TECHNICAL

BRIEF

DEVELOPMENT OF A PAVEMENT MANAGEMENT MANUAL AND DATA QUALITY PLAN

applied pavement TECHNOLOGY

Applied Pavement Technology

MDOT MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Mississippi Department of Transportation

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INTRODUCTION

Investments in transportation should achieve agency goals and lead to sound, long-term strategies. To successfully support transportation investments and achieve its goals, a state highway agency requires reliable business processes and software tools when managing its assets. Once in place, they should be continuously monitored and evaluated to ensure state of the art practices are utilized and regulatory requirements are met.

The Mississippi Department of Transportation (MDOT) has recently implemented new Pavement Management System (PMS) software tools. As part of that activity, the agency established and partially documented business processes supporting its pavement management activities. However, additional documentation was needed to meet reporting requirements established by both MDOT and Federal Highway Administration (FHWA) to establish pavement condition data collection quality procedures and to preserve institutional pavement management knowledge.

Assembling program documents in a single manual allows institutional knowledge about pavement management procedures and processes to be shared and adopted throughout the agency. A comprehensive manual also improves access to information about pavement management practices that can be used across disciplines and district lines, providing consistent guidance to managers leading preservation activities across the state.

PROJECT OVERVIEW

The study resulted in the development of a *Pavement Management Manual* that included two important features. First, the *Manual* includes a *Quality Management Plan (QMP)* that outlines quality checks to ensure the consistency and completeness of pavement condition data used to support pavement management. Secondly, the *Manual* documents pavement management practices, including pavement deterioration models and decision trees used to select preservation treatments, to help ensure continuity over time and to protect against the loss of institutional knowledge as staff transitions occur. More information on the *Pavement Management Manual* and the QMP is provided.

PAVEMENT MANAGEMENT MANUAL (PMM)

The PMM documents the pavement management processes used by the MDOT Pavement Management Group to collect and analyze pavement data to provide project and treatment recommendations. This document serves as a comprehensive source of information for MDOT personnel that includes documentation of:

- Pavement management's role and contribution to MDOT.
- Pavement management program roles and responsibilities.
- The annual schedule for pavement management activities.
- Pavement management legislative and policy directives (federal and agency).
- Program definitions and data dictionaries.
- Data collection protocols, pavement condition assessment techniques, and data quality procedures.

- Performance models.
- Treatment selection rules.
- Pavement management reporting.
- Future improvements.

Figure 1 illustrates the key pavement management processes used at MDOT.

