Michigan Department of Transportation - M•DOT

Mates

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PAVEMENT MANAGEMENT SYSTEM (PMS)

Pavement management systems (PMS) are not new to MDOT. We have always managed our network of pavements and selected projects for rehabilitation based on project and network needs. Decisions on which projects should be candidates and what rehabilitation treatments should be used were based on expert opinions founded upon the knowledge of recognized resource persons within the Department. Three factors have contributed to the need for more automated systems than were used in the past. First, reductions in staff require that we do more work with less personnel. Second, the complexity of managing the preservation of the trunkline system is increasing. The other major factor contributing to the need for a change is the necessity of making more efficient and effective use of available funds.

On January 13, 1989, the Federal Highway Administration (FHWA) published a mandate that state highway agencies develop and implement an acceptable PMS by January 13, 1992. This requirement was reinforced and broadened by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). This act mandated six management systems, one of which pertains to highway pavement on Federal Aid Highways.

The basic elements of a pavement management system have been identified in the 1990 American Association of State Highway and Transportation Officials AASHTO Guidelines for Pavement Mangement Systems as: a data base, an analysis procedure, and a feedback process. The Materials and Technology Division's Research Laboratory began developing a computer-based analysis procedure in 1984.

Early development of the PMS was guided by a task force composed of participants from the Bureaus of Planning and Highways. This multidisciplinary approach assured that the system would serve the needs of a broad range of potential users. An early effort of the task force was to survey all potential users to determine what types of questions they would like a PMS to answer for them. Not all potential users were able to respond to this request, leaving the task force and the PMS development staff with the responsibility of anticipating everyone else's needs. Another challenge presented by the respondents was for a system which could answer a very broad range of questions (a complex programming requirement) but which would be easily operated. The PMS development group answered this challenge by developing an analysis software system that provides all the capability requested by the respondents. However, the software needed to convert the products of this analysis to the most desirable user form is still in the development stage.

In recent years, the development of MDOT's Pavement Management System has been guided by a PMS users group. As the need for a PMS became critical for the Department's management, so did the need for user input. The users group consists of representatives from the Planning Bureau, the Office of Information Management, the Design, Maintenance, Materials and Technology Divisions, and three of the Department's nine District Offices. The Federal Highway Administration also participates in the users group as they must approve the final PMS by January 1993.

MDOT has a well defined project selection process established with the adoption of the Management of Highway Program and Project Development document, commonly reffered to in the Department as 'The Orange Book.' Michigan's PMS analysis method is designed to support the project and program development process. The software developed to date has been designed for operational policy level use. Additional software must be developed if the PMS products are to be used for project and program development. Decision support systems are a specialized part of the software that has been developed by the Research Staff. Michigan's PMS has been developed to assist the decision makers with developing program constraints. A computer system which makes decisions can become a 'black box' which only a few experts understand and the remainder of the Department distrusts. The analysis methods developed for MDOT are based on simple methods that can be performed manually as well as with the aid of computers. However, the volume of condition data and the analysis of that data into convenient forms requires the use of computers. We want our PMS to be used by as many people as can find a need for the data and analysis techniques in their assigned responsibilities.

The data base which supports our PMS consists of pavement condition files, a location reference file, cost files, and fix guides. Other files which are available are friction, longitudinal profile, and rut depth data. Future MATES issues will provide more detail on the data base and its various files.

The analysis procedures consist of condition, project, network, and strategy analyses.

- Condition analysis manipulates the condition data files to combine segments with uniform condition, and a decision support system identifies the primary causes of pavement distress.

- Project analysis is based on each District's cost and fix guide, and responsibility for the accuracy of cost and fix guides is with the District. For each feasible fix alternative, project analysis computes its cost, design, service life, and ranking position according to benefits provided.

- Network analysis computes the condition, average remaining service life, and primary causes of distress for any defined network of routes (e.g., District 5 freeways, statewide primary commercial network, etc.).

- Strategy analysis provides the relationship between annual cost and future condition of defined networks and any given strategy. A strategy is the average design service life and percent of network annually preserved.

Future MATES articles will provide more detail on these analysis procedures.

The feedback process is the least developed of the three basic elements of a PMS as defined by AASHTO. Part of the feedback process that is in place is the comparison of condition data, collected every two years, with our assumed condition of the pavement. Further development of the feedback process will provide for automatic updating of

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programmed projects, constructed projects, and fix costs. Automated updating will be necessary before data files are accurate and current.

Michigan's PMS analysis method software was developed for the mainframe computer. In the 1984 to 1988 time period in which the software was developed, the Reseach Laboratory didn't have personal computer (PC) programming capability. Only recently has the speed, memory, and networking capability of PCs made it possible for them to be used for PMS analysis and data storage. Because of the user friendly characteristics possible with PCs, compared to that of the mainframe computer, many user friendly features are planned to be incorporated into the new software. In response to the users group request, we have begun to rewrite the software for personal computers.

