Memorandum

Revised May 14, 2010

April 16, 2010

To:	MOVES Task Force
From:	Daivamani Sivasailam
	Department of Transportation Planning

Subject:	Development of Annual VMT for MOVES2010

At the April MOVES Task Force meeting staff presented this memorandum detailing the new methodology for developing annual VMT using the EPA provided convertor. One of the critical inputs in this effort is the use of HPMS 13 vehicle class (figure 1) counts and consolidating the 13 vehicle classes to 6 vehicle classes to match with the MOVES vehicle types. MOVES vehicle type 50 (heavy duty single unit truck) and MOVES vehicle type 60 (heavy duty combination unit truck) are made up of HPMS vehicle types 5 through vehicle type 13. During the allocation process, staff made an allocation error and incorrectly assigned vehicle types 8 through 10 (single trailer trucks) to MOVES vehicle type 50 which are called "single unit trucks", instead of to MOVES vehicle type 60 which are called "combination unit trucks". This error was isolated only to MOVES vehicle type 50 and 60 since this step involved splitting the heavy duty VMT into two parts and did not affect any of the other vehicle types. Subsequent to the meeting this incorrect allocation was corrected and staff has reestimated the annual VMT input for all the jurisdictions and rerun the MOVES2010 model and the results will be presented under item 4 at the May MOVES Task Force meeting.

The revision to the memo includes a new Table 1-A which shows the correct equivalencies between the HPMS 13 vehicle classes and the MOVES 6 vehicle classes; Table 1 in the April 16 memo is now called Table 1-B. In addition Table 2 also has been revised based on the correct allocation and the big variation that was noticed between MOVES vehicle type 50 and 60 is no longer there. District of Columbia and Montgomery County have a higher percentage of MOVES vehicle type 50 compared to type 60 whereas Fairfax County has a lower percentage of type 50 compared to type 60.

Background

Out of the four local transportation inputs to the MOVES model, annual VMT for the draft MOVES model by the six MOVES vehicle types were developed from the Mobile 6.2 post processor annual VMT and the methodology was presented to the MOVES Task Force and discussed in the November 17, 2009 memorandum from me to the MOVES Task force. For the MOVES2010 model in addition to the annual VMT as an input the user is encouraged to input local factors for estimating monthly VMT, weekend VMT from average weekday VMT and hourly factors to convert daily traffic to hourly traffic.

Along with the release of the MOVES2010 model EPA released a convertor to convert daily VMT, input as average annual weekday vehicle miles of travel at the HPMS level to calculate type of day, monthly and yearly VMT in terms of HPMS and/or MOVES source types to annual VMT. This memorandum describes the process staff undertook to develop this local input using the convertor.

Annual VMT

The first step was to review the local data available for use. They are:

- We have average summer weekday VMT generated by the regional travel demand model at the jurisdictional level by three vehicle types namely passenger vehicles, light commercial vehicles, and heavy duty vehicles.

- We have school bus and transit bus VMT based on a 2001 transit and school bus operator survey and broken down by jurisdiction for use in the periodic emissions inventory (PEI) submission.

- We have highway performance monitoring system (HPMS) VMT data by 13 vehicle types at the jurisdictional level in Virgina and at the state level in Maryland.

- We have classification counts by 13 vehicle types by different facility types in Maryland and the District of Columbia.

- We have factors to convert average summer weekday traffic to average weekday traffic, average weekday traffic to average daily traffic, factors to convert daily traffic to monthly traffic, and factors to convert daily traffic to hourly traffic. The methods used to develop these factors are described in detail in a memorandum from Mike Clifford/Daivamani Sivasailam to the TPB Technical Committee on Variation in Average Annual weekday vs. Average Annual Traffic and Seasonal Traffic dated May 5, 2005. Please refer to the conformity document for details on these factors.

The next step was to develop the process to use the locally available data identified above along with convertor to develop the MOVES2010 annual VMT input. The three vehicle type VMT (passenger vehicle, light commercial vehicle, and heavy duty vehicle) has to be split into 6 MOVES vehicle type (motorcycle, passenger cars, light commercial, buses, single-unit heavy duty, and combination-unit heavy duty) VMT. Table 1 illustrates the details of this process which is also explained by the following bullets.

1. Split the passenger vehicle VMT into motorycycle VMT, passenger car VMT and passenger truck VMT. The motorcycle VMT percentage is obtained from HPMS data whereas the passenger car and passenger truck VMT are obtained from the vehicle registration data files. The motor cycle and passenger car VMT provide MOVES type 10 and type 20 VMT.

2. Combining the passenger truck VMT with the light commercial vehicle VMT from the travel demand model will provide MOVES type 30 VMT.

3. Use the locally available school bus and transit bus VMT as is to provide MOVES type 40 VMT.

4. Subtract the bus VMT from travel demand model generated heavy duty vehicle VMT and split the balance between single-unit heavy duty vehicle VMT (MOVES type 50) and combination-unit heavy duty vehicle VMT (MOVES type 60) using HPMs factors.

The average daily weekday VMT by MOVES (HPMS) 6 vehicle types developed using the above processes is fed into the EPA provided VMT convertor along with the monthly adjustment factors, and weekend adjustment factor. The convertor developes the annual VMT required as an input to the MOVES2010 model along with two additional outputs namely "MonthVMT fraction" and "Day VMT fraction". Table 2 shows the comparison of annual VMT developed using the above method compared to the VMT- mix method described in the November 17th, memorandum for Montgomery, Fairfax and the District of Columbia. Staff is of the opinion that the new method is superior in forecasting motorcycle, light duty vehicles and heavy duty vehicles VMTs.

