GEOTEXTILE FABRICS UNDER AN ASPHALT CONCRETE OVERLAY TO RETARD REFLECTIVE CRACKING

Construction Report

Experimental Features
Project No. OR 91-03

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

by

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ABSTRACT

In an attempt to reduce the discontinuity between the bridge and the roadway due to the settlement and/or consolidation of the approach embankment, an experimental construction method was tested on the Lost River Bridge in Klamath County. The method consisted of combining soil in six 1′ lifts, interlaced with the geotextile reinforcement. This method was designed to reduce the settlement of the newly placed fill, thus reducing the discontinuity.

The Lost River Bridge was widened by 10′3″ on each side. The additional width of the bridge required short narrow sliver fills at all four corners. The geotextile reinforcement was only used in the sliver fills and did not run the whole width of the road-to-bridge transition. The material was easy to work with considering the small size of the project. Although the original plans called for the geotextile reinforcement to be used at two of the four corners, to allow for a control lane in the northbound direction, it was used at all four corners.

A settlement plate was installed at each fill location before the first lift was put down to measure the settlement of the original soil under the new fill. The settlement of the new fill will be found by subtracting the original settlement soil from the total fill settlement.

The construction of the sliver fills went well. The soil used for the fills was native soil from the job site. It consisted of about four different types of soil, and was granular in nature. Compaction requirements were met by placing each lift with 6 inches of loose soil.

The construction of the new sliver fills gave a good ride immediately after construction. There were no bumps at the road-to-bridge transition.

ACKNOWLEDGEMENTS

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DISCLAIMER

Geotextile Fabrics Under An Asphalt Concrete Overlay to Retard Reflective Cracking

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1.0 INTRODUCTION

The purpose of this report is to describe the placement of the geotextile fabrics (including any problems that occurred), to describe variations from the original workplan, and to document costs and the time required to place the materials.

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, placing an asphalt concrete leveling course, placing geotextile fabrics, and placing an asphalt concrete overlay.

The City of Portland decided to use geotextile fabrics for pavement reinforcement and crack retardation. The City of Portland decided to use 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 OBJECTIVE

The objective of this project is to evaluate the performance 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 two-inch (nominal) thick Class "B" (PBA-2) 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.

