LTPP Seasonal Monitoring Program

Site Installation and Initial Data Collection
Section 483739, Kingsville, Texas

Prepared by

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Prepared for

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16. Abstract

This report contains a description of the instrumentation installation activities and initial data collection for test section 483739, which is a part of the LTPP Core Seasonal Monitoring Program. This asphalt concrete surfaced pavement test section, which is located on US-77 in the northbound lanes, approximately 42.8 km north of the Kenedy-Willacy County line, was instrumented on December 6-7, 1993. The instrumentation installed included time domain reflectometry probes for moisture content, thermistor probes for temperature, tipping-bucket rain gauge, an observation well to monitor the ground water table, and an on-site data logger. Initial data collection was performed on December 6, 1993, which consisted of deflection measurements with a Falling Weight Deflectometer (FWD), elevation measurements, temperature measurements and TDR measurements. The report contains a description of the test site and its location, the instruments installed at the site and their locations, characteristics of the installed instruments and probes, problems encountered during installation, specific site circumstances and deviations from the standard guidelines, and a summary of the initial data collection.

17. Key Words	18. Distribution Statement
Pavement, Highway, Instrumentation, Monitoring, Time Domain Reflectometry, Thermistor, Observation Well, Test Equipment, Field Tests.	

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SEASONAL INSTRUMENTATION STUDY
INSTRUMENTATION INSTALLATION
TEXAS SECTION 483739/48SG

I. Introduction

The seasonal instrumentation installation of Section 483739 was performed on December 6-7, 1993, and was the seventh one completed in the Southern Region.

The GPS-1 test section resides in Seasonal Cell 5 and is located in a dry-no freeze zone. The site (see Figure A-1) is in the northbound lanes on US-77, approximately 42.8 km north of the Kenedy-Willacy County line. The divided highway consists of two 3.7 m wide travel lanes in each direction. The outside shoulder is 3.0 m wide.

The average maximum daily temperature for the months of June through August is 35°C and the average minimum daily temperature for the months of December through February is 9°C. The average annual precipitation is 607 mm.

The pavement is a flexible structure consisting of approximately 45.7 mm of asphalt concrete over 305 mm of granular aggregate base and 152 mm of lime-treated soil. The subgrade is classified as sandy. The typical soil profile under the pavement is illustrated in Figure A-2. This information was obtained from bore holes drilled during the GPS material sampling and testing. The dry densities of the unbound layers are given in Table 1.

Table 1. Layer Thicknesses and Dry Densities of the Unbound Layers

Material	Layer Thickness (mm)	In Situ Dry Density (kg/m^3)
Asphalt Concrete	45.7	- - -
Base	305	1954
Subbase	152.4	1954
Subgrade	- - -	1663

The annual average daily traffic (AADT) in the GPS lane is almost 2200, of which 21% is truck traffic. The estimated annual ESALs on the GPS lane were 131,000. This information is based on traffic data collected on site.

Installation of the instrumentation was completed through the cooperative efforts of the Texas Department of Transportation (Texas DOT), Federal Highway Administration (FHWA) Southern Region Coordination Office (SRCO) staff from Brent Rauhut Engineering Inc. (BRE). The following is a list of the personnel who participated in the installation:

Larry Peirce	SRCO, Brent Rauhut Engineering
Jon Peacock	SRCO, Brent Rauhut Engineering
Steve Davis	SRCO, Brent Rauhut Engineering
Richard Zamora	Federal Highway Administration

II. Instrumentation Installation

Pre-Installation Activities

A pre-installation meeting was held at the BRE offices on October 18, 1993. The meeting agenda appears in Appendix B. The Texas DOT elected to contract out both traffic control services and drilling and augering services to private firms for all seven sites in the state. Therefore, the participants at the meeting were personnel from the Southern Region Coordination Office, the Texas DOT, Campbell Industries (traffic control services) and Jones & Neuse, Inc. (drilling and augering services). No support was required from the Districts where the seasonal sites reside. At the planning meeting, roles and responsibilities for all the various tasks to be performed during installation were assigned. A slide presentation was given, highlighting the order of operations for the installations in Delta, Colorado and Grand Rapids, Minnesota.

A site inspection and a manual distress survey were performed on March 30, 1993 by Jerry Daleiden (SRCO). Deflection testing was conducted on March 30, 1993. The 0+00 end of the test section was selected for instrumentation, based on the amount of distress present and uniformity of the deflection profile. Both the deflection plots and distress survey data can be found in Appendix A.

Equipment Installed

The equipment installed at the test site included instrumentation for measuring air and subsurface temperature, rainfall and subsurface moisture contents. An equipment cabinet was installed to house the cable leads from the instrumentation, the data logger and the battery pack. In addition, an observation well was set to measure the depth to the water table. A benchmark was also set by the Texas DOT. A list of the equipment installed, with the respective serial numbers, is in Table 2.

Table 2. Equipment Installed

Equipment	Quantity	Serial Nº.
Instrument Hole		
MRC Thermistor Probe	1	225 (48 GT)
TDR Sensors	10	48G01-48G10
Equipment Cabinet		
CR10 Data Logger	1	16517
Battery Package	1	5666
Weather Station		
Tipping-Bucket Rain Gauge	1	12094-693
Air Temperature Probe	1	421316
Observation Well	1	None

Equipment Check/Calibration

Prior to installation, all instrumentation was checked or calibrated. The CR10 Data Logger was wired according to the Guidelines and the air temperature probe and thermistor probe were connected and monitored over a period of several hours to ensure that the sensors were working. The tipping-bucket was also connected to the data logger and the calibration was checked according to the method recommended by the manufacturer. These tests indicated that the air temperature probe and thermistor probe were working properly and that the tipping-bucket measurement was within the manufacturer's specifications.

In addition to the above tests, the distances between sensors in the thermistor probe were measured and are presented in Table 3.

Table 3. Sensor Spacing in MRC Thermistor Probe

Unit	Channel №.	Distance from Top of Unit (mm)	Remarks
1	1	Not Measured	This unit was installed in the AC layer.
	2	Not Measured	
	3	Not Measured	
2	4	18	This unit was installed in the base and subgrade.
	5	96	
	6	171	
	7	247	
	8	322	
	9	476	
	10	628	
	11	781	
	12	933	
	13	1085	
	14	1238	
	15	1389	
	16	1543	
	17	1695	
	18	1843	

Location of Instrumentation

The instrumentation was installed at Station 0-20 of the test section. Approximately 813 mm from the lane edge, in the outside wheel path, a 457 mm square was removed from the pavement and a 254 mm diameter hole, 2.0 m deep, was drilled to install the thermistor

probe and TDR sensors. Cables from the instrumentation were placed in a 51 mm diameter flexible conduit and buried in a 102 mm wide trench leading to the equipment cabinet located approximately 7.8 m from the lane edge.

The observation well was installed at Station 1+00 of the test section approximately 3.4 m from the lane edge. A permanent benchmark was also set at Station 1+50 approximately 3.4 m from the lane edge.

Installation

Installation of the monitoring equipment was completed on December 6, 1993. Verification that the instrumentation was working was made the following day. The Texas DOT provided the pavement sawing, pavement repair materials and a permanent benchmark. Texas DOT elected to contract the traffic control to Campbell Industries and the augering operations to Jones and Neuse, Inc.. The observation well was also drilled by Jones and Neuse due to licensing and construction requirements mandated by the Texas Water Commission. The monitoring equipment and cabinet installation was performed by the SRCO staff.

The first day of operations included traffic control; site layout and marking; installation of the thermistor probe, TDR probes, air temperature probe, and rain gauge; and wiring of the cabinet. The installation of all equipment was performed according to the procedures outlined in the "LTPP Seasonal Monitoring Program: Instrumentation and Data Collection Guidelines."

To ensure functioning of the TDR sensors during installation, the 1502B cable tester was connected to each sensor as backfilling of the instrumentation hole was performed. If a reasonable trace was displayed, it was assumed the sensor was functioning properly. The trace was printed for each TDR and the moisture content was determined using Topp's equation. The field moisture content was also measured by drying the soil on a propane stove. The TDR moisture contents, position of the TDR sensors and field moisture contents appear in Table 4. The field printed traces appear in Appendix C. Table 5 shows the distance from the top of the pavement to each individual thermistor sensor.

When backfilling of the instrumentation hole was completed, the asphalt concrete surface was patched using cold-mix asphalt. The overcuts from the pavement sawing operation (including the groove for the temperature probe) were also sealed with Dow-Corning 888 crack sealant.

Upon completion of the installation, the ONSITE program was downloaded to the onsite CR10 Data Logger and data from the air temperature probe, rain gauge and thermistor probe were collected overnight and evaluated the second day.

The second day activities included traffic control setup, evaluation of the data collected the previous night, monitoring of the TDR sensors, deflection testing and elevation surveys. The following sections describe these operations.

Table 4. Location of TDR Sensors and Measured Moisture Contents

Sensor Nº.	Sensor Depth (mm)	TDR Moisture Content (%, by wt)	Measured Moisture Content (%, by wt)
48G01	198	12.6	13.6
48G02	348	11.0	10.4
48G03	498	8.0	9.1
48G04	650	3.7	4.1
48G05	813	2.9	2.7
48G06	958	3.5	4.3
48G07	1123	5.3	4.6
48G08	1262	4.4	4.7
48G09	1575	5.3	4.6
48G10	1885	5.3	4.7

Table 5. Thermistor Sensor Locations

Unit	Channel Nº.	Depth from Pavement Surface (mm)	Remarks
1	1	13	This unit was installed in the AC layer.
	2	23	
	3	46	
2	4	89	This unit was installed in the base and subgrade.
	5	167	
	6	242	
	7	318	
	8	393	
	9	547	
	10	699	
	11	852	
	12	1004	
	13	1156	
	14	1309	
	15	1460	
	16	1614	
	17	1766	
	18	1914	

III. Initial Data Collection

Onsite Data Logger

The air temperature, subsurface temperatures and rainfall data were collected by the onsite CR10 Data Logger. The version of the ONSITE program used reads the thermistor probe (18 sensors) every minute. The average temperatures for the first five sensors are recorded hourly and the average temperature for every sensor is saved daily. The maximum and minimum temperature for all sensors are also saved on a daily basis.

The air temperature is read every minute by the ONSITE program and the average temperature is saved both daily and hourly. The maximum and minimum temperatures are saved daily. The precipitation is recorded on both an hourly and daily basis.

Figure D-1 shows the average hourly ambient air temperatures which were collected the night of December 6, 1993. Figure D-2 shows hourly average subsurface temperatures for the first five sensors for the same data collection period. Figure D-3 shows the measured average subsurface temperatures for all 18 sensors during the initial data collection.

Moisture Content Measurement by TDR Sensors

TDR data was collected using the mobile data-logging system provided by the FHWA. The mobile system consists of a CR10 Data Logger, battery pack and two multiplexors for TDR data collection.

To begin data collection using the mobile system the TDR cable leads and 1502B cable reader were connected to the proper channels and the MOBILE program was downloaded from the notebook computer to the CR10 Data Logger. After approximately five minutes, the cable reader was triggered by the MOBILE program and the TDR traces were displayed. The data collection process was completed in approximately five minutes and was automatically repeated four hours later. The data was then uploaded to the notebook computer. Traces displayed on the cable reader indicated that the sensors were working properly. Figures D-4 through D-13 show the plots of the TDR traces obtained approximately 24 hours after installation.

Deflection Measurements

Deflection measurements were made according to the procedures outlined in the "LTPP Seasonal Monitoring Program: Instrumentation Installation and Data Collection Guidelines." At this time no analysis has been performed on this data.

Elevation Surveys

The elevation of the benchmark was assumed to be 0.000 meters and surface elevations were measured following the guidelines. These elevations were measured using a Spectra-Physics Laser Plane 350 level and Lenker rod, and were converted to the SI system using soft conversion factors. The elevations are contained in Appendix D.

IV. Summary

The instrumentation installation on Section 483739 was completed on December 6, 1993 and initial data collection was completed on December 7, 1993. Instrumentation and equipment currently at the site includes time domain reflectometry probes for moisture content measurements; a thermistor probe for monitoring temperature gradient changes in the pavement, base and subgrade layers; a tipping-bucket rain gauge; an air temperature probe; an observation well to monitor ground water table movement; a permanent swell and frost-free benchmark; and an on-site data logger and battery pack.

At the time of this report, all of the equipment installed on-site appears to be functioning properly. After the initial installation, the alkaline battery pack was replaced with a gel-cell sealed battery.

The installation of the instrumentation at this site went fairly smoothly and all of the equipment appears to be functioning properly.

APPENDIX A

Test Section Background Information

Appendix A contains the following information:

Figure A-1.	Site Location Map
Figure A-2.	Profile of Test Section Layers
Figure A-3 thru Figure A-8.	Plots from FWDCHECK
Figure A-9.	Manual Distress Survey Data

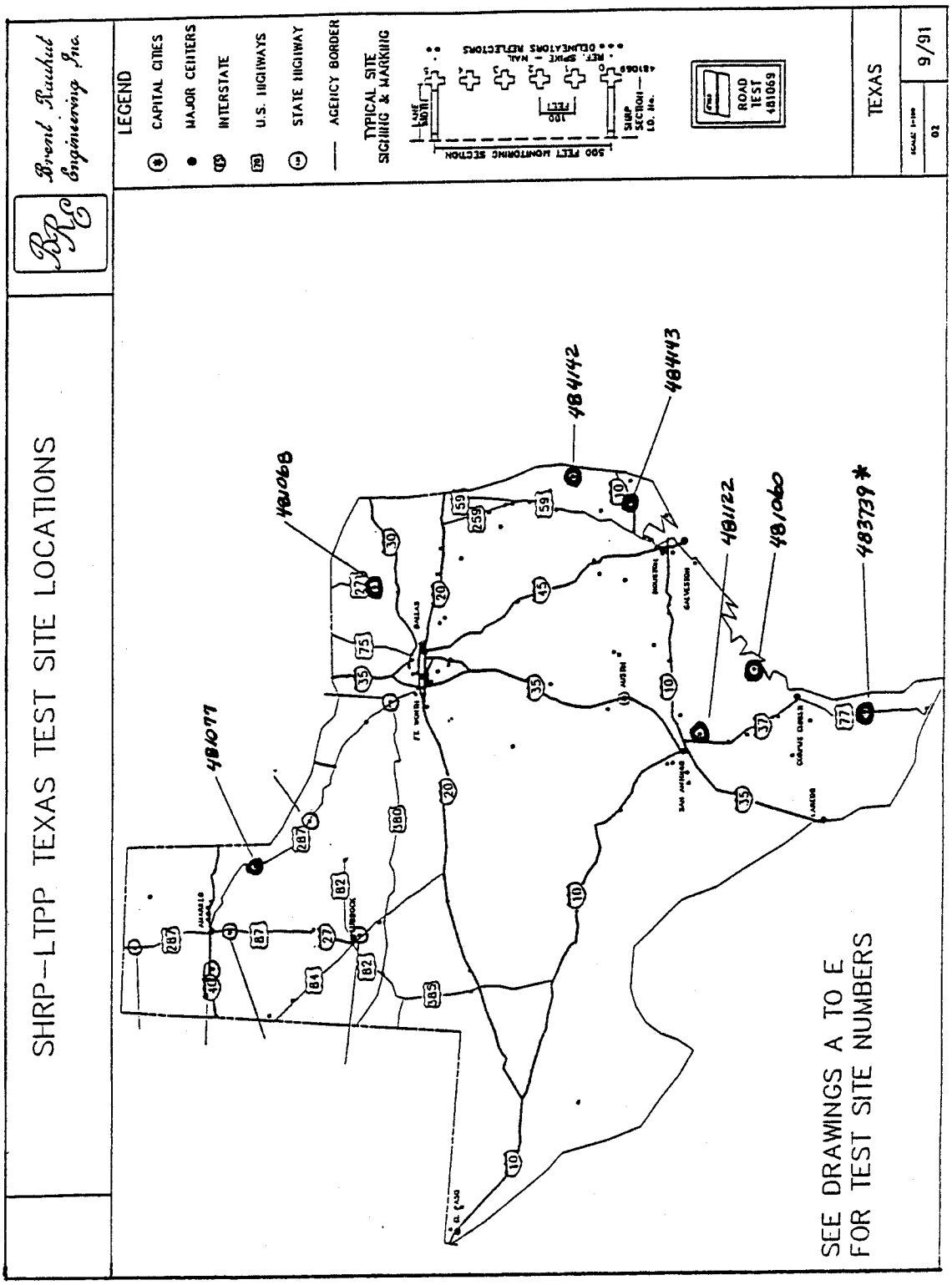
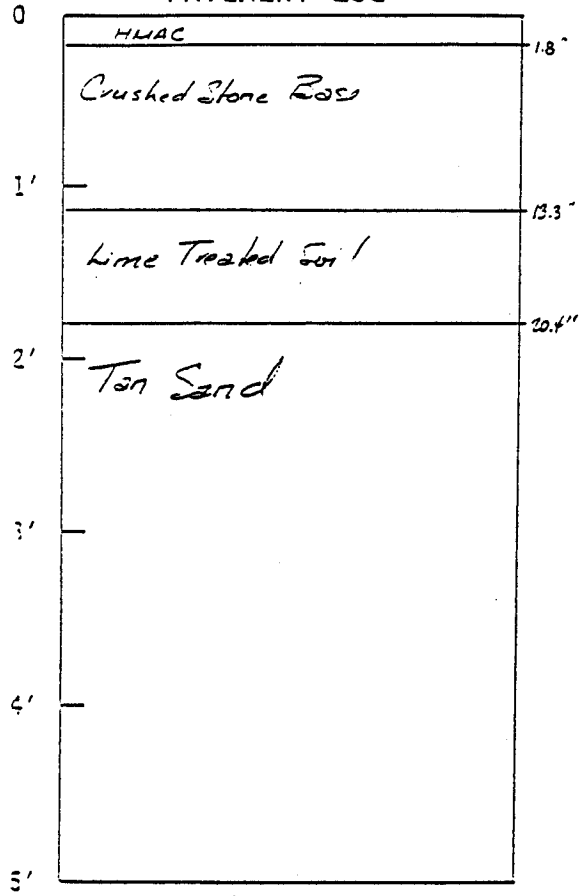


Figure A-1. Location of Test Site, GPS Test Section 483739

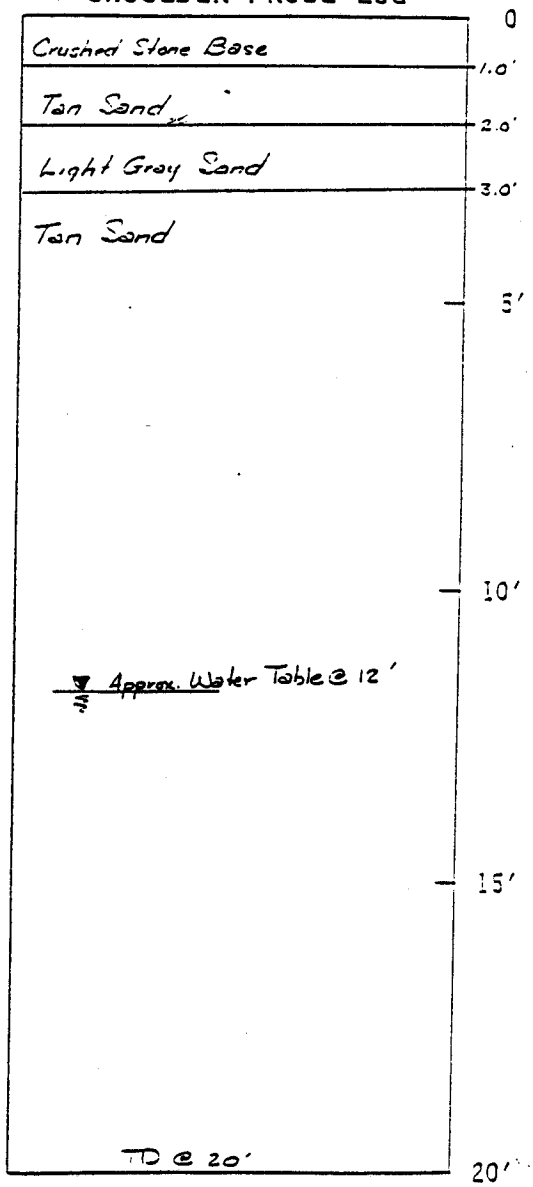
APPROXIMATE
SUMMARY OF FIELD LOGS
GPS TEST SECTIONS

TEST SECTION I.D. No. 483739 EXPERIMENT No. GPS-1
STATE TEXAS DATE SAMPLED 2-24-90

PAVEMENT LOG



SHOULDER PROBE LOG



Instuctions for Pavement Log:

1. Review logs of bore holes, cores, and test pit to establish approximate depths of layer changes.
2. Draw lines across log above to indicate approximate average layer depths and label to identify the materials.

structions for Shoulder Probe Log:
Same as for "Pavement Log," except depths are taken directly from field log.

