THEME 3
PROBLEM STATEMENTS

Theme 3 – The Broad Role of Pavement Management
Theme 3 includes problem statements that go beyond the standard functions of pavement management and include such areas as pavement design, impact of increasing load limits on pavement performance, and asset management.

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Development and Use of Effective Performance Measures

II. RESEARCH PROBLEM STATEMENT
To be most effective, pavement management should exist within an asset management framework that supports the integrated analysis of project needs and investment decisions. Agencies that have adopted asset management principles rely on performance management as a way of communicating needs, setting performance targets, and reporting progress. To date, a disconnect exists between performance measures used for strategic purposes and those that are reported in a pavement management system (e.g., IRI). In addition, many pavement management systems do not currently include measures needed to support the selection of pavement preservation treatments or the documentation of benefits for use in a pavement management cost/benefit analysis. Such measures might include maintenance patching or the consideration that pavement preservation might defer the need to patch. In some cases, existing performance measures are negatively impacted by the application of pavement preservation activities, such as an increase in roughness associated with the use of chip seals, so guidance must be provided on how to handle these instances.

Tasks: The research will include the following tasks:

1. Perform a literature review and survey of SHAs to synthesize performance measure terminology and targets, as well as thresholds and triggers.
2. Develop guidelines for determining effective performance measures and how to report measures according to the goals perceived by the target audience (e.g., technical, nontechnical, departmental, and political).
3. Perform a gap analysis of typical components and needs of pavement management systems compared to those of asset management practices, and identify strategies for closing the gap.
4. Develop guidelines for implementing a pavement management system with the intention of ultimately integrating it into an asset management plan.

Final Product:
The research will result in the development of a guidelines document recommending how to develop and/or synergize pavement management system performance measures to strategic initiatives. Additional products of this research will include definitions that will improve the consistency in the use of relevant terms, a synthesis of current pavement performance measures, and recommendations for using performance measures effectively.

III. RESEARCH OBJECTIVE
Under this study, states with successful asset management systems and their impact on pavement management will be documented, investigation of the connection between strategic and operational performance measures will be conducted, and guidelines on the use of pavement

management measures to support strategic initiatives will be developed. Innovative performance measures should be considered during this research. For instance, the use of nontraditional measures, such as the change in economic value over time, may be explored. Guidelines should also be developed for identifying effective performance measures for evaluating pavement preservation treatments in a pavement management system. Examples in which pavement management information has been used successfully for goal setting will be provided.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $250,000
Estimated Project Duration: 12 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Pavement Management Data Mining: Improving Current Uses and Leveraging New Applications of Pavement Management Data

II. RESEARCH PROBLEM STATEMENT
There is an untapped potential to make greater use of pavement management data to better address current agency needs and to provide insight into new areas (e.g., asset value, new design methods, improved construction practices, corridor studies, forensic investigation, and impacts of weight limits on performance). However, for these types of analyses to take place, it is important that data from related data sources are better leveraged.

Tasks: The research will include the following tasks:

1. Survey practitioners for types of pavement management data they collect.
2. Identify new areas where pavement management data can be utilized (e.g., asset value, new design methods, forensic investigation, and improved construction practices).
3. Develop case studies that illustrate the uses of pavement management data for the areas identified under task 2.
4. Develop guidelines (including case studies identified in task 3) on how to use pavement management data for addressing the areas identified in task 2.

Final Product:
The final product of the research is guidelines for using pavement management data to address the needs of other departments within an agency.

III. RESEARCH OBJECTIVE
There are two specific objectives for the research. First, the research will identify what pavement management data is collected. The second objective is to define how to leverage such data for use in other departments within an agency.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $350,000
Estimated Project Duration: 24 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Load Limit Impacts on Pavement Performance

II. RESEARCH PROBLEM STATEMENT
State legislatures are regularly faced with requests for load limit exemptions for a portion of the road system and often grant these requests without understanding the impacts to the road system. Nationally, there is pressure to raise the current 80,000 pound load limit on interstate highways to 97,000 pounds. In addition, agencies are faced with requests for permission to carry oversized loads or to levy fines to drivers of overweight vehicles. However, the impact of these heavy loads on performance measures, such as future pavement conditions, maintenance costs, and remaining service life, is not well understood and may be difficult for agency personnel to readily quantify.

