An Evaluation of Engineering Fabric in Pavement Rehabilitation (IHD-21)

Physical Research Report No. 88

Illinois Department of Transportation
Bureau of Materials and Physical Research

State of Illinois
DEPARTMENT OF TRANSPORTATION
Division of Highways
Bureau of Materials and Physical Research

AN EVALUATION OF ENGINEERING FABRIC IN PAVEMENT REHABILITATION
IHD-21

FINAL REPORT

By

Indalecio Mascunana
Development Studies Engineer

A Product Evaluation Project by
Illinois Department of Transportation
in cooperation with
U. S. Department of Transportation
Federal Highway Administration

March 1981

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA/IL/PR-088		

4. Title and Subtitle	5. Report Date
An Evaluation of Engineering Fabric in Pavement Rehabilitation (Project IHD-21)	March 1981
	6. Performing Organization Code
7. Author(s) Indalecio Mascunana Development Studies Engineer	8. Performing Organization Report No. Physical Research Report No. 88
9. Performing Organization Name and Address Illinois Department of Transportation Bureau of Materials and Physical Research 126 East Ash Street Springfield, Illinois 62706	10. Work Unit No.
	11. Contract or Grant No. IHD-21
	13. Type of Report and Period Covered Final Report July 1975 - July 1980
12. Sponsoring Agency Name and Address Same as 9	14. Sponsoring Agency Code

15. Supplementary Notes

Study conducted in cooperation with the U. S. Department of Transportation, Federal Highway Administration

16. Abstract

This report describes the use of four reflective cracking control materials in ten State and Local Roads agency resurfacing projects. The materials used include two commercially available engineering fabrics, a prefabricated interlayer membrane, and an asphalt-rubber membrane interlayer. The primary objective of the study was to evaluate the effectiveness of these materials in controlling reflective cracking of bituminous concrete overlays.

The results of this study indicate that the control methods used were not effective in preventing the development of transverse reflective cracking on overlays with rigid bases; however, they were generally effective in controlling longitudinal reflective cracking over the widening joints and center joints. Also, they were generally effective in reducing or retarding both transverse and longitudinal reflective cracking on overlays with flexible bases.

Recommendations are made concerning reflective cracking control on future resurfacing projects involving both rigid and flexible bases.

17. Key Words	18. Distribution Statement
Engineering fabric, crack control material, longitudinal & widening joints, reflective cracking and transverse crack.	No restrictions. This document is available to the public through the National Technical Information Service.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	41	

Form DOT F 1700.7 (8-69)

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

AN EVALUATION OF ENGINEERING FABRIC IN PAVEMENT REHABILITATION

INTRODUCTION

Objectives

The primary objective of this study was to evaluate the effectiveness of engineering fabrics and other materials for controlling reflective cracking of bituminous concrete overlays.

The contraction joints and major transverse cracks in portland cement concrete pavements usually begin to reflect through bituminous concrete overlays in a relatively short time - often less than a year for overlays up to three inches thick. Not only do these reflective cracks detract from the appearance of an overlay and degrade rideability, they also can allow surface water to enter the pavement structure and weaken the subgrade and contribute to both structural deterioration and further surface deterioration.

Preliminary Evaluation

Early in the 1970's, a considerable amount of interest was generated among highway engineers regarding the use of engineering fabrics to control reflective cracking. Among the fabrics tried by several state highway agencies were Petromat by Phillips Fibers Corporation, Mirafi 140 by Celanese Fibers Marketing Company, and Heavy Duty Bituthene by W. R. Grace & Company. A nonfabric treatment which has been used for the same purpose is the asphalt-rubber membrane interlayer by the Arizona Refining Company, and the Sahuaro Petroleum and Asphalt Company. Extensive promotional campaigns by these companies created much public awareness and optimism, especially at the local agency level.

The Petromat and Mirafi 140 are 4-oz. per sq. yd. nonwoven polypropylene fabrics, while the Heavy Duty Bituthene is a prefabricated interlayer membrane of rubberized asphalt reinforced with woven polypropylene fabric. The asphalt-rubber membrane interlayer is composed of paving-grade asphalt mixed with reclaimed rubber.

Petromat was first introduced to the Illinois Department of Transportation in late 1970. Preliminary evaluation of the product consisted of laboratory shear bond tests conducted in 1971. The test results indicated it had potential use as a bridge deck interlayer membrane.

In the fall of 1972 a Petromat interlayer membrane using an asphalt emulsion tack coat and a 3/4-inch sand-asphalt surface course was constructed on a bridge structure in Springfield. The Petromat-asphalt surface performed fairly well but the waterproofing was marginal based on resistivity tests made in 1974. After 6 3/4 years of service, the membrane was removed and replaced in 1979 with the Department's standard coal tar emulsion-fiberglass interlayer.

Based on rather variable results of Petromat installations reported by early investigators of reflective cracking control methods in other states and Canada, further study was delayed until more favorable information was received that could justify the use of the product. Later reports were more favorable and the evaluation of engineering fabrics for the purpose of reducing and/or retarding reflective cracking under the conditions found in Illinois was resumed.

Scope

The evaluation study includes four Local Roads agency projects completed in 1975 and 1977, an airport rehabilitation project in 1977, and five State Highway projects in 1978 and 1979 as indicated in Table 1.

The reflective cracking control materials that were field tested include two engineering fabrics, a prefabricated interlayer membrane and an asphalt-rubber membrane interlayer.

Conclusions

Based upon the performance of the Petromat and Mirafi 140 engineering fabrics, Heavy Duty Bituthene interlayer membrane, and the asphalt-rubber membrane interlayer used to control reflective cracking of bituminous concrete overlays in this study, the following conclusions are drawn:

1. Whether the reflection of a crack upward through a bituminous concrete overlay can be prevented or significantly delayed depends principally upon the type and amount of movement that takes place at that crack. Cracks which experience differential vertical movement reflect rapidly. Cracks which do not experience differential vertical movement apparently fail due to temperature-induced movement and/or fatigue of the overlay at some age which is determined by the volume of traffic and the strain at the level of the protective treatment.

2. When a crack reflects, the waterproofing function of a fabric treatment can be lost without actually rupturing the fabric.

3. None of the materials evaluated were successful in preventing the reflection of transverse joints or major transverse cracks over rigid bases such as CAM or PCC. However, each of the materials that were used to control the reflection of widening joints over PCC were successful. Also the one material that was used over a centerline joint over PCC was about 90 percent successful at the age of two years.

4. The one material that was placed over pavement-shoulder joints was successful in one project but a failure in the other - probably because of differential vertical movements, which are common at pavement-shoulder joints.

5. The one material that was used over flexible bases afforded significant delay and reduction of reflective cracking of all cracks regardless of orientation.

TABLE 1

ENGINEERING FABRIC IN PAVEMENT REHABILITATION PROJECTS

IDENTIFICATION	LOCATION	INSTALLED	WORK INVOLVED
Local Roads Agency Projects			
1. 1975 City Maintenance Champaign Co.	Cottage Grove in Urbana	7/75	Res. existing 2 1/2" bit. concrete over 7" Agg. base Petromat - 1170 sq. yd. 1" bit. binder course (surface mix) 1" bit. conc. surface
2. 76-00126-00-WR Rock Island Co.	7th St. in Moline	10/77	Res. existing 7" PCC (9-6-9), partly Res. 1" Bit. Surf. 3/4" leveling binder Petromat-10,900 sq. yd. 1 1/4"-bit. binder course 1" bit. surface course
3. 77-00000-00-GM DuPage Co.	St. Charles Rd. in Elmhurst	10/77	Res. existing 1 1/2" bit. surface on PCC pvmt. (9-7-9) w/20 Ft. joints leveling binder on patch work Petromat full coverage-(20,000 sq. yd.) 1 1/2" bit. surface
4. 78-00000-00GM Cook Co.	Prince Charles Lane & Prince Charles Court in Schaumburg	9/78	Res. existing 2" binder course on 6" POZ base 1" bit. leveling course Petromat full coverage (4790 sq. yd.) 1 1/2"-bit. surface course

