GEOTEXTILE FABRICS UNDER AN ASPHALT CONCRETE OVERLAY TO RETARD REFLECTIVE CRACKING

FINAL REPORT

East 39th Avenue – East 47th Avenue Section
East Burnside Street, Portland

Experimental Features Project OR 91-03

by

Eric W. Brooks, E.I.T.
Research Specialist
Oregon Department of Transportation

and

Randy Countryman
Bureau of Transportation Engineering
City of Portland

Prepared for

Federal Highway Administration
Washington, D.C. 20590

and

The City of Portland
Portland, Oregon 97204-1971

May 1999

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
OR-EF-99-21		

4. Title and Subtitle	5. Report Date
Geotextile Fabrics Under an Asphalt Concrete Overlay to Retard Reflective Cracking – Final Report	May 1999
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Eric W. Brooks, E.I.T., and Randy Countryman	
9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Oregon Department of Transportation Research Group 200 Hawthorne SE, Suite B-240 Salem, OR 97301-5192	11. Contract or Grant No. EF OR 91-03
12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Federal Highway Administration Washington, D.C. 20560 and Oregon Department of Transportation Research Group 200 Hawthorne SE, Suite B-240 Salem, OR 97301-5192	Final Report 1991-1998
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

In 1991, the City of Portland selected a section of East Burnside from 39th Avenue to 47th Avenue to grind-out and overlay asphalt concrete over an old portland cement concrete (PCC) pavement. Geotextiles were used to provide reinforcement and retard reflective joint cracking. A test section on the eastbound lanes of Burnside between 44th Avenue and 45th Avenue was placed in September 1991. The test section included four cracks, which were covered with Glasgrid 8501 or Polyguard NW-75. A control section in the westbound lanes between 44th and 45th Avenue was also constructed about the same time. The final inspection was completed in June 1998. A few small cracks have developed in the control and test sections. Because the control has only slightly more cracking than the test section, the benefit of the geotextiles is questionable at this time. The success of the project appears to be due to an excellent paving job.

17. Key Words	17. Distribution Statement
Asphalt Concrete, Reflective Cracking, Paving Geotextiles	Available through the Oregon Department of Transportation Research Group

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	23	

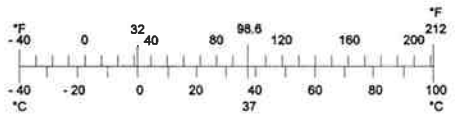
SI* (MODERN METRIC) CONVERSION FACTORS

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	meters 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 authors would like to thank Scott Nodes and Steve Armstrong for their contributions to the project. In addition, the authors thank the City of Portland Bureau of Engineering for its cooperation supplying technical data and assisting with condition inspections.

DISCLAIMER

TABLE OF CONTENTS

LIST OF FIGURES/PHOTOS

1.0 INTRODUCTION

The City of Portland did an experimental overlay to prevent reflective cracking on East Burnside Street in 1991. Four transverse cracks in the eastbound lanes and the entire width of the eastbound lanes between 44th Avenue and 45th Avenue were treated with geotextiles before the overlay. After the overlay was completed, a visual inspection of the project was made each year to check for reflective cracking. The purpose of this report is to describe the condition of the pavement surface after seven years of service.

1.1 BACKGROUND

In 1991, the City of Portland selected geotextiles with an asphalt concrete overlay for East Burnside Street between East 39th Avenue and East 47th Avenue. Because the section was on old portland cement concrete (PCC) pavement with an old asphalt overlay, many of the joint cracks had reflected through the overlay. The City developed a construction project to improve the pavement. The project included cold planing, placing an asphalt concrete leveling course, placing geotextile fabrics, and placing an asphalt concrete overlay.

The City of Portland elected to use geotextile fabrics for pavement reinforcement and crack retardation. In September 1991, the City placed Glasgrid 8501 and Polyguard NW-75 geotextiles on East Burnside Street. Following construction, the entire street surface was observed annually for evidence of reflective cracking. Observations were made at the test cracks 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.

Construction of the project is documented in the report *Geotextile Fabrics under an Asphalt Concrete Overlay to Retard Reflective Cracking*, Construction Report. Performance after two years is documented in the Interim Report. Both reports are available through the Oregon Department of Transportation Research Group.

