Appendix C1

Technical Support Document for the Development of Onroad Mobile Emissions Inventories for 2002, 2007, 2017, and 2025

(Washington, DC-MD-VA PM2.5 Nonattainment Area)

Appendix C1 consists of two separate attachments namely, Attachment A and Attachment B.

Attchment A - Description of inputs developed by MWCOG Department of Transportation Planning

Attachment B – Description of inputs provided by MWCOG Department of Environmental Programs

Appendix C1

Attachment A

(MWCOG/DTP)

Technical Support Document for the Development of MOVES2010a Inputs (Vehicle & Travel) for 2002, 2007, 2017, and 2025

(Washington, DC-MD-VA PM2.5 Nonattainment Area)

PM2.5 REDESIGNATION REQUEST & MAINTENANCE PLAN

PRECURSOR NO_x, PRIMARY $PM_{2.5}$ & SULFUR DIOXIDE ON ROAD MOBILE EMISSIONS

INVENTORIES DEVELOPMENT

TECHNICAL DOCUMENTATION

Prepared by the:
Metropolitan Washington Council of Governments
Department of Transportation Planning

October 25, 2012

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF REFERENCES

1. Motor Vehicle Emission Simulator MOVES2010a. Assessment and Standards Division Office of Transportation and Air Quality U.S. Environmental Protection Agency EPA-420-B-10-036 August 2010
   http://www.epa.gov/otaq/models/moves/index.htm

2. Air Quality Conformity Determination of the 2011 Constrained Long Range Plan for the Washington Metropolitan Region, November 16, 2011,
   TPB. http://www.mwcog.org/transportation

3. User's Guide for the TPB Travel Forecasting Model, Version 2.3.36, on the 3,722-Zone Area System. Draft Report. November 18, 2011
   http://www.mwcog.org/transportation/committee/committee/archives.asp?COMMITTEE_ID=43

4. Growth Trends to 2040: Cooperative Forecasting in the Washington, Metropolitan Washington Council of Governments, Publication Number: 20108397, December 17, 2010
   http://www.mwcog.org/uploads/pub-documents/oV5fV1o20110120090230.pdf

5. VinPOWER, Copyright: ESP Data Solutions Inc., Product version 4.0.0.16

6. RegistrationDistributionConverter_Veh16
   http://www.epa.gov/oms/models/moves/tools.htm

7. AAD VMT Calculator HPMS.XLS
   http://www.epa.gov/oms/models/moves/tools.htm

IINTRODUCTION

This technical report documents how the input data that was used in the development of the on road mobile emissions inventories was obtained, processed and incorporated in MOVES model runs. Its focus is to document how the travel-related and vehicle population-related input data were developed and integrated in the analyses as the Department of Transportation Planning (DTP) of the Metropolitan Washington Council of Governments/Transportation Planning Board (MWCOG/TPB) has had the primary responsibility of preparing this input data and executing MOVES model runs. While fuel supply and formulation, Inspection/Maintenance (I/M) and meteorology input data were also integral components of the MOVES model runs, which were executed by the DTP, the input data were supplied by the MWCOG Department of Environmental Programs (DEP) in a MOVES-ready format. As such, documentation pertaining to the origins and development of such input data is not part of this technical report. It will be provided by MWCOG/DEP.

This technical report has the following objectives:

- to provide contextual background on the travel-related and vehicle population-related input data categories
- to tabulate the mobile emissions inventories by state and by analysis year
- to thoroughly document how the input data was obtained, developed and integrated in the MOVES model runs for the purpose of developing on road mobile emissions inventories

The geographical area represented in the analyses encompasses jurisdictions (i.e., counties) in suburban Maryland, Northern Virginia and the District of Columbia (Figure 1). It is also the metropolitan Washington PM2.5 Non Attainment area.

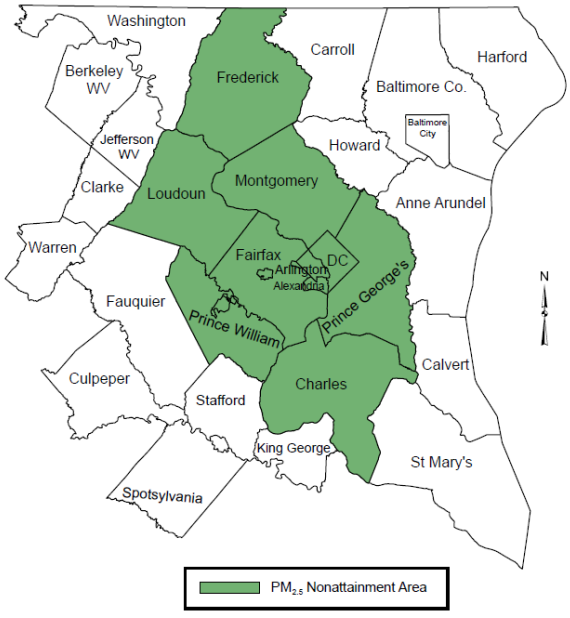

Figure 1 - $PM_{2.5}$ Air Quality Planning Area

TECHNICAL BACKGROUND

On road mobile emissions inventories were developed for the following years:

- Year 2002 (Base Year) – It is a historical year, and it was previously analyzed as part of the 2008 PM2.5 State Implementation Plan (SIP). It is analyzed again – using MOVES as the estimating model -- for consistency with the estimates for the other analysis years (i.e., 2007, 2017, 2025 and 2040).

- Year 2007 (Attainment Year)

- Year 2017 (Interim Year) – It was chosen by the participating air and transportation agencies as a year bridging the chronological gap between 2007 (the Attainment Year) and 2025 (the Final Year of the PM2.5 Maintenance Plan).

- Year 2025 (Final Year of the Maintenance Plan)

- Year 2040 (Final Year of the MWCOG/TPB Transportation Long Range Plan) – It is an additional (optional) year of analysis. Inclusion of year 2040 was not mandatory as part of the PM2.5 Maintenance Plan. Its inclusion, however, was viewed favorably by the participating air and transportation agencies as supplemental mobile emissions data – beyond year 2025 – would enable them to take a longer view of Air Quality Conformity.

Emissions Estimating Model: The mobile emissions inventories were developed using MOVES2010a [(1)].

Long Range Transportation Plan: The mobile emissions inventories were based on the 2011 Constrained Long Range Plan (CLRP) [(2)] of MWCOG/TPB. It was the most recently adopted long range transportation plan when this work was initiated. In accordance with established formal interagency consultation practices the plan went through an extensive review process and a 30-day public comment period as part of the 2011 CLRP Air Quality Conformity Determination. It was approved by MWCOG/TPB concurrently with the 2011 CLRP Air Quality Conformity Determination on November 16, 2011 and subsequently by the U S Department of Transportation (USDOT) on February 17, 2012.

Travel Demand Forecasting Model: Travel-related input data such as Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT), were generated using the newest version of the MWCOG/DTP travel demand forecasting model, which is Version 2.3 [(3)]. It is a Cube/Voyager model, developed under the oversight of the MWCOG/TPB Travel Forecasting Subcommittee, and it was first used in an official capacity in the 2011 CLRP Air Quality Conformity Determination.

The highway and transit networks coded in the model and used in the development of the mobile emissions estimates represent project inputs provided by participating state agencies. They reflect the scope and schedule of each project as reported by the sponsoring agencies. Project inputs were approved by MWCOG/TPB prior to the projects being coded in the model networks. The entire package consisting of the Version 2.3 model and the networks project assumptions were formally approved by MWCOG/TPB as part of the 2011 CLRP Air Quality Conformity Determination (November 16, 2011).

Cooperative Land Use Forecasts: The analyses were based on Round 8.0a Cooperative Land Use Forecasts [(4)], and Exhibit A1 in Appendix, and they are reflected in the 2011 CLRP Air Quality Conformity Determination. The Round 8.0a land use forecasts went through an extensive review process and a 30-day public comment period as part of the 2011 CLRP Air Quality Conformity Determination.

Methodologies: The final determination on whether to use local/county input data – as opposed to EPA default values -- in MOVES model runs for Air Quality Conformity Determinations was made by a special task force that was created at MWCOG/TPB to guide and oversee the MPO transition from the Mobile 6.2 platform to MOVES. The MOVES Task Force (MTF) was comprised of technical representatives from state air and transportation agencies, the U S Environmental Protection Agency (USEPA), and Federal Highway

Administration (FHWA). During 18 monthly meetings between August 2009 and January 2011, the MTF accomplished the following: (1) approved the use of local input data in the MOVES County Data Manager instead of EPA default values, a decision that was based on a series of sensitivity tests evaluating the appropriateness of using local data; (2) approved the county level as the appropriate level of disaggregation in the MOVES County Data Manager, a decision that was based on a series of sensitivity tests evaluating the appropriateness of the domain (reflecting state level) versus the county (jurisdictional level); and (3) selected the Inventory Approach as opposed to the Emissions Rate approach as the preferred method of developing mobile emissions inventories for Air Quality Conformity Determinations.

Table A1 in the Appendix tabulates the sources of the local/county input data, the methodologies, the approval process for each input data category and methodology, and the dates of key decisions by the MTF. It also provides web links to the technical memoranda, which document the findings of the sensitivity tests supporting the decisions made.

On road mobile emissions inventories were developed for the following criteria pollutants: Precursor NOx, Direct $PM_{2.5}$ and SO_2.

On road mobile emissions inventories for VOC and NH_3 were not inventoried here because these pollutants were considered insignificant for the $PM_{2.5}$.Non Attainment area of the metropolitan Washington region as part of the 2008 $PM_{2.5}$ SIP.

ON ROAD MOBILE EMISSIONS INVENTORIES

On road mobile emissions inventories for Precursor NOx , direct PM2.5 and SO_2 are summarized by state and analysis year in Tables 1, 2 and 3. Jurisdictional level on road mobile emissions inventories are shown in Table A2 of the Appendix.

