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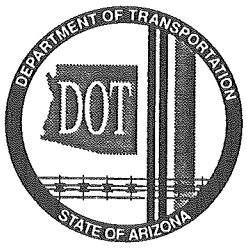

ARIZONA DEPARTMENT OF TRANSPORTATION

REPORT NUMBER: FHWA-AZ-8801

PAVING FABRICS FOR REDUCING REFLECTIVE CRACKING

Construction Report

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Prepared for:
Arizona Department of Transportation
206 South 17th Avenue
Phoenix, Arizona 85007
in cooperation with
U.S. Department of Transportation
Federal Highway Administration

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16. Abstract (21 lines including this one - delete this comment)

This report documents the installation of three commercially available paving fabrics for the reduction of reflective cracking in asphalt overlays. The fabrics installed were Paveprep, Glassgrid, and Tapecoat. The test section is in Willcox, Arizona, on State Route 186. The Willcox rehabilitation project, RS-274-(8)P, involved milling and replacing 2 inches of asphalt concrete, and placing pavement reinforcing fabric. A total of 600 linear feet of each product were placed over transverse cracks, and an additional 100 to 300 feet of each product were placed over random cracks. Markers were placed on the curbs to help monitor the performance of the fabrics during the next 3 years. Problems which occurred during installation of the fabrics are described. Recommendations include the need for proper binder coat selection when paving fabrics are used in pavement rehabilitation, the need for additional field testing of Paveprep on milled surfaces, and caution regarding the use of Glassgrid on rough surfaces.

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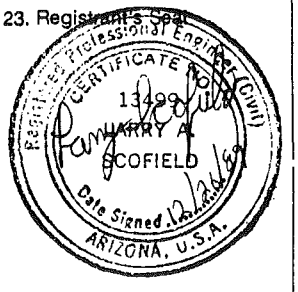
Paving fabrics, Reflective cracking, Paveprep, Glassgrid, Tapecoat	Document is available to the U.S. Public through the National Technical Information Service, Springfield, Virginia, 22161	

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

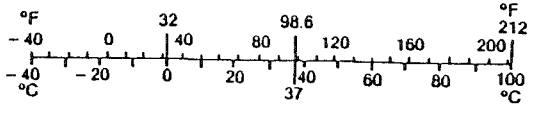
Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimetres	mm
ft	feet	0.305	metres	m
yd	yards	0.914	metres	m
mi	miles	1.61	kilometres	km
AREA				
in^2	square inches	645.2	millimetres squared	mm^2
ft^2	square feet	0.093	metres squared	m^2
yd^2	square yards	0.836	metres squared	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	kilometres squared	km^2
VOLUME				
fl oz	fluid ounces	29.57	millilitres	mL
gal	gallons	3.785	litres	L
ft^3	cubic feet	0.028	metres cubed	m^3
yd^3	cubic yards	0.765	metres 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	Celcius temperature	°C

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimetres	0.039	inches	in
m	metres	3.28	feet	ft
m	metres	1.09	yards	yd
km	kilometres	0.621	miles	mi
AREA				
mm^2	millimetres squared	0.0016	square inches	in^2
m^2	metres squared	10.764	square feet	ft^2
ha	hectares	2.47	acres	ac
km^2	kilometres squared	0.386	square miles	mi^2
VOLUME				
mL	millilitres	0.034	fluid ounces	fl oz
L	litres	0.264	gallons	gal
m^3	metres cubed	35.315	cubic feet	ft^3
m^3	metres 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	Celcius temperature	1.8C + 32	Fahrenheit temperature	°F



* SI is the symbol for the International System of Measurement

(Revised April 1989)

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1. INTRODUCTION

1.1 Background

Pavement rehabilitation is rapidly becoming the most important issue facing highway departments. The Arizona Department of Transportation (ADOT) is no exception. ADOT is responsible for 7,585 center line miles of pavement, of which 5,865 miles are asphalt concrete pavement. In the next 10 to 20 years the majority of this pavement will require major rehabilitation or replacement in order to maintain it at it's current level of performance.

A common form of rehabilitation of hot mixed asphalt concrete (HMAC) pavement has been asphalt concrete (AC) overlays. One of the problems with overlays has been the propagation of the original cracks through the overlay. This process, commonly referred to as reflective cracking, often occurs in 1 to 2 years and can rapidly deteriorate the performance of the pavement.

Reflective cracking is not a new phenomenon and as such many different techniques of reducing it have been tried. Among these techniques are stress absorbing membranes, asphalt-rubber binder, thicker overlays, asphalt additives, and paving fabrics. Some of these methods can reduce the amount and rate of cracking but currently there is no method of completely eliminating reflective cracking.

Although Arizona has been successful in using asphalt-rubber stress absorbing membrane interlayers (SAMI), in some cases the existing pavement only has localized distress and it is not cost effective to apply a SAMI across the entire pavement. For projects where only portions of the pavement require treatment, there is a need for a more economical method of reducing reflective cracking.

A number of manufacturers are producing fabrics that they claim will reduce reflective cracking. These fabrics are promoted for both full roadway width and localized "Band-Aid" treatment.

1.2 Purpose of Project

Three paving fabrics namely Paveprep, Glassgrid, and Tapecoat were submitted by their manufacturers to ADOT's Product Evaluation Committee. The committee recommended in June 1987 that these products be incorporated into an experimental project as part of the Arizona Transportation Research Center's (ATRC) experimental projects program, in order to evaluate their ability to mitigate the propagation of reflective cracks through asphalt overlay. Two asphalt overlay projects, which were scheduled for bid in February 1988, were proposed as candidate test sites by the Materials section of ADOT. These projects were:

1) S-366-937, on U.S. Route 89A in Oak Creek, Flagstaff, from mileposts 390.5 to 401.0, and

2) RS-274-(8)P, on State Route 186 (locally named as Rex Allen Drive), in Willcox, from mileposts 326.44 to 327.48.

The pavement of the first project (U.S. 89A) was originally constructed in 1940 and consisted of 2 in. of bituminous material over 12 in. of base material. In 1972, a 2-in. overlay was placed over the original pavement. Since then the only work has been routine maintenance. The research section of ADOT made a visual inspection in August 1987 to evaluate the existing pavement condition of the project. From field inspection it was found that the cracks were spalled and had produced transverse crack patterns as wide as 1 to 2 ft.. These wide cracks obviously could not be treated with small width paving fabrics such as the 4-in. or 6-in. wide Tapecoat. Moreover, the products being evaluated were not designed to bridge over such wide spalls. As a result this project was found unsuitable as a test site. Another concern was that the project could not allow all three fabrics to be evaluated on the same test section because of the severity of cracking.

On the other hand, the second project in Willcox had moderate to high distress condition with little spalling in the transverse cracks. The field inspection conducted in September, 1987 revealed suitability of this project as a test site. The widths of transverse cracks were found to be less variable, 0.5 to 1 in. wide, and quite uniformly spaced between 100 and 150 ft.. Out of the 30 to 40 cracks observed, approximately two thirds (20 to 25) were relatively straight and ran across the entire width of the pavement. This is a desirable feature in conducting a field experiment since it reduces variability between the objects, and facilitates future monitoring of the crack reflection through the overlay. The remaining cracks were either only 3 or 4 lanes wide or did not run across the pavement. The southern part of the project had moderate block cracking and low severity alligator cracking. There were also a few localized areas of ravelling. The roughness of the roadway surface was measured with a Maysmeter and a roughness value of 348 inches/mile was observed in the project location. Considering all these distress aspects of the pavement, this overlay project in Willcox was selected for installing the three paving fabrics side by side, in several replicates, for conducting the field evaluation experiment.

2. PROJECT LOCATION

The pavement rehabilitation project, a portion of which was selected as the test section for experimental fabric installation, is located on state route 186 and involved rehabilitating 1.04 miles of Rex Allen Drive in Willcox, Arizona. The project, RS-274-(8)P, begins at mile post 326.44 (station 24+30) near Interstate 10 and proceeds east to the intersection of Business 10 at mile post 327.48 (station 79+78).

The Willcox area includes most of the northern half of Sulphur Spring Valley in Cochise county and a small part of Graham county. The area is located 160 miles south east of Phoenix and 70 miles east of Tucson. The elevation of Willcox is 4190 ft. (project elevation 4255 ft.) and it is in

a transition zone between the desert and the higher elevations. Average annual precipitation is 12 to 14 in., average annual air temperature is 60 to 62^{O}F, and the frost-free season is 175 to 200 days. The seasonal variation in temperature is shown in FIGURE 1 and the seasonal variation in precipitation is shown in FIGURE 2. The figures were prepared based on data presented in a 1976 report titled Soil Survey of Willcox Area, Arizona (pp.70.). Topographically, Willcox is a closed basin that has interior drainage to Willcox Playa at the lowest part of the valley. Terrain features are flat and level. The soils in the area consist of moderately consolidated alluvium, poorly consolidated alluvium, and unconsolidated alluvium. All soils are highly alkaline in nature.

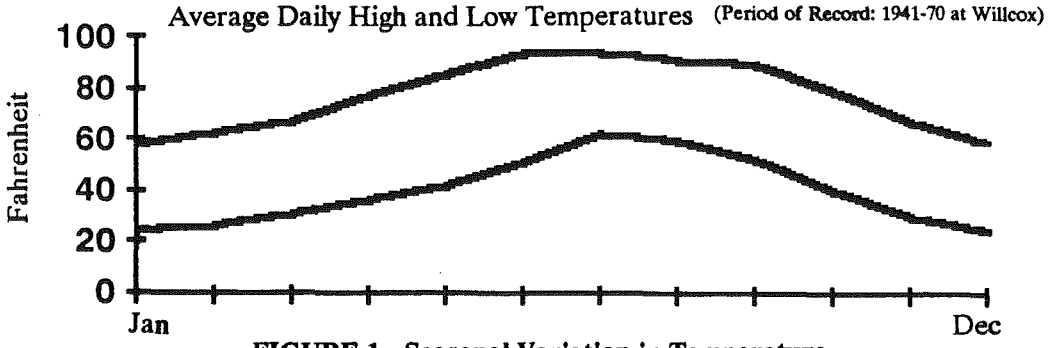


FIGURE 1 - Seasonal Variation in Temperature.

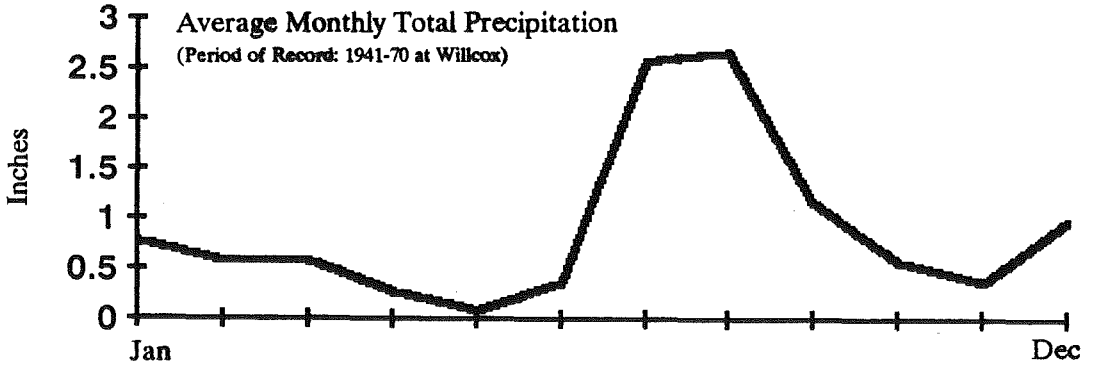


FIGURE 2 - Seasonal Variation in Precipitation.

FIGURE 3 depicts the test section of the project (station 24+30 to 56+53) where three paving fabrics were installed on transverse cracks prior to overlay placement. The stations which mark crack locations in the figure were fixed based on measured distances between cracks and with reference to station 24+30. The station 24+30 was used as a reference since it was marked on the roadway by the survey personnel. It should be noted here that the stationing which has been used in the figure is not consistent with the actual stationing as defined on the construction project plans. This is because the project stationing consists of six discontinuous segments and the governing equations for converting stations to mile posts are somewhat cumbersome.

RS-274(8)P
EXPERIMENTAL REINFORCING FABRIC INSTALLATION
PLANS AS BUILT

Location of Cracks by Stations

CRACK ID	1A	1B	1C	1D	2A	2B	2C	2D	3A	3B	3C	3D	4A	4B	4C	4D
STATION	24 + 30	25 + 00	25 + 51	28 + 20	29 + 02	30 + 00	31 + 40	32 + 25	33 + 20	34 + 20	35 + 00	36 + 70	37 + 75	38 + 98	39 + 55	41 + 05
CRACK ID	5A	5B	8B	8A	5C	8D	5D	6A	6B	6C	6D	8C	7A	7B	7C	7D
STATION	41 + 70	43 + 30	44 + 15	44 + 70	46 + 65	47 + 20	47 + 50	48 + 00	48 + 75	49 + 20	50 + 30	53 + 00	53 + 35	54 + 12	54 + 57	55 + 12

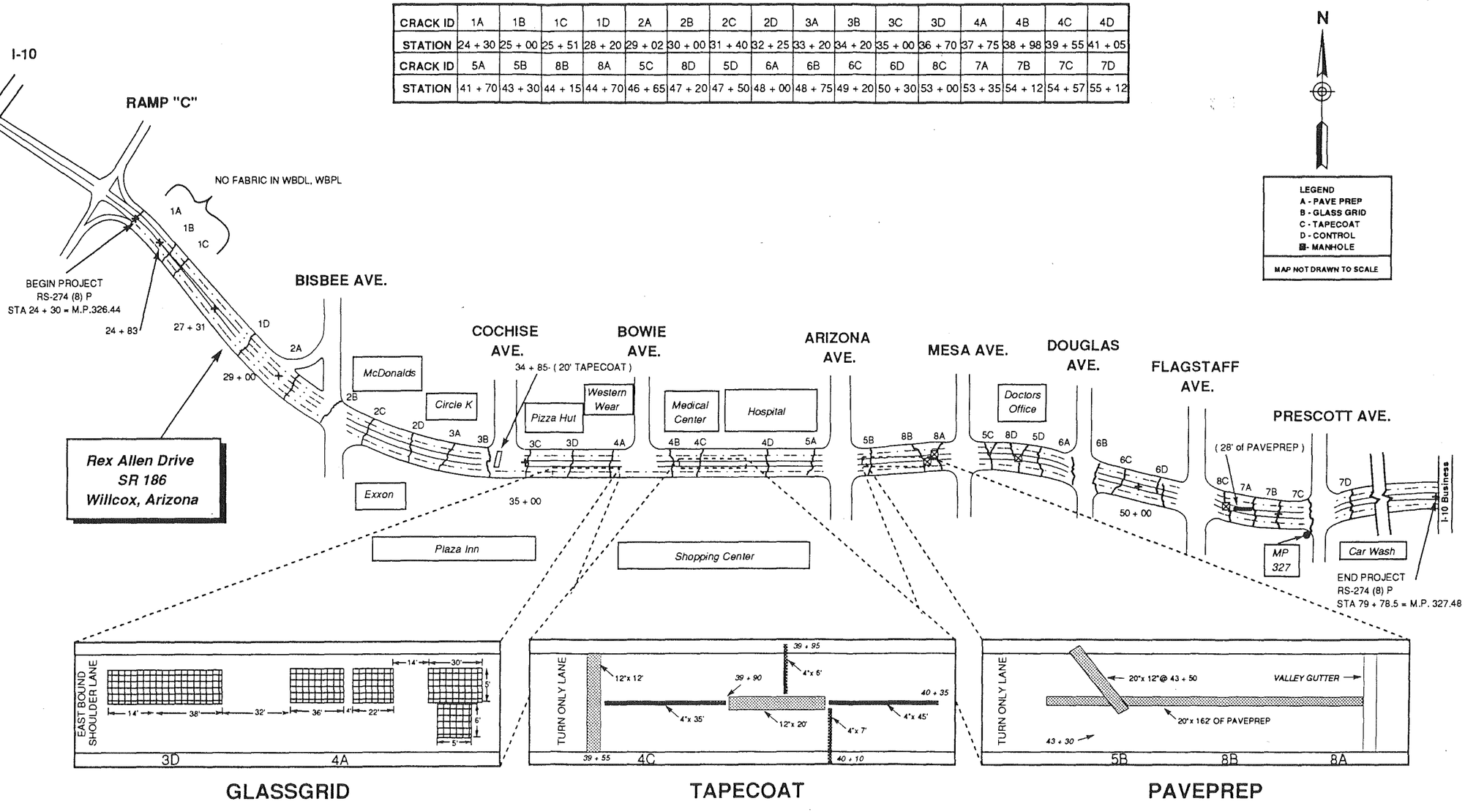


FIGURE 3 - As Built Plan.

