# EVALUATION OF 'GLASGRID' BITUMINOUS PAVEMENT REINFORCEMENT MESH AND A BITUMINOUS SEPARATION COURSE WITH AND WITHOUT LATEX

Construction Report


**MATERIALS and TECHNOLOGY DIVISION**

# EVALUATION OF 'GLASGRID' BITUMINOUS PAVEMENT REINFORCEMENT MESH AND A BITUMINOUS SEPARATION COURSE WITH AND WITHOUT LATEX
Construction Report

V. T. Barnhart

An Experimental Project by the
Michigan Department of Transportation
in cooperation with the
U.S. Department of Transportation
Federal Highway Administration

Research Laboratory Section
Materials and Technology Division
Research Projects 88 NM-845 and 89 D-56
Research Report No. R-1305


Lansing, March 1990

This project was initiated in 1988 to evaluate the use of 'Glasgrid' as a high-strength grid reinforcement mesh for bituminous pavements, and in 1989 it was expanded to include an evaluation of the use of a Modified Bituminous Base Course (9A) as a separation course for reducing reflective cracking in a bituminous overlay of an existing pavement.

There have been several installations of high-strength grid reinforcement mesh in pavement rehabilitation projects with bituminous overlays since 1980, but no long-term performance results are yet available. A Canadian laboratory study, completed in 1982, described the benefits of a high-strength grid reinforcement mesh within a flexible pavement system (1).

The concept of a separation course between bituminous overlays and concrete pavements to reduce reflective cracking was evaluated about 1962 by the Department. Several types of soil-aggregate cushions were used to act as separation courses, and the results of the evaluation were favorable (2, 3). In recent years the Department has used bituminous separation courses on several overlay projects; however, no investigative results are available.

Test sections of Glasgrid reinforcement mesh, and bituminous separation course with and without latex were placed as part of a project having concrete joint and pavement repairs and bituminous resurfacing (Control Section 73031, Job Number 26705A) on M 52 in Saginaw County. The two types of bituminous separation course were placed in October and the Glasgrid reinforcement mesh was placed in November. In addition, one section of conventional bituminous resurfacing (Bituminous Mix No. 1100T, 20AA; plus 1100L, 20AA) was placed as a comparison control section for the Glasgrid and the two types of separation course. Cross-sectional drawings showing pavement design details are presented in Appendix A.

The test section for the Glasgrid reinforcement mesh was further subdivided into two sections, each containing a different type of Glasgrid material (Glasgrid 8501 Complete Road System and Glasgrid 8502 Detail Repair System). The test section layout, including the control section, is shown in Figure 1.

The construction of the two types of bituminous separation course was done in accordance with MDOT 1984 Standard Specifications for Construction of Bituminous Base Course and Pavement (4.00) for a Modified Bituminous Base Course (9A). Materials and experimental features were covered in a "Special Provision for Separation Course 9A." The construction procedures for the Glasgrid reinforcement mesh, materials and experimental features were covered in a "Special Provision for Construction of Bituminous Pavement Reinforcement with Glasgrid Material." The special provisions for the test sections were included in the project proposal and are contained in Appendix B. The two types of bituminous separation course were produced in a conventional stationary drum mix plant owned by the paving contractor, and located in Saginaw.

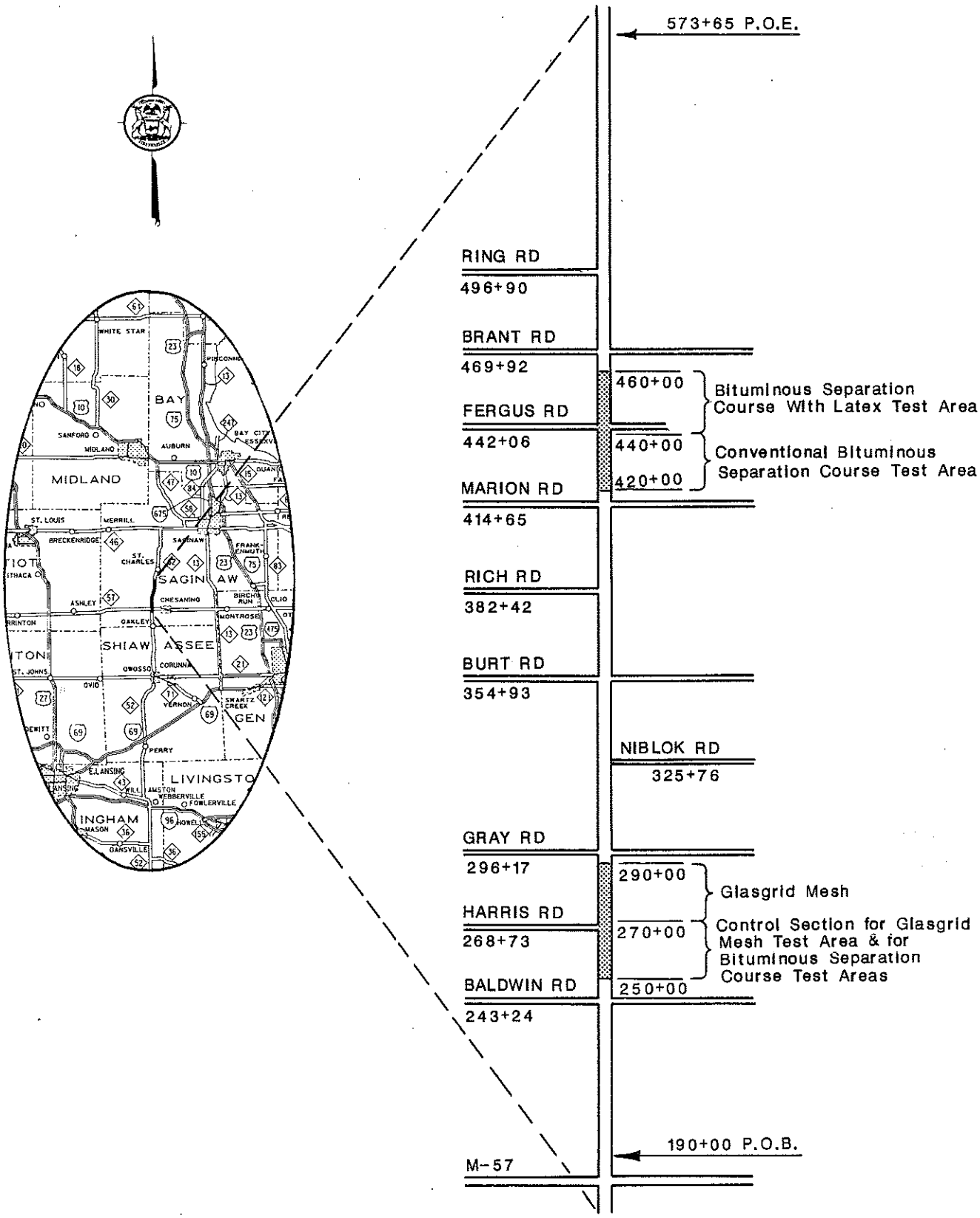



Figure 1. Glasgrid and bituminous separation course test areas, and control section locations.

