RESEARCH REPORT

EXPERIMENTAL EVALUATION PROGRAM

73-06-1
Slurry Seal Crack Treatment
Item 2712

AN EXPERIMENTAL RESURFACING PROJECT

I-35-3(88)126, Oklahoma County

Prepared

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An Experimental Resurfacing Project

I-35-3(88)126, Oklahoma County

General

In the spring of 1975 the resurfacing project I-35-3(88)126 was started. The experimental part of the project consisted of the use of an asphalt slurry to fill and seal cracks and spalls in the existing pavement, followed with a 1½" type C asphalt concrete overlay and a 3/4" Open Graded Friction Course. The project was completed in the summer of 1975 with what appeared to be an excellent job.

Special Provision

The special provision used for the experimental slurry seal was 409-3(a-d) dated 3-25-75. (See attached copy). The slurry seal specified in the special provision used a smaller sized aggregate, and a larger percent residual asphalt mix than the standard surface treatment slurry seal in the Oklahoma Standard Specifications, 1976 edition. Also, approximately five percent (5%) rubberized latex was added to the mix. These and other differences may be examined by comparing the attached sepcial provision to the standard specifications for slurry seal.

Reasons for Use

The primary reason for using the experimental slurry seal was for crack sealing. It was expected to flow into, fill, and seal cracks one-fourth (¼) inch and wider.

There are two secondary benefits, the slurry seal could fill and level wheel path rutting, and act as a deterrent to cracks reflecting through the overlay to the surface.

Typical cracking of the existing roadway. Note there is both transverse and longitudinal cracking.

Typical of the severe spalling and pavement breakup in some areas of the existing pavement.

Construction Problems

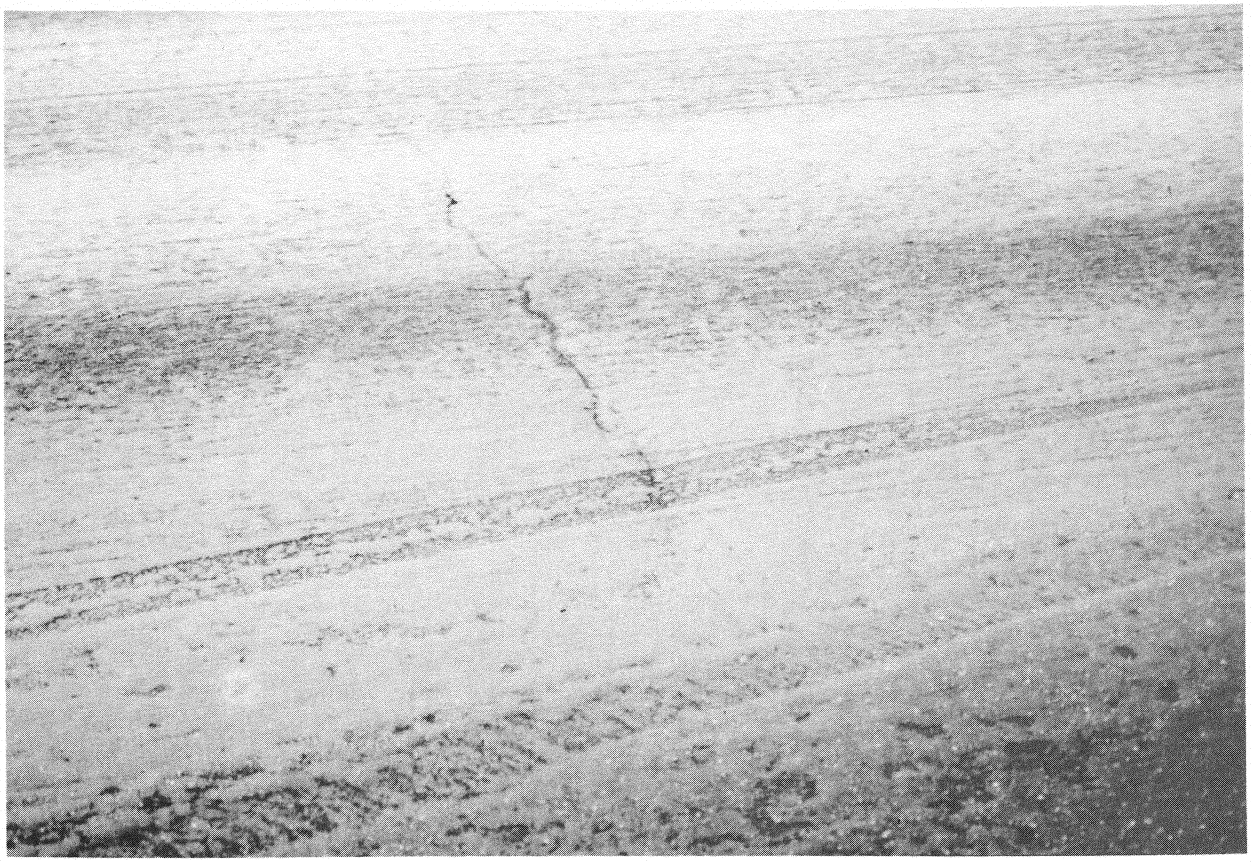
The contractor had three major problems when constructing this project:

1. Traffic Control - Keeping traffic off the newly laid slurry seal until after the emulsified asphalt broke.

2. Filling large cracks - Three passes failed to fill some of the wider cracks (two inch and wider).

3. Surface buildup - An undersirable buildup of the slurry seal on the surface caused by making multiple passes to fill the wider cracks.

To complete the filling of the wider cracks the contractor was allowed to use bladed on Hot Sand Asphalt to keep any more surface buildup from occurring.



Typical surface after the application of the slurry seal.

Note: The tire tracks and the crack which is not filled.

Typical slurry seal application when traffic was held off until after the asphalt emulsion broke.

Slurry seal that did not fill a wide spalled crack.

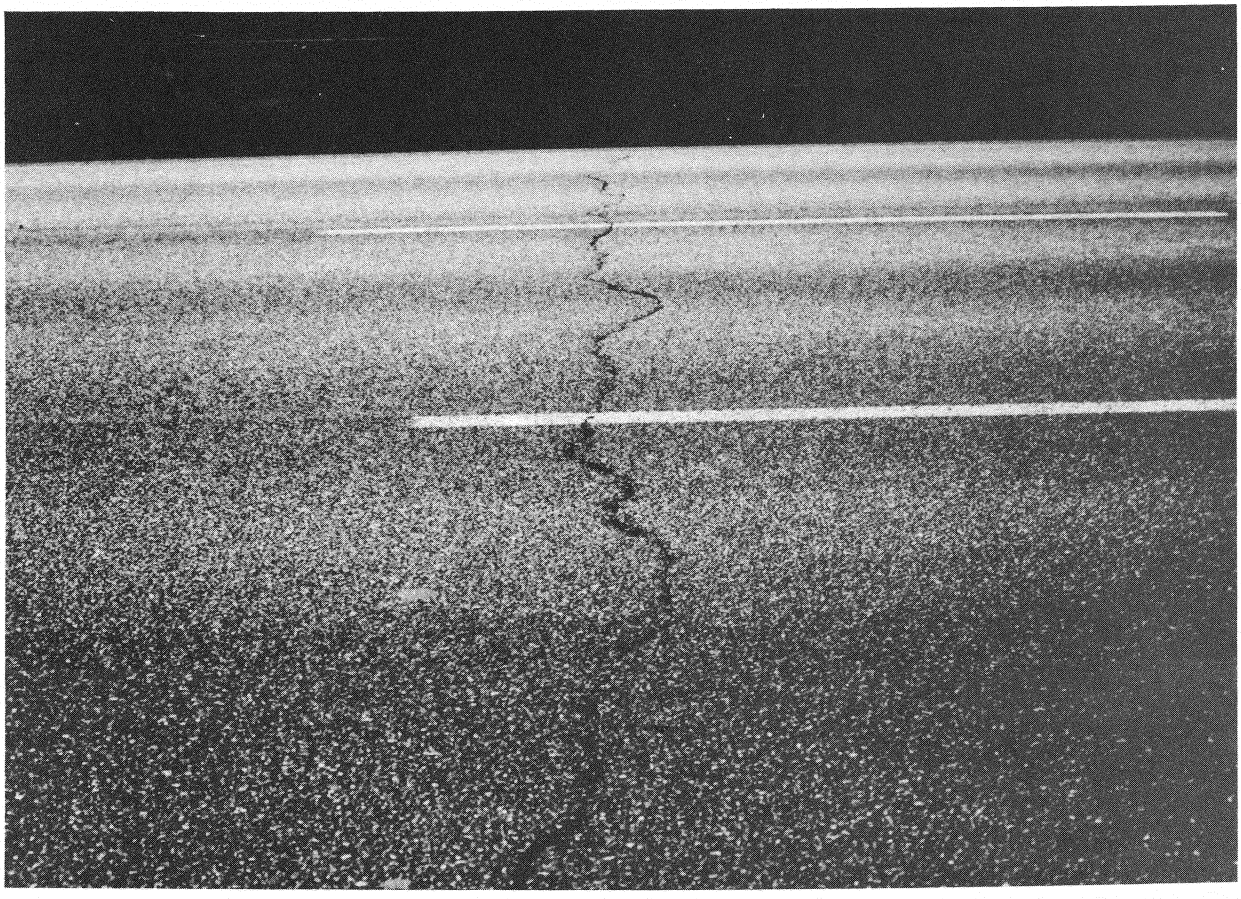
Slurry seal that has been picked up by traffic. Note that the crack was bridged over and not filled by the slurry seal.

