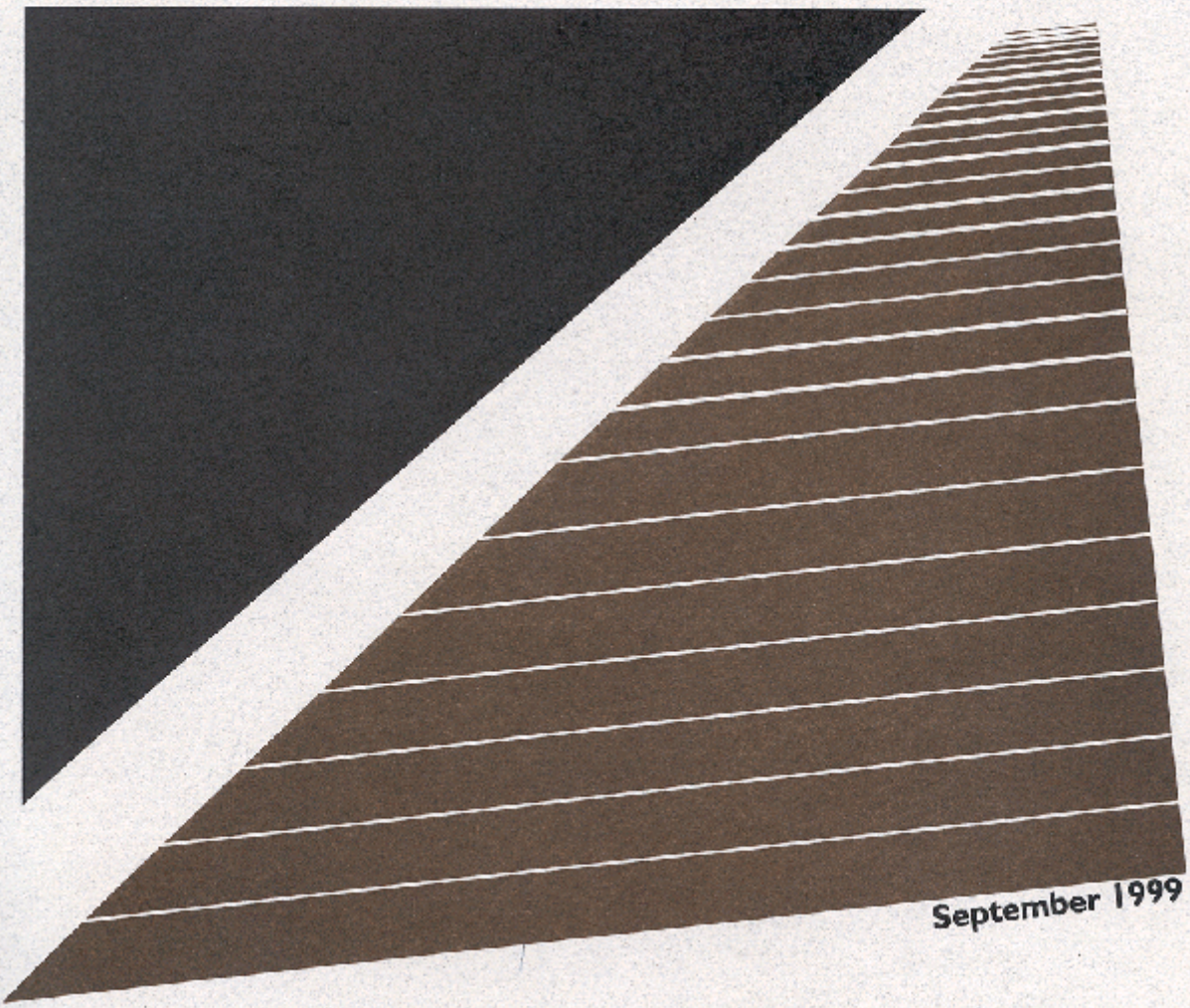
Research Protocols for Pavement Preservation

AASHTO Lead States' Work Plan



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Introduction

Pavement preservation is a concept that has long been employed by highway managers and engineers. The degree to which it is employed has varied considerably between different governmental agencies due to questions about the perceived cost-benefit of a pavement preservation program. Pavement preservation can have many benefits including substantial life cycle cost savings, improved customer service, and better system-wide pavement performance. Some benefits are not easily identifiable and require a long term commitment to performance based research before any positive results are seen or conclusions drawn. Financial and administrative support has been questioned by many agencies due to a lack of objective research data on pavement preservation.

The SPS-3 and SPS-4 studies of the Strategic Highway Research Program (SHRP) were intended to provide the research data needed to establish a good pavement preservation program in each state. The SPS-3 and SPS-4 studies have yielded some good information but there are voids in the required data needs. Due to insufficient information, additional research studies must be undertaken in a number of states/agencies to augment the SHRP studies and to ultimately provide answers to the cost-effectiveness of the various preservation strategies.