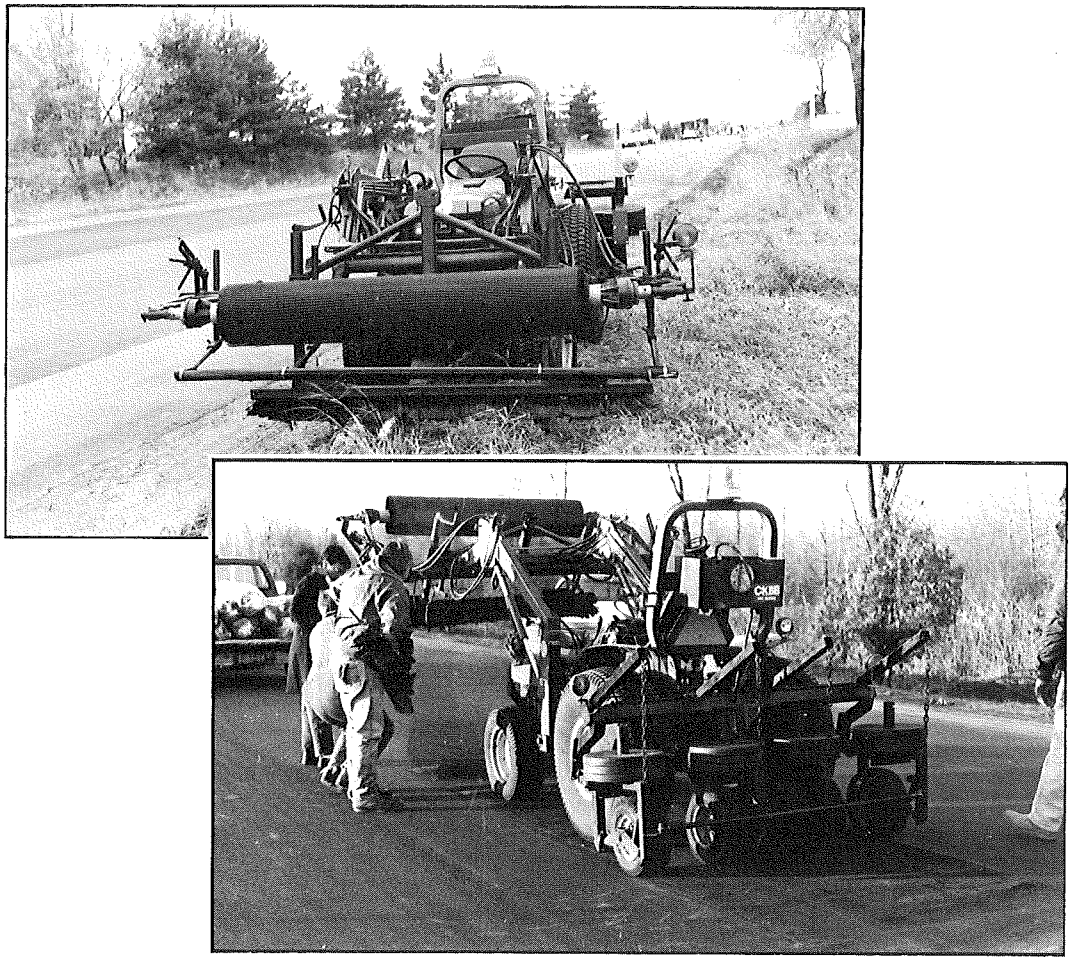


Figure 2. Modified tractor for installing the Glasgrid.

The Glasgrid reinforcement mesh was placed on a bituminous leveling course (Bituminous Mix No. 1100L, 20AA) by means of a tractor modified for the placement of the Glasgrid material (Fig. 2). The Glasgrid was placed on one lane at a time and then covered with a bituminous wearing course (Bituminous Mix No. 1100T, 20AA) at 170 lb/sq yd (1-1/2 in. thick) prior to the Glasgrid being placed on the other lane. The 5-ft wide Glasgrid strips were placed on the northbound lane first, starting at the centerline of the road and working outward toward the outside of the 3-ft shoulder ribbon (Figs. 3 and 4). It was then placed on the southbound lane starting with the overlapping of the material placed on the first pass of the northbound lane and again working outward toward the outside of the 3-ft shoulder ribbon, thus covering almost the entire paved portion of the roadway.

The bituminous separation courses, with and without latex, were both placed in a single 4-in. layer across the roadway, then covered with a bituminous leveling course (Bituminous Mix No. 1100L, 20AA) within 48