TABLE 1 (Continued)

IDENTIFICATION	LOCATION	INSTALLED	WORK INVOLVED
Division of Aeronautics Airport Rehabilitation			
1. Airport Maint. Cass Co.	Beardstown Airport in Beardstown	6/77	Res. existing 2" bit. surface over 8" CAM base 60' x 3600' runway Petromat 1" bit. binder course (surface mix) 1" bit. conc. surface
State Highway Projects			
1. Proj. I-IR-80-1(97)0 Sec. Intermittent Rock Island & Henry Co.	FAI 80, between Rapids City and the interchange w/FAI 74 in Colona	6/78	Res. existing 8" CRCP 1 1/2" bit. binder course Petromat full coverage (1,485 sq. yd.) 1 1/2" bit. surface course
2. Proj. F-706(5) Sec. 124 RS-2 DeWitt Co.	Ill. 48 from Weldon to Fullerton		Res. old PCC pavement
		a) 6/78	a) Bituthene over widening joint (18") or trans. cracks & joints (12") 235 sq. yd. 1 1/2" bit. binder 1 1/2" bit. surface
		b) 6/78	Stress Abs. Memb. Innerlayer or Strain Relieving Interlayer (SRI) over widening and ℄ joints (4') 1 1/2" bit. binder 1 1/2" bit. surface
		c) 7/78	1 1/2" binder + Petromat + 1 1/2" surf. over widening joint ((50") 2,473 sq. yd.
		d) 7/78	1 1/2" binder + Mirafi 140 + 1 1/2 surf. over widening joint (44") 2,648 sq. yd.

TABLE 1 (Continued)

IDENTIFICATION	LOCATION	INSTALLED	WORK INVOLVED
3. Proj. U-505(3) Sec. 108 W. & RS Stephenson Co.	Ill. 75 between Walnut Ave. and Ill. 26 in Freeport	10/78	Res. existing pvmt. (PCC res. w/1 1/2" Bit.) 3/4" Bit. conc. binder Petromat full coverage (7,582 sq. yd.) 1 1/4" bit. conc. surface
4. Proj. I-IR-57-4 Sec. 15 (23, 24) RS Coles Co.	FAI-57 1/2 mile No. of Ill. 16 in Mattoon	10/78	Northbound Pavement Only-7"-CRCP Res. 2" bit. binder course Petromat full coverage (7626 sq. yd.) 2" bit. binder course 1-1 1/2" bit. surface course
5. Proj. I-474-7(69)87 Sec. 90 (7, 7HB-3) Tazewell Co.	FAI 74 at the interchange w/ FAI 474, E. of E. Peoria	9/79	Res. Existing 10" PCC Petromat placed to cover up existing joints that fall in the middle of proposed traffic lane (3' strips, 2,564 sq. yd.) 5"-bit. binder & surface courses

Recommendations

Based on the results of this study, it is recommended that Petromat, H. D. Bituthene, and the asphalt-rubber membrane interlayer be allowed for overlays over flexible bases and for longitudinal joints such as centerline or other lane joints and widening joints over rigid bases. Since the test conditions for the Mirafi 140 in its only installation in this project were apparently exceptionally mild as evidenced by the good performance of its untreated control section, it is recommended that the evaluation of Mirafi 140 not be concluded at this time.

FIELD TEST INSTALLATIONS

Ten test installations were included in the evaluation study. These installations were constructed in several counties comprising the northern and central regions of the State. Different design configurations were utilized depending upon the need and purpose of the specifying agency.

City Maintenance, Champaign County

Experimental Features. This test installation involved the use of about 1170 sq. yd. of Petromat fabric over an existing 2 1/2-inch bituminous concrete pavement with 7-inch aggregate base. The 653 feet long resurfacing project was constructed in July 1975 on Cottage Grove Road, City of Urbana.

The old surface had alligator cracking covering most of the roadway. The edges of the cracks were rounded, indicating severe flexing movements of the surface due to unstable subgrade.

After all the necessary surface preparations, the old surface was sprayed with a 70-85 penetration grade asphalt cement at a rate of 0.25 to 0.30 gal./ sq. yd. Then the fabric was unrolled and manually placed on the asphalt binder. However, due to the sharp curving configuration of the street, the fabric could not be placed without causing large wrinkles or folds. It had to be slit and overlapped to lay flat. When the placement of fabric was completed, the desired two 1-inch lifts of bituminous concrete surface course were placed and compacted.

During initial rolling with a steel roller, the subgrade was noted to be flexing, causing some fine transverse cracks to develop. Further rolling with a pneumatic-tired roller removed most of the cracks.

Performance. Inspection of the installation after seven months of service indicated that the surface was performing well with only one short transverse reflective crack in the test section. Very fine random cracks believed to be caused by excessive deflection of the surface were noted. The adjoining control section without fabric also had one transverse reflective crack and generally was performing in a manner similar to the test section.

After sixteen months of service, both the test and control sections were performing well with no change in the number of cracks reported.

Twenty four months after installation, differences in both the number and width of cracks had become apparent. Fewer cracks were found in the test section than in the control (4 vs. 10), and they were tighter.

After sixty months of service, a few newer transverse cracks were noted in both the test and control sections. However, they appeared to be less in number and severity in the test section as shown in Figures 1 to 4.

In this project it appears that the fabric is providing some resistance to cracking as well as some waterproofing protection which helps to keep the subgrade stable.

76-00126-00-WR, Rock Island County

Experimental Features. This test installation involved the use of about 10,900 sq. yd. of Petromat fabric over an existing 9-6-9 portland cement concrete pavement partly resurfaced with 1-inch bituminous concrete surface. The 3800 feet long resurfacing project was completed in October 1977 on 7th Street, City of Moline.

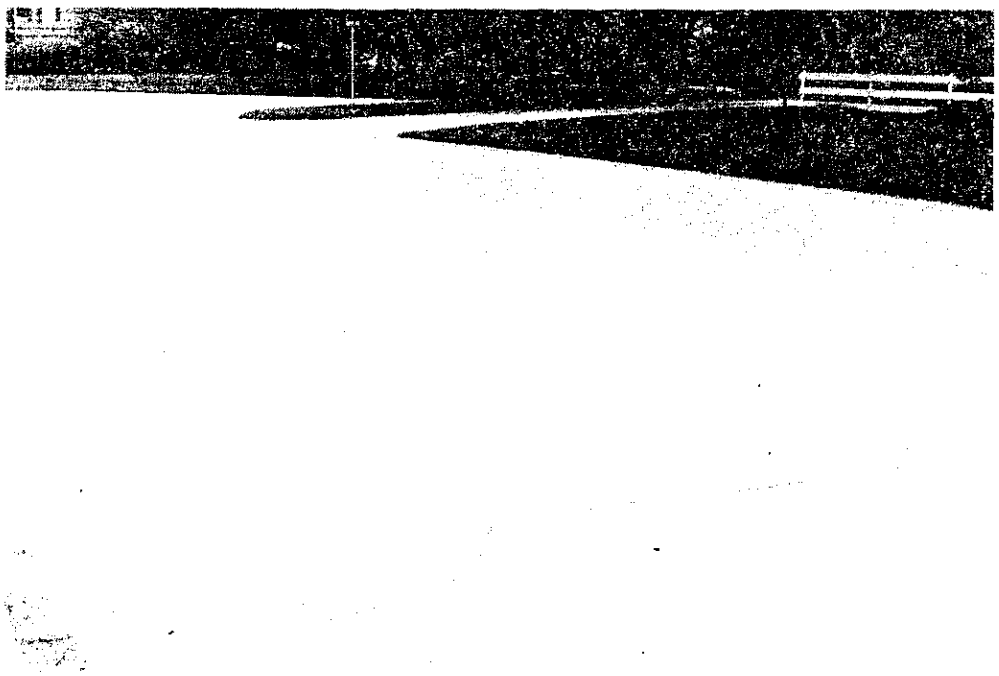

Figure 1. Typical Crack in Petromat Test Section, Urbana.