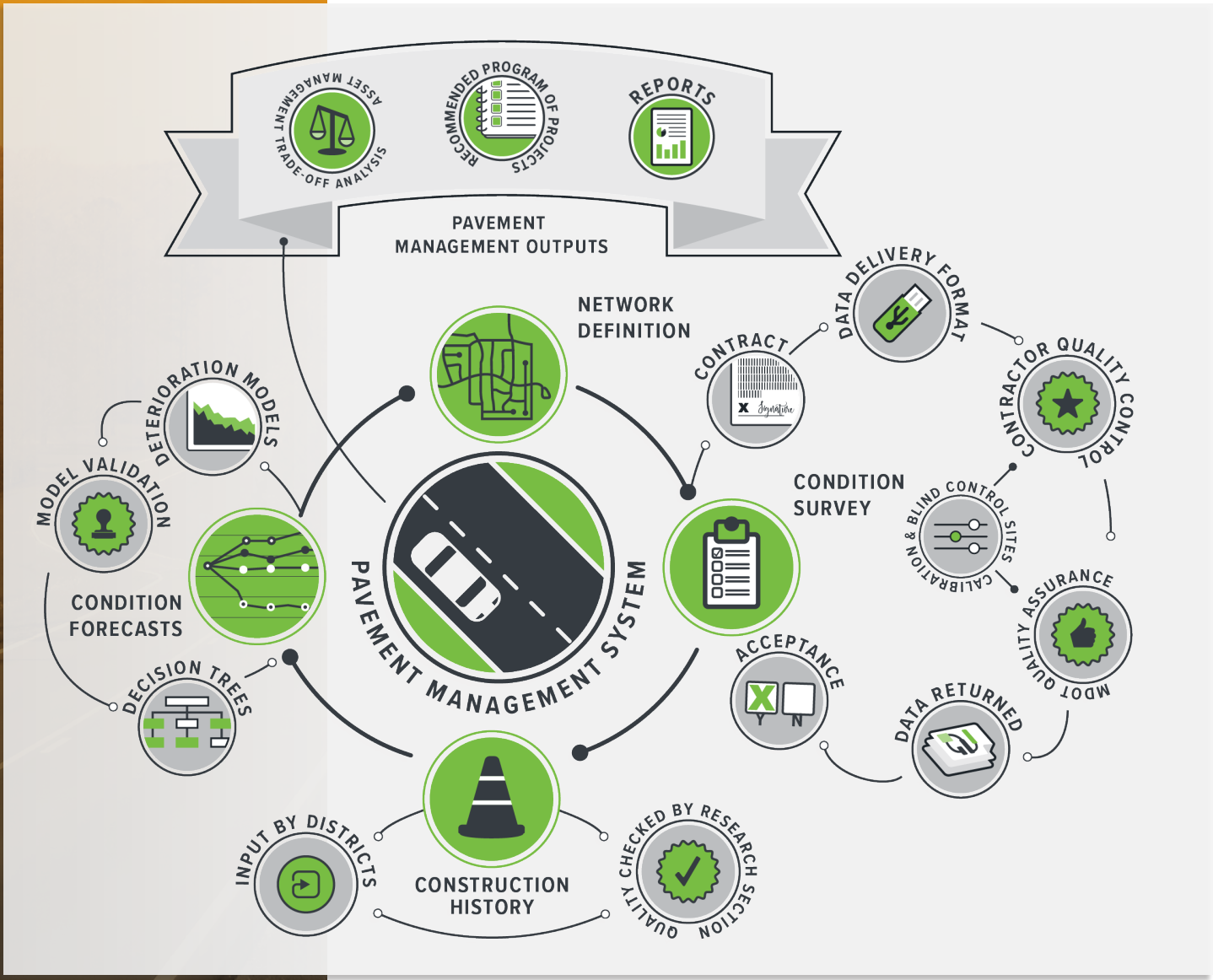

Figure 1. MDOT pavement management processes.

MDOT uses automated condition surveys to identify distresses that characterize the pavement network. Figure 2 shows typical images collected and the zones where certain distresses are likely to occur. Existing distresses are identified within each pavement section and rated either as low, medium, or high in severity.

