Highway Performance Monitoring System (HPMS) Reassessment 2010+

Draft Recommendations Report

draft

report

prepared by

Federal Highway Administration

January 2007

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prepared by:

Federal Highway Administration
Office of Highway Policy Information
http://www.fhwa.dot.gov/policy/ohpi/hpms/index.htm

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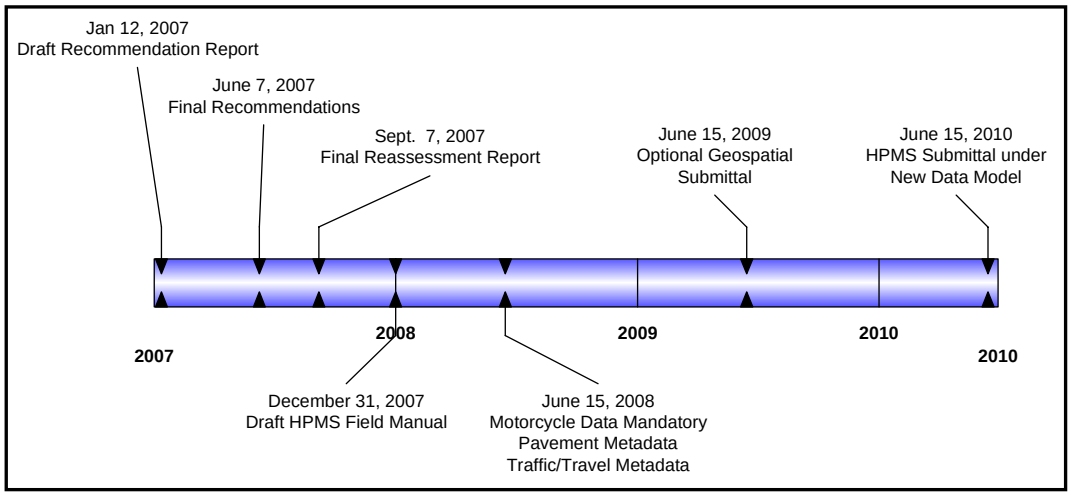
Executive Summary

The Highway Performance Monitoring System (HPMS) currently is undergoing a Reassessment to ensure it best meets the needs of its users and customers in 2010 and beyond. The Reassessment is intended to respond to current and future business needs, address any new data needs in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) legislation, capitalize on changing technology and where possible address resource constraints and institutional changes.

The Reassessment process began in late 2005 and will be complete by the fall of 2007. This report summarizes the status of the Reassessment recommendations at this point. The goals of this report are to summarize the recommendations to date, indicate a picture of HPMS in 2010, and encourage further feedback.

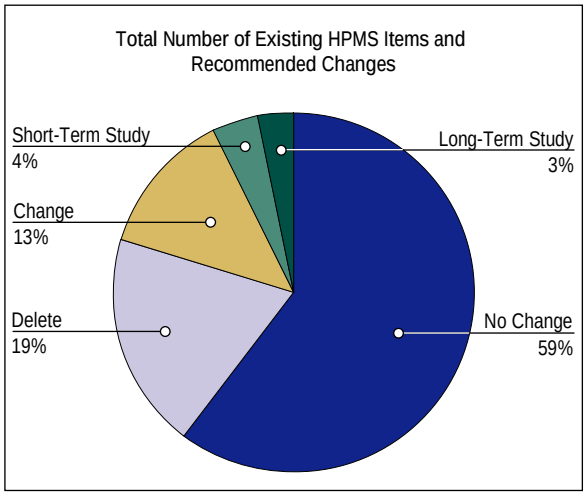
HPMS Reassessment Timeline



The FHWA is undertaking a very open, interactive approach to this Reassessment. Major emphasis has been and will continue to be directed towards determining the data needs of FHWA's partners, stakeholders, and customers, the various uses of the existing HPMS, as well as the ability of data providers to support these data needs.

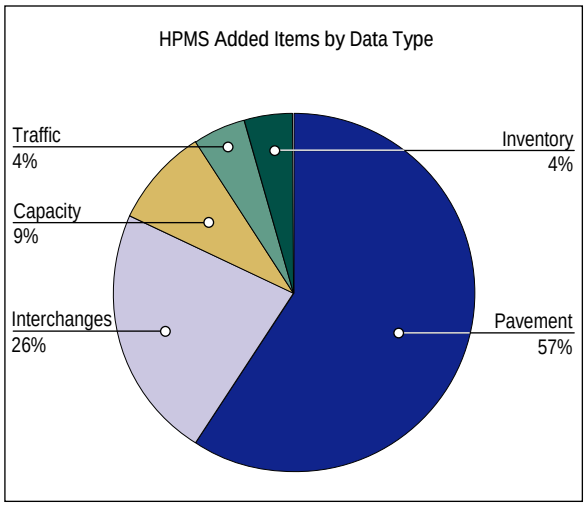
HPMS 2010 will be refined to eliminate some no longer needed data items, include new ones to ensure that appropriate needs especially related to pavement needs can be adequately addressed, and feature a geographic data model that allows for more efficient reporting of HPMS for both data collectors and users.

The recommended changes to HPMS can be classified into three broad categories: structure, data items, and data quality/process improvement. For each of these categories, there are several types of recommendations as follows: immediate implementation, short-term study which will occur during the remainder of the HPMS Reassessment study period and long-term study which will occur after the Reassessment. The following summarizes the recommended changes:



- The Federal needs for HPMS require that a number of items be changed and additional items be added to meet the needs.
- Critical information on pavement conditions is being added so the National assessment of pavement condition will be more comprehensive and more analogous to the pavement condition analyses performed by state and regional agencies. This will give Congress and the highway community a more thorough representation of the condition of the Nation's highways.
- SAFETEA-LU requires an extensive evaluation of safety data needs to meet the new Safety requirements in the legislation. The new safety data needs will be developed cooperatively with HPMS to assure that the needs are integrated.
- The Environmental Protection Agency (EPA) Air Quality Conformity regulations specify that HPMS estimates of VMT shall be considered as the primary measure of VMT within the nonattainment or maintenance area where Conformity must be determined. [40 CFR 93.122 (b)(3)]
- A new data model will be developed for the structure of HPMS which will allow for geographic locating, analysis, comparison, and reporting of data. This change is being studied as part of the Reassessment and final recommendations will be complete by mid 2007.
- **Regarding data items, of the total of 98 HPMS items, 59 items will remain unchanged, 19 items are recommended for deletion, 13 are to be changed, 4 for short-term study and 3 for long-term study.**

- A total of 23 items are proposed to be added. Thirteen of the new items pertain to pavement data, 1 relates to traffic, 6 to interchanges, 2 to capacity, and 1 inventory item. The following are recommended for immediate implementation: motorcycle travel data, Pavement metadata and Traffic metadata which means these items are optional for 2007 Reporting Year and required for 2008 Reporting Year. All remaining data items can be optionally submitted in Reporting Year 2009 and are mandatory in Reporting Year 2010.



- Two of the five interchange data items will be collected by FHWA.
- The items to be changed could be phased in beginning in 2008 with all states being in full compliance by 2010. This means that reports generated by FHWA in 2010 (Reporting Year) will include these changes.

These recommendations are in draft form and comments are encouraged through the end of June 2007. Following the release of the *Final HPMS Reassessment Recommendations Report* in September 2007, FHWA will finalize the draft *HPMS Field Manual*, which will be released in December 2007. In 2008, FHWA will begin an extensive outreach and training effort centered on the Reassessment recommendations and the data collection requirements in the new *Field Manual*. FHWA will also continue the annual HPMS workshops, which have been temporarily suspended for the duration of the Reassessment.

1.0 Introduction

The availability of accurate, representative national transportation data is critical to informing decisions across all levels of transportation agencies. The Highway Performance Monitoring System (HPMS) is a key national transportation data program that provides highway inventory, condition, performance, and operating characteristics data to national, state, and regional customers. Examples of the type of data available through HPMS include pavement condition and travel by vehicle type. It is used at the national level for apportionment, performance measures, highway statistics, and conditions reporting.

The HPMS currently is undergoing a Reassessment to ensure it best meets the needs of its users and customers in 2010 and beyond. The Reassessment is intended to respond to current and future business needs, address new data needs in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) legislation, capitalize on changing technology and, where possible, address resource constraints and institutional changes.

The Reassessment process began in late 2005 and will be complete by the fall of 2007. Critical to the success of the Reassessment is ongoing communication and coordination with both HPMS users and data collectors. The outreach conducted thus far has been extensive and resulted in an evolutionary development of recommendations related to proposed changes to the HPMS database and process.

This report summarizes the status of the Reassessment recommendations at this point. The recommendations are in draft form and comments are encouraged through the end of June 2007. Several forums have been scheduled to receive and address comments. HPMS users and data collectors are encouraged to review this report, assess impacts on their programs, and coordinate with the FHWA Office of Highway Policy Information (OHPI).

The Draft Recommendations report is organized as follows:

- **Background of HPMS –** This section contains a brief history of HPMS, describes the mission and goals, and highlights the contents and use of the database. It also refers to previous Reassessments and highlights the purpose of this Reassessment.
- **Stakeholder Input –** This section documents the meetings and outreach that have occurred. It also summarizes some of the major comments received.
- **Issue Recommendations –** Ten detailed Issue papers were written throughout the Reassessment process. This section summarizes the proposed recommendations.

- **Impacts of the Reassessment –** This section describes the perceived impacts of the Reassessment. Direct impacts resulting from data collection changes must be assessed individually by state data collectors.
- **Next Steps –** The Reassessment process will continue through the fall of 2007. This section describes the process to be used to gather additional input.

2.0 Background

2.1 HIGHWAY PERFORMANCE MONITORING SYSTEM (HPMS)

2.1.1 History of HPMS

The HPMS was developed in 1978 as a national highway transportation system database. In its current configuration, it includes limited data on all public roads, more detailed data for a sample of the arterial and collector functional systems, and area-wide summary information for urbanized, small urban, and rural areas. The HPMS replaced numerous uncoordinated annual state data reports as well as biennial special studies conducted by each state. These special studies had been conducted to support a 1965 Congressional requirement that a report on the Nation's highway needs be submitted to Congress every two years. The first such *Conditions and Performance Report* was compiled in 1968. The first report to make use of the HPMS database was the 1980 Conditions and Performance Report, which was forwarded to Congress in January 1981.

Providing a snapshot of highway conditions was another reason for the original development of HPMS. In the 1970s, FHWA discovered that it had to respond to Congressional inquiries about the status of the Nation's highways. HPMS provides a way to measure and track trends in highway characteristics, pavement conditions, and congestion at a national level.

The major purpose of the HPMS is to provide data that reflects the extent, condition, performance, use, and operating characteristics of the Nation's highways. To meet this primary objective, the HPMS has gone through an evolutionary process that has recognized over time the changing needs for data related to these purposes.

2.1.2 Mission and Goals of HPMS

It is the mission of the Highway Performance Monitoring System (HPMS), as an integral part of the Nation's suite of transportation databases, to provide a database and analysis process for assessing and reporting the extent, condition and performance of the Nation's highway system in the most cost-effective manner consistent with the following goals:

- Meet FHWA's highway stewardship responsibilities, including preserving the national interest in the NHS;
- Support Federal transportation policy analysis, planning, and performance measurement activities;

- Provide data for Apportionment formulae;
- Meet the various congressional requirements, including apportionment and the C&P report;
- Provide a publicly accessible, consistently high-quality, objective, and timely national highway database;
- Provide a database, analytical tools, and FHWA technical support that meets the needs of state, regional, and local agencies; and
- Evolve to a data system which:
  - Builds from the data systems of local, regional, and state governments;
  - Is connected with a common geo-referencing system; and
  - Avoids, whenever possible, collecting data which is not used by the collecting agency.

Appendix A contains a list of commonly used acronyms and abbreviations.

2.1.3 HPMS Description

The HPMS is a key national transportation data program that provides national-level highway inventory, condition, performance, and operating characteristics data to national, state, and regional customers. Examples of the type of data available through HPMS include pavement condition and travel by vehicle type.

There are three primary functions involved with HPMS: data collection, processing/reporting, and analyzing/applying. Although there is some overlap among functions, each function is primarily conducted by a different stakeholder group. Data collectors are state departments of transportation and metropolitan planning organizations. The processing and reporting of HPMS occurs within the FHWA Office of Highway Policy Information. Finally, users consist of a wide variety of customers, including U.S. DOT Federal Program Offices, other Federal agencies, U.S. Congress, states, MPOs, counties, and cities.

HPMS is used at the national level for apportionment, performance measures, highway statistics and conditions reporting, and analytical models; it is one of the primary databases used by FHWA for conducting national-level surface transportation planning and policy studies. It is also used by a variety of state and local transportation agencies as well as other transportation interests. Some of these uses are extremely important for highway financing. For example, the biennial *Conditions and Performance Report (C&P)* to Congress documents future highway funding needs and HPMS-derived vehicle-miles traveled (VMT) estimates are used in the annual allocation of Federal Aid highway funds to the states.

VMT estimation is probably the most ubiquitous use of HPMS – VMT is calculated and used at the national, state, and local levels. This is not surprising since the original primary intent of HPMS, when it was conceived in the late

1970s, was to provide a consistent basis for VMT estimation nationally. This is reflected in the sampling frame and the strong linkage to the *Traffic Monitoring Guide* for supplying traffic counts to HPMS.

The data also are used for assessing highway system performance under FHWA's strategic planning process. Pavement condition data, congestion-related data, and traffic data used to determine fatality and injury rates are used extensively by the Administration to measure FHWA's and the State's progress in meeting the objectives embodied in the Vital Few, FHWA's Performance Plan, and other strategic goals.

Over time, many applications have been developed that use HPMS as their source of data. These applications further demonstrate the utility of HPMS and also put increasing demands on it. For example, the HERS model has become FHWA's tool for developing the highly visible *C&P Report*.

In addition, the HPMS serves needs of the states, MPOs and local government and other customers in assessing highway condition, performance, air quality trends, and future investment requirements. Some states rely on traffic and travel data from the HPMS to conduct air quality analyses and make assessments related to determining air quality conformity, and are now using the same analysis models used by FHWA to assess their own highway investment needs, HERS-ST. As a result of these uses, states have an additional stake in assuring the completeness and quality of these data.

Finally, these data are the source of a large portion of information included in FHWA's annual *Highway Statistics* and other media and publications. They are widely used in both the national and international arenas by other governments, transportation professionals, and industry professionals to make decisions that impact national and local transportation systems and our transportation dependent economy.

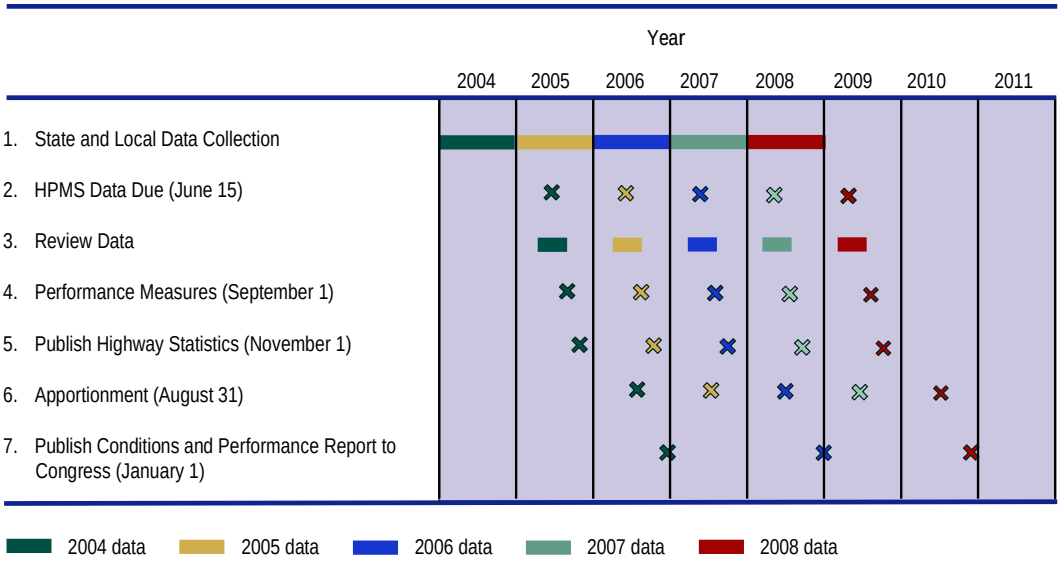
Table 2.1 summarizes the uses and users of HPMS.

Table 2.1 Some Users and Uses of HPMS Data

User Group	Type of Application	Description
FHWA	Forecasted highway investment needs and performance (user costs and impacts)	HPMS is the data source for the HERS model, which produces the information for the Biennial *Conditions and Performance Report* to Congress.
	Annual reporting of highway conditions	HPMS is the basis for much of the information produced in *Highway Statistics,* which includes trends in highway conditions, performance, and usage.
	Freight planning	HPMS data and the National Highway Planning Network are used by the Freight Analysis Framework for calibrating base year assignments and forecasting future freight flows.
	Special policy and planning studies	HPMS data are used in a variety of national studies every year. An example is 2004's *Traffic Congestion and Reliability Report.*
	Travel monitoring	HPMS is the official source of VMT estimates, which are used throughout FHWA and U.S. DOT. VMT from HPMS is a factor for allocating highway funds to the states.
	Public Road Mileage	HPMS data is the official source of roadway mileage by jurisdiction.
State DOTs	Forecasted highway investment needs and performance (user costs and impacts)	State-HERS is used by many states for investment planning.
Metropolitan Planning Organizations	Air quality conformity and planning	HPMS is used for local VMT estimation.
Texas Transportation Institute	National congestion monitoring	HPMS Universe data is the basis for the annual *Urban Mobility Study.*
Transportation Research and Interest Groups	Planning and policy analysis	HPMS is used by many transportation professionals to produce various reports, including AASHTO's "Bottom-line" reports, the Transportation Research Board's policy studies, and the American Highway Users Alliance bottleneck studies.

There is generally a lag between data collection in the field and the data showing up in a report. The following table indicates the timing of data collection and reporting.

Table 2.2 HPMS Timeline



The FHWA OHPI is not involved directly in data collection but relies on State DOTs for the HPMS Data. OHPI performs data quality checks, and provides technical support and software to ease reporting requirements. The fact that FHWA relies on other agencies to provide data is highly significant since FHWA must balance the needs of its users (internal and external) with the capabilities of its providers to provide data at a reasonable level of effort. The difference in views between data needs and collection capabilities is the crux of the issue to be addressed during any review of HPMS. There are a large number of issues that need to be considered and explored and the organization and prioritization of the issues from a user and provider standpoint are key elements of the Reassessment.

There are several reference documents describing HPMS located on the FHWA HPMS web site (http://www.fhwa.dot.gov/policy/ohpi/hpms/index.htm).

They include:

- *HPMS Field Manual*, May 2005, Office of Highway Policy Information, Federal Highway Administration; and
- *HPMS Primer – Overview of the HPMS for FHWA*, September 2006, Office of Highway Policy Information, Federal Highway Administration.

2.2 REASSESSMENT

2.2.1 Background of HPMS Reassessments

The HPMS has been modified several times since its inception. Changes in coverage and detail have been made since 1978 to reflect changes in highway

systems, legislation, and national priorities, to reflect new technology, and to consolidate or streamline reporting requirements.

Recognizing that needs and capabilities change over time, FHWA initiated a periodic review process for HPMS many years ago ("Reassessment"). The Reassessment process considers what changes should be made to HPMS data elements and collection procedures, including:

- Should existing data elements be eliminated because they are not needed for most applications or because they are too onerous a burden on data collectors?
- Are new data elements needed to support current and emerging applications? If so, can they be prioritized or limited to certain functional systems?
- Should data elements be redefined (e.g., valid values) to match applications' needs?
- Should data be collected in a different manner (e.g., the factoring and reporting of traffic counts)?
- What changes in the sampling schema should be made? Are the minimum VMT-based sample sizes adequate for providing system-level estimates of other highway conditions?

The last Reassessment was completed in 1999 and utilized a comprehensive stakeholder outreach process. In 1999, there was some question as to the need for HPMS, whereas this Reassessment is being performed in an environment where HPMS is recognized as an important program that needs some modifications to accommodate changing technological and application needs.

2.2.2 Purpose of this Reassessment

The purpose of this Reassessment is to review the HPMS in light of contemporary issues and anticipated future needs. The reauthorization of the Federal-aid highway program, as contained in SAFETEA-LU, provided an appropriate opportunity for the FHWA to undertake a Reassessment of the HPMS. Other reasons to reexamine the HPMS are further advancements in technology, changes to state data requirements, increased use of performance measures, and changes in the various uses of HPMS data by government, academia, and the private sector.

The vision for this Reassessment is *for HPMS to meet the transportation community's data needs in 2010 and beyond.*

The mission is to *respond to current and future business needs, address new data needs in SAFETEA-LU, capitalize on changing technology and, where possible, address resource constraints and institutional changes.*

The objectives are to:

1. Meet new Federal needs (Policy, Safety, Operations, and Infrastructure);
2. Explore potential changes to HPMS to be more useful for most states and MPOs;
3. Capitalize on changing technology to enhance quality, efficiency, and data integration; and
4. Ensure data items meet all required needs (definitions/standardization/ change, new items, delete items.)

The process for this Reassessment was carefully planned and implemented to ensure consistency with the process used for the last Reassessment. It also was designed to address policy/institutional (state and national) issues, data collection, data analysis tools/applications, emerging issues (such as safety), and all other issues related to HPMS users and collectors.

The first phase of the Reasssessment was to identify what needed to be changed in coordination with Federal agencies; this has been completed. The second phase, which is underway, is to work with stakeholders to identify how the needs can be met and balanced with collector requirements.

2.2.3 How HPMS Addresses National Transportation Data Needs

The Federal need for transportation data transcends functional classification, ownership, and jurisdiction. While functional class, ownership, and jurisdiction are important categories, for which HPMS data are often summarized, they do not define the limits of FHWA's needs for these data. Each issue area explored in this reassessment has had to consider, with differing Federal and state data needs, while weighing these needs against the states' ability (or willingness) to provide these data. The ability to provide these data, especially on roads not owned by the states (off-system), was often cited as being an area of concern. This was neither a surprise nor a new topic; this has been a concern of the states since the inception of HPMS in 1978. To get a complete picture of the highway system in each state it is necessary for FHWA to have data on off-system roads.

The existing HPMS structure attempts to address the off-system data concern, by dividing the data into three levels. Sample data are the most detailed, each sample section being comprised of up to 98 data items. Nationwide there are approximately 120,000 sample sections, with a total length of 137,000 miles. These sections represent approximately 980,000 miles of roads functionally classified from (Major) Collector through Interstate.

The next level is the universe data. Universe sections can contain a maximum of 46 data items on NHS sections, to a minimum of 28 data items on local roads. It should be noted that currently most of the data on local roads are identification, system, jurisdictional, or ITS in nature. The "section length" data item is the only apportionment item (from these data) for local roads. Nationwide there are

approximately 1.13 million universe sections that represent all 4.012 million miles of public roads.

The final HPMS data level is the summary data. These data provide travel data for all functional systems, as well as the distribution of travel by six vehicle classes for all functional systems. Additional summary data are collected by urban/urbanized area, and for air quality non-attainment and maintenance areas.

These data are used individually or in combination to satisfy the various Federal data needs. The apportionment of Highway Trust Funds relies on all three data levels. Performance measures can use either the sample data alone or in combination with the universe data. Much of the HERS analysis for the C&P Report utilizes just sample data.

Key to the multileveled structure of HPMS are the national uses of these data, the quality of data, and the types of analyses performed using these data. The multileveled approach also helps compensate for variability between state transportation data collection efforts. States typically focus their data collection efforts on roads owned and maintained by the state. The following illustrates the variability in state owned highway systems nationwide:

- The degree of state ownership ranges from a low of 6.1 percent of the mileage carrying 42.6 percent of the VMT to a high of 91.8 percent of mileage carrying 90.7 percent of VMT. The national averages are 19.5 percent of mileage and 64.2 percent of VMT.
- State ownership by Federal-aid system is 90.4 percent for Interstate, 95 percent for other NHS and 49.3 percent for other Federal-aid highways.
- While states generally have responsibility for higher functionally classified highways, 159,574 miles of state highways are functionally classified as local highways and 80,999 miles are urban collectors and rural minor collectors.

It is important to note that increasingly states are relying on other governmental agencies to provide HPMS data on off-state system roads. Cities, counties, and MPOs frequently provide HPMS data to the states, who then combine it with state collected data before submitting it to FHWA. Ideally, FHWA would like all data to be of equally high quality, but it realizes that this is not always possible across all functional systems. FHWA continues to support the utilization of locally collected data in states' HPMS submittals.

States generally follow the guidance and criteria, such as for functional class, but each state is different because of internal state and non-state highway organizations, highway system definitions, and operating procedures and regulations. To better accommodate these differences, FHWA is proposing several improvements to HPMS that will increase the ability of states to more efficiently provide quality, timely, and complete HPMS data. These improvements discussed in this report include:

- New data model;
- Alternate methods of providing VMT for air quality analysis;
- Metadata for pavements and traffic; and
- Coordination with safety, bridge, finance, and other databases.

Other areas that could be improved to address this issue are being proposed as long-term studies to be implemented beyond year 2010 are identified in this report. These include:

- Sampling size and national/state system schema; and
- Boundaries and functional classification.

These improvements will be further developed with all stakeholders and customers having an opportunity for input and review as FHWA further investigates and implements recommendations from this HPMS Reassessment. States will be involved in pilot testing some of these improvements and may be asked to contribute resources for long-term studies and research projects that may evolve from this reassessment.

3.0 Stakeholder Input

3.1 DESCRIPTION OF INPUT PROCESS

The FHWA is undertaking a very open, interactive approach to this Reassessment. Major emphasis has been and will continue to be directed towards determining the data needs of FHWA's partners, stakeholders, and customers, the various uses of the existing HPMS, as well as the ability of data providers to support these data needs. The Reassessment includes critical issues related to the future form and direction of the HPMS.

HPMS Reassessment efforts to date have included the following:

- Several meetings with national level users;
- Development and use of an Executive Resource Committee (ERC);
- Regional Workshops;
- Presentations at national Transportation Research Board (TRB) meetings;
- Extensive conduct of webinars;
- Development of Issue papers covering all pertinent technical issues and data areas, including: Sampling, Boundaries and Functional Classification, Safety, Pavements, Interchanges, Freight, Capacity, Data Quality, Process Improvement, and New Data Model;
- Docket posting;
- Receipt of comments through e-mail; and
- Discussion of Reassessment comments and feedback with several collector stakeholders.

Each of these input mechanisms are discussed in the following section.

3.2 SUMMARY OF INPUT

3.2.1 National Users

An HPMS Reassessment Scoping Session was held on February 1, 2006 with FHWA and other U.S. DOT program users of the HPMS data. The purpose of the meeting was to discuss openly the intention of the Office of Highway Policy Information to conduct a Reassessment of the HPMS and learn of the concerns and issues it would raise from those within U.S. DOT, especially FHWA. Detailed discussions were held on the following topics: Planning, Environment,

and Real Estate (rural/urban designations, linear referencing system, air quality conformity, capacity analysis); Infrastructure (HERS-ST, data integration and pavement management); Operations (freight analysis, vehicle classification, and ITS); Safety (roadway characteristics) and Policy (HERS and traffic Monitoring).

3.2.2 Executive Resource Committee

An Executive Resource Committee (ERC) was formed at the beginning of the process. The ERC was formed to assist FHWA staff with identifying present and future data needs for FHWA and users, and balance needs and resource requirements. The ERC is comprised of five state members, one Metropolitan Planning Organization, three FHWA Division Representative, eight FHWA Data Customers and three internal customers.

The role of the ERC was to:

- Actively participate in the development of Issue papers as reviewers and technical experts;
- Participate in Regional Workshops;
- Act as a sounding board at the end of Regional Workshops to assess future action on issues identified at Workshops; and
- Assist with recommendations regarding a full range of options that need to be considered in the Reassessment.

ERC meetings were held as follows:

- March 15, 2006 – Orientation Meeting;
- March 22-30, 2006 – Issue Module Meetings to review mission and goals of Reassessment;
- April 12, 2006 – Project Kickoff; and
- October 24, 2006 – Review of Progress.

3.2.3 Regional Workshops

Five Regional Workshops were held as follows: March 10-11, Washington, D.C., April 26-27, 2006 in Newington, Connecticut; May 10-11, 2006 in Atlanta, Georgia; May 24-25, 2006 in Portland, Oregon; and May 31-June1, 2006 in Lincoln, Nebraska.

A total of 92 people attended, six of them were ERC members. Twenty-three states were represented (Oregon, Washington, Texas, Idaho, Nevada, Arkansas, Colorado, Montana, Florida, Georgia, South Carolina, Virginia, Kansas, Michigan, Minnesota, Nebraska, New York, Wisconsin, Wyoming, Virginia, Pennsylvania, Massachusetts, and Connecticut). Three MPOs also were represented (Portland, Dallas/Fort Worth, and Southwestern Pennsylvania (SPC)). Nine FHWA Division offices also attended.

In general, states expressed that they would like a better explanation of the connection between HPMS and apportionment. They also requested a table to show existing HPMS items – what they are used for and who needs them along with Reassessment items – who needs them, what they will be used for, cost/benefit of collection, details related to collecting (where), and want versus need. The burden for collection on lower functionally classified roads also was an issue. Some expressed concern over the perception that HPMS is getting down to a project level (not originally intended for that level of analysis). Finally, there was a concern that the increased items will create a burden and subsequently lower overall data quality. It was clear from the Workshops that the HPMS Field Manual needs to be revised and many states indicated that they would like to be involved in that effort.

All of this feedback was considered in the development of the Issue papers and is summarized in Appendix C.

3.2.4 National Transportation Research Board Meetings

Two outreach Workshops were held as follows:

- On June 5, 2006 at the North American Travel Monitoring Exhibition and Conference in Minneapolis (NATMEC). FHWA staff also attended the following Transportation Research Board committee meetings to brief them: Statewide Data and Information Systems and Traffic Monitoring.
- July 10, 2006 at the (TRB) Midyear meeting in La Jolla, California. In addition to a dedicated session, FHWA staff and consultant attended the following Committee meetings to brief them on the HPMS Reassessment: Statewide Multimodal Transportation Planning Committee, Performance Measurement Committee, Freight Data, and Transportation Programming, Planning and Systems Evaluation.

3.2.5 Webinars

Fourteen issue-specific webinars held over the summer of 2006 with an average of 100 people and most states in attendance at each one. Interactive presentations and surveys were used to gather input. The poll questions used along with the feedback received during the webinars are included on the Docket.

