
Baystate Roads Program

Tech Notes



Tech Note #23

Sealing and Filling Cracks in Asphalt Pavements

Background

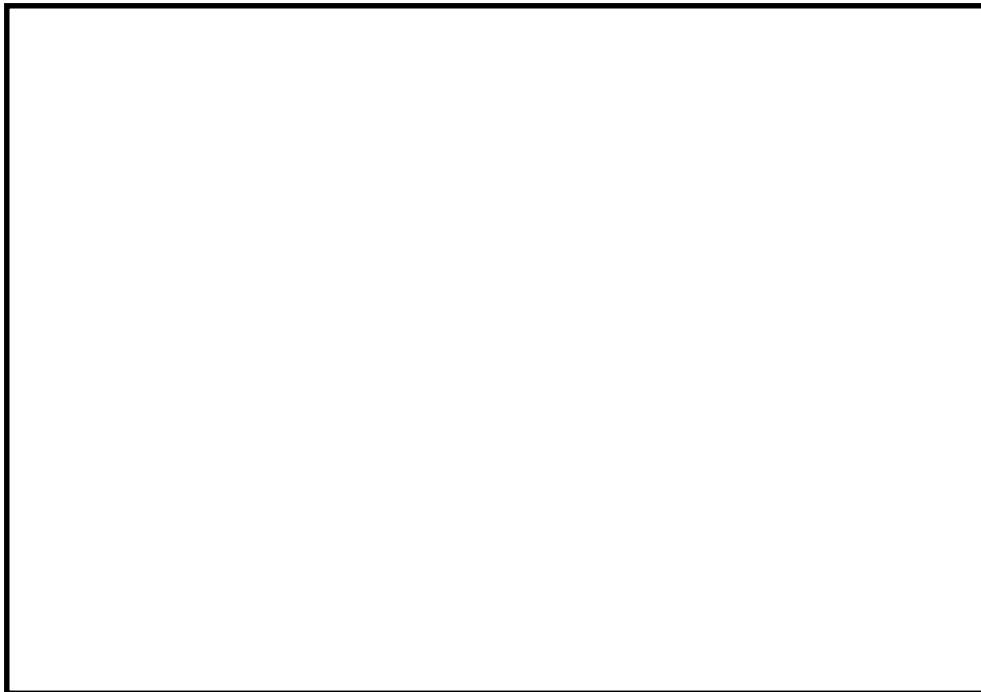
Sealing and filling asphalt concrete pavements cracks is a common road maintenance activity. Specialized materials are placed into or above cracks to prevent the intrusion of water and incompressible material into the cracks and to reinforce the adjacent pavement. To address deficiencies in current crack treatment materials, designs, and practices,

the Strategic Highway Research Program (SHRP) and the Federal Highway Administration (FHWA) sponsored the most extensive investigation of crack treatment effectiveness ever undertaken. Monitoring and evaluation of these treatments were performed under the Long-Term Pavement Performance (LTPP) program. Between March and August of 1991, four transverse

crack seal test sites and one longitudinal crack fill test site were constructed in the United States and Canada. Upon completion, 6,710 meters of cracks were treated with materials selected for evaluation.

Objectives

The primary objective of the crack treatment experiment was to determine the most effective



and economical materials and methods for conducting crack-sealing and crack-filling operations. Secondary objectives included the identification of performance related material tests and quicker, safer installation practices.

Key Benefits of This Research

The benefits of this study include service life estimates of crack sealants and fillers in asphalt concrete pavements, more cost-effective maintenance operations, decreased exposure of highway workers to traffic, and fewer maintenance delays for the traveling public.

Experiment Design

The test sites were located on highways of moderate traffic volume in four climatic regions. The four crack seal sites were located on the following roadways:

- Interstate 20 - Abilene, TX
Dry-nonfreeze region
- State Route 8 - Elma, WA
Wet-nonfreeze region
- State Route 254 - Wichita, KS
Dry-freeze region
- Interstate 35 - Des Moines, IA
Wet-freeze region

The longitudinal crack fill site was located at:

- Highway 401 - Prescott, Ontario
Wet-freeze region

Evaluations

Ten evaluations were performed

during the 6.5-year period. The following evaluations were used:

- Weathering
- Pull-Outs
- Overband wear
- Tracking
- Extrusion
- Stone intrusion
- Adhesion loss
- Cohesive loss as a result of tensile/shear forces
- Cohesive loss as a result of bubbling
- Edge deterioration

During each evaluation, detailed examinations and measurements were made at each crack to determine treatment effectiveness. Two sets of laboratory tests were conducted. Initial tests ensured that the materials used in the experiment met the specifications maintained by the manufacturer. Supplemental performance tests were intended to strengthen correlations between laboratory-determined engineering properties and actual field performance.

