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Research Project Title: Develop Maintenance Strategy Selection Procedures for Pavements Incorporating Semi-rigid or Chemically Stabilized Layers

16. Abstract

The Texas Department of Transportation (TxDOT) does not currently have a formal maintenance strategy selection procedure for pavements that have semi-rigid or chemically stabilized layers. Researchers developed questionnaires and interviewed experienced TxDOT personnel in each district to determine the appropriate maintenance treatments and timing in that district for a variety of expected situations and conditions. These were integrated into a decision support framework.

The result of this project was a field guide containing the district treatment assignments of each district for a matrix of expected conditions including:

- distress type, severity, and quantity;
- traffic level or importance;
- rate of development; and
- purpose of the treatment.

A similar field guide was also prepared for airfield pavements.

The research team developed a computer program and user's manual to assist in treatment selection.

17. Key Words	18. Distribution Statement
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Project Summary Report 1722-S
Project 0-1722: Develop Maintenance Strategy Selection Procedures for Pavements Incorporating Semi-rigid or Chemically Stabilized Layers

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MAINTAINING PAVEMENTS THAT HAVE CHEMICALLY STABILIZED LAYERS

As the Texas Department of Transportation (TxDOT) changes to meet new challenges and as experienced people retire or otherwise leave state service, new maintenance people and area engineers are hired to fill those positions. Since training in the areas of pavement performance and the impact of maintenance treatments is usually a hands-on, learn-by-doing effort, there exists a need to provide these people with some guidance as to when maintenance treatments should be applied. Also, since most formal education programs do not discuss when, why, or even how to apply maintenance treatments, inexperienced personnel are unprepared to deal with these problems.

This project addresses this need for the specific situation of asphalt pavements placed over chemically stabilized layers. In addition to providing guidance to inexperienced personnel, the results of this research will help standardize approaches to maintaining pavements within a district, and since each district has access to the guidelines from all other districts, new or different approaches used by other districts can be discovered.

The key question answered by this project is "what is the proper maintenance strategy and under what conditions should it be performed?" Pavements with stabilized layers perform differently, in terms of distress, than flexible base course pavements and must be maintained differently. For example, a typical, properly performing pavement with stabilized layers will have transverse cracks with a crack spacing (distance from one crack to another) of 6 - 20 feet caused by shrinkage of the underlying stabilized layer. These cracks develop more quickly and are often wider than cracks found on non-stabilized pavements. An inexperienced person might see this cracking as an impending failure of the pavement when, in fact, the pavement will typically remain in this condition and perform quite well for a long time.

The results of this project provide decision makers with strategies based on the decision-making processes used by experienced people in their district in a field guide that is small

enough to be taking into the field. The field guides detail the decision-making process, based on the type, severity, and extent of distress, and on the level of importance of the pavement. The data identify the appropriate maintenance technique. Often, the decision maker is trying to "buy time" until a more extensive rehabilitation can be performed. Knowing that a less expensive treatment will provide adequate service until the road or airport runway is reconstructed will be of tremendous help to those making the decisions.

What We Did...

The research team developed questionnaires for TxDOT personnel and submitted them to the Design Division and to each of the district engineers (DE). DEs forwarded one questionnaire to the district pavement management engineer and a different questionnaire to the maintenance engineer and maintenance foremen. Follow-up calls to districts from which we had not received at least one response was very successful. We received data from 17 districts.

Researchers used the results of the questionnaires, both from TxDOT and other sources, to develop a treatment strategy selection matrix. The research team tested and modified a variety of assignment procedures before developing the final matrix. The factors used to develop the matrix were:

- predominant distress type;
- extent and severity;
- fast or slow (development of distress);
- traffic level or importance; and
- action if localized repair only, short-term repair, or long-term treatment.

What We Found....

Primary Criteria

The questionnaires, combined with engineering judgment, determined which factors were most important in identifying appropriate maintenance treatments. Researchers selected the condition of the pavement (expressed as the type, severity, and extent of distress), traffic level, and purpose of the treatment as the primary factors.

