Georgia EPD

Documentation for the On-road Mobile Portion of the Emissions Inventory SIP

August 7, 2014

This document provides a description of how inputs were compiled for the emissions inventory SIP for the 2008 ozone NAAQS as well as a brief description of how outputs were post processed to provide the emissions results provide by Georgia. We rely on EPA defaults for meteorology. Fuel formulation and supply input data is continually updated by the EPA so the fuel data in this 2011 NEI submission was used (EPA defaults at the time). The inputs supplied with local data for Georgia in the calculation of emissions are listed below, with a summary of methodology and assumptions. Which input databases were replaced with local data typically depended on a county’s history of attainment with the ozone and PM2.5 NAAQS. In addition to the annual total emissions, estimates of emissions were also made for a weekday in July to reflect ozone seasonal conditions. July (height of ozone season) was chosen along with weekday (when ozone is highest and travel demand models simulate weekday travel) in parallel to the methodology conducted in conformity regional emission analyses and SIP work as suggested in “Emissions Inventory Guidance for Implementation of Ozone [and Particulate Matter] National Ambient Air Quality Standards (NAAQS) and Regional Haze Regulations”. Annual emissions were calculated by summing typical weekday and typical weekend day emissions for each month since MOVES could not run an annual aggregated run since some emission processes have to be run by hour. For all emissions calculations (including for a typical weekday in July), the values were determined for each county and scc. VOC emissions from refueling were separated out and listed for both annual and July weekday in the final calculations in the provided emissions table. This was achieved by parsing out emissions under the scc for evaporative emissions for processes #18 and #19 (refueling vapor displacement loss and refueling spillage loss). The calculations for annual emissions consist of 4 steps:

1. Aggregate emissions output into a 24-hr day by daytype (weekday or weekend) for each month in MySQL browser.
2. For each month, take the weekday 24-hr aggregated emissions value and multiply by number of weekdays in the month and take the weekend 24-hr aggregated emissions value and multiply by number of weekend days in the month.
3. Take all the values calculated in step 2 and sum them.
4. Repeat same steps for each county and scc (this can be conducted in Excel using the sumif() formula command).

**INPUT METHODOLOGY**

# Age Distribution

Replaced EPA default data with input data used for our recently submitted maintenance SIP for the Atlanta metropolitan area (ARC). Age distribution data has been developed from registration data from R.L. Polk & Co.’s National Vehicle Population Profile (current as of October 2002) and R.L Polk and Co’s TIPNet (current as of March 2003) and assumed not to vary by year so applied to 2011. The county by county data was aggregated into a representative 13 county and 7 county age distributions (e.g., each county in the 13 county area and each county in the 7 county area has the same age distribution). The assumption made here is that people travel between these counties in each region every day so age distributions should be very similar within each region. Also, the distribution is based on a larger pool of data, therefore more reliable. The 13 counties refer to these county IDs; 13057, 13063, 13067, 13077, 13089, 13097, 13113, 13117, 13121, 13135, 13151, 13223, and 13247. The 7 counties refer to 13013, 13015, 13045, 13139, 13217, 13255, 13297.

***Annual Average VMT (hpmsvtypeyear)***

ARC Travel Demand Model (TDM) output provides overall annual average daily VMT (AADVMT) for each county by road type. In order to get it into MOVES ready format of annual average VMT by 6 HPMS vehicle types, the following process was employed:

1. The TDM AADVMT output is divided into the 6 HPMS vehicle types using Georgia Department of Transportation (GDOT) HPMS data which distributes AADVMT by vehicle type for each road type. Since the distribution of AADVMT by vehicle type differ by road type, the relevant split must be applied to the matching TDM output road type. This initially results in 4 subtotals for AADVMT for each vehicle type (by the 4 road types). These subtotals for each vehicle type are summed together to get total AADVMT by vehicle type. As an additional note, the GDOT categorization was modified to include MOVES default light duty vehicle splits of type 20 (passenger cars) and 30 (light duty trucks) since GDOT HPMS data splits for those two types were based on different criteria than was desired..

2. AADVMT developed in step 1 is used to calculate an annual average VMT (hpmsvtypeyear). Annual average VMT was calculated by multiplying AADVMT by 365.

***Hour VMT Fractions***

Hourly VMT fractions are produced by the TDM based on road type and the assumption is that these fractions are the same for all vehicle types. The remainder (if there are any gaps or lack of data for a specific vehicle type) is MOVES/EPA defaults. HPMS based vehicle type 60 data from the models are used to calculate the vehicle population for vehicle type 62 as described below for source type population. The TDM was calibrated using HPMS data from the Georgia Department of Transportation. The TDM networks available for Atlanta were 2010 and 2016 from which 2011 was interpolated for annual average VMT. For hour VMT fractions, 2010 (just a year off and these fractions varied little from year to year) numbers were used. Also in the case of any counties where a TDM was used, weekend MOVES/EPA default data (e.g., VMT hourly fraction) was used for inputs as investigations demonstrated that they resembled reality and there were not any studies that provided any improvement to this data.