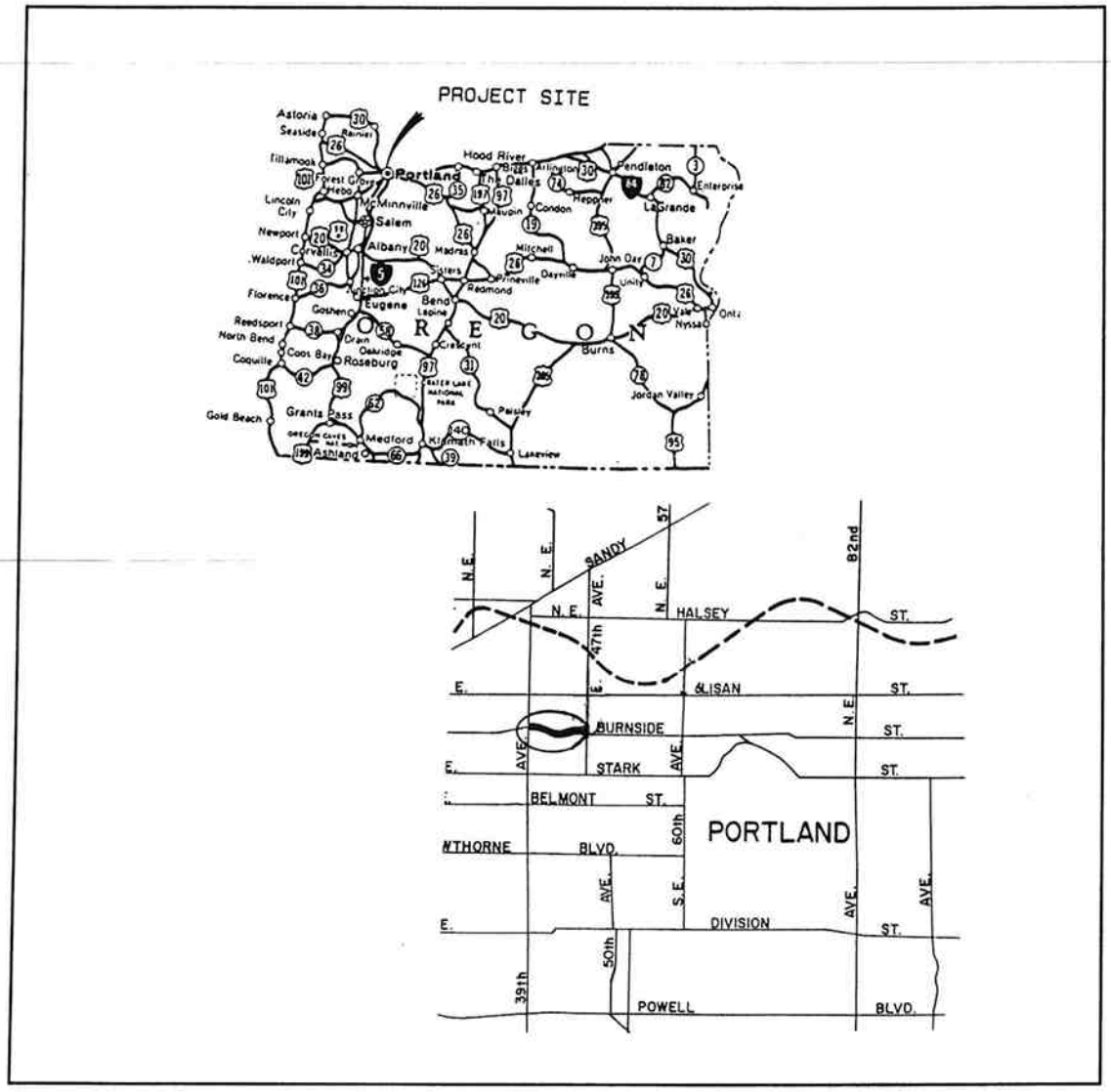
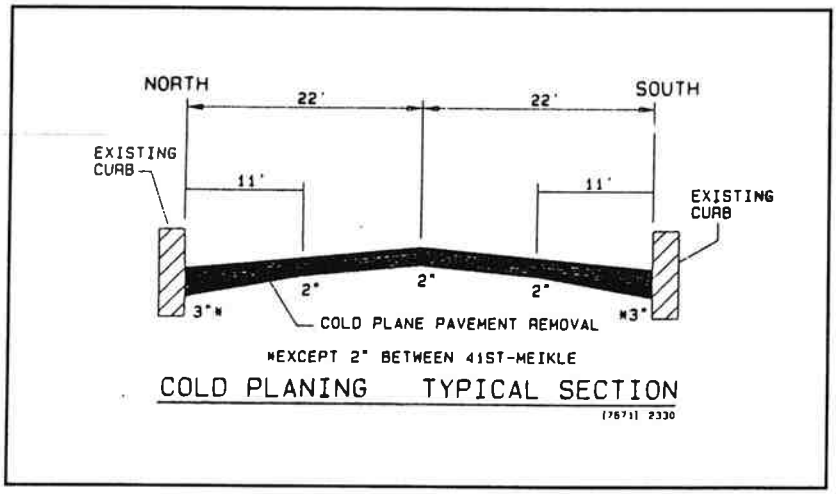


