

Axle and Length Classification

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Office of Policy Information
2013 Highway Information Seminar

Presentation Acronyms

- AADMT – Annual Average Daily Motorcycle Traffic
- AADTT – Annual Average Daily Truck Traffic
- ADTT – Average Daily Truck Traffic
- AASHTO – American Association of State Highway Transportation Officials
- ASTM – American Society of Testing and Materials
- ALEDA – Advanced Loop Event Detection Analyzer
- CVC – Continuous Vehicle Classifier (classifier)
- CCS – Continuous Count Station (Automatic Traffic Recorder - volume)
- DOW – Day of Week
- FHWA – Federal Highway Administration
- HPMS – Highway Performance Monitoring System
- HVTIS – Heavy Vehicle Travel Information System
- LTPP – Long Term Pavement Performance (SHRP)
- MEPDG – Mechanistic Empirical Pavement Design Guide
- NCHRP – National Cooperative Highway Research Program
- OD – Origin and Destination
- SBIR – Small Business Investment Research
- TMAS – Travel Monitoring Analysis System
- TVT – Traffic Volume Trends
- TMG – Traffic Monitoring Guide
- UPACS – User Profile and Access Control System

Getting Results - 4 Steps

- Construction/Support/Maintenance
- Factoring Classification data
- Processing of the data
- Reporting of the Information

Turn your Data into Information

Class – 2001/2013 TMG

- Classification counts – why do them?
- 25% - 30% of volume counts should be class
 - Coverage counts
 - Highway links
 - Annualized data
- Length classification - acceptable
 - Cross over to axle class
 - Defined bins

Classification Reporting

- TMAS 2.0 is now accepting all class data on a per site basis by month.
- TMAS 2.0 replaces the HVTIS
- New 2013 TMG formats for class data (C-card)
 - Time Intervals 5, 15 or 60 minute
 - Classification data reported in Per Vehicle Format (PVF)
 - Idaho DOT (done for over 10 years for portable and perm. sites)
 - Pennsylvania DOT (implementing it now)
 - Many vendors already do this behind the scene
- State specific axle class algorithm
 - Verify what you are using
 - Calibrate your classtree algorithms
 - LTPP classtree research (completed in 2012)
 - Numerous States and Types of Classtrees Checked

Axle Class Factoring

- Factoring for Trucks
 - Variability by DOW and month of year
 - Improves reporting on trucks for:
 - HPMS
 - Freight Movements
 - Pavement Designs
- Factoring for Motorcycles
 - Correct for the weekday portable counts
 - Correct for the month of year variance
 - Use processes and collection methods that correctly classifies motorcycles
- Factoring for Other Vehicle Types (see the new 2013 TMG)

Class-Specific AADT Calculation Example

- Calculate Annual Average Daily Motorcycle Traffic (AADMT) from Average Daily Motorcycle Traffic (ADMT) based on monthly and day-of-week factors
- 48-hour count (Tues/Wed 8/14-8/15)
- Same process as for trucks (AADTT from ADTT)

$$\text{ADMT} \times \text{MOY} \times \text{DOW} = \text{AADMT}$$

Class-Specific AADT Calculation Example

Month	Monthly ADT	Monthly Factor
Jan	474	1.05
Feb	453	1.10
Mar	506	0.99
Apr	510	0.98
May	516	0.97
Jun	523	0.95
Jul	513	0.97
Aug	524	0.95
Sep	508	0.98
Oct	512	0.97
Nov	492	1.01
Dec	458	1.09
AADT	499	1.00

Class-Specific AADT Calculation Example

Day	ADMT	Resulting MC Day-of-Week Factors
Monday	396	1.26
Tuesday	403	1.24
Wednesday	405	1.23
Thursday	428	1.17
Friday	655	0.76
Saturday	725	0.69
Sunday	483	1.03
ADMT	499	

