



Analysis of Maintenance Treatments Produces Usage Guidelines

The primary objectives for Project O-4040 were to establish the cost-effectiveness of typical and promising maintenance treatments used in Texas to prolong the life of asphalt pavements, to determine the optimum time and preventive maintenance strategies to prolong

pavement life, and to demonstrate positive rates of return on preventive maintenance funds.

The Supplemental Maintenance Effectiveness Research Program (SMERP) project evaluated the types of maintenance treatments typically used in Texas and

allowed the contractor to use local materials.

What We Did...

Twenty sites were constructed in 1993. Each site included a total of seven 500 foot (213.4 m) sections. The sections were:

- microsurfacing;
- fog seal;
- four chip seal types: asphalt rubber, latex modified, polymer modified, and conventional; and
- a control section with no maintenance treatment.

The sites were inspected approximately 6, 12, 24, 36, 48, 60, 72, 84, and 96 months after construction. [Figure 1](#) illustrates the locations of the sites, and [Figure 2](#) shows the layout of the test sections.

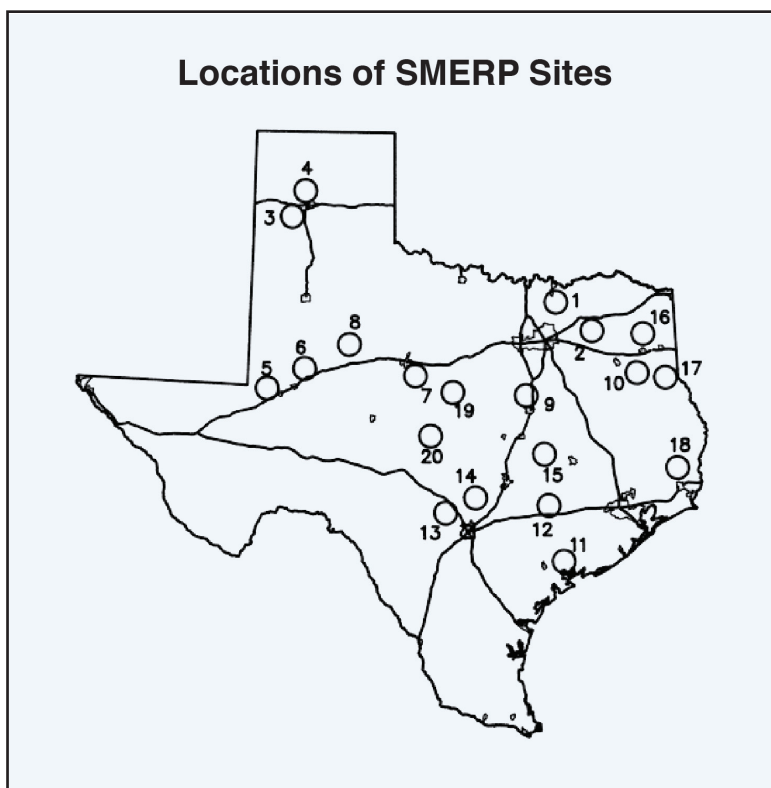


Figure 1. Site Locations.



Researchers collected considerable construction data in order to determine the quality of treatment. Report 1981-1F, *Development and Construction of the Texas Supplemental Maintenance Effectiveness Research Program (SMERP) Experiment*, contains additional details on the construction sequence, data collection during construction, materials used, and other information pertinent to the construction of the test sites.

During the eight-year post-construction course of the experiment, the overall condition of the road and other factors caused some sites to be eliminated. One was

eliminated within six months, but nine of the sites survived all eight years.

The condition of the pavement prior to application of maintenance treatments affects the performance of the treatment. The SMERP experiment design was set up with this in mind and, while sites were not chosen based on a rigid set of existing conditions, they did provide an acceptable distribution of pavement conditions. The analysis of the impact of pre-treatment condition on performance was based on grouping the actual pre-construction conditions into general categories of good, fair, and poor by ranking all

pavements using that specific criteria and determining logical divisions that would result in nearly equal distributions in the three categories.

Mixed modeling has become increasingly popular for analysis of longitudinal data. It can include random effects to describe the correlated structure of the serial observations for each subject. We applied this powerful tool throughout the analysis.

What We Found...

The primary question to be answered by this research was, “Which treatment is most effective in which situation?” To answer this question,