Traditional methods of predicting pavement performance for pavement management purposes have utilized historical pavement condition data. A statistical analysis using regression is typically performed on pavement condition data to estimate changes in pavement condition with time. The historical data are assumed to be reliable predictors of future performance. However, if increased load limits are allowed on existing pavements, it is reasonable to expect that existing pavements will deteriorate at an accelerated rate since they were not designed to accommodate these weights. Future maintenance and rehabilitation costs may also increase to reflect the increased deterioration. Further, increased pavement thicknesses may be required for agencies designing new pavements or for rehabilitating existing pavements to accommodate the new load limits.

Tasks: The research will include the following tasks:

1. Identify one or more performance metrics that can be used to quantify the impact of increased loads (e.g., pavement condition, remaining service life, and increased maintenance costs).
2. Develop a methodology that illustrates the use of existing pavement management data to quantify the impact of changes in load limits on each of the selected performance metrics. Existing tools should be utilized as much as possible in developing the methodology.
3. Conduct trial applications of the methodology using data provided by SHAs.
4. Verify the methodology using data from an agency that recently increased load limits and has data that could be used to document impacts. Verification should include historical data from an agency where load limits have been increased at least 5 years prior to the start of the study. Comparisons should be made between the predicted impacts and the actual impacts as measured through pavement management or other methods.
5. Develop guidelines (including case studies) on using pavement management data for quantifying the impact of load limit increases, on how SHAs can incorporate developed procedures into the pavement management process, and how to verify/calibrate developed models to local conditions.

Final Product:
The research will result in the development of a methodology for evaluating the impact of load limit changes and guidelines on use of the methodology.

III. RESEARCH OBJECTIVE

There are three specific objectives for the research. First, the research will identify performance measures that can be used to quantify the impacts to the agency of increased vehicle loading. The second objective is the development of a methodology that can be applied using existing data to quantify the impacts associated with heavy vehicles loads. The final research objective is the development of guidelines that transportation agencies can use to implement the methodology.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $500,000
Estimated Project Duration: 36 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Developing and Supporting a Pavement Management Business Plan

II. RESEARCH PROBLEM STATEMENT
Pavement management has been around for decades, but in some ways the integration of pavement management into the core business function of many agencies is very immature. Pigeonholing pavement management as the collection and reporting of pavement condition is too narrow, and the assumption that pavement management is a panacea of everything related to pavements is doomed to fail as too broad. Defining the focus for pavement management and defining and developing necessary skills should be documented in the form of a pavement management business plan. Although the purpose is to show the strong ties needed between pavement management and agency business plans, the focus should include a broad array of functions ranging from simplistic to very complex and anticipate use by established practitioners, pavement management newcomers, and agency executives.

The term "pavement management" means very different things to different people. Pavement management practitioners can use their systems for the traditional pavement condition data collection and reporting, generation of rehab/maintenance plans, support of design, materials, and construction activities, and support of research, among others. However, having all of these tasks greatly broadens the demands on pavement management systems and the practitioners. These demands also greatly broaden the skills needed in pavement management work groups to include communications, statistics, economics, electronics, computer science, physics, etc. The potential for a more unified pavement management community with targeted goals and business integration strategies should mature the field.

Tasks: The research will include the following tasks:

1. Define core business functions of pavement management.
2. Conduct a survey of SHAs to identify the status of pavement management systems in accordance with the core business functions.
3. Determine barriers that are preventing the success and develop plans to help address incorporation of the core business functions. This task could include training, institutional issues, staffing, appropriate data, competing requirements, and technology needs.
4. Determine what tangential areas are best for expansion and what practitioners need to accomplish incorporation of the core business functions.
5. Develop appropriate training, implementation strategies, marketing plan, etc. to promote and facilitate coordination between agency vision, mission, and pavement management.

Final Product:
Training, implementation strategies, marketing plan, etc. to promote and facilitate coordination between agency vision and mission and pavement management.