Depth to Rigid Layer, > 20 Ft.
(If Rigid Layer Not Encountered, Enter ">20.")

USE THIS FORM FOR ENTERING ONLY DEPTH TO RIGID LAYER INTO THE DATA BASE!

Figure A-2. Profile of Test Section Layers

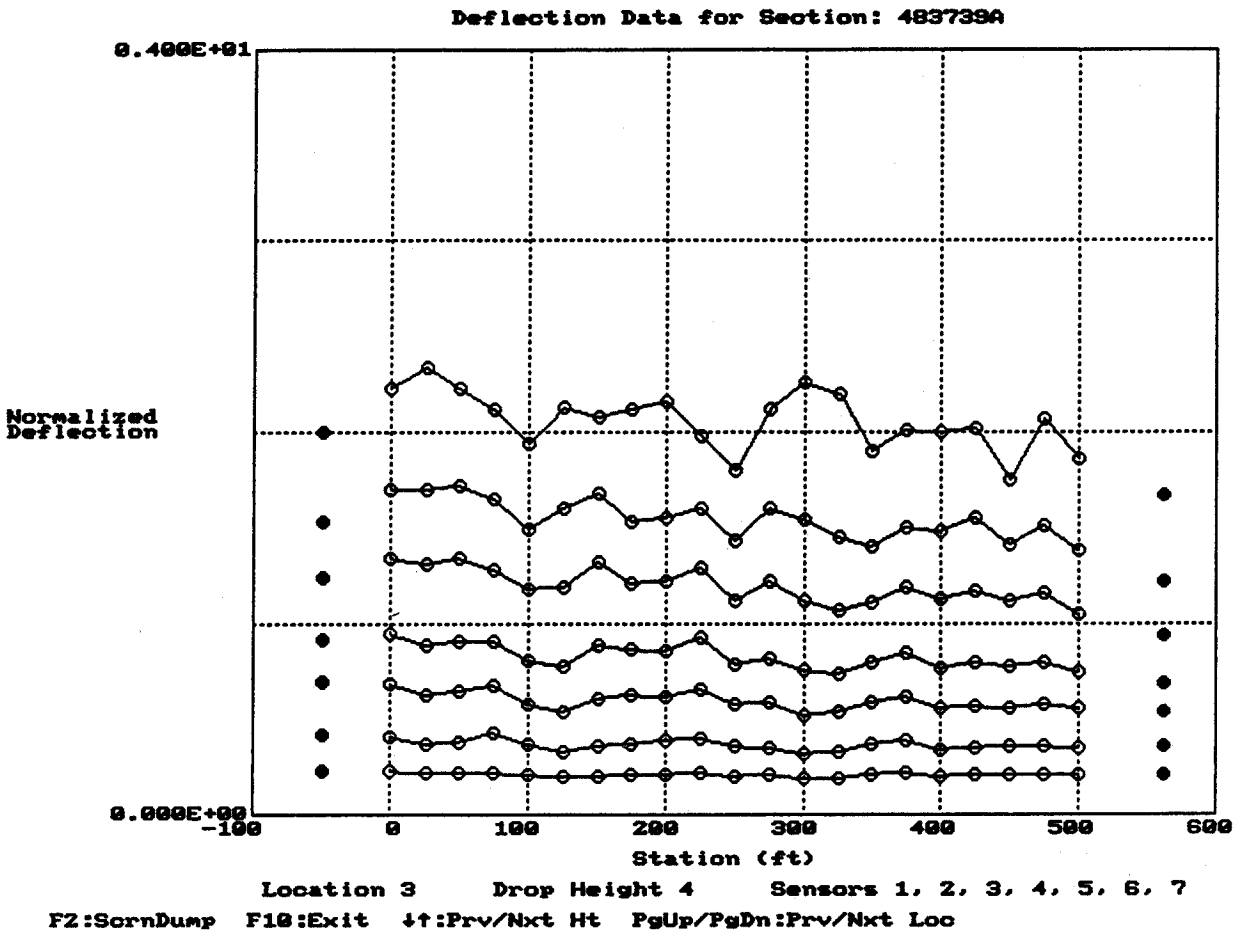


Figure A-3. Deflection Profiles from FWDCHECK

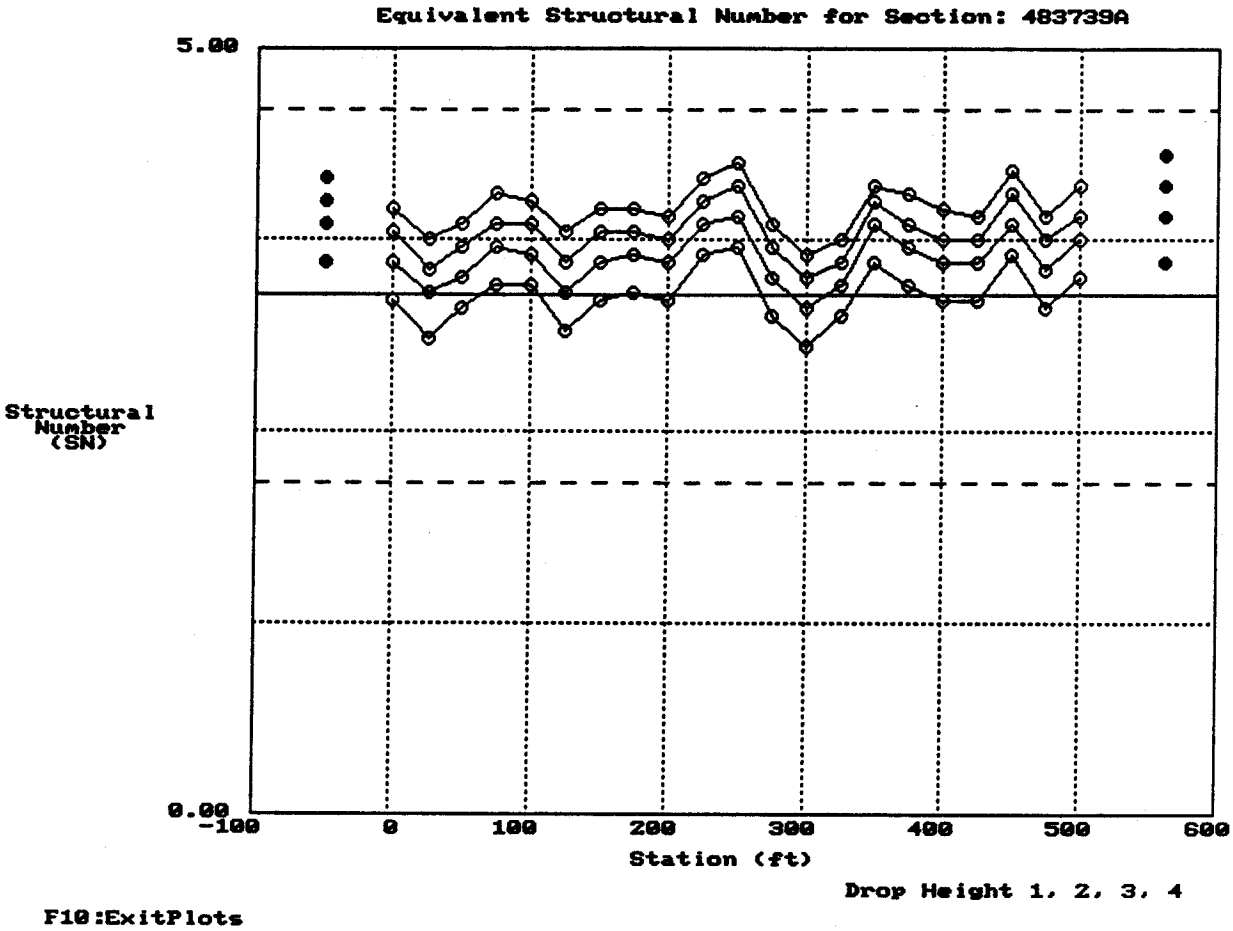


Figure A-4. Structural Number Profiles from FWDCHECK

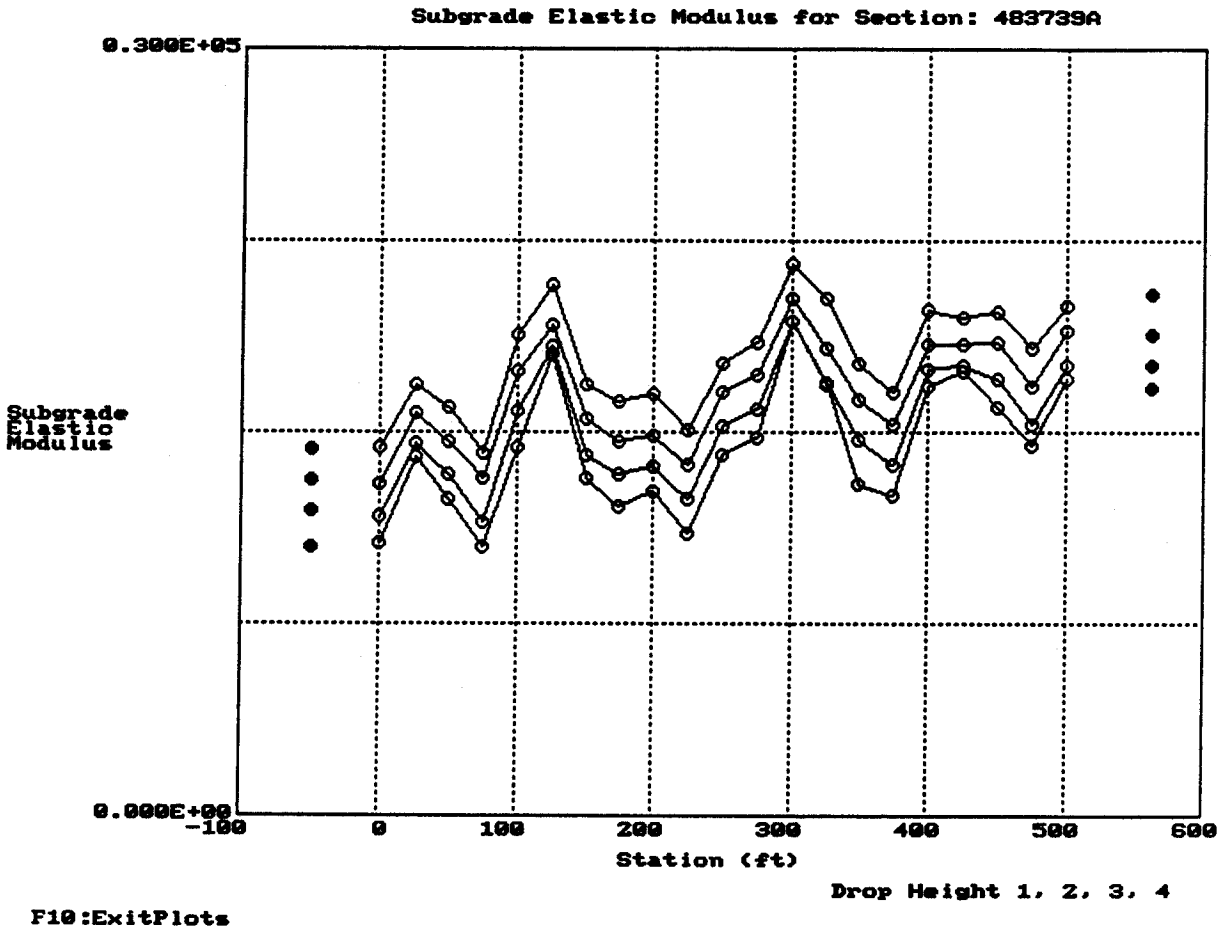


Figure A-5. Subgrade Modulus Profiles from FWDCHECK

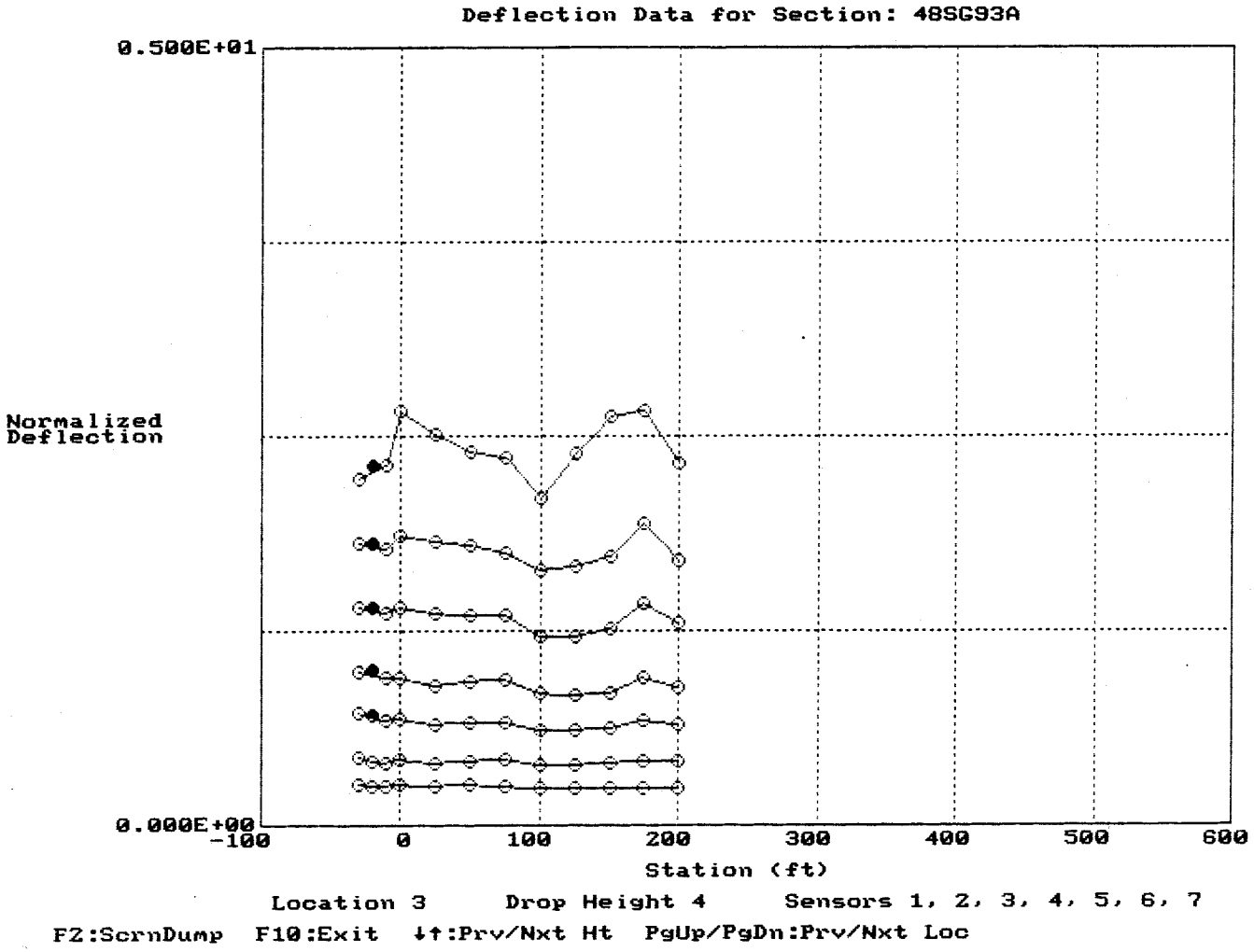


Figure A-6. Deflection Profiles from FWDCHECK on Installation Day

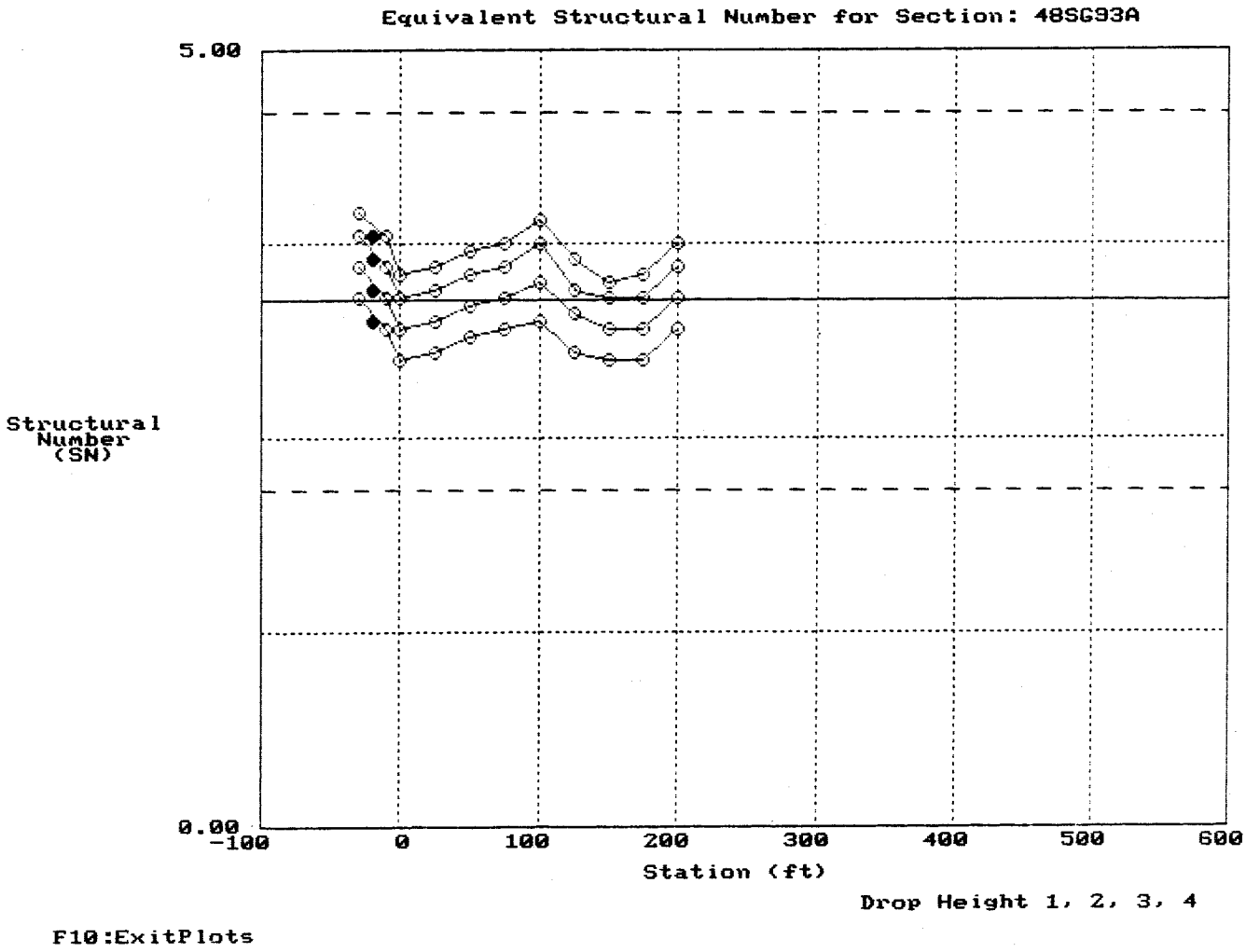


Figure A-7. Structural Number Profiles from FWDCHECK on Installation Day

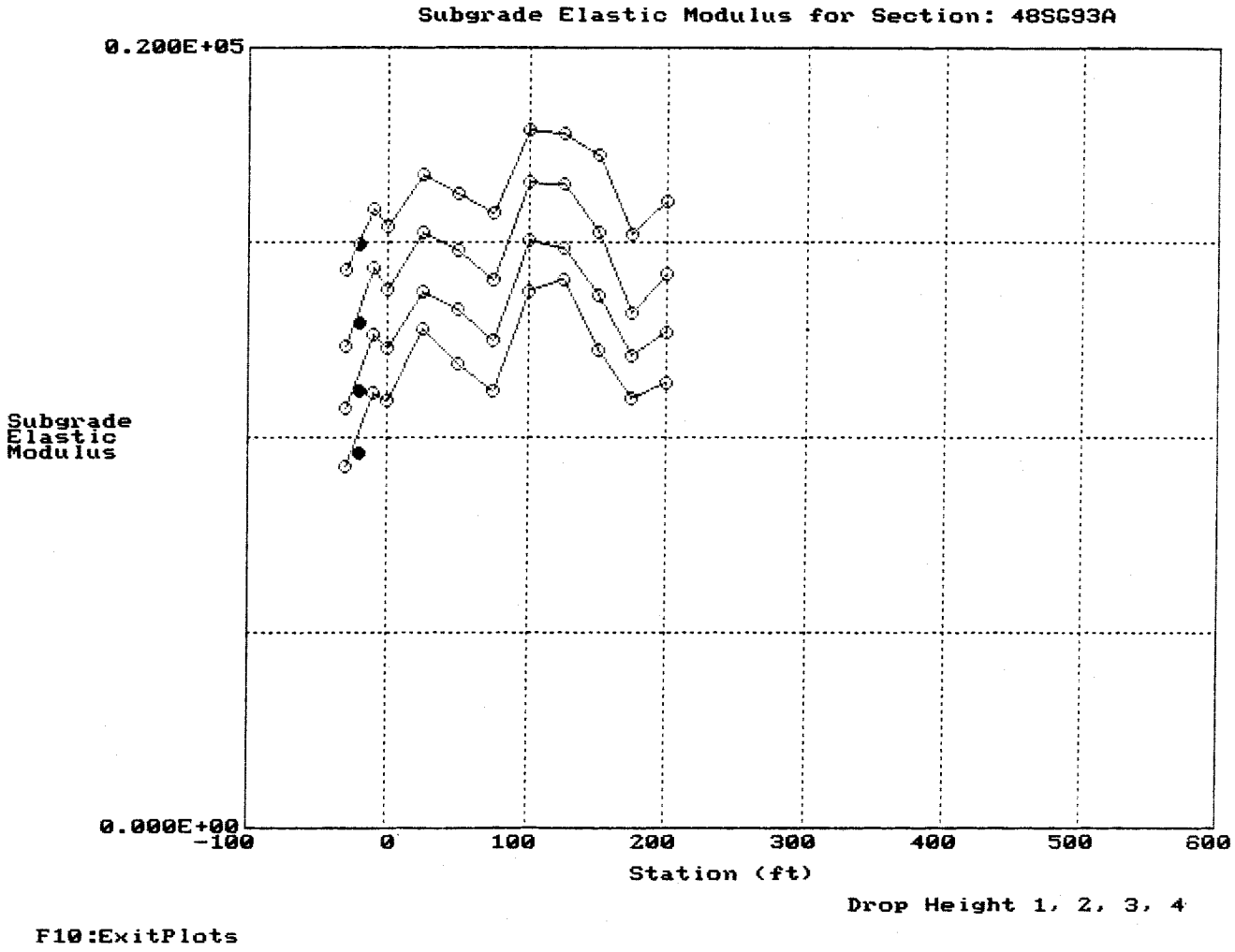


Figure A-8. Subgrade Modulus Profiles from FWDCHECK on Installation Day

SHEET 1

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID ____

STATE CODE 48

SHRP SECTION ID 3739

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 03/30/93

SURVEYORS: JFD, ____ PHOTOS, VIDEO, OR BOTH WITH SURVEY (P, V, B) B

PAVEMENT SURFACE TEMP - BEFORE __36°C; AFTER __38°C

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
CRACKING			
1. ALLIGATOR (FATIGUE) CRACKING (Square Meters)	4.9	0	0
2. BLOCK CRACKING (Square Meters)	0	0	0
3. EDGE CRACKING (Meters)	0	0	0
4. LONGITUDINAL CRACKING (Meters)			
Paving Lane-edge Related	0	0	0
Length Sealed (Meters)	0	0	0
Other	12.3	0	0
Length Sealed (Meters)	0	0	0
5. REFLECTION CRACKING AT JOINTS Number of Transverse Cracks	0	0	0
Transverse Cracking (Meters)	0	0	0
Length Sealed (Meters)	0	0	0
Longitudinal Cracking (Meters)	0	0	0
Length Sealed (Meters)	0	0	0
6. TRANSVERSE CRACKING Number of Cracks	0	0	0
Length (Meters)	0	0	0
Length Sealed (Meters)	0	0	0
PATCHING AND POTHOLES			
7. PATCH/PATCH DETERIORATION (Number)	0	0	0
(Square Meters)	0	0	0
8. Potholes (Number)	0	0	0
(Square Meters)	0	0	0

Figure A-9. Distress Survey Data

SHEET 2

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID ____

STATE CODE 48

SHRP SECTION ID 3739

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES (CONTINUED)

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
SURFACE DEFORMATION			
9. RUTTING - REFER TO SHEET 3 FOR SPS-3 OR Form TRNPROF1 from Dipstick Manual			
