MOVES Modeling Overview in Air Quality Conformity

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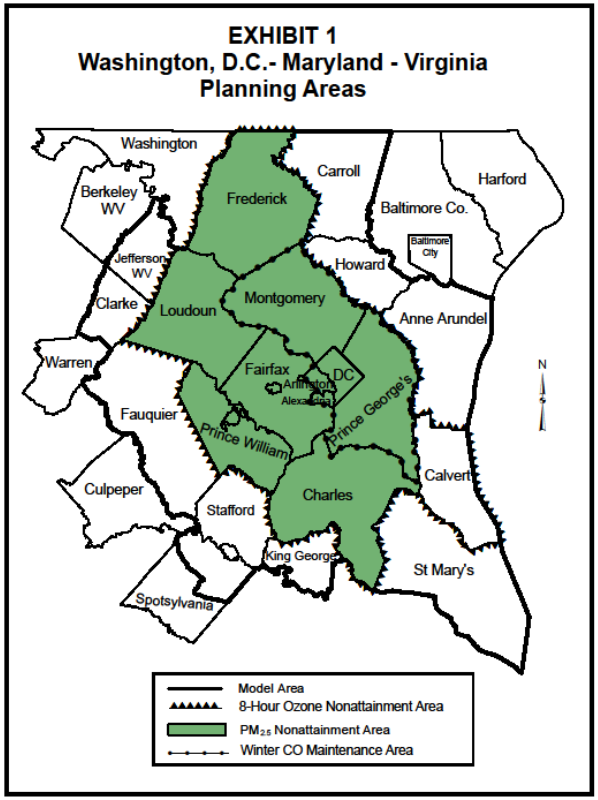
OVERVIEW

- MOVES (Motor Vehicle Emission Simulator); it is an EPA-developed model for estimating emissions from vehicles for a broad range of pollutants
- MOVES2010a is the official mobile emissions estimating model of TPB and is used for conformity and State Implementation Plan analyses
- MOVES2010a is currently applied to derive mobile emissions from:
  - Criteria Pollutants (i.e., Ozone, Fine Particles, Carbon Monoxide) for conformity
  - CO_2 for GHG analyses for the annual CLRP Performance Analysis
  - SO_2 for occasional analyses in support of MWAQC-driven initiatives
- MOVES2014 was released in July 2014; it was released again in October 2014 with improvements and corrections; and it is currently in a 2-year grace period for conformity (ending in October 2016) while validation and testing are ongoing

