

Improved in Depth HPMS Traffic Data Reviews

Office of Highway Policy Information

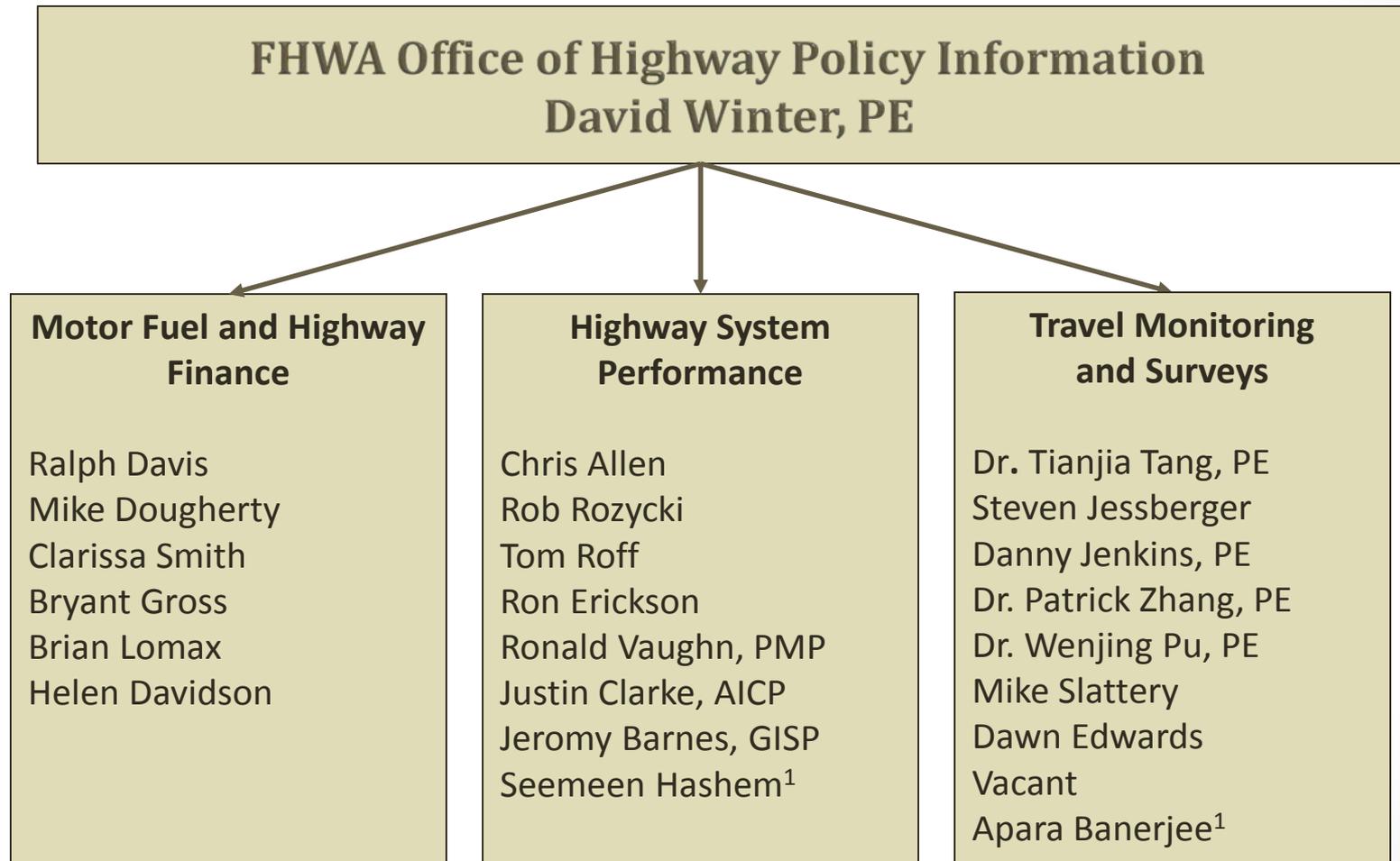
2017 Highway Information Seminar

Wednesday, November 15

Patrick Zhang and Steven Jessberger



Office Organizational Chart



1 – Indicates contractor



Topic Areas

- Key link Level traffic data QA/QC updates
- Vehicle Summary data
- GIS traffic data review