Table 1. ANNUAL INVENTORIES OF PRECURSOR NOx (t/y)

State	2002	2007	2017	2025	2040
DC	9,962.80	7,511.73	3,395.06	2,005.43	1,890.08
MD	63,391.74	47,279.13	22,097.45	14,225.15	13,381.33
VA	53,598.46	36,847.77	16,216.37	11,169.07	11,546.08
Area Total	126,952.99	91,638.63	41,708.88	27,399.65	26,817.49

Table 2. ANNUAL INVENTORIES OF DIRECT PM2.5 (t/y)

State	2002	2007	2017	2025	2040
DC	302.27	272.39	157.14	123.80	120.25
MD	2,056.87	1,756.91	890.64	637.90	645.89
VA	1,599.75	1,422.32	739.17	560.59	584.24
Area Total	3,958.89	3,451.62	1,786.95	1,322.29	1,350.38

Table 3. ANNUAL INVENTORIES OF SULFUR DIOXIDE, SO2 (t/y)

State	2002	2007	2017	2025	2040
DC	280.67	67.67	65.62	60.02	61.78
MD	1,706.46	319.18	320.97	303.02	331.18
VA	1,621.78	220.18	173.38	167.91	183.69
Area Total	3,608.92	607.03	559.97	530.95	576.65

INPUT DATA DEVELOPMENT

Input data from ten broad categories were used in the MOVES County Manager in order to generate the mobile emissions inventories. The modeling sequence that was followed is graphically illustrated in Figure 2.

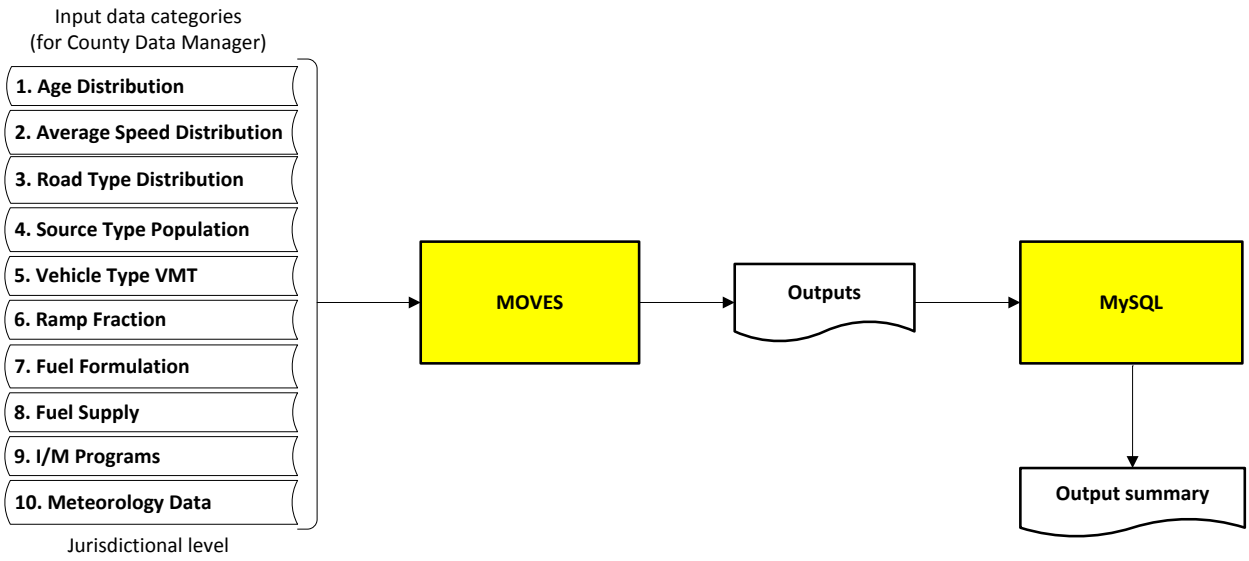

Figure 2. MOVES Modeling Process

Input data were obtained from local/county and regional sources (Table 4). The sources of the data, the methodologies and the processes are documented in the following sections. Fuel supply and formulation, I/M programs and Meteorology data documentation is provided in a companion document.

Table 4. Local Input Data Categories

No	Data Category	Data Table Name	Locality	Methodology
1	Age Distribution	**sourceTypeAgeDistribution**	County	based on VIN
2	Average Speed Distribution	**avgSpeedDistribution**	County	based on travel demand model's post-processor outputs + school bus/refuse truck data from Fairfax Co. + transit bus from WMATA
3	Road Type Distribution	**roadTypeDistribution**	County	based on travel demand model's post-processor outputs
4	Source Type Population	**sourceTypeYear**	County	based on CLRP Vehicle Projection & VIN
5	Vehicle Type VMT	**HPMSVTypeYear**	County	based on TDM's post-processor outputs
		monthVMTFraction	Region	based on Regional Data
		dayVMTFraction	Region	based on Regional Data
		hourVMTFraction	Region	based on Regional Data
6	Ramp Fraction	**roadType**	Region	8% of the urban/rural restricted access roads
7	Fuel	**FuelSupply**	State	from state air agency (state-wide data)
8		**FuelFormulation**	State	from state air agency (state-wide data)
9	I/M Programs	**IMCoverage**	State	from state air agency (state-wide data)
10	Meteorology Data	**zoneMonthHour**	State	from DEP (region-wide data)

Age Distribution

In recent years – 2005, 2008 and 2011 -- the Departments of Motor Vehicles (DMV) of the District of Columbia, Maryland and Virginia have been supplying to MWCOG/TPB vehicle registration data for use in Air Quality Conformity Determinations. The 2005, 2008 and 2011 databases contain a broad range of attributes of the vehicles registered in the jurisdictions of the PM2.5 Non Attainment area (Figure 1). They also reflect vehicles registered as of July 1 of these three years.

Prior to being used as inputs in MOVES model runs, the "raw" vehicle registration data – also known as Vehicle Identification Numbers (VIN) – were decoded using a commercial decoding software program (5). Due to the inability of the decoding software program to classify the decoded VIN entries into a MOVES-compatible format, the vehicle population decoding was achieved in two steps: (1) the "raw" data was decoded to a Mobile 6.2-compatible format (vehicle populations distributions stratified in 16 vehicle classes and in 25 vehicle age categories); (2) the previous vehicle population distributions were subsequently converted to a MOVES-compatible format (vehicle population distributions stratified in 13 vehicle classes and in 31 vehicle age categories) using an EPA-developed converter (6) while following the process recommended by EPA.

All three vehicle population databases were reviewed by the MWCOG/TPB technical oversight committees and went through public comments prior to becoming approved for transportation planning applications. The 2011 VIN database was formally approved by MWCOG/TPB concurrently with the 2012 CLRP Air Quality Conformity Determination in July 2012.

In 2002 the state agencies of the District of Columbia, Maryland and Virginia supplied Mobile 6.2-ready vehicle population registration data by jurisdiction, and MWCOG/TPB incorporated them directly into Air

Quality Conformity Determination analyses. Year 2007 mobile emissions estimates were based on the 2008 VIN database while remaining years' mobile emissions estimates for years 2017, 2025 and 2040 were based on the 2011 VIN database.

Average Speed Distribution (Hourly VHT Distribution by Vehicle Type Class)

A custom post processor (i.e., the V2.3 Post Processor) was developed in order to account for Vehicle Hours of Travel (VHT) stratified by three major vehicle type categories: passenger vehicles, commercial vehicles and heavy duty vehicles. The V2.3 Post Processor was necessary because the MWCOG/TPB travel demand model accounts for VHT by six travel markets, which are: light duty vehicles/Single Occupancy Vehicles (SOV), light duty vehicles/High Occupancy Vehicles (HOV2), light duty vehicles/High Occupancy Vehicles (HOV3+), Airport Passenger Trips, Commercial Vehicles and Trucks. The conversion of the VHT totals by the six travel markets to VHT totals by the three major vehicle type categories was done as follows:

- Passenger Vehicles (PVs) = SOV + HOV2 + HOV3+ + Airport Passenger Trips
- Commercial Vehicles (CVs) = Commercial Vehicles
- Heavy Duty Vehicles (HDVs) = Trucks

For each of the three major vehicle type categories, hourly VHT estimates were derived stratified by MOVES-compatible speed bins, jurisdiction (i.e., county level), and road type. MOVES calls for 16 speed bins along a continuous speed spectrum ranging from a low value of 2.5 mph to a high value of 75 mph in increments of 5 mph. MOVES calls for four road types: restricted access facilities (i.e., freeways and expressways) in urban and rural settings and unrestricted access facilities (i.e., major/minor arterials, collectors and local roads) in urban and rural settings.

Average Speed Distribution by the 16 MOVES-compatible speed bins was achieved as follows:

VHT Distribution to Restricted Facilities (all MOVES-compatible vehicle type categories):

- Weekday VHT Distribution:
  - All Day: Hourly distribution for all vehicles (as derived from the V2.3 Post Processor)
- Weekend VHT Distribution:
  - 11:00 am – 7:00 pm: Distribution across the 13 MOVES-compatible vehicle type categories reflecting the 3:00 pm hour on a weekday (as derived from the V2.3 Post Processor)
  - 7:01 pm – 10:59 am: Distribution across the 13 MOVES-compatible vehicle type categories reflecting the 12:00 am hour on a weekday (as derived from the V2.3 Post Processor)

VHT Distribution to Unrestricted Facilities (all MOVES-compatible vehicle type categories including intercity bus except Refuse Trucks, School Buses and Transit Buses)

- Weekday VHT Distribution:
  - All Day: : Hourly distribution for all vehicles (as derived from the V2.3 Post Processor)
- Weekend VHT Distribution:

- 11:00 am – 7:00 pm: Distribution across the 13 MOVES-compatible vehicle type categories reflecting the 3:00 pm hour on a weekday (as derived from the V2.3 Post Processor)
- 7:01 pm – 10:59 am: Distribution across the 13 MOVES-compatible vehicle type categories reflecting the 12:00 am hour on a weekday (as derived from the V2.3 Post Processor)

VHT Distribution to Unrestricted Facilities (Refuse Trucks, School and Transit Buses):

- Hourly VHT Distribution for refuse trucks (based on hourly distributions provided by Fairfax County)
- Hourly VHT Distribution for school buses (based on hourly distributions provided by Fairfax County)
- Hourly VHT Distribution for transit buses (based on hourly distributions provided by the Washington Metropolitan Area Transit Authority)

Road Type Distribution (VMT Distribution by Vehicle Type Class & Road Type)

The Version 2.3 Post Processor accounts for VMT by three vehicle types: passenger vehicles, commercial vehicles and heavy duty vehicles. In the MOVES environment, 13 vehicle type categories are identified. The challenge was to "expand" the VMT allocations (as percentages of the total) from the three vehicle type categories to the 13 MOVES-compatible vehicle type categories.