1.2 OBJECTIVE

The objective of this project was to evaluate the performance of Glasgrid 8501 self-adhesive pavement reinforcement and Polyguard NW-75 self-adhesive non-woven membrane under asphalt concrete overlays. More specifically, the evaluation concentrated on the ability of the products to prevent or retard reflective cracking from transverse joints in PCC pavement through a 51 mm (nominal) Class "B" (dense-graded) asphalt concrete overlay.

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.

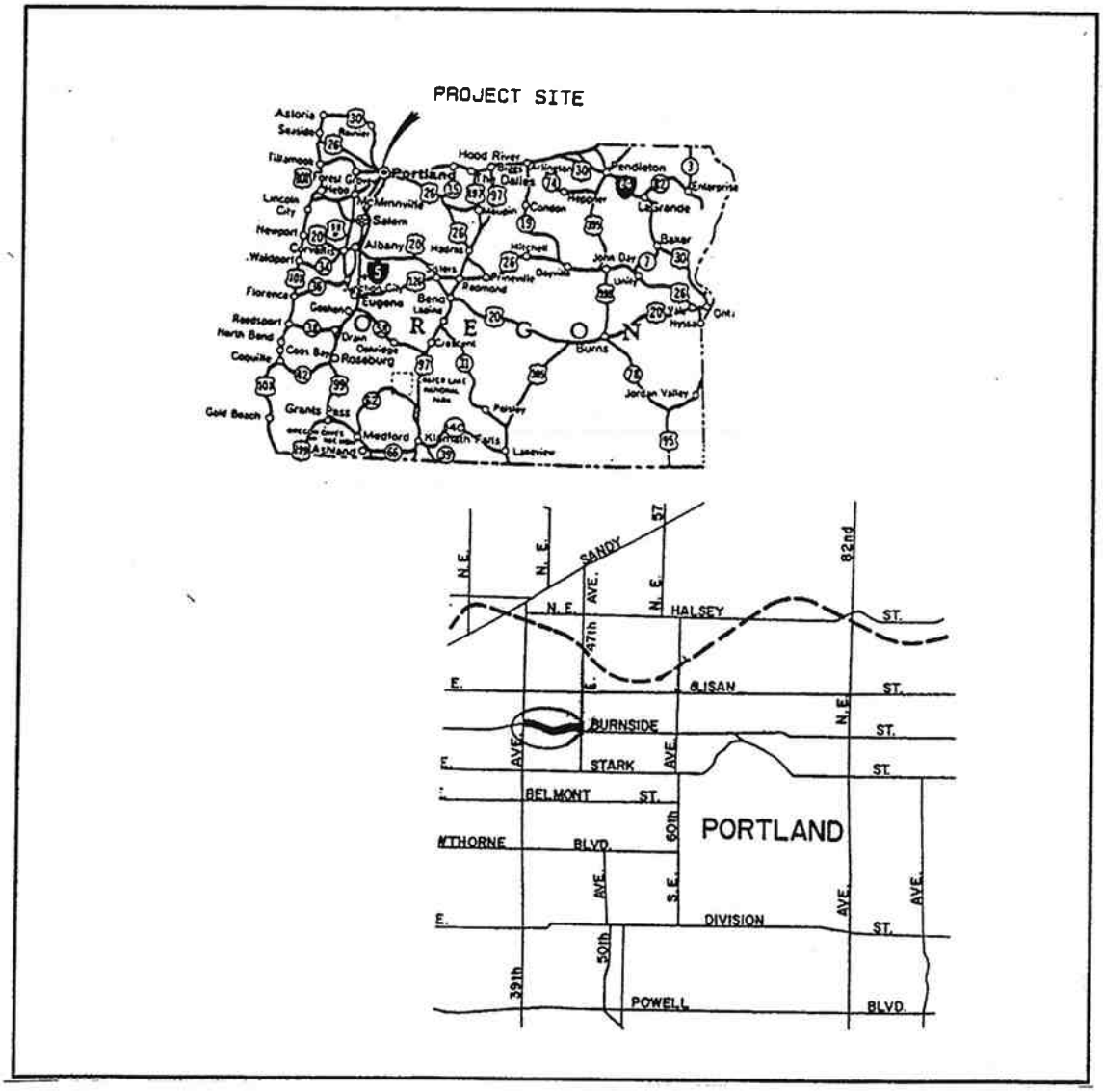


Figure 2.1: Location of Project

2.2 CROSS-SECTIONS

Typical cross-sections of the pavement are shown in Figure 2.2. The top 51 mm of the old pavement surface was cold planed. The new pavement surface is 51 mm of Class "B" (dense-graded) asphalt concrete. Underneath the new pavement surface is 180 mm of PCC. On the south side (eastbound lanes) of Burnside Street, Glasgrid 8501 and Polyguard NW-75 were placed between a leveling course and asphalt concrete overlay at four locations as shown in Figure 2.3. In addition, Glasgrid was placed for pavement reinforcement with no overlaps to a total width of 6.1 m and for 76.3 m on the south side of Burnside Street between 44th and 45th Avenues. On the north side of the street, no geotextiles were utilized.

The old pavement next to the curbs was rotomilled deeper than the rest of the cross-section and overlaid 13 mm less than the rest of the section, as shown in Figure 2.2. The taper effectively increased the curb height to improve drainage. Reflective cracks were first reported near the curb a couple of years after construction.

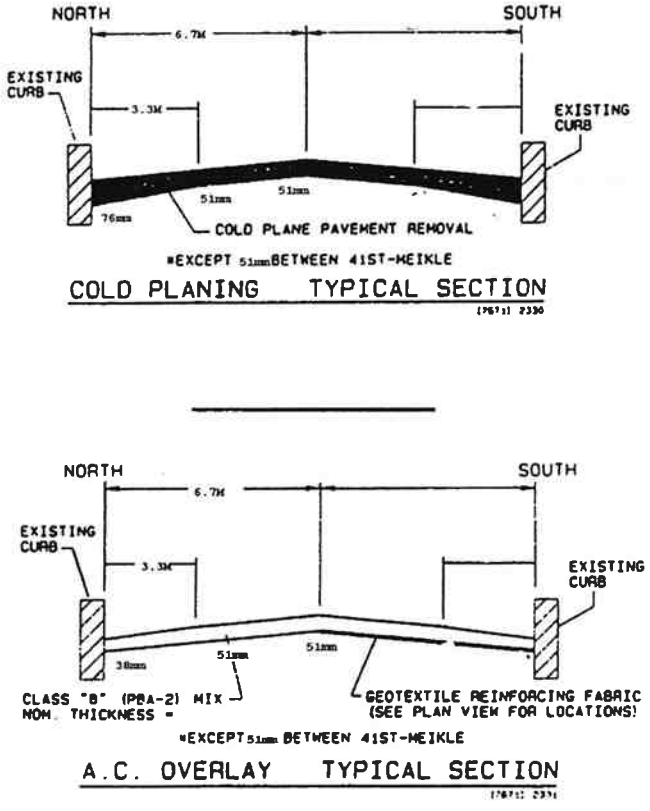
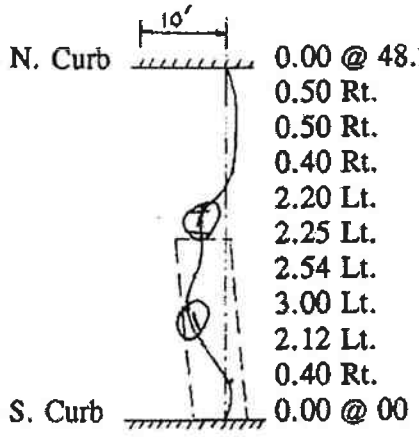
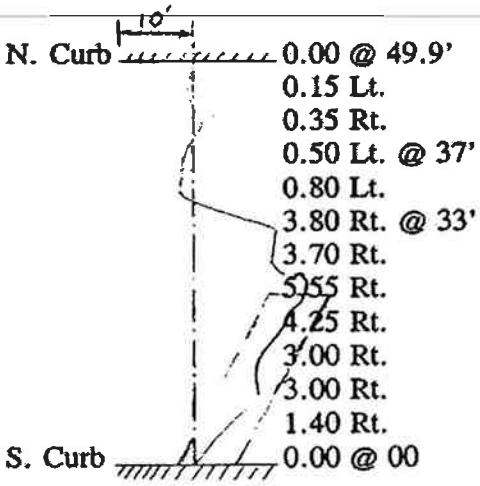


