RESEARCH REPORT DOCUMENTATION PAGE

1. Report No.	2. Report Date	3. Contract No.	4. Project No.
ND 94-02	January 1999	N/A	SS-6-017(015)112

5. Title and Subtitle

Experimental Feature "PavePrep" Pavement Interlayer To Halt Or Retard Reflective Cracking

6. Report Type

Work Plan ☐
Construction ☐
Evaluation ☐
Final ☒

7. Project No. NH-3-002(040)212R

8. Project No.

9. Project No.

10. Project No.

11. Author(s)/Principle Investigator(s)

Mike Marquart

12. Performing Organization Name and Address

NDDOT M+R ☒
NDDOT OTHER* ☐
NDSU ☐
UND ☐
UGPTI ☐
OTHER* ☐
*see supplementary notes

North Dakota DOT
Materials and Research Division
300 Airport Road
Bismarck ND 58504-6005

13. Sponsoring Agency Name and Address

North Dakota DOT
Materials and Research Division
300 Airport Road
Bismarck ND 58504-6005

14. Supplementary Notes

15. Abstract

Purpose and Need

PavePrep is a high-density joint sealing membrane manufactured by the PavePrep Corporation of Harrison, Ohio. The product consists of a flexible high-density asphaltic membrane laminated between a nonwoven polyester geotextile and a woven polyester geotextile. This project will evaluate effectiveness of PavePrep on pavement cracks under an asphaltic overlay to retard reflective cracking.

Objective

To evaluate PavePrep as astress-relief interlayer which is used in overlay applications to control reflective cracking

Scope

The research section is located on Highway 17 near reference point 123 by Grafton, North Dakota. The section will consist of one 1,000' test section and one 1,000' control section. The percentage of reflective cracks that appear in the HBP will be used to determine the success of the PavePrep fabric. The research and control section will be evaluated annually for five years.

Summary

SS-6-017(015)112

The control and PavePrep sections are both exhibiting reflective cracking. The PavePrep section has 9% less reflective cracks than the control section. This is after four years of service. Approximately 39% of the original cracks have reflected to date. Cores taken in 1996 and 1998 verify that the cracks are reflecting through the PavePrep and 85% of the PavePrep was torn. Based on these cores, PavePrep is not providing good protection from moisture intrusion into the roadway on this asphalt project.

NH-3-002(040)212R

Almost all of the reflected cracks occurred in the second year. Both the control and PavePrep sections reflected cracks at the same rate in 1996, 1997, and 1998. Both sections are equal at this time. Approximately 22% of the original joints have reflected to date in each section. Cores taken in 1996 and 1998 verify that the cracks are reflecting through the PavePrep. It seems that the joints in the concrete do not move as much as cracks in the asphalt project because 65% to 75% of the PavePrep was not torn in the concrete project. About 65% to 75% of the PavePrep is preventing moisture intrusion into the roadway on this project.

It can be said that PavePrep does not prevent reflective cracking or slow it down very much. PavePrep does provide some moisture barrier protection when used on concrete joints with an asphalt overlay. PavePrep used on asphalt cracks with asphalt overlay provided unsatisfactory results.

Recommendation

PavePrep does not control reflective cracking on either concrete or asphalt. The only benefit PavePrep provides is some moisture protection. PavePrep does not appear to retard reflective cracking. Recommend that PavePrep not be used to control reflective cracking.

16. Key Words	17. Distribution Statement	18. No. of Pages
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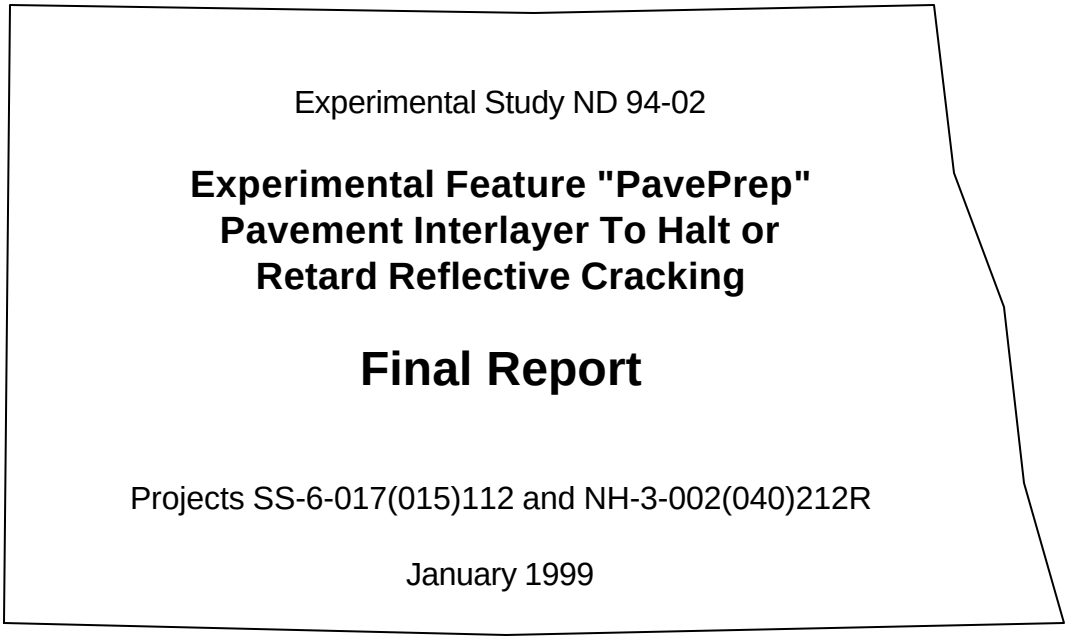
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

MATERIALS AND RESEARCH DIVISION



Experimental Study ND 94-02

Experimental Feature "PavePrep" Pavement Interlayer To Halt or Retard Reflective Cracking

Final Report

Projects SS-6-017(015)112 and NH-3-002(040)212R

January 1999

Prepared by

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION
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U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

EXPERIMENTAL PROJECT REPORT

EXPERIMENTAL PROJECT

EXPERIMENTAL PROJECT NO.

	STATE	YEAR		NUMBER	SURF
1	ND	94	-	02	

CONSTRUCTION PROJ NO
NH-3-002(040)212
8 SS-6-017(015)112

LOCATION
Benson and Walsh
28 Counties

EVALUATION FUNDING
1 X HP&R
2 CONSTRUCTION
3 DEMONSTRATION
4 IMPLEMENTATION
48

NEEP NO.
49

PROPRIETARY FEATURE?
X Yes
51 No

SHORT TITLE

TITLE
52 Fabric Interlayer Under Asphaltic Overlay to Retard Reflective Cracking

THIS FORM

DATE
140 0 1 - 9 9

REPORTING
1 INITIAL 2 ANNUAL 3 X FINAL

KEY WORDS

KEY WORD 1
145 Pavement Asphalt

KEY WORD 2
167 Overlays

KEY WORD 3
189 Reflective Cracks

KEY WORD 4
211

UNIQUE WORD
233

PROPRIETARY FEATURE NAME
255 PAVEPREP

CHRONOLOGY

Date Work Plan Approved	Date Feature Constructed:	Evaluation Scheduled Until:	Evaluation Extended Until:	Date Evaluation Terminated:
10-93	09-94	10-99		07-98
277	281	285	289	293

QUANTITY AND COST

QUANTITY OF UNITS
3614
297

UNITS
1 X LIN. FT
2 SY
3 SY-IN
4 CY
5 TON
6 LBS
7 EACH
8 LUMP SUM
305

UNIT COST (*Dollars, Cents*)
9503.30
306

AVAILABLE EVALUATION REPORTS

X CONSTRUCTION
315

X PERFORMANCE

X FINAL

EVALUATION

CONSTRUCTION PROBLEMS
1 NONE
2 SLIGHT
3 X MODERATE
4 SIGNIFICANT
318 5 SEVERE

PERFORMANCE
1 EXCELLENT
2 GOOD
3 SATISFACTORY
4 X MARGINAL
319 5 UNSATISFACTORY

APPLICATION

320
1 ADOPTED AS PRIMARY STD.
2 PERMITTED ALTERNATIVE
3 ADOPTED CONDITIONALLY
4 PENDING
5 REJECTED
6 NOT CONSTRUCTED

(Explain in remarks if 3, 4, 5, or 6 is checked)

REMARKS

321 PavePrep guidelines must be followed to avoid problems of PavePrep shoving and asphalt overlay compaction. PavePrep has not stopped reflective cracking but is providing a moisture barrier in the concrete overlay section. PavePrep over a milled asphalt provides no benefit.

700

Form FHWA 1461

Experimental Study ND 94-02

Experimental Feature "Paveprep"
Pavement Interlayer To Halt or
Retard Reflective Cracking

FINAL REPORT

Projects SS-6-017(015)112 and NH-3-002(040)212R

January 1999

Written by
Mike Marquart

Disclaimer

The contents of this report reflect the views of the author or authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not reflect the official views of the North Dakota Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

TABLE OF CONTENTS

EXPERIMENTAL FEATURE "PAVEPREP" PAVEMENT INTERLAYER TO HALT OR RETARD REFLECTIVE CRACKING

Objective

The objective of this experimental feature is to evaluate a product called PavePrep. PavePrep is a stress-relief interlayer which is used in overlay applications to control reflective cracking.

PavePrep is a high density joint sealing membrane manufactured by the PavePrep Corporation of Harrison, Ohio. The product consists of a flexible high density asphaltic membrane laminated between a nonwoven polyester geotextile and a woven polyester geotextile.

PavePrep contains approximately 0.9 gallon of asphalt mastic per square yard. It requires 0.10 gallon of asphalt cement per square yard on normal surfaces to bind it to the existing pavement. On a milled surface PavePrep requires 0.25 gallon per square yard for bonding purposes. PavePrep is supplied in rolls and is available in various widths. The PavePrep material is approximately 120 mils (1/8 inch) thick. A roll contains about 102 lineal feet. The PavePrep was supplied by Contech Construction Products, Inc. of Middleton, Ohio.