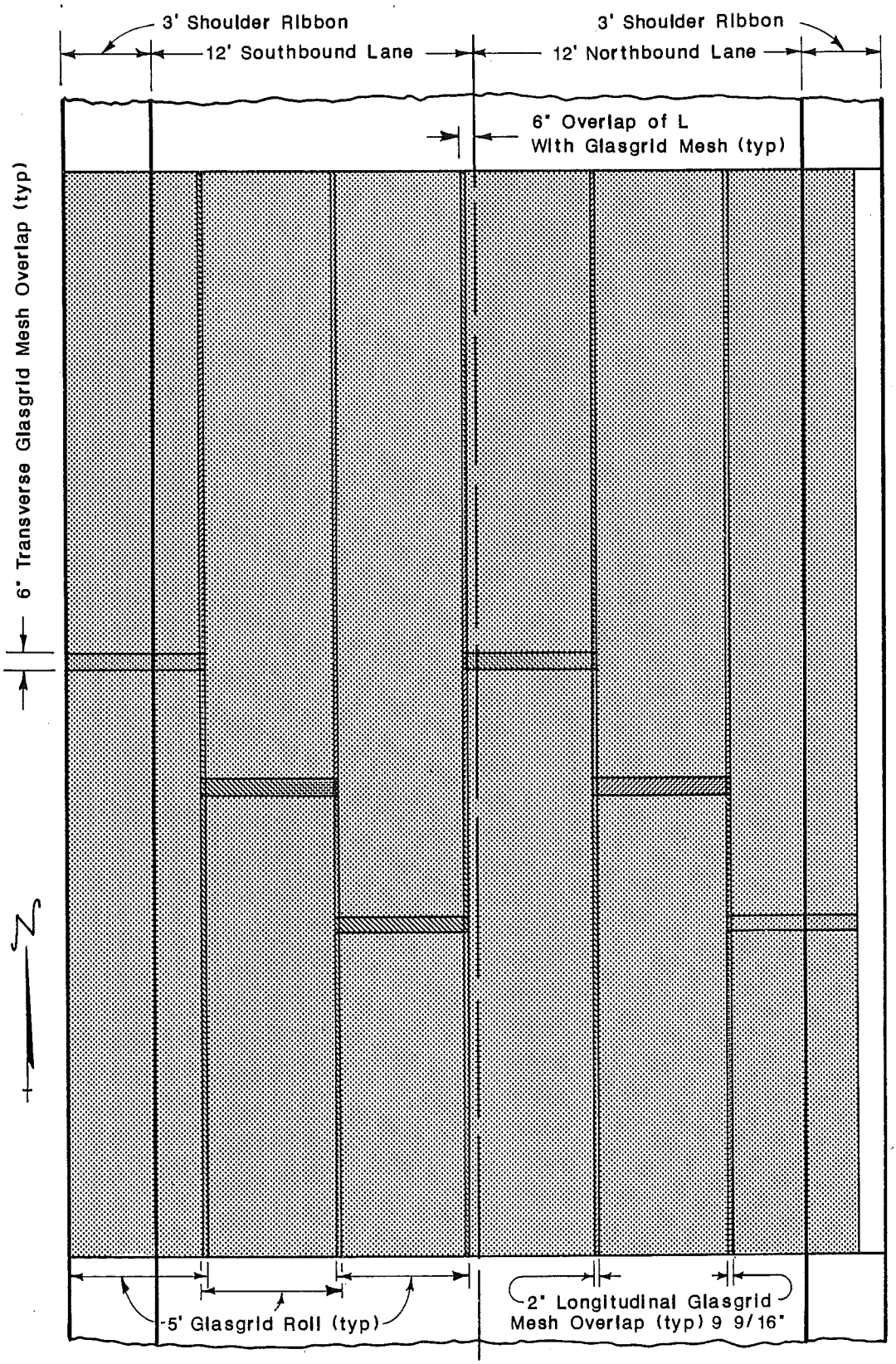



Figure 3. Typical Glasgrid coverage (M 52, Sta. 250+00 to Sta. 290+00).

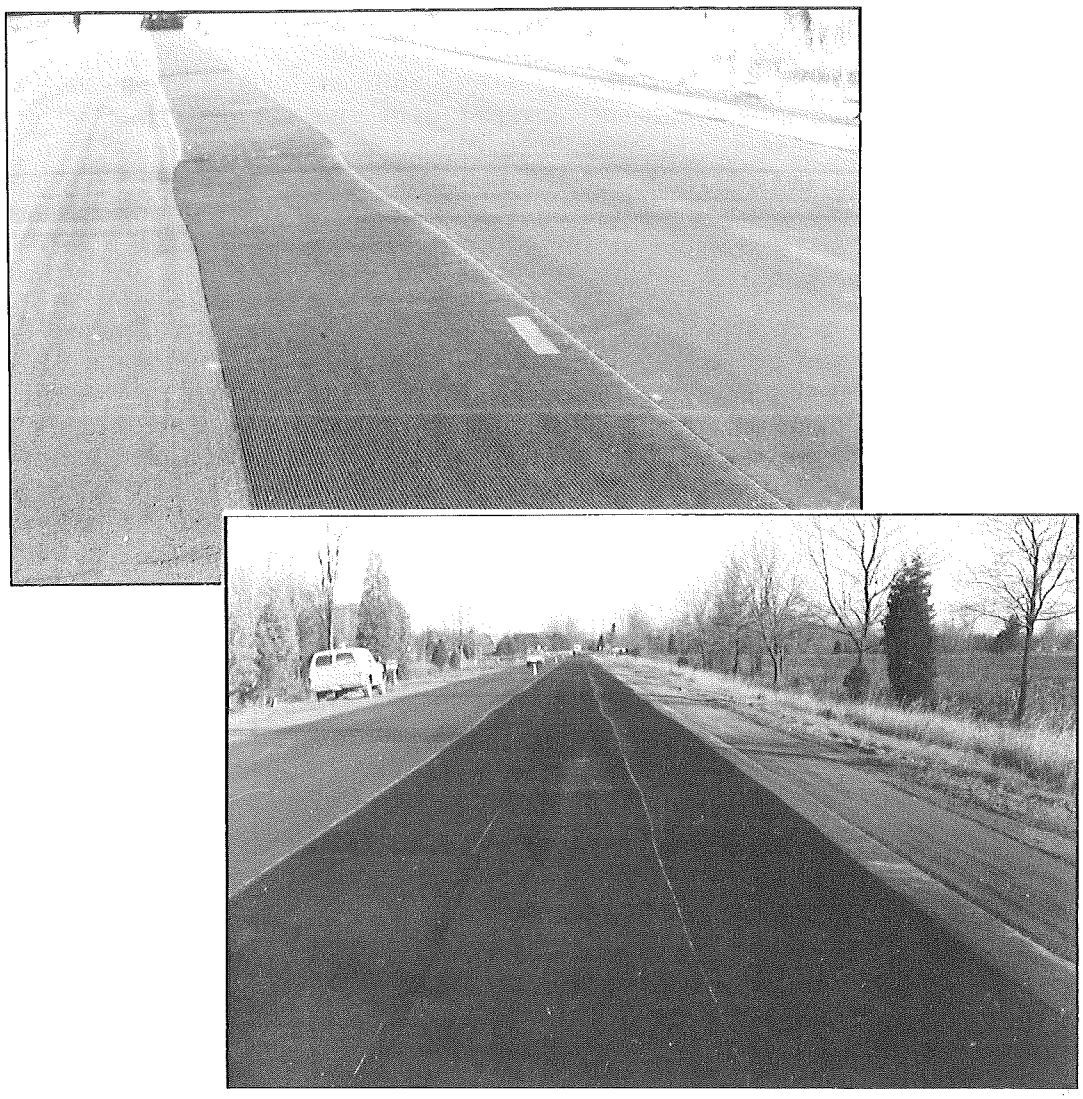


Figure 4. Glasgrid placement.

hours of placement of the separation course. Later, a bituminous wearing course (Bituminous Mix No. 1100T, 20AA) was placed over the leveling course. Because of the thickness of the separation course, it was necessary for safety purposes that at the end of each day, the separation course have the same point of ending on both lanes. The separation course was placed and compacted using the same type of equipment used for the bituminous leveling and wearing courses.