Service Life Comparison

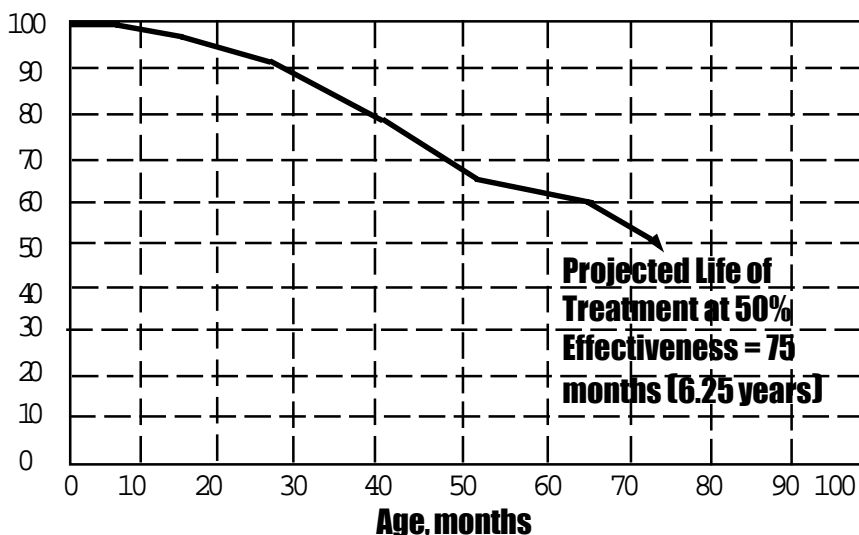
Throughout this study, treatments were subjected to numerous, highly detailed inspections for distresses and failures. For this reason, it was determined that field performance would best be framed in terms of service life, which was defined as the estimated time for a treatment to reach the 75 percent effectiveness level. In other words, the service life is the time required for the 25 percent of the crack length to develop failure.

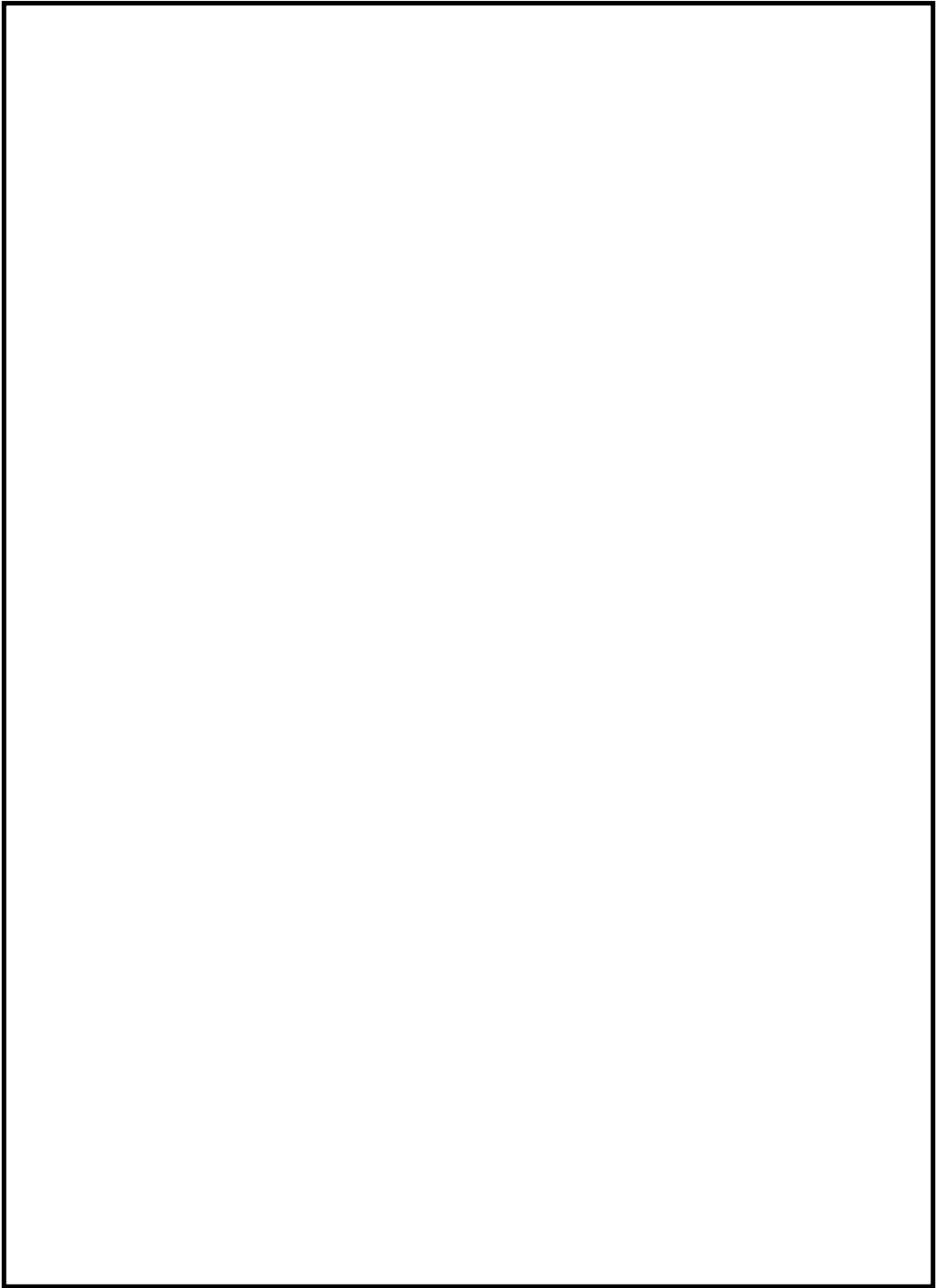
The effectiveness level is simply the failure level subtracted from 100 percent (i.e., 10 percent overall failure equals 90 percent overall effectiveness).