Contech recommended that we use the 20-inch width PavePrep for transverse cracks in order to combat the high stresses associated with this type of cracking. According to PavePrep literature, PavePrep not only dissipates stresses to stop reflective cracking, but also is imperious to moisture. Reduction of moisture penetration between new and old pavement surfaces would add greatly to the durability of the overlay.

Two test locations, each under a different project number, were selected for the evaluation. This report will begin with the asphalt project SS-6-017(015)112 and conclude with the concrete project NH-3-002(040)212 R.

Project SS-6-017(015)112

Location and Description

A 1000-foot test section was selected on Highway 17 near Grafton, North Dakota. This was a mill and overlay project between the towns of Park River and Grafton. The test section is near milepoint 123 and is preceded by a 1000-foot control section.

PavePrep was placed over selected transverse joints in the test section. The joints covered both left and right lanes including shoulders. Plan sheets showing the location of the test section on the project are found in Appendix A.

Project History

The project history is shown in table 1.

YEAR	THICKNESS	TYPE	WIDTH	OIL
PARK RIVER TO GRAFTON				
1940		GRADE	36'	
1941	6"	STABILIZED (AGGR.) BASE	32'	
1941	1.5"	BITUMINOUS MAT	22'	
1956	1.5"	HOT BIT. LEVELING COURSE	32'	120-150
1956	1.5"	HOT BIT. WEARING COURSE	24'	120-150
1974		SHOULDER WIDENING	58'	
1975	2.0"	HOT BIT. PAVEMENT	24'	200-300
1975	8.0"	AGGR. BASE SHOULDERS (2)	9'	
1975	2.0"	HBP SHOULDERS (2)	12'	200-300
1988		CONTRACT CHIP SEAL	24'	MC-3000

TABLE 1

Traffic Data

This portion of ND Highway 17 is a minor arterial highway. The traffic data for this highway is found in table 2.

YEAR	PASS	TRUCKS	TOTAL	EST. MAX HR.	Flex. E.S.A.L.'S
1994	2750	250	3000	300	160
1998	2690	250	2940	300	180
E.S.A.L.,s are for both directions					

TABLE 2

Design

Even though the pavement's ride was good, the roadway was patched in many areas. Rutting and breakups were the major problems with this segment of Highway 17.

This pavement was designed to be milled and overlaid partly based on these major problems. Milling would remove 2.5 to 3.0 inches from the driving lanes. The five inch overlay of Class 33 hot bituminous pavement (HBP) is to be placed in two separate lifts. The shoulders are to receive a Class 29 recycled HBP. The control section begins at station 592+00 and ends at station 602+00. The test section begins at station 602+00 and ends at station 612+00.

Construction

Before the PavePrep was installed, a crack survey was obtained at the test section using a total station with a data collector. This method was selected in order to be able to accurately locate the existing cracks after the asphalt overlay. The plans stated that the geotextile PavePrep shall be placed according to the manufacturer's directions. Appendix B contains the PavePrep Application/Construction Guidelines. Twenty-six full transverse cracks, twenty half cracks, and five longitudinal cracks were covered with PavePrep.

An AC 120-150 tack coat was applied at a rate of 0.25 gal/sy to each crack prior to installing the PavePrep. The installation method is shown in photo 1. The contractor placed the first asphalt overlay lift about an hour after the last PavePrep was laid. Problems developed soon after the paving began. The PavePrep material was being pulled up by the slow moving paver wheels. This is shown in photo 2. One reason this happened may be that the tack coat under the PavePrep did not cure enough to bond to the old roadway surface. Once the contractor got the feel of things the work progressed satisfactorily.

Photo 1--PavePrep installation

Photo 2--Paver wheels lifting PavePrep

Evaluation

The experimental project was evaluated and cored on June 3, 1998. Photo 3 shows the beginning of the control section at station 592+00. The control section originally had about the same number of cracks as the PavePrep section.

Photo 3--Control section--Highway 17

The annual crack survey was taken by the Grand Forks District in May of 1998. The crack data was plotted. It seems that the shoulders were not included in this year's annual survey. The lineal feet of the cracks by using a total station with a data collector is fairly close to the actual measurements taken in the field. The plots are located in Appendix C and show the original cracks (1994) and the location of the reflected cracks for 1998.

Photo 4 shows the beginning of the PavePrep section. PavePrep had been placed on 2189.49 lineal feet of cracks. Of this, 417 feet was on longitudinal cracks. On June 3, 1998, the project looked good. It provided a good ride with no visible rutting. More cracks in the PavePrep section are reflecting through the shoulder and into the driving lane about three feet. This is also occurring in the control section. The project was contract chip sealed in June of 1996 shortly after the 1996 evaluation. This made the reflected cracks harder to see in 1997

Photo 4--PavePrep section--Highway 17

Photo 5–Cores 5&6 on Highway 17-----PavePrep torn

but, a re much better in 1998. All cracks were visually observed and measured in the control and PavePrep sections. These measurements will be used in this report.

Cores were taken at three stations in 1996 in the PavePrep section. This was to determine if the PavePrep layer is still intact. The results are shown below.

Core Observations 1996			
PavePrep Locations	**PavePrep Broken**	**Remarks**	**Provides Water Barrier**
603+20.5 E.B.	Yes Partially	Bottom membrane torn	Yes
603+20.5 W.B.	Yes	Completely torn	No
606+68.2 E.B.	No	----------	Yes
606+68.2 W.B.	Yes	Completely torn	No
611+54 E.B.	Yes	Completely torn	No
611+54 W.B.	Yes Partially	Top membrane torn	Doubtful

TABLE 3

The 1996 cores revealed that the transverse cracks are reflecting through the PavePrep. One feature of the PavePrep was its ability to provide a moisture barrier even if a crack reflects up through it. The PavePrep served as a moisture barrier in only one-third of the cores evaluated. The PavePrep was completely torn in the other two-thirds of the cores. No cores were taken in 1997.

Nine cores were taken in the PavePrep section and five in the control section at Highway 17 for 1998. This was to determine if the reflected crack is directly over the underlaying old crack. Cores would also provide information about whether the PavePrep is functioning as a moisture barrier or not. Comparing the present reflected crack to the original crack photos taken before the asphalt overlay, it was determined that most cracks have reflected almost vertically from the old crack. The core results for 1998 are shown below.

Core Observations 1998			
PavePrep Locations	**PavePrep Broken**	**Remarks**	**Provides Water Barrier**
604+58.0 E.B. W. B.	Yes No	Completely torn Reflected crack not over old crack	No Yes
606+68 E.B.	Yes	Completely torn	No
608+86.6 E.B. W.B. Shoulder	Yes Yes Yes	Completely torn Completely torn Completely torn	No No No
609+90.8 E.B. W.B. Shoulder	Yes Yes NO	Completely torn Completely torn	No No Yes

TABLE 4

In 1996 it was estimated that 33% of the reflected cracks in the PavePrep were providing a moisture barrier. This compares to only 15% in 1998. Table 4 shown only two cores where PavePrep was intact. The original and reflected cracking is shown below.

Section	**Length**	**Linear Footage of original cracks**	**Lineal Feet of Reflected Cracks**			
			1995	**1996**	**1997**	**1998**
PavePrep	1000 L.F.	1772 L.F.	122	525	581	632
% Reflected			7	30	33	36
Control	1000 L.F.	1752 L.F.	147	550	691	692
% Reflected			8	31	39	39

TABLE 5

The PavePrep section has 3% less reflected cracks than the control section. Many

of the original cracks are believed to be thermal or stress cracks. Not all of these cracks were expected to reflect. It appears that in a mill and asphalt overlay project using PavePrep over the transverse cracks to stop or retard reflective cracking does not provide the benefits intended.

PROJECT NH-3-002(040)212

Location and Description

An 800-foot test section was selected to place and monitor a fabric interlayer called PavePrep. The test section was preceded by an 800-foot control section. The test section is located on Highway 2, south roadway, approximately two miles west of Knox, North Dakota. The control section begins at station 1212+00 and ends at station 1220+00. The PavePrep test section begins at station 1220+00 and ends at station 1228+00. Plan sheets showing the location of the test section are found in Appendix A.

Project History

The project history is shown in table 6.

RUGBY TO LEEDS			
YEAR	**THICKNESS**	**TYPE**	**WIDTH**
1976		Grade	46'
1976	2"	Aggregate Base	44'
1977	9"	Non Reinforced PCC Pavement	27'
1977	9"	Aggregate Shoulders	7' & 3'

TABLE 6

Traffic Data

This portion of Highway 2 is a principal arterial highway. The traffic data is found in table 7. The ESALS are for the eastbound lanes only.

YEAR	PASS	TRUCKS	TOTAL	EST. MAX HR.	Flex one-way E.S.A.L.'S
1993	625	175	800	90	155
1997	940	240	1180	120	200
1998	845	230	1075	110	180

TABLE 7

Design

The roadway was paved in 1977. It consisted of a six-inch layer of econocrete (low strength concrete) placed monolithicly with a three-inch PCC top (high strength concrete). A short time after this pavement was placed in service, longitudinal cracks began to develop. Cracking accelerated and "D" cracking was becoming more evident. Recycling the existing concrete pavement was not recommended because of the lower strength of the econocrete. Experience has shown that an asphalt overlay on existing PCC pavement with longitudinal cracking will not stop cracks from reflecting through to the surface. The NDDOT solution to this was to crack and seat the concrete and overlay with four inches of Class 33 HBP. There is a potential for reflective cracks to develop between the edge of the concrete and the existing gravel shoulder. Edge drains were included in the design to carry away any water that might infiltrate through these cracks. The typical sections are located in Appendix A.

Low quality aggregates were used to produce the econocrete. In a few areas on the project, concrete quality aggregates were used in the econocrete. One of these areas is located from station 1211+55 to station 1230+30, which is between mile marker 223 and 224.

The geotextile PavePrep was selected for use in a test section in this area. An 800-foot control section and an 800-foot test section were selected from station 1212+00 to station 1228+00 as shown in the plans. The plans stated that the geotextile PavePrep shall be placed according to the manufacturer's directions. Appendix A contains the project plans. Appendix B contains the PavePrep Application/Construction Guidelines.

