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STRATEGIC REASSESSMENT OF THE HIGHWAY PERFORMANCE MONITORING SYSTEM

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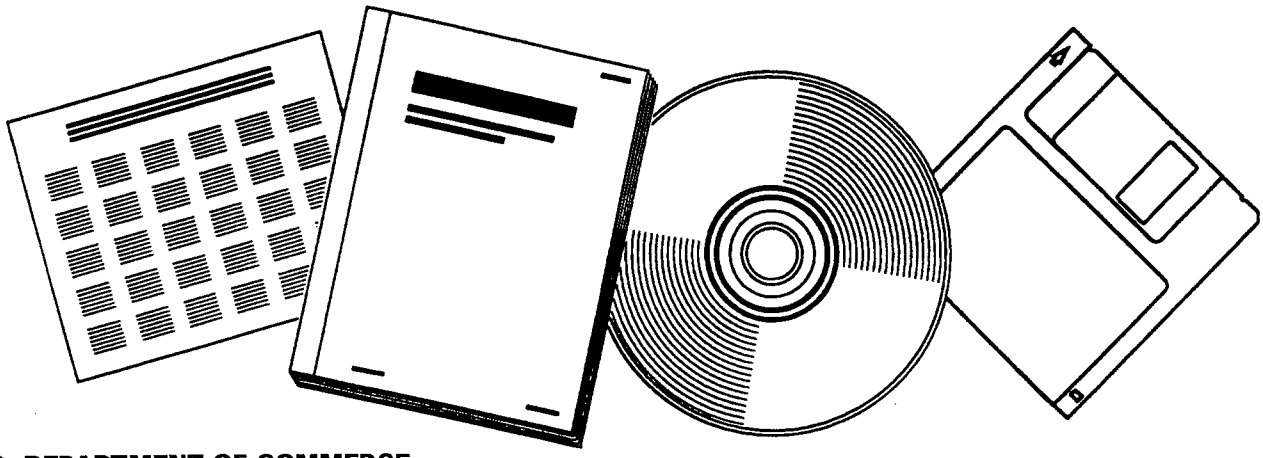

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

Strategic Reassessment of the Highway Performance Monitoring System

Phase I Final Report

Department of Transportation
Federal Highway Administration (FHWA)
Office of Highway Information Management
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FORWARD

This report documents the results of a Federal Highway Administration (FHWA) study of the agency's Highway Performance Monitoring System (HPMS). The purpose of this study was to assist FHWA in conducting a comprehensive review of the HPMS, designed to result in recommendations as to the future form and direction that this major FHWA data system should take. The study report represents a culmination of several serial activities including the identification and assessment of the impacts of the HPMS on FHWA, its State and other governmental partners, and the many and varied HPMS customers; the results of an extensive outreach program that was capped by a national HPMS workshop held in June 1997; and the subsequent assimilation of these inputs into a set of recommendations to the FHWA.

FHWA welcomes comments on this report. These comments will be useful in guiding the FHWA decision process that will be undertaken in the next phases of this project.

All signed, written comments should refer to **FHWA Docket Number 97-10**, and should be sent to:

Office of the Chief Counsel
HCC-10, Room 4232
400 Seventh Street, SW
Washington, DC 20590

All comments received will be available for examination at the above address from 8:30 a.m. to 3:30 p.m., EST, Monday through Friday, except Federal holidays. Those desiring notification of receipt of comments must include a self-addressed, stamped postcard or envelope.

Although the docket will remain open until the reassessment is complete, comments should be submitted on or before January 31, 1998, in order for comments on this report to be fully considered in the next phase of the reassessment.

Gary E. Maring
Director, Office of Highway Information Management
Federal Highway Administration

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INTRODUCTION

The Federal Highway Administration (FHWA) is conducting a strategic reassessment of the Highway Performance Monitoring System (HPMS). The purpose of the reassessment is to review HPMS in light of current issues, anticipate future needs, and determine what changes may be beneficial.

HPMS was developed in 1978 as FHWA's national highway transportation system data base. It presently includes limited data on:

- all public roads,
- more detailed data for a sample of the arterial and collector functional systems, and
- areawide summary information for urbanized, small urban, and rural areas.

HPMS replaced numerous, uncoordinated, annual State data reports as well as biennial special studies conducted by each State. A major purpose of HPMS was (and still is) to provide data that reflects the extent, condition, performance, use, and operating characteristics of the Nation's highways. HPMS has gone through an evolutionary process that has recognized the changing needs for data related to these objectives.

This review includes the identification and assessment of critical issues that impact the implementation of HPMS by FHWA and its State partners. The review also includes an extensive public outreach program. The outreach program is intended to provide maximum opportunity for participation in the strategic reassessment.

The reauthorization of the Intermodal Surface Transportation Efficiency Act (ISTEA) provides an excellent opportunity for FHWA to reassess HPMS. There are many other pressing reasons for this review:

- changing technology, including the development and deployment of the Intelligent Transportation System (ITS),
- evolving requirements of the Government Performance and Results Act (GPRA), and
- changing State and local data needs, including the increased use of management systems.

OBJECTIVES OF THE REASSESSMENT

- Conduct a comprehensive analysis of HPMS and its mission
- Make HPMS a more efficient and user-friendly system
- Examine more cost-effective methods for collecting data, including new technologies such as ITS
- Examine ways to create or enhance data partnerships with State, regional, and local governments as well as the private sector and other data source entities
- Consider the emerging needs of GPRA
- Ensure that HPMS is the definitive Federal source of information on roadway extent, characteristics and performance
- Conduct a fully participatory review
- Review current data entries and consolidate or remove those items which are of marginal use

PURPOSE OF THIS REPORT AND THE OUTSIDE CONSULTANT EFFORT

The Federal Highway Administration has developed a multi-faceted approach to this reassessment. The process began in conjunction with the HPMS Steering Committee, which is comprised of Federal, State, and local officials who have met several times in the past two years to identify critical issues for review. The notion of a comprehensive reassessment originated in conjunction with the Steering Committee. In addition to the strategic reassessment, the committee has been addressing several technical issues associated with HPMS, including:

- guidance on the proper use of HPMS data
- travel estimating and forecasting
- HPMS training
- measurement of congestion
- short-term refinements

With input from the Steering Committee, FHWA produced an options paper which was published in the Federal Register in December 1996. Comments are being received to FHWA Docket 97-10, which is still open.

In the reassessment process, a consultant was hired to assist FHWA. An ***initial*** report was produced by the consultant. The report examined the critical issues involved in the reassessment from the viewpoints of users and providers of data. It identified issues which required additional discussion and analysis.

The report was made available for comments and was used as input to a national workshop on HPMS held June 29-July 1, 1997, in Minneapolis. Following the workshop, the consultant evaluated the results, conducted further analysis and prepared this Phase I Final Report, which adds a synthesis of the reassessment process to date and contains a set of recommendations to FHWA for its review and possible response to the initial report.

PROCESS USED TO PREPARE THIS REPORT

Since one of the objectives of this reassessment was to allow for full participation of affected and interested users of HPMS, the process of compiling information for this report relied on a number of outreach efforts. In addition to reviewing the work of the HPMS Steering Committee and other written documentation on HPMS, the following outreach efforts were conducted:

- presentation before TRB data committees
- meeting with Washington-based organizations involved in transportation, with a follow-up survey form mailed to 32 organizations
- interviews with over 21 Federal employees who are customers of HPMS data or involved in Federal data and policy analysis activities
- assistance with an AASHTO survey of all States
- presentations to the Association of Metropolitan Planning Organizations (AMPO) and assistance with an AMPO survey of the larger member MPOs
- examination of HPMS reassessment as a current transportation issue at the TRB Conference on Information Needs to Support State and Local Transportation Decision Making into the 21st Century, March 2-5, 1997
- review of the responses to FHWA Docket 97-10
- several presentations at AASHTO Standing Committee on Planning meetings, NASTO, and North Atlantic Transportation Planning Officials (NATPO)
- a national workshop on HPMS (June 29-July 1, 1997)

Additional outreach activities will be conducted as the reassessment process continues to its conclusion.

ORGANIZATION OF REPORT

This final report is organized in two parts. **PART I** is the **EXECUTIVE REPORT**, which is made up of two sections.

⇒ **Section 1** describes key factors which are common to all areas of the reassessment and background for any recommendations of possible change.

⇒ **Section 2** presents the conclusions of the outreach effort and contains a set of recommendations to FHWA based on the reassessment process to date. The recommendations draw heavily on the results of the HPMS workshop and the Steering Committee meeting held following the workshop. While there were considerable discussion and input, the recommendations at this time are those of the consultant unless specifically noted otherwise.

PART II is the **TECHNICAL REPORT**, which documents the results of the outreach effort and the discussions at the workshop and Steering Committee meeting. The technical report has six sections.

⇒ **Section 1** examines the mission of HPMS and the responses to a proposed set of objectives from the various users and providers of HPMS data. A mission statement and set of objectives is established for use in the reassessment.

⇒ **Section 2** examines HPMS user viewpoints and uses from the Federal and national perspectives.

⇒ **Section 3** examines HPMS user viewpoints and uses from State perspectives.

⇒ **Section 4** examines HPMS user viewpoints and uses from regional and local perspectives.

⇒ **Section 5** examines the role of new technologies in HPMS.

⇒ **Section 6** provides a summary of the critical issues of reassessment. This section was used for discussion at the Minneapolis workshop in late June, 1997; further review through the FHWA Docket 97-10; and additional analysis during the remainder of this project.

This paper will not deal with specific data items for reduction. Many respondents to this process, especially States responsible for data collection, have commented on a number of items under consideration for data reduction. These items are being tabulated and will be assessed once the objectives, scope, and structure of the future HPMS have been decided. At the workshop and, more specifically, at the Steering Committee meeting, the process for reviewing individual data items was discussed. A process was agreed upon for this review, which incorporates: the mission and objectives of HPMS; a set of data objectives; and a process to review the need, format and statistical significance of each item. Appendix A contains a more detailed description of the data item review process.

There are several opportunities currently available for data reduction if the current format continues. However, several comments addressed the need for additional data, indicating that HPMS only measures a portion of congestion and is just one indicator of pavement condition. Tradeoffs in data items collected and methods of collection will also be reviewed.

This report does not deal with the issue of making HPMS a "world class" highway data and performance measurement system. There are a number of activities underway to look at practices with similar systems in other countries. These activities will be monitored and evaluated in subsequent stages of the reassessment.

The report also does not deal with the issue of using private data sources (data collected and processed by private companies for commercial purposes) as a means of supplementing HPMS. Additional information and viewpoints on this issue would be welcome for the next phase of the process.

The report was compiled from a variety of sources, including several surveys. The summarization of the survey results and the conclusions drawn from the surveys are subject to individual interpretation and, in some cases, are subjective. Therefore, the conclusions and recommendations presented in this report are solely those of the consultant and do not necessarily represent the views of the Federal government, States, MPOs, or any other group, unless specifically cited in the report. The conclusions and recommendations are put forth to FHWA for its consideration.

PART I
EXECUTIVE REPORT

SECTION 1: KEY FACTORS AFFECTING THE REASSESSMENT

A number of key factors emerged from review of the various efforts previously described. These factors, which affect the entire reassessment, are presented here so they will be considered when reading all the other sections of the report.

A. HPMS has an excellent reputation in the transportation and governmental field

While many issues were raised in the outreach portion of the reassessment, the overwhelming response to HPMS has been positive. It is viewed as an integral part of the national transportation data base and a premier system for government performance measurement. A study conducted by the U.S. Advisory Commission on Intergovernmental Relations, *Intergovernmental Accountability*, reviews 13 Federal agencies and applauds the scope of the USDOT's performance monitoring system for highways. In fact, many of interviewees who praised FHWA for its open approach to the reassessment were concerned that the system would be changed or diminished. The issues of change and refinement that this report will address are built upon a system which already has strong support.

B. Reassessment is occurring at a time of major transition in transportation and HPMS

The fact that the reauthorization of ISTEA is occurring at the same time as the strategic reassessment is both an opportunity and a challenge. It is an opportunity because the reassessment process will be essentially completed when the reauthorization is scheduled to be completed. FHWA can quickly adapt HPMS to new Federal legislation, if necessary. Timing is also a challenge since agencies and organizations are focusing on the larger question of reauthorization rather than on details of data systems.

HPMS is undergoing a transition from a mainframe-based system to a personal computer (PC) environment, and the use of the Internet and geographic information systems (GIS) are in their infancy. A new operating environment and increased ease of data sharing may help resolve some of the issues raised.

C. HPMS is a subset of the National Highway Data System

Figure 1 (Appendix A) illustrates the role of HPMS data in the total highway data set. A review of the two major Federal highway reports–*Highway Statistics* and *Status of the Nation's Surface Transportation System: Condition and Performance*–shows that all the various data sets are used. Therefore, the review of HPMS must address compatibility with other data sets when presenting issues dealing with the National Highway data base.

D. The highway data set is a subset of a larger transportation data set

While this report deals only with HPMS, several people interviewed for this study have commented on the need to have similar systems for other modes. They stressed the importance of looking at intermodal and multi-modal issues, which are consistent with the intent of ISTEA. Issues affecting multi-State corridors, international trade, and intermodal connections on the NHS were mentioned as policy issues being studied without an adequate data base. The TRB panel which produced the report, *Data for Decisions*, has recommendations for dealing with these issues which are still outstanding. The report led to the creation of the Bureau of Transportation Statistics and should be reviewed when considering intermodal and multi-modal issues. The Federal Transit Administration is currently in the process of developing the transit equivalent of HPMS.

E. HPMS is both a data set and an analytical process

The *Conditions and Performance Report* relies on HPMS and other highway data as well as an analytical process which assesses performance under different funding scenarios. The tendency in a reassessment of this nature is to focus on the data aspect of the review and not on the products of the process. This report attempts to do both and comments are welcome on both aspects of HPMS.