## Evaluation

The following problems occurred during the placement of the Glasgrid reiinforcement mesh.

1) During the first pass of the placement of the 8501 material on the northbound lane the material was accidentally extended past the intended split point between the 8501 and 8502 materials. To assure that the entire test area would be covered with glasgrid material the extra 8502 material that would have been placed on the northbound lane was placed on the outside edge of the southbound lane to make up for the shortage of the 8501 material on that lane. The rest of the passes of the material were stopped at the intended split point and the placement of the Glasgrid material went smoothly.

2) There were two areas where it was believed that the Glasgrid mesh had folded over on itself during the paving operation. Evidence of such a problem was the cracking that occurred in the bituminous wearing course at several locations within these areas immediately after compaction by the breakdown roller. The first area was on the northbound lane from Sta. 275+07 to Sta. 276+00. To determine if the material had folded over on itself, one of the cracks was dug out and it was found that the mesh had indeed done that (Fig. 5). The second area was on the southbound

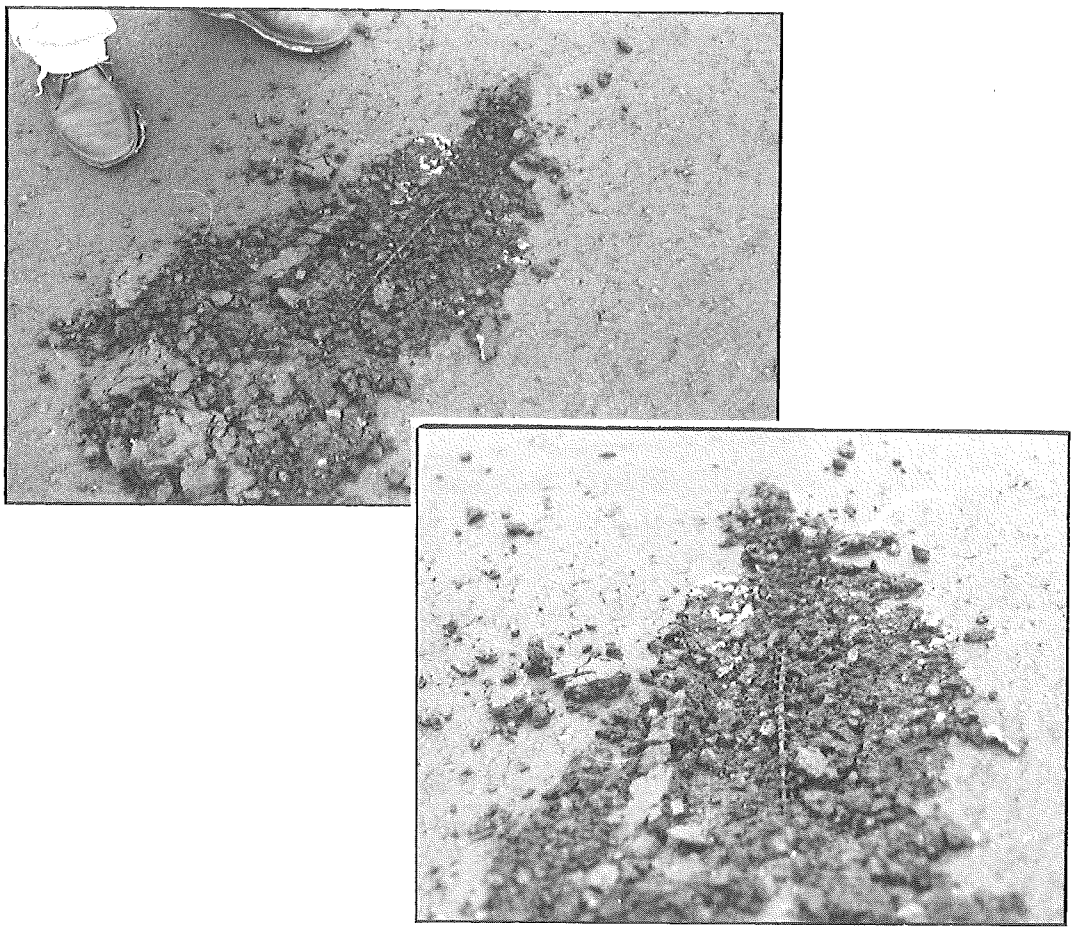


Figure 5. Glasgrid that folded over itself during the paving operation (northbound M 52).

lane from Sta. 274+27 to Sta. 274+66 and since the same type of cracking occurred there as at the first area it was assumed that the mesh had folded over itself there as well. It was noted at the second area, just before the bituminous wearing course was placed, that the mesh had been damaged, possibly by a truck stopping or starting quickly on the mesh thus loosening it sufficiently to cause it to fold over on itself. It was not noted if the same type of incident had occurred at the first area as at the second area. It should also be noted that the folding over of the mesh on itself occurred only in the center panel of the Glasgrid mesh in both areas. A representative from the manufacturer was present at the placement of the Glasgrid mesh and he indicated that this folding over of the mesh on itself should not affect the ability of the Glasgrid to stop reflective cracking.

The following problems occurred during the placement of the bituminous separation courses.

1) Because of the temperature at which the separation course with latex was placed, it was difficult getting it cool enough to allow traffic on it after the intended amount of time. If the mat was not sufficiently cool, the traffic would pick up some of the material when the lane closure was switched from one lane to the other and at the end of the day. This was especially a problem if the traffic had picked up any tack coat from the roadway prior to going onto the separation course.

2) Both types of separation course exhibited raveling and rutting of the material between the time of placement and the time it was covered with the bituminous leveling course (Fig. 6). The longer the time between the placement of the separation course and the time it was covered, the worse the raveling and rutting became (Fig. 7). The raveling and rutting were somewhat less evident for the separation course with latex than for the separation course without latex. It was found that a layer of tack coat placed on top of the separation course and allowed to dry before opening to traffic helped hold the top of the separation course together. However, it did not stop the raveling and rutting or the severity of the raveling and rutting if too much time elapsed before the leveling course was placed.