10. SHOVING (Number)			0
(Square Meters)			0.0
SURFACE DEFECTS			
11. BLEEDING (Square Meters)	305.0 ✓	0.0	0.0
12. POLISHED AGGREGATE (Square Meters)			0.0
13. RAVELING AND WEATHERING (Square Meters)	0.0	0.0	0.0
MISCELLANEOUS DISTRESSES			
14. LANE-TO-SHOULDER DROPOFF - REFER TO SHEET 3			
15. WATER BLEEDING AND PUMPING (Number)			0
Length of Affected Pavement (Meters)			0.0
16. OTHER (Describe) _____			

Figure A-9 (Continued). Distress Survey Data

SHEET 3

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID _ _ _ _

STATE CODE 48

SHRP SECTION ID 3739

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES (CONTINUED)

9. RUTTING (FOR SPS-3 SITE SURVEYS)

INNER WHEEL PATH			OUTER WHEEL PATH		
Point No.	Distance[1] (Meters)	Point Rut Depth (mm)	Point No.	Distance[1] (Meters)	Point Rut Depth (mm)
					NOT MEASURED
1	0.	_ _ _.	1	0.	_ _ _.
2	15.25	_ _ _.	2	15.25	_ _ _.
3	30.5	_ _ _.	3	30.5	_ _ _.
4	45.75	_ _ _.	4	45.75	_ _ _.
5	61.	_ _ _.	5	61.	_ _ _.
6	76.25	_ _ _.	6	76.25	_ _ _.
7	91.5	_ _ _.	7	91.5	_ _ _.
8	106.75	_ _ _.	8	106.75	_ _ _.
9	122.	_ _ _.	9	122.	_ _ _.
10	137.25	_ _ _.	10	137.25	_ _ _.
11	152.5	_ _ _.	11	152.5	_ _ _.

14. LANE-TO-SHOULDER DROPOFF

Point No.	Point Distance[1] Meters	Lane-to-Shoulder Dropoff (mm)
		NOT MEASURED
1	0.	_ _ _.
2	15.25	_ _ _.
3	30.5	_ _ _.
4	45.75	_ _ _.
5	61.	_ _ _.
6	76.25	_ _ _.
7	91.5	_ _ _.
8	106.75	_ _ _.
9	122.	_ _ _.
10	137.25	_ _ _.
11	152.25	_ _ _.

Note 1: "Point Distance" is the distance in meters from the start of the test section to the point where the measurement was made. The values shown are SI equivalents of the 50 feet spacing used in previous surveys.

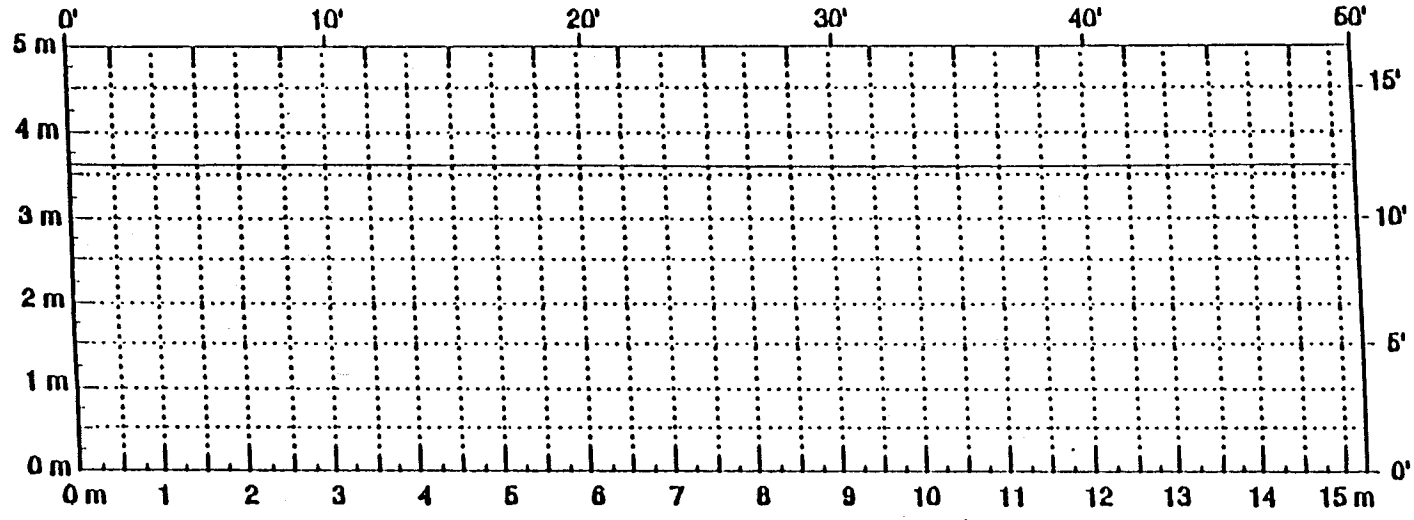
Figure A-9 (Continued). Distress Survey Data

3/30/93

State Assigned ID ____

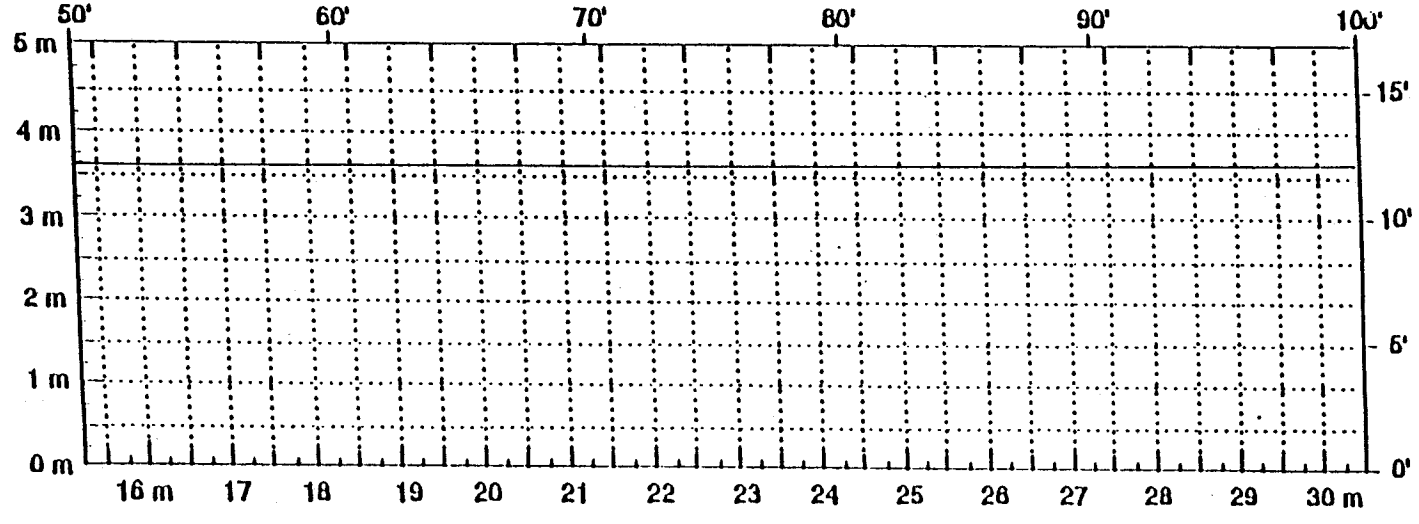
State Code 48

SHRP Section ID 3739



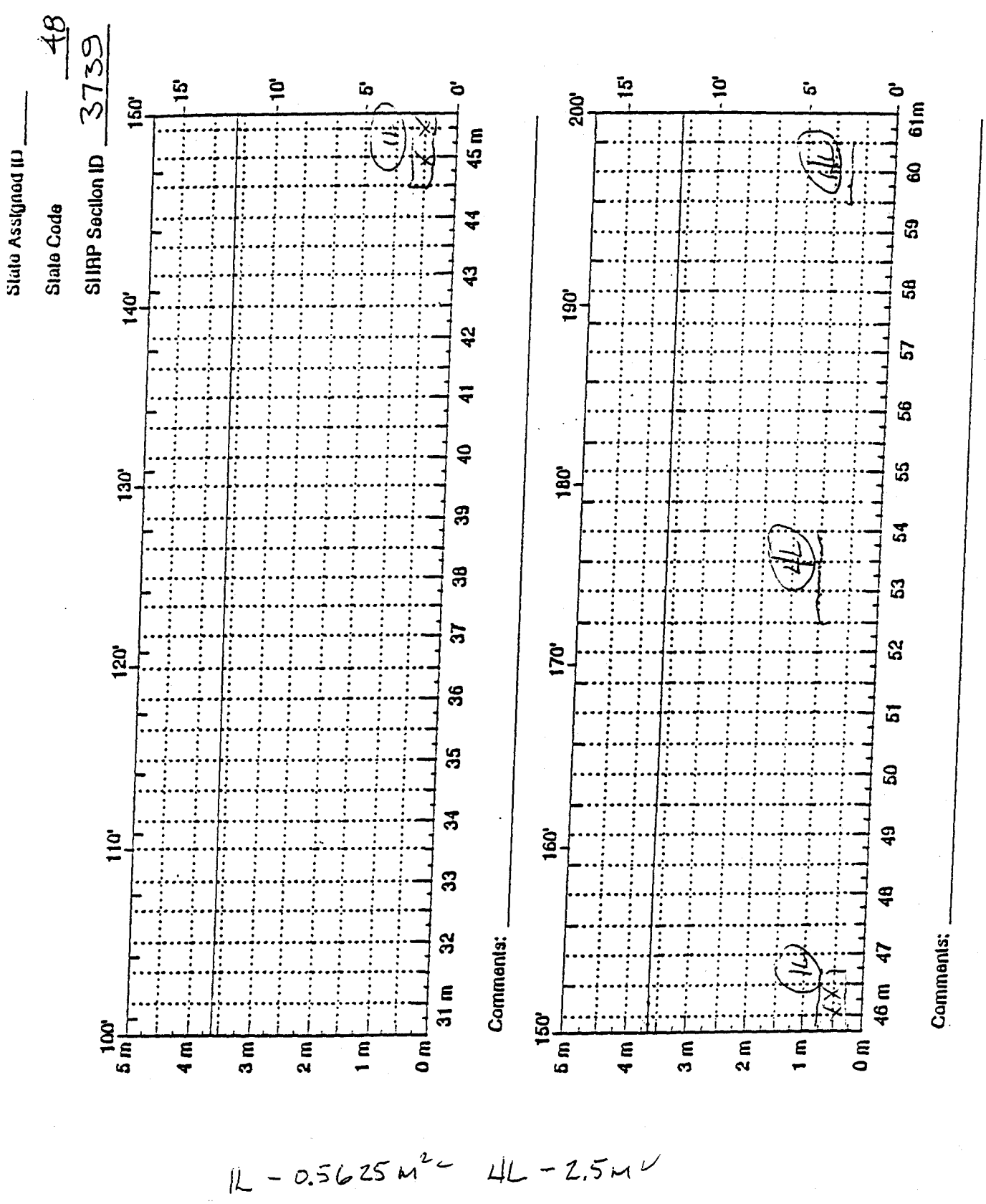
36°C

Comments: LOW SEVERITY BLEEDING (LL) THROUGHOUT SECTION, 1M IN FROM OUTSIDE WHEELPATH



Comments: _____

Figure A-9 (Continued). Distress Survey Data



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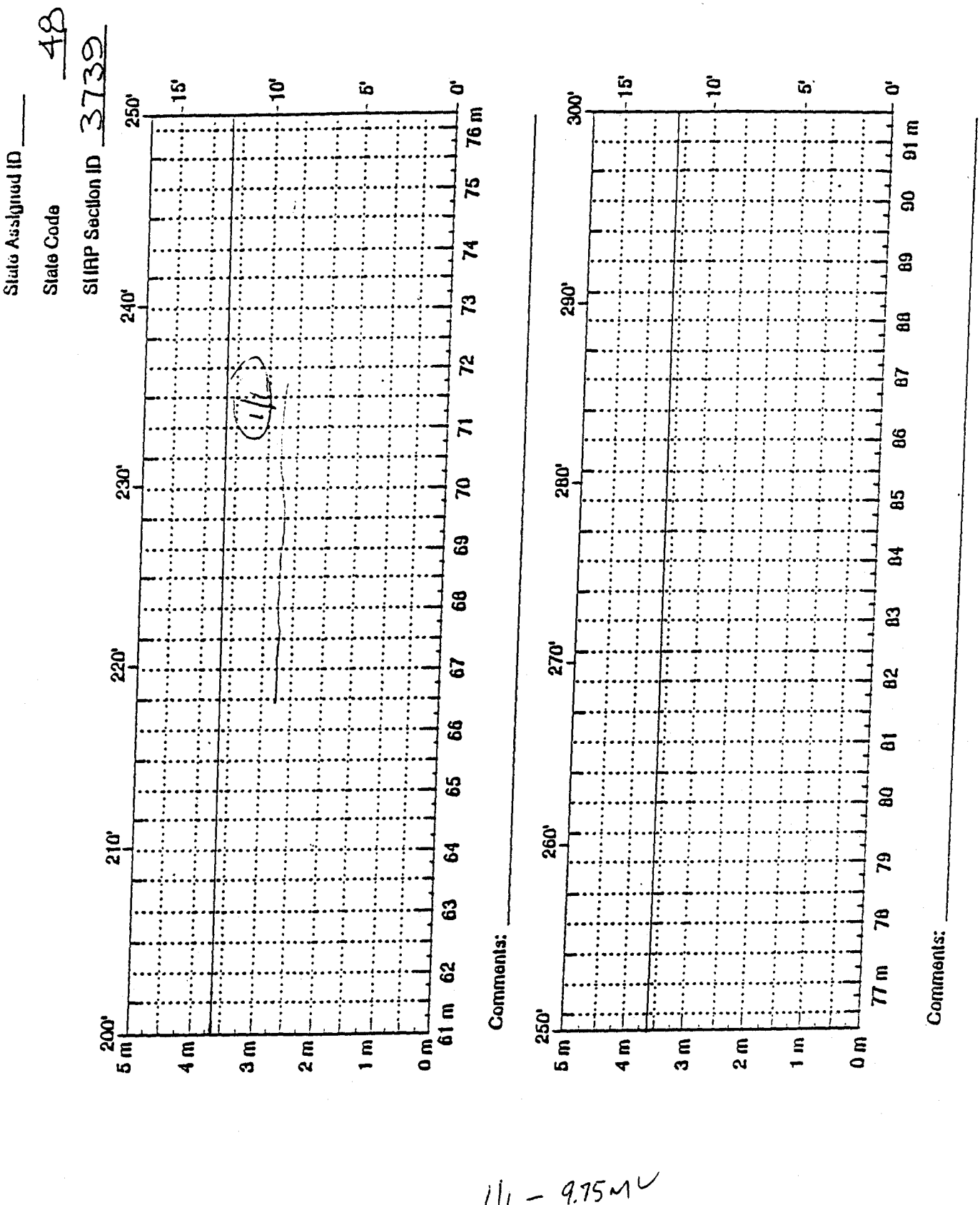
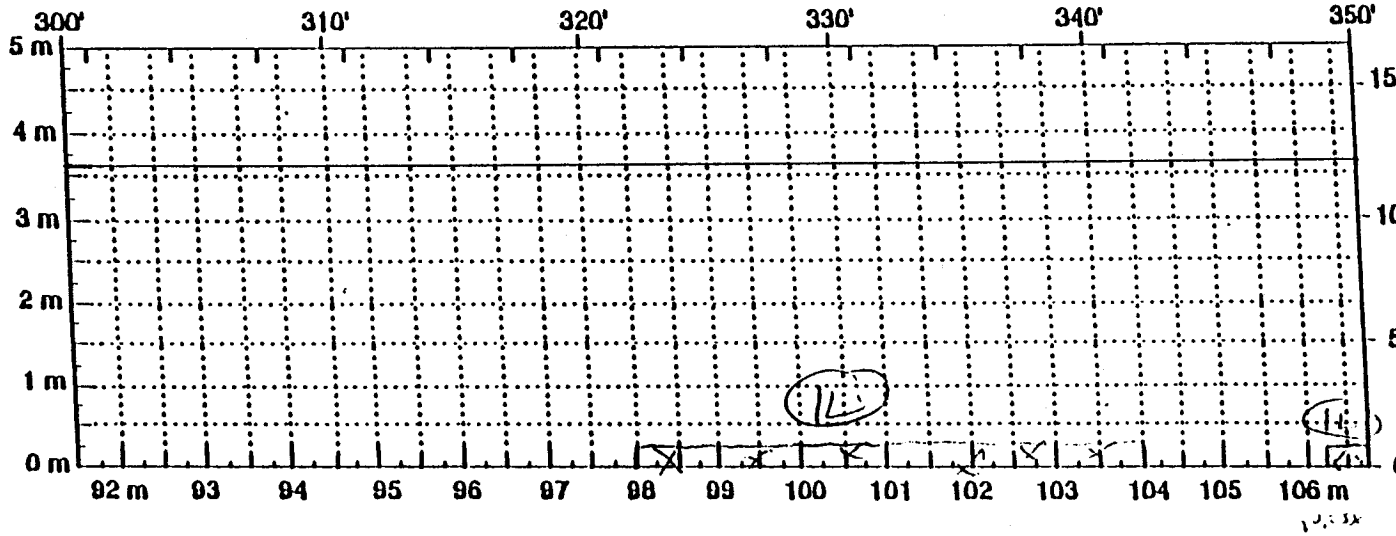