The webinars were particularly useful in further refining the Issue papers.

3.2.6 Issue Papers

The initial Reassessment outreach conducted with program managers within FHWA and the customers/users of HPMS information through a series of Regional Workshops with state and local data providers revealed 10 major issue areas. Issue papers were written by the Office of Highway Policy Information

with extensive coordination with HPMS users. More detail related to the Issue papers is found in Section 4.1.

3.2.7 Other Input

In addition to the aforementioned input mechanisms, feedback was provided directly to the FHWA project manager in the form of documents posted directly to the Docket, No. 23638 (http://dms.dot.gov/). Additional e-mails and phone calls were submitted to the project manager. All were taken into consideration in developing this report, but some may have been withheld at the senders' request. To the extent possible, all e-mails to the project manager have been put on the Docket with prior approval of the sender.

4.0 Issue Area Recommendations

Issue papers were developed for each of the major subject areas of the Reassessment. The 10 Issue paper areas are grouped into three categories as follows:

1. Structure of HPMS (one Issue paper for each):
   - New Data Model (formerly Linear Referencing and Data Integration);
   - Sampling; and
   - Boundaries and Functional Classification.
2. Data Items (one Issue paper for each):
   - Safety;
   - Freight;
   - Pavements;
   - Interchanges; and
   - Capacity.
3. Data Quality and Process Improvement (one Issue paper for each):
   - Data Quality; and
   - Process Improvement.

For clarification, collecting year refers to the year in which the data are collected, where reporting year refers to the year in which these data are reported to FHWA. HPMS data are expected to be collected over a one calendar year period and be reported to FHWA by the following June 15th. For example, data collected by a state in calendar year 2005 is reported to FHWA on June 15, 2006. The proposed timing for recommended changes to HPMS is very important and there are three basic levels of recommendations being made in the Reassessment:

1. Immediate Implementation – These are two levels of "immediate implementation":
   - 2008 Reporting Year which means the item is optional for 2007 Reporting Year and mandatory for the 2008 Reporting Year. The only data items in this category are motorcycle travel data, pavement metadata, and traffic metadata.
   - 2010 Reporting Year pertains to data collected in calendar year 2009. This is the last possible year for reporting new and changed items. States that have collected these data items in 2008 may report them in the 2009 Reporting Year. All States will be required to collect these data in 2009 for the 2010 Reporting Year. To the extent possible, similar data items

should be dropped and added in the same year. For example, pavement structural number should not be deleted until the new pavement data items are added.

2. Short-Term Study – These will be further studied through consultation with data users and collectors prior to the final recommendations being made in mid 2007.
3. Long-Term Study – These are areas which will require additional study beyond the period of the Reassessment and should be addressed in future Reassessments.

This section describes and summarizes the recommendations that were developed through the Issue papers. Section 4.1 describes the Issue papers in general. Sections 4.2, 4.3, and 4.4 summarize the recommendations for the structure of HPMS, data items, and data quality/process improvement respectively. Throughout these sections, several charts show a breakdown of state responses to several questions asked during the webinars. The results were used to arrive at recommendations regarding level of effort to change and/or add certain items. Section 4.5 summarizes all of the recommendations in a table format.

4.1 ISSUE PAPERS

All input was considered through an evolutionary development of these Issue papers. They were revised several times over the course of the workshop, webinar, and subsequent feedback phases. The Issue papers are included in Appendix C. A summary of the recommendations for each Issue area is included in Sections 4.2 through 4.4.

Each Issue paper is organized as follows:

4.1.1 Related Data Items

These items include data that currently are collected in HPMS and are being considered for modification or deletion, along with proposed new data items.

4.1.2 Background

Some papers include a section describing the background related to the issue.

4.1.3 Issue Description

This section defines the issue and identifies the purpose that warrants this issue. It describes "what" the data needs are and "why" these data are needed. Where possible, the customers, both internal and external are identified along with their individual data needs.

Each sub issue is labeled and consistently referenced throughout the remainder of the paper.

4.1.4 Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. It also attempts to capture the level of effort involved in both collecting the data, as well as processing data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs also are captured.

4.1.5 Options/Recommendations

This section of the issue papers was dynamic throughout the first phase of the Reassessment. Initially, it was based on the suggestions offered by the FHWA program offices. Other options and recommendations were added later based on feedback from the regional outreach workshops and issue-specific web seminars.

4.1.6 Resources

This section provides a link or connection to the program office(s) that have a vested need for the data items identified in the issue paper. Where possible, a contact person also is identified.

4.2 STRUCTURE OF HPMS

This section deals with potential changes to the structure of HPMS, which includes the database and methods of submitting HPMS data to FHWA. The recommended changes related to the structure of HPMS are directly linked to a critical goal of HPMS which is to evolve to a data system which builds from the data systems of local, regional, and state governments and is connected with a common geo-referencing system. The ability to connect HPMS data items with a common geo-referencing system also was identified as an outstanding need in the last Reassessment. An important mission of this Reassessment is to capitalize on changing technology to enhance quality, efficiency, and data integration.

The three main areas being considered in Section 4.2 are a new data model, sampling, and boundaries/functional classification. Processes such as data submittal, analysis, organization, and reporting are under consideration here. Although many ideas have evolved and developed over the course of the Reassessment thus far, many issues still need to be considered and studied further.

4.2.1 New Data Model

4.2.1.1 IMMEDIATE IMPLEMENTATION

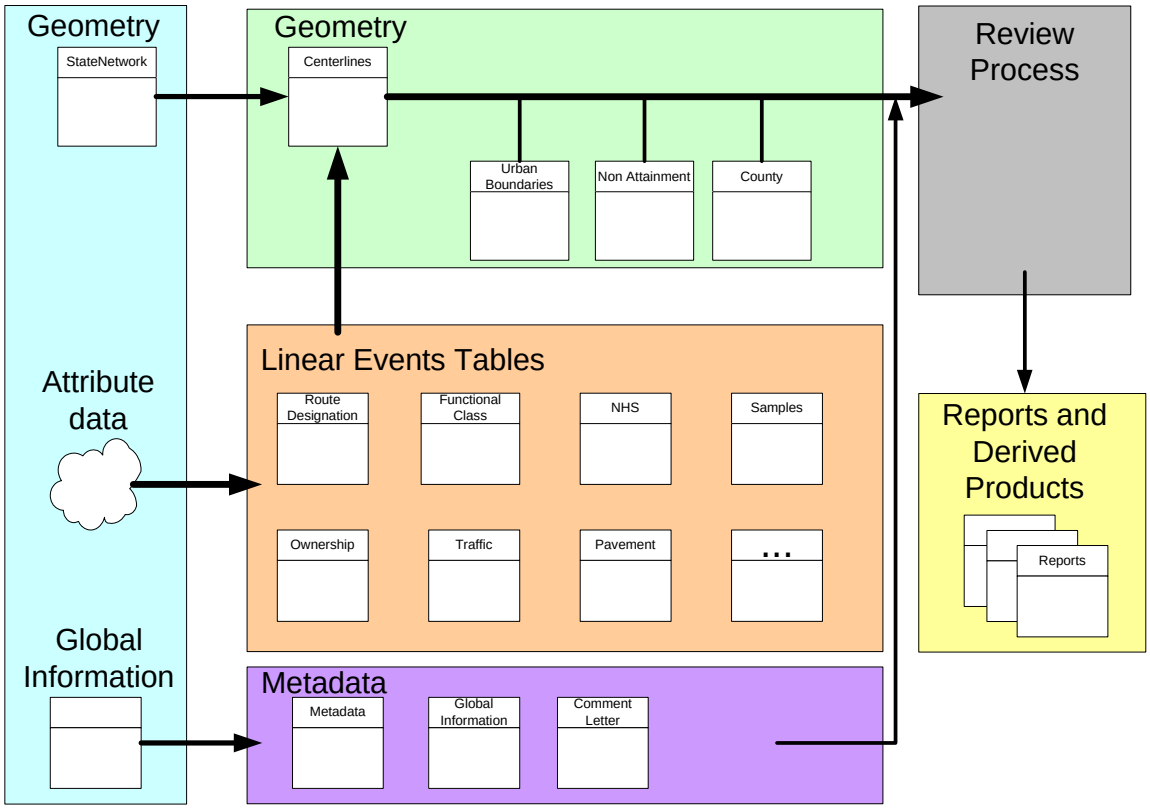
There are no immediate changes recommended related to the new data model.

4.2.1.2 SHORT-TERM STUDY

A basic concept for a new data model is proposed in the Issue paper which is to organize the HPMS data into program areas, and link them together through a

Geographic Information System (GIS) using spatial relationships. In other words, traffic would be collected as one layer, pavement in another, inventory in a third, etc. The following figure depicts what the new data model could look like.

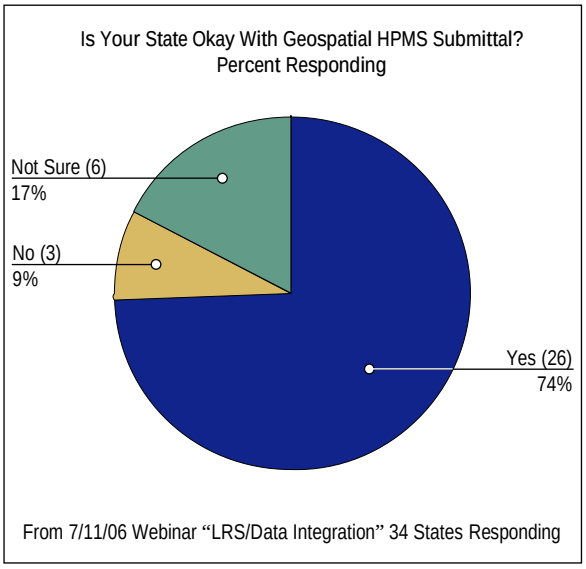
New Data Model



The recommended structure for the HPMS of 2010 goes a long way toward achieving the goal of HPMS building from the data systems of local, regional, and state governments and connected with a common geo-referencing system. The recommended Data Model has the following attributes:

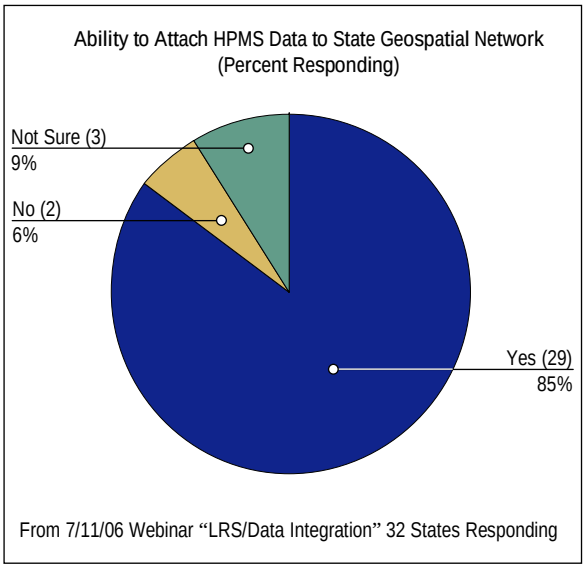
- The scope of HPMS remains the same. HPMS includes all public highway mileage.
- The scale of the HPMS also remains the same. There are Universe data items, sample information for a portion of the Universe and area-wide summary information for minor and local highways. Universe AADT coverage is extended through major collectors.
- New elements of the proposed structure are:
  - GIS-based framework; and
  - Multitable format linked to state-supplied network.

- Benefits of the new structure include:
  - Expands the coverage of "linkable" HPMS data. HPMS 2010 can more easily link to other Federal highway data files such as the Bridge Inventory system and the proposed Highway safety systems, and can provide data to "routable" Federal transportation networks such as NHPN and FAF.
  - Improves state feedback mechanisms.
  - The GIS approach may allow a different approach for populating urban/urbanized attributes.
  - Information on ramps will be added for all functional systems.



The recommendations are to:

- Implement a New Data Model, a GIS or geospatial database with multiple layers, for implementation for 2010;
- Perform a pilot to explore how this will be implemented:
  - Creating multiple tables within the HPMS submittal similar to the current table that states submit; or
  - Allowing states to submit their HPMS data as a GIS file or geospatial database with multiple layers; each layer representing a logical grouping of data (pavement, traffic, ITS, etc.); and
  - Establish the minimum criteria for the road geometry. Preliminary attributes regarding the network have been proposed and are included below. The FHWA and the Pilot States will be working on refining these attributes as they work on developing the new data model.
    - » **Scope –** It is recommended that the State supplied geospatial networks be dual carriageway.
    - » **Extent –** The State supplied geospatial network will need to include all roads through



rural Major Collector and urban Collector both on and off the State highway system.

» **Accuracy –** It is desirable that the State supplied geospatial networks have an accuracy of 1:10,000, although networks up to 1:24,000 will be accepted. Through the survey of State GIS staff at GIS-T (2006), 50 percent of the States indicated that their networks have an accuracy of 1:10,000 or better, with all but three of the responding States indicating that they have a network with an accuracy of 1:24,000 or better.

» **Intrastate Connectivity –** States are encouraged to use an LRS for HPMS reporting that is consistent with the LRS being used for all other Federal data reporting. Through the HPMS Reassessment, FHWA is proposing "one network and one LRS for all Federal data reporting." This theme has been widely embraced by most States and most if not all of the Federal agencies engaged through the Reassessment.

» **Maintenance –** The proposed data model will use the State supplied geospatial networks, which need to correspond to the HPMS data being submitted that year. To insure a 100 percent match between the HPMS data and the geospatial network, States are encouraged to submit a new network every year.

Develop new submittal package to include:

- A geometry file in the form of a shapefile or other acceptable format that has measured and calibrated routes;
- A series of event tables using the LRS field as a common identifier to link all data tables; and
- Global Information which would include information that applies to every record (such as Units, Year or Data, Summary Data, etc.).

4.2.1.3 LONG-TERM STUDY

None at this time.

4.2.2 Sampling

The general recommendations that were evaluated here include: modifying volume groups to be consistent across rural and urban functional classes; expanding upper and lower volume groups; and extending universe AADT coverage through Major Collectors. It is recommended that the basic standard sampling scheme for HPMS remain unchanged. Benefits of applying the following recommendations as described include: an ability to readily calculate a VMT value based on defined air pollutant boundaries (multiple pollutants/boundaries), an ability to calculate a VMT value for urbanized areas split by one or more nonattainment or maintenance area boundaries, and an

elimination of donut sample related data items and the effort needed to maintain sample adequacy in nonattainment or maintenance areas (donut samples).

4.2.2.1 IMMEDIATE IMPLEMENTATION

The following should be considered for immediate implementation:

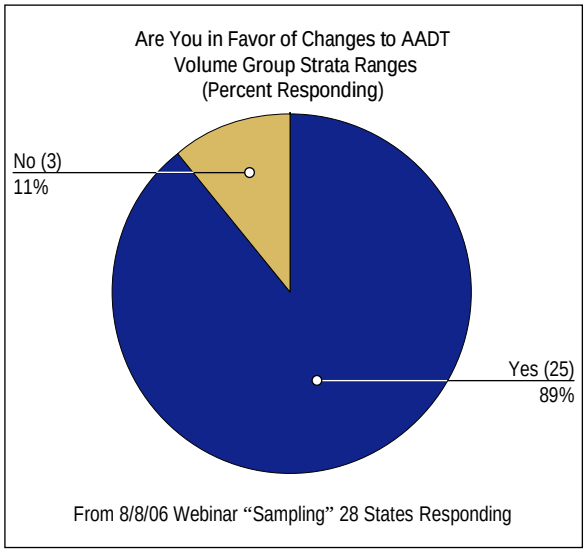
- Universe/Summary AADT – Present scheme of standard sampling within urbanized areas, small urban areas, and rural by functional system and by volume strata will be retained. (It is recommended that a study of alternative sampling schemes be scheduled for future years). However, it is recommended that the requirement for the Donut Area Sample[1] AADT Volume Group Identifier (Item 31) as well as the entire donut sampling procedure be deleted. The implementation of this recommendation will require the states to report estimated AADTs for all Minor Arterials and Major Collectors at least within a special study area(s). A Special study area is the area which encompasses all nonattainment or maintenance areas.
- FHWA also proposes to include AADT (Item 33) as a required item for all reported Federal-aid highway segments. Inclusion of AADT for all Minor Arterials and Collectors (Major) segments would greatly simplify the estimation of VMT for specific geographic areas as well as nonattainment or maintenance areas by pollutant. Currently, only the standard and donut samples require AADTs to be reported on all Minor Arterials, rural Major Collectors, and urban Collectors. Please note that AADT reporting is currently required on a universe basis for all Principal Arterials, NHS, STRAHNET, and for sample sections on Minor Arterials, rural Major Collectors, and urban Collectors.
- The current Summary Template used for the air quality nonattainment and maintenance areas would be modified to accommodate reporting a combined estimate of DVMT for the lowest systems by area and pollutant; these lowest systems would include any rural Minor Collectors and rural/urban Locals located within the nonattainment or maintenance area. The Donut sampling scheme would be deleted in favor of reporting estimated AADTs in special study areas to populate the rest of the AADT cells on the Minor Arterials and Collectors (Major) segments that are not already samples or part of the NHS or STRAHNET.
- Drop the Urbanized Area Sampling Technique Code (Item 14).

4.2.2.2 SHORT-TERM STUDY

[1] Donut Area refers to the portion of a non-attainment or maintenance area that is outside an urban or urbanized boundary. The Donut Area Sample is a supplementary sample that is used to determine travel in the Donut Area, so when combined with the travel for the urban or urbanized area, is representative the entire non-attainment or maintenance area.

The following needs to be considered in the short term and recommendations made prior to final recommendations in 2007 so they can be included in the Reassessment.

- NHS Sample – A NHS sampling scheme by states could be implemented using the existing standard samples supplemented with extra standard samples where needed. A separate Item would be retained for the NHS expansion factor such as the standard sample expansion factor. An in-depth analysis is needed to verify the proposed results. NHS Expansion Factors (applicable to the non-Interstate parts) will be developed.
- A recommendation needs to be made regarding how to keep the sample panel representative of the entire urbanized area in cases where large additions are added to an existing urbanized area sample panel. The Urbanized Area Sampling Technique (Item 14) would be dropped. A decision needs to be made regarding allowance of subarea sampling within a large urbanized area.
- AADT volume group strata adjustment – FHWA proposes establishing a single AADT Volume Group (Item 32) stratification that would apply across all geographic area types (i.e., rural, small urban, urbanized, nonattainment, etc.)
- Item 32 – Standard Sample AADT Volume Group Identifier – Common generic AADT Volume Groups.



The suggested AADT volume group strata shown below should be evaluated to determine the impact of various options (i.e., wider volume ranges as the volume increases, use same volume ranges across urban/rural, etc.). AADT volume group strata adjustment should be tested to determine the impact of various options (i.e., wider volume ranges as the volume increases, use same volume ranges across urban/rural, etc.). The expectation is that this change has the green light. A generic set of common AADT Volume Groups is proposed as follows:

AADT Volume Groups	Code
Under 500	1
500-1,999	2
2,000-4,999	3
5,000-9,999	4
10,000-19,999	5
20,000-34,999	6
35,000-54,999	7
55,000-84,999	8
85,000-124,999	9
125,000-174,999	10
175,000-249,999	11
250,000 and more	12

4.2.2.3 LONG-TERM STUDY

The following should be considered for long-term study in the future.

- **National Sample –** This option deals primarily with obtaining those data items required only for national level analysis (e.g., HERS, FAF, Highway Cost Allocation etc). There are two scenarios that need to be further studied:
  - Collect the sample data items only used for national-level analysis as a national sample for all functional systems; or
  - Create a national sample for data on those functional systems currently not covered by the existing sample. Under this scenario, the national sample would compliment the existing sample.
- **Alternative Sampling Methods –** Alternative variable schemes, if viable, could be reviewed and proposed. Levels of precision needed for FHWA purposes need to be visited, since the level of precision directly affects the amount of samples required. If a commitment is made, then criteria would be very helpful in deciding the alternative schemes as well as the appropriate levels of precision to employ.

4.2.3 Boundaries and Functional Classification

4.2.3.1 IMMEDIATE IMPLEMENTATION

- Revise functional classification codes to eliminate separate urban and rural classifications (please note the rural, small urban, and urbanized area designation is kept as a separate item);
- Allow designation of rural Other Freeways and Expressways; and
- Allow optional disaggregation of urban Collectors into urban Major and Minor Collectors.
- Add additional data item describing type of pollutant to summary form.

4.2.3.2 SHORT-TERM STUDY

- Research options for updating urban and urbanized areas and air quality boundaries;
- Develop functional classification for noncenterline facilities (discussed in Interchanges paper); and

4.2.3.3 LONG TERM STUDY

- FHWA will issue instructions on adjusting urban/urbanized boundaries to Division Offices and States prior to the next decennial Census.

4.3 DATA ITEMS

The following data items are recommended to be modified or added because of FHWA business needs as described in the Issue papers for safety, pavements, interchanges, freight, and capacity.

Recommendations of each of the main areas are included below. One should refer directly to the Issue papers for background and specifics regarding the recommendations.

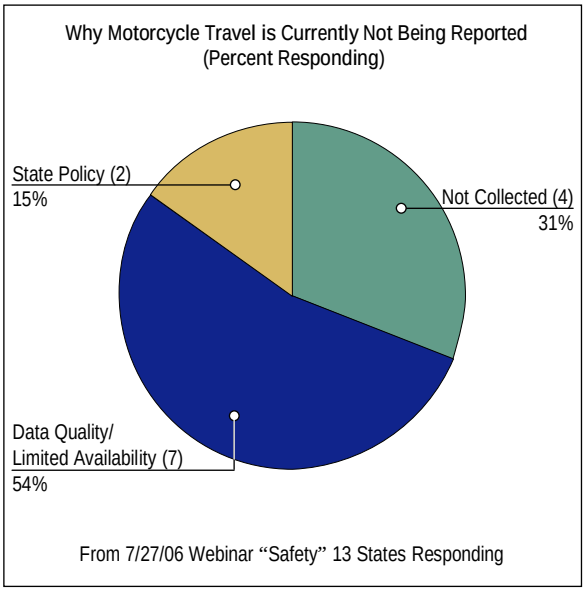
4.3.1 Immediate Implementation

The mandatory Reporting Year is indicated in parenthesis. Unless otherwise noted, states will be able beginning reporting these data to FHWA in 2008. States already submitting the new/changed data, are expect to continue to do so. All other states are expected to submit data in the revised format as soon as it is available, and not wait till the required reporting year (2010).

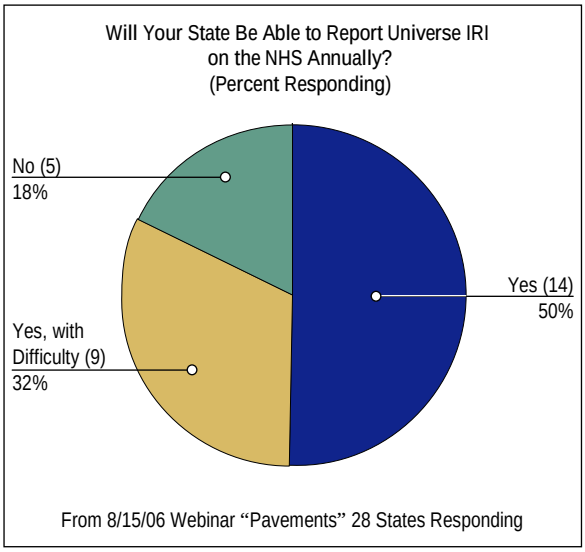
4.3.1.1 SAFETY

Motorcycles (2008 Reporting Year)

- States to include motorcycle travel data collected in calendar year 2006, as part of their June 2007 HPMS submittal. The reporting of these data in 2007 would be optional, but starting in 2008, the reporting of these data in the area-wide summary table would be mandatory.



4.3.1.2 PAVEMENT



Frequency of submitted/reported IRI data (2010 Reporting Year)

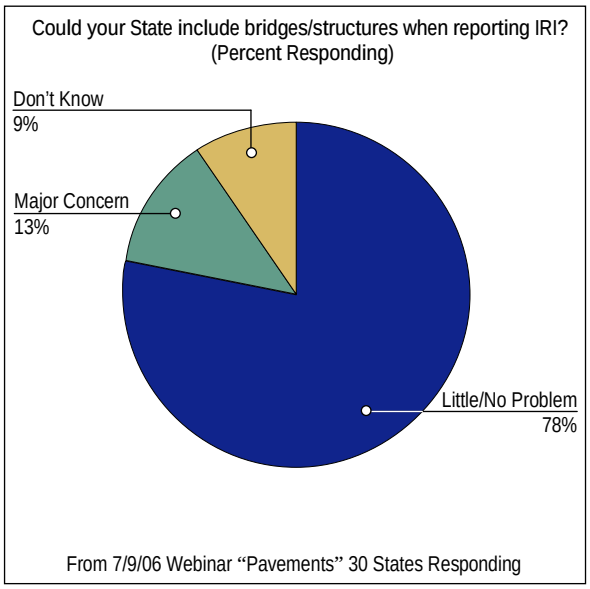
- Collect and Report IRI and IRI Year *annually* on a universe basis on the NHS. (The collection of IRI data off the NHS may remain on a two-year cycle).

Consistency of submitted/reported IRI data (2010 Reporting Year)

- Better "enforce" the current collection procedures and requirements of IRI in the HPMS based on AASHTO PP37-04 (Appendix E, *HPMS Field Manual*);
- Report various metadata and date of collection, including IRI Year, on IRI from the states (as currently defined in HM-66 of *Highway Statistics* or modify);
- Continue reporting average of both right and left wheel path quarter-car IRI in HPMS as a Mean Roughness Index (MRI); and
- Report IRI data on structures and railroad crossings where IRI is required.

Additional pavement data items and dropping of less useful ones

- Implement standards (AASHTO) and collection procedures in HPMS for the collection of all of the defined additional pavement data items as required sample data items. FHWA – Define and require reporting of metadata for applicable data items.
- Drop reporting of SN**.** Need for this data item is obsolete and redundant based on acquisition of new data items.
- Collect additional pavement data items through a mix of required fields, optional fields, phased-in reporting, and statewide default tables.
  - Rutting/Faulting – Add as required sample data items (data to be collected via profilometer at same time as IRI).



- IRI Year – Add for all sections where IRI is required (including structures).
- Cracking – Add percent cracking (regardless of severity) as a sample data item.
- Add Date of Last Overlay and Date of Last Reconstruction – Add as required sample data items.
- Thickness of Latest Overlay – Optional sample data field until next post-2010 overlay.
- The following data items would be required for all sample sections beginning in Reporting Year 2010 (Optional in Reporting Year 2009). It is realized that many of these data items may not currently be available for individual sections; therefore the reporting of default values will be acceptable until such time as the State has developed a system to populate these data. Default values are acceptable for both on-state and off-state sections, and can be based on typical design defaults (statewide, functional system etc). To facilitate the reporting of these data, FHWA is considering adding one or more tables in the data model that would allow states to code these data on a functional class basis.
  - » Asphalt Bound Thickness;
  - » Concrete Thickness;
  - » Base Type;
  - » Base Thickness;
  - » Asphalt Mix Binder Type;
  - » Dowel Bars; and
  - » Joint Spacing.
- Subgrade AASHTO Soil Type: FHWA would code a default from maps while allowing states to override based on readily available local information.

4.3.1.3 INTERCHANGES

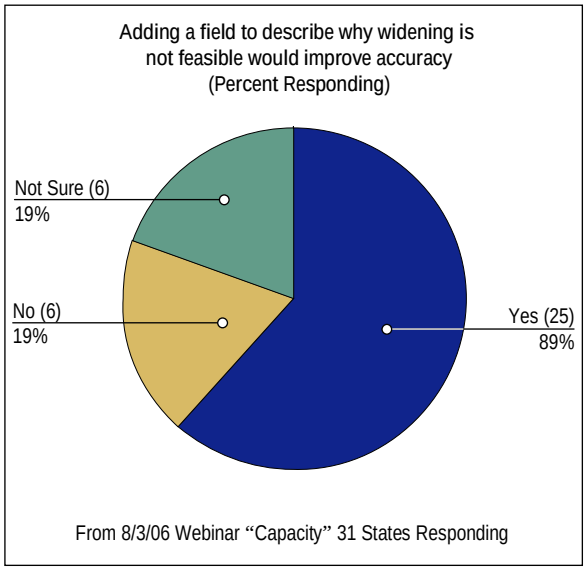
States to report ramp location, length, number of lanes and functional classification data for all functional systems (2010 Reporting Year)

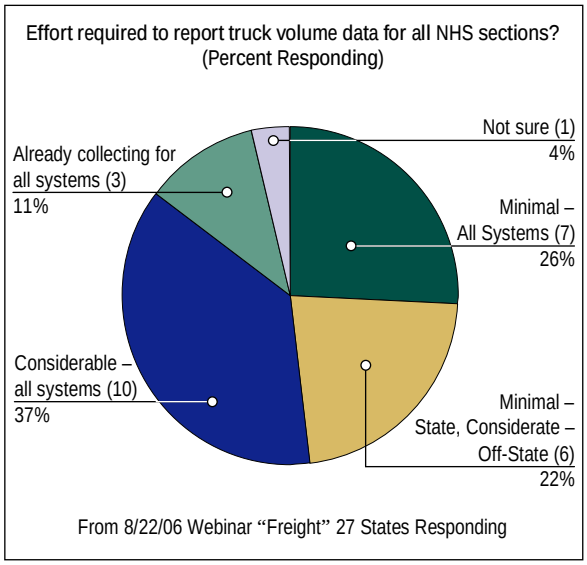
- Ramps, as defined by AASHTO in the publication *A Policy on Geometric Design of Highways and Streets* "…includes all types, arrangements, and sizes of turning roadways that connect two or more legs at an interchange." Where a ramp connects two facilities with different functional classifications, the ramp will be coded with the functional classification of the "higher" facility. For example, a ramp that connects an Interstate and a Principal Arterial would be coded as an Interstate ramp.