3) Difficulty was encountered in holding the separation course without latex together, even after it had cooled during the first day of placing it. This occurred when the percentage of asphalt cement in the mix was inadvertently lowered from 2.0 to 1.7 percent and the temperature of the mix was raised at the same time. The percentage of asphalt cement was raised back to 2.0 percent and the temperature was lowered and the placement continued without interruption. The material that had been placed the first day was inspected the following day. It was decided that for safety purposes, and in an effort to save the material, that covering it with bituminous leveling course was advisable even though the weather was not ideal for its placement. The area was checked prior to the placement of the bituminous wearing course and it appears to be holding up well.

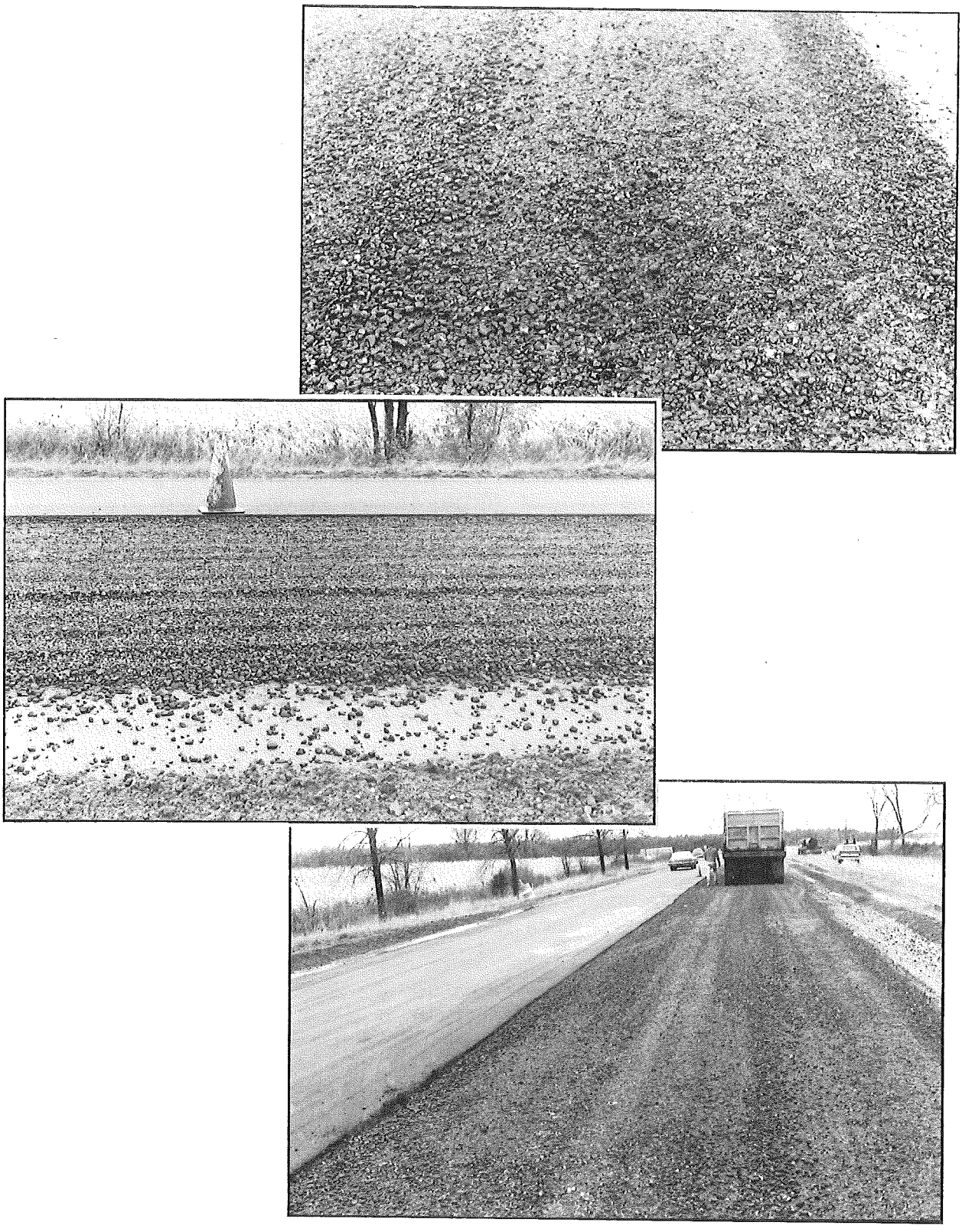


Figure 6. Bituminous separation course in fair to good condition after being opened to traffic.