Construction

The contractor, gaining experience from the Highway 17 project, was better prepared for this Highway 2 test section. Working on concrete with joints that are in a straight line also helps. The same basic procedure was used to install the PavePrep here as on Highway 17. The roadway was cleaned. A tack coat was applied over the joints at a rate of approximately 0.1 gal/sy. The PavePrep was placed over the joint and worked into the tack. Photo 6 shows a view of the PavePrep on the east end of the test section.

Photo 6 --East end overview of PavePrep section

The PavePrep was overlaid two days later. PavePrep was not pulled up by the paver wheels as it was on the Highway 17 asphalt project. The main reason being that the tack material

had sufficient time to cure. This provides an adequate bond between the PavePrep and the pavement.

One problem that developed was that shoving took place over a few joints during compaction of the first asphalt lift. This is mainly attributed to the PavePrep which is 120 mils thick and tends to compress under the roller. After the second asphalt lift was put down, this shoving problem was no longer evident.

Each section, control or PavePrep, contained 50 joints. PavePrep was placed on 1350 lineal feet of transverse joints and 75 lineal feet of longitudinal cracks. Joint spacings alternate approximately from 16, 14, and 18 feet. Offset pins were placed at the beginning of each section. A survey chain was used to locate the station of each joint or crack.

Evaluation

All of the joints in the PavePrep section were covered with the PavePrep material before the asphalt overlay. An overview of the PavePrep test section is shown in photo 7.

Photo 7 --PavePrep section overview--looking east

The project was evaluated on June 1, 1998. The roadway appearance looked good. No rutting could be seen and the ride was smooth. The joints on this project are skewed and can be seen by the reflected crack in photo 8. Photo 8 is at station 1213+23.9 and shows that the crack reflects directly over the underlying joint. The crack is quite straight.

Photo 8 --Control section--reflected joint crack--sta.1213+23.9

Photo 9 shows a reflected crack in the PavePrep section. The crack is fairly straight except for the shoulder.

Photo 9 --PavePrep section--typical reflected joint crack--sta.1221+0.6

Cores were taken at various locations on reflected joints in the PavePrep section in August of 1996. This was to determine if the PavePrep interlayer was still intact and functioning as a moisture barrier. The core locations and results are shown below.

Core Observations of 1996			
PavePrep Locations	**PavePrep Broken**	**Remarks**	**Provides Water Barrier**
Station 1222+1.5	Yes Partially	Top membrane torn	Yes
Station 1224+22	No	----------	Yes
Station 1225+18	No	----------	Yes

Table 8

Two of the three cores show that the reflected crack does not start at the joint and travel up to the surface but starts off to one side about 1½". The cores were carefully split at the PavePrep interlayer to determine if the PavePrep was torn apart or still functioning as a moisture barrier. All of the reflected PavePrep joints that were cored will keep moisture from penetrating any further into the roadway. No cores were taken in 1997. Cores were obtained on June 2, 1998 for a final evaluation. The results are shown in table 9.

Core Observations of 1998			
PavePrep Locations	**PavePrep Broken**	**Remarks**	**Provides Water Barrier**
Station 1223+44.6	Yes	crack reflected	No
Station 1223+60.5	No	crack not reflected	Yes
Station 1225+83.5	No	crack reflected	Yes
Station 1227+26.9	No	crack reflected	Yes

Table 9

All cores were taken over reflected cracks except one, which was at station 1223+60.5. The old underlaying joint was measured and marked for coring. The intent was to core the joint and determine the condition of the PavePrep. The PavePrep at this station was in good condition. In all reflected crack locations, the crack reflected up through the PavePrep. The PavePrep outer membranes were not torn in 65% to 75% of the cases, thus providing protection from water entering the roadway system.

The original crack survey and 1998 reflected crack surveys were plotted and are found in Appendix C. In 1996, nine joint cracks had reflected in the control section and nine joints had reflected in the PavePrep section. In 1997, two more joints reflected in each section. The control and PavePrep sections each have 11 reflected cracks. The reflected crack count of 11 is the same for 1998. This is attributed to the very mild winter conditions. Most of the joints

reflected sometime during the second year of service. Both sections are presently reflecting cracks at the same rate.

The original and reflected cracking is shown below. The 417 L.F. of longitudinal cracks covered in the PavePrep section is not included.

Section	Length	Linear Footage of original cracks	Lineal Feet of reflected cracks				Crack Spacing 1998	
			1995	1996	1997	1998	Average	Stan. Dev.
PavePrep	800 L.F.	1350 L.F.	none	243	297	297	72.0	40.7
% Reflected			0	18	22	22		
Control	800 L.F.	1350 L.F.	54	243	297	297	76.8	29.0
% Reflected			4	18	22	22		

Table 10

Summary

SS-6-017(015)112

The control and PavePrep sections are both exhibiting reflective cracking. The PavePrep section has 9% less reflective cracks than the control section. This is after four years of service. Approximately 39% of the original cracks have reflected to date. Cores taken in 1996 and 1998 verify that the cracks are reflecting through the PavePrep and 85% of the PavePrep was torn. Based on these cores, PavePrep is not providing good protection from moisture intrusion into the roadway on this asphalt project.

NH-3-002(040)212R

Almost all of the reflected cracks occurred in the second year. Both the control and PavePrep sections reflected cracks at the same rate in 1996,1997, and 1998. Both sections are equal at this time. Approximately 22% of the original joints have reflected to date in each section. Cores taken in 1996 and 1998 verify that the cracks are reflecting through the PavePrep. It seems that the joints in the concrete do not move as much as cracks in the asphalt

project because 65% to 75% of the PavePrep was not torn in the concrete project. About 65% to 75% of the PavePrep is preventing moisture intrusion into the roadway on this project.

It can be said that PavePrep does not prevent reflective cracking or slow it down very much. PavePrep does provide some moisture barrier protection when used on concrete joints with an asphalt overlay. PavePrep used on asphalt cracks with an asphalt overlay provided unsatisfactory results.

Recommendations

PavePrep does not control reflective cracking on either concrete or asphalt. The only benefit PavePrep provides is some moisture protection. PavePrep does not appear to retard reflective cracking. Recommend that PavePrep not be used to control reflective cracking.

APPENDIX A

SS-6-017 (015) 112

JOB# 12

FHWA REGION	STATE	PROJECT NO.	SHEET NO.
8	ND	SS-6-017(015)112	1

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

IN WALSH COUNTY

FEDERAL AID PROJECT NO. SS-6-017(015)112 &
TES-6-017(015)112

MILL & OVERLAY HOT BITUMINOUS PAVEMENT

DESIGN DATA

Park River East to Jct ND 18

Traffic	Average Daily						Est. Max Hr.
Current 1994	Pass.	1700	Trucks	200	Total	1900	190
Forecast 2014	Pass.	1700	Trucks	200	Total	1900	190

Jct ND 18 East to Grafton

Traffic	Average Daily						Est. Max Hr.
Current 1994	Pass.	2750	Trucks	250	Total	3000	300
Forecast 2014	Pass.	2700	Trucks	250	Total	3000	300

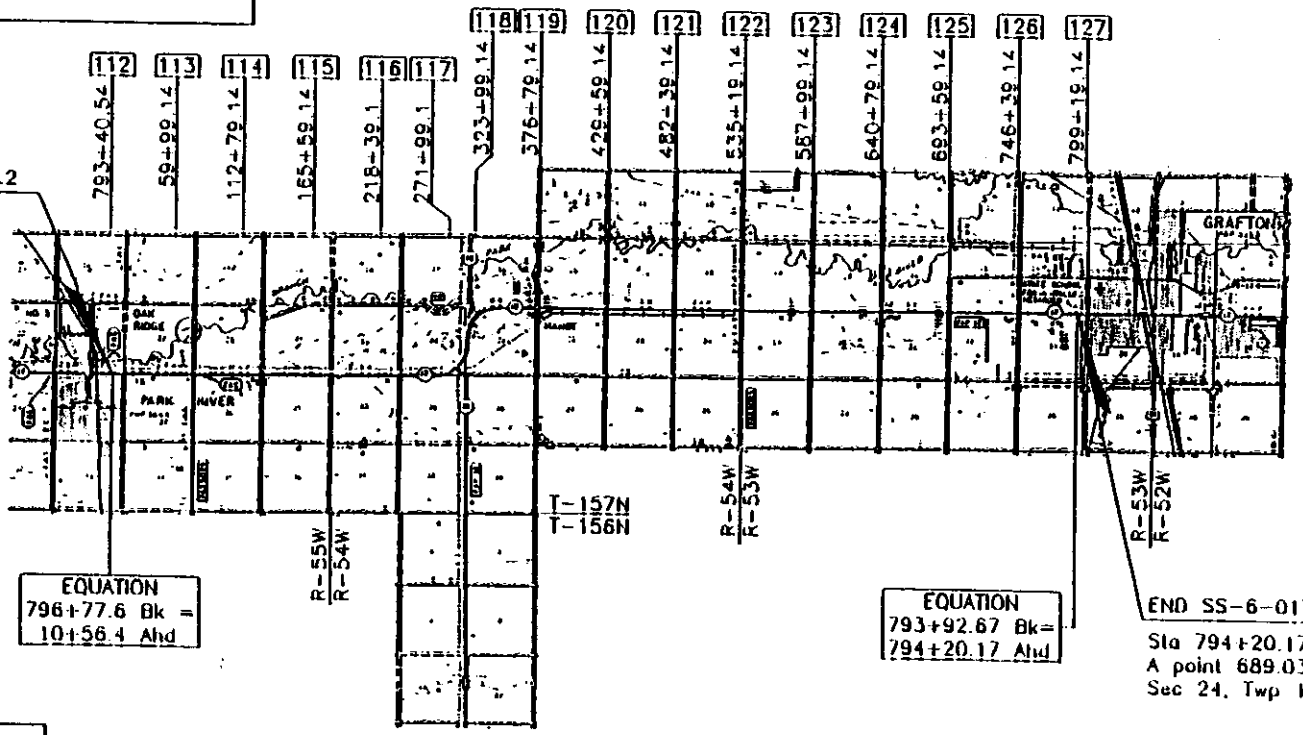
Minimum Sight Dist. for:	Design Speed 70 MPH
Stopping	850'
Safe Passing	3200'
Passing for Marking	1200'

GOVERNING SPECIFICATIONS:

Standard Specifications adopted by the North Dakota Department of Transportation September 1992; Standard Drawings currently in effect; and other Contract Provisions submitted herein.