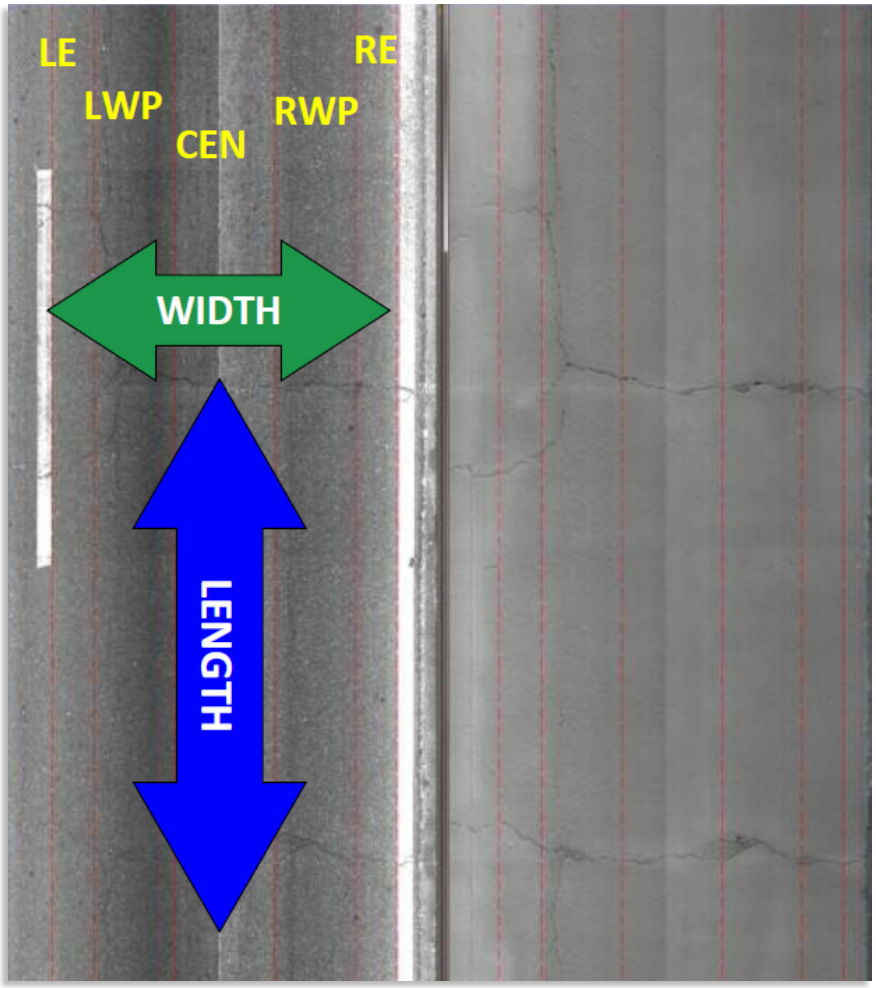

Figure 2. Typical pavement survey image with LE indicating the left edge, LWP indicating the left wheelpath, CEN representing the center lane, RWP indicating the right wheelpath, and RE representing the right edge. (Image courtesy of Pathways)

The *Manual* describes the process that occurs within the dTIMS PMS software to model pavement deterioration over time. The system uses a transition probability matrix for each distress identified that predicts a probability that the distress will degrade to the next highest category over an analysis period. As predicted pavement conditions are determined in future years, appropriate treatments can be proposed and prioritized. MDOT uses decision trees based on the roadway classification and pavement type for developing the pavement needs list within each District. Figure 3 shows a typical decision tree for a four-lane, flexible pavement section that is based on severity and extent of cracking distresses, rutting, and roughness. Proposed budgets can be evaluated by MDOT to determine what conditions could be achieved with each scenario, so that funding decisions can be made based on the likely outcome.