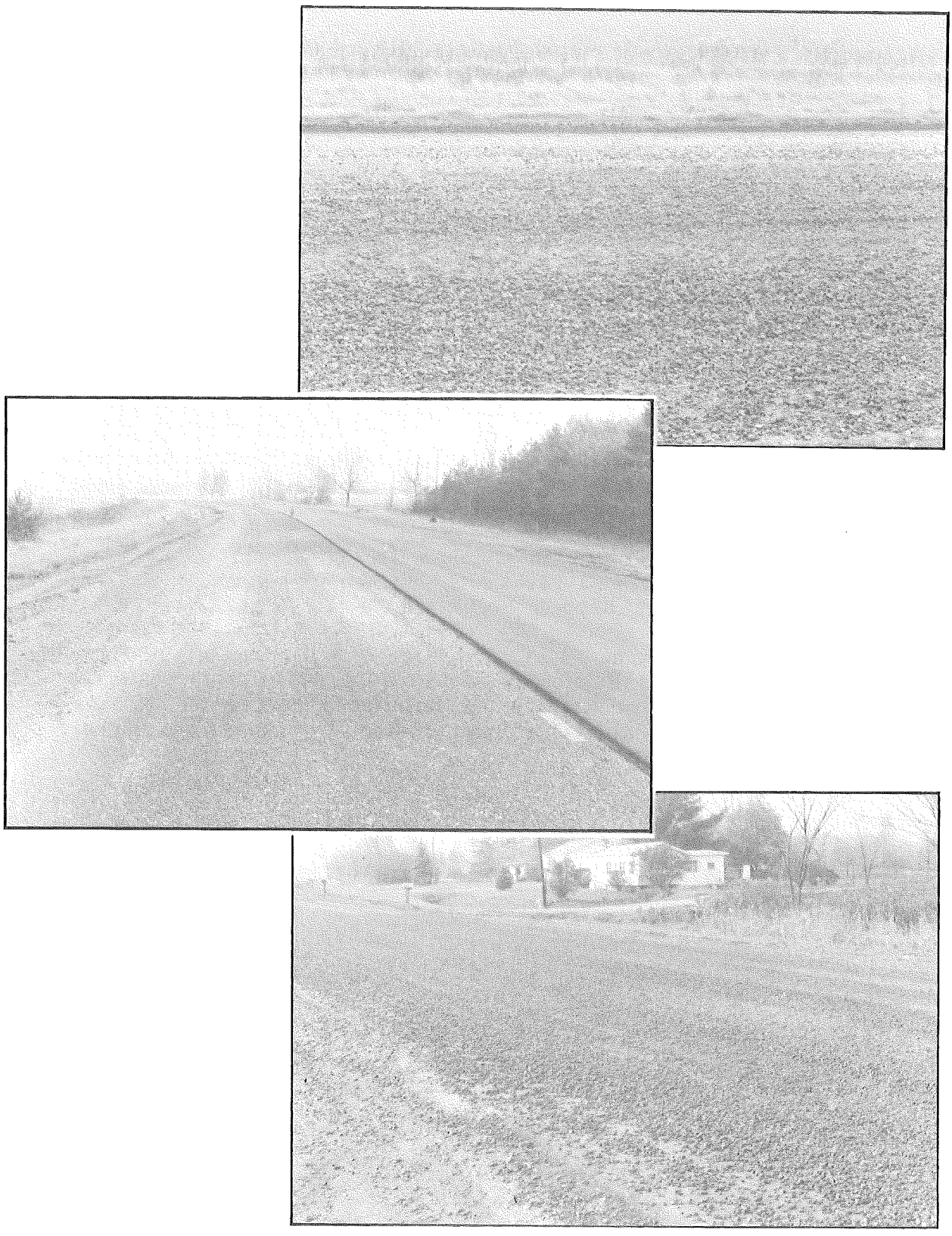


Figure 7. Bituminous separation course in poor to bad condition.

The integrity of the cross-section of the roadway where the separation course was placed should not be affected by the above noted problems.

During the next three years condition surveys and performance evaluations will be made on all of the test sections and core samples will be obtained to determine the integrity of the Glassgrid reinforcement mesh and both of the bituminous separation courses.

---

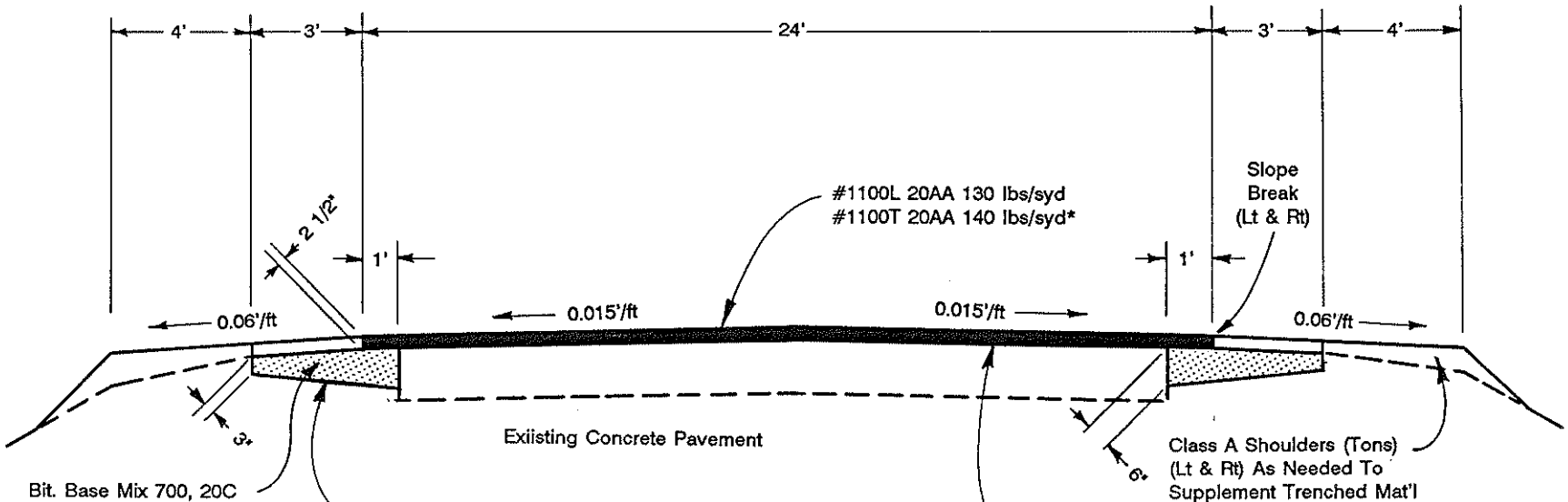
## REFERENCES


1. Halim, A. O., Hass, Ralph, and Phang, William A., "Geogrid Reinforcement of Asphalt Pavement and Verification of Elastic Theory," Transportation Research Record No. 949, pp. 55-65.

2. Copple, F., "Soil-Aggregate Cushions for Prevention of Reflective Cracking of Resurfaced Pavements," Michigan Department of Transportation Research Reports No. R-423, R-470, R-599R, and R-649.

3. Copple, F., and Oehler, L. T., "Michigan Investigation of Soil-Aggregate Cushions and Reinforced Asphaltic Concrete for Prevention or Reducing Reflective Cracking of Resurfaced Pavements," Michigan Department of Transportation Research Report No. R-649 and Highway Research Record No. 239.