2016 HPMS Traffic Data Review Summary

- More states submitted the traffic data on time 2016
- More states pass the review first time 2016
- The most common issue is missing data: Future AADT, AADT, Truck AADT, K factor, D factor, and %Peak Truck
- Two States put vehicle summary data at incorrect columns
- 6 state Vehicle summary data has dramatic changes
- Future AADT does not make sense (it may be created in a different tool, does not link to HPMS properly)



Key Link Level Data: F_System missing example

The screenshot shows the TransCAD interface with a map of North Carolina. A data table window titled 'Dataview 1 - NorthCarolina_Sectio Info' is overlaid on the map. The table contains the following data:

Attribute	Value
aad_id	22696
aad_corb	488
aad_sing	1500
access_con	0
at_grade	0
base_thk	0.0000000000
base_tpe	0
countn_jn	0
county_cod	0
cracking_p	0.0000000000
curves_a	0.0000000000
curves_b	0.0000000000
curves_c	0.0000000000
curves_d	0.0000000000
curves_e	0.0000000000
curves_f	0.0000000000
dr_factor	0.0000000000
F_System	0
facility_1	6
fauling	0.0000000000
future_aad	0

Key Link Level Data: AADT - Full extent data

Functional System		1	2	3	4	5	6	7
	NHS	Int	OFE	OPA	MiA	MaC	MiC	Local
Rural	FE+R	FE+R	FE+R	FE+R	FE+R	FE+R		
Urban	FE+R							

FE = Full Extent
R = Ramp



Key Link Level Data: AADT Full extent check

AADT is a full extent data item for rural FC=1 to 5, urban FC=1 to 6. It should not be 0 or null

1. Facility_Type_VN <=3, F_System_VN=1,2,3,4,5
AADT_VN=0 or null?
2. Facility_Type_VN <=3, F_System_VN=6,
Urban_Code_VN<>99999, AADT_VN=0 or
null?



Key Link Level Data: AADT Single Unit Vehicle & Combination Truck

Functional System		1	2	3	4	5	6	7
	NHS	Int	OFE	OPA	MiA	MaC	MiC	Local
<u>Rural</u>	<u>FE</u>	<u>FE</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>		
<u>Urban</u>	<u>FE</u>	<u>FE</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>	

FE = Full Extent
 R = Ramp
 SP= Sample Panel



Key Link Level Data: Truck AADT (full extent & sample panel)

Truck AADT data is a full extent data item for interstate, and NHS and sample panel data for other function classes

1. Facility_Type_VN <=3, F_System_VN=1, AADT_Single_Unit_VN=null? AADT_Combination_Truck_VN =null?
2. Facility_Type_VN <=3, NHS_VN=1, AADT_Single_Unit_VN=null? AADT_Combination_Truck_VN =null? AADT_VN=0 or null?
3. Facility_Type_VN <=3, Is_sample=1, AADT_Single_Unit_VN=null? AADT_Combination_Truck_VN =null?