Figure A-9 (Continued). Distress Survey Data

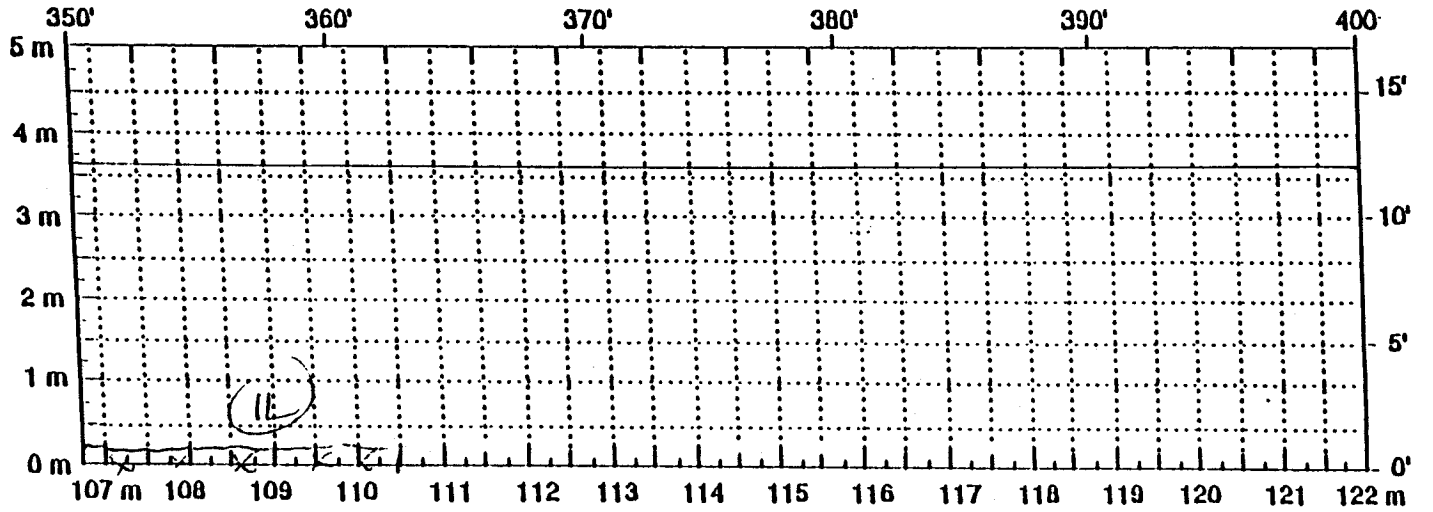
State Assigned ID _____

State Code 48

SHRP Section ID 3739



Comments: _____



Comments: _____

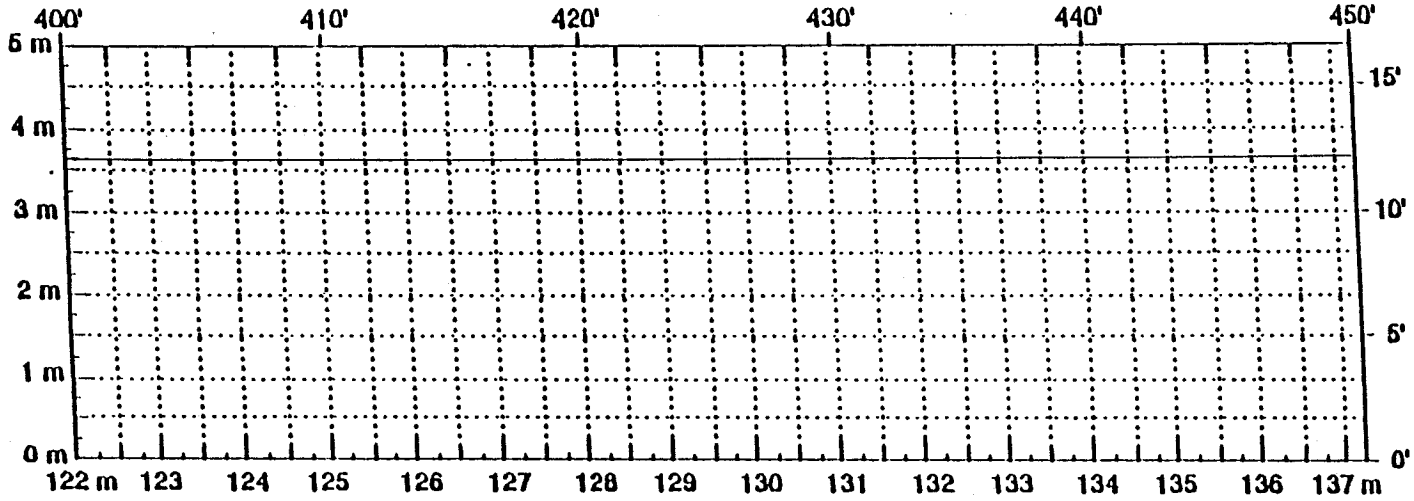
L - 2.5625 m²

Figure A-9 (Continued). Distress Survey Data

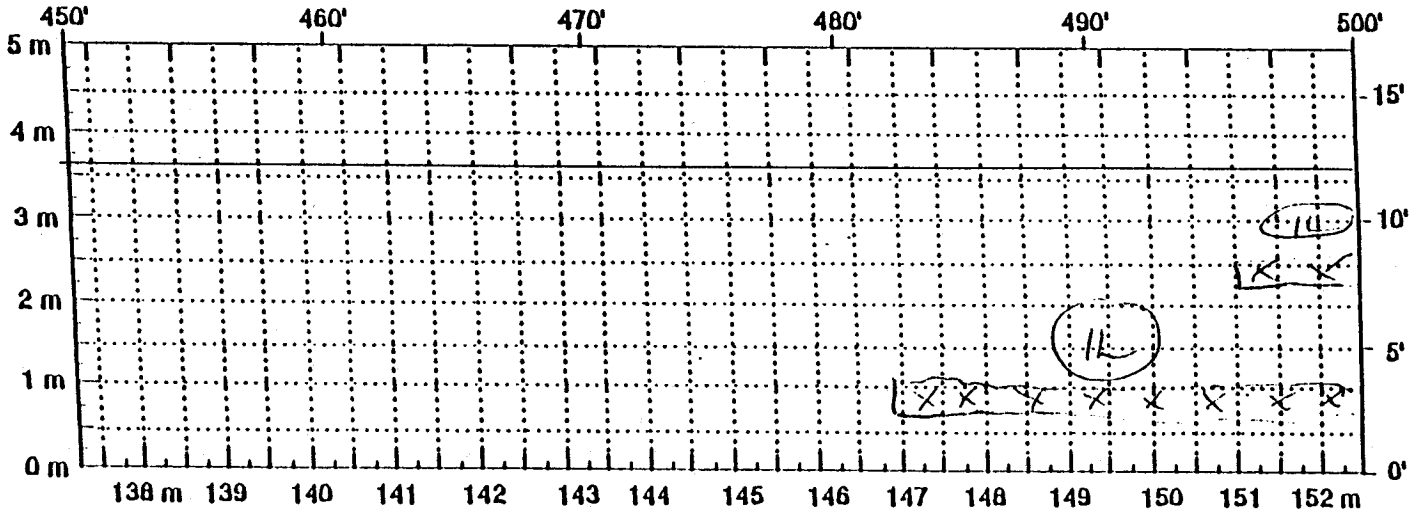
State Assigned ID ____

State Code 48

SHRP Section ID 3739



Comments: _____



Comments: _____

Figure A-9 (Continued). Distress Survey Data

APPENDIX B

Pre-installation Activities

Appendix B contains the following information:

Seasonal Monitoring Meeting Agenda

Seasonal Site Information

Figure B-1. TDR Traces Obtained During Calibration

AGENDA
Seasonal Monitoring Meeting
October 18, 1993

I. Introductions

II. Brief Overview of the Seasonal Program

III. Roles & Responsibilities

IV. Activities on Site - Day 1

- A. Arrival
- B. Traffic Control
- C. Marking Section
- D. FWD Testing
- E. Sawing/Coring
- F. Observation Well
- G. Instrumentation Hole
- H. Weather Station
- I. Hook-up all Electronics
- J. Patching/Clean-up

V. Activities on Site - Day 2

- A. Instrumentation Check
- B. Data Collection
  1. FWD Testing
  2. Rod/Level Elevations
  3. Download Instrumentation Data

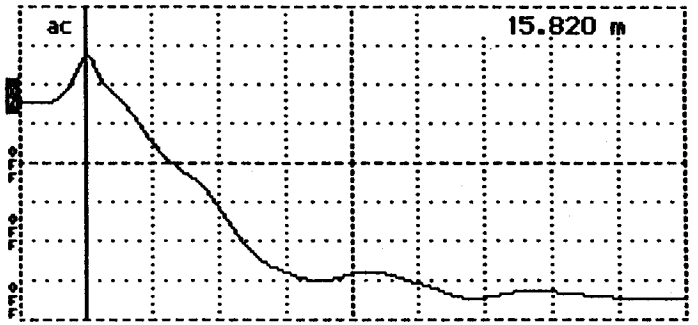
VI. Questions/Discussion

TEXAS SEASONAL SITE INFORMATION

Type	SHRP ID	Hwy. Nº.	Location of Test Section
AC over Granular Base	481060	US-77, Refugio Co., Northbound	0.7 mi. S. of SH-289, 2 mi. S. of the Refugio/Victoria Co. line.
AC over Granular Base	481068	SH-19, Lamar Co., Northbound	2.1 mi. N. of the North Sulfur River, 1.3 mi. S. of FM-1184.
AC over Granular Base	481077	US-287, Hall Co., Southbound	2.1 mi. S. of the Red River, 1100' N. of FM-658.
AC over Granular Base	481122	US-181, Wilson Co., Northbound	4.9 mi. N. of Loop 181, 2.5 mi. S. of the Bexar/Wilson Co. line.
AC over Granular Base	483739	US-77, Kenedy Co., Northbound	Milepost 20.05-19.95. 26.6 mi. N. of the Kenedy/Willacy Co. line, 20.1 mi. S. of the Kenedy/Kleberg Co. line.
JRCP	484142	US-96, Jasper Co., Northbound	7.6 mi. N. of US-190, 1.9 mi. S. of Recreation Rd. 255.
JRCP	484143	US-90, Jefferson Co., Eastbound	2.2 mi. E. of FM-365/SH-326, 11.0 mi. W. of FM-364.

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

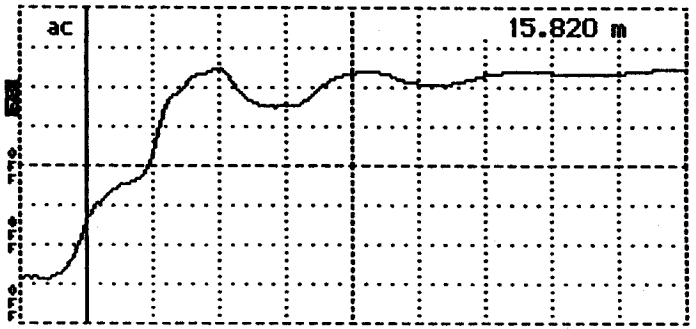
Cursor ..... 15.820 m
Distance/Div..... .25 m/div
Vertical Scale.... 167 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G01
Notes SHORTED
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	__.__

Cursor ..... 15.820 m
Distance/Div..... .25 m/div
Vertical Scale.... 167 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



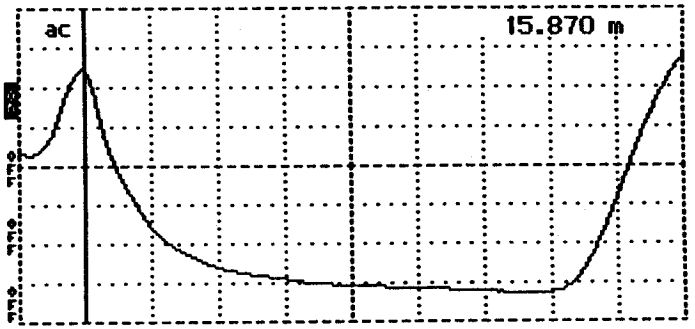
Tektronix 1502B TDR
Date 11-10-93
Cable 48G01
Notes IN AIR
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Figure B-1. TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 15.870 m
Distance/Div..... .25 m/div
Vertical Scale.... 86.4 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G01
Notes IN WATER
WATER TEMP 20.6
V.O.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.76	76.67

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48G01 Measured Length of Coax Cable: 12.3 m

Comments: _____

Prepared by: Matt G&G Employer: BRE

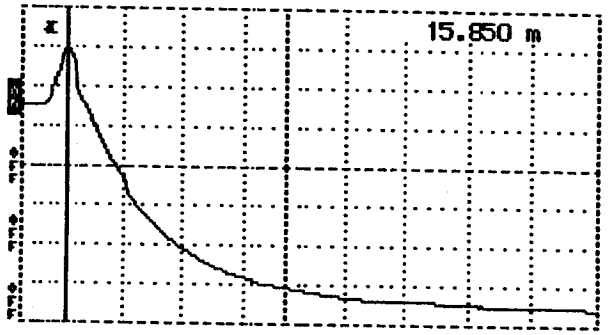
Date (dd/mm/yy): 01/09/94

Data Sheet SMP-C01 TDR Probe Check (Continued)

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

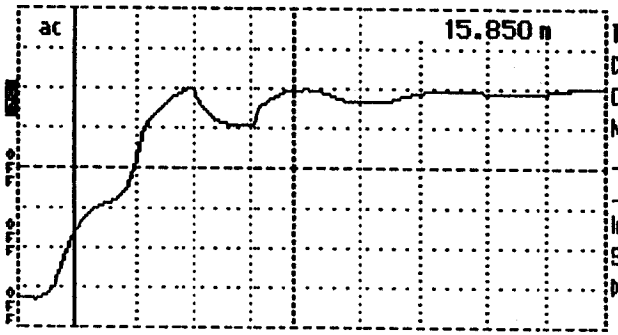
Cursor ..... 15.850 m
DistnceDiv .... .25 m/div
Vertical Scale... 167 mV/div
Vp 0.99
Noise Filter .... 1 avg
Power ..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G02
Notes SHORTED, N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	__.__

Cursor 15.850m
Distnce/Div ..... .25 m/div
Vertical Scale.... 167 mV/div
Vp 0.99
Noise Filter ..... 1 avg
Power ..... ac



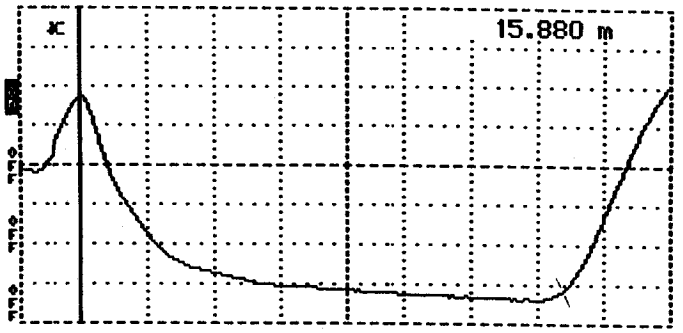
Tektronix 1502B TDR
Date 11-10-93
Cable 48G02
Notes IN AIR N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 15.880 m
Distance/Div..... .25 m/div
Vertical Scale.... 94.1 mV/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G02
Notes IN WATER
WATER TEMP 20.6
N.D.
InputTrace
Stord Trace
Diffeence Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48G02 Measured Length of Coax Cable: 12.3 m

Comments: _____

Prepared by: Matt Cole Employer: BRE

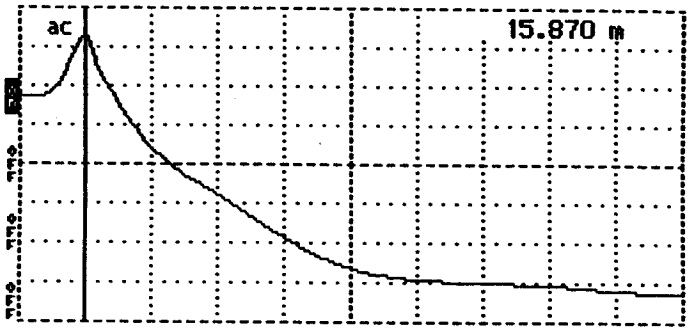
Date (dd/mm/yy): 01/09/94

Data Sheet SMP-C01 TDR Probe Check (Continued)

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

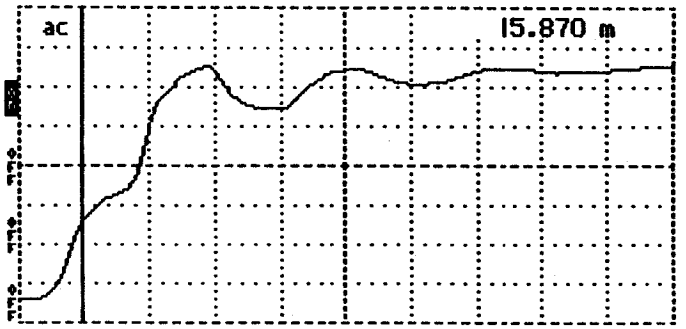
Cursor ..... 15.870 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G03
Notes SHORTED
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	___.__

