GEOTEXTILE FABRICS UNDER AN ASPHALT CONCRETE OVERLAY TO RETARD REFLECTIVE CRACKING

INTERIM REPORT

Experimental Features Project
No. OR 91-03

East 39th Avenue - East 47th Avenue Section
East Burnside Street
City of Portland

by

Steve Armstrong
Research Specialist
Oregon Department of Transportation

Prepared for

FEDERAL HIGHWAY ADMINISTRATION
Washington, D.C. 20590

and

THE CITY OF PORTLAND
PORTLAND, OREGON 97204-1971

February 1994

ABSTRACT

The City of Portland identified pavement surface distress on East Burnside Street between East 39th Avenue and East 47th Avenue. Therefore, the City developed a construction project to improve the pavement. The project included cold planing, an asphalt concrete leveling course, geotextile fabrics, and an asphalt concrete overlay.

The City of Portland decided to use geotextile fabrics for pavement reinforcement and crack retardation. In September 1991, the City placed Glasgrid and Polyguard geotextile fabrics on East Burnside Street. If the fabrics successfully retard reflective cracking, the City anticipates the following benefits:

1. Reduction of water infiltration into underlying cracks;

2. Retardation of vegetation growth in cracks;

3. Improvement of pavement surface quality; and

4. Reduction of future pavement maintenance costs.

Over two years have elapsed since the installation of the geotextile fabrics. The overlay over the geotextile fabrics has been inspected twice since construction. The inspections revealed some cracks in the section without the geotextile fabrics. However, the cracks are small and the performance of the test and control sections are similar; additional time is needed to evaluate the sections to determine if the City of Portland will receive the benefits listed above.

Inspections will be conducted annually until at least 1996 or until the test and control sections fail. Then, if enough information exists to determine the cost effectiveness of the geotextile fabrics (Glasgrid and Polyguard) a final report will be written.

SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

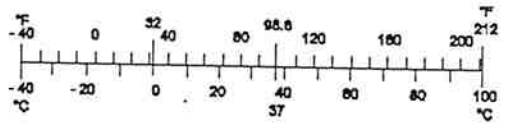
Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	millimeters squared	mm^2
ft^2	square feet	0.093	meters squared	m^2
yd^2	square yards	0.836	meters squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometers squared	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	meters cubed	m^3
yd^3	cubic yards	0.765	meres cubed	m^3

NOTE: Volumes greater than 1000 L shall be shown in m^3.

		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5(F-32)/9	Celsius temperature	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	millimeters squared	0.0016	square inches	in^2
m^2	meters squared	10.764	square feet	ft^2
ha	hectares	2.47	acres	ac
km^2	kilometers squared	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	meters cubed	35.315	cubic feet	ft^3
m^3	meters cubed	1.308	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.205	pounds	lb
Mg	megagrams	1.102	short tons (2000 lb)	T
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8 + 32	Fahrenheit	°F



* SI is the symbol for the International System of Measurement

(4-7-94 jbp)

ACKNOWLEDGEMENTS

The author thanks Randy Countryman, Project Manager for the City of Portland, for his on site inspection and comments regarding this report. In addition, the author thanks Jan Phillips, ODOT Research Unit, for helping type this report.

DISCLAIMER

Geotextile Fabrics Under An Asphalt Concrete Overlay to Retard Reflective Cracking

TABLE OF CONTENTS

1.0 INTRODUCTION 1
1.1 BACKGROUND 1
1.2 OBJECTIVES 1

2.0 LOCATION AND CROSS-SECTIONS 3
2.1 LOCATION 3
2.2 CROSS-SECTIONS 4

3.0 CONSTRUCTION 5

4.0 INSPECTIONS AND EVALUATION 7
4.1 INSPECTIONS 7
4.2 EVALUATION 8

5.0 CONCLUSIONS 9
5.1 CONCLUSIONS 9

APPENDIX A: CRACK REPAIR INFORMATION

APPENDIX B: PHOTOGRAPHS

LIST OF FIGURES

Figure 2.1: Location of Project 3
Figure 2.2: Pavement Cross-Sections 4
Figure 4.1: Cracks in the Asphalt Concrete Overlay 7
Figure A.1: Location of Crack Repairs A-1
Figure A.2: Crack Repair Reference Measurements A-2
Figure B.1: Photographs of Cracks Observed in the Asphalt Concrete Overlay on January 28, 1994 . . . . . B-1

1.0 INTRODUCTION

The purpose of this report is to describe the inspections and evaluations of geotextile fabrics under an asphalt concrete overlay to retard reflective cracking.

