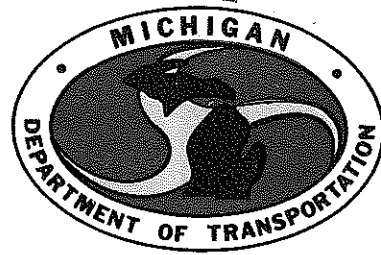


PERFORMANCE EVALUATION OF PLASTIC
FABRICS AS OVERLAY REINFORCEMENT
TO CONTROL REFLECTION CRACKING



MATERIALS and TECHNOLOGY DIVISION

PERFORMANCE EVALUATION OF PLASTIC
FABRICS AS OVERLAY REINFORCEMENT
TO CONTROL REFLECTION CRACKING

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Research Laboratory Section
Testing and Research Division
Research Projects 71 NM-286,
74NM-414, 72 NM-323, 78 NM-552,
80 NM-617, and 78 NM-566
Research Report No. 1243

Michigan Transportation Commission
William C. Marshall, Chairman;
Lawrence C. Patrick, Jr., Vice-Chairman;
Hannes Meyers, Jr., Carl V. Pellonpaa,
Weston E. Vivian, Rodger D. Young
James P. Pitz, Director
Lansing, April 1984

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The Problem

For the past 15 years considerable experimental work with fabrics as reinforcement for asphalt overlays has been underway across the nation, in search of a practical solution to the problem of reflection cracking in bituminous resurfacing (1). Reflection cracks are caused by vertical and horizontal movements due to load applications and temperature and moisture variations in the existing pavement beneath the asphaltic overlay. Because of these movements, the working joints and cracks in the underlying pavement 'reflect' through the overlay, generally after one or two years of service. Prevention or reduction of reflection cracking is critical to the service life of the rehabilitated pavement. Although several synthetic fabrics intended to control reflection cracking are on the market, an economical fabric to provide effective cracking resistance has yet to be developed.

A comparative performance evaluation of six different types of fabrics (Protecto Wrap, Y-78, Pave Prep, Roadglas, Bituthene, and Polyguard) is the main purpose of this investigation.

Scope

This field experiment included the rehabilitation of a 43 year old reinforced jointed concrete pavement with an asphaltic concrete overlay by the use of fabric reinforcing strips, placed over repaired joints and cracks in an attempt to eliminate or reduce reflection cracking through a new asphalt overlay. The trial project included a 0.9-mile section of the concrete pavement exhibiting substantial transverse joint failures and cracks where repairs were required before resurfacing. Both longitudinal and transverse joints were treated with fabric for the evaluation.

Objectives

Specifically, this investigation was designed to place six different types of fabric strips as reinforcement over conventionally repaired joints and cracks in a 43-year old reinforced concrete pavement being prepared for asphalt resurfacing; and, to determine reflection crack performance of these fabric-treated and untreated conventional repaired joints (used as controls) in the asphalt overlay. Crack surveys at these joint locations are limited to visual inspections with no attempt to determine causes of reflection cracking through the new asphalt overlay or evaluate the waterproofing capability of the test fabrics. Also, no attempt was made to determine whether the test joints and cracks were partially or fully working or completely frozen.

Background

In August 1975, the City of Ann Arbor, Michigan installed 34,000 sq yd of Petromat fabric over an old resurfaced concrete pavement as a trial reinforcement experiment on a new asphalt overlay (2). The De-

partment was invited to follow-up on the field performance of this Petromat-treated overlay. After seven years in service, the Petromat fabric did not provide improved pavement durability as claimed by the manufacturer (3).

In September 1977, the Department placed 330 ft of Mirafi 140 fabric mat (24 ft wide) between a 15-year old cracked asphalt pavement and a 2-1/2 in. asphalt overlay in an attempt to reduce reflection cracking (4). After a 4-1/2 year service period following resurfacing, about 45 percent of the original transverse cracks reflected through the new overlay (5).

In October 1979, the Department installed a 132-ft test section with Bituthene-treated joints before resurfacing a 30-year old concrete pavement. This test section, after three winters of pavement service, showed about 20 percent of joint reflection cracking (6).

Subsequently, the MDOT proposed an experimental installation including six different synthetic fabrics (Mirafi 140, Petromat, Cerex, Prepave, Bituthene, and Polyguard) to ensure that the fabric-treated joints and cracks in the old concrete pavement be tested under similar circumstances. This proposal was approved February 29, 1980 by the FHWA as a Category 2 Experimental Construction project to be conducted according to Work Plan No. 72 (Projects 71 NM-286, 72 NM-323, 74 NM-414, 78 NM-552, 78 NM-566, and 80 NM-617). However, during the planning period from June 1979 to September 1981, for the proposed project, some modification of the Work Plan was made without impairing the project objectives. As recommended by the fabric suppliers involved in the project, the following changes were made.

- 1) Mirafi 140 fabric (Project file 77 TI-398) was replaced by Protecto Wrap (74 NM-414).
- 2) Petromat fabric was replaced by Y-78 (71 NM-286).
- 3) The product name "Prepave" was changed to "Pave Prep" (78 NM-552).
- 4) Cerex fabric (72 NM-318) was replaced by Roadglas (80 NM-617).

Therefore, six different types of fabrics (Protecto Wrap, Y-78, Pave Prep, Roadglas, Bituthene, and Polyguard) were included in the trial project. Their relative merit in retarding reflection cracking through asphalt overlays was to be compared with the conventional practice of crack sealing and joint repair as required before resurfacing a concrete pavement.

Project Location

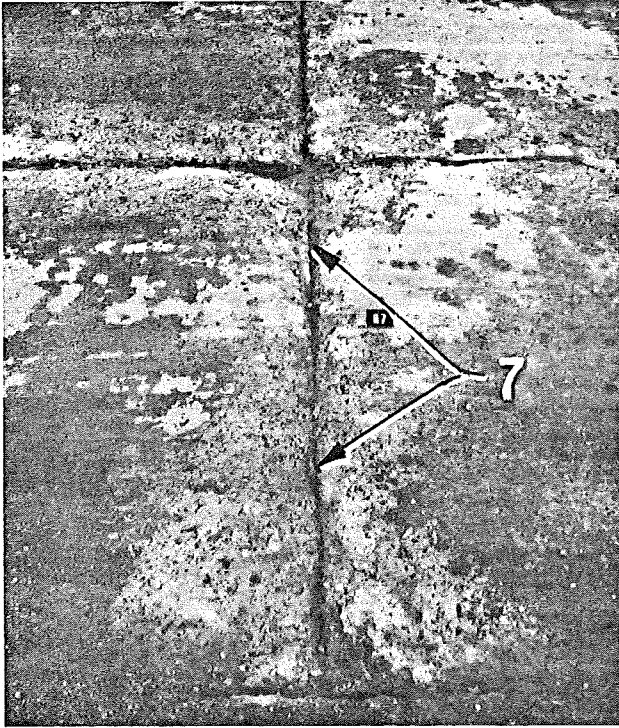
The 0.9-mile installation project (partly utilizing two and three lanes of a five-lane concrete pavement) was located on the eastbound roadway of I 94 BL, between Howard Ave and Michigan Ave, Kalamazoo, Michigan (Fig. 1). The 43-year old experimental area, carrying an average daily traffic of 21,000 vehicles in 1977, was originally built in 1939 as a jointed, reinforced concrete pavement (9 in. thick, 30-ft joint spacing) resurfaced in 1959, and widened to 60-ft in 1963.

Shortly before the construction work began, a change was made in the experimental work plan to include Roadglas in the evaluation project. As a result of this change, the test site involving the fabrics A, B, C, D and E with repeated or replicated test sections, required an additional test section F for Roadglas at the end of the installation layout (Fig. 1). Typical cross-sections and layout of the installation site are shown in Appendix A. The limits shown for each type of fabric are "as constructed" limits. These are considerably different from the proposed layout and reflect limit adjustments that were made during construction.