III. RESEARCH OBJECTIVE
The research should provide means to create practitioners with the skills to more fully understand pavements and associated technologies and skills to communicate that knowledge for business and marketing decisions. Presumably, in an altruistic sense, this research will result in better decisions by the agencies that can be strongly supported by pavement management and practitioners and ultimately by the users of transportation.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $350,000
Estimated Project Duration: 24 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Use of Pavement Management Information for National Reporting

II. RESEARCH PROBLEM STATEMENT
In many states, Highway Performance Monitoring System (HPMS) data and pavement management data are collected by separate divisions or reported by someone not involved in the data collection process. In some cases, the HPMS data are "passed off" without regard for the accuracy of reporting the information. As a result, there can be issues with data quality between what is collected by pavement management and what is reported to FHWA through the HPMS process. Additionally, there is an inefficient use of resources if similar data are being collected by two different groups within the same agency. There is also generally less buy-in or credibility in the HPMS data than in the pavement management data. Furthermore, HPMS data does not always represent data that drives an agency's project and treatment selection processes.

Tasks: The research will include the following tasks:

1. Identify example SHAs who could supply both HPMS and pavement management system data.
2. Compare and identify data inconsistencies or quality issues that would keep an agency's pavement management data from meeting HPMS requirements.
3. Develop guidelines for standardizing data elements to meet both pavement management and HPMS needs.

Final Product:
The final product of the research is development of guidelines for a standardized method of reporting this information.

III. RESEARCH OBJECTIVE
There are two specific objectives for the research. First, the research will identify common inconsistencies between pavement management and HPMS data needs. The second objective is to develop guidelines for standardizing data collection and reporting to satisfy both requirements.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $100,000
Estimated Project Duration: 12 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Using Pavement Management Data to Support Design Activities

II. RESEARCH PROBLEM STATEMENT
Historically, pavement management activities have been implemented to support activities associated with the planning and programming of rehabilitation projects and preservation treatments. However, information from pavement management could be used to better support design functions if data integration and data quality issues are addressed. In this regard, additional tools are needed to use pavement management data to support the prediction of pavement performance (including the structural aspect) as are guidelines for using this information to locally calibrate performance prediction models using measured data. In addition, with the upcoming release of AASHTO DARWin-ME, more and more states will be looking toward their pavement management data to aid in the calibration process. The communication between the pavement design and pavement management staff will be critical to fully capture the benefits of mechanistic empirical based design and the predicted outcomes. A process to compare/check the predicted performance from mechanistic-empirical based design to the performance predicted from the pavement management system is needed.

Tasks: The research will include the following tasks:
1. Survey practitioners regarding how implementing AASHTO DARWin-ME has impacted, or compares to, their pavement management practices and/or recommendations, and how such impacts have been addressed.
2. Develop guidelines for determining the compatibility of prediction and recommendations from both the pavement management system and AASHTO DARWin-ME.
3. Develop software to reconcile and calibrate performance prediction models using pavement management and AASHTO DARWin-ME.

Final Product:
The research will result in the development of guidelines for determining the compatibility of pavement performance prediction between a pavement management system and AASHTO DARWin-ME, as well as the development of software to reconcile and calibrate the performance prediction models within a pavement management system and AASHTO DARWin-ME.

III. RESEARCH OBJECTIVE
There are two specific objectives for the research. First, the research will develop guidelines for determining the compatibility of pavement management and AASHTO DARWin-ME prediction and recommendations, and the second objective will develop guidelines and software tools for reconciling and calibrating pavement management systems and AASHTO DARWin-ME performance prediction models.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $350,000
Estimated Project Duration: 24 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
National Funding Allocations that Account for State Priorities

II. RESEARCH PROBLEM STATEMENT
Each state has its own way of prioritizing needs and allocating funding. As a result, there will be differences in the pavement performance measures that can be accomplished within each agency. However, there is a tendency toward national comparisons of pavement performance that do not account for these differences.

Tasks: The research will include the following tasks:

1. Survey SHAs regarding allocation of state funds toward highway transportation, conditions of their networks, and pavement management priorities.
2. Correlate SHA objectives and priorities to network condition and annual budget and expenditures.
3. Develop a methodology for determining a SHAs' success in terms of pavement condition relative to funding.

Final Product:
The final product of the research is a formula or set of benchmark guidelines for comparing SHA pavement management practices relative to funding priorities.

