LTPP Seasonal Monitoring Program

Site Installation and Initial Data Collection
Section 010101, Opelika, Alabama

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 010101, which is a part of the LTPP Core Seasonal Monitoring Program. This asphalt concrete surfaced pavement test section, which is located on US-280 in the westbound lanes, approximately 2.90 km west of CR-183, was instrumented on 24-26 July 1995. The instrumentation installed included time domain reflectometry probes for moisture content, thermistor probe for temperature, tipping-bucket rain gauge, a piezometer observation well to monitor the ground water table, and an on-site data logger. Initial data collection was performed on 26 July 1995, which consisted of deflection measurements with a Falling Weight Deflectometer (FWD), elevation measurements and temperature 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.

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Table of Contents

List of Tables

SEASONAL INSTRUMENTATION STUDY
INSTRUMENTATION INSTALLATION
ALABAMA SECTION 010101/01SA

I. Introduction

The seasonal instrumentation installation of Section 010101 was performed on 24-26 July 1995.

The SPS-1 test section resides in Seasonal Cell 10 and is located in a wet-no freeze zone. The site (see Figure A-1) is in the westbound lanes on US-280, approximately 2.90 km west of CR-183.

The average maximum daily temperature for the months of June through August is 33°C and the average minimum daily temperature for the months of December through February is 2.1°C. The average annual precipitation is 1265 mm.

The pavement is a flexible structure consisting of approximately 177.8 mm of asphalt concrete over 203.2 mm of crushed stone base. The subgrade is classified as a silty clay. The typical soil profile under the pavement is illustrated in Figure A-2. This information was obtained from bore holes drilled during the SPS material sampling and testing.

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

Material	Layer Thickness (mm)
Asphalt Concrete	178
Base	203
Subgrade	---

Installation of the instrumentation was completed through the cooperative efforts of the Alabama Department of Transportation (Alabama DOT), and Southern Region Coordination Office (SRCO) staff from Brent Rauhut Engineering Inc. (BRE), with guidance and training previously provided by the Federal Highway Administration Long Term Pavement Performance office (FHWA-LTPP) and its Technical Assistance Contractor (TAC). The following is a list of the personnel who participated in the installation:

Larry Peirce	SRCO, BRE	Lynne Wolfe	Alabama DOT
Jon Peacock	SRCO, BRE	Bobby Lusk	Alabama DOT
Steve Davis	SRCO, BRE	Henry DeLong	Alabama DOT
Robin Belt	SRCO, BRE	James McCleod	Alabama DOT
Hunter Estes	SRCO, BRE	Mike Williams	Alabama DOT

II. Instrumentation Installation

Pre-Installation Activities

A pre-installation meeting was held at the Alabama DOT office of Materials and Research on 22 May 1995. The meeting agenda appears in Appendix B. The participants at the meeting were Larry Lockett, Lynne Wolfe, James McCleod and Larry Peirce. 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, Grand Rapids, Minnesota and various Texas installations.

A site inspection and a manual distress survey were performed on 26 July 1995 by Jon Peacock and Hunter Estes (SRCO). Deflection testing was conducted on 24 July 1995. The 5+10 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, a piezometer observation well was set to measure the depth to the water table. A list of the equipment installed, with the respective serial numbers, is in Table 2.

Table 2. Equipment Installed

Equipment	Quantity	Serial Number
Instrument Hole		
MRC Thermistor Probe	1	244 (01AT)
TDR Sensors	10	01A01-01A10
Equipment Cabinet		
CR10 Data Logger	1	16527
Battery Package	1	Gel Cell
Weather Station		
Tipping-Bucket Rain Gauge	1	12078-693
Air Temperature Probe	1	421316
Piezometer Observation Well	1	N/A

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. The TDR probes were also calibrated using an "in-air" test and "in-water" test for accuracy, the results of which can be found in Appendix B.

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

Table 3. Sensor Spacing in MRC Thermistor Probe

Unit	Channel Nº.	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	20	This unit was installed in the base and subgrade.
	5	95	
	6	169	
	7	246	
	8	324	
	9	474	
	10	625	
	11	779	
	12	931	
	13	1082	
	14	1237	
	15	1387	
	16	1540	
	17	1693	
	18	1840	

Location of Instrumentation

The instrumentation was installed at Station 5+10 of the test section. Approximately 800 mm from the lane edge, in the outside wheel path, a 305 mm core was removed from the pavement and a 254 mm diameter hole, 2.08 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 7.77 m from the lane edge.

The piezometer observation well was installed at Station 3+97 of the test section approximately 5.9 m from the lane edge. The piezometer observation well also serves as the swell-free benchmark for this project.

Installation

Installation of the monitoring equipment was begun on 24 July 1995 and was completed the following day. The Alabama DOT provided all coring, drilling and sawing equipment and manpower for the instrumentation activities. The monitoring equipment and cabinet installation was performed by the SRCO staff. Traffic control was also provided by the Alabama DOT.

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. Both the field moisture contents and the field printed traces appear in Appendix C. Table 5 shows the distance from the top of the pavement to each of the individual thermistor sensors.

In addition, a single field density (one-point Proctor) test was performed on material taken at a depth of 1.24 m. The results from this test appear in Appendix C.

When backfilling of the instrumentation hole was completed, the pavement core was repaired and replaced using PC-7 epoxy and Dow 890 crack sealant. The overcuts from the pavement sawing operation (including the groove for the temperature probe) were also sealed with Dow-Corning 890 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 №.	Sensor Depth (mm)	TDR Moisture Content (%, by wt)	Measured Moisture Content (%, by wt)
01A01	285	6.1	7.4
01A02	430	6.4	17.3
01A03	580	7.8	19.0
01A04	735	7.8	14.4
01A05	875	8.2	23.8
01A06	1045	6.4	25.0
01A07	1195	6.8	28.8
01A08	1340	6.1	20.1
01A09	1640	6.1	21.1
01A10	1960	6.1	17.6

Table 5. Thermistor Sensor Locations

Unit	Channel №.	Depth from Pavement Surface (mm)	Remarks
1	1	25	This unit was installed in the AC layer.
	2	91	
	3	155	
2	4	252	This unit was installed in the base and subgrade.
	5	327	
	6	401	
	7	478	
	8	556	
	9	706	
	10	857	
	11	1011	
	12	1163	
	13	1314	
	14	1469	
	15	1619	
	16	1772	
	17	1925	
	18	2072	

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 26 July 1995. 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 were 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 were 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. It should be noted that initial TDR readings yielded very low moisture contents, but have since stabilized.

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 010101 (01SA) was completed on 24 July 1995 and initial data collection was completed on 26 July 1995. 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; a piezometer observation well to monitor ground water table movements and serve as a permanent swell and frost-free benchmark; and an on-site data logger and battery pack. Photos from the installation day appear in Appendix E.

At the time of this report, all of the equipment installed on-site appears to be functioning properly. 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-5.	Plots from FWDCHECK
Figure A-6.	Manual Distress Survey Data

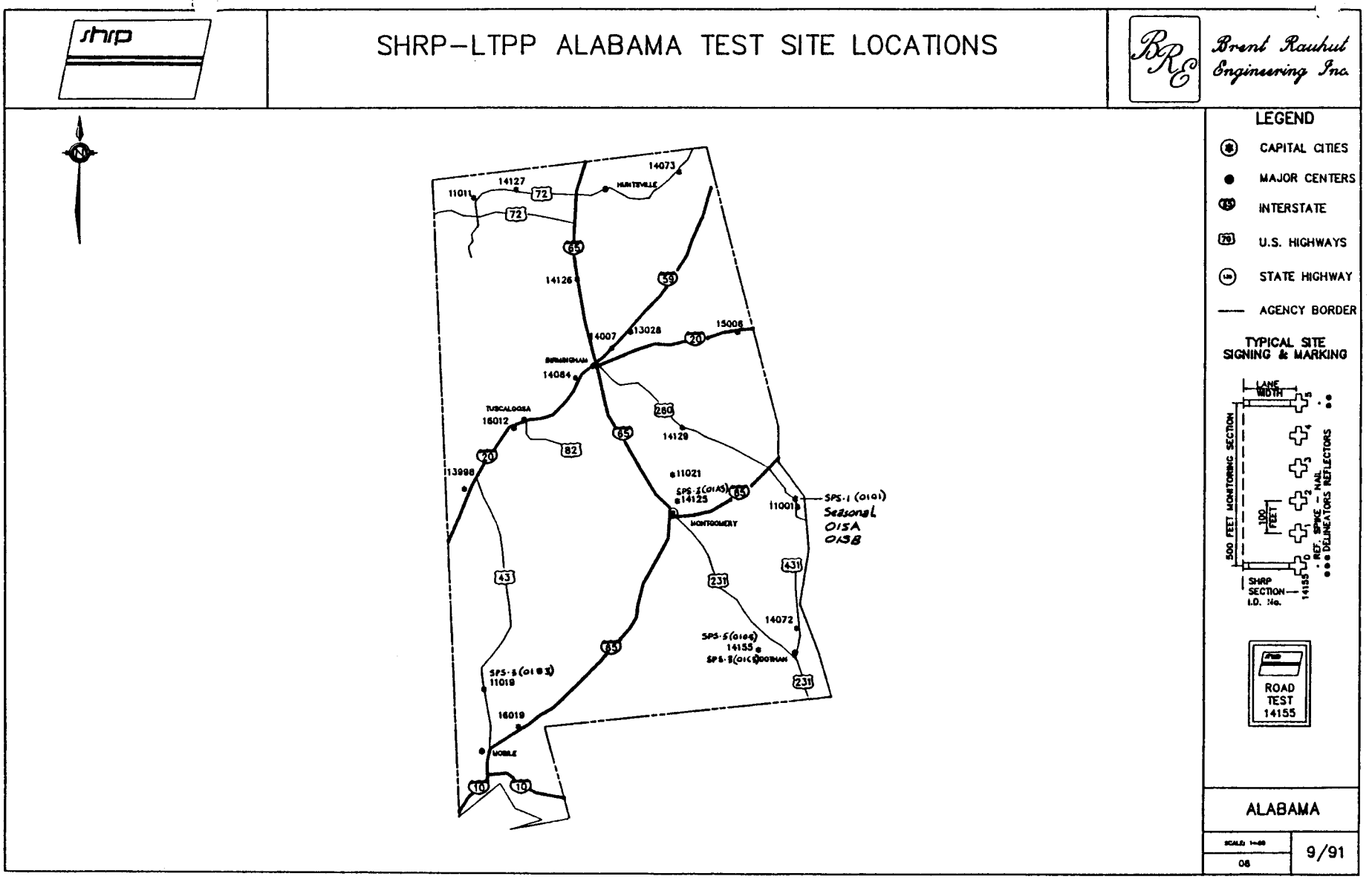


Figure A-1. Location of Test Site, GPS Test Section 010101

LTPP Seasonal Monitoring Program Data Sheet SMP-I04 Log of Instrumentation Hole	Agency Code 01SA [01] LTPP Section ID [0101]

Operator: _____ Equipment Used: CME

Location: Station: 5+10 Offset: +0.80 m (from lane edge)

Bore Hole Diameter: 228 . mm

Scale (m)	Strata Change[1] (m)	Material Description	Material Code[2]
0.10	0.181	AC	
0.20			
0.30	0.382	CRUSHED STONE	23
0.40			
0.50		TAN MICACEOUS SILTY CLAY Schisty	53
0.60			
0.70			
0.80			
0.90			
1.00			
1.10			
1.20			
1.30			
1.40			
1.50			
1.60			
1.70			
1.80			
1.90			
2.00	2.08	TD.	
2.10			
2.20			
2.30			
2.40			
2.50			

