Implementation and Improvement of Pavement & Asset Management Systems in Tennessee (RES2013-31)

Purpose of the project

The main purpose of this project is to produce an implementation guide of Pavement Management System (PMS) and Asset Management System (AMS), including pavement asset inventory data management, asset performance data collection, pavement asset condition report, pavement maintenance effectiveness evaluation and maintenance strategy analysis. This implementation guide will be accomplished by a comprehensive study on the current application of PMS and AMS systems of Tennessee Department of Transportation (TDOT).

Scope and significance of the project

The evaluation and preservation of existing highway assets are important for both the public and the transportation agencies. Since the 1990s, TDOT has been using the Highway Pavement Management Application (HPMA), a PMS software, to monitor and manage its 1,073 miles Interstates and 13,077 miles state routes. Recently, TDOT is developing a new Asset Management System (AMS) and integrating it with traffic and geographic systems. It is of great importance to set up a practical asset management plan to assist engineers in selecting proper asset performance measures and conducting maintenance analysis.

The successful implementation of PMS and AMS involves developing and managing inventory data, defining reliable performance index and maintenance criteria, collecting high quality condition data, tracking maintenance records, producing accurate condition report and conducting cost-effective maintenance strategy analysis under different funding and pavement condition levels. Those tasks as a whole are of great importance to help TDOT track its assets and apply the maintenance funds correctly and effectively for all assets.

Expecting outcomes

The research team worked closely with TDOT maintenance engineers and staff during the project and has achieved the following accomplishments:

1. The new pavement asset inventory, traffic, distress, and maintenance records information were compiled and updated in the HPMA.
2. Annual reports of pavement condition and maintenance strategies for the four Regions of TDOT were produced and the working templates were generated. Figure 1 shows a chart of pavement conditions under a predetermined budget level.
3. The research team worked with TDOT maintenance and transportation engineers to generate the annual pavement asset condition report for the Highway Performance Monitoring System (HPMS) of FHWA, upon the requirement of MAP-21.
4. The poor pavement sections in Tennessee (PSI or PDI lower than 2 in the 0 to 5 scale) were identified and diagnosed. As shown in Figure 2, the details of the poor sections, including structure, maintenance records and locations, were examined and the potential causes were analyzed.
5. The research team investigated the sampling method in pavement quality inspection and found that passing percent is the most significant factor for sample size. The current practice of TDOT has a confidence interval of ±0.007 at state level, ±0.014 at region level, and ±0.069 at county level, which are more precise than the NCHRP

recommendation. An effective approach for improving the precision at lower management levels without increasing sample size is to evenly assign sample size among different subgroups, regardless of the road mileage within that subgroup.

6. The failure probabilities of four typical asphalt pavement seals, including slurry seal, chip seal, thin asphalt overlay and fog seals were investigated by survival analysis and the following factors were identified: traffic level, freeze index, and structural capacity. It is noted that the most significant factor is the pre-treatment pavement condition. Cautions should be exercised when preventive maintenance treatments are used in poor sections.
7. To analyze the effects of overlay thickness, with or without milling, traffic and highway type factors on the specific pavement distress, the research team investigated 232 historical maintenance projects and adopted the Structural Equation Modeling (SEM) method to establish the correlations between the factors and each distress.

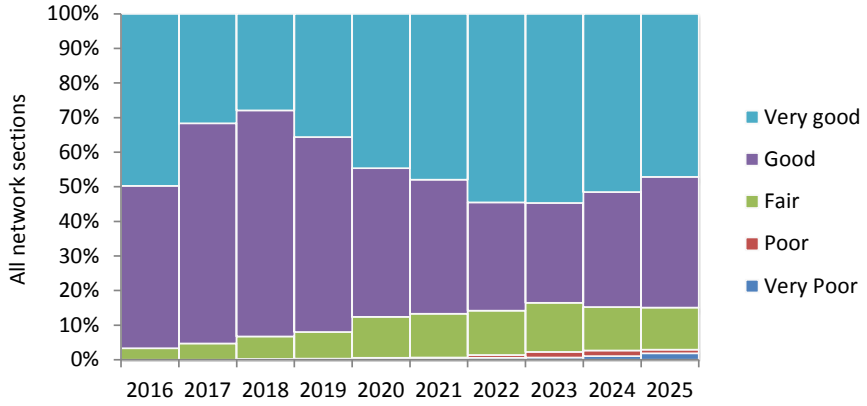

Figure 1 Predicted pavement conditions for Interstates at current budge level (66 $million/year)

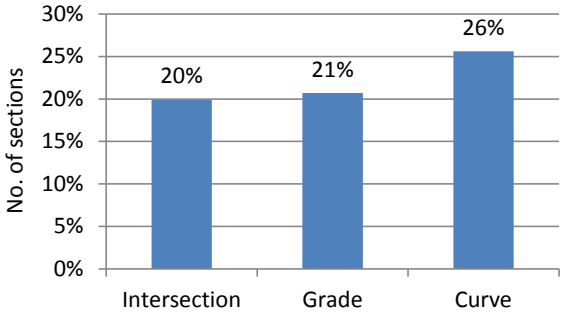

Figure 2 Geometry features of identified “poor” pavement sections

Time periods and status of the project

The project was initiated on July 1, 2013 and was completed on July 31, 2016. Upon the completion of the project, related working templates and analysis reports were submitted to TDOT. The outcomes were also presented and disseminated on international conferences and in journal papers.

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