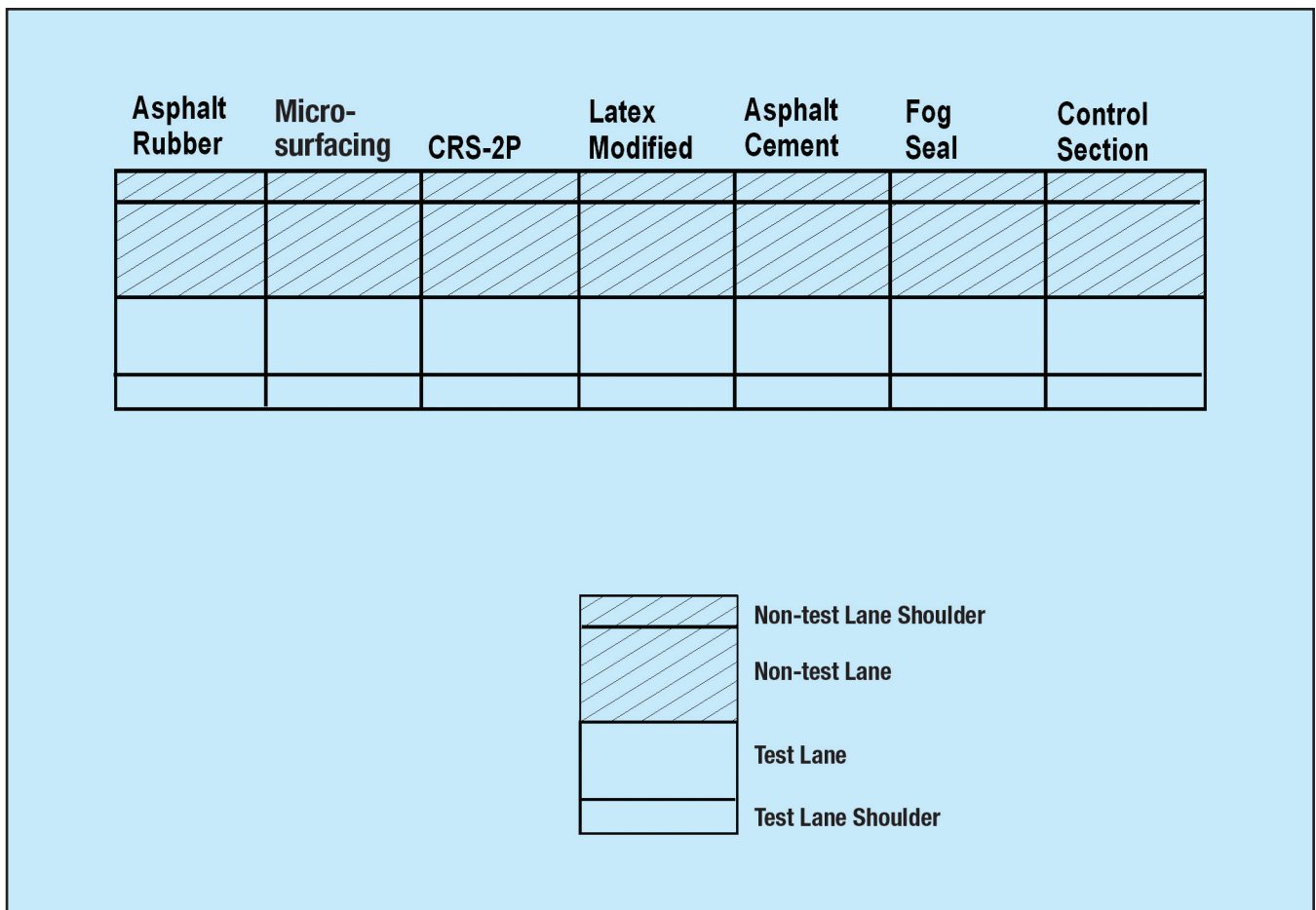


Figure 2. Layout of Test Sections.



researchers undertook the previously described comprehensive statistical analysis. The result of this analysis was a complete set of performance curves, which are included as the appendices to Report 4040-3, *Analysis and Treatment Recommendations from the Supplemental Maintenance Effectiveness Research Program (SMERP)*.

For each condition category, performance curves for all treatments (except that fog and control sections are always shown together), for any equivalent groupings, and for each treatment were developed. The results of these are a mix of the expected and the surprising:

- For all performance measures, treatments placed on sections in good condition performed better than those placed on pavements in fair or poor condition.
- For all performance measures, treatments placed on sections in fair condition performed better than those placed on pavements in poor condition.
- Seal coat treatments performed well in reducing cracking.
- The asphalt rubber seal coat did the best job of reducing cracking but had the most bleeding.

- Microsurfacing did reduce bleeding but did not reduce long-term cracking.
- Seal coat treatments increased bleeding, but the polymer modified emulsion treatment performed better.
- There was very little alligator cracking plus patching, but all treatments performed well.
- Each treatment usually did a very good job of reducing the quantity of distress over the short- and long-term periods.

The Researchers Recommend...

Maintenance treatments are chosen for a variety of reasons. The guidelines developed from the work described in this report add an important tool for making treatment decisions. Many districts choose a specific maintenance treatment because that is what has historically been done in the district, because a high-level engineer has had good experience with that treatment, or because of material or contractor availability. Less frequently has expected performance been used as a deciding factor. Factors like availability of materials, qualified contractors, and potential windshield damage will continue to play a significant role in treatment selection, even when there

are long-term performance differences.

The recommendations below are based on the results of this maintenance study and the authors' experiences.

- To reduce the effect of bleeding, asphalt application rates should be varied in the wheelpaths. Guidelines from the Texas Department of Transportation (TxDOT) seal coat manual should be followed.
- Pavements should be treated while still in good condition.
- For rural roadways with low traffic, unmodified asphalt cement seal coats performed as well as latex and polymer modified seal coats.
- Pavements must be structurally sound. If alligator cracking is continuous in one wheelpath, the treatment will not perform well without patching. If there is more distress than this, a maintenance treatment should not be used.
- If sections were properly patched at least six months prior to placing the maintenance treatments, the treatments should behave quite well with little distress.



For More Details . . .

Related Reports:

Report 4040-3, *Analysis and Treatment Recommendations from the Supplemental Maintenance Effectiveness Research Program (SMERP)*

Report 1981-1F, *Development and Construction of the Texas Supplemental Maintenance Effectiveness Research Program (SMERP) Experiment*

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TxDOT Implementation Status

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The recommendations of this research are being evaluated for possible inclusion in a preventive maintenance manual to be developed later using implementation funds.

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