Rating	Effectiveness Level (%)
Very good	90-100
Good	80-89
Fair	65-79
Poor	50-64
Very poor (failed)	<50

Most of the distresses observed represented a *reduction* in a

Figure 1
Treatment Effectiveness, % crack length





treatment's ability to perform its function (i.e., to keep water and incompressible materials out of the crack channel). Examples of these distresses include partial-depth adhesion and cohesion loss and overband wear. Some distresses, such as full-depth pull-outs and full-depth adhesion and cohesion loss, signified a treatment's *failure* to perform its function. These latter distresses were termed failure distresses. The total amount of failure distress observed in a treatment formed the basis for performance comparison.

Key Findings

- Of 61 treatments, 32 had failed after the final round of evaluations.
- Half of the eight crack-fill treatments performed favorably after the final evaluation period. The other half failed.
- Generally, the test sites with greater amounts of crack movement and traffic showed lower levels of treatment effectiveness than sites with less crack movement and traffic.
- The predominant modes of treatment failure were adhesion loss and cohesion loss.
- The most cost-effective treatments were usually those consisting of rubberized asphalt placed in a standard or shallow-recessed Band-Aid configuration.

Recommendations

- For short-term crack-seal per-

formance (between 1 and 3 years) in pavements with ordinary working cracks (2.55-5.0 mm of horizontal crack movement) and moderate traffic levels, a standard rubberized asphalt should be placed in a simple Band-Aid configuration.

- For medium-term crack-seal performance (between 3 and 5 years) under the above conditions, either a standard rubberized asphalt may be placed in a recessed Band-Aid configuration or a modified rubberized asphalt may be placed in a simple Band-Aid configuration.
- For long-term crack-seal performance (between 5 and 8 years) under the above conditions, a modified rubberized asphalt sealant should be installed in either a standard or shallow recessed Band-Aid configuration.
- For short-term crack-fill performance (1 to 3 years) in pavements with nonworking cracks (less than 2.5 mm of horizontal crack movement) and low to moderate traffic levels, asphalt cement should be placed in flush-fill configuration.
- For long-term crack-fill performance (between 5 and 8 years) under the above conditions, an asphalt rubber or rubberized asphalt may be placed in either a flush-fill or overband configuration, or a fiberized asphalt may be placed in an overband configuration.

- The importance of quality con-

trol in crack sealing and filling operations cannot be overemphasized. Crucial to quality control is an objective, hands-on inspector.

References

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2. Evans, L.D. et al., 1991, "Strategic Highway Research Program (SHRP) H-106 Experimental Design and Research Plan," SHRP Contract SHRP-89-H-106, SHRP National Research Council, Washington, D.C.
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