During 1978 and 1979 the following five projects were constructed in which an Asphalt-Rubber mixture was used either as a surface seal (SAM) or as an interlayer prior to a hot mix overlay (SAMI).

- **K-268 Osage County**: 268-70-F 058-1(17)
- **US-77 Marion County**: 77-57-F 055-2(6)
- **US-54 Allen County**: 54-1 KR 038-5(24)
- **US-54 Woodson County**: 54-104 KR 038-5(26)
- **US-83 Thomas County**: 83-97 KR 017-3(19)

Two of these projects (K-268 and US-77) have had final reports written previously but are again included in this report to provide complete coverage of the subject.

Table 1 gives a brief comparison of the performance of the five projects based on periodic crack surveys conducted since project completion.

A brief discussion of individual projects is provided along with graphs of the results of periodic crack surveys performed throughout the course of each project.

**K-268 Osage County:**

The original pavement was nine inches ACB-3R with 1.5 inches HM-Special built in 1964. Several maintenance patches and a 1970 slurry seal had been applied prior to rehabilitation. Preparation for the 1977 overlay consisted of milling 0.5 inch to reprofile, filling cleared cracks with rubber asphalt, then applying rubber asphalt interlayer membrane (Overflex) applied at the rate of 0.75 gallons per square yard and covering with 35 to 42 pounds of 3/8 inch chips per square yard. After completion of the chip seal a one inch BM-1 hot mix was laid in July 1977.
<table>
<thead>
<tr>
<th>Project I.D.</th>
<th>Test Section I.D.</th>
<th>Survey Period</th>
<th>% Original Cracks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Years</td>
<td>Longit.</td>
</tr>
<tr>
<td>K-268 Osage Co.</td>
<td>Control (1&quot; BM-1)</td>
<td>4</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Test (SAMI + 1&quot; BM-1)</td>
<td></td>
<td>75</td>
</tr>
<tr>
<td>US-77 Marion Co.</td>
<td>Control (0.75&quot;H/S+2.5&quot; BM-2)</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Test (0.75&quot;H/S+SAMI+2.5&quot; BM-2)</td>
<td>45</td>
<td>37</td>
</tr>
<tr>
<td>US-54 Allen Co.</td>
<td>Control (3&quot; BM-2)</td>
<td>6</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>Test (SAMI + 3&quot; BM-2)</td>
<td></td>
<td>80</td>
</tr>
<tr>
<td>US-83 Thomas Co.</td>
<td>Control (3.5&quot; BM-2)</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Test (SAMI+ 3.5&quot; BM-2)</td>
<td>20</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Test (3.5&quot; BM-2 + SAM)</td>
<td></td>
<td>23</td>
</tr>
</tbody>
</table>
Detailed crack surveys and visual inspections were conducted in a control section without SAMI and in a test section with SAMI for 4.5 years (see figures 1 and 2) and a final report was written in 1983. Conclusions stated in the report follow.

1. The asphalt rubber membrane has retarded, but not prevented, reflective cracking.

2. Serious transverse cracking had occurred in both sections six months after construction.

3. The cracks within both sections needed and received asphalt crack pour in 1985 (5 years after construction).

4. The asphalt rubber SAMI cannot be economically justified. The asphalt rubber possibly would perform better as a seal coat (SAM) instead of in interlayer (SAMI). However this was not proven in the US-83 Thomas County project which had both SAM and SAMI.

US-77 Marion County:

The original pavement structure consisted of six inches of AB-3 (limestone) with 2.5 inches of HM-2A built in 1949. In 1958, three inches of HM-6 and in 1969, 0.75 inches HM-R overlays were added. In addition, by 1978 many areas had been patched using cold mix maintenance materials.

The 1978 rehabilitation procedure included heater scarification to a depth of 0.75 inches, then the application of the asphalt-rubber chip seal followed by 2.5 inches of BM-2 hot mix. The asphalt rubber was a 75-25 mixture and was diluted 5% with kerosene and applied at the rate of 0.75 gallons per square yard. The chips were spread at about 25 lbs. per square yard and rolled with a pneumatic roller.

Two 1000' sections were established (one with the asphalt-rubber layer and one without) to monitor the performance of the surface repair through
K-268 Osage County

- Control (1" BM-1)
- Test (Asphalt-Rubber SAMI + 1" BM-1)

Figure 1. Percent Transverse Cracks vs. Time.

Figure 2. Percent Longitudinal Cracks vs. Time.
detailed crack surveys before and after rehabilitation and by other observations of pavement distress. The results of the crack surveys are plotted in Figures 3 and 4, and indicate that the control section without the asphalt-rubber performed better than the test section with the Stress Absorbing Membrane Interlayer (SAMI).

In October 1986 a detailed final report was prepared on this project. The conclusion was that the cracks reappeared more rapidly in the section with the SAMI and since it cost over $20,000 more per mile to install it was not cost effective.