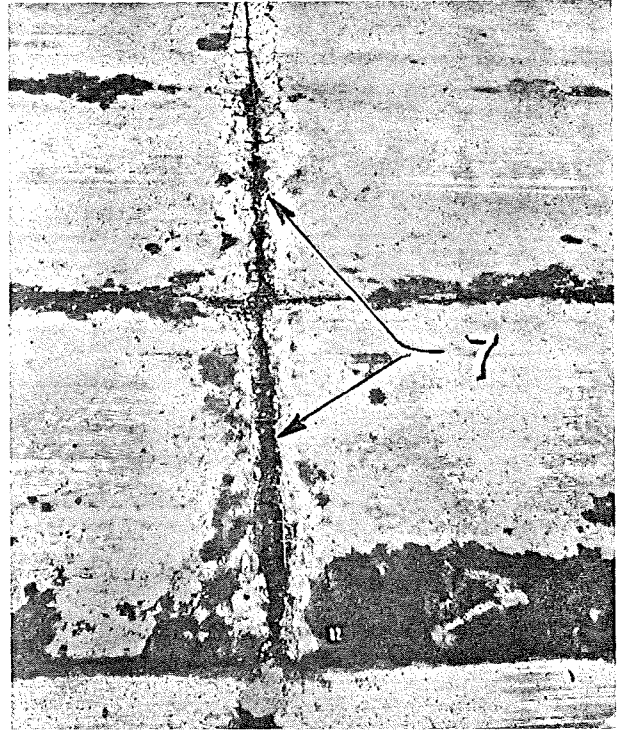
Installation Procedure

In brief, the successive steps in the construction procedure of the 0.9-mile test area were: 1) removing the existing asphalt surfacing shown on the plans and cleaning out failed joints and adjacent cracks with compressed air; 2) repairing the failed joints and cracks according to MDOT Standard Plan II-44E for concrete pavement repairs. Figure 2 shows typical failed joints that required Detail 7 and 8 repairs (Appendix A); 3) priming and placing the fabric strips over repaired joints and cracks according to manufacturer's recommendations (Fig. 3). Special provision for placing the fabric reinforcement was included in the project proposal (Appendix B); 4) placing a 1-1/4-in. bituminous concrete No. 12 leveling course with 40 percent recycled bituminous mixture; and 5) placing a 1-in. bituminous concrete No. 12 wearing course. Removing the existing asphalt surface and resurfacing with the leveling and wearing courses were conducted according to the 1979 Standard Construction Specifications and Supplemental Specifications included in the project proposal. The first 0.4-mile test area was completed October 9, 1981, and the remaining 0.5-mile test area was completed on May 25, 1982. Sunny weather and air and pavement temperatures over 60 F prevailed during the fabric installation work.

In general, the fabric strip treatment over each test site required 1 to 2-ft wide strips for longitudinal joints and cracks and 2 to 6-ft wide strips for repaired transverse joints. Transverse joints and cracks were fabric treated (reinforced) before the longitudinal joints according to the manufacturer recommendations. The fabric strips covered the entire length of the longitudinal test joint throughout each test site and the entire width of the transverse test joints and cracks at each test site.



Detail 7 Sta 266+67
Detail 8 Sta 268+17



Detail 7 Sta 269+40
Detail 8 Sta 268+17

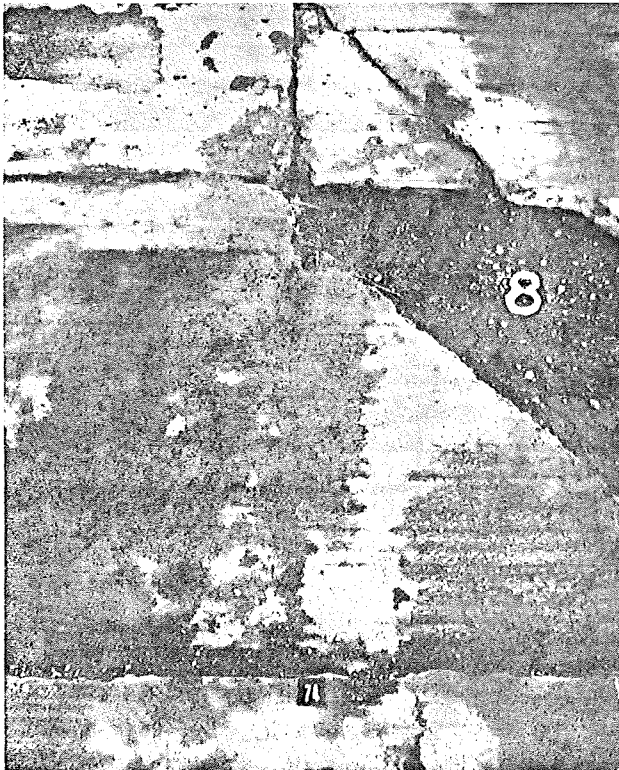


Figure 2. Typical failed transversed joints that required Detail 7 and 8 repairs before fabric treatment.

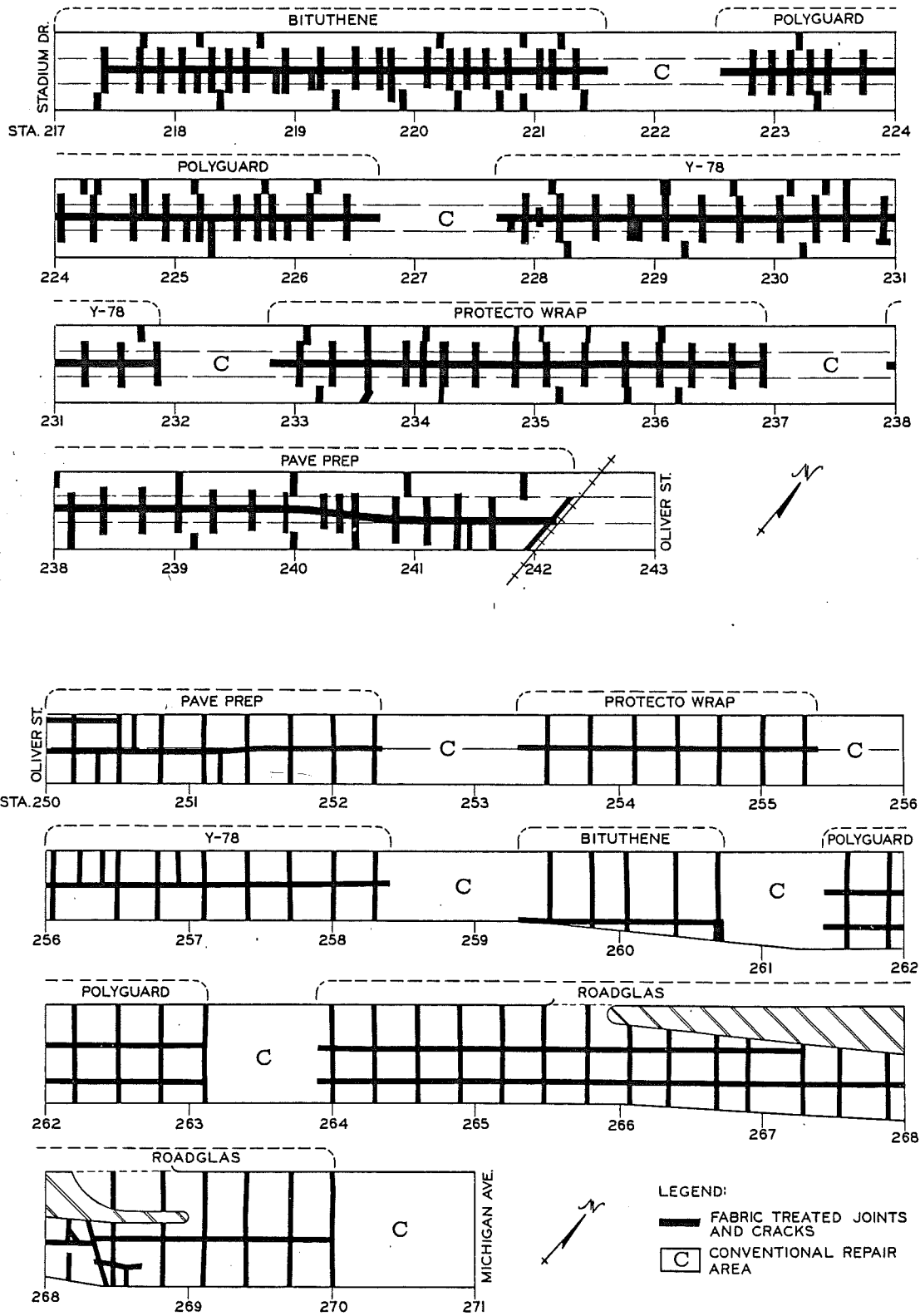


Figure 3. Fabric strip locations on I 94BL.