F. A distinction should be made between the Federal use of HPMS data and the national highway data base

One of the key issues in the reassessment is the distinction between the use of HPMS data for Federal policy and planning purposes, and the obligation of the Federal government to provide a national highway data base for a variety of public and private uses. These can be two distinctly different data bases in scale and geographic coverage.

G. The HPMS data base should continue to be supplemented with additional external data to better measure condition and performance

Many data items are collected in a uniform manner through the State departments of transportation and are reported to FHWA to form the HPMS data base. This data base is publicly available and is part of the National Highway Data base. There are other data which cannot be collected uniformly from all States cost-effectively and with consistent quality, but which can be, and are, used to improve the knowledge and measurement of conditions and performance. Derived from management systems, special studies, partial implementation of operating systems such as ITS, and other techniques, such external data are a useful supplement to HPMS data and add information and accuracy to the measurement of condition and performance.

H. HPMS serves many purposes at the Federal level, including many which were not originally envisioned when HPMS was established

Federal officials interviewed for this study cited numerous instances where HPMS was used to answer questions from DOT executives, Congress, and other outside inquiries because it was the only analytical process available. They cited the limitations on the data and analysis process, and the number of assumptions that were made to complete the analysis. A statement made in an interview summarizes the Federal user view of HPMS:

> ***"The HPMS data set is too robust for its original purposes and not nearly robust enough for the current requests for data and analysis."***

One of the issues for the reassessment is to strike the proper balance between maintaining: a very large, continuous data set which can deal with current and anticipated future issues; and a smaller continuous data set which meets the current objectives, but which can't deal with every issue.

I. The collection of HPMS data will always be an intergovernmental activity

Continuing the traditional Federal-State relationship in the highway program, FHWA relies on State governments to collect HPMS data. Three categories are used in collecting data on the highway system:

- **functional system**
- **NHS and other Federal-aid highway systems**
- **jurisdiction of the facility**

Many States maintain a complete inventory of the State highway system within their operating jurisdiction but do not maintain records on other agencies' highway systems. State highway systems vary greatly among the States. In rural areas, the range of State responsibility for rural highways is from a low of 7.7 percent of highway length accommodating 50 percent of daily travel to a high of 96 percent of highway length covering 99.5 percent of travel. Four States have over 90 percent of the length under State jurisdiction while 10 States have less than 10 percent. Similar statistics occur in urban areas. Nineteen States have less than 10 percent of urban length, with a low of 4 percent handling 28.8 percent of travel. Six States have over 40 percent of the urban length, with a high of 78 percent handling 93 percent of travel. The degree of intergovernmental data collection is greater for the States with smaller State jurisdictional systems.

The alignment of State and local jurisdiction with the functional classification of highways is not along jurisdictional lines. For example, States have jurisdictional responsibility for about 150,000 miles of roads functionally classified as local. Similarly, local governments have jurisdictional responsibility for some principal arterials. Furthermore, the alignment of jurisdiction with Federal-aid highways is not consistent.

Limiting HPMS to the National Highway System (NHS), which was one of the options presented in the FHWA options paper, would still require data collection on county, city, town and independent toll and bridge agency facilities which are included in NHS. Likewise, the data collection efforts to support the National Highway Planning Network (NHPN) would require additional intergovernmental data collection (see Figure 2, Appendix A). The collection of data and the possible sharing of data across intergovernmental lines is implied in all the various options for restructuring HPMS.

J. The implications of the Government Performance and Results Act on HPMS will not be known for some time

GPRA requires each Federal agency to:

- develop strategic plans prior to Federal fiscal year (ffy)1998
- prepare annual plans setting performance goals beginning with ffy 1999
- report annually on actual performance compared to goals starting in March 2000

FHWA is having discussions with AASHTO and other partners and customers on its strategic planning and on the appropriate role of national performance measures vis-à-vis the States, the use of HPMS to meet the requirements, and many other challenging issues. These discussions will be continuing after this report is prepared.

K. The timeliness of data collection and presentation and the timing of any changes to HPMS are critical parts of the reassessment

Figure 3 (Appendix A) presents an illustration of the time cycles involved in the HPMS process. The cycle for the HPMS process is a rolling 3½-year cycle from consideration of instructions to publication of the *Conditions and Performance Report*. During this time period, 3 years of data are in various stages of collection and analysis. Several points emerge for the purposes of this report. Under current cycles, any changes to HPMS resulting from this reassessment could be reflected in the 1998 instructions for the 1999 data collection. This would be reported in the 2000 version of *Highway Statistics* and the 2001 *Conditions and Performance Report*. Advances in data collection, data transmission, and analysis techniques present opportunities to possibly tighten the cycle times shown in Figure 3.

L. One of the most important indicators for policy makers is consistent time series data which show trends

Interviewees stressed the need to preserve time series data if changes are made to HPMS. The implications of this concern are that either:

- a duplicate set of data would need to be collected until a new time series relationship is established; or
- the old time series data can be replicated or related to the new data and measures.

M. Data collected in HPMS is necessary to support decision making

At the HPMS workshop, it was stressed that the primary criteria for reviewing the various data items was to determine if they support decision making by the various levels of government.

N. There is a large sunk cost in the current HPMS data collection system – changes should recognize cost implications

The current HPMS system was established over a number of years. For some data collection agencies, the cost and labor requirements to maintain and periodically update the data set have become manageable. There is fear that large scale changes to HPMS will, in fact, create more work. This is particularly important in creating new sample sections, which is very costly compared to updating information on existing sample sections.

O. A theoretical framework and principles for intergovernmental data collection and sharing can be proposed as a guide

There are several data collection principles and trends which were discussed at the recent *State and Local Data Needs Conference* and can be incorporated into a theoretical data framework for HPMS (see Figure 2, Appendix A):

- State and local agencies are reducing staffing levels; in particular, staffing for planning and data collection are at risk. Reduced staffing leads to concerns about the quality of the data collected. Data collection agencies are unanimous in their concern for limiting the data collected to the minimum essential for the objectives which will, in turn, assist in improving data quality.

- With reduced staffing, agencies must minimize the collection of data which is not of use to their own mission. Data, therefore, ideally should be collected at the level consistent with the use of that data; e.g., to control the quality of the data collected, it should be collected by an agency which has use for the data and is affected by the outcomes of its use.

- There is a move toward democratization and increased accessibility of data through the Internet and other media. Standardization of data definitions and quality, plus reduction of subjective data items, may limit the improper or deliberate misuse of data.

- Data partnerships, sharing, and warehousing arrangements should be explicit objectives of any data collection and analysis process.

- Resulting performance measures which are consistent with State and local objectives, but also share elements of common national goals, can be shared upward.

- Figure 2 (Appendix A) illustrates the relative distribution of highway mileage by jurisdiction and functional system. This could be used to build a theoretical reporting framework in which data is collected and shared upward from the lowest level consistent with the first instance need for that data. Tools to facilitate this upward sharing could include data partnerships and a common data geo-referencing system. The current HPMS is a long way from using such a theoretical reporting framework. One consideration of this reassessment, however, should be whether the collection of HPMS data can be modified through data partnerships or other data sharing mechanisms, and FHWA's LRS or other reference system to meet some of the objectives of such a reporting framework. Several respondents have suggested developing prototypes for effecting such a change to the HPMS.

SECTION 2: CONCLUSIONS AND RECOMMENDATIONS

From the outreach and research accomplished to date in the reassessment, there are a number of conclusions which can be drawn:

- HPMS has wide acceptance as the highway performance monitoring system for a variety of Federal policy and planning purposes and is a key component of the national highway data base.

- The goals and objectives for HPMS are generally accepted and supported by the various State and local agencies who collect data for input to HPMS.

- HPMS is not always well integrated into State and local planning processes. In many cases, the collection of HPMS data is regarded as a separate activity to fulfill Federal requirements; the full potential of HPMS as a State and local planning tool is not well understood and/or not being utilized. This is as much an institutional issue as a technical one.

- In many cases, regional and local planning and transportation agencies are not brought into the HPMS process; this can result in duplicate data collection activities.

- There is widespread concern for the cost and commitment of time for collecting HPMS data given constrained resources at the State and local level. There are concerns regarding the quality of the data collected, especially data off the State highway system. The need for standardization of data collection is becoming more important as data collection resources diminish.

- As data becomes more easily available to outside users because of the Internet and other technology advances, there is increased concern for the accuracy, quality, and standardization of data to minimize the misuse of the data base.

- There is not a uniform understanding of the HPMS data set and the analytical capability of HPMS in the different offices in USDOT, States, and local governments.

- The collection of HPMS data will always be an intergovernmental effort given the diffusion of jurisdictional responsibility between State and local governments in most States. There are some examples of integrated data collection and data sharing partnerships.

- The national analysis of highway conditions and performance is widely used, but there are some concerns about the scope and content of the analysis. This is discussed in more detail in Part II.

- Many data collection agencies are employing advanced technologies for the collection of HPMS data, but there does not appear to be a good way for the various agencies to share information and experiences with new techniques and equipment.

The following summarizes the issues discussed throughout the reassessment process and presents a series of recommendations for FHWA to review and consider. This section is organized around four basic aspects of HPMS:

WHY	The mission and objectives of HPMS
WHAT	The content, scope, and format of HPMS
HOW	How HPMS data should be collected and how FHWA should handle such issues as quality, new technology, partnerships, data sharing, and standards
FUTURE	Identify trends in data systems and examine how HPMS can prepare for the future

A. WHY

1. ISSUE – What are the mission and objectives of HPMS?

DISCUSSION ⇨
A mission statement and a set of objectives were proposed for comment. Based on survey results and discussions at the workshop, a revised mission statement and six objectives have been developed and accepted by the HPMS Steering Committee.

RECOMMENDATION ⇨
The revised mission and six objectives should be accepted by FHWA for the purposes of the HPMS reassessment and should be used to review any proposed changes to HPMS in the future. The mission and objectives should be reviewed periodically, especially after major Federal legislation affecting transportation.

MISSION It is the Mission of the Highway Performance Monitoring System, as an integral part of the National Highway Data Base and a component of the National Transportation Data Base, to provide a data base and analysis process for assessing and reporting the condition and performance of the Nation's highway system in the most cost-effective manner consistent with the following objectives:

Objective 1: Meet FHWA's highway stewardship responsibilities, including preserving the national interest in the NHS.

Objective 2: Support Federal transportation policy analysis and planning activities.

Objective 3: Meet the various congressional requirements, including the *Conditions and Performance Report.*

Objective 4: Provide a publicly accessible, consistently high quality, objective and timely national highway data base.

Objective 5: Provide, at the State and local government option, an HPMS data base, an analytical process, and FHWA technical support which meets the needs of State, regional, and local agencies.

Objective 6: Evolve HPMS 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.

2. ISSUE – What are the criteria for including data items in the national HPMS data base (see Objective 4)?

DISCUSSION ⇨
The report makes the distinction between data which can be collected on a consistent, high quality and timely basis by all States and external data which can be collected from a variety of sources to achieve a better understanding of condition and performance but which cannot be collected in a cost-effective manner on a consistent, high quality and timely basis.

RECOMMENDATION ⇨
The decision process for reviewing data items (Appendix B) should be used when any new data is being considered for HPMS.

3. ISSUE – How can HPMS include better and more comprehensive information on pavement condition and congestion?

DISCUSSION ⇨
The review of HPMS with the various users and stakeholders created a consensus view that the *Conditions and Performance Report* should include a more comprehensive analysis of pavement condition and congestion using external data sources and that in the long-term additional data should be considered for addition to the HPMS data base if the necessary criteria are met.

RECOMMENDATION ⇨
External sources should be evaluated for additional information on pavement condition and congestion. The report lists several sources and possibilities for pavement condition, including State pavement management systems, new AASHTO pavement protocols, and greater use of SHRP pavement monitoring programs. Regarding congestion, the Steering Committee is currently reviewing several possibilities which would be consistent with the recent studies on developing new definitions of and parameters for congestion. It is recommended that FHWA conduct the necessary studies to incorporate ITS data for planning purposes and for HPMS measurement of condition and performance.

4. ISSUE – How do changes to the HPMS data base affect other highway data bases?

DISCUSSION ⇨
HPMS is a subset of a larger highway data base and there are linkages between the various data bases. These linkages are important for many of the analyses performed on the highway system and for several of the traditional data tables in *Highway Statistics*.

RECOMMENDATION ⇨
FHWA should review the linkages between the various highway data systems (see Figure 1), prepare documentation on the entire highway data base, and evaluate the impact of any proposed changes to one subset of the larger highway data base. FHWA should consider developing a centralized clearance process to approve changes only after the larger impact is reviewed.

B. WHAT

1. ISSUE – What should be the scope of HPMS?

DISCUSSION ⇨
The FHWA options paper outlined several options for changing the scope of HPMS. This issue was discussed in depth at the workshop and Steering Committee meeting and a consensus was developed.

RECOMMENDATION ⇨
The current scope of HPMS, which includes information on all functional systems, should be retained.

2. ISSUE – Which data items should be included in the HPMS data base, in what format (section-by-section versus aggregate), and at what level of statistical significance?

DISCUSSION ⇨
At the workshop and Steering Committee meeting, a data item review process was developed to accomplish the review of individual data items. This review is currently underway with FHWA personnel and the consultant. When completed, the results will be reviewed with the Steering Committee and FHWA management and will be presented for public comment.

RECOMMENDATION ⇨
The data review process should be completed and modifications to the HPMS Manual should be prepared after public review. The cost implications of the revised data base should be quantified. The data review process should be used in the future to review any new data requests for HPMS.