3. PROJECT DESCRIPTION

3.1 Existing Roadway

The roadway is 64 ft. wide and has 2 lanes in each direction plus a center turning lane. A certain segment of the roadway does not have the center lane, which spans between stations 24+30 and 27+31. The annual average daily traffic (AADT) on the roadway is 5300 vehicles/day consisting primarily of passenger vehicles.

The existing pavement was constructed in 1971 and consisted of 6 in. of cement treated base (CTB), 5.5 in. of asphalt concrete (AC), and 0.5 in. of asphalt concrete friction course (ACFC). FIGURE 4 depicts the layout of the original pavement lifts.

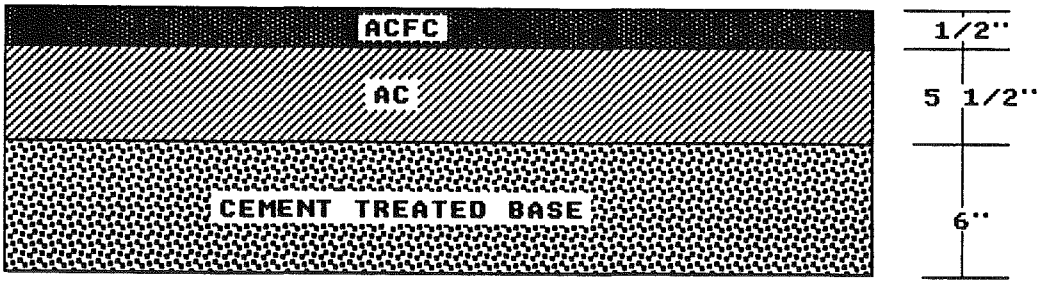


FIGURE 4 - Original Pavement Section.

3.2 Construction Features

The construction project, RS-274-(8)P, consisted of furnishing and placing asphalt concrete, removal of asphalt concrete, furnishing and placing pavement reinforcing fabric, constructing concrete wheel chair ramps and other incidental work.

The work under pavement reinforcing fabric item consisted of furnishing all equipment, materials, labor, and placing by use of mechanical equipment, between station 56+61 to 79+78, a reinforcing interlayer between the milled surface and the surfacing course. The fabric was required by specification to be nonwoven polyester, polypropylene, or polypropylene/nylon materials conforming to the standards given in TABLE 1. The contractor chose to use Travira Spunbound as the pavement reinforcing fabric between the specified stations of the project.

The specification required surface preparation, and a binder coat of paving grade asphalt (AC-30). The milled surface was specified to be open to normal traffic not more than 72 hours, and the bare reinforcing fabric was specified not to have public traffic except turning vehicles. The rate of binder coat application was specified by a range of 0.25 to 0.30 gallons/square yard. It was recommended that the binder coat application be reduced at the intersections by approximately 20%, to minimize the chance of developing a slippage plane.

TABLE 1. - Specifications for Pavement Reinforcing Fabric.

Weight, Oz,/sq.yd., ASTM Designation: D 1910	3.0 to 8.0
Grab Tensile Strength (1-inch grip), Pounds, ASTM Designation: D 1117	90 min.
Elongation at Break, % ASTM Designation: D 1117	40 min.
Fabric Thickness, ASTM Designation: D 461	30 to 100 mils

The work under experimental fabrics installation consisted of furnishing and applying 3 experimental fabrics to function as interlayers between the milled surface and 2-in. AC overlay to control reflection cracking. These fabrics were supplied by their respective manufacturers for experimental use and the work consisted of furnishing the equipment, materials and labor required in applying these fabrics (between station 24+30 to 56+53) to the milled surface directly over the existing transverse cracks.

4. EXISTING PAVEMENT PERFORMANCE

The project was scheduled for an overlay because the level of roughness and the amount of cracking was increasing rapidly. Cracking involved 0.5-in. wide transverse cracks and occasional "random cracking" throughout the project. The term random cracking has been used in this report to define a group of cracking consisting of small width longitudinal cracking and alligator cracking, and small-length, small-width linear cracking either skewed or not-skewed in the transverse direction.

FIGURE 5 shows a typical transverse crack in the pavement. The transverse cracks had been filled with crack sealant, but most of the sealant had been tracked onto the pavement. The cracks were full of dirt and incompressibles. The curbs, gutters, and side walks were badly cracked as shown in FIGURE 6. It appears that the severity of cracking was increased by moisture intrusion into the subgrade.

Drainage on the road is a problem. There is no provision for removing rain water and as such the water tends to settle along the curbs and gutters. The water then migrates through the cracks and joints into the base and subgrade. FIGURE 7 depicts the drainage problem.

Subgrade samples were taken during the initial construction phase and the moisture content of the subgrade was found to be 30.7 percent.

FIGURE 5 - Typical Transverse Cracking in the Pavement.

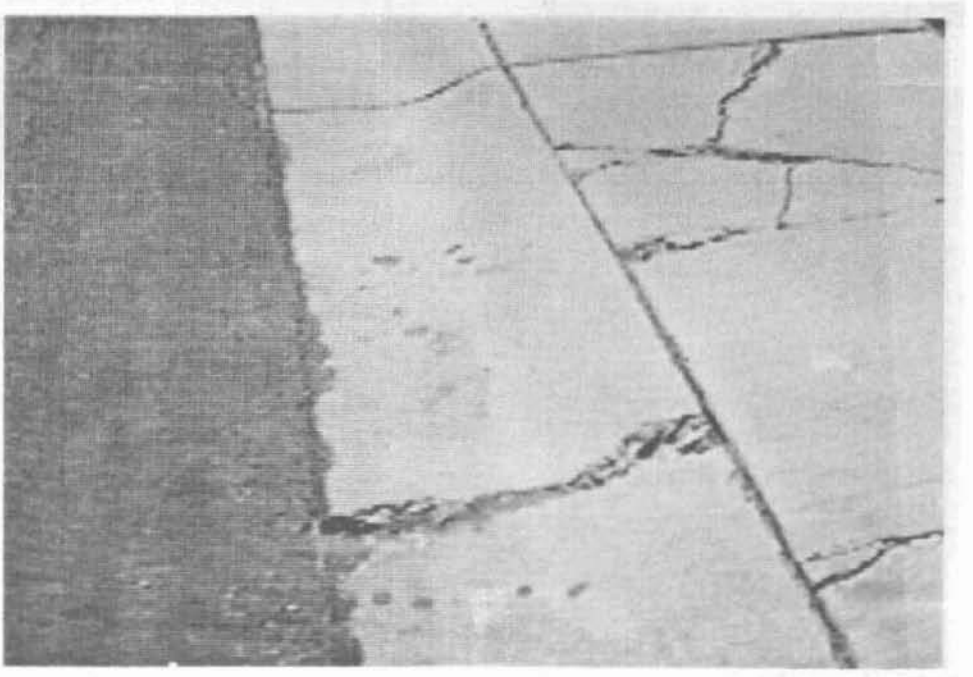


FIGURE 6 - Typical Curb Cracking.

FIGURE 7 - Curbs Filled with Rain Water.

5. EXPERIMENTAL PLAN

The purpose of installing three pavement reinforcing fabrics in the rehabilitation project is to evaluate their individual field performance in controlling reflection cracking on Arizona's highway pavements. In addition, it is intended to make a performance comparison study between the fabrics, and particularly with the "do nothing" alternative.

With these objectives, an experiment was designed which involved treating 32 transverse cracks of moderate severity with 4 treatment alternatives namely Paveprep, Tapecoat, Glassgrid, and "do nothing". The conceptual layout of the design is shown in FIGURE 8. From the figure it can be seen that the design allowed 8 replicates for each alternative. The sample size (number of replicates) of 8 was chosen based on availability of uniform full-roadway-width transverse cracks in the test section.

The eight replicates were spread over eight different locations in the test site, e.g., location 8 represents manholes. This provides a statistical design structure which blocks the effect of location variability on fabric performance in reducing reflective cracking.

The physical locations of test cracks were marked with epoxy and washer on the curb of the pavement to facilitate future monitoring and evaluation.

6. PRODUCT DESCRIPTIONS

Paveprep, previously called Prepave or Pre-Pave, is a high density polymerized asphalt mastic sandwiched between two layers of polyester fabric. FIGURE 9 displays the fabric texture. Paveprep is manufactured by International Coating Systems, Inc. It's total thickness is 120 mils and comes in 12 to 42 in. wide rolls and requires the application of an asphalt cement to bind it to the surface. The estimated freight-on-board (FOB) cost of using Paveprep is $9.00 per sq. yd. Five 20-in. wide rolls, each 102 ft. long, were used in the project and they were supplied free of cost by the manufacturer.

Glassgrid is a paving fabric manufactured by Bay Mills Limited. It is composed of glass fibers which are bundled into strands. The strands are held in place in both the transverse and longitudinal direction by a polyester thread. The grid structure, shown in FIGURE 10, is obtained by weaving the strands together. The grid structure is coated with a polymer modified asphalt cement, applied at a rate of 10 to 20% of the weight of the glass. Glassgrid is manufactured in two categories namely "detail repair" and "complete road" systems. Rolls of both systems have a width of 5 ft. and a grid size of 0.5-in. by 0.5-in. The "detail" system has double strands and as such have higher tensile strength and higher weight (20 oz/sq.yd.) compared to the "complete" system. The rolls of "detail" system are 195 ft. long and the "complete" system is 325 ft. long.

In the Rex Allen Drive project, the "detail" system of glassgrid was used, and was supplied free of cost by the Bay Mills. The cost of Glassgrid is $2.25 per square yard.

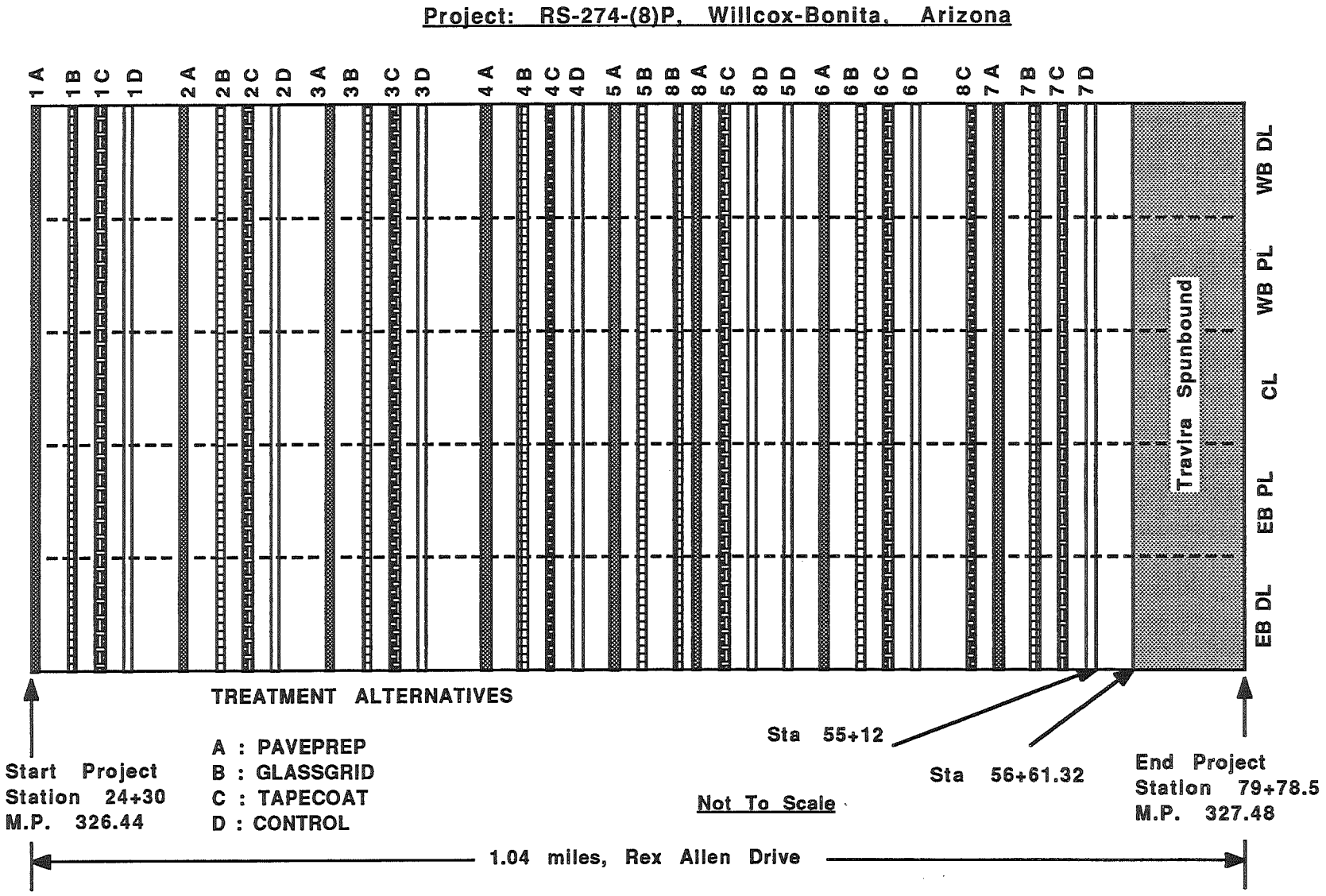


FIGURE 8 - Design of the Experiment.

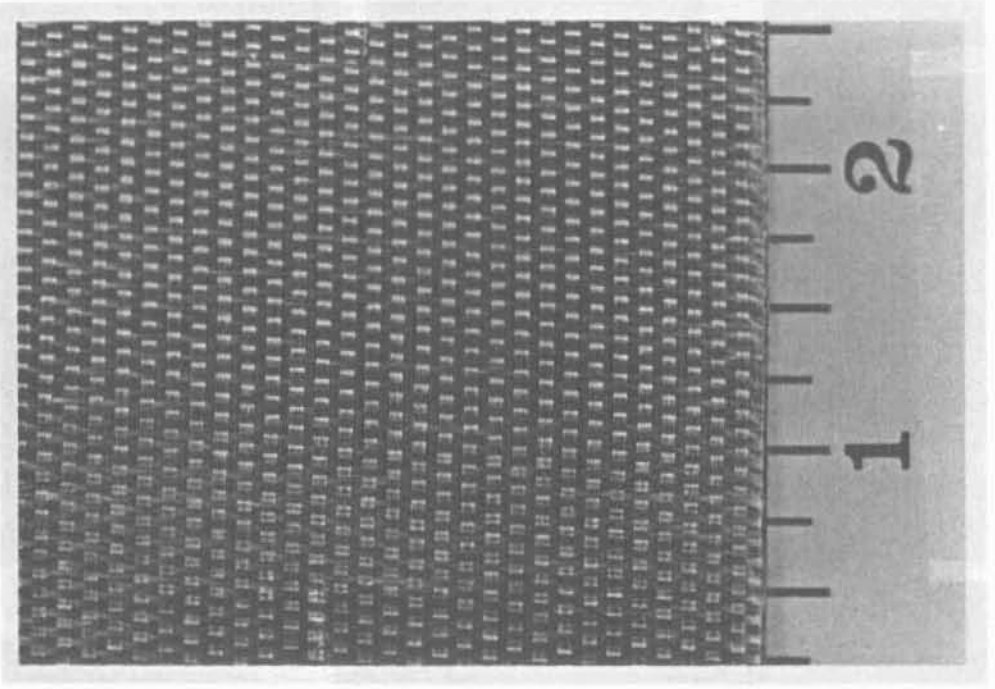


FIGURE 9 - Surface Texture of the Paveprep Fabric.