In spite of the experimental nature of the project, no serious difficulties were encountered while changing fabric types every 175 sq yd of strip treatment per test section (Appendix A). Except for three joint locations where strip damage from paving equipment occurred, placing fabric strips over test joints and cracks was a relatively simple manual operation. Unrolling and applying fabric strips to 12-ft transverse joints required three men and at least five minutes for each strip application. Traffic continued to move along the open lanes while the work was in progress. Project data are summarized in Appendix C.

Fabric Costs

The contract was awarded on July 30, 1981 to the lowest bidder, Globe Construction Company. The unit costs for the six experimental fabrics were as follows:

Fabric or Mat	Manufacturer	Area Covered sq yd	Fabric Cost \$/sq yd	Tack Coat or Primer Cost \$/sq yd	Total Cost \$/sq yd
Pave Prep	McAdam Mgn. Co.	310	4.68	0.14	4.82
Protecto Wrap	Protecto Wrap Co.	328	3.59	0.63	4.22
Y-78	Phillips Fiber Corp.	330	3.00	0.30	3.30
Bituthene	Grace Const.	371	3.17	0.37	3.54
Polyguard	Polyguard Prod. Inc.	313	3.32	0.26	3.58
Roadglas	Owens/Corning	342	3.78	9.72	13.50

In addition, other costs related to the test joints were as follows: \$.15/sq yd for removing bituminous surface, \$.75/lin ft for longitudinal joint cleanout, \$6.00/lin ft for Detail 7 joint repair, \$9.00/lin ft for Detail 8 joint repair, \$22.40/ton LC Mixture No. 12, and \$23.70/ton WC Mixture No. 12.

Reflection Cracking

Since completion of the resurfacing project in May 1982, two detailed crack surveys have been made during cold weather when existing working cracks and joints in the old pavement open up. Figure 4 and Table 1 summarize the results of the March 1983 and February 1984 crack surveys. Reflection cracks, visible under dry surface conditions and generally located directly over the underlying fabric treated joints and cracks, were expressed in terms of percentages of the total length of test joints and cracks in the old pavement which have reflected through the new overlay. After a 2-1/3-year service period, the experimental project has developed visible surface cracking as follows:

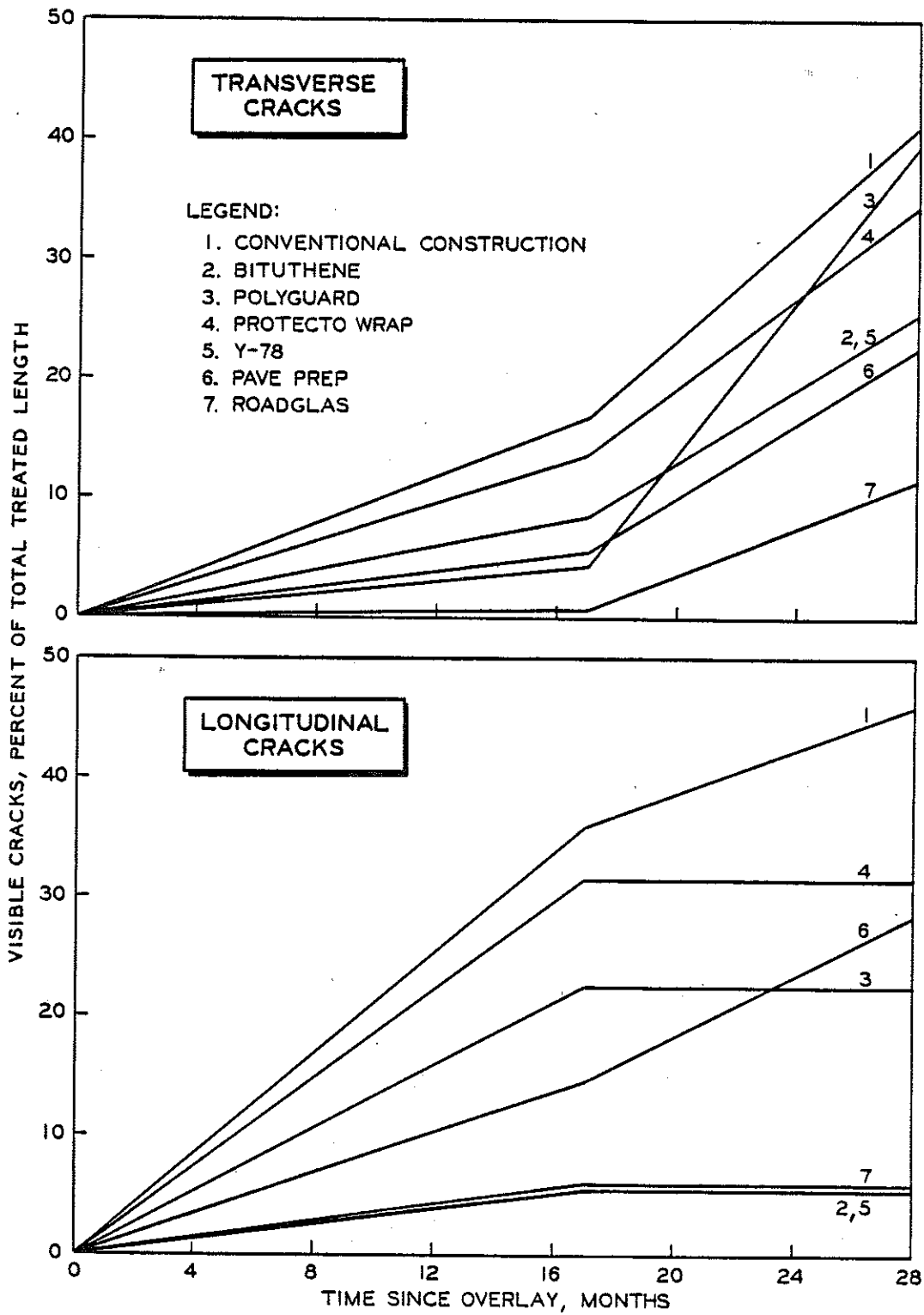


Figure 4. Rate of increase of visible longitudinal cracks through asphaltic concrete resurfacing after the 1983-84 winter.

1) Transverse reflection cracking over fabric-treated joints ranged from 34 to 40 percent for Polyguard and Protecto Wrap strips; 22 to 26 percent for Bituthene, Y-78, and Pave Prep strips. On the other hand, Roadglas treated joints and cracks showed the lowest proportion of reflective cracking, 11.5 percent. By comparison, 41 percent of the untreated joints (conventional construction) used as a control developed reflective surface cracking. Furthermore, the crack growth curves for transverse cracking are currently showing an annual increase in crack formation averaging 18 percent for conventional construction; 16 percent for Polyguard and Protecto Wrap strips; 11 percent for Bituthene, Y-78, and Pave Prep strips; and 5 percent (the lowest proportion) for Roadglas strips.

2) Longitudinal reflection cracking over treated joints ranged from 22 to 32 percent for Polyguard, Pave Prep, and Protecto Wrap strips; developed a crack proportion of about 6 percent for Bituthene, Y-78, and Roadglas strips; and averaged about 46 percent for the conventional untreated longitudinal joints. On the other hand, the crack growth curves for longitudinal fabric-treated joints are currently showing an annual increase in crack formation averaging 3 percent for Bituthene, Y-78, and Roadglas strips; 12 percent for Polyguard, Protecto Wrap, and Pave Prep strips; and 20 percent for untreated, conventional longitudinal joints used as controls.