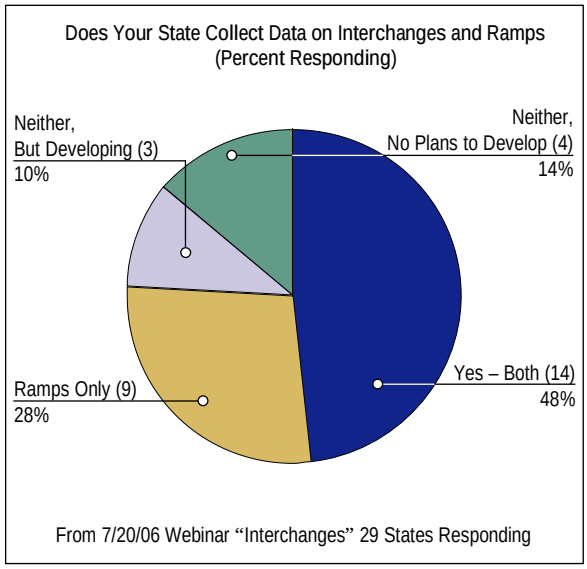
4.3.1.4 FREIGHT

Truck Volumes as Universe Data on the NHS (2010 Reporting Year)

- Report the actual truck AADTs for two categories of trucks, single unit, and combinations.
- Continue to report the percent single unit and combination trucks during the peak hour for all sample sections (rounded to the nearest 10th).
- Report average truck volumes that represent average conditions for that location. This means that the actual truck counts obtained would need to be adjusted just as volume data is adjusted to represent average conditions or an AADTT as promoted in the 2001 TMG. States would be allowed to use existing procedures or may need to develop an interim process to adjust raw truck count data to represent average conditions until their traffic monitoring programs have collected sufficient data to calculate reliable AADTTs.







4.3.1.5 CAPACITY

Highway surveillance systems (2009 Reporting Year)

- Delete these data items from HPMS – there are other sources of information for this data besides HPMS that should be used.

Capacity calculations (2010 Reporting Year)

- Change edit routines in the submittal software so V/SF calculations less than 1.4 would be accepted as accurate data; and
- Require states to explain their process(es), in the data narrative, used for calculating capacity and the override values reported in HPMS.

Widening feasibility (2010 Reporting Year)

- States to identify obstacles within a specific distance from the roadway that would greatly complicate widening, and report this condition as a separate data item.

Counter-Peak Lanes (2010 Reporting Year)

- Add a new data item to indicate number of lanes in the counter-peak direction.

4.3.2 Short-Term Study

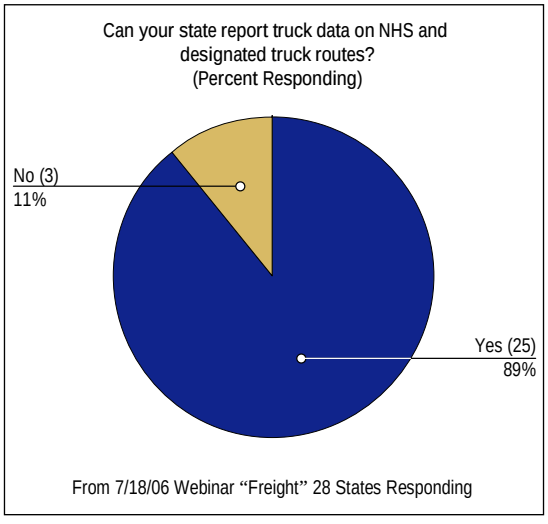
4.3.2.1 SAFETY

Coordination of HPMS with other Safety Databases

- The Office of Safety and the Office of Highway Policy Information should continue to coordinate regarding HPMS and Minimum Inventory of Required Elements (MIRE) standards.

4.3.2.2 INTERCHANGES

FHWA is considering adding ramps to apportionment formulae, however to make this possible, states will also need to report travel on ramps (VMT is a portion of most apportionment formulae). Since this has not yet been vetted with all interested parties, it has been intentionally omitted from the recommendations. Provided adequate state support, FHWA will likely add ramp travel data to the Draft Recommendations Report pending the outreach sessions in early 2007.



4.3.2.3 FREIGHT

Redefine vehicle classification categories on the HPMS Summary Form (merge buses

with single unit trucks) to agree with HPMS Sample definition of the single unit trucks (of categories 4-7).

4.3.2.4 CAPACITY

Widening Feasibility

- FHWA to develop a better description of how to code this for both data collectors and data users – i.e., still code the number of lanes that could be added coded and if widening is not feasible, code the features that are an obstacle to widening.

4.3.3 Long-Term Study

4.3.3.1 SAFETY

Off-System Safety Data

- Investigate seeking this information from information sources other than the HPMS.

4.3.3.2 INTERCHANGES

Research Project

- A research project is needed to determine the interchange information needed at the national level, the systems for which these data are required, and the best data collection method(s). It is anticipated that these data will likely be collected through a second research project, the results of which would be incorporated into HPMS and ultimately provided to the states for integration into their own data programs.

4.3.3.3 CAPACITY

K and D – Factors

- FHWA, along with interested states, will explore changing the existing K.factor from 30th highest hour to 100 or 200th highest hour.

4.3.3.4 FREIGHT

Truck Volume Data

- Research may be needed on a process to easily calculate truck AADTs, to standardize peak hour definitions, explore use of ITS technology, and relevance to truck commodity surveys.

4.4 DATA QUALITY AND PROCESS IMPROVEMENT

The discussions at the workshops and webinars identified a concern for improving the quality of the data provided by state and local governments and for process improvements. These recommendations will be initiated by FHWA to assist the data providers to improve the overall quality and consistency of the data and to improve the quality of the analysis and use for FHWA business

purposes. Exploration of data quality and process improvement ensures adherence to afore mentioned HPMS and Reassessment goals.

4.4.1 Data Quality

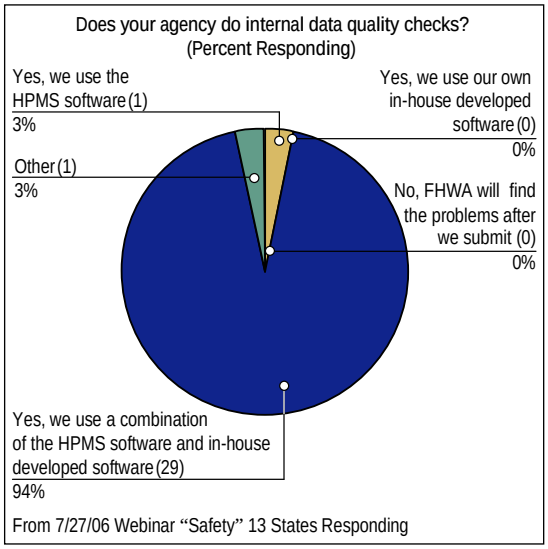
4.4.1.1 IMMEDIATE IMPLEMENTATION

There are no immediate changes recommended.

4.4.1.2 SHORT-TERM STUDY

New Data Model

State DOTs are encouraged that the use of already existing GIS-based databases from each state will allow for a smoother transition to the new data requirements. The pilot program, which is described in the Data Model Issue paper, along with input from a team of state GIS and HPMS staff will help make it easier for States to transition to the new data model.



Field Manual

The guidance to the states in the HPMS Field Manual appears to be the source of some data consistency and quality concerns. The Office of Highway Policy Information will work with the data users and data providers to rewrite the Field Manual as part of the HPMS Reassessment. The revised Field Manual will employ additional, more detailed descriptions and where appropriate, more illustrations. Whenever possible, actual state examples will be incorporated. A team of data users and state data providers will be put together to rewrite the manual. The target completion data for the new Field Manual is December 2007.

Data Validation

FHWA will continue to improve its validation software to make certain that invalid data does not appear within any field in the database (e.g., a 4 is not coded in a field with valid inputs of 1, 2, or 3). FHWA also will work with users of the HPMS data to determine if/what invalid data may be appearing in the database that is sent to the users.

4.4.1.3 LONG-TERM STUDY

Oversight

The validation software should be reviewed, especially in light of the data adjustments that appear to be taking place in order to resolve data verification errors. The verification software is intended to improve data quality, but it appears that in some instances it is encouraging just the opposite. FHWA needs

to determine the extent to which this is happening, and if there is anything that can be done at the administrative level to alleviate this. A working group will be put together to review the software validations (or something like that).

4.4.2 Process Improvement

4.4.2.1 IMMEDIATE IMPLEMENTATION

Pavement Metadata (2008 Reporting Year)

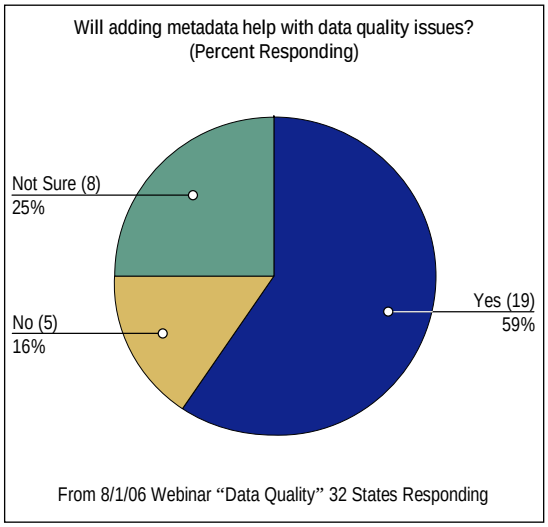
The pavement metadata that are being proposed describe the processes used for collecting and reporting the IRI data. These data would need to be expanded if additional pavement data items are added to HPMS. Also, if the IRI requirements are changed, some of these data items could be eliminated. It has been proposed that the following data items be optional with the submittal of the 2006 HPMS data in June 2007 and required for the data reported in 2008 and beyond:

- Type of vehicle (sonar, multilaser, scanning laser, other);
- Inclusion of structures and railroad crossings;
- Measurement wheel path;
- Measurement lane;
- IRI simulation (half-car, quarter-car, other); and
- Adherence to provisional standard AASHTO PP37-04 (yes, no, partially).

Traffic Metadata (2008 Reporting Year)

As with the pavement metadata, the reporting of traffic metadata would be optional in 2007 and required in 2008 and beyond. The traffic metadata would focus on the reporting of quality HPMS traffic data in accordance with the HPMS Field Manual, the Traffic Monitoring Guide (TMG), and the Traffic Monitoring System for Highways (TMS/H) regulation. The questions to be answered are:

- What portion of current year AADTs are based on actual current year counts? On factored prior year counts?
- How many vehicle classification stations are used for each functional system in the "Travel Activity by Vehicle Type" summary data form?
- How is the travel determined for motorcycles, buses, and trucks (AADT and percent of travel)?
- Describe the quality assurance program for both State and non-State traffic data collection.



Federal Ownership Code (2010 Reporting Year)

Finally, it is being proposed that the Governmental Ownership code be changed to match the coding of Ownership in the NBI. Governmental Ownership would be changed from a one to two-digit field with the following coding options:

01 – State Highway Agency
02 – County Highway Agency
03 – Town or Township Highway Agency
04 – City or Municipal Highway Agency
11 – State Park, Forest, or Reservation Agency
12 – Local Park, Forest, or Reservation Agency
21 – Other State Agency
25 – Other Local Agency
26 – Private (other than railroad)
27 – Railroad
31 – State Toll Authority
32 – Local Toll Authority
40 – Other Public Instrumentality (i.e., Airport, School/University, etc.)
50 – Indian Tribal Nation
60 – Other Federal Agency (not listed below)
62 – Bureau of Indian Affairs
63 – Bureau of Fish and Wildlife
64 – U.S. Forest Service
66 – National Park Service
67 – Tennessee Valley Authority
68 – Bureau of Land Management
69 – Bureau of Reclamation
70 – Corps of Engineers
72 – Air Force
73 – Navy/Marines
74 – Army
80 – Unknown

Toll Facility Identifier (2010 Reporting Year)

The FHWA Office of Highway Policy Information will develop the toll facility codes as part of developing the new data model, and published in the 2007 *Toll Facility Report*. Data on toll facilities are proposed to be collected in a separate table in HPMS as outlined in the new data model. Each toll facility will be represented as single record with a beginning and ending LRS, and the toll facility code.

4.5 SUMMARY OF DATA RECOMMENDATIONS

Several specific HPMS data items may be affected by the Reassessment. The impacts are summarized in the following tables and pie charts.

4.5.1 HPMS Items Recommended for Change or Deletion

Table 4.1 (Recommended Changes to Existing HPMS Items) shows all HPMS data items and the recommended changes (delete, change, short- and long-term study). A blank in this space indicates that the existing item will remain unchanged. Some of these unchanged items were considered for change as indicated in the Issue papers, however, the recommendation at this time is to not change the items. Short-term study pertains to items that will be further studied through consultation with data users and collectors prior to the final recommendations being made in mid 2007. Long-term study are items which will require additional study beyond the period of the Reassessment.

Table 4.1 Recommended Changes to Existing HPMS Items

Item No.	Data Item	Delete/Change/Short- or Long-Term Study	Issue Paper
1	Year of Data		
2	State Code		
3	Reporting Units – Metric or English		
4	County Code	Change	Sampling
5	Section Identification	Delete	Sampling
6	Is Standard Sample		
7	Is Donut Sample	Delete*	Sampling
8	State Control Field	Delete*	Sampling
9	Is Section Grouped?	Delete*	Sampling
10	LRS Identification	Change	Data Model
11	LRS Beginning Point		
12	LRS Ending Point		
13	Rural/Urban Designation		Boundaries
14	Urbanized Area Sampling Technique	Delete*	Sampling
15	Urbanized Area Code		Boundaries
16	NAAQS Nonattainment Area Code		Sampling
17	Functional System Code	Change	Data Quality, Boundaries, Sampling
18	Generated Functional System Code	Delete	Sampling, Boundaries
19	National Highway System (NHS)		
20	Planned Unbuilt Facility		
21	Official Interstate Route Number		Data Quality
22	Route Signing	Change	Data Quality
23	Route Signing Qualifier	Change	Data Quality
24	Signed Route Number		
25	Governmental Ownership	Change	Data Quality, Process Improvement
26	Special Systems	Change	Data Quality
27	Type of Facility		
28	Designated Truck Route		
29	Toll	Short-Term Study	Data Quality
30	Section Length		
31	Donut Area Sample AADT Volume Group Identifier	Delete*	Sampling
32	Standard Sample AADT Volume Group Identifier	Short-Term Study	Sampling
33	AADT	Change	Sampling
34	Number of Through Lanes		
35	Measured Pavement Roughness (IRI)	Change	Data Quality
36	Present Serviceability Rating (PSR)		
37	High-Occupancy Vehicle (HOV) Operations		
38	Electronic Surveillance	Delete	Capacity
39	Metered Ramps	Delete	Capacity
40	Variable Message Signs	Delete	Capacity
41	Highway Advisory Radio	Delete	Capacity
42	Surveillance Cameras	Delete	Capacity
43	Incident Detection	Delete	Capacity
44	Free Cell Phone	Delete	Capacity
45	On-Call Service Patrol	Delete	Capacity
46	In-Vehicle Signing	Delete	Capacity
47	Sample Identifier		
48	Donut Area Sample Expansion Factor	Delete*	Sampling, Boundaries
49	Standard Sample Expansion Factor		
50	Surface/Pavement Type		
51	SN or D	Change	Pavement
52	General Climate Zone		
53	Year of Surface Improvement	Change	Pavement

Table 4.1 Recommended Changes to Existing HPMS Items (continued)

Item No.	Data Item	Delete/Change/Short- or Long-Term Study	Issue Paper
54	Lane Width		
55	Access Control		
56	Median Type		
57	Median Width		
58	Shoulder Type		
59	Shoulder Width – Right		
60	Shoulder Width – Left		
61	Peak Parking		
62	Widening Feasibility		
63	Length Class A Curves		
64	Length Class B Curves		
65	Length Class C Curves		
66	Length Class D Curves		
67	Length Class E Curves		
68	Length Class F Curves		
69	Horizontal Alignment Adequacy	Delete	Safety
70	Type of Terrain		
71	Vertical Alignment Adequacy	Delete	Safety
72	Length Class A Grades		
73	Length Class B Grades		
74	Length Class C Grades		
75	Length Class D Grades		
76	Length Class E Grades		
77	Length Class F Grades		
78	Percent Passing Sight Distance		
79	Weighted Design Speed		
80	Speed Limit		
81	Percent Single Unit Trucks – Peak	Change	Freight
82	Percent Single Unit Trucks – Average Daily	Change	Freight
83	Percent Combination Trucks – Peak	Change	Freight
84	Percent Combination Trucks – Average Daily	Change	Freight
85	K-Factor	Short-Term Study	Capacity
86	Directional Factor	Short-Term Study	Capacity
87	Number of Peak Lanes		
88	Left Turning Lanes		
89	Right Turning Lanes		
90	Prevailing Type of Signalization		
91	Typical Peak Percent Green Time		
92	Number At-Grade Intersections – Signals		
93	Number At-Grade Intersections – Stop Sign		
94	Number At-Grade Intersections – Other/ No Control		
95	Peak Capacity		
96	Volume/Service Flow Ratio (V/SF)		
97	Future AADT		
98	Year of Future AADT		

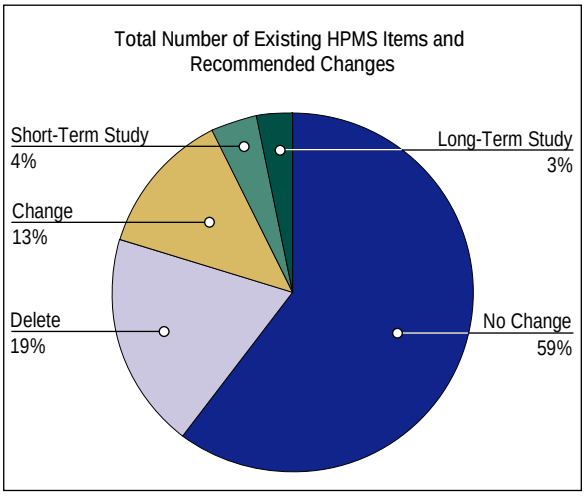
Definitions of terms:
No entry in last column = No change to this data item. – 59.
Delete = These items will be deleted from HPMS.
Delete* = The deletion of these items is contingent on the short-term data model study. – 6 items.
Change = These items will be changed.
Short-Term Study = These items may change as a result of short-term study which will occur during the remainder of the HPMS Reassessment study period.
Long-Term Study = These items will not be changed during this Reassessment.

The following items were considered to be changed but feedback resulted in a recommendation to leave them unchanged for this Reassessment: pavement friction data, truck forecasts, truck parking, interchange data on type and location, interchange ramp pavement data, interchange ramp vehicle classification, rumble strips, curve and grade data, HOV and HOT lanes, K&D Factors, consistent volume groups for rural and urban, expanding upper and lower volume groups, AADT on major collectors, dual roadway data, toll facility owner and coding, and NHS expansion factors.

Regarding data items, of the total of 98 HPMS items, 60 items will remain unchanged, 19 items are recommended for deletion, 15 to be changed, and 4 for short-term study.

Most of the items recommended for deletion are associated with the Capacity Issue paper (these include intelligent transportation systems detection items (38-46). The items recommended for future study generally pertain to the sampling or data model concepts described in Section 4.0.

The following figure summarizes the items to be added, changed, deleted, and unchanged. They are color coded by data type (traffic, pavement, surveillance, etc.)



Summary of Data Recommendations

ADD
Traffic Metadata
Obstacles to Widening
Counter – Peak Lanes
Interchange Location
Interchange Type
Ramp Number of Lanes
Ramp Location
NHS Expansion Factor
Ramp Length
Ramp Functional Class
Pavement Metadata
IRI Year
Rutting
Faulting
Cracking
Year of Last Construction
Last Overlay Thickness
Base Type
Base Thickness
Binder Type
Dowel Bars
Joint Spacing
Soil Type

CHANGE
Percent Single Unit Trucks – Peak
Percent Single Unit Trucks – Average Daily
Percent Combination Trucks – Peak
Percent Combination Trucks – Average Daily
AADT
Motorcycle VMT
IRI
SN or D
Year of Surface Improvement
County Code
Route Signing
Route Signing Qualifier
Special Systems
Toll
LRS Identification
Functional System Code
Governmental Ownership
Standard Sample AADT Volume Group Identifier

UNCHANGED
Year of Data
State Code
Reporting Units- Metric or English
Signed Route Number
Sample Identifier
Is Standard Sample
Standard Sample Expansion Factor
General Climate Zone
National Highway System (NHS)
Planned Unbuilt Facility
Official Interstate Route Number
Section Length
LRS ID and Begin/End
Surface/Pavement Type
Present Serviceability Rating (PSR)
High-Occupancy Vehicle (HOV) Operations
Type of Facility
Designated Truck Route
Widening Feasibility
Lane Width
Number of Through Lanes
Access Control
Median Type
Median Width
Shoulder Type
Shoulder Width -Right
Shoulder Width – Left
Peak Parking
Length Class A Curves
Length Class B Curves
Length Class C Curves
Length Class D Curves
Length Class E Curves
Length Class F Curves
Type of Terrain
Length Class A Grades
Length Class B Grades
Length Class C Grades
Length Class D Grades
Length Class E Grades
Length Class F Grades
Percent Passing Sight Distance

UNCHANGED (continued)
Weighted Design Speed
Speed Limit
Number of Peak Lanes
Left Turning Lanes
Right Turning Lanes
Prevailing Type of Signalization
Typical Peak Percent Green Time
Number At-Grade Intersections – Signals
Number At-Grade Intersections – Stop Sign
Number At-Grade Intersections – Other/No Control
Volume/Service Flow Ratio (V/SF)
Future AADT
Year of Future AADT
K-Factor
Directional Factor

DELETE
Electronic Surveillance
Metered Ramps
Variable Message Signs
Highway Advisory Radio
Surveillance Cameras
Incident Detection
Free Cell Phone
On-Call Service Patrol
In-Vehicle Signing
Horizontal Alignment Adequacy
Vertical Alignment Adequacy
Is Donut Sample
Donut Area Sample Expansion Factor
Section Identification
State Control Field
Is Section Grouped?
Urbanized Area Sampling Technique
Generated Functional System Code
Donut Area Sample AADT Volume Group Identifier

Key:	Pavement	Traffic	Geometrics	ITS	Other

5.0 Impacts of Reassessment

5.1 OVERVIEW

As stated earlier, the HPMS Reassessment process has been iterative. Comments, questions, and concerns from data users and collectors have been considered and addressed throughout. The Issue papers were established as the main vehicle for communicating recommended changes. They were initially written to reflect HPMS user needs at the Federal level. The Office of Highway Policy Information acted as a neutral party to identify necessary changes to HPMS and then to obtain feedback regarding the changes under consideration with HPMS data collectors. The Issue papers were subsequently revised and rewritten several times to take into account comments and concerns from data collectors during the extensive feedback process (workshops, webinars, surveys, docket, etc.)

In many cases, recommendations were changed significantly to address collector concerns. For example, original recommendations suggested obtaining off-system traffic and roadway data to support safety analysis. Subsequent concerns from state data providers resulted in concluding that off-system data should be sought from other non-HPMS sources. In some cases, surveys and feedback revealed that data previously assumed not to be available, are actually available. The example of interchange data is appropriate here. The process was a constant balancing act between needs at the Federal level and abilities to collect data at the state level.

The potential impact of the recommended changes on the states varies considerably. The surveys conducted during the webinars revealed that many states are well positioned to report on some additional data items. For example, most are in a good position to transition to spatial submittal of HPMS data while other states are not as advanced in terms of Geographic Information System (GIS) development and use within their states.

As discussed in Section 4.0, the recommended changes fall into three categories. Analysis of the overall potential impacts is difficult because one must take into account different timeframes for changes as well as changes to both collection and processing of HPMS data. The perceived negative impacts of additional data items may for most states be offset by positive changes in the processing of HPMS data. For example, the impact of the collecting of pavement data on a more regular cycle may result in an increased collection burden to some states. In many states, the additional burden may be offset by the reduced amount of data processing and manipulation required with the new data model. Additionally, states should consider the benefits the additional data will have on improved analysis capabilities of pavement needs, both at the state and national levels. Even more important to the states is the fact that the HPMS Reassessment

as a complete package will result in positive impacts to both users and collectors. Unfortunately, the timing of Reassessment changes vary considerably as well. While additional collection may be requested within the next year or two, improvements to processing and sampling may not occur for three to five years. The schedule of implementation will depend on funding available to continue research and develop solutions in the areas of Data Quality and Process Improvement.

5.2 ANALYSIS OF HPMS ITEMS RECOMMENDED FOR CHANGE

The following table (Table 5.1) shows the items to be changed and those recommended for short-term study. It includes specific changes recommended, proposed timing for the change, and an estimate of level of effort to collect the data. Level of effort is a qualitative assessment derived from webinars and other stakeholder feedback.

Table 5.1 Timing and Level of Impact for Changed and Short-Term Future Study Items

Item No.	Data Item	Type of Change	Description of Change	Estimated Level of Effort
4	County Code	Change	Use FIPS code	1
10	LRS Identification	Change	Expand from 12 to 32 and format restrictions are removed	-1
17	Functional System Code	Short-Term Study	Eliminate bifurcation	2
22	Route Signing	Change	Coding to be changed slightly	1
23	Route Signing Qualifier	Change	Coding to be changed slightly	1
25	Governmental Ownership	Change	Make it consistent with bridge	1
26	Special Systems	Change	Coding to be changed slightly	1
29	Toll	Short-Term Study	Link to toll report	1
32	Standard Sample AADT Volume Group Identifier	Short-Term Study	Sample strata	2
33	AADT	Short-Term Study	Nonattainment issues	2
35	Measured Pavement Roughness (IRI)	Change	Change to one year reporting cycle	3
51	SN or D	Change	Change Pavement depth only	2
53	Year of Surface Improvement	Change	Rehab year	1
81	Percent Single Unit Trucks – Peak	Change	Not rounding, no zero (2010)	1
82	Percent Single Unit Trucks – Average Daily	Change	Change to number (not %)	1
83	Percent Combination Trucks – Peak	Change	Not rounding, no zero (2010)	1
84	Percent Combination Trucks – Average Daily	Change	Change to number (not %)	1
N/A	Motorcycle	Change	Will be required	2

Notes: Level of Effort
-1 – Improvement, less effort than now.

1 – Can be generally accommodated within the current or planned data collection structure within most state DOTs.

2 – May result in some burden to some states (will require change to collection process and/or additional resources).

3 – Will result in additional collection/coordination burden on most states i.e., pavement.

Timing – The changes could be phased in beginning in 2008 Reporting Year with all states being in full compliance 2010 (Reporting Year 2009).

5.3 HPMS ITEMS RECOMMENDED FOR ADDITION

Table 5.2 shows which data items are proposed to be added to HPMS. The items are sorted by type of item (traffic, pavement, interchanges, capacity, and inventory) and by proposed year of implementation. The table indicates the item name; timing, level of effort (as defined above) whether the universe or sample is impacted; and if a table description is being requested.

Table 5.2 Recommended Items to be Added to HPMS

Data Type	Data Item	Timing (Required Reporting Year)	Level of Effort	Universe	Sample	Summary/ Description
Traffic	Traffic Metadata	2008	1		X	X
Pavement	Pavement Metadata	2008	1		X	X
	IRI Year	2010	1	X	X	
	Rutting	2010	3		X	
	Faulting	2010	3		X	
	Cracking	2010	3		X	
	Year of Last Construction	2010	2		X	
	Last Overlay Thickness	2010	3		X	
	Base Type	2010	3		X	
	Base Thickness	2010	3		X	
	Soil Type	2010	3		X	
	Binder Type	2010	3		X	X
	Dowel Bars	2010	3		X	X
	Joint Spacing	2010	3		X	X
Interchanges	Interchange Location	2010	2	X		
	Interchange Type	2010	2	X		
	Ramp Length	2010	2	X		
	Ramp Number of Lanes	2010	2	X		
	Ramp Functional Class	2010	2	X		
	Ramp Location	2010	2	X		
Capacity	Obstacles to Widening	2010	2		X	
	Counter – Peak Lanes	2010	2		X	
Other	NHS Expansion Factor	2010	0	X		

Notes: Level of Effort

0 – Calculated by Software

1 – Can be generally accommodated within the current or planned data collection structure within most state DOTs.

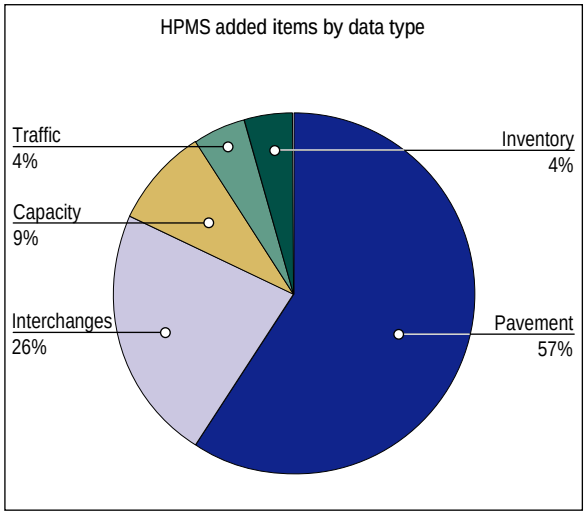
2 – May result in some burden to some states (will require change to collection process and/or additional resources).

3 – Will result in additional collection/coordination burden on most states i.e., pavement.

Timing – The additions could be phased in beginning in 2008 with all states being in full compliance 2010 (Reporting Year 2009). Three of these items are recommended for immediate implementation: motorcycle class data, Pavement metadata and Traffic metadata which means the items are optional for 2007 Reporting Year and required for 2008 Reporting Year.

A total of 23 items are proposed to be added. Thirteen of the new items pertain to pavement data, 1 relate to traffic, 6 to interchanges, 2 to capacity, and 1 inventory item.

This pie chart shows a comparison of the item subject areas for added items. They are grouped by traffic, pavement, interchanges, capacity, and inventory.



It is imperative for all states to review the recommended changes, assess the potential impacts, and report any concerns to FHWA through the many comment mechanisms available. These include several workshops scheduled for the spring, as well as direct communication with the project manager. The comment period will extend through the end of June 2007.

6.0 Next Steps

The balancing of collector abilities and user needs is still underway. Additional input sessions are planned as follows:

- Executive Webinar to be held January 17, 2006;
- Transportation Research Board (TRB) Session – at TRB Annual Meeting – January 22, 2007; and
- Three additional Regional Workshops are planned:
  - Baltimore, Maryland – March 7/8, 2007;
  - Sacramento, California – Week of March 12, 2007; and
  - Topeka, Kansas – March 27/28, 2007.

All of these will provide yet another opportunity for stakeholders to comment on the Reassessment Recommendations.

During the first half of 2007, the items identified for short-term study will be underway. Longer-term studies (such as sampling) will be started and work will begin on the Field Manual changes. This will be an important component of the Reassessment as it will define "how" some of the changes will be implemented during data collection.

The HPMS Reassessment should be complete by the end of summer 2007 with implementation beginning in 2008. The outcomes will include improvement of HPMS to support customer business needs, maximization of existing, future, and other data sources, and enhanced value of information to providers and customers.