Cursor ..... 15.870 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power.....ac



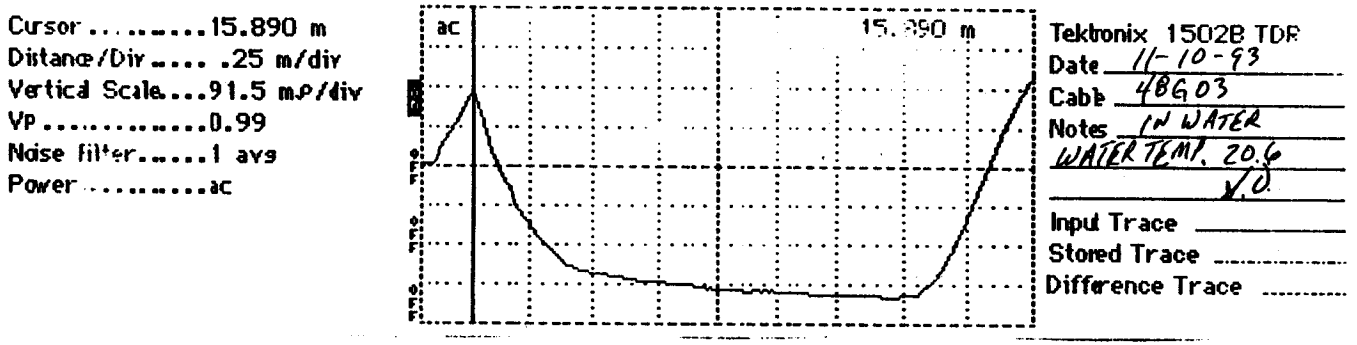
Tektronix 1502B TDR
Date 11-10-93
Cable 48G03
Notes IN AIR
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP-C_ , TDR Probe Check

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]



TDR Trace	Apparent Length, (m)[1]	Dielectric Constant[2]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48G03 Measured Length of Coax Cable: 12.3 m

Comments: _____

Prepared by: Matt Cole Employer: DRE

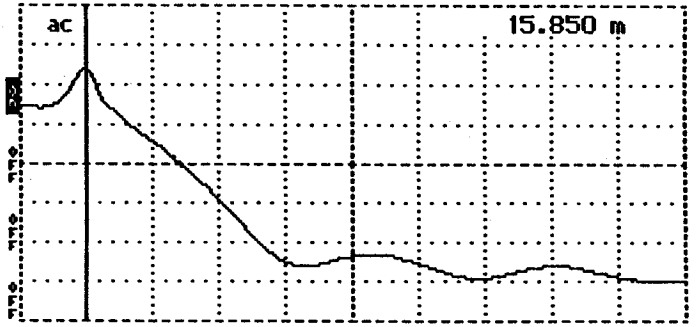
Date (dd/mm/yy): 01/09/94

Data Sheet SMP-C01: TDR Probe Check (Continued)

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

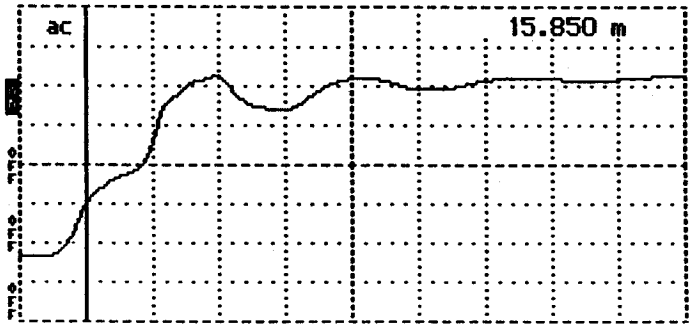
Cursor ..... 15.850 m
Distance/Div..... .25 m/div
Vertical Scale.... 193 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11/10/93
Cable 40G04
Notes Shorted
Input Trace J.P.
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	___.___	___.___

Cursor ..... 15.850 m
Distance/Div..... .25 m/div
Vertical Scale.... 193 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11/10/93
Cable 40G04
Notes AIR
Input Trace J.P.
Stored Trace
Difference Trace

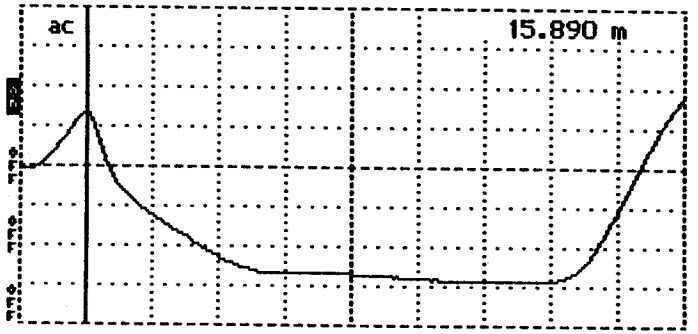
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP-C . TDR Probe Check

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 15.890 m
Distance/Div..... .25 m/div
Vertical Scale.... 106 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11/10/93
Cable 48G04
Notes uATTn
20.7°
Input Trace J.R
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48 G 04 Measured Length of Coax Cable: 12.3 m

Comments: _____

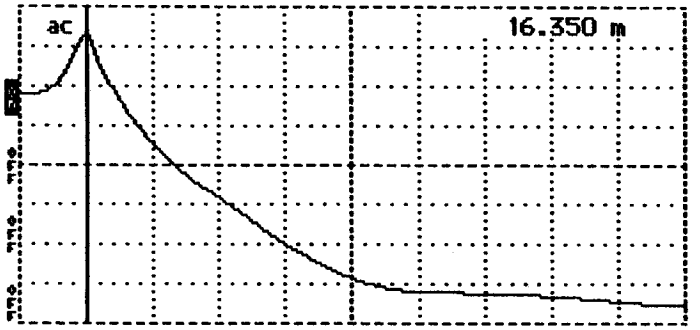
Prepared by: Matt Cole Employer: BRE

Date (dd/mm/yy): 01/09/94

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [37391]

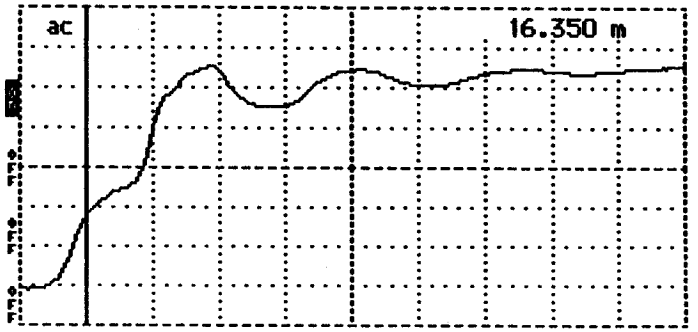
Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G05
Notes SHORTED
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	__.__

Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G05
Notes AIR
N.D.
Input Trace
Stored Trace
Difference Trace

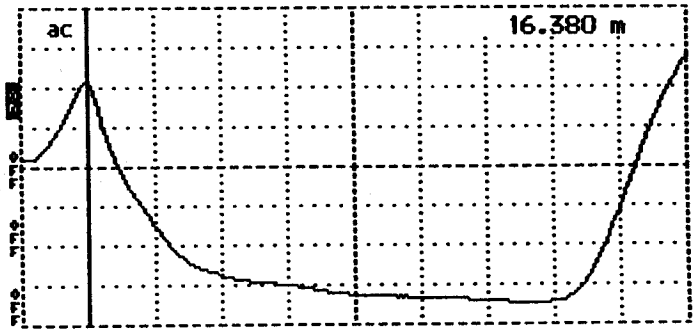
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP-C . TDR Probe Check

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48]
	LTPP Section ID [3739]

Cursor ..... 16.380 m
Distance/Div..... .25 m/div
Vertical Scale.... 83.9 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G05
Notes IN WATER
WATER TEMP 20.7
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48905 Measured Length of Coax Cable: 12.3 m

Comments: _____

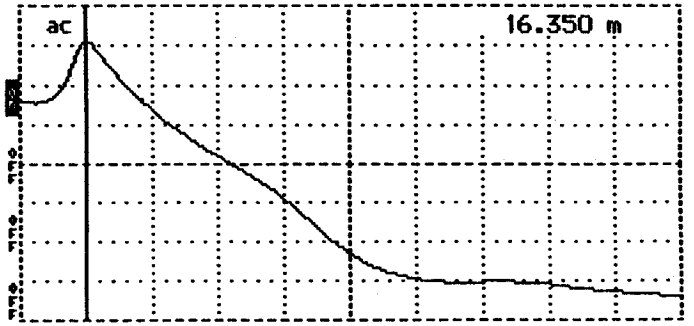
Prepared by: Matt Cole Employer: BRE

Date (dd/mm/yy): 01/09/94

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 167 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

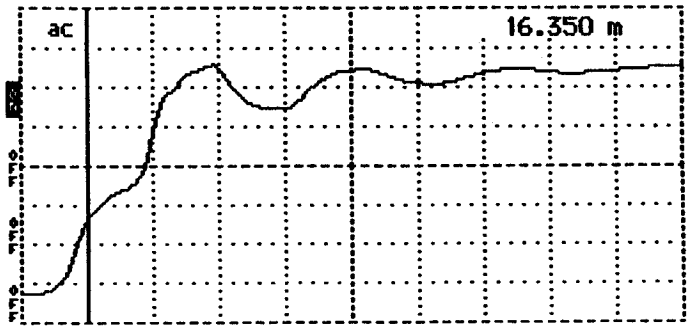


Tektronix 1502B TDR
Date 11-10-93
Cable 48G06
Notes SHORTED N.D.

Input Trace _____
Stored Trace _____
Difference Trace _____

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	___.__

Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G06
Notes IN AIR N.D.

Input Trace _____
Stored Trace _____
Difference Trace _____

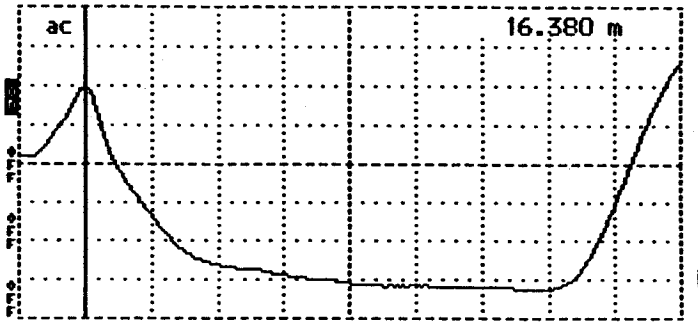
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP-C . TDR Probe Check

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 16.380 m
Distance/Div..... .25 m/div
Vertical Scale.... 88.9 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G06
Notes IN WATER
WATER TEMP. 20.0
N.O
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48906 Measured Length of Coax Cable: 12.3 m

Comments: _____

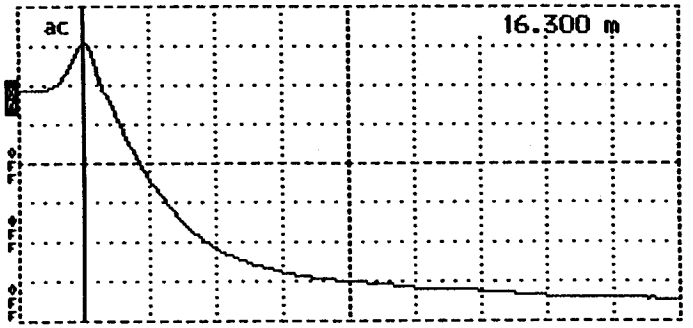
Prepared by: Matt Cole Employer: BRE

Date (dd/mm/yy): 01/09/94

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

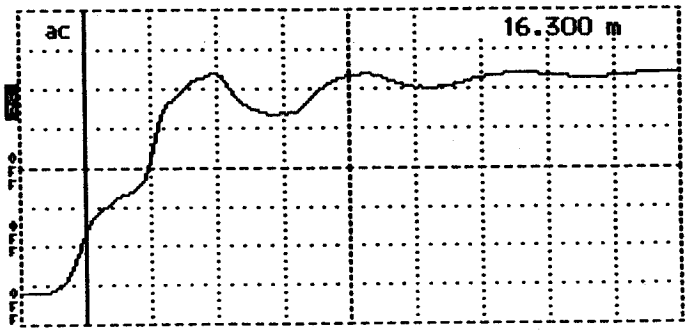
Cursor ..... 16.300 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G07
Notes SHORTED
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	__.__

Cursor ..... 16.300 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G07
Notes IN AIR
N.D.
Input Trace
Stored Trace
Difference Trace

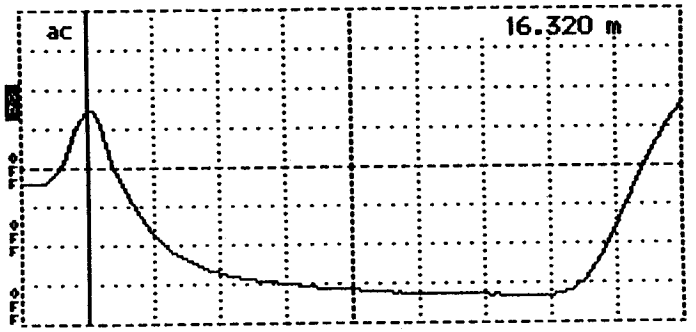
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP C... TDR Probe Check

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 16.320 m
Distance/Div..... .25 m/div
Vertical Scale.... 103 mV/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48607
Notes IN WATER
WATER TEMP 20.9 C.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48607 Measured Length of Coax Cable: 12.3 m

Comments: _____

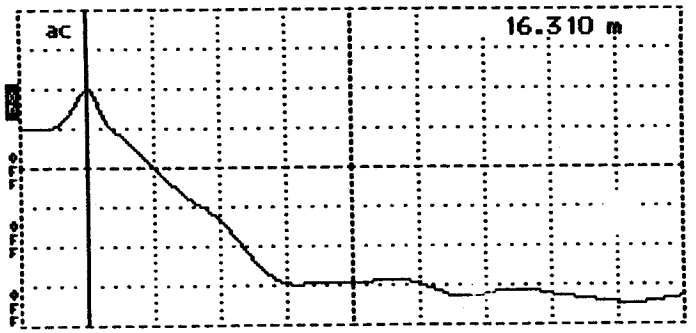
Prepared by: Matt Cole Employer: BRE

Date (dd/mm/yy): 01/09/94

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

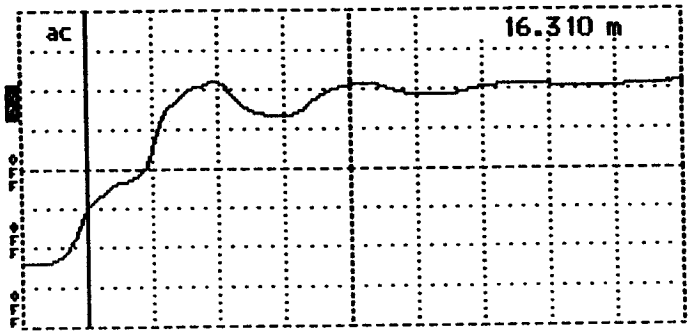
Cursor ..... 16.310 m
Distance/Div..... .25 m/div
Vertical Scale.... 193 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G08
Notes SHORTED
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	__.__

Cursor ..... 16.310 m
Distance/Div..... .25 m/div
Vertical Scale.... 193 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



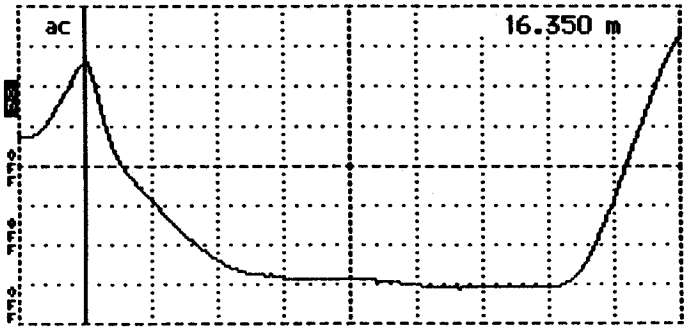
Tektronix 1502B TDR
Date 11-10-93
Cable 48G08
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [37 39]

Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 79.2 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G08
Notes IN WATER
WATER TEMP 20.9
✓.0.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48G08 Measured Length of Coax Cable: 12.3 m

Comments: _____

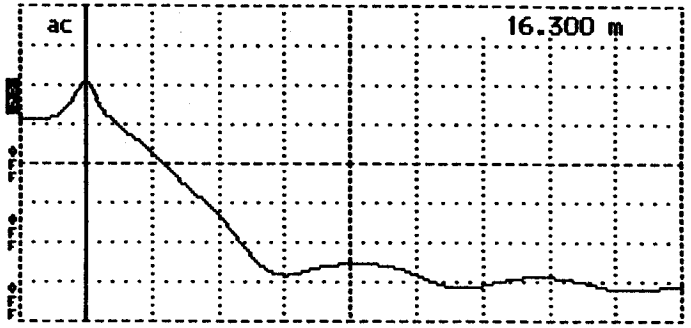
Prepared by: Matt Cole Employer: BRE

Date (dd/mm/yy): 01/09/94

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [37391]

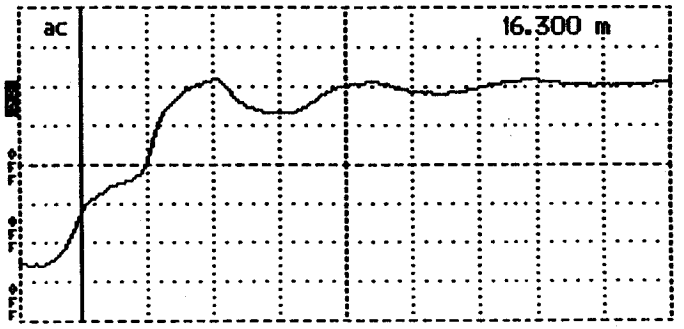
Cursor ..... 16.300 m
Distance/Div..... .25 m/div
Vertical Scale.... 188 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power.....ac



Tektronix 1502B TDR
Date 11/10/93
Cable 40G09
Notes SHORTED
Input Trace J.P
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	___.__

Cursor ..... 16.300 m
Distance/Div..... .25 m/div
Vertical Scale.... 188 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power.....ac



Tektronix 1502B TDR
Date 11/10/93
Cable 40G09
Notes AIR
Input Trace J.P.
Stored Trace
Difference Trace

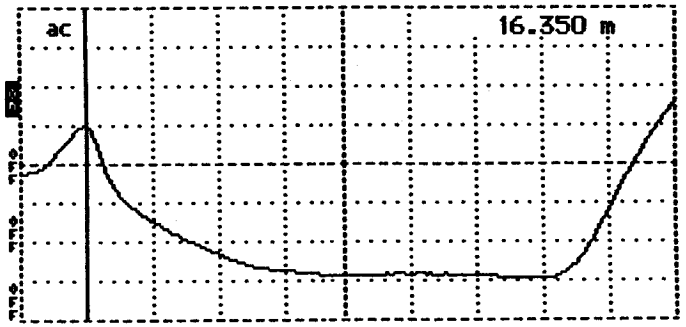
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.25	1.55

Data Sheet SMP-C . TDR Probe Check

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 112 mV/div
Vp 0.99
Noise Filter..... 1 avg
Power ..... ac



Tektronix 1502B TDR
Date 11/10/93
Cable 48609
Notes WATER
20.7°C
Input Trace J.P.
Stored Trace .....
Differnce Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.55

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48609 Measured Length of Coax Cable: 12.3 m

Comments: _____

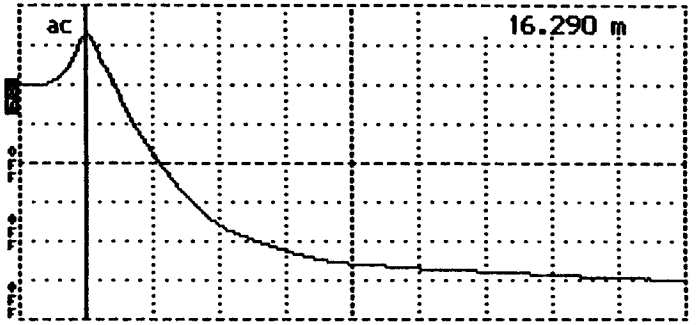
Prepared by: Matt Cole Employer: BRE

Date (dd/mm/yy): 01/09/94

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

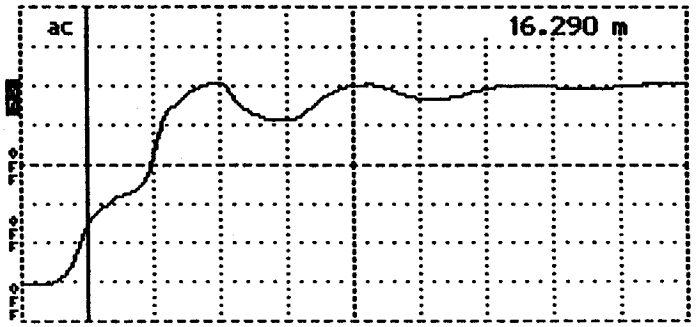
Cursor ..... 16.290 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G10
Notes SHORTED
A.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"	__.__	___.__

Cursor ..... 16.290 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



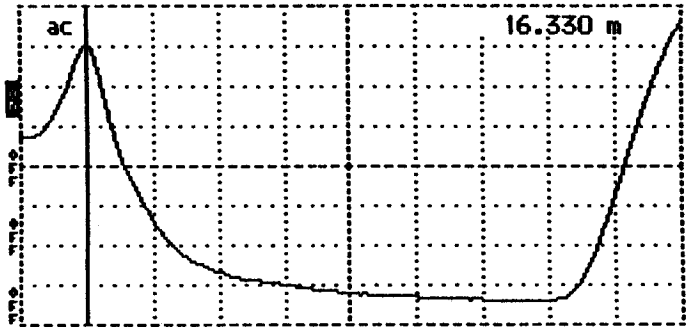
Tektronix 1502B TDR
Date 11-10-93
Cable 48G10
Notes IN AIR
A.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Figure B-1 (Continued). TDR Traces Obtained During Calibration

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [48] LTPP Section ID [3739]

Cursor ..... 16.330 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mρ/div
Vp 0.99
Noise Filter..... 1 avs
Power..... ac



Tektronix 1502B TDR
Date 11-10-93
Cable 48G10
Notes IN WATER
WATER TEMP 20.7
N.D.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.76	76.67

[1] If dielectric constant not between 0.75 and 2.0, contact FHWA LTPP Division
[2] If dielectric constant not between 76 and 84, contact FHWA LTPP Division

Note: Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2$$

where ε = dielectric constant; L_a = apparent length of probe, m; L = actual length of probe units (= 0.203 m (8 in) for FHWA probes); V_p = phase velocity setting (= 0.99).