Class-Specific AADT Calculation Example

Date ____	ADMT	ADT
Aug. 14 (Tues)	518	50,761
Aug. 15 (Wed)	494	51,231
Average	506	50,996

$$\text{ADMT} \times \text{MOY} \times \text{DOW} = \text{AADMT}$$

$$518 \times 0.95 \times 1.24 = 610$$

$$494 \times 0.95 \times 1.23 = 577$$

$$(610 + 577) / 2 = 594$$

506 vs. 594 = 15% underestimation

Class-Specific AADT Calculation Example

- The same process must be performed with each of the vehicle classes (or grouped classes)
- Sum of class-specific AADTs compared against total volume AADT to create final AADT by class

Class-Specific AADT Calculation Example

Date	MC Volume	PC Volume	LT Volume	Bus Volume	SU Volume	CU Volume	ADT
Aug. 14 (Tues)	518	30,705	11,215	58	4,103	4,162	50,761
Aug. 15 (Wed)	494	31,689	11,834	48	3,697	3,469	51,231
Tuesday Factor	1.24	1.02	1.02	1.06	0.88	0.8	
Wednesday Factor	1.23	1.00	1.00	1.03	0.89	0.79	
August Factor By Class	0.95	0.97	0.97	0.81	0.84	0.91	
AADT Based on Tuesday	610	30,380	11,096	50	3033	3030	48,199
AADT Based on Wednesday	577	30,738	11,479	40	2764	2,494	48,092
Average	594	30,559	11,288	45	2898	2,762	48,145
AADT computed from total volume = $(50,761 + 51,231) \times 0.95 \times 0.98$ DOW factor) =							47,477
Difference of average computed from total volume minus average computed by class specific factors and then summed							-668
Fraction of Traffic	0.012	0.635	0.234	0.001	0.060	0.057	
Proportional Adjustment (Fraction of Vehicles \times Error)	-8	-424	-157	-1	-40	-38	
Final AADT by Class (Volume + Proportional Adjustment)	585	30,135	11,131	44	2,858	2,724	47,477

Vehicle Length Class Data

- Flexibility
- Dual loops – last longer
- Allows for non-intrusive technologies
 - Side fire technology
 - Over head technology
 - Under the road technology
- All States are welcome to join FHWA sponsored pooled funds
- Test and verify your bins

Vehicle Length Class Data

- Calibrate your sites
- Test and verify your bins
 - Variances for length used in classes 2-3 bin

18', 19.5', 20', 21', 21.8' and 22.5'

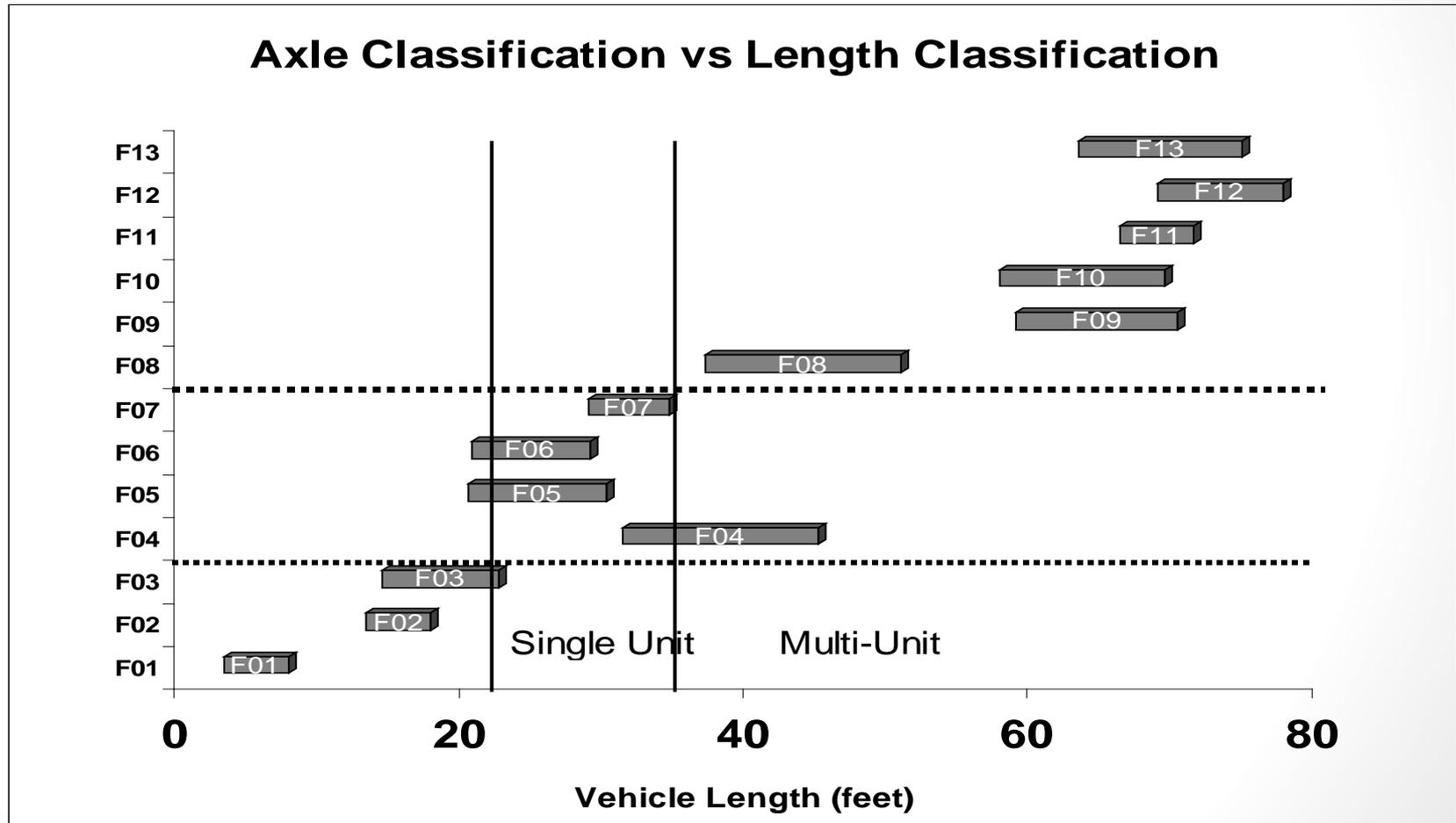
Example of possible bins:

- Bin 1 class 1
- Bin 2 classes 2-3
- Bin 3 classes 4-7
- Bin 4 classes 8-10
- Bin 5 classes 11-13

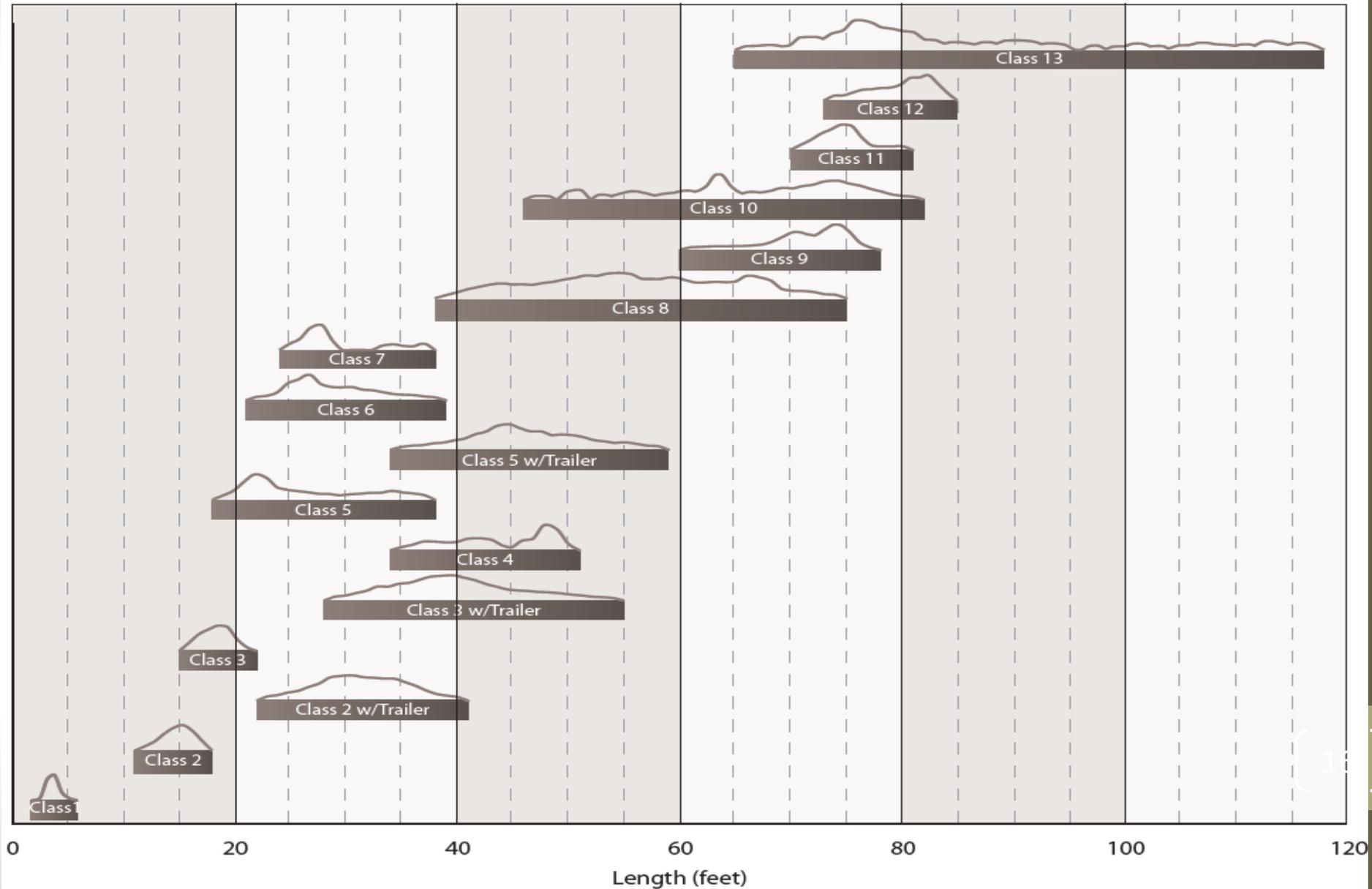
What do you use?