The HPMS Field Manual will be rewritten and a draft version distributed in December 2007. In the winter and spring of 2008, FHWA will provide training and technical assistance for state DOTs and FHWA Division Offices. In 2008, OHPI will resume its annual HPMS Workshops, which serve as an HPMS training and technology exchange venue for states and FHWA Division staff.

For further information, contact Mr. David Winter in the Office of Highway Policy Information at David.Winter@fhwa.gov or go to the FHWA Site at http://www.fhwa.dot.gov/policy/ohpi/hpms/hpmsreassessment.cfm.
Detailed meeting notes and summaries can be found on the Docket at http://dms.dot.gov/. Once there, please refer to Docket # 23638.

Appendix A

List of Acronyms and Abbreviations

Acronyms and Abreviations

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AMPO	Association of Metropolitan Planning Organizations
ATR	Automatic Traffic Recorder
AVC	Automatic Vehicle Classifier
CAAA	Clean Air Act Amendments of 1990
CFR	Code of Federal Regulations
C&P Report	Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance Report to Congress
CTIPS	Comprehensive Transportation Information Planning System
EPA	Environmental Protection Agency
ERC	Executive Resource Committee
FAF	Freight Analysis Framework
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
FIPS	Federal Information Processing Standard Codes for States
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GIS	Geographic Information System
HERS	Highway Economic Requirements System
HPMS	Highway Performance Monitoring System
HPPI	Office of Highway Policy Information
HRI	Half-car Roughness Index
IRI	International Roughness Index
ITS	Intelligent Transportation System
LRS	Linear Referencing System
MCMIS	Motor Carrier Management Information System
MIRE	Minimum Inventory of Roadway Elements
MMUCC	Model Minimum Uniform Crash Criteria
MPO	Metropolitan Planning Organization
MRI	Mean Roughness Index
NAAQS	National Ambient Air Quality Standards
NAPCOM	National Pavement Cost Model
NBI	National Bridge Inventory
NHPN	National Highway Planning Network
NHS	National Highway System
NHTSA	National Highway Traffic Safety Administration
NIST	National Institute of Standards and Technology
OMB	Office of Management and Budget
OPA	Other Principal Arterial
OST	Office of the Secretary of Transportation
PMS	Pavement Management System
PSR	Present Serviceability Rating

Acronyms and Abreviations (continued)

SDDC	Military Surface Deployment and Distribution Command
SEMCOG	Southeast Michigan Council of Governments
SPC	Southwestern Pennsylvania Commission
STRAHNET	Strategic Highway Network
TIGER	Topologically Integrated Geographic Encoding and Referencing System
TMG	Traffic Monitoring Guide
TRB	Transportation Research Board
TRCC	Traffic Record Coordinating Committee
TTI	Texas Transportation Institute
USC	United States Code
VMT	Vehicle Miles Traveled
WIM	Weigh-in-Motion

Appendix B

Regional Workshop Summary

Regional Workshop Summary

HPMS
Reassessment 2010+

Regional Outreach Workshop Summary

Four Regional Workshops were held as follows:

- April 26-27, 2006 in Newington, CT
- May 10-11, 2006 in Atlanta, GA
- May 24-25, 2006 in Portland, OR
- May 31-June1, 2006 in Lincoln, NE

A total of 92 people attended, six of them were ERC members. Twenty three states were represented (OR, WA, TX, ID, NV, AK, CO, MT, FL, GA, SC, VA, KS, MI, MN, NE, NY, WI, WY, VA, PA, MA and CT). Three MPOs were also represented (Portland, Dallas/Fort Worth, and SPC). Nine FHWA Division offices also attended.

The following summarizes major comments received by Issue area.

PROCESS IMPROVEMENT

The idea of multi-tables and/or submitting the data in a spatial format was very well received. States see it as a way to reduce their burden and like the idea of FHWA being able to more closely report data consistent with their state's data.

Most states represented believe that a requirement or guidance from FHWA to move in the direction of spatial submittals will help them to obtain upper management support and move more quickly toward getting common LRS and GIS capabilities. It will be important to obtain AASHTO's support early on regarding process improvement.

FHWA should work with a few States this year to ask them to provide their data in a multi table format as well as in a spatial format. This would allow FHWA an opportunity to evaluate the level of effort involved with States submitting their data in these formats.

OPERATIONS

Most states are somewhat reluctant to provide truck AADT. They tend to store percentage rather than actual AADTTs and it is easier to estimate percentages. Technical issues associated with equipment and placement of classification sites were cited as the main impediments.

Where states have classifiers within their coverage program and for samples, truck AADT would be available.

This group was not aware of truck forecasts; perhaps state planners should be consulted regarding the availability of this information.

Regarding ITS data, the states generally agreed that it is difficult to obtain the data in the field. On the other hand, they recognize that ITS information is very important and should be tracked somewhere. It was suggested that State Operations staff should report this information directly to the Federal Operations office.

There appears to be a need to change the TMG to be consistent with the HPMS Field Manual. Several States reported that their traffic people do not give them classification counts for sample sections since the TMG says that classification counts are only required for 30% of their counts (this is a rule of thumb, not a requirement). The TMG also states that truck AADT should be developed on a 6 year basis.

Note – the speed limit issue is not currently addressed in the Issue paper. Also, the need for combo trucks is not clear in the issue paper.

DATA QUALITY

States generally want to submit quality data and are concerned about having specific guidance on issues such as through/auxiliary lanes.

The Field Manual came up a number of times. Most feel that it is partially to blame for data inconsistencies and poor data quality. A number of States said that they would be interested in helping to rewrite the manual. What they would like is primarily more clarification on certain data items and more examples, including pictures, where applicable.

Many states indicated they felt that increasing the total number of data items would result in an overall decrease in the quality of all data.

There was no general agreement regarding bridges in versus bridges out.

Regarding growth factors, many states do not agree that they must enter a growth factor when they do not have other information available. They are comfortable showing no growth.

The states questioned whether it is worth spending time on local roads (growth factors, etc.) They want to see the "bang for the buck" of improving quality. They also want to know if certain data elements are more important than others (priority list).

States generally want some standards to improve quality but not if they go beyond state business needs.

The definition of metadata was also discussed – perhaps using a word such as "process description" would be more appropriate.

CAPACITY/CONGESTION

Some states were surprised by how important widening feasibility is.

There appears to be a disconnect as to whether widening is feasible from an engineering, modeling, or political standpoint.

It would make sense to look at a corridor level analysis to determine widening feasibility to take into account state policies and planning. Planning offices and MPOs in the states should also be involved with this data item. There may be other sources in long-range plans related to widening feasibility that would be more appropriate. More coordination with planning at state and national levels is necessary.

FEDERAL AGENCIES

There are several issues related to Ownership: What to do about privately owned roads, how to record BLM mileage, and definitions in the Field Manual.

INTERCHANGES

Most of the states have locations of ramps, although not necessarily point locations for the interchanges. Some have traffic data, but it is not consistent. All states would like guidance related to coding interchange types. All agreed that HPMS may be the appropriate reporting vehicle for interchange data, particularly as HPMS moves to spatial submittal.

SAFETY

The general feeling of the States regarding safety was relatively negative because not much of the data is readily available (particularly on the local system).

Most states have motorcycle data, however, the quality is questionable due to classification and equipment limitations.

Curve and Grade data is collected in many states and used for more than just HPMS in only a few states.

Rumble strips and friction data is variable across states.

Safety and MIRE came up a number of times; people are concerned about this. While FHWA is planning on working closely with Safety and their contractor on this, it may be a good idea to find a way to bring in a number of States.

PAVEMENT

The states were fairly divided on the pavement issue. There was a range of in-depth knowledge of the topic from some states and little knowledge from other states that were represented. The issue of needing data on local roads was a concern.

Automated data collection does not appear to be occurring in all states – many need to defer to the pavement staff.

There does not appear to be consistent use of PSR – most report it and there was no real opinion on SN.

Left and Right wheel path does not appear to be a problem.

Data may be available from construction plans to start phased in reporting.

The reaction to the additional pavement items was focused primarily on the increased burden, especially on the off State system. The condition data items didn't receive the harsh criticism that the structural items did. It was pointed out by one State that it is just as easy for them to take their pavement data and calculate the structural number. They couldn't see the benefit of providing the individual data items so that HERS can calculate the SN. Note – Participants may not be familiar with the new Design Guide.

Everyone agreed that it would be good to have a clear standard so everyone would be aware of what is needed regarding cracking. The issue of a national sample for this item was generally discussed.

BOUNDARIES

There is a definite need for a distinction between urban and rural, many states appear to be using the adjusted census boundary for planning and design purposes (design standards and at the local level for funding). When asked if other boundaries would work, the general response was probably not.

There was a general consensus that it takes to long to adjust the boundaries due to coordination issues and lack of guidance.

Most states agree that it would be a major effort to go to one functional classification across the boundary (and do away with urban vs. rural), however, that would make it easier in the long run.

The general consensus was to stick with the adjusted urban boundaries and provide more guidance.

We definitely need to ask work program, policy, planning oriented staff in DOTs to determine what the use of the boundaries really is and if a different boundary could be appropriate.

We should come up with a short list of questions for upper management in states (through SCOP?) – related to boundaries, capacities, widening feasibility, etc.

SAMPLING

Most states are comfortable with existing sampling schema. Sample data is generally not being used.

The states clearly need more explanation regarding the importance of sampling on lower classified roads. Narrowing the groups at the lower end and widening them at the higher groups was discussed.

States would prefer providing the entire database rather than providing sample data where they have it available on the SHS.

GENERAL COMMENTS

States would like a better explanation of the connection between HPMS and apportionment.

A table needs to be created to show:

- Existing HPMS items – what they are used for and who needs them.
- Reassessment items – who needs them, what they will be used for, cost/benefit of collection, details related to collecting (where), and want versus need.

The burden for collection on lower functionally classified roads was an issue.

The Field Manual needs to be revised – states want to be involved.

There was a concern that HPMS is getting to a project level (not originally intended for that level of analysis).

There was a concern that the increased items will create a burden and subsequently lower quality data overall.

Appendix C

Issue Papers

New Data Model
(Formerly: Linear Referencing and Data Integration)

December, 2006
Prepared by: Tom Roff, Office of Highway Policy Information, FHWA
David Winter, Office of Highway Policy Information, FHWA
Champions: Bruce Spear, Office of Planning, FHWA

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "bold" font to make it easier for the reader to locate and reference these data items. At the end of this paper is a table that summarizes the data impacts.

- Linear Referencing System (LRS)
- State geospatial network

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, the author has tried to identify the customers, both internal and external, and define their individual data needs.

The HPMS data structure has not changed much since its beginnings in 1978. Other than adding, deleting and modifying attributes, the database has remained fairly consistent as a flat table of highway data. The requirements of the FHWA and the ability to produce national level summary statistics, for the most part, are easily met from this format. However, with the technology that is available today, along with additional requests for more detailed data, there is a need to assess the efficiency of the current data model that HPMS is built on. Preliminary discussions on this topic have yielded an initial concept to normalize the HPMS data into program areas, and link them together through a Geographic Information System (GIS) using spatial relationships. In other words, traffic would be collected as one layer, pavement in another, inventory in a third etc. It is assumed that the quality of the data would improve, as each attribute would not be forced into a traffic model, as the current structure requires. It is also assumed that once this

structure is in place, less post processing would be necessary. A direct link to the actual data could be established, hopefully decreasing the state reporting burden. Integrating HPMS with other non-HPMS datasets could also be achieved through the same method of linking the individual tables within HPMS. Finally, normalization will encapsulate the data and rules of behavior, creating an environment where program areas could be reassessed individually without affecting the other areas.

As a minor issue, incorporating metadata and quality review reports into the database are also seriously being considered. An in-depth discussion on the subject is provided in the *Process Improvement* issue paper. Figure 1 provides a conceptual "picture" of how these data would be integrated with the existing and proposed HPMS data.

If this concept moves forward, it will not come without a cost. This will be a complete change in the way HPMS is processed, submitted, and stored as well as widening the purpose for which it was originally intended. The products that HPMS currently produces will need to be carefully recreated in the new environment, which take at least a couple of years to develop and implement. With the inclusion of GIS data, a completely new piece of data (road geometry) will be reported at varying degrees of accuracy and scope from each State. At this point it is not clear if the different State-supplied geometries need to be linked; if they do, it would likely increase the effort spent by FHWA processing these data after they have been submitted by the States.

This paper will focus on these data issues, as well as on a number of different data formats that have been suggested. Eventually, the proposed data formats should reduce the data processing required by States in preparing and submitting their HPMS data, and would likely have a positive impact on the HPMS data quality. Careful consideration to the effort required to achieve the new structure will need to be made. To gain some insight into the level of effort, for the State data providers and FHWA, a pilot program has been initiated. Pilot States will provide their HPMS data in the current and proposed formats to FHWA. This will allow FHWA and the Pilot States to quantify the costs and benefits of the proposed data formats.

The data providers, who have participated throughout the Reassessment, have indicated a positive, yet cautious response to this concept. Most feel that dividing the data by program area will work well with their current process(es). Many are able to provide the road geometry down through the major collector level, which would be required for the new data model. Most also understand the costs involved, but feel this is a step in the right direction and long-term benefits would outweigh the initial setup costs.

The following example provides a generalized overview of the "typical" data collection, management, and reporting process used by many States. Typically States collect data by program area, or management system, i.e. the pavement management unit collects the pavement data; the traffic management unit collects the traffic data; and the inventory unit collects the roadway characteristic data, or geometrics. Furthermore, since the separate units collect these data for their own independent needs, the highway sections that each use are often different. (The term "highway section" refers to the portion of highway for which the management system collects and reports data.) Each management system will have a set of rules for defining when a

highway section should break since each one is interested in maintaining highway sections that are homogenous for their data.

Within each State, having multiple data sets is not a serous data reporting issue, since often these data are reported separately by each unit, and when these data are combined the State uses a process that reflects the business need for these combined data, (i.e. programming projects, safety analysis etc). In preparing their HPMS submittal, each State must first define their HPMS sections, which are often homogenous for traffic, number of through lanes, functional class, ownership, State, county etc. The HPMS sections may match sections that the State uses for other purposes (programming projects, safety analysis etc), but often do not. For States where the HPMS sections don't match other sections in common use, the HPMS data is often considered useless for State level analysis. This stems from the fact that there is often a summarization or averaging process that has to take place to merge the multiple datasets into the HPMS submittal. The results are data summaries that don't match those produced by the individual data management units, or from the merged datasets used for State business needs.

The clearest example of this discrepancy in data reported, from the different datasets, is in the pavement area. Up until recently, FHWA's performance measure for pavement smoothness was the percent of mileage on the National Highway System (NHS) with an IRI of 170 or less. This involves comparing the total number miles of NHS with an IRI $\leq$ 170 against the total NHS mileage. The following illustrates how the average IRI value reported for a single HPMS section, comprised of five shorter pavement sections, can be greatly impacted by a single (exceptionally rough) pavement section.

Table 1 - IRI Example

Section	Length (miles)	IRI (in./mile)	Inches of roughness
A	1.2	134	160.8
B	.5	128	64.0
C	1.4	243	340.2
D	1.1	157	172.7
E	.8	164	131.2
Total	4.6		868.9
	Average IRI	189	

As we can see, in this example, the 4.6 miles for this HPMS section would not be counted toward the total number of miles of NHS with an IRI $\leq$ 170, since the weighted average IRI for the section is 189. This is a concern to both FHWA and the State, especially in verifying the pavement smoothness performance measure. For this fictitious HPMS section, the State's pavement management unit would correctly report that 3.2 miles have an IRI $\leq$ 170, which obviously does not correspond to what is reported in HPMS. This is not meant to imply that HPMS needs to collect pavement data at the same granularity as a State pavement management system, but rather to illustrate how the summarization of certain data in HPMS has led to a loss of accuracy in the analysis and reporting of certain data, the resolution of which will be discussed later in this paper.

Besides the data summarization issues involved with merging multiple datasets into one HPMS submittal, there is the obvious issue of level of effort. In many States, the process of merging the multiple datasets is not automated, and requires considerable effort. This effort ranges from the manual entry of data into the final HPMS submittal, to the semi-automated approach where a State uses a number of different software packages to merge the datasets. Obviously, if this process could be reduced or eliminated, there would be a substantial decrease in the overall burden for the States, as well as the possible improvement in data quality due to the elimination of any manual transcription errors.

There have been several requests to the Office of Highway Policy Information (OHPI) establishing the need to relate HPMS sections to non-HPMS elements. For example: The HERS model requires bridge information from the National Bridge Inventory (NBI) that pertains to a specific HPMS section. The Office of Safety has expressed an interest in being able to relate HPMS information to crash locations. The National Highway Traffic Safety Administration (NHTSA) and The Federal Rail Administration (FRA) are interested in at grade rail crossing and fatal crashes integrated with HPMS data. As more and more of these requests are made, it is quickly being realized that HPMS is evolving into a geospatial database and integral part of the larger transportation data program at FHWA and the U.S. DOT. Whether it is a bridge, interchange, traffic counter, crash location or other feature/event, the attributes behind the feature all contain some kind of geospatial identity that can be used as an integrating agent. There is no doubt that HPMS is heading in this direction. OHPI recognizes that an increased emphasis on section level detail is somewhat of a shift away from the original intent and purpose of HPMS.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

The Highway System Performance Division, which is responsible for the HPMS program, would realize the greatest impact of changing the HPMS data structure. The following potential impacts would all need to be addressed: modifying the existing HPMS software, data compatibility with previous years, and the ability to support existing data products.

The impact on States would likely be more variable, with some realizing a larger impact than others. If the HPMS submittal is broken into multiple tables or layers, it is assumed that some logical grouping, which reflects how these data are collected and managed within the States, would be used. While each State has most of the previously mentioned management systems, the data collected and reported by each is not necessarily consistent.

The grouping of the data will need to be studied further, with much input from the States. This concept was initially vetted with State HPMS coordinators and State pavement management engineers, all of who indicated that this would be beneficial, but for different reasons. The HPMS coordinators liked the idea of the pavement management units submitting their data directly to FHWA and in a form that requires little or no extra effort on

their end, and that the pavement management unit would be directly responsible for "their" data. The pavement management engineers like the idea of not having to "post-process" their data and being able to submit it to FHWA in their current format. It should be noted that by implementing this approach, FHWA is assuming some of the States' data translation and dynamic segmentation burden.

The HPMS data users could also be impacted, but probably not to the same extent as the Highway System Performance Division, the State data collectors, and the State HPMS program managers. Most data customers use the summary statistics reported in FHWA's *Highway Statistics* publication, and would therefore not notice a difference, except where improvements in data quality are realized. However, data customers that use the "raw" HPMS data might be more significantly impacted, but not necessarily in a negative way. If the proposed changes are implemented, the current output files would still be produced, at least for a while, so as to ensure minimal impact on the current analytical products currently in use within FHWA. The positive impact could be realized if these analytical products are modified to make use of the individual tables or layers, since these would allow for greater data granularity, improved integration with other data programs, and possibly improved data.

The HPMS currently uses the National Highway Planning Network (NHPN) as a means to graphically display information. The NHPN uses the **Linear Referencing Fields** (County_code, LRS_ID, Begin LRS, and End LRS) in the dynamic segmentation process to link HPMS to the **network**. Unfortunately, the NHPN is sufficiently limited in accuracy, extent, and maintenance to serve as a long term integrating agent for FHWA. Another issue is that not all data use a **linear referencing system** to locate features. For example: Data that uses latitude and longitude can only be "snapped" to a **network** as long as certain tolerances are met.

This issue not only affects HPMS but all other datasets that hope to link up to it. It cuts across all business units and data within FHWA. For any hope of creating an integrated system of data programs that talk to each other, there needs to be a common backbone **geographic network** for these data. The starting point is to establish the criteria for this **network**.

A couple of efforts are currently underway in OHPI to move in the direction of creating a more robust **network** that could be used for data integration at the national level. In 2005, States were given the option of submitting their **geospatial network** to FHWA as part of their HPMS submittal. At the same time, the HPMS software was modified to handle a much wider range of **linear referencing system** (**LRS)** data, so as to allow all States to submit their "native" **LRS**, rather than changing their **LRS** field to match the previous HPMS **LRS** "standard." The reasoning behind this was that if HPMS was able to make use of a State's "native" **LRS**, it would be easier for States to submit, updated more frequently than the previous HPMS-specified **LRS**, and produce a better, more accurate geospatial match to the State **network** provided along with the HPMS data submittal. In order to make the best possible use of these State **networks**, OHPI has initiated a research project titled the State Network Project. This project is exploring the best use of these **network**s at the national level and will address, among other things, the need for creating a routable national network.

Options/Recommendations

This section has been dynamic throughout the first (outreach) phase of the reassessment and only now, in the final version of the issue paper, is the "how" clearly defined. Initially, this section was based on the suggestions offered by the FHWA data users. In this version, the recommendations offered in this section are based on the combined input from the data users, State data providers, and other interested parties. This feedback has been provided in the regional outreach workshops, issue-specific web seminars, and from comments posted to the Docket web site.

There are two possible approaches to disaggregating the current HPMS submittal file that have been discussed in the outreach workshops and in subsequent webinars. While there are some subtle differences between the two approaches, they both are essentially the same and both would employ the same **data model**. The first would create multiple tables within the HPMS submittal similar to the current table that States submit. These tables would be functionally grouped, comma delimited files. These files would then be combined through a process known as dynamic segmentation within the HPMS software using the State provided geospatial networks and the State's LRS. The uniformity of the LRS across the tables would be critical for this method to be successful. An advantage of using comma-delimited files is that the existing HPMS software, especially the Oracle database, would not require major changes. As the Reassessment has progressed, this previous statement has proven to not be entirely correct. While it is true that converting the HPMS database from a flat-file database to a geospatial database would be a sea change, both would require about the same level of effort. It appears at this time that converting the database to a geospatial database would provide benefits exceeding any extra costs that might be incurred.

Currently, LRS is only collected on Principal Arterials and the NHS. It is being proposed that this would be expanded to include all functional classes through rural Major Collector and urban Collector, since this would cover all roads that are eligible for federal funds. The States' geospatial networks would also need to include all these roads. It was initially thought that this might be a concern for some States, especially for those sample sections off the State network, but in the workshops and webinars most States indicated that they have a complete geospatial network or networks through Major Collector. A couple of States indicated that they have two separate networks, one for State system roads and the other for off-State system roads. The HPMS software and database would probably be able to handle two networks and data for one State, but this will need to be explored further in the pilot.

The second approach that is being considered would allow States to submit their HPMS data as a GIS file or geospatial database with multiple layers; each layer representing a logical grouping of data (pavement, traffic, ITS etc). As previously mentioned, from the FHWA perspective, this is the desired approach. Most States indicated that they would be supportive of providing the HPMS data in a GIS format; with most agreeing that this is probably the best method to employ for future data submittal. However, there were a few States that indicated that they would have trouble linking data for sample sections off the State highway system to their existing State network. Additionally, there are a couple of States that currently would not be able to provide data in a GIS format. Most, if not all of these States did indicate that changing HPMS to a GIS format might provide the impetus that they need to develop a State GIS system, which most seemed to feel was desirable.

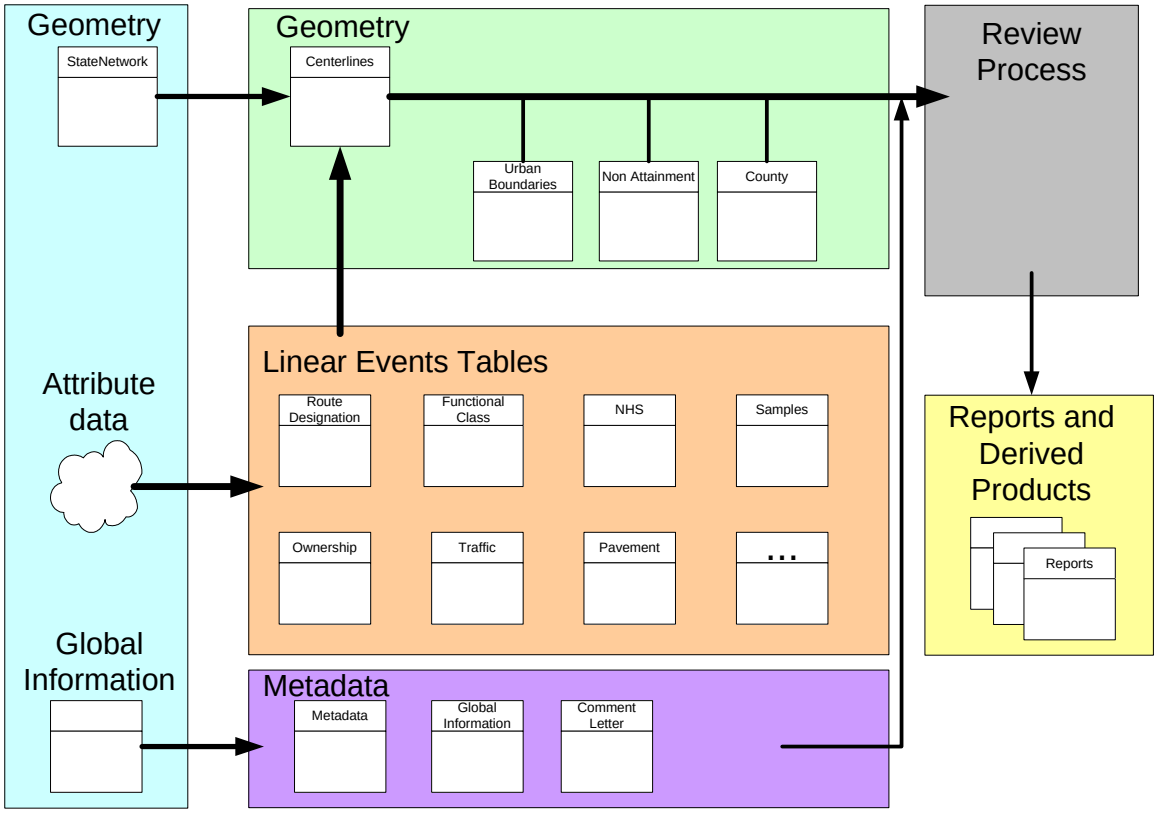


Figure 1 - Data Model

It's possible to implement this approach while still allowing States to submit their data in the current format. Depending on how the HPMS database is structured, the submittal file could be used as submitted, or it could be disaggregated. The possibility also exists for States to submit a disaggregated file for the sample and universe sections on the State highway system along with a second file, in the current format, for those sample sections off the State highway system. This would be more complicated to implement within the HPMS software and database, but would likely be easier for many States since these data for the HPMS sections off the State highway system often only exist in the State's HPMS database, and not in the State's separate management systems. This will have to be explored as part of the pilot.

The Submittal Package

The submittal package would include a geometry file in the form of a shapefile or other acceptable format that has measured and calibrated routes. The package would also contain a series of event tables. These tables would contain the core of the HPMS data that would link to the geometry file. For example, the Lanes table will have a record that has the LRS, BEGIN_LRS, END_LRS, THROUGH_LANES, and TYPE_FACILITY. The LRS field would serve as a common identifier that would be used for linking all data tables and attaching them to the State provided geospatial network.

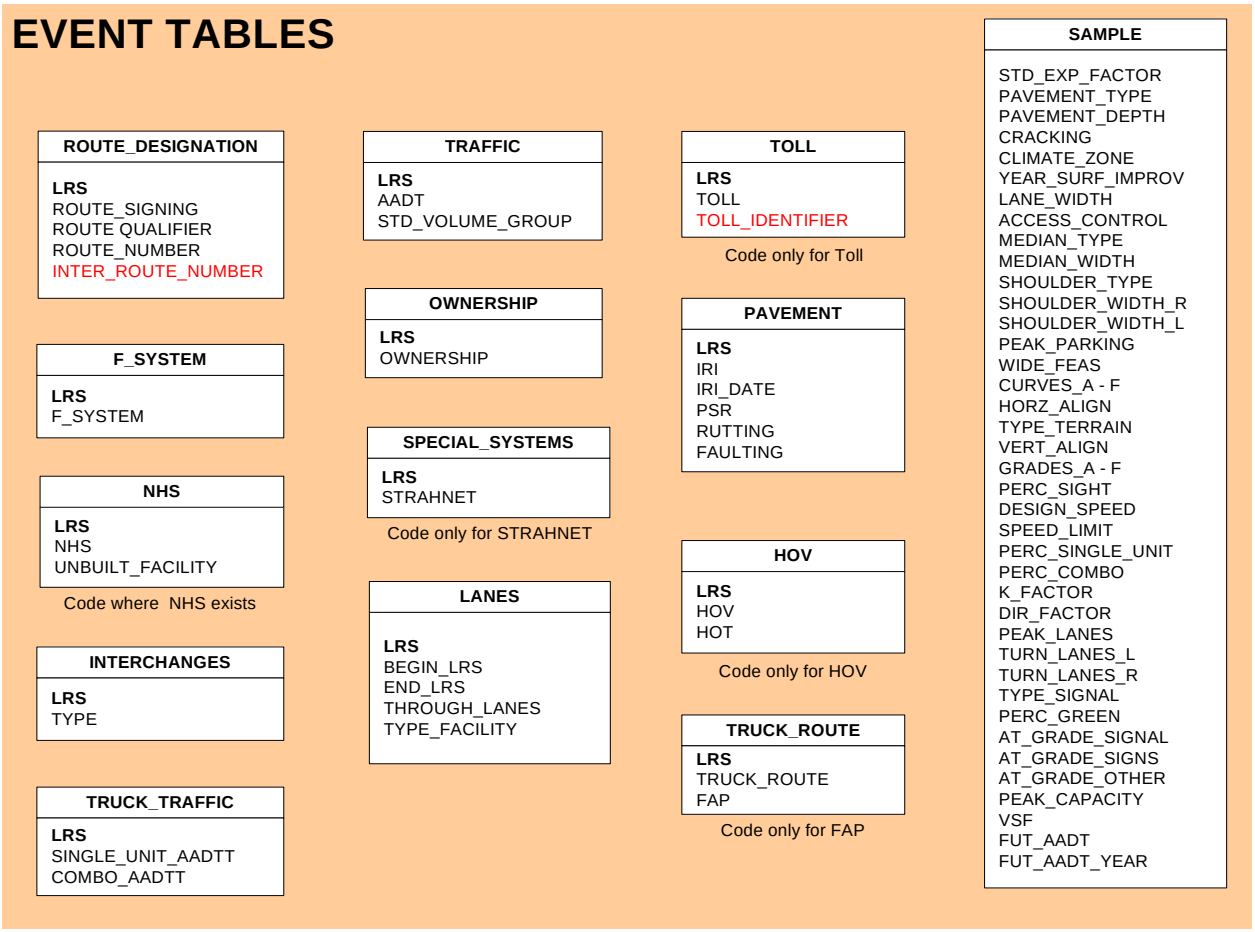


Figure 2 - Proposed HPMS Event Tables

The submittal package would also contain a Global Information which would include information that applies to every record such as Units, Year or Data, Summary data etc. This would also include the comment letter and submittal history information.

