MoDOT Maintenance Management System (MMS)

Prior to the development of the Maintenance Management System (MMS), maintenance staff used eight software programs to document maintenance activities conducted by the department. Data was stored in approximately 100 tables and collected on sticky notes, notepads and dry erase boards before being entered into various spreadsheets. The spreadsheets then had to be compiled together to create a statewide report. This process was complicated, inefficient and led to missed opportunities for federal reimbursements. MoDOT has 191 maintenance buildings and approximately 3,000 maintenance workers, which represents 60 percent of the workforce. Maintenance supervisors needed an efficient way to gather and share data so decisions could be made quickly and efficiently at local and statewide levels. This project was a result of many months of research to understand how MoDOT's seven districts managed maintenance activities, what obstacles they faced, what software they used and how to make tracking and reporting their tasks more efficient.

This web-based enterprise software is on a single platform where maintenance staff can assign and document their work and location, note the materials, record or approve fleet usage and calculations, look up asset information and access data from multiple data tables. In addition, the system provides results and performance data so leadership could make informed decisions on the best use of available resources. It produces high-level consistency on processes and documentation. Extracting and utilizing data are simple with the tools available within MMS and reduces duplication of effort. It takes a huge step forward in process uniformity which contributes to more accurate data. Using a specific, custom-designed software does not require an annual fee and system adjustments can be made when needed. MMS is a system perfectly matched to Missouri's needs and embodies the input of numerous individuals at MoDOT who contributed thought and effort into crafting an outstanding product to be used for years to come.

MMS was created to maximize MoDOT's ability to step out of the past, with its abundant limitations and obstacles and into a future of interconnected systems in an easy-to-use, sophisticated and integrated environment. The seismic shift will be felt for years to come and will make MoDOT more efficient as it continues to maintain approximately 34,000 miles of state roads and 10,400 state bridges. The access to rich amounts of reliable and timely data will take decision-making to the next level. We estimate MMS saves maintenance employees approximately 25 minutes per week year just by simplifying the process, which is 65,000 hours per year! This results in a return on investment of about $2.73 million yearly.

MoDOT's MMS received the prestigious Missouri Governor's Award for Quality and Productivity in Efficiency/Process Improvement in 2020. Only one award is selected from those submitted by the 16 Missouri state agencies to recognize service excellence throughout state government.

Department Integration

A steering team was established that involved representatives from every district and division that played a role in maintenance operations or its data. A steering committee was integral in

determining if an off the shelf solution or a custom application would meet the department's needs. They spent months talking with staff across the state, evaluating other systems, and determining what the system needed to include.

A dedicated team was developed to provide monthly updates to the steering committee and planned demonstrations throughout the development project. Maintenance staff was utilized to create videos of the demonstrations which were then shared on the wall monitors in every building. Finally, all maintenance buildings were given the ability to utilize the test environment to practice and train for several weeks ahead of their planned date to go live. Routine updates were also provided to MoDOT's executive and senior leadership. It was imperative to keep leadership informed and have their support.

MMS has allowed MoDOT maintenance to move out of a restrictive and somewhat painful past. No longer will employees need to access multiple programs. Supervisors will not need to spend so much time documenting work efforts. Trying to get data will not require running a special report. MMS includes mobile capability, tremendous use of data integration, application of Automatic Vehicle Location/Global Positioning System meter readings (miles and/or hours), utilization of a sophisticated Geographic Information System/Linear Referencing System platform and includes individualized computer access for all maintenance staff. For example, supervisors who plan work can now look at data for road and bridge conditions along with traffic counts to help prioritize projects. Also, data accuracy and detail are improved because exact begin and end log points can be selected from a map when documenting where the work was performed. Formerly, work coordinates could only be provided as estimates. MoDOT has moved into a technologically advanced future. Due to the success of MMS, other state departments of transportation have contacted MoDOT asking MoDOT for permission to share information on MMS to address the various needs of maintenance forces.