[1] Format: _._____ m; [2] Format: ___

Prepared by: S. DAVIS Employer: BRE

Date (dd/mm/yy): 24/07/95

Data Sheet SMP-I04: Log of Instrumentation Hole

Figure A-2. Profile of Test Section Layers

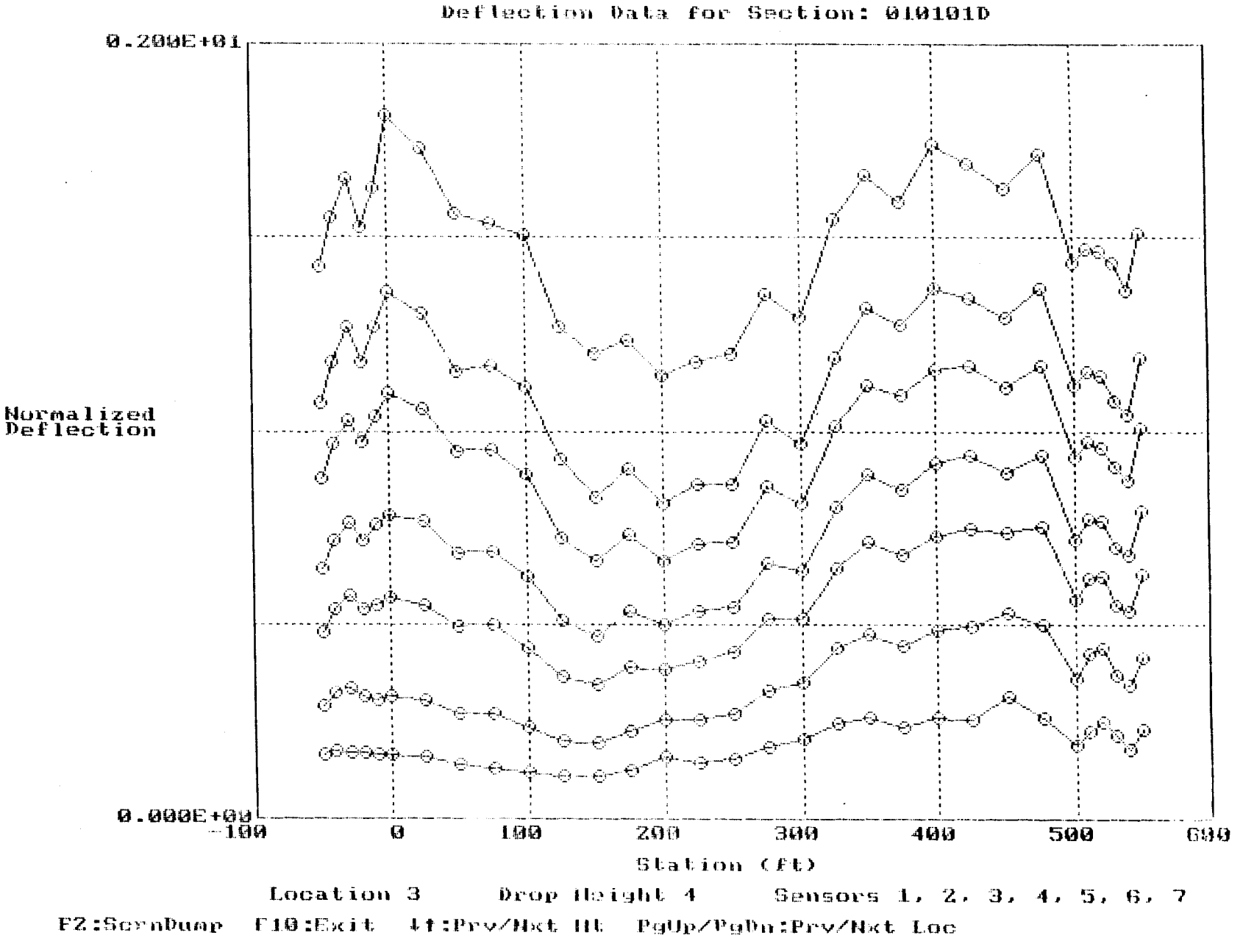


Figure A-3. Deflection Profiles from FWDCHECK

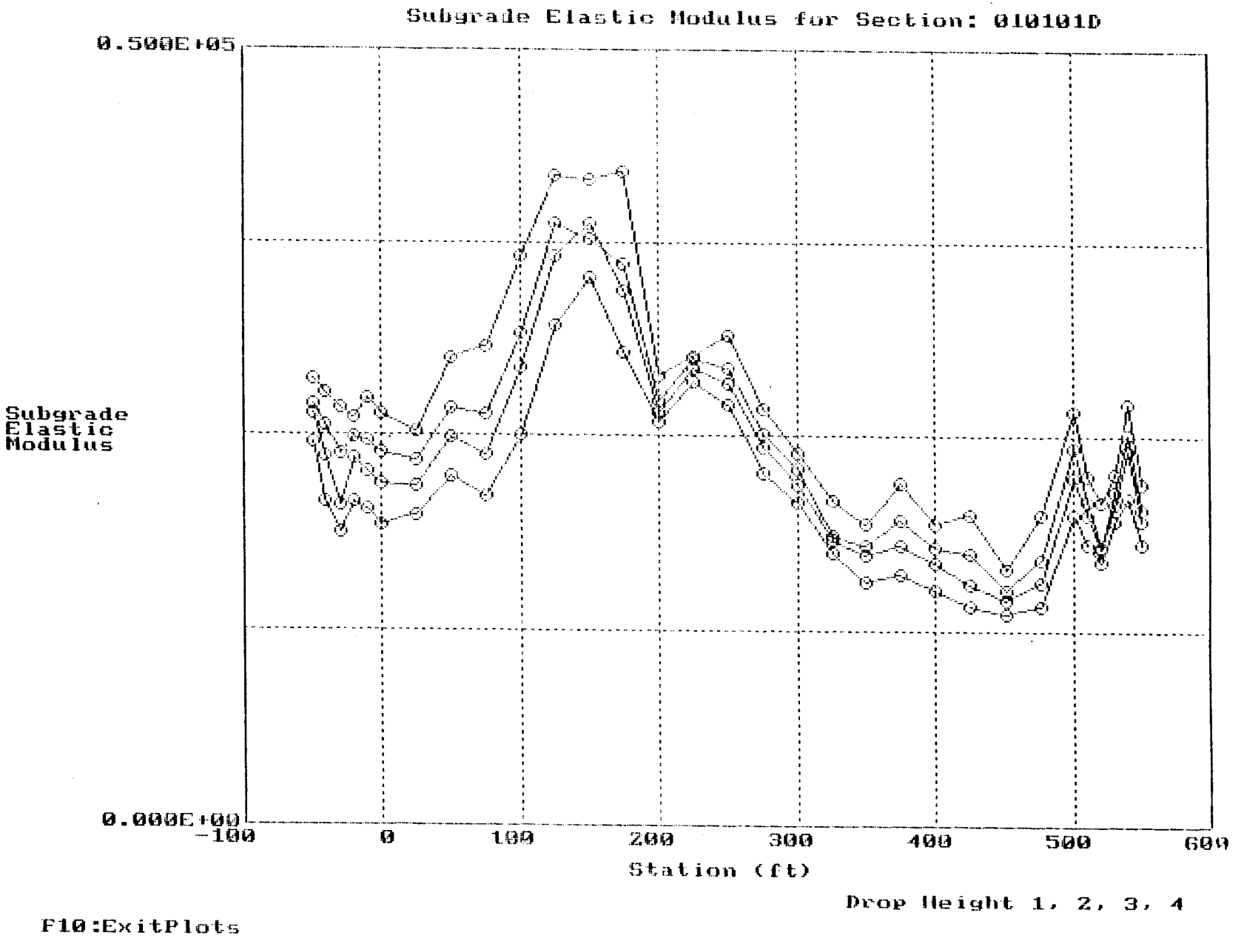


Figure A-4. Structural Number Profiles from FWDCHECK

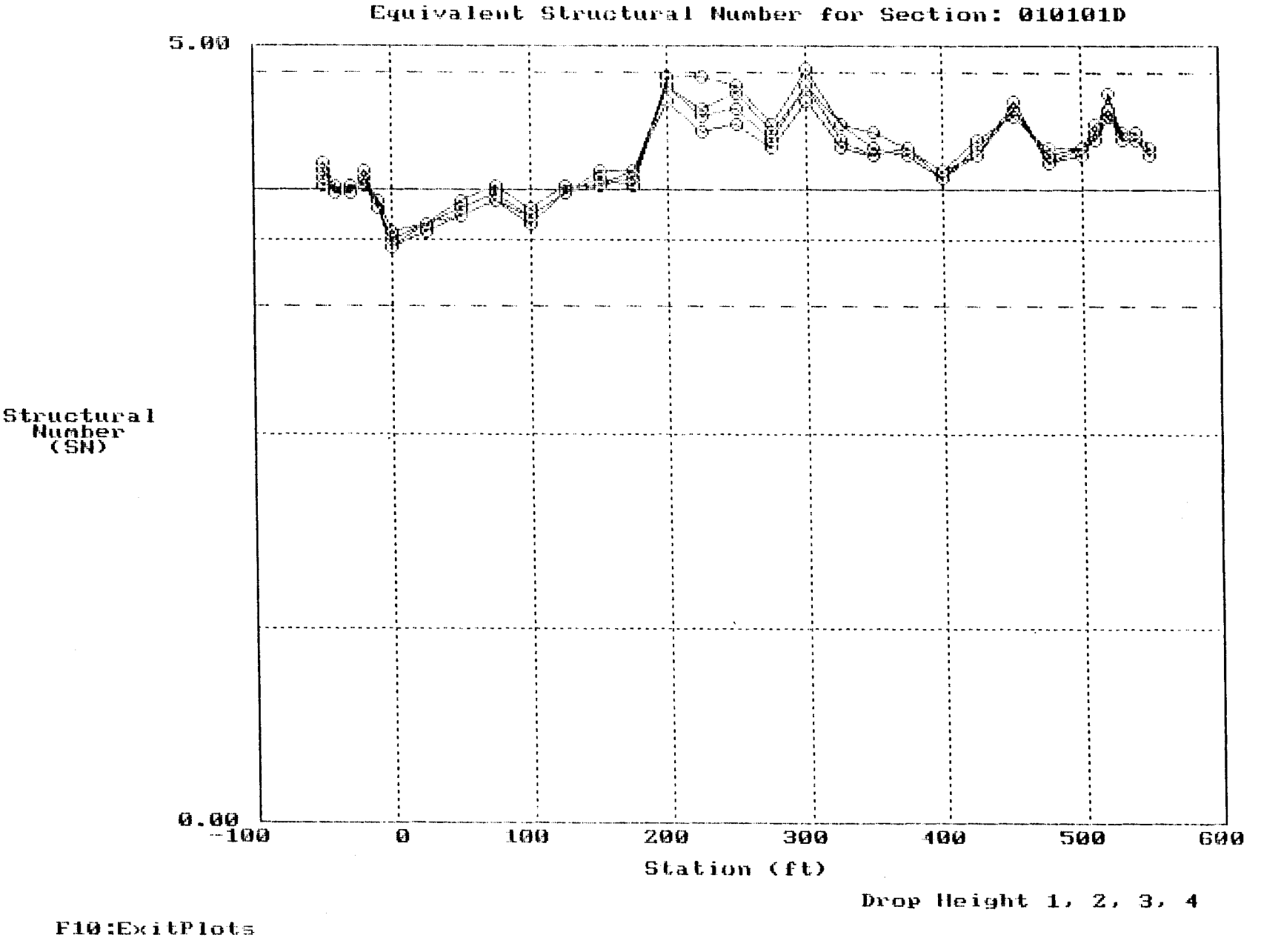


Figure A-5. Subgrade Modulus Profiles from FWDCHECK

OISA

Revised December 1, 1992

SHEET 1

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID ____

STATE CODE 01

SHRP SECTION ID 0101

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 07/26/95

SURVEYORS: AP, WE PHOTOS, VIDEO, OR BOTH WITH SURVEY (P, V, B) ~
PAVEMENT SURFACE TEMP - BEFORE ~__°C; AFTER ~___°C

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
CRACKING			
1. FATIGUE CRACKING (Square Meters)	0	0	0
2. BLOCK CRACKING (Square Meters)	0	0	0
3. EDGE CRACKING (Meters)	0	0	0
4. LONGITUDINAL CRACKING (Meters)			
4a. Wheel Path	0	0	0
Length Sealed (Meters)	0	0	0
4b. Non-Wheel Path	0	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

Revised December 1, 1992

SHEET 2

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID ____

STATE CODE 01

SHRP SECTION ID 0101

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 07/26/95

SURVEYORS: AP, HE

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 S1 from Dipstick Manual			
10. SHOVING (Number) (Square Meters)			2 / 0.2
SURFACE DEFECTS			
11. BLEEDING (Square Meters)	0.0	0.0	2.0
12. POLISHED AGGREGATE (Square Meters)			0.0
13. RAVELING (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

Revised May 29, 1992

SHEET 3

STATE ASSIGNED ID _ _ _ _

DISTRESS SURVEY

STATE CODE 0 1

LTPP PROGRAM

SHRP SECTION ID 0 1 0 1

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 0 7/2 6/9 5

SURVEYORS: J A P. _ _ _

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES
(CONTINUED)

9. RUTTING (FOR SPS-3 SITE SURVEYS) NOT TAKEN

INNER WHEEL PATH			OUTER WHEEL PATH		
Point No.	Point Distance[1] (Meters)	Rut Depth (mm)	Point No.	Point Distance[1] (Meters)	Rut Depth (mm)
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)
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	152.5	_ _ _.

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 ft spacing used in previous surveys.

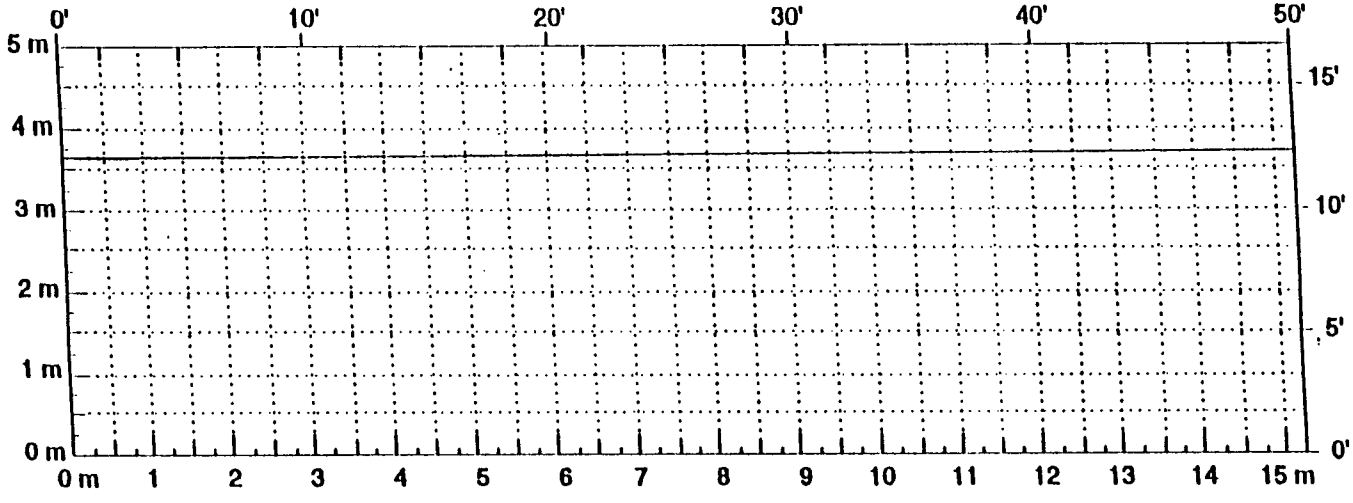
Figure A-9 (Continued). Distress Survey Data

NH, NE
26, July, 1995

State Assigned ID _____ 01A

State Code 01

SHRP Section ID 0101



Comments: 3.4 M LANE No Distress Noted

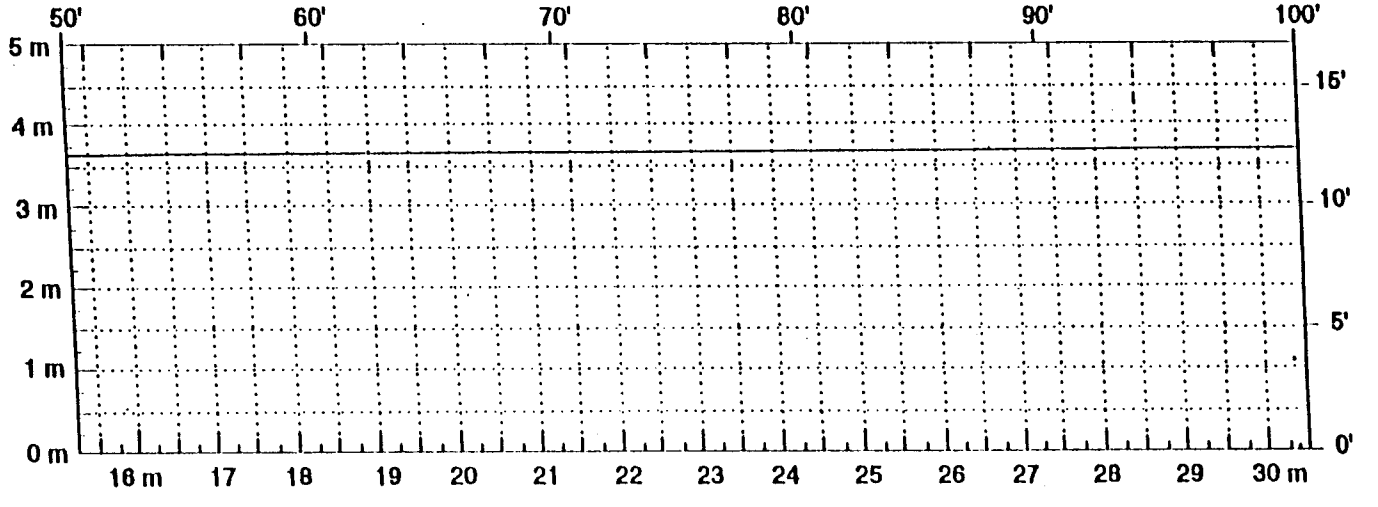


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Figure A-9 (Continued). Distress Survey Data

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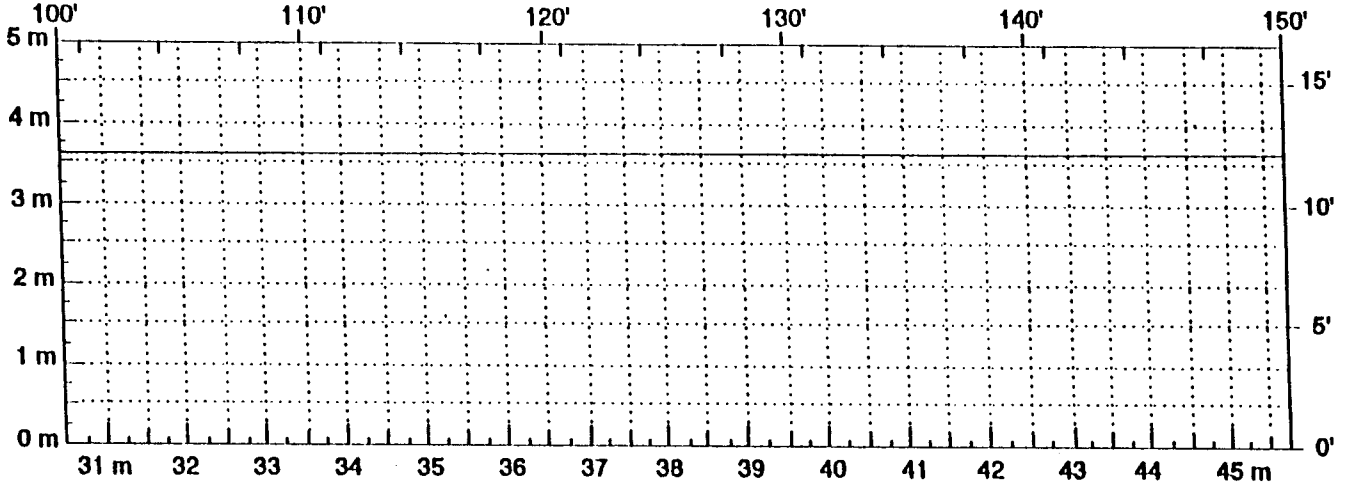
State Code 01

SHRP Section ID 0101



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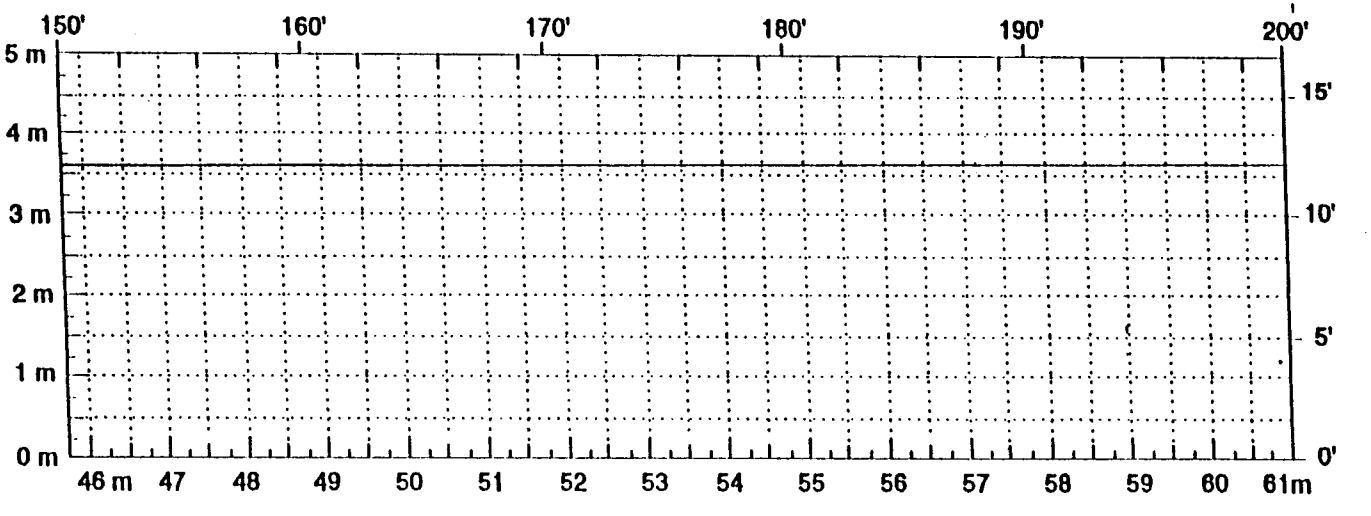