3. ISSUE – FHWA and the States can reduce the cost of HPMS significantly without hurting the accuracy of the HPMS data.

DISCUSSION ⇨
FHWA reported at the workshop that the number of samples required for State level statistical significance could be reduced from 123,000 current samples to 80,000 samples. This reduction represents a significant cost savings to both States and the Federal Government. In addition, States have been allowed to send in data in excess of the minimum amount required to meet HPMS requirements. This additional data is processed by the Federal Government and is used in the HPMS data base.

RECOMMENDATION ⇨
Following the resolution of the data item review (see recommendation B2), each State should reanalyze the current sample selection using FHWA sample adequacy software to eliminate extra samples that are not used for HPMS State or local purposes. FHWA should discuss with the Steering Committee the pros and cons of having each State uniformly report only the minimum information necessary for Federal analytical and data base purposes. Each State should decide how much additional information should be collected in the HPMS format and kept for State and local uses.

4. ISSUE – Is the current relationship between HPMS and the Clean Air Act (CAA) understood and working?

DISCUSSION ⇨
The results of the surveys revealed that there was not a universal understanding or use of HPMS data for Clean Air Act purposes. This issue was discussed at the workshop. Complicating the issue is a new set of Clean Air Act regulations which may be implemented in the future. The consensus was to deal with clarifying the current regulations, thus creating a base for implementing any future regulations.

RECOMMENDATION ⇨
FHWA and EPA should work to clarify the administrative processes and issues dealing with the use of HPMS for CAA purposes. The HPMS Field Manual should be revised to include clearer reporting instructions.

5. ISSUE – Several concerns were raised about the content of the policy analysis in the *Conditions and Performance Report.*

DISCUSSION ⇨
In the responses to the surveys and in discussions with national organizations, several issues were raised about the analysis and content of the biennial *Conditions and Performance Report.* While there was not time at the workshop to discuss these issues in any depth, there are a number of issues which need further review.

RECOMMENDATION ⇨
FHWA should review the issues raised in this report regarding the biennial *Conditions and Performance Report,* including:

- reporting of condition and performance from a user perspective;
- additional impacts of alternative funding scenarios;
- reduction of HPMS derived needs outside the HPMS process;
- presentation and comparison of conditions and performance of highway systems under the various jurisdictions (State, county, city, other local); and
- the effect of inflation on conditions and performance.

The results of the review should be incorporated in the 1999 *Conditions and Performance Report.*

C. HOW

1. ISSUE – How should the new Objective 6, which concerns data partnerships and data sharing, be implemented?

DISCUSSION ⇨
Responses to the surveys, especially responses from MPOs and subsequent discussion at the workshop, dealt with the issue of creating data partnerships and data sharing arrangements. Several criteria were suggested which could be used to judge the feasibility of such arrangements, including:

- Will the arrangement improve data quality?
- Will it reduce redundancy of data collection?
- Will it promote multiple use of the same data?
- Is the agency capable of collecting data of high quality on a timely basis?

A number of different approaches were discussed at the workshop, including presentations by Pennsylvania and Michigan.

RECOMMENDATION ⇨
FHWA, in conjunction with AASHTO and AMPO, should sponsor an NCHRP synthesis of current practices in data partnerships and data sharing to establish a set of best practices, examples, and arrangements currently existing. The history of the arrangements should be documented, as should the benefits to the parties involved in the partnerships. Following the synthesis, the parties should consider establishing several pilot studies to test the results of the synthesis. FHWA should also review the development of Unified Planning Work Programs (UPWP) between the States and the MPOs and consider requiring a review of the various data collection requirements, including those of HPMS, so that Federal funds are not used to collect the same data more than once.

2. ISSUE – In reviewing the opportunities for data partnerships, should the States and local agencies conduct a reassessment of their approach to HPMS?

DISCUSSION ⇨
Responses to the surveys and discussions at the workshop revealed several points which would suggest that a State-by-State reassessment may be appropriate. Several States reported that HPMS is not in the mainstream of their planning process and is basically an ad hoc activity to satisfy Federal requirements. The full potential of the HPMS data base and the analytical process is not well understood at all levels of State agencies and within regional and local agencies. Several States have developed arrangements to share data on a multi-State basis.

RECOMMENDATION ⇨
After completion of the data item review and a recommendation by FHWA on any revisions to the current HPMS, it is recommended that FHWA encourage and offer technical assistance to States to undertake a five-part reassessment of HPMS at the State and local level, which would include:

- Examination of all highway data collection and analysis activities within the State agency to consider the role and use of HPMS data and the analytical process. This activity should be coordinated by top management so there is a uniform understanding of the potential of HPMS within the entire organization and opportunities to share data and information are fully explored.

- Examination of opportunities to collect and share HPMS data with other agencies at the State level, including other State agencies with jurisdictional responsibilities for highways (such as toll authorities and parkways), motor vehicle agencies, State police, environmental agencies, and others involved in transportation.

- Examination of the opportunities for multi-State cooperation at the borders with other States and in the distribution of the data collection responsibility among several States. At the workshop, the New England States reported an interesting new approach to sharing data collection responsibilities.

- Examination of the opportunities for data partnerships with the various MPOs, including a joint review of the UPWP and the State data collection activities, to avoid duplication. The existing sample sections and the selection of any new sample sections should be reviewed and coordinated with the MPO so that the sample information can have multiple uses.

- Examination of the opportunities for data partnerships with local governments.

3. ISSUE – How can the quality of HPMS data be improved?

DISCUSSION ⇨

The results of the surveys and the workshop showed a serious concern for the quality of the HPMS on a uniform basis across all States. The discussion included the need for new standards, better monitoring of quality, fewer data items, and better data collection instructions. Developing new data standards was not deemed necessary, but several steps were recommended. Several participants suggested that the use of Metadata standards (which explain the quality of the data collected and the collection methods) could help improve the user's understanding of the HPMS data quality.

RECOMMENDATION ⇨

FHWA should provide direction from top management to the field offices to review their approach to implementing the HPMS data quality assurance process and to place additional emphasis on working with the States to ensure high quality data to meet the HPMS objectives. FHWA should also review the definitions of the data items in the field manual and encourage the creation of regional forums of HPMS data providers, similar to the annual meeting in FHWA Region 1, to improve understanding, quality, and data sharing. FHWA should investigate the implications and possible application of Metadata standards to the HPMS and report the results of this analysis to the Steering Committee.

4. ISSUE – How can the use of new technology in collecting HPMS data be employed in a cost-effective manner and the results shared by other agencies?

DISCUSSION ⇨

In the surveys and at the workshop, it was apparent that many agencies are continuously exploring opportunities to use the new techniques for collecting data, including HPMS data. Concerns driving this activity include the desire to reduce the cost of data collection as well as to improve the quality and consistency of data. Another major concern driving the search for new technology is the safety of personnel while they are collecting the data. Participants at the workshop agreed that there currently is not a good process for sharing experiences on new technology with other agencies.

RECOMMENDATION ⇨

FHWA should prepare a catalog of new technology applications being used by the States and other agencies in the collection of HPMS data. Following the creation of the catalog, a process should be developed to periodically update the information, serve as a clearinghouse, and create a forum for HPMS data collectors to share information. Use of the FHWA web site should be explored for this purpose. The process should also consider the development of equipment standards and creation of a pool-funded test center for product development, either in conjunction with the existing center for traffic monitoring equipment or as a similar center.

5. ISSUE – How can FHWA provide enhanced training on HPMS to the data collection agencies?

DISCUSSION ⇨

The issue of additional training was initially raised by the HPMS Steering Committee. The need for additional training was also raised in response to the various reassessment outreach efforts. FHWA conducted a study of the various methods of training and presented the results to the Steering Committee.

RECOMMENDATION ⇨
Once the reassessment is completed and the field manual updated, FHWA should develop a computer-based training program for distribution to the State and local agencies.

D. FUTURE

DISCUSSION ⇨
The recommendations presented herein generally deal with the current HPMS and express ideas for improving the existing process. Several speakers at the workshop cautioned that the FHWA should also be looking at the future trends in data systems to position HPMS for the future. Future trends include:

- increase in the electronic distribution of data and less emphasis on printed reports,
- piggybacking data collection and analysis on other data systems, such as ITS,
- more integration through GIS,
- more emphasis on real-time data,
- systems operations orientation,
- public agencies tying into private sector data sources and joint data collection partnerships, and
- use of data for governmental accountability.

RECOMMENDATIONS ⇨
A number of recommendations are presented to help FHWA position HPMS to be consistent with these trends:

1. FHWA should complete the current program of changes to the computing environment as outlined in Appendix C. FHWA should also analyze the necessary steps required to have HPMS become a managed geographic data system where the various components can be readily accessed, downloaded, analyzed, and printed by users of HPMS.

2. FHWA should expand its efforts to make the geo-referencing system of HPMS (LRS) more easily interfaced with existing State and local GIS systems. FHWA and the Steering Committee should monitor and participate in NCHRP Project 20-73(3) and the NSDI effort, with the goal of assuring that HPMS geo-referencing systems are compatible with national, State and local NSDI GIS systems.

3. FHWA should review the current time line for HPMS (see Figure 3, Appendix A), with the objective of reducing the overall time from the issuance of the collection instructions to the publication of the *Conditions and Performance Report*. Currently this is a 3½-year cycle. One improvement would be to have the presentation of the report be at the beginning of the calendar year rather than in the third quarter of the year. With the goal of reducing time, the Steering Committee should also review the current schedule, which allows State and local agencies 1 year to collect HPMS data. The reduction of data items, increased data partnerships, and increased electronic data transmission may help achieve this goal.

4. The various offices within FHWA and USDOT should jointly investigate the best methods of including systems operations performance and the users view of system performance into the *Conditions and Performance Report* and, eventually, into HPMS. This effort would include the current ITS inventory maintained by the Joint Program office, the use of NPTS and NQI surveys, and the congestion management systems being developed by the States.

PART II
TECHNICAL REPORT

SECTION 1: MISSION, SCOPE, AND OBJECTIVES OF HPMS

The first step in the comprehensive reassessment of the HPMS process was to reexamine its mission, scope, and objectives, and to test the support and acceptance of these objectives. After the mission and objectives are set and agreed upon, the various components of the system can be assessed for consistency with the objectives. In this study, a draft goal and set of objectives were developed and tested through a series of surveys and interviews. The following goal and objectives were presented.

Goal of HPMS

To provide a data base and analysis process for assessing and reporting the condition and performance of the Nation's highway system in the most cost-effective manner.

Objective 1 To meet FHWA's highway stewardship responsibilities, including preserving the national interest in NHS.

Objective 2 To support Federal transportation policy analysis and planning activities at USDOT and other Federal agencies.

Objective 3 To meet various legislative requirements, including the *Conditions and Performance Report* and the Clean Air Act requirements.

Objective 4 To provide a publicly accessible, high quality, timely, and comprehensive national data base on highways for State governments, local agencies, and other organizations and individuals.

Objective 5 To provide, at the option of State and local government, a data base and analytical process for State and local purposes.

Opportunity was provided in the survey and interviews to comment on the objectives, suggest modifications, and/or propose additional objectives.

A. RESULTS

Federal and National Organization Response

Based on interviews with various Federal officials who are involved in HPMS or are customers of HPMS data, there was generally agreement with HPMS goals and objectives. From those representatives of national organizations in attendance at a briefing session and telephone conversations with industry representatives, there was also agreement. Further attempts to solicit comments from national organizations involved in transportation were only marginally successful. To date, two comments from national organizations have been received to FHWA Docket 97-10. While the objectives were not mentioned in the Docket, those responding indicated support for HPMS and offered suggestions for improving the process.

State Response

A survey was distributed by the AASHTO Standing Committee on Planning. One of the questions asked for indication of Strong Support, Support, Do Not Support, or Propose Modifications for each objective. With 47 States responding, the results were:

Objective 1: Federal Stewardship	
⇒ Strong Support	21
⇒ Support	22
⇒ Do Not Support	1
⇒ Propose Modifications	3

Modifications were proposed to limit Federal involvement to the NHS or arterials, and to have the Federal Government responsible for the collection and integrity of the data. Comments included:

- ⇒ the need to concentrate on national issues only,
- ⇒ let each State deal with its own issues,
- ⇒ keep collecting data on the entire highway system, and
- ⇒ limit data collection to cost-effective items.

A question was raised on whether HPMS was the best way to meet FHWA's stewardship responsibility.

Objective 2: Support Federal Policy Analysis*	
⇒ Strong Support	17
⇒ Support	28
⇒ Do Not Support	0
⇒ Propose Modifications	2
* One State did not select.	

Modifications and comments received were the same as objective 1, with increased emphasis on the need to reduce and simplify the data requirements and process, and include State concerns and the qualifier: "*to the extent data are reasonably available.*"

Objective 3: Meet Legislative Requirement	
⇒ Strong Support	9
⇒ Support	31
⇒ Do Not Support	0
⇒ Propose Modifications	7

Comments dealt primarily with dropping or modifying the Clean Air Act support requirements, with a concern that either the State or the MPO should be responsible, not both. Other comments included:

- ⇒ requiring standardized equipment for measuring pavement condition,
- ⇒ changing the Objective 3 heading to "**Help** Meet Legislative Requirements,"
- ⇒ reporting only on items legislatively required,
- ⇒ limiting data collection to current items,
- ⇒ requiring only a biennial data submittal,
- ⇒ requiring all parties to agree to the uses, models, and standards, and
- ⇒ calling for Federal funding for data collection activities.

Objective 4: National Data Base	
⇒ Strong Support	13
⇒ Support	21
⇒ Do Not Support	8
⇒ Propose Modifications	5

Those who did not support the national data base were concerned with inappropriate use or misuse of information for creating comparisons between States. Among the concerns are the:

- ⇒ variable quality of information among the States;
- ⇒ necessity for State data reports being the same;
- ⇒ subjective nature of some data items; and
- ⇒ lack of standards in some areas.

Modifications and comments were along the same lines as those who did not support Objective 4. The national data base should be of consistent quality between States and include data that is objectively defined and accurate. Those who only collect the data and send it to FHWA should receive some benefit in return.