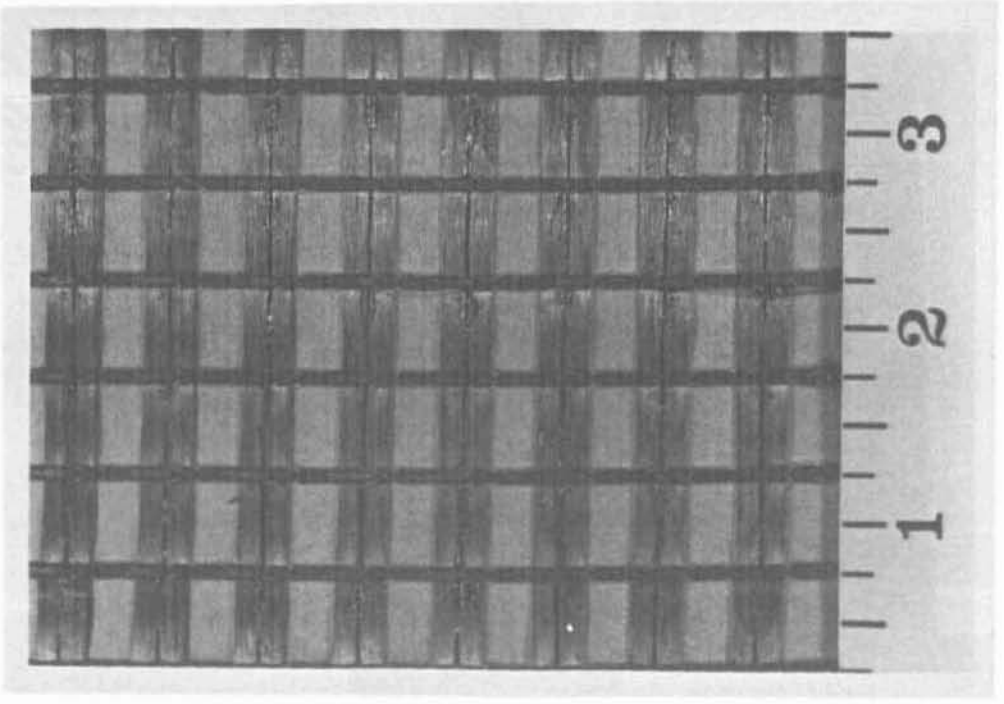


FIGURE 10 - Surface Texture of the Glassgrid Fabric.

Tapecoat M-860 is a pre-formed, cold applied, self adhering product manufactured by The Tapecoat Company. It is an elastomeric resin, adhesive bonded to a woven polymer fabric, and is available in 4, 6, and 12 in. wide rolls each 150 ft. long. FIGURE 11 illustrates the Tapecoat fabric. The Tapecoat Company offers three different price levels for their product, depending on the number of cartons purchased. A carton consists of either one 12-in roll, or two 6-in rolls, or three 4-in rolls which is equivalent to 16.67 square yards of material. The estimated costs per square yard of Tapecoat are $5.76 for 1 to 12 cartons, $4.86 for 13 to 71 cartons, and $4.14 for more than 71 cartons.

For the experimental project, the 12 in. wide rolls were used for treating the transverse cracks and 4 in. wide rolls were used for random cracks. All material was supplied by the vendor free of cost.

Samples of promotional brochure information supplied by Paveprep, Glassgrid, and Tapecoat manufacturers are given in APPENDIX A.

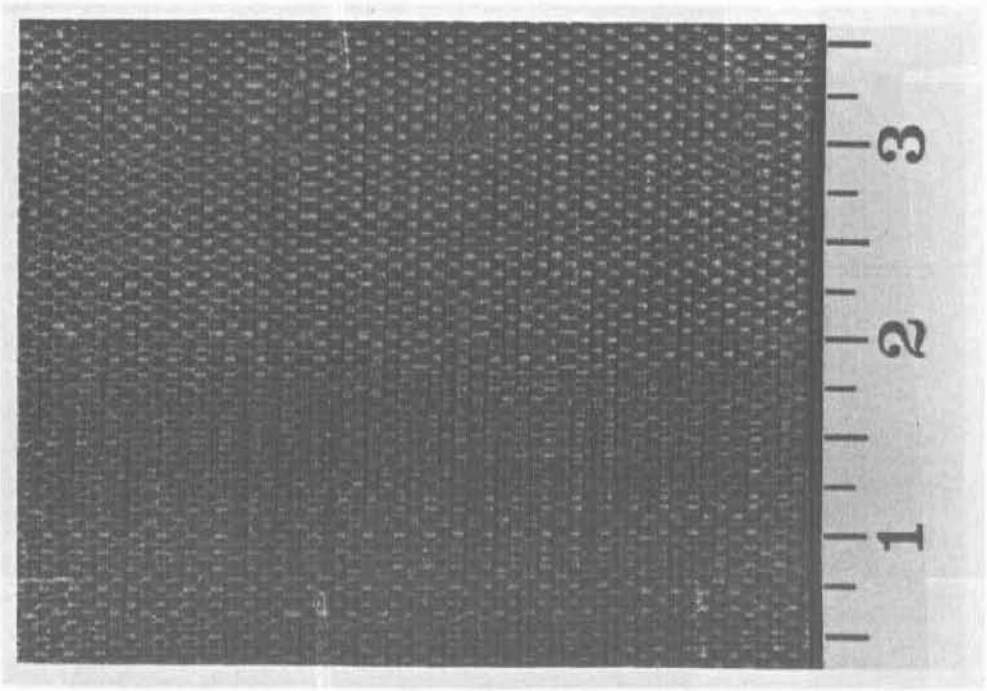


FIGURE 11 - Surface Texture of the Tapecoat Fabric.

7. CONSTRUCTION PROCEDURES

7.1 General

ADOT's District 2 provided construction inspection, testing and contract administration of the project. Mr. Noland Durnell was the resident engineer. The construction contract was awarded to the Ashton Company for the amount of $254,815.00. Project construction began on August 1, 1988 and the paving began on August 8, 1988. The contractor hired Rail-H as a subcontractor to mill the pavement. APPENDIX B lists the bid items, their quantities and unit prices.

A Caterpillar milling machine was used to mill the top 2-in. of the existing pavement. The milling machine could only mill a 6 ft. wide trench and it took almost an entire week (8/1/88 to 8/5/88) to mill out the roadway. The actual sequence of the milling activity is depicted in FIGURE 12. After milling, the contractor used a power broom to remove the debris. The power broom used in the project is shown in FIGURE 13.

Due to heavy rains and flooding of the street the contractor was unable to start paving until August 8, 1988. Immediately prior to placing the fabric the contractor again broomed the pavement to remove the remaining dirt and debris. FIGURE 14 shows the milled pavement surface. Each of the fabrics were placed on the milled pavement surface according to the ADOT special provisions. The ADOT special provisions for asphalt concrete, pavement reinforcing fabric, and experimental fabrics installation are given in APPENDIX C. A list of personnel who either observed, or inspected or supervised the project construction is given in APPENDIX D.

7.2 Paveprep

Eight transverse cracks with a total length of 600 ft. (i.e., average length of crack is 75 ft.) and 202 ft. of random cracks were treated with Paveprep. Fabric installation was carried out by lanes, similar to paving, and approximately 400 ft. ahead of the paving machine. Paveprep installation involved tacking the surface with an AC-30 paving grade asphalt, cutting and rolling out the fabric, and walking across it. FIGURE 15 shows a Paveprep installation.

During the placement of Paveprep there was a problem with the fabric not bonding to the existing pavement. As a result, several strategies were tried during construction to achieve better bonding of the fabric with the milled surface. First, the contractor applied the binder coat for the entire overlay at a rate of 0.2 gallon/sq. yd., and then laying the Paveprep. This was unsuccessful in terms of achieving good bondage between the fabric and the existing pavement surface, so the contractor tried to lay the fabric first with an AC-30 tack, and then apply the binder coat of AC-30 for the overlay. This strategy also had limited success. The supplier of the AC-30 asphalt cement did not have a paving wand with a reinforced hose to apply the tack for Paveprep installation.

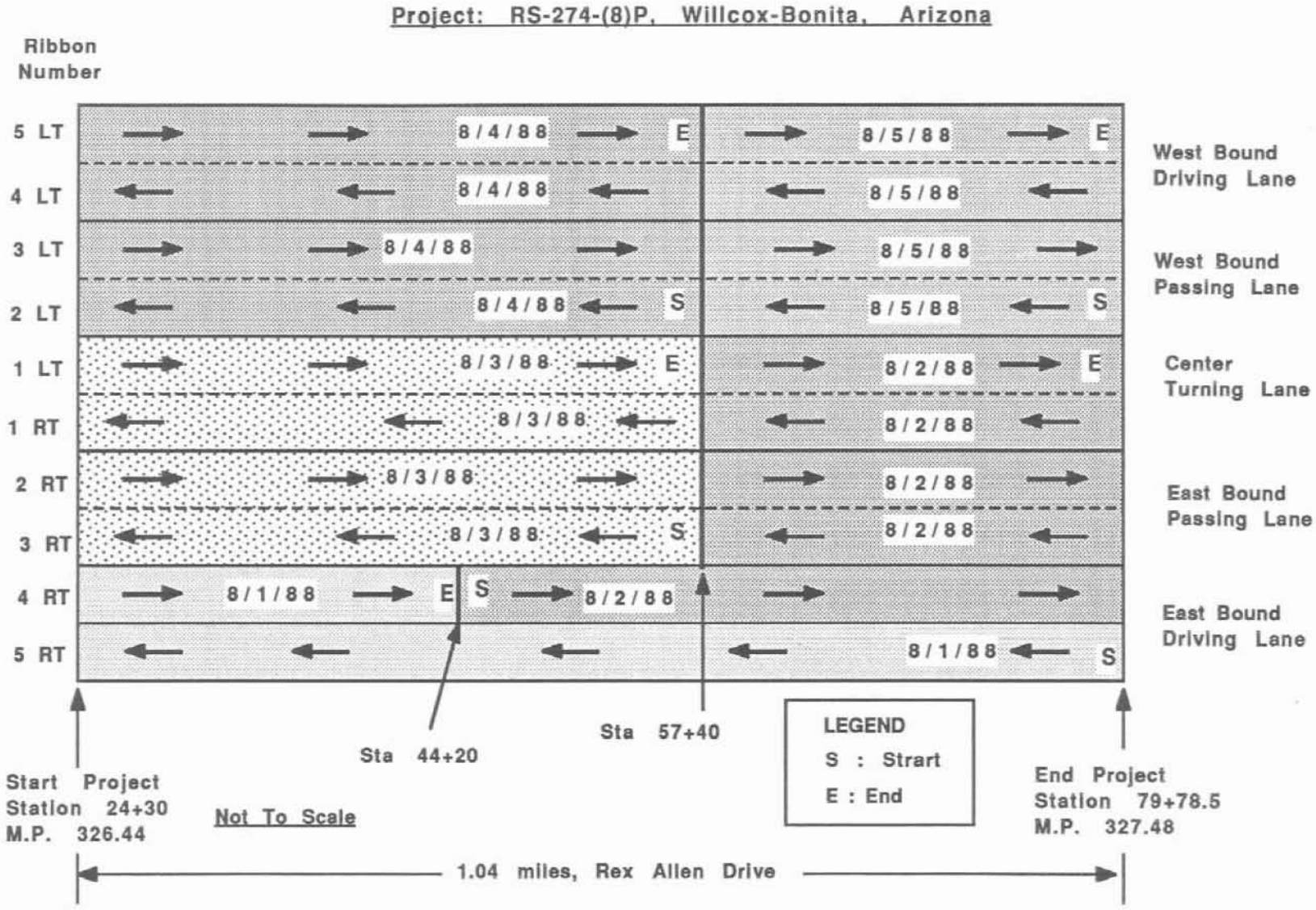


FIGURE 12 - The Milling Sequence.

FIGURE 13 - The Power Broom.

FIGURE 14 - Milled Pavement Surface.

FIGURE 15 - Paveprep Installation on a Transverse Crack.

Instead, the spray nozzles on the back of the boot truck were turned on and off as the driver drove over the cracks. This caused problems with getting adequate coverage and proper quantities.

The boot truck which was carrying AC-30 asphalt cement was not able to keep the temperature of the asphalt at the desired levels of 320°F to 350°F. On the first day of paving (8/8/88) the temperature of AC-30 was 310°F . On subsequent days of paving the temperature was much lower. For example, on August 10, 1988, around noon time, the temperature of AC-30 was observed to be 225°F. A sample taken out of the end nozzle showed the temperature to be 205°F. The level of asphalt in the boot truck was below the heating coils, and as such it was not possible to heat it up any further.

During paving, the binder coat was sticking to the tires of the trucks and the laydown machine, which subsequently caused the fabric to be pulled up. FIGURE 16 and FIGURE 17 show how the construction traffic picked up the installed fabrics during overlay placement. In some instances, the fabric tended to ball up in the overlay during compaction due to poor bonding.

After the first day of paving the binder coat for the overlay was changed from an AC-30 to a CSS-1 emulsion. FIGURE 18 shows specific locations where two different binder coats were used in the project. The boot truck carrying AC-30 was used in tacking Paveprep and Spunbound, and the boot truck carrying CSS-1 was used in applying the binder coat in the westbound roadway of the test section. The strategy of using CSS-1, which is a cold applied liquid emulsion, solved some of the problems that were faced with AC-30 binder coat. Fabrics did not get picked by the construction traffic as often as with AC-30.

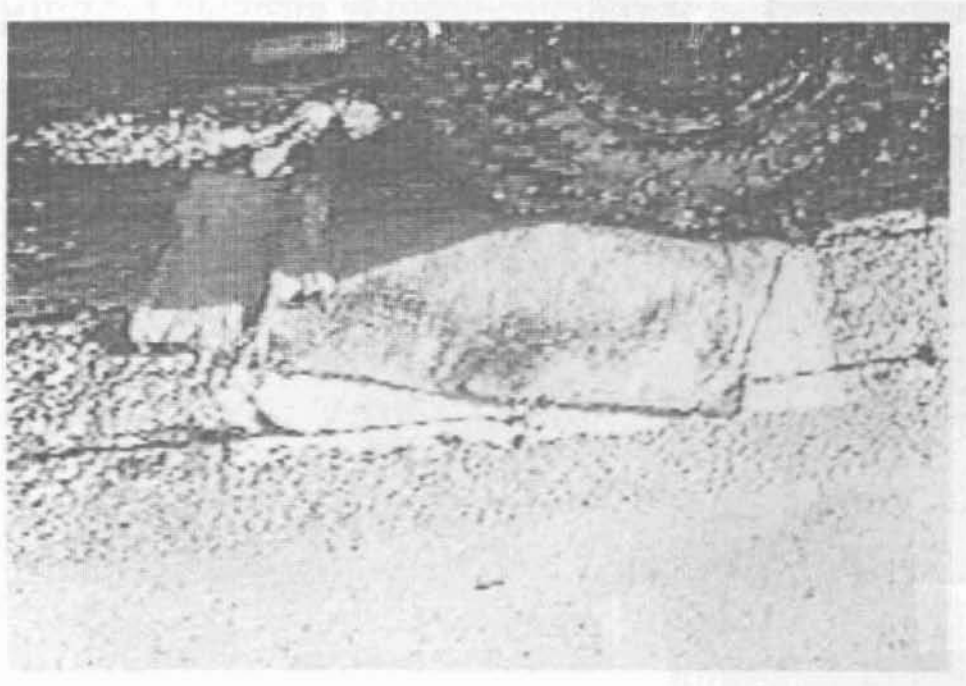


FIGURE 16 - Paving Machine Picking up Paveprep.