Key Link Level Data: Future AADT, K factor, D-factor

Functional System		1	2	3	4	5	6	7
	NHS	Int	OFE	OPA	MiA	MaC	MiC	Local
<u>Rural</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>	<u>SP</u>		
<u>Urban</u>	<u>SP</u>							

FE = Full Extent
 R = Ramp
 SP= Sample Panel



Key Link Level Data: K-Factor

**Facility_Type_VN <=3, Is_sample=1,
K_FACTOR_VN=null?**

- $K_FACTOR \leq 4.2\%$ -- impossible
- $4.2\% < K_factor \leq 6.0\%$ -- questionable
- $6.0\% < K_factor \leq 7.0\%$ -- caution
- $7.0\% < K_factor \leq 15.0\%$ -- acceptable
- $15.0\% < K_factor \leq 20.0\%$ -- caution
- $K_FACTOR > 20.0\%$ -- questionable



Big Picture - “data need to make sense”

- Population
- Fuel Consumption
- Number of licensed drivers
- Number of vehicles
- Gross Domestic Product (GDP)



Total VMT % of Change

- Population growth %
- GDP growth %
- Fuel Consumption %



Vehicle Summary Data

U.S. Department of Transportation
Federal Highway Administration

Highway Performance Monitoring System v8.0

Submittal Review National Maintenance

DATA EDITORS DATA VALIDATION SAMPLE MANAGEMENT CALCULATIONS REPORTS & ANALYSIS SUBMIT DATA ADMIN EXIT

State Summary Year: 2016 State: 9 - Connecticut

Summary Pavement Data Vehicle Type

Edit

	Rural			Urban		
	Interstate	Other Arterial	Other Rural	Interstate	Other Arterial	Other Urban
Motorcycles	0.04 %	1.71 %	1.77 %	0.34 %	1.12 %	1.54 %
Passenger Cars	74.17 %	72.42 %	73.06 %	80.75 %	78.41 %	73.75 %
Light Trucks	13.82 %	17.31 %	18.93 %	11.52 %	15.05 %	18.52 %
Buses	0.29 %	1.20 %	0.61 %	0.19 %	0.29 %	0.37 %
Single Unit Trucks	3.75 %	4.69 %	4.10 %	2.62 %	2.82 %	3.98 %
Combination Trucks	7.93 %	2.67 %	1.53 %	4.58 %	2.31 %	1.84 %
Total	100.00 %					

Last Modified On 6/1/2017 9:43:51 AM
Last Modified By Dominguez, Facundo



Truck VMT for Interstate Method A

$$\text{Truck VMT} = \sum_{i=1}^n \text{Truck AADT}_i \cdot \text{Length}_i$$

- Truck AADT has been released every year in HPMS shape file
- Daily Truck VMT for interstate can be calculated easily by all users



Truck VMT for Interstate by VM-4 Method B

$$\text{Truck VMT} = \text{VMT} \cdot \text{VMT}\%$$

- VMT can be obtained from VM-2
- VMT% can be obtained from VM-4
- Both tables are released annually in HS



Challenges

Method *A* = *Method B*?



Special Attention !

- Dramatic VMT % changes for Motorcycle, Bus and Combination Truck, consequently VMT by vehicle type has dramatic changes
- Some states have not adopted FHWA VMT weighted method
- Some lower function class of roadways for certain geographical areas do not have class data



VMT% Trends

U.S. Department of Transportation
Federal Highway Administration

Highway Performance Monitoring System v8.0

Submittal Review National Maintenance

DATA EDITORS DATA VALIDATION SAMPLE MANAGEMENT CALCULATIONS REPORTS & ANALYSIS SUBMIT DATA ADMIN HELP EXIT

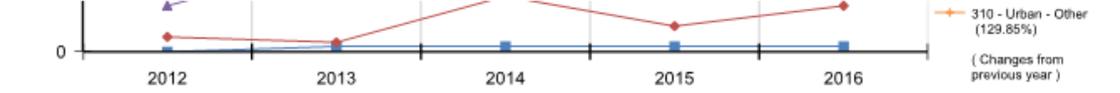
Reports Year: 2016 State: 11 - District of Columbia