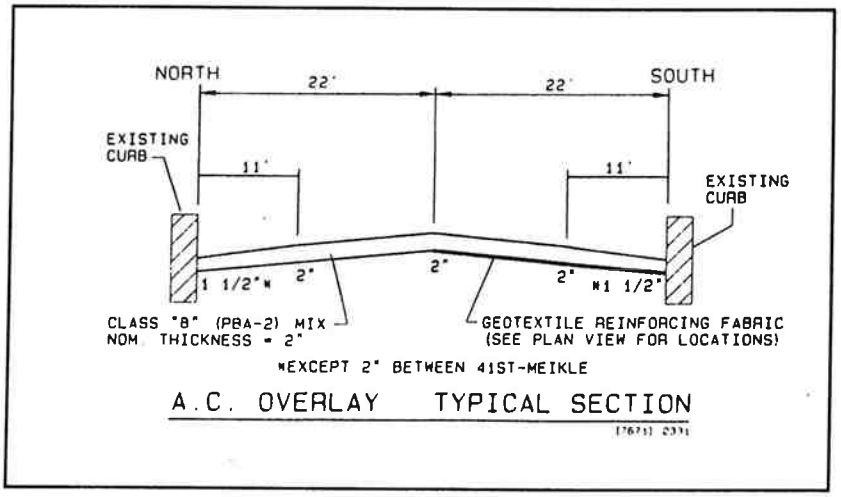
Figure 2.1: Location of Project

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 two-inch Class "B" asphalt concrete. Underneath the new pavement surface is seven inches 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 B.1 of Appendix B. 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-Section

3.0 CONSTRUCTION

The construction of this project consisted of cold planing, placing an asphalt concrete leveling course, placing geotextile fabrics, and placing an asphalt concrete overlay. The geotextiles were installed for crack retardation (Glasgrid and Polyguard) and pavement reinforcement (Glasgrid).

Prior to cold planing, the surface cracks in East Burnside Street between East 39th Avenue and East 47th Avenue were observed. The cracks varied in size from hairline to approximately 1 inch wide; most of the cracks were transverse cracks. Photographs of cracks taken after cold planing are included in Appendix A.

The top two inches of the asphalt concrete wearing surface were cold planed with a rotary milling machine. (The milled asphalt concrete became the property of the contractor.)

After the old asphalt concrete pavement was cold planed, City of Portland staff verified that the majority of cracks in the old asphalt concrete pavement were reflective cracks. The vast majority of them occurred at the joints of the portland cement concrete (PCC) pavements. There was no evidence of major movement of the PCC slabs.

Following cold planing, the four cracks to be repaired were highlighted with spray paint. Then, the locations of the cracks were measured relative to straight lines across the street at each crack, and the offset distances from each crack to the reference lines were recorded. The locations of the crack repairs are shown in Figure B.1 of Appendix B, and the reference measurements for the four cracks are shown in Figure B.2 of Appendix B.

Glasgrid 8501 and Petrotac were specified in the contract. The five-foot wide Glasgrid and the three-foot wide Petrotac were to be placed over two cracks each. However, the contractor requested and was granted approval to substitute Polyguard NW-75 self-adhesive non-woven membrane in place of Petrotac. It was not known when the substitute was approved that Polyguard only comes in one-foot and two-foot wide rolls. The specifications required a three-foot wide roll be used. A copy of the project specifications is included in Appendix C.

The contract included adequate quantities of Glasgrid 8501 to cover the area of pavement reinforcement, with sufficient material left to repair two cracks. The contractor misinterpreted the plans, and did not realize that Fabric 1 for crack repairs and the fabric for the pavement reinforcement were the same materials. Consequently, the contractor initially ordered only one roll of Glasgrid 8501 for the crack repairs.

Prior to placing the fabrics, a 0.5 inch or less Class "C" asphalt concrete leveling course was placed over the full street surface. Then, the cracks were located by the reference measurements and marked with spray paint on the leveling course 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 geotextile fabrics were not to be placed.

On September 20, 1991, the contractor placed the five-foot wide Glasgrid 8501 (Fabric 1) and the two-foot wide Polyguard (Fabric 2) on the freshly constructed leveling course over three of the four test cracks between Meikle Place and 44th Avenue. Since Polyguard is only two feet wide, the contractor was instructed to lap the two-foot wide Polyguard one foot, which resulted in a three-foot wide patch, with the one-foot center lap being a double thickness of fabric, over crack #2. The fabric was placed immediately ahead of the paving machine that placed the final asphalt concrete wearing course.