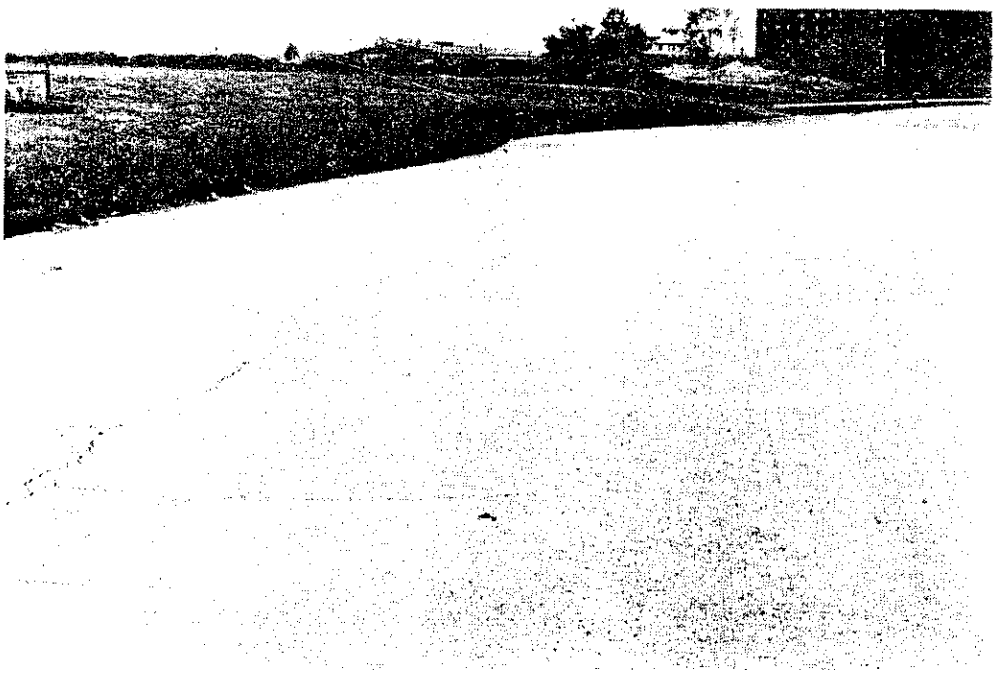

Figure 2. Typical Crack in Control Section, Urbana.

Figure 3. Typical Crack Opening in Petromat Test Section, Urbana.

Figure 4. Typical Crack Opening in Control Section, Urbana.

The existing surface was badly cracked and deteriorated, especially at the transverse joints and intermediate panel cracks. Badly deteriorated concrete was removed and patched with a bituminous binder material.

After all the necessary surface preparations, a 3/4-inch thick bituminous leveling binder course was used to fill low spots. The binder course was sprayed with 85-100 penetration grade asphalt cement at a rate of 0.25 gal./sq. yd. Then the fabric was unrolled and manually placed with essentially a wrinkle free surface. This was immediately followed by a 1 1/4" bituminous binder course and a 1" bituminous concrete surface course. There was no problem paving over the fabric.

The 1000 ft.-long control section without fabric is located just south of the test section.

Performance. When the project was inspected after eight months of service, both the test section and the control section were performing very well with no sign of surface distress or reflective cracking.

Two years after construction, fourteen reflective cracks were observed in the test section and ten in the control section. However, these cracks were tight and hardly visible from a short distance.

After almost three years of service, twenty one cracks were noted in the test section and twelve in the control section. Some cracks are more prominent than others but the pavement surface is still in excellent condition as shown in Figure 5 and 6. Figure 7 shows a closeup of a typical crack in the test section.

In this project, the fabric seems to be effective in at least retarding the reflection of wide transverse cracks. Most of the reflective cracks which did occur are not fully developed across the roadway. The fabric should help increase the service life of the resurfacing if it can keep the subgrade relatively dry.

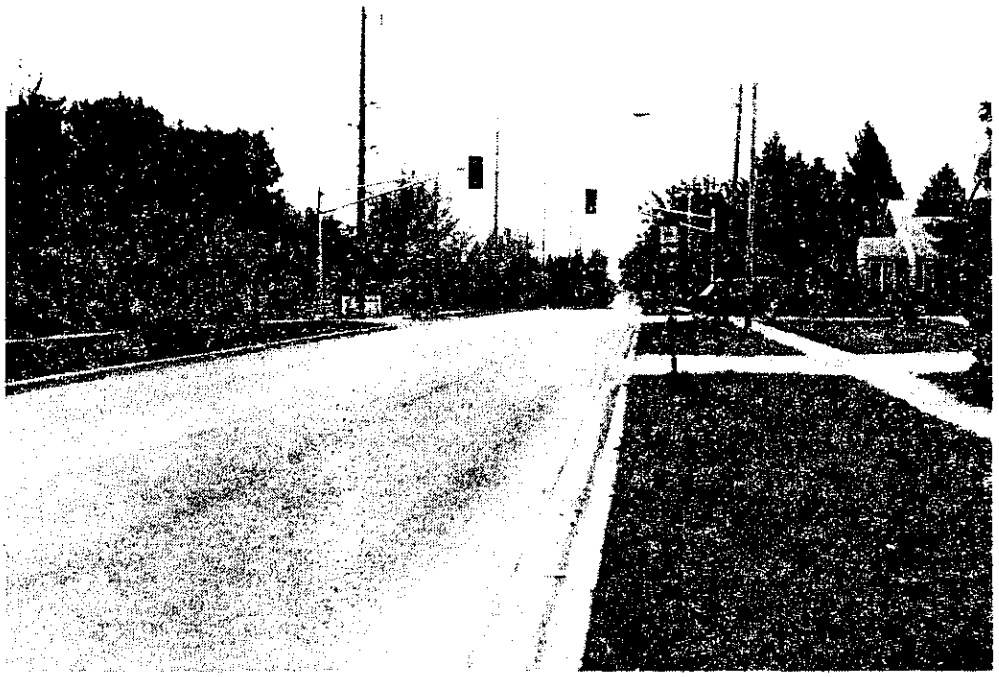

Figure 5. General view of Petromat Test Section, Moline.

Figure 6. General view of Control Section, Moline.

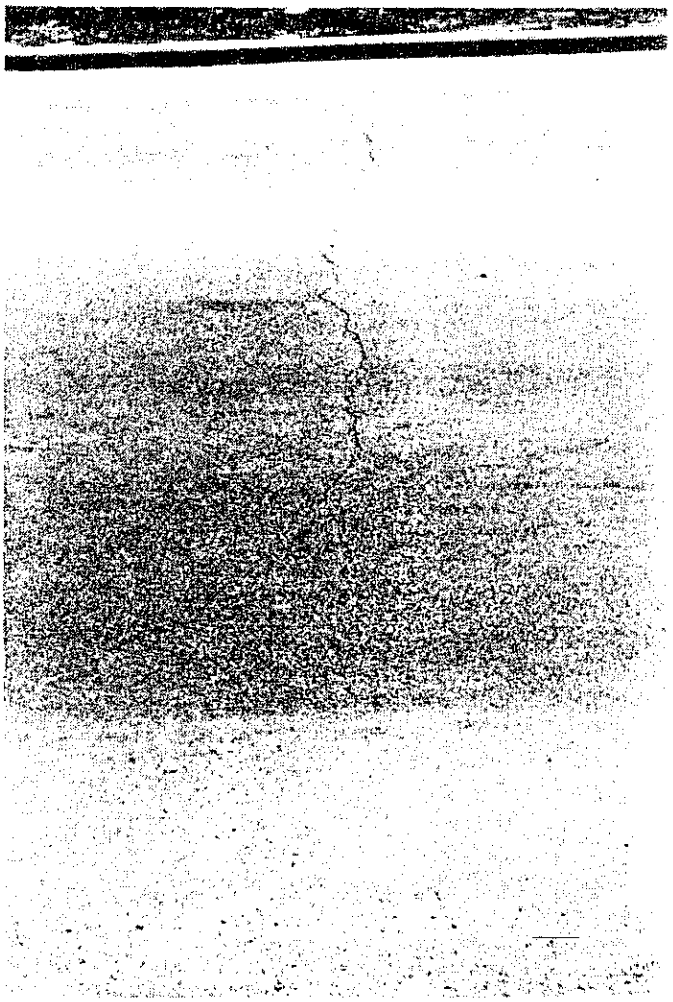

Figure 7. Typical Crack in Petromat Test Section, Moline.