1.1 BACKGROUND

The City of Portland identified pavement surface distress on East Burnside Street between East 39th Avenue and East 47th Avenue. Therefore, the City developed a construction project to improve the pavement. The project included cold planing, an asphalt concrete leveling course placement, geotextile fabrics placement, and an asphalt concrete overlay.

The City of Portland decided to use geotextile fabrics for pavement reinforcement and crack retardation. The City of Portland selected Glasgrid 8501 and Polyguard NW-75 to prevent or retard reflective cracking from transverse joints in portland cement concrete (PCC) pavement through an asphalt concrete overlay on a city street. In September 1991, the City placed Glasgrid and Polyguard geotextile fabrics on East Burnside Street. If the fabrics successfully retard reflective cracking, the City anticipates the following benefits:

1. Reduction of water infiltration into underlying cracks, thus reducing freeze/thaw and "pumping" damage to pavement;

2. Retardation of vegetation growth in cracks, which results in expansion and associated pavement damage;

3. Improvement of the pavement surface quality; and

4. Reduction of future pavement maintenance costs.

1.2 OBJECTIVES

The objectives of this project are to evaluate the performances of Glasgrid 8501 self-adhesive pavement reinforcement mesh and Polyguard NW-75 self-adhesive non-woven membrane under asphalt concrete overlays. More specifically, the evaluation will concentrate on the ability of the products to prevent or retard reflective cracking from transverse joints in PCC pavement through a 5 cm (2 in. nominal) thick Class "B" (dense-graded) asphalt concrete overlay. The entire street surface will be observed for evidence of reflective cracking; in particular, at the test cracks, areas of pavement reinforcement, on the south side of the street (where the fabric was placed), as well as on the north side of the street (where no fabric was applied).

2.0 LOCATION AND CROSS-SECTIONS

2.1 LOCATION

The project is located in the City of Portland on East Burnside Street between East 39th Avenue and East 47th Avenue. The location of the project is shown in Figure 2.1.

