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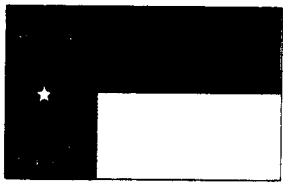

LTPP Seasonal Monitoring Program

Site Installation and Initial Data Collection
Section 370201, 370205, 370208, and 370212
Lexington, North Carolina

Report No. FHWA-TS-97-37-01

March 1997

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Report No. FHWA-TS-97-37-01

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The report is a cooperative effort between North Carolina Department of Transportation (NCDOT) Research and Development Unit Pavement Management Division, Long Term Pavement Performance (LTPP) Division Federal Highway Administration, and ITX Stanley Limited LTPP North Atlantic Region Coordination Office.

16. Abstract

This report provides a description of the installation of seasonal monitoring instrumentation and initial data collection for the seasonal experimental study conducted as part of the Long Term Pavement Performance (LTPP) program at the SPS-2 project on US 52, Southbound Lanes, Lexington By-pass, Lexington, North Carolina. This PCC surface pavement project was instrumented prior to the open house on May 9-10, 1994. The environmental instrumentation installed includes time domain reflectometry probes for moisture content, thermistor probes for temperature, piezometer to monitor the ground water table, and an on-site data logger. The instrumented sites were included in the LTPP SMP program and initial data collection was performed on May 15, 1995 which consisted of deflection measurements with a Falling Weight Deflectometer, elevation measurements, temperature measurements, TDR measurements, and water table 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
Instrumentation, Monitoring, Survey, FWD, Profilometer, Time Domain Reflectometry, Thermistor, Piezometer, Electrical Resistance, Electrical Resistivity.	

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Table of Contents

List of Tables

List of Figures

SEASONAL INSTRUMENTATION STUDY
INSTRUMENTATION INSTALLATION
NORTH CAROLINA SECTIONS
370201, 370205, 370208 and 370212

I. Introduction

The installation of the seasonal monitoring and load response instrumentation at SPS-2 sites 370201, 370205, 370208 and 370212 near Lexington, North Carolina was initiated during the construction of the experimental sections and completed prior to the open house held to showcase the experiment and instrumentation on May 9-10, 1994. The seasonal instrumentation was installed jointly by NCDOT and FHWA-LTPP to capture the environmental changes and their effects on pavement load response. Of particular interest was the pavement gradient moisture and temperature at the time of load testing.

The TDR and MRC thermistor probes were installed at the completion of the subgrade preparation at the SPS-2 experimental sites on October 17-18, 1993. Thermocouples were installed in the Lean Concrete Base (LCB) and Dense Graded Aggregate Base (DGAB) at the time of placement. The stainless steel thermistor surface layer temperature probes were installed during the paving of the Portland Cement Concrete (PCC) surface. The test sections are part of the SPS-2 experiment, located on Southbound US 52, Lexington By-pass. The SPS-2 starts at the north end of the project near the US 52 overpass at the Welcome exit and goes to SR 1232 Lexington; a distance of 7.8 km (4.85 miles). It is a four lane divided highway, with the main line southbound lanes varying from 7.3 m to 7.9 m. The primary driving lanes vary from 3.65 m to 3.9 m depending on the experiment type. Add on lanes were incorporated for experimental sections 370201, 370202, 370205, 370206, 370209 and 370210 as these test sites were considered to have a shorter time line to failure. A 20.7 m median separates the north and south bound lanes. Appendix A, Figures A-1 to A-3, depict the site location, site layout and location of the instrumented test sections.

The pavement structure varies between the four sections from 203 mm to 279 mm. The bases used for the four sections also vary. A LCB is used at sections 370205 and 370208. A DGAB is used at section 370201 and a Permeable Asphalt Treated Base (PATB) in combination with a DGAB is at 370212. Also, the top of the subgrade was treated with lime at all the sites. Pavement structure information from the SPS-2 material drilling logs is presented in Appendix A, Figure A-4. Properties determined from the laboratory material tests are shown in Table 1.

Table A-1 in Appendix A summarizes the distress, IRI values from the Profilometer longitudinal profile measurements, and Falling Weight Deflectometer deflection values as monitored since March 30, 1994. The uniformity survey results are summarized in Table A-2 and the deflection values and analysis results from FWDCheck are also presented in Appendix A, Figure A-5 and Table A-3.

Site 370201 is included with the core Seasonal Monitoring Program (SMP) sites, which are monitored on a monthly basis on a yearly cycle every two years. Site 370205, 370208 and 370212 are supplemental sites which are monitored twice yearly as part of the testing performed on the sections instrumented for load response.

Site 370201 is in a wet-no-freeze zone and resides in cell 18 (JPCP on a fine subgrade) of the Seasonal Monitoring Program. Below is a summary from the LTPP climatic database based on eleven years of data:

- Freezing Index (C-Days) 95
- Precipitation (mm) 1118
- No. of Freeze/Thaw Cycles 79
- Days Above 32°C 32
- Days Below 0°C 75
- Wet Days 129

The climatic data listed above was taken from site 373807, since there was no long term data available for site 370201. Site 373807 is approximately 16 km north of 370201, on US 52 northbound. An Automated Weather Station (AWS) was installed August 4, 1994 adjacent to site 370260, near the West Central Extension overpass. This AWS will collect air temperature, relative humidity, solar radiation, wind speed/direction and rainfall for the SPS-2 test sections.

The SPS-2 was constructed in 1993; it was completed and opened to traffic in 1994. Traffic for this section is monitored by a Weigh in Motion (WIM) installed at the 5+00 end of section 370260. Traffic information (volume, weight and vehicle classification) has been continuously collected since the opening of this SPS-2 site to traffic, but the data as of yet has not been available to the RCOC for the LTPP database.

Installation of the instrumentation was a co-operative effort between the North Carolina Department of Transportation (NCDOT), Federal Highway Administration (FHWA) Long-Term Pavement Performance (LTPP) Division, and Pavement Management Systems Limited (PMSL; now ITX Stanley Ltd.) LTPP North Atlantic Region Co-ordination Office (NARCO) staff. The installation, from installing the inground instrumentation (TDR, MRC Thermistor Probes, Thermocouples), installing the conduit, equipment cabinets, dataloggers, Automated Weather Station (AWS), to the initial data collection on May 15, 1995, took place over a 20 month period. The following personnel participated in the installation and were instrumental in completing the project.

<u>Instrumentation Installation:</u>

Dr. Shin Wu	NCDOT - Pavement Management Unit
Dr. Judith Corley-Lay	NCDOT - Pavement Management Unit
Kevin Ray Blaylock	NCDOT - Geotechnical Unit
Donald Larry Newsome	NCDOT - Geotechnical Unit

Ed Arrowood	NCDOT - Construction Co-ordinator
John Klemunes	FHWA-LTPP
Alex Rutka	NARCO - Pavement Management Systems
Mike Zawisa	NARCO - Pavement Management Systems
Brandt Henderson	NARCO - Pavement Management Systems

Installation of Conduit, Cabling, Cabinet and Dataloggers:

Ed Arrowood	NCDOT - Construction Co-ordinator
Mike Zawisa	NARCO - Pavement Management Systems
Rick Brown	NARCO - Pavement Management Systems
Scott Comstock	NARCO - Pavement Management Systems
Brandt Henderson	NARCO - Pavement Management Systems

Completion of Installation and Initial Data Collection:

Mrinmay Biswas (LTPP Co-ordinator)	NCDOT - Research and Development
Aiman Kuzmar	NCDOT - Research and Development
Alfred Lip	NARCO - Pavement Management Systems
Brandt Henderson	NARCO - Pavement Management Systems
Dilan Singaraja	NARCO - Pavement Management Systems
Douglas Marshall	NARCO - Pavement Management Systems
James Orzulak	NARCO - Pavement Management Systems

Traffic control was provided by the NCDOT District 1, Division 9. Chuck Sharp was the traffic services supervisor.