TDR Probe Assigned Serial Number: 48G10 Measured Length of Coax Cable: 12.3 m

Comments: _____

Prepared by: Matt Gb Employer: BRE

Date (dd/mm/yy): 01/09/94

Figure B-1 (Continued). TDR Traces Obtained During Calibration

APPENDIX C

Instrumentation Installation Information

Appendix C contains the following information:

Figure C-1. TDR Traces During Installation

Table C-1. Field Measured Moisture Contents

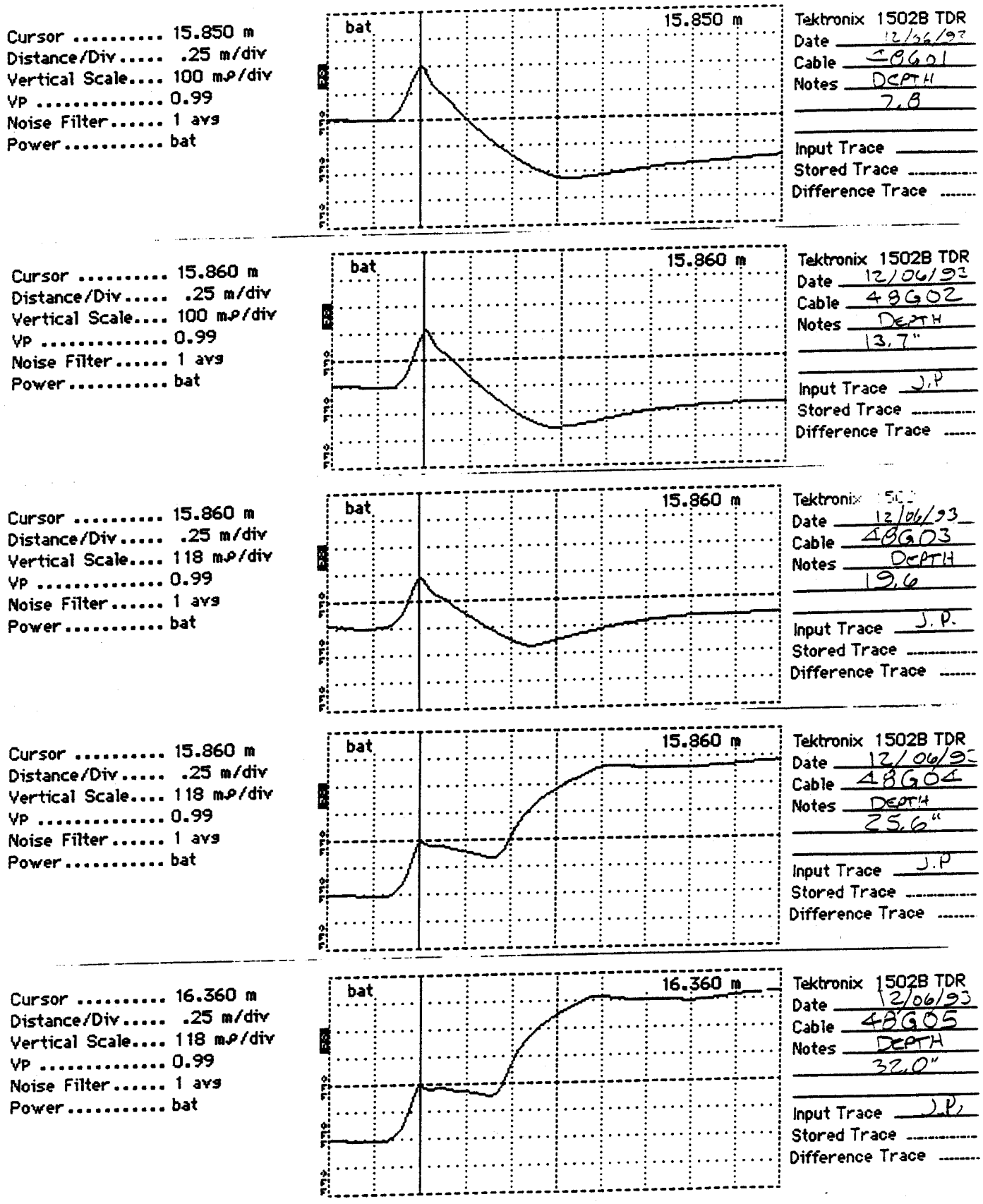


Figure C-1. TDR Traces During Installation

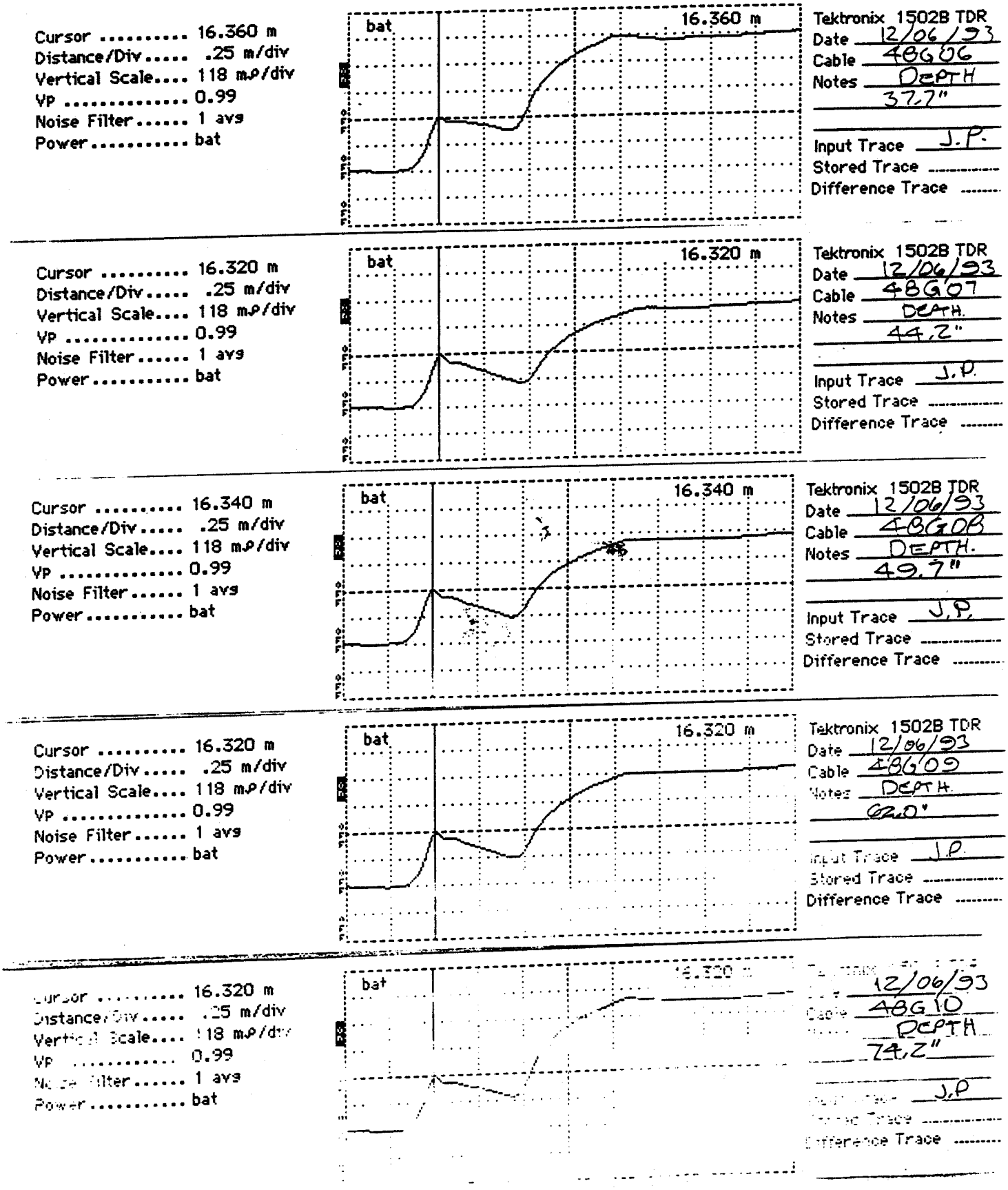


Figure C-1 (Continued). TDR Traces During Installation

Table C-1. Field Measured Moisture Contents

SITE NO. 483739 12/06/93

MOISTURE CONTENTS FOR TDR

TDR #	WT. OF PAN(g)	(WET) PAN & SOIL(g)	(DRY) PAN & SOIL(g)	M.C. (%)
48F10	149.5	406.2	394.7	4.69%
48F09	171.7	423.5	412.4	4.61%
48F08	203.4	400.5	391.6	4.73%
48F07	152.4	388.2	377.9	4.57%
48F06	179.1	405.6	396.2	4.33%
48F05	149.3	388.6	382.3	2.70%
48F04	171.5	385.1	376.6	4.14%
48F03	203.3	428.2	409.5	9.07%
48F02	152.3	410.5	386.2	10.39%
48F01	178.9	453.2	420.4	13.58%

APPENDIX D

Initial Data Collection

Appendix D contains the following support information:

Table D-1.	Raw Data from the On-site Data Logger
Figure D-1.	Measured Air Temperature During Initial Data Collection
Figure D-2.	Measured Average Subsurface Temperature for the First 5 Sensors During Initial Data Collection
Figure D-3.	Measured Average Subsurface Temperature for all 18 Sensors During Initial Data Collection
Figure D-4. thru Figure D-13.	Traces from TDR Sensor
Table D-2.	Elevation Measurements from Installation

Table D-1. Raw Data from the On-Site Datalogger During Initial Data Collection

2,1994,26,2400,23.89,23.66,23.51,22.93,22.37,21.88,21.39,21.13,20.78,20.62,20.58,20.66,20.83,21.04,21.32,21.6,21.93,22.25
3,1994,26,2400,30.23,1447,29.15,1449,28.03,1504,25.37,1728,23.81,1935,22.82,2133,22.16,0,21.66,2337,21.21,0,20.93,2257,20.82,2226,20.9,2333,21.01,2333,21.17,2122,21.
4,2253,21.75,2251,22.02,147,22.35,49
4,1994,26,2400,20.47,256,20.63,415,20.82,538,21.19,727,21.28,1015,21.28,1249,21.07,1226,20.78,2,20.33,19,20.26,8,20.29,33,20.43,205,20.68,2,20.93,419,21.22,19,21.51,12
51,21.85,530,22.18,1452
5,1994,26,2400,11.46,21.52,0
6,1994,26,2400,22.36,22.46,22.72,23.36,23.24
5,1994,27,100,11.46,21.38,0
6,1994,27,100,22.11,22.2,22.44,23.08,23.08
5,1994,27,200,11.46,21.26,0
6,1994,27,200,21.85,21.94,22.19,22.82,22.9
5,1994,27,300,11.46,21.15,0
6,1994,27,300,21.62,21.7,21.93,22.6,22.74
5,1994,27,400,11.46,21.78,0
6,1994,27,400,21.68,21.73,21.9,22.42,22.6
5,1994,27,500,11.46,21.68,0
6,1994,27,500,21.35,21.43,21.67,22.28,22.46
5,1994,27,600,11.46,21.73,0
6,1994,27,600,21.35,21.37,21.54,22.11,22.34
5,1994,27,700,11.46,21.63,0
6,1994,27,700,21.57,21.54,21.65,22,22.23
5,1994,27,800,11.46,21.64,0
6,1994,27,800,21.72,21.65,21.72,21.95,22.14
5,1994,27,900,11.46,21.63,0
6,1994,27,900,21.71,21.65,21.73,21.93,22.07
5,1994,27,1000,11.46,21.95,0
6,1994,27,1000,21.97,21.82,21.83,21.92,22.02
5,1994,27,1100,11.46,22.94,0
6,1994,27,1100,23.26,22.83,22.58,21.99,21.98
5,1994,27,1200,11.46,23.72,0
6,1994,27,1200,24.74,24.04,23.55,22.31,22.02
2,1994,28,2400,15.66,15.93,16.4,18.48,19.84,20.88,21.32,21.53,21.59,21.52,21.42,21.37,21.39,
21.46,21.62,21.8,22.04,22.31

Site 483739

January 27, 1994

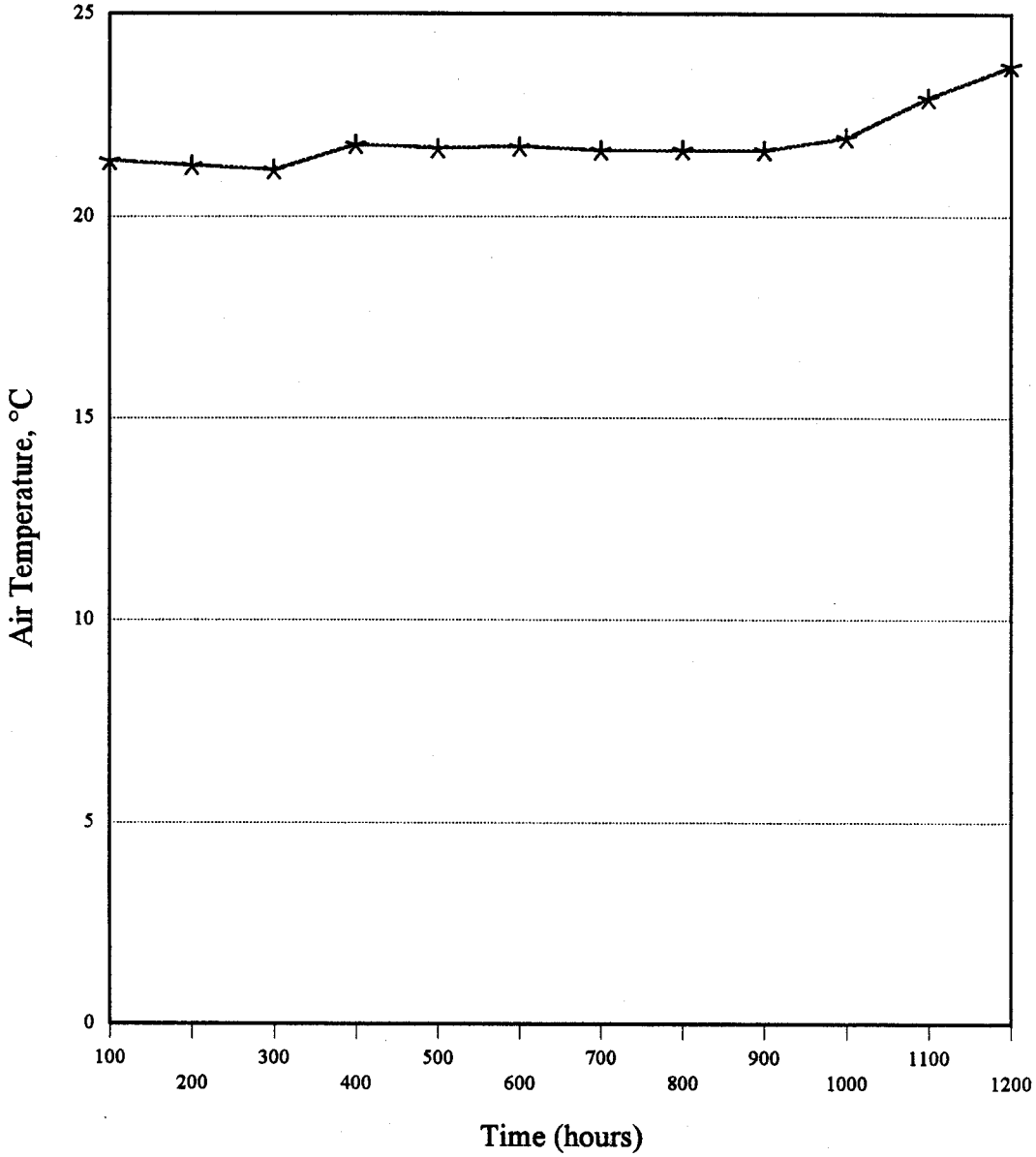


Figure D-1. Measured Air Temperature During January Data Collection.