Objective 5: Optional State and Local Use*	
⇒ Strong Support	11
⇒ Support	22
⇒ Do Not Support	11
⇒ Propose Modifications	2
* One State did not select.	

Comments from those who did not support Objective 5 indicated that the States had their own data base and did not need or use the HPMS process. One State suggested modifying the objective to read *"using HPMS and other sources."* Modifications and comments included the same concern raised by those not supporting the objective. Several States called for making the analytical process more useful to States and local governments by simplifying the models and making them less "data-rich." The use of data from management systems was also raised.

Additional Objectives Proposed

The only proposed objective that received more than one comment emphasized States having the ability to use HPMS for comparative information between States and for bench marking purposes. This was suggested by seven States and opposed by one State. The use of HPMS information by States for comparisons between States also shows up in responses to other questions. The issue of State-by-State comparisons was discussed extensively at the workshop. It was recognized that these comparisons are inevitable, given the public nature of the data. The concern for data quality and consistent definitions was raised in this context. While the State DOTs routinely use the data for comparisons and bench marking, they believed that only they have the knowledge to decide which States and data items are truly comparable. The data providers caution others making comparisons to understand the limitations of the data set and vast differences in the States before drawing any conclusions. Also in response to this concern, FHWA has included a "truth in data" statement as part of the publication, *Highway Statistics*.

Responses from MPOs

In conjunction with the Association of Metropolitan Planning Organizations (AMPO), a survey was distributed to 128 of the larger member MPOs. Forty-four surveys were returned. While the survey and the responses are not statistically based, the results are from a broad range of MPO sizes, cover 25 States, and should be fairly representative of the MPOs.

Objective 1: Federal Stewardship*	
⇒ Strong Support	10
⇒ Support	28
⇒ Do Not Support	3
⇒ Propose Modifications	1
* Two MPOs did not select.	

The proposed modification, which applies to all objectives, was to recognize subsequent Federal mandates in the HPMS objectives.

Objective 2: Support Federal Policy Analysis*	
⇒ Strong Support	12
⇒ Support	29
⇒ Do Not Support	1
⇒ Propose Modifications	1
* One MPO did not select.	

Objective 3: Meet Legislative Requirements*	
⇒ Strong Support	9
⇒ Support	27
⇒ Do Not Support	5
⇒ Propose Modifications	2
*One MPO did not select.	

Those who did not support Objective 3 questioned the use of HPMS for meeting the Clean Air Act requirements. This issue is discussed in more detail in the report.

Objective 4: National Data Base*	
⇒ Strong Support	12
⇒ Support	26
⇒ Do Not Support	4
⇒ Propose Modifications	1
* One MPO did not select.	

Comments included the need to improve accuracy and limit the data to the NHS. It was observed that the HPMS data base does not meet local needs for a data base.

Objective 5: Optional State and Local Use*	
⇒ Strong Support	17
⇒ Support	15
⇒ Do Not Support	6
⇒ Propose Modifications	3
* Three MPOs did not select.	

A modification was suggested to drop "local" since many local governments cannot make use of the data base. Other comments indicated that the use of HPMS should not be optional, the collection of HPMS data should be the States responsibility, and the use of HPMS should be for the Federal Government only.

Additional Comments

A number of additional comments were offered. The most common comments suggested:

⇒ obtaining local input into the process of data collection and selection of samples,
⇒ publishing the data on a finer scale, such as by region or county,
⇒ using MPO data and models for some of the HPMS data, and
⇒ encouraging the integration of Federal, State and regional data files.

Two MPOs responded to FHWA Docket 97-10. One indicated it did not use HPMS and viewed HPMS as a sample for national use. The other supported HPMS and is in a State where there is a direct partnership between the State and MPO in the collection and use of HPMS. One association of local governments supported only incremental changes to HPMS and urged that HPMS be used to build data partnerships with local governments.

Summary and Conclusions

Based on the outreach process results to date, there is support for the proposed goal and objectives. The least supported objective, No. 5, still had the support of over two-thirds of the States and three-fourths of the MPOs. Some important qualifications and comments which were presented in this section suggest modification to the proposed wording.

The Mission Statement and Objectives were discussed extensively at the HPMS Workshop. The workshop participants were assigned to one of four working groups. Each group discussed the draft mission, the five proposed objectives, and any new objectives. Each working group then reported its findings to the larger group for further discussion. The HPMS Steering Committee then reviewed the work of the four groups and recommended modifying the mission statement and several of the original objectives and recommended a new objective.

The following mission statement and revised objectives are proposed to FHWA for use in evaluating the current HPMS and any modifications to HPMS.

MISSION

It is the Mission of the Highway Performance Monitoring System, as an integral part of the National Highway data base and a component of the National Transportation data base, to provide a data base and analysis process for assessing and reporting the condition and performance of the Nation's highway system in the most cost-effective manner consistent with the following objectives:

Objective 1 Meet FHWA's highway stewardship responsibilities, including preserving the national interest in the NHS.

Objective 2 Support Federal transportation policy analysis and planning activities.

Objective 3 Meet the various congressional requirements, including the *Conditions and Performance Report.*

Objective 4 Provide a publicly accessible, consistently high quality, objective and timely national highway data base.

Objective 5 Provide, at the State and local government option, an HPMS data base, an analytical process, and FHWA technical support which meets the needs of State, regional, and local agencies.

Objective 6 Evolve HPMS 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.

SECTION 2: USERS AND USES OF HPMS DATA FROM THE FEDERAL AND NATIONAL VIEWPOINT

The discussion in this section is based on documentation on the HPMS process; minutes of the HPMS Steering Committee meetings; interviews with 21 FHWA and USDOT officials; a briefing session held with Washington-based transportation organizations; responses to FHWA Docket 97-10; and a limited survey of transportation industry representatives.

A. USDOT USES AND USERS

The following is a list of the uses of HPMS gathered from interviews within USDOT. This is probably not a complete list, but it does cover those activities required by Congress and those supporting major policy initiatives.

- Publication of *Highway Statistics, Selected Highway Statistics and Charts,* and *Our Nation's Highways, Selected Facts and Figures,* and assorted publications from the Bureau of Transportation Statistics.
- Publication of the *Biennial Conditions and Performance Report.*
- FHWA budget proposal, including the impact of alternative funding scenarios.
- Use of HPMS derived travel for:
  - allocation of Interstate Maintenance Funds
  - requirements of the Clean Air Act Amendments of 1990, including tracking travel
  - accident and fatality data for the Section 207 Highway Safety Report
- Lane miles of Interstate for the allocation of Interstate Maintenance Funds.
- Data for system and area description for the Section 207 Safety Report.
- Analysis of the impacts of alternative allocation formulas.
- IRI information to analyze trends in pavement condition and alert field offices of pavement condition concerns on Federal-aid highways.
- The Truck Size and Weight Study for Congress.
- The 1997 Federal Highway Cost Allocation Study, which was published this year and is proposed to be repeated periodically, is available on the Internet at www.ota.fhwa.dot.gov/hcas/final (for study) or hcas/summary (for summary).
- The National Highway Planning Network (NHPN), which is used to document the NHS and to fulfill ad-hoc data and analysis requests.

- The HPMS is used within and outside FHWA for national highway data to fulfill numerous ad-hoc requests for data and analysis from other Federal agencies, Congress, and other organizations.

- In preparation for the HPMS workshop, FHWA prepared a paper on the capabilities and uses of the HPMS models. The models produce the following items which are used by the Federal Government:

  - summarize base (inventory) year conditions and performance;
  - forecast highway system deficiencies (needs);
  - simulate highway system conditions;
  - analyze investment strategies; and
  - estimate user costs.

Discussion

The users (customers) at USDOT are basically satisfied with the current HPMS. Many would welcome more detailed data to handle some of the requests which come in, but most officials are aware of and sympathetic to the increasing data burden on State and local officials. Some of the customer concerns include:

- **User Friendliness**: The occasional user is turned away by the apparent complexity of the data set.

- **Timeliness of the Data**: Several offices could use data at an earlier point in the year.

- **Lack of Understanding of HPMS**: The occasional user in DOT doesn't understand the data or analytical capabilities of HPMS and several requested briefings on HPMS.

Additional Data: Additional data was requested on pavement condition and congestion.

B. USES OF HPMS BY OTHER FEDERAL AGENCIES

The Defense Department and the Environmental Protection Agency are the only other Federal agencies identified as HPMS users. The Defense Department uses HPMS information on the STRAHNET and other roadways for analysis of force deployment issues. FHWA and the Defense Department are currently working on a joint program which will enhance the use of HPMS for defense purposes. FHWA and EPA entered into an agreement to use HPMS derived travel and forecasted travel for CAAA purposes. The agreement, however, allows flexibility for local and State agencies to use travel forecasts derived from other methods in lieu of using HPMS derived travel.

In order to provide travel estimates in non-attainment areas, additional traffic information must be gathered outside the urbanized area boundary but within the area declared to be in non-attainment of Clean Air Act standards. This additional traffic data can be used to produce a statistically significant estimate of travel and a basis for projecting future travel in the non-attainment area. One of the issues reviewed in this reassessment and discussed in detail at the workshop was whether the agreement, which is about 5 years old, is in fact working and producing the results expected with the additional data.

New EPA rules may modify the need and extent of traffic monitoring and forecasting for Clean Air Act purposes. It was decided that the HPMS review was not the appropriate venue to discuss changes to the process for meeting Clean Air Act requirements. Rather, these issues are being discussed external to this effort. The issue for the HPMS review concerns the establishment of **clear procedures** for determining when and where to collect additional data to permit HPMS to be used for this purpose. If EPA, State, and local officials agree on an alternative method for measuring travel, additional HPMS data **should not** be collected and reported.

C. USES OF HPMS BY OTHER NATIONAL ORGANIZATIONS

Several organizations commented on their use of HPMS data for a variety of purposes, including:

- ⇒ tracking highway condition and performance,
- ⇒ making comparisons between States on highway condition and performance, and
- ⇒ scaling use of industry products.

FHWA conducted a survey of over 20 organizations who have purchased data and analyses from HPMS. The users who responded indicated satisfaction with the products purchased.

No major concerns were raised with the current data set or analysis.

D. FEDERAL AND NATIONAL ISSUES WITH HPMS ANALYSIS; COMMENTS RECEIVED ON THE USE OF HPMS FOR NATIONAL POLICY ANALYSIS

In the surveys and interviews, respondents had various concerns about the use of HPMS to address transportation policy issues.

1. Federal and National Organization Issues

At the Federal level, there was support for the current policy analysis as reflected in the *Conditions and Performance Report.* As previously mentioned, several people suggested that the analysis be on a multi-modal basis, but not at the expense of the current HPMS. Several national organizations also commented on the use of HPMS in the policy analysis.

a. The Timing and Content of the *Conditions and Performance Report*

While supporting the HPMS effort and the current analysis process, there were concerns that the publication of the *Conditions and Performance Report* was not timely for major issues before the Congress. The report is usually made available to the public in the middle of the year. Several organizations would like to see the report at the beginning of the calendar year. These organizations also suggested that the analysis could be more specific regarding the impact of various funding levels on highway condition and performance. For example, what is the impact of the Administration's Reauthorization proposal on condition and performance if the fully authorized level is funded? What is the impact if only historic obligation ceiling funding levels are allowed? What is the impact of delay in the preservation of the infrastructure? ("Pay me now or pay me a lot later.") What is the real cost of deterioration?

b. Reduction of Calculated Needs Using Non-HPMS Data

The *Conditions and Performance Report* (page 173) indicates that the projected year 2013 lane-mile requirements were reduced by 42 percent from the HPMS derived lane mile requirements by:

- ✓ reducing HPMS derived travel forecasts based on MPO forecasts;
- ✓ making adjustments for spreading the peak hour;
- ✓ factoring into account the new *Highway Capacity Manual*; and
- ✓ considering transportation system management strategies

FHWA should conduct a study on the impact of these adjustments, individually and in combination, on the resulting performance of the highway system under various funding scenarios before the next *Conditions and Performance Report.* Adjustments of this magnitude call into question the need for the detailed data base which was used to develop the unadjusted estimates.

c. Presentation on the Escalation of Construction Prices Which Will Require Additional Funds at the Year of Construction

In the *Conditions and Performance Report*, annual investment requirements are presented in 1994 dollars. Estimates based on historic price increases should be presented to illustrate that authorization and appropriation levels will need to be higher (or lower) based on trends in construction prices to meet the performance targets presented in the report.

d. Presentation of Performance of the System from the User's Perspective

HPMS measures the performance from a system viewpoint, but several participants recommended looking at performance from the user's viewpoint. The information from the *National Personal Transportation Survey* (NPTS) and the *National Quality Initiative* (NQI) reveals interesting facts from the user's viewpoint. For example, the surveys found significantly different perceptions of the performance of the system between men and women, and between different age groups. Ranked as major considerations surpassing traffic issues were concerns over crimes against motorists, air quality, and being stranded. One should consider if these kinds of concerns should be added to the measurement of condition and performance.

2. State Issues with the Analysis

Of the 47 States that responded to the survey, 12 States had no comment while 22 States expressed support for the current policy analytical process. Several States questioned the reliability of the data and the remainder had comments on the relationship between Federal and State analyses. In response to a question on new policy issues to be addressed by HPMS, several suggestions were made:

- ⇒ Expand HPMS to a transportation performance monitoring system.
- ⇒ Address new policy issues through other means, not HPMS.
- ⇒ Analyze commercial vehicle travel separately.
- ⇒ Change emphasis from improvements to preservation and management.
- ⇒ Mandate participation by MPOs and other regional organizations.
- ⇒ Address data collection issues and needs on local jurisdiction highways.
- ⇒ Address the implications of the changes to National Air Quality Standards.