Data Analytics

MoDOT established an MMS steering committee in 2015, tasked with gathering information from field staff for a better understanding of the complexities of collecting maintenance activity data. Additional sub-teams were established to gather requirements, design, develop, implement and support a custom maintenance management system.

Off-the-shelf solutions were evaluated but were expensive and limited on customization specific to MoDOT's needs. The goal was to be more efficient by allowing the field staff to enter the work themselves. An innovative system was designed using our existing Transportation Management System as its framework. TMS is an elaborate system developed more than two decades ago to store roadway related data using a common linear referencing system. This gave MMS the ability to easily locate and map maintenance activities across the state. The new enterprise software was also designed to interface with several other systems critical to supporting a comprehensive maintenance platform. MMS interfaces with MoDOT's time reporting system, general services fleet application, Automatic Vehicle Location, Global Positioning System, Financial and Human Resources DataMart, as well as the State of Missouri's Office of Administrations Financial, HR, and Payroll systems.

No amount of preparation and design would be effective if the end product was too difficult to use. The project team never lost sight of the end-user, designing MMS to be user-friendly, web responsive and perform as efficiently as possible in low bandwidth areas. This would be the first time the majority of MoDOT employees would be using this type of technology. Every precaution was taken to make sure they had the best experience possible.

MMS software utilizes .NET coding to access multiple Oracle-based tables of data. Security level assignments and user identification credentials display a personal experience to each employee based on defined capabilities. Nearly 3,000 maintenance staff members now have web access via smart phones and 380 new touchscreen-capable laptops placed in the field. Batch processes, data verification methods and error detection are used extensively to ensure data accuracy and availability.

Lastly, MMS project designers created a dedicated testing environment for the project. This gave the project team flexibility to continue developing and addressing bug fixes without impacting testing. The project team was made up of contracted and in-house data experts. Comprehensive technical specifications and test scripts were created to ensure technical requirements were tested, and results were accurate. The project team spent months testing throughout the development phase, and the project schedule allowed users across the state to test for several weeks. This was another critical factor in the success of the project. Users were able to enter real data in the test environment just as they would when MMS went live. This resulted in smooth transitioning for many buildings as they moved to production mode.

Implementation

MoDOT's seven geographical districts have a total of 191 maintenance urban and rural buildings placed throughout the state. All facilities bandwidth capabilities were tested and evaluated for internet service improvements as part of the preparation. Baselines were marked for each building so degradation comparisons could be made after the system was implemented.

A lack of available computers was a problem in most facilities. MoDOT leadership recognized this challenge and agreed to purchase new laptops so that there would be a 4 to 1 employee-to-computer ratio in every building. Touchscreen laptops further simplified the user experience versus having to use a keyboard and mouse. Many users had little experience with a business application of this type, so user-friendly and simplicity were the keys to success. Many of the buildings also had to be modified to handle the additional machines. Everything from new wiring, switches, routers and mounting solutions were made to the buildings in order to quickly move staff in and out of the buildings at shift changes.

Technical manuals, testing and user guides were part of the deliverables of the project. These were critical parts that led to the success of the project. MMS affects many business areas within MoDOT. Testing guides were created by the project business analysts to ensure all scenarios programmed into the system were tested. The development team used train-the-trainer techniques to train dedicated and core team members. The dedicated team members used guides to train representatives from each district. The champions did an amazing job selling this system

to their peers, and the use of video software proved to be extremely valuable. The same software was used to create training videos for MoDOT users.

Due to the thousands of users across the state, the project team elected to go live in a phased approach. Each district determined the number of buildings they wanted to go live each week. It was critical for the districts to choose their own schedule within the allotted timeframe. The phased approach allowed the project team to monitor system performance, troubleshoot errors and receive user feedback on fixes needed. The dedicated team provided the key role of end-user support for every building. The data collected benefits every person who travels in the State of Missouri. MMS moved three thousand employees from pen and paper to a fully customized and integrated one-stop system.