Table 1. Material Properties

Description	Surface				Base				Subgrade			
Section ID (37*)	0201	0205	0208	0212	0201	0205	0208	0212	0201	0205	0208	0212
Material	Portland Concrete Cement				DGAB	LCB	LCB	PATB	Silty	Clay	Silty	Silty
(Strength, psi)	550	550	900	900				DGAB	Clay		Sand	Clay
Thickness (mm)	236	221	284	284	152	175	150	109,97				
Lab Max. Dry Density (kg/m³)	2352	N/A	N/A	2161					1618	N/A	1410	1666
Lab Opt Moisture Content (%)	6.8	N/A	N/A	6.1					22	N/A	30	20
In-situ Wet Density (kg/m³) *												
In-situ Dry Density (kg/m³) *									1299	1442	1414	1422
In-situ Moisture Content (%) *									40.4	26.6	29.5	29.6
Bulk Specific Gravity	2.32	2.32	2.32	2.32					20.3	N/A	39.9	N/A
Max. Specific Gravity	2.47	2.47	2.47	2.47								
Liquid Limit					18				61		64	48
Plastic Limit					0				30		41	26
Plasticity Index					NP				31		22	22
% Passing # 200					8.8				70.3		70.7	66.4

* Note: SPS-2 Testing was used.

II. Instrumentation Installation

Site Inspection and Meeting with Highway Agency

The installation of the inground instrumentation was initiated at the completion of the subgrade preparation, prior to the placement of base materials. This was arranged by Dr. Shin Wu (NCDOT), Monty Symons (FHWA-LTPP) and Dr. Bill Phang (PMSL). The decision was to install the instrumentation "during construction" at the planned locations where the pavement response to load is measured. Information on the load instrumentation is provided in *Pavement Instrumentation Program for SPS-1 and SPS-2: Instrumentation Details, PCS/Law, August 1993*. The installation (environmental and load response) was showcased at an open house May 9-10, 1994. A FWD uniformity survey was included with the late fall (December 9, 1994) testing of the SPS-2 weak sections. The results of the uniformity survey indicated that the deflections were higher at the location of the instrumentation. This could be partially a result of the reduced compaction effort in the area of the instrumentation, as the contractor was concerned with the possibility of damage to the inground instrumentation.

The SMP meeting in Austin, Texas (spring 1994) committed the SPS-1, SPS-2 and SPS-8 sections for inclusion into the SMP program. Those sections with unbound bases and/or sub-bases only (i.e. no stabilized subsurface layers) and those having the weakest (thinnest) structure could be included in the SMP. The North Carolina SPS-2 site 370201 was nominated to this category on August 24, 1994 for the Loop 2 SMP.

A preliminary planning meeting was held at the conference facility of the Pavement Management Unit in Raleigh, North Carolina on April 11, 1995. The attendees at the meeting were:

• Mrinmay Biswas	NCDOT Research and Development
• Pat Strong	NCDOT Research and Development
• Jerry Blackwelder	NCDOT Pavement Management
• Wm. Kenneth Creech	NCDOT Pavement Management
• Jim Trogdon	NCDOT Maintenance Unit
• Max Tate	FHWA
• Brandt Henderson	Pavement Management Systems, NARO
• Bill Phang	Pavement Management Systems, NARO

A presentation on the seasonal monitoring instrumentation and monitoring requirements were provided by Bill Phang and Brandt Henderson of Pavement Management Systems. This was followed by a review and discussion on the seasonal site near Lexington. Plans for the initiation of data collection on May 14 and May 15, 1995 were discussed. Correspondence from the site inspection and planning meeting are in Appendix B.

Equipment Installed

The equipment installed at the test sites included instrumentation for measuring pavement and subsurface temperatures, and subsurface moisture content. A piezometer was installed at section 370201 to measure the water table. An equipment cabinet was installed at each site to hold the datalogger, battery pack, and all electrical connections from the instrumentation. Precipitation and air temperature information would be obtained from the AWS located at 370260 in the south end of the project. The equipment installed is shown in Table 2.

Equipment Check/Calibration

Prior to installation, each measurement instrument was checked or calibrated. The thermistor probes were connected to the CR10 datalogger. They were checked by placing the probes in ice, room temperature, and hot water. In order for the probes to pass this check, the temperatures for each probe needed to correspond to the water temperature. The check indicated that the thermistor probes were working properly. Time constraints did not allow for connecting the MRC thermistor probes to obtain a 24 hour minimum, maximum and average temperature reading. The results from the calibration of the thermistor probes along with the spacing between the thermistors are presented in Appendix B.

The functioning of the TDR probes were checked by performing measurements in air, water, methyl alcohol, and with the prongs shorted at the circuit board and the end of the probe. The traces were taken and the dielectric constant was calculated for the water, air, and methyl alcohol. These values were checked against expected dielectric constants for each medium. The tests indicated that all probes were functioning properly. A resistance check was performed and results recorded for future reference in troubleshooting probe conditions or malfunctions. The probe connectors were dipped in a rubberized sealing compound for water proofing. A 's-loop' was placed just above the connector and tie rapped to protect the connector during installation. Results of the TDR measurements are presented in Appendix B.

Equipment Installation

The TDR probes and MRC thermistor probes were installed on October 17 and 18, 1993. Site 370208 at the south end was the first site to be instrumented. The instrument hole was excavated using an auger at station 5+15 to a depth of 1.85 m. The primed surface crust was removed prior to excavation. A 254 mm hollow stem auger, operated by K. Blaylock and D. Newsome of the NCDOT Geotechnical, was used to drill the instrument hole. Material was removed in 450 mm lifts. The auger's hollow stem did not contain a plug, so the material retained in the auger was tapped from the barrel at each depth level. Care was taken to ensure that the excavated material was stored in the order that it was

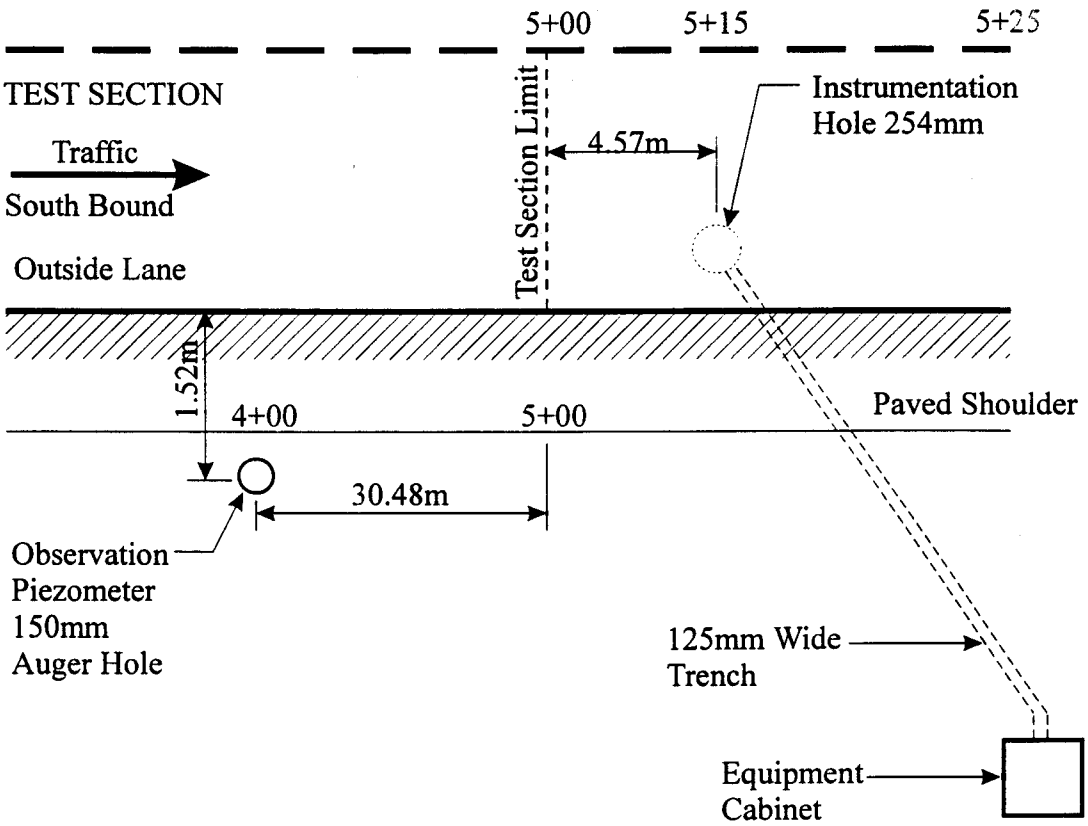
Table 2. Equipment Installed

Equipment	370201		370205		370208		370212	
	Quantity	Serial Number	Quantity	Serial Number	Quantity	Serial Number	Quantity	Serial Number
Instrumentation Hole:								
MRC Thermistor Probe	1	37CT	1	37DT	1	37AT	1	37BT
CRREL Resistivity Probe	0	N/A	0	N/A	0	N/A	0	N/A
TDR Probes	10	37C01-37C10	10	37D01-37D10	10	37A01-37A10	10	37B01-37B10
Equipment Cabinet:								
Campbell Scientific CR10 Datalogger	1	16553	1	-	1	-	1	-
Campbell Scientific PS12 Power Supply	1	5614	1	-	1	-	1	-
Weather Station:								
TE525MM Tipping Bucket Rain Gage	0	N/A	0	N/A	0	N/A	0	N/A
Campbell Scientific 107-L Air Temperature Probe	0	N/A	0	N/A	0	N/A	0	N/A
Observation Well/Bench Mark	1	N/A	0	N/A	0	N/A	0	N/A
State Benchmark	0	N/A	0	N/A	0	N/A	0	N/A