3. MPO Issues with the Analysis

Thirteen MPOs said that the information and analysis provided by HPMS was adequate for addressing Federal policy and financing issues while three said it needs improvement. Six MPOs said that HPMS was not adequate, citing the:

- ⇒ need to use MPO data directly in the analysis process;
- ⇒ need for more detailed local data in HPMS;
- ⇒ lack of analysis of alternative modes; and
- ⇒ the unrealistically high estimates of future highway needs.

Twenty-two MPOs either did not respond or said that they did not have sufficient knowledge to make a judgment. This illustrates the need for a better method of reaching out to local agencies on the purposes and uses of HPMS. Discussions with AMPO members also highlighted the need to look at the view of condition and performance from the user perspective. Several MPOs are trying to adapt the planning process to include the user perspective and perceptions. The ultimate progression of HPMS to a Transportation Performance Management System (TPMS) was also suggested.

In response to a question of other Federal policy issues which should be addressed with HPMS, the 12 responses included:

- ⇒ doing a multi-modal analysis;
- ⇒ using relationships between land use and transportation;
- ⇒ placing greater emphasis on local issues as a national concern;
- ⇒ recognizing the need for travel time information to measure congestion;
- ⇒ reporting on the maintenance status of the Interstate System; and
- ⇒ integrating HPMS, GIS, and model capabilities with local capabilities.

4. Summary of Federal and National Issues

a. Sample Issues

One issue which is linked to the comprehensive analysis is whether to continue to have a sample which is statistically significant at the State level or to cut back to a nationally significant sample – approximately 15,000 samples. States are reporting that the collection of sample information is the costliest part of providing HPMS data, ranging from 60 to 70 percent of data collection costs. The Federal cost of maintaining and analyzing this information is also large. Thus, the decision on this issue will have important cost implications.

At the request of the Steering Committee and the consultant, FHWA prepared an analysis of alternative sampling approaches. The initial finding was that the current number of samples, 123,000, could be reduced by almost 35 percent, to 80,000 samples, without materially changing the statistical accuracy of the data set if the States review the current samples and use the existing software provided by FHWA for sample selection. Some of the additional samples exist because States have expanded the sample size for State analytical purposes. Other samples (18,193) exist because portions of the original highway sample section were modified by construction which caused "split sections." The FHWA analysis done for this reassessment shows that the States may be able to significantly reduce the number of samples without affecting the accuracy of the analysis at the Federal level while still retaining the option to add additional samples for State purposes.

FHWA estimated that 15,000 samples would be required for national statistical significance. FHWA also estimated the number of samples required for different scenarios, should the scope of HPMS be modified.

After discussion at the workshop, the Steering Committee recommended that each individual item be reviewed for the appropriate level of statistical significance. This process is described in Appendix B.

Another sample issue that has been raised concerns the volume ranges from which samples are selected. Some believe they are too narrow and that as traffic grows on roads, the roads fall into different sample ranges which will require that new samples be selected. The creation of the data base for any new sample is the costliest part of data collection in HPMS. Therefore, some have recommended that the volume ranges be reviewed with the intent of minimizing "volume range creep." Based on this recommendation, FHWA has reviewed the size of the volume ranges and the need for statistical accuracy within the volume ranges. Preliminary results reveal that the number of samples required may, in fact, increase if the volume ranges are increased but that there may be opportunities to reduce the number of required samples by reducing the standard for statistical accuracy in rural areas.

b. Pavement Condition Issues

A significant issue regarding the current information about the condition of pavements on the Nation's highway network in HPMS is that it is limited to roughness indicators. It is recognized that the roughness indicator is only one of several indicators of pavement condition. FHWA and AASHTO have agreed that information and protocols on rutting, faulting, and cracking/surface distress are also required to measure pavement condition. If the additional pavement condition indicators are to be collected and reported to Congress, it is questionable whether the current HPMS process is the most cost-effective method for collecting additional pavement information. Several important activities are underway which may help.

- While the requirement for each State to develop a pavement management system has been relaxed, a recent survey conducted by the U.S. General Accounting Office reported that ali States are in the process of implementing pavement management systems.
- FHWA and AASHTO have been developing a distress measurement protocol which, if adopted by each State, could provide the opportunity to achieve a more comprehensive and standard pavement assessment.
- A new standard protocol has been developed for the collection of IRI which, if adopted, should improve consistency of the data reported.
- A great deal of information on pavement performance is currently being collected through the Strategic Highway Research Program (SHRP) with the Long-Term Pavement Performance (LTPP) sections. The integration of this information into the evaluation of pavement condition needs to be explored further, as does the establishment of the relationships between pavement performance factors.

Pavement related projects constitute a large portion of annual Federal highway obligations. In 1995, almost 50 percent of funds obligated for roadway projects were classified as system preservation projects. Therefore, it is important that additional, more comprehensive information about the condition of pavements be available.

One can draw a helpful analogy between the analysis of our pavements and the analysis of the Nation's bridges. The national bridge information system is founded on a detailed inventory of each bridge in the country, based on standard inspection procedures. Each bridge must be inspected at least every 2 years or more often, depending on the condition of the bridge. The cost of the national bridge inspection is not currently known; however, one State spends more that $30 million per year on bridge inspections. This is twice the amount that all States report as expenditures on the entire HPMS. The annual expenditure on pavement projects (reconstruction and 3R) is about twice the expenditure for bridges. While the consequences of a bridge failure are certainly more serious than the failure of a pavement, additional funding for evaluating pavement condition seems warranted. Also, some of the problems concerning comparisons between States on pavement conditions can be overcome with more standard State systems based on a more comprehensive approach to pavement condition analysis.

It is recommended that FHWA, working with AASHTO:

- develop a process for the use of State pavement management systems; and
- incorporate standard distress protocols as the basis for an enhanced evaluation of the true conditions on the Nation's highways.

The purpose of this joint effort should be to develop more complete data and a better understanding of the relationships between physical data and pavement condition or the remaining useful life of the pavement. This knowledge can initially be an external input into the conditions and performance model analysis and projection of pavement condition. Eventually, as pavement management systems evolve and more standard pavement measurement standards are developed and adopted, it may be possible to include additional pavement condition indicators in the HPMS data base.

c. Congestion Measurement

The current method used in HPMS to measure congestion is limited to estimating the service level on the road as represented by the V/SF ratio. It does not measure congestion caused by incidents, which are estimated to be as much as 50 to 60 percent of daily congestion, and also does not measure the extent and duration of congestion.

It is doubtful HPMS is the appropriate way to measure additional congestion factors. The HPMS Steering Committee has done much work on this issue and is currently working with FHWA to find better ways to estimate congestion. It is recommended that this effort continue and that FHWA analyze the potential for using information collected from Intelligent Transportation Systems for planning and policy purposes, such as estimating current congestion in all dimensions.

Where ITS has been established, congestion-related information is routinely collected for operating purposes and then often discarded without having been analyzed for planning and policy purposes. It is estimated there are six or seven areas where ITS is sufficiently developed so that case studies can be performed on the costs and benefits of using ITS for these purposes.

To establish better national estimates of both recurring and non-recurring congestion, any case studies should seek to develop relationships between ITS collected data in several areas and HPMS data collected nationwide. Similar to collecting external information on pavements (see above), information from ITS would initially be used for analysis and projection of the full spectrum of congestion in the analytical models. After more areas have consistent data and measures, it may be possible to add additional consistent information on congestion to the HPMS data base.

d. National Data Base

One HPMS objective with a high degree of acceptance is the Federal responsibility to create and maintain a national highway data base. The scope and coverage of the HPMS portion of this data base needs to be established. Several issues are evident from the various outreach efforts.

- ❑ One issue is the consistency of the data reported by each State. States currently have the option of submitting more information than is required; e.g., more sample information if additional samples are collected for State purposes. States also have the option of submitting section-by-section information for lower functionally classified highways or lumping the data together on a geographic basis. It is recommended that FHWA consider requiring a consistent data response from each State to ensure that each State is equally represented in the national data base and subsequent analyses.

- ❑ Another issue deals with the cutoff point where the national data base should include section-by-section data and where areawide summaries should be the reporting framework. As part of the data item review process (Appendix B), each item will be evaluated against the current level of reporting for each of the functional systems. The review will determine whether the data item should continue to be collected and reported on a section basis or whether the item should be collected and reported on an areawide or aggregate basis.

e. Analysis Process and the *Conditions and Performance Report*

The production of the next *Conditions and Performance Report* should be reviewed in light of the concerns expressed:

- ✓ timing,
- ✓ impact of different funding scenarios,
- ✓ reduction of HPMS derived needs outside the HPMS process,
- ✓ effect of inflation on conditions and performance, and
- ✓ addition of information on the user perspective of highway conditions and performance from NPTS and NQI surveys

f. Quality of the Data Collected

To ensure that all staff responses are of a consistent high quality, FHWA should review the current quality control procedures, including the role of the division offices.

SECTION 3: USERS AND USES OF HPMS DATA FROM THE STATE VIEWPOINT

In conjunction with the AASHTO Standing Committee on Planning (SCOP), a survey form was prepared and sent to SCOP representatives from each State. Forty-seven States responded to the survey and the other three States responded to an abbreviated phone survey. Twenty-three States responded to the options paper in FHWA Docket 97-10 and an additional four States who were members of the Steering Committee responded to the draft options paper. Their comments are also used in this section.

A. SUPPORT FOR HPMS

One of the most significant findings was the almost unanimous support for the first three objectives of HPMS:

- ✓ for USDOT and FHWA stewardship responsibilities,
- ✓ for Federal policy analysis, and
- ✓ to meet legislative requirements, including the *Conditions and Performance Report.*

Many respondents recognized these Federal responsibilities and indicated they would continue to do the best job possible in providing quality data, although resources were limited or diminishing. Of the 22 States that responded to the options paper and expressed an opinion on the options, eight selected little or no change and four States selected only incremental changes. This result may be a recognition of several factors, including:

- the large sunk cost of the existing system,
- satisfaction with the current process, and
- concern that change will require more work.

B. STATE USES OF HPMS DATA AND ANALYTICAL PROCESS

1. Categorization of States as HPMS Users

It is difficult to segregate States into user categories because of the vast difference in size, complexity, and jurisdictional responsibility of State DOTs, but the following is a categorization based on the survey results of all 50 States.

⇨ Six States report that they use HPMS as their basic highway information data system and the HPMS analytical process as their State policy analysis process.

⇨ Two States use the HPMS as their State highway data base, but do not use the analytical process.

⇨ Eighteen States report that they basically collect HPMS for Federal purposes and the data items unique to HPMS are not used by the State.

⇨ The remaining 24 States are somewhere in the middle. For example eight States say they use or have used the HPMS analytical process.

2. State Uses of HPMS Data

A series of questions were established to determine the extent of the use of HPMS data by the States. Since one of the objectives is to provide an optional data base for State and local use, the answers give some indication of the success of this objective. The results are for the 47 States which completed the full survey.

a. Areawide Data

Twenty-five States reported use of the areawide summaries, with the greatest use being travel summaries by the different breakdowns.

b. Universe Data

All but eight States reported using HPMS universe data for various activities. Much of the use is from existing State data bases, in some cases supplemented with HPMS items.

c. Sample Data

⇨ Twenty-eight States reported that they only collect the minimum sample size required under HPMS.

⇨ Four States collected the minimum, but collected 100 percent of the Interstate System.

⇨ Two States collected 100 percent on the State system.

⇨ The remainder of the States did not specify their sampling in the questionnaire.

⇨ Eighteen States reported that they use sample information for State purposes, with two States indicating that their use is restricted to the samples on the State system.

d. Donut Sample Data

Ten States reported that they did not have non-attainment areas in their States and, therefore, did not collect donut sample data. Of the remaining States, 14 said that they used the data. The implication is that the other States collect but do not use the data. While the survey may not be totally accurate, the results indicated an area for further evaluation and discussion. Following discussion at the workshop and the HPMS Steering Committee meeting, FHWA and EPA have agreed to work to clarify the administrative processes and issues dealing with the use of HPMS for CAA purposes to improve the way the system operates.

e. State Uses of HPMS for Legislative or State Policy Purposes

Eighteen States reported that they use HPMS data for State legislative or State policy purposes. Many uses were cited:

- to support management systems (3);
- use of HPMS derived data in State allocation formulas (3);
- condition reporting (3);
- State requirement for length reporting (2);
- estimation of long range needs (2);
- travel for conformity purposes (2);
- travel for other purposes (2);
- performance measures for State budgeting purposes (1)
- support for the State GIS (1);
- State budgeting purposes (1);
- legislation preparation (1);
- establishing typical standards (1);
- comparing travel versus fuel sales (1); and
- 5-year needs report (1).

f. State Uses of HPMS Data for Comparison with Other States

Twenty-seven States use HPMS data to compare their operations with other States, with 12 States qualifying their use as being occasional or infrequent. Seventeen States reported they do not use the data for comparison. Three States did not respond to this question.

g. State Uses of FHWA Computer Analysis Programs

Of the 50 States which responded:

- 34 States use the data preparation package,
- 32 States use the data review package,
- 14 States use or have used the analytical package.