Vehicle Length Class

Example of length class vs. axle class



Loop - Length Based Class Pooled Fund Table - Results



Pooled Fund Results

- The length thresholds for these four length bins are:
 - Motorcycle: 0 to 6.5 feet
 - Short vehicle: 6.5 to 21.5 feet
 - Medium vehicle: 21.5 feet to 48 feet
 - Long vehicle: 48 feet and larger

Traffic Data Research

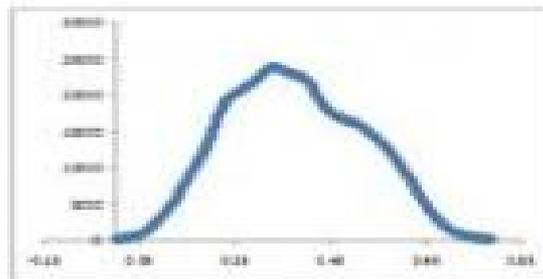
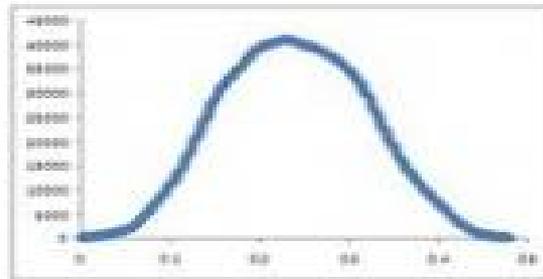
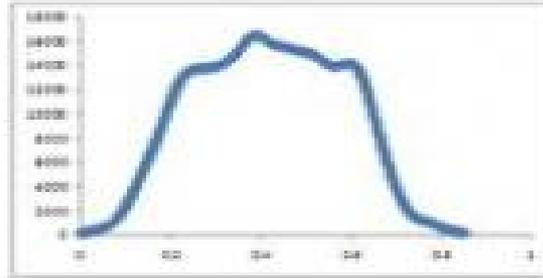
- LTPP Pooled Fund and Falcon Work
- NCHRP (motorcycle, trucks...)
- Pooled Fund TPF-5(292) Assessing Roadway Traffic Count Duration & Frequency Impacts on AADT Estimation (2014)
- Loop Sensitivity Tuning – Dr. Yinhai Wang (ALEDA)
- State Research - what are you doing?