The Version 2.3 Post Processor also accounts for VMT by two facility types: restricted access facilities (i.e., freeways and expressways), and unrestricted access facilities (i.e., major/minor arterials, collectors and local roads). The VMT allocated to each of the three vehicle type categories is also stratified by the two facility types.

The VMT distribution by Vehicle Class Type and Facility Type was done as follows:

- The VMT percentages of passenger vehicles by facility type – as derived from the Version 2.3 Post Processor – were applied to motorcycles, passenger cars and passenger trucks
- The VMT percentages of commercial vehicles by facility type – as derived from the Version 2.3 Post Processor – were applied to light commercial trucks
- The VMT percentages of heavy duty vehicles by facility type – as derived from the Version 2.3 Post Processor – were applied to single unit short haul trucks, single unit long haul trucks, combination short haul trucks, combination long haul trucks
- A MOVES default percent value was applied to refuse trucks and motor homes
- Local network VMT percentages – based on local data supplied by bus operators – were applied to school, transit and intercity buses.

Urban versus rural percentage split factors were subsequently applied to differentiate VMT allocations between urban and rural facilities. These factors varied by jurisdiction as they were based on the latest Highway Performance Monitoring System (HPMS) VMT data provided by the three state transportation agencies. Figure 3 graphically illustrates the process that was followed to allocated VMT percentages by vehicle type class and road type in a format that is MOVES-compatible.

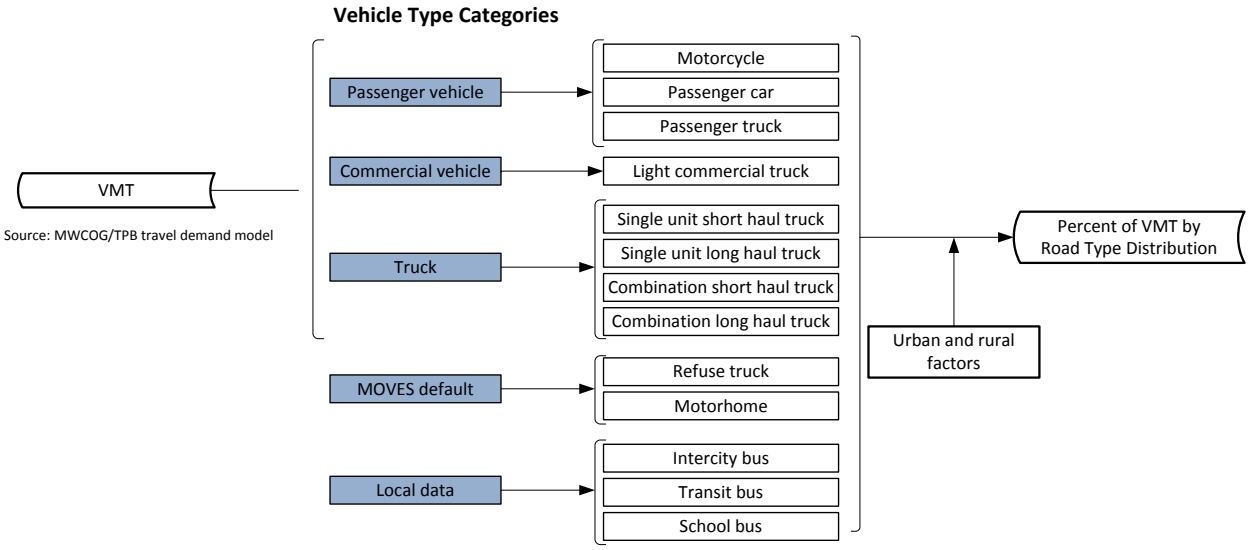

Figure 3. VMT Distribution Development Process

Source Type Population (Regional Vehicle Fleet)

Mobile emissions inventories were developed for the following analyses years: 2002, 2007, 2017, 2025 and 2040. Since these analysis years span a long time period, and the composition and characteristics of the regional vehicle fleet vary over time, different vehicle population profiles were used to develop the mobile emissions inventories for each of the above analysis years.

Each vehicle population profile that was used reflected the actual (and unique) composition of the regional vehicle fleet of the corresponding year in terms of its vehicle type and age distributions. While only modest changes in the vehicle type distributions were observed over time, substantial changes in the vehicle age distributions were observed over time. It is noteworthy that in the most recent vehicle population profile the regional fleet was found to be substantially older than before. For informational purposes, the area vehicle fleet is documented in Table 5.

Table 5. Vehicle Population in Metropolitan Washington Region (PM2.5 Air Quality Planning Area)

State	2002 Area Total	2007 Area Total	2017 Area Total	2025 Area Total	2040 Area Total
DC	247,230	260,385	285,814	295,720	314,294
MD	1,522,566	1,666,524	1,928,529	2,208,174	2,732,508
VA	1,549,440	1,631,964	1,968,282	2,234,885	2,734,766
Area Total	3,319,236	3,558,873	4,182,625	4,738,779	5,781,568

Note:
- 2002 area total was provided by state air agencies
- 2007 area total was based on 2005 Vehicel Registration Data and linear growth factors (by jurisdiction)
- 2017, 2025 and 2040 area totals were based on the 2011 Vehicle Registration Data and linear growth factors (by jurisdiction)

In order to capture the prevailing vehicle population characteristics (i.e., vehicle type and age distributions) over time, the most representative vehicle population profile for each analysis year was used. For the development of year 2002 mobile emissions, the 2002 vehicle population profile (i.e., vehicle type and age distributions) was used. Similarly, for the 2007 emissions, the year 2005 vehicle population profile was used. Finally, for the emissions inventories of years 2017, 2025 and 2040 – future year projections -- the 2011 VIN database profile was used as the best proxy of future vehicle populations.

Year 2002 vehicle population data were supplied by the state agencies of the District of Columbia, Maryland and Virginia. Years 2005, 2008 and 2011 vehicle population data were provided by the state agencies in a "raw" format, which were required decoding to a Mobile 6.2 format using a commercially available Vehicle Identification Number (VIN) decoding software program. The vehicle population data used throughout this analysis was considered as 100-percent representative samples of the vehicles registered in jurisdictions in the air quality planning area (Figure 1). As such, they did not require any extrapolation or any other type of "expansion" in order to capture the entire vehicle population in the jurisdictions of the air quality planning area.

The 2011 vehicle population profile – by jurisdiction -- was projected to years 2017, 2025 and 2040 using linear growth factors, which were unique for each jurisdiction since they were derived from historical local data. Similarly, the 2005 VIN vehicle population profile was projected to analysis year 2007 using the same jurisdiction-level annual growth factors. Finally, the resulting vehicle populations for all analysis years were converted to a MOVES-compatible format (i.e., 13 MOVES vehicle types) using the population mapping table provided by the EPA Technical Guidance (Appendix: Table A3 Population Mapping from MOBILE 6.2 Vehicle Types to MOVES Source Types). Figure 4 graphically illustrates the process.

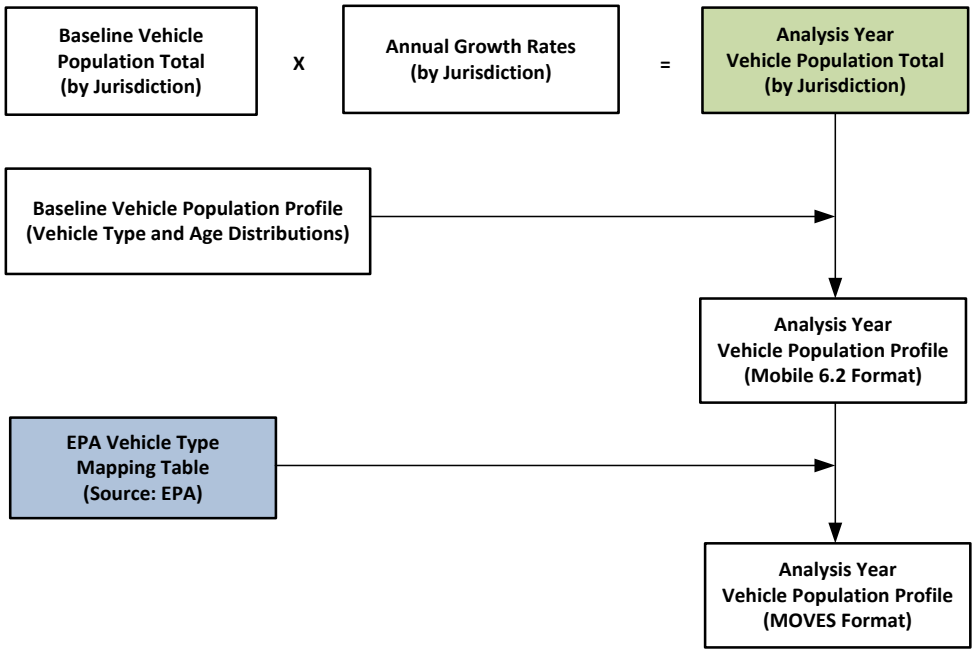

Figure 4. Source Type Population Development Process

Vehicle Type VMT

Unlike other transportation inputs mentioned in the previous sections in this report, MOVES requires annual VMT by six Highway Performance Monitoring System (HPMS) vehicle types instead of the 13 MOVES vehicle types. The Version 2.3 Post Processor produces average annual weekday VMT estimates by three vehicle types: passenger vehicles, commercial vehicles and heavy duty vehicles. Based on the VMT percent by 13 HPMS vehicle types and the vehicle registration data, average annual weekday VMT in three vehicle types from the Version 2.3 post processor and the local bus, VMT estimates are split into six HPMS vehicle types (Table 6).