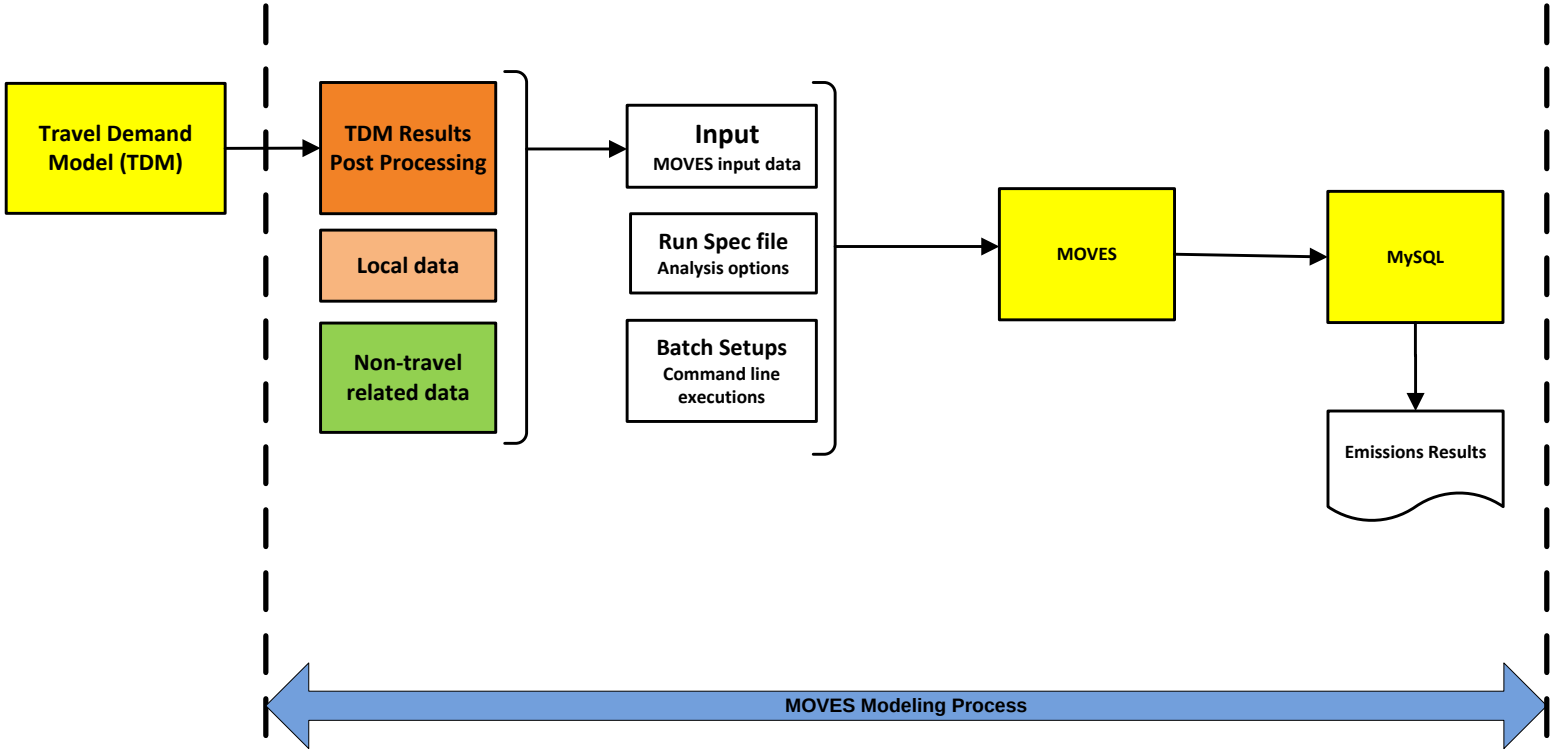
POLLUTANTS AND JURISDICTIONS



States	Jurisdictions	Pollutants: Ozone NOX & VOC	Fine Particles Direct PM2.5 & Precusor NOX	Carbon Monoxide CO	Greenhouse Gas CO2 Equiv.
DC	District of Columbia	✓	✓	✓	✓
Maryland	Montgomery County	✓	✓	✓	✓
	Frederick County	✓	✓		✓
	Charles County	✓	✓		✓
	Calvert County	✓			
	Prince George's County	✓	✓	✓	✓
Virginia	Arlington County	✓	✓	✓	✓
	City of Alexandria	✓	✓	✓	✓
	Fairfax County	✓	✓		✓
	Loudoun County	✓	✓		✓
	Prince William County	✓	✓		✓
	Total	**11**	**10**	**5**	**10**