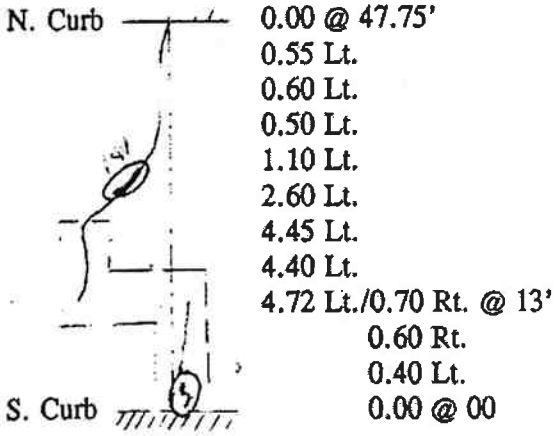
Figure 2.2: Pavement Cross-section



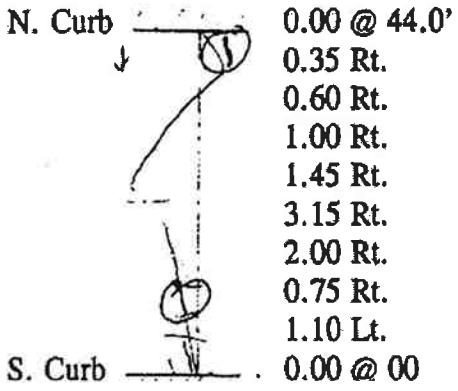
Crack #1, Fabric 1
E. of N.E. Meikle Pl.
Single layer of 5-foot wide Glasgrid



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



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



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

*General Note Regarding All Four Cracks
PK nails in new asphalt surface, 1 ½ inches from face of curb, at termination of each crack and 10.0 feet west of each crack, for future reference.

1998 reflective cracks are circled.

Figure 2.3: Crack Repair Reference Measurements

3.0 CONSTRUCTION

Project construction began on September 19 and was completed September 26, 1991. A complete description of the construction is documented in the Construction Report. Some problems handling and laying the geotextile occurred but the contractor successfully solved them.

When the contractor removed the protective sheeting from the self-adhesive strip, the sheet tried to curl. By applying a light pressure to one edge, the contractor was able to overcome the problem. Construction using the self-adhesive strips is documented in a video that would be helpful for anyone applying this type of material.

The Glasgrid used on crack #3 required an application of loose asphalt concrete before it was rolled. The asphalt concrete was placed to keep the material from sticking to the roller. A problem occurred when substitution of the Polyguard NW-75 for the Petrotac material resulted in a smaller roll-width. The City of Portland inspector requested that the contractor overlap the 0.6 m rolls 0.3 m, for a total width of 0.9 m. The contractor had already laid one strip to repair crack #2 when the inspector made the request. To meet the request, the original strip was picked up and moved to the left 0.3 m, so the overlap joint would lay in about the center of the crack being repaired.

4.0 TRAFFIC

The average daily traffic (ADT) for this street is about 13,000 vehicles. Most of the traffic is passenger cars; however, there are many delivery trucks and about 143 city buses travelling in each direction. Both the buses and trucks usually use the right lane. The city buses are typically overloaded for their axle configuration. Figure 4.1 is a graph of daily traffic taken one day in the fall of 1996. On this day, the morning traffic peaks on the westbound lanes at about 7:00 A.M. while the eastbound traffic peaks at about 5:00 P.M.