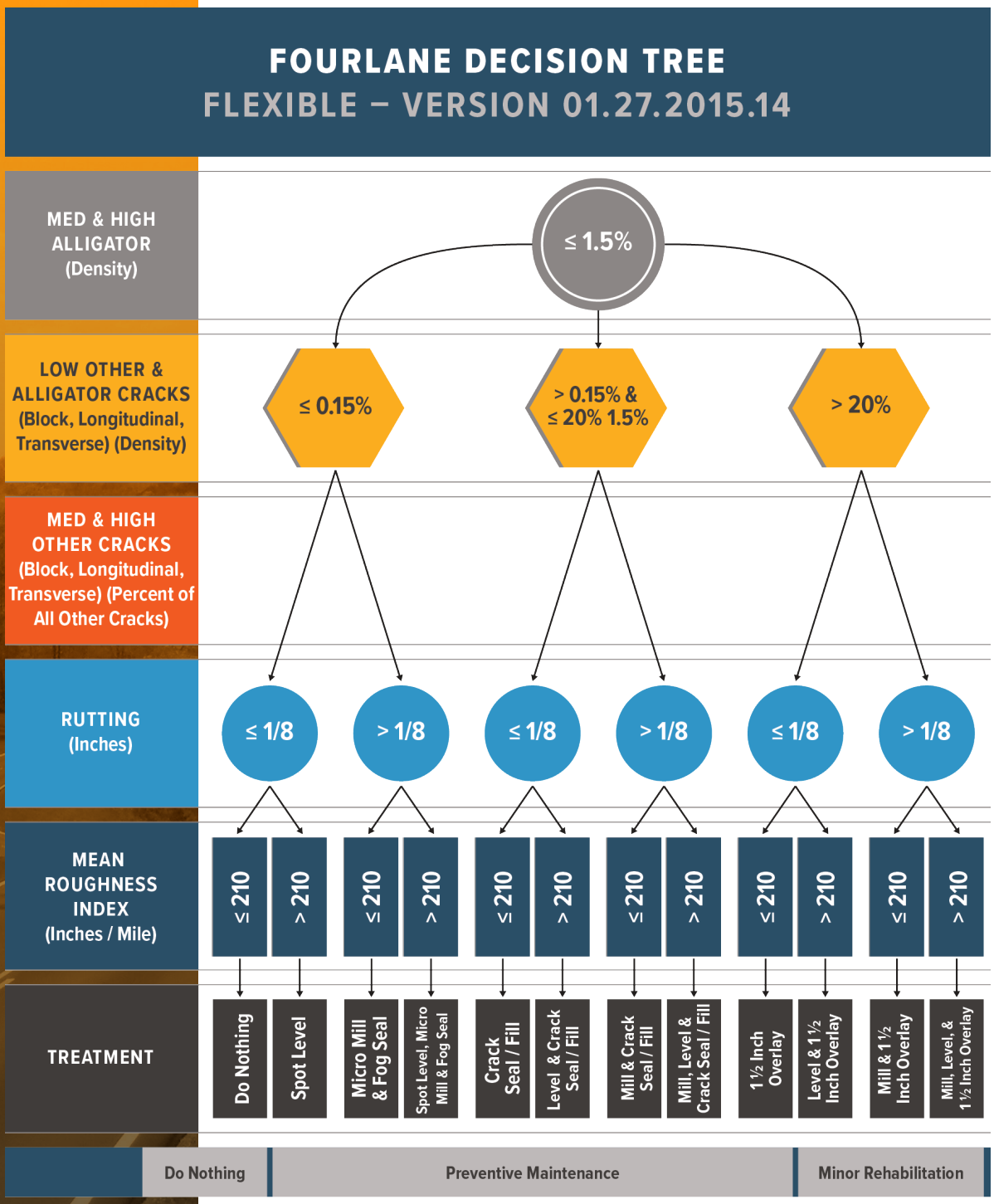

Figure 3. Four-lane, flexible pavement decision tree.

The *Network-Level Pavement Condition Data Collection Quality Management Plan*, described in the next section, is included in the *Manual* as Appendix E.

QUALITY MANAGEMENT PLAN

Under current FHWA requirements, pavement condition data is to be used by each state highway agency to establish 10-year pavement performance targets for the National Highway System (NHS) and to document interim progress towards meeting the targets that have been set. Reported field conditions are used to determine pavement deterioration rates and to trigger treatment recommendations. Therefore, improvements in pavement condition data quality are expected to lead to more reliable performance models in the PMS that better represent expected network conditions.

To ensure the reliability of the information used to make project selection decisions, accurate and consistent data to forecast future conditions is needed. A QMP documents acceptable levels of data quality, data collection procedures, quality control and acceptance criteria, roles and responsibilities for the data quality management team members, and reporting requirements. Developed following the guidance available in the *Practical Guide for Quality Management of Pavement Condition Data Collection* published by FHWA, the QMP covers all three stages of data collection. Critical activities carried out before data collection commences, during data collection, and after the data has been collected are described within the document. The main quality management features for each stage are as follows.

PRIOR TO COLLECTION

- Selecting deliverables; their data collection method; and the protocols, resolution, and accuracy for each deliverable.
- Establishing roles and responsibilities for the agency and vendor.

DURING COLLECTION

- Completing quality control practices for data collection equipment operation.
- Ensuring data consistency and quality expectations for Mean Roughness Index (MRI), rutting, faulting, friction, and other distress data.
- Delivering data at appropriate intervals for agency verification.

AFTER COLLECTION

- Verifying data quality for acceptance based on data completeness, pavement type, Pavement Condition Ratings (distresses and densities), mean roughness index, and videologging.
- Reporting data quality findings, steps taken toward resolution, and data acceptance.

The QMP is designed to be used by the Pavement Management Group during the data acceptance process and as part of the data collection contract. Sample pages from the QMP are shown in figure 4.