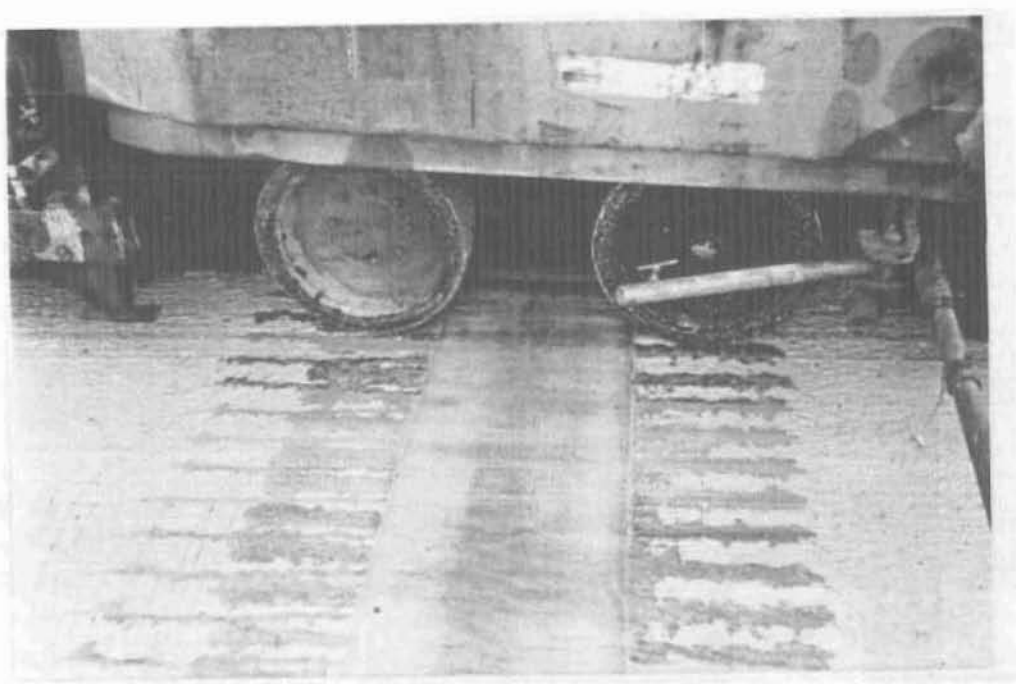


FIGURE 17 - Tack Build-up on the Wheels of Paving Machine.

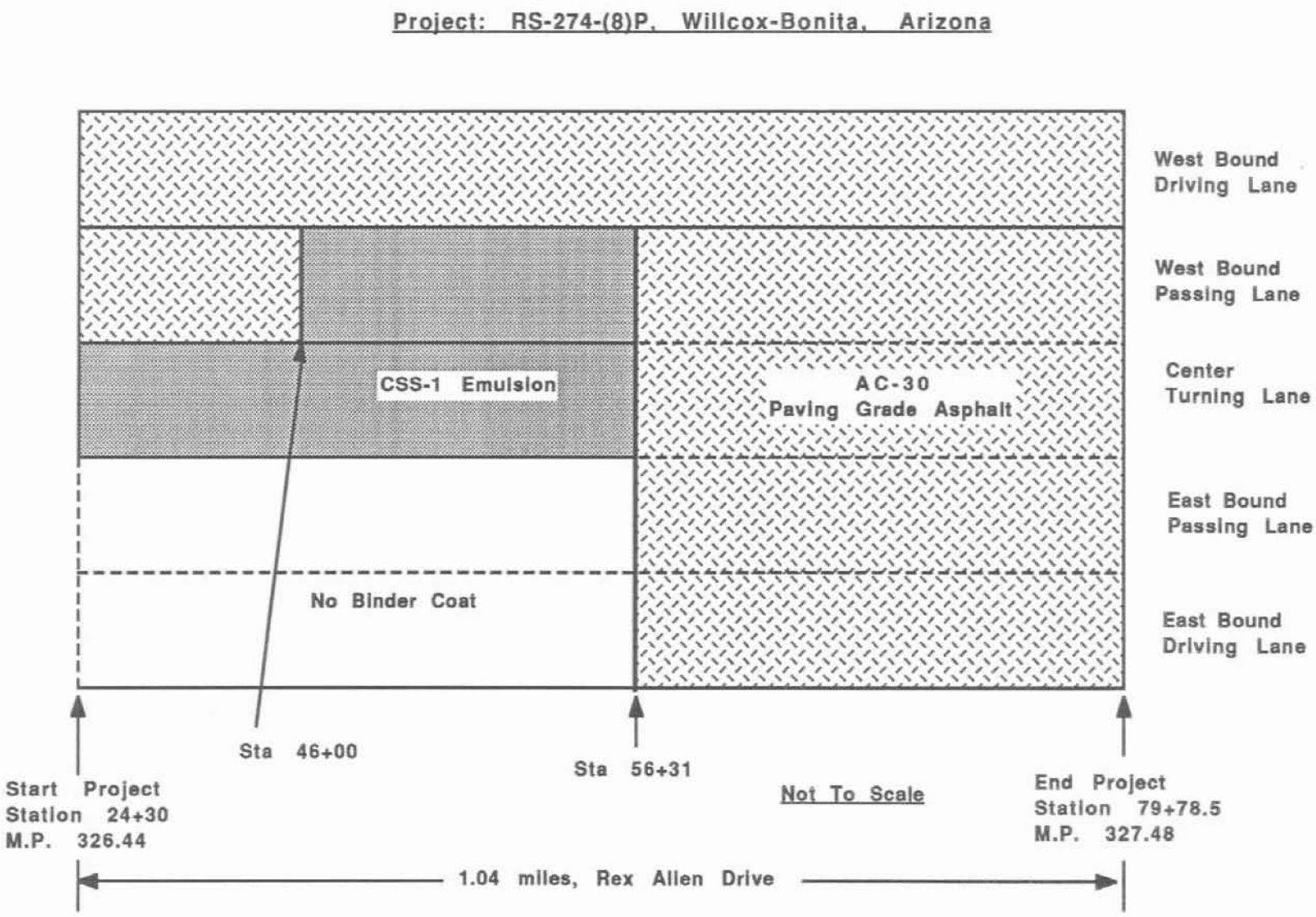


FIGURE 18 - Location of Different Binder Coats.

However, the Paveprep continued to move or slide under the tires due to improper application of AC-30 tack. To resolve this problem, the tack coat was applied in different quantities, but good bondage still could not be attained. Even hot asphalt concrete was spread over the fabric to reduce the stress due to the tires, but a good bond with the existing pavement could not be observed. Even after a setting period of 2 hours, the fabric still picked up under the laydown machine. The paving ski had metal plates on the bottom which tended to catch the edge of the fabric and roll it up.

During later stages of construction it was decided not to use any binder coat for the overlay between stations 24+30 and 56+31 on the eastbound passing and driving lanes. This strategy was adopted to deal with the problems of fabric picking up by the paving machine, but did not provide any solution to the bonding problem of Paveprep installation. It continued to pull up under the construction traffic.

A total of 202 ft. of random cracking was treated by Paveprep in the turn only lane. FIGURE 3 shows the locations of each "Band-Aid" treatment by Paveprep.

7.3 Glassgrid

A total of 8 transverse cracks (total length 600 ft.) and 146 ft. of random cracking were treated with Glassgrid. The Glassgrid is self adhering and as such installation involved cutting, laying and rolling the fabric. A pickup with dual tires was used to roll the fabric. FIGURE 19 shows a Glassgrid installation on a transverse crack.

The Glassgrid did not bond properly to the existing surface. It had less bond than the Paveprep, and construction traffic was able to completely pull it off the surface. It picked up under the boot truck, belly dump, and under the paving machine. It was discovered that a slight amount of asphalt cement on the truck tires would cause the fabric to pick up. Hot asphalt concrete was spread under the tires to try and keep the fabric from being picked up.

Glassgrid, because of its mesh structure, has limited surface area for bonding, and a milled pavement surface does not provide a smooth surface for uniform bonding of a mesh. As a result, Glassgrid bonded poorly on the milled surface. Even after changing the binder coat from AC-30 to an emulsion the fabric still picked up. However, the fabric did not pick up as much when the tack coat was completely eliminated. This is depicted in FIGURE 20.

In an attempt to obtain good bonding of the Glassgrid installation, a pneumatic roller was used (instead of the pick-up truck) to roll the fabric. No significant improvement could be made and there was still a problem with fabric picking up.

FIGURE 19 - Glassgrid Installation on a Transverse Crack.

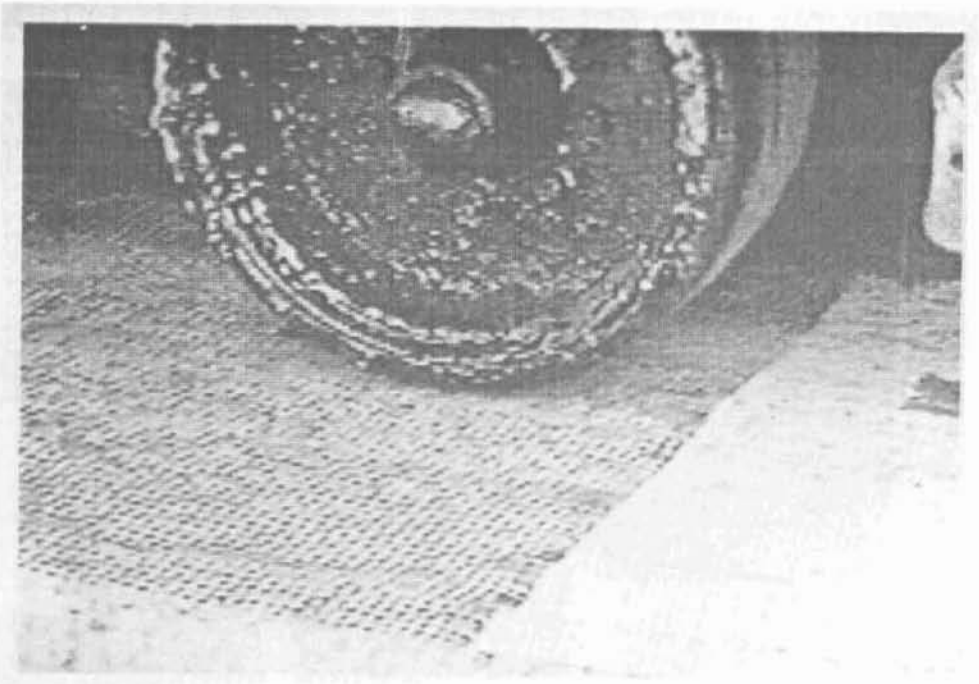


FIGURE 20 - Glassgrid Performance without the Binder Coat.

7.4 Tapecoat

A total of 8 transverse cracks (total length 600 ft.) were treated with 12 in. wide Tapecoat. In addition, 93 ft. of relatively small-width random cracking was treated with 4 in. wide Tapecoat, and 52 ft. of random cracking was treated with 12-in. wide Tapecoat. FIGURE 3 shows the locations of each of the localized treatment. FIGURE 21 shows a typical installation for 12-in. Tapecoat. FIGURE 22 shows an installation for 4-in. Tapecoat. The Tapecoat is self adhering like Glassgrid and as such its installation involved cutting the material to the proper length, peeling off the backing, and laying and rolling the fabric. A pickup with dual tires was used to roll the fabric.

The same problem was faced with Tapecoat installation as with Paveprep and Glassgrid when AC-30 binder coat was used for the overlay, but with less frequency. The Tapecoat curled up when the paving machine drove over it with AC-30 tack build-up on the tires. When the binder coat was changed to an emulsion the Tapecoat no longer picked up under the tires.

7.5 Travira Spunbound

On the eastern end of the project from stations 56+61 to 79+78, a full-width, full-length pavement reinforcing fabric was used. This fabric, called Travira Spunbound, is not considered part of the test section, however it's performance will also be monitored.

A tack coat of AC-30 at 0.3 gallon/sq.yd. was placed on the existing milled surface. The fabric was then placed using a fabric installer attached to the bucket of a loader. FIGURE 23 depicts the installation of Travira Spunbound. The tack coat was applied in 12 ft. wide lanes and placed 6 in. wider than the fabric. Subsequently, the fabric was also placed 6 in. wider (i.e. overlapped on to the adjoining lane) than the overlay paving passes. The ends of the new roll were tacked and overlapped 1 ft. Wrinkles greater than 0.5 in. high were cut and overlapped.

7.6 HMAC Overlay Placement Procedures

The overlay was a 2-in. thick, 0.5-in. dense graded mix. It was placed using a Barber Greene laydown machine with KoCal pickup. FIGURE 24 depicts this paving machine.

The asphalt concrete was hauled from Tucson, Arizona, using Belly Dump trucks. The average hauling period was 45 minutes. The paving began on August 8, 1988, and was performed on the west bound driving lane starting from the east end of the project at station 79+78. FIGURE 25 illustrates the entire paving sequence in terms of daily starting and ending location. From these start and end locations, production rates were estimated for the paving activity. It was determined that 1.44 miles of paving was done on the first day (August 8, 1988), 1.53 miles on the second day (August 9, 1988), 1.55 miles on the third day (August 10, 1988), and 0.68 mile on the last day (August 11, 1988).

FIGURE 21 - Installation of the 12-in. Tapecoat on a Transverse Crack.

FIGURE 22 - Installation of 4-in. Tapecoat on a Random Crack.

FIGURE 23 - Installation of the Travira Spunbound Fabric.

FIGURE 24 - The Barber Greene Paving Machine.

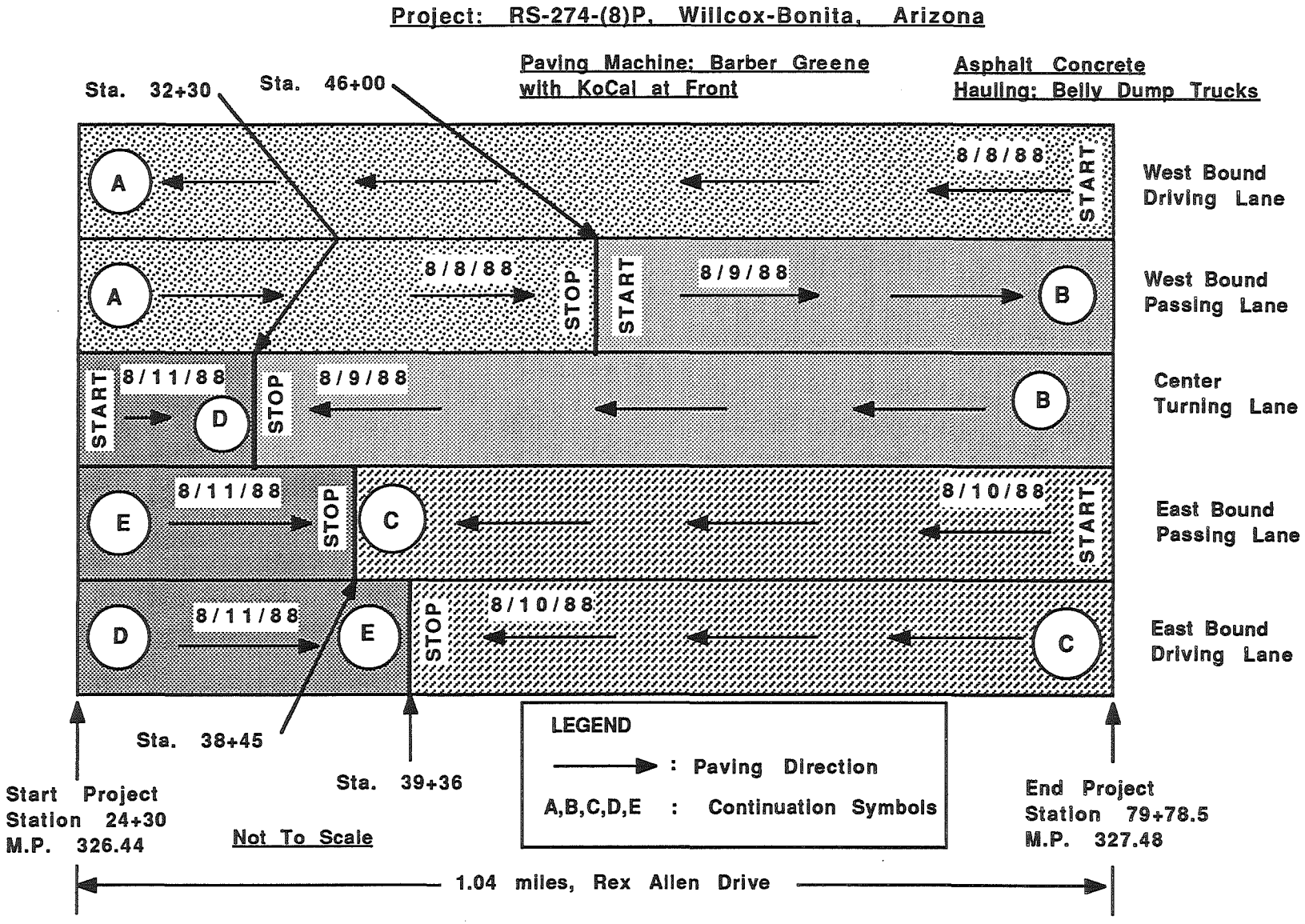


FIGURE 25 - The Paving Sequence.