# APPENDIX A

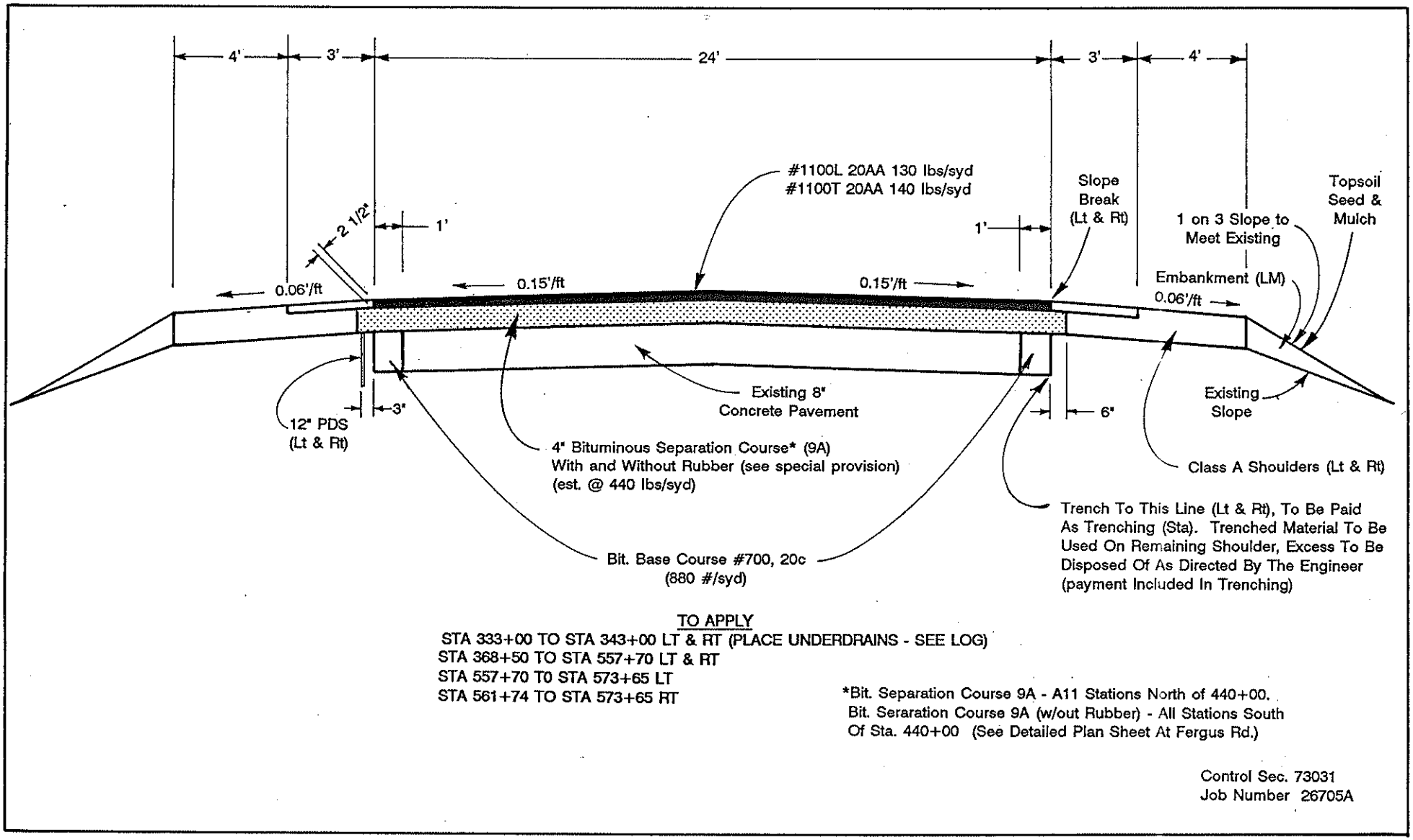



TO APPLY
STA 190+00 TO STA 333+00
STA 343+00 TO STA 368+00

*Use 1100T 20AA 170/lbs syd Where
Glasgrid Membrane Is Placed

Note: Dowelled Concrete Repairs And Detail 7 & 8
Repairs As Per Log Prior To Resurfacing.

Control Sec. M73031
Job Number 26705A




TO APPLY

STA 333+00 TO STA 343+00 LT & RT (PLACE UNDERDRAINS - SEE LOG)
STA 368+50 TO STA 557+70 LT & RT
STA 557+70 T0 STA 573+65 LT
STA 561+74 TO STA 573+65 RT

*Bit. Separation Course 9A - A11 Stations North of 440+00.
Bit. Seraration Course 9A (w/out Rubber) - All Stations South
Of Sta. 440+00 (See Detailed Plan Sheet At Fergus Rd.)

Control Sec. 73031
Job Number 26705A

# BITUMINOUS APPLICATION CHART

| ITEM | APP. RATE LBS/SYD | ESTIMATED THICKNESS | ASPHALT PENETRATION | REMARKS |
|---|---|---|---|---|
| BITUMINOUS MIX. NO. 1100T, 20AA | 140 | 1 1/4" | 120 - 150 | |
| BITUMINOUS MIX. NO. 1100T, 20AA | 170 | 1 1/2" | 120 - 150 | |
| BITUMINOUS MIX. NO. 1100L, 20AA | 130 | 1 1/4" | 120 - 150 | |
| BITUMINOUS MIX. NO. 700, 20C | 330 | 3" | 120 - 150 | |
| BITUMINOUS MIX. NO. 700, 20C | 660 | 6" | 120 - 150 | |
| BITUMINOUS MIX. NO. 700, 20C | 880 | 8" | 120 - 150 | |
| BITUMINOUS SEPARATION COURSE 9A | 440 | 4" | 120 - 150 | |
| BITUMINOUS SEPARATION COURSE 9A (w/out Rubber) | 440 | 4" | 120 - 150 | |
| BITUMINOUS BOND COAT O.O - 0.1 GAL/SYD (FOR INFORMATION ONLY NOT A BID ITEM) | | | | |



CONTROL SECTION 73031
JOB NUMBER 26705A

APPENDIX B

MICHIGAN
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

SPECIAL PROVISION
FOR
CONSTRUCTION OF BITUMINOUS PAVEMENT
REINFORCED WITH GLASGRID MATERIAL

D:PMC:blr  5/25/88

**Description:**

This work consists of the placement of GLASGRID bituminous pavement reinforcement. The GLASGRID is to be placed from station 270+00 to Station 290+00 between the bituminous concrete leveling and wearing courses. Coverage will include traffic lanes plus 3 (three) feet of paved shoulder on each side for a total width of 30 (thirty) feet.

**Materials:**

Glasgrid will be purchased from Bay Mills Limited, 277 Lakeshore Road, Suite 400, Oakville, Ontario. Bay Mills will provide the GLASGRID at a cost of $3.25 per sq. yds (which includes the use of a mechanical fabric placement tractor and the operator) delivered to the job site. Inquiries and arrangements concerning GLASGRID should be made to Mr. Jon H. Woolstencroft, Project Manager at (416)842-8808.

**Glasgrid Material:**

| | |
|---|---|
| Roll Width | 60 in. |
| Roll Length | 330 ft. |
| Roll Weight | 183 lb. |

**Glasgrid Installation:**

Glasgrid shall be installed on the leveling course in accordance with the following procedures:

The leveling course shall be made clean, smooth, dry and free of fines, oil, grease and loose or foreign material.

The placement of the Glasgrid should proceed within 30 (thirty) minutes of the placement of the wearing course. A mechanical fabric placement tractor (which meets the manufactures specifications) shall be used for applying Glasgrid to ensure a smooth, tight application, free of any wrinkles. The longitudinal overlap for strips of Glasgrid must be 2 (two) inches and the transverse overlap for strips of Glasgrid must be a minimum of 6 (six) inches. Centerline overlap is not required.