Last updated: 3:02:31 PM

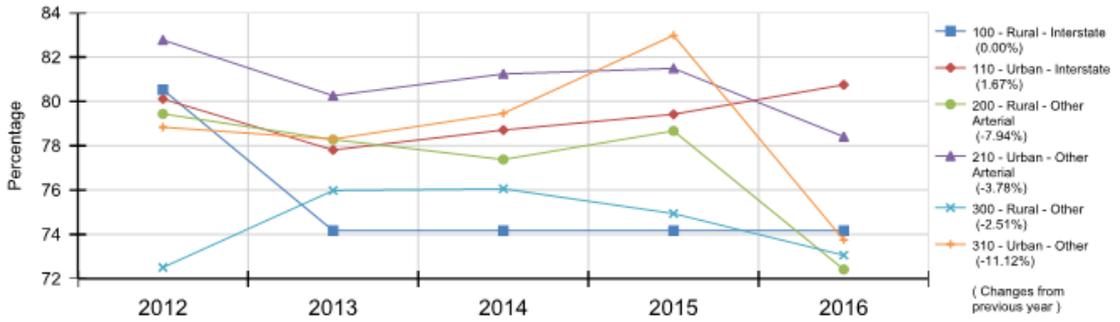
Report Name	Report Status	Submitted By	Submitted On	Last Modified On	Create	Cancel	Download	Preview PDF
Consistency	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:12 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Extent and Travel on the Interstates	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:16 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Extent and Travel on the NHS	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:23 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Extent and Travel Report	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:31 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Extent and Travel Report (Urban/Rural Summary)	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:33 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IRI on the Federal Aid Highways	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:36 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
IRI on the NHS	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:38 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Length of Missing Pavement Data	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:57 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Overview	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:31:58 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ownership	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:32:00 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Pavement Report Card	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:32:19 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Validation Summary	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:32:20 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample Adequacy	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:32:21 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Vehicle Summary Changes	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:32:22 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample VMT Comparison	5 - Report Created	Carpenter, Edward	8/17/2017 10:18:08 AM	8/17/2017 11:32:26 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Sample and TOPS Review Report	5 - Report Created	Zhang, Patrick P	8/18/2017 8:30:35 AM	8/18/2017 8:36:12 AM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Create Selected Reports Cancel Selected Reports Download Selected Reports

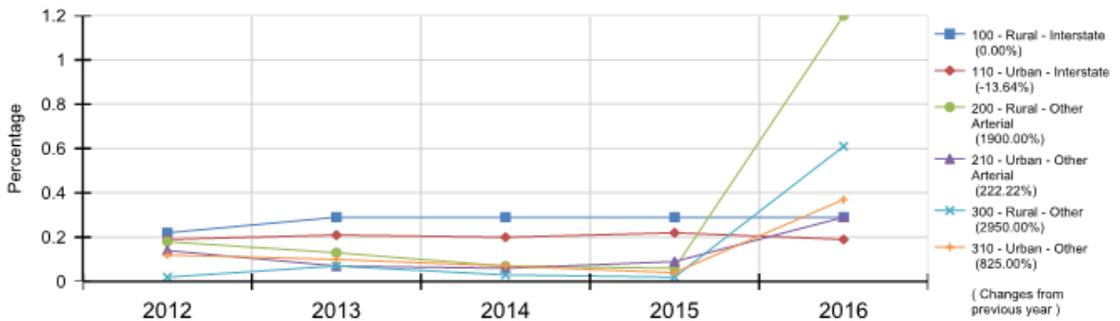




Passenger Cars



Buses



Get Class Data Ready

- County is the smallest jurisdiction in HPMS. The VMT weighted method at county level produces a stable result
- Review class data for possible data quality issues
- Annualize and seasonally adjust class data – keep and annualize the 6 vehicle types for HPMS for all class counts (both portable and permanent)
- Add county code, function classes, urban types to the class data set
- Use class data to calculate vehicle counts percentage by urban type, function classes, county



Sequence

- Upload (submit) your HPMS traffic data
- Download your HPMS traffic immediately and perform QA/QC steps
- Resubmit as needed, download again to verify errors have been fixed
- Final HPMS data is going to be used for truck VMT and VMT weights



Key steps

Step 1. Calculate VMT by function classes (11 of our 14) and by county

Step 2. Obtain VMT for **R6, R7, and U7** from Extent Travel Report

Step 3. Calculate Truck VMT% for **Interstate, NHS, and sample panel segments** by function classes and by county



Step 1 A: download final data

Intersection Selection Window

Build Intersecting Criteria

Instructions: Specify Data Item filter clauses using T-SQL notation. You may type it in manually or click on you. Click 'Get Results' to retrieve intersecting values.