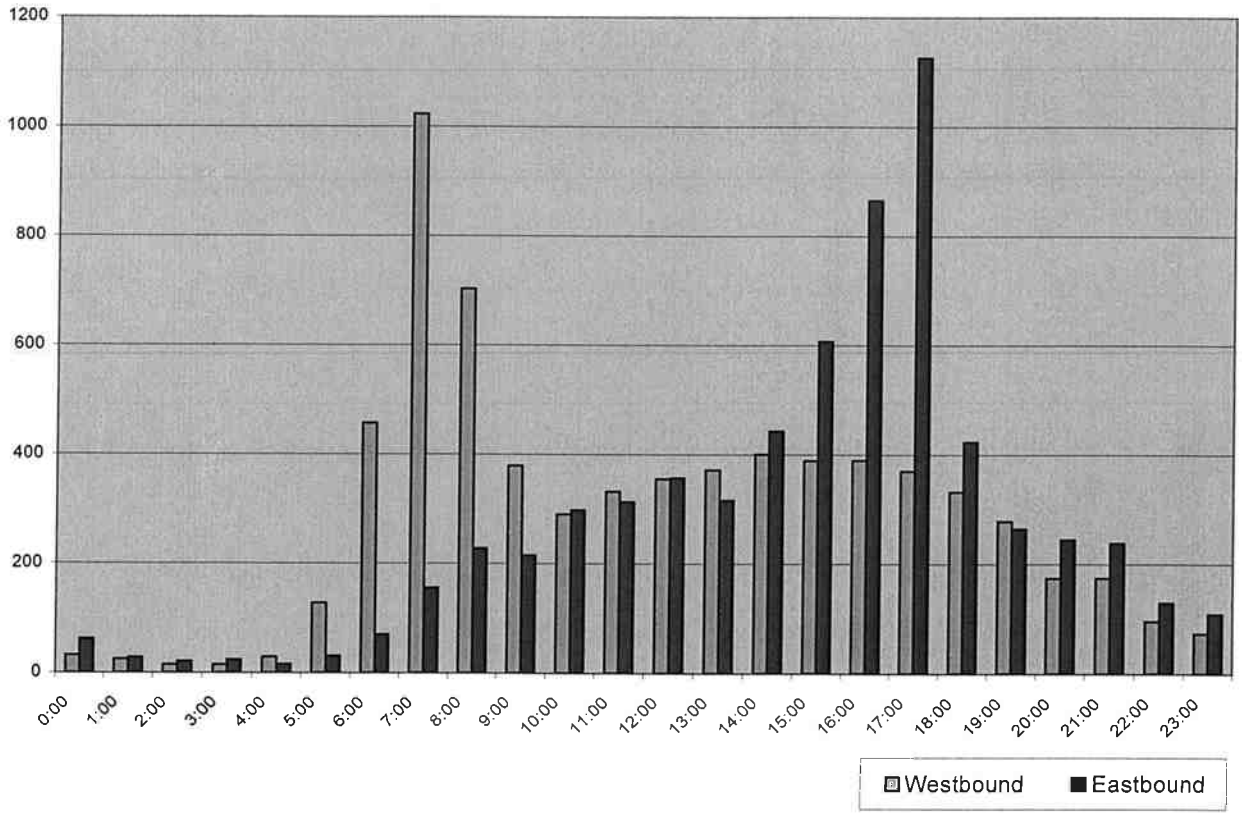


Figure 4.1: Daily Traffic by Hour for East Burnside (typical weekday)

5.0 EVALUATION

The project was evaluated once each year from 1992 to 1998. For the first few years in the reinforced section, only a few cracks were found. In 1996, more and larger cracks started to grow. Longitudinal cracks found in this area were visible on the original pavement after the grinding was completed. The cracks are starting to reflect through the overlay in the test section. However, the total cracking today in either the test or control sections is much less than the original reflective cracks shown in the pre-construction videotape. Figure 5.1 is a sketch of the 1998 noted cracking in the reinforced section and Figures 5.2 and 5.3 include photographs of the test and control sections. Note from the crack map (Figure 5.1) that the control section has slightly more cracking than the test section. Rutting was found to be less than 6 mm.

The four test cracks were also observed. Only very minor reflective cracking was found. Crack #3 was in the best condition with zero linear meters of cracking. Crack #4 had the most reflective cracking, but the location was not conclusive. A curb replacement and widening job after the overlay destroyed one of the reference nails, thus the exact location of the existing crack is not certain. The Polyguard at test crack #4 was not overlapped. Overlap of the Polyguard on the other cracks may have improved the performance of the geotextile.

