Memorandum

April 16, 2010

To:	**MOVES Task Force**
From:	**Daivamani Sivasailam**
	Department of Transportation Planning
Subject:	**Development of Annual VMT for MOVES2010**

Background

This memorandum, supplement to my April 13, 2010 memo to the MOVES Task Force on development of local transportation inputs to the MOVES2010 model, addresses the 4th and final required input: Annual VMT by the 6 MOVES vehicle types. In developing this input to the draft MOVES2009 model annual VMT by the 6 MOVES vehicle types were developed from the Mobile 6.2 post-processor annual VMT.   The methodology was presented to the MOVES Task Force and discussed in my November 17, 2009 memorandum 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. 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 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.   (figure 1 for HPMS vehicle types)

- 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 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 also refer to air qulaity conformity documentation 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. Even though we have registration data for motorcycles since they are used more for recreational purposes and not for commuting we decided to use actual observed data.   The motorcycle VMT percentage as a percentage of passenger vehicles VMT was obtained from HPMS data and the remaining VMT was split between passenger car and passenger truck VMT using their respective vehicle registration percentages. 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. The remaining VMT will be split between the single-unit heavy duty vehicle VMT (MOVES type 50) and combination-unit heavy duty vehicle VMT (MOVES type 60). The method of using local VMT mix/MOVES equivalencies show an almost even split with a slightly higher percentage for type 60 (2.4% versus 2.1%). However observed HPMS data for all three states (Maryland, Virginia, and the District of Columbia) indicate the percentage of type 50 is much higher compared type 60 (4.5% versus 0.1%). Since this is consistent across all three states and the previous method relied on national equivalencies staff decided to use HPMS data for spliting type 50 and type 60.

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 percentages developed using the above combination of local

HPMS/registration data compared to the VMT-mix/MOVES equivalencies method described in the November 17th, memorandum for Montgomery, Fairfax and the District of Columbia.

Recommendation: To develop annual VMT staff recommends that we use the new convertor and the related local data from state traffic counts.
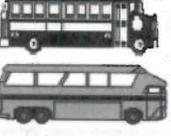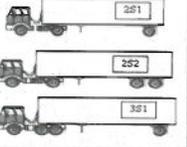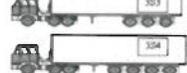
Table 1. Development of MOVES VMT by Vehicle Type

Source	Available	Factoring Method	MOVES Daily VMT
Network	Passenger Vehicle VMT	Motorcycle (HPMS)	Motor Cycle (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%	4.54%	2.14%	5.11%	1.96%	4.24%
60	2.33%	0.15%	2.46%	0.16%	2.03%	0.18%
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