LENGTH OF PROJECT

SS-6-017(015)112	14.798 Miles
TES-6-017(015)112	0.803 Miles



Beg SS-6-017(015)112 Sta 121+60.2
Sec 21, Twp 157N, Rge 55W

EQUATION
796+77.6 Bk =
10+56.4 Ahd

EQUATION
793+92.67 Bk=
794+20.17 Ahd

END SS-6-017(015)112 Sta 793+92.67 =
Sta 794+20.17 Beg SS-6-017(010)127
A point 689.03' West of the NW Cor of
Sec 24, Twp 157N, Rge 53W

PAVING SECTION Dave Junkin
URBAN SECTION
TRAFFIC SECTION
RURAL SECTION
RECOMMEND APPROVAL 1-31 1994
DESIGN ENGINEER David K.D. Lee

APPROVED DATE 1/31/94

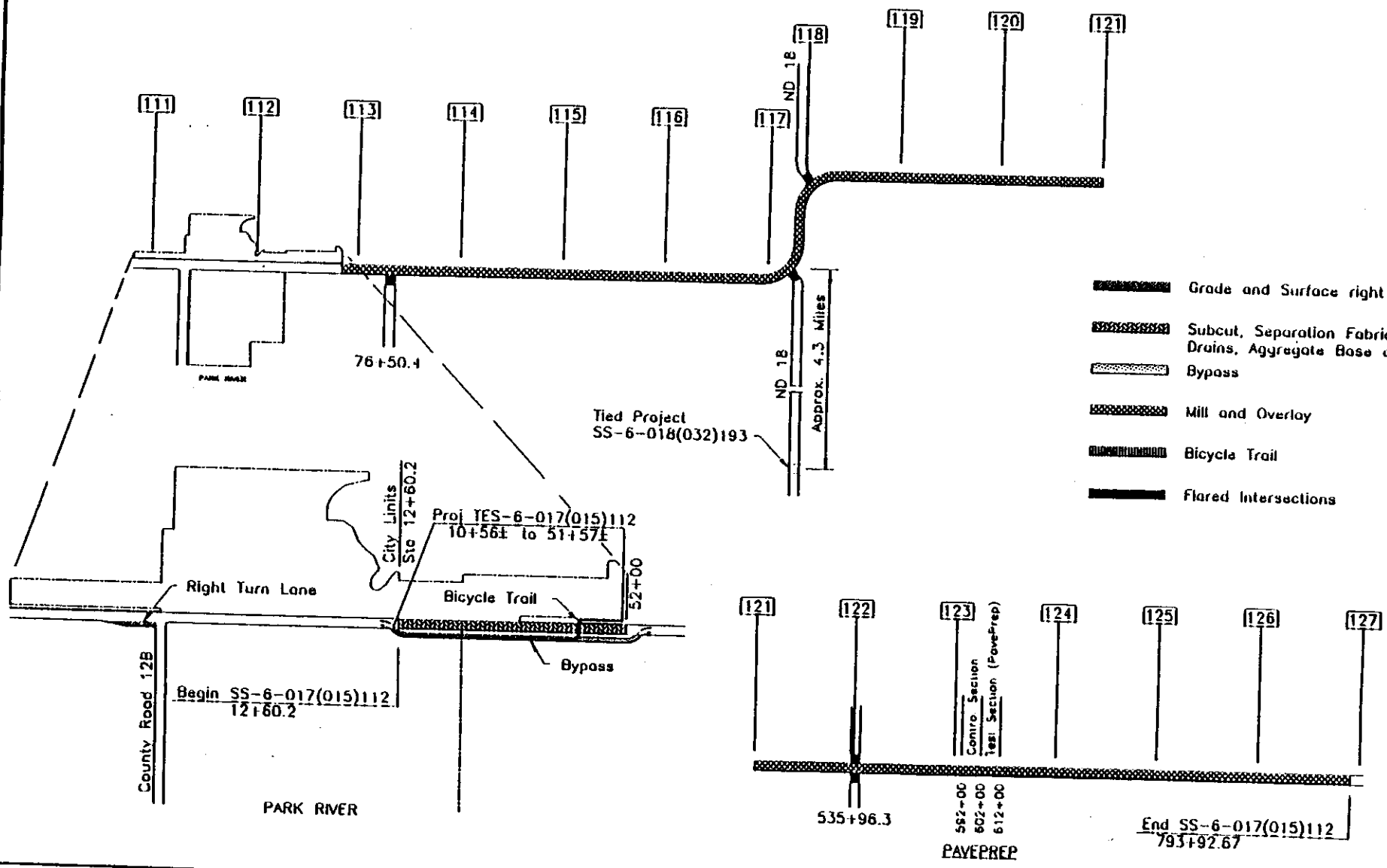
for DIRECTOR OF HIGHWAYS
AND ENGINEERING
NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION

FRANCIS G. ZIESLER
REGISTERED
PROFESSIONAL
P.E. 1179
ENGINEER
NORTH DAKOTA

T-A

FHWA REGION	STATE	FED. AID PROJ. NO.	SHEET NO.
8	N.D.	SS-6-017(015)112 TES-6-017(015)112	3

SCOPE OF WORK



NH-3-002 (040) 212

DESIGN DATA				
Traffic	Average Daily			Est. Hourly
Current (1993)	Pass. 625	Trucks 175	Total 800	90
Forecast (2013)	Pass. 925	Trucks 275	Total 1200	140
Minimum Sight Dist. For:	Design Speed 70 MPH			
Stopping 600'				
LIMITED CONTROL ACCESS				

JOB# 12

NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

FHWA REGION	STATE	PROJECT NO.	SHEET NO.
8	ND	NH-3-002(040)212	1

IN

PIERCE & BENSON COUNTIES

FEDERAL AID PROJECT No. NH-3-002(040)212

PCC Pavement Cracking and Seating

Hot Bituminous Overlay

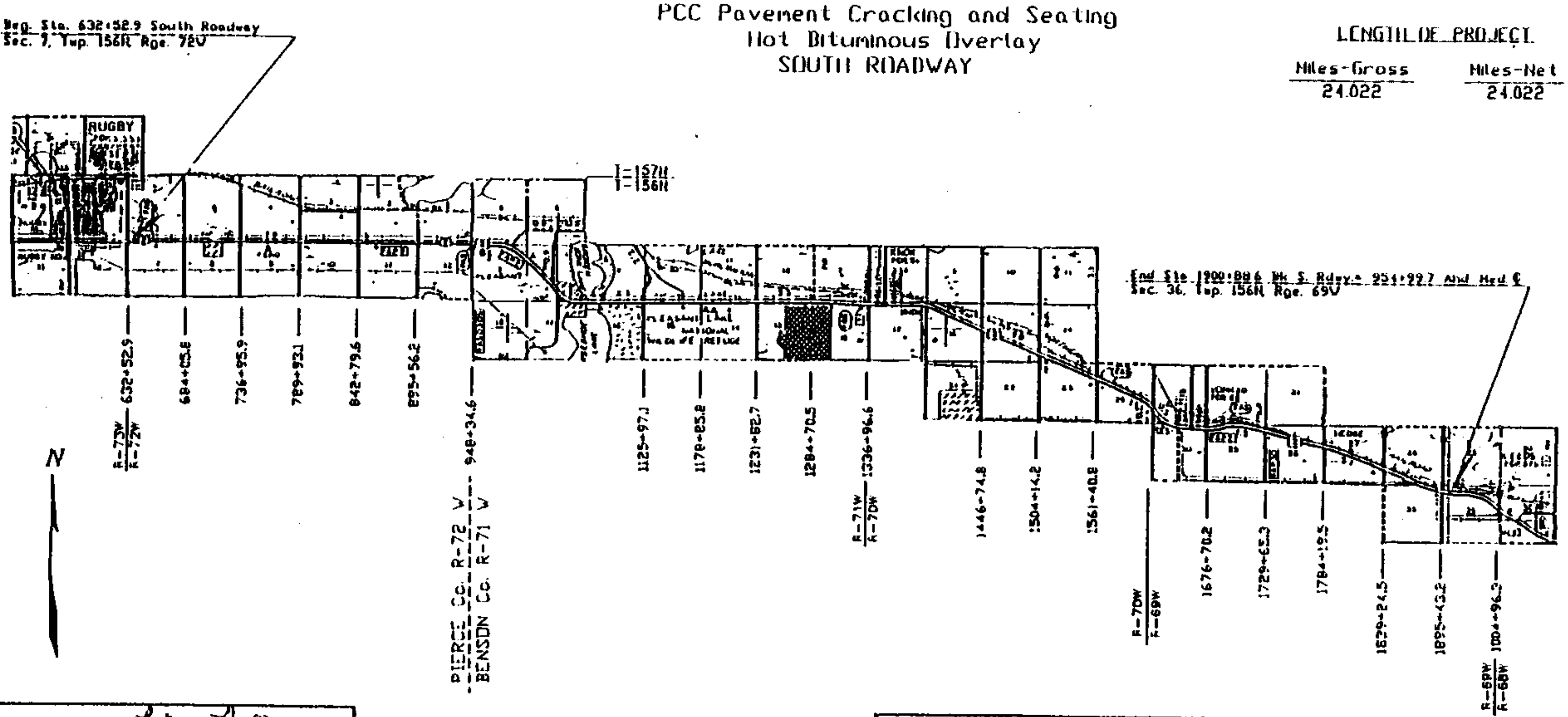
SOUTH ROADWAY

GOVERNING SPECIFICATIONS:

Standard Specifications adopted by the North Dakota Department of Transportation September 1992; Standard Drawings currently in effect; and other Contract Provisions submitted herein.