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Figure A-9 (Continued). Distress Survey Data

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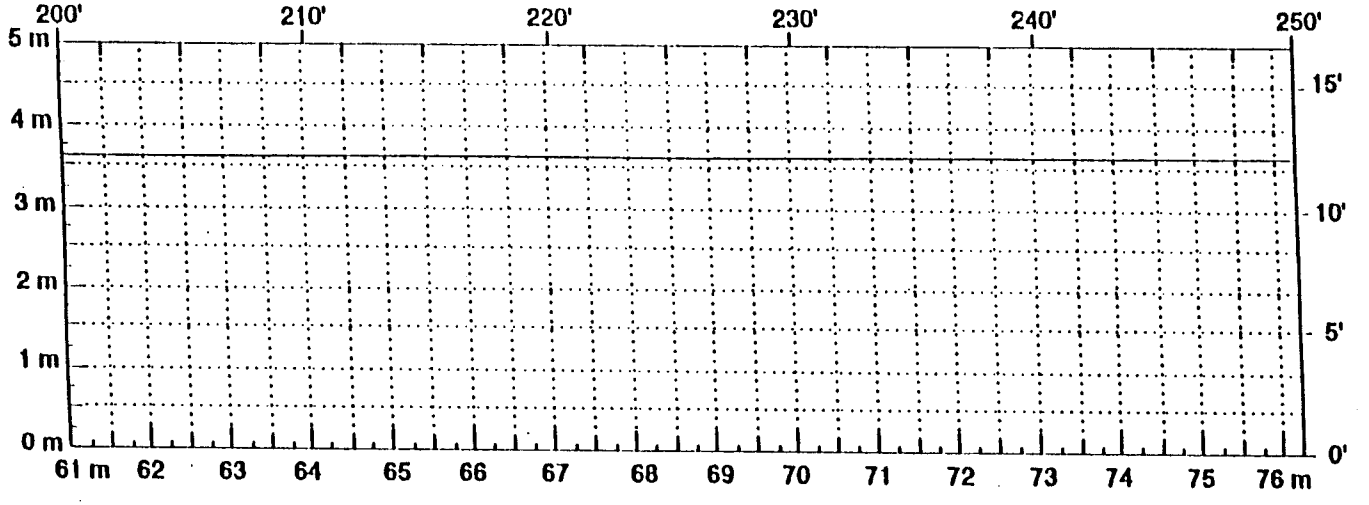
State Code 01

SHRP Section ID 0101



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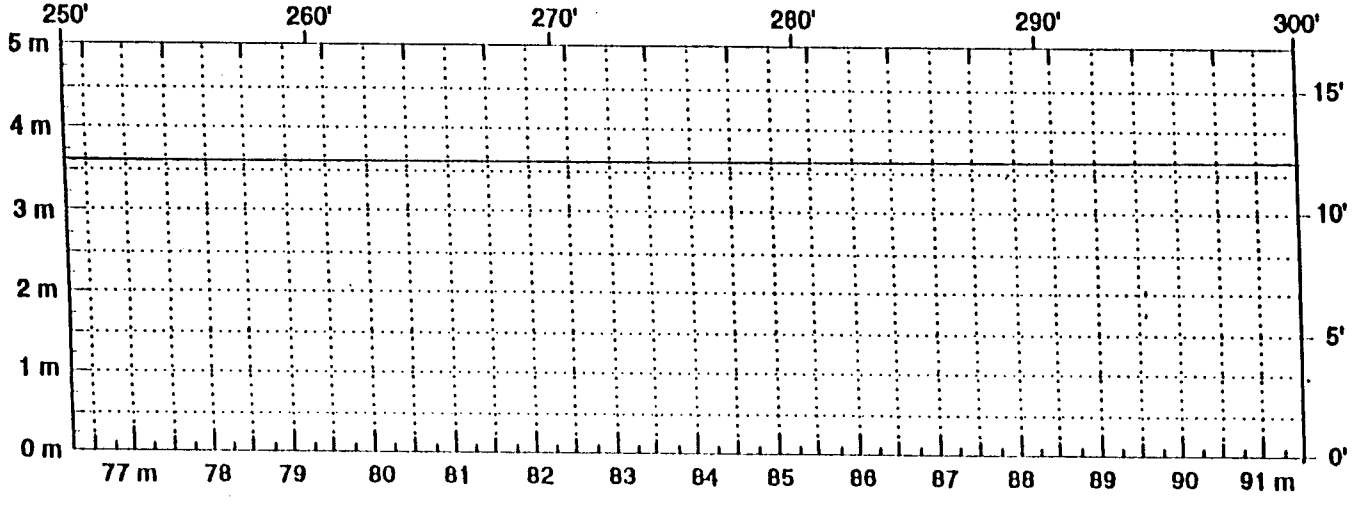

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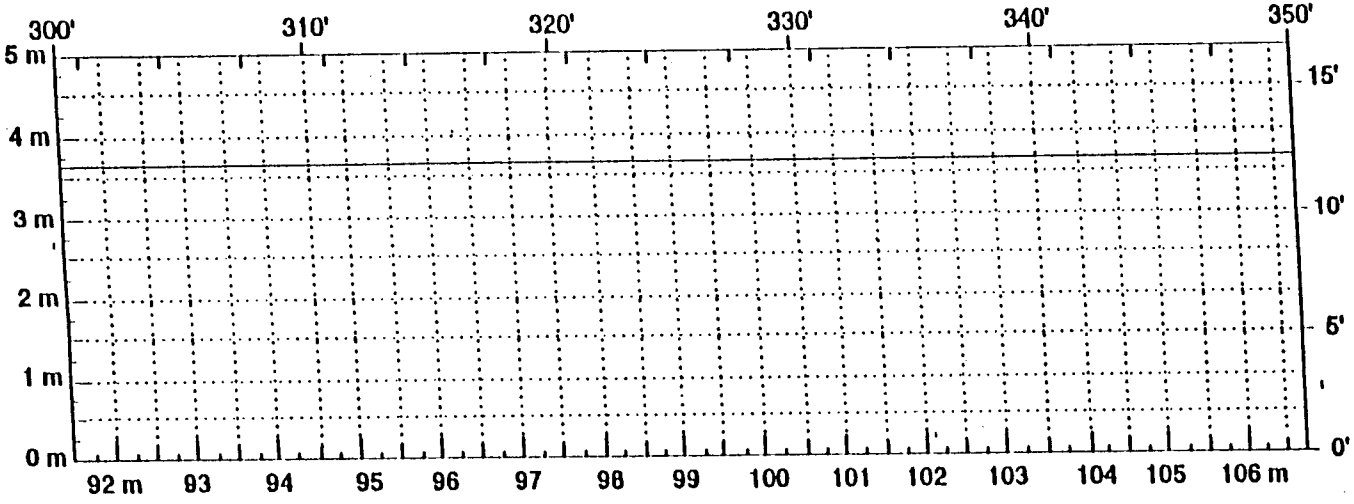
Figure A-9 (Continued). Distress Survey Data

State Assigned ID _____

State Code 01

SHRP Section ID 0101



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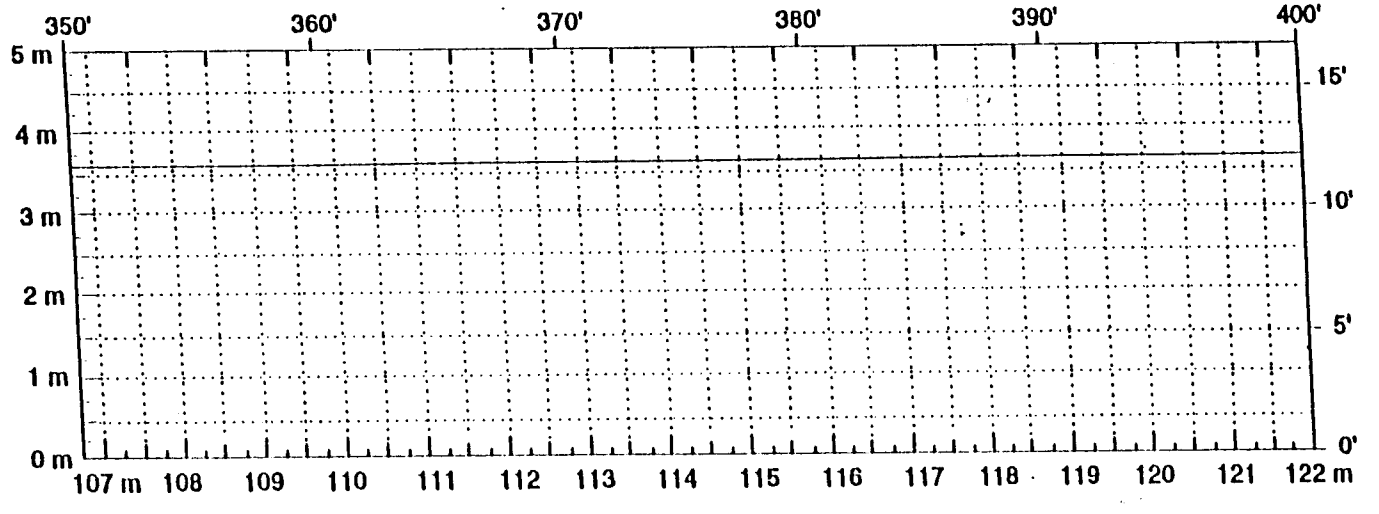


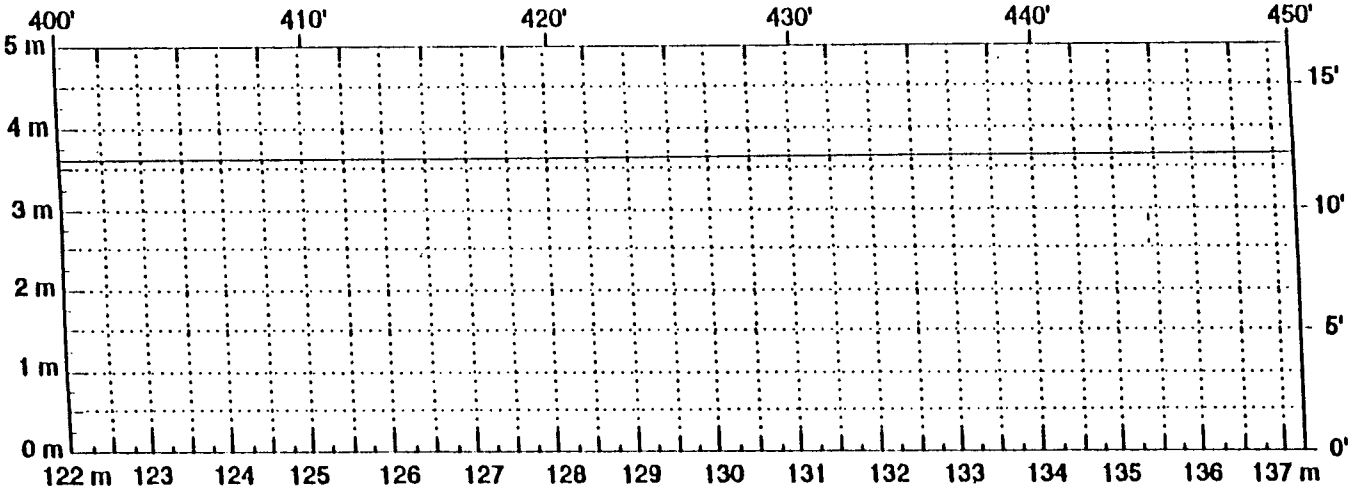
Comments:

Figure A-9 (Continued). Distress Survey Data

State Assigned ID _____

State Code 01

SHRP Section ID 0101



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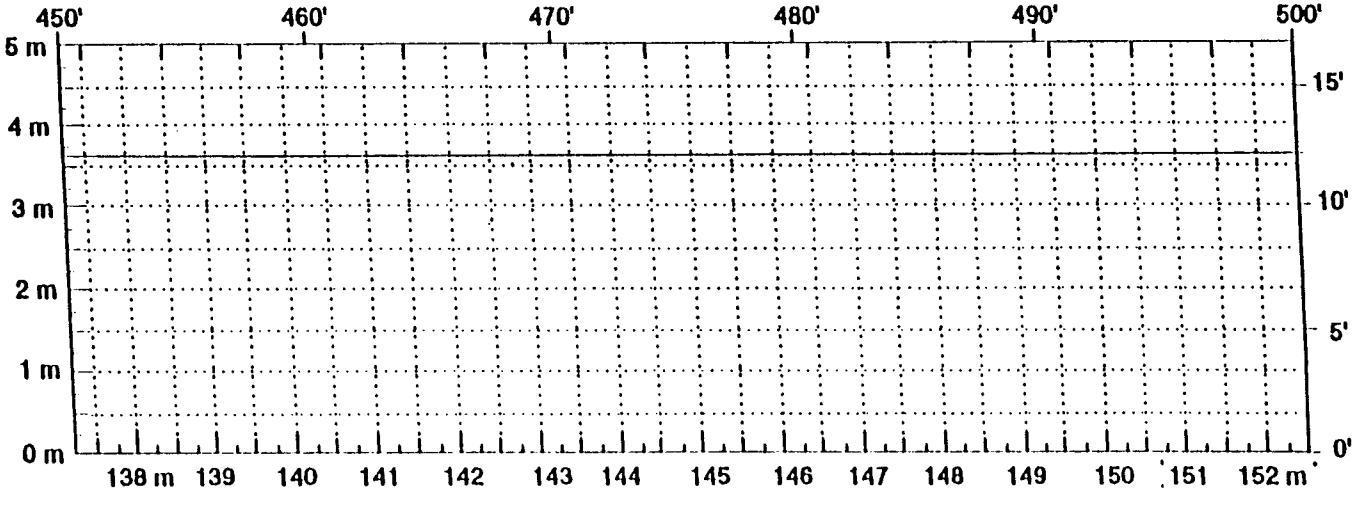


Comments: _____

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

22 May 1995

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

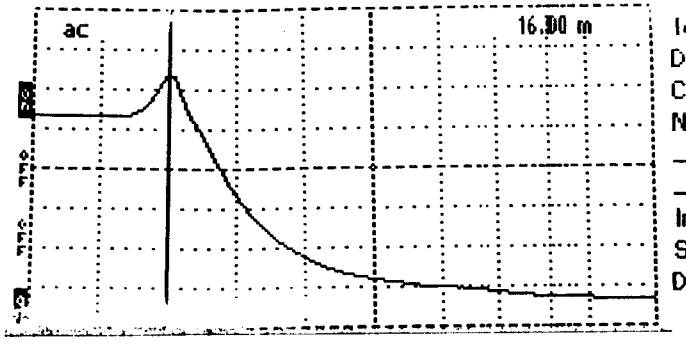
VI. Questions/Discussion

ALABAMA SEASONAL SITE INFORMATION

Type	SHRP ID	Hwy №.	Location of Test Section
AC over Granular Base	010101	US-280, Lee Co. Westbound	2.90 km W. of CR-183.
AC over Granular Base	010102	US-280, Lee Co. Westbound	4.51 km W. of CR-183.