Table 6. Annual VMT in Metropolitan Washington Region (PM2.5 Air Quality Planning Area)

State	2002 Area VMT Total	2007 Area VMT Total	2017 Area VMT Total	2025 Area VMT Total	2040 Area VMT Total
DC	3,739,392,134	3,958,909,906	4,155,214,419	4,326,158,542	4,614,913,658
MD	20,090,976,143	20,926,701,687	23,071,489,084	24,705,756,640	27,700,884,113
VA	16,730,587,862	18,024,722,031	20,472,567,625	22,339,692,536	24,968,189,974
Area Total	40,560,956,140	42,910,333,623	47,699,271,128	51,371,607,718	57,283,987,745

The average annual weekday VMT by six HPMS vehicle types is then fed into the EPA-provided annual VMT converter (AAD VMT Calculator HPMS.XLS) [7] with local monthly adjustment factors and weekend-day adjustment factors. The converter develops annual VMT in six HPMS vehicle types required as an input to MOVES with two additional outputs (i.e., 'monthVMTfraction' and 'dayVMTfraction'). The local "hourlyVMTfraction" is also provided as part of the annual VMT input.

Ramp Fraction

Local data was used to estimate the appropriate percentage of ramps representing the metropolitan Washington region. The methodology and estimates were reviewed and audited by the MOVES Task Force (MTF), which resulted in a regional percent estimate equal to 8 percent. It is the same as the national default value.

APPENDIX

TABLE A1 - Methodologies, Sources, Approval Process and Dates of Key Decisions of the MOVES Task Force

MOVES TASK FORCE

Local Input Data Development Matrix for the County Data Manager (Emissions Inventory Approach)*

as of January 11, 2011

LOCAL INPUT DATA CATEGORIES		DATA DESCRIPTION	DATA FORMAT		DATA DEVELOPMENT			LOCAL INPUT DATA APPROVAL DATE
			MOBILE6.2	MOVES	METHODOLOGY	METHODOLOGY DOCUMENTATION **	SENSITIVITY TESTING DOCUMENTATION **	
1	Age Distribution	Registered vehicles stratified by age and vehicle type	25 Age Groups (covering 1-25+ years of vehicle age) 28 Vehicle Types	31 Age Groups (covering 0-30+ years of vehicle age) 13 Vehicle Types	DTP used an EPA Converter to convert local registration data from MOBILE6.2 format to MOVES format	Memorandum titled "Development of Local Transportation Data Inputs for MOVES2010 Model" D. Sivasailam Memorandum Drafted: 4/13/2010 Memorandum Presented: 4/20/2010 (Item 3) Memorandum Revised: 5/14/2010 (Item 3b)	Memorandum titled "Results of MOVES 2010 Model Sensitivity...", E. Lucas, Drafted/presented 4/20/2010 (Item 4) Memorandum titled "Results of MOVES2010 Model Sensitivity... ," E. Lucas, Drafted/presented 5/18/2010 (Item 4a)	4/20/2010
2	Average Speed Distribution	Average vehicle speeds stratified by vehicle type, road type, time of day/type of day (i.e., weekday vs weekend)	N/A	Distributions of hourly average vehicle speeds by vehicle type, road type, and type of day (weekday/weekend)	DTP used MOBILE6.2 post-processor speed distribution augmented by local input data for school and transit buses and refuse trucks	Memorandum titled "Local Vehicle Hours of Travel (VHT) Distributions," D. Sivasailam Drafted/presented 7/20/10 (Item 3b) Tables titled "School Bus Average Speed Distribution," Drafted/presented 9/21/2010 (Item 3a) Memorandum titled "Vehicle Hours of Travel (VHT) for Refuse Trucks," D. Sivasailam and E. Morrow, Drafted/presented on 9/21/2010 (Item 3a) Memorandum titled "MOVES Vehicle Hours of Travel (VHT) Distribution for Transit Buses," Y. Gao" Drafted/presented on 10/19/2010 (Item 3)	Memorandum titled "Results of MOVES2010 Model Sensitivity Tests: Final Scenario for Average Speed Testing," E. Lucas Memorandum Drafted: 10/16/2010 Memorandum Presented: 10/19/2010 (Item 4) Memorandum titled "Proposed Sensitivity Tests with Different Average Speed Distributions/SIP Temperatures" Drafted/presented 9/21/2010 (Item 3a)	Local VHT 7/20/2010 School Buses 9/21/2010 Refuse Trucks 9/21/2010 Transit Buses 10/19/2010
3	Fuel Supply	Market share of available fuels by county, month, year, state	DC/MD/VA - EPA Methodology/data in MOBILE6.2 format	MD/VA - EPA Methodology/local data in MOVES format DC - EPA Default Values	None Required (Direct Data Input from DC, MD, and VA air agencies)	Memorandum titled "Development of Methodologies for Meteorology, I/M Program, and Fuel Inputs for Upcoming Ozone SIP (2008 or 2010 Standard) and Existing Conformity Analyses (Ozone & PM2.5 - 1997 Standards, CO - 1971 Standard)," S. Kumar Drafted/presented 6/22/2010 (Item 4a)	Memorandum titled "Results of MOVES2010 Model Sensitivity Tests:...Maryland Clean Car Program-ZEV," E. Lucas, Drafted/presented 5/18/2010 (Item 4a)	Not Required
4	Fuel Formulation	Fuel formulation data stratified by state						
5	I/M Programs	Available Inspection/Maintenance Programs stratified by state						
6	Meteorology Data	Hourly temperature and relative humidity readings	Hourly Records of temperature and relative humidity in MOBILE6.2 format Start Time: 6:00 am End Time: 5:00 am (next day)	Hourly Records of temperature and relative humidity in MOVES format Start Time: 12:00 am End Time: 11:00 pm	For Conformity Determinations - DEP converted meteorology data from existing SIPs to MOVES format using an EPA converter For Upcoming SIP Development - DEP compiled meteorology datasets from two weather stations based on a 3-yr period (2007-09) pending EPA approval	Memoranda titled "Development of Methodologies for Meteorology, I/M Program, and Fuel Inputs for Upcoming Ozone SIP (2008 or 2010 Standard) and Existing Conformity Analyses (Ozone & PM2.5 - 1997 Standards, CO - 1971 Standard)," S. Kumar Drafted/presented 6/22/2010 (Item 4a) & "Development of Meteorology Inputs for existing Conformity Analyses (Ozone & PM2.5 – 1997 Standards, CO – 1971 Standard)",)," S. Kumar Drafted/presented 7/20/2010	Memorandum titled "Results of MOVES2010 Model Sensitivity Tests:...Maryland Clean Car Program-ZEV," E. Lucas, Drafted/presented 5/18/2010 (Item 4a)	06/22/2010 (SIP for 2008 or Later Ozone Standard) 07/20/2010 (Conformity for Ozone & PM2.5 – 1997 Standards, CO – 1971 Standard)
7	Ramp Fraction	Percentage of driving time on ramps stratified by road type	N/A	8% of VHT (EPA National Default)	DTP tested local input data and found consistent with the EPA National Default value	Memorandum titled "Results of MOVES 2010 Model Ramp Analysis," E. Lucas, Drafted/presented 7/20/2010 (Item 4a)	Memorandum titled "Results of MOVES 2010 Model Ramp Analysis," E. Lucas, Drafted/presented 7/20/2010 (Item 4a)	7/20/2010
8	Road Type Distribution	Percentages of VMT allocated to each road type by vehicle type	N/A	VMT percentages by road type and vehicle type	DTP combined VMT from the travel demand model; and VMT distributions from the travel demand model, NEI data, and MOVES default data	Memorandum titled "Development of Local Transportation Data Inputs for MOVES2010 Model," D. Sivasailam Memorandum Drafted: 4/13/2010 Memorandum Presented: 4/20/2010 (Item 3) Memorandum Revised: 5/14/2010 (Item 3b)	Memorandum titled "Results of MOVES 2010 Model Sensitivity...", E. Lucas, Drafted/presented 4/20/2010 (Item 4) Memorandum titled "Results of MOVES2010 Model Sensitivity... ," E. Lucas, Drafted/presented 5/18/2010 (Item 4a)	4/20/2010
9	Source Type Population	Population of registered vehicles by county and vehicle type	N/A	13 Vehicle Types	DTP used vehicle registration and source type fractions			
10	Vehicle Type VMT	Annual VMT by HPMS vehicle type	Annual VMT at link level	Annual VMT allocated by HPMS vehicle type	DTP used daily VMT and an EPA converter	Memorandum titled "Development of Annual VMT for MOVES2010,"D. Sivasailam Memorandum Drafted: 4/16/2010 Memorandum Presented: 4/20/2010 (Item 3) Memorandum Revised: 5/14/2010 (Item 3b)	Memorandum titled "Results of MOVES 2010 Model Sensitivity...", E. Lucas, Drafted/presented 4/20/2010 (Item 4) Memorandum titled "Results of MOVES2010 Model Sensitivity... ," E. Lucas, Drafted/presented 5/18/2010 (Item 4a)	4/20/2010

*** The Task Force adopted the Emissions Inventory Approach (October 19, 2010)**

**** Documents can be found on the MOVES Task Force website:** http://www.mwcog.org/committee/committee/documents.asp?COMMITTEE_ID=253

Appendix C1-Attachment A

(Washington DC-MD-VA Redesignation Request & Maintenance Plan, May 22, 2013)

TABLE A1 - (Continues)

Web Links for the Sensitivity Testing Documentation:

- MOVES Task Force, September 15, 2009 Meeting Agenda Item 3: MOVES Model Testing: Work Plan and Schedule http://www.mwcog.org/uploads/committee-documents/aV5bV1xa20090914163330.pdf

