NO BOUNDARIES
Roadway Maintenance Practices

Survey Results: Maintenance Management Systems

October 2016

Introduction

Many state departments of transportation (DOTs) use a maintenance management system (MMS) to manage roadway maintenance activities. At some agencies, the MMS is part of a department-wide asset management system. The MMS may also be linked with other agency systems and databases, such as human resources or financial systems.

To learn more about state DOTs' use of maintenance management systems, in July 2016 the No Boundaries pooled fund project sent an online survey to maintenance representatives in all 50 states. The survey questions were designed to build on previous surveys conducted by Iowa DOT (February 2016) and Montana DOT (March 2014, through the AASHTO Research Advisory Committee).

Representatives from 33 states responded to the survey; Virginia DOT submitted two responses. This report summarizes the survey results in the following topic areas:

- Current State of Practice
- Features and Functionality of an Effective MMS
- Commercial Software Systems
- In-House vs. Commercial Systems
- Obstacles to Implementing a New System
- Challenges of Configuring and Using an MMS
- Recommendations and Lessons Learned

Current State of Practice

- 88% of respondents are using or considering an MMS.
- Of the states using or developing an MMS, 79% use commercial off-the-shelf systems, usually customized to their agency's needs.
- States' systems are in varying stages of maturity or development. Several states are implementing new systems, while several others have had the same MMS in place for over a decade, including commercial off-the-shelf systems in Delaware, Kentucky, North Carolina and Tennessee. Among systems developed in-house, some have been in place even longer; Kansas and Florida DOT both reported having an in-house MMS in place since the 1980s. The chart on the next page shows the stages of development of survey respondents' systems.

**Stage of MMS Use/Development
at Respondents' Agencies**
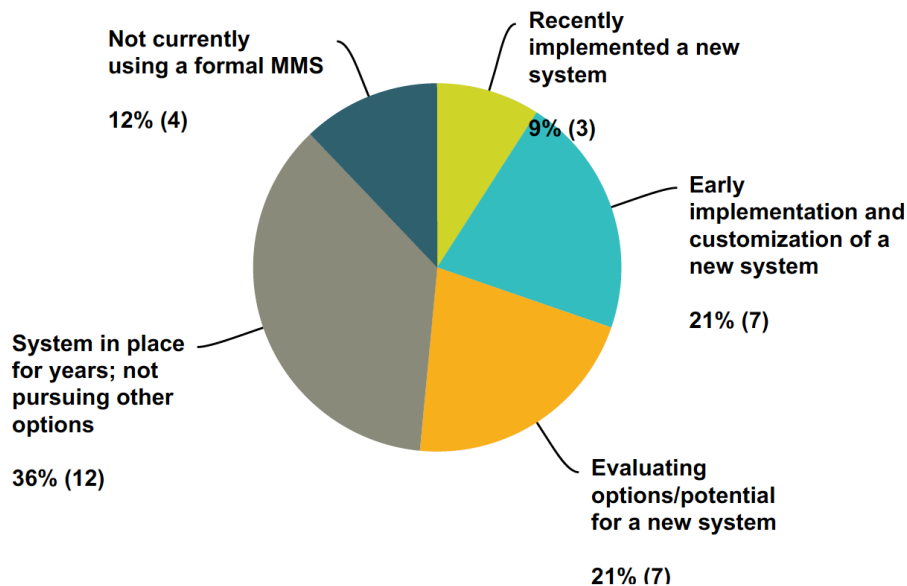
Several respondents noted that they stay informed about other MMS options even though they may not be formally considering a change. Comments included:

"We have been using a system for several years but have looked at some other systems. We have not yet made any decisions on changing." (Indiana)
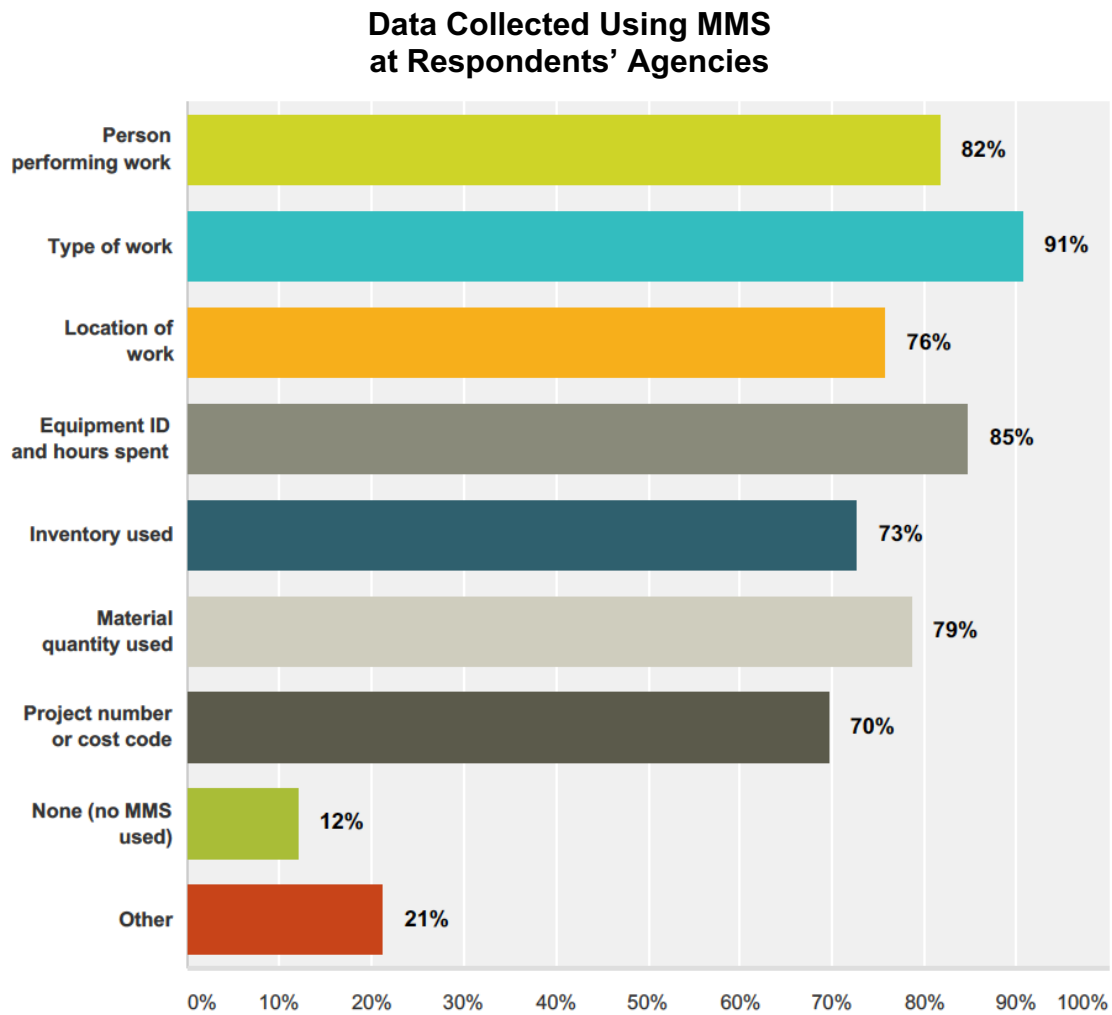
"We are using something that is close to a MMS, but doesn't satisfy all of our needs. We will be determining if we need to look for a new software or use the one that we are currently using with upgrades." (Vermont)

Features and Functionality of an Effective MMS

Respondents described the features and functions that are most important in an effective MMS, including:

- **User-friendly interface**, both for ease of data entry and to minimize training needs.
- **Mobile app** or compatibility with mobile devices for field data collection.
- **GIS-based system with map interface** (tied to asset inventory, work orders, etc.), paired with robust location services to accurately pinpoint work locations.
- **Ability to run desired reports.**
- **Interface with other databases and systems,** including ability to:
  - Use asset condition and inventory to inform maintenance planning, programming and budgeting.
  - Determine maintenance costs by mile.
  - Manage work orders.
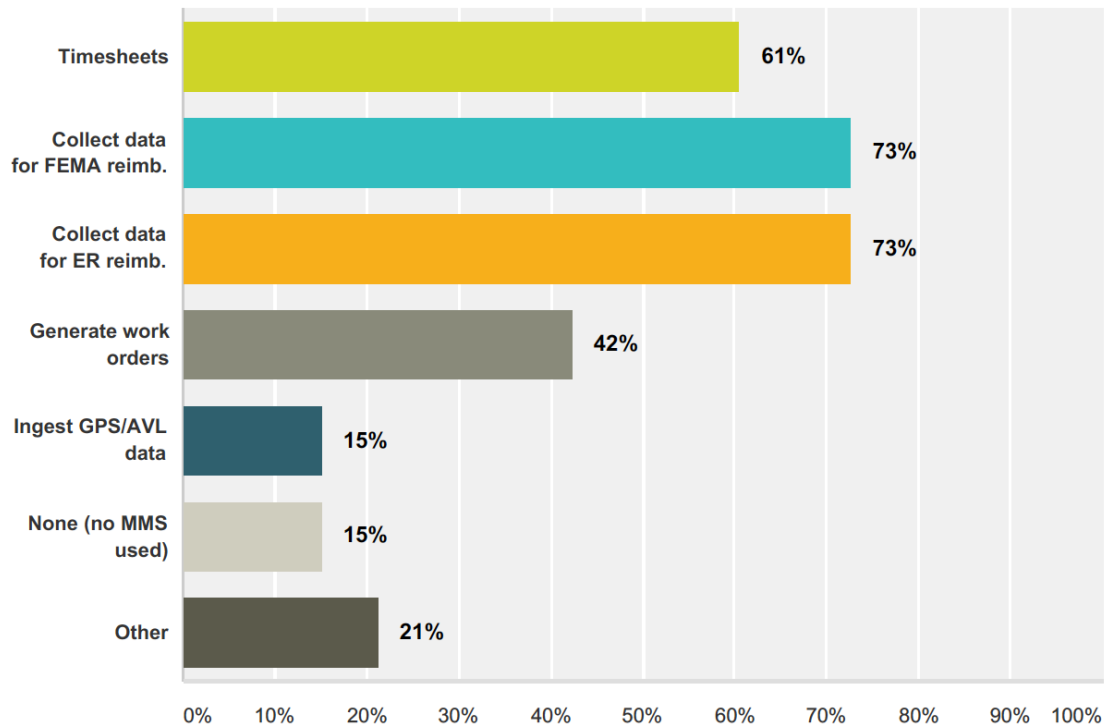 - Collect inventory and cost data.