Observations

After the first winter the only noticable problems occurring on the project are that the cracks are reflecting through to the surface and are spalling in the open graded surface course. Transverse cracks occur about every fifty (50) to one-hundred (100) feet over the entire length of the project. Longitudinal cracks are randomly spaced, but usually connected to a transverse crack. As seen in the photographs, many of these cracks are spalled down to the bottom of the open graded friction surface

Reflective cracking and the beginning of spalling in the surface course.

course. While the width of most of the cracks is ½-inch or less, some of the spalling has produced cracks as wide as 1½-inch at the pavement surface. It should be noted in any evaluation of this project, that the existing roadway was in extremely poor condition with extensive spalling along the cracks and complete pavement breakup in many areas.



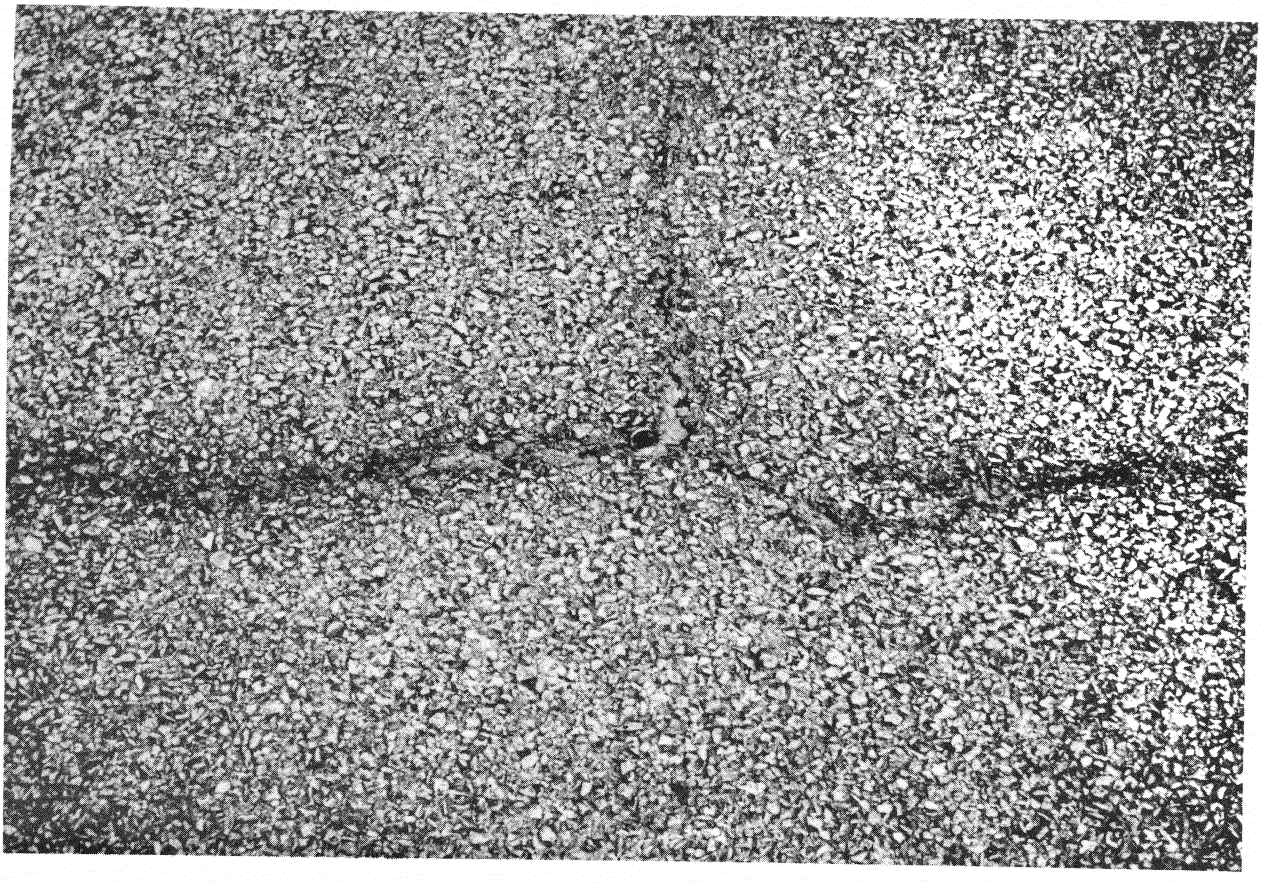
Reflective cracking and spalling across three lanes of traffic.