77-00000-00-GM, DuPage County

Experimental Features. This test installation involved the use of about 20,000 sq. yd. of Petromat fabric over an existing jointed (20 ft. spacing) PCC pavement (9-7-9) resurfaced with a 1 1/2-inch bituminous concrete surface. The 4300-foot-long resurfacing project was completed in October 1977 on St. Charles Road, City of Elmhurst.

Prior to placing the fabric, all badly deteriorated cracks were removed and patched with a leveling binder. In order to maintain the curb elevations, a cold milling machine was used to remove a 2-foot wide, 1-inch deep wedge adjacent to the curb.

After all the patching work was completed, the surface was sprayed with 85-100 penetration grade asphalt cement at a rate ranging from 0.25 to 0.30 gal./sq. yd. following which the fabric was mechanically placed on the primed surface. Occassionally wrinkles in the fabric had to be pressed flat with a broom. This operation was immediately followed by paving with a 1 1/2-inch bituminous concrete surface course. No problem was encountered during paving.

A 300-foot control section without fabric was located between the two test sections in order to have the same traffic and surface conditions.

Performance. After one year of service under fairly heavy traffic, approximately 30 percent of the old cracks had reflected in both the control and test sections. The cracks were sealed with a bituminous joint sealer.

The latest inspection of both sections after 2 1/2 years of service revealed that almost all of the original cracks had reflected, including some longitudinal cracks. Secondary cracking and raveling also has developed at several transverse cracks as shown in Figure 8.

In this project it appears that the fabric had little effect in retarding the development of reflective cracking.

78-00000-00-GM, Cook County

Experimental Features. This test installation involved the use of about 4790 sq. yd. of Petromat fabric over an existing 2-inch bituminous concrete surface with a badly deteriorated 6-inch pozzolanic base. Conventional construction would have required the removal of the unstable base and would have been expensive. The project was completed in September 1978 on Prince Charles lane and Prince Charles Court, Village of Schaumburg.

Prior to placing the fabric, a 1-inch leveling bituminous binder course was placed over the existing surface. The leveling course was then sprayed with 85-100 penetration grade asphalt cement at the specified rate of 0.25 to 0.30 gal./sq. yd. The asphalt binder was applied in short stretches to allow the fabric placement to keep pace.

The fabric was placed on the prepared surface using hand methods. Due to the curving nature of the street, it was necessary to place short pieces of fabric, approximately 50 to 150 feet long, and then cut the piece from the roll to re-align the placement with the edge of pavement. The 12 1/2-foot widths were overlapped approximately 1 inch at the centerline of the street, and 1 1/2-foot widths were placed along the outside edges. Some wrinkling of the fabric occurred, but it did not appear to be excessive.

After the fabric placement, a 1 1/2-inch bituminous concrete surface course was placed over it. Compaction was accomplished with two rollers, a dual wheel vibratory type roller and a standard tandem roller. Vibration of the roller was not used due to displacement of the membrane when it was attempted.

Performance. After 21 months of service under relatively light local traffic, the test section is performing very well with only two minor cracks. The fabric seems to be effective in controlling reflective cracking of a

rather unstable pozzolanic base. Figures 9 & 10 show general views of Prince Charles Lane and Prince Charles Court, which are in excellent condition.

Airport Maintenance, Cass County

Experimental Features. This test installation involved the use of about 26,000 sq. yd. of Petromat fabric over an existing 2-inch bituminous concrete surface with 8-inch cement aggregate mixture (CAM) base course. The project was completed in June 1977 on the 60' x 3600' runway, taxiway, turnaround, and apron of the Beardstown Airport, in Beardstown.

The airport is located in a very sandy and well drained area. The original bituminous surface was about 8 years old and had 160 transverse cracks on the west half of the runway and 150 cracks on the east half.

Prior to placing the fabric, most of the cracks were routed out and filled flush to the surface with a mixture of sand and asphalt. Asphalt cement of 85-100 penetration grade was then sprayed on the prepared surface at the rate of 0.26 gal./sq. yd.

Placing of the fabric over the primed surface was a problem due to laydown equipment that was out of alignment. The alignment problem was corrected later; however the equipment still could not place a satisfactory wrinkle-free surface. Some wrinkles were worked out with the feet while larger ones were slit and relaid. All of the fabric surface was sanded with approximately two pounds/sq. yd. of sand and rolled with numerous passes of a pneumatic roller.

Paving was started after all the fabric was in place. No problem was encountered in placing the two 1-inch compacted lifts over the fabric.

Performance. After 9 months of service, a condition survey was made to determine the amount of reflective cracking on the surface. The result of the survey indicated that 53 percent of the cracks reflected on the west half of the runway and 60 percent on the east half.

Figure 8. Badly Deteriorating Crack in Petromat Test Section, Elmhurst.

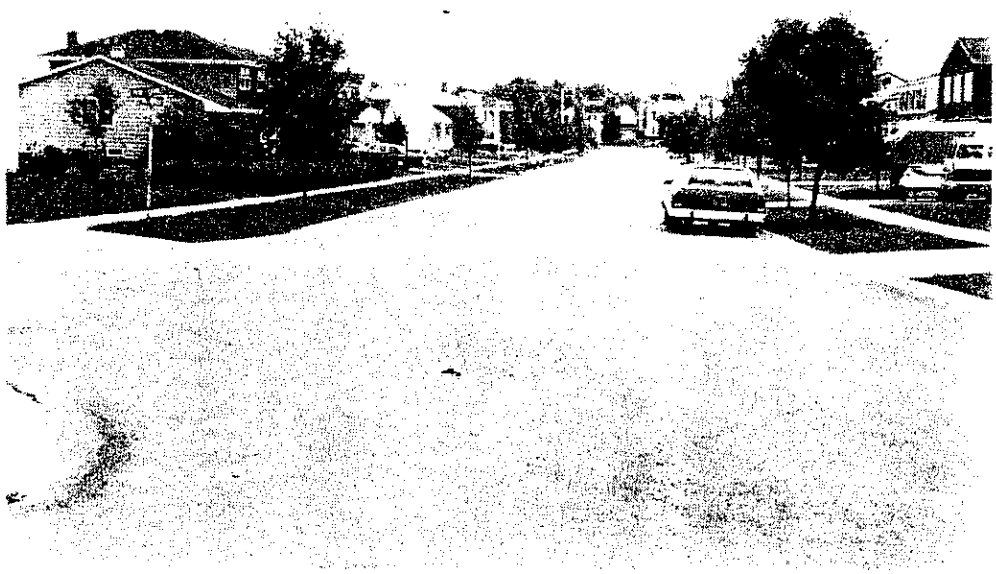

Figure 9. General View of Petromat Test Section, Schaumburg.

Most of the reflective transverse cracks were wide open (1/4") and extended all the way across the runway surface as shown in Figure 11. To determine if the fabric was intact and retarding the flow of surface water, cores were taken at three locations directly over the cracks. Figure 12 shows the location of a core previously taken when the crack was tight.

Visual examination of the cores showed the fabric was not broken over the cracks. Permeability tests were run on the cores by waxing a plastic graduate to the surface. A constant head of 1 3/4 inches was maintained for five minutes. Although the cracks were not water tight, the rate at which water passed through the fabric was reduced as compared to an open crack.

The results of the latest survey after three years of service indicate that the amount of reflective cracks had increased from 53 to 73 percent on the west half of the runway and from 60 to 82 percent on the other half.