***Source Type Population***

Replaced EPA default with input data developed using the same methodology as mentioned in recently submitted maintenance SIPs for the Atlanta metropolitan area (ARC). Source type population data has been developed from registration data from R.L. Polk & Co.’s National Vehicle Population Profile (current as of October 2002) and R.L Polk and Co’s TIPNet (current as of March 2003). This data through the help of EPA converters was modified from being sorted by MOBILE 6 vehicle types into being based on MOVES based vehicle types.

This data had already been “grown” from 2002-2003 values to 2007 values for use in ARC’s transportation conformity analyses and application to SIP revisions. The data can be grown either based on human population growth trends over the time period or growth trends in vehicle population from the Georgia vehicle registration database (only trends can be used not exact numbers due to difficulty of matching vehicle types in the Georgia motor vehicle registration data to the vehicle types used in R.L Polk and Co’s data). Table 1 below lists the vehicle type and preferred method. Using this table is consistent with what has been in used in the previous NEI compilation and with regards to any SIP motor vehicle budget determinations with MOVES. As indicated in Table 1, human population is adequate for all vehicle types except motorcycles, buses and combination long haul trucks. For motorcycles and buses, ratio of vehicle population is used instead. For example, if source type population is grown from 2007 to 2011 then the 2007 data is multiplied by 2011 human population/2007 human population unless a bus or motorcycle where it will be multiplied by 2011 vehicle population/2007 vehicle population.

The ARC summarized this process (only using human population growth and their 20 county population numbers) in a “Source Type Population Growth Table” which was used to grow the source type population data from the previously produced 2007 numbers to the final 2011 value for this data set for everything except buses, motorcycles and long haul combination trucks. For motorcycles and buses, the 2007 vehicle population numbers in the “Source Type Population Growth Table” were multiplied by the ratio of vehicle populations from 2011 and 2007 contained in the Georgia motor vehicle registration database. Handling combination long haul trucks is discussed at the end of the source type population section. The vehicle registration data for 2007 and 2011 for every county in Georgia can be extracted from the “Georgia Statistics System – University of Georgia” website, www.georgiastats.uga.edu.

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

|  |  |
| --- | --- |
| **Vehicle types** | **Growth factor** |
| 11 (Motorcycles) | Georgia registration data (2007 and 2011), Motor cycles |
| 21 (Passenger cars) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 31 (Passenger truck) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 32 (Light commercial truck) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 41 (Intercity Bus) | Georgia registration data (2007 and 2011), Buses |
| 42 (Transit Bus) | Georgia registration data (2007 and 2011), Buses |
| 43 (School Bus) | Georgia registration data (2007 and 2011), Buses |
| 51 (Refuse Truck) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 52 (Single Unit Short Haul Truck) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 53 (Single Unit Long Haul Truck) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 54 (Motor Home) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 61 (Combination Short Haul Truck) | Population 2007 and 2010 (2011 if in 20 county ARC) |
| 62 (Combination Long Haul Truck) | Special methodology (see below) |

***For all cases with vehicle type 62-long haul combination trucks***, a special determination is required because these vehicles do not reside in the areas investigated but usually just pass through the area along interstate routes. So, local population and vehicle registration data is not going to help since these vehicles are not part of the local population or registered in the state, but how far they all travel while they are in Georgia and how much far an average vehicle travels yearly in the U.S. are helpful. Local annual average ***total*** VMT for vehicle type 62 and national annual average VMT ***per*** ***vehicle 62*** are required (this latter term is directly from MOVES). MOVES ***national default*** total population of vehicle type 61 and 62 plus estimated local annual VMT of HPMS based vehicle type 60 are required as well for preliminary calculations. The original data is in terms of HMPS vehicle type 60 (which includes vehicle types 61 and 62) and one needs to know what fraction of this VMT amount is from vehicle type 62. This preliminary calculation is:

local annual average total VMT by vehicle type 62=

HPMS vehicle type 60 VMT x national default population vehicle type 62/(sum of national default population vehicle type 61+62))

The final calculation is:

vehicle type 62 population= local annual average total VMT for vehicle 62/national average VMT per vehicle 62.

HPMS vehicle type 60 VMT data used in this calculation is from TDM model-based annual VMT output data for the 20 county ARC region and Floyd/Bibb counties. Annual VMT data is compiled and processed from *2011 GDOT 445 Report* data for all other counties.

***Road Type and Road Type Distribution***

ARC TDM output provided VMT for ramps and AADVMT by MOVES road type. This data was aggregated county by county by road type.