Recommendation: Staff recommends that we use the new convertor to develop annual VMT and the related local data from state traffic counts.

Table 1-A. Equivalency Table of 13 FHWA Vehicle Classes and 6 HPMS Vehicle Classes

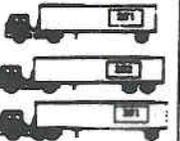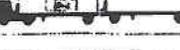| FHWA Vehicle Classes	HPMS Vehicle Classes
Class 1: Motorcycles	Motorcycle (10)
Class 2: Passenger Cars	Passenger Car (20)
Class 3: Light Trucks	Light Commercial +Passenger Truck (30)
Class 4: Buses	Bus(40)
Class 5: 2 Axle 6 Tire Single-Unit Trucks	Single Unit (50)
Class 6: 3 Axle Single-Unit Trucks	
Class 7: 4 Axle or More Single-Unit Trucks	
Class 8: 4 Axle or Less Single-Trailer Trucks	Combination Unit (60)
Class 9: 5 Axle Single-Trailer Trucks	
Class 10: 6 Axle or More Single-Trailer Trucks	
Class 11: 5 Axle or Less Multi-Trailer Trucks	
Class 12: 6 Axle Multi-Trailer Trucks	
Class 13: 7 Axle or More Multi-Trailer Trucks	

Table 1-B. Development of MOVES VMT by Vehicle Type

Source	Available	Factoring Method	MOVES Daily VMT
Network	Passenger Vehicle VMT	Motorcycle (HPMS)	Motorcycle (10)
		Passenger Car (registration data)	Passenger Car (20)
		Passenger Truck (registration data)	Light Commercial +Passenger Truck (30)
	Light Commercial Truck VMT	Light Commercial Truck (none)	
Off-Network/PEI	School Bus VMT	Bus (none)	Bus (40)
	Transit Bus VMT		
Network	Heavy Vehicle VMT	Single-Unit (HPMS)	Single Unit (50)
		Combination-unit (HPMS)	Combination Unit (60)

Table 2: Comparison of Annual VMT Percentage Developed Using VMT Mix/MOVES Equivalency and HPMS/Vehicle Registration

HPMS	MTG		FFX		DC	
	VMT MIX/MOVES Equivalency	HPMS/Vehicle Registration	VMT MIX/MOVES Equivalency	HPMS/Vehicle Registration	VMT MIX/MOVES Equivalency	HPMS/Vehicle Registration
10	0.48%	0.22%	0.49%	0.20%	0.52%	0.72%
20	41.07%	56.07%	41.13%	53.54%	41.66%	62.27%
30	53.38%	38.38%	53.25%	40.45%	53.16%	31.92%
40	0.65%	0.64%	0.54%	0.53%	0.67%	0.67%
50	2.10%	2.98%	2.14%	2.17%	1.96%	2.63%
60	2.33%	1.70%	2.46%	3.10%	2.03%	1.80%
Total	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Figure 1 : **Description of Classes**

	CLASS 1: *Motorcycles* -- All two or three-wheeled motorized vehicles. Typical vehicles in this category have saddle type seats and are steered by handlebars rather than steering wheels. This category includes motorcycles, motor scooters, mopeds, motor-powered bicycles, and three-wheel motorcycles.
	CLASS 2: *Passenger Cars* -- All sedans, coupes, and station wagons manufactured primarily for the purpose of carrying passengers and including those passenger cars pulling recreational or other light trailers.
	CLASS 3: *Other Two-Axle, Four-Tire Single Unit Vehicles* -- All two-axle, four-tire vehicles, other than passenger cars. Included in this classification are pickups, panels, vans, and other vehicles such as campers, motor homes, ambulances, hearses, carryalls, and minibuses. Other two-axle, four-tire single-unit vehicles pulling recreational or other light trailers are included in this classification.
	CLASS 4: *Buses* -- All vehicles manufactured as traditional passenger-carrying buses with two axles and six tires or three or more axles. This category includes only traditional buses (including school buses) functioning as passenger-carrying vehicles. Modified buses should be considered to be a truck and should be appropriately classified.
	CLASS 5: *Two-Axle, Six-Tire, Single-Unit Trucks* -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with two axles and dual rear wheels.
	CLASS 6: *Three-Axle Single-Unit Trucks* -- All vehicles on a single frame including trucks, camping and recreational vehicles, motor homes, etc., with three axles.
	CLASS 7: *Four or More Axle Single-Unit Trucks* -- All trucks on a single frame with four or more axles.
	CLASS 8: *Four or Fewer Axle Single-Trailer Trucks* -- All vehicles with four or fewer axles consisting of two units, one of which is a tractor or straight truck power unit.
	CLASS 9: *Five-Axle Single-Trailer Trucks* -- All five-axle vehicles consisting of two units, one of which is a tractor or straight truck power unit.
	CLASS 10: *Six or More Axle Single-Trailer Trucks* -- All vehicles with six or more axles consisting of two units, one of which is a tractor or straight truck power unit.
	CLASS 11: *Five or fewer Axle Multi-Trailer Trucks* -- All vehicles with five or fewer axles consisting of three or more units, one of which is a tractor or straight truck power unit.
	CLASS 12: *Six-Axle Multi-Trailer Trucks* -- All six-axle vehicles consisting of three or more units, one of which is a tractor or straight truck power unit.
	CLASS 13: *Seven or More Axle Multi-Trailer Trucks* -- All vehicles with seven or more axles consisting of three or more units, one of which is a tractor or straight truck power unit.

Descriptions based on Traffic Monitoring Guide - May 1, 2001; Section 4: Vehicle Classification Monitoring
http://www.fhwa.dot.gov/ohim/tmguide/tmg4.htm#tab4a1