Site 483739

January 27, 1994

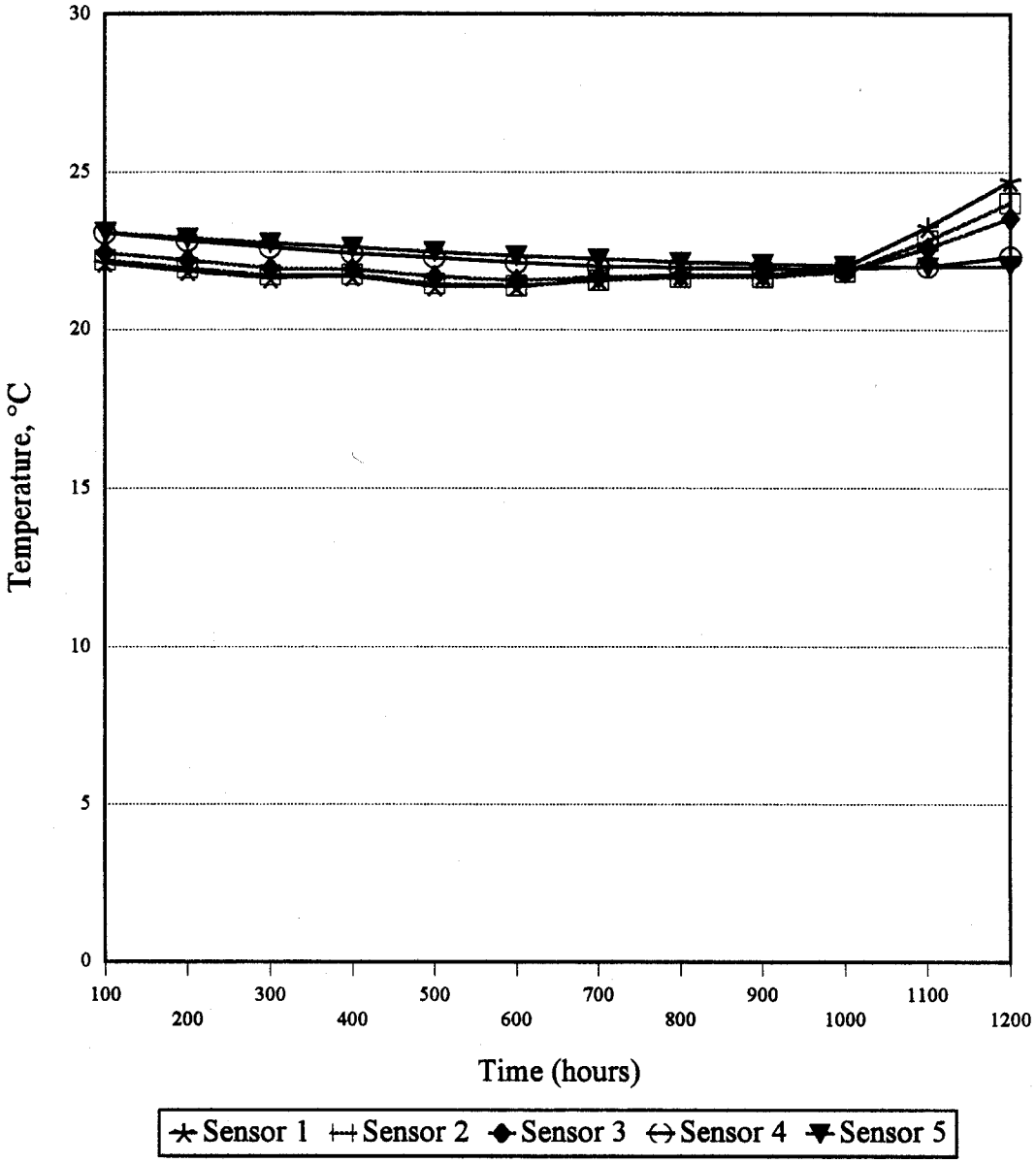


Figure D-2. Measured Average Subsurface Temperature for the First 5 Sensors During January Data Collection.

Site 483739

January 26 and 28, 1994

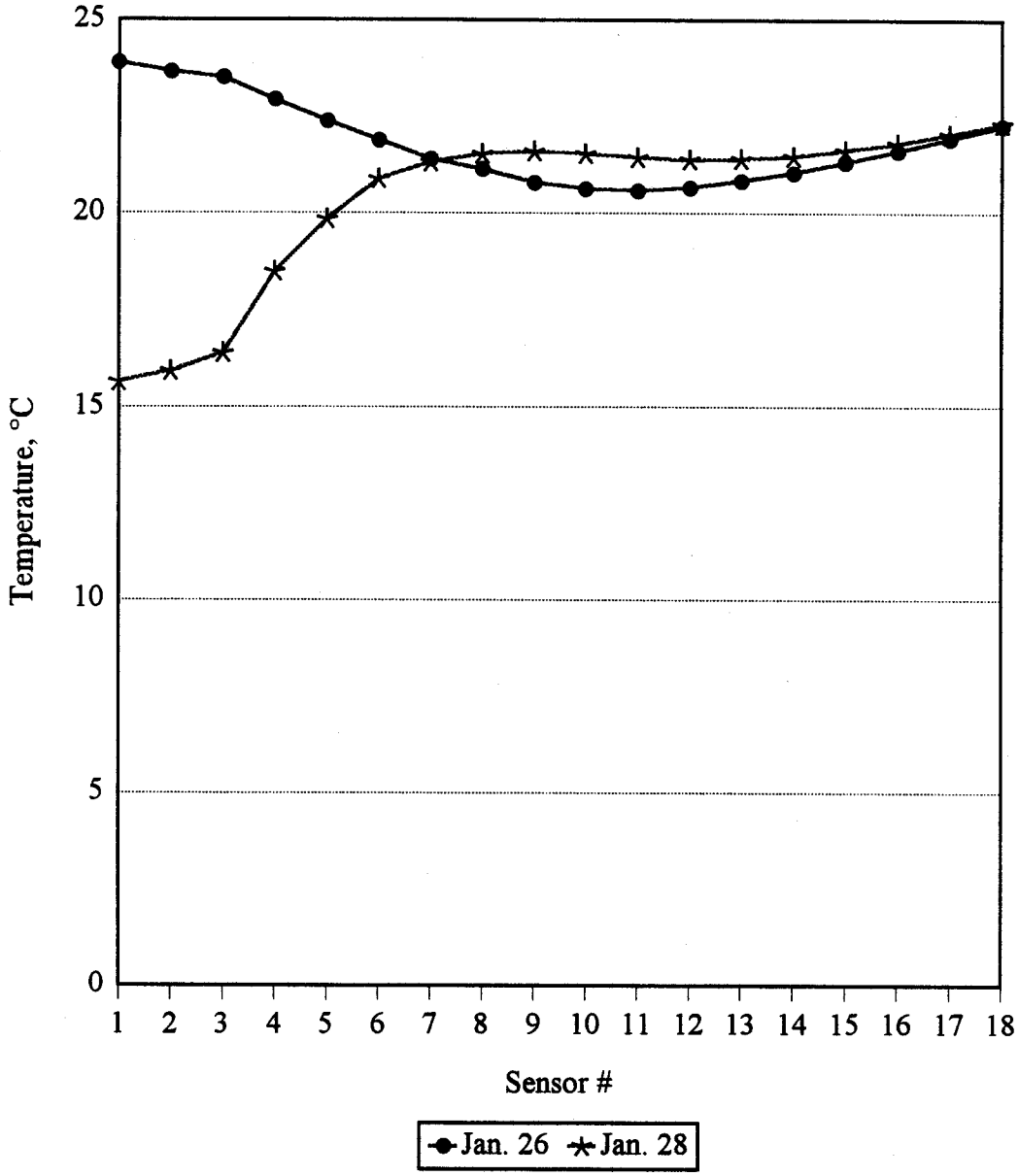


Figure D.3. Measured Average Subsurface Temperature for all 18 Sensors on January 26th and 28th.