- Small Business Investment Research (2013-2016)
 - Phase I – \$150,000 (2013 – completed)
 - Phase II - \$800,000 (2014-2016)
 - Truck Re-Identification using Loop Signatures and other vehicle attributes

Inductive Signature Technology

- Axle class with loops only
- Re-identification of vehicles
- Calibration transfer between sites
- Characteristics of Traffic Stream transfer between sites for:
 - OD studies – freight movement and loadings
 - Improved Pavement Designs
 - Travel Times
 - Model Inputs for Travel Patterns
 - Improved Safety

Loop Signature Examples



FHWA – Office of Policy Information

<http://www.fhwa.dot.gov/policyinformation/travelmonitoring.cfm>

Office of Highway Policy Information (OHPI) – Travel Monitoring and Traffic Volume - Windows Internet Explorer

<http://www.fhwa.dot.gov/policyinformation/travelmonitoring.cfm>

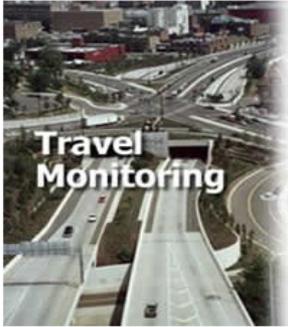
U.S. Department of Transportation
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Search FHWA

Office of Highway Policy Information Travel Monitoring and Traffic Volume

[OHPI Home](#) > [Travel Monitoring and Traffic Volume](#)

Data and information on traffic volume, vehicle classification, and truck weight are basic to many highway and transportation functions. The Federal Highway Administration's (FHWA's), Office of Highway Policy Information has traditionally maintained national programs to track traffic trends, vehicle distributions, and weight to meet data needs specified in federal highway legislations. Activities include development of guidelines, regulations, direct data collection (from State DOT sources), data processing, research, analysis, and professional conferences. The products of these activities are listed in the publications in the next column.



The publications and reports on travel monitoring include data periodically updated, software to process the data, paper reports, related databases, and information related issues. Links to relevant organizations are also included to make your search easier.

SOURCES

- [Community of Practice](#)
- [Traffic Volume Trends](#)
- [Vehicle Travel Information System \(VTRIS\)](#)
- [ITS Data Archiving](#)
- [Other Sites and Resources](#)
- [Traffic Monitoring Guide](#)
- [CFR: Title 23 – Highways – Managing and Monitoring](#)

Quick Find Data

(Tables from Highway Statistics, tables VM-1, VM-2)

Publications and Reports

- [Accuracy of Traffic Monitoring Equipment](#)
- [Analysis of Vehicle Classification and Truck Weight Data of the New England States](#)
- [Archive and Use of ITS-Generated Data](#)
- [Case Studies of Traffic Monitoring Programs in Large Urban Areas \[PDF\]](#)
- [Commodity Flow Survey](#)

[more...](#)

Outside Sources

- [North American Travel Monitoring Exposition and Conference \(NATMEC 2010\)](#)
- [North American Travel Monitoring Conference and Exposition \(NATMEC 2008\)](#)
- [North American Travel Monitoring Exposition and Conference \(NATMEC 2006\)](#)
- [North American Travel Monitoring Exposition and Conference \(NATMEC 2004\)](#)
- [North American Travel Monitoring Exposition and Conference \(NATMEC 2002\)](#)
- [North American Travel Monitoring Exposition and Conference \(NATMEC 2000\)](#)
- [North American Travel Monitoring Exposition and Conference](#)

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FHWA – Highway Community Exchange(CoP)

Topics - Windows Internet Explorer

https://www.transportationresearch.gov/dot/fhwa/hcx/Pages/Topics.aspx?Topic=Travel Monitorin

U.S. Department of Transportation
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Site Actions