Both fabric materials were unrolled adjacent to the crack with the adhesive side face up, then the fabric was cut to length. The Polyguard fabric was extremely sticky and was covered with a protective layer of plastic sheeting. This sheet was peeled away, leaving the exposed sticky side up. With one worker on each end of the sheet of fabric, it was lifted, then flipped over onto the crack with the adhesive side face down. The same procedure was used for the Glasgrid, except that the Glasgrid had no protective sheeting to be removed.

Placing the Polyguard by removing the protective sheeting with the sticky side face up, then turning the fabric over did not work satisfactorily. When turning the second layer of fabric at crack #2, the fabric stuck to itself. It was extremely difficult to separate the material from itself so that it could be reset in its original position. The material was turned successfully on the second effort.

Both fabrics were rolled with the dual wheels of a truck until each fabric made full contact and adhered to the leveling course. The asphalt concrete wearing course was then placed immediately over the fabric.

The following week, the contractor placed Polyguard over crack #4. The same procedure was used to place the Polyguard on crack #4 as on the other crack repairs, except that only a single two-foot width of material was used.

On September 26, 1991, the balance of the contractor's supplemental order for additional Glasgrid 8501 arrived and was placed for pavement reinforcement (see Figure B.1, Appendix B). The five-foot wide pavement reinforcement Glasgrid material was placed over the freshly placed asphalt concrete leveling course by dragging it behind a truck with a chain attached to each end of a pipe acting as an axle by connecting it through the hollow center of the roll of fabric. One worker standing on the end of the fabric prevented the fabric from sliding forward as the roll advanced. The fabric was placed with no end or longitudinal side laps. A ten-wheel rubber tire roller was used to ensure that the surface of the fabric made full contact with the leveling course.

After placing all pavement reinforcement and repairing crack #4, the asphalt concrete wearing course was then placed over the Glasgrid and Polyguard. (All placement activities were videotaped.) There had been some concern that the paving operation might damage the geotextile fabrics or that there might be bumps in the asphalt concrete pavement at the edges of the geotextile fabrics, but there were no problems paving the asphalt concrete wearing course over the geotextile fabrics.

In summary, geotextile fabrics were placed on a Class "C" asphalt concrete leveling course over a cold planed surface on the south half (eastbound lanes) of East Burnside Street between East 39th Avenue and East 47th Avenue. The specific locations and dimensions of the fabric are shown on the plans and contract specifications (see Appendix B and Appendix C), except as follows:

1) Polyguard NW-75 in two-foot wide rolls was substituted as Fabric 2 for Petrotac in three-foot wide rolls.

2) Polyguard was placed over crack #2 at 43rd Avenue in a three-foot wide width and a one-foot wide lap (double thickness) directly over the crack.

3) Polyguard was placed over crack #4, west of 47th Avenue, in a two-foot wide width (single thickness) directly over the crack.

4) Glasgrid pavement reinforcement was placed with no overlaps to a total width of twenty feet (4 widths of material) and to a length of 250 feet on the south side of Burnside Street between 44th Avenue and 45th Avenue.

5) 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. The straight lines are referenced with PK nails imbedded in the asphalt concrete wearing course located over each crack 1-1/2 inches from the face of each curb on the north and south sides of Burnside Street. Another reference PK nail is located ten feet to the west of each crack on each side of the street, also located 1-1/2 inches from the face of each curb. The reference measurements of each of the cracks are shown in Figure B.2 of Appendix B.

6) After the geotextile fabrics were placed and rolled, a two-inch Class "B" asphalt concrete (with PBA-2 asphalt) wearing course was placed on East Burnside Street between East 39th Avenue and East 47th Avenue.

4.0 COST OF GEOTEXTILE FABRICS

The two activities of paving and placing fabric were performed simultaneously and by the same work crew. The asphalt concrete leveling course would have been required over the rough cold planed surface with or without the fabrics, so its use did not add any costs or affect the production rate of fabric placement. The contractor did not have or need any special equipment for placing the fabrics, but instead used trial and error methods to find the most effective placement procedure. Because the activities of paving and placing fabric were combined, it was not possible to isolate the labor and equipment costs associated with placing the fabrics.