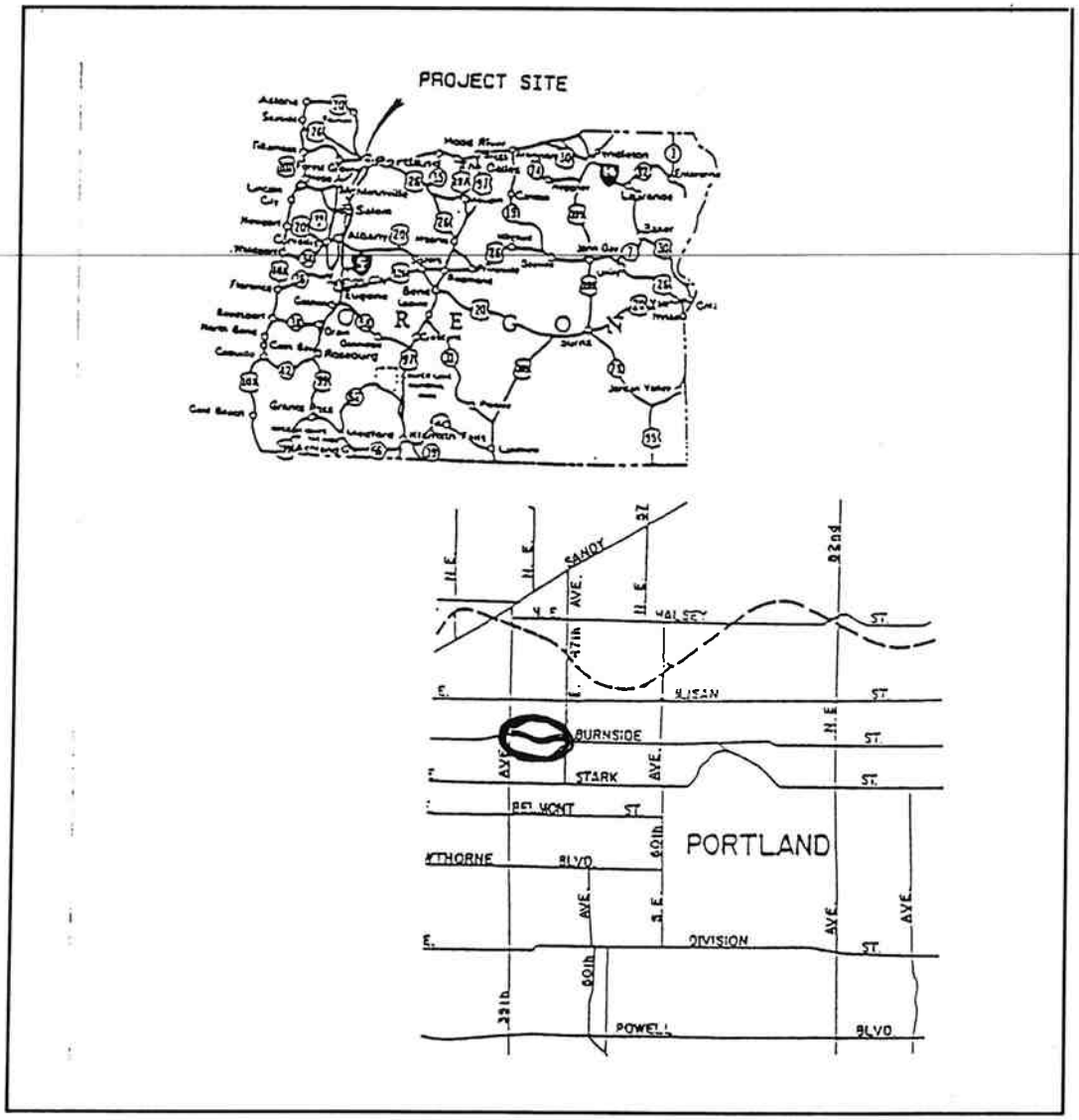
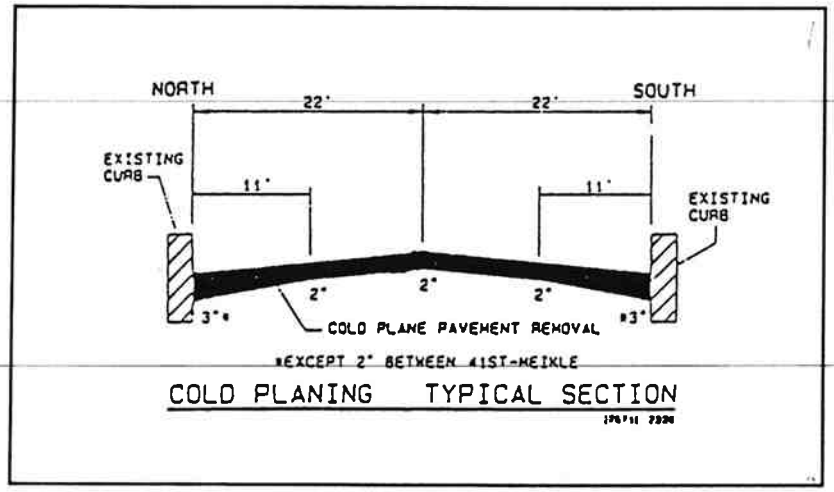