On the second day of paving, a meeting was called at the construction office with the resident engineer to discuss the status of the project. The main topics of discussion were the method of cleaning the milled surface, methods and problems of placing fabrics, and the binder coat problems. In the meeting, the Glassgrid representative expressed his concerns about the fine material that was left on the milled pavement surface after brooming, and about the binder coat that was used for the overlay. The Paveprep representative expressed his concern about the low temperature of AC-30. Based on Glassgrid's concern about the binder coat, and research interests involved in the project, the resident engineer decided to try a section of the roadway without using any binder coat prior to overlay.

The asphalt concrete placement temperatures are presented in TABLE 2 and depicted in FIGURE 26. The weather condition during construction is listed in TABLE 3.

TABLE 2. - Asphalt Concrete Placement Temperatures.

Lot #	Date	Asphalt Concrete Temperature (°F)	Location Placed	Roadway Lane
1	8/8/88	300	29+80 to 27+50	WB DL
1	8/8/88	298	33+50 to 35+10	WB PL
1	8/8/88	280	39+25 to 40+50	WB PL
1	8/8/88	285	43+90 to 45+25	WB PL
2	8/9/88	240	47+75 to 48+90	WB PL
2	8/9/88	270	48+90 to 50+20	WB PL
2	8/9/88	275	61+00 to 62+90	WB PL
2	8/9/88	285	79+79 to 77+40	CTL
2	8/9/88	280	64+40 to 62+60	CTL
2	8/9/88	280	55+50 to 53+85	CTL
2	8/9/88	270	60+90 to 59+50	CTL
2	8/9/88	276	50+10 to 48+85	CTL
2	8/9/88	278	44+15 to 42+80	CTL
3	8/10/88	274	65+50 to 66+75	EB DL
3	8/10/88	280	71+10 to 73+15	EB DL
3	8/10/88	281	71+15 to 69+00	EB PL
3	8/10/88	280	60+00 to 58+60	EB PL
3	8/10/88	282	50+80 to 49+10	EB PL
3	8/10/88	279	43+00 to 41+15	EB PL
3	8/10/88	286	55+20 to 53+50	EB DL
3	8/10/88	276	46+40 to 44+50	EB DL
4	8/11/88	280	24+30 to 25+40	CTL
4	8/11/88	280	32+00 to 30+50	EB PL

WB: West Bound, EB: East Bound, CTL: Center Turning Lane, DL: Driving Lane, PL: Passing Lane.

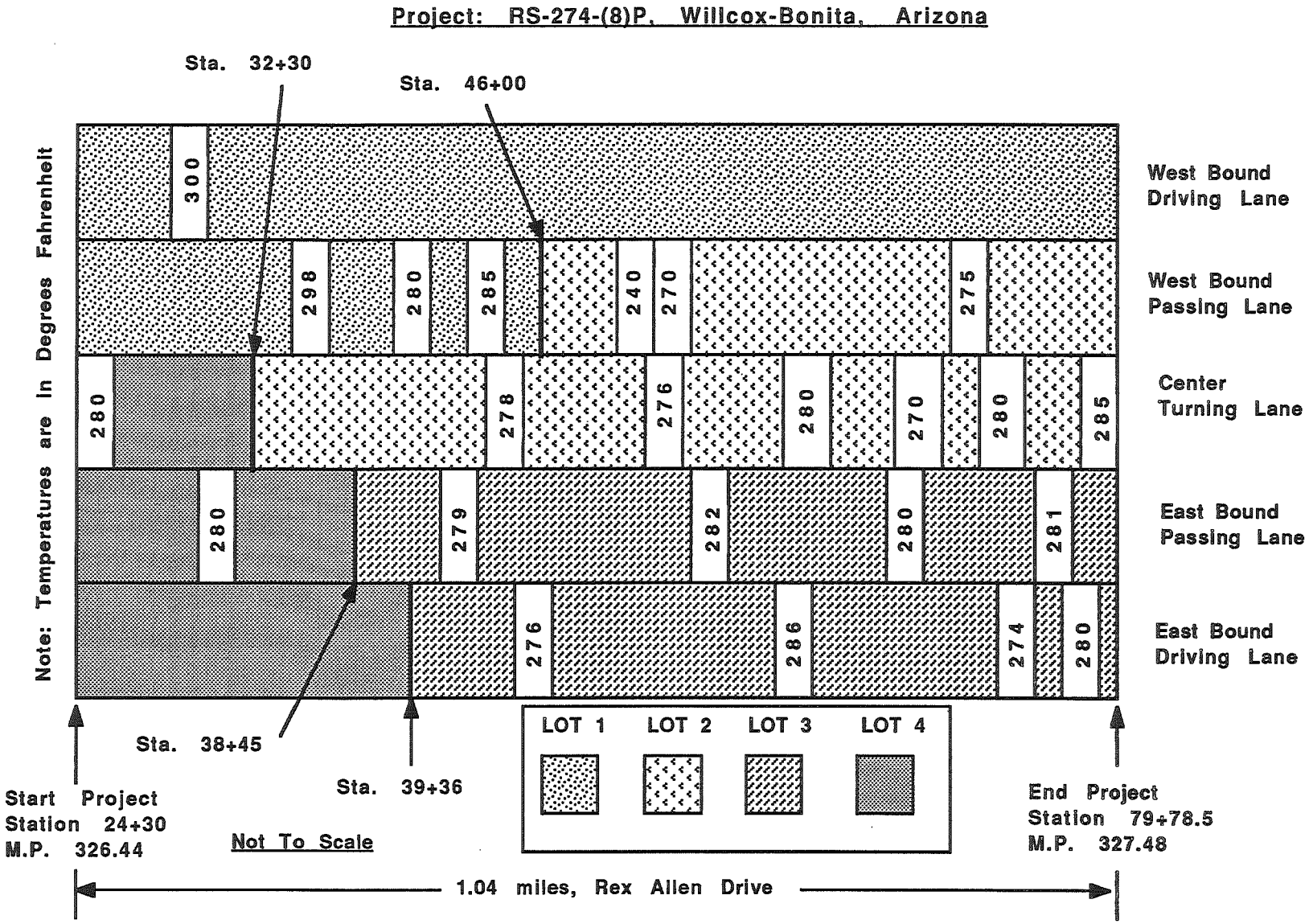


FIGURE 26 - Asphalt Concrete Placement Temperatures.

TABLE 3. - Weather Condition During Construction.

Date	Project Activity	Weather
8/ 1/88	Milling & Pickup Broom	Warm & Cloudy
8/ 2/88	Milling & Brooming in Rain	Cloudy, Rain at 9:30
8/ 3/88	Milling & Pickup Broom	Cool, Heavy Clouds
8/ 4/88	Milling & Brooming	Cloudy, Rain Last night
8/ 5/88	Milling & Brooming	n/a
8/ 8/88	Paving & Fabric Placement	Hot & Partly Cloudy
8/ 9/88	Paving & Fabric Placement	Hot & Partly Cloudy
8/10/88	Paving & Fabric Placement	Hot & Partly Cloudy
8/11/88	Paving & Fabric Placement	Hot & Partly Cloudy

At the end of the third day of paving (August 10, 1988), some of the Paveprep and Tapecoat installations on the east bound lanes were left exposed to normal traffic. This, however, did not damage the installations, rather this overnight traffic movement helped bonding of the fabrics on the milled pavement surface. Another incident worth mentioning is that on the first day of paving three transverse cracks marked 1A, 1B, and 1C were overlaid without any fabric on the westbound driving and passing lanes. This has been marked on FIGURE 3.

For compaction of the overlay, three rollers were used to achieve the required density. First a vibratory steel roller made 3 passes using the vibrator. Then a pneumatic roller made 2 passes and finally a second steel roller performed the finish rolling. FIGURE 27 shows the vibratory type roller and FIGURE 28 shows the pneumatic roller used in the project.

ATRC has made several video tapes during initial field inspection and project construction. These tapes were later used to develop a final video production showing the construction of the experimental project. These tapes are listed below:

31 : Field Inspection, 9/15/87.

51 : Milling, 8/1/88 to 8/2/88; Fabric Installation & Paving, 8/8/88 to 8/9/88.

52 : Fabric Installation & Paving, 8/9/88 to 8/11/88.

55 : Rex Allen Drive, Final Production.

FIGURE 27 - The Vibratory Roller.

FIGURE 28 - The Pnuematic Roller.

8. MATERIAL CHARACTERISTICS

8.1 General

Mix design criteria for the asphalt concrete was specified according to TABLE 4. Specifications for mix design grading limits are presented in TABLE 5. TABLE 6 presents specified mineral aggregate characteristics and TABLE 7 presents the criteria for verification testing. These tables were prepared based on ADOT standard specifications and special provisions.

ADOT's Materials section and a private lab conducted the asphalt concrete mix design verification testing. Data obtained from these tests are presented in APPENDIX E.

8.2 Test Results

8.2.1 HMAC

All of the lots except one were within the specifications in terms of asphalt concrete density. TABLE 8 presents the asphalt concrete log used for acceptance testing. A view of the sampling locations used in acceptance testing is depicted in FIGURE 29.

8.2.2 Mineral Aggregates

TABLE 9 presents the materials log used for acceptance testing.

8.2.3 Experimental Fabrics

No testing was performed on the fabrics to verify the strength standards claimed by respective manufacturers.

9. CONCLUSIONS

In general there were a number of problems with the paving fabrics. Some of these problems were unique to an individual product while other problems were common to all three materials.

All three fabrics did not properly bond when a paving grade asphalt was used as a binder coat prior to overlay. All three fabrics also had problems with snagging under the ski of the paving machine.

There were problems unique to Paveprep. These problems primarily had to do with the tack coat used to bond the fabric. The tack was not hot enough. The application rate of the tack was highly variable. It was either too heavy or too light. Also, the tack was not evenly distributed.

There were also problems unique to Glassgrid. It did not bond properly to the milled surface due to the presence of fine material and its limited surface area. It frequently picked up under the construction equipment. In general, it was sensitive to construction practices.

The only problem unique to Tapecoat was the placement of the 4 in. material over cracks that were not straight. The 4 in. wide Tapecoat was not wide enough for some irregular shaped cracks.

TABLE 4. - Mix Design Criteria.

Criteria	Requirements (1/2" Mix)	Arizona Test Method
Voids in Mineral Aggregate, %, Range	15.5-18.5	815
Effective Voids, %, Range	6.0 + 0.2	815
Index of Retained Strength %, Minimum	50	802
Wet Strength, psi, Minimum	150	802
Stability, Pounds, Minimum	2000	815
Flow, 0.01 inch, Range	8-16	815
Absorbed Asphalt, %, Range	0-1.0	815

Source: ADOT Standard Spec., Tab. 406-1, pg. 198 and Special Provisions, Sec. 406, pg. 30.

TABLE 5. - Mix Design Grading Limits.

Sieve Size	Percent Passing, Mineral Aggregate 1/2 inch Mix, With Admixture
3/4 inch	100
1/2 inch	90 - 100
3/8 inch	70 - 85
No. 8	44 - 52
No. 40	13 - 23
No. 200	3.0 - 7.5

Source: ADOT Standard Spec., Tab. 406-2, pg. 199

TABLE 6. - Mineral Aggregate Characteristics.

Characteristic	Test Method	Requirement
Combined Bulk Specific Gravity	AASHTO T 85 AZ Test Method 211	2.35 - 2.85
Combined Water Absorption	AASHTO T 85 AZ Test Method 211	0.00 - 2.50
Sand Equivalent	AASHTO T 176	Minimum 45
Crushed Faces	AZ Test Method 212	Minimum 30%
Abrasion	AASHTO T 96	100 Rev., Max 9% 500 Rev., Max 40%
Note: Abrasion shall be performed separately on samples from each source of mineral aggregate. All sources shall meet the requirements for abrasion.		

Source: ADOT Standard Spec., Tab. 406-3, pg. 200 and Special Provisions, Sec. 406, pg. 31.

TABLE 7. - Verification Testing Criteria.

Property	Allowable Deviation From Proposed Targets	Limiting Values
Sand Equivalent	- 10	45 Min.
Crushed Faces, %		30 Min.
Abrasion 100 Rev 500 Rev		9 Max. 40 Max.
VMA, %	+ 1.5	14.5 Min.
Effective Voids, %	+ 1.0	
Stability, Pounds		1,750 Min.
Flow, 0.01 inch		7 - 17
Index of Retained Strength, %		45 Min.
Wet Strength, psi		140 Min.

Source: ADOT Standard Spec., Tab. 406-6, pg. 204 and Special Provisions, Sec. 406, pg. 31.

TABLE 8. - Asphalt Concrete Log for Acceptance Testing.

SN	LN	1/2 inch Asphalt Concrete Mix Design Data											
		3/4"	1/2"	3/8"	#4	#8	#40	#200	Asph	VMA	EV	VF	BD
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	1	100	93	83	64	49	17	2.8	5.3	15.6	5.2	66.9	142.7
2	1	-	-	-	-	-	-	-	-	-	-	-	141.9
3	1	100	95	87	67	50	15	1.9	5.6	17.3	6.5	62.3	140.2
4	2	100	90	78	55	42	15	2.9	4.9	14.8	5.2	64.8	143.9
5	2	-	-	-	-	-	-	-	-	-	-	-	142.4
6	2	100	89	76	54	41	14	2.1	5.2	15.8	4.2	73.4	142.2
7	3	100	93	81	63	47	16	3.6	5.6	15.7	3.9	74.2	143.9
8	3	-	-	-	-	-	-	-	-	-	-	-	144.2
9	3	100	94	83	62	47	17	3.5	5.1	15.2	5.2	66.0	143.2
10	4	100	94	84	66	49	18	3.7	5.5	15.1	4.2	72.0	143.8
11	4	-	-	-	-	-	-	-	-	-	-	-	143.5
12	4	100	92	81	61	45	15	1.3	5.3	15.2	4.8	68.1	143.4
Average		100	93	82	61	46	16	2.7	5.3	15.6	4.9	68.5	142.9
Standard Dev.		0	2	3	5	3	1	0.9	0.3	0.8	0.8	4.3	1.1

SN: Sample No., LN: Lot No., Asph: % Asphalt, VMA: % Voids in Mineral Aggregates, EV: % Effective Voids, VF: % Voids Filled with Asphalt, BD: Bulk Density in pcf,
Note: Columns 3 through 9 are aggregate gradation data, % passing through different sieve sizes.