removed. The surface material was a clayey sand silt mixture with the top 200 mm treated with a lime stabilization; the remaining material consisted mainly of a silty sand, to 1.803 m below the subgrade surface. The drilling was stopped approximately 50 mm below the required depth and the installation began. The findings from the excavation of the instrumentation hole at station 5+15 are presented in Figure 2.3. All the material excavated from the instrument hole was placed and compacted in the order of removal with the TDR probes and the thermistor probe placed at the specified locations. The location and elevation information of the instrumentation are presented in Figure 2.3. Samples of the material placed around the TDR probes were retrieved to determine the gravimetric moisture at these locations. A field moisture determination was done at the site with sample material retained for laboratory moisture determination by the NCDOT Materials and Tests unit. No material was left after the hole was filled and compacted.

The instrument hole installation at station 5+15 of site 370212 proceeded as above with the following exceptions: the Permeable Asphalt Treated Base (PATB) was already in place. This material, along with the DGAB, was loosened and removed to access the subgrade material for excavation. Care was taken during the excavation process to ensure the PATB was not contaminated with the base/sub-base material. The 100 mm of DGAB was loosened and removed by hand. The auger was then used to loosen the lime treated subgrade, which was kept separate from the remainder of the subgrade material. The reddish silty clay with traces of mica was much more difficult to remove from the auger furrows and formed a solid plug within the auger barrel. This was scooped out at 400-500 mm depths. The hole was covered with a plastic sheet over a plywood support to catch the material removed from the auger. The excavation extended to a depth of 2.235 m, which was deeper than necessary. The MRC thermistor probe was placed to within 25 mm of the PATB surface. The bottom TDR probe was placed at 2.134 m from the PATB surface with probes placed in the subgrade, lime treated subgrade, DGAB and PATB. Moisture samples were done on all materials with the exception of the PATB as provided in Figure 2.4. Any of the PATB or DGAB that was contaminated with the subgrade material was replaced with fresh material and firmly compacted to the desired depth. There was little, if any, contamination of the PATB or DGAB at the instrument hole location.

The installation at station 5+15 of site 370201 was similar to 370208, with the exception that the material was a reddish silty clay with significant amounts of mica particles. Removal was the same procedure used as for 370212. The MRC thermistor probe was placed to within 45 mm of the subgrade surface. A mistake was made in determining the depth of the TDR probes which required extending the depth between TDR probes 1 (DGAB), 2 (Lime Treated Subgrade) and 3 (Subgrade) to 305 mm and 228 mm respectively. The spacing should typically be 150 mm. Figure 2.1 provides the profile of pavement structure and probe depths for 370201. The DGAB was retrieved from a nearby stockpile to cover the probes (approximately 2 20 liter pails) as protection from construction activity. Figure 1 shows the location of the equipment installed at 370201.