The cost of materials was determined by the invoices provided by the contractor. The bid quantities were established so that one full roll of Petrotac (3 feet x 45 feet) and one pallet board of four rolls of Glasgrid (5 feet x 330 feet) were required. Polyguard NW-75 comes in rolls of 2 feet x 100 feet. By requesting a change of brand, the contractor ended up with approximately 34 feet of unused material on the roll (100 feet minus 3 lengths of 22 feet each). By not noticing that Glasgrid was intended for use in the pavement reinforcement as well as for crack repair Fabric 1, the contractor paid a premium price by having to order twice and paying air freight for the second shipment.

The actual costs of materials used, including the waste of the unused portions of Polyguard and the full cost of freight for the Glasgrid, were as follows:

Polyguard NW-75
2 rolls, 2 ft. x 100 ft. at $88.88 per roll = $177.76
Unit Cost = $0.89/L.F. = $4.00/S.Y.

Glasgrid 8501

100 meters x 1.5 meters (329 ft. x 4.9 ft.) at $5.68 per meter	=	$ 568.00
300 meters x 1.5 meters (985 ft. x 4.9 ft.) at $7.95 per meter	=	$2,385.00
Total Cost, Free on Board (FOB) Portland	=	$2,953.00

Unit Cost = $2.25/L.F. = $4.12/S.Y.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 CONCLUSIONS

1) The methods of placing the Glasgrid for both the crack repairs and pavement reinforcement worked satisfactorily for the small quantities of material used. The method of placing Glasgrid in the area of pavement reinforcement was innovative and worked successfully after a few modifications.

2) Placing the Polyguard by removing the protective sheeting with the sticky side face up, then turning the fabric over did not work satisfactorily. It was extremely difficult to separate the material from itself so that it could be reset in its original position.

3) The Glasgrid fabric is more rigid and has less surface area than Polyguard; consequently, Glasgrid was much easier to place than Polyguard.

5.2 RECOMMENDATIONS

1) When placing small quantities of Polyguard or similar self-adhesive membrane with a protective plastic sheet and without a spreading machine, the roll should be set with the adhesive side face down, and the protective sheet removed as the fabric is rolled into position. (The material should not be unrolled with the protective sheet face up, then the sheet removed and the exposed membrane turned over into position with the adhesive side face down.)

2) When placing quantities larger than those placed for this project, a spreading machine should be used for both types of fabric.

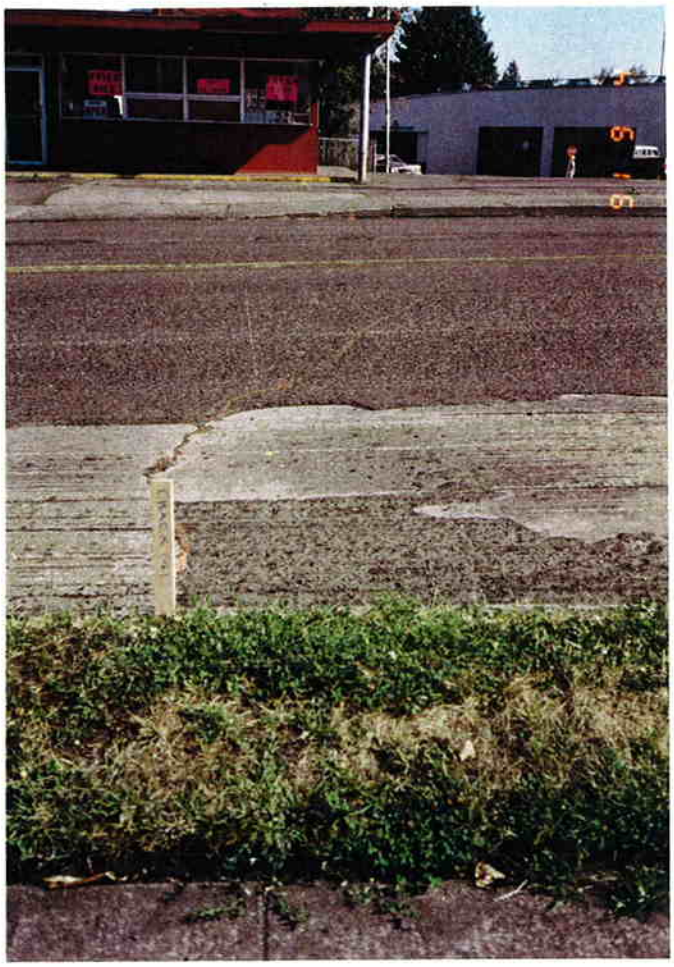
3) A leveling course would have not been necessary prior to placing the highly adhesive Polyguard membrane; however, thorough rolling with a rubber tired roller or normal traffic rolling in the traffic lanes would be required if no leveling course were applied.