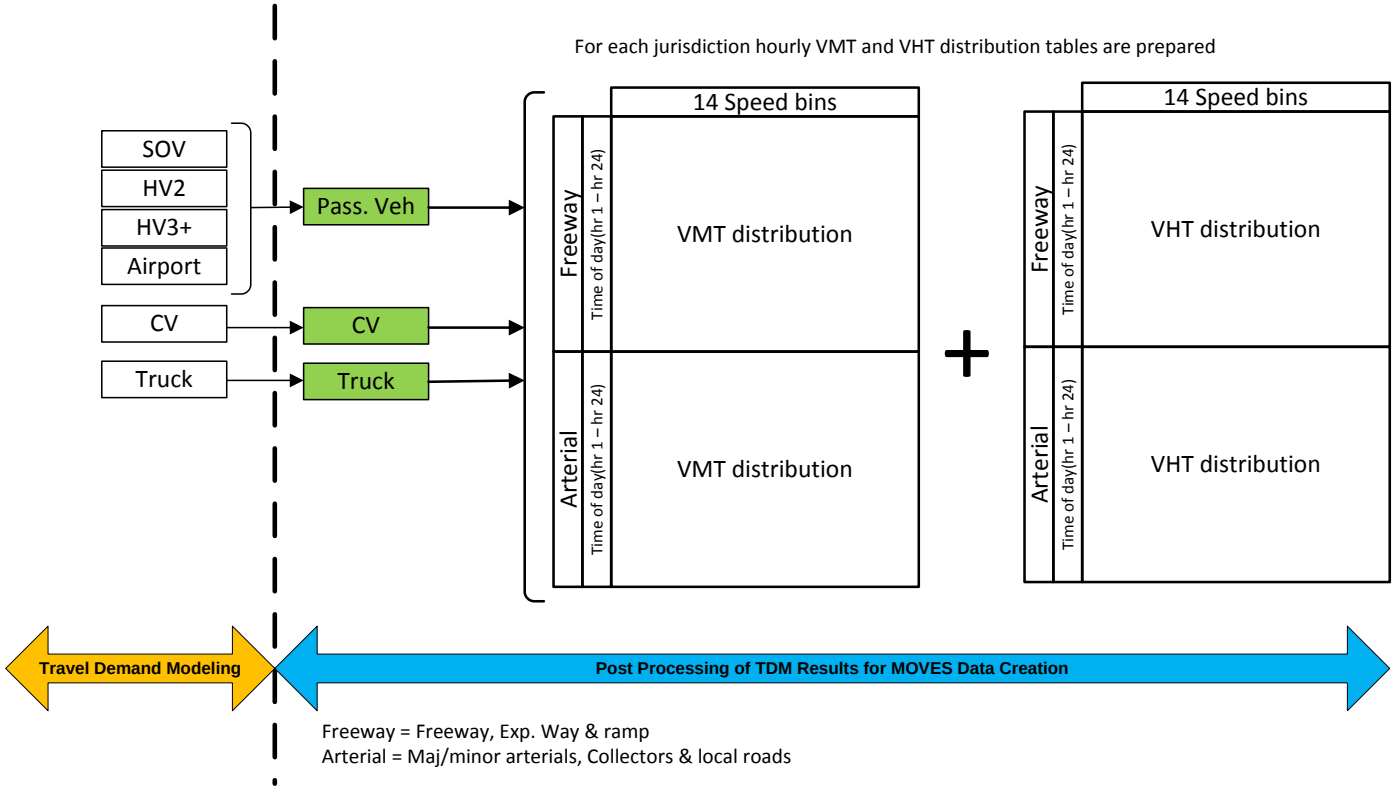
THE MOVES MODELING PROCESS

- **Objective:** To calculate mobile emissions using travel-related, regional vehicle population and non-travel related inputs
- **Modeling Process** = Data Processing -> Setup Creation -> MOVES Execution -> Summary of outputs



MOVES: Post Processing of TDM Results

- **Objective**: To derive hourly VMT and VHT distributions in a MOVES-compatible format through post processing
- **Outputs**: Hourly VMT and VHT distributions by speed bin
- **Challenge:** Travel Demand Model's VMT and VHT distributions are not compatible with MOVES, so the data require post processing