- "Development of Local Transportation Data Inputs for MOVES2010 Model", May 14, 2010 Technical memorandum from D. Sivasailam to MTF Item 3b; "Results of MOVES2010 Model Sensitivity...," Technical memorandum E. Lucas, Item 4a, May 18, 2010
  http://www.mwcog.org/uploads/committee-documents/Zl5ZV1ta20100514180205.pdf
  http://www.mwcog.org/uploads/committee-documents/ZF5ZV1la20100517155131.pdf

- "Development of Annual VMT for MOVES2010 Model," May 14, 2010, Technical memorandum from D. Sivasailam to MTF, Item 3b
  http://www.mwcog.org/uploads/committee-documents/Z15ZV1tb20100514180126.pdf

- "Local Vehicle Hours of Travel (VHT) Distributions ", July 20, 2010, Technical memorandum from D. Sivasailam to MTF, Item 3b
  http://www.mwcog.org/uploads/committee-documents/ZV5YXFhY20100719160715.pdf

- "School Bus Average Speed Distribution", September 21, 2010, Technical memorandum from E. Morrow to MTF, Item 3a
  http://www.mwcog.org/uploads/committee-documents/Y15YV1tY20100920171335.pdf

- "Vehicle Hours of Travel (VHT) for Refuse Truck", September 21, 2010, Technical memorandum from D. Sivasailam and E. Morrow to MTF, Item 3a
  http://www.mwcog.org/uploads/committee-documents/YV5YV1tW20100921084613.pdf

- "MOVES Vehicle Hours of Travel (VHT) Distribution for Transit Buses", October 19, 2010, Technical memorandum from Y. Gao to MTF, Item 3
  http://www.mwcog.org/uploads/committee-documents/al5XX1pZ20101015155653.pdf

- "Results of MOVES Model Ramp Analysis", July 20, 2010, Technical memorandum from E. Lucas to MTF, Item 4a
  http://www.mwcog.org/uploads/committee-documents/aV5YXFhc20100719150333.pdf

- "Development of Methodologies for Meteorology, I/M Program, and Fuel Inputs for Upcoming Ozone SIP (2008 or 2010 Standard) and Existing Conformity Analyses (Ozone & PM2.5 - 1997 Standards, CO - 1971 Standard)", June 22, 2010 Technical memorandum from S. Kumar to MTF, Item 4a
  http://www.mwcog.org/uploads/committee-documents/b15YXlxc20100628132825.pdf

- "Development of Meteorology Inputs for existing Conformity Analyses (Ozone & PM2.5 – 1997 Standards, CO –1971 Standard)" July 20, 2010 Technical memorandum from S. Kumar to MTF, Item 3a http://www.mwcog.org/uploads/committee-documents/aF5YXFhb20100719153740.pdf

TABLE A2 – Mobile Emissions Inventories (Jurisdictional Level)

ANNUAL INVENTORIES OF PRECUSOR NOX BY JURISDICTION (t/y)

State	Jurisdiction	2002	2007	2017	2025	2040
DC	DC	9,962.80	7,511.73	3,395.06	2,005.43	1,890.08
MD	Charles County	3,813.95	2,993.74	1,631.57	1,034.64	947.98
	Frederick County	11,264.93	8,970.68	4,672.49	3,029.73	2,739.08
	Montgomery County	21,692.31	15,896.74	7,023.95	4,697.68	4,573.33
	Prince George's County	26,620.54	19,417.96	8,769.43	5,463.10	5,120.94
	MD Total	63,391.74	47,279.13	22,097.45	14,225.15	13,381.33
VA	City of Alexandria	2,457.24	1,445.54	650.04	428.90	424.40
	Arlington County	4,210.91	2,683.65	1,025.22	680.94	652.59
	Fairfax County	28,390.46	19,203.65	8,104.39	5,535.10	5,624.50
	Loudoun County	7,275.93	5,412.87	2,596.69	1,909.13	2,072.88
	Prince William County	11,263.92	8,102.06	3,840.03	2,615.01	2,771.71
	VA Total	53,598.46	36,847.77	16,216.37	11,169.07	11,546.08
Area Total		126,952.99	91,638.63	41,708.88	27,399.65	26,817.49

ANNUAL INVENTORIES OF DIRECT PM2.5 BY JURISDICTION (t/y)

State	Jurisdiction	2002	2007	2017	2025	2040
DC	DC	302.27	272.39	157.14	123.80	120.25
MD	Charles County	130.67	112.96	60.54	42.00	43.41
	Frederick County	374.66	340.90	180.63	119.75	117.25
	Montgomery County	685.23	596.94	309.28	233.31	239.36
	Prince George's County	866.31	706.12	340.19	242.84	245.87
	MD Total	2,056.87	1,756.91	890.64	637.90	645.89
VA	City of Alexandria	68.60	53.61	31.65	24.35	24.27
	Arlington County	113.66	97.92	51.37	40.72	39.88
	Fairfax County	828.29	733.16	372.46	282.23	285.05
	Loudoun County	244.94	228.70	120.10	94.21	104.84
	Prince William County	344.27	308.92	163.58	119.07	130.20
	VA Total	1,599.75	1,422.32	739.17	560.59	584.24
Area Total		3,958.89	3,451.62	1,786.95	1,322.29	1,350.38

TABLE A2 – Mobile Emissions Inventories (Jurisdictional Level) (Continues)

ANNUAL INVENTORIES OF SULFUR DIOXIDE, SO2, BY JURISDICTION (t/y)

State	Jurisdiction	2002	2007	2017	2025	2040
DC	DC	280.67	67.67	65.62	60.02	61.78
MD	Charles County	98.53	18.05	18.91	18.52	21.50
	Frederick County	301.94	51.70	54.14	52.13	59.41
	Montgomery County	601.98	122.08	119.27	112.68	123.20
	Prince George's County	704.01	127.35	128.65	119.69	127.07
	MD Total	1,706.46	319.18	320.97	303.02	331.18
VA	City of Alexandria	76.17	9.87	8.01	7.50	7.78
	Arlington County	141.63	18.28	14.30	12.95	13.17
	Fairfax County	875.03	116.93	90.61	86.04	91.56
	Loudoun County	216.19	31.05	25.01	26.43	31.22
	Prince William County	312.78	44.05	35.45	35.00	39.96
	VA Total	1,621.78	220.18	173.38	167.91	183.69
Area Total		3,608.92	607.03	559.97	530.95	576.65

TABLE A3 - Population Mapping from MOBILE6.2 Vehicle Types to MOVES Source Types

MOBILE6.2 Vehicle		MOVES Source Type		
ID	Name	ID	Name	Fraction
1	LDGV	21	Passenger Car	1.00
2	LDGT1	31	Passenger Truck	0.78
		32	Light Commercial Truck	0.22
3	LDGT2	31	Passenger Truck	0.78
		32	Light Commercial Truck	0.22
4	LDGT3	31	Passenger Truck	0.78
		32	Light Commercial Truck	0.22
5	LDGT4	31	Passenger Truck	0.78
		32	Light Commercial Truck	0.22
6	HDGV2B	31	Passenger Truck	0.63
		32	Light Commercial Truck	0.37
7	HDGV3	31	Passenger Truck	0.63
		32	Light Commercial Truck	0.37
8	HDGV4	31	Passenger Truck	0.06
		32	Light Commercial Truck	0.94
9	HDGV5	31	Passenger Truck	0.06
		32	Light Commercial Truck	0.94
10	HDGV6	43	School Bus	0.04
		52	Single Unit Short-haul Truck	0.69
		53	Single Unit Long-haul Truck	0.03
		54	Motor Home	0.23
		61	Combination Short-haul Truck	0.01
11	HDGV7	43	School Bus	0.04
		52	Single Unit Short-haul Truck	0.69
		53	Single Unit Long-haul Truck	0.03
		54	Motor Home	0.23
		61	Combination Short-haul Truck	0.01
12	HDGV8A	52	Single Unit Short-haul Truck	0.90
		53	Single Unit Long-haul Truck	0.08
		61	Combination Short-haul Truck	0.02
13	HDGV8B	52	Single Unit Short-haul Truck	0.90
		53	Single Unit Long-haul Truck	0.08
		61	Combination Short-haul Truck	0.02
14	LDDV	21	Passenger Car	1.00

TABLE A3 - Population Mapping from MOBILE6.2 Vehicle Types to MOVES Source Types (continues)

MOBILE6.2 Vehicle Type		MOVES Source Type		
ID	Name	ID	Name	Fraction
15	LDDT12	31	Passenger Truck	0.42
		32	Light Commercial Truck	0.58
16	HDDV2B	31	Passenger Truck	0.43
		32	Light Commercial Truck	0.57
17	HDDV3	31	Passenger Truck	0.43
		32	Light Commercial Truck	0.57
18	HDDV4	31	Passenger Truck	0.10
		32	Light Commercial Truck	0.90
19	HDDV5	31	Passenger Truck	0.10
		32	Light Commercial Truck	0.90
20	HDDV6	51	Refuse Truck	0.01
		52	Single Unit Short-haul Truck	0.72
		53	Single Unit Long-haul Truck	0.06
		54	Motor Home	0.07
		61	Combination Short-haul Truck	0.11
		62	Combination Long-haul Truck	0.03
21	HDDV7	51	Refuse Truck	0.01
		52	Single Unit Short-haul Truck	0.72
		53	Single Unit Long-haul Truck	0.06
		54	Motor Home	0.07
		61	Combination Short-haul Truck	0.11
		62	Combination Long-haul Truck	0.03
22	HDDV8A	51	Refuse Truck	0.02
		52	Single Unit Short-haul Truck	0.30
		53	Single Unit Long-haul Truck	0.02
		61	Combination Short-haul Truck	0.35
		62	Combination Long-haul Truck	0.31
23	HDDV8B	51	Refuse Truck	0.02
		52	Single Unit Short-haul Truck	0.30
		53	Single Unit Long-haul Truck	0.02
		61	Combination Short-haul Truck	0.35
		62	Combination Long-haul Truck	0.31
24	MC	11	Motorcycle	1.00
25	HDGB	43	School Bus	1.00
26	HDDBT	41	Intercity Bus	0.62
		42	Transit Bus	0.38
27	HDDBS	43	School Bus	1.00
28	LDDT34	31	Passenger Truck	0.42
		32	Light Commercial Truck	0.58

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS

One Region Moving Forward

Date: May 11, 2011

To: Elena Constantine
Department of Transportation Planning

From: Paul DesJardin
Department of Community Planning and Services

Subject: Round 8.0a Cooperative Forecast TAZ file

We have completed compilation of the Round 8.0a Cooperative Forecast 3,722 zone TAZ file for use in this year's Air Quality Conformity Analysis of the TIP and CLRP. The file, "rd80a_tpb3722.txt", contains base year 2005 estimates and 5-year forecasts through 2040, and is located on the SAS server at S:\DTP\zteam\coop5.