Several States reported that they were not familiar with all of the available computer software and requested additional information. The current workshops being held by FHWA on changes to the computing environment should inform users of the capabilities of these programs.

h. State Uses of Federal Reports

Thirty-three States report using the *Conditions and Performance Report* at least occasionally. Eight States commented on the importance of the report and its use for comparative purposes. All but three States use *Highway Statistics*, with five States qualifying their use as limited or occasional. For many States, *Highway Statistics* is listed as a valuable resource and many States use it for comparisons with other States. Similar results were obtained from the use of *Selected Highway Statistics and Charts* and *Our Nation's Highways, Selected Facts and Figures*. The latter report was cited by several States as an excellent resource which is distributed to MPOs and local governments for their information. The responses showed seven States are currently using the Internet to access the highway statistics data. Seventeen States indicated they were unaware of their ability to use the Internet or that they planned to use it in the future.

i. Use of HPMS by Other State Agencies or Organizations

Twenty States reported no outside use or knowledge of any outside use. Five States did not respond and the remaining 25 States reported uses. Examples included filling of data and analysis requests from:

- legislatures
- other State agencies, such as State environmental agencies
- motor vehicle agencies
- public safety agencies
- comptrollers office
- tax agencies
- research institutions
- local governments
- private organizations

C. COST OF COLLECTING HPMS DATA

In framing this question in the survey to the States, it was recognized that it would be difficult to obtain detailed and accurate information on the incremental cost of HPMS for several reasons:

- State accounting systems are not set up to detail costs in this manner.
- The amount of data on the State data base and the amount of data needed to be collected off the State system result in different costs.
- Where HPMS is integrated into the State data base, it is difficult to separate out the HPMS cost.
- The entire highway data collection effort is eligible for Federal and State planning and research (SPR) funds.

The responses to the survey indicated a wide range of costs:

- from $9,900 per year in a State with its own data base, where HPMS is not used and the cost is merely reformatting data to Federal formats,
- to a State cost of almost $2 million, where the State system is very extensive and HPMS is integrated into the State and regional data base.

Using reported data and extrapolating for non-reporting States, the average cost is about $300,000 per year, with a total cost of about $15 million. Of this cost, about $9 million is charged to Federal SPR funds. This represents about 3.7 percent of the amount of SPR funds made available to the States for non-research activities. The range of the percentage use of SPR for HPMS purposes by the States is from 23 percent to less than 1 percent. Other fund sources, in the order of $1.8 million (mainly PL funds), were used for HPMS, with the remainder being classified as State matching funds. Again, most of the costs were described by respondents as estimates.

Eighteen States were able to break out or estimate the cost by the different categories of data collection. About 13 percent of the effort is spent on the areawide data, 24 percent on universe data, and 63 percent on sample data. Information on the cost of donut samples was too vague to estimate, but it is less than 10 percent of the total sample cost.

D. TOP ISSUES RAISED BY THE STATES REGARDING HPMS

Each State was asked to provide a list of the top five items recommended for review in the HPMS reassessment. States could also add additional items. The following is a summary of their priority items.

1. First Priority – Issues Related to Data Collection and Data Reduction

This area was ranked as the top issue for the States by a two-to-one ratio over other issues. There was support for:

- the current effort of the HPMS Steering Committee to look for short-term reductions in data items; and
- identifying specific data items for reduction.

As stated earlier, the consultant, with input from the Steering Committee, has developed a process (see Appendix B) for evaluating each data item.

2. Second Priority – Issues Related to the Scope of HPMS

These comments were split between those recommending that the scope be restricted to the NHS, NHS and State facilities, or other combinations, and those favoring status quo or incremental change. This split also shows up in the response to FHWA Docket 97-10, where of the 23 States which expressed a choice of options:

- 8 States favored little or no change,
- 4 States favored incremental change,
- 4 States favored reducing the scope to the NHS and some other roads,
- 2 States favored collecting only a national sample, and
- 5 States favored a combination of a reduced sample and reduced scope to the NHS, plus some other highways.

This was also discussed extensively at the workshop. Each of the four working groups was asked to list the advantages and disadvantages of the various scope options. Following review of the workshop products, a recommendation was made to retain the current scope of HPMS.

3. Third Priority – Issues labeled "FHWA Should"

Issues related to what FHWA should do include:

- providing additional training,
- providing better technical support,
- resolving the English-metric issue,
- opening up the analytical process to include the involvement of States and regional organizations in the framing of policy issues and the resulting analysis, and
- addressing concerns with the conversion to PC-based software.

FHWA presented its proposal for additional training to the Steering Committee. It was agreed that the training options would be implemented after the reassessment is completed. Also at the workshop, FHWA presented the proposed program for changes to the HPMS computing environment over the next few years (Appendix C).

4. Fourth Priority – the Collection and Use of Travel Information and the Relationship of HPMS to the EPA Programs

The collection and use of travel information is an area currently under review by the Steering Committee. FHWA conducted several case studies on the linkage between traffic counting, HPMS-based travel forecasting, and MPO model-based travel forecasting in several major urbanized areas. The case studies revealed a wide variety of organizational arrangements and program structures. In addition, a separate consultant study of urbanized traffic counting programs has been completed by the Center for Transportation Information. Two reports, "An Overview of Traffic Monitoring Programs in Large Urban Areas" (July 1997) and "Case Studies of Traffic Monitoring Programs in Large Urban Areas" (July 1997), are available on the Internet at http://ctil.volpe.dot.gov/ohim. Regarding the relationship of HPMS to EPA programs, FHWA and EPA will work to clarify the expectations, process, and institutions based on discussions held at the workshop.

5. Fifth Issue – Concerns for the Quality of Data Collected

Concerns for quality of data collected included:

- the need for better data standards,
- the need to collect only that data which can be collected accurately with limited staffing, and
- the desire to see the various data systems required by the Federal Government integrated with those at the State and local level.

Workshop participants generally concluded that clarification of existing standards in the HPMS Field Manual and additional efforts by FHWA to improve quality were more important than efforts to create new data standards.

6. Other Issues

Other issues, in order of priority, included:

- timing of data submission and reporting,
- cost,
- proper use of HPMS data,
- measuring congestion,
- sample issues,
- IRI issues,
- alternate approaches to data collection, and
- intergovernmental coordination.

The responses to FHWA Docket 97-10 have also been cataloged and the results from the States are nearly identical to the survey results.

E. ADDITIONAL COMMENTS FROM STATES

A section in the survey was provided for States to present additional comments or qualify their survey responses in the light of their reauthorization position. Nineteen States provided comments. The responses indicated that the States did, in fact, respond to the survey within the context of the current ISTEA legislation, as requested. Three States presented their reauthorization position. Most of the comments were a clarification on the State position on the reassessment and were consistent with the split of opinion described above.

F. SUMMARY OF STATE ISSUES

The summary of the information gathered from the States shows that there is wide support for the continuation of HPMS and recognition of the Federal need for highway information and policy analysis. There is also support for a national highway data base of which HPMS is a critical part.

The survey reveals a mixed picture on the use of HPMS information and analytical processes by the States, with many expressing limited or no use for the additional information required by HPMS for State policy and planning purposes. This is particularly focused on the use of sample information, which was shown to be the costliest portion of the State data collection effort.

This finding further supported the recommendation that FHWA prepare alternative sampling schemes, which can be evaluated for their impacts and implications. Some alternative sampling schemes prepared and presented at the workshop indicate the kinds of opportunities to reduce the effort of collecting data without reducing the statistical accuracy. As a result of workshop discussions, each data item will be evaluated for the appropriate level of statistical significance.

The issues of data quality and consistency were also discussed and recommendations are included in the Executive Report.

Several States described data partnerships with MPOs and local agencies, but the majority of States indicated little or no contact with regional and local governments. It should be determined if:

- progress can be made toward the theoretical data framework and principles described in Part I, Section 1 and incorporated into new objective 6,
- there is a better framework or set of principles,
- the extent of intergovernmental jurisdictional fragmentation is too extensive and at this time not worth the effort to deal with,
- this an issue for reauthorization language, as several States suggested, and
- data partnerships do, in fact, reduce fragmentation and improve data consistency.

To look for best practices and guidance to the States and local agencies, the recommendation from the workshop was to conduct a synthesis of current practices in data partnerships and data sharing arrangements. Following the synthesis, a number of pilot projects could be pursued to test various approaches.

Discussion was held concerning the impact of the new computing environment and FHWA's long range plans for improving the computing environment. While FHWA's plans were well received by the workshop participants, it still needs to be determined if the PC-based system will:

- ✓ encourage the use of FHWA analytical programs,
- ✓ help solve some of the timing issues raised in Part I, Section 1, and
- ✓ allow for the ease of data sharing.

Recommendations are proposed for increased information on pavement condition and congestion using other sources and processes than HPMS.

There were many comments on the quality of the data collected. FHWA has a process established through the FHWA division offices to monitor and check the quality of the State data collection. Suggestions were made to review the effectiveness of this monitoring program, look at the responses provided by the division offices, and take the necessary steps to upgrade the monitoring to assure consistently high quality.

SECTION 4: REGIONAL AND LOCAL USES OF HPMS DATA

Since the ownership of highways is split among many State and local jurisdictions, the collection of HPMS data is an intergovernmental activity. In addition, metropolitan planning organizations, which are required in urbanized areas, collect and analyze large amounts of transportation and land use data as part of their planning processes. The purpose of this section was to determine from a variety of sources the extent of use of HPMS at the regional and local level.

A. INVOLVEMENT AND USE OF HPMS BY MPOS

As mentioned previously, a survey was conducted of 128 MPOs in conjunction with AMPO. The results presented here are from 44 completed surveys, which represent a broad spectrum of MPOs.

1. Involvement of MPOs in Collecting HPMS Data

MPOs were asked to report if they were involved in the collection of several different types of data for HPMS.

- ➛ 19 reported that they had no involvement in the data collection.
- ➛ 14 collected highway inventory information.
- ➛ 13 collected traffic counts.
- ➛ 16 provided traffic forecasts.
- ➛ 5 coordinated the local collection of data for the State.
- ➛ 10 said that the data collected was from existing data resources.
- ➛ 5 said that the data was partially from existing data.
- ➛ 3 said that they collected the data for HPMS only.
- ➛ The remainder of MPOs did not specify how the data were collected.
- ➛ Only 17 MPOs reported cost information. Costs ranged from $300 to $122,000. The average cost was about $22,000 per MPO.

The MPOs were asked to suggest modifications to HPMS which would facilitate their involvement.

- By a three-to-one margin, the MPOs chose to have better integration, linkages, and coordination between State, regional, and local data bases. This way, data is collected only once, at the appropriate level, and can be used by all participants. One MPO described a pilot project to accomplish this objective.
- The second ranking modification was to allow access to the raw or disaggregated HPMS data for local use. Several MPOs wanted to obtain this information.
- Designing HPMS to be statistically significant at the local level was the third ranking modification. Several MPOs reported that they did not have enough information on HPMS and its capabilities, and requested some type of outreach program.

2. Uses of HPMS by MPOs

- 29 MPOs reported that they used HPMS data at least partially.
- 15 MPOs said they did not use the data.
- Primary uses were for Clean Air Act purposes. The second most mentioned use was for traffic count information.
- 18 MPOs said that they produce reports from HPMS data; again, Clean Air Act reports were the large majority of the use.

A series of questions was asked to better understand how HPMS is being used for Clean Air Act purposes. Under an existing agreement between FHWA and EPA, HPMS was cited as the primary data source for travel information, unless the State and local governments, DOT, and EPA agree to alternative ways of calculating and projecting travel. The results of the survey are not conclusive, but they do indicate the need to study this issue further.

Of the MPOs reporting:

- 10 said that they were in attainment areas and did not fall under this agreement;
- 10 indicated that they had no confidence in the HPMS/travel numbers;
- 14 said that the HPMS/travel numbers were used;
- 2 said the State calculated the travel; and
- the remainder said they had limited confidence in the numbers

When asked if HPMS forecast data is used for conformity analysis, those MPOs responding from non-attainment areas reported mixed results:

- 12 said yes and 17 said no,
- 18 reconciled their models with HPMS data and 21 did not, and
- 14 indicated they use HPMS data to benchmark or validate their models while 17 said they did not use HPMS for this purpose.

During a discussion with several MPOs, there was concern expressed that the agreement between FHWA and EPA was being interpreted differently in different parts of the country. There was also concern with the calculation of travel on roads classified as local roads. There is no standard process required for the calculation of local travel, although guidance exists in the *Traffic Monitoring Guide*. Several areas have found that this calculation has had a large impact on the overall travel projection and the conformity process. As identified in the State section, as a result of the discussion at the workshop, FHWA and EPA have agreed to clarify the administrative processes and issues dealing with the use of HPMS for CAA purposes.

3. Use of Federal Reports by MPOs

The most widely used report by the MPOs is *Highway Statistics*, with 34 MPOs indicating that they use the report at least sometime. *Our Nation's Highways* was also mentioned as a frequently used report. The biennial *Conditions and Performance Report* was used by 20 MPOs. A similar number used the Internet to access highway statistics data. When asked the degree of satisfaction with these reports, the results were split between those satisfied and those not satisfied. Many MPOs stated that they did not have enough detailed knowledge of the reports to make a judgment.

4. Suggestions for Changes to HPMS

Suggestions included:

- having information statistically significant at the local level,
- permitting access to the raw or disaggregated data,
- encouraging more integration of data between the various levels of government,
- letting local governments have a role in selection of sample sections,
- having the reports provide greater local focus on the issues, and
- learning more about HPMS through training and outreach.

5. Potential for MPOs to Play a Larger Role in HPMS

Each MPO was asked to check off a list of data items traditionally associated with the planning process and to indicate whether they collected, processed and/or used the data. For the data items related to HPMS the results were:

	Collected	Processed	Used
Number of Lanes/Capacity	**24**	**29**	**40**
Intersection Capacity	**13**	**21**	**35**
Vehicle Volumes	**21**	**29**	**39**
Vehicle Occupancy	**17**	**18**	**35**
Travel	**13**	**23**	**36**
Highway Travel Time	**17**	**24**	**35**
HPMS	**10**	**15**	**29**

The responses show that many of the data items collected and processed by the MPOs for planning purposes are data items required for HPMS. Yet the responses from the State and MPO surveys indicate that the role of MPOs in providing data for HPMS is not uniform. For example, some States collect information such as traffic counts independently, although traffic data are also collected by MPOs and local agencies. The results show that the role of the MPOs in the provision and use of HPMS could be expanded in some areas.

