APCD Technical Documentation for Using EPA Motor Vehicle Emission Simulator (MOVES) 2010 to Develop Mobile Source Emissions
May 2011

Adjustment Factors for Travel Model Output

The VMT and speeds from the travel demand model were adjusted before being used in the calculation of regional emissions. The purpose of these adjustments was to reconcile the model output with travel estimates from other sources, such as the Highway Performance Monitoring System (HPMS) estimates of VMT. To perform this adjustment, factors were developed for the year of the HPMS or other estimates and applied to model output for other years.

The outputs of the travel demand model were compared to estimates of speed based on: (1) the equations of the Highway Economic Reporting System (HERS) and (2) the use of data from the Automatic Continuous Traffic Recorders (ATRs) of the Kentucky Transportation Cabinet (KYTC). The HERS equations were used to estimate speeds on 402 sections of urban roadways for five functional classifications. The speeds from these roadway sections were used to determine the average speed for each of five functional classes. The speeds used in the travel model were also averaged for each urban functional class. The speed adjustment factor for each urban functional class was calculated as the ratio of the average speed using the HERS equations to the average speed using the travel model data.

The KYTC ATR data was used to estimate speeds on 84 sections of rural roadways for four functional classifications. The speeds from these roadway sections were used to determine the average speed for each of four functional classes. The speeds used in the travel model were also averaged for each rural functional class. The speed adjustment factor for each rural functional class was calculated as the ratio of the average speed using the ATR data to the average speed using the travel model data.

The procedures described above produced speed adjustment factors for all functional classes except rural minor collectors and rural and urban local roads and ramps. (Ramps are not officially a separate functional class, but the speed behavior of traffic on ramps is not expected to be like that of any other functional class. Therefore, the ramps were treated as a separate “functional class.”) There was not sufficient data to estimate speeds for the roadways of these classes. For the rural minor collectors and rural and local roads, the speed adjustment factor of the next higher functional class was used. For ramps, the speeds in the travel model were used without adjustment (i.e. the speed adjustment factor for ramps = 1).

MOVES

The following table (Table 1) summarizes the MOVES specifications for the runs used to produce data for the four Louisville Metro area counties to develop SIP PM2.5 MVEB's. VMT data for the runs was supplied by KIPDA's TDFM. The summary reflects the format of the MOVES input panels, in addition to the 13 input files that the County Database Manager (CDM) requires. A complete collection the CDM local input files, as well as the specification files, input databases, and output databases is included separately, along with sample MySQL script and a linked excel workbook. The file *Documentation_main.docx* lists the contents of the folders. MOVES was run in the inventory mode ("calculation type" in the "Scale" input panel) in order to provide the quickest and most accurate emission totals, given the data development schedule requirements.

MOVES RunSpecs: PM2.5 Redesignation SIP MVEB data; Louisville, KY PM2.5 Area

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MOVES RunSpec Parameter	Settings / Assumptions
MOVES Version 2010a, MOVES default database 20100830	
Analysis Years Run	2002, 2009, 2012, 2020, 2030; post-process interpolated to 2005, 2008, 2015, 2025
Scale	County, Emission Inventory mode
Time Span	Time aggregation = Hour; 12 months; All hours of day; weekdays & weekends
Meteorology	All 12 months were input, representing (historical) average annual temperatures and humidity for each month. Local temperature and humidity data was collected from NOAA weather stations in Louisville by APCD. Hourly distributions were then propagated using the EPA MOBILE6-MOVES conversion workbook customized by APCD, and used for all four counties.
Geographic Bounds	2 Indiana counties (Clark, Floyd), 2 Kentucky counties (Bullitt, Jefferson) - all run separately and for each analysis year. The small area in Madison Township, Jefferson Co., IN was calculated by IDEM (contracted - using MOVES with assistance and data supplied by APCD).
Vehicles/Equipment	All source types, gasoline and diesel; CNG population was set to 0 for transit buses using the AFV input file.
Fuel Supply Formulations	From most recent (2006) EPA data as well as IAC agreement for each county. Jefferson Co, KY: RFG, Clark & Floyd Co.'s IN: RVP, Bullitt Co., KY: conventional
I/M Programs	2005 runs for Floyd and Clark Co., IN; otherwise none for any county (last active was 2002 (KY) and 2006 (IN)).

Vehicle Populations & Age Distributions	Local county vehicle registration was used to derive vehicle populations and age distributions for Bullitt & Jefferson Counties (KY); 2002 VIN-decoded registration data supplied by IDEM was used for Floyd & Clark Counties (IN); pass-through heavy duty vehicle population and age distribution was developed using national data. MOBILE6 formatted data was converted using the EPA MOBILE6-MOVES converter workbooks, customized by APCD.
Vehicle VMT	Vehicle VMT was derived from earlier MOBILE6 modeling work, which used MOBILE6 default mileage accumulation rates and FHWA 1997 VMT. Fleet VMT mixes in MOBILE6 input format were then converted using the EPA MOBILE6-MOVES converter workbooks, customized by APCD.
VMT Distributions	Monthly=default, Hourly Profile=default, Road Type=data from KIPDA's TDFM (converted from MOBILE6 format), Speed=data from KIPDA's TDFM (converted from MOBILE6 format),
Ramp Fractions	Specific to each county from KIPDA supplied data.
Road Type	All road types including off-network
Pollutants and Processes	NOx, All $PM_{2.5}$ categories, SO_2, Total Energy Consumption
Strategies	Modified AVFT strategy file to reflect 0% CNG buses in the transit fleet
General Output	Units= grams, joules and miles
Output Emissions	Time = annual; Location = county; onroad inventory emission totals by process and pollutant.
Advanced Performance	none

Table 1: MOVES input summary

LMAPCD executed the MOVES runs to produce the onroad emissions data, and also post-processed the data to calculate the emission totals by county. Totals were calculated by using MSExcel workbooks that were linked to exported Excel files produced with the MySQL browser – part of the MOVES 2010a installation suite of programs – which operated on SQL MOVES output databases created for each run. Inputs were formatted for the MOVES CDM by making use of the EPA conversion workbooks, customized by APCD for easier 'cut and paste' transference. Only VMT input data was supplied by KIPDA's TDFM (and converted from MOBILE6 format to MOVES CDM input records). LMAPCD maintains a 'suite' of data with the most recent local data for its *APCD Mobile Suite*. This was used as a source for the MOVES runs required for the MVEB data (*Mobile Suite version g6*). For the Indiana Counties (Clark and Floyd) two sets of runs were made to provide data using both the older '2004' Indiana fleet data (actually 2002 fleet data, updated in 2004), and the new, but as yet not quality assured 2009 Indiana fleet data. *To date, the older (2002) Indiana fleet data was used in development of the SIP MVEB's.*