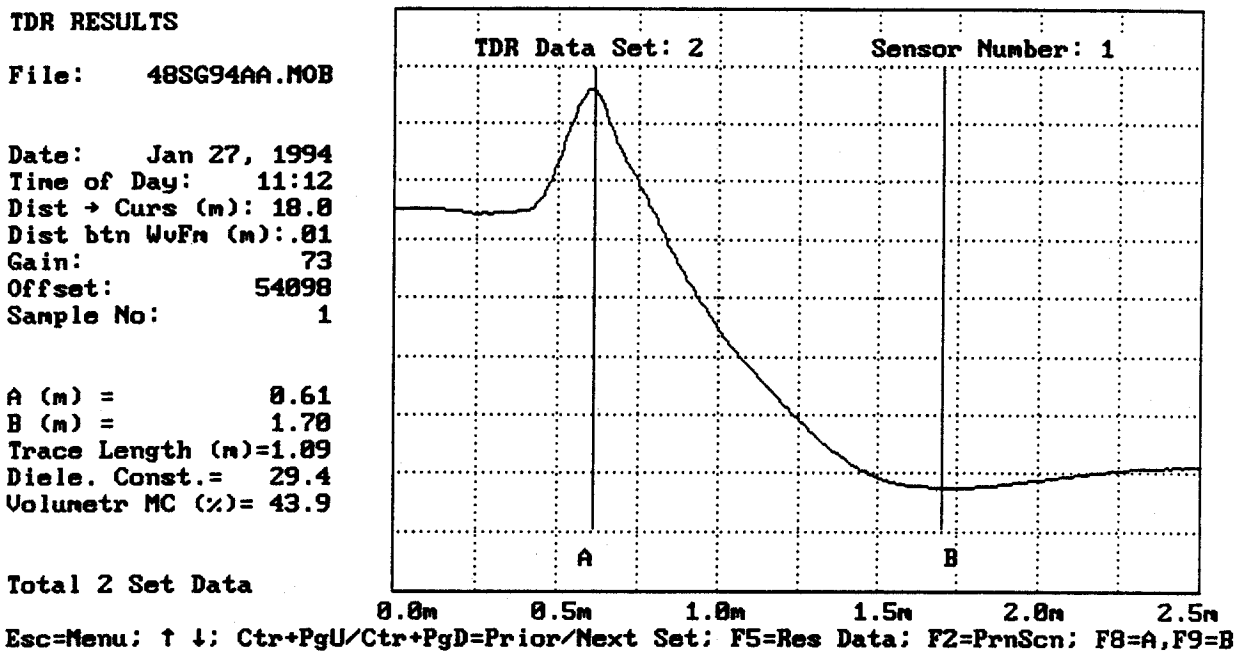


Figure D-4. Trace from TDR Sensor 1

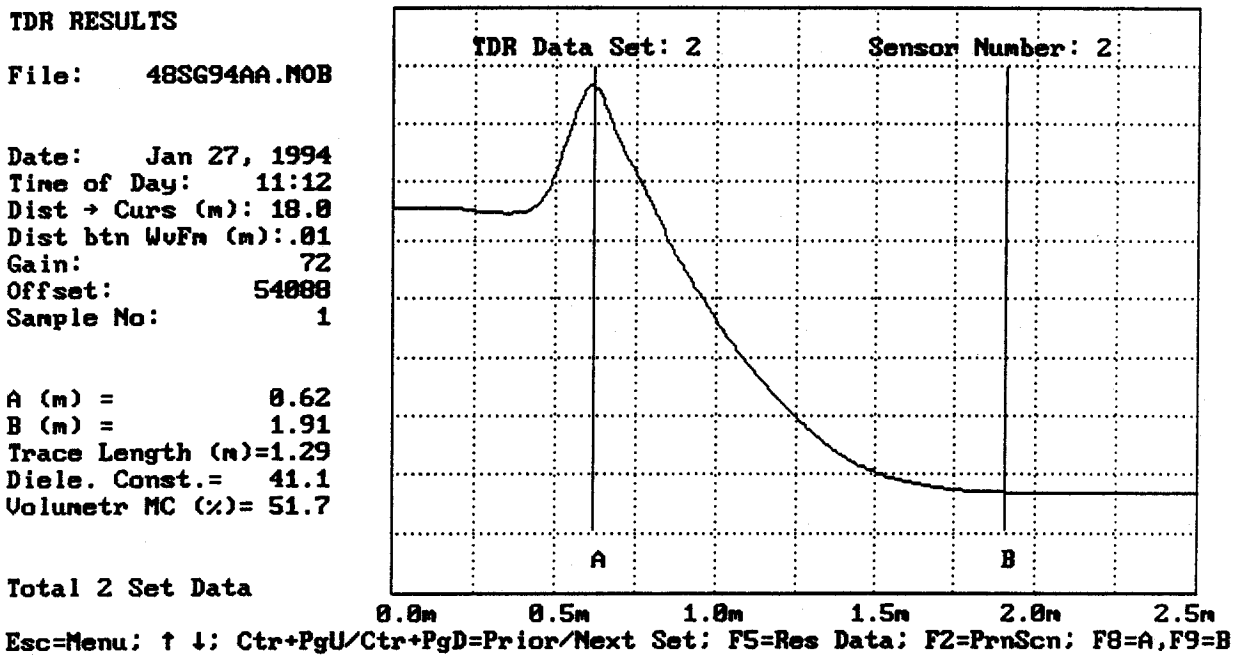


Figure D-5. Trace from TDR Sensor 2

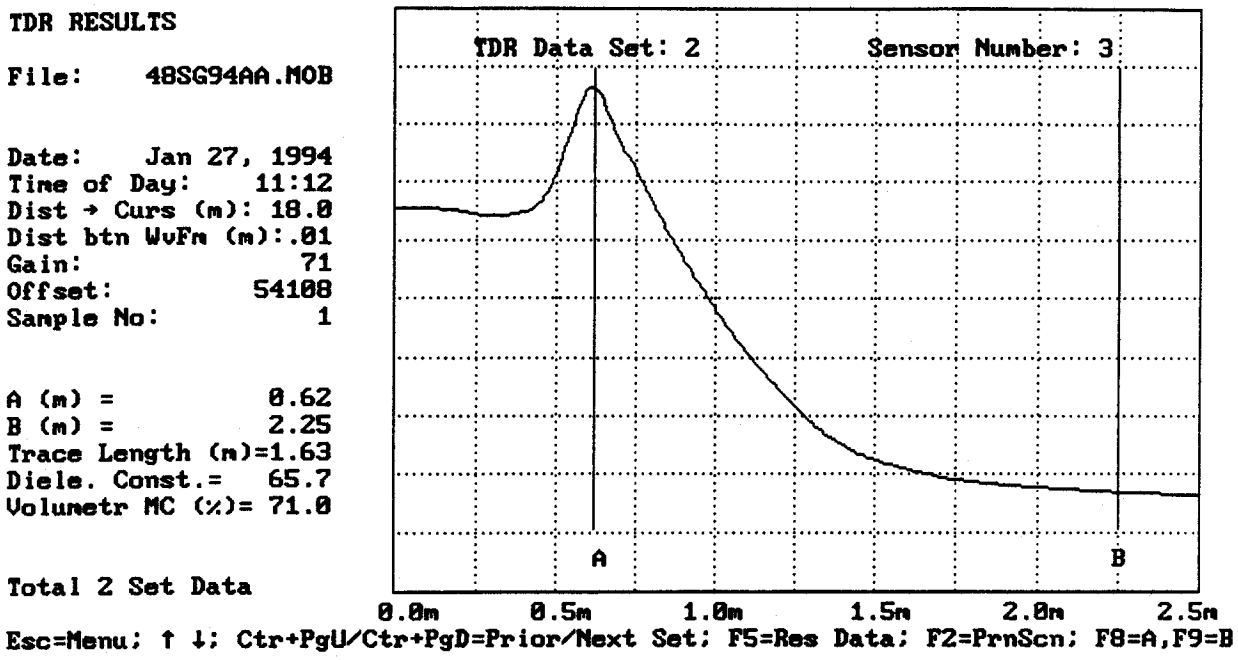


Figure D-6. Trace from TDR Sensor 3

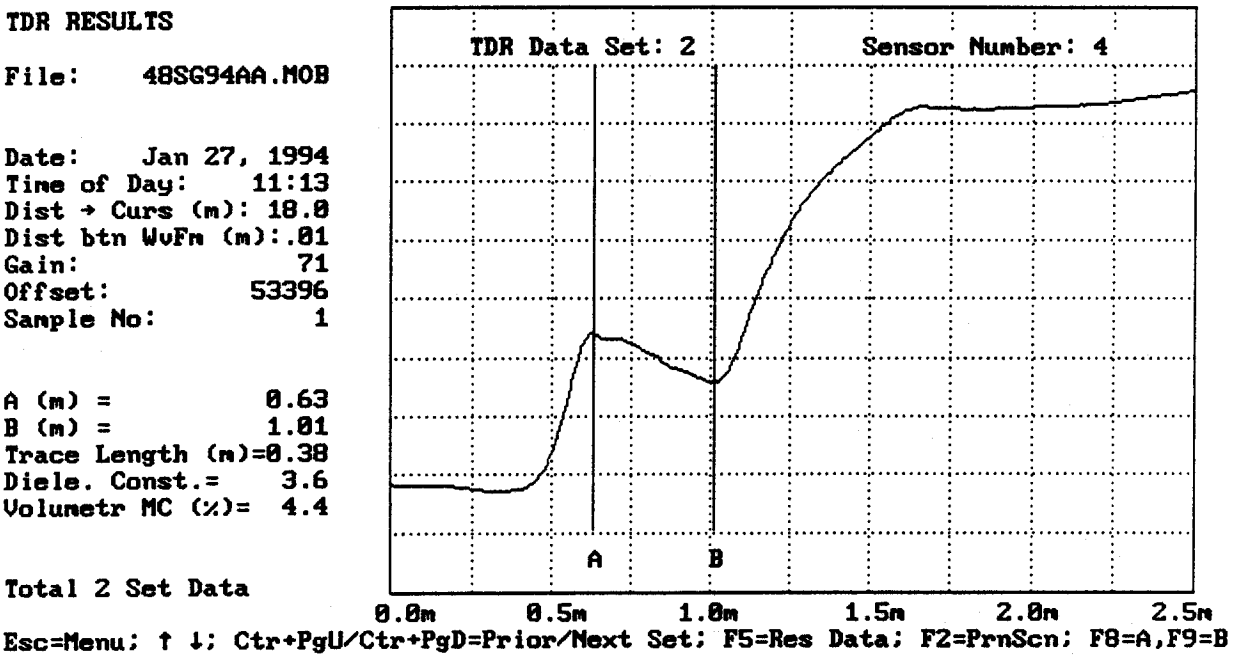


Figure D-7. Trace from TDR Sensor 4

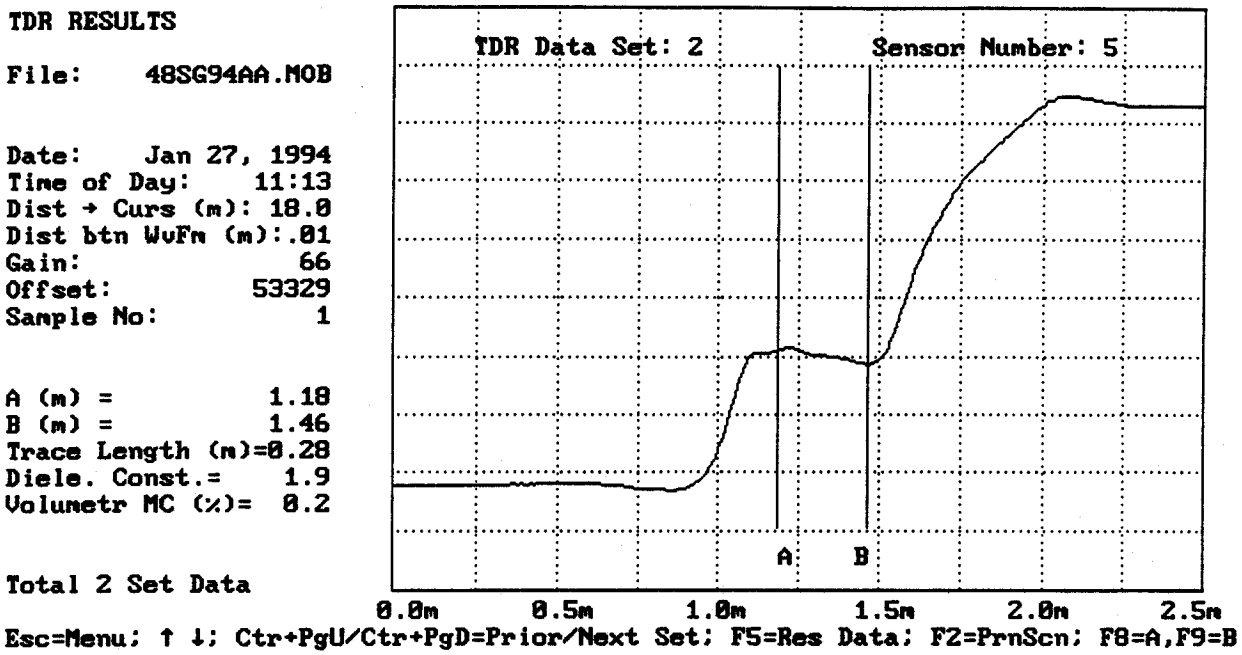


Figure D-8. Trace from TDR Sensor 5

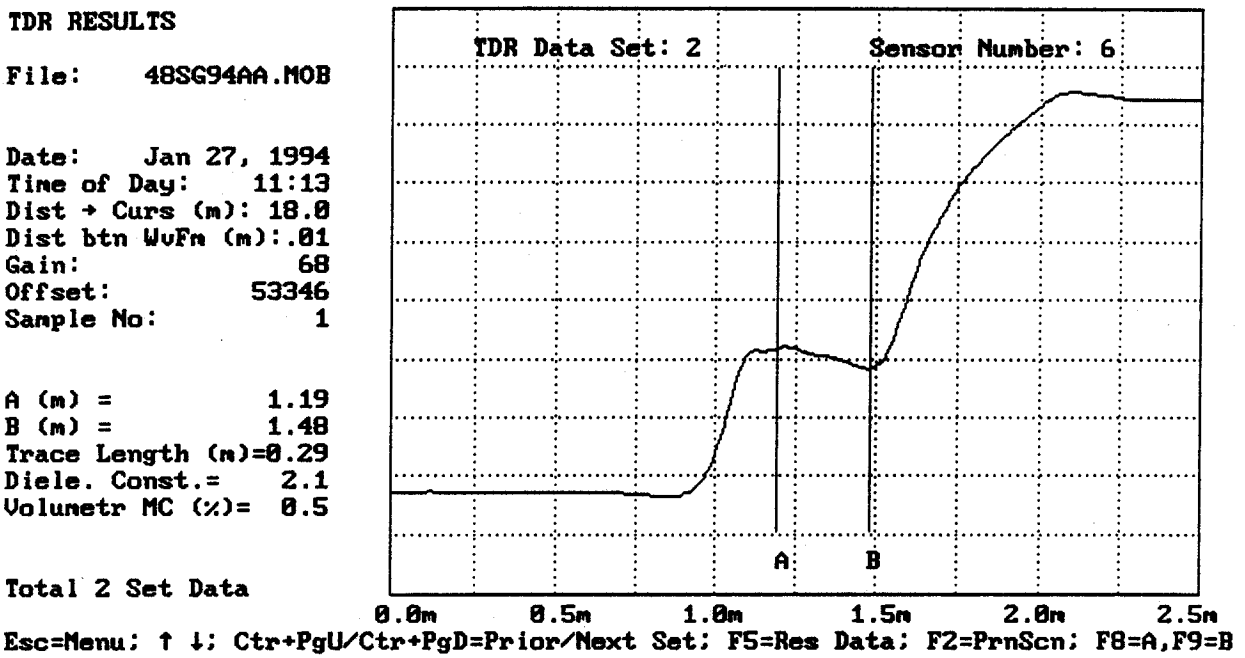


Figure D-9. Trace from TDR Sensor 6

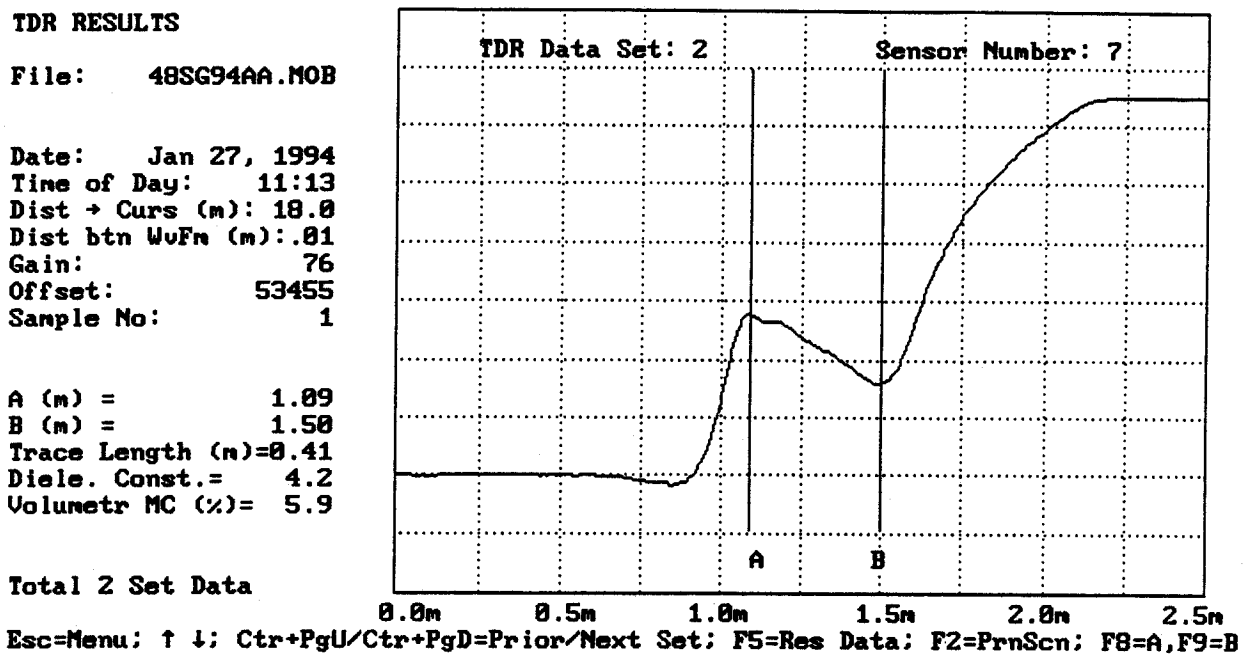


Figure D-10. Trace from TDR Sensor 7

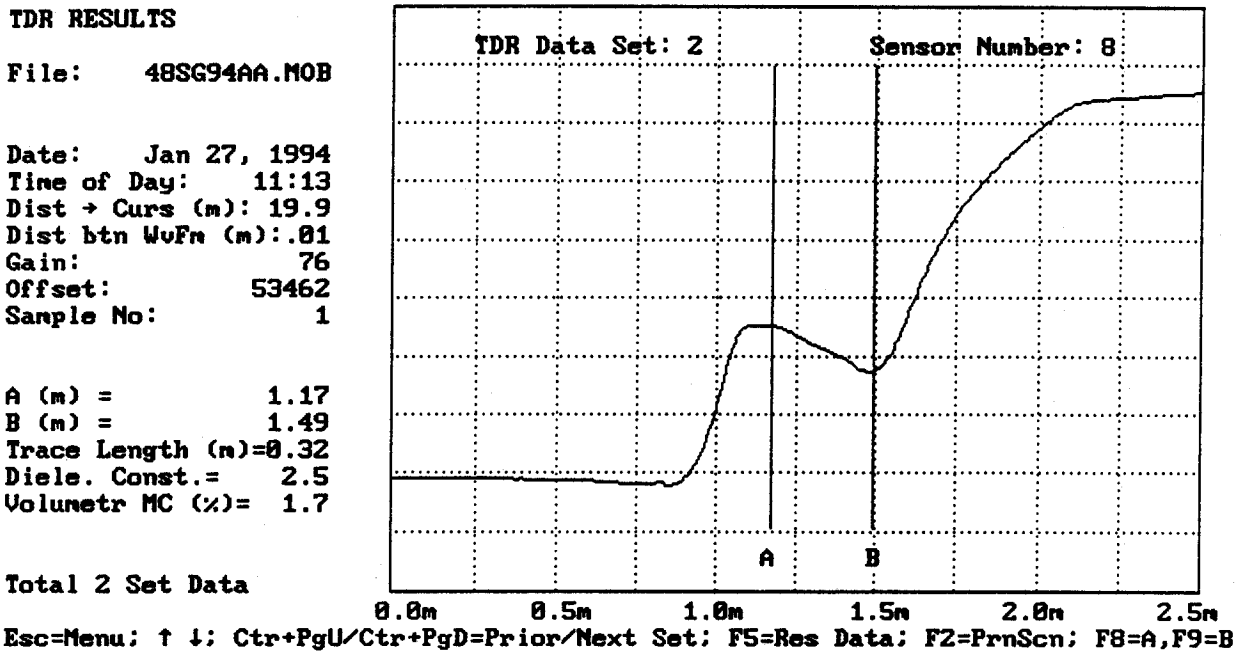


Figure D-11. Trace from TDR Sensor 8

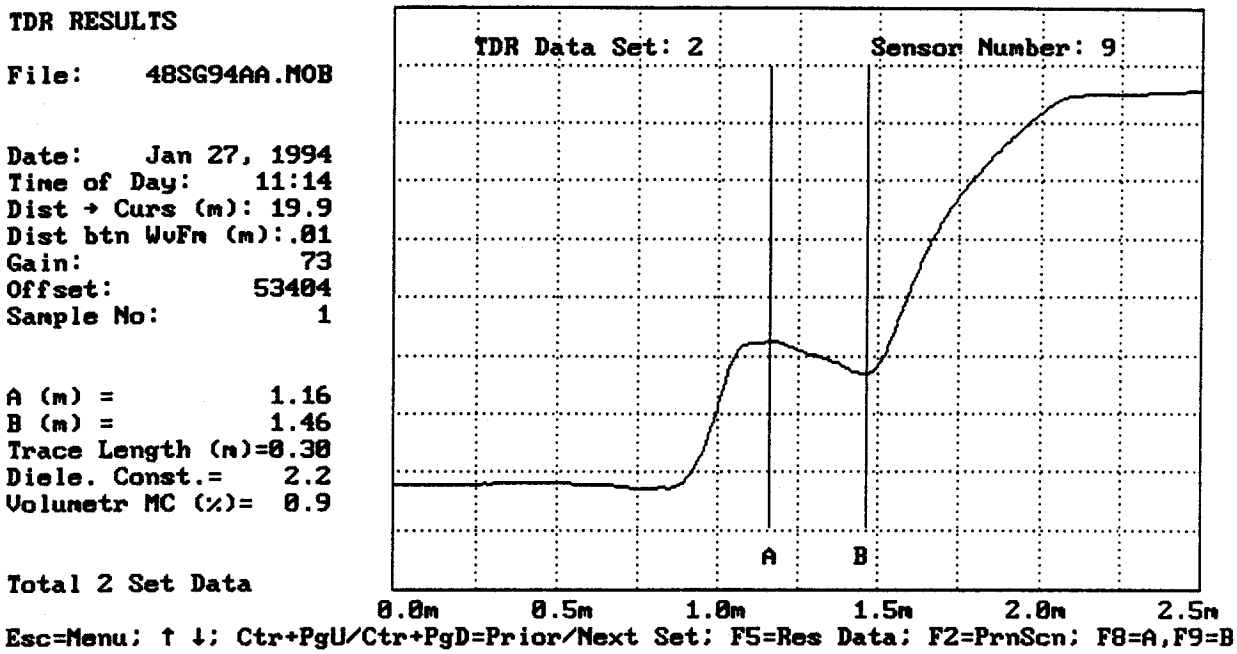


Figure D-12. Trace from TDR Sensor 9

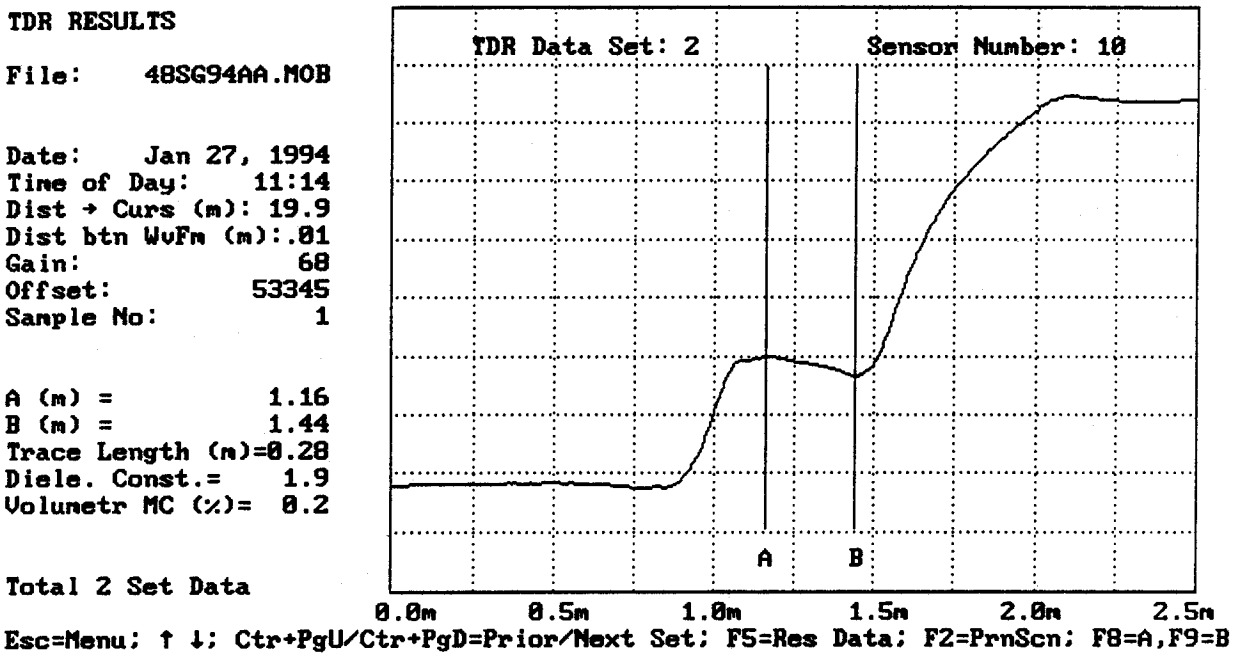


Figure D-13. Trace from TDR Sensor 10

Table D-2. Elevation Measurements from Installation

SEASONAL MONITORING
"FLEX" TRANSVERSE ELEVATION MEASUREMENTS[1]

485G

Station	Outside Edge		OWP		ML		IWP		Inside Edge	
	O/S	Elev.	O/S	Elev.	O/S	Elev.	O/S	Elev.	O/S	Elev.
0-30	M		.95	10.734	M		M		M	
0-20					1.90	10.763				
0-10			.95	10.734						
0+00	.20	10.725	.95	10.731	1.90	10.765	2.75	10.763	3.75	10.781
0+25	"	10.709	"	10.718	"	10.753	"	10.751	"	10.778
0+50	"	10.700	"	10.710	"	10.745	"	10.747	"	10.772
0+75	"	10.689	"	10.703	"	10.742	"	10.744	"	10.771
1+00	"	10.683	"	10.693	"	10.732	"	10.740	"	10.757
1+25	"	10.677	"	10.684	"	10.726	"	10.727	"	10.748
1+50	"	10.669	"	10.681	"	10.719	"	10.716	"	10.738
1+75	"	10.655	"	10.668	"	10.705	"	10.710	"	10.732
2+00	"	10.645	"	10.657	"	10.689	"	10.692	"	10.716

Bench Mark: T.B.M. NAIL IN P.P. STA ±1+40 ; ±70' RT. EDGE PVMT. ASSUMED ELEV. 10.00 M. T.B.M. SIDE SHOT, MONUMENT IN CONC. @ EDGE SHOULDER STA. 1+50 ELEV. 10.560 ✓
ELEV. 35.34 FT
TIE IN. ✓

Comments: BASELINE IS P.K. NAILS SET @ OUTSIDE EDGE OF SHOULDER STRIPE; PK. & CONC. NAILS SET @ 3.80 M LT. FOR O/S ±
INST @ 0 + 25 MIDDLE OF SHOULDER
I DIDN'T USE MONUMENT AS B.M. BECAUSE IT DIDN'T APPEAR PERMANENT (TO SHALLOW)

Test Section No. 483739
Start Time 8:10 AM
Recorded By J.P.; R.Z.

Date 12/07/93
Finish Time
Device Used LASER PLANE LEVEL

[1] OWP and ML readings to be taken at FWD test locations

10/29/93

APPENDIX E

Photographs

Appendix E contains the following photographs:

Photo E-1. General Photo of Test Section

Photo E-2. Location of Instrumentation Area

Photo E-3. Preparing for Instrumentation Installation

Photo E-4. Preparing Weather Station for Installation

Photo E-5. Patched Instrumentation Area

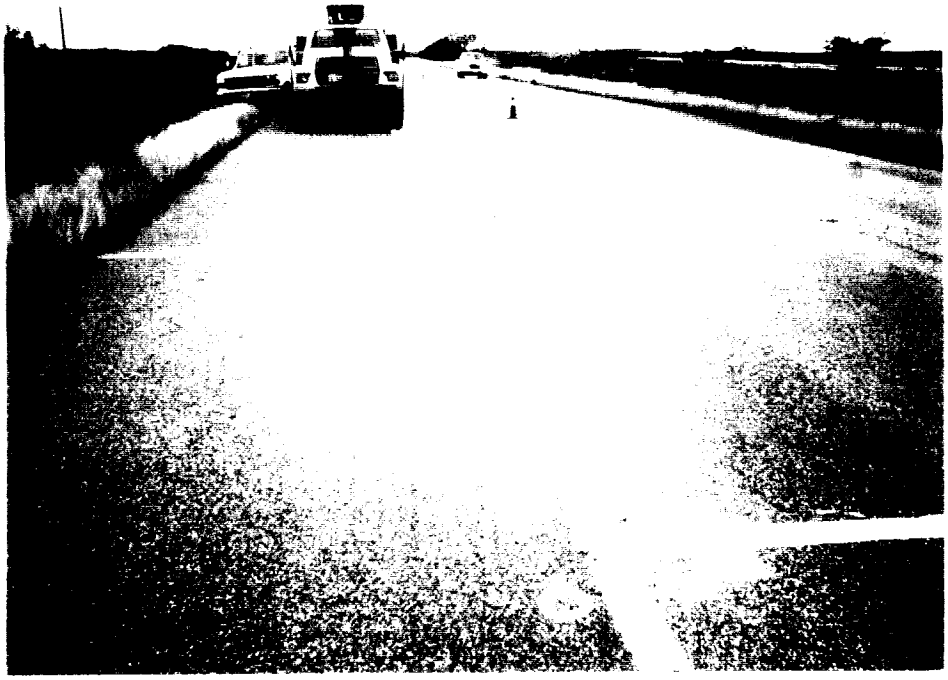


Photo E-1. General Photo of Test Section

Photo E-2. Location of Instrumentation Area

Photo E-3. Preparing for Instrumentation Installation

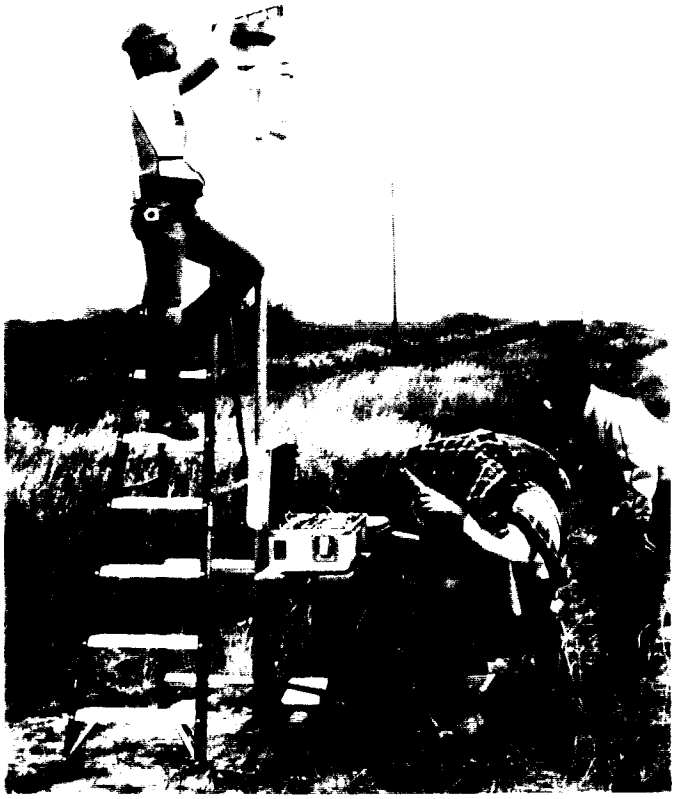


Photo E-4. Preparing Weather Station for Installation

Photo E-5. Patched Instrumentation Area