Highway Community Exchange

FHWA TR.gov Manage Account Register Communities Hosted Sites Archives Help

Discussions References

Subject	Created By	Replies	Last Updated
Receiving Notification of New Discussions	Tricia Tanner	8	10/18/2012 11:31 AM
Talking Traffic for October 2012 cancelled	Steven Jessberger	1	10/9/2012 2:13 PM
TMAS 2.0 is going live for State users on October 1, 2012	Steven Jessberger	0	9/26/2012 12:48 PM
Laying Tubes across sidewalks or bike lanes	Don Crossover	1	9/21/2012 11:33 AM
Talking Traffic webinar on Urban Traffic Counts / High Volume Counts (August 14, 2012)	Steven Jessberger	0	8/6/2012 8:07 AM
JULY 10, 2012 TALKING TRAFFIC WEBINAR	Brad Gudzin	0	7/6/2012 7:10 AM
FHWA Traffic Data QA/QC Tool	Brad Gudzin	0	6/22/2012 10:01 AM

Related Links

Type	URL
	Highway Statistics
	Traffic Monitoring Guide

Topic Navigator

- [Alternative Contracting](#)
- [Border Technology Exchange Working Group](#)
- [Cross Border Data Dogs](#)
- [Detectable Warnings](#)
- [Highway Finance Data Collection](#)
- [Highway Performance Monitoring System \(HPMS\)](#)
- [Knowledge Management Practice CoP](#)
- [LTPP Info Standard Data Release](#)
- [Marketing and Communications](#)
- [Midwestern Transportation Research Network](#)
- [Motor Fuel Reporting and HTF Attribution](#)
- [National Highway Visibility](#)

Archived Discussions Archived References

Subject	Replies	Date Created	Original Author
Federal Highway Administration's (FHWA) Traffic Monitoring Guide (TMG) Update	0	3/15/2012 9:58 AM	David L Jones Sr.
Re: Talking Traffic (March 13th) on HPMS GIS Data Quality Control Checks	0	3/14/2012 6:29 PM	Leroy
Talking Traffic (March 13th) on HPMS GIS Data Quality Control Checks	0	3/8/2012 7:01 AM	Steven Jessberger
ASTM document reviews	0	3/5/2012 1:57 PM	Steven Jessberger

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Standards

- FHWA - Traffic Monitoring Guide (September 2013)
- FHWA – HPMS Field Manual (updated yearly)
- ASTM documents related to classification counts
 - 1957-04 Installing & Using Pneumatic Tubes with Roadway Traffic Counters and Classifiers
 - 2300-06 Highway Traffic Monitoring Devices
 - 2415-05 Installing Piezoelectric Highway Traffic Sensors
 - 2467-05 Developing Axle Count Adjustment Factors
 - 2468-05 Metadata to Support Archived Data Management Systems
 - 2532-06 Evaluating Performance of Highway Traffic Monitoring Devices
- AASHTO
 - Loop Detector Handbook 2006
 - Guidelines for Traffic Data Programs 2009
 - WIM Successful Practices 1997

MEPDG Required Classification Inputs

- Level 1 Design
 - Site specific class data (continuous or 4 seasons)
- Level 2 Design
 - Regional class data (continuous or 4 seasons)
- Level 3 Design
 - National class data (system defaults)

How to improve your class data?

- Full width axle sensors (motorcycles)
 - road tubes
 - piezo
- Axle Sensors as primary sensor for class sites
- Length can detect motorcycles as bin 1
- More class sites for proper factoring
- Class data QC (TMAS/LTPP/Pooled Fund)
- Collect per vehicle format records (Idaho and Penn DOT)
- Calibrated your class algorithm(s) –
 - 2011 State Survey – only 15 States use State specific trees
- By lane class checks – done daily
- Calibrate class sites annually

Commonly Misclassified Vehicles

- 6 Axle Dump Truck
- 7 axle Dump Truck
- 7 Axle Semi-Truck with a quad in the rear
- 2 Axle Pick-up Truck pulling a 2 or 3 axle trailer
- Others



State/Vendor Best Practices



What practices have you experienced that others could benefit from?

What problems have you encountered that need to be dealt with?

Questions??

FHWA – Headquarters

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FHWA Highway Community Exchange (CoP)

<https://www.transportationresearch.gov/dot/fhwa/hcx/default.aspx>

Talking Traffic monthly webinar – held every second Tuesday at 2 pm (EST)

<https://connectdot.connectsolutions.com/fhwatalkingtraffic/>