Conclusions and Recommendations

In general, no serious problems were encountered during the Fabric Installation Project. In spite of the experimental nature of the project, which required changing fabric types every 175 sq yd of strip treatment per test section, human errors were easily corrected. Unrolling and applying fabric strips to 12-ft transverse joints required a minimum of three men and at least five minutes for each strip application.

Since the experimental results are still inconclusive to date, an attempt to make cost-benefit projections based on early reflection cracking of the test area might give erroneous interpretations. To make a reasonable evaluation in this study, additional documentation about the extent and severity of the joint defects will be needed. The reflective cracking percentages given represent the total result for each individual test site and do not take into account the actual number of potential working joints and cracks in the test section. This information would allow a realistic comparison of the performance of fabric treated and untreated joints in terms of fabric installation costs and estimated expenditure in maintenance and repair of the test joints. Therefore, it is recommended that the winter condition surveys be continued until sufficient information is obtained to warrant conclusions.

REFERENCES

1. "Report on Performance of Fabrics in Asphalt Overlays" Developed in conjunction with National Experimental and Evaluation Program Project No. 10 "Reducing Reflection Cracking in Bit. Overlays" U.S. Department of Transportation, FHWA, September 1982.
2. Zapata, C.A., and Bateman, L. M., "Reinforcement of Asphaltic Concrete Overlays with Petromat Fabric" MDOT Research Report No. R-972, September 1975.
3. MDOT Project File 71 NM-286.
4. Zapata, C.A., "Performance Evaluation of 'Mirafi 140' Fabric as Overlay Reinforcement to Control Reflection Cracking" MDOT Research Report No. R-1125, July 1979.
5. MDOT Project File 77 TI-398.
6. MDOT Project File 72 NM-323.

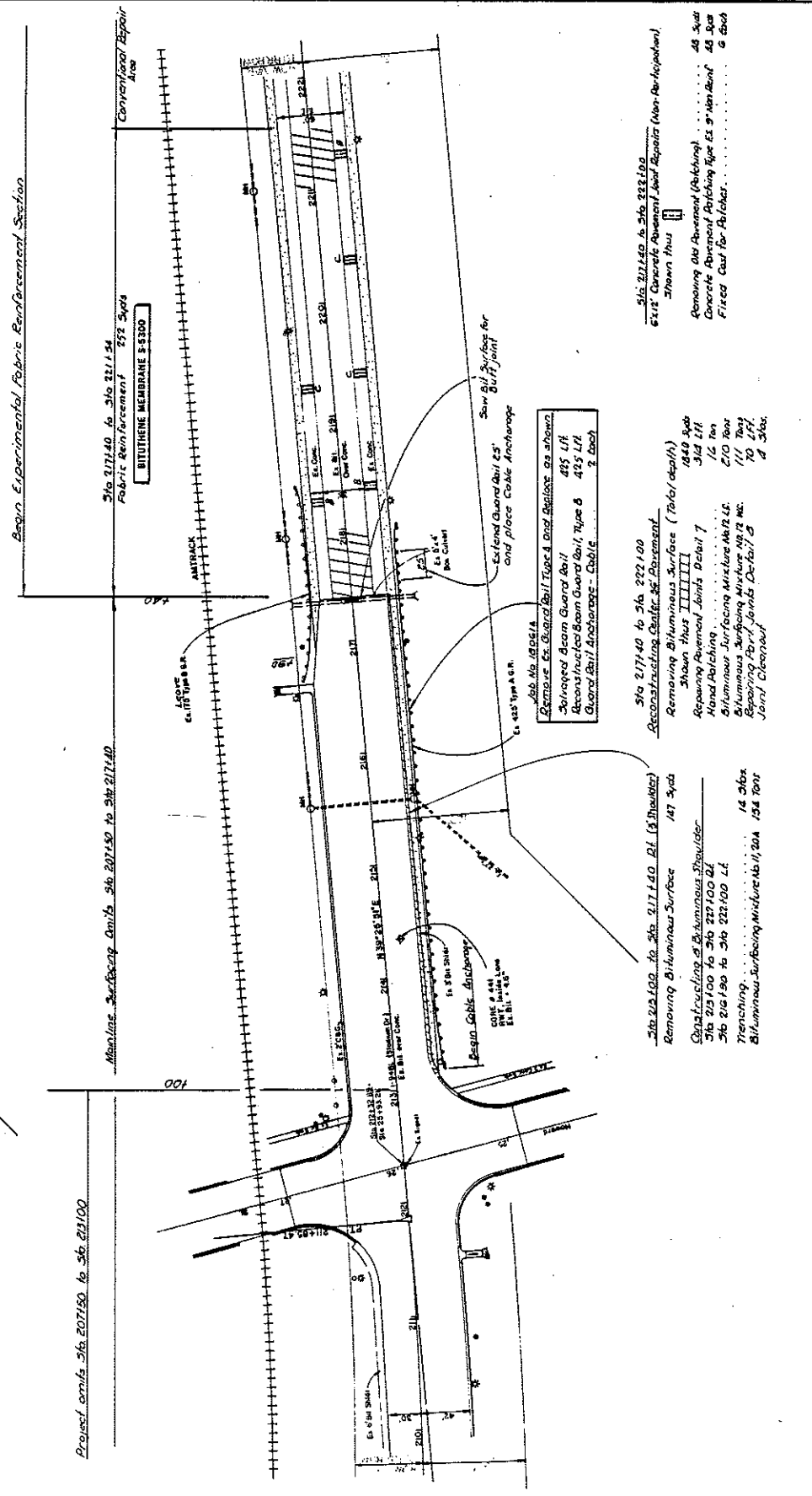
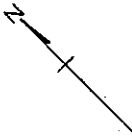
APPENDIX A

1. Typical cross-sections of the trial project
2. As Constructed, POB and POE of the installation area
3. Pavement joint repairs Detail 7 and 8

Howard St

DATE	NO.	REVISION

Sheet 20
125' x 150'
City of Milwaukee



Project limits Sta 207150 to Sta 221100

Mainline Surfacing Limits Sta 207150 to Sta 217140

Sta 217140 to Sta 221154
Fabric Reinforcement 552 Syds

Begin Experimental Fabric Reinforcement Section

Conventional Repair Area

Sta 207140 to Sta 207100
Reinforcing Bituminous Surface 147 3/4 ft

Reinforcing Bituminous Surface
Sta 207100 to Sta 221100 Bit
Sta 216750 to Sta 221100 LF
Trenching 14 3/4 ft
Bituminous Surfacing Mixture No. 11 20A 135.8 Ton

Remove Bituminous Surface (Total depth)
1849 Syds
312 LF
1/2 Ton
270 Ton
111 Ton
10 241
4 360

Reinforcing Bituminous Surface Detail 7
Bituminous Surfacing Mixture No. 12 LF
Reinforcing Bituminous Mixture No. 12 MC
Joint Clearcut

Sta 217140 to Sta 221100
6' x 8' Concrete Around Joint Repair (Per Department)
Shown thus

