EXPERIMENTAL USE OF PAVEMENT REINFORCING FABRICS TO REDUCE REFLECTIVE CRACKING

FINAL REPORT 80-4

July 1980

Reporting On

Work Plan 78-R-20

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS & RESEARCH DIVISION

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STATE OF VERMONT

DIVISION OF ENGINEERING AND CONSTRUCTION

133 State Street, Montpelier, Vermont 05602

Subject: Performance of synthetic fiber fabrics used with bituminous overlays.

From: R. F. Nicholson, P.E., Materials & Research Engineer

Date: April 17, 1981

To: Recipients of Report 80-4

The objective of Work Plan 79-R-20 was to evaluate the effect of using synthetic fiber fabrics as an interlayer to reduce reflective cracking in bituminous overlays. Report 80-4 titled Experimental Use of Pavement Reinforcing Fabrics to Reduce Reflective Cracking concluded, "results to date indicate that the four pavement reinforcing fabrics evaluated do not eliminate or significantly reduce reflective cracking of a 1½ inch bituminous overlay under Vermont's climatic conditions".

Although the fabrics did not perform as desired, recent field cores taken from the test sections, indicate the fabrics may be preventing or inhibiting the infiltration of moisture into the underlying pavement and sub-base. Further investigation is planned to document product performance in this area. Any further findings on the subject will be forwarded to recipients of Report 80-4.

ABSTRACT

Four synthetic fiber fabrics were applied on a 15 year old bituminous pavement to determine their effectiveness in reducing or eliminating reflective cracking of a new bituminous overlay.

The fabrics were placed in a tack coat of asphalt and then covered with a 1 1/2 inch lift of Type II bituminous pavement.

The fabric was placed at a cost of $3.50 per square yard. Field inspections through the second winter revealed that the fabrics have not eliminated or significantly reduced reflective cracking.

INTRODUCTION

The search for a method or means of eliminating or reducing reflective cracking in new bituminous pavements has been underway for a number of years. Vermont has experimented with several processes since observations revealed that a high percentage of the cracks in old pavements reflect up through new bituminous overlays, often during the first winter of exposure. Among the processes tried were; a strain relieving interlayer, cold recycling, and an asphalt rubber interlayer.

In 1978 four commercially available synthetic fiber fabrics were installed as a Category II experimental project. This report includes observations made during installation of the fabrics and follow-up information on performance.

PRODUCT INFORMATION

PRODUCT	MANUFACTURER	DISTRIBUTOR	DESCRIPTION	MATERIAL COST 7/80 (BULK)
Petromat	Philips Petroleum Co., Chemical Dept., Greenville, S.C. 29602 Phone: 803-242-6600	Sealcoating, Inc. 120 Industrial Park Road Hingham, Mass. Phone: 617-749-6802	A non-woven polypropylene fabric. Available in 6'x 300'and 12.5'x 300' rolls.(4oz/sy)	$.97 a sq. yd.
Typar 3401	E. I. DuPont DeNemours & Co. Explosives Products Wilmington, Delaware 19898	Vermont Explosives Co. Inc. 107 N. Main Street Barre, Vermont 05641 Phone: 802-476-7651	A sheet composed of randomly dispersed isotatic polypropylene continuous filaments thermally bonded. Available in 12.5'x 432', and 15.5x300' rolls (4 oz/sy)	$.70 a sq. yd.
Bidim (Style (-22))	Monsanto Textiles Co. Nonwoven Business Group 809 N. Lindbergh Bend St. Louis, Missouri 63166 Phone: 314-694-1000	Armco Steel Corp. Box 152 Palmer, Mass. 01069 Phone: 413-283-7611	A continuous filament polyester fabric. Available in 15.5'x 984' and 17.5'x984' rolls. (4½oz/sy)	$.63 a sq. yd.
Mirafi 140	Celanese Fibers Marketing Co. 1211 Ave. of the Americans New York, N.Y. 10036 Phone: 212-764-7640	Red Head Supply Inc. P.O. Box 274, Troy Ave. Fort Ethan Allen Winooski, Vt. 05404 Phone: 802-655-3505	A non-woven polypropylene continuous filament and nylon fabric. Available in 12.5'x432', 15'x360', and 17' x 318' rolls. (5⅓oz/sy)	$.63 a sq. yd.