• Depth of Piezometer: 4.83m

Figure 1. Location for Seasonal Monitoring Instrumentation at 370201

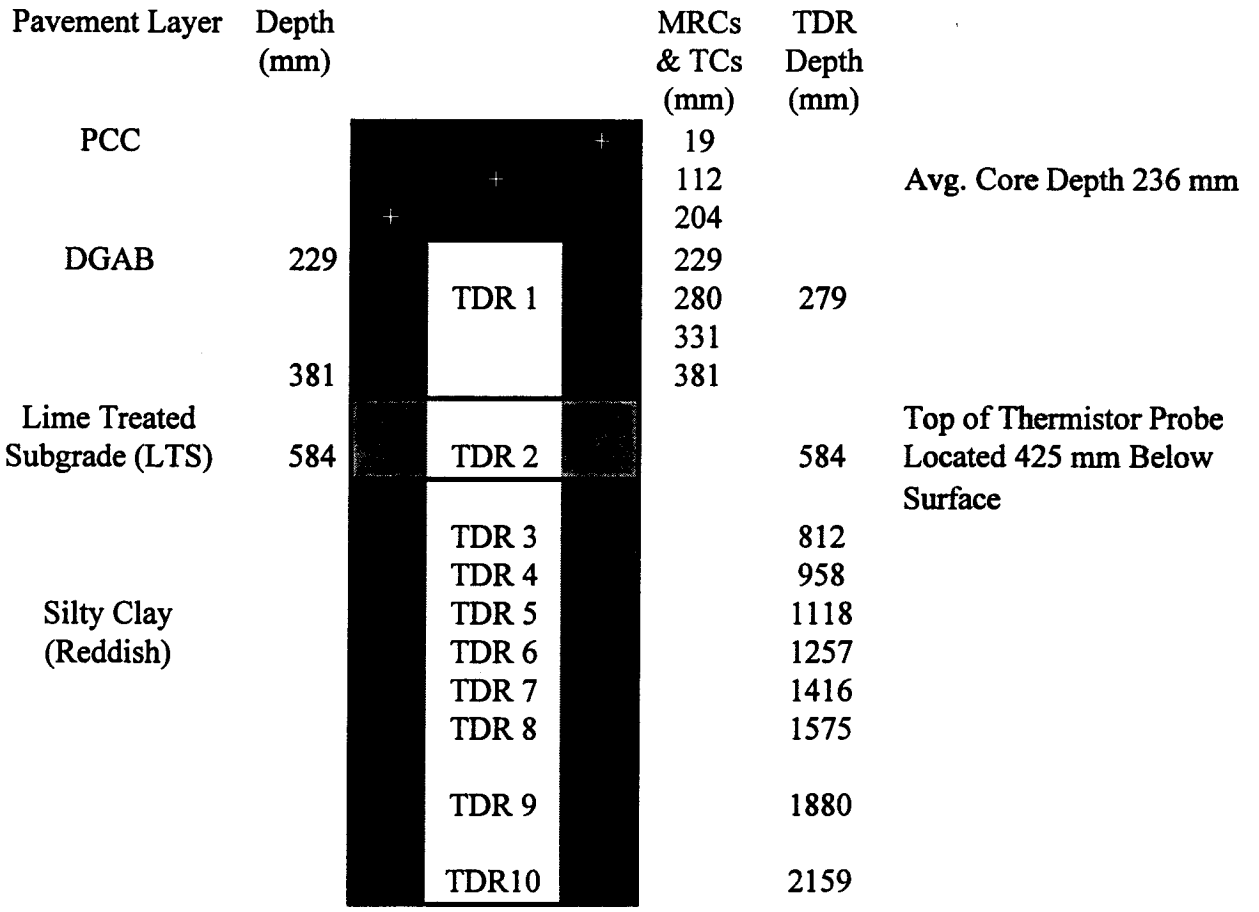


Figure 2.1 Profile of Pavement Structure and Probe Depths, 370201

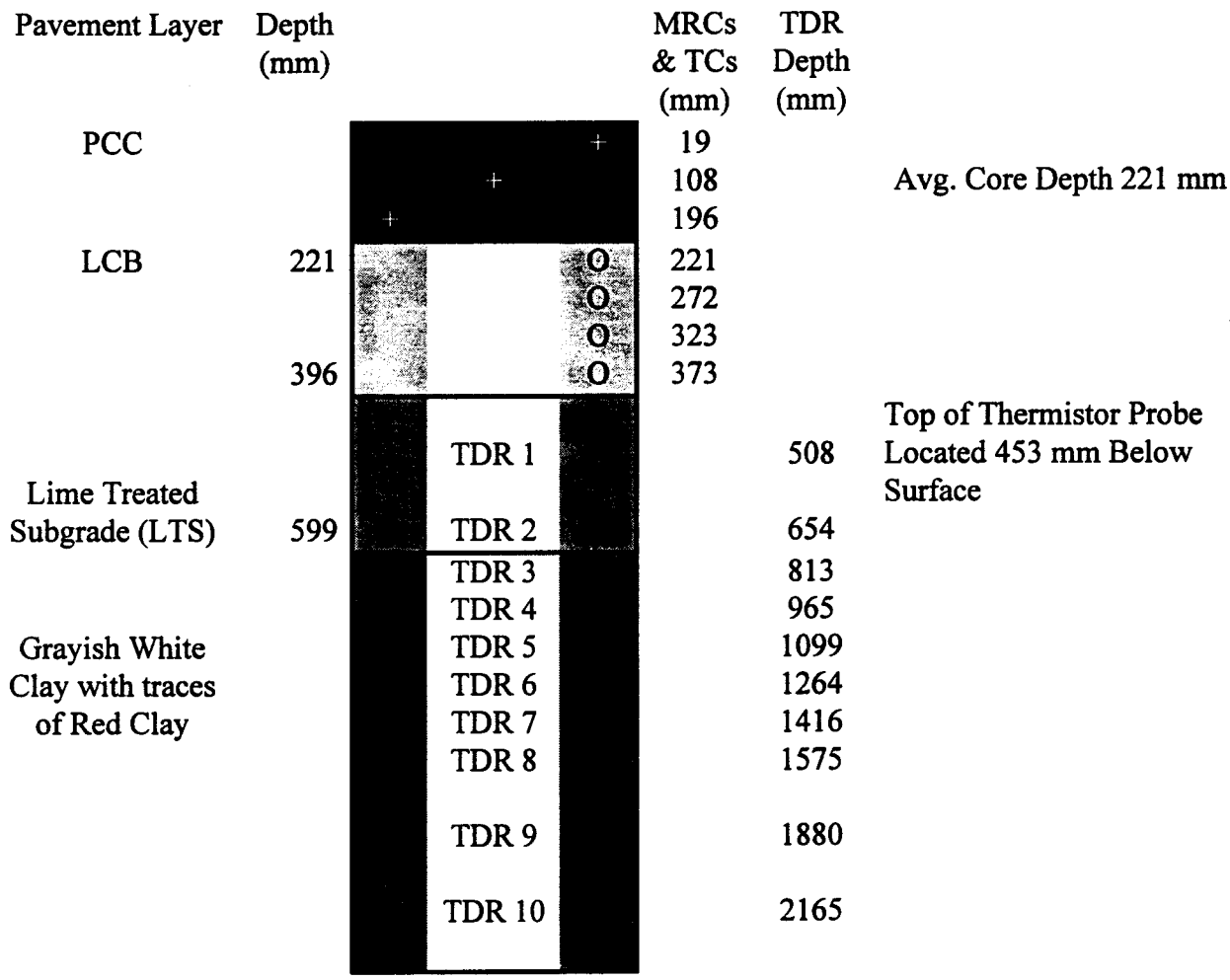


Figure 2.2 Profile of Pavement Structure and Probe Depths, 370205

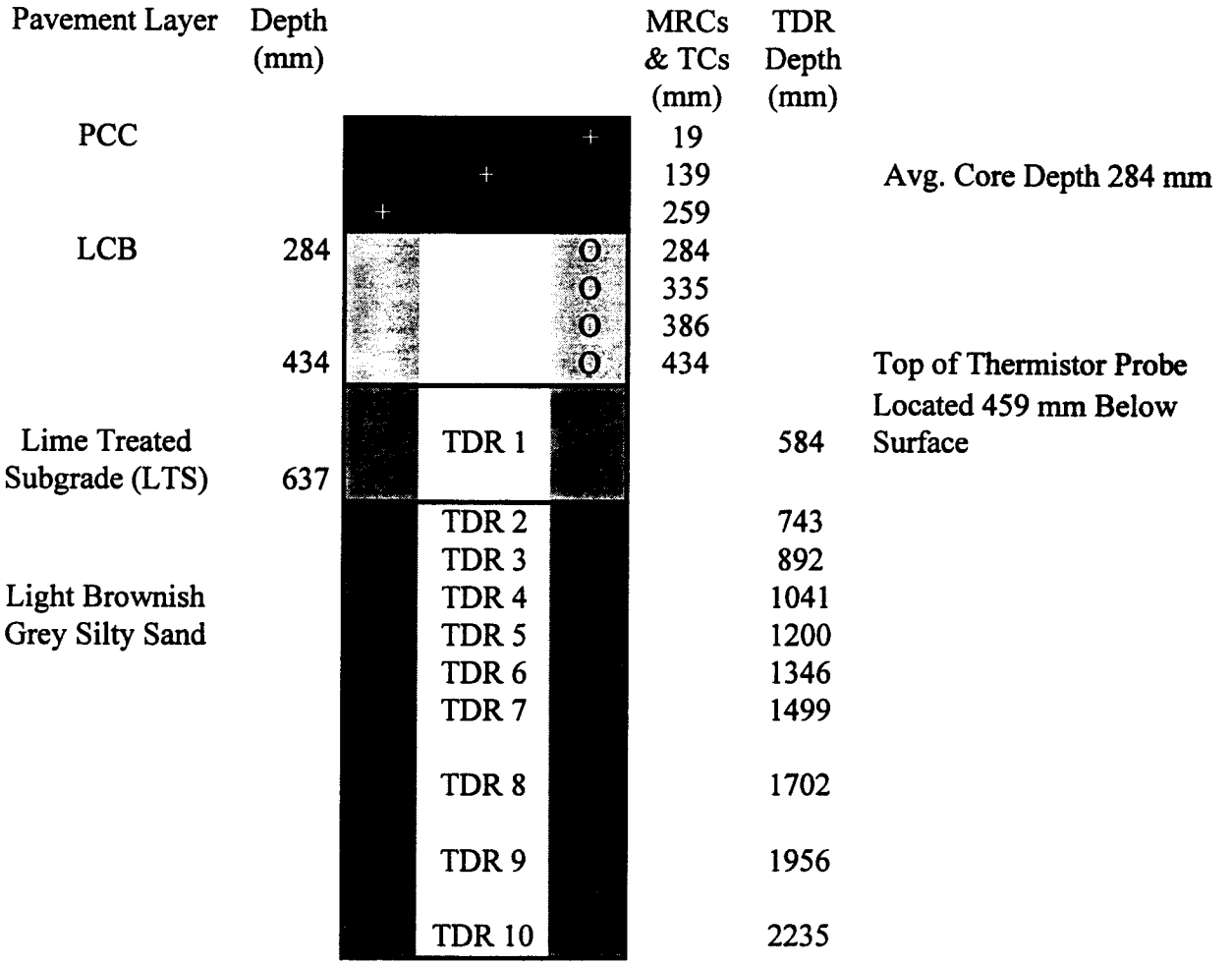


Figure 2.3 Profile of Pavement Structure and Probe Depths, 370208

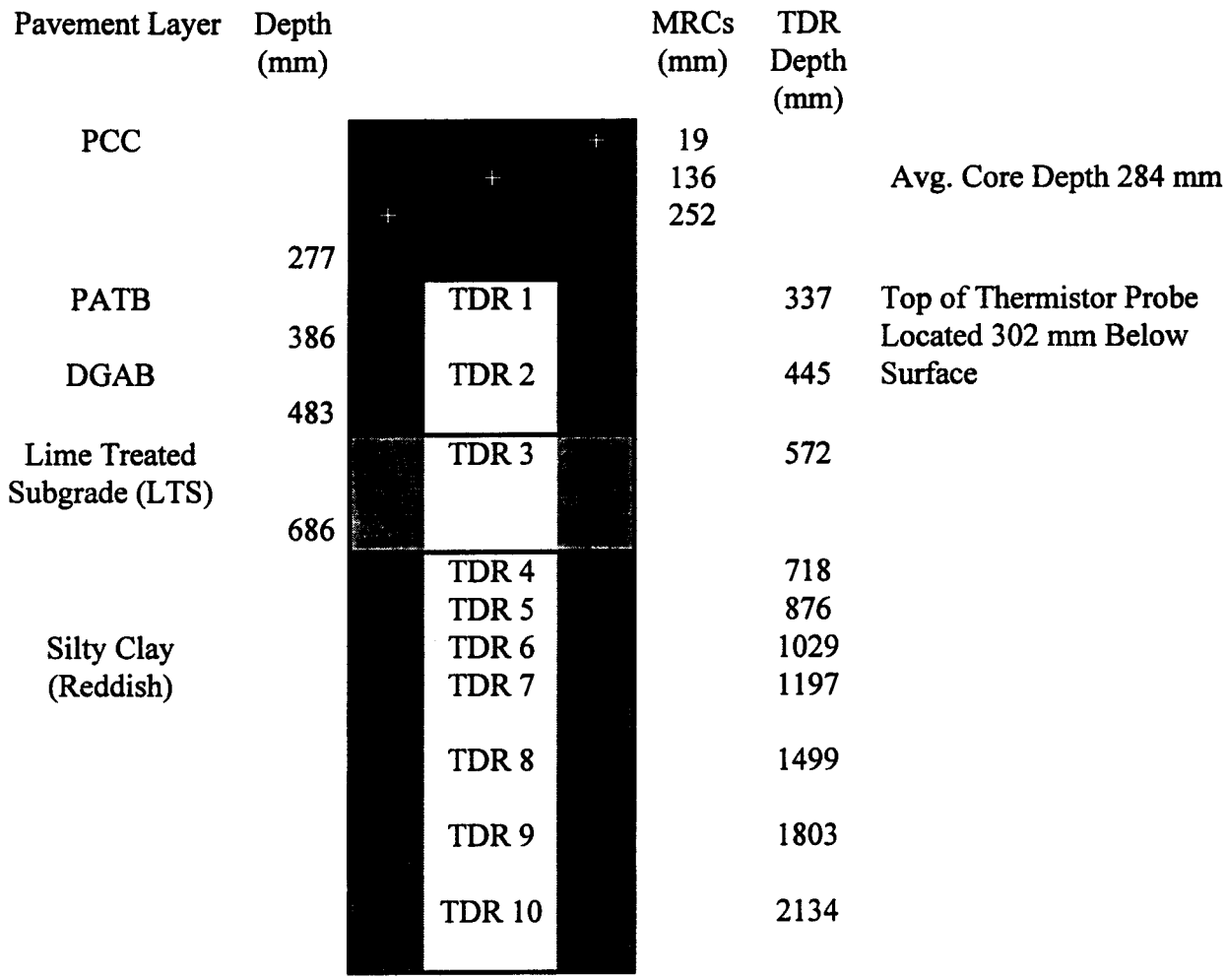


Figure 2.4 Profile of Pavement Structure and Probe Depths, 370212

The instrumentation installation at station 5+15 of 370205 was completed on October 18, 1993. Excavation proceeded as it did for 370201 with the exception of a material change between 300-500 mm below the subgrade surface. The reddish silty clay with mica turned to a mottled grayish white clay with particles and traces of reddish silty clay with mica. Handling of this material was difficult and time consuming to ensure placement consistent with removal. The MRC thermistor probe was placed to within 57 mm of the subgrade surface with the bottom TDR probe placed at 2.165 m. The other TDR probes were placed in order as defined in Figure 2.2.

To check for breakage of the TDR probes during installation, each probe was connected to the cable tester and the wave form was monitored during compaction of the material around it. The TDR traces are included in Appendix C. The cables coming from the TDR probes were staggered along the perimeter of the instrument hole to decrease the amount of water channeled into the hole. The top of the thermistor probe was 45 mm for 370201 and 57 mm for 370205 from the surface of the subgrade layer. For site 370212 the thermistor probe was 25 mm below the PCC layer and for site 370208 the top of the thermistor probe was placed within 25 mm of the PATB surface. The cables from all instrumentation installed converged at the opening of the flexible conduit pipe, which was placed about 50 mm from the edge of the instrumentation hole. The cables were then tie wrapped and passed through the conduit to the location where the equipment cabinet would be placed. The end of the conduit was plugged with a mastic pipe sealant.

For all four sites the conduit with MRC, TDR and thermocouple cables was placed at an angle to meet up with the load instrumentation cables to be installed at stations 5+25. The cable ends were installed in ziploc bags and wrapped and buried in green garbage bags at the shoulder of the roadway. Survey stakes were used to define the location.

Tables 3 and 4 present the installed depths of the TDR probes, and the thermistor sensors respectively. Table 5 gives TDR, field, and laboratory measured moisture content during installation. A comparison of the moisture content from the TDR traces, field, and laboratory determination indicate some discrepancies. The discrepancies are particularly pronounced for 370208 where the TDR moisture readings are much higher than the field or laboratory determinations. The field and laboratory moisture contents generally compare more favorably. Some moisture could have been released during drilling and handling of the soil because of the high temperatures on the day of installations. This would explain the consistently lower readings obtained from the field and laboratory testing as opposed to the TDR readings. It should also be noted that the calculation of moisture is dependent on the calibration inputs to the TDR model. Differences of moisture content in the range of 1 to 2% are not uncommon.

During construction of the base layers at 370201, 370205 and 370208, four thermocouples were placed in the LCB or DGAB layer at 0, 51, 102 and 152 mm depths from the interface at the subgrade layer. If the LCB was less than 152 mm the thermocouple was placed at the LCB surface. The 330 mm length stainless steel probe was placed 19 mm into the PCC on a angle so that thermistors are 25 mm from the