Control totals for each year and a record layout / file format are attached. Bob Griffiths, Greg Goodwin and I have all reviewed the data for quality and accuracy.

Should you have any questions concerning the file, please don't hesitate to contact me on extension 3293.

CC: Greg Goodwin
Bob Griffiths
Ron Kirby
Ron Milone
Jane Posey

777 North Capitol Street, NE, Suite 300, Washington, D.C. 20002
202.962.3200 (Phone) 202.962.3201 (Fax) 202.962.3213 (TDD)

www.mwcog.org

File Format

Programmer: DesJardin **Date:** 11-May-11 11:00 AM
Data File: rd80a_tbp3722.txt LRECL 437 3,669 records

Description of Contents:
Format for the Round 8.0a Cooperative Forecasts of population, households and employment to 2040 by COG / TPB 3722 Zone TAZ system

Field Number	Characters First	Last	#	A / N	Field Description
1	1	2	2	A	**Jurisdiction Code** 00 = District of Columbia 01 = Montgomery County 02 = Prince George's County 03 = Arlington County 04 = City of Alexandria 05 = Fairfax County / City / Falls Church 06 = Loudoun County 07 = Prince William / Manassas / Manassas Park 09 = Frederick County 10 = Howard County 11 = Anne Arundel County 12 = Charles County 14 = Carroll County 15 = Calvert County 16 = St. Mary's County 17 = King George County 18 = City of Fredericksburg 19 = Stafford County 20 = Spotsylvania County 21 = Fauquier County 22 = Clarke County 23 = Jefferson County
2	5	8	4	N	**TAZ (3722 Zone System)**
3	9	13	5	A	**FIPS State and County Code**
4	9	53	45	A	**Jurisdiction Name**
					2005 Data
5	54	59	6	N	Households
6	60	65	6	N	Household Population
7	66	71	6	N	Group Quarters Population
8	72	77	6	N	Total Employment
9	78	83	6	N	Industrial Employment
10	84	89	6	N	Retail Employment
11	90	95	6	N	Office Employment
12	96	101	6	N	Other Employment
					2010 Data
13	102	107	6	N	Households
14	108	113	6	N	Household Population
15	114	119	6	N	Group Quarters Population
16	120	125	6	N	Total Employment
17	126	131	6	N	Industrial Employment
18	132	137	6	N	Retail Employment
19	138	143	6	N	Office Employment
20	144	149	6	N	Other Employment

					2015 Data
21	150	155	6	N	Households
22	156	161	6	N	Household Population
23	162	167	6	N	Group Quarters Population
24	168	173	6	N	Total Employment
25	174	179	6	N	Industrial Employment
26	180	185	6	N	Retail Employment
27	186	191	6	N	Office Employment
28	192	197	6	N	Other Employment
					2020 Data
29	198	203	6	N	Households
30	204	209	6	N	Household Population
31	210	215	6	N	Group Quarters Population
32	216	221	6	N	Total Employment
33	222	227	6	N	Industrial Employment
34	228	233	6	N	Retail Employment
35	234	239	6	N	Office Employment
36	240	245	6	N	Other Employment
					2025 Data
37	246	251	6	N	Households
38	252	257	6	N	Household Population
39	258	263	6	N	Group Quarters Population
40	264	269	6	N	Total Employment
41	270	275	6	N	Industrial Employment
42	276	281	6	N	Retail Employment
43	282	287	6	N	Office Employment
44	288	293	6	N	Other Employment
					2030 Data
45	294	299	6	N	Households
46	300	305	6	N	Household Population
47	306	311	6	N	Group Quarters Population
48	312	317	6	N	Total Employment
49	318	323	6	N	Industrial Employment
50	324	329	6	N	Retail Employment
51	330	335	6	N	Office Employment
52	336	341	6	N	Other Employment
					2035 Data
53	342	347	6	N	Households
54	348	353	6	N	Household Population
55	354	359	6	N	Group Quarters Population
56	360	365	6	N	Total Employment
57	366	371	6	N	Industrial Employment
58	372	377	6	N	Retail Employment
59	378	383	6	N	Office Employment
60	384	389	6	N	Other Employment
					2040 Data
61	390	395	6	N	Households
62	396	401	6	N	Household Population
63	402	407	6	N	Group Quarters Population
64	408	413	6	N	Total Employment
65	414	419	6	N	Industrial Employment
66	420	425	6	N	Retail Employment
67	426	431	6	N	Office Employment
68	432	437	6	N	Other Employment

Round 8.0A Control Totals for TPB 3722 Zone System
Total Population 2005 to 2040
File: "rd80a_tpb3722.txt"

10:30 Thursday, May 12, 2011 1

JURIS	_FREQ_	TPOP05	TPOP10	TPOP15	TPOP20	TPOP25	TPOP30	TPOP35	TPOP40
District of Columbia	393	582,049	605,513	651,526	669,790	693,825	711,890	730,363	760,538
Montgomery County	376	929,097	979,996	1,016,996	1,064,995	1,108,997	1,151,997	1,181,997	1,198,997
Prince Georges County	635	835,705	846,171	873,103	895,742	913,402	928,281	939,908	950,119
Arlington County	141	199,189	212,318	224,816	235,544	241,394	247,275	249,566	251,969
City of Alexandria	65	135,853	145,010	149,076	158,463	166,918	173,330	180,862	188,287
Fairfax County/Cities	549	1,066,666	1,091,566	1,132,585	1,187,939	1,237,004	1,274,820	1,307,261	1,326,117
Loudoun County	282	247,333	290,002	318,675	357,678	397,114	418,952	431,179	439,707
Prince William County/Cities	376	405,298	451,852	501,060	539,317	571,785	598,946	621,209	639,197
Frederick County/City	130	220,876	243,221	265,566	287,913	311,071	340,030	371,719	406,401
Howard County	68	272,008	283,570	298,820	312,228	321,196	328,171	332,822	332,822
Anne Arundel County	98	513,699	532,788	546,520	556,577	565,594	574,270	581,608	581,608
Charles County	113	136,363	144,594	160,098	175,953	191,475	202,552	213,651	224,871
Carroll County	58	169,216	175,519	183,603	192,300	199,977	207,309	213,516	220,043
Calvert County	47	86,451	91,748	96,500	100,450	103,253	105,099	106,980	108,882
St Mary's County	75	96,091	104,854	118,184	130,098	141,135	151,403	162,572	173,832
King George County	25	21,486	24,171	26,848	30,323	33,758	37,275	40,748	44,265
Fredericksburg City	14	22,638	23,193	23,743	25,293	26,817	28,346	29,853	31,382
Stafford County	90	108,125	132,183	156,237	177,025	197,725	218,017	238,207	258,499
Spotsylvania County (north half)	62	88,862	105,124	121,378	136,404	151,352	165,221	179,011	192,880
Fauquier County	50	64,931	74,762	86,175	99,438	114,681	132,294	152,587	175,906
Clarke County	9	14,056	15,421	16,175	16,915	17,870	18,806	19,792	20,831
Jefferson County	13	46,692	51,189	56,669	62,144	68,854	75,565	83,109	91,394
	======	=========	=========	=========	=========	=========	=========	=========	=========
	3669	6,262,684	6,624,765	7,024,353	7,412,529	7,775,197	8,089,849	8,368,520	8,618,547

Round 8.0A Control Totals for TPB 3722 Zone System
Household Population 2005 to 2040
File: "rd80a_tpb3722.txt"

JURIS	POP05	POP10	POP15	POP20	POP25	POP30	POP35	POP40
District of Columbia	540518	563728	609339	627195	650818	668567	686620	716307
Montgomery County	918400	967900	1002800	1050700	1092500	1134400	1164200	1180700
Prince Georges County	815646	826112	851697	874336	891996	906875	918502	928713
Arlington County	195035	208164	220371	231099	236949	242830	245121	247524
City of Alexandria	133953	143110	147176	156393	164848	171260	178792	186217
Fairfax County/Cities	1052131	1075114	1116133	1171487	1220552	1258368	1290809	1309665
Loudoun County	246482	289151	317605	356608	395860	417698	429925	438453
Prince William County/Cities	401700	448034	497242	535499	567967	595128	617391	635379
Frederick County/City	216221	238095	260440	282787	305945	334904	366593	401275
Howard County	268426	279983	295233	308641	317609	324584	329235	329235
Anne Arundel County	497104	516054	529537	539477	548203	556700	563676	563676
Charles County	134939	143049	158397	174043	189283	200051	210789	221594
Carroll County	165637	171740	179624	188221	195798	203030	209132	215553
Calvert County	85787	91026	95724	99584	102248	103912	105609	107327
St Mary's County	92875	101278	114360	125922	136420	146063	156519	166972
King George County	21131	23816	26493	29968	33403	36920	40393	43910
Fredericksburg City	20319	20874	21424	22974	24498	26027	27534	29063
Stafford County	106631	130689	154743	175531	196231	216523	236713	257005
Spotsylvania County (north half)	88361	104623	120877	135903	150851	164720	178510	192379
Fauquier County	64363	74194	85607	98870	114113	131726	152019	175338
Clarke County	13744	15109	15863	16603	17558	18494	19480	20519
Jefferson County	45547	50044	55524	60999	67709	74420	81964	90249
	6124950	6481887	6876209	7262840	7621359	7933200	8209526	8457053