Background

AASHTO recognized a need for a national program to be implemented to help carry out the findings of SHRP's pavement preservation research. In 1996, five states were identified as the lead states, in cooperation with the FHWA and industry, to develop and implement technologies for pavement preservation. The five states are Georgia, Michigan, Minnesota, Texas and Wisconsin. These states were recognized as champions in the field of pavement preservation. The lead states believe that the SHRP research findings must be further developed by various states/agencies in order to create an understanding of what pavement preservation techniques work, under what conditions they will work, and when they are cost effective.

Definition

There are no formal definitions of pavement preservation. For the purpose of this Lead State's Work Plan, pavement preservation will be defined as follows (tailored after AASHTO definition of preventive maintenance).

> Pavement preservation is the planned strategy of cost-effective pavement treatments to an existing roadway to extend the life or improve the serviceability of the pavement. It is a program strategy intended to maintain the functional or structural condition of the pavement. It is the strategy for individual pavements and for optimizing the performance of a pavement network.

Typical pavement preservation treatments include crack and joint seals, seal costs, fog seals, slurry coats, milling or grinding, thin overlays, underseals, retrofit dowels, patches/repairs, and retrofit edge drains.

Benefits

There are many benefits that accrue from pavement preservation. By starting treatments of pavement preservation early it can create a domino effect of benefits. With early treatments, the pavement may survive longer without a major rehabilitation or reconstruction, thus reducing the life cycle cost. The service life of the pavement may be extended. Since most pavement preservation techniques can be accomplished in a short time period, there may be less interruption to traffic by postponing rehabilitation and reconstruction; thus, user delays and inconveniences may be reduced. All of this results in the ultimate increase in customer satisfaction and comfort. However, as attractive as pavement preservation is, it does not follow that all such techniques are cost-effective, that all pavement problems can effectively treated, etc. Thus, the need for objective research.

Other side benefits that may result from a pavement preservation program would be the increased efficient use of transportation funds. Decision making for transportation planning and programming would be improved. Along with this comes an increase in uniformity and consistency in the design and construction of transportation facilities to create a safer roadway. Based upon compelling research and proven pavement performance, transportation policies will become better logically, objectively, and defensibly. Since proven performance and cost-effective of pavement preservation techniques is insufficient (or lacking in some cases), research programs in various state/agencies need to be established.

Philosophy and Goal

A research program to establish a pavement preservation strategy has to have a philosophy to guide the conceptual aspects, to determine its scope of influence, and to establish program values. The philosophy of pavement preservation is based upon infrastructure optimization.

The overall goal of pavement preservation is to provide the highest quality service possible to the customer per unit of expenditure and to maximize customer satisfaction. This can be accomplished in different ways. Pavement preservation should minimize the pavement life cycle costs, reduce delays and inconveniences, and maximize user comfort and safety.

A goal of the Lead State Team is to establish the need for pavement preservation research and to have various states/agencies construct test sections (with control test sections) by the year 2000. A milestone to reach is to properly prepare the documentation that will enable states/agencies to implement a pavement preservation program.

Establishing a Research Program

A. Performance Measures

Using correct and appropriate performance measures is key to the success of pavement preservation research. There are times when a treatment may require both summer and winter performance measures. For example, ride may be influenced more in the winter by crack sealing than in the summer.

Performance measures must reflect the purpose of the treatment. For example, a fog seal is intended to delay pavement aging not to enhance a pavement's strength. Therefore, tests of pavement hardening are appropriate while testing with the falling weight deflectometer may not be appropriate. In this case, core samples to measure "aging" should be taken both the test sections and control sections at predetermined internals.

Performance measures are very important, and they should relate primarily to the customer's needs. While pavement experts may be very concerned about distress, customers may be less concerned with distress than riding comfort, safety, and pavement longevity.

Many treatments "cover up" or "mask" real distress. The distress will reappear in time. Testing and evaluation should be conducted in a manner that recognizes the "masking" effect so that the true effect is seen. Ultimately, we have to make sure our pavement preservation treatments are **treating the cause of the problem(s) not just the symptoms.**

When researching the value of any pavement preservation treatment, the research should measure those factors that relate to customer satisfaction and not the relative merits or longevity of a treatment. Accordingly, the research must answer these questions and in the following order:

1. Does the treatment enhance pavement performance?

Enhanced performance can be measured in terms of comfort, convenience, safety, or life cycle costs. If there are no improvements in any of these customer-related issues, then there is no need to use this treatment. If there are enhanced performance, then the research should be proceed to step 2.