Michigan's pavement management system was not designed to be a static system and used only as developed. Rather, it is intended to be a dynamic learning system that is periodically upgraded to best meet the needs of managers, engineers, and planners. It is anticipated that PMS development specialists will always be kept on staff so that the PMS continues to be responsive to the Department's needs.

-Larry Heinig

TECHADVISORIES

The brief information items that follow here are intended to aid MDOT technologists by advising or clarifying, for them, current technical developments, changes or other activities that may affect their technical duties or responsibilities.

PERSONNEL NOTES

Two stalwart members of the Materials and Technology Division retired recently. **James Collinson** retired from the Geotechnical Services Unit of the Geotechnical and Geoenvironmental Section after 35 years with the Department. Jim was in charge of the boring and coring crews and was the master of many difficult situations over the years. The other retiree, with 27 years, was **James Eubank, Jr.** Jim was a technician in a chemical laboratory in the Chemical Technology Unit of the Research Laboratory Section. Both Jims brought a sense of humor to work with them, and their presence will be missed. We wish Jim C. and Jimmy E. the very best in their retirement years...In the past months, we have taken on some new employees. New engineers include **John Barak**, who joins the Testing Laboratory's Bituminous Technical Services Unit...**Mark Grazioli** in the Testing Lab's Structural Fabrications Unit...**Leonard Habel,** an environmental engineer in the Geoenvironmental Services Unit of the Geoenvironmental and Geotechnical Services Section...**Tom Holm** who is with the Structural Services Unit of the Testing Laboratory Section. We welcome these young and enthusiastic engineers, and know that they will be an asset to the Division. Three engineering technicians are among the new personnel, **Marc Beyer** joins the Testing Laboratory Section's Bituminous Technical Services Unit... **Dan Etelamaki** is a new member of the Materials Support Unit of the District Support Section...and, **Joe Rios** is with the Geoenvironmental Services Unit of the Geoenvironmental and Geotechnical Section. Two other new faces at M&T, though not new to the Department, have transferred their expertise from the Maintenance Division. **John Dunham** and **Larry Pope** are equipment technicians, assigned to the Instrumentation and Data Systems Unit of the Research Laboratory Section. As always, it's with great regret that we lose some of our veterans to retirement, but it's gratifying to note the caliber of the newly hired, and we extend the Division's welcome to them all.

M&T PUBLICATIONS

Cantilever Sign Structure Inspection - Final Report, Report No. R-1319, by Brian W. Ness and Roger D. Till. Because of the failure of two cantilever sign structures in early 1990, the Department mandated a yearly inspection for the six smaller cantilever types used in Michigan, and a six-month inspection for the two larger types. This report summarizes the findings of these inspections, and provides recommendations for future sign support practice. The spring 1990 inspection resulted in the removal of seven structures. The fall 1990 reinspection of the larger structures resulted in the removal of five more, for various reasons. Three structures were removed in the spring 1991 inspection, all of them were the smaller type cantilevers. Based on the results of the inspection programs, it was recommended that the Maintenance Division inspect the structures and ultrasonically evaluate their anchor bolts on a variable frequency (between one and two years is recommended) using contract personnel, and the Division should institute a statewide anchor nut tightening program using a calibrated hydraulic torque wrench. Further suggestions involve a review by the Design Division, closer monitoring of the installation of signs by the Construction Division, and District and Traffic and Safety Division programming of replacement of outdated, deteriorating, or no longer needed cantilever structures.

Evaluation of Ice Detection and Highway Weather Information Services - Final Report, Research Report No. R-1316, by J. H. DeFoe. This project, conducted in cooperation with the Federal Highway Administration, was to evaluate the usefulness and cost effectiveness of MDOT's pavement surface sensors and pavement forecasting system as part of a nationwide project. The study was conducted over two winter seasons and involved six MDOT Maintenance Garages. Although MDOT, and other highway agencies, have evaluated pavement sensors and weather forecasting systems in the past, most of these evaluations have addressed the performance of the equipment. The report contains a brief review of the State's winter maintenance operations, and winter maintenance policy, and describes the MDOT Weather Information System. This system consists of pavement condition sensors, Scancasts (forecasts provided by a contracted private company), weather radar, and a TV cable weather channel. Winter maintenance event forms were given to maintenance garage personnel, and these were compared with the information provided by the weather system. After two winters, it was concluded that sensors in bridge decks and pavements were dependable and cost effective. The pavement forecasting system is considered useful by some maintenance supervisors but more reliable and timely information can be obtained from local cable television weather broadcasts. Weather radar at local airports proved to be unreliable and was not used by any of the garages.

This document is disseminated as an element of MDOT's technical transfer program. It is intended primarily as a means for timely transfer of technical information to those MDOT technologists engaged in transportation design, construction, maintenance, operation, and program development. Suggestions or questions from district or central office technologists concerning MATES subjects are invited and should be directed to M&T's Technology Transfer Unit.

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