While States are welcome to use an existing public or commercial network, FHWA is not at this time considering using a single network (TIGER, Commercial) to create a national backbone network. The benefits of using State provided networks out weigh the costs associated with creating and maintaining a national backbone network. While FHW does have a business need for a routable national network, the primary geospatial need is for State networks that can be

used for integrating various datasets and for performing data analysis at the State level and national level. Since States are already maintain a geospatial network for their own business needs, it makes sense to modify HPMS to use these networks rather than duplicating this effort at the national level for a very minimal increase in geospatial data analysis and reporting capabilities.

The following are the requirements for the State geospatial networks. It should be noted that these recommendations take into consideration the comments provided by the data users and data providers in the Reassessment workshops and webinars. At this time, FHWA is not prepared to further define the many other "attributes" of the State geospatial networks. The State pilot will attempt to identify those network attributes that need to be standardized in HPMS. Data providers and data customers not involved in the State pilot are encouraged to submit their recommendations on additional network standards.

- Scope – It is recommended that the State supplied geospatial networks be dual carriageway. The State pilot should consider if this could be a phased implementation that would allow States with single line networks time to develop a dual carriageway network. A dual carriageway network will ensure that the HPMS data and the associated networks will be linkable with all data sets. States will need to indicate the inventory direction in their metadata.
- Extent – The State supplied geospatial network will need to include all roads through rural Major Collector and urban Collector both on and off the State highway system. For those States that maintain the roads functionally classified below rural Major Collector and urban Collector in their State network, these systems can also be included in their HPMS submittal and do not have to be taken out.
- Accuracy – It is desirable that the State supplied geospatial networks have an accuracy of 1:10,000, although networks up to 1:24,000 will be accepted. Through the survey of State GIS staff at GIS-T, 50% of the States indicated that their networks have an accuracy of 1:10,000 or better, with all but three of the responding States indicating that they have a network with an accuracy of 1:24,000 or better.
- Interstate Connectivity – While there are offices within the FHWA that require a routable national network, it is anticipated that the previously mentioned research project will result in a method that can be used to convert the individual State networks into a routable national network; this should address the State-to-State connectivity need of all FHWA users. The connectivity of the data to the network will be through the States' own LRS.
- Intrastate Connectivity - States are encouraged to use an LRS for HPMS reporting that is consistent with the LRS being used for all other federal data reporting. Through the HPMS Reassessment, FHWA is proposing "one network and one LRS for all Federal data reporting." This theme has been widely embraced by most States and most if not all of the Federal agencies engaged through the Reassessment.
- Maintenance – The proposed data model will use the State supplied geospatial networks, which need to correspond to the HPMS data being submitted that year. To insure a 100% match between the HPMS data and the geospatial network, States are encouraged to submit a new network every year.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person has been identified

- Thomas Roff, Office of Highway Policy Information, FHWA
- Bruce Spear, Office of Planning, FHWA
- David Winter, Office of Highway Policy Information, FHWA

Summary of Data Impacts

Data Item	Add/Delete/Change	Area	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS	
LRS	C		X	X	X		X	X	X	X	X	X			X	X	X	X	X	X		X	

Sampling Background Issue Paper

December 2006

Prepared by: Paul Svercl, Office of Highway Policy Information, FHWA
Robert Rozycki, Office of Highway Policy Information, FHWA
Champions: Ross Crichton, Office of Highway Needs & Investment, FHWA
Cecilia Ho, Office of Natural & Human Environment, FHWA
Alan Jeeves, Office of Statistical Quality, RITA

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Background

This paper is intended to present and document the various HPMS sampling issues for use in the current or future reassessment activities and decision-making. Also, assumed is an understanding of the current HPMS sampling scheme, it's design, purpose, functionality, and limitations. The HPMS sampling framework is a core basis for the utility of the sampled data items. It is a schema intended to reduce the data item collection burden on the State data providers while allowing a statistically meaningful expansion of the sampled items back up to the universe. In general, the randomly selected samples are stratified based on area, functional system, and traffic volume group ranges. All public roads are to be considered, including those of the Federal, State, and Local governments. Precision levels and confidence intervals are set for each area/functional system to ensure statistical validity at certain standards.

Impact from boundary changes, several boundaries, split boundaries: An ongoing issue has been how to deal with sampling when urbanized area boundaries change. Current HPMS recommendations are to redraw additional (or deletions) of samples from an area for which the boundary has changed. Other options should be explored such as concentrating on new samples in the newly expanded portion of an **urbanized area** to meet the criteria without introducing bias. In the worst case, drawing of a complete new sample panel for an area may be necessary.

The concept of breaking down a State into the rural area, small urban area, and urbanized areas individually for a sampling purpose may need to be re-examined. Since the boundaries of some of these shift significantly especially after each decennial, a revised concept based on stable boundaries might be an improvement.

Since different **nonattainment or maintenance area** boundaries may exist for a variety of pollutants, methods should be explored that are flexible enough to account for them, including those boundaries that may overlap or be altogether separate from one another. The current

HPMS sampling scheme is unable to fully represent the VMT in all **nonattainment or maintenance areas** limited to situations where a whole **urbanized area** is involved. This is because the **nonattainment or maintenance area** VMT estimate is based on the VMT of the entire **urbanized area**(s) supplemented by a **donut** sample.

Handling of an **urbanized area** that is split by a **nonattainment or maintenance area** in the past has been avoided. The current HPMS sampling scheme is unable to fully represent VMT in a **nonattainment or maintenance area** if only part of which lies within an **urbanized area**. Only cases involving a whole urbanized area are considered; the VMT for the entire **nonattainment or maintenance area** is based on the VMT of an **urbanized area** (complete) plus any additional non-urbanized area represented by a "**donut**" sample that covers the part of the **nonattainment or maintenance area** that lies outside of the **urbanized area**. This situation deserves further study for possible alternatives so that the goal of a statistically valid VMT for a given **nonattainment or maintenance area** is reached.

The gathering of traffic and other information traditionally is the State's role, however, some States do not have the legal authority to collect information on local jurisdiction public roads. In these cases, the States normally have worked out agreements.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "**bold**" font to make easier for the reader to locate and reference them.

- Item 7 -- **Is Donut Sample**
- Item 14 -- **Urbanized Area Sampling Technique**
- Item 16 – **NAAQS Nonattainment/Maintenance Code**
- Item 31 -- **Donut Area Sample AADT Volume Group Identifier**
- Item 32 – **Standard Sample AADT Volume Group Identifier**
- Item 33 -- **AADT**
- Item 48 – **Donut Area Sample Expansion Factor**

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, we've tried to identify the customers, both internal and external, and define their individual data needs.

Universe **AADT**: The entire process of estimating VMT for specified geographic areas could be greatly simplified if **AADT** was reported (as like the **AADT Volume Group**) for all the Minor Arterials and Collectors (Major) that were not samples or part of **NHS** or **STRAHNET**. Presently, **AADT** on all Principal Arterials, **NHS, STRAHNET**, and sample segments must

reported strictly based on Appendix F and TMG under the 3-year monitoring program; reporting on the other Federal-aid Highways need only conform to the 6-year program and do not require annual adjusted factors for the **AADT Volume Groups**. States and metropolitan planning organizations (MPOs) face great difficulties in developing estimates of VMT for specific areas, such as a **nonattainment and maintenance areas** by pollutant. The existing "donut" procedure is both confusing and limiting, especially in those areas with overlapping **nonattainment area boundaries**. Grouping of Census designated **urbanized areas** under 200,000 persons (Code "3") was phased out after the 2000 Census; however, slightly over half of the States would like to reconsider this option for the non-air quality urbanized areas. Also, some States were interested in using counties as a sampling framework, if the option were allowed.

The information for **AADT Volume Group** and **AADT** are not reported on the rural Minor Collectors and rural and urban Locals. For the rural area, small urban area, urbanized area, **non-attainment area** & **maintenance area**, an estimate of highway travel for all the non-Federal-aid Highways is submitted on the Travel and Demographic Data Summary Template. No specific instructions have been given on how these estimates should be derived; however, several States have requested assistance in this area.

National sample: The legislative requirement to produce the highway needs projections for the *Conditions and Performance* report is not limited to the **functional classes** currently sampled in the HPMS; needs for rural minor collectors, rural local, and urban local are estimated using a primitive procedure outside of the analytical models. One approach to addressing this issue would be to set up a National-level sample for these **functional classes**. (Even a sample with relatively low precision would be an improvement on the existing modeling procedures.) Another option would be to modify HPMS to allow States to code sample data for these lowest **functional classes** on a voluntary basis. While such data would not be statistically representative, they could be utilized to refine the existing procedures for estimating needs for these **functional classes**.

Alternative sampling methods: This issue deserves an in-depth study as to the various possible alternative sampling schemes that could be used for HPMS to meet "all" business needs for all internal and external customers. What should the primary variable(s) be for which the sampling rate is set? Should it be limited to VMT as presently is the case or multi variables or a different variable? Which variables might make good candidates? Should all sample HPMS Items be assigned to a given variable (or group of variables) or should groups of HPMS Items be assigned to different variable(s) which might involve different sampling rates? If more than one variable is used, then the complexity of reporting should be considered. If the minimum and maximum sample length criteria significantly influence the results, then it should also be included in the study. If alternative schemes are to be considered, then what criteria should be used for deciding which scheme to use. What would be objective criterion to be used for examining the levels of precision needed for FHWA purposes?

AADT volume group strata adjustment: **AADT volume group** strata adjustment should be studied to determine the impact of various options (i.e., widen volume ranges as the volume increases, use same volume ranges across **urban/rural**, etc.) to be more flexible in accommodating the specific traffic trends and conditions in a given State and/or **nonattainment**

or maintenance area. Common **volume groups** across highway **functional classes** and **rural/urban** designation are highly desired to reduce the reporting burden when boundaries or **functional class** change. In addition, many of the stakeholders recommended widening the ranges of the groups to reduce the annual maintenance of samples migrating from one group to another. **AADT volume groups** are only identified for the Federal-aid highway classes, i.e., excluding sections on rural minor collectors or rural or urban locals (unless on the **NHS).** These groups would be used together with specific **boundaries** (e.g., **urban and urbanized area**, **nonattainment or maintenance area**) and **functional classes** in developing the number of the standard samples needed as well as the applicable expansion factors.

NHS sample: The concept of a separate **NHS** sampling framework (perhaps just for the non-Interstate segments) with its own precision/ confidence interval at National level or State level should be explored. This sample will depend on the customer data need(s). Either this sample could be drawn from existing State samples or drawn separately based on its own independent schema. Any sampling must be limited to only the open-to-traffic segments. If all segments of the **NHS** need some of the sample items, than special HPMS standard samples would need to be drawn from the rural and urban Locals and Rural Minor Collectors, where needed. What was not identified here is which NHS items might qualify to only be reported using the National expansion factors.

Geospatial expansion factors: Within the new operations proposal of HPMS, the information would be reported directly from each central data collection shop within the State, such as traffic or pavement or geography, etc. Each shop potentially would be allowed to report its pertinent items separately as long as the applicable geo-spatial identification of the segments is included. This means that the segment lengths depending on the item could potentially differ among shops. Based on this operations concept, the question should be asked how the sampling framework will work if the different HPMS items can be reported separately directly from the various shops. Potentially each set of items reported from a shop for "their" generic segments could have a different expansion factors using the existing HPMS standard sampling technique. (Although the various segment lengths from a shop might vary along a route, the total length of the route should be the same for all shops.) This would allow the flexibility of having different segment lengths depending on the particular HPMS item. An in-depth study needs to be undertaken to look at all concepts and recommend the best ways to implement them.

Sample size formula: The sample size formula and how it is used to calculate the required sample size within each volume group may need to be explored. An improvement of the formula could easily be considered at this point of the reassessment.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

Universe **AADT**: Keeping the present standard sampling scheme in place creates no additional burden on the States. Most States are satisfied with the present scheme except for the annual maintenance required when samples migrate and leave some volume groups unsampled. Generally, a sampling adequacy run should be made at least on a 3-year cycle. New sampling in the new areas of an existing urbanized area may warrant some attention to be sure that the new parts are reasonable represented. This may call for making a separate sampling adequacy run of only the new parts to ensure that sufficient samples have been drawn to actually represent the new areas. If not, then additional samples may be required to be drawn only from the new areas of an existing urbanized area until representation is accomplished. The Item 14 – **Urbanized Area Sampling Technique** was deleted since grouping of urbanized areas for sampling purposes was discontinued after the 2000 decennial Census. Reporting of the individual urbanized areas allows better trackage of their extent as well as performance. Some States suggested if given the option, they would prefer to sample some areas on a county basis. Allowing an option of sub-areas within a large urbanized area might be beneficial and better represent the parts; however, the extent of the combined sample panel would be expected to be higher. If a State considers the possible options of using subareas (or county basis) in selected cases, then the revised procedures in selected cases may create an extra sampling burden.

In **air quality non-attainment or maintenance** situations or other special studies, populating the rest of the **AADT** field with **AADT** estimates for the Minor Arterials and Collectors (Major) that are not Samples or **NHS** or **STRAHNET** may be required for analysis purposes. In lieu of the **Donut** procedures, the amount of DVMT could be derived as the sum of the product of segment **AADT** times the segment length for all Federal-aid Highway segments in a special area. This approach allows a flexibility of boundaries to analyze the entire area or subparts of it as may be desired. The burden of reporting certainly would be on those areas that require special attention; reporting of estimated **AADTs** for the other areas of the State on those classes would be optional. Not all air quality areas agree on whether using VMT model developed values or a HPMS VMT approach would be more representative. However, developing an independent estimate based on one HPMS approach could be consistent and reasonably accurate and certainly would be highly desired among the environmental agencies. In a worse case situation, maybe HPMS should not be the vehicle to handle VMT estimates for air quality areas.

Safety has voiced its concerns that the traffic volume of the segments needs to be known to further evaluate the relationships of crashes with the volumes. Certainly the safety folks would be supportive of requiring 100% universe reporting of **AADT** on all Federal–Aid Highways. Requiring **AADT** values based on actual counts could increase the data collection burden for States and MPOs; however, in many cases the State/local governments indicated that they already collected additional traffic data on these applicable systems to derive the **AADT Volume Group**. In the Webinars, about 70% of the States indicated they would be able to provide 100% universe **AADT** reporting on the Major Collectors. States in assisting local governments may find that traffic monitoring programs might be increased and this could require additional resources. Options for alternative, simplified data collection strategies should be explored.

If travel estimates were needed by pollutant in each **nonattainment area** or **maintenance area**, then some modification of the Summary Template would be needed to accommodate an additional column by pollutant.

National sample: More thought would be needed to decide what might be done to gather some additional information on the lowest systems, i.e., rural minor collectors and rural/urban locals. Most likely existing collection resources would be tapped and mostly likely not be an extra burden. This information would be to support discussions in the *Conditions and Performance Report* to the Congress. Safety advocates would like to have a sample panel representing the non-Federal-aid highways to obtain a better representation of needs and conditions, including safety. At this point, no specifics of what the safety advocates had in mind have been discussed.

Alternative sampling methods: Use of alternative sampling variables and adjusting the precision levels is a wide-open subject and is very dependent on proper statistical analysis. Should some attention be given to analyzing the amount of precision and range of variation needed of selected HPMS Items to meet FHWA's objectives? At this point, few comments at Webinars have been made to change the scheme. We could assume that most users and providers are happy with the current scheme. We also need more input to develop some objective criterion to examine the levels of precision. Excessive precision increases the number of samples needed and likewise increases the burden un-necessarily.

AADT volume group strata adjustment: Wider ranges of **volume groups** and common **AADT volume groups** across rural and urban/urbanized should reduce the burden of frequent resampling and annual maintenance within **volume groups** and be especially helpful when the **boundaries** changed. Further, the volume ranges can increase in range as the volume increases. Generic **volume groups** are more flexible in accommodating the specific traffic trends and conditions in a given State. Also some States indicated that they 100% sample the highest volume groups, so changing the volume group ranges will not affect them in the highest groups. About 75% of the States supported the change to reduce sample migration; however, some wanted to see the results. A testing of the proposed adjustments of wider volume ranges and common volume ranges across rural and urban remains to be performed.

NHS sample: Since the Interstate System is already part of the **NHS** and has its appropriate expansion factors, then only the non-Interstate System parts of the **NHS** will need to be reviewed that sufficient standard samples are available to derive the **NHS** expansion factors. The proposal for the non-Interstate **NHS** factors would be to derive them using the **AADT Volume Group** within rural areas, small urban areas, and individual urbanized areas by State similar to what is done for the regular sample expansion factors. (The sampling framework probably would not include breaks by functional system depending on the study results.) The minimum of 3 samples per strata or full universe rules would be applicable. The **NHS** sample adequacy could be checked with the existing software used for the standard samples. In addition, the **NHS** levels of precision would need to be determined. If **NHS** segments on the rural and urban locals and the Rural Minor Collectors must be included (about 160 miles nationwide), than a similar sampling scheme should be employed for them. This would result in a small additional burden for the State. About 75% of the States felt that FHWA should investigate the use of a National sample in future HPMS Reassessments. Finally, someone needs to identify which HPMS Items would be applicable to use the National sample scheme.

Geospatial expansion factors: The flexibility in handling the expansion factors for items from the various shops allows the information to be kept at the level of collection (reducing the burden of summarization). A complete study is needed. Hopefully this would be a step up from the present situation to merging all data items and making them fit a particular common road segment.

Sample size formula: There is a need to review the sample size formula and how it is used to calculate the required sample size within each volume group. Using the coefficient of variation of **AADT**, within each volume creates a bias in the number of required sample, because the mean is going up within each group, but the standard deviation does not necessarily rise at all or rises much slower than the mean. Since the coefficient of variation is the standard deviation divided by the mean, the coefficient of variation goes down at higher volume groups. A simple illustration of the problem, using the recommended new **AADT volume groups**, and assuming 100 sections within each volume group, a 90-5 confidence level, and a uniform distribution, the 0-499 volume group requires a sample size of 78.5, while the 175,000 to 249,000 group only requires a sample size of 10.2. An alternative method would be to calculate the required sample size at the functional class level and then distribute that sample to the volume groups. Since this is a newer concern recently voiced following the Webinars, we have not had much chance to really explore and digest the impact of this situation.

Options/Recommendations

This section is dynamic throughout the first phase of the reassessment. If possible, this is where the "how" will be defined. Initially, this section will be based on the suggestions offered by the FHWA program offices. Other options and recommendations will be added later based on feedback from the regional outreach workshops and issue-specific web seminars.

Below is a summary and discussion of various recommendations and options for consideration in the current HPMS reassessment effort or for future consideration and study. The basic sampling scheme for HPMS is not recommended for significant change at this time. Below are three sections into which the issues are separated: Immediate implementation is applicable only to #1 below, short-term study is applicable for #2 (completed by September 2007), and long term study is recommended for the remainder until which time a further/future in-depth study can be made.

Immediate Implementation

Universe/Summary **AADT**: Present scheme of sampling within urbanized areas, small urban areas, and rural by functional system and by volume strata could be retained (a study proposal should be scheduled for a future years when more research monies would be expected to be available). The State should report estimated **AADT's** at least within a special study area(s) to populate the rest of the **Minor Arterials and Collectors (Major)** universe not already reported with **AADTs** (Data Item 33) for any **NHS** or **STRAHNET** or standard sample segment in order to avoid having to develop **donut areas** and add **donut** samples. If this would be an acceptable option, the **Donut Area Sample AADT Volume Group Identifier** (Item 31) as well as the entire donut sampling procedure could be deleted. FHWA also proposes to include **AADT**

(Item 33) as a required item for all reported Federal-aid highway segments. Inclusion of **AADT** for all Minor Arterials and Collectors (Major) segments would greatly simplify the estimation of VMT for specific geographic areas as well as **nonattainment or maintenance** areas by pollutant. Currently, only the standard and donut samples required AADTs to be reported on all Minor Arterials, rural Major Collectors, and urban Collectors. Please note that **AADT** reporting was already required on a universe basis for all Principal Arterials and **NHS** and **STRAHNET** and samples on Minor Arterials, rural Major Collectors, and urban Collectors.

The current Summary Template used for the **air quality nonattainment & maintenance areas** would be modified to accommodate reporting a combined estimate of DVMT for the lowest systems by area and pollutant; these lowest systems would include any rural Minor Collectors and rural/urban Locals located within the **nonattainment** or **maintenance** area. The **Donut** scheme would be deleted in favor of reporting **estimated AADTs** in special study areas to populate the rest of the **AADT** cells on the minor arterials and collectors (major) segments that are not already samples or part of the NHS or STRAHNET.

The statisticians need to make a recommendation how to keep the sample panel representative of the entire urbanized area in cases where large additions are added to an existing **urbanized area** sample panel. The **Urbanized Area Sampling Technique** (Item 14) would be dropped. A decision needs to be made regarding allowance of sub-area sampling within a large urbanized area.

- Item 7 -- **Is Donut Sample** – eliminated
- Item 14 -- **Urbanized Area Sampling Technique –** eliminated
- Item 31 -- **Donut Area Sample AADT Volume Group Identifier** – eliminated
- Item 33 -- **AADT** – estimated AADTs would be allowed to populate the minor arterials and (major) collectors at a minimum for **nonattainment/maintenance areas** that are not on a sample, **NHS**, or **STRAHNET**
- Item 48 – **Donut Area Sample Expansion Factor** – eliminated

Short Term Study

AADT volume group strata adjustment: FHWA proposes establishing a single **AADT Volume Group** (Item 32) stratification that would apply across all geographic area types (i.e., **rural, small urban, urbanized, nonattainment**, etc.) The suggested **AADT volume group** strata shown below should be evaluated to determine the impact of various options (i.e., wider volume ranges as the volume increases, use same volume ranges across **urban/rural**, etc.). **AADT volume group** strata adjustment should be tested to determine the impact of various options (i.e., wider **volume** ranges as the **volume** increases, use same **volume** ranges across urban/rural, etc.). The expectation is that this change has the green light. A generic set of common **AADT Volume Groups** is recommended. Adjustments in volume ranges might be made if the studies confirm further change is needed.

AADT Volume Groups	Code
Under 500	1
500 – 1,999	2
2,000 – 4,999	3
5,000 – 9,999	4
10,000 – 19,999	5
20,000 – 34,999	6
35,000 – 54,999	7
55,000 – 84,999	8
85,000 – 124,999	9
125,000 – 174,999	10
175,000 – 249,999	11
250,000 and more	12

- Item 32 – **Standard Sample AADT Volume Group Identifier** -- Common generic **AADT** Volume Groups

Long Term (Future) Study

National sample: Further exploration of obtaining additional items on a sample basis for the non-Federal-aid Highways would be looked at most likely on a case study basis. No final decision has been made.

Alternative sampling methods: Alternative variable schemes, if viable, could be reviewed and proposed. Levels of precision needed for FHWA purposes need to be visited, since the level of precision directly affects the amount of samples required. If a commitment is made, than criteria would be very helpful in deciding the alternative schemes as well as the appropriate levels of precision to employ.

NHS sample: A **NHS** sampling scheme by State would be implemented using the existing standard samples supplemented with extra standard samples where needed. A separate Item would be retained for the **NHS** expansion factor as like the standard sample expansion factor. An in-depth analysis is needed to verify the proposed results. Also, a decision would need to be made whether to sample on the **NHS Locals** and **Rural Minor Collectors**. A final decision should be made regarding the scheme and levels of precision. Nobody has stated which HPMS Items would be applicable with the **National** sampling scheme; this needs to be worked out.

- New Item – **NHS Expansion Factors** (applicable to the non-Interstate parts)

Geospatial expansion factors: When the results of a study of allowing expansion factors to be created separately for each set of items reported by a particular shop are available, then appropriate decisions can be made.

- Item 16 – **NAAQS Nonattainment/Maintenance Code** (option) -- These items would not be needed for States that submit HPMS using a geospatial format – It could include up to 6 possible pollutants using the EPA-named area name (entry means yes the segment is within the affected area).

Sample size formula: No decision has been made of the exploration of the sample size formula and how it is used to calculate the required sample size within each volume group. Logically, it should be considered early if some fine tuning adjustments are to be taken.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

HPMS team – Office of Highway Policy Information, FHWA

Data Item	Add/Delete/Change	Summary	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
Is Donut Sample	D			X				X			X	X							X	X		
Nonattainment Code	D*		X					X	X	X	X	X				X	X	X	X	X		
Urbanized Area Code	D*		X		X											X	X	X	X	X	X	
UZA Samping Technique	D		X	X												X	X	X	X	X	X	
Functional System Code	C		X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	
Gen Functional S Code	D															`						
Donut AADT Vol Grp	D										X	X							X	X		
Standard AADT Vol Grp	C		X						X	X	X	X	X	X	X	X	X	X	X	X	X	X
AADT	C		X		X	X	X	X	X	X	X	X			X	X	X	X	X	X		X
NHS Expansion Factor	A			X	X		X			X	X	X	X	X	X		X	X	X	X	X	X
Note: D* - These items would be deleted only for States who submit HPMS using a geo-spatial format																						
Summary -- Add an estimated VMT entry for each nonattainment area and pollutant																						

Boundaries and Functional Classification

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Prepared by: Paul Svercl, Office of Highway Policy Information, FHWA
Champions: Bruce Spear, Office of Planning, FHWA
Cecilia Ho, Office of Natural & Human Environment, FHWA

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have been placed in a "**bold**" font to make easier for the reader to locate and reference them.

- Item 13 – **Rural/Urban** Designation
- Item 15 – **Urbanized Area** Code
- Item 16 – **NAAQS Nonattainmen**t Area Code
- Item 17 – **Functional System** Code
- Item 18 – **Generated Functional System** Code

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, we've tried to identify the customers, both internal and external, and define their individual data needs.

Boundaries:

Several **boundary** related issues are known to exist that perhaps could be improved and addressed during this HPMS reassessment process. HPMS data are analyzed, summarized, and reported using multiple, often overlapping geographic areas (e.g., by state, county or **urbanized area**, by **urban vs. rural**, or by **air quality nonattainment or maintenance area**). In order to facilitate this geographic selection and summarization, several geographic identifiers are hard-coded as attribute fields in each HPMS data record. These geographic identifiers are of limited usefulness when geographic areas overlap (e.g., a highway segment located in two or more overlapping **nonattainment areas** can currently be assigned to only one area). Also, these

identifiers are burdensome to maintain (e.g., **Urban/Rural** Designation codes must be updated whenever **urban and urbanized area** boundaries are adjusted).

The application of modern geo-spatial technologies (i.e., GIS software tools) largely eliminates the need for hard-coded geographic identifiers in HPMS data records, provided that (1) each highway segment record is appropriately referenced to a known location on the Earth using either geographic coordinates or a linear referencing system, and (2) geo-spatial databases exist which delineate the boundaries of each geographic area of interest (e.g., adjusted **urban and urbanized areas, nonattainment areas**, etc.).

As HPMS evolves towards a geo-spatial data submission format in which HPMS data records are linked to a well-defined geo-spatial highway network base map, many of the geographic identifier fields in the current HPMS record will become unnecessary. Geo-spatial analysis tools will allow the data to be selected and summarized by any geographic area. With this vision in mind, issues associated with the two most problematic geographic identifiers – **Urban/Rural** Designation and **NAAQS Nonattainmen**t Area Code in areas with multiple overlapping nonattainment areas can be addressed. (Further discussions on the geo-spatial aspects can be found in other papers, i.e., the Process and the Data Model.)

Both users as well as providers should be aware of the use of adjusted **urban and urbanized area boundaries** in reporting HPMS information. Federal law [See 23 USC 101 (a)(36 &37)] allows each State to adjust or "smooth" the **(small) urban and urbanized area boundaries** identified in the most recent decennial Census, and to use these adjusted **boundaries** to functionally classify segments on the Federal-aid Highways. States are encouraged to limit adjustments to areas that are "developed" or expected to be within the year; they are discouraged from including undeveloped adjacent areas that might become urbanized within the 20-year forecast period (i.e., the metropolitan area).

Adjusting Census-defined **urban boundaries** and functionally classifying highway segments based on these adjusted **urban boundaries** have traditionally been part of the statewide and metropolitan planning processes, and support FHWA's requirements regarding data and information needs. However, updating **urban and urbanized area boundaries** and the functional classification for all applicable HPMS segments takes a considerable amount of effort and time. Most of the functional class changes result simply from of shifts in **boundaries** from **rural to urban**.

FHWA no longer has a compelling business need for using "adjusted" **urban and urbanized areas** to distinguish highway segments in HPMS [The provision in Federal Highway Law that allows States to adjust or "smooth" the Census defined boundaries for (small) **urban** and **urbanized areas** is really a holdover from the time, prior to ISTEA, when Highway Trust fund monies were allocated to separate Federal-Aid Primary, Federal-Aid Secondary, and Federal-Aid Urban Programs.]. Following the 2000 decennial Census, many States were slow to update their adjusted **urban and urbanized area boundaries**, or to revise the **functional classification** codes on their HPMS segments to reflect the change from **rural to urban**; currently, only a few States have yet to submit the rest of them. Consequently, highway statistics reported by **urban vs. rural** areas and **functional classification** is inconsistent and misleading across States

especially during the early years of each decade. Furthermore, since every Federal agency other than FHWA and NHTSA use Census-defined **boundaries**, comparisons with other Federal statistics involving **urban and urbanized areas** are inconsistent and confusing to both analysts and the general public.

Metropolitan Planning Organizations and/or State DOTs in **air quality nonattainment and maintenance areas** are required to meet specific Clean Air Act requirements through the Transportation Conformity regulation. One such requirement is that HPMS must be considered as the primary measure of VMT used in emissions analyses. However, the current HPMS record format allows only one **nonattainment or maintenance area** to be identified for each highway segment record. In those instances where the **nonattainment or maintenance areas** for different criteria pollutants (e.g., carbon monoxide, ozone, or dust) overlap, HPMS submitters must arbitrarily choose which **Nonattainment** Area Code to report. HPMS segments in those portions of overlapping **nonattainment or maintenance areas** outside the selected area might not be coded at all and, consequently, might be under-sampled.

Functional Classification:

The current highway **functional classification** codes used in HPMS stratify highway segments along two dimensions: (1) by functional purpose (i.e., **principal and minor arterial**, **major and minor collector**, **or loca**l), and (2) by where the segment is located geographically (i.e., **urban versus rural** designation). The geographic dimension for highway **functional classification** is defined by the adjusted **urban and urbanized area boundaries** (as discussed above). Most of the changes that occur in **functional classification** of highway segments are attributable to changes in the **urban** versus **rural** designation, not the **functional** purpose. Updating the old **Functional** System Codes for HPMS submittals is time consuming, error prone, and inconsistently applied from one State to another.