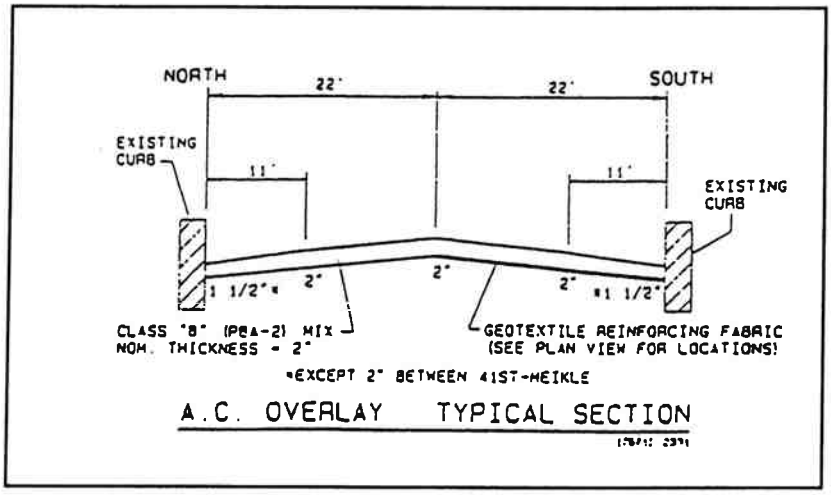
Figure 2.1: Location of Project

2.2 CROSS-SECTIONS

Typical cross-sections of the pavement are shown in Figure 2.2. The top two inches of the old pavement surface was cold planed. The new pavement surface is a 5 cm (2 in.) Class "B" asphalt concrete. Underneath the new pavement surface is 18 cm (7 in.) of PCC. On the south side of Burnside Street, two different types of geotextile fabric were placed between the existing PCC and the new AC wearing course at several locations as shown in Figure A.1 of Appendix A. On the north side of the street, no geotextiles were utilized.



(a) Cold Planing - Typical Section



(b) AC Overlay - Typical Section

Figure 2.2: Pavement Cross-Sections

3.0 CONSTRUCTION

The construction work for this project was done in 1991 and it consisted of cold planing, placing an asphalt concrete leveling course, placing geotextile fabrics, and placing an asphalt concrete overlay. The construction of this project is documented in a construction report.[1] The geotextiles were installed for crack retardation (Glasgrid and Polyguard) and pavement reinforcement (Glasgrid).

After cold planing the top 5 cm (2 in.) of the old asphalt concrete wearing surface with a rotary milling machine, the City of Portland staff verified that the majority of cracks in the old asphalt concrete pavement were reflective transverse cracks. Four major transverse cracks were referenced as test cracks (see Appendix A).

Before placing the geotextile fabrics, a 1.3 cm (0.5 in) or less Class "C" asphalt concrete leveling course was placed over the full street surface. There was no significant difference in the surface preparation for the areas where the geotextile fabrics were to be placed compared to the areas where geotextiles were not to be placed.

The geotextile fabrics were placed over the referenced cracks on the south half (eastbound lanes) of East Burnside Street between 39th Avenue and 47th Avenue. The fabrics were rolled with the dual wheels of a truck until each fabric made full contact and adhered to the leveling course.

Polyguard NW-75 in 0.61 m (2 ft.) wide rolls was substituted for Petrotac in 0.92 m (3 ft.) wide rolls. Polyguard was placed over crack #2 at 43rd Avenue in a 0.92 m (3 ft.) wide width and a 0.31 m (1 ft.) wide lap (double thickness) directly over the crack. Polyguard was also placed over crack #4, west of 47th Avenue, in a 0.61 m (2 ft.) wide width (single thickness) directly over the crack.

Glasgrid 8501 was placed in 1.5 m (5 ft.) wide widths (single thickness) over cracks #1 and #3. Glasgrid was also placed for pavement reinforcement with no overlaps to a total width of 6.1 m (20 ft., 4 widths of material) and to the length of 76.3 m (250 ft) on the south side of Burnside Street between 44th and 45th Avenues. A ten-wheeled rubber tire roller was used to ensure that the surface of the fabric made full contact with the leveling course.

---

[1]John G. Phipps and Scott E. Nodes, Geotextile Fabrics Under An Asphalt Concrete Overlay to Retard Reflective Cracking, Construction Report (City of Portland and Oregon Department of Transportation, July 1992).

