vehicle characteristic data elements used by Polk are derived from the unique 17 position vehicle identification number (VIN) assigned to every vehicle. Vehicle geography is assigned based on the registration address linked to each VIN.

In order to assign a MOBILE6 category to all registered vehicles, Polk constructed a master vehicle workfile using data from Polk's TIPNet and NVPP databases. This master vehicle workfile accounts for all registered vehicles, including: cars, vans, sport utility vehicles, trucks, buses, school buses, and motorcycles (GVWR classes 1-8 + motorcycle). The GVWR classes are:

Class 1	0 - 6,000 lbs.
Class 2	6,001 - 10,000 lbs.
Class 3	10,001 - 14,000 lbs.
Class 4	14,001 - 16,000 lbs.
Class 5	16,001 - 19,500 lbs.
Class 6	19,501 - 26,000 lbs.
Class 7	26,001 - 33,000 lbs.
Class 8	33,001 - 150,000 lbs.

The TIPNet database contains vehicles from full-size pickups/vans through class 8 (GVWR classes 1c-8), and is structured to serve the commercial vehicle market. The NVPP database contains vehicles GVWR classes 1-3 and is designed to serve the car, light truck/van, and motorcycle aftermarket.

[7] The GVWR is the maximum weight of the vehicle when it is fully loaded, as specified by the manufacturer.

Using the data elements listed above, Polk assigned one of the 16 MOBILE6 categories to each of the vehicles in the workfile. Care was taken to assure that no makes and models are duplicated between the two databases. Note that the unit volume for same make/model vehicles can be divided among two or more MOBILE6 categories due to varying vehicle types and GVWR classes within a specific make/model. TIPNet data supplies GVWR classes 1c-8 (full-size pickups/vans & heavier), while NVPP data provides passenger car, motorcycle, light truck, and light vans from GVWR class 1.

The 16 composite MOBILE6 vehicle types are listed and defined below, with examples of the types of vehicles they include.

Number	Abbreviation	Description
1	**LDV**	**Light-Duty (LD) Vehicles (Passenger Cars)**

- Class 1 GVWR
- Include: Passenger Cars
- Fuel: All Types
- Source: R.L. Polk NVPP as of October 2002

2	**LDT1**	**LD Trucks 1 (0-6,000 lbs. GVWR, 0-3,750 lbs. LVW[8])**

- Class 1 GVWR
- Trucks, SUVs, & Vans
- Exclude Full-Size Pickups & Vans
- Fuel: All Types
- Source: R.L. Polk NVPP as of October 2002

3	**LDT2**	**LD Trucks 2 (0-6,000 lbs. GVWR, 3,751-5,750 lbs. LVW)**

- Class 1 GVWR
- Trucks, SUVs, & Vans
- Fuel: All Types
- Include all Full-Size Pickups & Vans (e.g. 150/1500 series vehicles: F150, C/K 1500, E150, Ram 1500 etc.)
- Include Vehicle Types: Incomplete Pickup + Cab Chassis
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003 & NVPP as of October 2002

4	**LDT3**	**LD Trucks 3 (6,001-8,500 lbs. GVWR, 0-5,750 lbs. ALVW[9])**

- Class 2 GVWR
- Trucks, SUVs, & Vans
- GVWR: 6,001-8,000 for Ford, Chevy, Dodge, plus all Toyota Tundra Models

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[8] Loaded vehicle weight, the weight of vehicle sitting empty (curb weight) plus 300 pounds.
[9] Adjusted loaded vehicle weight, average of the gross vehicle weight and the curb weight.

- Fuel: All Types
- Exclude: Pickups with Long Bed or Vans with Extended Length (Except Tundra)
- Exclude Vehicle Types: Incomplete Pickup + Cab Chassis + Incomplete Vehicle + Straight Truck + School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003 & NVPP as of October 2002

Number **Abbreviation** **Description**

5 LDT4 Light-Duty Trucks 4 (6,001-8,500 lbs. GVWR, >5,750 lbs. ALVW)

- Class 2 GVWR
- Trucks, SUVs, & Vans
- GVWR: 6,001-8,000 for Ford, Chevy, & Dodge
- Exclude: all Toyota Tundra Models
- Fuel: All Types
- Include: Pickups with Long Bed or Vans with Extended Length
- Include Vehicle Types: Incomplete Pickup + Cab Chassis + Incomplete Vehicle + Straight Truck
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003

6 HDV2B Class 2b Heavy-Duty Vehicles (8,501-10,000 lbs. GVWR)

- Class 2 GVWR
- Trucks, SUVs, & Vans
- GVWR: 8,001-10,000 for Ford, Chevy, & Dodge
- Exclude: All Toyota Tundra Models
- Fuel: All Types
- Include: Pickups with Long Bed or Vans with Extended Length
- Include Vehicle Types: Incomplete Pickup + Cab Chassis + Incomplete Vehicle + Straight Truck
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003