Longitudinal and transverse reflective cracking.

Reflective cracking and spalling to the bottom of the surface course. Note the penney in the crack.

Conclusion

The experimental slurry seal seems to work well in filling the small (¼) to medium (1") width cracks and in leveling rutted wheel paths. However, it has obviously failed in two other aspects. It failed to fill wide cracks completely and another material had to be used to finish the filling. Also,



Spalling of a reflective crack that is 3/4" wide at the surface. Note the penney in the crack.

it failed as a reflective crack deterrent as evidence by the cracking in the present surface.

While not directly connected to the problem of examining the experimental slurry seal, it should be noted that spalling of the open graded friction surface course may not be expected to be an isolated occurrence of this project. Spalling of the open graded surface should be expected on any project that overlays existing pavement cracks that reflect to the surface.

Recommendations

The design committee needs to discuss the continued use of the special slurry to fill and seal pavements prior to overlay.

There are two recommendations that can be made in the case of the continued use of the experimental slurry seal:

1. Latex Additive - Many commercial latex modified asphalt joint sealers use a higher percentage of latex than the five percent specified in the special provision. Experimentation to find an optimum amount of latex could conceivably result in better performance from the slurry seal. The amount to use could be determined by increasing the amount of latex by two (2) percent at a time on different sections of a project up to the point where the mix could no longer be handled by the lay-down equipment. Subsequent observation and evaluation of the performance of the different sections would determine the approximate percentage to use for the best results.

2. Crack cleaning - Cracks should be air or water cleaned. While the special provision provided for brooming the surface of the existing pavement there was no requirement for cleaning any foreign material from the cracks. This undoubtly caused the slurry seal to bridge across many of the cracks rather than flowing to the bottom.

Again while not directly related to this evaluation it is obvious that finding an effective reflective crack deterrent for use when an open graded surface course is to be used over thin overlays ($1\frac{1}{2}$") would seem imperative. Continued spalling as observed on this project indicates extensive future maintenance requirements, or even worse a reconstruction project to correct the condition.

SPECIAL PROVISION
FOR
SLURRY SEAL CRACK TREATMENT
(EXPERIMENTAL)

409.01. DESCRIPTION. This work shall consist of a mixture of emulsified asphalt, rubberized latex, mineral aggregate, and Portland cement or hydrated lime filler; proportioned, mixed and spread on a pavement surface where shown on the plans, as specified herein, and as directed by the Engineer.

The mixture when applied with conventional slurry seal equipment will flow into and seal (rather than bridge) pavement cracks one-fourth (1/4) inch wide and larger. Some areas may require more than one application to satisfactorily fill and seal the cracks. Even though the buildup of material on the surface is not required some build-up may occur in rutted areas and will be tolerated provided the material firmly adheres to the pavement surface.

409.02. MATERIALS.

(a) Aggregate.

(1) The aggregate shall be sharp, angular natural sand or manufactured sand that will meet the following grading requirements when tested by AASHTO Method T-27.

Sieve Size	Percent Passing
No. 3/8	100
No. 4	100
No. 10	85-100
No. 20	55-75
No. 40	35-50
No. 80	20-35
No. 200	10-20

(2) The aggregate shall be free from vegetable matter, lumps or balls of clay, adherent films of clay or other material that will prevent thorough coating with asphaltic material.