4) A leveling course is essential prior to placing Glasgrid fabric. Rolling with a rubber tired roller should follow placement of Glasgrid, followed as quickly as possible with a final lift of pavement prior to opening the street to traffic.

APPENDIX A

PHOTOGRAPHS

(a) Crack Number 2



(b) Crack Number 4

Figure A.1: Photographs of Crack Numbers 2 and 4 After Cold Planing

APPENDIX B

CRACK REPAIR INFORMATION

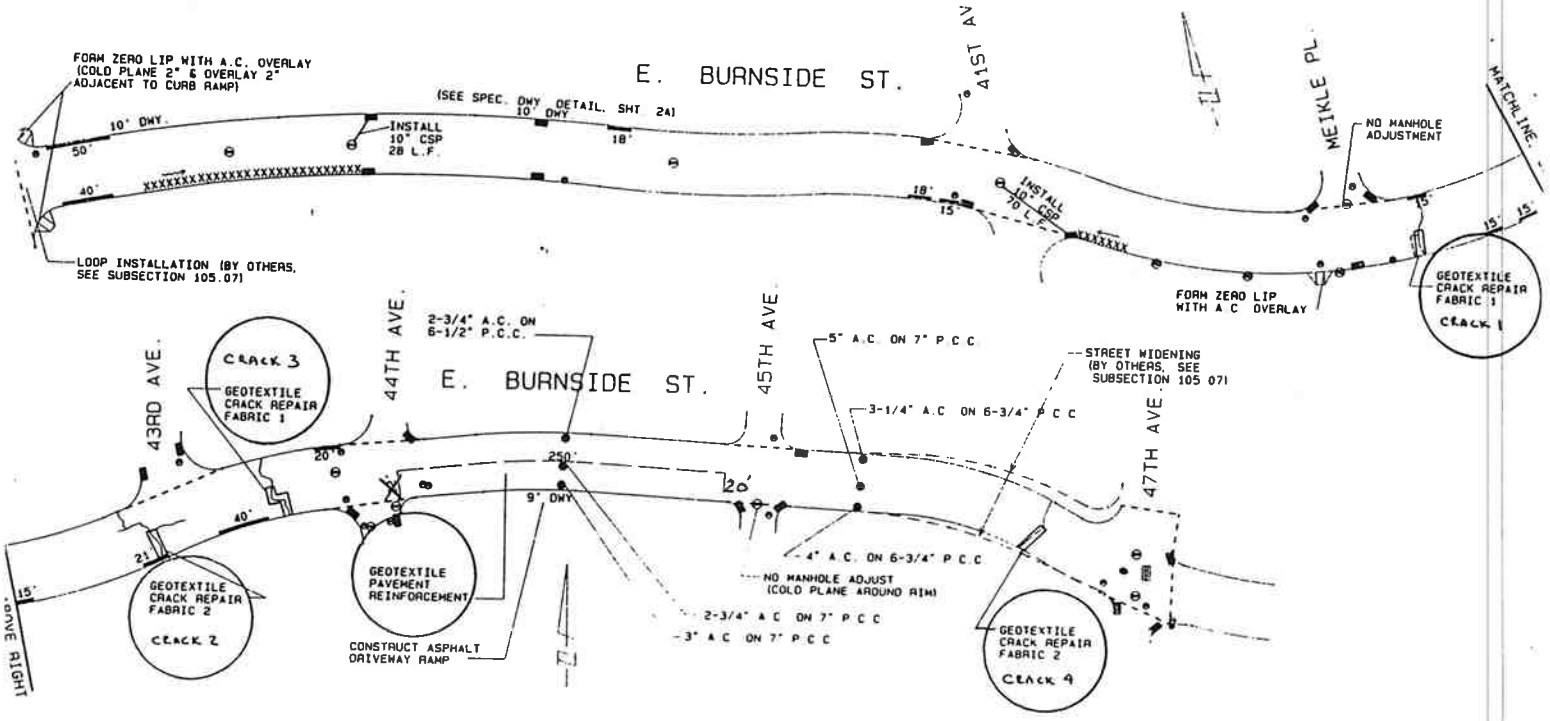
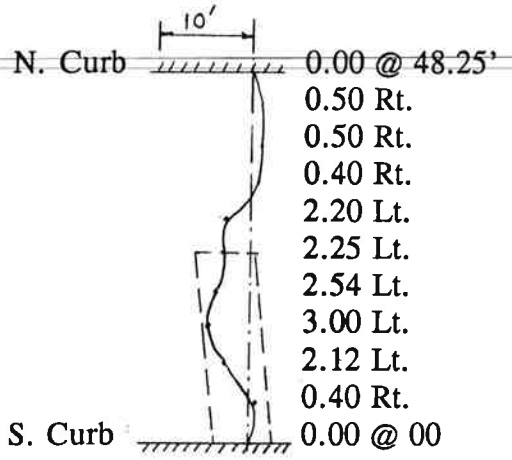
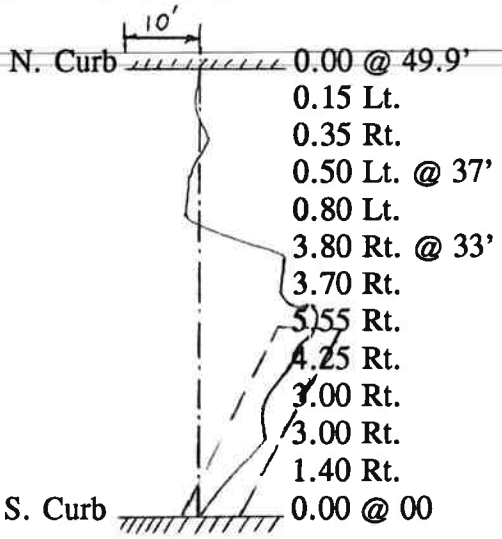


Figure B.1: Location of Crack Repairs

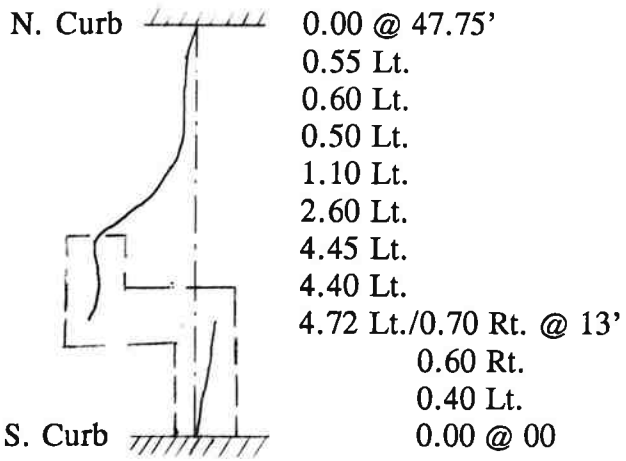
East Burnside Street, Meikle Place - 47th Avenue