The specific locations of the test cracks and repairs implemented are shown in Figure A.1 of Appendix A. The locations of all test cracks are referenced to straight lines extending between curbs with offset distances between each crack and the straight line recorded at least every five feet along the line (see Figure A.2, Appendix A).

Immediately after the geotextile fabrics were placed and rolled, 5 cm (2 in.) of Class "B" asphalt concrete (with PBA-2 asphalt) wearing course was placed on East Burnside Street between East 39th and East 47th Avenues.

4.0 INSPECTIONS AND EVALUATION

4.1 INSPECTIONS

On June 8, 1993, Eric Brooks met with Randy Countryman of the City of Portland, at 47th Avenue and East Burnside Street. They observed the test sections and control sections. The pavement was in good condition; with only two small cracks observed in the control sections.

On January 28, 1994, I met with Randy Countryman, at East 44th Avenue and East Burnside Street. A visual inspection of East Burnside was conducted. The test sections and control sections were observed. The pavement where the Polyguard was applied was in good condition with no noticeable cracks existing in either the test or control sections. In the Glasgrid pavement reinforcement control section, as shown in Figure 4.1, only two small cracks were observed on the north side (westbound lane) of Burnside Street, approximately 31 meters (100 ft.) west of 45th Avenue (see Figure B.1 (a), Appendix B). No evidence of cracking was observed in the test section (eastbound lane). Pavement cracking was also observed on Burnside Street (westbound lane) just west of the Glasgrid pavement control section at the intersection of 44th Avenue (see Figure B.1 (b), Appendix B), as shown in Figure 4.1.

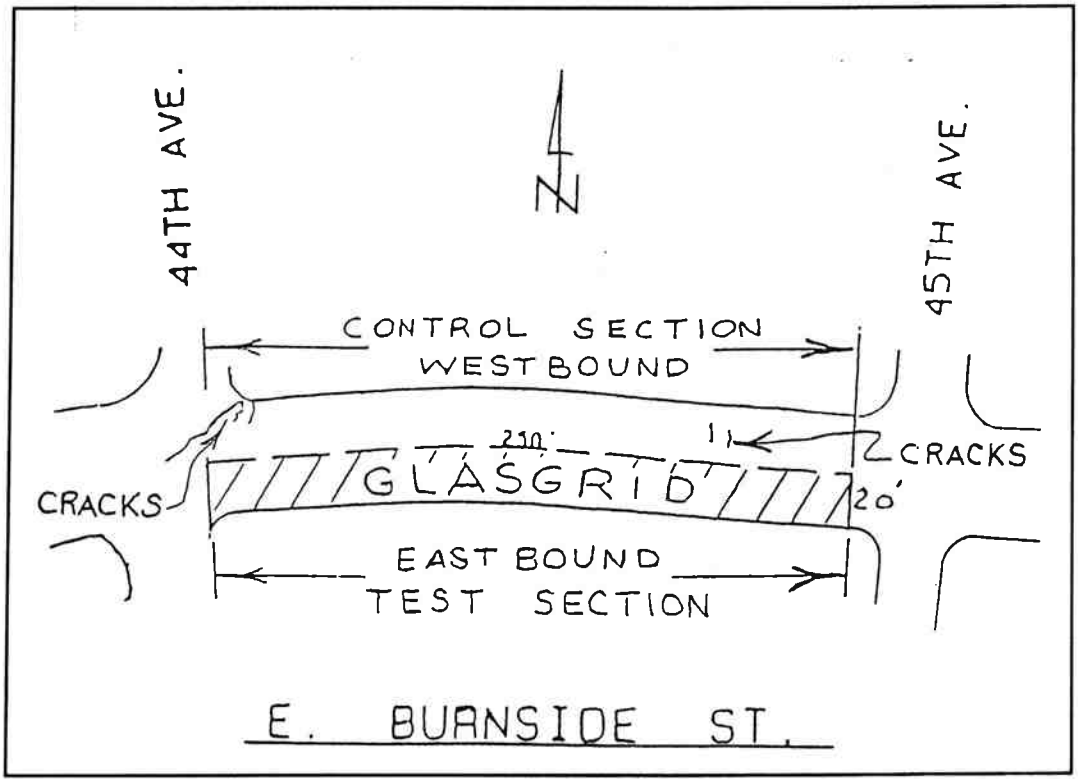


Figure 4.1: Cracks in the Asphalt Concrete Overlay

4.2 EVALUATION

1) The existence of these small cracks appearing in the control section and nonexistence of cracks in the pavement reinforcement control section correlates with an inspection done by Eric Brooks and Randy Countryman in June 1993. These small cracks were documented at this time and apparently have not become any larger in size.