Source: Field Report for Week Ending 8/13/88 of Project RS-274-(8)P

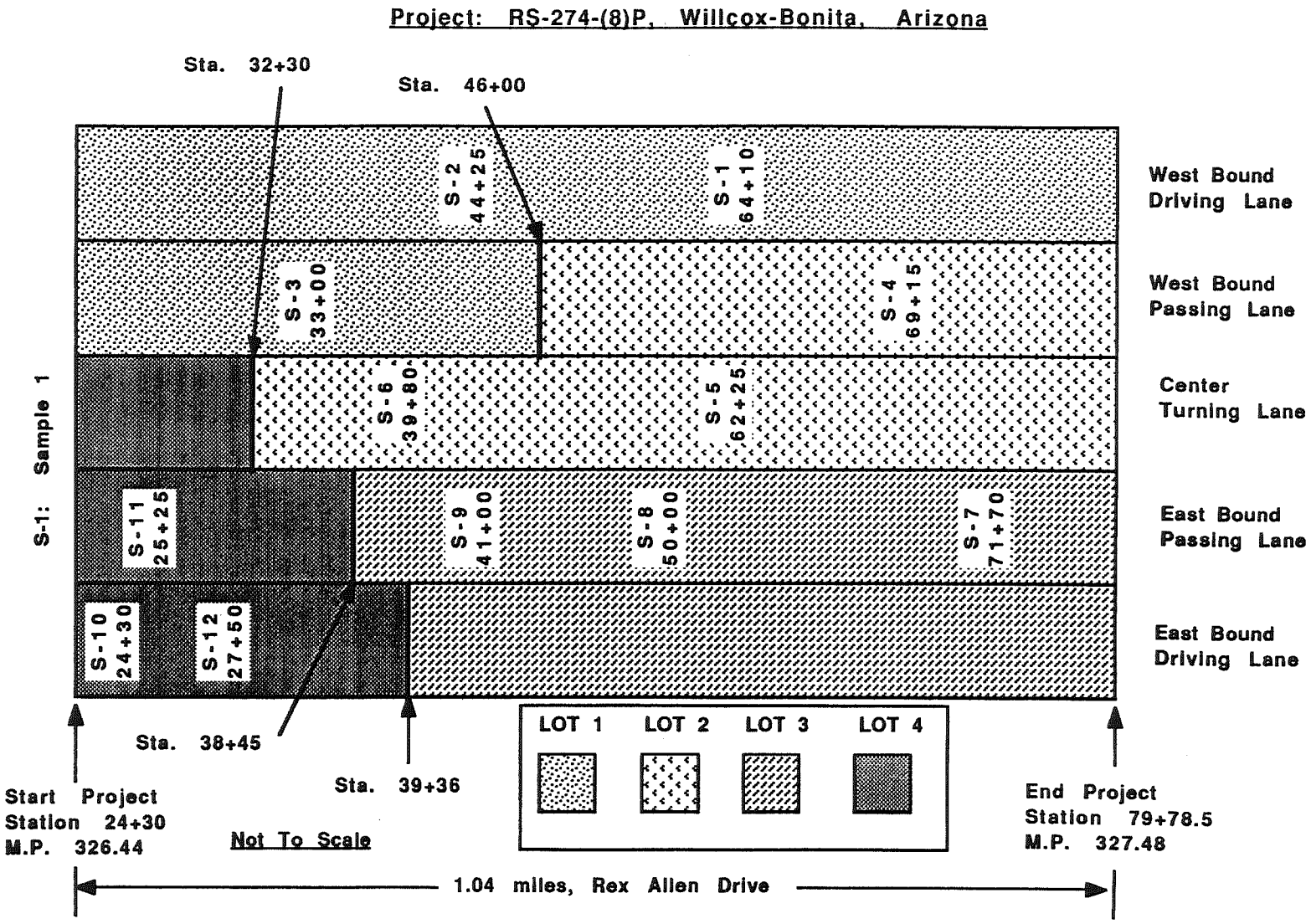


FIGURE 29 - Sampling Locations for Acceptance Testing.

TABLE 9. - Materials Log for Acceptance Testing.

SN	Sampled From	MA Gradation, 1/2" Mix, 1% Admx; %Passing						SE	FFC
		3/4"	1/2"	3/8"	#8	#40	#200		
1	CFB	100	92	82	48	15	2.5	-	-
2	CFB	100	91	82	47	14	2.6	-	-
3	CFB	100	92	81	46	15	2.5	-	-
4	CFB	100	91	81	48	15	2.9	-	-
5	CFB	100	91	81	47	16	2.8	-	-
6	CFB	100	91	80	45	14	3.1	-	-
7	CFB	100	92	83	49	16	3.2	-	-
8	CFB	100	92	82	47	15	2.8	-	-
9	CFB	100	91	81	49	18	3.3	-	-
1	SP (CP)	-	-	-	-	-	-	73	80
2	SP (CP)	-	-	-	-	-	-	74	81
3	SP (GP)	-	-	-	-	-	-	57	40
AVG		100	91	81	47	15	2.9	68	67
SD		0	0.5	0.9	1.3	1.2	0.3	9.5	23.4
SPEC		100	87-99	67-88	42-54	11-25	2.5-8.0	> =45	> =30

SN: Sample No CFB: Cold Feed Belt, SP: Stock Piles, CP: Calmat Pit, GP: Granite Pit, SE: Sand Equivalent, FFC: Crushed Faces, AVG: Average, SD: Standard Deviation, SPEC: Arizona Specifications, MA: Mineral Aggregate, Admx: Mineral Admixtures

Source: Field Report for Week Ending 8/13/88 of Project RS-274-(8)P

10. RECOMMENDATIONS

The following recommendations have been made based on the construction experiences:

1) When paving fabrics are used in pavement rehabilitation, selection of binder coat should be based on the expected construction conditions and product selections.
2) Additional field testing of Paveprep on milled surfaces should be performed prior to utilizing it on a routine basis.
3) Glassgrid should not be used on rough surfaces or in applications where a binder coat is required prior to overlay placement. It seems to have questionable use on milled surfaces.

During the next 3 years the fabrics placed on this project will be periodically evaluated. It is hoped that the information obtained will be of benefit in designing cost effective pavements that can effectively combat the problem of reflective cracking in overlaid pavement.

THE PavePrep CORPORATION™

PavePrep is a unique stress-relief interlayer material consisting of high-density, heavy duty mastic between two layers of rugged polyester fabric. The mastic, rated No. 1 nationally, provided PavePrep with durability, water impermeability and compatibility with the final hot-mix asphalt overlay. The polyester fabrics add to the durability, impart dimensional stability and, above all, confer exceptional flex resistance.

Pave Prep makes your paving dollars more durable.

Installed over existing concrete or asphalt, cracked or spalled, Pave Prep strips stabilize and safeguard the new asphalt surface. *Details at right.*

The service advantages of PavePrep include:

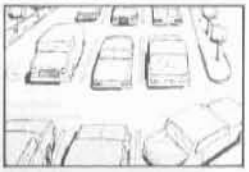
- Ease of installation (no special equipment needed) with minimum adhesive requirement
- Minimum traffic disruption (traffic may flow over PavePrep prior to final paving)
- High versatility in end-use application and wide working-temperature range i.e. performance is climate-independent
- Further structural decay of surface or underlying base or structure is arrested.

By substantially prolonging the lifetime of streets, highways and other traveled surfaces, PavePrep has major positive impact on maintenance budgets.

PavePrep's component system with its dual stress-relief and water-proofing mechanism-of-action are shown graphically here.

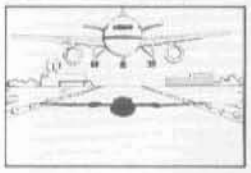
For detailed product specifications and product line and availability see overleaf.

PARKING LOTS



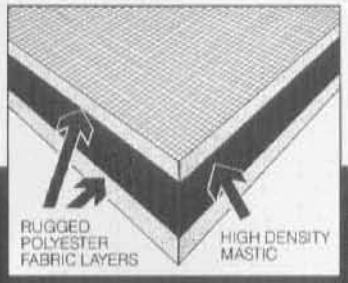
HIGHWAYS & BRIDGES

AIRPORT RUNWAYS & APRONS



CITY STREETS

WATER-PROOFING



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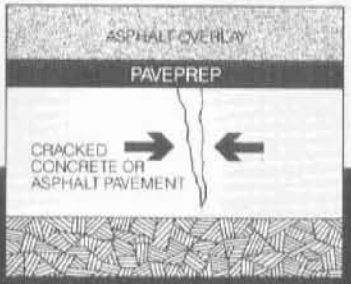
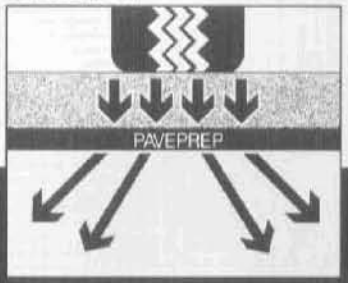


STRESS RELIEF



THE PavePrep CORPORATION™

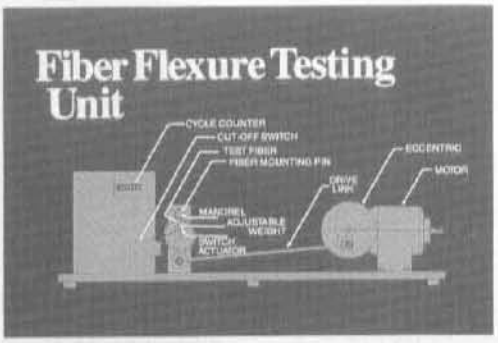
PavePrep Specifics

HEAT STABILITY	No dripping or delamination after 2 hours @ 190° (2" × 5" sample suspended vertically in mechanical convection oven)
FLAMMABILITY	Self-extinguishing/NBR (Federal FMVSS 302)
COLD FLEX	No separation (2" × 5" specimen, 180° bend on 2" mandrel @ 0°F)
POLYESTER REINFORCEMENT	Cycles to break* (single fiber), 2,100,000
EQUIVALENT GLASS REINFORCEMENT	Cycles to break (single fiber), 30,500
ELONGATION	100% (Instron)
TENSILE STRENGTH	1000 lbs. per inch width min. (Instron)
WEIGHT	0.9 lbs/ft²
DENSITY	80 lbs/ft³ (ASTM E 12-70)
CALIPER	0.135 in. † (ASTM D1777)
ABSORPTION	1% Max (ASTM D517-68)
BRITTLENESS	passes (ASTM D517-68)
SOFTENING POINT	200°F (min.) (ASTM D2398-68)

† 95% retained after loading
* Special flexing, non-abrading test method (details on request)

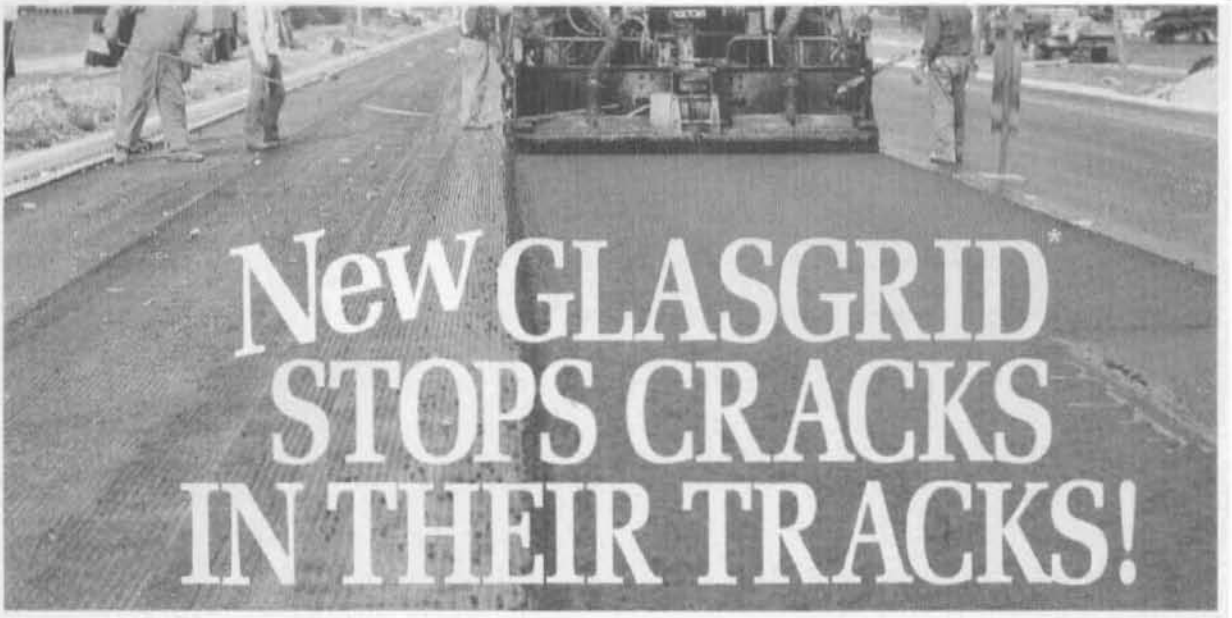
Widths: 12" - 20" - 36" - 42" (non-standard widths available on request)
Roll Lengths: 48' - 102'

THE PAVEPREP SYSTEM IS PROTECTED BY U.S. PATENT NO. 4,417,939



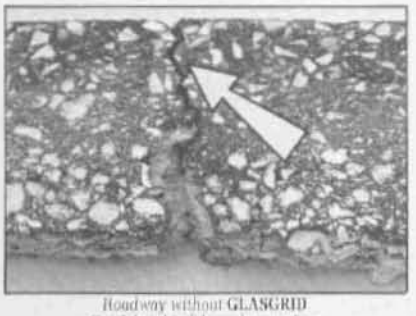
Further detailed technical information, sample and prices are available from:

West Sales Office	4606 Wynn Road Las Vegas, Nevada 89103 702-362-4269 1-800-367-3939
Midwest Sales Office	105 May Drive Harrison, Ohio 45030 513-367-6540 1-800-544-7737 Fax: (1)-513-367-6543
East Sales Office	141 Central Avenue Westfield, NJ 07090 201-233-4444 1-800-233-7737 Fax: (1)-201-233-4215



New GLASGRID* STOPS CRACKS IN THEIR TRACKS!

INNOVATIVE NEW PAVEMENT REINFORCEMENT STRONGER THAN STEEL SHARPLY REDUCES PAVING AND MAINTENANCE COSTS



Roadway without **GLASGRID**
Crack breaking through to surface

Roadway with **GLASGRID**
Crack prevented from breaking through to surface

GLASGRID

*Registered trade mark, patent pending

Reflective cracking virtually eliminated –

GLASGRID mesh, an engineered product from Bay Mills, offers a proven solution to the major problem of pavement cracking due to load and thermal effects. Glasgrid effectively changes the fundamental mode of crack propagation. (See illustration). When placed between the old pavement and new asphalt concrete overlay, GLASGRID disperses crack development, thus reducing crack break-through to the surface.

Exceptional Strength –

The secret of GLASGRID lies in glass fiber, which is stronger than steel, fabricated into a unique grid structure and protected with a special coating developed by Bay Mills Ltd. Each strand of the high modulus glass fiber is encapsulated in the coating which provides intimate bonding with the underlying pavement and permits utilisation of the potential strength inherent in glass fiber. High tensile GLASGRID significantly increases the load capacity of asphaltic overlays.

Cuts costs now and tomorrow –

Properly applied GLASGRID effectively reduces the need for repair and maintenance and can significantly reduce the frequency of overlaying pavement. In many applications, GLASGRID will permit the use of thinner overlays with corresponding cost savings.