bottom and at the middle of the PCC layer. The thermocouples and the MRC stainless steel thermistor probes were temporarily protected during the placement of LCB with a sandbag. After the passage of the paving train, the thermocouples were positioned at required levels in the LCB and the hole left by the sandbag was patched with fresh lean concrete. The MRC stainless steel thermistor probe was pulled up into position in the fresh Portland Cement Concrete by a string before the concrete had set.

Table 3. Installed Depths of TDR Sensors

Sensor #	Depth from Pavement Surface (m)				Layer			
	Section ID				Section ID			
	370201	370205	370208	370212	370201	370205	370208	370212
01	0.279	0.508	0.584	0.337	DGAB	LTS	LTS	PATB
02	0.584	0.654	0.742	0.445	LTS	LTS	SG	DGAB
03	0.813	0.813	0.892	0.572	SG*	SG	SG	LTS
04	0.959	0.965	1.041	0.718	SG	SG	SG	SG
05	1.118	1.099	1.200	0.876	SG	SG	SG	SG
06	1.257	1.264	1.346	1.029	SG	SG	SG	SG
07	1.416	1.416	1.499	1.097	SG	SG	SG	SG
08	1.575	1.575	1.702	1.499	SG	SG	SG	SG
09	1.880	1.880	1.956	1.803	SG	SG	SG	SG
10	2.159	2.165	2.235	2.134	SG	SG	SG	SG

* SG-subgrade

The moisture probe and thermocouples installed in the DGAB layer of section 370201 could not be compacted without shattering the probe or displacing the thermocouples. Compaction was avoided in a area about 1.9 m^2 around the stake location of the probe. NCDOT (Dr. Shin Wu, Ed Arrowood) and Alex Rutka (PMSL) installed the majority of the thermocouples in the LCB layers, and the thermistor probe in the PCC layers, during the construction of these layers.

The equipment cabinet to hold the datalogger, battery pack and cabling from the instrumentation hole was installed at 370201 on May 5, 1994 in preparation for the open house to showcase the environmental and load response instrumentation. Data collection took place on May 9-10, 1994. The wiring of the datalogger and the ONSITE program were modified to incorporate the four thermocouples.

A hole to accommodate the piezometer was drilled in conjunction with the holes to install the multi-depth deflectometers (MDD) on May 6, 1994. The hole collapsed due to heavy rains before the piezometer could be installed. The installation of the piezometer was rescheduled to August 5, 1994. The installation followed the procedures as described in the "LTPP Seasonal Monitoring Program: Instrumentation Installation and Data

Collection Guidelines." The combination piezometer/benchmark was installed 0.3 m off the edge of the PCC paved shoulder at station 4+00 of site 370201 to a depth of 4.470 m. A 150 mm flight auger was used for drilling the hole. The hole was extended to 4.825 m to compensate for the material that collapsed into the hole during drilling. After the piezometer /benchmark was placed in the hole 2 bags of clean filter sand were added and compacted, followed by 0.432 m of bentonite pellets; the native soil was packed tightly around the frost sleeve. The piezometer/benchmark cover was placed in concrete and the surface leveled and finished.

The cabinets at 370205, 370208 and 370212 were installed August 4-5, 1994. These cabinets were equipped with dataloggers and batteries supplied by NCDOT. Excess washed sand from the piezometer installation was used as bedding material for the equipment cabinet, and also in the trench from the instrument hole to the equipment cabinet. This trench was extended past the equipment cabinet towards the ditch at a downward slope to help drain excess surface water away from the equipment cabinet.

Subsequent to the installation of the equipment cabinets a request by Max Tate (FHWA) to Ivan Pecnik, North Atlantic Regional Engineer, to have the cabinets moved to the opposite side of the ditch from the pavement shoulder area for safety and security reasons was received. Extension cables, 4.7 m to 5.5 m in length, were fabricated at the NARCO to move the cabinets from their present location. The cabinets were moved September 21-22, 1994. The MRC thermistor, thermocouples (type T) and TDR cables were extended. Water tight connections were completed at each connection and the flexible conduit was extended to the location on the opposite side of the ditch. The cabinets were moved and the cables reconnected.