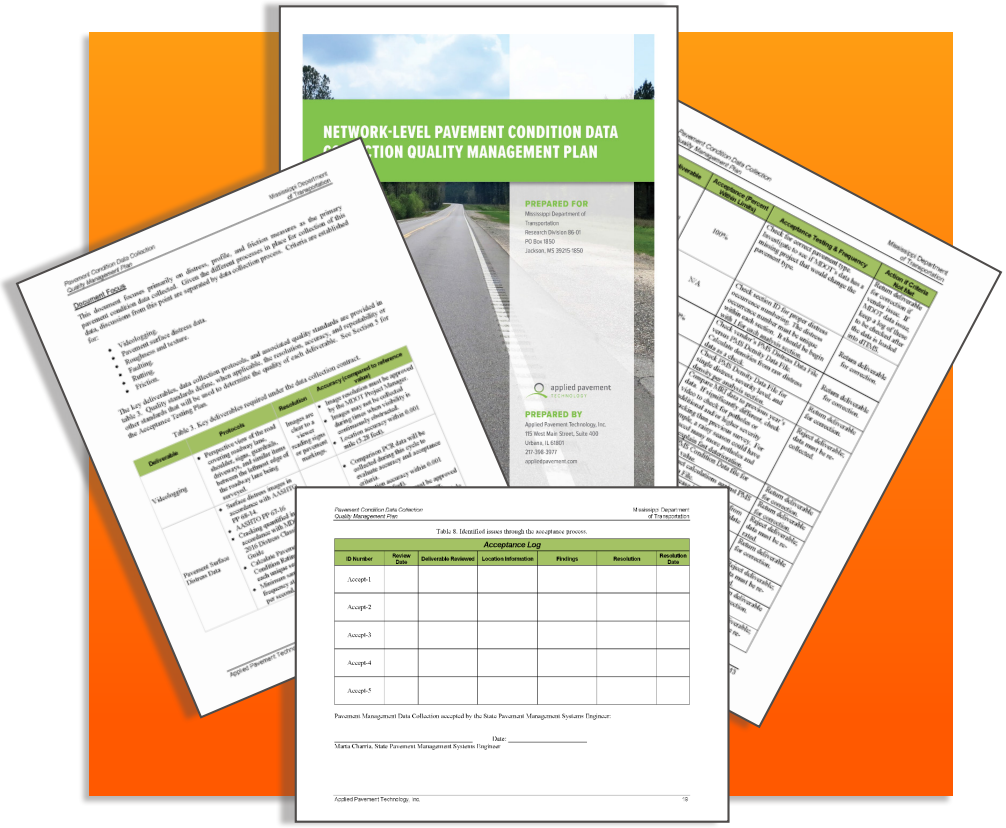

Figure 4. The QMP establishes deliverables and quality acceptance requirements, and also provides a location to track data quality concerns and resolutions.

MDOT evaluates data on 100 percent of the sections collected by the data collection contractor. MDOT's quality assurance personnel compare current and previous ratings to evaluate differences in the values. Pavement condition data is accepted based on the percent within limits for each criteria. Section identification and location values are reviewed by MDOT and, if discrepancies are found, the sections are returned to the contractor for re-collection. The QMP quality control and data acceptance logs provide a format for promoting regular communication between the contractor and quality assurance personnel to quickly identify data quality issues and to discuss the process to address any inconsistencies.

MDOT uses calibration sites, such as the one shown in figure 5, to verify the accuracy and repeatability of roughness, rut depth, and skid testing measures. To verify distress data, the survey results are compared to previous years' inspections for both completion and validity. Controlling the quality of the data prior to acceptance has proven to be an important step towards the agency's target of achieving a robust PMS that allows for future maintenance and rehabilitation planning. The Pavement Management Group is considering additional steps to improve PMS data quality that will further increase project selection credibility and allow district staff to have greater confidence in the system reports to assist in making preservation and maintenance decisions.

Figure 5. Manual pavement rating used as data quality assurance.

FIND OUT MORE

To get a copy of the PMM or QMP, or to learn more about these products, contact:

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