Note: the treatment must enhance pavement performance. The researcher must not get absorbed into measuring "treatment performance". This is an area that causes much confusion. Measuring the enhancement to total pavement performance, as a result of the treatment, should not be confused with measuring the treatment's performance (a treatment may perform well yet do nothing to overall pavement performance).

2. Is the treatment cost-beneficial?

The benefits imparted to the pavement as a result of the treatment have to be evaluated to determine if they are cost-effective compared to the do nothing option (the control sections). For example, consider evaluating the cost effectiveness of a seal coat. Assume for this example that the measure being evaluated is life with all other factors being equal. The issue is to determine the extra life imparted to the pavement as a result of the seal coat. This issue is not to determine the life of the seal coat. The extra life imparted to the pavement can only be determined by comparing the treated section to an untreated control section. Thus, if the treated section has a life of 15 years and the untreated section has the same life, the treatment is not cost-beneficial (even though the seal coat itself may perform well for 10 years).

The error often seen in research occurs when the cost and life of the treatment is compared to the cost and life of the pavement. This comparison is invalid. In the above example, what is needed is an analysis of the cost of the treatment and its benefits to pavement life compared to the cost and life of the untreated pavement. If the treatment is found to be cost-beneficial, then proceed to step 3.

3. What is the best treatment system to use?

Step three determines the best system or "brand name" for each treatment. For example, this is the step that determines if sealant A, B, C or D is the most cost-beneficial. Too often research starts and ends at this step without every determining the more critical factors in steps 1 and 2.

4. What is the optimum timing for the treatment?

This step is designed to determine the best time in the pavement's life for the treatment application. For example, when studying seal coats, a pavement may have to have a different section seal coated every couple years to determine the optimum placement time.

B. Implementation

In order to implement a functional pavement preservation program, it is essential to thoroughly evaluate pavement performance using pavement management as a tool. Using the example of the lead states, typically implementation is a stepped up process starting with test and control sections and using existing data. Once the program is established, cost benefit analysis will help support results. This will lead to full implementation of a pavement preservation system. Research guidelines and tasks are necessary for a successful pavement preservation implementation. These guidelines and tasks are listed below:

C. Research Guidelines

1. **Isolate/simplify variables.** Specific pavement problems must be treated individually (do not try to treat a number of distresses/problems at the same time). On a one by one basis,

try to find which problems or distresses are effectively treated (and which ones are not) by a specific treatment.

2. **Control sections.** One (or more) control sections (no treatment applied, null condition) are a requirement. The control section must be the same pavement (age, general location, mix, etc.) and in the same condition as the test section.

3. **Duplicate test sections.** Multiple test sections (with the same treatment) are needed. These can be on the same project or scattered around the state/agency provided each group of test section has its corresponding control section.

4. **Minimum length of test/control sections.** Minimum test and control section length is 500 feet (167 meters) each. Longer sections are preferred.

5. **Material and Specifications.** Treatments should use locally available materials but use national specifications, if possible.

6. **Construction.** The use of proper techniques and proper quality control are critical elements. For example, a seal coat should be applied using designed application rates such as procedure developed by the Asphalt Institute. Using good construction techniques, calibrated equipment and proper application procedures are vital for getting optimum performance for a given treatment.

7. **Tracking performance.** Most importantly, use of a pavement management system to track performance is essential.

D. Tasks

Task 1: Define current treatments

Each state/agency uses different treatments depending on the climate and traffic. Most states/agencies are practicing some form of pavement preservation. These treatments need to be defined in order to be recognized into the pavement preservation strategy.

Task 2: Evaluate current treatments

Once the treatments are defined, an evaluation of the treatments may begin. Determine what treatments are effective for each specific pavement distress or problem. For example, asphalt pavements with a seal coat need to be evaluated for each distress type. These distress types include (but are not limited to) block cracking, alligator cracking, transverse cracking, or raveling.

Task 3: Explore other treatments and existing programs

Sharing with and learning from others the proper techniques and methods that have the best performance.

Task 4: Determine the optimum timing for the treatment

Evaluation of the best time in the pavement's life for the treatment application is also important. For example, when studying seal coats, a pavement may have to have a different section seal coated every couple years to determine the optimum placement time.

Task 5: Establish test sections and control sections

Once the different types of treatments are explored, test sections and control sections need to be established. This is mentioned above in the research guidelines.

Task 6: Perform cost-benefit analysis

Cost benefits analysis is important to help support the results. Thus, cost records are needed in addition to a measure of the benefits (performance measures).

If the above Research Protocols are followed by numerous states/agencies there will be a wealth of objective, compelling research data on the value of pavement preservation. This data will be the key factor in further promotion of the value and use of a pavement preservation strategy/program in each agency. The AASHTO Lead State Team encourages each state or agency to follow these Protocols and to let the Lead State Team know what they are doing so that it can be documented as part of the overall effort for pavement preservation research.

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