JURIS	GQS05	GQS10	GQS15	GQS20	GQS25	GQS30	GQS35	GQS40
District of Columbia	41,531	41,785	42,187	42,595	43,007	43,323	43,743	44,231
Montgomery County	10,697	12,096	14,196	14,295	16,497	17,597	17,797	18,297
Prince Georges County	20,059	20,059	21,406	21,406	21,406	21,406	21,406	21,406
Arlington County	4,154	4,154	4,445	4,445	4,445	4,445	4,445	4,445
City of Alexandria	1,900	1,900	1,900	2,070	2,070	2,070	2,070	2,070
Fairfax County/Cities	14,535	16,452	16,452	16,452	16,452	16,452	16,452	16,452
Loudoun County	851	851	1,070	1,070	1,254	1,254	1,254	1,254
Prince William County/Cities	3,598	3,818	3,818	3,818	3,818	3,818	3,818	3,818
Frederick County/City	4,655	5,126	5,126	5,126	5,126	5,126	5,126	5,126
Howard County	3,582	3,587	3,587	3,587	3,587	3,587	3;587	3,587
Anne Arundel County	16,595	16,734	16,983	17,100	17,391	17,570	17,932	17,932
Charles County	1,424	1,545	1,701	1,910	2,192	2,501	2,862	3,277
Carroll County	3,579	3,779	3,979	4,079	4,179	4,279	4,384	4,490
Calvert County	664	722	776	866	1,005	1,187	1,371	1,555
St Mary's County	3,216	3,576	3,824	4,176	4,715	5,340	6,053	6,860
King George County	355	355	355	355	355	355	355	355
Fredericksburg City	2,319	2,319	2,319	2,319	2,319	2,319	2,319	2,319
Stafford County	1,494	1,494	1,494	1,494	1,494	1,494	1,494	1,494
Spotsylvania County (north half)	501	501	501	501	501	501	501	501
Fauquier County	568	568	568	568	568	568	568	568
Clarke County	312	312	312	312	312	312	312	312
Jefferson County	1,145	1,145	1,145	1,145	1,145	1,145	1,145	1,145
	137,734	142,878	148,144	149,689	153,838	156,649	158,994	161,494

Round 8.0A Control Totals for TPB 3722 Zone System
Households 2005 to 2040
File: "rd80a_tpb3722.txt"

JURIS	HHS05	HHS10	HHS15	HHS20	HHS25	HHS30	HHS35	HHS40
District of Columbia	253,415	265,190	287,323	296,765	308,980	317,235	325,420	338,980
Montgomery County	347,500	360,500	377,000	398,000	417,000	438,000	453,000	463,000
Prince Georges County	299,867	306,006	319,057	331,066	340,456	348,806	355,337	360,110
Arlington County	92,213	100,476	108,091	114,382	118,013	121,341	122,712	124,207
City of Alexandria	66,311	66,632	68,508	73,678	78,629	82,884	87,013	90,555
Fairfax County/Cities	389,959	400,172	418,742	442,272	463,570	479,839	493,851	502,041
Loudoun County	87,482	102,331	112,669	127,409	141,848	150,209	154,978	158,299
Prince William County/Cities	135,991	152,404	172,583	188,801	202,785	214,454	223,935	231,495
Frederick County/City	79,493	87,708	95,923	104,139	112,481	123,125	134,778	147,529
Howard County	100,221	107,502	117,700	125,600	132,182	135,486	137,773	137,773
Anne Arundel County	192,462	202,314	210,888	217,782	223,822	229,371	234,332	234,332
Charles County	47,445	50,950	57,528	64,299	70,833	75,847	80,876	85,901
Carroll County	59,401	61,592	65,691	69,614	73,417	76,111	78,720	81,464
Calvert County	29,900	32,046	34,298	36,027	37,374	38,348	39,322	40,301
St Mary's County	35,052	38,870	44,443	49,352	53,960	58,143	62,326	66,509
King George County	7,606	8,852	10,097	11,411	12,689	14,030	15,318	16,659
Fredericksburg City	8,754	10,231	11,700	12,462	13,206	13,971	14,704	15,469
Stafford County	34,665	43,366	52,079	59,037	65,913	72,712	79,406	86,205
Spotsylvania County (north half)	29,705	36,434	43,170	48,536	53,836	58,796	63,671	68,631
Fauquier County	23,303	26,871	30,982	35,730	41,197	47,502	54,773	63,154
Clarke County	5,497	6,069	6,423	6,722	7,108	7,487	7,886	8,308
Jefferson County	18,294	20,427	23,192	25,957	29,518	33,075	37,062	41,527
	2,344,536	2,486,943	2,668,087	2,839,041	2,998,817	3,136,772	3,257,193	3,362,449

JURIS	TEMP05	TEMP10	TEMP15	TEMP20	TEMP25	TEMP30	TEMP35	TEMP40
District of Columbia	750,245	785,963	822,911	868,256	897,872	923,988	950,104	977,163
Montgomery County	500,000	506,000	540,000	585,000	628,000	673,000	703,000	723,000
Prince Georges County	347,885	358,385	370,135	383,635	399,635	419,635	444,135	474,635
Arlington County	195,158	205,175	218,214	243,835	262,358	268,606	278,539	281,120
City of Alexandria	105,750	108,895	117,666	124,115	135,439	142,257	153,606	160,447
Fairfax County/Cities	639,331	680,041	725,524	788,508	830,009	863,803	891,296	917,484
Loudoun County	125,594	143,736	167,570	206,458	236,327	257,195	271,462	285,415
Prince William County/Cities	139,429	144,532	166,671	188,769	209,892	232,597	256,059	280,697
Frederick County/City	122,162	142,412	151,456	158,278	163,464	167,257	171,139	175,109
Howard County	176,800	195,402	214,527	230,914	248,369	261,926	267,837	274,635
Anne Arundel County	318,435	339,012	363,161	385,641	404,390	419,975	434,701	434,701
Charles County	58,552	62,199	68,405	71,695	74,695	77,499	80,298	83,097
Carroll County	76,308	84,255	86,767	88,267	89,280	90,301	91,318	92,338
Calvert County	32,431	35,200	41,097	44,501	46,305	47,206	48,102	49,003
St Mary's County	57,652	62,994	68,202	71,601	74,599	76,596	78,637	80,731
King George County	6,705	9,039	11,377	13,150	14,855	16,390	17,825	19,339
Fredericksburg City	25,448	28,377	31,305	34,848	38,338	41,034	43,694	46,360
Stafford County	35,579	42,129	48,626	54,627	60,396	65,101	69,576	74,224
Spotsylvania County (north half)	27,615	33,236	38,794	43,578	48,255	51,966	55,553	59,240
Fauquier County	19,721	22,315	24,907	29,202	32,155	35,409	38,990	42,932
Clarke County	4,722	5,055	5,387	5,718	6,032	6,363	6,713	7,082
Jefferson County	14,768	16,786	18,803	20,818	22,639	24,452	26,410	28,524
	3,780,290	4,011,138	4,301,505	4,641,414	4,923,304	5,162,556	5,378,994	5,567,276

JURIS	OFF05	OFF10	OFF15	OFF20	OFF25	OFF30	OFF35	OFF40
District of Columbia	431,388	452,291	465,889	492,665	512,253	517,933	523,404	538,386
Montgomery County	254,477	247,631	271,113	300,971	331,831	364,491	384,017	398,128
Prince Georges County	82,656	84,639	88,041	91,862	96,707	103,861	111,689	118,138
Arlington County	101,305	109,014	123,832	148,069	164,448	169,747	178,698	181,528
City of Alexandria	55,822	58,461	66,450	72,459	83,325	89,977	101,148	107,711
Fairfax County/Cities	431,021	462,810	501,390	552,752	585,686	612,502	634,540	655,744
Loudoun County	40,774	48,687	58,563	76,237	91,269	102,140	111,132	119,547
Prince William County/Cities	55,520	58,519	70,339	81,930	93,484	106,153	119,667	134,218
Frederick County/City	47,614	54,561	57,477	60,008	62,352	63,553	65,011	66,528
Howard County	51,082	56,571	62,326	67,106	72,177	76,210	78,016	79,936
Anne Arundel County	86,349	91,899	98,233	105,046	110,598	114,522	118,615	118,615
Charles County	22,875	24,424	26,892	28,207	29,410	30,526	31,642	32,756
Carroll County	20,794	23,050	23,727	24,101	24,366	24,659	24,935	25,217
Calvert County	13,268	14,535	17,119	18,655	19,523	19,979	20,394	20,809
St Mary's County	25,429	28,025	30,424	32,081	33,429	34,359	35,237	36,146
King George County	2,068	2,142	2,220	2,496	2,767	2,995	3,203	3,424
Fredericksburg City	7,086	6,864	6,643	7,470	8,288	8,943	9,592	10,237
Stafford County	10,644	10,712	10,775	12,129	13,447	14,524	15,554	16,612
Spotsylvania County (north half)	7,506	8,325	9,140	10,297	11,438	12,341	13,228	14,123
Fauquier County	5,664	6,378	7,095	8,273	9,085	9,981	10,967	12,049
Clarke County	564	603	642	682	719	758	799	843
Jefferson County	5,738	6,519	7,301	8,086	8,794	9,497	10,257	11,080
	1,759,644	1,856,660	2,005,631	2,201,582	2,365,396	2,489,651	2,601,745	2,701,775