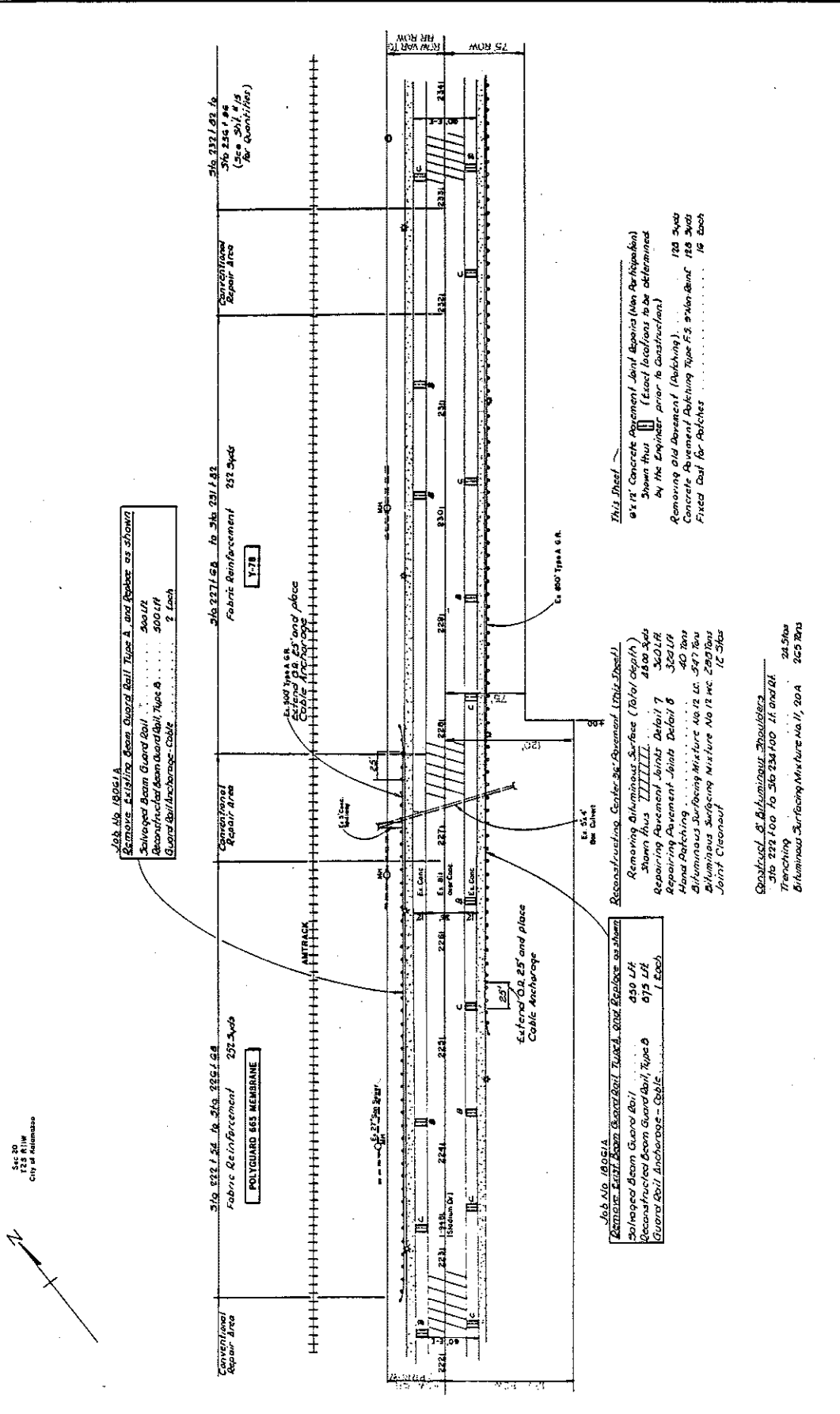
Remove Old Concrete (Sloping)
Concrete Around of Patching Type E, 9' x 10' x 10' 6"
Fixed Car for Pilehead

48 Syds
48 3/4
6 240



DATE	SCALE	COUNT NO.	PROJECT NO.	DATE
7/78	1" = 40'	MP 39041	1837A	7/78

DATE	BY	CHKD	APP'D



540 20
125 R/W
City of Milwaukee

Job No. 18061A
Remove Existing Beam Guard Rail, Type A, and Replace as shown
Salvaged Beam Guard Rail 300 LF
Reconstructed Beam Guard Rail, Type B 500 LF
Guard Rail Anchorage - Cable 2 Each

316 227.68 to 316 231.88
Fabric Reinforcement 252 days
1-78

316 222.54 to 316 225.68
Fabric Reinforcement 252 days
POLYGUARD 665 MEMBRANE

Conventional
Repair Area

Conventional
Repair Area

Extend O.D. 25' and place
Cable Anchorage

Extend O.D. 25' and place
Cable Anchorage

Job No. 18061A
Remove Existing Beam Guard Rail, Type A, and Replace as shown
Salvaged Beam Guard Rail 450 LF
Reconstructed Beam Guard Rail, Type B 675 LF
Guard Rail Anchorage - Cable 1 Each

Reconstructing Centerline Avenue (This Detail)
Remove Bituminous Surface (70' x 6' depth)
Shown Thus 480 SqYd
Repairing Pavement Joints Detail 7 360 LF
Hand Patching 320 LF
Aluminous Surfacing Mixture No. 12 Lt. 547 Tons
Aluminous Surfacing Mixture No. 12 Hc. 290 Tons
Joint Compound
12 Sigs

This Detail
9" x 12" Concrete Pavement Joint Repair (Non-Asphaltic)
Shown Thus (Exact locations to be determined
by the Engineer prior to construction.)
Removing Old Pavement (Asphltg) 120 SqYd
Concrete Pavement Patching Type E.S. 9' x 12' x 4" 120 SqYd
Fixed Curb for Sidewalk 16 Each

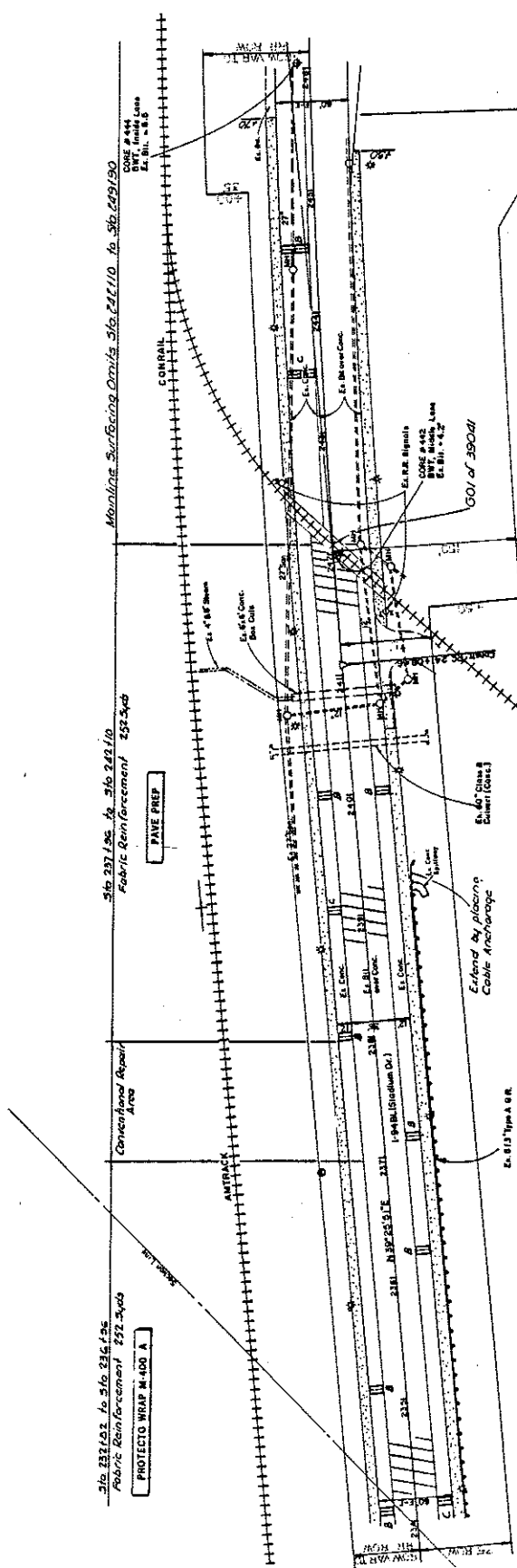
Construct 8" Bituminous Spaulter
316 222.100 to 316 224.100 Lt. and Hc.
Trenching 24 Sigs
Bituminous Surfacing Mixture No. 11, 20A 265 Tons