(3) The aggregate shall have a minimum sand equivalent of 45 when tested by AASHTO T-176.

(b) Bituminous Material.

(1) Emulsified Asphalt. The emulsified asphalt shall be mixing type conforming to the provisions for SS-1, in Section 715. Approximately 5% rubberized latex shall be added to the emulsified asphalt.

The rubberized latex may be pre-blended with the asphalt at the place of manufacture of the asphalt or at the job-site. A properly proportioned, homogeneous asphalt-latex product is necessary.

(2) The percent of residual asphalt shall be ten to sixteen percent on the theoretical dry weight of the aggregate.

(c) Filler Material.

(1) Portland Cement or Hydrated Lime as specified in Section 701.01 or Section 706, shall be included in the mix when a filler is required. In producing the required mix, if more than one type of aggregate is used, each type shall be proportioned separately in a manner that will result in a uniform, homogeneous blend.

(d) Rubberized latex. The latex modifier shall be an anionic emulsion of butadiene-styrene low-temperature copolymer in water, stabilized with fatty-acid soap so as to have good storage and mechanical properties and possessing the following properties:

Monomer ratio, B/S	from 85/15 to 70/30
Minimum solids content	76%
Solids content per gal. at 67%	5.3 lbs
Coagulum on 80-mesh screen	0.1% max.
Type Anti-oxidant	staining
Mooney Viscosity of Polymer (M/L 4 at 212 F)	100 min.

pH of Latex	9.4 - 10.5
Surface tension	28-42 dynes/cm^2
Brookfield Viscosity of Latex	1200 ps max. at 67% solids

The manufacturer shall furnish through the Contractor four copies of a certification consisting of a report covering tests condicted by an approval laboratory indicating that the material furnished meets the specifications above. The certification shall be signed by a responsible representative of the company which issues the certification.

409.03. EQUIPMENT. The Slurry Seal Coat shall be mixed in either a continuous type spiraled blade or a pugmill mixer.

The mixers shall be in approved condition and equipped with calibrated controls to measure the proper amount of asphalt latex emulsion, water, filler, and aggreates.

Spreading Equipment. The Slurry mixture shall be uniformly spread by means of a controlled spreader box conforming to the following requirements:

(1) The spreader shall have strips of flexible rubber belting or similar material on each side of the spreader box and in content with the pavement to prevent loss of slurry from the box.

(2) The box shall have baffles, augers or other suitable means to insure uniform application on superlevated sections and shoulder slopes.

(3) The rear flexible strike-off blade shall be adjusted to obtain a uniform spread of the Slurry Seal Coat.

409.04. CONSTRUCTION. Prior to the application of the Slurry Seal, the contractor shall place a trial panel, at a location established by the Engineer, to demonstrate mix uniformity and that the mix complies to the requirements of proportioning the asphalt, rubberized latex, filler, aggregate and crack-sealing capability in a satisfactory manner. From this demonstration panel, the exact proportions will be determined and a job established by the Engineer.

The job-mix formula with the allowable tolerances shall be within the master range specified above. The job-mix formula shall establish a single percentage of aggregate passing each required sieve size, a single percentage of bituminous latex material to be added to the aggregate, and a single percentage of filler material to be added to the mix.

After the job-mix formula is established, all mixtures furnished for the project shall conform thereto with the following ranges of tolerances:

Passing No. 200 screen	±2 percent
Residual Asphalt	±0.4 percent
Filler Material	±0.2 percent

Should a change in sources of materials be made a new job mix formula shall be established before the new material is used. When unsatisfactory results or other conditions make it necessary, the Engineer may establish a new job mix formula.

Slurry Seal Coats shall be placed in accordance with weather and seasonal limitations specified in Section 402.04(a). All dirt, mud, trash, or other loose materials shall be cleaned from the surface area to be covered prior to placing the Slurry Seal Coat.

Hand tools shall be available in order to remove spillage, ridges, or bumps in the finished Slurry Seal course.

Work shall be completed early enough to allow traffic to safely travel over finished work before dark.

409.05. MEASUREMENT AND PAYMENT. Slurry Seal Coat will be measured and paid for by the square yard of surface area of completed and accepted work. All costs incidental to the Slurry Seal Coat as specified herin will be included in the price bid per square yard of Slurry Seal Coat.

If a second application is deemed necessary the payment shall be at the price bid per square yard for Slurry Seal Coat.