B. STATE REPORTING OF REGIONAL AND LOCAL USES OF HPMS

Of the 50 States reporting:

- 25 said that there was no use by regional or local governments of HPMS data or that they had no knowledge of any local use,
- 4 States said that there was only limited use,
- 4 States did not answer this question,
- 17 States identified specific regional and local uses, and
- 9 States reported use of basic travel and traffic information, in conjunction with MPOs, for conformity purposes and model calibration purposes.

Other regional and local uses included: IRI and PSR information, local data requests, and congestion management systems.

As reported in the AASHTO survey, Pennsylvania and Michigan have extensive interaction with MPOs with HPMS:

PENNSYLVANIA

The MPOs in Pennsylvania are full partners in the HPMS program. They are contracted annually through the Unified Planning Work Programs to collect HPMS information. The MPOs consistently use the information for their regional planning activities, including:

- travel forecasting
- CAAA requirements
- long range planning
- policy development

The department routinely responds to requests for information from the MPOs and others for data that is derived from RMS (Pennsylvania's Roadway Management System) or HPMS.

MICHIGAN

Collection of HPMS data outside of MPOs (and with MPOs) in Michigan is accomplished by Michigan DOT through a work item in annual contracts with Michigan's regional planning agencies. The planning agencies perform this task in a variety of ways:

- Some make traffic counters available to county road commissions and communities who, in turn, provide HPMS data free of charge to the planning agency.
- Other planning agencies pass funds to counties and communities to provide the data.
- Still other agencies operate under variations of these methods.

As a result, counties and many communities, as well as the MPOs, are familiar with the HPMS data collection process and are using the data in various ways:

- Regions identify growth areas.
- Regions assist counties to assemble transportation profiles (inventories).
- Regions and counties, townships, and communities provide information to developers, which is a very popular use of these data.
- Regions assist counties and townships, and others prepare the transportation portion of master plans.
- Regions prepare GIS generated traffic flow maps for counties, townships, and others.

C. SUMMARY OF ISSUES FROM THE REGIONAL AND LOCAL VIEWPOINT

From input of metropolitan planning organizations and the limited contact with local governments, one can conclude that there is support for the objectives of HPMS and the recognition of HPMS as a Federal policy activity. The major concern expressed in the surveys is the need for reevaluation of the data collection process to examine opportunities and, thus, better integrate the various Federal and State data collection processes. Many of the data items required for HPMS are, in fact, already collected at the regional and local levels for other purposes. Yet, not all MPOs or local governments are involved in the process.

The important issues raised by MPOs and local governments were discussed at the workshop and the Steering Committee meeting. These included:

- ◊ How can better data partnerships be established between Federal, State, regional, and local programs? Are there models of partnerships which can be used in other areas, such as the partnerships in Pennsylvania and Michigan? Both States and an MPO from each State made presentations at the Workshop on the benefits of the current data partnership. The Steering Committee has recommended a new objective 6 to encourage the formation of additional data partnerships and data sharing arrangements.
- ◊ Should FHWA, AASHTO, and AMPO establish several pilot areas to encourage data partnerships and data sharing? The workshop concluded that a synthesis of current practices should be completed before developing pilot projects.
- ◊ How can HPMS be modified in a cost-effective manner to deal with local issues which are of national importance? For example, there is concern that local highways and bridges are deteriorating at a faster rate and are in worse condition than State highways. Is this an issue of national concern? While data on local bridges is available from the National Bridge Inventory (NBI), should HPMS be reporting on this local road deterioration? The workshop and Steering Committee concluded that the current scope of HPMS, which includes data on all highway systems, should be retained. The issue of greater reporting on local systems conditions and performance needs further discussion within FHWA.
- ◊ How can the various activities of the MPOs, including the Congestion Management Systems, be integrated into HPMS as noted above? The first step in reviewing this issue was to call for a synthesis of current practices to establish working models for integration.
- ◊ Is the agreement between FHWA and EPA regarding the use of HPMS for Clean Air Act purposes working or should the requirements for data collection and use be optional? As reported in the State section, a joint effort of FHWA and EPA will attempt to resolve the administrative issues relating to the use of HPMS for CAA purposes.

- ◊ If new technologies prove to be cost-effective, what role should MPOs and local governments have in the use of these technologies? Can the use of innovations such as ITS data for planning purposes help create new partnerships? From the workshop and Steering Committee meetings, it was recommended that: a cataloging of new technologies used to collect HPMS data be implemented by FHWA; a mechanism be developed to share information on the successes and failures associated with these techniques; and a clearinghouse be established for States, MPOs and local governments to obtain information when they are considering improvements to their data collection and processing systems. It was also recommended that FHWA further study the use of its data as an external data source for analyzing condition and performance.
- ◊ How can FHWA more effectively inform MPOs and local governments about the capabilities and uses of HPMS? The consultant has recommended a five-step State reassessment process that would include FHWA, MPOs and local governments.

SECTION 5: POTENTIAL FOR THE USE OF NEW TECHNOLOGY

The State survey and the AMPO survey contained a question on the potential opportunities for using advanced technology for collecting and analyzing HPMS data.

A. STATE RESPONSES TO USES OF NEW TECHNOLOGY

Nine States did not provide any specific suggestions on the use of advanced technologies; however, the remaining States did include specific comments.

1. GIS and GPS

The area of greatest interest to 25 States is the use of GIS and global positioning systems (GPS). Many States have an established GIS or are in the process of establishing one. GPS is being used to establish spatial relationships. FHWA has incorporated GIS concepts into HPMS with a linear referencing system (LRS) which is used with the National Highway Planning Network (NHPN).

2. Geo-Referencing Systems

The issue of compatibility and establishment of a common geo-referencing system needs to be discussed. The discussion should include the National Spatial Data Infrastructure (NSDI) and the role of the NSDI to help create a common geo-referencing system. While most States have complied with the provision of LRS information, maintenance of that system will be expensive and should have multiple purposes.

3. Other Advanced Technologies

Seven States commented on the use of automatic roadway analyzers for their potential to increase the accuracy and consistency of HPMS data while reducing overall cost. Several States called for research on advanced methods to collect traffic count information because of the labor-intensive and inherently dangerous nature of current traffic count methods. Use of ITS data was mentioned and is discussed in Part II, Section 2. Additional work is necessary in this area. The use of digital video logging was also mentioned as a promising technology.

Several States were concerned that the use of new technologies would, in fact, add work rather than reduce it. A careful cost-effectiveness analysis should be conducted before any of these techniques are incorporated into any State's HPMS data collection process.

B. MPO RESPONSES TO NEW TECHNOLOGIES

Again, the technology of greatest interest is GIS for a geo-referencing system:

- □ 23 mentioned this in their responses.
- □ 12 mentioned the use of sensors to gain information.
- □ 10 mentioned the use of ITS information for planning purposes.

SECTION 6: REVIEW OF CRITICAL ISSUES FOR REASSESSMENT

The conclusions presented in Part I (Executive Report), Section 2, and the information reported in Part II (Technical Report) lead to a number of issues which were presented for further discussion at the workshop and Steering Committee meeting. The challenge in dealing with these issues was to assess if the current respected and useful data base and analysis process could in fact be made better for most parties while still meeting stated objectives. Following were the critical issues which were discussed.

1. MISSION AND OBJECTIVES OF HPMS

While the five proposed objectives received wide support, an additional objective was proposed. **Objective 6** on data integration would change the way data is collected in many States and urban areas. It has been suggested that a synthesis of current practices be undertaken to determine the feasibility and benefits of such an approach. Participants at the workshop stressed that HPMS and the resulting data requirements must be linked to the decision making processes at the Federal, State and local levels. The primary test for reviewing any data item in HPMS should focus on how the item is used in decision making. Bruce MacDowell described a performance management process where the stresses on the system can be measured, the possible interventions can be formulated, and the impacts on possible outcomes can be quantified. HPMS is evolving into a system which meets these attributes.

Those involved in the reassessment process were also concerned that HPMS not be used for purposes for which it was not designed. While some State-by-State comparisons can be made with some data items, great caution must be used in selecting the items for comparison, recognizing the limitations on the data and vast differences in States, not only in their physical configurations but in their policies on transportation and government in general. Similarly, there was concern that subjective, estimated, or calculated HPMS data not be used for the allocation of funds.

2. SCOPE OF HPMS

There are two major issues regarding the scope of HPMS. For this discussion, scope was defined as the extent of the highway system included in HPMS.

The first issue relates to the extent of the highway system to be included in HPMS. While there is some support for limiting the data collection to the NHS or the NHS plus some additional higher class highways, there was not a consensus on the different scope options prior to the workshop. Based on information from the consultant and the various working groups at the workshop, a list of arguments for maintaining the current scope and for modifying the scope was developed.

Arguments for maintaining the current scope include:

- ⇨ Many of the data items are used by a variety of HPMS users.
- ⇨ Local governments are concerned that local highway needs are not being well presented and that lower class highways are in worse condition than the NHS. They feel that conditions on local highway systems are in the national interest and should be reported to Congress.
- ⇨ The ability to create data partnerships and cooperative planning would be hindered.
- ⇨ There is a large sunk cost in the current HPMS system.
- ⇨ Federal funds are spent on lower class systems; Congress and the public need to know the condition and performance of these systems.

There are also several arguments for limiting the data collection to the NHS or the NHS plus some higher order roads:

- ⇨ Limit the cost of the data collection through greater reliance on existing State highway data bases and minimum intergovernmental data collection.
- ⇨ Improve the quality of the data and analyses for the higher order systems.
- ⇨ There is a lack of consistently high quality data on local systems.
- ⇨ The Federal role may need to be limited to or concentrated on the NHS.

As previously reported, the Steering Committee, based on input from the workshop, has recommended that the current scope be retained in HPMS.

The second issue considered was the need to collect additional information in two areas:

1. **Pavement Condition**
2. **Congestion**

This report presents the arguments for collecting this information and recommends that it be collected through methods other than the current HPMS data collection. The results of the workshop confirm this direction.

3. SCALE OF HPMS

There are a number of issues raised in this report regarding the future scale of HPMS. For this discussion, scale is defined as relative to the types of data collected (data items) and their statistical level of significance. The largest issue concerns the level (national, State, regional) at which the information collected from the sampled data items is statistically significant. Currently, 45 data items are collected on 123,000 sample sections to achieve statistical significance at the State and limited sub-State levels. It is a conclusion of this report and the Steering Committee that travel related information and pavement condition information should continue to be collected for State statistical significance because of the various requirements and uses of this information, which are documented in the report. The need to continue to collect the other 40 data items at the same level of significance will be reviewed as part of the data item review process outlined in Appendix B.

There are several possible reasons for continuing the current sampling levels.

- ⇨ Some of this information is included in traditional tables in *Highway Statistics* on a State-by-State basis.
- ⇨ Some of the data is used to make State-by-State comparisons and for bench marking purposes.
- ⇨ The data is used for many Federal data requests and for a number of Federal activities, such as the cost allocation study.
- ⇨ Data is used by consultants and other outside organizations.

There are also reasons for having a nationally significant data sample:

- ⇨ There is a potential for significant cost savings to the States and local governments since the sample information is the costliest portion of the HPMS data collection effort. Federal costs could also be reduced with a smaller data set to process and analyze.
- ⇨ The analytical process does not need State level significant data to produce the information contained the current *Conditions and Performance Report.*
- ⇨ The projected future highway conditions were reduced by 42 percent using non-HPMS data in the last report. This calls into question the need for the detailed data base.
- ⇨ Sample data is collected every year but is only used every other year for analytical reporting.
- ⇨ States who use HPMS for State planning purposes would be free to collect the additional information for State purposes; the additional information would not be sent to FHWA for national processing and analysis.

The conclusions of the workshop and the Steering Committee confirmed the need for travel and pavement condition on a State statistically significant basis and to review each individual item for the proper level of statistical significance.

The second issue raised regarding scale is to determine where the information should be reported on a section-by-section basis for the higher functional classification systems and on an areawide basis for the lower functional classification systems. The conclusion was also to review each individual data item for each of the functional classes to make these decisions.

The third issue of scale concerned requiring a uniform data set to be submitted by each State. This report makes that recommendation. Once the review of individual data items is completed, it is recommended that FHWA address this recommendation, discuss it with the States and local governments involved in data collection, then develop a specific

proposal.
The fourth issue concerns the processes and regulations for determining the need for collecting additional information for Clean Air Act purposes. Pending the review of the new EPA rules on this subject, FHWA and EPA have agreed to review the current administrative issues and guidance regarding the use of HPMS for CAA purposes. The HPMS manual should be revised to clearly indicate the process for making the decision on this data collection. If there is a decision to use an alternative method for travel information, the additional HPMS information should not be collected and sent to FHWA for processing.

The fifth issue regarding scale concerns the timing of the process. As described in the report, the current HPMS process is a rolling 3½-year process. Advances in technology and a potentially smaller data set could reduce current time frames.

The final issue of scale concerns the review of individual data items in HPMS, with the objective to eliminate those items which are of marginal value. This effort is well underway and additional information was gathered from the various surveys. The HPMS Steering Committee will play an active role in this next phase.

4. ISSUES CONCERNING CONDITIONS AND PERFORMANCE REPORTING

Suggestions have been made on the analysis and reporting, including:

- ☆ adding a "user perspective,"
- ☆ improving the timing of the release of the report, and
- ☆ utilizing the full potential of the analytical process to examine additional cost scenarios and impacts of alternative funding proposals.