DATE 7/78
SCALE 1" = 40'
JOB NO. 18061A
CONTRACT NO. 39041
SHEET NO. 14
DESIGNED BY H. H. HINDEMANN

Sec. 50
125 R1W
City of Indianapolis

Sec. 21
125 R1W
City of Indianapolis

NO.	DATE	BY	REVISION



Stationing: Sta. 232+00 to Sta. 236+00

Stationing: Sta. 237+00 to Sta. 240+10

Stationing: Sta. 237+00 to Sta. 240+10

Sta. 232+00 to Sta. 236+00
 Fabric Reinforcement - 535-340
 PROTECTO WRAP M-100 A

Sta. 237+00 to Sta. 240+10
 Fabric Reinforcement - 535-340
 FABR PREP

Sta. 232+10 to Sta. 236+100
 Concrete Reinforcement Joint Repairs (Non-Anchorages)
 Shown thus []

Stationing: Sta. 232+10 to Sta. 236+100

Stationing: Sta. 232+10 to Sta. 236+100

Stationing: Sta. 232+10 to Sta. 236+100

Stationing: Sta. 232+10 to Sta. 236+100

- Remove existing beam guard (No. 7) Type 3 and replace w/ 2x beams
- Scrapped beam guard No. 1
- Reconstructed beam guard Type 3
- Guard (No. 7) Anchorage - Cable
- 513 LF
- 1 Each

- Remove Bituminous Surface (To 10' depth)
- Repairing Bituminous Surface
- Hand Patching
- Bituminous Surfacing Mixture No. 12LC
- Bituminous Surfacing Mixture No. 12HC
- Repairing Port Joints Det. 3
- Joint Cleanout
- 320 LF
- 350 LF
- 370 Ton
- 195 Ton
- 250 LF
- 3 Slabs

- Construct & Bituminous Shoulder
- Sta. 234+00 to Sta. 245+70 LF
- Sta. 234+00 to Sta. 245+30 LF
- Trenching
- Bituminous Surfacing Mixture No. 12A
- 25 Slabs
- 250 Tons

- Remove Old Asphalt (Patching)
- Concrete Placement Patching Type 2.5 - 3 Men labor 100 Slabs
- Fixed cost for Patches
- 15 Each

- Stationing: Sta. 232+10 to Sta. 236+100
- Where drainage structures occur within a joint repair area, the following items are included to be used as directed by the Engineer:
- Adjusting Drainage Structure Covers
- 4 Each
- Drainage Structure Covers (D)
- 1600 lbs

- Stationing: Sta. 232+10 to Sta. 236+100
- Stationing: Sta. 232+10 to Sta. 236+100

- Stationing: Sta. 232+10 to Sta. 236+100



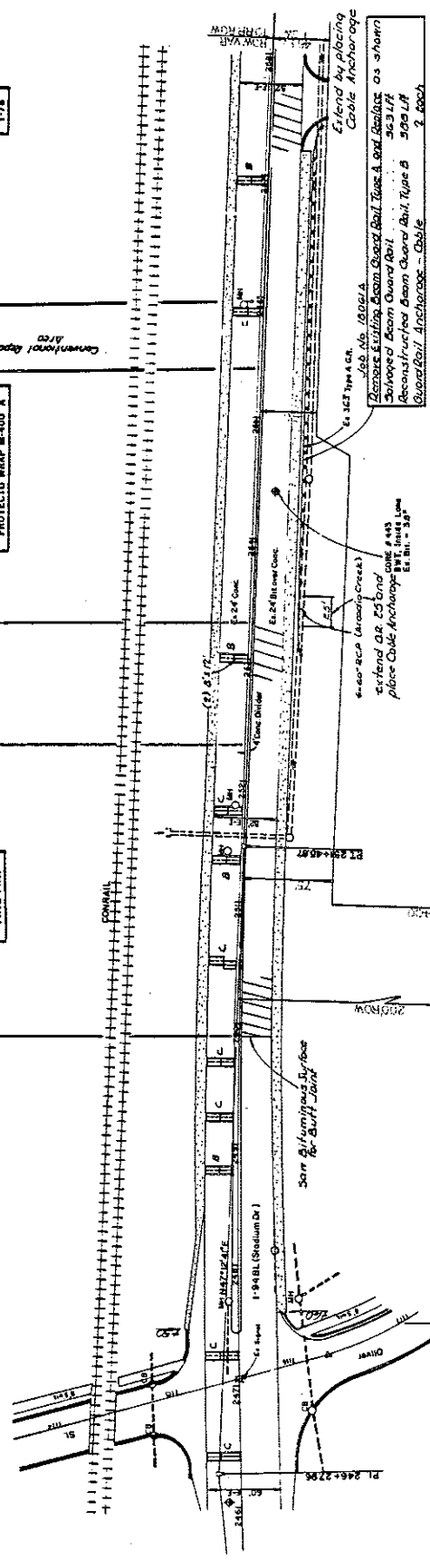
DATE: 7/80
 SCALE: 1"=40'
 CONT. NO.: M-1 39041
 SHEET NO.: 12576
 PROJECT NO.: 8061A
 SHEET NO.: 15

Oliver St

Sheets
City of Baltimore

DATE	BY	REVISION

Mainline Surfacing from Sta 247+70 to Sta 247+30
 Sta 249+90 to Sta 252+28 Fabric Reinforcement 40 5/8" x 40
 PAVE REEP
 Sta 253+30 to Sta 255+40 PROTECTO WRAP M-400 A
 Conventional Repair 40 5/8" x 40
 Sta 255+95 to Sta 258+36 Fabric Reinforcement 40 5/8" x 40
 Y-7B



5/8" 249+90 to 5/8" 252+28
 Reconstructing Roadway
 Removing Bituminous Surface (Total depth)
 Show Thus [diagram] 2487 5000
 Repairing Pavement Joints Detail 7 2506 174
 Road Patching 2716 474
 Bituminous Surfacing Mixture No. 12-C 37 tons
 Bituminous Surfacing Mixture No. 12-W/C 150 tons

5/8" 253+30 to 5/8" 255+40
 Concrete Pavement Joint Repairs (Non-Participating)
 Show Thus [diagram]
 Removing Old Pavement (Patching) 182 540
 Concrete Pavement Patching Type 53 8" Non-Bent 102 340
 Fixed Coat for Patches 22 200

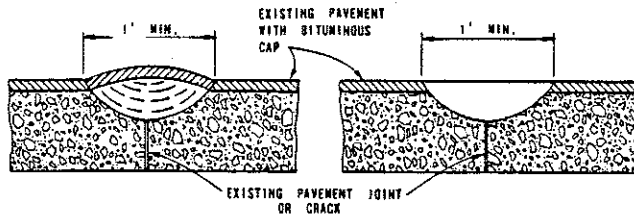
5/8" 255+95 to 5/8" 258+36
 Concrete Pavement Joint Repairs (Non-Participating)
 Show Thus [diagram]
 Removing Old Pavement (Patching) 182 540
 Concrete Pavement Patching Type 53 8" Non-Bent 102 340
 Fixed Coat for Patches 22 200

5/8" 247+70 to 5/8" 247+30
 Bituminous Surfacing Mixture No. 12-C 37 tons
 Bituminous Surfacing Mixture No. 12-W/C 150 tons

Concrete & Bituminous Shoulder
 5/8" 247+50 to 5/8" 250+00 LF
 5/8" 247+60 to 5/8" 251+45 LF
 20 5103
 Bituminous Surfacing Mixture No. 12-C 222 700



DATE	SCALE	DATE REC.	DESIGN UNIT	PROJECT NO.
7/79	1" = 40'			

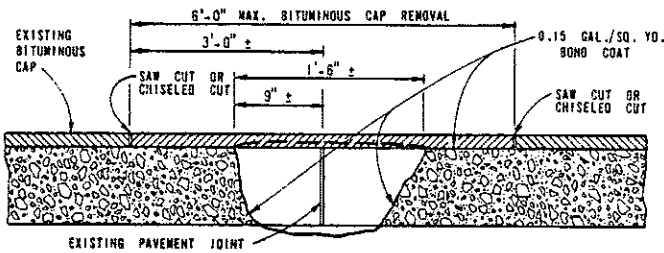


REMOVE ASPHALT SURFACING AND LOOSE SPALLED CONCRETE AROUND JOINT AND CLEAN JOINT.