LENGTH OF PROJECT

Miles-Gross	Miles-Net
24.022	24.022



PAVING SECTION	*(signature)*
URBAN SECTION	
TRAFFIC SECTION	*(signature)*
RURAL SECTION	
RECOMMEND APPROVAL	2-24 1997
DESIGN ENGINEER	*(signature)*

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

APPROVED

DIVISION ADMINISTRATOR DATE

APPROVED DATE 2-24-97

(signature)

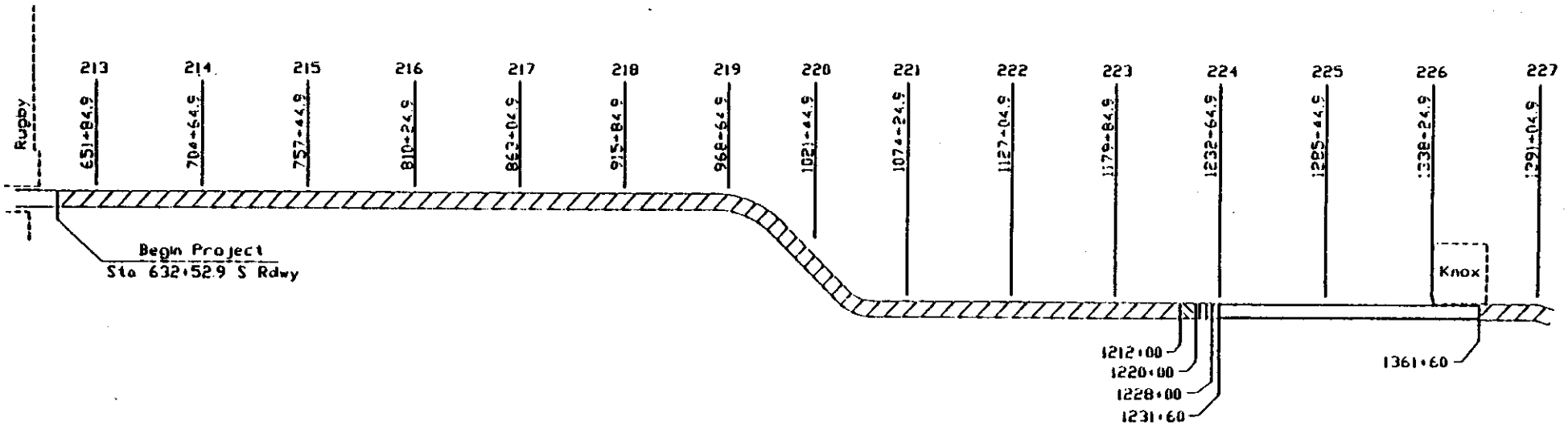
DIRECTOR OF HIGHWAYS AND ENGINEERING
NORTH DAKOTA DEPARTMENT OF TRANSPORTATION

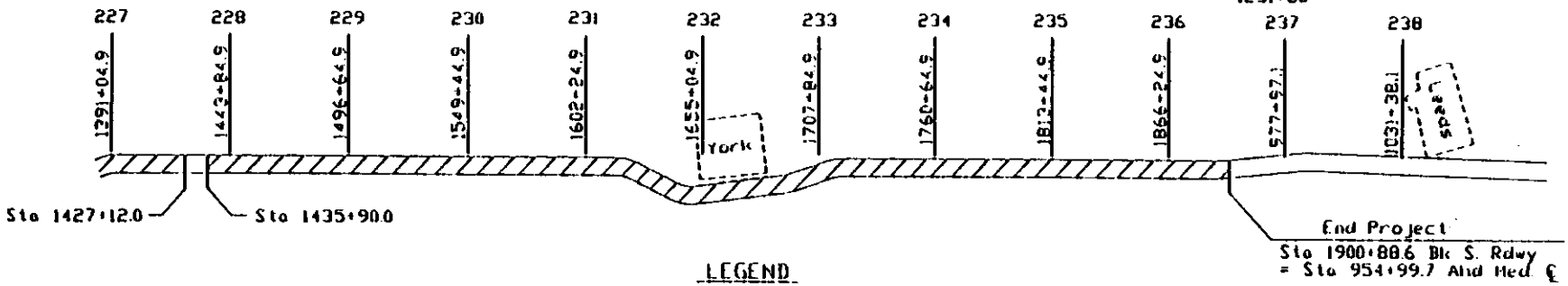
RAY ZINK REGISTERED PROFESSIONAL ENGINEER P.E. 873 NORTH DAKOTA

A-3

FHWA REGION	STATE	FED AID PROJ NO.	SHEET NO.
8	N.D.	NH-3-002(040)212	3

SCOPE OF WORK





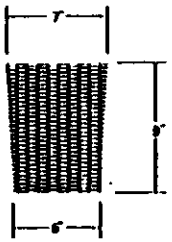
LEGEND

- Crack and Seat, HBP Overlay
- HBP Pave Shoulders
- HBP Overlay, Saw and Seal
- Test Control Section, HBP Overlay
- Pave Prep Test Section, HBP Overlay

FHWA REGION	STATE	FED. AID PROJ. NO.	SHEET NO.
8	N.D.	IM-3-002(040)212	16

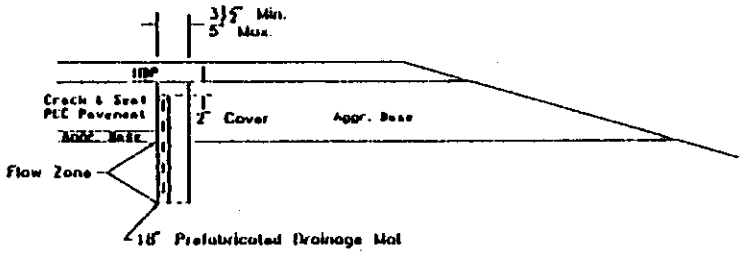
REVISED 8-13-93

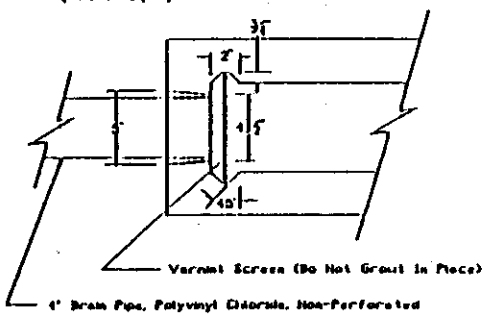
PAVEMENT EDGE DRAIN, PRECAST CONCRETE HEADWALLS, OUTLET PIPE, AND TRENCH DETAILS



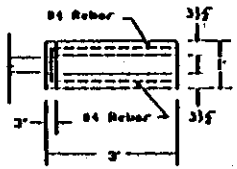
VARMINT SCREEN

3X3 Galv. Hardware Cloth .063 (Wire or Equal)



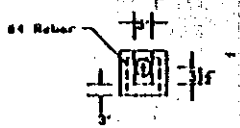


4" PIPE HOLE DETAIL

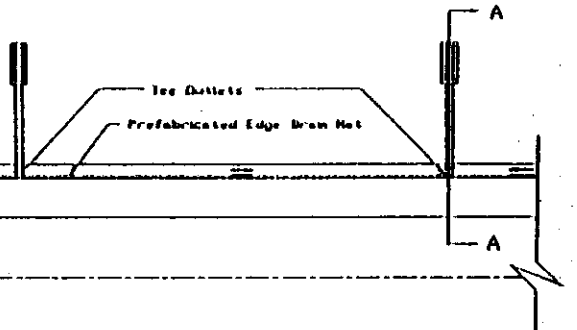


PRECAST CONCRETE HEADWALL
(Top View)

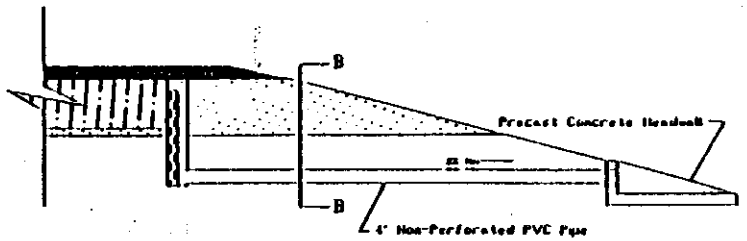
PRECAST CONCRETE HEADWALL
(Side View)



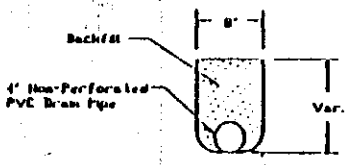
PRECAST CONCRETE HEADWALL
(Front View)



NOTES: Outlets shall be placed every 250' Max



TYPICAL SECTION A-A



DETAIL CUT B-B

NOTE: All dimensions shown for concrete headwall are minimum dimensions.

APPENDIX B

PAVEPREP GUIDE SPECIFICATION

The heavy-duty crack reduction/stress relief interlayer material shall consist of a flexible high density asphaltic membrane laminated between a nonwoven polyester geotextile and a woven polyester geotextile meeting or exceeding the physical properties outlined below:

TABLE 1

Heat Stability:	No dripping or delamination after 2 hours @ 190°F on a 2" x 5" sample (88°C on a 5 cm x 13 cm sample) suspended vertically in mechanical convection oven
Flammability:	Self-extinguishing/NBR - Federal FMVSS 302
Cold Flex:	No separation - ASTM D146-90 (2" x 5" specimen, 180° bend on 2" mandrel @ 0°F) (5 cm x 13 cm specimen on 5 cm mandrel @ -18°C)
Polymeric Reinforcement:	Cycles to break (single fiber) - 2,100,000 cycle
Equivalent Glass Reinforcement:	Cycles to break (single fiber) - 30,500 cycle
Elongation:	100% - ASTM D412-87
Tensile Strength:	2380 lbs/in² (167 kg/cm²) - ASTM D412-87
Weight:	0.9 lbs/ft² (4.4 kg/m²)
Density:	80 lbs/ft³ (1281 kg/m³) - ASTM E12-70
Caliper:	0.135 in. (3.43 mm), 95% retained after loading - ASTM D1777
Absorption:	1% maximum - ASTM D517-92
Brittleness:	Passes - ASTM D517-92
Softening Point:	212°F (100°C) minimum - ASTM D36-86
Specific Gravity (Mastic Compound):	1.67 - ASTM D70-82
Weight/Gallon (Mastic Compound):	14.0 lbs. minimum (6.4 kg) - ASTM D70-82

To be considered an equal product, alternate materials submitted for approval must meet the above physical properties and must have been used successfully for five (5) years as a heavy-duty crack reduction/stress relief interlayer with documented field performance results in a minimum of six (6) similar applications and/or over a wide geographic area and a variety of substrates equal to or exceeding those under consideration.