5. ISSUES CONCERNING DATA COLLECTION, QUALITY, STANDARDIZATION AND INSTITUTIONAL ARRANGEMENTS

- The workshop concluded that AASHTO, AMPO, and FHWA should pursue an NCHRP synthesis to examine the benefits and challenges associated with creating data partnerships for the collection of HPMS data and other data which is shared by the various Federal, State, and local agencies. A presentation was made at the workshop on the experiences in Michigan and Pennsylvania on data partnerships. Workshop participants also identified other areas and States with experience in different approaches to data partnerships and sharing.
- The responses to the surveys indicated that there was not a uniform understanding of the requirements, potential analytical capability, and products of HPMS among Federal offices, State agencies, and local governments. To improve understanding, the consultant has recommended a five-step reassessment process involving discussions with high level officials as well as those involved in the day-to-day HPMS activities at the State and local level. Consideration should also be given to delegating this effort to the Division offices.
- Many States and local agencies are using different technologies for the collection and analysis of HPMS data and their own data collection efforts. The discussion at the Workshop confirmed that there is not a uniform method for the States and local governments to obtain and/or share information on the use of different technologies. This report makes a recommendation to establish such a process.
- FHWA has a quality assurance process in place through the Division offices to ensure that HPMS data is high quality. Yet, the responses to the surveys questioned the quality of some of the data. The consensus of the Workshop and Steering Committee was that FHWA should review the implementation of the quality assurance process and add emphasis to this effort.
- The issue of a common geo-referencing system and the ability of the various participants to reconcile LRS with other GIS systems needs to be addressed on a continuing basis. The progress of the NSDI and the results of that effort should be integrated into HPMS, as appropriate. The Steering Committee recommended that the goal of this effort should be to assure that HPMS geo-referencing systems are compatible with national, State, and local GIS systems (NSDI) and that the HPMS GIS issues should be considered as part of NCHRP project 20-27(3).

The recommendations resulting from the discussion of these issues are presented in Part I, Section 2, of this report.

APPENDIX A

Figures

FIGURE 1

HPMS AS A SUBSET OF A
NATIONAL HIGHWAY DATA BASE AND INTERMODAL
TRANSPORTATION DATA BASE

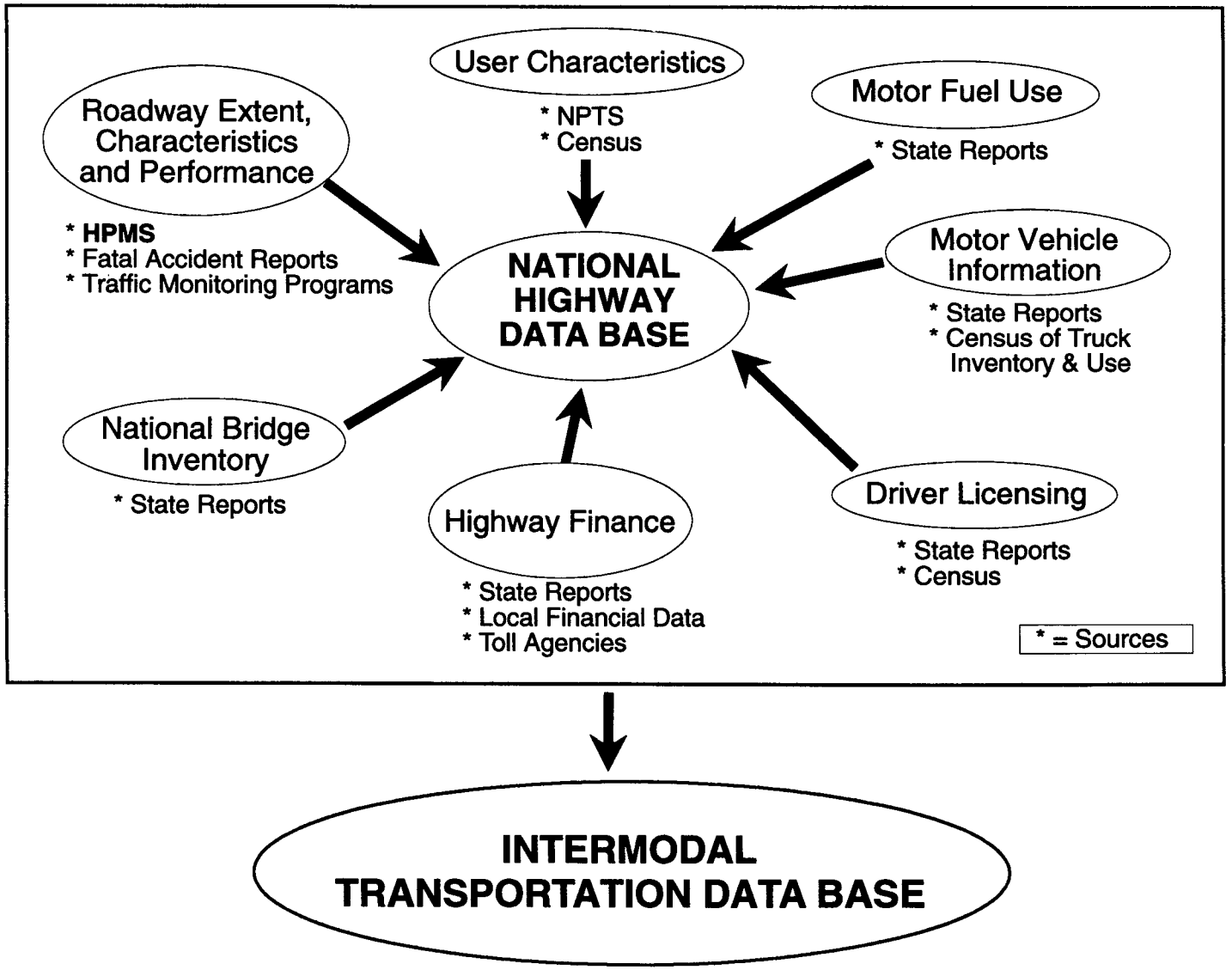
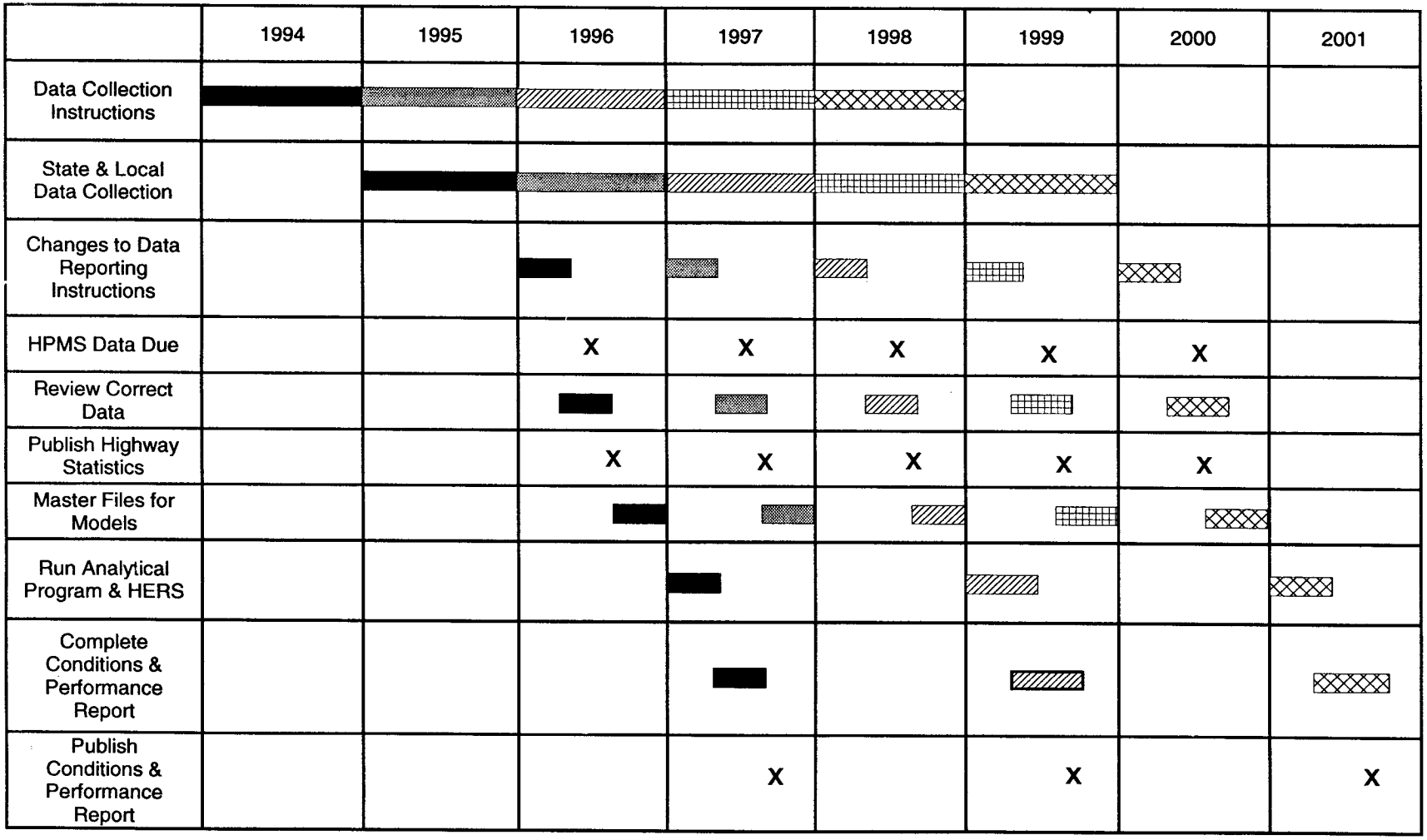


FIGURE 2
THEORETICAL FRAMEWORK

JURISDICTION / FUNCTIONAL CLASS	COUNTY	TOWN	MUNICIPALITY	STATE DOT	OTHER STATE	FEDERAL-AID SYSTEM
INTERSTATE				xxxxxxxxxxx	x	INTERSTATE
PRINCIPAL ARTERIAL	x	x	x	xxxxxxx	x	NHS
MINOR ARTERIAL	xx	xx	xx	xxxx		NHS/OTHER FED.-AID
COLLECTOR	xxxx	xxxx	xxxx	xx		NHS/OTHER FED.-AID
LOCAL	xxx	xxxxxx	xxxxxx	x		NHS/OTHER FED.-AID
DATA COLLECTION	↑	↑	↑	↑	↑	

xxx = Indication of mileage distribution by jurisdiction.

FIGURE 3
HPMS TIMELINE



APPENDIX B

Process for Evaluating Data Items

DECISION PROCESS FOR HPMS REASSESSMENT

Step 1 - Screen Each Data Item Against Criteria

Review each item, stratified by functional system, against each of the screening criteria. Determine which items should continue to be candidates for a revised HPMS data base.

Step 2 - Evaluate Section Level Versus Aggregate Reporting

Evaluate each remaining data item against the current level of reporting for each of the functional systems. Determine whether the data item should continue to be collected and reported on a section basis or whether the item should be collected and reported on an areawide, or aggregate, basis.

Step 3 - Evaluate Statistical Significance

Evaluate each data item obtained on a section basis to determine if the data should be collected for all sections or for a sample of sections. For those sections to be sampled, evaluate the appropriate level of statistical significance - national versus State. To meet travel tracking requirements, section length and traffic data will be needed at the urbanized area level of statistical significance.

Step 4 - Review Resulting HPMS Data Base

Evaluate the resulting data collection and reporting process on the basis of:

- Is the new data base consistent with the HPMS mission and objectives?
- Is the new data base an improvement over the current system?
- What is the cost of change versus the costs saved?
- What decisions on individual data items can be reconsidered when they are viewed as a group?
- What is the process and timing of change?

Step 5 - Public Input and Final Decision

The final step includes internal review and additional outreach to SCOP, AMPO, user and other outside groups and the public through the Federal Register.

APPENDIX C

Plan for Changes to the Computing Enviroment

CHANGES TO THE HPMS COMPUTING ENVIRONMENT

PROGRAM OBJECTIVES

The software development project is designed to:

- Provide a user friendly tool set to collect, analyze, and disseminate HPMS data
- Move HPMS operations to a client-server desktop computer environment
- Improve user access to HPMS data and analysis programs
- Add value to the HPMS for providers and users

OVERVIEW

The software development process is divided into four phases:

- Phase 1: Data Submittal
- Phase 2: Data Manipulation, Review, Summary
- Phase 3: Data Base Query
- Phase 4: Expert Systems Applications

Phase 1: Data Submittal

- CHARACTERISTICS:
  - Create HPMS data submittal in desktop environment
  - Update supporting HPMS records in desktop environment
  - Import/export data to/from mainframe systems
  - Link HPMS to State GIS

- STATUS:
  - Submittal software fully tested and developed
  - Workshops held March/April 1997
  - About ten States using this year
  - Wider use for 1997 data in 1998 expected
  - GIS linking process under development

Phase 2: Data Manipulation, Review, Summary

- CHARACTERISTICS:
  - Computer-aided data review capabilities
    - ◊ Cross comparisons
    - ◊ Trends
    - ◊ Graphic review - ArcView
  - Master file construction and update in client-server desktop environment
  - Create/maintain electronic highway statistics data base in client-server desktop environment
  - Linked electronic HPMS data base/National Highway Planning Network (NHPN) available over Internet
  - Enhanced analytical process for FHWA and States

- STATUS:
  - Partially operation Calendar Year 1997
  - HPMS/NHPN link operational early Calendar Year 1998 for States with complete networks
  - Enhanced analytical process Calendar Year 1999

Phase 3: Data Base Query

- CHARACTERISTICS:
  - Data base query in client-server desktop environment
  - On-the-fly query capability
  - SQL based interface
  - Generate ad hoc reports, charts, graphs, multi-year trends
  - User access via Internet

- STATUS:
  - Complete prototype Calendar Year 1997
  - Complete and deploy to users Calendar Year 1998

Phase 4: Expert Systems Applications

- CHARACTERISTICS:
  - Heuristic evaluation of HPMS data
  - Prototype as internal application
  - Extend capability to data providers

- STATUS:
  - Begin research in Calendar Year 1999

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