In this project, it is obvious that the fabric did not control reflective cracking and it is just a matter of time before all of the cracks will show up on the surface. How much moisture will be passing through the cracks into the base is dependent on the ability of the fabric to remain unbroken and watertight.

Project I-IR-80-1(97)0, Rock Island & Henry Counties

Experimental Features. This test installation involved the use of 1485 sq. yds. of Petromat fabric over an 8-inch continuously reinforced concrete pavement that was surface-spalled due to deficient cover over the reinforcing bars. The project was completed in June 1978 on the westbound lane of FAI Route 80, just east of Exit 1, Ill. 84.

The original design concept was to place the fabric directly on the existing CRC pavement surface to attempt to prevent further spalling and deterioration of the concrete. Because of the presence of exposed rebars,

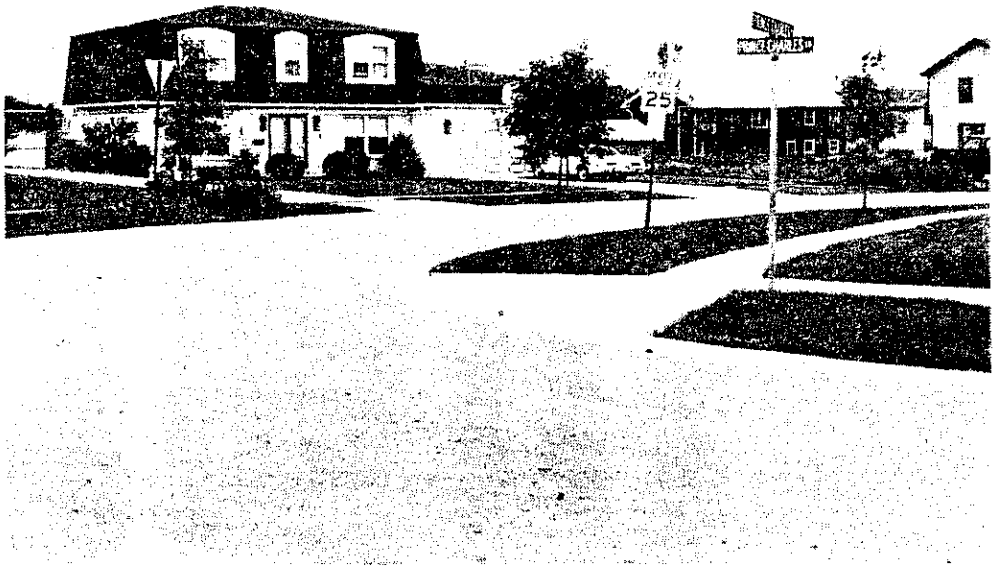

Figure 10. Another View of Petromat Test Section, Schaumburg.

Figure 11. Typical Crack in Petromat Test Section, Beardstown Airport.

the design was changed in the field to sandwich the fabric between the 1 1/2-inch binder course and the 1 1/2-inch surface course.

The installation procedures involved the necessary removal of loose aggregate and foreign material from the deteriorated CRC surface; application of prime coat; placing of the 1 1/2-inch leveling binder course; application of 85-100 penetration grade tack coat at 0.28 gal./sq. yd.; manually placing the fabric; spreading of sand blotter to prevent pick-up; and finally the 1 1/2-inch bituminous surface course.

The surface course was not placed until five days after the installation of the fabric and sand blotter because of bad weather prevailing during that period. Meanwhile traffic was allowed on the fabric as shown in Figure 13. The fabric held up very well and no sign of tearing, wear, or traffic pick-up was noted during paving of the surface. I-80 at this point has an ADT of 13,600 on four lanes including 2900 trucks.

Performance. Inspection made of the installation after two years of service indicates that the test section is performing very well with no signs of any surface distress or reflective cracking as shown in Figure 14. The results could be reasonably expected because of the rigid CRC pavement underneath that permits only negligible vertical displacement along its closely spaced transverse cracks. As long as these cracks are prevented from further deterioration and are held together by the heavy reinforcing bars, reflective cracking in this project should be minimal.

Project F-760(5), Sec. 124 RS-2, DeWitt County

Experimental Features. This test installation involved the use of 2473 sq. yd. of Petromat fabric; 2648 sq. yd. of Mirafi 140 fabric; 235 sq. yd. of Heavy Duty Bituthene; and about 4500 lbs. of asphalt-rubber mixture in a membrane interlayer over the longitudinal concrete widening and center joints.

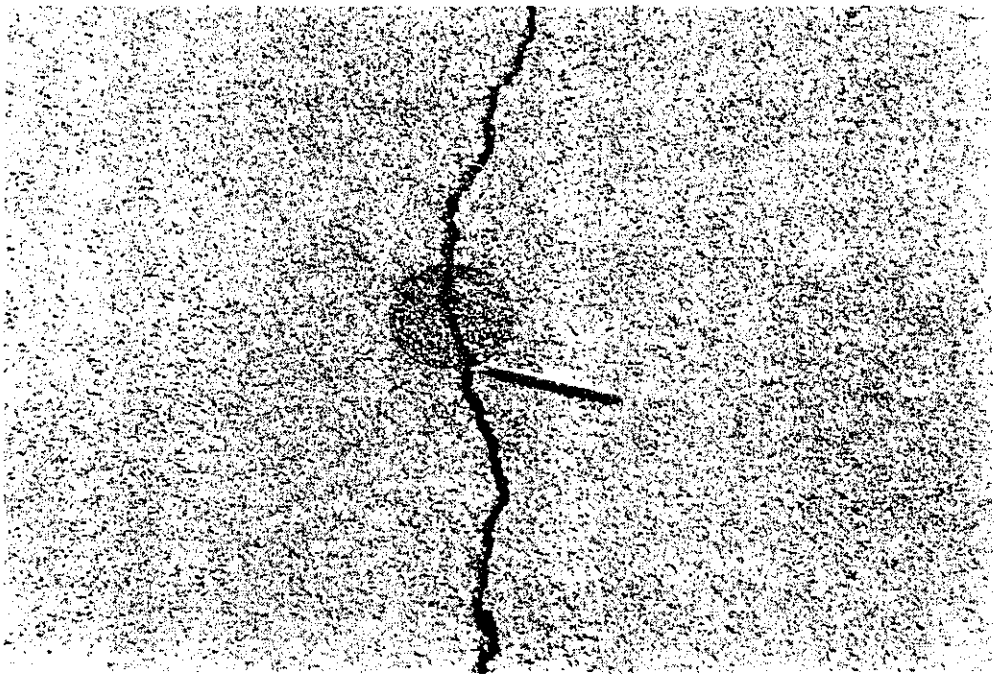

Figure 12. Closeup of Crack at Core Sampling Location, Beardstown Airport.

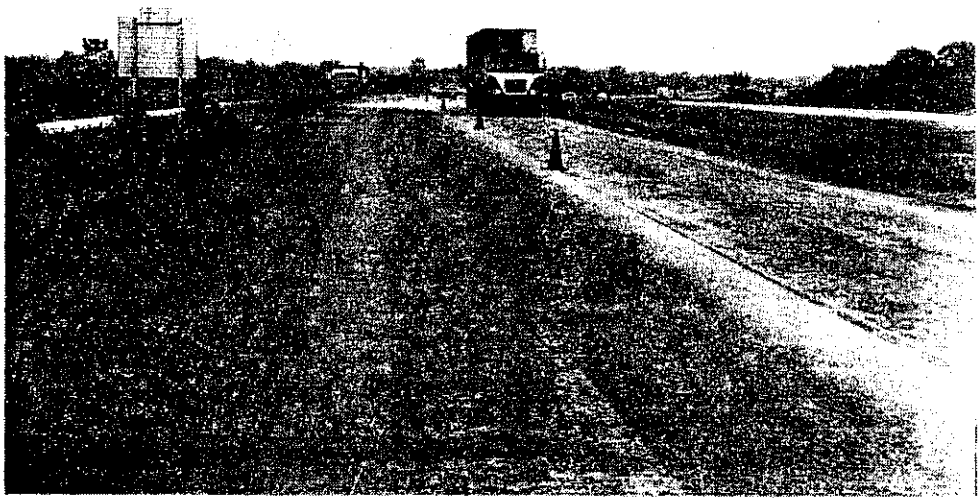

Figure 13. Sand-Blotted Petromat Fabric Surface Opened to Traffic, I-80.