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [01] LTPP Section ID [5A__]

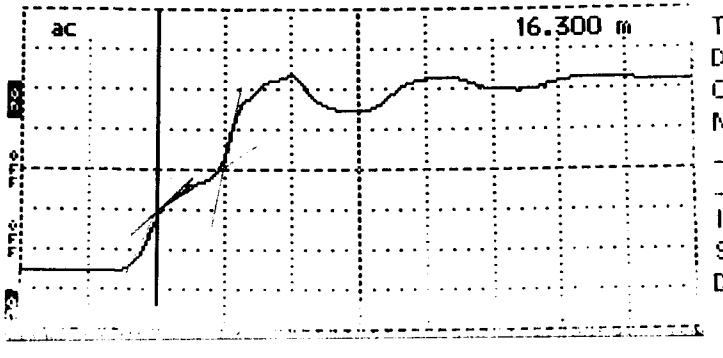
Cursor ..... 16.300 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 07/25/95
Cable 01A 1
Notes Shorted
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.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 07/25/95
Cable 01A01
Notes AIR
CN'
Input Trace
Stored Trace
Difference Trace

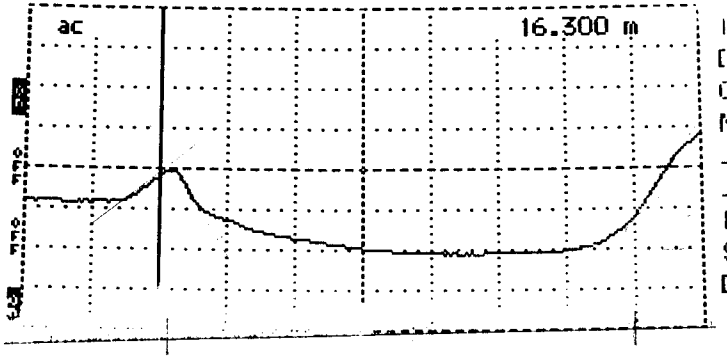
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.25	1.54

Figure B-1. TDR Traces Obtained During Calibration

Data Sheet SMP-C01: TDR Probe Check

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [01] LTPP Section ID [SA]

Cursor ..... 16.300 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mV/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



[illegible] 2B TDR
Date 07/05/95
Cable 01A01
Notes WATER
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.75	75.81

[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 Serial Number: 01A01 TDR Probe Length, L: 0.203 m Length of Coax Cable: ___.__ m

Comments: _____

Prepared by: Josh Pocock Employer: BRE

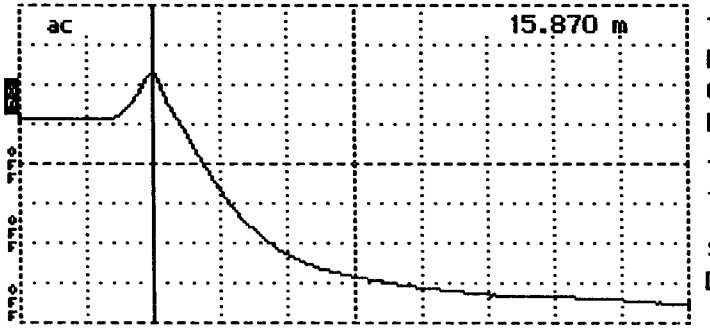
Date (dd/mmm/yy): 05/JUL/95

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 [01] LTPP Section ID [SA__]

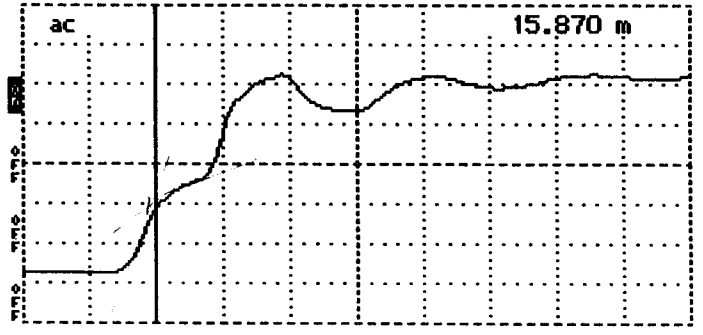
Cursor ..... 15.870 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A02
Notes shorted @ 0
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.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A02
Notes IN AIR @ 0
Input Trace
Stored Trace
Difference Trace

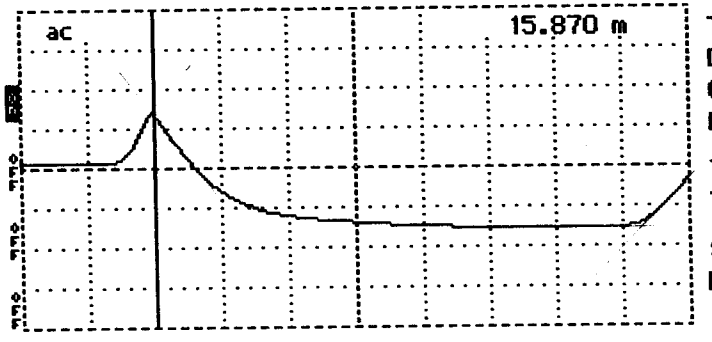
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP-C01: 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 [01] LTPP Section ID [SA__]

Cursor ..... 15.870 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A02
Notes IN WATER X0.

Input Trace _____
Stored Trace .....
Difference Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.80	80.28

[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 Serial Number: 01A02 TDR Probe Length, L: 0.203 m Length of Coax Cable: __.__ m

Comments: _____

Prepared by: Steve Davis Employer: BKE

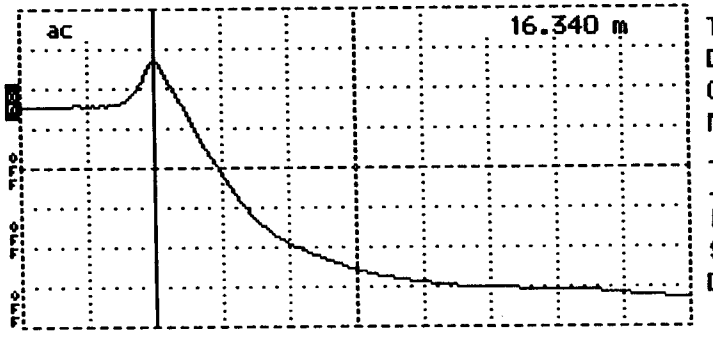
Date (dd/mmm/yy): 12/JUL/95

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 [01] LTPP Section ID [SA__]

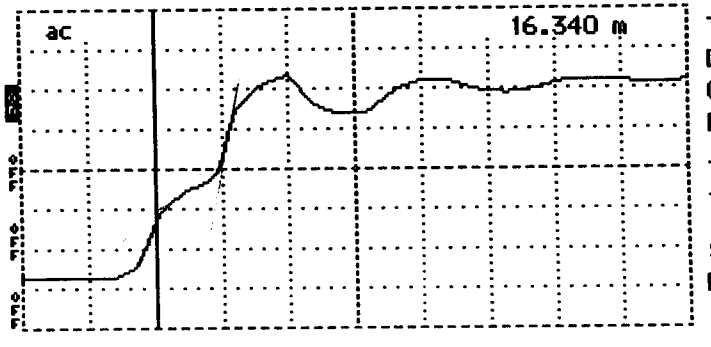
Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A03
Notes Shorted at D.
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A03
Notes IN AIR at D.
Input Trace
Stored Trace
Difference Trace

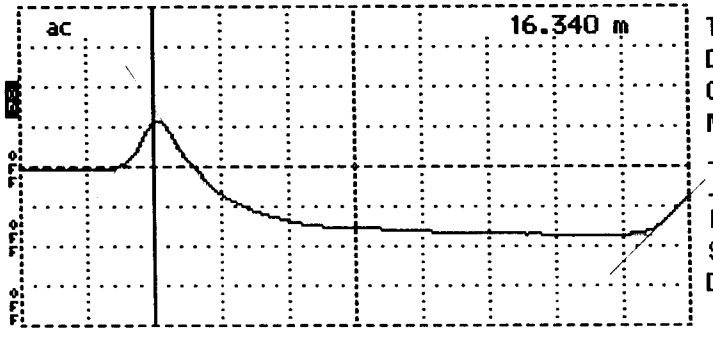
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.25	1.55

Data Sheet SMP-C01: 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 [01] LTPP Section ID [SA__]

Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A03
Notes IN WATER 10

Input Trace _____
Stored Trace .....
Difference Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.84	83.88

[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 Serial Number: 01A03 TDR Probe Length, L: 0.203 m Length of Coax Cable: __.__ m

Comments: _____

Prepared by: Steve Davis Employer: BRE

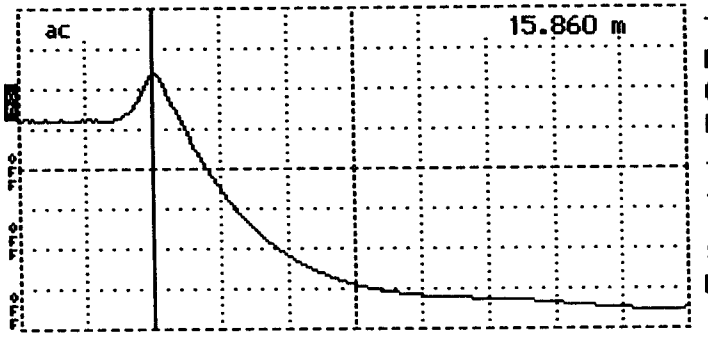
Date (dd/mmm/yy): 12/JUL/95

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 [01] LTPP Section ID [SA__]

Cursor ..... 15.860 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

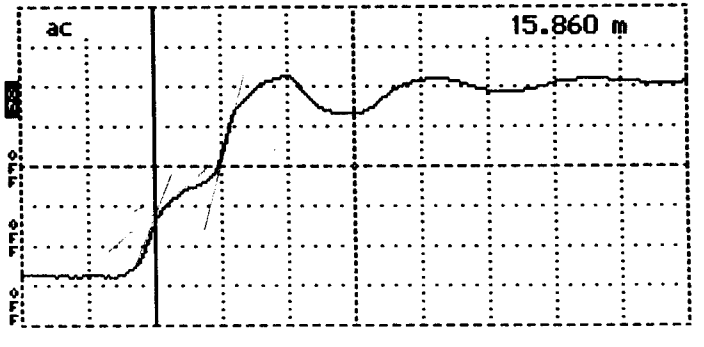


Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A04
Notes shorted X.0

Input Trace _____
Stored Trace .....
Difference Trace .....

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

Cursor ..... 15.860 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A04
Notes IN AIR X.0

Input Trace _____
Stored Trace .....
Difference Trace .....

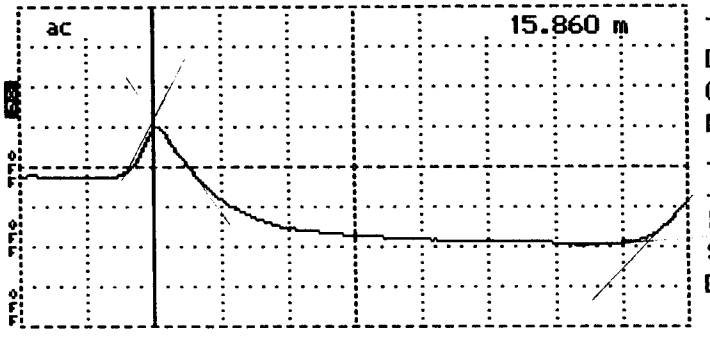
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP-C01: 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 [01] LTPP Section ID [SA__]

Cursor ..... 15.860 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A04
Notes IN WATER X10.

Input Trace _____
Stored Trace .....
Difference Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.84	83.88

[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 Serial Number: 01A04 TDR Probe Length, L: 0.203 m Length of Coax Cable: ___.__ m

Comments: _____

Prepared by: Steve Davies Employer: BRE

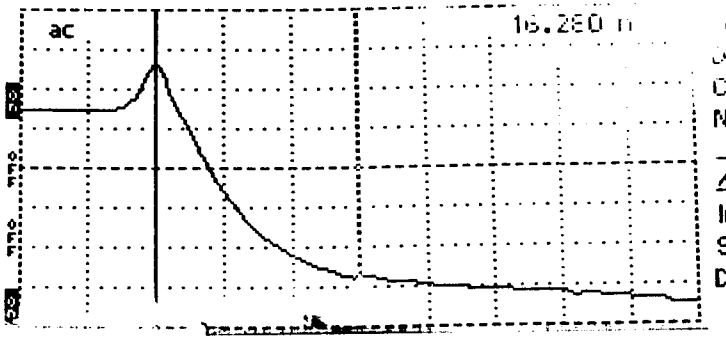
Date (dd/mmm/yy): 12/JUL/95

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 [01] LTPP Section ID [5A__]

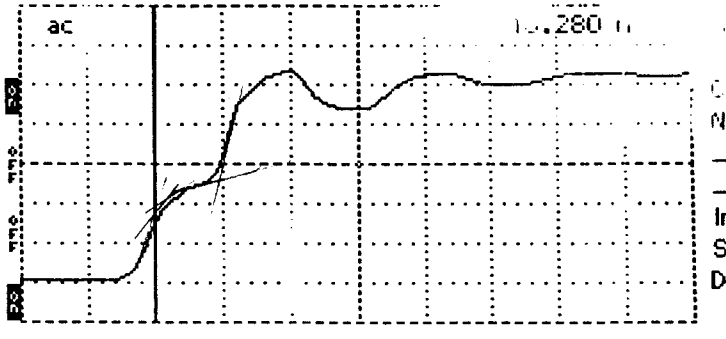
Cursor ..... 16.280 m
Distance/Div..... .25 m/div
Vertical Scale.... 163 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Date 07-05-95
Cable 01A 05
Notes Shorted at S.D.
Printer compaction

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

Cursor ..... 16.280 m
Distance/Div..... .25 m/div
Vertical Scale.... 163 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Date 07-05-95
Cable 01A 05
Notes IN AIR A.D.

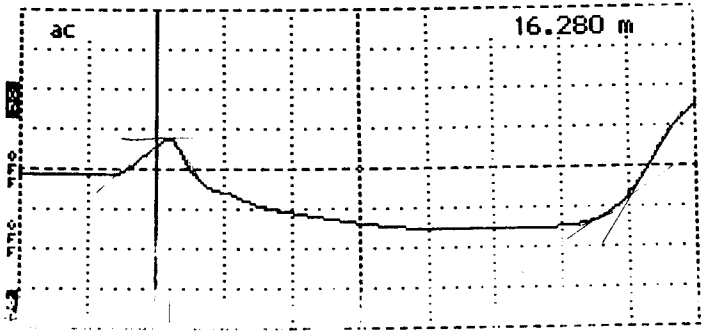
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.25	1.49

Data Sheet SMP-C01: 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 [01] LTPP Section ID [SA__]

Cursor ..... 16.280 m
Distance/Div..... .25 m/div
Vertical Scale.... 163 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.75	75.88

[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 Serial Number: 01A05 TDR Probe Length, L: 0.203 m Length of Coax Cable: ___.__ m

Comments: _____

Prepared by: Steve Davis Employer: RRE

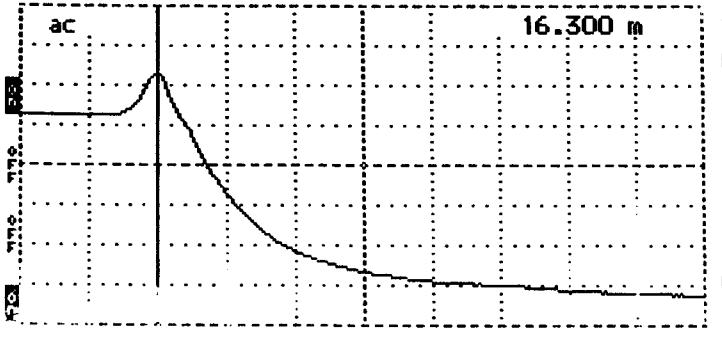
Date (dd/mmm/yy): 05/JUL/95

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 [01] LTPP Section ID [SA__]

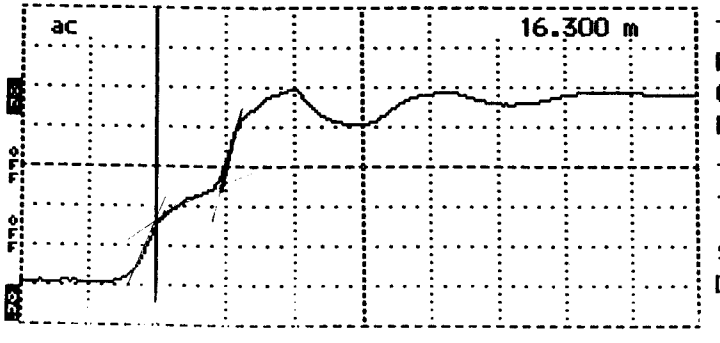
Cursor ..... 16.300 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mV/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 07/05/95
Cable 01A06
Notes SHORTED
AIR
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.... 177 mV/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



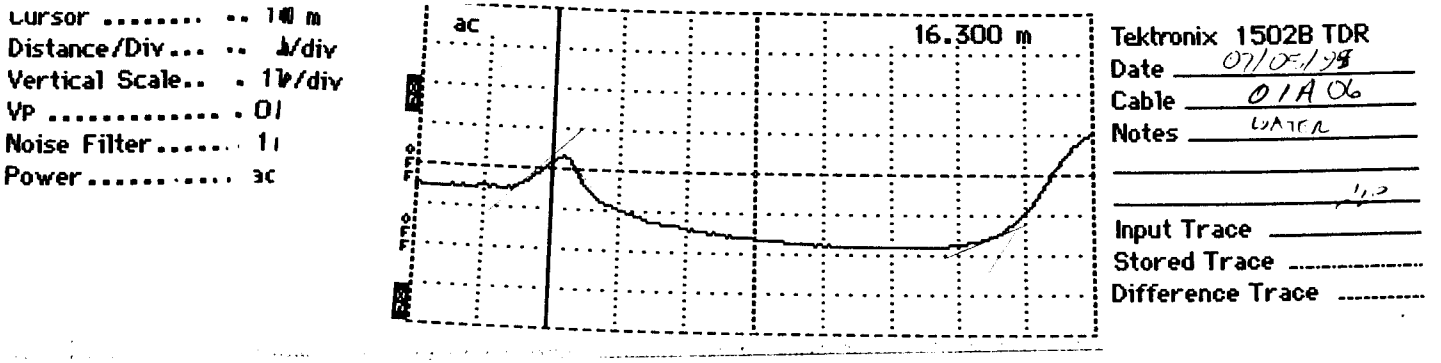
Tektronix 1502B TDR
Date 07/05/95
Cable 01A06
Notes AIR
Input Trace
Stored Trace
Difference Trace