In addition, the application of the criteria for **functional classification** appears to be inconsistent across and within States. For example, the existing guidance recommends that the extent of **principal arterials** should be within a 2 – 4 percent for **rural** (exceeded by over half of the States) and within 5 – 10 percent for **urban** (exceeded by at least 7 States). Current guidance is subject to a wide range of interpretations.

Eliminating the **urban** versus **rural** designation from highway **functional classification** and collapsing the number of classification codes from the current 12 to 6 or 7 would reduce the burden on States of having to update the HPMS attribute field whenever a change occurs in an **urban or urbanized area boundary**, and could lead to more consistent reporting of highway **functional classes** across and within States. Please note the **urban** versus **rural** information duplicates the more detailed information contained within the **rural-urban** designation Item.

Currently, there are at least two **functional classes** that require our attention: **Principal Arterial – Other Freeways & Expressways** is associated only with **urban** areas, **Major and Minor Collectors** are associated only with **rural** areas, and **Collectors** are associated only with **urban** areas. The **Non-Interstate Freeways & Expressways**, while more prevalent in **urbanized areas**, can also exist in **small urban** and **rural areas;** States should have the option of

designating such highways segments, irrespective of their geographic location. Note, there are several States that either do not have **Other Freeways & Expressways** in **urban** or did not elect to functionally classify them separately but instead include them with the **Other Principal Arterials**. A breakout by **rural Minor Collectors** is not necessary for apportionment purposes or FHWA performance trends, but may have some informational value with the States. The breakout of **Major** and **Minor Collectors** in urban was not considered in the **Functional Classification** Guide and has no known business use by FHWA.

Under the current **functional classification** system, there are no applicable classification codes for non-centerline facilities, such as ramps and other intermittent auxiliary roads that service the centerline through lanes. These highway segments warrant some type of **functional classification** scheme for purposes of asset management and crash analyses. Some stakeholders also have mentioned the possibility of creating **functional class** codes for the parts of interchanges. If such a scheme is needed, perhaps the order might use the highest level facility the chosen ramp being coded connects within the interchange, i.e., the primary ramp connecting an **Interstate** to anything would be coded **Interstate**, a **principal arterial** with a lower level facility would be coded **principal arterial**, etc. Of course, if ramps were to be coded within the interchanges, then a non-centerline road record would be needed to keep these facilities separate from the regular public road centerline segments. This also opens up a discussion if the number of lanes and levels of traffic would need to be known for analysis purposes.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

Boundaries:

FHWA allows the States the option of either submitting adjusted **urban and urbanized area boundarie**s following a decennial Census, or using the unadjusted Census-defined **boundaries**. States that choose to adjust their **urban and urbanized area boundaries** would be required to submit the adjusted **boundaries** to FHWA as a geo-spatial database at a level of accuracy and resolution consistent with their HPMS highway network geo-spatial database. States would be given a fixed time period (TBA), following each decennial Census, to prepare any Census **boundary** adjustments in cooperation with the local governments.

In absence of, or until an approved set of adjusted **urban and urbanized area boundaries** is submitted, FHWA could augment the most recent adjusted **urban and urbanized boundaries** by those Census-defined **urban and urbanized areas** that extend beyond the old adjusted boundaries. These interim boundaries would be used by FHWA for summarizing and reporting HPMS data by **rural, small urban and urbanized area** classifications.

Based on information from the webinars, some States agreed that the Census **urbanized areas** criteria did not recognized commercial space by definition, which is true. Census concentrates mostly on where the population resides. Normally major adjustments to the **boundaries** if any occur at least every 10 years; however, in high growth areas, minor adjustments may happen more frequently, which some States do and report for any Census recognized **urbanized area**. In fact, Census can do a special Census for a proposed new **urbanized area** between the decades, if requested for a nominal fee.

Although all the States use the adjusted **urbanized area boundaries** in conjunction with reporting HPMS, about two-thirds of the States indicated that they use them for other State activities. In some cases some States indicated that they do not always use the Census place or cluster boundaries in reporting small urban areas in HPMS. All areas considered, however, should have a minimum of 5,000 persons within the Census defined area.

States generally complained during the webinars about the lack of sufficient instructions from FHWA headquarters concerning **boundaries** and **functional re-classification** activities during the last adjustment period following the 2000 Census. In some cases, States delayed starting the process of boundary updates even though updates had been requested or found working with some urbanized area officials very time consuming. Timeliness can be a major concern. Some States suggested that any instructions / guidance should be made available at least 2 years in advance.

Geo-spatial boundary databases currently exist for all Census-defined **urban and urbanized areas**, and for all **Nonattainment and Maintenance Areas**. Use of the EPA electronic boundaries as amended for all air quality areas by pollutant would reduce the burden on the State in defining the applicable segments. States that choose to adjust their **urban and urbanized area boundaries** would be required to submit a geo-spatial boundary database to FHWA. This database would be used for all subsequent statistical analyses and reporting involving **urban and urbanized areas**, and would be made available by FHWA as a public domain database.

Functional Classification:

FHWA proposes to consolidate the current set of **functional classification** codes used in HPMS submittals by eliminating the **urban** versus **rural** within the coding scheme (e.g., a single code would be given to all **minor arterials**, regardless of whether they were located in an **urban or rural** area). The **rural/urban** designation would continue to be reported separately either under the **rural/urban** designation item or in a geospatial environment as part of the code. **Principal Arterials** in **rural and urban** would include three subcategories: **Interstate, Other Freeways & Expressways, and Other.** Nearly all States that participated in the Conferences indicated no problem in coding of **Other Freeways & Expressways** in **rural** since the information was kept in the State's database. States in the past may have some **Other Freeways & Expressways** in urban that were not identified and presently are being reported under **Other Principal Arterials;** this would need to be corrected. Almost all States responded during the webinars that **Other Freeways & Expressways** were identified in their databases at least on the State system.

The States that do classify **Minor Collectors** in **rural** should be able to continue to report them as an option. Those States that do not classify any public roads **Minor Collectors** would continue to report them under **Locals.**

Any updates to the **functional classes** of the public roads generally are done at least once each decade in conjunction with the **boundaries** adjustments. This practice is expected to continue.

To gain better consistency in application of the **functional classes** among the States, some updates to FHWA's **Functional Classification** Guidelines appear needed. These would include the percentages by **functional classes** for **rural** and **urban**, the new class of **Freeways & Expressways** in rural, etc. Better administrative instructions and training workshops also appear needed to assist the officials of States, regions, and **urbanized areas**. These views and others were voiced during the webinars and conferences.

For those States that submit their HPMS data using a geo-spatial format, **Urban/Rural** Designation would be calculated by FHWA using geo-spatial analysis methods as part of the HPMS data preparation process. For States that do not submit their HPMS data using a geo-spatial format, the determination of **urban** versus **rural** would be based on the **Rural/Urban** Designation (Item 13) geographic identifier in each HPMS data record.

Any use of **functional** class for non-centerline facilities would be further discussed under the Interchanges paper. Adding these non-centerline facilities into the database would be an extra burden on the States (does the extreme costs of interchanges warrant additional data for more detailed analysis). During the webinars, over half of the States indicated that they already have inventoried the ramps and collector-distributors in the State databases; in addition, some of the States reported that they tracked the number of lanes and the amount of user traffic. Several States reported that they functional classify private roads normally open to the public. HPMS traditionally has limited reporting to only the extent of public roads measured along the centerline.

Options/Recommendations

This section is dynamic throughout the first phase of the reassessment. If possible, this is where the "how" will be defined. Initially, this section will be based on the suggestions offered by the FHWA program offices. Other options and recommendations will be added later based on feedback from the regional outreach workshops and issue-specific web seminars.

- Allow options for updating **urban and urbanized areas and air quality boundaries**
- Revise functional classification codes to eliminate separate **urban and rural** classifications (please note the rural, small urban, and urbanized area designation is kept as a separate item)
- Allow designation of **Other Freeways & Expressways** in **rural** and as an option **Minor Collectors** in **rural**
- Update the guidance and provide additional training
- Develop **functional classification** for non-centerline facilities (discussed in Interchanges paper)

Boundaries:

HPMS needs to evolve towards a geo-spatial data submission format in which HPMS data records are linked to a well-defined geo-spatial highway network base map: therefore, many of the geographic identifier fields in the current HPMS record will become unnecessary. Geo-spatial analysis tools will be further developed to allow the data to be selected and summarized by any geographic area. CAUTION: Geo-spatial (i.e., GIS) analysis techniques enable spatially referenced data to be summarized by any geographic area, as long as that area has well defined geographic **boundaries**, represented in a geo-spatial database. Additional efforts would be best spent to assist States that were unable to reach a satisfactory level of geo-spatial reporting.

Adjustments to the latest Census-defined **urban and urbanized area boundaries** would be optional by State. The minimum default **boundaries** would be the most recent Census-defined **urban and urbanized area boundaries**. If a State chooses to adjust **boundaries**, then it would be given a very tight schedule (TBA) for submitting them following the release of information from Census.

After a grace period (TBA) and with no submittal of revised **boundaries** since the last decennial Census, FHWA would proposed to use the latest Census-defined **urban and urbanized area boundaries** to bump out existing adjusted **urban and urbanized area boundaries** as well as to define any new **small urban** or **urbanized areas** in order to prepare the HPMS data for purposes such as Highway Statistics, performance trends, etc. One of the HPMS goals is to maintain consistency of definitions for performance trends and Highway Statistics as well as use by the general public.

States that submit their HPMS data using a geo-spatial format would not be required to report the following data items on each HPMS record: Donut Sample (Item 7), **Rural/Urban** Designation (Item 13), **Urbanized Area** Code (Item 15), **Nonattainment Area** Code (Item 16). These data items, along with **Urban/Rural and Nonattainment Area** expansion factors, would be calculated automatically by FHWA as part of the HPMS data preparation process. Those States that do not submit their HPMS data using a geo-spatial format would continue to code these geographic identifiers in each HPMS data record.

Functional Classification:

Functional System	**Code**
Principal Arterials:	
Interstate	1
Other Freeways & Expressways	2
Other	4
Minor Arterials	6
Collectors (Major)	7
Minor Collectors	8
Locals	9

Functional Classes (Item 17) would be consolidated to eliminate the distinction between **urban and rural** classes (i.e. a segment could be coded as "**minor arterial**", not "**urban minor arterial**" or "**rural minor arterial**." Classes could be reduced to only **Interstate**, **Other Freeways & Expressways**, **Other Principal Arterials, Minor Arterials, Collectors (Major), Minor Collectors,** and **Locals**. The **Major Collectors** in rural and **Collectors** in urban would be combined under one code. Those States that do classify public roads as **Minor Collectors** could as an option report them as **Minor Collectors** in HPMS. Any public roads not classified as **Arterials** or **Collectors** would be classified as **Locals**.

States would classify all the facilities that are considered **Freeways & Expressways** in **urban** and **rural**. The **rural/small urban/urbanized** area information would be reported in the **Rural/Urban** Designation Item or as part of the geo-spatial code.

Update the **Functional Classification** Guidance and applicable administrative instructions and provide the appropriate **functional classification** training to staff.

The **generated functional system** (Item 18) would be dropped.

Any decision for reporting the non-centerline facilities, i.e., ramps and other intermittent auxiliary roads, as well as number of lanes and AADT on them would be stated in the Interchanges paper. Development of some **functional class** guidance for coding of non-centerline auxiliary facilities may be considered if such facilities are to be reported (see Interchanges paper). No decision has been made to add any other private roads, except those that already are considered as public roads because they serve the public, i.e., toll facilities that operate under the State's or local government's blessing.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

Bruce Spear, Office of Planning, FHWA, bruce.spear@dot.gov
Paul Svercl, Office of Highway Policy Information, FHWA, paul.svercl@dot.gov
Tom Roff, Office of Highway Policy Information, FHWA, thomas.roff@dot.gov
HPMS team – Office of Highway Policy Information, FHWA.

Data Item	Add/Delete/Change	Area	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
Rural/Urban Designation	D*		X		X	X			X	X	X	X	X	X		X	X	X	X	X	X	
Urbanized Area Samp Tec	D			X												X	X	X	X	X		
Urbanized Area Code	D*		X		X											X	X	X	X	X	X	
Nonattainment A Code	D*								X	X	X	X	X	X		X	X	X	X	X	X	
Functional System Code	C		X		X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	
Gen Functional S Code	D								X	X	X	X	X	X		X	X	X	X	X	X	
Note: D* - These items would be deleted only for States who submit HPMS using a geo-spatial format																						

Safety-Related Issues for HPMS Reassessment

December 2006
Prepared by: David Winter, Office of Highway Policy Information
Issue Champions: Mr. Robert Pollack, Office of Safety
Dr. Darren Timothy, Office of Legislative & Governmental Affairs

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Background

To meet its mission to save lives, prevent injuries and reduce traffic-related health care and other economic costs resulting from motor vehicle traffic crashes, the U.S. Department of Transportation (U.S. DOT) develops, promotes and implements at the Federal level (or in cooperation with its partners at the state and local levels) engineering, educational, and enforcement programs aimed at ending these preventable tragedies. To develop and implement these programs, much information about the traffic safety environment, human behavior, and vehicle performance in that environment, is required. Traffic Safety Data – such as motor vehicle crash data and highway environment and monitoring data like the HPMS – are the primary source for this information. Consequently, the U.S.DOT, and its modal Agencies, is committed to obtaining timely, accurate, complete, uniform, integrated and accessible safety data.

At any level, safety analysis is data intensive. At the State and local level analysis often involves identifying the crash location so that information pertaining to roadway geometrics, physical properties of the roadway such as friction, and traffic patterns can be assessed. Travel data by vehicle type at that location, especially by time of day, can be used to determine how congestion may have contributed to the crash. Of course, this information on the environment of the crash location cannot be obtained unless the crash location is first identified. These locations, as well as other characteristics of the crash, are obtained through a crash report completed by a law enforcement agency. These reports, when combined with hospital reports and documentation from other sources provide safety analysts with a comprehensive view of not only what happened, but also the possible causes both within and outside the drivers' control. Of course, all of these data sources are provided either through State or local agencies.

At the National level, the U.S. DOT's safety agencies have a variety of data available, but they are all dependent to a significant degree on States. Information on fatal crashes is obtained through the National Highway Traffic Safety Administration's (NHTSA) Fatality Analysis Reporting System and is rather abundant and fairly detailed. National information on police-

reported non-fatal crashes is available through NHTSA's NASS General Estimates System. The Federal Motor Carrier Safety Administration (FMCSA) collects information on all truck crashes through its Motor Carrier Management Information System (MCMIS). NHTSA also obtains from many States a copy of the state-wide crash file developed from police reports to use in vehicle intensive analyses. Each of these data systems is based primarily on data extracted from the police crash reports, although FARS and MCMIS are supplemented with additional data, and contain limited travel and roadway geometric data.

The FHWA has developed a highway safety analysis system that for eight states combines state-wide crash data with detailed highway and travel data. This system is called the Highway Safety Information System (HSIS). The highway data has been provided to FHWA on a voluntary basis by the cooperating State Departments of Transportation. FHWA has developed a suite of safety analysis tools that use the HSIS data for analyzing individual crash locations, as well as network level safety analysis.

As the linking of police-reported crash data to roadway data is essential for safety analyses at the State and local levels (and at the National level, too), so is being able to link aggregated crash data to roadway performance data. The U.S. DOT measures the progress and success of highway safety programs at the National level by movement of fatality and injury rates. Comparisons between States (and often within a State) on their highway safety progress are also made using fatality rates. Those fatality rates are dependent on accurately measured (and timely) vehicle miles of travel (VMT) – not only at the State level, but also by roadway functional classification and by vehicle type. Providing these performance data, as well as roadway environment data, through the Highway Performance Monitoring System is crucial.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "**bold**" font to make easier for the reader to locate and reference these data items.

- Motorcycle travel, measured as vehicle miles of travel (VMT)
- Coordination of HPMS with other safety databases
- Curve and Grade data
- Linear Referencing System (LRS)
- Friction data

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, we've tried to identify the customers, both internal and external, and define their individual data needs.

While collecting more detailed crash environment data is highly desired by the federal agencies involved in analyzing highway safety, it was realized early in the Reassessment process that HPMS was likely not the best source for most of these data. This paper focuses on the data items that are currently being collected in HPMS and how they can be enhanced to improve the quality of the safety analysis being done at the national level. It should be noted that travel data for the various truck classes is also an important issue for safety, particularly the FMCSA. Recognizing its importance, the issue of truck VMT is addressed in the *Freight Issues for HPMS Reassessment* paper.

A. Motorcycle Data

The quality of travel data for **motorcycles** has been an ongoing area of concern. In HPMS, the **motorcycle** travel data comes from the area wide summary table and is coded as percent travel by vehicles by functional system. There are a number of issues with the **motorcycle** data. In the area wide summary table, reporting the **motorcycle** data is optional and several States have chosen not to code it. A greater concern is the fact that collecting **motorcycle** travel data is not a priority in most States. Since **motorcycles** are much less common than other types of vehicle travel, a proportionately larger effort would be needed to detect the same percent change. **Motorcycle data is important because the number of serious and fatal crashes associated with motorcycles continues to increase nationally.**

B. Curve and Grade Data

Data users in the FHWA Office of Legislative and Governmental Affairs have indicated that any data on geometric alignment that could be used to calculate average **curves** and **grades** and **horizontal** and **vertical alignment adequacy** on a section would be sufficient to support the analysis of alignment-related investment needs. The current data collection scheme, based on the length of the section in different **curve** classes, is adequate for this purpose, but other data would also be acceptable. The current data items on horizontal and vertical alignment that are allowed for rural major collectors in lieu of curve and grade data, however, are not sufficient to be used for calculating average curves and grades.

States often use **curve** and **grade** data in a different format. States are most interested in more specific information about curves such as point on curve (PC), point on tangent (PT), point of intersection (PI), length of curve, radius, super-elevation etc. States often collect data that can be converted into more meaningful measures, such as those mentioned above. States seldom if ever use **curve** and **grade** classes required in HPMS. The data required by Safety R&D is more similar to the data used by States – PC, PT, PI, length of **curve** and super. While most if not all States use this data in the project development and design phases, it is questionable whether this data exists in most States inventory system.

C. Friction Data

Road friction is an important measure of pavement deficiency and safety risk that is not currently in HPMS. Roadways with low **friction** have poor skid resistance and high risk of wet-weather crashes. FHWA policy is that federal-aid highways have a skid resistant surface but has no way of determining the degree that this policy is being met. Road **friction** combined with better geometry data are needed to estimate, based on an NTSB recommendation, the number of locations where the posted speed limits are higher than the critical speed for safe stopping and

mitigation measures are necessary. **Having a measure for the friction would permit safety analyses of the interaction between the friction and other roadway design characteristics (e.g. gradient, curvature), environmental factors (e.g. wet weather) and vehicle characteristics (e.g. tire performance capabilities, vehicle speed interactions and vehicle type).**

D. Rural Travel Data

The collection, completeness and quality of HPMS data collected on rural roadways (Major Collector, Minor Collector, and Local), often off of the state system, are an issue for Safety. The Highway Safety Improvement Program (HSIP) is the principal safety program under SAFETEA-LU. The HSIP has a focus on and needs data on **all public roadways**. HPMS is currently only able to provide summary data for the Local and Minor Collector systems, and sample and summary data for the Major Collectors. It should be noted states need section level travel data on these systems to identify roads targeted for the High Risk Rural Roads Program (HRRRPs). This information will also be needed by the FHWA Division Offices to oversee the adequacy of the state determination of roads for the HRRRPs and selected countermeasures.

E. Coordination of HPMS with other safety databases

Data collected in HPMS are not sufficient for safety analysis in FHWA Safety R&D. This would require collecting additional data (more data per section as well as on more sections) in HPMS that could be used in a slightly modified version by Safety Analyst software package or one of the other safety analytical products.

Another issue related to coordination of safety data are linear referencing systems (LRS). **Linking HPMS data with FARS and MCMIS is not easy** given the use of **LRS** or highway/milepost in HPMS, and the highway/milepost or Lat/Long fields in FARS and MCMIS. The network (NHPN) that is used by FHWA is not the same one used by most States, therefore using Lat/Long for linking data between the databases is not a good option. HPMS also contains **LRS** data, but FARS and MCMIS do not. The highway and milepost data fields in HPMS are not consistent with those in FARS and MCMIS, so using these data for linking is also not an option.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

A. Motorcycles

Some States may have problems providing accurate classification count data for all functional systems. The higher functional systems, especially those on the State highway systems should be fairly well covered, but on lower order systems these data may be more difficult to provide. Since these data are being used more frequently by FHWA and NHTSA as input into performance measures and to provide incentive rewards to states, the quality of this information becomes more critical. Of particular interest, because of the significant increase in motorcycle

fatalities, is motorcycle travel. The limited motorcycle travel data affects the credibility and accuracy of analyses and hampers the ability to produce precise motorcycle statistics. This problem is compounded by the low priority placed on obtaining accurate motorcycle travel by many states. Within FHWA, the area wide summary table is the primary source of travel statistics by vehicle type. Part of the reassessment should be to determine how states are populating this table and evaluate whether it would be beneficial to collect additional metadata on the procedures the states are using.

B. Curve and Grade

A comprehensive review of the sources and collection method(s) of **curve** and **grade** data could increase the use of this information. This review could lead to streamlining the collection, formatting and use of these data to both reduce cost and increase the usefulness and meaningful results derived from these data.

Some states have indicated that it is difficult to provide the **curve** and **grade** data in the specified format. Many States use automated equipment for collecting **curve** and **grade** data. These devices do not always provide the data in the same format required in HPMS. Once States have gone through the process of converting the output from **curve** and **grade** classes required in HPMS, they then have to go through a process of summarizing the data for each section. This is because **curve** and **grade** data is point specific

C. Friction Data

Most states currently collect information on pavement **friction** (skid number) for various roadways. Road **friction** data would allow annual estimates of highway mileage on federal-aid highways that do not have a skid resistant surface in accordance with FHWA policy and thus in need of improvement due to high risk of wet-weather crashes. Without **friction** data, HPMS, HERS, and the various safety programs will fail to adequately assess infrastructure investments needed to improve pavement skid resistance and safety. FHWA will not be able to adequately respond to the NTSB recommendation to determine the number of locations and types of roads where posted speeds are higher than the safe speed for stopping on wet pavements. The criterion for measuring **friction** may be influenced by a study currently being conducted by the Battelle Memorial Institute to determine methods, procedures and regulations to best measure and qualify pavement friction. This report is anticipated to be ready by mid 2006.

It's worth noting that in the Outreach Workshops and Webinars, States were asked about the availability of other Safety related data such as guardrails and rumble strips. In general, data on these roadside features are not collected and stored in the States' databases and in most cases would be difficult to collect.

Additional Implications Related to Issues A, B and C (Motorcycle, Curve & Grade and Friction)

- Quality – The quality of these data can vary by functional classification within a State, and from State to State. This is often due to the priorities of the State(s), often focusing primarily on collecting quality data on those facilities that carry the majority of the traffic. The methods being used to collect these data can also vary within a State and between States. For example, there are a number of ways to collect travel data. Often the

more accurate and robust technologies being deployed on the higher volume facilities, and those less accurate and manual methods reserved for the low volume routes. The manual classification of vehicles is an example of a traffic counting method that is fairly accurate and appropriate for counting travel on low volume roads, but unfortunately its deployment is often during the work week, not on the weekends when much of the **motorcycle** travel occurs.

- Consistency – Data quality and consistency are closely linked. This can vary within a State depending on the methods being used for gathering these data. For the same reason, it can also vary from State to State, depending on the priorities of the States, and the focus of the people responsible for collecting these data.
- Timeliness – For the most part, timeliness is not an issue, except when it comes to the reporting of travel by vehicle type for each State. The Office of Safety, NHTSA, and FMCSA are usually the first to request this data, and almost always this request comes before the data is ready to be released. With the travel data being imbedded in the HPMS data, these groups must wait for all the HPMS data to be verified and checked for quality before any estimates of travel are released.
- Reporting – Reporting these data can be an issue for some States. This primarily stems for the lack of these data, or the process used to extract these data from the various State databases.
- Collection – For some data items collection may not be an issue, but when it comes to better **motorcycle** data or more extensive **curve** and **grade** data it probably will be a concern for many States.

D. Off System

The lack of quality off-state system data hampers a states ability to determine the severity and extent of traffic safety problems that occur on all public roadways. The exposure data generated by the HPMS are used to normalize crashes occurring on different roadway segments. Without this data, it will be more difficult for states to establish the severity and extent of traffic safety problems on all public roadways. The absence of traffic count or VMT exposure data prohibits establishing mileage rate based estimates of crash severity. Without travel data, crash severity rates will be determined either by frequency counts of crashes or using less precise normalizing data such as, population or licensed drivers.

E. Coordination of HPMS with other Safety Databases

FHWA Safety R&D and the Office of Safety have initiated a process to establish a Model Minimum Inventory of Roadway Elements (MMIRE). The MMIRE would be a minimum set of data elements on which a state should be collecting information. While the MMIRE elements have not yet been established, with certainty, some of the elements will be HPMS elements. The Safety R&D and the Office of Safety will be active participants with the Office of Highway Policy Information to assure internal consistency between the data elements included in MMIRE and the data elements required through the HPMS Reassessment process.

Options/Recommendations

This section is dynamic throughout the first phase of the reassessment. If possible, this is where the "how" will be defined. Initially, this section will be based on the suggestions offered by the FHWA program offices. Other options and recommendations will be added later based on feedback from the regional outreach workshops and issue-specific web seminars.

A. Motorcycle

The options for revising the motorcycle data depends heavily on the quality, consistency, timeliness, reporting, and collection issues raised in the previous section.

An addition source of **motorcycle** travel data that should be explored is the National Household Travel Survey (NHTS). The survey samples households by telephone from all regions across the country. The data include demographic characteristics of households, people, vehicles, and detailed information on travel for all purposes by all modes. It may be worth considering a special **motorcycle** "add-on" to the 2008x NHTS.

The quality of **motorcycle** travel data will likely continue to suffer until States start to make the collection of these data a priority. FHWA's Office of Safety and the NHTSA feel that collecting these data from all States, regardless of the initial quality, is very important. Therefore, they are recommending that that States begin submitting these data as soon as possible. **It has been suggested that States include motorcycle travel data collected in calendar year 2006, as part of their June 2007 HPMS submittal. The reporting of these data in 2007 would be optional, but starting in 2008, the reporting of these data in the area wide summary table would be mandatory.**

B. Curve and Grade

The current format of the curve and grade data meet FHWA's Office of Legislative & Governmental Affairs' needs. They would propose only changing these data if there are other, more readily available data currently being collected by the States. If such other data could also allow average curves and grades to be calculated on rural major collectors (on which horizontal and vertical alignment adequacy only are currently collected), then this would be an improvement over the current data structure.

Regarding the above comment that, "the Office of Safety (HSA) 'concurs' with no change to the current method for collecting curve and grade data", the current method of measuring curves and grades does not satisfy the purpose for which the HSA wants this data, for use in analytic models (e.g. *Safety Analyst, Interactive Highway Safety Design Model and others)*. Based on input received from states in numerous outreach sessions it appears that only a few states collect curve and grade data at a level of precision suitable for use in the predictive models. It would require a major change in States' HPMS collection methods for curve and grade data to be upgraded to meet HSA requirements for use in the models. A better method to obtain curve and grade data for use in the predictive models may be to obtain it through the establishment of a roadway inventory process such as the Model Minimum Inventory of Roadway Elements (MMIRE).

Although the FHWA's Office of Safety would like to have more detailed curve and grade data they realize that this is very difficult for most States to provide, therefore they concur with the Office of Legislative & Governmental Affairs recommendation to not change the format of the curve and grade data collected in HPMS.

C. Friction

Given the sensitivity of States in releasing their friction data along with the general lack of availability beyond the project-level, the request for these data is being dropped.

During the input sessions, some states expressed a reluctance to provide friction data due to the potential for discovery and possible litigation. Another issue expressed for not wanting to provide friction data was differences in collection methods and different level of sensitivity of this measure. However, if it is determined that friction data will provide a measure by which safety can be increased, HPMS may provide the best medium for the collection and reporting of this data and we may want to push for it's inclusion into the HPMS reporting requirements. Again, recognizing that the HPMS will not provide this information for the universe of roads.

Regarding rumble strips and guardrails, few states that provided input reported having data on these safety measures in their roadway inventory database. Some states indicated they had a policy on the adding rumble strips and guardrails when they are making improvements to roads. But the inclusion of these measures would be an additional burden on the states. **Both of these items may be variables better captured in the MMIRE where they would be part of an inventory.**

D. Off-System

While it is highly desirable to collect HPMS data for Local and rural Minor Collectors, the Office of Safety realizes that this is not practical for most States.

Regarding the collection of data by HPMS on local roads and rural minor collectors, FHWA presently gets summary travel information (VMT) by vehicle type for these classes of roads. A state may or may not have travel counts for specific potential HRRRs to allow rate-based determinations of crash problem severity. Since these roads have traditionally not been eligible for federal funding (other than through safety), states have not been required to collect and report HPMS data about these roads, other than summary travel data. For purposes of identifying roadways eligible for High Risk Rural Roads Program (HRRRP) funding, the current reporting of travel allows FHWA to at least establish a statewide average VMT for these classes of roadways. Information regarding the crashes and VMT on specific rural roads in a state can be used to establish whether that particular rural road exceeds the statewide average for that class of roads. Therefore, in the absence of a complete inventory of VMT for all roads in the state, FHWA's needs are essentially being met. In order to better fulfill the purpose of the HRRRP, states should perhaps be seeking coordination with the agencies responsible for the HRRR to obtain road specific travel volumes. **Therefore, it may be more appropriate to seek this information from information sources other than the HPMS.**

E. Coordination of HPMS with other Safety Databases

The coordination of the HPMS and MMIRE standards will be a coordinated effort between the Office of Safety and the Office of Highway Policy Information. Each data item will need to be reviewed independently along with the various business needs that data item. This is a process that will likely not be completed until early 2007. **It is the recommendation that this effort continue as a parallel but coordinated manner, only entering into future Reassessment discussions after proposed HPMS changes have been identified.**

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

- Mr. Robert Pollack, Office of Safety, FHWA
- Dr. Darren Timothy, Office of Legislative & Governmental Affairs, FHWA
- Mr. Dennis Utter, National Center for Statistics and Analysis, NHTSA
- Mr. Thomas Keane, Office of Research and Analysis, FMCSA

Summary of Data Impacts

Data Item	Add/Delete/Change	Summary	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other (HCA/TS&W)	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
Motorcycle VMT	C	X			X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Horiz. Align. Adequacy	D			X	X			X	X	X	X	X			X	X	X	X	X	X		X
Vert. Align. Adequacy	D			X	X			X	X	X	X	X			X	X	X	X	X	X		

Freight-Related Data Issues

October 2006
Prepared by: Fred Orloski, Office of Highway Policy Information

Champion Office: Office of Freight Management and Operations
Office of Legislative and Governmental Affairs

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "**bold**" font to make easier for the reader to locate and reference these data items.