However, for any other road type distribution, VMT by road type varies by vehicle type as shown in the GDOT HPMS data described earlier in the “Annual Average VMT (hpmsvtypeyear)’ section of this documentation. The TDM output, which did not split VMT by vehicle type, needed to be refined more to provide us our local road type distributions by vehicle type. Therefore, the road type distribution from the TDM was modified through the use of GDOT HPMS data and MOVES default splits for passenger cars and light duty trucks (these two data sets described earlier in the documentation). For instance, combination trucks (especially long-haul) travel mostly on rural interstates unlike other types of vehicles as indicated in the HPMS data, so the road type distribution from the TDM was modified to reflect this through weighting rural interstates higher for that type of vehicle. In the end, 6 different road type distributions specific to each of the GDOT HPMS vehicle types were produced from the overall TDM distribution and inserted into the NEI for each county. These 6 different road type distributions were easily mapped to 13 MOVES vehicle types since MOVES vehicle types are a subset of the 6 HPMS vehicle types (e.g., HPMS vehicle type 30 incorporates MOVES vehicle types 31 and 32, HPMS vehicle type 40 incorporates MOVES vehicle type 41, 42, and 43 etc..). Therefore, the road type distribution for a given MOVES vehicle type is exactly the same as its overarching HPMS vehicle type. There is no data available at this time that can split VMT by road type specifically down to 13 different distributions, just 6 as of now. For more details on this analysis, contact Di Tian (contact information at end of the document).

Ramp fraction determination was made by summing by county the total ramp AADVMT by road type and dividing it by total AADVMT by the same road type and county. If there was a case where there was no data provided for ramp fractions or a scarcity of data, aggregated ramp fraction data was employed (e.g., used 13 county aggregated data if data gap was for one of these 13 counties; if data gap is for a county not part of the original 13 county non-attainment area then used the 7 county aggregated input file, see earlier section titled “Age Distribution” for more details on aggregated data).

In all these cases, interpolation between TDM network years was applied as described in the “Annual Average VMT (hpmsvtypeyear)” section. Each distribution described above was determined separately for years 2010 and 2016, interpolated to 2011.

***Average Speed Distribution***

ARC TDM output provided average speed and speed bins by road type and source type. The distributions were developed from this output by adding up all the VHT from all the relevant traffic links for a given speed bin, hour, and road type and dividing this value by the total VHT for all speed bins at that same hour for the same road type. The distribution adds up to 1. The same network years were chosen as with hour VMT fractions described above (i.e., used the 2010 data for 2011). Average speed distributions have been found to vary little from year to year. The average speed distribution data was aggregated into 13-county or 7-county annualized profiles, applied to the relevant county. This is the same data prepared by the ARC for conformity work for that road type and source type. It is assumed that the congestion level and typical speeds do not vary significantly within the 13-county and 7-county areas and among source types.

Since TDMs assume weekday patterns, average speed distribution for the weekend was developed by revising the speed distribution for weekdays during traffic hours. That is, the average speed distribution for weekends during hour 7-10 and hour 16-22 was set to the speed distribution for hour 11 for weekdays. The speed distribution for weekend during the rest of time is the same as the speed distribution for weekdays.

.

***I/M coverage***

The original 13 county Atlanta non-attainment area for the 1-hour based ozone NAAQS has an ongoing I/M program. We have included in the submission an “imcoverage” table which includes the EPA/MOVES default data set to “useIMyn=N”. The replacement Georgia local data is provided as well with “useIMyn=Y” in those cases. This local I/M data is provided from the Georgia EPD Mobile & Area Sources program’s I/M unit. 2 counties (Bartow (13015) and Newton (13217)) have no I/M program so defaults (i.e., empty table) are sufficient.

***Day VMT Fractions and Month VMT Fractions***

GDOT provided, based on the Georgia Department of Transportation (GDOT)’s ***Georgia Roadway Mileage and Characteristics Reports (400 Reports)*** data series, a breakdown of VMT by weekend/weekday as well as month. The data processed by GDOT provides day VMT fractions (weekend versus weekday) by sourcetype, month and roadtype. Due to data limitations, these fractions are not for every county, but by regions (3 regions are “Northern District”, “Central District”, and “Southern District”). Counties in each region will have the same day VMT fractions. A map of these regions is in Appendix A. The month VMT fractions provided by GDOT are sorted by vehicle type and whether it is a leap year (“isLeapYear=N”). As required for formatting purposes, data was included for “isLeapYear”=Y as placeholders with each month VMT fraction 0.0833333 (or 1/12).

***County Year- Stage II vapor recovery efficiency***

For SIP work and transportation conformity assessments the state of Georgia has assumed, for the 13 county area, a vapor recovery efficiency of 81% during refueling with regards to any vapors released into the air. A 0% reduction in fuel spillage benefit has been determined. This differs from the assumption in the MOVES default database (86% for vapor, 50% for spillage) so a county year table is provided in this submission. 2 counties (Bartow (13015) and Newton (13217)) required only defaults since no program for Stage II vapor recovery.

All remaining tables and databases not mentioned in this discussion related to the EPA default database were not replaced; MOVES/EPA defaults were used.

Gil Grodzinsky

Georgia Environmental Protection Division

Department of Natural Resources

State of Georgia

404-363-7123

[gil.grodzinsky@dnr.state.ga.us](mailto:gil.grodzinsky@dnr.state.ga.us)

Di Tian

Georgia Environmental Protection Division

Department of Natural Resources

State of Georgia

404-363-7092

[di.tian@dnr.state.ga.us](mailto:di.tian@dnr.state.ga.us)