APPLICATION/CONSTRUCTION GUIDELINES

SURFACE PREPARATION: The surface upon which the material is to be placed should be free of dirt, water, and vegetation. Surface cracks 1-1/4" wide or less need not be cleaned or filled. Surface cracks and/or other distressed areas greater than 1-1/4" wide shall be cleaned and filled with an approved crack filler or cold/hot-mix asphalt to the existing elevation. Cracks and/or joints with vertical deformations greater than 1/2" shall be wedged with cold/hot-mix asphalt to level the distressed area.

MATERIAL PLACEMENT: PavePrep must be dry prior to installation. The material shall be placed into the tack prior to the time the asphalt has cooled and lost its tackiness. The woven polyester side of the material should be placed up (exposed to traffic), with the nonwoven polyester side worked into the tack. The material shall be applied when the ambient temperatures are 45°F and rising. The material shall be cut (when necessary) with a razor knife from the woven polyester side.

It is critical that the edges of the mat are securely bonded to the pavement surface. Walk or roll in the edges of the mat to ensure a good bond.

Placement of the material should be made 24 hours in advance of paving operations when possible. PavePrep can be opened to traffic as soon as the tack has cooled sufficiently to lose its stickiness. If the material must be applied immediately ahead of the paving operation, it may be necessary to use a rubberized crackfiller (such as PCF-100) as a tack to bond the material to the pavement surface. Material should be rolled in a manner to ensure that an adequate bond is made between the material and the pavement surface.

ASPHALTIC TACK: The asphaltic tack applied to the pavement surface shall meet the following requirements:

Material	Grade	Specification
Asphalt Cement	AC-20	AASHTO M226

If AC-20 is not locally available contact your local PavePrep Representative concerning the use of other asphalt cement materials.

APPLICATION OF TACK: The tack coat should be applied at a rate of approximately .1 gallons/square yard over existing surfaces and approximately .25 gallons/square yard over milled surfaces. In high temperature conditions a fog coat may be all that is needed; colder temperatures may require a heavier spray. In no case should the tack coat application rate exceed .25 gallons/square yard. Application of the tack coat in excess of recommendations may cause slippage of the mat when the heat of the hot mix re-liquifies the binding agent.

The minimum recommended application temperature for the AC-20 tack is 250°F.

The maximum width of the tack coat application should be the width of the material plus three (3) inches and shall not be applied any further in advance of material placement than can be accomplished without losing the adhesion qualities of the tack. The weather conditions will be the determining factor; for example, in cold weather this distance might be no more than five (5) feet.

The use of emulsified asphalts and/or cutbacks are not allowed for use as a tack to bond the PavePrep to the pavement..

A rubberized crackfiller such as PCF-100 shall be used as a tack for more difficult applications such as bridge decks and heavily spalled pavements, and if the material must be applied immediately ahead of the paving operation. The crackfiller must meet Specification ASTM D3405 and employ no solvents. The minimum recommended application temperature for PCF-100 tack is 350°F. The application rate shall be equal to that of AC-20.

Where transverse and longitudinal joints meet, the mat may be butted or lapped. The overlap shall be made in the direction of vehicular traffic flow and direction of paving operations. An overlap is mandatory on bridge decks or where intentional waterproofing is desired. Additional tack is required to bond two mat areas together where overlapping is used.

Removal and replacement of material that is damaged after placement is required. Cut and replace the damaged material three (3) feet in either direction of the damaged area. Retack and follow the above installation recommendations.

ASPHALT OVERLAY: Paving operations can only begin when the PavePrep is adequately bonded to the Pavement. Adequate bonding is a function of the temperature of the pavement, tack at application and the ambient temperature. The recommended tack over PavePrep prior to placement of the new overlay is a slow set emulsified asphalt (such as SS-1 or SS-1h) at a rate specified by the engineer. Material installed in cold weather should be overlaid as soon as possible. The combination of cold brittle tack and traffic may cause some breaking loose of the mat from the pavement surface. The minimum recommended asphalt overlay thickness is 1-1/2" compacted. When using a vibratory roller for compaction, care must be taken to avoid the use of excessive amplitude. Compaction procedures should be in accordance with acceptable asphalt paving standards and practices. Use of excessive amplitude during the compaction process may result in an undesirable riding surface.

SAND: Although not required, small amounts of washed sand may be used to blot excess asphalt if necessary to facilitate movement of traffic or construction equipment over material prior to the placement of the asphalt overlay. If the proper amount of tack coat was used this should not be required. Hot mix can be sanded out on PavePrep ahead of the paver if material is sticking to tires of trucks, or paving equipment to eliminate such problems.

PAVEPREP PERFORMANCE IS BEST ACHIEVED WHERE CRITERIA FOR THE MIX DESIGN, PLACEMENT, AND ENGINEERING FOR HOT MIX OVERLAYS IS DONE IN ACCORDANCE WITH ACCEPTABLE STANDARDS AND PRACTICES. These standards should meet or exceed the state DOT, FAA, ASTM and AASHTO specifications for the manufacture and placement of hot mix asphalt. Failure to require and achieve acceptable hot mix standards and practices may affect the overall performance of PavePrep in the control of reflective cracking.

STORAGE: Material shall be stored inside and not exposed to moisture or rain prior to installation. Exposure to moisture and/or rain may affect the ability to bond the material to the pavement surface. Inside storage temperature shall not exceed 120°F.

METHOD OF MEASUREMENT: The unit of measurement of the high density crack reduction/stress relief interlayer shall be in linear or square feet.

BASIS OF PAYMENT: Payment shall be made at the contract price per unit of material in place including all preparation, installation, labor and equipment required.

GUIDELINES FOR USE OF VARIOUS WIDTHS OF PAVEPREP:

12" Wide Material: To be applied over longitudinal PCC joints that do not exhibit signs of spalling or further deterioration.

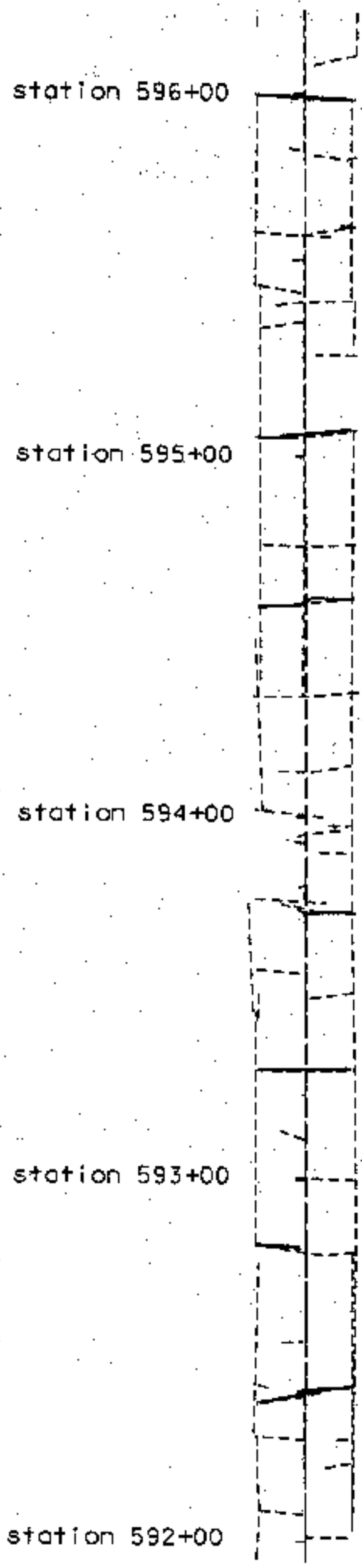
20" and 24" Wide Material: To be applied over both asphalt and concrete surfaces; typically, transverse joints and cracks, random cracks, slightly spalled surfaces, and longitudinal paver joints that exhibit double cracking, and joints between dissimilar pavement materials (asphalt/concrete).

36" and 40" Wide Material: To be applied over the following asphalt and concrete surfaces:

A. Previously repaired areas, such as saw-cut/removal/repair joints.
B. Severely spalled-deteriorated areas.
C. Bridge decks.
D. Utility cuts.

In addition to guidelines above, when conditions warrant further consideration of material width, material shall extend 6 inches minimum beyond the area to be repaired. Additional questions regarding width of material should be directed to your PavePrep Representative.