PREPARE JOINT OR CRACK FOR RESURFACING BY PLACING BITUMINOUS BOND COAT ON CLEANED SURFACE AND FILL WITH BITUMINOUS MATERIAL OF THE SAME TYPE AS USED IN THE RESURFACING COURSE. THE BITUMINOUS MATERIAL SHALL BE COMPACTED WITH A MACHINE VIBRATOR OR APPROVED ROLLER.

TRANSVERSE OR LONGITUDINAL JOINT OR CRACK REPAIR

DETAIL 7



1. STRIP OFF EXISTING BITUMINOUS CAP AND BREAK OUT EXISTING CONCRETE PAVEMENT.
2. REPLACE BROKEN OUT AREA WITH BITUMINOUS AGGREGATE 4.11 OR BITUMINOUS CONCRETE 4.12 AND COMPACT WITH WHEELED OR VIBRATORY EQUIPMENT.
3. REPLACE BITUMINOUS CAP WITH BITUMINOUS AGGREGATE 4.11 OR BITUMINOUS CONCRETE 4.12 AND COMPACT WITH APPROVED ROLLER.

TRANSVERSE JOINT REPAIR

DETAIL 8

APPENDIX B

1. Special provision for furnishing and placing Fabric Reinforcement
2. Fabric Technical Service
3. Experimental Fabrics

SPECIAL PROVISION
FOR
FURNISHING AND PLACING FABRIC REINFORCEMENT

a. Description.-This work shall consist of furnishing and placing waterproofing fabrics and membranes over joints and cracks in existing concrete pavements that are being prepared for bituminous overlays. The Contractor shall invite field representatives of each fabric material to be tested to provide on-site assistance if needed during fabric installation. Since the fabric installation will be experimental and subject to changes, construction methods shall be varied according to manufacturer's recommendations. The fabric installations designated as treatments A, B, C, D, E, and F shall be constructed according to provisions noted herein and details and locations shown on the plans or as directed by the Engineer. Placing bituminous mixtures over the test sections shall be accomplished as specified in the proposal, or on the plans, or as directed by the Engineer.

b. Materials.-The experimental fabrics furnished for field installation shall conform to the material properties specified by each manufacturer for the designated material. The Contractor shall furnish the Engineer with certifications, to be provided by the manufacturer with each shipment of fabric, attesting that the fabric is the type specified and meets all the physical and chemical requirements specified.

The Contractor shall furnish a sample of the fabric, at least 5 square yards in size, from each shipment for verification testing by the Department. The fabric shall not be installed until results of the verification testing are available. The Department may require up to two weeks to obtain the test results. The test fabrics shall be free of defects or flaws which significantly affect their physical, chemical, or waterproofing properties. The material shall be resistant to salt water, alkalies, acids, and other chemicals, and shall not rot or mildew. During all periods of shipment and storage, the fabric shall be wrapped in heavy duty covering to protect it from direct sunlight, temperatures greater than 100 F, dirt, mud, and other contaminants. At the time of installation, fabric shall be rejected if it shows defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or storage.

Fabric A, Bituthene Membrane S-5300.-Fabric A shall be Bituthene Membrane S-5300, as manufactured by the W. R. Grace and Company. The material shall consist of a tough reinforcement of polypropylene woven mesh laminated to 1/16 inch thick layer of self-adhesive rubberized asphalt. The tacky surface of the membrane shall be covered with a protective paper which is removed at the time of application.

Binder for Fabric A.-The binder for use with Fabric A shall be Primer Bituthene P-3000.

Fabric B, Pave Prep.-Fabric B shall be Pave Prep, as manufactured by the McAdam Mgn. Co. The fabric shall consist of a 1/8 inch thick layer of spun bonded polypropylene combined with asphalt mastic material.

Binder for Fabric B.-The binder for use with Fabric B shall be Asphalt Cement AC-20 or, if recommended by the manufacturer and approved by the Engineer, Asphalt Emulsion RS-1, RS-1h, RS-2, CRS-1, CRS-2, SS-1, or SS-1h may be used.

Fabric C, Polyguard 665 Membrane.-Fabric C shall be Polyguard 665 Membrane, as manufactured by Polyguard Products, Inc. The material shall consist of a tough reinforcement of polypropylene mesh laminated to about 1/6 inch thick layer of self-adhesive rubberized asphalt. The tacky surface of the membrane shall be covered with a disposable treated paper to prevent fabric damage.

Binder for Fabric C.-The binder for use with Fabric C shall be Polyguard 650 Primer.

Fabric D, Protecto Wrap M-400A.-Fabric D shall be Protecto Wrap M-400A, as manufactured by Protecto Wrap Company. The material shall consist of aromatic bituminous resins modified with synthetic resins and laminated to about 70 mil thickness with a strong inert reinforcement.

Binder for Fabric D.-The binder for use with Fabric D shall be No. 80 primer or other primers as recommended by the supplier.

Fabric E, Y-78.-Fabric E shall be Y-78, as manufactured by Phillips Fiber Corp. The test fabric shall consist of a plastic mat of non-woven polypropylene 80 mils thick.

Binder for Fabric E.-The binder for use with Fabric E shall be one of the following bituminous materials. The materials are listed in the order of the manufacturer's preference.

1. Asphalt Cement, Grade 85-100, (AC-10)
2. Cationic Asphalt Emulsion, CRS-2, CRS-1h
3. Anionic Asphalt Emulsion, RS-2, RS-1
4. Cationic Asphalt Emulsion with Rubber, CRS-2R, CRS-1hR

Fabric F, Roadglas.-Fabric F shall be "Roadglas," as manufactured by the Owens-Corning Fiberglass Corporation. The fabric shall be a high strength fiberglass reinforcement coating with roadbed binder, to about 50 mils thick.

Binder for Fabric F.-The binder for use with Fabric F shall be "Roadbond" Binder, a polymeric hot asphalt applied at the rate specified by the supplier.

c. Construction Methods.-The test sections shall be constructed in the sequence shown on the plans unless otherwise approved by the Engineer. The Contractor shall invite manufacturers representatives to provide on-site assistance during fabric installation. The test area to be covered by each fabric shall not exceed 350 square yards.

1. Pavement Preparation.-Prior to placement of the fabric, pavement surfaces, joints, and cracks shall be made clean, smooth, dry, and free of fins, sharp edges, oil, grease, and loose or foreign materials. Joints and cracks exceeding 1/4 inch in width and localized depressions greater than 1/2 inch in depth shall all be filled with an asphalt slurry, a cold bituminous mixture, a hot bituminous mixture (No. 11 or No. 12), or other suitable fillers, as approved by the Engineer.

2. Binder Placement.-The binder for the fabric shall be spread over the area to be covered by the fabric and to at least 4 inches wider. The binder shall be applied at the rates specified herein and as directed by the Engineer.

For Fabric A, the Primer Bituthene P-3000 shall be applied at a rate of 250 to 350 square feet per gallon.

For Fabric B, Asphalt Cement AC-20 shall be applied at a rate of 0.15 to 0.25 gallons per square yard.

For Fabric C, the Polyguard 650 Primer shall be applied at a minimum rate of 300 square feet per gallon.

For Fabric D, The No. 80 primer shall be applied at the rate specified by the supplier.

For Fabric E, the asphalt binder used shall be applied at a rate of 0.25 to 0.30 gallons per square yard.

For Fabric F, the Polymeric hot asphalt binder shall be applied at the rate specified by the supplier.

3. Fabric Placement.-The test fabrics shall be placed at the locations shown on the plans or as directed by the Engineer. The fabric vendor, dealer, or distributor shall be available to provide technical assistance. Fabrics shall be applied to transverse joints and cracks before longitudinal joints. Fabric overlaps shall be a minimum of 4 inches. At faulted joints, the fabric shall be placed such that no voids will be left between the fabric and pavement. Fabric shall not be placed when the air temperature is 40 F or below.