JURIS	RET05	RET10	RET15	RET20	RET25	RET30	RET35	RET40
District of Columbia	81,734	86,844	90,930	97,797	99,508	103,158	106,645	109,794
Montgomery County	87,796	90,830	93,568	98,318	102,734	106,737	111,056	112,580
Prince Georges County	80,854	83,653	87,145	90,671	94,661	98,935	104,627	113,881
Arlington County	36,266	37,580	37,587	38,685	40,673	41,517	42,443	42,296
City of Alexandria	26,947	27,498	28,094	28,474	29,147	29,580	30,063	30,381
Fairfax County/Cities	113,625	119,511	123,636	131,129	136,210	140,386	143,617	146,766
Loudoun County	26,507	32,534	37,282	45,247	50,258	53,149	54,352	55,432
Prince William County/Cities	42,806	45,466	53,099	61,342	69,436	78,305	87,720	97,816
Frederick County/City	33,984	40,148	43,164	45,023	46,324	47,998	49,047	50,008
Howard County	23,547	25,673	27,529	29,597	31,823	33,285	33,785	34,826
Anne Arundel County	59,379	63,317	68,471	70,497	72,579	76,414	78,881	78,881
Charles County	19,342	20,638	22,750	23,864	24,839	25,735	26,646	27,556
Carroll County	13,928	15,117	15,577	15,974	16,178	16,332	16,512	16,692
Calvert County	8,693	9,392	10,753	11,526	11,942	12,157	12,362	12,565
St Mary's County	12,218	14,030	15,338	16,166	16,949	17,455	18,001	18,570
King George County	501	2,613	4,717	5,662	6,554	7,405	8,216	9,067
Fredericksburg City	4,190	7,785	11,376	12,438	13,474	14,205	14,918	15,649
Stafford County	3,647	9,993	16,301	18,240	20,055	21,529	22,914	24,388
Spotsylvania County (north half)	5,097	8,261	11,374	12,687	13,941	14,943	15,869	16,871
Fauquier County	11,113	12,608	14,098	16,572	18,271	20,143	22,205	24,476
Clarke County	3,458	3,701	3,945	4,186	4,417	4,661	4,918	5,190
Jefferson County	3,433	3,901	4,370	4,839	5,261	5,684	6,138	6,630
	699,065	761,093	821,104	878,934	925,234	969,713	1,010,935	1,050,315

Industrial Employment 2005 to 2040

File: "rd80a_tpb3722.txt"

JURIS	IND05	IND10	IND15	IND20	IND25	IND30	IND35	IND40
District of Columbia	60,997	63,961	69,316	78,063	81,377	92,821	104,270	106,853
Montgomery County	46,680	47,231	48,407	51,157	55,136	60,099	63,801	66,527
Prince Georges County	55,683	56,652	57,642	58,822	60,192	61,612	63,130	65,066
Arlington County	22,538	22,436	21,332	21,400	21,453	21,464	21,484	21,445
City of Alexandria	7,471	7,554	7,386	7,336	7,121	6,854	6,549	6,509
Fairfax County/Cities	61,935	64,666	66,087	68,626	70,356	71,805	73,002	74,181
Loudoun County	25,410	28,808	32,626	39,165	43,958	47,497	50,259	52,832
Prince William County/Cities	27,480	27,574	29,522	31,281	32,675	33,997	34,997	35,773
Frederick County/City	15,892	18,811	20,039	20,950	21,555	21,869	22,421	23,003
Howard County	51,089	56,587	62,346	67,105	72,192	76,221	78,020	79,937
Anne Arundel County	86,358	91,897	98,224	105,052	110,615	114,517	118,590	118,590
Charles County	9,482	9,769	10,677	11,129	11,555	11,971	12,390	12,810
Carroll County	20,792	23,038	23,736	24,091	24,370	24,651	24,936	25,212
Calvert County	6,679	7,092	8,352	9,042	9,342	9,454	9,640	9,830
St Mary's County	9,879	12,139	12,957	13,478	13,891	14,149	14,457	14,754
King George County	2,068	2,142	2,220	2,496	2,767	2,995	3,203	3,424
Fredericksburg City	7,086	6,864	6,643	7,470	8,288	8,943	9,592	10,237
Stafford County	10,644	10,712	10,775	12,129	13,447	14,524	15,554	16,612
Spotsylvania County (north half)	7,506	8,325	9,140	10,297	11,438	12,341	13,228	14,123
Fauquier County	967	1,090	1,213	1,433	1,574	1,738	1,915	2,108
Clarke County	266	285	303	322	339	358	378	399
Jefferson County	3,660	4,162	4,663	5,162	5,616	6,064	6,550	7,072
	540,562	571,795	603,606	646,006	679,257	715,944	748,366	767,297

Round 8.0A Control Totals for TPB 3722 Zone System
Other Employment 2005 to 2040
File: "rd80a_tpb3722.txt"

JURIS	OTH05	OTH10	OTH15	OTH20	OTH25	OTH30	OTH35	OTH40
District of Columbia	176,126	182,867	196,776	199,731	204,734	210,076	215,785	222,130
Montgomery County	111,047	120,308	126,912	134,554	138,299	141,673	144,126	145,765
Prince Georges County	128,692	133,441	137,307	142,280	148,075	155,227	164,689	177,550
Arlington County	35,049	36,145	35,463	35,681	35,784	35,878	35,914	35,851
City of Alexandria	15,510	15,382	15,736	15,846	15,846	15,846	15,846	15,846
Fairfax County/Cities	32,750	33,054	34,411	36,001	37,757	39,110	40,137	40,793
Loudoun County	32,903	33,707	39,099	45,809	50,842	54,409	55,719	57,604
Prince William County/Cities	13,623	12,973	13,711	14,216	14,297	14,142	13,675	12,890
Frederick County/City	24,672	28,892	30,776	32,297	33,233	33,837	34,660	35,570
Howard County	51,082	56,571	62,326	67,106	72,177	76,210	78,016	79,936
Anne Arundel County	86,349	91,899	98,233	105,046	110,598	114,522	118,615	118,615
Charles County	6,853	7,368	8,086	8,495	8,891	9,267	9,620	9,975
Carroll County	20,794	23,050	23,727	24,101	24,366	24,659	24,935	25,217
Calvert County	3,791	4,181	4,873	5,278	5,498	5,616	5,706	5,799
St Mary's County	10,126	8,800	9,483	9,876	10,330	10,633	10,942	11,261
King George County	2,068	2,142	2,220	2,496	2,767	2,995	3,203	3,424
Fredericksburg City	7,086	6,864	6,643	7,470	8,288	8,943	9,592	10,237
Stafford County	10,644	10,712	10,775	12,129	13,447	14,524	15,554	16,612
Spotsylvania County (north half)	7,506	8,325	9,140	10,297	11,438	12,341	13,228	14,123
Fauquier County	1,977	2,239	2,501	2,924	3,225	3,547	3,903	4,299
Clarke County	434	466	497	528	557	586	618	650
Jefferson County	1,937	2,204	2,469	2,731	2,968	3,207	3,465	3,742
	781,019	821,590	871,164	914,892	953,417	987,248	1,017,948	1,047,889

Appendix C1

Attachment B

(MWCOG/DEP)

Technical Support Document for the Development of MOVES2010a Inputs (Fuel Characteristics, I/M Programs, Meteorology) for 2002, 2007, 2017, and 2025

(Washington, DC-MD-VA PM2.5 Nonattainment Area)

Table of Contents

1.0 INTRODUCTION

This portion of the onroad mobile technical support document (TSD) describes in detail data and their sources and the methodologies used to develop a few inputs namely, fuel formulation, fuel supply, meteorology, and Inspection & Maintenance (I/M) Programs for the MOVES2010a model. This model was used to develop emissions inventories for the onroad mobile sources for 2002, 2007, 2017, and 2025 for PM2.5-Pri, NOx, and SO2 for the Washington, DC-MD-VA PM2.5 nonattainment area counties.

Onroad mobile emissions inventories were developed by the MWCOG Department of Transportation Planning (MWCOG/DTP) in association with the MWCOG Department of Environmental Planning (MWCOG/DEP). MWCOG/DEP provided to MWCOG/DTP four specific inputs for the MOVES2010a model. These inputs along with the other inputs developed by MWCOG/DTP (See Appendix C1-Attachment A for details of DTP input development) were used to develop emissions inventories for the four milestone years mentioned above.

1.1 DESCRIPTION OF MOVES2010a MODEL INPUTS USED FOR INVENTORY DEVELOPMENT

The emissions inventories were developed at the county level. Therefore input files for the four inputs namely, fuel formulation, fuel supply, meteorology, and Inspection & Maintenance (I/M) Programs were also developed in MOVES2010a format at the county level. The methodologies, data, and their sources are being described for each input below.

1.1.1 FUEL FORMULATION

Inputs for fuel formulation were provided by the state air agencies of the District of Columbia, Maryland, and Virginia. Four sets of input files were provided at the state level for the four milestone years, which were then applied to individual counties within the three states.

1.1.2 FUEL SUPPLY

Inputs for fuel supply were provided by the state air agencies of the District of Columbia, Maryland, and Virginia. Each state developed a single set of inputs applicable to a particular milestone year and applied that to each county within their jurisdictions. Thus each state provided four such sets for the four analysis years.

1.1.3 INSPECTION & MAINTENANCE PROGRAMS

Inputs for I/M programs were provided by the state air agencies of the District of Columbia, Maryland, and Virginia. Each state developed a single set of inputs applicable to a particular milestone year and applied that to each county within their jurisdictions. Thus each state provided four such sets for the four analysis years.

1.1.4 METEOROLOGY

Inputs for meteorology (temperature & relative humidity) were developed by MWCOG/DEP in the MOVES201 format for all Washington, DC-MD-VA PM2.5 nonattainment area counties. These inputs were the same as used in the NMIM model for developing nonroad model emissions inventories for the three milestone years (2007, 2017, 2025) of the PM2.5 maintenance plan. NMIM used county-specific default hourly average temperature and relative humidity for each of the twelve months. Meteorology data used for the 2007 analysis were also used for the 2017 and 2025 NMIM analyses. For the sake of consistency, NMIM county-specific default meteorology data for the year 2002 were also used for the 2002 MOVES2010a analysis.

Detailed information regarding the default meteorology data in the NMIM model is provided in the EPA document titled "EPA's National Inventory Model (NMIM), A Consolidated Emissions Modeling System for MOBILE6 and NONROAD, EPA420-R-05-024, page 16".