Data Items	Filter
<input checked="" type="checkbox"/> AADT	
<input checked="" type="checkbox"/> F_SYSTEM	
<input checked="" type="checkbox"/> FACILITY_TYPE	
<input checked="" type="checkbox"/> IRI	
<input checked="" type="checkbox"/> THROUGH_LANES	
<input checked="" type="checkbox"/> URBAN_CODE	

[Add Intersection Layer](#)

Include Samples **Intersecting Scope** No Missing Data Item Full Intersections



Step 1B: Calculate VMT for Weights

 Report Filter	 Column Labels
<p>FACILITY_TYPE ▼</p> <p>Facility Type<=3</p>	<p>Ucode ▼</p> <p>F_SYSTEM ▼</p>
 Row Labels	 Values
<p>COUNTY_CODE ▼</p>	<p>Sum of VMT ▼</p>



Step 2A: R6 and R7 Daily VMT

HPMS 8.0.1

Extent and Travel Report Urbanized Area Summary

Stage: Submit
Year: 2016
State: 41 - Oregon
Date: 09/01/2017

	Miles			Lane Miles			Daily Vehicle Miles		
	2016	2015	% Change	2016	2015	% Change	2016	2015	% Change
99999 - Rural									
1 - Interstate	495.18	495.18	0.00%	2,020.88	2,020.88	0.00%	10,712,365.00	10,294,885.00	4.06%
2 - PA - Other Freeways and Expressways	0.00	0.00	0.00%	0.00	0.00	0.00%	0.00	0.00	0.00%
3 - PA - Other	2,656.96	2,657.71	-0.03%	5,905.30	5,906.71	-0.02%	11,476,331.70	11,017,845.10	4.16%
4 - Minor Arterial	2,223.47	2,225.49	-0.09%	4,540.73	4,544.78	-0.09%	4,955,682.60	4,810,971.30	3.01%
5 - Major Collector	8,174.09	8,168.75	0.07%	18,360.16	16,349.48	0.07%	5,012,009.60	4,856,283.70	3.21%
6 - Minor Collector	7,929.34	8,037.48	-1.35%	15,858.68	16,074.98	-1.35%	2,099,702.00	2,121,444.00	-1.02%
7 - Local	37,113.08	37,056.71	0.15%	74,226.16	74,113.42	0.15%	5,557,672.00	6,085,148.00	-8.67%
Total	58,592.1	58,641.3	-0.08%	118,911.9	119,010.2	-0.08%	39,813,752.9	39,186,577.1	1.60%

R6=?

R7=?