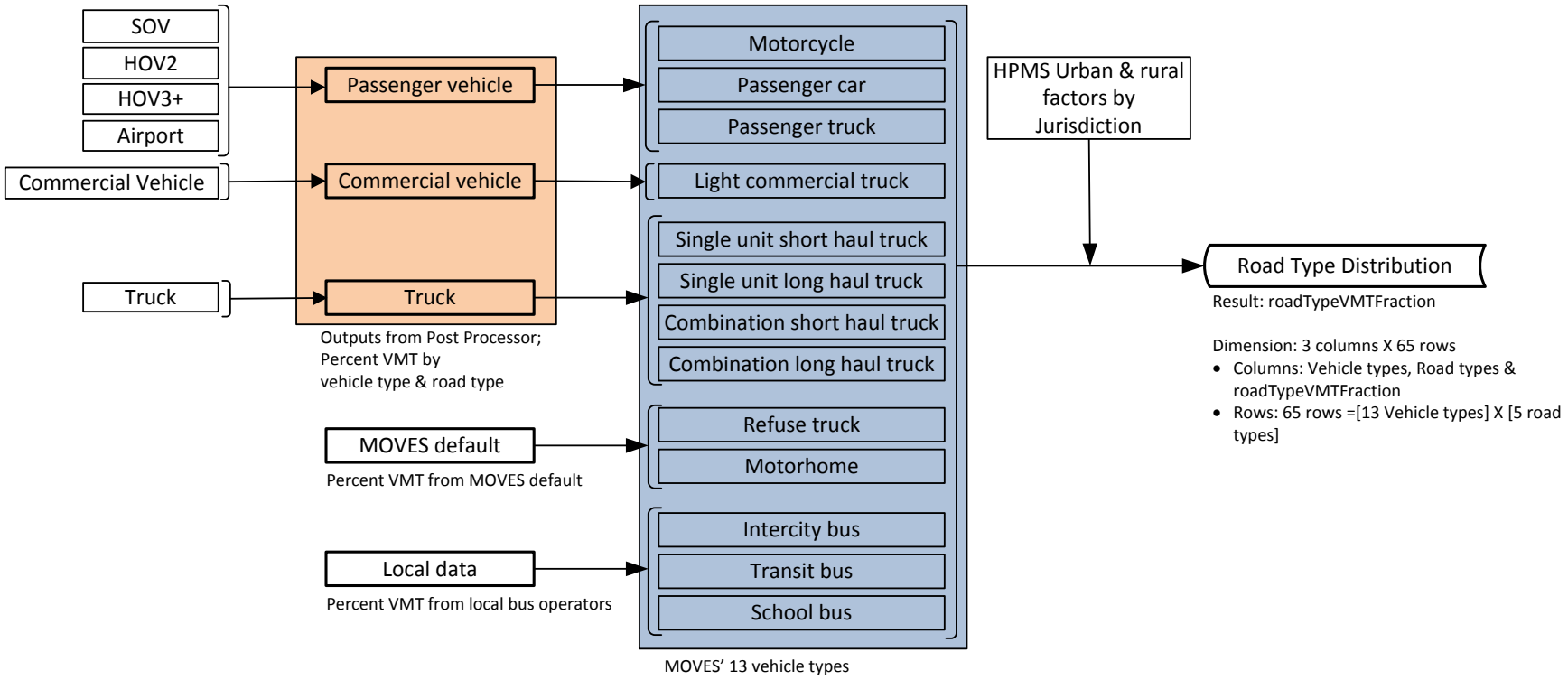


MOVES INPUT DATA

Data Type	Data Category	MOVES Name	Origin	Data Source
Travel-Related Inputs	Average Speed Distribution	avgSpeedDistribution	County	TDM Post Processing Fairfax Co. (School Buses & Refuse Trucks) WMATA (Transit Buses)
	Vehicle Type VMT	HPMSVTypeYear	County	TDM Post Processing
		monthVMTFraction	Region	Regional Data
		dayVMTFraction	Region	Regional Data
		hourVMTFraction	Region	Regional Data
	Road Type VMT Fraction	roadTypeDistribution	County	County
VIN Inputs	Vehicle Population	sourceTypeYear	County	VIN Database & Jurisdictional Growth Rates
	Age Distribution	sourceTypeAgeDistribution	County	VIN Database
MOVES Default	Ramp Fraction	roadType	Region	MOVES Default
Non Travel-Related Inputs	Fuel	FuelSupply	State	MD-DC-VA Air Agencies
		FuelFormulation	State	MD-DC-VA Air Agencies
	I/M Programs	IMCoverage	State	MD-DC-VA Air Agencies
	Meteorology Data	zoneMonthHour	State	Local Airport Monitors

AN EXAMPLE OF POST PROCESSING: Road Type Distribution

- **Objective**: To derive VMT fractions by vehicle type and road type



AN EXAMPLE OF POST PROCESSING:
Road Type Distribution (Cont'd)

65 rows

sourceTypeID	roadTypeID	roadTypeVMTFraction
11	1	0.0000
11	2	0.2841
11	3	0.2259
11	4	0.2730
11	5	0.2170
…	…	…
…	…	…
62	4	0.3252
62	5	0.1648

MOVES: Travel-related Input Data and Dimension

- Data map of each travel-related inputs and Vehicle Identification Number (VIN) inputs

			Travel-related Inputs						VIN Inputs	
			Avg. Speed Distribution	Vehicle Type VMT						
	Data Columns	Data Dimension	avgSpeedDistribution	HPMSVTypeYear	monthVMTFraction	dayVMTFraction	hourVMTFraction	roadTypeDistribution	SourceTypeYear	sourceTypeAgeDistribution
Data Requirements	SourceTypeYear	1		1					1	
	SourceTypeID	13	13		13	13	13	13	13	13
	HPMSVType	6		6						
	isLeapYear	2			1					
	monthID	12			12	12				
	roadtypeID	5	4			5	5	5		
	dayID	2	2			2	2			
	hourID	24	24				24			
	AgeID	31								31
	AverageSpeedBin	16	16							
	No. of Data Rows		**39,936**	**6**	**156**	**1,560**	**3,120**	**65**	**13**	**403**

WHAT DOES IT TAKE?: MOVES Runs and Time

Each Air Quality Conformity Cycle requires:

- ✓ 36 MOVES runs for each analysis year (in recent years there have been five analysis years); typically 180 model runs
- ✓ 24 consecutive computer hours for each analysis year (in a workstation w/ i5 3.1GHz CPU w/ 4GB ram)
- ✓ 5 Work Days per analysis year consisting of:
  - TDM Data Post Processing (1 day)
  - Inputs Preparation (2 days)
  - Setups/Execution/Data Organization(2 days)

WHAT IS AHEAD…

- The 2015 CLRP & FY2015-2020 TIP Conformity will be conducted using MOVES2010a (expected completion: Fall 2015)
- Update of the 2013 PM2.5 Maintenance Plan will be conducted using MOVES2014 (schedule still undetermined pending validation/testing of MOVES2014)
- Focus areas of current research and MOVES2014 testing:
  - Local data inputs
  - Operability of certain MOVES2014 processes

Questions?