- Truck Volume
    - Percent Single Unit Trucks - Peak
    - Percent Single Unit Trucks - Average
    - Percent Combination Trucks - Peak
    - Percent Combination Trucks – Average
    - Single Unit AADTT (New Data Item)
    - Combination AADTT (New Data Item)
- Truck Forecasts
    - Future Truck AADT
- Truck Parking
    - Truck Parking Spaces

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" these data are needed? Where possible, we've tried to identify the customers, both internal and external, and define their individual data needs.

Truck Volume Data

The current requirement for reporting **percent average single unit and combination trucks** on all HPMS sample sections would be changed to reporting **Annual Average Daily Truck Traffic (AADTT)** on all PAS, NHS, standard sample sections, and donut area sample sections. There would actually be two data items for reporting average truck data: **single unit AADTT** and **combination AADTT**. The **percent single unit and combination trucks during the peak**

hour would continue to be reported for all sample sections. This would provide the ability to monitor truck volume trends in urban areas and identify where truck routes or additional truck facilities may be needed.

The **percent trucks** is a calculated number rounded to the nearest whole percent based on actual volumes of trucks monitored by States. When zero values are reported it is not known whether there is no truck traffic on the section or if the **percent trucks** is less than one-half of one percent due to rounding. Since the HPMS uses a single expansion factor for all variables, this distorts the information resulting from the expanded sample. The volume of trucks is converted into a percent for HPMS reporting and then FHWA converts this percent back into a volume to show truck volumes for freight analysis and truck flow purposes. **Percent trucks** is used in capacity calculations, which can still be obtained from a calculation FHWA performs rather than States.

Truck volume data is available in all states for at least the State highway system and is typically collected according to the 13 vehicle classification categories in the Traffic Monitoring Guide (TMG). This data is often adjusted to better represent average conditions and is frequently used to calculate **AADTTs** and can easily be used to calculate the two categories of truck **AADTTS; single unit and combination**. Off state system data is not as readily available and may need further collection efforts and coordination to assure quality truck data is available for reporting in HPMS. Since many States are collecting more truck data following the guidance in the TMG, the ability to calculate **AADTTs** and the quality of that data will only improve as it is being used for both State and HPMS data needs.

B. Truck Forecast Data

Truck volumes are expected to grow more quickly than passenger vehicle volumes over the next 20 years. While FHWA currently models future truck flows by estimating traffic for different commodities on the highway network, these estimates cannot currently be validated through comparison with State forecasts. Nationwide default values are being used which may not be very accurate for individual states and may not adequately represent future truck volumes. **Truck forecast data** would be used to better forecast future needs and as an input for pavement deterioration models.

Since the majority of states do not have **truck forecast data** available for either state or non-state systems, there is no easy method to provide this information. The most logical method would be to estimate based on traffic volume trends or to use the same increase as the future AADT forecast.

C. Truck Parking

This refers to parking facilities for trucks such as truck stops, rest areas, or other off roadway locations where trucks can park off the mainline roadway. This information will be used to determine truck patterns, truck flows, and capacity of these facilities to provide adequate services to improve safety of trucks and other vehicles on the highway. It may also be related to congestion by providing trucks a location to pull off the highway during peak hour conditions, especially in urban areas.

The majority of States have informed us that **truck parking** data is not available other than possibly basic rest area information. There may be other source of data but the State HPMS contacts were not knowledgeable about this.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

A. Truck Volume Data

The reporting of **truck AADTs** would better meet our data needs by providing more useful information to assess future conditions to determine priorities and funding requirements. Since truck and freight flows are important to FHWA, this will provide useful information to determine where improvements are needed. This would have a minimal impact on HPMS since this data is already being collected by the States. It is also a result of FHWA's emphasis for States to increase monitoring of trucks, which has recently been promoted by 100% federal funds for equipment purchases and guidance in the 2001 Traffic Monitoring Guide. The quality of truck data would be improved by adding this requirement and this should not affect the timing or reporting of HPMS data. Additional effort and resources may be needed by States to develop more accurate and reliable truck monitoring programs to support FHWA's need for comprehensive truck data to better assess the impacts of trucks and freight on transportation.

B. Truck Forecast Data

Adding this optional data field could provide FHWA with more reliable and relevant information on **Future Truck AADT** and provide necessary data to identify deficient areas in needs studies and performance measures. Forecasting methods will be improved with more reliable data. This should not impact timeliness, collection, or reporting once guidance is provided on methods of reporting this information. It does not involve additional data collection, just forecasting data based on existing conditions. It is also important that improved reporting of existing truck volumes would help forecasting future volumes.

C. Truck Parking

Better information on **truck parking** facilities would provide useful data to assess the safety of the facility, to identify where additional capacity or improvements may be necessary, or where determining alternate truck routes would be helpful. Using this information with the geometric characteristics already available would provide the ability to assess routes and facilities where existing and future trucks can be safely accommodated for truckers and general motorist safety benefits. Since this data would not change very much from year to year, it may be reported at one time and the minor updates would not be a major burden to States.

Options/Recommendations

This section is dynamic throughout the first phase of the reassessment. If possible, this is where the "how" will be defined. Initially, this section will be based on the suggestions offered by the FHWA program offices. Other options and recommendations will be added later based on feedback from the regional outreach workshops and issue-specific web seminars.

A. Truck Volume Data

Since states already collect this information to meet the TMG guidelines that 30 percent of all volume counts should be classification counts, the requirement would be to report the actual **truck AADTs** for two categories of trucks, single unit and combinations. The percent single unit and combination trucks during the peak hour would continue to be reported for all sample sections. The vehicle classification categories on the HPMS Summary Form will be redefined to agree with the single unit trucks definition of categories 4-7.

States would be required to report average **truck volumes** that represent average conditions for that location. This means that the actual truck counts obtained would need to be adjusted just as volume data is adjusted to represent average conditions or an **AADTT** as promoted in the 2001 TMG. States would be allowed to use existing procedures or may need to develop an interim process to adjust raw truck count data to represent average conditions until their traffic monitoring programs have collected sufficient data to calculate reliable **AADTTs**.

Research may be needed on a process to easily calculate **truck AADTs**, to standardize peak hour definitions, explore use of ITS technology, and relevance to truck commodity surveys.

B. Truck Forecast Data

This additional data collection activity would not be added to HPMS reporting requirements. Other sources of this data would be used by those that have a need for it from State procedures. Another option would be to use either the State's process or the values used by their pavement design section to estimate future axle loadings derived from existing truck loading information to estimate future truck traffic.

C. Truck Parking

Information on truck parking facilities may be available from other sources, such as Rand McNally, and would not be added to HPMS. Other databases and publications illustrating locations and descriptions of truck routes and other information useful to truckers may be a source of truck parking information.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

Contact persons: Rolf Schmitt, Office of Freight Management and Operations
Ross Crichton, Office of Legislative & Governmental Affairs
Karen White, Office of Transportation Policy Studies

Data Item	Add/Delete/Change	Area	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
% single unit trucks - peak	C			X	X				X	X	X	X			X	X	X	X	X	X		X
% single unit trucks - average	D			X	X				X	X	X	X			X	X	X	X	X	X		X
% conbination trucks - peak	C			X	X				X	X	X	X			X	X	X	X	X	X		X
% conbination trucks - average	D			X	X				X	X	X	X			X	X	X	X	X	X		X
Single unit AADTT	A			X	X			X	X	X	X	X			X	X	X	X	X	X		X
Combination AADTT	A			X	X			X	X	X	X	X			X	X	X	X	X	X		X

Pavement-Related Data Issues

October, 2006
Prepared by Robert Rozycki, Office of Highway Policy Information (HPPI-20)

Champions:
Ross Crichton/Darren Timothy, Office of Legislative & Governmental Affairs (HPLS-30)
Mark Swanlund, Office of Pavement Technology (HIPT-20)
Bob Orthmeyer, FHWA Resource Center, Olympia Fields, IL

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Background:

Under consideration in this paper are issues dealing with currently reported and suggested future additional HPMS pavement data items. The current HPMS pavement-related data items currently collected are: **IRI** (#35), **PSR** (#36), **Surface/Pavement Type** (#50), **SN/D** (#51), **Climate Zone** (#52), and **Year of Surface Improvement** (#53). The table on page 9 (last page) summarizes the current and proposed data items and their respective collection extents.

The main FHWA uses of HPMS pavement data items are in pavement cost and deterioration models (HERS, HERS-ST, and NAPCOM), as an agency performance indicator (**IRI**), and published products such as *Highway Statistics* (annually), the biennial *Conditions & Performance Report* to Congress, and *Our Nation's Highways*. There are also several other uses for these data in the public and private sectors.

Due to the extensive use of these data throughout FHWA and the scope of the changes being considered, this paper describes three main issues: 1) frequency of submitted/reported **IRI** data; 2) consistency of submitted/reported **IRI** data; and, 3) collection of additional pavement data items and dropping less useful ones. Two web-based seminars (webinars) were held on these issues on July 6 and August 15, the general results of which are incorporated into this paper where applicable along with relevant input from the series of outreach workshops. While participation in the webinars and outreach workshops were not comprehensive on a nationwide basis, it is assumed that the discussed issues are applicable to other non-participants.

Related Data Items:

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "**bold**" font to make easier for the reader to locate and reference these data items.

1. Frequency of submitted/reported IRI data.

- **IRI** (#35), **IRI Year**.

2. Consistency of submitted/reported IRI data.

- **IRI** (#35), **IRI Year**.

3. Collect additional pavement data items and drop less useful ones.

- **IRI** (#35), **PSR** (#36), **Surface/Pavement Type** (#50), **SN/D** (#51), **Climate Zone** (#52), **Year of Surface Improvement** (#53); **IRI year**, **Rutting, Faulting, Cracking**; Historic**: Pavement Type**, **Date of Last Overlay, Date of Last Reconstruction, Thickness of Latest Overlay**, Existing **Asphalt** Bound **Thickness** (including previous overlays), Existing **Concrete Thickness**, **Base Type**, **Base Thickness**; Other: Asphalt Mix **Binder Type**, **Dowel Bars**, **Joint Spacing,** and Sub-grade AASHTO **Soil Type**.

Issue Descriptions:

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, we've tried to identify the customers, both internal and external, and define their individual data needs.

1. Frequency of submitted/reported IRI data.

This issue was raised by the Office of Pavement Technology. The need is to have **IRI** data reported in HPMS annually for the NHS. Current HPMS data submittal processes collect **IRI** on a 2-year cycle with older data remaining in place until updated with newer, measured values. **IRI** is used to calculate a percentage of miles and travel on the NHS having **IRI** values <95 in/mi and <= 170 in/mi for purpose of tracking long term system performance trends. These performance trends are used to identify program needs and prioritize internal resource allocation. These data are also published by the Office of Policy & Governmental Affairs in the biennial *Conditions & Performance Report* to Congress. It is most useful in that it is a good indicator of the public's perception of ride quality (but not necessarily pavement condition). The concern for the Office of Pavement Technology is the two-year data collection cycle results in the annual update of the NHS performance indicator representing data that is from one to three years old. Using data of this type makes trend analysis and resource prioritization very difficult. To make effective decisions about evolving trends, analysis of the timely data is critical. Put a different

way—if you were a parent of a college student, would you be satisfied with waiting two years until you receive the first report card?

2. Consistency of submitted/reported IRI data.

This issue was also raised by the Office of Pavement Technology and impacts the uses for the Office of Policy & Governmental Affairs as well. There is concern over the consistency of the currently collected HPMS **IRI** data. Much variation in collection equipment and procedures exists among the States. This is an ongoing issue and outstanding recommendation from the previous HPMS reassessment; while HPMS procedures recommend the use of AASHTO protocol PP37-04 along with other procedures outlined in Appendix E of the *HPMS Field Manual*, adherence continues to lack among the States to varying degrees for a variety of reasons including State data collection policy, equipment, cost, and system coverage to name a few. The webinar poll results seem to verify this. **IRI** is used to calculate a percentage of miles and travel on the NHS having **IRI** values <95 in/mi and <= 170 in/mi for purpose of tracking long term system performance trends. These data are also published and used by the Office of Policy & Governmental Affairs in the biennial *Conditions & Performance Report* to Congress and various pavement deterioration and cost models. It is most useful as a good indicator of the public's perception of ride quality (but not necessarily pavement condition). The Office of Pavement Technology notes that it is not so much concerned with which details of reporting are to be followed as long as they are consistent. The inclusion of **IRI** on structures and railroad crossings is also being recommended partly due to the decreased burden of removing them during the collection or post-processing. It follows that **IRI** reporting on structures in HPMS would describe smoothness on a systemic basis rather than for pavements only. As a note, **IRI** tends to "spike" at structure abutments rather more so than on the structure itself and this transition zone is often inconsistent among the States as to whether it is part of the structure or adjacent pavement project.

All of the above directly impacts the usefulness and credibility of HPMS **IRI** data. There is a continued need to encourage **IRI** data collection and reporting standards for HPMS including roadway sections off the State system. It is recommended that specified metadata be reported along with **IRI** for purposes of defining and clarifying what exactly is being submitted in addition to the proposed new data item **IRI Year**. The inclusion of structures in **IRI** reporting would also necessitate a caveat and publication footnotes when used in trend analysis so that any data discontinuity can be described.

3. Collect additional pavement data items and drop less useful ones.

This issue was raised by the Office of Legislative & Governmental Affairs. This Office, along with the Office of Transportation Policy Studies and the Office of Asset Management have embarked on a joint effort to upgrade the pavement deterioration models being used by the FHWA for policy analysis. There is a growing concern that relying excessively on **IRI** data in pavement modeling may provide a skewed picture, resulting in the underestimation of national level pavement investment needs. FHWA's current plan is to base its new pavement performance models on procedures developed as part of NCHRP Project 1-37A (Mechanistic-Empirical Pavement Design Guide (ME-PDG)). These models will use a broader range of data inputs that is currently collected in HPMS, but will be designed to use default values if section-

specific data are not available. These new pavement procedures will be built into individual models such as HERS, HERS-ST and NAPCOM, to improve consistency among the various types of policy analyses. Items have been identified, an issue of standards also exists among the data items that would be collected; as yet, no firm uniform standards exist for the collection of some of these additional data items for reporting at the national level. Data items that would be collected and reported in HPMS and utilized in these new pavement models would include:

Periodic: **IRI, IRI Year, Rutting**, **Faulting, Cracking** (wheelpath, asphalt transverse, and concrete transverse cracking);

Historic: **Pavement Type, Date of Last Overlay, Date of Last Reconstruction, Thickness of Latest Overlay,** Existing **Asphalt** Bound **Thickness** (including previous overlays)**,** Existing **Concrete Thickness**, **Base Type, Base Thickness**;

Other: **Asphalt Mix Binder Grade, Dowel Bars, Joint Spacing,** and **Sub-grade AASHTO Soil Class**.

The Office of Infrastructure expressed a need to obtain remaining service life perhaps by rural/urban, functional class, and pavement type breakouts. One of the long term goals of the new policy pavement models is to produce remaining service life as an output at some point in the future.

The issue of applicable standards was discussed and several polls were conducted during the webinars indicating mixed results; there is some variation in State application of various collection and reporting (AASHTO) protocols. It also appears to present challenges/difficulties to collect some of these data off of the State system. This seems to be an area where metadata would be of value and broad support has been indicated in the outreach workshops and webinars. Further study for which data items and what type of metadata to report is warranted.

Issue Implications:

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

1. Frequency of submitted/reported IRI data.

A change to annual from biennial frequency of **IRI** data reporting on a universe basis on the NHS would generally enhance and strengthen the Vision and Objectives of the reassessment and FHWA stewardship responsibilities—and there are no apparent negative impacts for FHWA if the need for annual in lieu of biennially reported **IRI** is not met. State and FHWA users of these data would benefit from a more frequent reporting of NHS performance trends in that system improvements or deficiencies would be noted in a more timely manner. This option however, would likely result in increased financial and workload requirements by some States that do not

already collect **IRI** annually on the NHS. Most participants in the webinars (over half) indicated that they would be able to provide annual **IRI** on the NHS with little or no difficulty.

2. Consistency of submitted/reported IRI data.

The biggest impact on HPMS and FHWA's responsibilities and ability to meet it's needs would be a beneficial one—these data would be more credible, useful, consistent, and of a higher quality if defined standards were better applied by the States. This issue would impact all reassessment Goals and may result in increased financial and workload requirements for some States.

The reporting of metadata would benefit users of these data in that relevant information would be accessible to describe the variability. This may prevent misuse or misreporting of **IRI** data in any subsequent statistics or analyses. It is also possible via further study that metadata could be used to develop relationships among the variables to "normalize" the data for purposes of national consistency. Normalization however, may not allow for an objective use of **IRI** data since it would likely not be uniformly applied and data would thus be manipulated for national needs.

Webinar proceedings indicate broad support for allowing structures to be included in the reporting of **IRI**. This would result in a reduction in level of effort on the part of the data providers (and equipment operators) and would simplify and make more consistent the reporting of **IRI** in that irregularities among States data practices would be reduced/eliminated; webinar poll results indicate a minimal to non-existent burden for those States that currently remove structures/railroad crossings to put them back in. Users of HPMS **IRI** data would thus need to be informed that this statistic becomes a measure of "system" rather than solely "pavement" performance.

While the issue point of maintaining **IRI** data collection and reporting standards remains generally agreed upon among webinar participants, success has been limited in the past due to confusion and the persistence of varying State practices. However, the need remains and it is proposed that a continuing effort be made to promote their use. The webinars also bore out the general agreement that metadata and the reporting of **IRI Year** would be beneficial to users of these data.

3. Collect additional pavement data items and drop less useful ones.

While the addition of new pavement data items in HPMS will serve to enhance and improve modeling capabilities, it will place new collection/reporting burdens on the States. It is anticipated that many of these data items currently exist in State pavement management systems (and some of these data items were reported previously in HPMS), but may be much more difficult to obtain for sample sections off the State highway or other systems. The table on page 9 describes the system coverage for the pavement data items in HPMS. These data items would be reported for paved roadway sample sections only. While adding pavement data items would allow for more detailed policy modeling, improved quality will not necessarily be an outcome in the modeling process since data sources and collection procedures more determine that. Overall

however, all FHWA Goals and other stakeholders would benefit from reporting the additional pavement data items since the addition of even reasonable defaults and estimates, if not measured values, would be an improvement over the current techniques.

HPMS collection and reporting standards and procedures would need to be developed, defined, and implemented. For the time being, AASHTO standards PP38-00, PP44-01, and R36-04 would be used for **Rutting, Cracking**, and **Faulting**, respectively. PP37-04 is the current standard for **IRI** with an update to this protocol expected in the next year or two. Webinar feedback appears to indicate a mixed result of roughly half the respondents being able to adhere at least partially to the current AASHTO standards for these items.

Most of the pavement data items would be sampled on paved non-structure roadway sections of the currently sampled functional systems (with the exception of **IRI** and **IRI Year**—see above). Summary data reporting is required for the data items noted in the table on page 9. Non-reported/missing data would be estimated by FHWA until actual measured values could be reported via the use of defaults and phased-in reporting.

The Outreach Workshop participants seemed to indicated that most of them would be able to provide **Rutting, Faulting, Cracking,** and **Last Overlay** data elements although it should be noted that a minority would not be able to provide some or would only be able to provide data for certain systems such as the NHS or State highway system only. The webinar participants appear to concur with this. On the issue of reporting standards for these additional items, results from the two webinars indicate that at least half of participants would likely be able to provided data to AASHTO standards for **Rutting** and **Faulting,** and **Cracking** to at least a "reasonable" methodology for both State and off-State roadways. For the data items of **Pavement Type, Pavement Construction Year,** and **Year of Last Resurfacing,** webinar results indicate that a majority of respondents have these data for the State system, in another database, or have these data in their PMS and would be able to provide. **Asphalt Thickness, Base Thickness** and **Last Overlay Thickness** mostly exist only for the State system and it appears that the use of defaults or estimates may be needed for any remaining roadway sections off the State system. It is possible that **Soil Type** can be coded by FHWA based on section location via the use of maps.

The Summary data elements of **Joint Spacing, Binder Type, and Dowel Bars** present more of a challenge regardless of whether the data are available on or off the State system. Webinar results indicate that a majority of States could not provide these data off the State system. It is probable that the use of default values would be needed for these data until/if a consistent and accurate methodology can be developed to collect and report them outside of functional class defaults.

Options/Recommendations:

This section is dynamic throughout the first phase of the reassessment. If possible, this is where the "how" will be defined. Initially, this section will be based on the suggestions offered by the FHWA program offices. Other options and recommendations will be added later based on feedback from the regional outreach workshops and issue-specific web seminars.

1. Frequency of submitted/reported IRI data.

- Require States to report **IRI** and **IRI Year** annually on a universe basis on the NHS. (The collection of **IRI** data off the NHS could remain on a 2-year cycle, since its primary use is to support a biennial report and is published in tables).

2. Consistency of submitted/reported IRI data.

- Better "enforce" the current collection procedures and requirements of **IRI** in the HPMS based on AASHTO PP37-04.
- Report various metadata and date of collection, including **IRI Year,** on **IRI** from the States (as currently defined in HM-66 of *Highway Statistics* or modify).
- Continue reporting average of both right and left wheelpath quarter-car **IRI** in HPMS (MRI).
- Report **IRI** data on structures and railroad crossings where **IRI** is required.

3. Collect additional pavement data items and drop less useful ones.

- Implement standards (AASHTO) and collection procedures in HPMS for the collection of all of the defined additional pavement data items as required sample data items. Define and require reporting of metadata for applicable data items.
- Drop reporting of **SN.** Need for this data item is obsolete and redundant based on acquisition of new data items.
- Collect additional pavement data items through a mix of required fields, optional fields, phased-in reporting, and Statewide default tables.
    - **Rutting/Faulting**: Add as required sample data items (data to be collected via profilometer at same time as **IRI**).
    - **IRI Year**: Add for all sections where IRI is required (including structures).
    - **Cracking**: Add % cracking (regardless of severity) as an optional sample data item, to allow States to provide information if their data is consistent with a standard FHWA definition.
    - Add a separate HPMS table for data items that only change when an improvement occurs. Include the historic data items as listed above and shown in the table on page 9.
    - **Date of Last Overlay** and **Date of Last Reconstruction**: Add as required sample data items.
    - **Thickness of Latest Overlay**: Optional sample data field until next post-2010 overlay.
    - Existing **Asphalt** Bound **Thickness**, Existing **Concrete Thickness**, **Base Type**, **Base Thickness**: Optional sample data fields until next post-2010 reconstruction. For off State-system, allow States to code based on State design standards (i.e., the standards that the local governments would have been expected to follow), if these types of data are not readily available from local governments.
    - Asphalt Mix **Binder Type**, **Dowel Bars**, **Joint Spacing**: Add a separate HPMS table to collect Statewide defaults by functional class.

- Sub-grade AASHTO **Soil Type**: FHWA would code from maps while allowing States to override.

Resources:

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified.

1. Frequency of submitted/reported IRI data.

Mark Swanlund, Office of Pavement Technology (HIPT-20)
Ph: 202-366-1323
Email: mark.swanlund@fhwa.dot.gov

2. Consistency of submitted/reported IRI data.

Mark Swanlund, Office of Pavement Technology (HIPT-20)
Ph: 202-366-1323
Email: mark.swanlund@fhwa.dot.gov

Bob Orthmeyer, Pavement Management Specialist
FHWA Resource Center, Olympia Fields, IL
Ph: 708-283-3533
Email: robert.orthmeyer@fhwa.dot.gov

3. Collect additional pavement data items and drop less useful ones.

Ross Crichton, Office of Policy &Governmental Affairs (HPLS-30)
Ph: 202-366-5027
Email: ross.crichton@fhwa.dot.gov

Table summarizing disposition of existing and new pavement-related data item elements:

Data Item	Add/Delete/Change	Summary	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other (HCA/TS&W)	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
IRI	C		X		X		X	X	X	X	X[3]				X	X	X	X				X
IRI Year	A		X		X		X	X	X	X	X[3]				X	X	X	X				X
PSR				X	X			X				X							X	X		
Surf/Pave Type	C[1]			X	X			X	X	X	X	X				X	X	X	X	X		
SN/D	D			X	X			X	X	X	X	X				X	X	X	X	X		
Climate Zone				X	X			X	X	X	X	X				X	X	X	X	X		
Year of Surf Imp	D			X	X			X	X	X	X	X				X	X	X	X			
Rutting	A			X	X			X	X	X	X	X				X	X	X	X	X		
Faulting	A			X	X			X	X	X	X	X				X	X	X	X	X		
Cracking	A			X	X			X	X	X	X	X				X	X	X	X	X		
Year of Last Resurface	A			X	X			X	X	X	X	X				X	X	X	X	X		
Year of Last Construction	A			X	X			X	X	X	X	X				X	X	X	X	X		
Last Overlay Thickness	A			X	X			X	X	X	X	X				X	X	X	X	X		
Asphalt Thickness	A			X	X			X	X	X	X	X				X	X	X	X	X		
Concrete Thickness	A			X	X			X	X	X	X	X				X	X	X	X	X		
Base Type	A			X	X			X	X	X	X	X				X	X	X	X	X		
Base Thickness	A			X	X			X	X	X	X	X				X	X	X	X	X		
Soil Type	A[2]			X	X			X	X	X	X	X				X	X	X	X	X		
Binder Type	A	X			X			X														
Dowel Bars	A	X			X			X														
Joint Spacing	A	X			X			X														

Notes:
1/ Additional pavement types.
2/ Software coded with State override option.
3/ Sample only.

New Interchange Data Issue Paper

December, 2006
Prepared by: David Winter, Office of Highway Policy Information
Champion: Dr. Darren Timothy, Office of Legislative & Governmental Affairs

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "**bold**" font to make it easier for the reader to locate and reference these data items. At the end of this paper is a table that summarizes the data impacts.

- Ramp location
- Ramp length
- Ramp functional classification
- Interchange location
- Interchange type

Issue Description:

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, the author has tried to identify the customers, both internal and external, and define their individual data needs.

This issue has been raised by the FHWA Offices of Freight Management and Operations (HOFM), Transportation Policy Studies (HPTS), and Legislative and Governmental Affairs, and by the Office of the Assistant Secretary for Transportation Policy. These offices' interest in collecting data on highway interchanges is being driven by two key factors. First, recent studies of highway bottlenecks have indicated that severe recurring congestion problems in many locations can be attributed to interchange deficiencies, rather than mainline capacity deficiencies. This is a particular issue for HOFM and HPTS, which have responsibility for tracking and analyzing the freight flows within the U.S. Second, surveys conducted by AASHTO have revealed that an increasing percentage of State capital spending is going for interchange improvements. This raises serious questions as to whether the estimates of future highway investment requirements for capacity additions in the Conditions and Performance report to

Congress are adequately capturing interchange needs. This is a particular concern for HPLS and OST-Policy.

At the present time, however, there is no systematic collection of interchange inventory and performance data at the national level. This severely restricts the ability of the agency to analyze interchanges and their impact on the Nation's transportation system.

Issue Implications:

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

This would be a new data collection effort. However, an initial FHWA survey of 21 states found that a majority of them currently collect at least some data on freeway **interchanges**. FHWA would need to define exactly what constitutes "an" **interchange** for data collection purposes, particularly in cases where multiple routes converge in close proximity to one another. Subsequent polls of States in the 5 Outreach Workshops and Reassessment Webinar on interchanges shows that most States are currently in the process of developing an inventory of **interchanges** and **ramps**. Most States are collecting length data on the **ramps**, while about half of the States that responded collect traffic data on **ramps**. A few States indicated that they collect additional data such as pavement condition and vehicle classification on **ramps**.

It was initially thought that **interchange** data would be collected as "node" data rather than as "link" data. This would have made it easier to integrate the interchange data with the existing HPMS data, which is in a "link" format. With the proposed data model, this will not be an issue, since the interchanges and ramps will be spatially represented in the States' highway networks, with the specific data on these facilities residing in a separate data table.

Initially there were some concerns about whether HPMS would be the right vehicle for collecting this information. However, states have indicated that such data would originate from the same sources as the current HPMS data, and **interchange** data does fit within HPMS' traditional role as the source of highway performance data. Furthermore, States indicated that if data on **interchanges** and **ramps** is going to be collected, they felt it would best be done as part of HPMS, especially with the new data model.

Another aspect of **interchange** data is that it is inherently directional in nature. This differs from the current HPMS process, in which data is collected only in the inventory direction. The new data model is being designed to handle multi-directional highway data and dual carriageway networks, so directional interchange data should not be an issue for HPMS in the future.

Currently there are no standard designations (e.g., numbers or codes) for all the ramps and lanes on an interchange. The intelligent transportation systems (ITS) community has identified this need and the ASTM Traffic Monitoring Committee may address it. A standard designation would greatly facilitate the reporting of traffic data on ramps.

Options/Recommendations:

This section has been dynamic throughout the first (outreach) phase of the reassessment and only now, in the final version of the issue paper, is the "how" clearly defined. Initially, this section was based on the suggestions offered by the FHWA data users. In this version, the recommendations offered in this section are based on the combined input from the data users, State data providers, and other interested parties. This feedback has been provided in the regional outreach workshops, issue-specific web seminars, and from comments posted to the Docket web site. Unless otherwise noted, the collection of new and revised data items would be phased in beginning 2008 with all States being in full compliance 2010.

The following data options were originally considered and presented to the States, data users, and other interested parties in the Outreach meetings and Webinars.