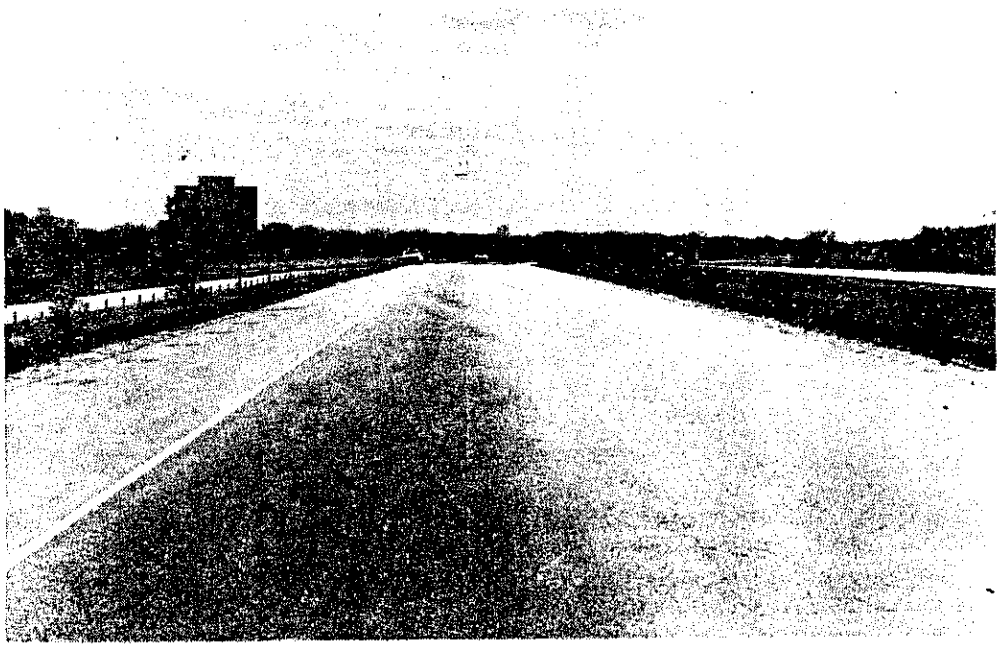

Figure 14. General View of Petromat Test Section, I-80.

The project consists of resurfacing Ill. 48 from Ill. 10 near Weldon to Ill. 54 near Fullerton, and reconstruction of the intersection at Ill. 54.

The existing pavement was the original 18 foot concrete pavement which has been previously widened to 22 feet and resurfaced with 3 inches of bituminous concrete. The pavement had developed unusually severe longitudinal cracking and raveling over the joint between the original pavement and the concrete widening. The different reflective crack control methods used attempted to minimize the reflection of the existing cracks to the new surface.

The Heavy Duty Bituthene and the asphalt-rubber membrane interlayer test sections were completed in June 1978.

The Heavy Duty Bituthene was installed on the old surface over the widening joint (18-inch strips) and over the transverse cracks and joints (12-inch strips). The Bituthene consists of a tough reinforcement of polypropylene woven mesh laminated to a thick layer of self-adhesive rubberized asphalt. The membrane instantly bonds to the primed pavement surface. After the membrane was placed, a tack coat was applied, followed by the paving operation placing 1 1/2 inches of bituminous concrete binder course and 1 1/2 inches of surface course.

The asphalt-rubber membrane interlayer was applied on the old surface four feet wide, on two widening joints and one center longitudinal joint. The material consisted of a mixture of 3450 lbs. of 85-100 penetration grade asphalt, 900 lbs. of reclaimed rubber (G-274 high natural rubber content) and 10 gallons of extender oil. This is a nominal 80 percent asphalt and 20 percent rubber mixture. The extender oil was added to reduce the viscosity of the mix for easier spraying.

An asphalt distributor was used to apply the asphalt-rubber at 400°F temperature at a rate of about 0.6 gal./sq. yd. This was immediately followed by a chip spreader applying CA-16 crushed stone over the asphalt-rubber. The pavement was opened to traffic for several days before placing the 1 1/2-inch bituminous binder course and the 1 1/2-inch surface course.

The Petromat and Mirafi 140 test sections were completed in July 1978.

The Petromat and Mirafi 140 fabrics were installed over the 1 1/2-inch leveling binder course on the widening area in 50-inch and 44-inch strips, respectively. Then a 1 1/2-inch surface course was placed over them to complete the resurfacing work.

One major difference in the installation procedure between the two fabrics was in the rate of application of tne 85-100 penetration grade asphalt cement tack coat. The Special Provision specified 0.25 to 0.30 gal./sq. yd. for Petromat and only 0.15 to 0.20 gal./sq. yd. for Mirafi 140.

Performance. Periodic inspections and condition surveys were made of the Ill. 48 widening and resurfacing project.

After two years of service under fairly light traffic the following results have been observed.

H. D. Bituthene Test Section. Ten out of 16 full pavement width transverse cracks or joints have reflected full width and wide open as shown in Figure 15. No reflective cracking has occurred over the widening joints, but most of the untreated longitudinal centerline joint has reflected.

Asphalt-Rubber Membrane Interlayer Test Section. Four out of 11 full width untreated transverse cracks or joints have reflected. However, most of these transverse reflective cracks stop at the asphalt-rubber treatment over the centerline and widening joints as shown in Figure 16. About 10 percent of the centerline joints has reflected over the asphalt-rubber, while most of it has reflected in the untreated control section. None of the widening joints with the asphalt-rubber have reflected.

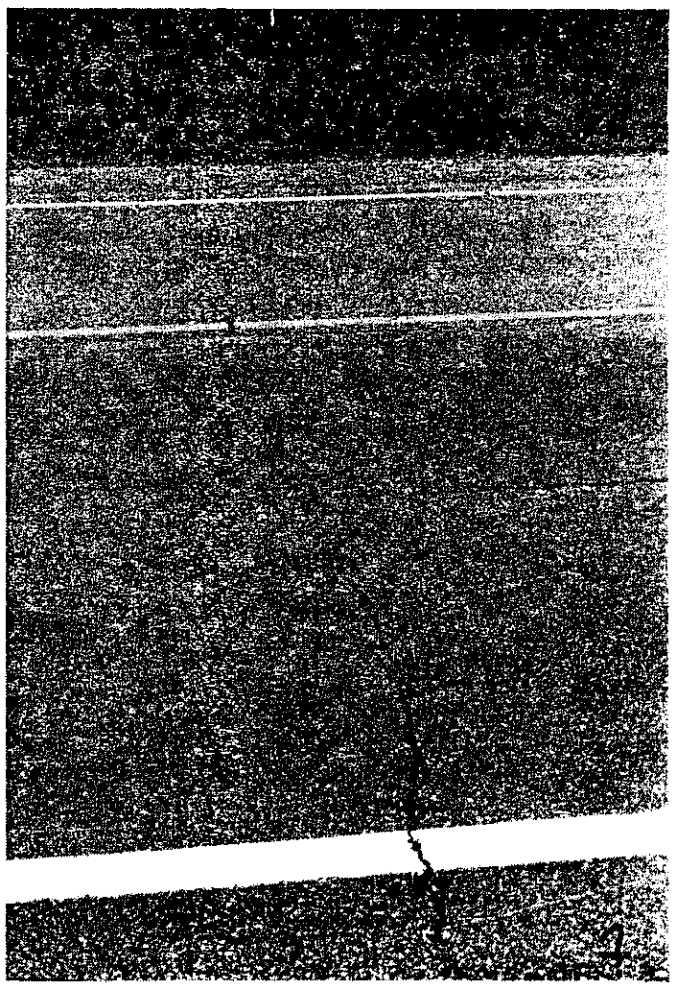

Figure 15. Typical Crack in Heavy Duty Bituthene Test Section, Ill. 48.