Want More Information? –

Let a Bay Mills representative show you how to reduce reflective cracking and save money. Call or write:

BAY MILLS LTD.

MIDLAND SALES OFFICE
277 Lakeshore Rd. E., Suite 400
Oakville, Ontario L6J 6J3
Telephone (416) 842-8808
Telex: 0698-2459

GLASGRID* PAVEMENT REINFORCEMENT

APPLICATIONS

GLASGRID glass fiber mesh is designed to reinforce asphalt concrete overlays in pavement construction. When placed between an existing pavement surface and asphalt overlay, GLASGRID will reduce both thermal and stress cracks breaking through the overlay to the surface. GLASGRID will also improve the structural capacity of asphalt concrete overlays.

GLASGRID's performance can lead to significant economies in both construction materials and maintenance costs.

MECHANICAL CHARACTERISTICS

*Tensile Strength
- Across Width 100 kN/m
- Across Length 50 kN/m

Modulus of Elasticity – 69,000,000 kPa (10,000,000 psi)

*Independent laboratory tests (November 1984) based on component strand strength

PRODUCT SPECIFICATIONS

Roll Length	up to 200 m
Roll Width	up to 4.0 m
Weight	300 g/m²
Material	Glass fiber with modified asphalt coating
Colour	Black
Grid Size	25 mm x 12.5 mm

INSTALLATION PROCEDURE

GLASGRID mesh can be installed on flexible pavements (asphalt concrete) and rigid pavements (portland cement concrete) using conventional paving procedures. However, GLASGRID mesh should not be used on structurally unsound pavements.

FLEXIBLE PAVEMENTS

SURFACE PREPARATION Perform any medial work such as base repairs, crack sealing, pothole filling, levelling course application, etc. that normally would be done during asphalt concrete overlay construction. Clean the pavement to be reinforced thoroughly to remove any deleterious material.

TACK-COAT APPLICATION A **uniform** application of CRS-1 emulsified asphalt **must** be applied in advance of GLASGRID placement. Recommended emulsion application rates vary from:
- Tight Rich Surfaces – 0.20 l/m²
- Old Open Surfaces – 0.50 l/m²

GLASGRID INSTALLATION GLASGRID can be applied manually or with mechanical equipment immediately after the initial "set" of the tack coat. Pavers and trucks can begin normal operations when the emulsified tack coat has **completely** "set." GLASGRID mesh must be firmly bonded to the existing pavement.

RIGID PAVEMENTS

Installation is the same as for flexible pavements except that a levelling course of asphaltic concrete (minimum 25 mm) must be placed prior to the tack coat and GLASGRID. GLASGRID is effective when it becomes encapsulated in the matrix to be reinforced.

RECOMMENDED ASPHALT CONCRETE OVERLAY THICKNESS TO REDUCE REFLECTIVE CRACKING

CONVENTIONAL PROCEDURES		PROCEDURE USING GLASGRID**	
1. Flexible Pavement	**2. Rigid Pavement**	**1. Flexible Pavement**	**2. Rigid Pavement**
Tack coat. Minimum overlay thickness 75 mm of asphaltic concrete	Tack coat. Minimum overlay thickness 75-150 mm of asphaltic concrete. Limited success is expected using this technique.	Tack coat GLASGRID. Minimum overlay thickness – 40 mm of asphaltic concrete	Tack coat. Levelling course – 25 mm. Tack coat GLASGRID. Minimum asphaltic concrete overlay thickness – 40 mm

STOPS CRACKS IN THEIR TRACKS!

* GLASGRID is the Registered Trademark of Bay Mills Limited. Patent pending.

**The information presented herein, while not guaranteed, is to the best of our knowledge true and accurate. Except when agreed to in writing for specific conditions of use, no warranty or guarantee expressed or implied is made regarding the performance of any product, since the manner of use and handling are beyond our control. The user of such information assumes all risk connected with the use thereof. Nothing contained herein is to be construed as permission or as a recommendation to infringe any patent.

TAPECOAT

M-860 Specifications

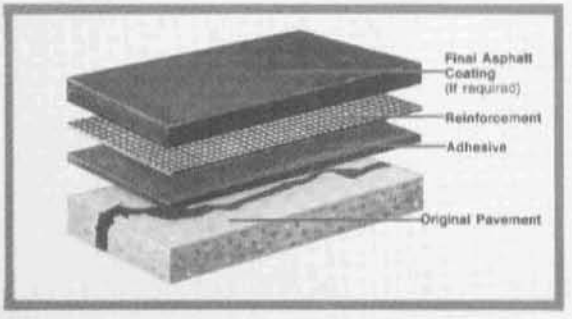
Tapecoat M-860 is a pre-formed, cold applied, self-adhering material that is impermeable to water and salt. The adhesive is manufactured from specially formulated elastomeric resins bonded to a woven polymer for high puncture resistance. The rolls have an easy-to-remove plastic release film that protects the adhesive from contamination prior to application.

Tapecoat M-860 should be applied over dry pavement that is free of dirt, debris or other foreign matter. When used as a temporary patching material, TC M-860 Primer should be placed on the surface and shall extend at least 1" wider than the material. The primer should be allowed to dry to the touch before applying Tapecoat M-860.

Packaged in cartons as follows: 3 rolls — 4" x 150'; 2 rolls — 6" x 150'; 1 roll — 12" x 150'. Additional widths up to 24" wide available upon request.

PHYSICAL PROPERTIES

PROPERTY	VALUE	TEST METHOD
Thickness	.065" Nominal	—
Water Vapor Transmission Rate, Permeance	0.01 perms (grains/sq.ft./hr./in. Hg) Maximum	ASTM E-96 Method B
Tensile Strength	50 lb./in. Minimum	ASTM D-882 Modified for 1" Opening
Puncture Resistance (Mesh)	200 lb. Minimum	ASTM E-154
Pliability-1/4" Mandrel 180° bend -30°F	No cracks in mesh or adhesive	ASTM D-146



The TAPECOAT Company

A DIVISION OF TC MANUFACTURING CO., INC.

P.O. Box 631, Evanston, IL 60204-0631
Phone: 312/866-8500 • Telex: 265541 TCMF UR

Printed in USA

TAPECOAT M-860

...A Unique Repair Coating That Insures Added Life For Concrete And Asphalt Surfaces

The Tapecoat Company, a leader in the protective coating field since 1941, has broadened its line of quality products with the addition of a pressure-sensitive pavement repair material. Tapecoat M-860 is a cold-applied, self-adhering, puncture-resistant product that has been designed to provide extended repair protection for concrete and asphalt surfaces.

Typical uses for Tapecoat M-860 are maintenance problems such as pot holes, cracks in paving material, pavement deformation at bus stops and other heavy-traffic areas and airport and bridge surface repair.

Used in conjunction with hot or cold patching materials, the unique, highly aggressive, pressure-sensitive adhesive provides excellent bonding to the substrate. It retains its ability to bond under pressure at temperatures as low as 0°F, an important consideration when fast, temporary repairs must be made during the winter months.

When combined with the additional mechanical strength received from the reinforcement material, Tapecoat M-860 provides the quick, easy and economical answer to your maintenance problems.

Supplied in easy-to-use rolls for fast, efficient application, Tapecoat M-860 is cost effective when used in combination with a complete asphalt overlay or alone as a temporary patching material.

ROADS AND STREETS

Tapecoat M-860 is easy to apply, even in cold weather or in long lengths as well as short runs.

The plastic release film permits proper alignment over cracks and is easily removed for rapid application.

Once the Tapecoat M-860 is in place, pressure may be used to accelerate bonding to the surface being protected.

Due to its aggressive bonding capabilities, Tapecoat M-860 may often be used under a hot, cost prior to final asphalt coating.

For added strength, a final coating over the Tapecoat M-860 completes the job.

AIRPORTS

Airport surface deterioration is another practical target for the application of Tapecoat M-860.

BRIDGES

Tapecoat M-860 provides added protection against the destructive forces of water and salt on bridge decks.

FEATURES

- Excellent bond to concrete and asphalt surfaces
- High puncture-resistance
- Quick and easy application
- Pre-fabricated to provide uniform thickness
- Impermeable to water and salts
- Specially formulated adhesive to extend service life
- Cold-applied for safety during application
- Completely non-toxic
- Year-around use

ARIZONA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

DATE: 04/05/88

AGREEMENT ESTIMATE &
PROGRESS AND FINAL PAYMENT REPORT

CONTRACTOR: THE ASHTON CO INC

PROJECT NUMBER	TERMINI	LOCATION	FUND CODE	ITEM NUMBER
RS 274- (8)	WILLCOX-BONITA (SR 186)	REX ALLEN DRIVE	82512	0491

COUNTY	GROSS LENGTH	NET LENGTH	PREPARED BY	TYPE OF WORK
COCHISE	01.050	01.050	AG	MILL & RESURFACE

RECEIVED
MAY 16 1988
BENSON, ARIZONA

B-1

ITEM NO.	ITEM DESCRIPTION	UNIT	PLANS	REVISED	UNIT PRICE	ACCUM QTY	ACCUM AMT	PERCENTAGE
2020029	REMOVAL OF ASPHALTIC CONCRETE PAVEMENT	SQ.YD.	37,220 $31,637.00	37,220 $31,637.00	.85			
2060001	FURNISH WATER SUPPLY	L.SUM	1 $5,169.00	1 $5,169.00	5,169.00			
4040034	ASPHALT CEMENT (AC-30) (FOR 1/2" MIX)	TON	199 $29,850.00	199 $29,850.00	150.00			
4040111	BITUMINOUS TACK COAT	GAL	6 $240.00	6 $240.00	40.00			
4040116	APPLY BITUMINOUS TACK COAT	HOUR	16 $2,000.00	16 $2,000.00	125.00			
4040131	PROVISIONAL SEAL COAT	TON	12 $2,400.00	12 $2,400.00	200.00			
4040136	APPLY PROVISIONAL SEAL COAT	HOUR	4 $340.00	4 $340.00	85.00			
4040163	BLOTTER MATERIAL	TON	37 $370.00	37 $370.00	10.00			
4060004	ASPHALTIC CONCRETE (1/2" MIX)	TON	3,868 $96,700.00	3,868 $96,700.00	25.00			
4060024	MINERAL ADMIXTURE (FOR 1/2" MIX)	TON	72 $5,760.00	72 $5,760.00	80.00			
4060951	PAVEMENT REINFORCEMENT FABRIC	SQ.YD.	15,450 $15,450.00	15,450 $15,450.00	1.00			
4060956	PAVEMENT REINFORCEMENT FABRIC	L.FT.	3,000 $2,100.00	3,000 $2,100.00	.70			
7010001	MAINTENANCE AND PROTECTION OF TRAFFIC	$LSUM	21,250 $21,250.00	21,250 $21,250.00	1.00			
7040003	PAVEMENT MARKING (WHITE HOT-SPRAYED THERMOPLASTIC)(0.0	L.FT.	3,000 $600.00	3,000 $600.00	.20			
7040004	PAVEMENT MARKING (YELLOW HOT-SPRAYED THERMOPLASTIC)(0.0	L.FT.	13,450 $2,690.00	13,450 $2,690.00	.20			

CS250-830-1 ARIZONA DEPARTMENT OF TRANSPORTATION DIVISION OF HIGHWAYS AGREEMENT ESTIMATE & PROGRESS AND FINAL PAYMENT REPORT
DATE: 04/05/88

ESTIMATE NO:
PROJECT NO: BS 274-(8)P SECTION: 01

BITUMINOUS CONCRETE ROADWAY CODE: EA 1000

ITEM NO.	ITEM DESCRIPTION	UNIT	PLANS	REVISED	UNIT PRICE	ACCUM QTY	ACCUM AMT	PERCENTAGE
7050022	PAVEMENT MARKING, PREFORMED, TYPE I, WHITE STRIPE	L.FT.	720 $900.00	720 $900.00	1.25			
7050023	PAVEMENT MARKING, PREFORMED, TYPE I, SINGLE ARROW	EACH	4 $448.00	4 $448.00	112.00			
7050026	PAVEMENT MARKING, PREFORMED, TYPE I LEGEND	EACH	2 $430.00	2 $430.00	215.00			
7060015	PAVEMENT MARKER, RAISED, TYPE D	EACH	800 $2,720.00	800 $2,720.00	3.40			
7060018	PAVEMENT MARKER, RAISED, TYPE G	EACH	270 $945.00	270 $945.00	3.50			
7420070	ELECTRICAL CONDUIT (3") (PVC)	L.FT.	270 $2,295.00	270 $2,295.00	8.50			
7520420	PULL BOX (NO. 7)	EACH	4 $1,300.00	4 $1,300.00	325.00			
9010001	MOBILIZATION	L.SUM	1 $8,421.00	1 $8,421.00	8,421.00			
9080289	CONCRETE WHEEL CHAIR RAMP (DETAIL A)	EACH	32 $20,800.00	32 $20,800.00	650.00			
		TOTALS:	$254,815.00	$254,815.00			$.00	

CS250-880-1

ESTIMATE NO:
PROJECT NO: RS 274- (5) P

ARIZONA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
AGREEMENT ESTIMATE &
PROGRESS AND FINAL PAYMENT REPORT
SECTION: 02
CODE: EA X080

TRAINING (CONSTRUCTION PROJ)

ITEM NO.	ITEM DESCRIPTION	UNIT	PLANS	REVISED	UNIT PRICE	ACCUM QTY	ACCUM AMT	PERCENTAGE
9230001	PROVIDE TRAINEES WITH ON-THE-JOB TRAINING	HOUR	200 $160.00	200 $160.00	.80			
		TOTALS:	$160.00	$160.00			$.00	

SECTION 406 - ASPHALTIC CONCRETE:

406-2 Asphaltic Concrete Mix Design Criteria: TABLE 406-1 of the Standard Specifications is modified to add:

The Minimum Index of Retained Strength shall be 50 percent for 1/2 inch mix.

Absorbed asphalt shall be 0-1.0 percent for 1/2 inch mix when tested in accordance with Arizona Test Method 815.

406-2 Asphaltic Concrete Mix Design Criteria: mix design criteria for effective voids in Table 406-1 of the Standard Specifications is revised to read:

Criteria	Requirements 1/2" Mix	Arizona Test Method
Effective Voids, Percent, Range	6.0 ± 0.2	815

406-3.02 Mineral Aggregate: Table 406-3 of the Standard Specifications is modified to add:

The Combined Bulk Specific Gravity shall be 2.35 to 2.85.

The Combined Water Absorption shall be 0 to 2.50.

406-3.02 Mineral Aggregate: Note 2 of Table 406-3 of the Standard Specifications is revised to read:

Abrasion shall be performed separately on samples from each source of mineral aggregate. All sources shall meet the requirements for abrasion

406-3.02 Mineral Aggregate: of the Standard Specifications is modified to add:

For comparative purposes, quantities shown in the bidding schedule have been calculated based on the following data:

	1/2" Mix
Unit Weight, Pounds per Cubic Foot	147
Percent, Asphalt Cement	5.0
Percent, Mineral Admixture	2.0

406-3.04 Bituminous Material: of the Standard Specifications is modified to add:

The grade of bituminous material to be used shall be AC-30.

406-6 Verification Testing: Table 406-6 of the Standard Specifications is modified to add:

The limiting value for the Index of Retained Strength shall be 45.

* Note: The limiting value for Index of Retained Strength should be 5 less than Index of Retained Strength.

406-6 Verification Testing: effective voids in Table 406-6 of the Standard Specifications is revised to read:

The allowable deviation from proposal targets for effective voids shall be ±1.0 percent. The requirement for limiting value for effective voids is hereby deleted.