1. Data coverage options include:
    a. Interstates Only. The Federal interest is stronger for Interstates than for any other part of the Nation's highway system. Interstate interchanges are one of the few areas within the Federal-aid highway program where FHWA directly approves projects. The Interstate Justification Request approval process also provides a potential source within the agency for updating interchange inventory data in the future.
    b. Interstates Plus Other NHS Routes. This would be consistent with the interest in identifying and analyzing interchange-related bottlenecks on the Nation's freight transportation system
    c. Urban Only. Operational performance issues associated with freeway interchanges are primarily a concern in urban areas. Interchanges in rural areas could be analyzed in some other fashion, or perhaps require a lower level of data reporting.
2. Potential freeway interchange data items that have been identified include:
    a. Interchange identification and location (LRS, intersecting route ID's, etc.)
    b. Interchange Type
        i. Freeway-Surface Road (diamond, single point, cloverleaf, trumpet, etc.)
        ii. Freeway-Freeway (fully directional, directional by quadrant, etc.)
    c. Ramp Volumes
    d. Weaving Areas
    e. Merge Type
    f. HOV Access Type
    g. ITS Deployment (ramp meters, etc.)
    h. Other Capacity Variables
3. As a new data effort, interchange data collection might be a good candidate for a phased implementation or separate research effort that could be incorporated into HPMS. Initial efforts might focus on basic inventory items and/or limited coverage, with gradual expansion to other performance data items and other systems.

Based on the extensive feedback received during the outreach phase of the Reassessment, it is apparent that most States that participated in the outreach meetings are collecting data on Interchanges and/or ramps. Many of the States in attendance at these meetings are only collecting data on ramps, while none are collecting data on just interchanges. A small number of

these States indicated that they are classifying the interchanges and storing these data in their databases.

It's clear from the outreach sessions that States have a business need for collecting information on interchanges and ramps. These assets constitute a significant investment for States, and often times a sizeable number of additional lane-miles that must be maintained. Furthermore, it has been shown that interchanges are often a source for recurring bottlenecks. Considering these facts along with FHWA's business needs for these data, it seems reasonable to begin collecting data on interchanges and ramps. The following recommendations reflect the national need for interchange and ramp data, while taking into consideration data:

1. FHWA is recommending that States report ramp location, length and functional classification data for all functional systems. Ramps, as defined by AASHTO in the publication *A Policy on Geometric Design of Highways and Streets* "…includes all types, arrangements, and sizes of turning roadways that connect two or more legs at an interchange." Where a ramp connects two facilities with different functional classifications, the ramp will be coded with the functional classification of the "higher" facility. For example, a ramp that connects an Interstate and a Principle Arterial would be coded as an Interstate ramp.
2. While FHWA would prefer to have States collect and report data on Interchanges, the federal need requires further study. Therefore, it is recommended that FHWA undertake a research project to determine the interchange information needed at the national level, the systems for which these data are required, and the best data collection method(s). It's anticipated that these data will likely be collected through a second research project, the results of which would be incorporated into HPMS and ultimately provided to the States for integration into their own data programs.

FHWA is prepared to add ramps to apportionment formulae, however to make this possible, States will also need to report travel on ramps (VMT is a portion of most apportionment formulae). Since this has not yet been vetted with the HPMS data providers, it has been intentionally omitted from the recommendations. Provided adequate State support, FHWA will likely add ramp travel data to draft Recommendations Report pending the outreach sessions in early 2007.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

- Dr. Darren Timothy, Office of Legislative & Governmental Affairs, FHWA
- David Winter, Office of Highway Policy Information, FHWA

Summary of Data Impacts

Data Item	Add/Delete/Change	Area	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
Ramp Location	A				X				X	X					X	X	X	X				X
Ramp Length	A				X				X	X					X	X	X	X				X
Ramp Functional Class	A				X				X	X					X	X	X	X				X

Capacity-Related Data Issues for HPMS Reassessment

October 2006
Prepared by: Fred Orloski, Office of Highway Policy Information

Champion Office: Office of Legislative and Governmental Affairs

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "**bold**" font to make easier for the reader to locate and reference these data items.

- Highway Surveillance Systems
  - Electronic Surveillance
  - Metered Ramps
  - Variable Message Signs
  - Highway Advisory Radio
  - Surveillance Cameras
  - Incident Detection
  - Free Cell Phone
  - On-Call Service Patrol
  - In-Vehicle Signing
- Capacity Calculations
  - Peak Capacity
- K-Factor and Directional (D)-Factor
- Widening Feasibility
- Obstacles to Widening (New Data Item)
- Counter-Peak Lanes (New Data Item)

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, we've tried to identify the customers, both internal and external, and define their individual data needs.

A. Highway surveillance systems

These are universe **data items 38 through 46** currently reported in HPMS. These data are used in the HERS analysis and in congestion performance monitoring to reflect the impact that these systems have on the operation of sections where they have been deployed. However, the existing HPMS data alone are not adequate for this purpose since the information reported is, in many cases, less than that reported in separate ITS deployment surveys. In order for these data to be more useful, the accuracy and completeness of reporting these data would need to improve. An alternative approach would be to delete these items from HPMS and rely solely on other surveys and data sources. As these surveys do not identify equipment on a location-by-location basis, some data precision would be lost.

The webinar poll survey shows that only about half of the States maintain a database of the **highway surveillance** items, mostly on the State system. Many States collected these data just for HPMS, often by visual inspection, whereas those that have a database of this information rely heavily on freeway monitoring or ITS agencies as a source of this data.

B. Capacity calculations

There may be more accurate methods of calculating **capacity** and states should be overriding the value calculated by the HPMS software. The data items needed to calculate **capacity** may not always be available or coded properly and in many cases the **capacity** is much greater than the calculated values from the software. If states know that other conditions contribute to increased **capacity**, such as using shoulders during peak hours, reversible lanes, or HOV facilities, then they should be encouraged to override the calculated **capacity** with these more realistic values. Guidance could be provided on how to calculate these override values.

The reassessment discussions have shown that more than half of the States would like to see a V/SF ratio greater than 1.2 as the value for identifying potential errors. States are often reluctant to override the HPMS software calculated values and prefer to either explain the high values in the submittal letter or adjust other data items used for calculating **capacity**. States that override the values usually use the Highway Capacity Manual procedures in conjunction with traffic engineering staff assistance.

C. K-Factor and D-factor

A better definition may be needed to determine these **factors** based on either short term or continuous ATR traffic monitoring sites. There would be less actual data available from continuous ATR sites, which may not represent actual conditions for all sample locations. Since short-term traffic data is often available and the only or best source of site specific travel conditions, a better and more uniform procedure to estimate these **factors** may be needed. The **K-factor** is not necessarily collected or based on peak hour conditions yet it is used to estimate peak hour factor and peak capacity calculations.

The majority of States have a database that contains **K-factors** which most often includes off State system locations based on data from short term and continuous traffic monitoring sites and is typically updated annually. Very few States use functional class or geographic area averages.

Just about all States have **D-factors** in their database based on site specific data which are updated frequently.

D. Widening feasibility

This item is a critical input to the biennial Condition and Performance report to Congress. **Widening feasibility** is used to determine the cost to add capacity in a given location. If it is feasible to widen, it is assumed that lanes could be added at a "normal cost" which varies considerably based on functional class and population area. If it is not feasible to widen, it is assumed that lane-mile capacity equivalents could only be added at "high cost," ranging from building a parallel route or bypass in a rural area to tunneling in the largest urbanized areas. If this data item is to provide accurate information its definition may need to be clarified to reduce the level of coding subjectivity.

The addition of another data item to explain conditions relevant to coding **widening feasibility** could be added to make this information more useful and to allay concerns on various interpretations of the coding options available. This was expressed by a majority of the States during reassessment discussions. The additional data item would provide options for coding various obstacles to **widening** such as expensive right-of-way, dense development, extreme terrain, environmentally sensitive areas, landmarks, water, and railroads.

Most States do not have an internal use for this data item and collect it just for HPMS. All the States expressed a need for additional and clearer guidance on coding this item to more accurately reflect conditions in their State. States would be discouraged from coding **widening feasibility** based on State policies and political decisions since this would not provide for uniform coding and uniform identification of additional costs and options for adding capacity nationwide.

E. Counter-peak lanes

The number of travel lanes in the peak hour direction is currently an HPMS sample data item (#87). It is the key data item used to calculate peak directional capacity, and reflects operational features such as reversible lanes and shoulder use as a travel lane. However, no data is required for the number of lanes in the **counter-peak** direction. This forces the use of an analytical procedure that estimates this number based on other information such as peak parking restrictions and HOV operations. These estimates may be inaccurate and can severely impact the analysis of highway capacity deficiencies and improvements.

Visual inspection is the principle method used by States to determine number of peak lanes, and probably **counter-peak lanes**, which are already being collected or can be collected with minimal effort.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

A. Highway surveillance systems

More complete and consistent coding of these data items may provide more use for this information. Dropping the data would preclude their use for other analyses in the future.

B. Capacity calculations

Capacity data that more accurately reflects actual conditions would allow for improved identification of **capacity** deficiencies and more accurate estimates of future system expansion needs. This would provide a better measure of congestion since the V/SF ratios would be more realistic and more accurate congestion monitoring would result.

C. K and D factors

This would result in more accurate capacity calculations and easier procedures for states to use to provide this data item.

D. Widening feasibility

If this data were coded based on number of lanes that can be added, more realistic data would be available to determine if increased capacity can be added and at a reasonable cost. This could make the future cost of improvements less showing that added capacity can be accomplished with minimal effort. It would also better identify those deficient areas, especially in urban areas, where added lanes would be very costly unless above or below grade facilities were considered. There is no other source of this data other than that provided by the States. Improving the definition of **widening feasibility** or replacing it with a different data items that approach the question from a different way could reduce the reporting burden on States to provide this information.

E. Counter-peak lanes

Collecting this data should not involve any greater effort on the part of data providers than does the current collection of number of peak lanes data. Currently the models estimate this information, which may not be very accurate.

Options/Recommendations

This section is dynamic throughout the first phase of the reassessment. If possible, this is where the "how" will be defined. Initially, this section will be based on the suggestions offered by the FHWA program offices. Other options and recommendations will be added later based on feedback from the regional outreach workshops and issue-specific web seminars.

A. Highway surveillance systems

There are other sources of information for this data besides HPMS that should be used. These data items would be deleted from HPMS.

B. Capacity calculations

Overridden **capacity values** may already exist at the state or may need to be a separate calculation. The edit routines in the submittal software would be changed so that the V/SF calculations of less than 1.4 would be acceptable as accurate data. States would be asked to explain their process for calculating **capacity** and the override values reported in HPMS.

C. K and D factors

It appears that coding **K and D factors** is not an issue for States since this data is readily available from existing databases including many off State system locations. States are encouraged to continue using existing procedures for collecting this data based on guidance from the Highway Capacity Manual and other documents. Since capacity is usually not an issue on lower functional

classes, estimates currently being used appear to meet the user needs. It is recommended that there be no change in the collection and coding of this data for HPMS.

D. Widening feasibility

Since this is already a data item, a better description of how to code it would be developed for both data collectors and data users. The number of lanes that could be added would still be coded and if **widening** is not feasible, then code the features that are an obstacle to **widening**.

Information would be developed on the cost to widening, which features could be eliminated to allow **widening,** and the cost to eliminate these features. States would identify obstacles within a specific distance from the roadway that would greatly complicate **widening**, and report this condition as a separate data item.

E. Counter-peak lanes

This would be a new data item to add the number of lanes in the **counter-peak** direction.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

Contact person: Ross Crichton, Office of Legislative & Governmental Affairs

Data Item	Add/Delete/Change	Area	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
Electronic Surveilklance	D		X					X	X	X	X	X			X	X	X	X	X	X		X
Metered Ramps	D		X				X	X	X	X	X	X			X	X	X	X	X	X		X
Variable Messsage signs	D		X					X	X	X	X	X			X	X	X	X	X	X		X
Highway Advisory Radio	D		X					X	X	X	X	X			X	X	X	X	X	X		X
Surveillance Cameras	D		X				X	X	X	X	X	X			X	X	X	X	X	X		X
Incident Detection	D		X					X	X	X	X	X			X	X	X	X	X	X		X
Free Cell Phone	D		X					X	X	X	X	X			X	X	X	X	X	X		X
On-Call Service Patrol	D		X				X	X	X	X	X	X			X	X	X	X	X	X		X
In-Vehicle Signing	D		X					X	X	X	X	X			X	X	X	X	X	X		X
Peak Capacity	C			X	X				X	X	X	X			X	X	X	X	X	X		X
Widening Feasibility	C			X	X				X	X	X	X			X	X	X	X	X	X		X
Obstacles to Widening	A			X	X				X	X	X	X			X	X	X	X	X	X		X
Counter-Peak Lanes	A			X	X				X	X	X	X			X	X	X	X	X	X		X

Data Quality Background Paper

October 2006
Prepared by: David Schrank, Texas Transportation Institute
Champions: David Winter, Office of Highway Policy Information
Dr. Darren Timothy, Office of Legislative & Governmental Affairs

This paper is being prepared in conjunction with several other issue papers relating to the HPMS reassessment effort. In particular, it will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "bold" font to make it easier for the reader to locate and reference these data items. At the end of this paper is a table that summarizes the data impacts.

This paper touches on numerous data items that will likely be impacted as a result of the Reassessment. This paper will not cover in detail any of the data changes, but rather address the data quality issue from a global perspective. The reader is encouraged to review the individual issue papers for a thorough description of the specific data changes being considered.

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, the author has tried to identify the customers, both internal and external, and define their individual data needs.

Data Quality is an important consideration for any database. The quality of the data in HPMS is a key issue. All of those involved with HPMS—data providers, collectors, and users—want to know that the database contains high-quality data.

New Data Model

The HPMS reassessment will bring changes to the existing database. Some existing variables may be removed or overhauled. Data elements such as additional pavement items, new safety and truck items, and many other possible items may be added to the database during the reassessment process. There have already been many discussions about moving to a GIS-based system to allow for linkage with other existing databases such as traffic safety or pavement management databases. How this might be accomplished will be discussed in more detail in the

data model issue papers. The question in this discussion is how the quality of the database will be assured.

Field Manual

The *HPMS Field Manual* intended for use by both data providers and data users. The manual describes how HPMS data is to be collected and reported to FHWA. Through the various outreach workshops and webinars, data users have indicated that some data quality issues could be resolved through better data descriptions and additional example in the Field Manual. While the Field Manual cannot prevent the misuse of the HPMS data, it could be improved so as to inform data users on the proper use and limitations of these data.

Oversight

The FHWA Division Offices play a key role in assuring the quality of HPMS data. On an annual basis, the Division Offices verify the quality and accuracy of these data through reviews of the data collection, analysis, and reporting processes. These reviews are officially referred to as the Field Reviews. Recently, the Office of Highway Policy Information revised its Field Review instructions and adopted a series of risk assessments that look at the data processes, staffing levels and turnover, and State Planning and Research (SPR) funding levels for data collection. These Field Reviews are to be sent to the Office of Highway Policy Information by November 1st.

Data Validation

The HPMS software performs multiple data validations that check for miscoded or unreasonable data. Testing for miscoded data is fairly objective and involves comparing two data fields that are directly related i.e. urbanized area code and population. Checking for unreasonable data is more subjective and involves comparing data to expected data ranges i.e. traffic growth on a given functional class should fall between x and y percent. Through the outreach portion of the Reassessment, many data providers and users have expressed concern about data validations being performed in the software.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

New Data Model

FHWA is working with the state DOT's on developing a merged highway network, as part of the new data model, which will include all functional classes through Major Collectors. This network will allow FHWA and the state DOT's to link the various databases (current HPMS, pavement management, etc.) together spatially, by using each States' referencing system, which are currently used by the States for spatially referencing the various sections and data items within their own databases.

A few of the concerns/issues voiced by the state DOT's and FHWA are listed below regarding new data elements, quality of existing data and what might result if steps are not taken to ensure data quality.

- The state DOT's are concerned that they know little about the data in the lower functional classes and have little control over any databases that do exist for those levels. Thus, if States are supposed to supply data at the local or collector level, this may place a large data collection burden on them to fulfill the requirements.
- Many States are hoping that the new data model recommended by FHWA will only incorporate the functional classes from freeways down to major collectors, at most, and will not include the minor collectors and local streets.
- The state DOT's pointed out that regardless of how smooth the transition for any new information into HPMS, it may take two or three years to get all of the problems worked out and have a high quality information submittal of any new information.
- The quality of the HPMS submittal may continue to vary from state to state. Some state DOT's use the HPMS database as one of their primary data sources within their state while other DOT's only submit the HPMS database to fulfill the requirements of FHWA.
- For any new data, the state DOT's feel they can, at best, provide sample data for the lower functional classes since these roadways tend to fall under other agency jurisdiction. The state DOT's may be able to provide universe data for any new data requirements if the new items are collected on the state-maintained roadway system.

Field Manual

It's clear from feedback from State data providers and data users that the Field Manual needs to be enhanced to provide better data descriptions and more examples. FHWA anticipated that the Field Manual would have to be revised following the Reassessment. The extent to which the manual needs to be revised varies, with some chapters needing only minor editing, while others need to be completely rewritten. A number of States and data users have volunteered to help FHWA revised the Field Manual. Given the lack of research funds, this activity will have to be undertaken entirely by FHWA staff and any States and data users that wish to participate.

Oversight

The revision of the Field Review Guidelines has already been completed, including the training of all the FHWA Division office staff responsible for overseeing HPMS. Initial feedback from the Division Offices' is very positive; many indicate that the new Field Reviews are easier to conduct, while providing more meaningful and consistent reviews. With all Divisions performing essentially the same review, it is anticipated that the new Field Reviews will be helpful in identifying States that would benefit from technical assistance.

Data Validation

A number of validation rules need to be reviewed to ensure that the HPMS Software is using the correct values. The value that the software uses as the upper limit for checking the volume to service flow ratio (v/sf) is an example of one of the rules that will be reviewed. A number of States have indicated that they change their data to resolved v/sf errors, even when they feel that their original data were correct. In other words, they are willing to submit incorrect data if it results in fewer HPMS software validation errors.

The existing data validation routines are quite extensive and will require a great deal of effort to review. It would probably be most effective to review only those routines that are suspect along with those that deal with the more critical data items such as travel, congestion, and pavement quality. The data providers and data users may be asked to participate in this process, but it is anticipated that FHWA and their software contractors will conduct most of the work.

Options/Recommendations

This section has been dynamic throughout the first (outreach) phase of the reassessment and only now, in the final version of the issue paper, is the "how" clearly defined. Initially, this section was based on the suggestions offered by the FHWA data users. In this version, the recommendations offered in this section are based on the combined input from the data users, State data providers, and other interested parties. This feedback has been provided in the regional outreach workshops, issue-specific web seminars, and from comments posted to the Docket web site. Unless otherwise noted, the collection of new and revised data items would be phased in beginning 2008 with all States being in full compliance 2010.

A few of the recommendations voiced by the state DOT's and FHWA are listed below regarding data quality for new data elements and existing data.

New Data Model

State DOT's are hoping that the use of already-existing GIS-based databases from each state will allow for a smoother transition for the new data requirements. The pilot program, which is described in the Data Model issue paper, along with input from a team of State GIS and HPMS staff should help insure that the new data model will not be extensively burdensome for most States.

Field Manual

The guidance to the States in the HPMS Field Manual appears to be the source of some data consistency and quality concerns. The Office of Highway Policy Information will work with the data users and data providers to rewrite the Field Manual as part of the HPMS Reassessment. The revised Field Manual will employ additional, more detailed descriptions and where appropriate, more illustrations. Whenever possible, actual State examples will be incorporated. A team of data users and State data providers will be put together to rewrite the manual. The target completion data for the new Field Manual is December 2007.

Oversight

Each state DOT will continue to work with their District offices and data collection contractors to guarantee that the data is collected correctly and timely and is input properly for submittal. The new risk assessment based HPMS Field Reviews will be conducted by FHWA Division Offices on an annual basis. These reviews will focus less on reviewing actual data and more on the data collection and reporting processes. Staffing and SPR program reviews will also be included in these reviews. The detection of possible program deficiencies will trigger a more in-depth process review. The results of the Field Reviews are to be submitted to the Office of Highway Policy Information by November 1st.

Data Validation

FHWA will continue to improve its validation software to make certain that invalid data does not appear within any field in the database (e.g., a 4 is not coded in a field with valid inputs of 1, 2, or 3). FHWA will also work with users of the HPMS data to determine if/what invalid data may be appearing in the database that is sent to the users.

The role of the validation software should be reviewed, especially in light of the data falsification that appears to be taking place in order to resolve data verification errors. The verification software is intended to improve data quality, but it appears that in some instances it is doing just the opposite. FHWA needs to determine the extent to which this is happening, and if there is anything that can be done at the administrative level to alleviate this. This appears to be as much an education and outreach issue as it is a data validation issue.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

Data quality is unique amoung the issues being addressed in this Reassessment in that all data users and data providers have a vested interest. Listed below is the author of this paper, a representative from the Office within FHWA that uses HPMS most extensively, and the person responsible for overseeing HPMS. These people are good resources for anyone interested in exploring this issue in more detail.

- David Schrank, Texas Transportation Institute
- Dr. Darren Timothy, Office of Legislative & Governmental Affairs
- Champions: David Winter, Office of Highway Policy Information

Process Improvement Background Paper

October, 2006
Prepared by: David Winter, Office of Highway Policy Information

This paper is being prepared in conjunction with several other background and issue papers relating to the HPMS reassessment effort. The background papers differ from the issue papers in that they present crosscutting issues that relate to many or all of the identified issues. This paper will address the current data item(s) and process issues, as well as incorporating the various inputs of internal FHWA stakeholders and users of HPMS data. Note that some of the issues are carryovers from the last HPMS reassessment effort and that many of the data uses are long-standing ones. What follows should be taken as being integral with the general HPMS reassessment framework, vision, mission, objectives, and phases. Each numbered issue will be presented, implications for the HPMS documented, options described, and recommendations made.

Related Data Items

Listed below are the data items related to this issue paper. These items include data that are currently collected in HPMS and are being considered for modification or deletion, along with proposed new data items. Throughout the text of this issue paper you will find that these data items have placed in a "**bold**" font to make it easier for the reader to locate and reference these data items. At the end of this paper is a table that summarizes the data impacts.

- Metadata
- Federal Ownership code
- Toll Facility Identifier

Issue Description

The intention of this section is to define the issue, and to identify the purpose that warrants this issue. In other words, "what" are the data needs and "why" are these data needed. Where possible, the author has tried to identify the customers, both internal and external, and define their individual data needs.

Metadata

The inclusion of **metadata** in the HPMS submittal is gaining support with both data users and data providers. **Metadata** allows State data providers to provide important information on how their data was collected and processed, which allows for the more meaningful reporting and analysis of HPMS data at the national level. For years there has been quite a bit of concern about the variability of IRI data reported by the States in HPMS. Those familiar with these data realized that this variability was due to differences in way each State collects IRI. This past year, approximately half the States included optional IRI **metadata** that described where and how IRI data was collected, and the processes used for reporting these data. This information was

reported in the new HM-66 table in the *2004 Highway Statistics* publication, and has been very well received. Due to the positive feedback, it has been suggested that other data areas be included for the inclusion of required **metadata**. These areas include, but are not limited to, traffic, ITS, and geometrics along with the continued collection of pavement **metadata**.

Federal Ownership Code

There are a number of data fields in HPMS that overlap with other FHWA databases. When practical, FHWA should attempt to ensure consistency between the coding requirements and standards for these data. One example is **Government Ownership**, which is in both HPMS and the National Bridge Inventory (NBI). In HPMS, **Government Ownership** is a one-digit field with eight coding options ranging from "1" to "8." In the NBI, the field is called "Ownership" and is a two digit field with 29 coding options ranging from "01" to "80." Most of the additional options for the coding of Ownership in NBI are for Federal Agencies that own public roads and bridges. By having these fields consistent between the two databases, it would be easier to merge and compare the two databases by ownership. More detailed information on ownership in HPMS, would also make it easier for FHWA to verify the data submitted by the States on Federally owned roads against information provided by the various Federal agencies. In most States there is a discrepancy between the Federally owned mileage reported by the States in HPMS and the mileage reported by the Federal agencies, but since the mileage in HPMS can not be broken down by agency, it is only possible to perform an aggregate comparison of all federally owned roads against the total mileage reported by all Federal agencies.

Toll Facility Identifier

Modifying the **toll facility code** to allow HPMS data to be linked to the Toll Facility Report was suggested following the Reassessment Outreach Workshops and the subsequent webinars; few if any State data providers are aware of this suggestion, as are only a handful of data users. Therefore this suggestion still needs to be vetted with the State data providers and data users.

The toll data collected in HPMS is a universe field coded as a "1" or a zero, depending on whether or not the highway section is a toll facility. Within the Office of Highway Policy information, there is a second set of data on toll facilities that is updated on a biennial basis. These additional toll data are maintained and disseminated in the *Toll Facility Report*, which includes information on the toll facility operator, location description, and annual revenues and expenditures. At this time these two data cannot be easily joined.

A number of data users have expressed an interest in joining these two data sets to allow for more advanced analysis of the economic impacts of toll facilities on highway transportation. Some of the groups within the U.S. DOT that have expressed interest in this are the Office of the Secretary of Transportation (OST), the Office of Legislative & Governmental Affairs, and the Office of Operations.

Issue Implications

This section focuses on the impact on data items, including items being deleted or changed, as well as new data items to be collected. This section also attempts to capture the level of effort involved in both collecting the data, as well as processing the data within FHWA. Where possible, the consequences of not fulfilling the issue's data needs have also been captured.

Metadata

Both data customers and data providers agree that providing **metadata** is needed. The data providers are obviously concerned about the level of effort, which should not be too great. A disaggregated approach offers the potential for greater data documentation and accountability, since the group within the State directly responsible for data collection, would also be the ones providing the data submittal and appropriate documentation.

Federal Ownership Code

There are a number of problems that have been raised by States concerning the determination of roadway **ownership**. Some States have indicated that it is difficult to determine who owns a road, especially in the case where the road is owned by a Federal agency, but maintained by either the State or a local government. Military garrisons present a problem for most States, since usually the State's inventory personnel are not allowed on the garrison. Finally, since disaggregated Federal **ownership** was dropped in a previous HPMS reassessment, it may be difficult to add it again to HPMS; many States have indicated that they no longer track this information.

Toll Facility Identifier

The easiest way to link HPMS with the *Toll Facility Report* is through the creation of a common data item that would take the place of the "1" in the toll facility field in HPMS and would also be added to the *Toll Facility Report*. This data item would be similar to the State and County _____ (FIPS) codes that are currently used to identify State and County in HPMS. This would require States to code the **toll facility code** in accordance with the *Toll Facility Report*. Since this idea has not yet been presented to the State data providers, the level of effort is not clear, although it would likely require some effort to populate HPMS, but after that, only minimal effort. Developing the **toll facility codes** would be done by FHWA, and would require minimal effort.

The coding of toll bridges, ferries, and multi-state toll facilities will present a challenge for FHWA and the States. FHWA will work with the data model pilot States and other data providers to develop rules for coding these toll facilities.

Options/Recommendations

This section has been dynamic throughout the first (outreach) phase of the reassessment and only now, in the final version of the issue paper, is the "how" clearly defined. Initially, this section was based on the suggestions offered by the FHWA data users. In this version, the recommendations offered in this section are based on the combined input from the data users, State data providers, and other interested parties. This feedback has been provided in the regional outreach workshops, issue-specific web seminars, and from comments posted to the Docket web site. Unless otherwise noted, the collection of new and revised data items would be phased in beginning 2008 with all States being in full compliance 2010.

Metadata

The pavement **metadata** that are being proposed describe the processes used for collecting and reporting the **IRI** data. These data would need to be expanded if additional pavement data items are added to HPMS. Also, if the **IRI** requirements are changed, some of these data items could be eliminated. It has been proposed that the following data items be optional with the submittal of the 2006 HPMS data in June 2007 and required for the data reported in 2008 and beyond:

- Type of vehicle (sonar, multi-laser, scanning laser, other)
- Inclusion of structures
- Inclusion of railroad crossings
- Measurement wheel path
- Measurement lane
- **IRI** simulation (half-car, quarter-car, other)
- Adherence to provisional standard AASHTO PP37-04 (yes, no, partially)

Like the pavement **metadata**, the reporting of traffic **metadata** would also be optional in 2007 and required in 2008 and beyond. These data primarily look at compliance of the State's traffic data collection processes with those outlined in the *Traffic Monitoring Guide* (TMG) and the *Traffic Management Systems for Highways* (TMS/H) guidance produced by FHWA.

- Current years data – all sections updated
- Traffic program meets TMS/H requirements
- Use of short-term counts (< 48 hrs.)
- All sample sections counted at least once every three years
- Process in place to verify data, including local data where used

Federal Ownership Code

Finally, it is being proposed that the **Governmental Ownership** code be changed to match the coding of Ownership in the NBI. **Governmental Ownership** would be changed from a one to two digit field with the following coding options:

01 – State Highway Agency	63 – Bureau of Fish and Wildlife
02 – County Highway Agency	64 – U.S. Forest Service
03 – Town or Township Highway Agency	66 – National Park Service
04 – City or Municipal Highway Agency	67 – Tennessee Valley Authority
11 – State Park, Forest, or Reservation Agency	68 – Bureau of Land Management
12 – Local Park, Forest, or Reservation Agency	69 – Bureau of Reclamation
21 – Other State Agency	70 – Corps of Engineers (Civilian)
25 – Other Local Agency	71 – Corps of Engineers (Military)
26 – Private (other than railroad)	72 – Air Force
27 - Railroad	73 – Navy/Marines
31 – State Toll Authority	74 – Army
32 – Local Toll Authority	75 – NASA
60 – Other Federal Agency (not listed below)	76 – Metropolitan Washington Airports Service
61 – Indian Tribal Government	80 – Unknown
62 – Bureau of Indian Affairs	

Toll Facility Identifier

The FHWA Office of Highway Policy Information will develop the **toll facility codes** as part of developing the new data model, and published in the 2007 *Toll Facility Report*. Data on toll facilities are proposed to be collected in a separate table in HPMS as outlined in the new data model. Each toll facility will be represented as single record with a beginning and ending LRS, and the **toll facility code**.

Resources

This section will provide a link or connection to the program office(s) that have a vested need with this issue. Where possible, a contact person will be identified

- David Winter, Office of Highway Policy Information, FHWA
- Thomas Roff, Office of Highway Policy Information, FHWA

Summary of Data Impacts

Data Item	Add/Delete/Change	Area	Universe	Sample	C&P/HERS	Apportionment	Performance Measure	Other	Rural - Int	Rural - OPA	Rural - MA	Rural - Maj Coll	Rural - Min Coll	Rural - Local	Rural - NHS	Urban - Int	Urban - OFE	Urban - OPA	Urban - MA	Urban - Coll	Urban - Local	Urban - NHS
Pavement Metadata	A		X	X	X		X	X	X	X	X	X			X	X	X	X	X	X		X
Traffic Metadata	A		X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X		X
Government Ownership	C		X	X	X				X	X	X	X			X	X	X	X	X	X		X
Toll Facility Identifier	A		X	X	X			X	X	X	X	X			X	X	X	X	X	X		X