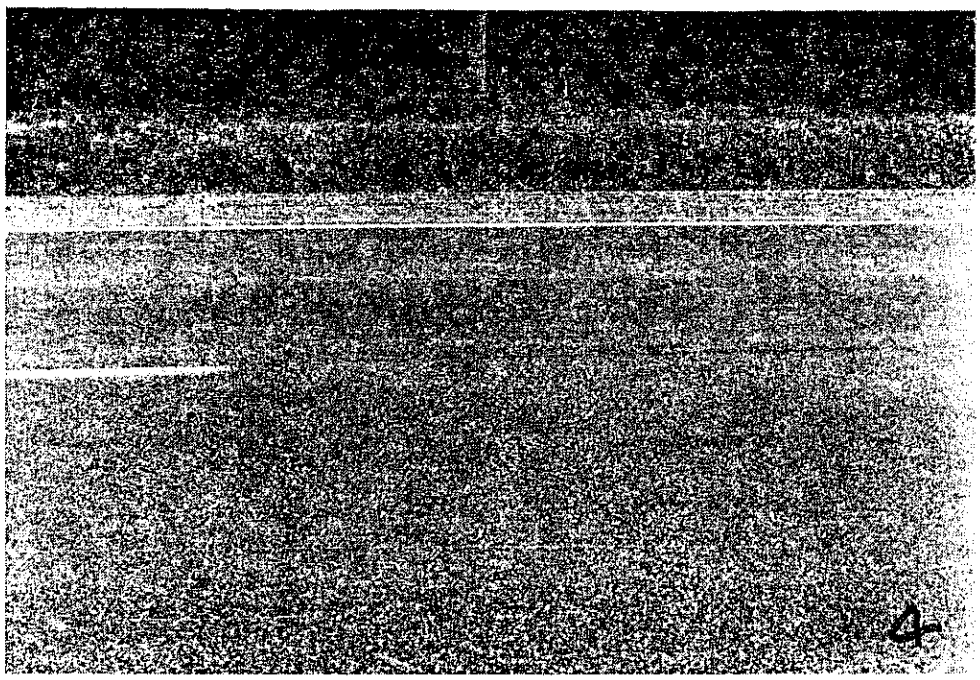

Figure 16. Typical Crack Stops at Fringes of Asphalt-Rubber Membrane Interlayer Centerline and Widening, Ill. 48.

Petromat Test Section. The Petromat was placed only on the east widening joint and no reflective cracking was found over it. About 400 feet (17%) of the widening joint has reflected in the control side as shown in Figure 17.

Mirafi 140 Test Section. The Mirafi 140 was placed only on the east widening joint and no reflective cracking was found on it. About 50 feet (2%) of the widening joint has reflected on the control side.

In this project, it appears that all of the reflective cracking control materials were effective in controlling reflective cracking along the widening. Where no crack control method was used, longitudinal reflective cracking developed in about one year of service. Transverse cracks over rigid bases are harder to control and Heavy Duty Bituthene was not successful in preventing reflection of transverse cracks.

Project U-505(3), Sec. 108 W&RS, Stephenson County

Experimental Features. This test installation involved the use of 7582 sq. yd. of Petromat fabric over existing resurfaced PCC pavement. The resurfacing work was completed in October 1978 on Douglas Street, City of Freeport.

The work included the placing of a 3/4-inch bituminous leveling binder course, Petromat fabric over 0.25 gal./sq. yd. bituminous material (AC-85/100 pen.), and a 1 1/4-inch bituminous surface course.

The fabric came in 75-inch and 150-inch widths. The wider fabric was mechanically placed on both sides of the pavement, while the narrower fabric was manually placed on the center section. Some wrinkles were noted occassionally on the wider fabric but not on the narrower. No problems were encountered in placing the surface course over the fabric.

Performance. Initial inspection of the installation made after 10 months of service under fairly heavy traffic indicated that the test section had 20 reflective cracks developing in about 3400 feet of pavement. The pavement surface generally was performing well.

Figure 17. Reflective Cracking on Widening Joint of Control Section. (None in Petromat Section), Ill. 48.

After almost two years of service, the test section has 65 reflective transverse cracks and 3 longitudinal cracks as shown in Figure 18 and 19. These cracks are well defined and wide open. The pavement in general still looks good.

In this project it appears that the fabric has not prevented the development of numerous reflective cracks in the test section. It is probably only a matter of time until all the original cracks will show up in the surface. Whether the fabric layer will extend the service life of the resurfacing is not known at the present time.

Project I-IR-57-4, Sec. 15(23, 24)RS, Coles County

Experimental Features. This test installation involved the use of 7626 sq. yd. of Petromat fabric over an extensively patched and badly deteriorated 7-inch CRC pavement.

The primary purpose of the installation was to determine if fabric will hold loose pieces of concrete caused by continued D-cracking in place and prevent them from damaging the resurfacing.

The resurfacing work was partially completed in October 1978 on the 2700-foot-long test section on northbound FAI Route 57, north and south of Dorans overpass bridge, Coles County.

The work included the use of the fabric between two 2-inch bituminous concrete binder courses over the CRC pavement. Construction was accomplished one lane at a time and immediately opened to interstate traffic. The 1 1/2-inch bituminous surface course was placed in August 1979.

Performance. Inspection of the installation after almost one year since the bituminous concrete surface course was completed and opened to traffic indicates no difference in the amount and severity of reflective cracking between the Petromat test section and the control section. The reflective transverse cracks are mostly in patched areas as shown in Figure 20. This

Figure 18. Typical Crack in Petromat Test Section, Douglas St., Freeport.

Figure 19. Longitudinal Crack in Petromat Test Section, Douglas St., Freeport.

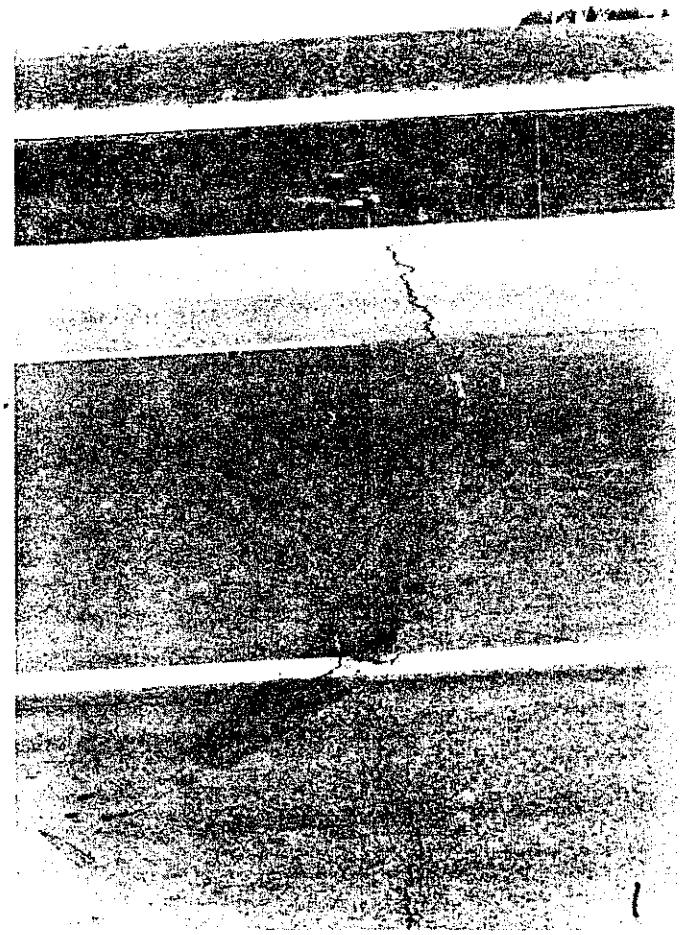

Figure 20. Typical Crack in Petromat Test Section (Patched Area in CRC Pavement), I-57.

seems to be an indication of movement of the patch, either laterally or vertically or both.