During the initiation of 370201 into the core SMP on May 15, 1995 some of the TDR cables were extended with 0.6 m to 1.2 m coaxial extensions for easier access to the mobile data collection unit. The problems with the thermocouple leads (poor datalogger connections) were resolved and all instrumentation was in working order with the exception of TDR cable 10 at 370212; the connector was damaged and not accessible for repair.

Snap rings were installed to measure joint width and movement at the initiation of data collection on May 15, 1995.

Site Repair and Cleanup

The instrumentation at the SPS-2 sites were installed during construction; there is no visible evidence as to the location of the instrumentation. The cabinets were filled with crushed rock to dissipate the moisture. A sandy-gravel was placed around the cabinets at 370201 and 370205 as the clayey material made it difficult to setup the data collection equipment.

Assessment of the Instrumentation Areas

No settlement or cracks have formed at any of the environmental instrument areas. In fact, the location of the instrumentation cannot be visibly determined.

Table 4. Installed Location of MRC Thermistor Sensor

Unit	Channel Number	Depth from Pavement Surface (m)				Remarks
		Section ID				
		370201	370205	370208	370212	
1	1	0.019	0.019	0.019	0.019	This unit was installed in the PCC layer.
	2	0.112	0.108	0.139	0.136	
	3	0.204	0.196	0.259	0.252	
2	TC1	0.229	0.221	0.284	*	This unit was installed in the base
	TC2	0.280	0.272	0.335	*	
	TC3	0.331	0.323	0.386	*	
	TC4	0.381	0.373	0.434	*	
3	4	0.441	0.469	0.481	0.318	This unit was installed below the base in the Subgrade
	5	0.520	0.548	0.553	0.392	
	6	0.593	0.624	0.629	0.467	
	7	0.668	0.701	0.705	0.543	
	8	0.744	0.775	0.784	0.618	
	9	0.895	0.929	0.932	0.770	
	10	1.047	1.080	1.086	0.923	
	11	1.203	1.232	1.237	1.075	
	12	1.354	1.385	1.388	1.228	
	13	1.506	1.537	1.542	1.380	
	14	1.657	1.688	1.691	1.531	
	15	1.811	1.842	1.845	1.685	
	16	1.963	1.993	1.996	1.836	
	17	2.116	2.147	2.150	1.990	
	18	2.273	2.299	2.304	2.137	

* No thermocouples were installed.

Table 5.1 TDR, Field, and Laboratory Moisture Content During Installation
Section 370201

Sensor Number	Sensor Depth (m)	Layer	TDR Moisture Content (by wt)*	Field Moisture Content (by wt)*	Lab Moisture Content (by wt)*
37C01	0.279	DGAB	11.40%	N/A	N/A
37C02	0.584	LTS	41.98	35.1%	33.0%
37C03	0.813	Subgrade	26.00	34.8	14.9
37C04	0.959		35.91	36.0	34.2
37C05	1.118		33.12	36.6	34.6
37C06	1.257		41.03	37.2	34.5
37C07	1.416		31.97	38.9	34.8
37C08	1.575		41.03	34.2	35.8
37C09	1.880		33.12	36.1	35.2
37C10	2.159		30.18	42.0	37.5

* Note: Raw data given in Appendix C

Table 5.2 TDR, Field, and Laboratory Moisture Content During Installation
Section 370205

Sensor Number	Sensor Depth (m)	Layer	TDR Moisture Content (by wt)*	Field Moisture Content (by wt)*	Lab Moisture Content (by wt)*
37D01	0.508	LTS	31.97%	24.3%	22.1%
37D02	0.654		29.03	24.5	24.5
37D03	0.813	Subgrade	36.45	30.5	28.5
37D04	0.965		40.05	29.0	28.6
37D05	1.099		34.81	31.2	30.6
37D06	1.264		38.54	30.7	30.3
37D07	1.416		38.54	33.2	30.6
37D08	1.575		38.54	30.7	29.7
37D09	1.880		33.12	32.9	31.6
37D10	2.165		N/A	31.3	29.6

* Note: Raw data given in Appendix C

Table 5.3 TDR, Field, and Laboratory Moisture Content During Installation
Section 370208

Sensor Number	Sensor Depth (m)	Layer	TDR Moisture Content (by wt)*	Field Moisture Content (by wt)*	Lab Moisture Content (by wt)*
37A01	0.584	LTS	16.75%	16.3%	13.9%
37A02	0.743	Subgrade	26.61	18.0	15.2
37A03	0.892		19.82	11.3	10.0
37A04	1.041		19.82	10.9	10.4
37A05	1.200		17.97	12.1	10.0
37A06	1.346		18.59	9.8	9.4
37A07	1.499		20.44	10.5	9.3
37A08	1.702		24.77	11.8	11.0
37A09	1.956		22.92	11.1	11.7
37A10	2.235		N/A	10.6	10.3

Note: Raw data given in Appendix C

Table 5.4 TDR, Field, and Laboratory Moisture Content During Installation
Section 370212

Sensor Number	Sensor Depth (m)	Layer	TDR Moisture Content (by wt)*	Field Moisture Content (by wt)*	Lab Moisture Content (by wt)*
37B01	0.337	PATB	10.83%	N/A	N/A
37B02	0.445	DGAB	3.09	2.7%	2.9%
37B03	0.572	LTS	34.81	12.3	10.2
37B04	0.718	Subgrade	39.05	33.8	32.1
37B05	0.876		38.54	34.3	19.6
37B06	1.029		40.05	32.8	30.9
37B07	1.197		35.91	32.4	30.5
37B08	1.499		33.69	34.3	30.1
37B09	1.803		41.03	34.3	30.2
37B10	2.134		N/A	33.1	29.6

* Note: Raw data given in Appendix C

III. Initial Data Collection

Environmental data was collected at sites 370201, 370205, 370208 and 370212 to correspond with the pavement load response testing in the spring and fall of 1994 and 1995. Site 370201 was included in the SMP core experiment on May 14, 1995. Environmental data was collected at all four SMP sites on May 15 and 16, 1995.

The May 15 and 16, 1995 activities included initial data collection on the site and checks on the functionality of installed equipment. This consisted of the examination of the data collected over the day by the onsite datalogger, data collection with the mobile CR10 datalogger and checking the data collected with the mobile unit. Deflection testing and an elevation survey were done as part of the data collection for 370201. A sample of the data collected by the onsite datalogger is presented in Appendix D (Table D-1).

Subsurface Temperature

The pavement subsurface temperature profiles collected on May 15 and 16, 1995 by the CR10 dataloggers, were examined. The equipment and dataloggers appeared to be functioning properly. The battery voltages were checked and found to be acceptable. The plots of the temperature profiles are presented in Appendix D (figures D-1 and D-2).

TDR Measurements

TDR data was collected using the mobile system provided by FHWA. The mobile system contains a CR10 datalogger, battery pack, two TDR multiplexers, and a resistance multiplexer circuit board. Version 2.2 of the MOBILE program was used to collect and record the TDR wave form traced for each sensor.

Figure D-3 in Appendix D shows the initial TDR traces collected with the MOBILE data acquisition system for all 10 sensors at site 370201. Only the second set of TDR traces are shown in the appendix because the first set of traces were used to fine tune the starting locations of the traces. The traces indicated that the multiplexers of the mobile system and TDR sensors were working properly. Also shown in Appendix D are the TDR traces, for site 370201, collected after the cabinet was moved in August 1994. For the supplemental sites TDR 10 at 370212 was non-functional; all the others provided excellent traces.

Deflection Measurement Data

Deflection measurements were performed at site 370201 following procedures described in the "LTPP Seasonal Monitoring Program: Instrumentation Installation and Data Collection Guidelines". The analysis results from the FWDCHECK program from the May 15, 1995 testing are presented in Appendix D.

Longitudinal Profile Data

According to the guidelines, since this is in a non-frost area, the survey should be performed on four different occasions; one survey during the middle of each season. Five surveys have already been performed at site 370201; the first in the spring of 1994 (March 30, 1994), the second and third in the winter (January 6, 1996 and February 28, 1996), the fourth in the spring of 1996 (April 23, 1996) and the fifth during the summer season (August 26, 1996).