III. RESEARCH OBJECTIVE
There are two specific objectives for the research. First, the research will correlate SHA funding priorities with pavement management activities. The second objective is to formulate a sort of common denominator for all SHAs so as to appropriately compare relative success of pavement management practices.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $250,000
Estimated Project Duration: 12 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Identify Data Needs to Support Other Processes

II. RESEARCH PROBLEM STATEMENT
As data collection has become more sophisticated, the demand on data contained within the pavement management system has increased. This increase has been noted by pavement performance data for use in calibration of the Mechanistic-Empirical Pavement Design Guide (MEPDG), the HPMS reassessment, warranties, public-private partnerships, and forensic studies, among others. An assessment of what and how pavement management data can be used to support these various applications is needed.

Tasks: The research will include the following tasks:

1. Identify applications that can benefit from the use of pavement management data.
2. For the identified applications, determine the type of data, the amount of data, and the level of detail needed to support the various applications.
3. Determine the cost/benefit of collecting and incorporating the data into the pavement management system if not already present.
4. Quantify the risk of managing known versus unknown problems.
5. Conduct case studies to demonstrate benefit of using pavement management data in other applications.
6. Develop guidelines that demonstrate how pavement management data can be used in other applications.

Final Product:
Guidelines on what and how data contained within a pavement management system can be used to support other applications within a highway agency.

III. RESEARCH OBJECTIVE
The objectives of this research include identifying applications that could benefit from pavement management data, identifying current data that can be used to improve/enhance these applications, identifying gaps in needed data, and providing guidelines on how to better utilize pavement management data in other applications.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $350,000
Estimated Project Duration: 24 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Methodologies to Reliably Support Innovative Contracting

II. RESEARCH PROBLEM STATEMENT
With increases in the use of warranty, concessionary, and public-private partnerships, as well as other innovative contracting processes, changes in the use of pavement management data can be expected. For instance, historical pavement performance data and forecasted conditions may be used to set acceptable condition levels and to determine whether contractual performance requirements have been satisfied. As a result, a higher level of reliability is required of the data than is needed for traditional processes, and so data collection processes may need to be modified.

Tasks: The research will include the following tasks:

1. Identify data needs for managing innovative contracting projects, such as critical data for measuring performance.
2. Determine the impacts innovative contracting has on pavement management practices, and develop recommendations for accommodating these impacts (i.e., selecting applicable performance measures).
3. Identify means for collecting data to support performance measures.
4. Develop guidelines for ensuring pavement management needs are satisfied by innovative contracted projects.

Final Product:
The final product of the research is a set of guidelines for ensuring pavement management needs are satisfied by innovative contracting practices.

III. RESEARCH OBJECTIVE
There are three specific objectives for the research. First, the research will identify the various impacts innovative contracting has on pavement management systems. The second objective is to determine how to account for the impacts innovative contracting has on pavement management systems; for example, developing performance metrics and applicable data to measure said impacts. The final research objective is to develop guidelines for ensuring pavement management needs are satisfied by innovative contracting practices.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $250,000
Estimated Project Duration: 12 months

RESEARCH PROBLEM STATEMENT

I. PROBLEM TITLE
Impact of Earmarks on Pavement Performance

II. RESEARCH PROBLEM STATEMENT
Earmarks can consume considerable SHA funding, leaving less funds to address the needs of the entire highway system. Some earmarks require bond indebtedness that has a long lasting obligation to the SHA. When earmarks are large in dollars or numbers, they significantly alter the ability of the SHA to address pressing needs such as pavement preservation.

Tasks: The research will include the following tasks:

1. Survey practitioners and prepare a synthesis regarding the impact earmarks have on long range programming and planning.
2. Reconcile SHA network needs with earmarks relative to funds allocated.
3. Identify any trends between the status of network condition in the wake of large expenditures for earmarked projects.
4. Prepare a report that summarizes findings.

Final Product:
The final product of the research is a report analyzing the impacts earmarks have on a pavement management program and agency priorities and goals in terms of services provided by such earmarks, as well as any reduction in services provided according to the recommendations based on pavement management information.

III. RESEARCH OBJECTIVE
The primary objective for the research is to determine the impact earmarks have on an SHA achieving its network condition goals and/or addressing recommendations provided by its pavement management system.

IV. ESTIMATE OF PROBLEM FUNDING AND RESEARCH PERIOD

Estimated Budget: $100,000
Estimated Project Duration: 12 months