Longitudinal reflective cracks also were noted at the pavement-shoulder joint in the test section. It is interesting to note that the shoulder joint crack does not continue through the patch as shown in Figure 21. This seems to be a case where the CRC pavement and the patch area have separated thereby isolating the patch from any significant movement of the pavement structure.

Project I-474-7(69)87, Sec. 90(7, 7HB-3), Tazewell County

Experimental Features. This test installation involved the use of 2564 sq. yd. of Petromat fabric over the widening in the areas of major convergence and divergence at the interchange of FAI Route 474 and FAI Route 74. The installation was completed in September 1979.

The work included the widening of the existing 10-inch PCC with a 10-foot PCC base course, placing the 3-foot strip of fabric over the longitudinal joint, and resurfacing with 5-inches of bituminous concrete binder and surface courses. The fabric was intended to control longitudinal cracking in the area and, hopefully extend the service life of the pavement.

Performance. Inspection of the installation after nine months of service indicates no reflective cracking in the widening area as shown in Figure 22 & 23. With 5 inches of bituminous resurfacing, early reflective cracking was not anticipated; however, the fabric will probably retard the development of reflective cracking in the area. It is much too early to draw conclusions about the performance of the fabric in this project.

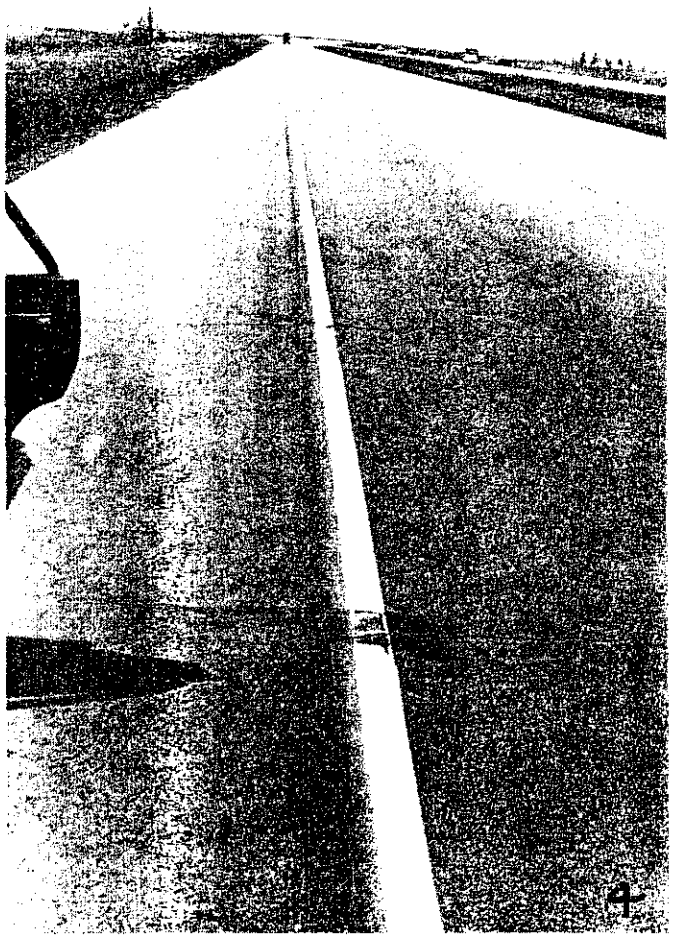

Figure 21. Pavement-Shoulder Joint Crack in Petromat Test Section. (No Crack in Patched Area), I-57.

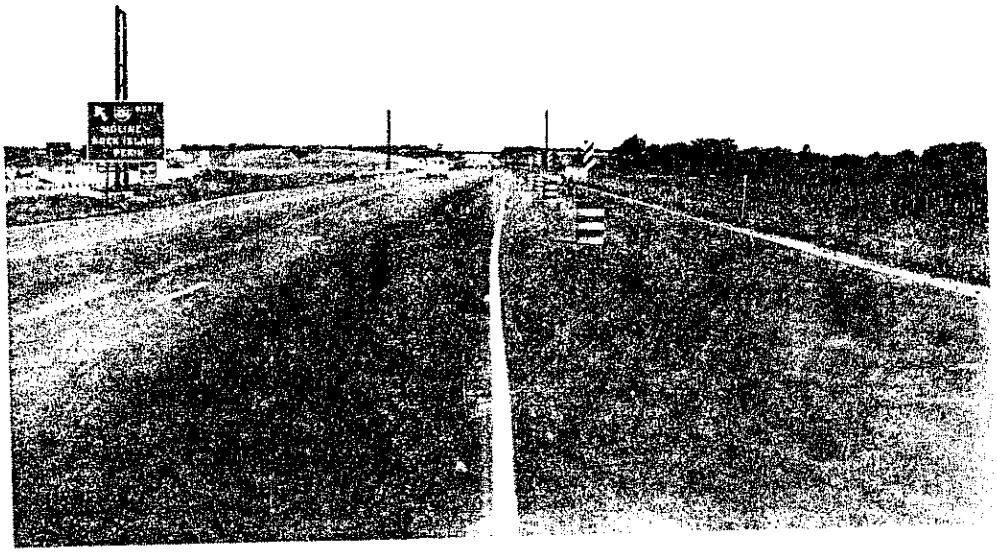

Figure 22. View of Petromat Test Section (Divergence Area), I-474.

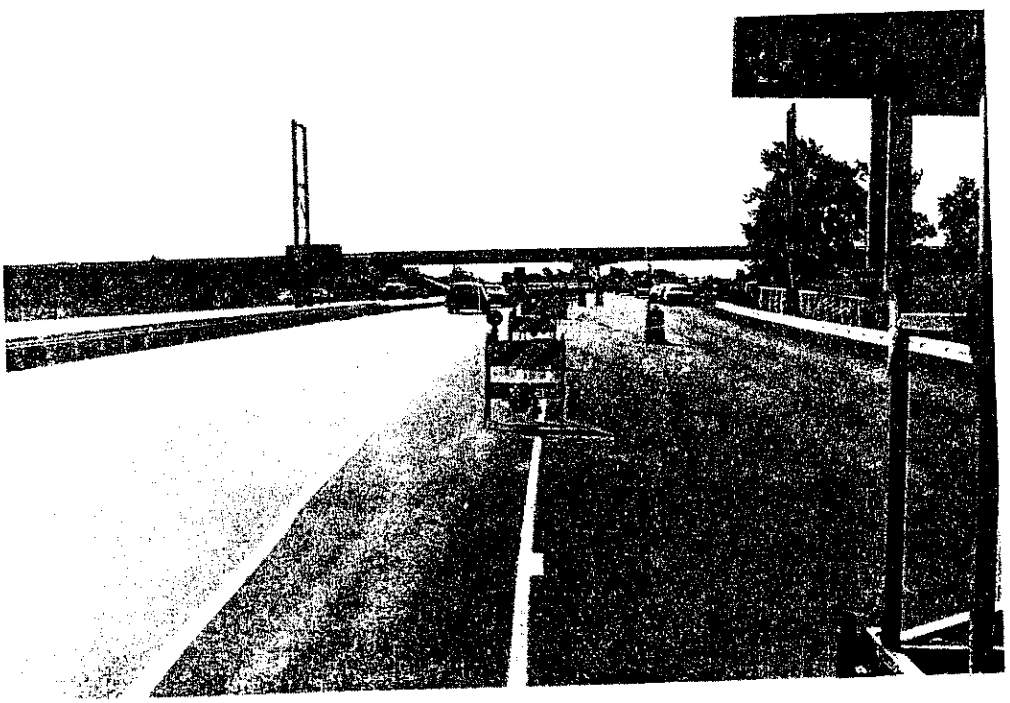

Figure 23. View of Petromat Test Section (Convergence Area), I-474.