Elevation Surveys

One surface elevation survey was performed, following the guidelines, on the initial data collection day at site 370201. It was assumed that the elevation at the top of the piezometer pipe was 1.000 meter. The survey was conducted on May 15, 1995 and the results are presented in Appendix D. Since then, six surface elevation surveys have been performed at site 370201.

Water Depth

The piezometer on May 15, 1995 was dry, meaning that the groundwater level was below the depth of the piezometer bottom. The clayey soil at 370201 is highly impermeable. The ditch adjoining the roadway fills at each rainfall; the moisture slowly seeps into the soil or evaporates.

Joint Opening and Faulting

The installation of snap rings to measure the joint opening was completed on May 15, 1995; a joint opening and faulting survey were completed on that date. The joint opening and the joint faulting measurements are taken in conjunction with the FWD joint test during each site visit.

IV. Summary

The installation of the seasonal monitoring instrumentation at the North Carolina SPS-2 site near Lexington, NC was initiated on October 17 and 18, 1993. The installation was completed in stages in conjunction with the construction of the base and surface layers. Four sections of the SPS-2 were instrumented for seasonal monitoring; these sections were: 370201, 370205, 370208 and 370212. Section 370201 was included as a core SMP site, while the other three sites were included as supplemental sites. After the initial installation, the equipment cabinets were moved for safety and security reasons on September 21 and 22, 1994. A check of the equipment and initial data collection was completed on May 15 and 16, 1995. The instrumentation, permanently installed at the site, were:

- Time domain reflectometer probes for moisture measurements - 10 probes at each section,
- Thermistor probes for pavement and soil gradient temperature measurements - 1 probe at each section,
- Thermocouples for base temperature measurements - 4 at sections 370201, 370205 and 370208
- Combination piezometer (well) and bench mark to determine changes in water level and pavement elevations - 1 at section 370201 only.

The pavement gradient temperature data has continuous data collection stored in an on-site datalogger at all four sites. The moisture is collected during each site visit (12 times per year) using a mobile datalogger system. The water level and elevation data are to be collected manually for section 370201 during site visits. An AWS was installed August 4, 1994, near section 370260 in the south end of the SPS-2 project. The data collected at the AWS will be used for the seasonal sites as well as the SPS-2.

The test section is on Southbound US Route 52 Lexington By-pass. The SPS-2 is a distance of 7.8 km on a four lane divided highway consisting of two lanes in each direction with a 20.7 m wide median. The pavement structure is different for each of the four seasonal test sections. The PCC layer varies from 203 mm to 279 mm. The base used at sections 370205 and 370208 is a LCB and the base used at section 370201 is a DGAB. Section 370212 has a PATB in combination with a DGAB as its' base. The subgrade for the four sections varies from a silty clayey sand to a clay with traces of mica.

All instrumentation was checked prior to installation at the PMSL facility in Amherst, NY. These initial checks indicated that the instrumentation was within specifications, as required for the seasonal monitoring program. Operational checks during installation indicated that all instrumentation was functioning properly. Some problems were initially encountered with the thermocouple to datalogger connections, but these were resolved over time. The temperature profile for the pavement soils appear reasonable with no outlying sensors.

Moisture content of the soil was determined by TDR method, field moisture determination at time of installation by soil drying, and laboratory results provided by NCDOT Materials and Tests Unit. There were slight differences between the moisture content determined by the TDR method and gravimetric moisture content determined from the samples taken at sites 370201, 370205 and 370212. The fairly large differences for site 370208 were believed to be caused by the handling of the soil material (delay in processing/storing samples) on a very hot installation day. These differences were within the acceptable tolerance. TDR cable 10 at section 370212 had the connector damaged and it could not be repaired, otherwise the TDR sensors for all four sites are providing acceptable traces.

Since the site is an SPS-2 and the seasonal equipment was installed during construction, the installation proceeded differently than the other seasonal sites that have been installed in the North Atlantic Region. This brought with it new challenges which were worked through and the installation was completed.

Data was collected at the sites during the second round monitoring from May 15, 1995 to October 28, 1996. North Carolina has continued the data collection from the ONSITE dataloggers until the resumption of data collection activities by NARCO later this year. Since the completion of installation activities, solar panels have been installed at the SMP sites.

APPENDIX A

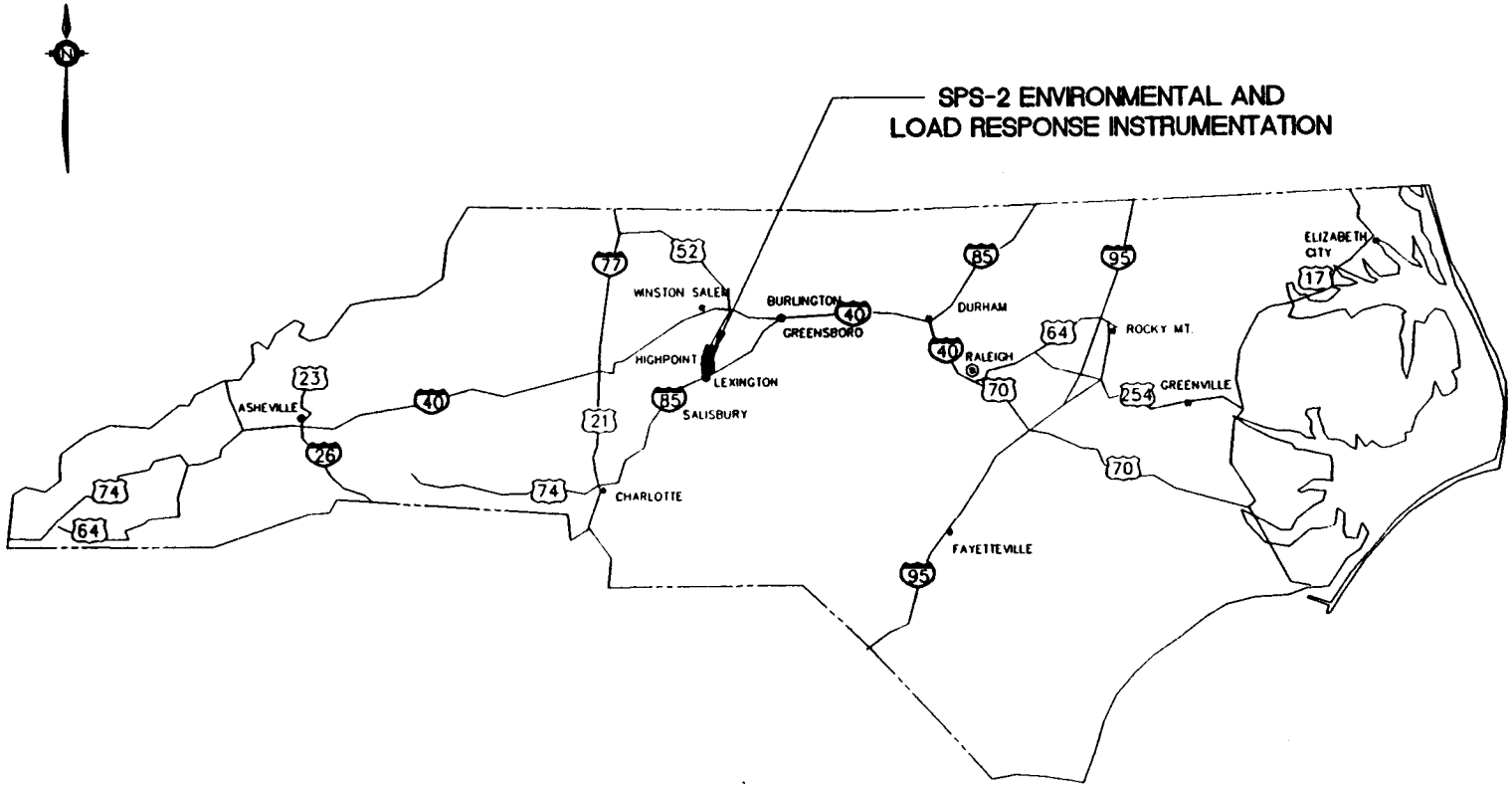
Test Section Background Information

Appendix A contains the following supporting information:

FHWA-LTPP SPS-2 NORTH CAROLINA LOCATION PLAN

STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PAVEMENT MANAGEMENT SYSTEMS LIMITED