7 HDV3 Class 3 Heavy-Duty Vehicles (10,001-14,000 lbs. GVWR)

- Class 3 GVWR
- Trucks, SUVs, & Vans
- Fuel: All Types
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003

Number **Abbreviation** **Description**

8 **HDV4** **Class 4 Heavy-Duty Vehicles (14,001-16,000 lbs. GVWR)**

- Class 4 GVWR
- Trucks, SUVs, & Vans
- Fuel: All Types
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003

9 **HDV5** **Class 5 Heavy-Duty Gasoline Vehicles (16,001-19,500 lbs. GVWR)**

- Class 5 GVWR
- Trucks, SUVs, & Vans
- Fuel: All Types
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003

10 **HDV6** **Class 6 Heavy-Duty Vehicles (19,501-26,000 lbs. GVWR)**

- Class 6 GVWR
- Trucks, SUVs, & Vans
- Fuel: All Types
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003

11 **HDV7** **Class 7 Heavy-Duty Vehicles (26,001-33,000 lbs. GVWR)**

- Class 7 GVWR
- Trucks, SUVs, & Vans
- Fuel: All Types
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Source: R.L. Polk TIPNet as of March 2003

12 **HDV8A** **Class 8a Heavy-Duty Vehicles (33,001-60,000 lbs. GVWR)**

- Class 8 GVWR
- Trucks, SUVs, & Vans
- Fuel: All Types
- Exclude Vehicle Types: School Bus + Bus Non-School (Coach)
- Include Vehicle Types: 4x2 Non-Tractor Vehicles + All Tractors + Motor Home Chassis
- Source: R.L. Polk TIPNet as of March 2003

13 **HDV8B** **Class 8b Heavy-Duty Vehicles (>60,000 lbs. GVWR)**

- Class 8 GVWR
- Trucks, SUVs, & Vans

- Fuel: All Types
- Exclude Vehicle Types: All Tractors + School Bus + Bus Non-School (Coach)
- Exclude Wheels: 4x2
- Source: R.L. Polk TIPNet as of March 2003

14 HDBS School Buses

- Include Vehicle Type: School Bus
- Fuel: All Types
- Source: R.L. Polk TIPNet as of March 2003

Number	**Abbreviation**	**Description**

15 HDBT Transit & Urban Buses

- Include Vehicle Type: Bus Non-School (Coach)
- Fuel: All Types
- Source: R.L. Polk TIPNet as of March 2003

16 MC Motorcycles (All)

- Fuel: All Types
- Source: R.L. Polk NVPP as of October 2002

The data acquired from Polk was queried to determine the number of vehicles registered in the Rome-Floyd metropolitan statistical area by age and vehicle type. Results of this query were used to develop Registration distribution by age inputs. For each of the 16 composite vehicle types, the fraction of all vehicles of that type which are zero-to-one model year old, two model years old, three model years old, etc., up to the oldest category, 25-model-years-and-older, was determined. The resulting input data is shown on the following two pages. Note that the Polk-derived distribution for Class 8b vehicles (vehicle type 13) is commented out; in accordance with EPA guidance, defaults were used for this vehicle type.

Exhibit 6: Source Type Population Input Data Preparation

1) **Date sources**

2002-2003 Polk's data: Registration data from R. L. Polk & Co.'s National Vehicle Population Profile ® (current as of October 2002) and R. L. Polk & Co.'s TIPNet ® (current as of March 2003) are used. This database includes number of vehicles by age and 16 vehicle types in each Georgia county, and has been used to develop age distribution.

Georgia registration data (2003 and 2007): These registration data were obtained from www.georgiastats.uga.edu. This database includes number of vehicles by passenger vehicles, trucks, trailers, motorcycles, buses and others in each county as explained on the Georgia Department of Revenue website (http://motor.etax.dor.ga.gov/stats/renewalsstats.aspx). Passenger Vehicles include Ambulances, Convertibles, Coupes, Hearses, Jeeps, Limousines, Mixers, Motor Homes, Multi-Purpose Vehicles, Roadsters, Station Wagons, Touring Cars, Vans, 2 Doors, 3 Doors, and 4 Doors. Trucks include Truck Tractors, Trucks, and Wreckers.