Step 2B U7 Daily VMT

HPMS 8.0.1

Extent and Travel Report Urbanized Area Summary

Stage: Submit
Year: 2016
State: 41 - Oregon
Date: 09/01/2017

	Miles			Lane Miles			Daily Vehicle Miles		
	2016	2015	% Change	2016	2015	% Change	2016	2015	% Change
All Areas									
1 - Interstate	729.56	729.56	0.00%	3,129.29	3,129.29	0.00%	28,157,584.00	25,465,150.00	2.72%
2 - PA - Other Freeways and Expressways	59.54	57.22	4.06%	259.49	250.35	3.66%	3,919,530.00	3,799,821.00	3.15%
3 - PA - Other	3,512.89	3,513.71	-0.02%	8,653.75	8,651.50	0.03%	28,853,030.00	28,016,172.30	3.22%
4 - Minor Arterial	3,507.67	3,511.17	-0.10%	7,535.09	7,539.89	-0.06%	16,887,428.00	16,530,916.30	2.16%
5 - Major Collector	10,296.45	10,290.24	0.06%	20,651.19	20,839.57	0.06%	12,375,445.50	12,059,954.70	2.62%
6 - Minor Collector	8,423.71	8,532.33	-1.27%	18,851.73	17,088.92	-1.27%	2,831,254.80	2,855,285.50	-0.84%
7 - Local	46,999.13	46,909.49	0.19%	93,998.26	93,818.98	0.19%	11,301,380.00	11,898,760.00	-5.02%
Total	73,529.0	73,543.7	-0.02%	151,078.8	151,098.5	-0.01%	100,925,852.1	98,626,039.8	1.72%
955 - Albany, OR									
1 - Interstate	8.67	8.67	0.00%	34.68	34.68	0.00%	521,706.00	507,341.00	2.83%
2 - PA - Other Freeways and Expressways	0.00	0.00	0.00%	0.00	0.00	0.00%	0.00	0.00	0.00%
3 - PA - Other	17.21	17.21	0.00%	57.71	57.49	0.38%	310,257.00	308,724.00	0.50%
4 - Minor Arterial	35.74	35.76	-0.06%	75.50	75.26	0.32%	242,722.40	239,799.00	1.22%
5 - Major Collector	45.31	45.31	0.00%	90.82	90.82	0.00%	107,160.20	108,936.70	-1.63%
6 - Minor Collector	15.68	15.78	-0.63%	31.36	31.56	-0.63%	18,923.20	22,378.70	-15.44%
7 - Local	190.92	189.85	0.56%	381.84	379.70	0.56%	94,124.00	89,989.00	4.60%
Total	313.5	312.6	0.30%	671.7	669.3	0.36%	1,294,892.8	1,277,168.4	1.39%

U7=All-R7



Step 3 Calculate Truck VMT%

Truck AADT: FS=1 or NHS=1 or Is_sampe=1, and facility type<=3
 Alternative: AADT_Combination_vn<>0, facility type<=3

Begin_Poi	End_Point	AADT_VN	AADT_CI	AADT_SIN	COUNTY_F_SYSTEM	FACILITY_	URBAN_CI	IS_SAMPL	Ucode	VMT	SUVMT	CTVMT	
0.235	0.24	2000	50	120	5	4	2	99998	1	2	10	0.6	0.25
0.24	0.3	2000	50	120	5	4	2	99998	1	2	120	7.2	3
0.3	0.39	2000	50	120	5	4	2	99998	1	2	180	10.8	4.5
0.39	0.394	2000	50	120	5	4	2	99998	1	2	8	0.48	0.2
0	0.1	2100	30	100	19	5	2	99999	1	1	210	10	3
0.1	0.2	2100	30	100	19	5	2	99999	1	1	210	10	3
0.2	0.225	2100	30	100	19	5	2	99999	1	1	52.5	2.5	0.75
0.595	0.6	3300	10	40	7	3	1	11755	1	2	16.5	0.2	0.05
0.6	0.7	3300	10	40	7	3	1	11755	1	2	330	4	1
0.7	0.8	3300	10	40	7	3	1	11755	1	2	330	4	1
0.8	0.837	3300	10	40	7	3	1	11755	1	2	122.1	1.48	0.37
0	0.005	230	0	10	21	3	2	99999	1	1	1.15	0.05	0
0.244	0.3	9900	180	470	21	2	2	99998	1	2	554.4	26.32	10.08
0.3	0.4	9900	180	470	21	2	2	99998	1	2	990	47	18
0.4	0.425	9900	180	470	21	2	2	99998	1	2	247.5	11.75	4.5
1.635	1.64	11100	220	580	21	3	2	99998	1	2	55.5	2.9	1.1
1.64	1.7	11100	220	580	21	3	2	99998	1	2	666	34.8	13.2
1.7	1.8	11100	220	580	21	3	2	99998	1	2	1110	58	22



Policy and Governmental Affairs Office of Highway Policy Information

Knowledge Center

Knowledge Center

The following presentations are short, single subject matter presentations that may be used as a reference on how to report data to the FHWA Office of Highway Policy Information. The ultimate reference for reporting is the [Guide to Reporting Highway Statistics](#).