Glasgrid shall be seated with a rubber tire roller to eliminate any placement discontinuities and insure a good bonding between the Glasgrid and the leveling course.

The asphalt spreader shall not be turned sharply on the road and the hauling units shall stop and turn with care to prevent shifting of the Glasgrid.

Wearing course application and compaction may be performed in the usual manner after Glasgrid placement has been completed.

It is recommended that gloves be worn when handling this product.

A pre-bid meeting will be scheduled by MDOT to discuss Glasgrid installation.

The contractor shall be responsible for scheduling the placement of Glasgrid with Bay Mills Limited.

**Open to Traffic:**

The area where the Glasgrid was placed may be opened to construction traffic in accordance with the manufacturer's specification or as directed by the Engineer. No general traffic shall be allowed on the area where the Glasgrid was placed until the wearing course has been placed.

**Measurement and Payment:**

The completed work as measured for BITUMINOUS PAVEMENT REINFORCEMENT will be paid for at the contract unit prices for the following contract item (pay item).

| Pay Item | Pay Unit |
|---|---|
| Glasgrid | Square Yard |

Glasgrid will be measured by area in square yards with no allowances for necessary laps and splices.

MICHIGAN
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAYS

SPECIAL PROVISION
FOR
SEPARATION COURSE 9A

a. Description.-This work shall consist of furnishing materials, blending them in the proper proportions and placing them in the specified manner. This work shall be done in accordance with the applicable requirements of Sections 4.00, 7.10, and 8.02 of the 1984 Standard Specifications, except as otherwise specified herein.

Separation Course Mixture

b. Materials.-The materials shall meet the requirements specified herein or shall meet the requirements specified in the section of the 1984 Standard Specifications designated, as follows:

1. Bituminous Materials 8.04
2. Aggregate (9A Gradation and Physical Requirements) 8.02
3. Rubber Compound.-The rubber compound to be used in the bituminous concrete mixture shall be an approved unvulcanized virgin synthetic rubber in the liquid latex form. The Manufacturer of the rubber compound shall provide a written certification showing the target value for total rubber solids content of the rubber compound and containing actual test results showing compliance with the following requirements for ash content and viscosity:

| | |
|---|---|
| Allowable Range of Target Value for Total Rubber Solids, % by Weight | 45-72% |
| Allowable Variation from Target Value for Total Rubber Solids, % by Weight | ± 1% |
| Ash, % of Total Rubber Solids, ASTM D297, maximum | 3.5% |
| Viscosity, Brookfield Units, Model RVF, Spindle No. 2 at 20 rpm at 25C, maximum | 2000 |

The rubber compound shall be compatible with the reference asphalt such that the following properties are exhibited:

| | |
|---|---|
| Softening Point, C Raise from Reference Asphalt, ASTM D 36, minimum | 8 |
| Penetration at 25C, 100 g, 5 sec., mm/20 drop from Reference Asphalt, ASTM D 5, minimum | 6 |
| Viscosity, Poises, 60C, minimum | 2500 |
| Penetration at 4C, 200 g, 60 sec, mm/10 increase from Reference Asphalt, ASTM D5, minimum | 1 |
| Ductility at 4C., 1 cm/min., ASTM D113 | 150+ |

The rubber compound shall be compatible with the reference asphalt and reference aggregates such that the following properties are exhibited:

| | |
|---|---|
| Dispersion of Rubber: Number of remaining black particles visible to the naked eye | None |

c. Composition of the Bituminous Mixture.-The 9A aggregate will be blended with the bituminous material of the grade specified at the following proportions (by total weight):

| | |
|---|---|
| 9A Aggregate | 97% to 98 1/2% |
| Bituminous Material | 1-1/2% to 3% * |

*The Engineer can increase the percentage of asphalt cement above 3% if needed to ensure coating of aggregates.

The mixture shall be produced as per Section 7.10 of the 1984 Standard Specifications except as herein specified.

d. Rubber Compound Handling Equipment.-The rubber insertion equipment shall be capable of precisely metering and uniformly distributing the latex into the asphalt mixture. The insertion system shall be calibrated in order to verify that the output rate is matched with the plant production rate within the specified tolerance.

e. Bituminous Plant.-The use of a surge bin for the storage of bituminous mixtures will be permitted. The maximum time material may be stored in a surge bin is 30 minutes. If drainage of the asphalt from the mixtures occurs during the use of the surge bin, the time allowed for storage shall be reduced until there is no drainage of the rubber-asphalt separation course.

f. Composition of Rubber-Asphalt Mixture.-The rubber-asphalt required for the mixture shall contain rubber solids whose weight equals 3 $\pm$ 0.3 percent of the weight of the asphalt cement. The asphalt cement shall be penetration grade 120/150 asphalt cement or viscosity grade AC-5. In batch plants the rubber compound shall be added to the pugmill approximately 10 seconds after the addition of the asphalt cement. In drum plants the rubber compound shall be added at a point after the aggregate has been coated with asphalt cement but at a distance from the discharge end of the drum adequate to insure thorough mixing.

g. Mixture Temperature Limitations.-The temperature of the aggregate when introduced into the mixture shall not exceed 380 F; this maximum temperature limit for the aggregate will be lowered if it is found that the rubber-asphalt binder is separating from the aggregate while transporting to the job site. The mixture shall be placed at a temperature of not less than 300 F nor greater than 350 F as measured in the hauling unit just prior to unloading into the spreader when rubber is present in the mixture.

h. Weather Limitations.-The mixtures shall not be placed unless the surface to be paved is dry. The minimum air temperature for placement shall be 50 F.

i. The pavement section from the Pickerel River Bridge (station 368+50$\pm$) northerly to station 440+00 shall not have the rubber compound added to the Separation Course 9A. Asphalt cement of the proper grade only shall be used in the mixture.

## Construction Methods

Construction methods shall meet the requirements of Section 4.00 of the 1984 Standard Specifications for Construction, except as otherwise specified herein. The separation course shall be Plant-Mixed and placed directly over the prepared existing concrete pavement, aggregate shoulders or bituminous base mixture in one course of 440 pounds per square yard and shall provide a mat approximately four inches thick.

Bond Coat: Bond coat will be required at a rate as specified by the engineer.

Placing Separation Course Mixtures.-The work shall be planned such at the completion of each day's paving operations, all lanes will have been resurfaced with the same point-of-ending. A temporary bituminous construction joint, 25 feet in length, shall be placed at the end of each day's resurfacing sections prior to placement of traffic. The joint shall be of a bituminous mixture suitable for a smooth transition. The joint shall be removed prior to commencing the subsequent paving operation.