The survey asked what types of data states use their MMS to collect and what functions the MMS performs. The two charts below show states' responses:

Data Collected Using MMS at Respondents' Agencies

Category	Percentage
Person performing work	82%
Type of work	91%
Location of work	76%
Equipment ID and hours spent	85%
Inventory used	73%
Material quantity used	79%
Project number or cost code	70%
None (no MMS used)	12%
Other	21%

The respondents who selected "Other" listed additional data collected, including:

- Date of work.
- Specific individual operating each piece of equipment.
- Inventory condition.

**Functions Performed Using MMS
at Respondents' Agencies**

Function	Percent
Timesheets	61%
Collect data for FEMA reimb.	73%
Collect data for ER reimb.	73%
Generate work orders	42%
Ingest GPS/AVL data	15%
None (no MMS used)	15%
Other	21%

Several respondents used the "Other" choice to clarify their answers. For example:

- Two states noted that they are working on adding the capability for their system to ingest GPS/AVL data.
- One noted that FEMA and Emergency Relief reimbursement requires additional data from the agency's financial management system.

Commercial Software Systems

The table below lists the commercial off-the-shelf software systems used by survey respondents.

Asset Management Software
Used by Survey Respondents

Software	Vendor	Number of States	States
AgileAssets	AgileAssets	11	Georgia, Idaho, Illinois (implementation in progress), Indiana, Kentucky, Louisiana (for linear assets), Minnesota (implementation in progress), North Carolina, Ohio, Utah, Wyoming
VUEWorks	DTS	3	Michigan, Rhode Island, Virginia
CMS	CitiTech Systems	2	Alabama, Mississippi
Managing Assets for Transportation Systems (MATS)	Parsons/Delcan	2	New Hampshire, Vermont (custom system jointly developed for New Hampshire, Vermont and Maine; Maine did not respond to the survey)
Maximo	IBM	1	Delaware
Synergen	[not provided]	1	Connecticut
Maintenance Productivity Enhancement Tool (MPET)	Four Winds Group	1	Washington State DOT (for bridge and tunnel maintenance)
SAP ERP (Plant Maintenance module)	SAP	1	Louisiana (for equipment and facilities)
Highway Maintenance Management System (HMMS)	Booz Allen Hamilton	1	Tennessee. [Note that Booz Allen Hamilton no longer offers HMMS.]

More agencies use AgileAssets than any other system. For more detail on states' experiences with specific vendors, see the March 2014 AASHTO RAC survey conducted by Montana DOT at http://research.transportation.org/_layouts/15/AASHTORAC/RACSurveyResultDetail.aspx?SurveyID=235.

In-House vs. Commercial Systems

A few survey respondents shared their experiences and perspectives on in-house and commercial systems:

- *"Overall, we believe our emphasis on developing systems in-house has been successful and far more cost-effective than purchasing and implementing commercial systems. We will continue to follow this emphasis in the foreseeable future."* (Washington)

- (Discussing an AgileAssets system) *"Housing the database on our state servers has been somewhat of a roadblock when we have wanted things changed. The red tape that is involved can sometimes be a bigger hassle than the need or want to have the database changed."* (Utah)
- (Listing obstacles to implementing a new system) *"Cost and designating a system that is somewhat commercial but customizable and can be supported by the vendor. If the system becomes more custom than commercial, then some support may be lost or possible upgrades that will not work."* (Arkansas)

Obstacles to Implementing a New System

Survey respondents identified similar issues as the biggest obstacles to implementing a new software system for maintenance management. Key challenges include:

- **Functionality.** Finding a new system that provides all desired functionality. (See "Features and Functionality of an Effective MMS" on page 2 for examples.)
- **System integration.** Integrating the new software with existing systems; undertaking pre-implementation testing; upgrading the software as needed.
- **Training and support.** Providing adequate training (especially on mobile devices), software documentation, and technical support (in-house or from the vendor).
- **Data issues.** Managing data collection (especially on mobile devices); concerns about data accuracy.
- **Staff concerns/new work processes.** Overcoming resistance to change (staff and/or management); establishing new work flows and data entry processes.
- **Managing costs and scope.**

Respondents' examples of obstacles to implementing a new MMS included:

"1) Making the new software fit existing data structure. 2) Making the software fit established business processes. 3) Keeping mobile software up to date with mobile technology. 4) Growing pains with training and adjustment of the management protocols." (Mississippi)

"Quality, accurate data. Need people to check accuracy of data all the time. Buy-in from the people that are using the system. Also support of the software after implementation. Fitting our processes into their software that could not be customized." (Louisiana)

"Obtaining a system with all of our needs and wants. Finding a system that fits our business practices as they are now. Training is always a hurdle when implementing anything new." (Utah)

(Describing an unsuccessful attempt to procure an MMS) *"Procurement support; consultants' lack of maintenance knowledge/processes. Functional requirements grew outside of maintenance, then sank under its own weight."* (Maryland)

Challenges of Configuring and Using an MMS

Respondents also identified ongoing challenges to configuring and using an MMS. Some issues overlap the obstacles to implementing a new system listed above. Challenges included:

- **Finding the right level of detail** for data collection and in reports to management.
- **Gaining staff buy-in:**
  - Compliance in entering required data.
  - Getting managers to use MMS data to make business decisions.
- **Filling ongoing training and support needs**, especially training for new staff.
- **Mobile data collection.**
- **Data accuracy concerns.**

Respondents' comments included:

> *"The system is only as good as the data that gets entered. The more detail you try to capture, the more of a chance that it will not be accurate. Limit the number of activities and data buckets for the employees to charge to."* (Kansas)

Recommendations and Lessons Learned

- **Establish up front how the MMS will be used.**
  - **Assemble a team representing multiple roles** and geographic areas to develop the system requirements. In Missouri, "We have a team of 22 employees that are currently working on the RFP from all of our divisions and geographic districts so that we have buy-in for the new system."
  - **Determine how MMS data will be used** to make decisions. Decide what the data can do and what it can't. Two perspectives:

    > *"MMS is not an accounting tool. Reconciling MMS data with accounting data can often lead to MMS failures if not mutually accepted as separate programs with distinct agendas."* (Maryland)

    > *"Overcoming hesitancy to use data provided from the system in decision-making processes [is a challenge]. Because there's a lack of trust in the data, leadership is often reluctant to use it. This lack of use leads to a lack of concern over the quality of the data entered into the system. It's a bit of a chicken/egg situation that you have to break out of in order to get the benefits of the system."* (Kentucky)

- **Plan for future functionality.** When configuring a new MMS, keep in mind that some current functions of the system may become obsolete over time, while other functions that are not used initially may become useful in the future.

- **Keep it simple.** Limit the amount of detail employees must enter, and use drop-down menus rather than free-form data entry. This improves accuracy and consistency and facilitates report generation.

- **Provide adequate training and support:**
  - Conduct just-in-time user training. If possible, assemble a full-time support team for the MMS, including software trainers.
  - For commercial systems, select a vendor that has adequate technical support staffing.
  - Put together a good change management team.
  - Provide adequate software documentation.

Respondents' comments on lessons learned included:

"Training is always the issue. Garbage in, garbage out. Finding the right level of detail so that it doesn't overwhelm the data entry but also has enough for management's consumption. Finding the right reports that paint the picture of where we are using our people, materials and tools." (Delaware)

"Challenge with new system will be deciding what is the 'right' amount of data to collect. There will be significant advantages to having a map-centric, transportation-centric software to help plan and deliver such a large maintenance program. Work order management and asset inventory are our initial priorities to implement." (Virginia)

"One of our biggest challenges has been in moving toward mobile collection of MMS data. KYTC has a lot of experience with mobile data collection for various purposes but we've not yet overcome this challenge for MMS." (Kentucky)

"Our current system does not have the ability to link our planning/programming of maintenance to the condition of the assets. The next system must provide this capability and make it easier to optimize our maintenance budgets based on available funding and inventory of assets. A GIS map interface is also a desired function in the future. The current system interfaces with our financial accounting system for labor and equipment, making the accuracy of this data much better; however, without an interface for stockroom inventory requisitions and local material purchasing, the accuracy of material costs suffers greatly." (Tennessee)

"As more people learn and use the system, it is becoming more accepted and new ideas are being presented for expanding its use." (Rhode Island)