**US-54 Allen County:**

The original roadway consisted of an eight inch rockbase (AB-3) with prime and seal built in 1958. Six inches of ACB-3 and 1.5 inches of HM-3B were added in 1961 and a slurry seal in 1972. A combination of block, alligator and transverse cracking with some ruts ranging from 0.125 to 0.375 inches deep were evident in the original surface.

Rehabilitation in 1978 consisted of applying an asphalt rubber (Overflex) interlayer membrane diluted with 5% kerosene and applied at a rate of 0.66 gallons per square yard. Approximately 37 pounds of 3/8 inch chips were applied per square yard, rolled with pneumatic roller and opened to traffic and then overlaid with three inches of BM-2 hot mix placed in two lifts.

Detailed crack surveys were conducted for six years in the 430 foot control section without SAMI and in the 500 foot test section with the asphalt rubber interlayer. The results shown in Figure 5 and 6 indicate a very close parallel of the percent of longitudinal cracking and a slightly lower percent of transverse cracks in the test area compared to the control section. The cost of the SAMI was not justified by the results of this project.
US-77 Marion County

- SAMI (0.75" Heater Scarification + SAMI + 2.5" BM-2)
- Control (0.75" Heater Scarification + 2.5" BM-2)

Figure 3: Percent Transverse Cracks vs Time

- SAMI (0.75" Heater Scarification + SAMI + 2.5" BM-2)
- Control (0.75" Heater Scarification + 2.5" BM-2)

Figure 4: Percent Longitudinal Cracks vs Time
US-54 Allen County

- Control (3" BM-2)
- Test (Asphalt-Rubber SAMI + 3" BM-2)

Figure 5. Percent Transverse Cracking vs. Time.

Figure 6. Percent Longitudinal Cracking vs. Time.
US-54 Woodson County:

The original pavement consisted of a six inch rock base (AB-3) with a prime and seal coat built in 1940, a four inch HM-5 overlay in 1958, and a bituminous seal added in 1972. Substantial block cracking with some transverse cracks existed with minor rutting and some maintenance patching.

The rehabilitation treatment in 1978 consisted of an asphalt-rubber (overflex) membrane diluted with 4.1% kerosene applied at a rate of 0.61 gallons per square yard. Approximately 37 pounds of 3/8 inch chips were applied per square yard and rolled with pneumatic rollers. Traffic was allowed on the chip seal interlayer during construction and a three inch BM-2 hot mix overlay was placed using two lifts. A 500 foot test section and 500 foot control section were established for evaluation. Initially an SS-1H tack coat was used but was discontinued because the membrane layer was peeling up. The use of blotter sand was also stopped because of dust under traffic.

Detailed crack surveys and visual inspections were conducted for six years. As shown in the two graphs (Figure 7 and 8) the test section with the SAM1 has cracked more than the control section which has only the overlay. Therefore the added cost of the SAM1 was not justified.

US-33 Thomas County:

The original roadway consisted of six inches of AA-1R south of US-24 and eight inches of AA-1R north of US-24 built in 1959 plus a slurry seal in 1969 and a conventional seal in 1975. There were transverse cracks spaced ten to thirty feet apart with secondary cracking and some spalling.

Two methods of rehabilitation were tried in the 1979 project including a 3.5 inch BM-2 overlay with the stress absorbing membrane SAM on top as a riding surface and on the bottom as an interlayer. The average rate of the
Figure 7. Percent Transverse Cracking vs. Time

Figure 8. Percent Longitudinal Cracking vs. Time.
US-83 Thomas County

- Control (3.5" BM-2)
- Test (26% Rubber Asphalt SAM over 3.5" BM-2)
- Test (20% Rubber Asphalt SAMI over 3.5" BM-2)
- Test (20% Rubber Asphalt SAMI + 3.5" BM-2 overlay)
- Test (26% Rubber Asphalt SAMI + 3.5" BM-2 overlay)

Figure 9. Percent Transverse Cracking vs. Time.

Figure 10. Percent Longitudinal Cracking vs. Time.
asphalt rubber was 0.62 gal. per square yard and an average of 34.6 pounds of 3/8 inch chips were applied per square yard. Four test sections and one control section were established and detailed crack surveys have been performed for six years. The graph in Figure 9 shows the development of transverse cracks since construction. Figure 10 shows the development of longitudinal cracks. The cost of the asphalt rubber chip seal was not justified by the performance of the project.

Whether the use of rubber-asphalt as a stress absorbing layer is appropriate for retarding the reappearance of transverse cracks may be debatable. These five projects did not provide economic justification for the use of Rubber-Asphalt since the cracks did reappear and in most instances at about the same rate as in the control sections where the Rubber-Asphalt was not used.

Based on these five studies, the use of Rubber-Asphalt SAMI's to prevent or retard transverse and longitudinal cracks which are well established in an existing surface is not recommended. The surface seal (SAM) on US-83 bonded well and has stood the test of traffic providing good performance, however there was no test section established of a chip seal using asphalt without rubber as the binder so a comparison could not be made.

Bureau of Materials and Research
Research Unit
Prepared by: William H. Parcells, Jr., P.E.
Pavement Surface Research Engineer
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