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

Data Sheet SMP-C01: TDR Probe Check

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

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [01] LTPP Section ID [SA__]



TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.75	75.88

[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 Serial Number: 01A06 TDR Probe Length, L: 0.203 m Length of Coax Cable: ___.__ m

Comments: _____

Prepared by: Jon Peacock Employer: ERE

Date (dd/mmm/yy): 05/JUL/95

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

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

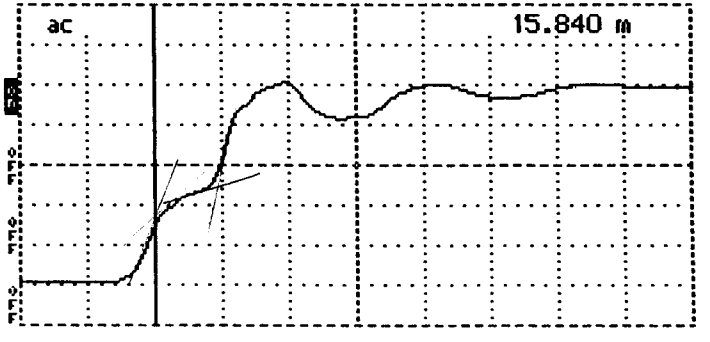
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [01] LTPP Section ID [SA__]

Cursor ..... 15.840 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

Tektronix 1502B TDR
Date 12/JULY/95
Cable 01A07
Notes shorted at S.G.
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 15.840 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JULY-95
Cable 01A07
Notes IN AIR S.G.
Input Trace
Stored Trace
Difference Trace

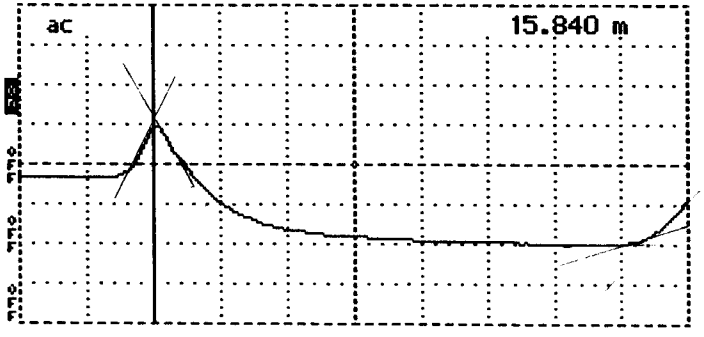
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

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

Data Sheet SMP-C01: TDR Probe Check

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [01] LTPP Section ID [SA__]

Cursor ..... 15.840 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A07
Notes IN WATER .VJ.
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.80	80.28

[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 Serial Number: 01A07 TDR Probe Length, L: 0.203 m Length of Coax Cable: __.__ m

Comments: _____

Prepared by: Steve Davis Employer: BRE

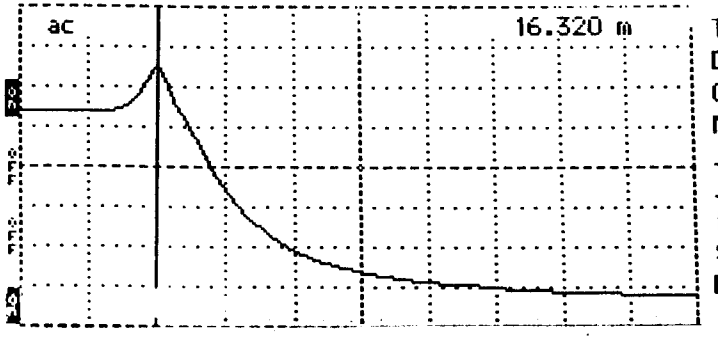
Date (dd/mmm/yy): 12/JUL/95

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 [01] LTPP Section ID [5A]]

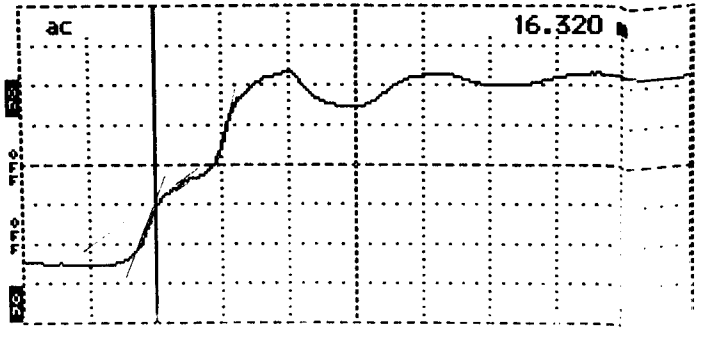
Cursor ..... 16.320 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 07/05/95
Cable 01A
Notes Shorted
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.320 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 07/05/95
Cable 01A
Notes Air
Probes Removed
HP
Input Trace
Stored Trace
Difference Trace

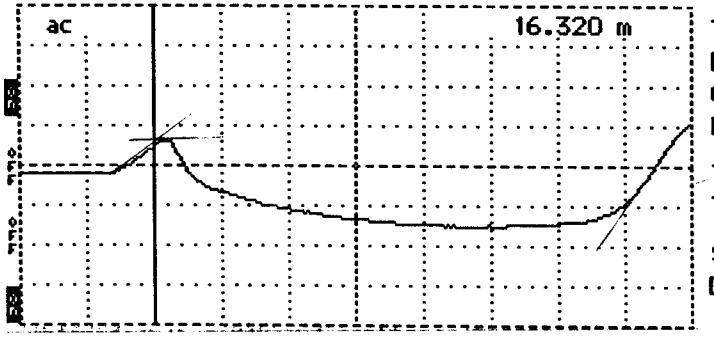
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.25	1.55

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

Data Sheet SMP-C01: TDR Probe Check

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [01] LTPP Section ID [SA__]

Cursor ..... 16.320 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 07/25/95
Cable 01A
Notes LVA16 C
JP
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.75	75.88

[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 Serial Number: 01408 TDR Probe Length, L: 0.203 m Length of Coax Cable: __.__ m

Comments: _____

Prepared by: Jon Peszek Employer: BRE

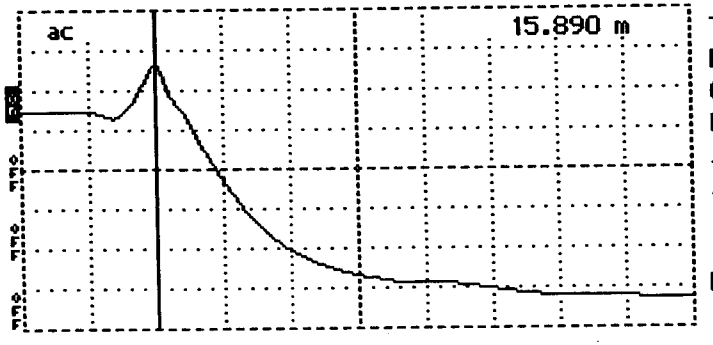
Date (dd/mmm/yy): 05/JUL/95

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 [01] LTPP Section ID [SA__]

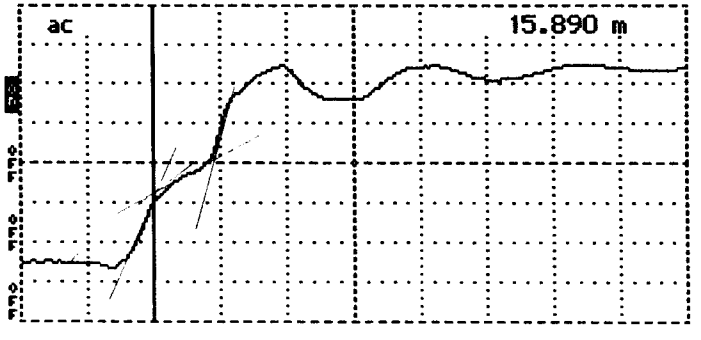
Cursor ..... 15.890 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JULY-95
Cable 01A09
Notes shorted N.D.
note suspicious form...
bent lead to block.
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 15.890 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JULY-95
Cable 01A09
Notes IN AIR N.D.
Input Trace
Stored Trace
Difference Trace

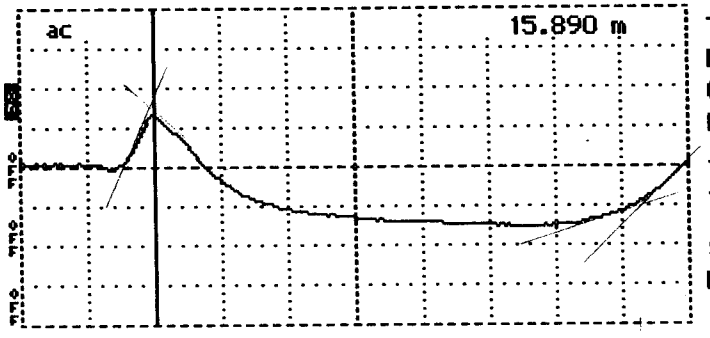
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

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

Data Sheet SMP-C01: TDR Probe Check

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [01] LTPP Section ID [SA__]

Cursor ..... 15.890 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JUL-95
Cable 01A09
Notes IN WATER
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.80	80.28

[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 Serial Number: 01A09 TDR Probe Length, L: 0.203 m Length of Coax Cable: ___.__ m

Comments: _____

Prepared by: Steve Davis Employer: BRE

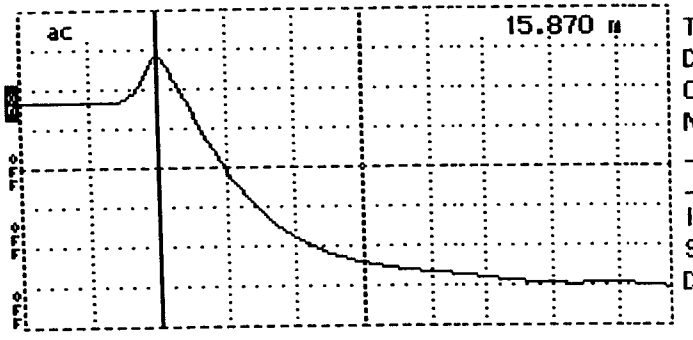
Date (dd/mmm/yy): 12/JUL/95

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 [__] LTPP Section ID [____]

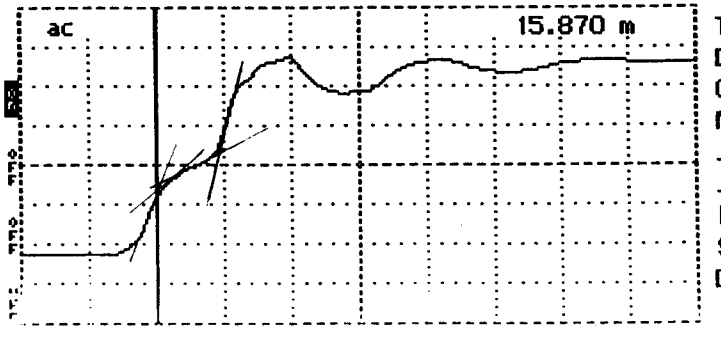
Cursor ..... 15.870 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JULY-95
Cable 01A10
Notes Shorted at 0.
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.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JULY-95
Cable 01A10
Notes IN AIR #1.
Input Trace
Stored Trace
Difference Trace

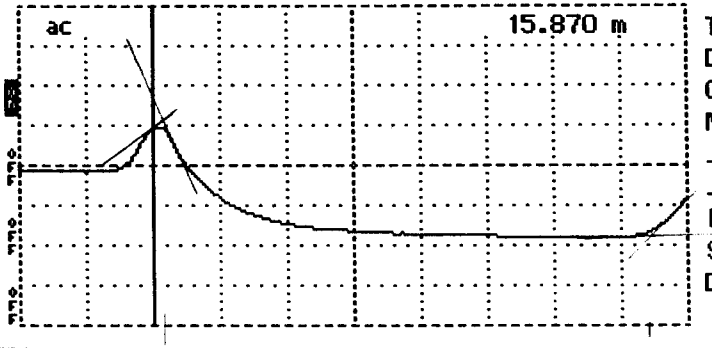
TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.24	1.43

Data Sheet SMP-C01: 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 [__] LTPP Section ID [____]

Cursor ..... 15.870 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12-JULY-95
Cable 01A10
Notes IN WATER 4-J
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.81	81.17

[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 Serial Number: 01A10 TDR Probe Length, L: 0.203 m Length of Coax Cable: __.__ m

Comments: _____

Prepared by: Steve Davis Employer: BRE

Date (dd/mmm/yy): 12/JUL/95

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

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

APPENDIX C

Instrumentation Installation Information

Appendix C contains the following information:

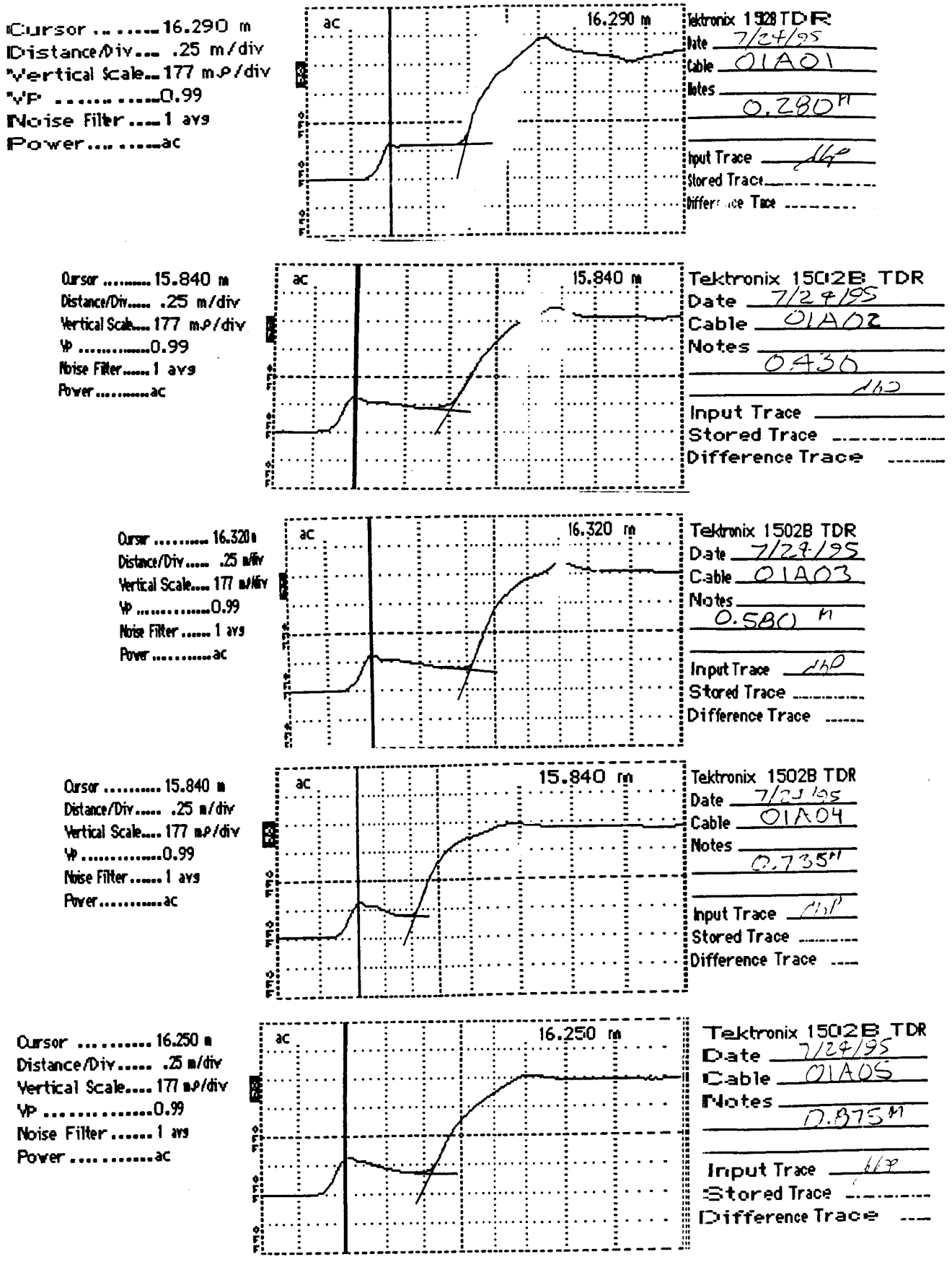


Figure C-1. TDR Traces During Installation

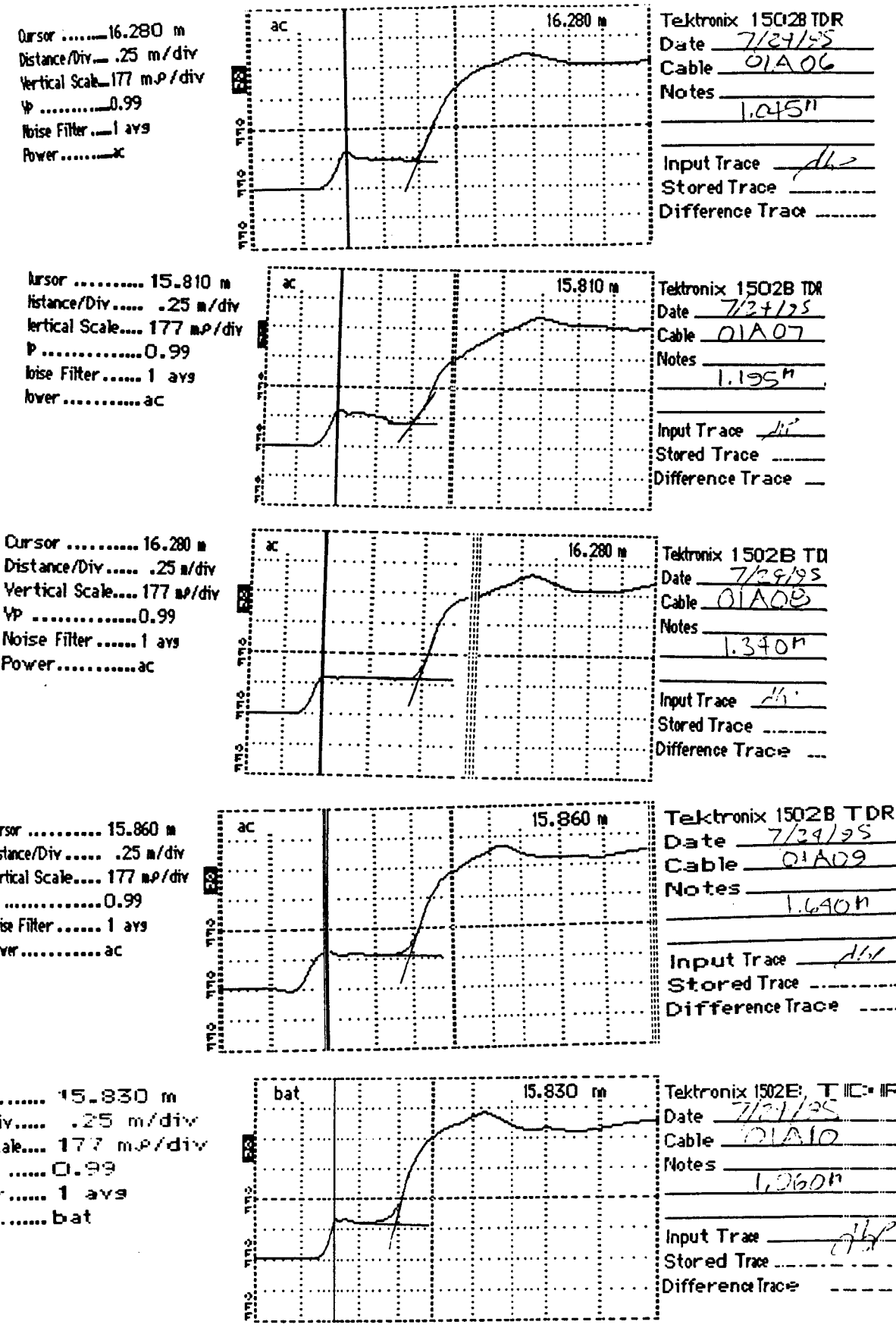


Figure C-1 (Continued). TDR Traces During Installation

Table C-1. Field Measured Moisture Contents

SITE NO. 010101 7/26/95

MOISTURE CONTENTS FOR TDR

TDR #	WT. OF PAN(g)	(WET) PAN & SOIL(g)	(DRY) PAN & SOIL(g)	M.C. (%)
01A10	173.2	270.0	255.5	17.6%
01A09	150.0	272.8	251.4	21.1%
01A08	202.7	309.1	291.3	20.1%
01A07	181.0	255.6	238.9	28.8%
01A06	151.0	268.0	244.6	25.0%
01A05	202.0	303.9	284.3	23.8%
01A04	172.8	284.5	270.4	14.4%
01A03	142.2	245.0	228.6	19.0%
01A02	153.6	253.2	238.5	17.3%
01A01	176.5	278.0	271.0	7.4%

LTPP Seasonal Monitoring Program Data Sheet SMP-I07 Representative Dry Density	Agency Code	[01]
	LTPP Section ID 01SA	[0101]

Depth of Representative Sample (from pavement surface): 1.22 m

Dry Density Determination:

a.	Tare Weight of Empty Mold:	4099 g	(9.02 lb)
b.	Weight of Mold and Compacted Soil:	5938 g	(13.06 lb)
c.	Weight of Compacted Soil (b - a):	1839 g	(4.05 lb)
d.	Unit Weight of Compacted Soil = (c ÷ 943.0) =	1.95 g/cm³	
	([c / (1 ÷ 30)] =	121.4 lb/ft³)	
e.	Dry Density of Compacted Soil = [d / (1 + r/100)] =	1.68 g/cm³	
		(104.3 lb/ft³)	

Moisture Content Determination:

m.	Tare Weight of Pan:	150.9 g
n.	Weight of Pan and Moisture Sample:	243.0 g
o.	Weight of Pan and Dry Sample:	230.0 g
p.	Weight of Moisture (n - o):	13.0 g
q.	Weight of Dry Sample (o - m):	79.1 g
r.	Moisture Content by Weight = [(p / q) * 100] =	16.4 %

Comments: Soil compacted very nicely. Was a reddish color. Contained very few rocks. No clay present. Soil was easy to trim off and cut by mold.

Prepared by: Hunter Estes Employer: BRE

Date (dd/mmm/yy): 24/JUL/95

Data Sheet SMP-I07: Representative Dry Density

Figure C-2. Field Proctor Test

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 D13.	Traces from TDR Sensor
Table D-2.	Elevation Measurements from Installation

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

5,1995,207,100,12.67,25.95,0
6,1995,207,100,34.95,37.23,39.05,39.72,39.6
5,1995,207,200,12.67,25.46,0
6,1995,207,200,33.99,36.26,38.29,39.23,39.29
5,1995,207,300,12.67,24.93,0
6,1995,207,300,33.28,35.5,37.59,38.73,38.95
5,1995,207,400,12.67,24.04,0
6,1995,207,400,32.59,34.8,36.97,38.24,38.59
5,1995,207,500,12.67,23.41,0
6,1995,207,500,31.94,34.16,36.38,37.77,38.22
5,1995,207,600,12.67,23.29,0
6,1995,207,600,31.33,33.56,35.82,37.3,37.85
5,1995,207,700,12.66,23.59,0
6,1995,207,700,30.84,32.99,35.29,36.86,37.48
5,1995,207,800,12.64,25.1,0
6,1995,207,800,31.35,32.79,34.84,36.42,37.11
5,1995,207,900,12.65,27.49,0
6,1995,207,900,34.42,33.68,34.68,36.04,36.76
5,1995,207,1000,12.66,29.14,0
6,1995,207,1000,37.92,35.72,35.17,35.84,36.46
5,1995,207,1100,12.66,31.57,0
6,1995,207,1100,42.53,38.25,36.12,35.92,36.29
5,1995,207,1200,12.65,32.9,0
6,1995,207,1200,46.9,41.37,37.55,36.29,36.33
5,1995,207,1300,12.66,33.8,0
6,1995,207,1300,49.31,43.79,39.17,36.97,36.57
5,1995,207,1400,12.66,34.81,0
6,1995,207,1400,50.79,45.8,40.69,37.81,37.01
5,1995,207,1500,12.69,31.01,0
6,1995,207,1500,45.92,45.21,41.75,38.69,37.57
5,1995,207,1600,12.69,32.96,0
6,1995,207,1600,46.71,44.29,41.74,39.35,38.14
5,1995,207,1700,12.68,31.77,0
6,1995,207,1700,43.85,43.7,41.84,39.72,38.58
5,1995,207,1800,12.68,25.5,3
6,1995,207,1800,38.24,41.42,41.43,39.95,38.92
5,1995,207,1900,12.67,23.44,0
6,1995,207,1900,34.95,37.98,40.09,39.86,39.1
5,1995,207,2000,12.66,23.41,0
6,1995,207,2000,34.6,36.89,38.83,39.39,39.04
5,1995,207,2100,12.66,23.07,0
6,1995,207,2100,33.57,35.9,37.96,38.85,38.81
5,1995,207,2200,12.65,23.26,0
6,1995,207,2200,32.8,35.06,37.2,38.32,38.49
5,1995,207,2300,12.65,22.57,0
6,1995,207,2300,32.17,34.36,36.52,37.81,38.14
1,1995,207,2400,12.66,12.7,1442,12.64,725,26.87,35.37,1345,22.25,2349,3,4067
2,1995,207,2400,37.36,37.69,37.95,38.02,37.96,37.66,37.07,36.34,35.33,33.91,32.95,31.81,30.86,30.03,29.21,28.68,27.89,27.23
3,1995,207,2400,51.37,1331,46.24,1359,41.89,1441,40.01,1755,39.74,1,38.93,1,37.68,126,36.59,639,35.44,2358,34.04,2328,33.04,2324,31.88,2347,30.89,2311,30.05,1756,29.23,2241,28.7,1758,27.92,2059,27.27,2359
4,1995,207,2400,30.72,642,32.77,702,34.63,810,35.82,930,36.27,1032,36.45,1218,36.38,1358,36.05,1539,35,1,33.73,1,32.88,1,31.77,846,30.83,1344,29.98,525,29.18,152,28.66,410,27.87,354,27.2,108
5,1995,207,2400,12.65,22.41,0

Site 010101

July 26, 1995

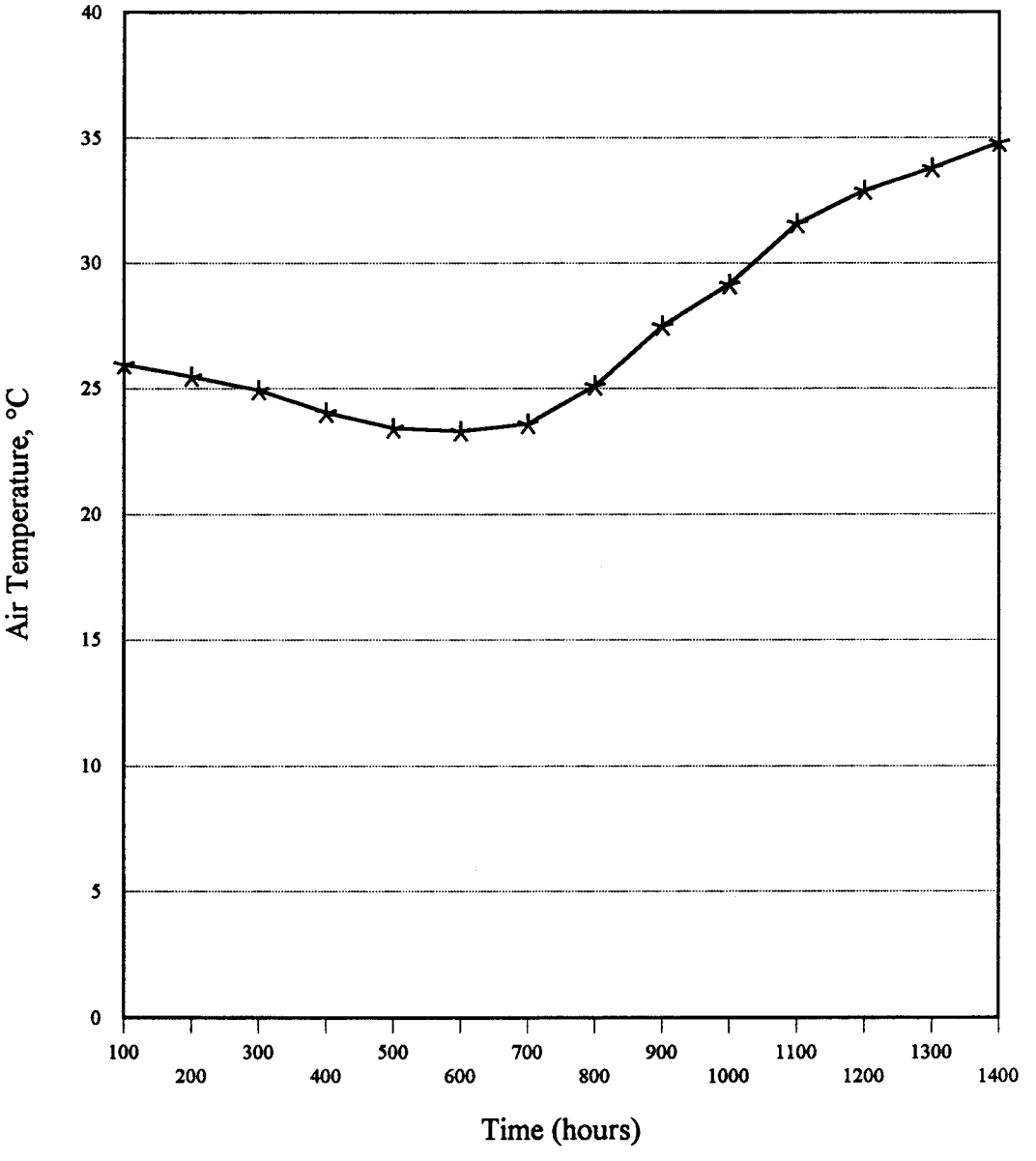


Figure D-1. Measured Air Temperature During Initial Data Collection

Site 010101

July 26, 1995

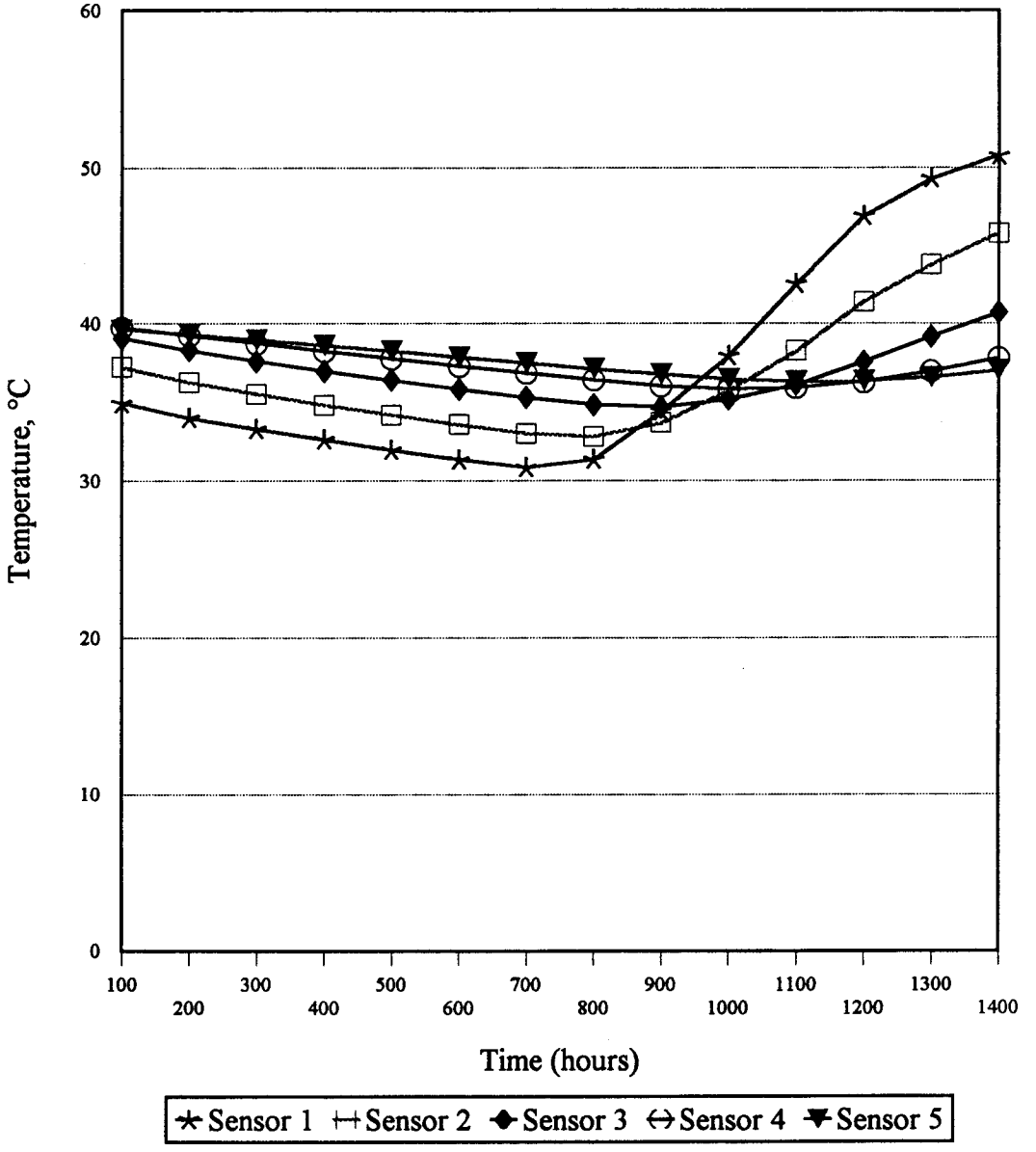


Figure D-2. Measured Average Subsurface Temperature for the First 5 Sensors During Initial Data Collection