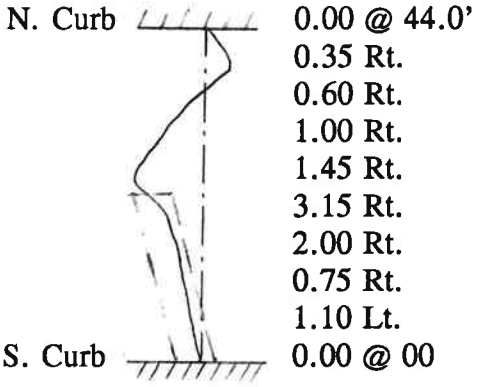
Crack #1, Fabric 1
E. of N.E. Meikle Pl.
Single layer of
5-foot wide Glasgrid



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 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 B.2: Crack Repair Reference Measurements

APPENDIX C

PROJECT SPECIFICATIONS

PROJECT SPECIFICATIONS

SECTION 618 - GEOTEXTILE FABRICS

Geotextile fabrics shall be constructed in conformance with section 618 of the Standard Specifications supplemented and/or modified as follows:

618.01 Scope - This work consists of furnishing and placing reinforcing and crack repair fabrics on areas and over cracks on E. Burnside Street between N.E. Meikle Place and N.E. 47th Avenue, as shown on Sheet 3 of the plans, or as directed.

618.11 Materials - Reinforcing Fabric and Crack Repair Fabric 1 shall be Glasgrid 8501 mesh fiberglass strands in a grid structure, with self-adhesive glue or approved equal. Materials are available from Bay Mills Ltd., 39 Seapark Drive, P.O. Box 728, St. Catherines, Ontario, Canada L2R 6Y3. For further information contact Jon Woolstencroft, International Sales & Marketing Manager, at 416/688-3160 or 1-800-263-5715. Materials are available in 5-foot by 330-foot rolls, weighing approximately 185 pounds per roll.

Crack Repair Fabric 2 shall be Petrotac non-woven fiber in a 36-inch by 45-foot roll, or approved equal, weighing approximately 48 pounds per roll.

618.31 Construction - Fabrics are to be placed in accordance with manufacturer's recommended placement procedures on a sound, dry, level and thoroughly cleaned, freshly cold planed pavement surface. Cold planed surfaces shall be cleaned with a vacuum sweeper. Any surface depressions or potholes caused by cold planing shall have a Class "C" asphalt concrete leveling course or patches placed prior to placement of the fabric. The fabric is to be rolled in place by hand, unless a suitable method of mechanical placement is proposed by the Contractor and accepted by the Engineer. If a leveling course is required, the surface temperature shall be cooled to below 150°F before placing fabric. Air and pavement temperature shall be 45°F or above when placing fabric.

Longitudinal and end overlaps are to be a minimum of 2 inches. Placement of the fabric shall be followed by rolling with a rubber-tired roller. All fabric placed in a day shall be covered with an asphalt overlay the same day. The only traffic allowed on the fabric prior to overlay shall be construction equipment and local access traffic to private driveways. The Contractor shall ensure that the fabric is free of dirt, undamaged and bonded to the roadway surface prior to placing the pavement overlay.

618.81 Measurement - Measurement of Reinforcing Fabric will be by the square yard of material used, to the nearest 1/10 square yard. Crack Repair Fabric 1 and Crack Repair Fabric 2 will be measured by the linear foot of material used, to the nearest 1/10 linear foot. There will be no deductions for overlaps.

618.91 Payment - Add the following pay items:

(d)	Reinforcing Fabric	Sq.Yd.
(e)	Crack Repair Fabric 1	Lin. Ft.
(f)	Crack Repair Fabric 2	Lin. Ft.

Payments made for (d), (e), and (f) above also include all work of furnishing and placing the material, preparing the surface, rolling the material in place and protecting the material and surface from damage during and after its placement and during the placement of the asphalt concrete overlay. Any required asphalt leveling course will be paid for in accordance with subsection 104.04 as Extra Work.