Motor Fuel Reporting

- [Form 551M and 556 \(Revenue\) – Reporting Monthly Motor Fuel Data](#)

Vehicle Registrations

- [Form 561 – Vehicle Registration Reporting](#)
- [Form 566 – State Motor Vehicle and Motor Carrier Revenue](#)
- [Form 571 – State Taxation of Motor Carriers](#)

Highway Travel

- [HPMS Pavement Performance Data Report Card Webinar](#)
- **[How To Submit Annual Highway Performance Monitoring \(HPMS\) Vehicle Summary Data](#)**
 - [Part 1 – Understand What the Vehicle Summary Data Is \(PowerPoint, 4.3 mb\)](#)
 - [Part 2 – Processes and approaches associated with the FHWA method \(PowerPoint, 1.6 mb\)](#)
 - [Part 3 – Understand Some HPMS Data Items and Other Related Concepts \(PowerPoint, 2.0 mb\)](#)
 - [Part 4 – HPMS Vehicle Summary Data Computation \(PowerPoint, 430 kb\)](#)

Heavy Vehicle Use Tax

- [Heavy Vehicle Use Tax Governor's Certification](#)

Finance

Driver Registrations

If you are having trouble viewing any of the above presentations, please contact Michael Dougherty at (202) 366-9234, or michael.dougherty@dot.gov.

VMT Weighting Method Website

https://www.fhwa.dot.gov/policyinformation/knowledgecenter/vmt_training/



INTRO, PART 1

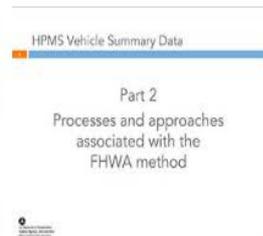
Describes the characteristics of vehicle summary data.



BEGIN PART 1

PART 2

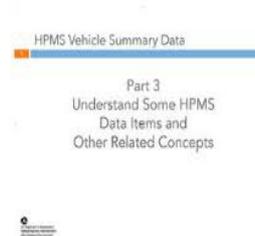
Outlines the process and approach for using the FHWA method to prepare the vehicle summary data.



BEGIN PART 2

PART 3

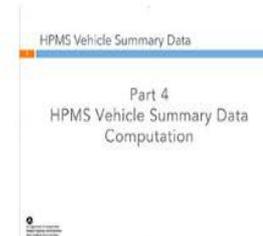
Presents basic HPMS data items and other related concepts important to understanding how to prepare the vehicle summary data.



BEGIN PART 3

PART 4

Example of how to compute the vehicle summary data.



BEGIN PART 4



GIS Review of Traffic Data

- AADT – Annual Average Daily Traffic
- Ramp AADT
- Future AADT
- D Factor and K Factor
- % Peak SU and % Peak CU
- SU AADT and CU AADT
- State to state AADT
- State to state both SU AADT and CU AADT



2017 GIS Review Feedback

- **What can be improved:**

- GIS review – is data reported by route show travel trends that have large changes or if there are large changes they are verified okay.
- % Peak SU and CU – check AADT, SU AADT and % Peak SU to make sure the proper ratio of number of trucks is in the peak hour that balances well with not too few or not too many for the day.
- FAADT – ratio the same, lower FAADT than AADT, ratio of near zero growth or very large growth of 300% reported.

- **What is going right:**

- GIS networks are looking a lot better
- AADT and Ramp AADT
- SU AADT and CU AADT
- State to state AADT



GIS Demonstration

Questions/Comments

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