APPENDIX C



SS-6-017(015)112
crack survey
Pavement Prep

REFLECTED CRACK 1998
ORIGINAL CRACK 1994
CENTERLINE

9402m98-DCM

station 600+00

station 599+00

station 598+00

station 597+00

C-2

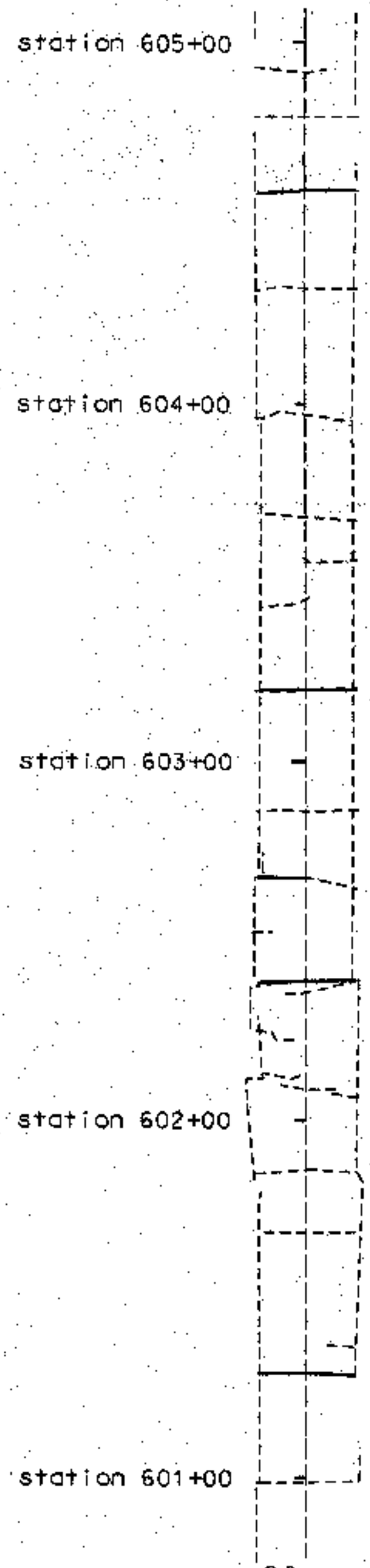
REFLECTED CRACK 1998

ORIGINAL CRACK 1994

CENTERLINE

SS-6-017(015)112
crack survey
PavePrep

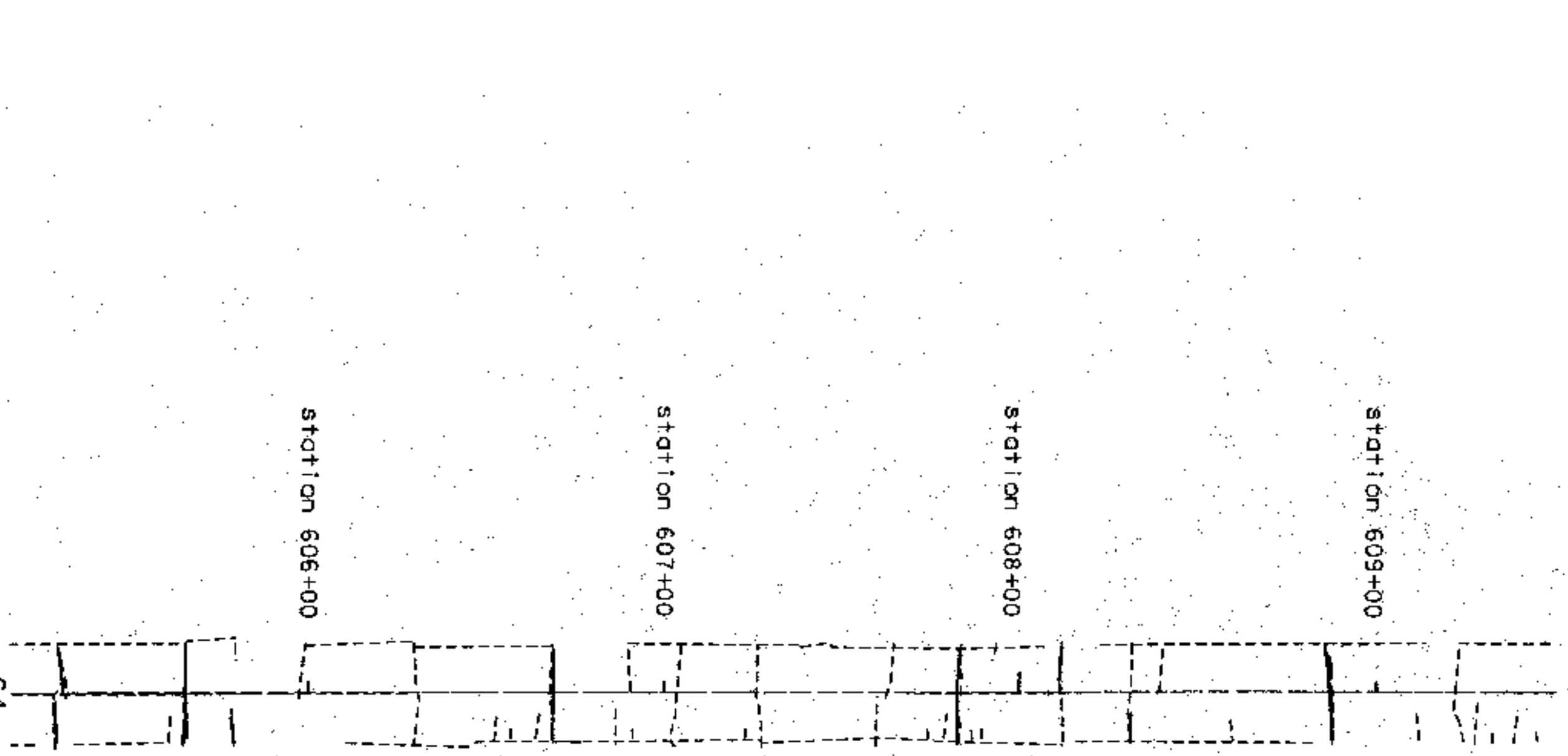
9402m98.DGN



SS-6-017(015)112
crack survey
PavePrep

REFLECTED CRACK 1998
ORIGINAL CRACK 1994
CENTERLINE

9402m98.DGN



REFLECTED CRACK 1998

ORIGINAL CRACK 1994

CENTERLINE

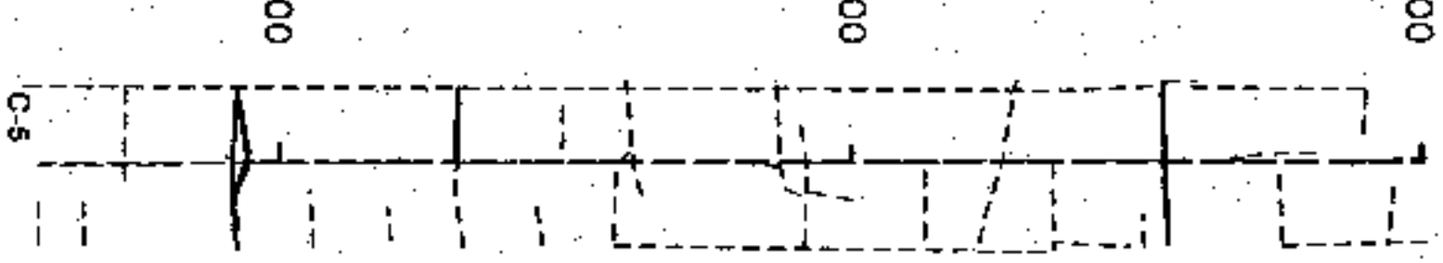
SS-6-017(015)112
crack survey
PavePrep

9402w98.DGN

station 610+00

station 611+00

station 612+00



REFLECTED CRACK 1998

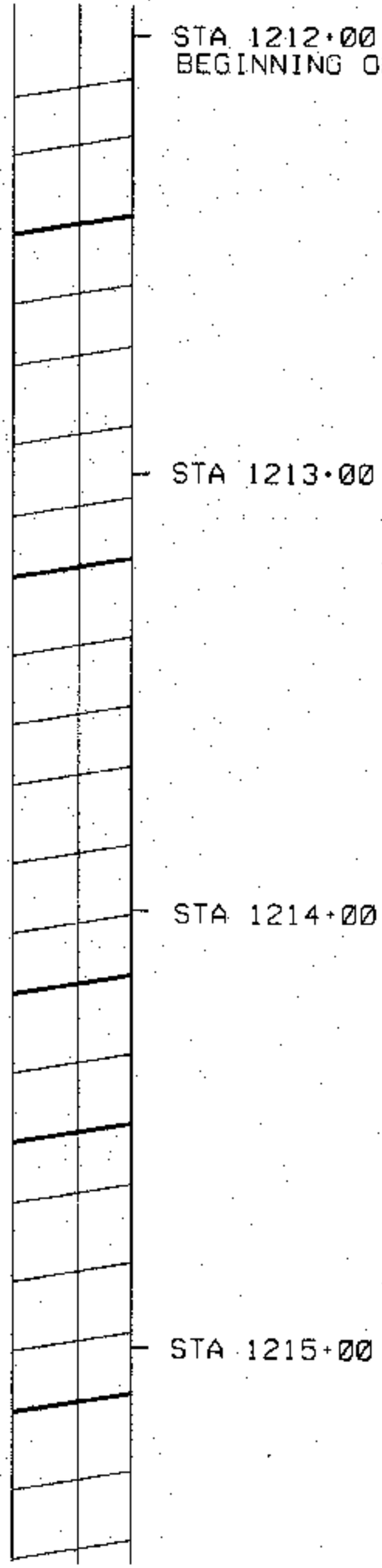
ORIGINAL CRACK 1994

CENTERLINE

SS-6-017(015)112
crack survey
PavePrep

9402m98.DGN

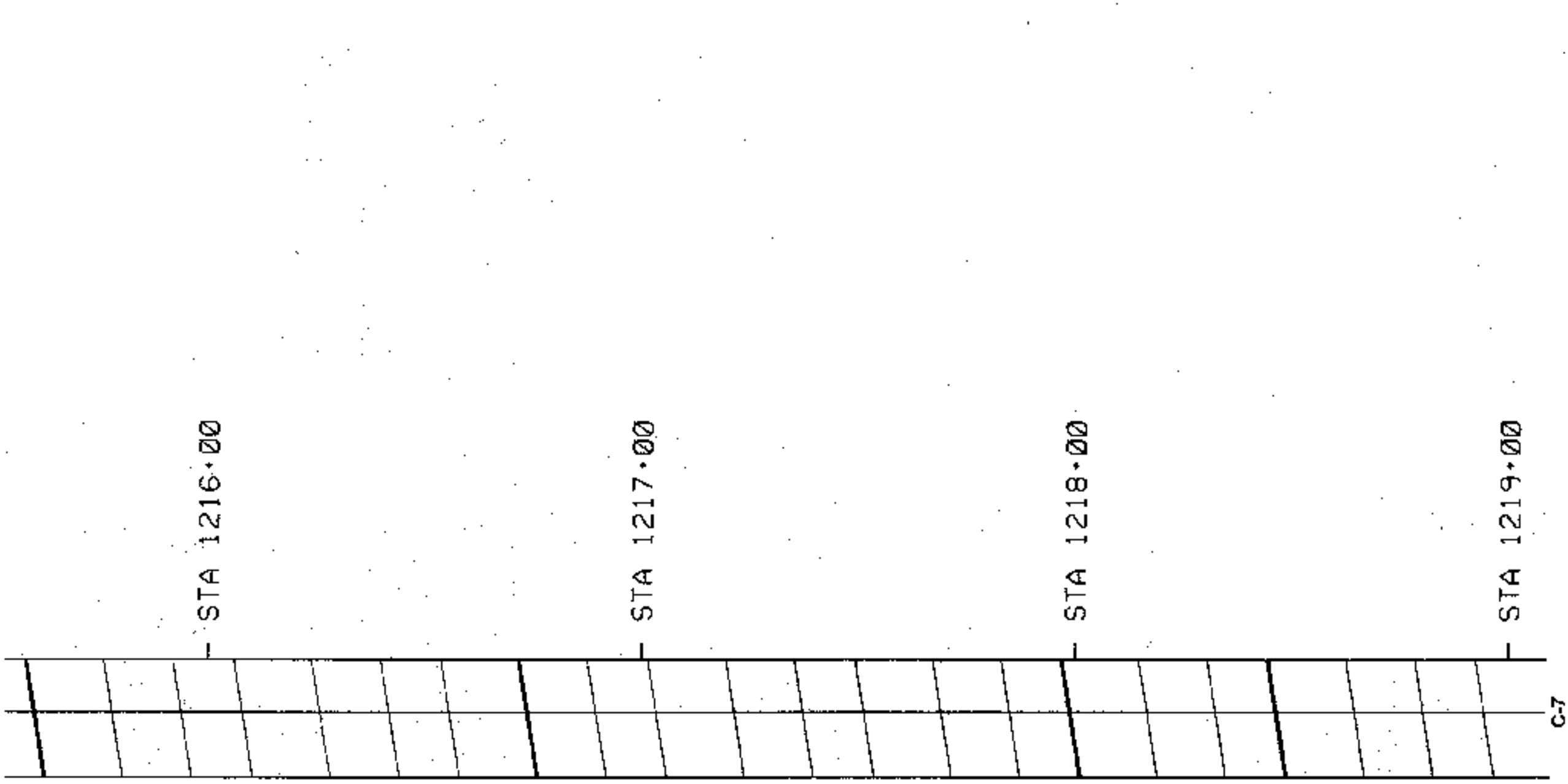
NH-3-0021(040)212R - East Bound Lanes