Site 010101

July 26, 1995

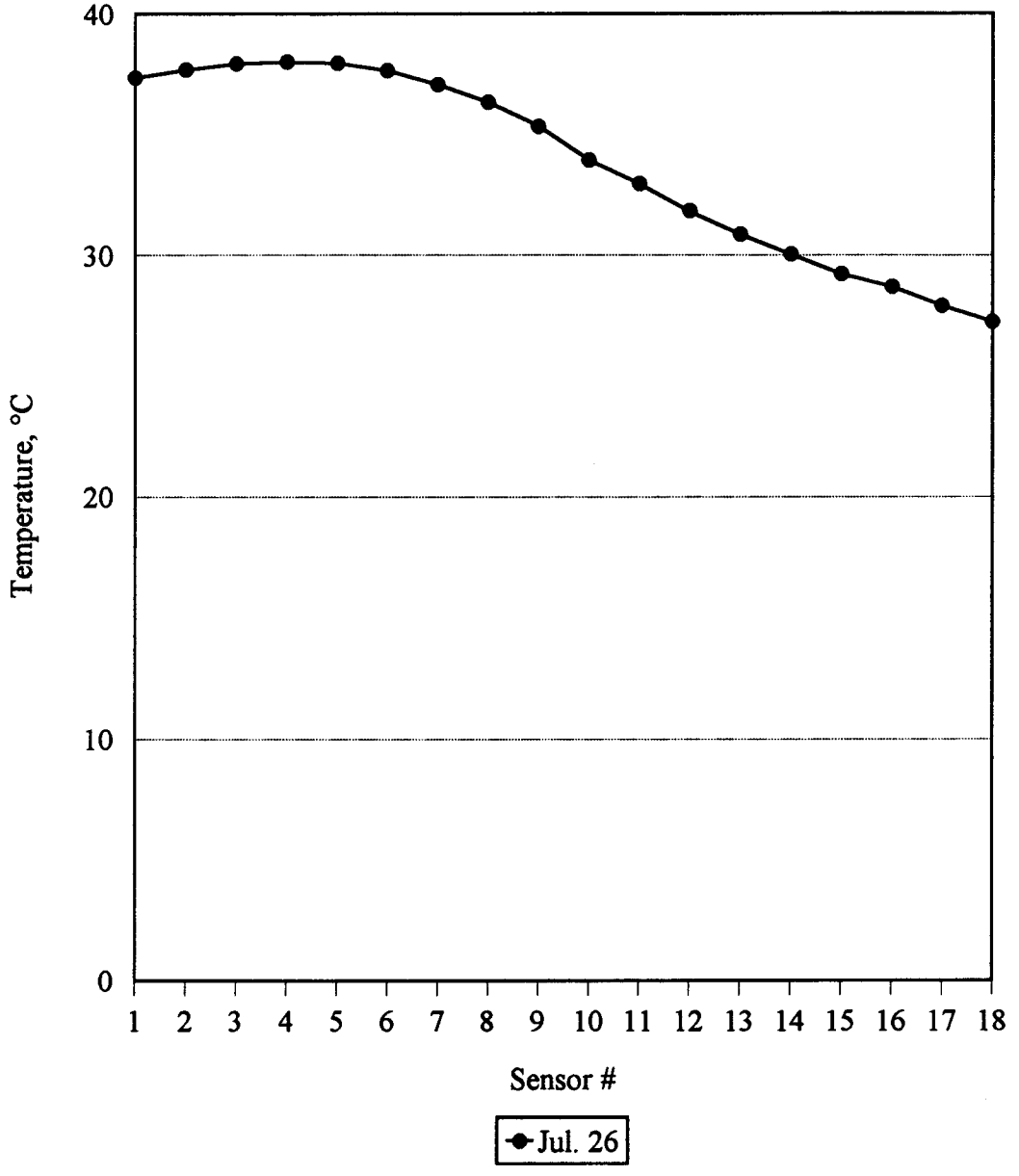


Figure D-3. Measured Average Subsurface Temperature for All 18 Sensors During Initial Data Collection