ITEM 4060951 - PAVEMENT REINFORCING FABRIC

Description:

The work under this item consists of furnishing all equipment, materials, labor, and placing by use of mechanical equipment, between Sta. 56+31.32 to 79+78.5, a reinforcing interlayer between the milled surface and the surfacing course in accordance with the details shown on the project plans, these special provisions, and as directed by the Engineer.

Pavement reinforcing fabric shall be nonwoven polyester, polypropylene, or polypropylene/nylon materials conforming to the following when tested in conformance with the listed ASTM Designation:

Weight, Oz,/sq. yd., ASTM Designation: D 1910	3.0 to 8.0
Grab Tensile Strength (1-inch grip), Pounds, ASTM Designation: D 1117	90 min.
Elongation at Break, Percent, ASTM Designation: d 1117	40 min.
Fabric Thickness, ASTM Designation: D 461	30 to 100 mils

Pavement reinforcing fabric shall be accompanied with a Certificate of Compliance conforming to the provisions in Section 106.05 of the Standard Specifications.

The fabric shall be protected from exposure to ultraviolet rays and shall be kept dry until placed.

Construction Requirements:

Surface preparation shall involve cleaning the milled surface free of milling dust, dirt and moisture by methods approved by the Engineer.

Prior to the placement of the reinforcing fabric, the milled and cleaned surface shall receive a binder coat consisting of approximately 0.25 - 0.30 of a gallon per square yard of paving grade asphalt (AC-30). The exact rate of application will be determined by the Engineer.

The reinforcing fabric (interlayer) shall be unrolled and spread uniformly directly by the mechanical means on the coated surface. Transverse joints shall be overlapped a minimum of 12 inches, and the longitudinal joints shall be overlapped a minimum of 3 inches, and the lap joints shall be sealed with an application of binder coat. The rate of application shall be as specified above.

Fabric placement on the milled surface and subsequent application of the overlay shall be accomplished by the end of each shift. Milling operation shall not commence until notification of an approved AC mix design is received and in no case shall the milled surface be open to normal traffic longer than 72 hours before application of the fabric and subsequent overlay are initiated.

Fabric Laydown Equipment:

Mechanical laydown equipment shall be capable of handling full rolls of fabric, and shall be capable of laying the fabric smoothly, without excessive wrinkles and/or folds that lap. The test for lapping shall be made by gathering together the fabric in a wrinkle. If the height of the doubled portion of extra fabric is 1/2 inch or more, the fabric shall be cut to remove the wrinkle, then lapped in the direction of paving. When manual laydown is required, a length of standard one-inch pipe, together with suitable roll tension devices, shall be used. The fabric shall be unrolled, stretched, aligned and placed in increments of approximately 30 feet.

Application of Binder Coat:

The binder coat must be uniform spray applied at the specified rate. Quantity specified will vary with the condition of the milled surface, but will normally be applied at the rate of 0.25 to 0.30 gallons per square yard of residual asphalt.

At major intersections or other areas where vehicular speed changes and turning movements occur, it is recommended that the binder coat application be reduced by approximately 20% (0.20 to 0.25 gallons per square yard) to minimize the chance of a slippage plane developing. The exact location of these areas will be as specified by the Engineer. Care shall be taken to avoid tracking binder material onto the pavement reinforcing fabric or distorting the fabric. If necessary, exposed binder material shall be covered lightly with sand.

Traffic:

Only necessary construction equipment shall be allowed on the fabric until the application of the asphalt concrete overlay and subsequently opening to normal traffic. Public traffic shall not be allowed on the bare reinforcing fabric, except that public cross traffic shall be allowed to cross the fabric, under traffic control, after the contractor has placed a small quantity of asphalt concrete over the fabric. Construction equipment turning movements as well as sudden stops/starts on the fabric should be minimized.

Method of Measurement:

Measurement will be made by the square yard of fabric placed.

Basis of Pavement:

The accepted quantities of fabric placed, measured as provided above, will be paid for at the contract unit price per square yard, which price shall be full compensation for the work, complete in place, as specified and described herein and as shown on the plans. No measurement or additional compensation will be made for cleaning the milled asphaltic concrete surface or furnishing and applying the binder coat, the cost being considered as included in the cost of ITEM 4060951.

ITEM 4060956 - PAVEMENT REINFORCING FABRIC (INSTALLATION):

Description:

The work under this item consists of furnishing and applying three experimental pavement reinforcing fabrics which will function as interlayers between the milled surface and two inch AC inlay to control reflection cracking. These fabrics will be supplied by their respective manufacturers for experimental use and the work shall consist of furnishing the equipment, materials and labor required in applying these fabrics between Sta 24+30 and 56+53.32, to the milled surface directly over the existing transverse cracks in accordance with the details shown on the project plans, these special provisions, and as directed by the Engineer.

Surface preparation shall involve cleaning the milled surface free of milling dust, dirt and moisture by methods and equipment approved by the Engineer prior to the application of all pavement reinforcing fabrics.

Approximately 1,000 linear feet of 'Paveprep' will be supplied by the manufacturer. The material is a high density asphalt mastic sandwiched between two layers of polyester fabric. The material will be delivered to the jobsite in rolls that hold 102 feet of the 20 inch wide fabric. A tack coat of AC-30 paving grade asphalt shall be applied at the approximate rate of 0.10 gallons per square yard prior to applying the fabric. A distributor or motorized tar kettle, both equipped with a hand held wand are acceptable for the tack coat application. The width of the tacking should be the material width (20 inches) plus 3 to 4 inches and shall be applied no further in advance of the fabric placement than can be accomplished without loss of the tack coat adhesion. The tacking coverage should span the meandering cracks as evenly as possible so as to insure adhesion of the fabric edges.

No special equipment is needed for handling the fabric rolls. A steel bar or pipe can be inserted through the core for easy take-off or simply rolled along the crack manually. It should be unrolled so that the corners naturally turn down since it makes no difference which side of the fabric contacts the tacked surface. Where transverse and longitudinal cracks meet, or when splices are required, the fabric may be butted as neatly as possible by cutting with razor knives. Cornering can be accomplished without sectioning, if desired, by walking fabric to a point where gathering occurs, slicing out the bubble and tacking the overlap.

Approximately 1,000 linear feet of 'Tape Coat' M-860 will be supplied by the manufacturer and delivered to the jobsite in rolls 12 inches wide that contain 150 feet of the fabric. This material shall be applied to the cleaned surface in a manner similar to that recommended by 'Paveprep' except that no tack coat is required since the fabric is a cold applied and self adhering pressure sensitive material. The rolls have an easily removable plastic release film that protects the elastomeric resins from contamination prior to application. The manufacturer recommends applying rolling pressure after placement to accelerate bonding.

Approximately 1,000 linear feet of 'Glas Grid' will be supplied by the manufacturer and delivered to the jobsite in 5 foot wide rolls. This fabric does not require a tack coat since it is a self adhering material, although the manufacturer recommends utilizing a tractor mounted placement apparatus to achieve best results. The fabric shall be smooth and free of wrinkles and overlaps and shall be butt spliced, where required. Bonding shall be accomplished through the use of a rubber-tired roller.

Approximately 1,000 linear feet of pavement cracks will be designated for control purposes and will not receive a fabric application. The placement locations for each experimental fabric and those used for control purposes shall be as designated and recorded by the Engineer.

Method of Measurement:

Measurement will be made by the linear foot of fabric placed.

Basis of Payment:

The accepted quantities of fabric placed, measured as provided above, will be paid for at the contract unit price per linear foot, which price shall be full compensation for the work, complete in place, as specified and described herein and as shown on the plans. No measurement or additional compensation will be made for cleaning the milled asphaltic concrete surface or furnishing and applying the tack coat, when required, the cost being considered as included in the cost of ITEM 4060956.

APPENDIX D

Project Construction Observers

The following persons were present during construction of the project:

Timothy Wolfe, Arizona Transportation Research Center
Guy Clerc, Project Supervisor, Safford Construction
Jon Woostencroft, Bay Mills Ltd.
Walter Zavitz, Tapecoat Company
Bruce Christianson, Paveprep Corporation
Gary Bowen, Contractor
Bob Sinohui, Inspector

MATERIALS SECTION
ASPHALTIC CONCRETE MIX DESIGN VERIFICATION

H0179010

PROJECT NUMBER: I-10-6-923 CONTRACTOR: ASHTON COMPANY MIX TYPE: ADOT 1/2"
ORIGINATING LAB: W.T.I.TUCSON DESIGN LAB NO: 88-313A START DATE: 06/27/88

AGG. #	1	2	3	4	5	6
TYPE	BIN #3	BIN #2	BIN #1			
SOURCE	C 1255	C 1255	C 1255			
% USE	25.0	27.0	48.0			

	TYPE	SOURCE	PERCENT	SP. GR.
ASPHALT CEMENT:	AC-30	CHEVRON-RICHMOND	5.4	1.022
ADMIXTURE:	TYPE II	RILLITO	2.00	3.14

GRADATION (% PASSING)

SIEVE SIZE	GRAD. W/O ADMIXTURE	GRAD. W/ ADMIXTURE	VERIFICATION BAND W/O ADMIX.	CONTRACTORS TARGET W/ AD.	GRADATION BAND W/ AD.
1.5 IN.	100	100		100	100
1 IN.	100	100		100	100
3/4 IN.	100	100	100	100	100
1/2 IN.	98	98	94 - 100	97	90 - 100
3/8 IN.	78	78	73 - 79	76	70 - 85
1/4 IN.	59	60		60	
#4	52	53		56	
#8	44	45	44 - 48	47	44 - 52
#10	42	43		44	
#16	34	35		36	
#30	24	25		25	
#40	18	20	14 - 18	18	13 - 23
#50	11	13		12	
#100	4	6		5	
#200	2.2	4.1	1.2 - 2.2	3.6	3.0 - 7.5

AGGREGATE PROPERTIES: % ABRASION AT 100 REV. 4 500 REV. 19
SAND EQUIVALENT 68 % CRUSHED FACES 60

SPECIFIC GRAVITIES: O.D. COARSE 2.560 O.D. FINE 2.585 O.D. COMBINED 2.573
COMBINED WATER ABSORPTION: 1.32%

MIX PROPERTIES TO BE VERIFIED	ADOT RESULT	VERIFICATION BAND	CONTRACTORS RESULT	SPECIFICATION REQUIREMENT
STABILITY	2875	1750 +	2410	2000 +
FLOW	9	7 - 17	8	8 - 16
VMA	15.4	15.7 - 18.7	17.2	15.5 - 18.5
AIR VOIDS	3.9	4.9 - 6.9	5.9	5.8 - 6.2
RETAINED STRENGTH	67	45 +	53	50 +
WET STRENGTH	287	140 +	323	150 +

OTHER MIX PROPERTIES:

ASPHALT ABSORPTION 0.34 % MAXIMUM DENSITY 149.8 #/FT^3 AT 5.4 % ASPH.
BULK DENSITY 143.9 #/FT^3 % VOIDS FILLED 74.7 EFF. ASPHALT 5.1 M.T. Waste
FILM THICKNESS 12 MICRONS

REMARKS ON DESIGN

THIS DESIGN ALSO FOR PROJECT RS-274(8)P.
DESIGN FAILED VERIFICATION CRITERIA WITH LOW AIR VOIDS AND VMA.

JUL APPROVED BY

MATERIALS TESTING SECTION
MIX DESIGN NOT ACCEPTABLE

PRIVATE LAB MIX DESIGN TABULATION

DESIGN LAB # 88-313 DATE 06/29/88 ORIGINATING LAB: W.T.I.TUCSON
MIX TYPE ADOT 1/2" PROJECT NUMBER: I-10-6-923

GRADATION TARGETS-- % PASSING

SIEVE	W/O ADMIX	W/ ADMIX
1.5 IN.	100	100
1 IN.	100	100
3/4 IN.	100	100
1/2 IN.	97	97
3/8 IN.	76	76
1/4 IN.	59	60
#4	55	56
#8	46	47
#10	43	44
#16	35	36
#30	23	25
#40	16	18
#50	10	12
#100	3	5
#200	1.7	3.6

DESIGN INFORMATION

ADMIXTURE: TYPE II SOURCE: RILLITO PERCENT: 2.00

ASPHALT: AC-30 SOURCE: CHEVRON-RICHMOND SPECIFIC GRAVITY: 1.018

AGGREGATE: SAND EQUIVALENT 61 LOSS FROM ABRASION: 100 REV 4% 500 REV 21%
CRUSHED FACES 52
O.D. SP. GR.: COARSE 2.589 FINE 2.591 COMBINED 2.590
ABSORPTION: WATER 1.17% ASPHALT 0.37%

MIX: % ASPHALT 5.4 BULK DENSITY 141.7 #/FT^3 STABILITY 2410 FLOW 8
VMA 17.2% AIR VOIDS 5.9% RETAINED STRENGTH 53.0% WET STRENGTH 323 PSI

MAXIMUM THEORETICAL DENSITY IS 150.6 #/FT^3 AT 5.4 % ASPHALT

REMARKS: THIS DESIGN ALSO FOR PROJECT RS-274(8)P.

Douglas A. Fortie

JUL 19 1988

MATERIALS TESTING ENGINEER

TEST RESULTS FOR ADOT 1/2" MIX DESIGN, LAB # 88-313A . PROJECT NUMBER: I-10-6-923

AGGREGATE SAMPLES:

LAB #	TYPE	FROM	DATE	SOURCE	1"	3/4"	3/8"	#4	#8	#16	#40	#100	#200
88-313	BIN #3	BIN	06/22/88	C 1255	100.0	100.0	18.0	2.0	1.0	0.0	0.0	0.0	0.00
88-312	BIN #2	BIN	06/22/88	C 1255	100.0	100.0	93.0	16.0	2.0	0.4	0.4	0.4	0.40
88-311	BIN #1	BIN	06/22/88	C 1255	100.0	100.0	100.0	99.0	90.0	71.0	37.0	8.0	4.00
88-310	5/8"	STOCKPILE	06/22/88	C 1255	100.0	100.0	27.0	2.0	0.4	0.4	0.4	0.4	0.40
88-309	3/8"	STOCKPILE	06/22/88	C 1255	100.0	100.0	92.0	7.0	1.0	1.0	1.0	1.0	0.80
88-308	WFINES	STOCKPILE	06/22/88	C 1255	100.0	100.0	100.0	97.0	84.0	62.0	29.0	4.0	1.20

AGGREGATE SOURCES:
SOURCE NO: C 1255 DESCRIPTION: INDUSTRIAL ASPH.# 66

SPECIFIC GRAVITY TEST(S):

TEST #	TYPE	SOURCE NO.	OD SP. GR.	SSD SP. GR.	WATER ABSORPTION	USED IN DESIGN?
1	FINE	C 1255	2.585	2.614	1.09 %	YES
1	COARSE	C 1255	2.560	2.600	1.55 %	YES

MARSHALL TESTS:

TEST #	METHOD	DATE	% ASPHALT	%ADMIX	BULK DENSITY	STABILITY	FLOW	VMA	VOIDS	USED IN DESIGN?
1	MECH	06/30/88	5.4	2.0	143.9	2930	9	15.4	3.9	NO
2	HAND	06/30/88	5.4	2.0	145.2	3274	12	14.6	3.0	NO
3	MECH	07/01/88	5.4	2.0	143.9	2875	9	15.4	3.9	YES

RICE TESTS: (WITHOUT ADMIXTURE)

TEST #	DATE	% ASPHALT	MAXIMUM DENSITY	EFFECTIVE SP. GR.	USED IN DESIGN?
1	07/11/88	6.0	148.6	2.607	NO
2	07/12/88	6.0	148.0	2.595	YES

IMMERSION COMPRESSION TESTS:

TEST #	DATE	% ASPHALT	LOAD	MARSH. DENSITY	% OF MARSH. DENSITY	DRY STR.	WET STR.	RETAINED STR. %	USED IN DESIGN?
1	07/07/88	5.4	2150	143.9	95.1	428	287	67.1	YES

Douglas A. Foster

JUL 19 1988

MATERIALS TESTING ENGINEER