FIELD TRIAL LOCATION AND ROADWAY CONDITION

The experimental applications were made on the Colchester-Essex F 030-1 (7) project on the westbound lane of Vt. Rte. 15 beginning at the entrance to the District No. 5 Office and extending easterly .28 miles. This is between mileage markers 00/93 and 01/21 in the Town of Colchester.

The condition of the roadway involved in this experiment was poor. A crack count revealed 2606 feet of cracking in the 1499 foot test section. This averaged out to 174 linear feet of cracks per 100 feet of pavement. These cracks were 69 percent transverse, 29 percent longitudinal, and 2 percent miscellaneous.

See the chart below for a breakdown of each individual test section.

PRODUCT	MILEAGE MARKER	LENGTH OF TEST SECTION	LINEAL FT. OF CRACK IN TEST SECTION	LINEAL FT. OF CRACK PER 100 FT. OF PAV"T.
Petromat	00/93-00/98	299'	448'	150'
Bidim	00/98-01/04	301'	519'	172'
Mirafi	01/04-01/09	299'	626'	209'
Typar	01/09-01/15	300'	460'	154'
Control	01/15-01/21	300'	554'	185'

MATERIAL APPLICATION

The fabrics were applied in August of 1978 under cloudy skies with ambient temperatures in the sixties. Prior to fabric application, significant cracks in the existing pavement were filled with a hot poured joint sealer meeting Federal specification SS-S-001401. The existing pavement was shimmed with a 1/2" course of bituminous pavement. Prior to application of the fabrics, the leveling course was swept clean of debris as needed.

An AC-5 tack coat was applied in the following amounts: Petromat - .25 gal./s.y.; Typar - .20 gal./s.y.; Mirafi and Bidim - .18 gal./s.y..

The fabrics were then rolled into the tack coat. The Mirafi representative used a pole to help unroll his fabric to lessen slack in the roll and prevent wrinkles. Petromat and Typar developed numerous wrinkles when placed. The Bidim went down particularly well with few wrinkles. Brooms were used to smooth out the fabrics. The fabrics were overlapped 13 to 25 inches at the centerline of the lane.

A 1 1/2" lift of Type II (3/4" maximum aggregate size) pavement was placed over the fabric at approximately 275^{o} F. The pavement in the test sections remained free of cracks following compaction.

COST INFORMATION

The fabric placement was bid at $3.50 per square yard on July 21, 1978.

FOLLOW UP

Four crack counts have been conducted since the fabrics were installed in August 1978. The first count was taken the sixth of January, 1979, at which time there were no signs of cracking.

Crack counts were taken again February 21 and April 14 of 1979 and May 5th of 1980. Refer to the chart below for the percentage of cracks found on these dates.

PERCENT OF CRACK REFLECTION

Service Life Inspection Date	Petromat	Typar	Mirafi	Bidim	Control
6 Months 2/21/79	1	8	6	5	10
8 Months 4/14/79	9	19	20	12	15
20 Months 5/5/80	34	29	40	25	25

On February 21, 1979 Petromat was the only product which significantly reduced reflective cracking with a return of 1 percent as compared to a return of 10 percent on the Control. The other three fabrics had an average crack return of 6 percent, which was 4 percent better than the Control.

The April 1979 survey found that Bidim and Petromat had out performed the Control, with Typar and Mirafi doing poorer than the Control.

The May 1980 observations revealed that the Control out performed all the fabrics except Bidim. Bidim performed the best with the same percent of cracks returning as the Control,and Mirafi was the poorest with 15 percent more cracks returning than the Control.

SUMMARY

Pavement reinforcing fabrics were tested to determine if they could reduce or eliminate reflective cracking in a new bituminous overlay when exposed to Vermont's climatic conditions.

The fabrics were laid in an AC-5 tack coat and then paved over with a 1 1/2" course of Type II pavement. Some difficulty was encountered in laying the fabric down.

The most recent field inspection, following two winter seasons, disclosed that the Control has out performed all but one of the fabrics.

Results to date indicate that the four pavement reinforcing fabrics evaluated do not eliminate or significantly reduce reflective cracking of a 1 1/2" bituminous overlay under Vermont's climatic conditions.

Field evaluations will continue on this test installation, however, no further reports are planned.