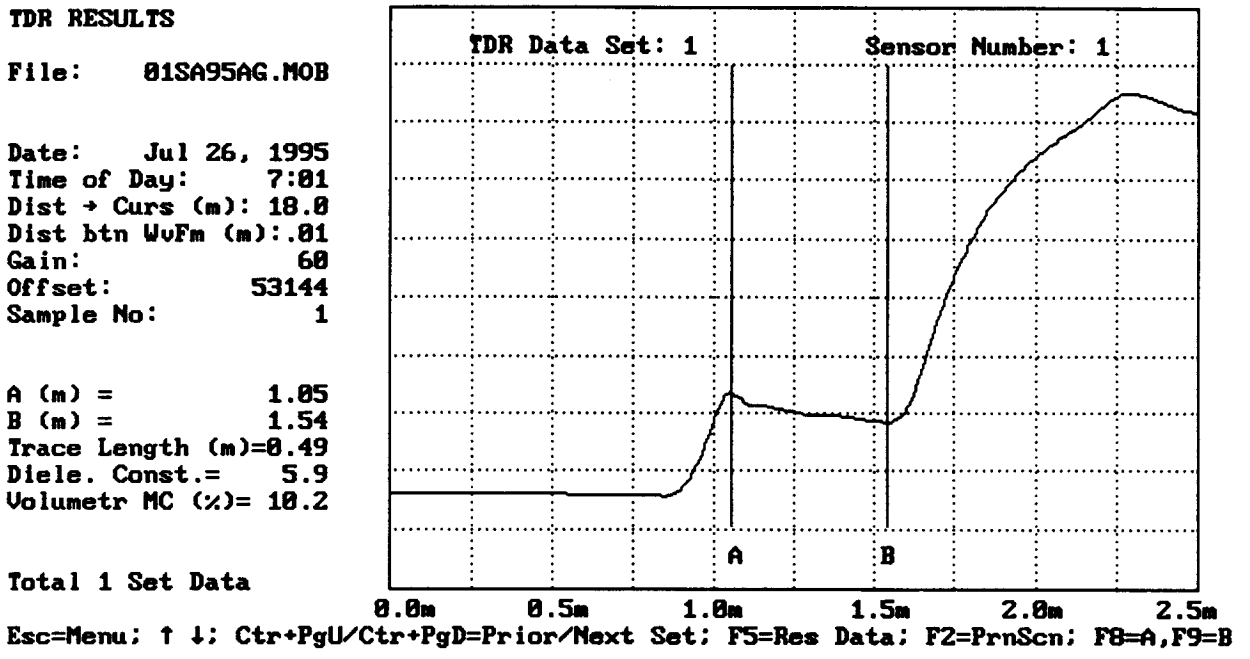


Figure D-4. Trace from TDR Sensor 1

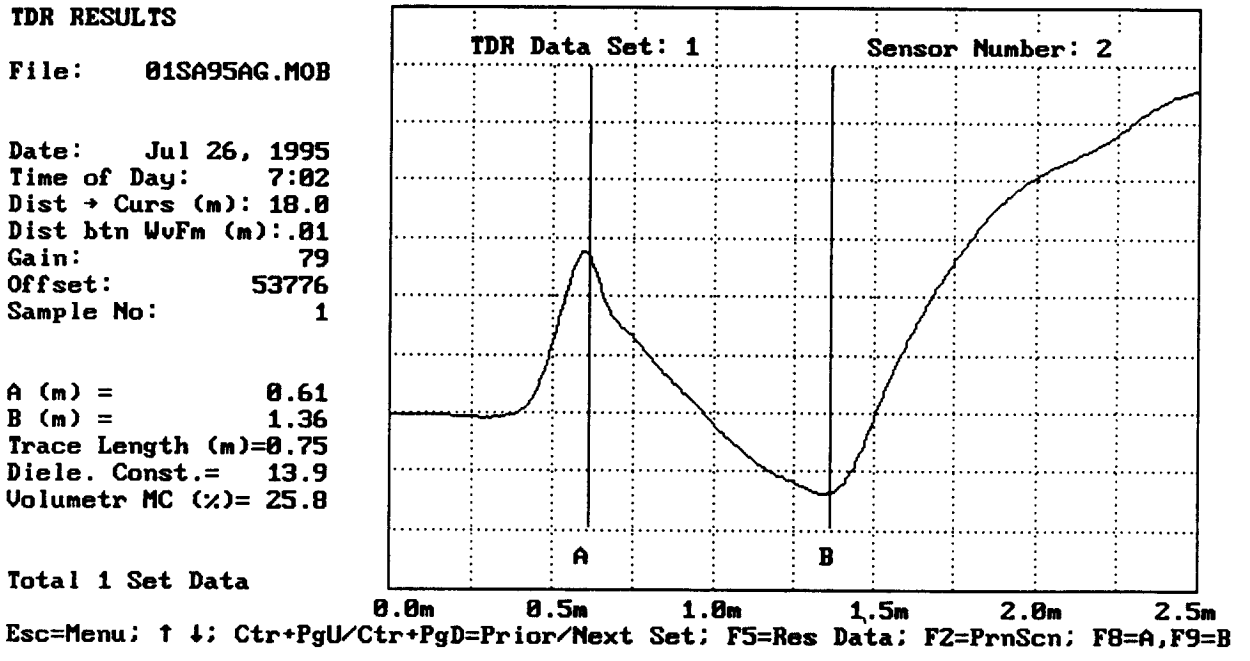


Figure D-5. Trace from TDR Sensor 2

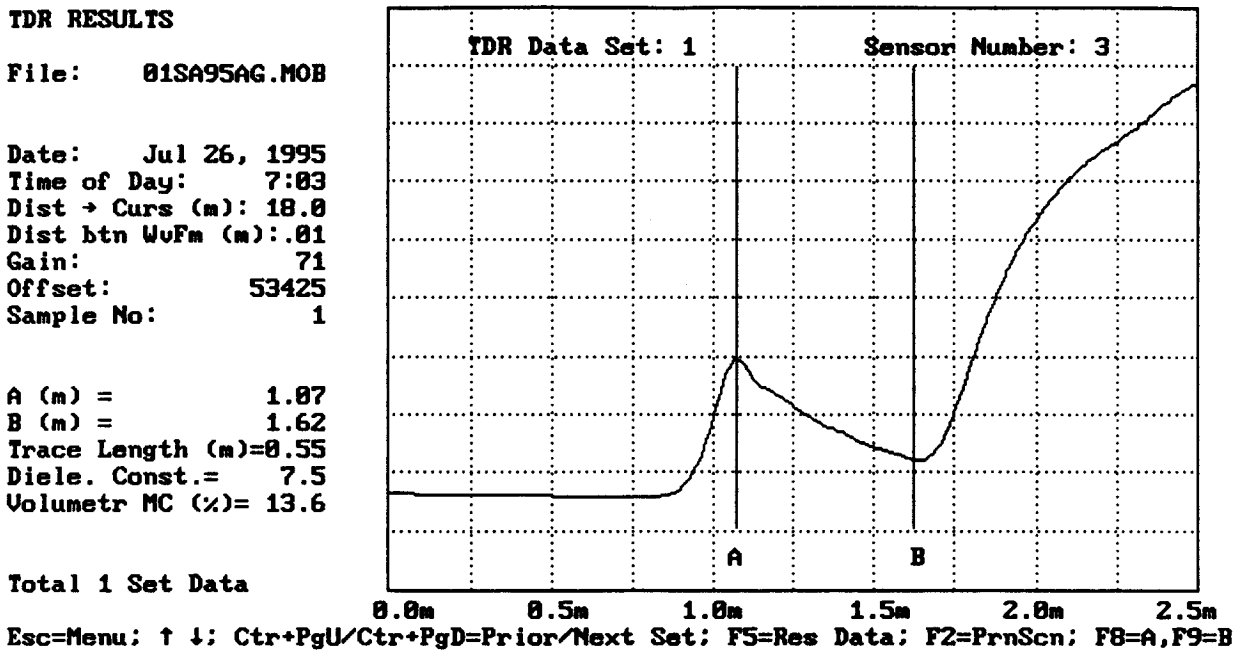


Figure D-6. Trace from TDR Sensor 3

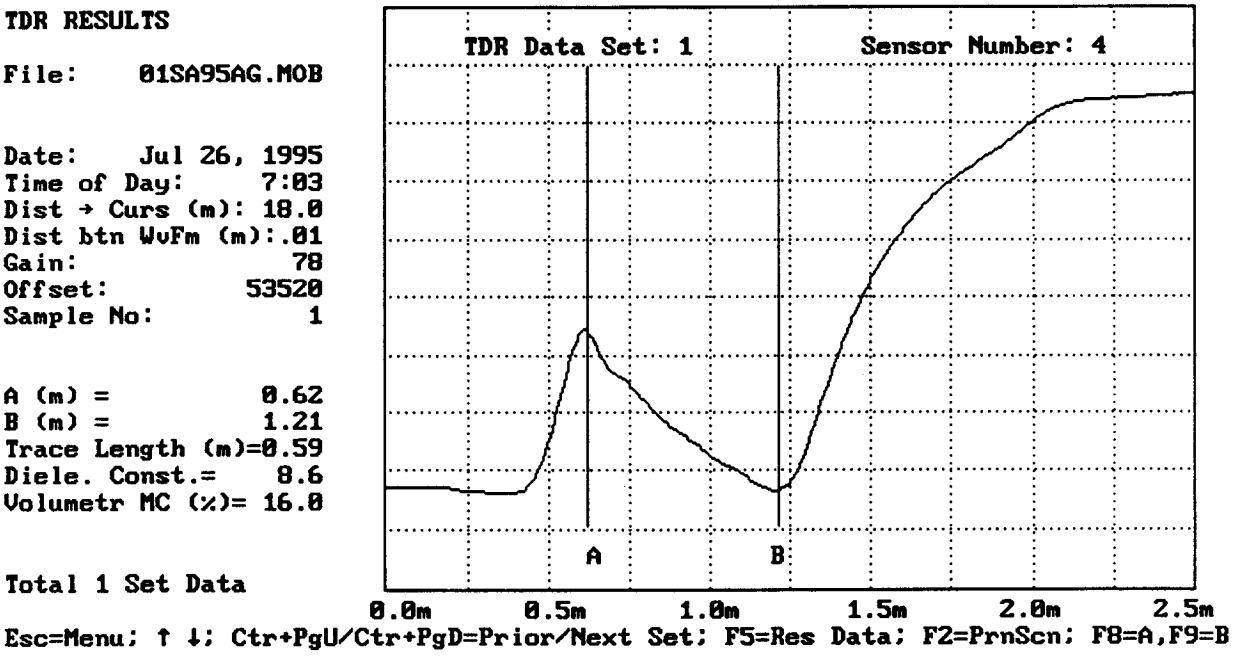


Figure D-7. Trace from TDR Sensor 4

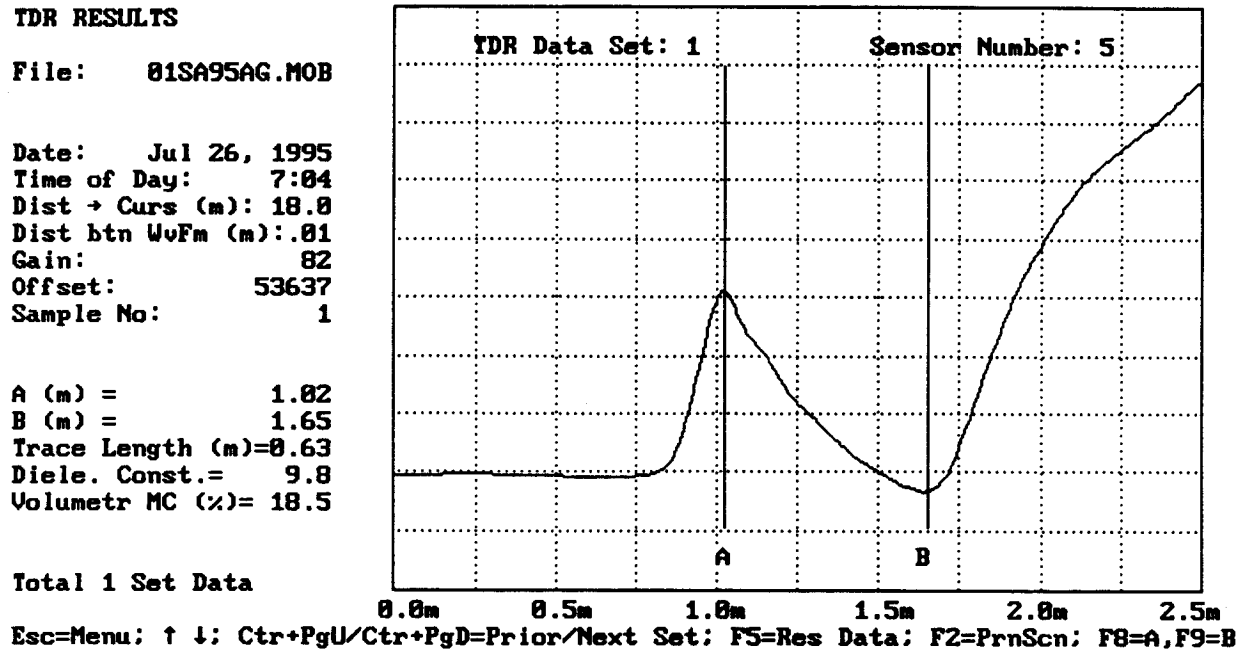


Figure D-8. Trace from TDR Sensor 5

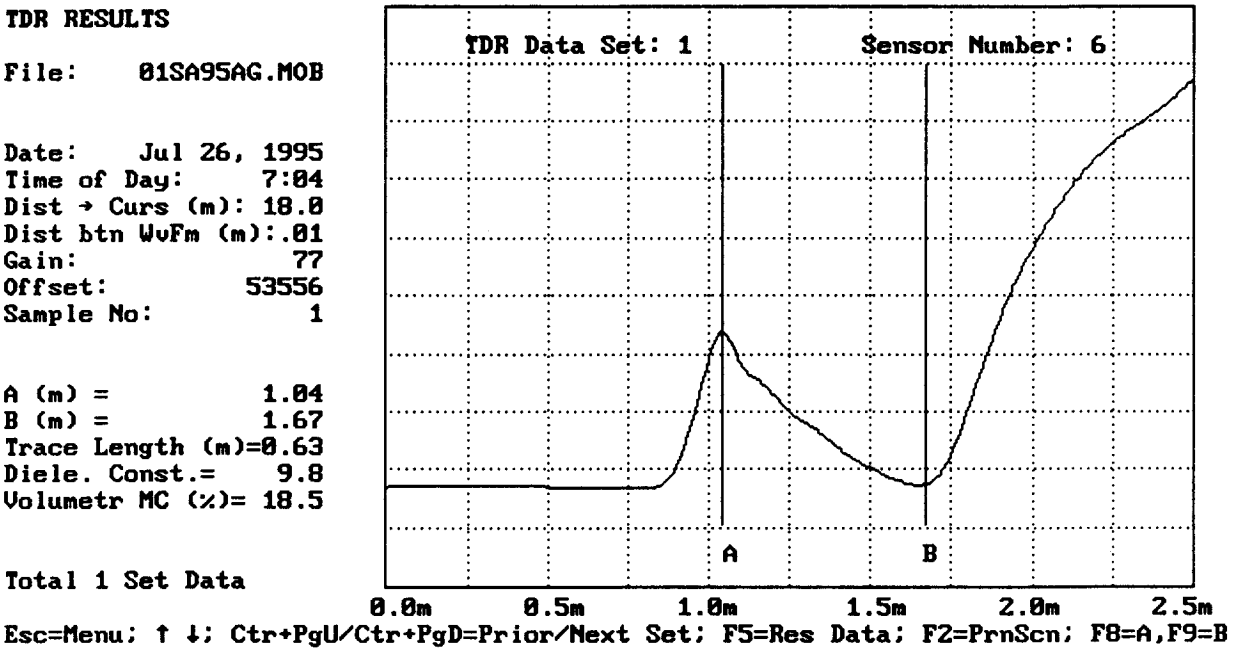


Figure D-9. Trace from TDR Sensor 6

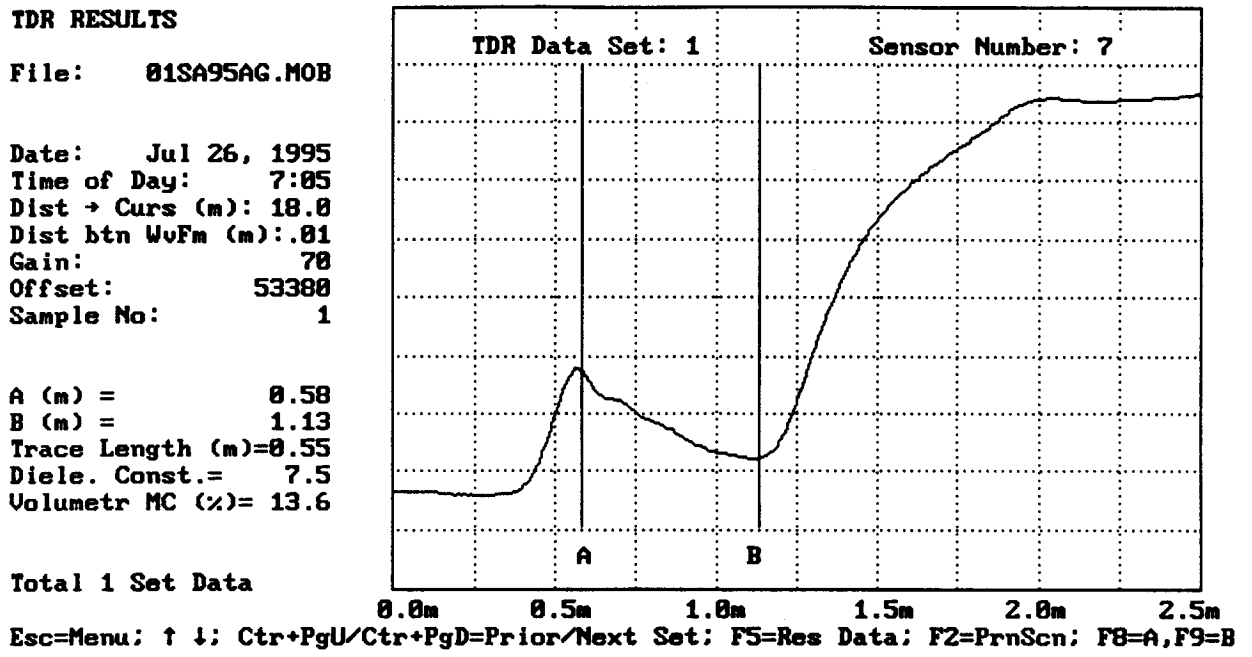


Figure D-10. Trace from TDR Sensor 7

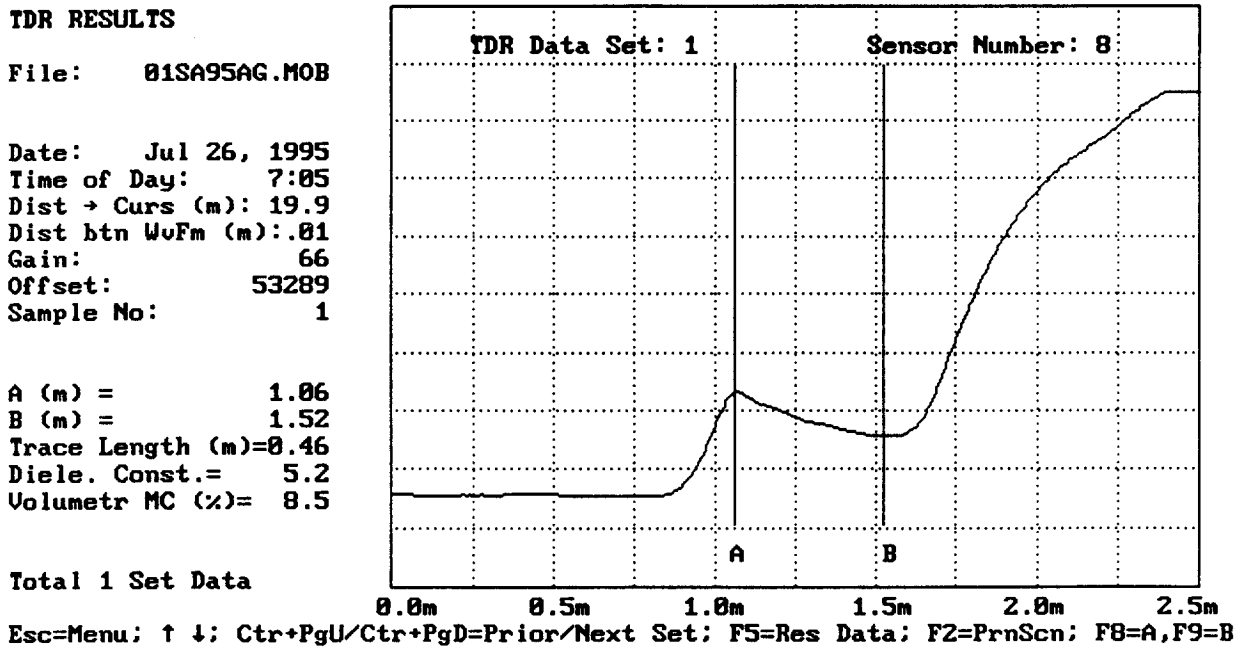


Figure D-11. Trace from TDR Sensor 8

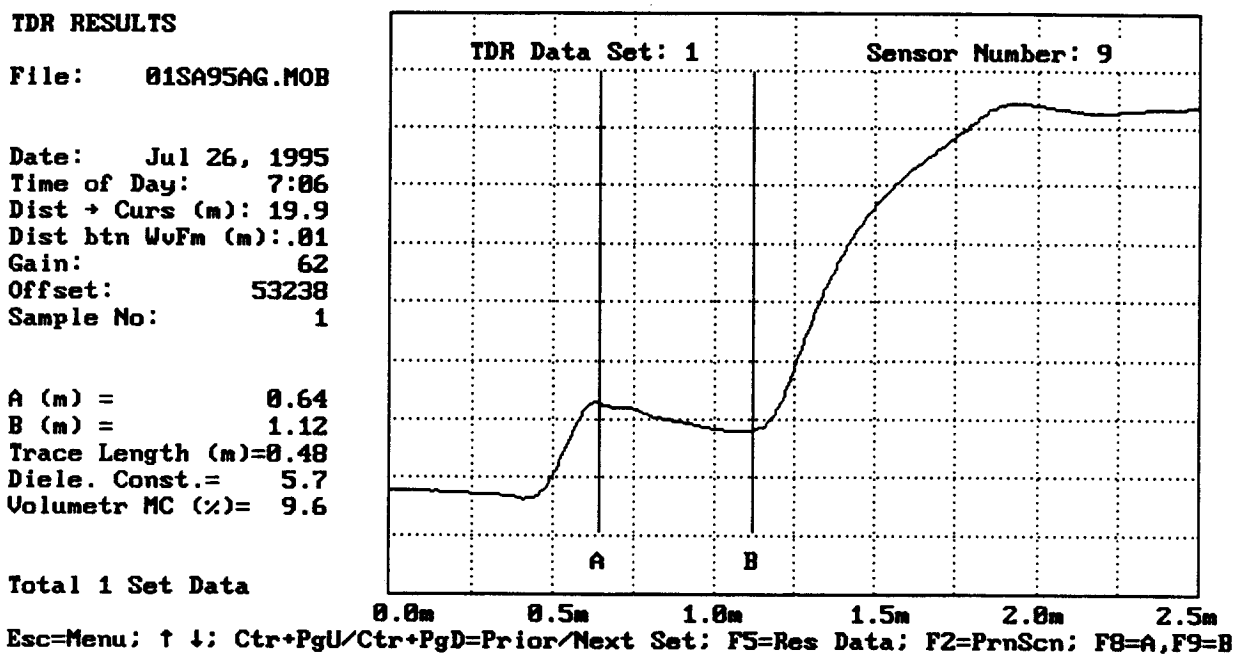


Figure D-12. Trace from TDR Sensor 9

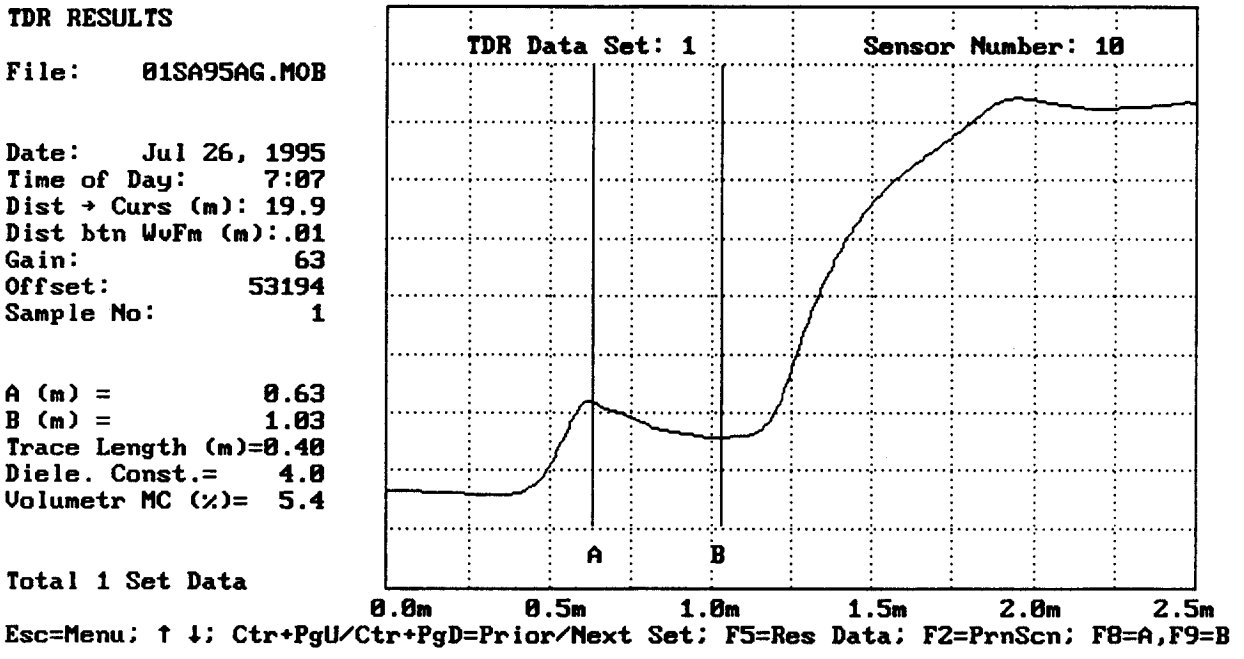


Figure D-13. Trace from TDR Sensor 10

Table D-2. Elevation Measurements Data Sheet - AC

SEASONAL MONITORING
"FLEX" TRANSVERSE ELEVATION MEASUREMENTS[1]

01SA

Station	Outside Edge		OWP		ML		IWP		Inside Edge	
	O/S	Elev.	O/S	Elev.	O/S	Elev.	O/S	Elev.	O/S	Elev.
3+00	0.20	10.719	0.90	10.728	1.90	10.753	2.80	10.766	3.60	10.785
3+25	"	10.701	"	10.710	"	10.734	"	10.747	"	10.766
3+50	"	10.665	"	10.674	"	10.699	"	10.719	"	10.734
3+75	"	10.618	"	10.628	"	10.654	"	10.667	"	10.688
4+00	"	10.577	"	10.585	"	10.610	"	10.624	"	10.647
4+25	"	10.524	"	10.534	"	10.558	"	10.573	"	10.595
4+50	"	10.468	"	10.480	"	10.504	"	10.519	"	10.540
4+75	"	10.411	"	10.418	"	10.442	"	10.457	"	10.478
5+00	0.2	10.341	0.90	10.349	1.90	10.372	2.80	10.396	3.60	10.406
5+10		INSTRUMENTATION								
5+20	---		0.90	10.288						
5+30			0.90	10.259	1.90	10.282			---	

Bench Mark : TOP OF 1" PIPE MONITOR WELL STA 3+93, 19'(5.80M) RT
ASSUMED ELEV. 10.000 M
T.B.M. CHISELED PLUS '+' ON S.W. CORNER OF CATCH BASIN STA 5+15
31'(9.4M) RT. OF BASELINE; ELEV. 9.033 M

Comments: 3.80 METERS PK NAIL TO PK NAIL. BASELINE IS PK NAILS
SEE 0.10M OUTSIDE OF OUTSIDE EDGE OF SHOULDER STRIPE

INST. @ 4+20 SHOULDER TIE IN ✓

Test Section No. 010101
Start Time (Military) 818
Recorded By HE Hancock

Date (dd,mm,yy) 26/07/95
Device Used LASER "B" ME350
Employer ERE

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

APPENDIX E

Photographs

Appendix E contains the following photographs:

Photo E-1. Augering of Piezometer Observation Well

Photo E-2. Pavement Sawing of Marked Area

Photo E-3. Downloading of Information from Equipment Cabinet

Photo E-4. General Photo of Test Section

Photo E-1 Augering of Piezometer Observation Well

Photo E-2. Pavement Sawing of Marked Area

Photo E-3. Downloading of Information from Equipment Cabinet

Photo E-2. General Photo of Test Section