4. Bituminous Overlay.-Except when authorized by the fabric manufacturer and approved by the Engineer, traffic shall not be allowed over the fabric before the bituminous concrete leveling or wearing course is applied. The test fabrics shall be surface dry before placement of the bituminous overlay. Paving operations shall follow fabric placement as soon as the Contractor receives instructions from the fabric representative and as approved by the Engineer.

d. Measurement and Payment.-The completed work as measured for FURNISHING AND PLACING FABRIC REINFORCEMENT will be paid for at the contract unit price for the following contract item (pay item).

PAY ITEM

PAY UNIT

Fabric Reinforcement-----Square Yard

Fabric Reinforcement quantities are determined by the actual number of square yards in place, completed, and accepted. Payment for the work of Fabric Reinforcement includes the cost of furnishing the materials, labor, and equipment for preparing the pavement surface, joints, and cracks; furnishing and placing the fabric binder, and furnishing and placing the fabric reinforcement.

FABRIC TECHNICAL SERVICE

For the Contractor's benefit, complete technical assistance and information were available from the following sources.

A. Bituthene Membrane

✓ Steve Gordon, Field Advisor
Construction Products Division
W. R. Grace and Company
2133 85th Street
North Bergen, New Jersey 07047
(201) 869-5220

✓ Robert J. Richardson, Field Advisor
W. R. Grace and Company
Box 21
DeWitt, Michigan 48820
(517) 669-5962

B. Pave Prep Fabric

✓ R. R. McAdams, Product Manager
The Logan-Long Company
Division of Bird and Son, Inc.
1200 South Main Street
Franklin, Ohio 45005
(513) 746-2891

6600 South Central Avenue
Chicago, Illinois 60638
(312) 767-1100

C. Polyguard Membrane

✓ Joseph E. Day, Jr.
Polyguard Products, Inc.
P.O. Box 37
Pryor, Oklahoma 74361
(918) 825-2850

P.O. Box 755
Ennis, Texas 75119
(214) 875-8421

D. Protecto Wrap

✓ Kenneth Peisker, Product Manager
Protecto Wrap Company
2255 South Delaware
Denver, Colorado 80233
(303) 777-3001

E. Y-78 Fabric

✓ Jerry McFeeters, P.E.
Sales Engineer
Phillips Fibers Corporation
2700 Landsburn Drive
Columbus, Ohio 43229
(614) 475-6669

✓ Dahlgren and Associates
P.O. Box 5134
West Bloomfield, Michigan 48033
(313) 332-7370

F. Roadglas Fabric

✓ Tom Bryant, Sales Manager
Detroit Concrete Products Corp.
P.O. Box 618
44300 Grand River
Novi, Michigan 48050
(313) 349-4440

✓ Highway Systems Group
Owens-Corning Fiberglass
P.O. Box 415
Granville, Ohio 43023

Experimental Fabrics
(Waterproofing Membranes)

A. Bituthene: A tough reinforcement of polypropylene woven mesh laminated to a thick layer of self-adhesive rubberized asphalt; 1/16-in. thick.

B. Pave Prep: An asphalt mastic sandwiched between two layers of a non-woven polypropylene protected by a release sheet to be removed at the time of membrane installation; 1/8-in. thick.

C. Polyguard: A high strength heat resistant polypropylene mesh embedded (laminated to) in the outer surface of self-adhesive rubberized asphalt; 1/6 in. thick.

D. Protecto Wrap: A laminate of premium grade aromatic tars modified with synthetic resins and reinforced with a synthetic non-woven polypropylene fabric. The membrane is interwound with polyethylene release film which is left in place until just before the overlay application; 70 mils thick.

E. Y-78 (Petrotac): A combination of non-woven polypropylene fabric pre-coated with rubberized asphalt protected by a release sheet to be removed at the time of membrane installation; 80 mils thick.

F. Roadglas: The end-product is a high strength fiberglass reinforcement sandwiched between two coats of rubberized asphalt binders; 50 mils thick.

APPENDIX C

EXPERIMENTAL FABRICS PROJECT

Location: Eastbound and center lanes of I 94 BL, between Howard Avenue and Michigan Avenue, Kalamazoo, Kalamazoo County, Michigan.

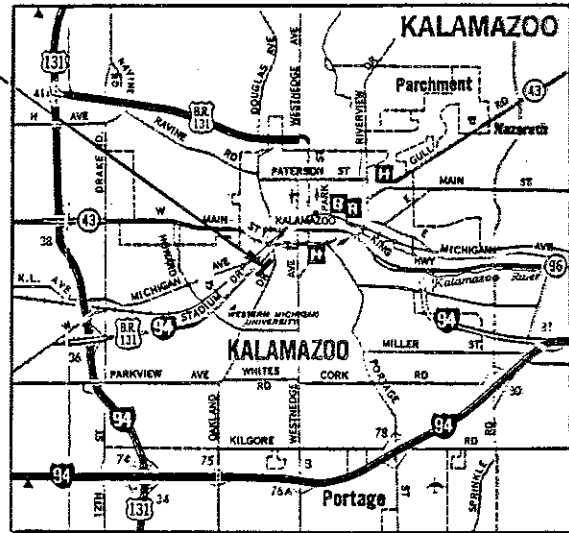
Test Area: 4,480-ft test site partly utilizing 2 and 3 lanes of a 5-lane concrete pavement.

ADT: 21,000 vehicles in 1977.

Old pavement: 9-in. concrete, 22-ft wide; placed over well-drained subgrade, built in 1939, resurfaced in 1959, and widened to 60-ft in 1963.

Installation data:

Forty percent of fabric reinforcement (0.4-mile area) installed October 9, 1981. The remaining 60 percent (0.5-mile test area) completed on May 25, 1982.



Fabric or Mat	Manufacturer	Area Covered Sq Yd	Fabric Cost \$/Sq Yd	Tack Coat or Primer Cost \$/Sq Yd	Total Cost \$/Sq Yd
Pave Prep	McAdam Mgn. Co.	310	4.68	0.14	4.82
Protecto Wrap	Protecto Wrap Co.	328	3.59	0.63	4.22
Y-78	Phillips Fiber Corp.	330	3.00	0.30	3.30
Bituthene	Grace Construction	371	3.17	0.37	3.54
Polyguard	Polyguard Prod. Inc.	313	3.32	0.26	3.58
Roadglas	Owens/Corning	342	3.78	9.72	13.50

Contractor: Globe Construction Company, Kalamazoo, Michigan

Construction:

1. Removing existing bituminous surface.
2. Repair of distressed joints and cracks using conventional methods in preparation for asphalt resurfacing of old concrete pavement.
3. Priming and placing fabric strips over repaired joints and cracks in the existing concrete pavement.
4. Placing 1-1/4-in. bituminous concrete No. 12 leveling course with 40% recycled bituminous mixture.
5. Resurfacing with a 1-in. bituminous concrete No. 12 wearing course.

Table 1
Summaries of Field Surveys on Kalamazoo Fabric Project

Fabric Type	Fabric Strip		Transverse Cracking			
	Transverse Length Lin Ft	Area Covered Sq Yd	1983		1984	
			Lin Ft	Percent	Lin Ft	Percent
Bituthene	709	181.4	59	8.3	182	25.7
Polyguard	489	111.2	21	4.3	194	39.7
Protecto Wrap	588	152.0	81	13.8	204	34.7
Y-78	671	153.4	55	8.2	169	25.2
Pave Prep	557	143.0	29	5.2	127	22.8
Roadglas	652	125.6	4	<1.0	76	11.7
Conventional	792	No Fabric	133	16.8	325	41.0

Fabric Type	Fabric Strip		Longitudinal Cracking			
	Longitudinal Length Lin Ft	Area Covered Sq Yd	1983		1984	
			Lin Ft	Percent	Lin Ft	Percent
Bituthene	570	189.6	32	5.6	32	5.6
Polyguard	748	201.6	167	22.3	167	22.3
Protecto Wrap	623	176.0	195	31.3	195	31.3
Y-78	660	176.5	37	5.6	37	5.6
Pave Prep	696	167.0	100	14.4	197	28.3
Roadglas	1438	216.6	85	5.9	85	5.9
Conventional	4735	No Fabric	1666	35.2	2171	45.9