Crack Survey for Paveprep Control



ORIGINAL JOINT CRACK

REFLECTED CRACK 1998

9402F98.DGN



—— ORIGINAL JOINT CRACK

—— REFLECTED CRACK 1998

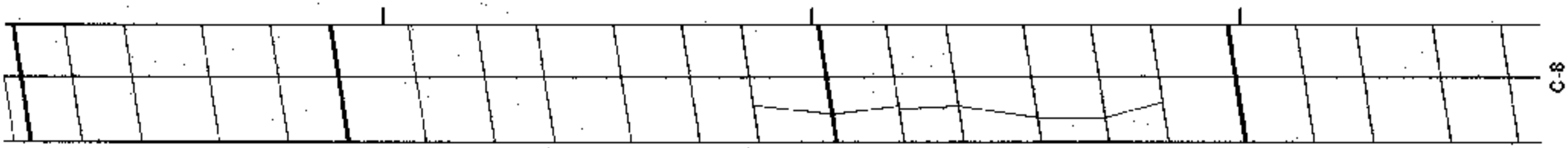
NH-3-002(040)212R - EAST BOUND LANES
CRACK SURVEY FOR PAVEPREP CONTROL

9402F98.DGN

END OF CONTROL SECTION
STA 1220+00
BEGINNING OF PAVEPREP SECTION

STA 1221+00

STA 1222+00

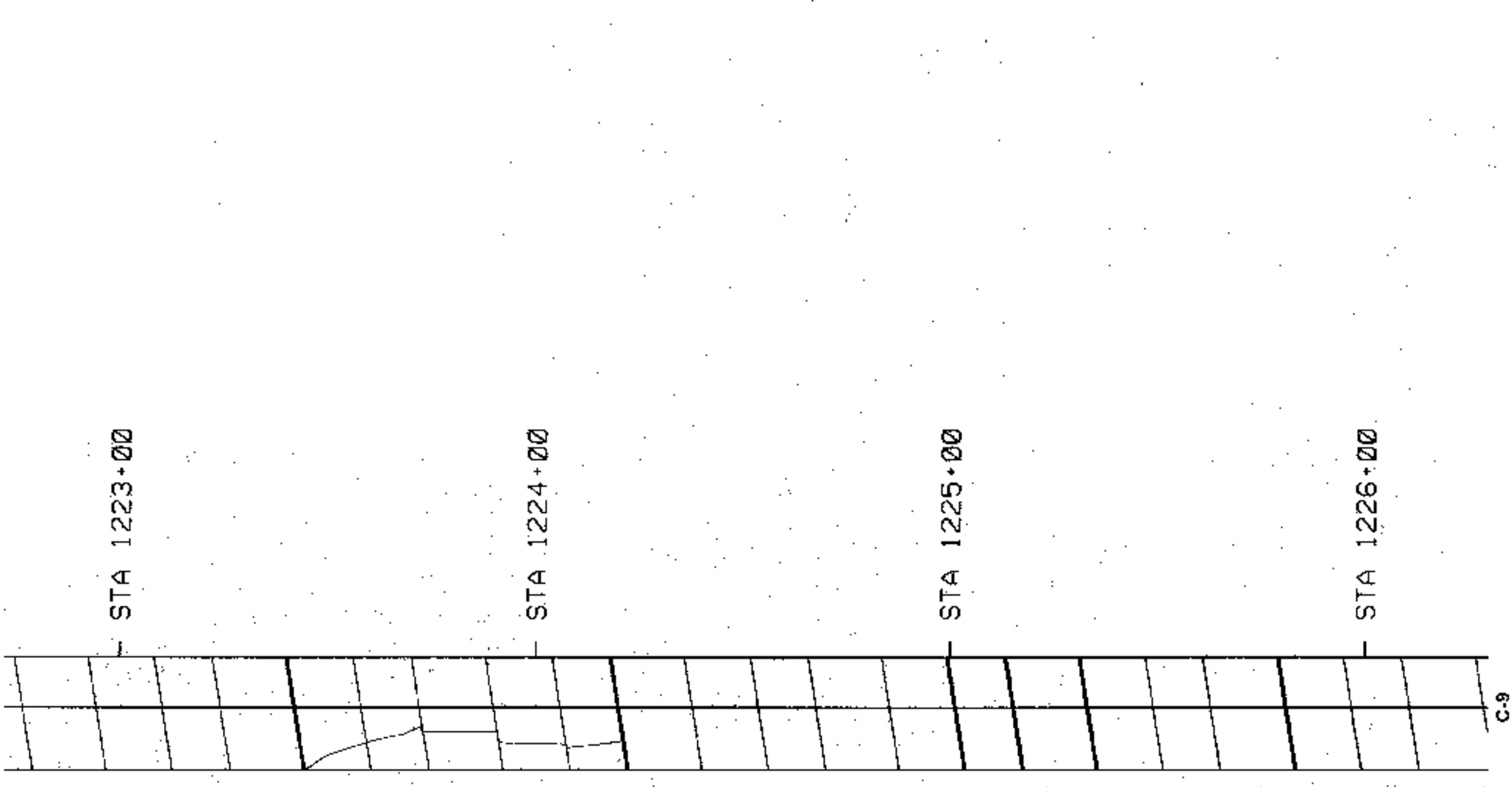


NH-3-002(040)212R - EAST BOUND LANES
CRACK SURVEY FOR PAVEPREP

——— ORIGINAL JOINT CRACK

——— REFLECTED CRACK 1998

9402F98.DGN



NH-3-002(040)212R - EAST BOUND LANES
CRACK SURVEY FOR PAVEPREP

ORIGINAL JOINT CRACK

REFLECTED CRACK 1998

9402F98.DGN

STA 1227+00

STA 1228+00
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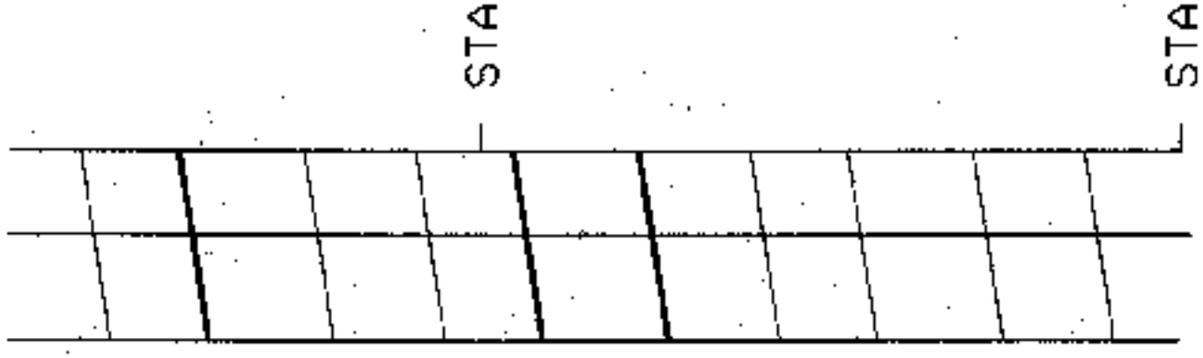

NH-3-002(040)212R - EAST BOUND LANES
CRACK SURVEY FOR PAVEPREP

——— ORIGINAL JOINT CRACK

——— REFLECTED CRACK 1998

9402F98.DGN

SS-6-017(015)112