STATE OF VERMONT
AGENCY OF TRANSPORTATION
MATERIALS DIVISION - RESEARCH & DEVELOPMENT SUBDIVISION

WORK PLAN FOR CATEGORY II EXPERIMENTAL PROJECT

REDUCING REFLECTION CRACKING IN BITUMINOUS OVERLAYS WITH THE USE OF PAVEMENT REINFORCING FABRICS

WORK PLAN 78-R-20

OBJECTIVE OF EXPERIMENT

To evaluate the effect of using synthetic fiber fabrics as an interlayer to reduce reflective cracking in bituminous overlays.

PROJECT

Colchester-Essex F 030-1(7)

WORK LOCATION

On the westbound lane of Vt. Rte. 15 beginning 0.93 miles east of the Winooski-Colchester Town Line and extending easterly 0.32 miles to the intersection of Vt. Rte. 15 and the gate to the Air Base in Colchester, Vt. (Rte. 15 Route Log Stations 4900-6600.)

MATERIALS TO BE USED

Pavement Resurfacing Membrane Item 413.10. The experimental fabrics shall include the following:

Petromat Fabric, a non-woven polypropylene fabric manufactured by Phillips Petroleum Company, Chemical Department, Greenville, South Carolina 29602, Phone 803-242-6600. Distributor - Sealcoating, Inc., Hingham Industrial Center, Hingham, Mass. Phone 617-749-6802.

Bidim Fabric, Style C-22, a continuous filament polyester fabric manufactured by Monsanto Textiles Company, Nonwovens Business Group, 809 N. Lindbergh Bend, St. Louis, Missouri 63166, Phone 314-694-1000. Distributor - Armco Steel Corp., Box 152, Palmer, Mass. 01069, Phone 413-283-7611.

Typar 3401, a spunbonded polypropylene fabric manufactured by E. I. DuPont de Nemours & Co. Explosives Products, Wilmington, Delaware 19898. Distributor-Vermont Explosives Co., Inc., P.O. Box 574, 107 North Main Street, Barre, Vt. 05641. Phone 802-476-7651.

MIRAFI 140, a non-woven continuous filament polypropylene and nylon fabric manufactured by Celanese Fibers Marketing Company, 1211 Avenue of the Americas, New York, N.Y. 10036, Phone 212-764-7640. Distributor - Red Hed Supply Inc., Winnooski, Vt. 05404. Phone 802-655-3505.

TREATMENT ON EXPERIMENT SECTION

Treatment shall be as follows:

1. Significant cracks in the existing pavement shall be filled with Joint Sealer, Hot Poured conforming to the requirements of Federal Specification SS-S-001401.

2. The existing pavement shall be shimmed with a 1/2 inch course of bituminous pavement.

3. The leveling course shall be swept clean prior to the application of the tack coat and fabric if debris has accumulated.

4. A tack coat of AC-5 asphalt cement shall be applied at a rate of 0.15 to 0.25 gallons per square yard depending on the recommendation of the fabric manufacturer.

5. The fabric shall be placed in the hot asphalt tack coat. Any significant wrinkles in the fabric shall be cut and leveled with additional asphalt if required.

6. A 1 1/2 inch thick Bituminous Concrete riding course shall immediately follow the fabric application.

CONTROL SECTION

The control section shall be approximately 500 feet long and shall be adjacent to the fabric installation. The control treatment shall be equal to that carried out on the experimental section except for the absence of tack coat and fabric.

COST

The cost of the experimental fabrics is estimated to be $2.00 per square yard for a total cost of $6,400.00.

DATE OF INSTALLATION

Prior to September 1, 1978.

DURATION OF STUDY

The project will be evaluated for the length of time required to obtain valid conclusions on the effectiveness of the materials.

SURVEILLANCE

The experimental and control section shall be monitored during construction and at least once each winter and spring for the duration of the study. The surveillance shall include detailed crack surveys prior to construction and at each inspection period.

REPORTS

An initial report covering the installation and initial observations, interim reports, and a final report drawing conclusions on the effectiveness of the experimental materials shall be submitted to the Federal Highway Administration.

Materials Division
Agency of Transportation
June 7, 1978

Reviewed By:

R. F. Nicholson

R. F. Nicholson, P.E., Materials Engineer

Date: June 9, 1978