2) Randy Countryman commented on the cracking observed at the intersection of Burnside Street and 44th Avenue. He said this cracking is probably due to a drainpipe under the asphalt concrete overlay which had been installed prior to construction. This pipe connects an inlet from the northeast corner of 44th Avenue to a manhole located in the center of the intersection. This is an area where matching the grades at the intersection was critical. Other cracking that is occurring at this intersection is from roots of a tree that is located near the curb at the northeast corner of 44th Avenue and E. Burnside Street.

5.0 CONCLUSIONS

5.1 CONCLUSIONS

The inspections revealed two small cracks in one of the control (without geotextile fabrics) sections, however, the performance of the test and control sections are similar. Thus, no conclusions can be made regarding significant advantages of the test sections compared to the control sections.

Inspections will be conducted annually until at least 1996 or until the test and control sections fail. Then, if enough information exists to determine the cost effectiveness of the geotextile fabrics (Glasgrid and Polyguard) a final report will be written.

APPENDIX A

CRACK REPAIR INFORMATION

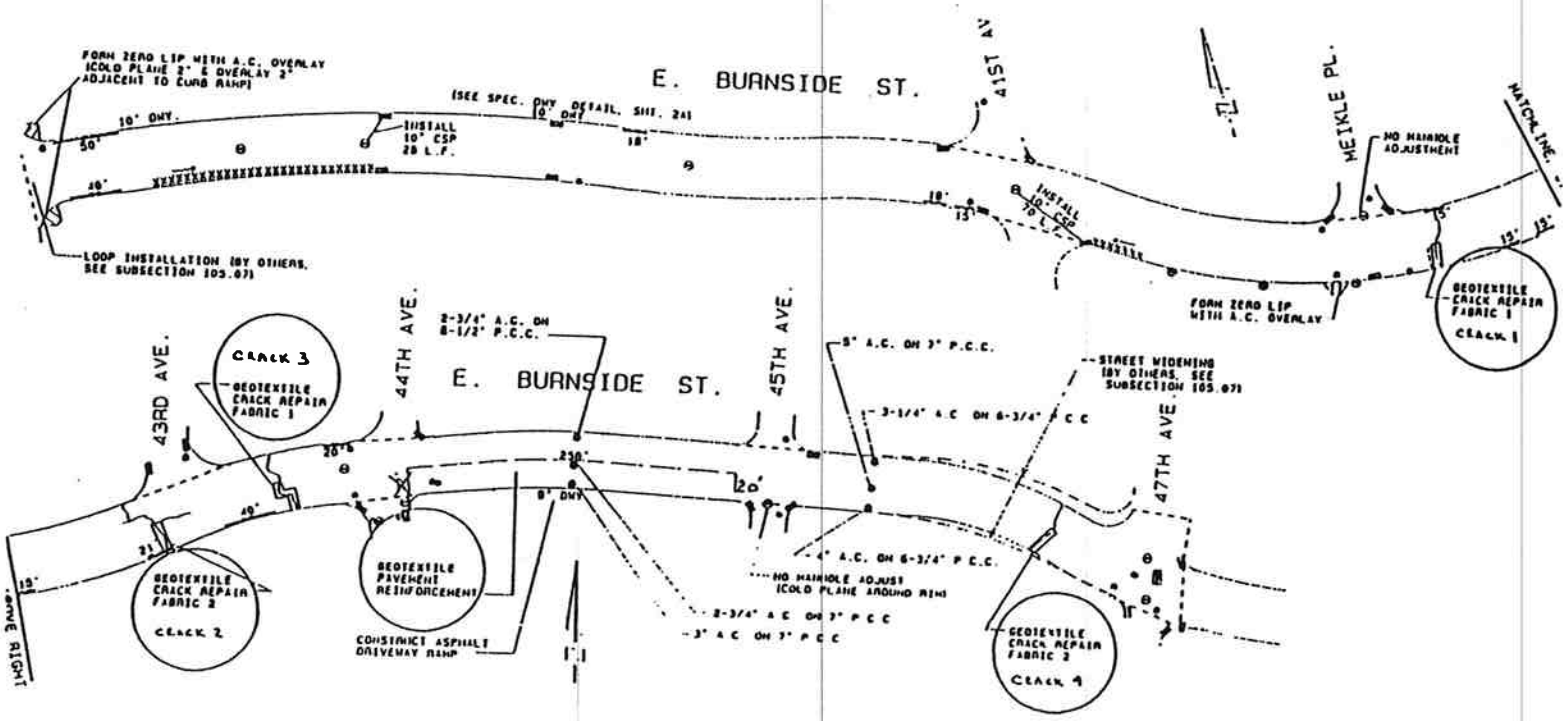


Figure A.1: Location of Crack Repairs

N. Curb	*	0.00 @ 48.25'
		0.50 Rt.
		0.50 Rt.
		0.40 Rt.
		2.20 Lt.
		2.25 Lt.
		2.54 Lt.
		3.00 Lt.
		2.12 Lt.
		0.40 Rt.
S. Curb	*	0.00 @ 00

Crack #1, Fabric 1
E. of N.E. Meikle Pl.

N. Curb	*	0.00 @ 49.9'
		0.15 Lt.
		0.35 Rt.
		0.50 Lt. @ 37'
		0.80 Lt.
		3.80 Rt. @ 33'
		3.70 Rt.
		5.55 Rt.
		4.25 Rt.
		3.00 Rt.
		3.00 Rt.
		1.40 Rt.
S. Curb	*	0.00 @ 00

Crack #2, Fabric 2
W. of 43rd Avenue
Two sheets of 2-foot wide Polyguard placed with 1-foot wide lap

N. Curb	*	0.00 @ 47.75'
		0.55 Lt.
		0.60 Lt.
		0.50 Lt.
		1.10 Lt.
		2.60 Lt.
		4.45 Lt.
		4.40 Lt.
		4.72 Lt./0.70 Rt. @ 13'
		0.60 Rt.
		0.40 Lt.
S. Curb	*	0.00 @ 00

Crack #3, Fabric 1
E. of 43rd Avenue
Single layer of
5-foot wide Glasgrid

N. Curb	*	0.00 @ 44.0'
		0.35 Rt.
		0.60 Rt.
		1.00 Rt.
		1.45 Rt.
		3.15 Rt.
		2.00 Rt.
		0.75 Rt.
		1.10 Lt.
S. Curb	*	0.00 @ 00