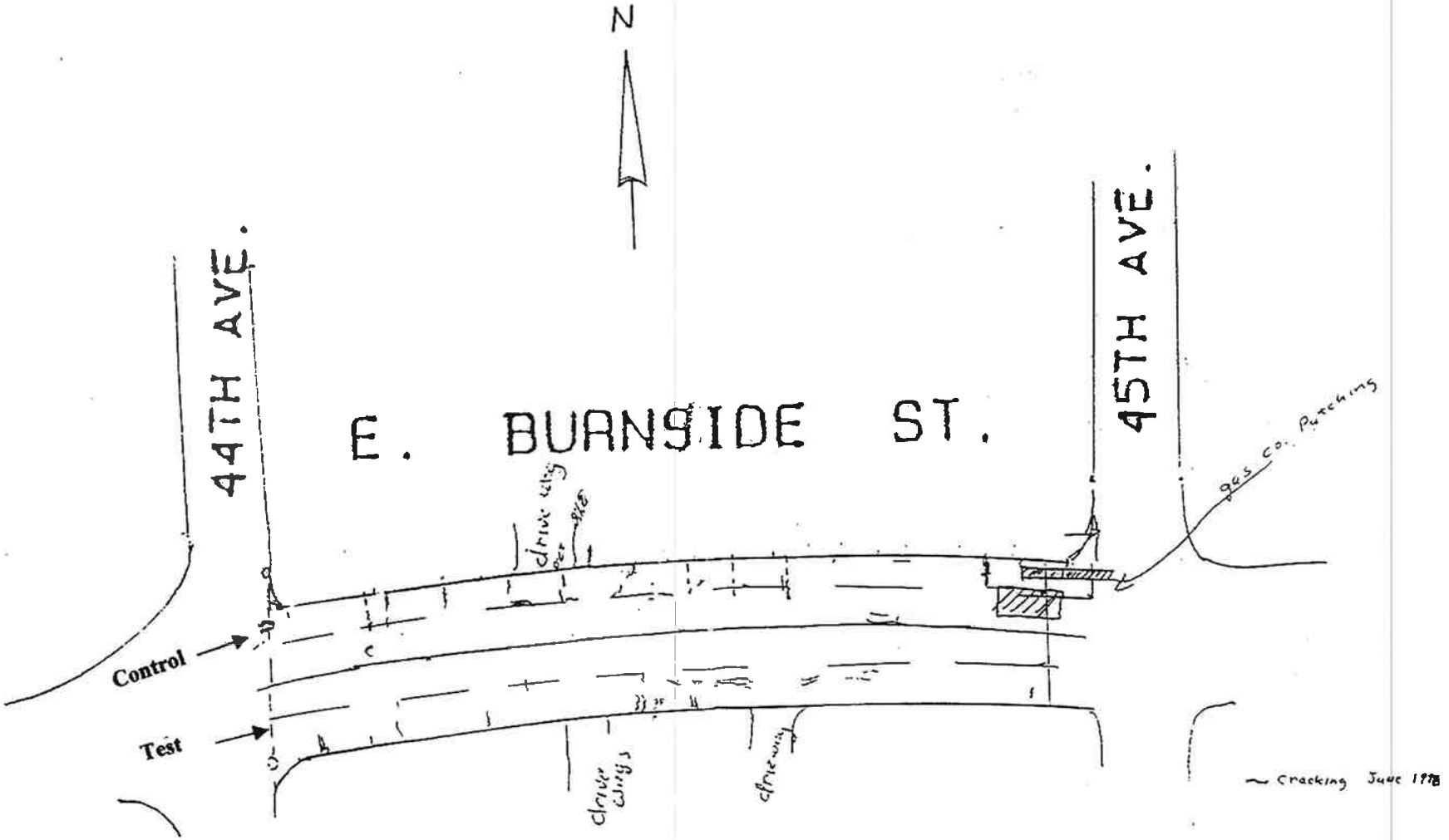


Figure 5.1: Crack Map of Test and Control Sections

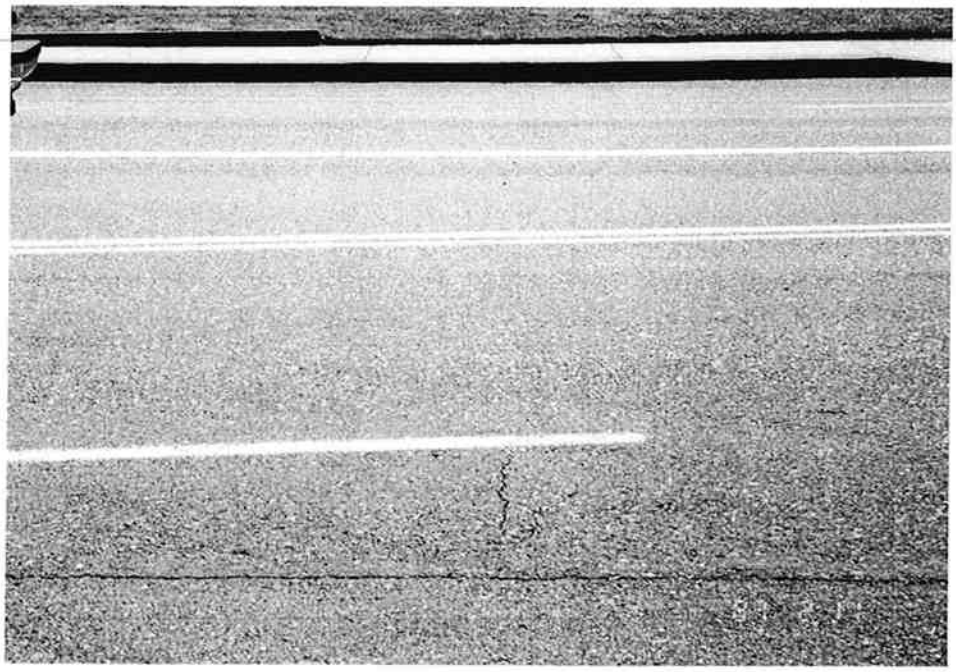


Figure 5.2: Typical View of the Test Section

Figure 5.3: Typical Cracking in the Control Section

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

1. Reflective cracking has developed in both the test and control sections. However, the distress is at a low level and very sparse.

2. The control section has slightly more cracking than the test section. Because they are both at low levels, it is not conclusive if the geotextile has retarded the crack growth.

3. The low level of distress may be the result of a good paving job.

6.2 RECOMMENDATIONS

1. The ODOT Research Group, with the City of Portland, should continue to monitor the sections annually to determine the benefits of using geotextiles.