2) **Methodology**

The Polk's data were summarized by 16 vehicles types in each county and then grown to 2007 using different growth factors by vehicle types (Table 1). The number of HDBS, HDBT and MC in Polk's data is comparable to Georgia registration data (Table 2 and Table 3). Therefore, the numbers of HDBS and HDBT were grown to 2007 by multiplying ratios of the number of buses in Georgia motor vehicle registration data in 2007 and 2003. The number of MC was grown to 2007 by multiplying ratios of the number of motor cycles in Georgia motor vehicle registration data in 2007 and 2003. The number of the rest of vehicle types was grown to 2007 by multiplying ratios of human population in 2007 and 2002. The Georgia motor vehicle registration data were not used for these vehicle types due to the difficulty to match the vehicle type used in Georgia motor vehicle registration data to the 16 vehicle types as used in the Polk's data. Since the ratios of 2007 and 2003 passenger cars and trucks in motor vehicle registration data are comparable to the ratios of population data (Table 4), population data were used as the growth indicator.

Table 1. List of different growth factors used by vehicle types

Vehicle types	Growth factor
HDBS	Georgia registration data (2003 and 2007), Buses
HDBT	Georgia registration data (2003 and 2007), Buses
HDV2B	Population 2002 and 2007
HDV3	Population 2002 and 2007
HDV4	Population 2002 and 2007
HDV5	Population 2002 and 2007
HDV6	Population 2002 and 2007
HDV7	Population 2002 and 2007
HDV8A	Population 2002 and 2007
HDV8B	Population 2002 and 2007
LDT1	Population 2002 and 2007
LDT2	Population 2002 and 2007
LDT3	Population 2002 and 2007
LDT4	Population 2002 and 2007
LDV	Population 2002 and 2007

MC	Georgia registration data (2003 and 2007), Motor cycles

Table 2. Summary of 2002-2003 Polk's data by 16 mobile vehicle types in four Georgia regions

Vehicle types	ATL13	ATL7	GAGAS	GAOTHER	Total
HDBS	7,854	1,333	2,032	8,221	19,440
HDBT	1,362	102	139	540	2,143
HDV2B	56,809	11,761	15,405	49,039	133,014
HDV3	27,628	5,996	7,822	23,797	65,243
HDV4	13,623	2,262	2,850	10,351	29,086
HDV5	6,005	1,162	1,550	5,577	14,294
HDV6	19,294	4,088	5,932	21,688	51,002
HDV7	16,380	2,528	3,838	15,309	38,055
HDV8A	37,555	4,307	6,619	31,883	80,364
HDV8B	14,449	2,201	3,061	10,926	30,637
LDT1	722,044	131,873	181,393	607,189	1,642,499
LDT2	95,101	28,933	37,692	156,187	317,913
LDT3	302,139	62,530	75,409	284,851	724,929
LDT4	43,616	8,019	9,721	39,432	100,788
LDV	1,723,769	255,647	346,907	1,383,696	3,710,019
MC	50,081	10,657	13,767	41,123	115,628

Table 3. Summary of 2003 Georgia registration data by 4 mobile vehicle types

Vehicle types	ATL13	ATL7	GAGAS	GAOTHER	Total
Buses	10,676	1,559	2,434	9,797	21,237
Trucks	558,496	168,930	237,022	823,867	1,788,315
Passenger Cars	2,259,027	339,456	449,177	1,744,474	4,792,134
Motorcycles	46,836	10,203	13,124	38,561	108,724

Table 4. Comparison between different growth factors

				Ratios	
	2002	**2003**	**2007**	**2007/2002**	**2007/2003**
Motor vehicle registration					
Passenger Car		4,792,134	5,330,256		1.112
Trucks		1,788,315	1,952,470		1.092
Motor Cycle		108,724	174,617		1.606
Bus		21,237	35,124		1.654
Population in Georgia, U.S. Census					
Population	8,585,535	8,735,259	9,533,761	1.110	1.091
Total Average Annual Daily VMT in Georgia, Georgia DOT 445 report, miles					
VMT	292,562,380	296,810,994	305,327,543	1.044	1.029
MOVES national SALESGROWTH factor defaults					
Motorcycle				1.383	1.311
Passenger Car				0.940	1.001
Passenger Truck				0.972	0.948
Light Commercial Truck				0.972	0.948
Intercity Bus				1.353	1.268
Transit Bus				1.353	1.268
School Bus				1.353	1.268
Refuse Truck				1.353	1.268
Single Unit Short-haul Truck				1.353	1.268
Single Unit Long-haul Truck				1.353	1.268
Motor Home				1.353	1.268
Combination Short-haul Truck				1.464	1.405
Combination Long-haul Truck				1.464	1.405

The projected 2007 vehicle population by 16 vehicle types in each county were then converted to 32 vehicles types, which were matched with 28 vehicle types and 12 vehicle types (corresponding to 12 SCC codes) as shown in the EPA MOVES converter tool. The EPA MOVES converter tool was also used to convert vehicle population in MOVES format by each of the four reference counties. These populations are the sum of populations of all counties sharing the same reference counties.