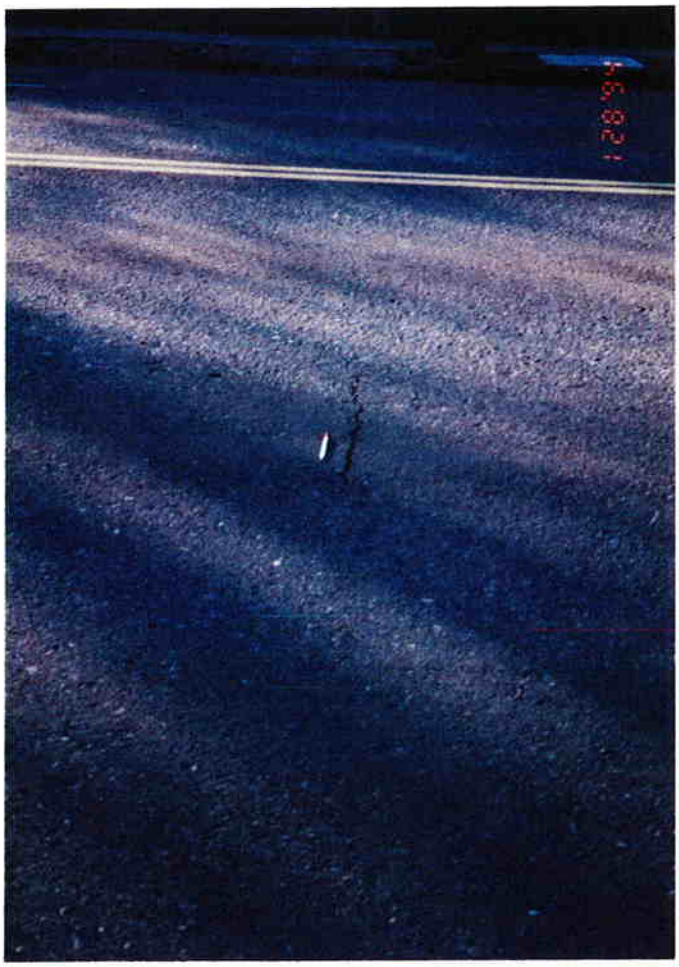
Crack #4, Fabric 2
W. of 47th Avenue
Single sheet of 2-foot wide Polyguard

*General Note Regarding All 4 Cracks
PK nails in new asphalt surface, 1 1/2 inches from face of curb, at termination of each crack and 10.0 feet west of each crack, for future reference.

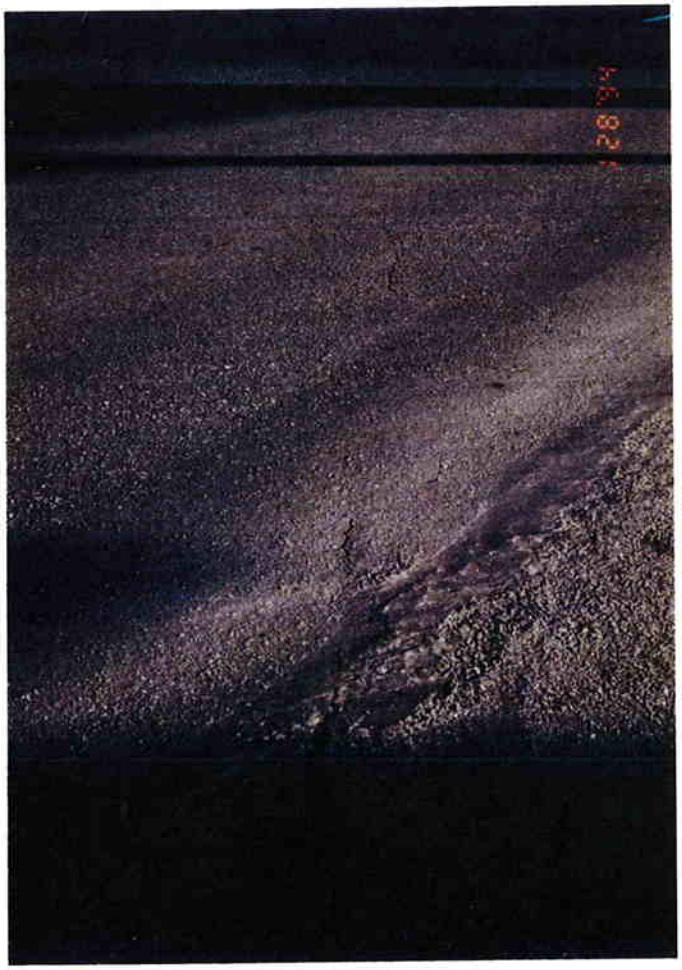
Figure A.2: Crack Repair Reference Measurements

APPENDIX B

PHOTOGRAPHS



(a) Cracks in the AC Overlay in the Pavement Reinforcement (Glasgrid) Control Section



(b) Cracks in the AC Overlay at the Intersection of East Burnside Street and East 44th Avenue

Figure B.1: Photographs of Cracks Observed in the Asphalt Concrete Overlay on January 28, 1994