2. The location of crack #4 should be reestablished.

APPENDIX A

CRACK REPAIR INFORMATION

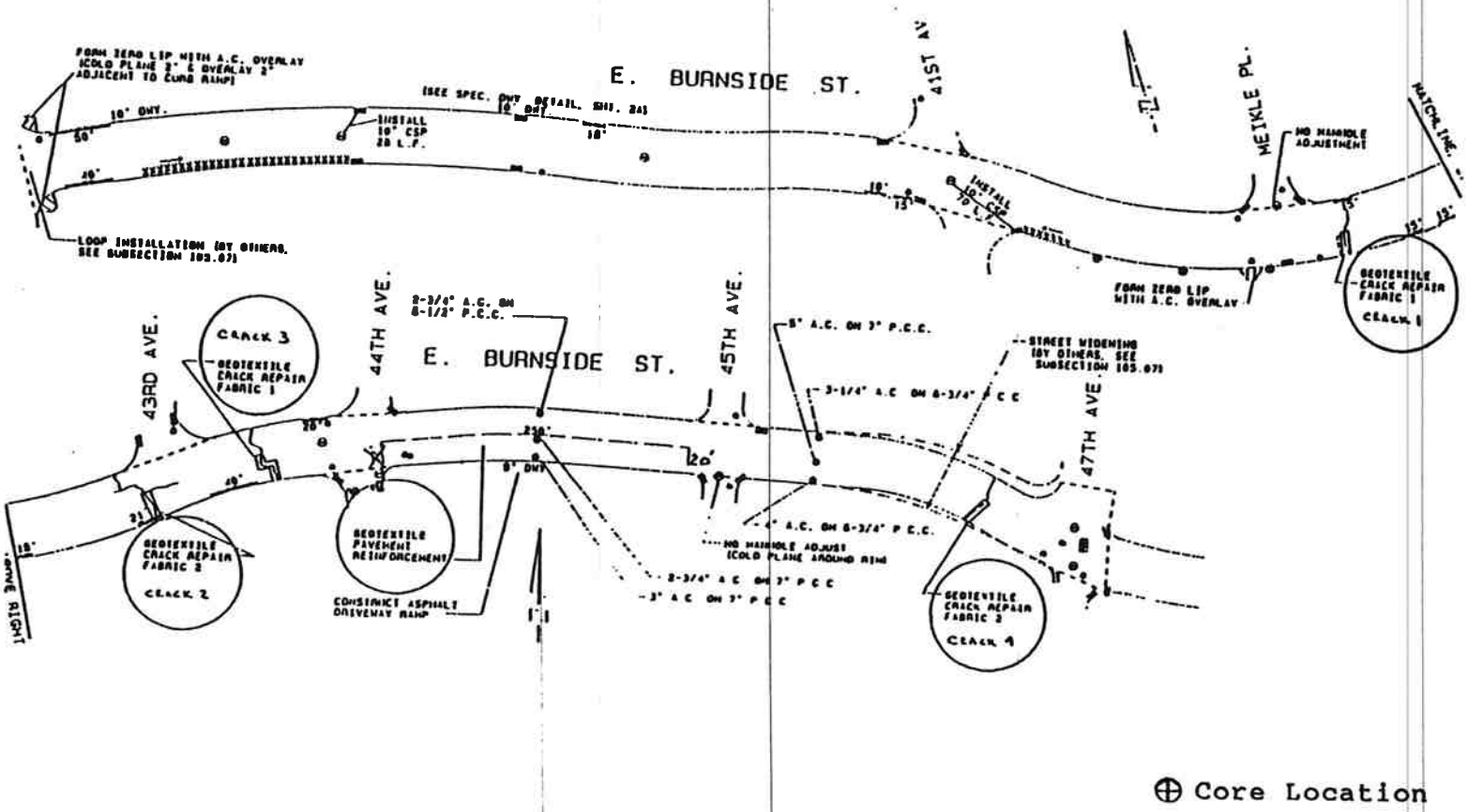


Figure A.1: Location of Crack Repairs

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

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

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

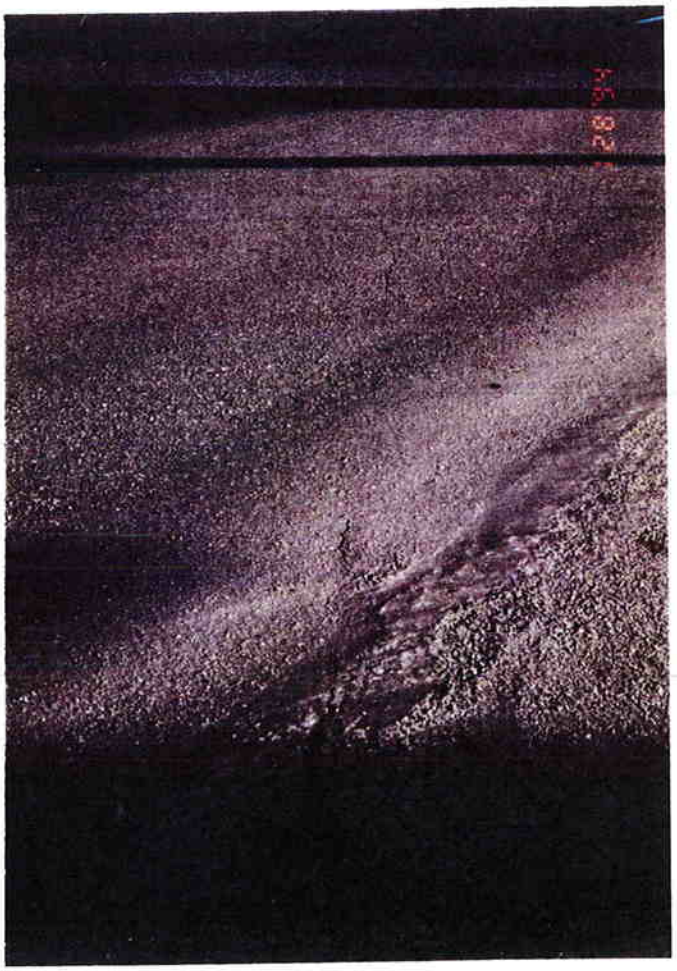
*General Note Regarding All 4 Cracks
PK nails in new asphalt surface, 1 1/2 inches from face of curb, at termination of each crack and 10.0 feet west of each crack, for future reference.

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