The most common distress types identified in the responses and the literature were selected and included as primary criteria. These distress types were:

- transverse cracking,
- longitudinal cracking,
- rutting,
- alligator cracking,

- swell/roughness, and
- failures.

Other distresses could have been included, but these six appear to cover the vast majority of typical problems. The definition of the distresses and severities were taken from the *Pavement Management Information System Rater's Manual* because district personnel are likely to be familiar with these definitions, regular training classes in data collection using this method are available, and new or inexperienced personnel would be likely to have seen or used these definitions.

In addition to the type of distress, the extent or spacing of the cracks was important. For example, one transverse crack every 50 feet could be maintained much differently than several cracks spaced 10 feet apart.

The severity of the distress was also important. Crack sealing is very effective for cracks less than 0.5 inch, but is less effective on very wide or very narrow cracks. Another example of the importance of distress severity is rutting where the ruts can be 0.5 - 1 inch or greater than 1 inch. Each of these cases is treated differently.

Traffic was included in the primary matrix at three user-defined levels. A criteria of low, medium, or high traffic volume or importance was used instead of identifying specific traffic volumes or number of vehicles. Several urban districts have low volume farm to market (FM) routes with a higher average annual daily traffic (AADT) than the high volume routes in more rural districts. Greater flexibility was achieved by letting each district define low, medium, and high. The qualifier for level of importance was added to the traffic criteria since traffic volume alone may not account for all the differences in decision making on routes.

The final decision matrix criterion was for the treatment purpose. The three categories of localized repair, short-term repair, and long-term treatment divide the matrix into three categories based on the intent of the treatment:

- If the purpose of the treatment is to fix the problem and restore the road, the long-term treatment criterion would be chosen.
- In many instances the purpose of a treatment is to last a short time, or hold the road condition, until a more substantial treatment or rehabilitation can be performed. This difference is reflected in the short-term treatment criterion.

- The first category is for the situation in which the distress is only in a localized area. In this instance not all treatments are applicable. For example, although microsurfacing is often used to fill ruts, it would be impractical to use microsurfacing if the rutting occurs only small amounts in widely scattered areas.

Researchers assembled and reviewed the matrix of questions and arranged face-to-face interviews at each district, except for El Paso, Laredo, and Odessa, which were done by phone and fax. The interviews were set up with the district pavement engineers, or designated contacts, with assistance from as many maintenance personnel as needed. Typically, two people were involved in completing the questionnaire. Each questionnaire was sent back to the districts via e-mail for review.

Software Development

The research team developed a very simple computer program, using the computer software Microsoft C++^{R}, to display the specific treatment information identified by the experts in each district. While it would have been easier, and far more elegant, to develop the program for a Windows 95, 98, or NT with a graphical user interface (GUI) that would allow the user to pick assignments using the mouse, this operating system would not have been compatible with older systems at some area offices. Therefore, a DOS program was written. If the program receives wide support, a Windows version could be developed inexpensively and easily.

The purpose of the computer program is to guide the user through a decision matrix by describing certain features about the roadway to be maintained. The research team prepared two pocket field guides based on the appropriate input to the computer program and to the appropriate district attachment. The roadway version guides users through the decision criteria to the treatments identified by their districts. A separate guide for airports recognizes the uniqueness of their situations and pavement maintenance work. The nature of airport traffic requires a much smoother pavement than pavements needed for roadways.

The Researchers Recommend....

Researchers recommend that the data in the research reports be updated and the computer program updated and upgraded to the current operating systems used by TxDOT. TxDOT

should also update and distribute the field guides to each district.

For More Details....

Related Reports:	Report 1722-6, *Maintenance Strategies for Pavements with Chemically Stabilized Layers*
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TxDOT Implementation Status

Disclaimer

These photos show examples of transverse cracks of different widths, which would be best treated with different methods.