CAPITAL CITIES

MAJOR CENTRES

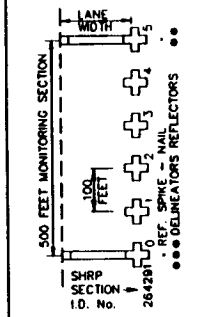
INTERSTATE

U.S. HIGHWAYS

STATE HIGHWAY

AGENCY BORDER

TYPICAL SITE SIGNING & MARKING



SPS 2 CHIPSEAL 36B350

ROAD TEST 264291

NORTH CAROLINA

SCALE: 1-30

FIGURE A-1 - LOCATION PLAN OF NORTH CAROLINA SPS-2 PROJECT ON US 52 SB LEXINGTON BY-PASS, NC. (from SR 1232 at Lexington to Existing US 52 at Welcome)

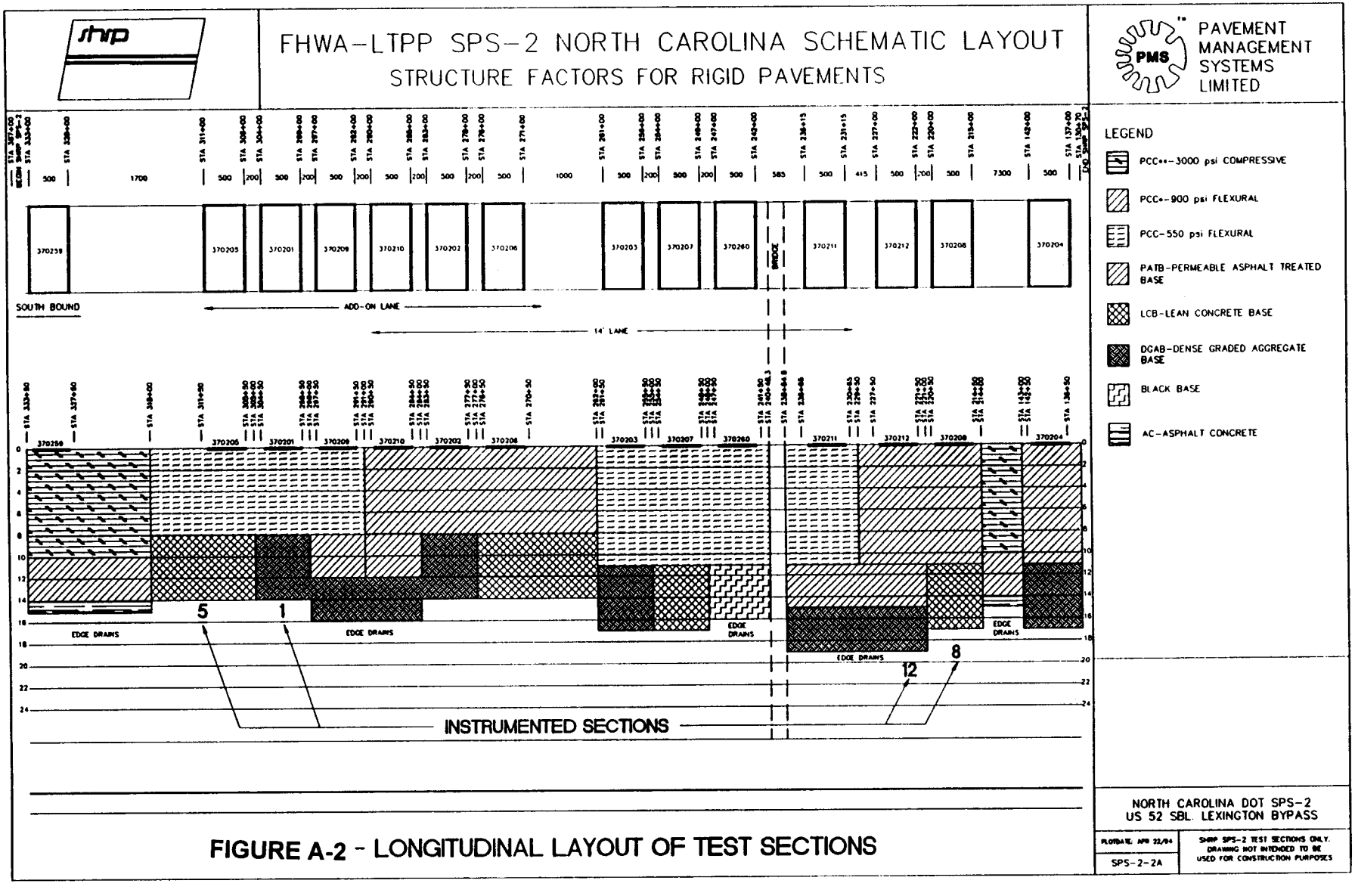
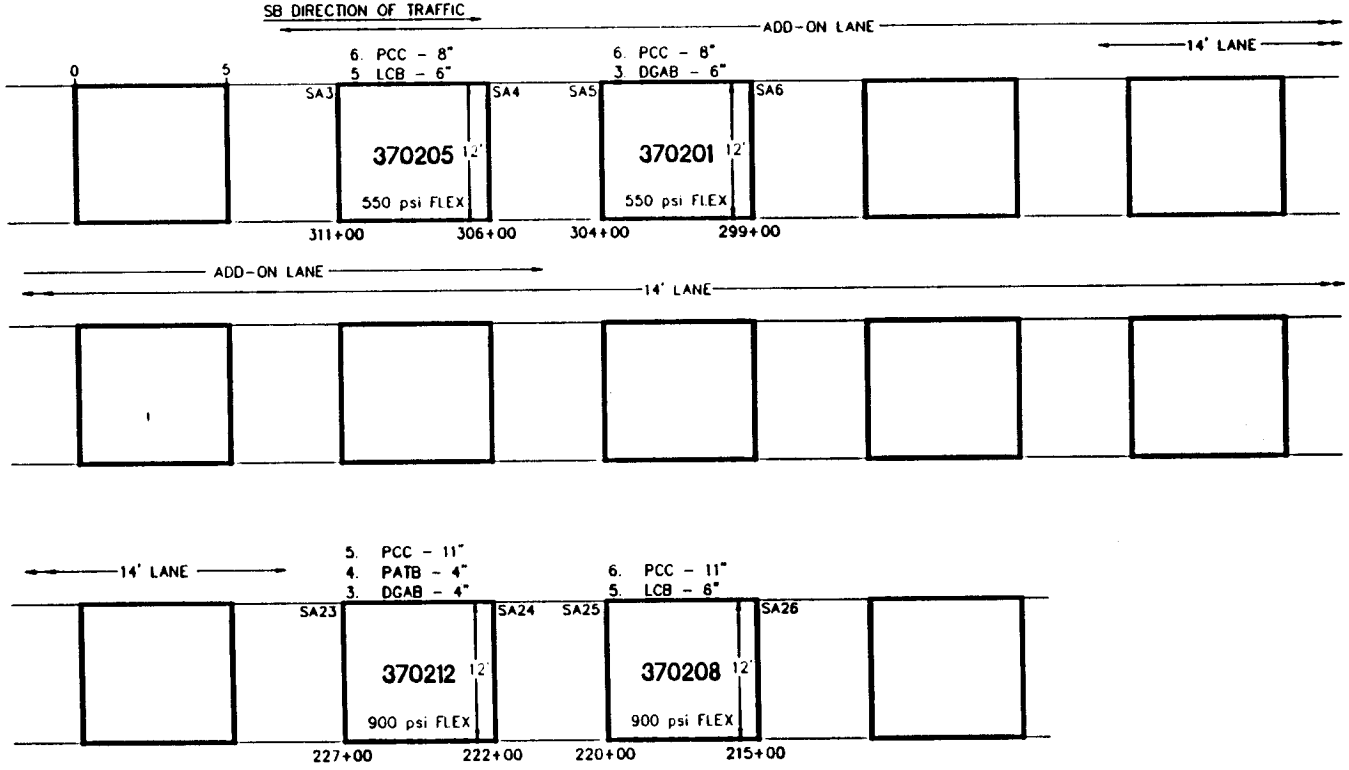


FIGURE A-2 - LONGITUDINAL LAYOUT OF TEST SECTIONS

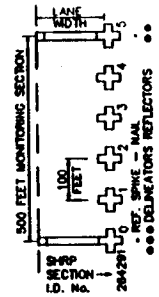
FHWA–LTPP SPS–2 NORTH CAROLINA SEASONAL INSTRUMENTATION

STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PAVEMENT MANAGEMENT SYSTEMS LIMITED



TYPICAL SITE SIGNING & MARKING



ROAD TEST

NORTH CAROLINA DOT SPS–2
US 52 SBL LEXINGTON BYPASS

SPS–2–23a

FHWA SPS–2 TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

FIGURE A-3 - SPS-2 TEST SECTIONS SELECTED FOR INSTRUMENTATION

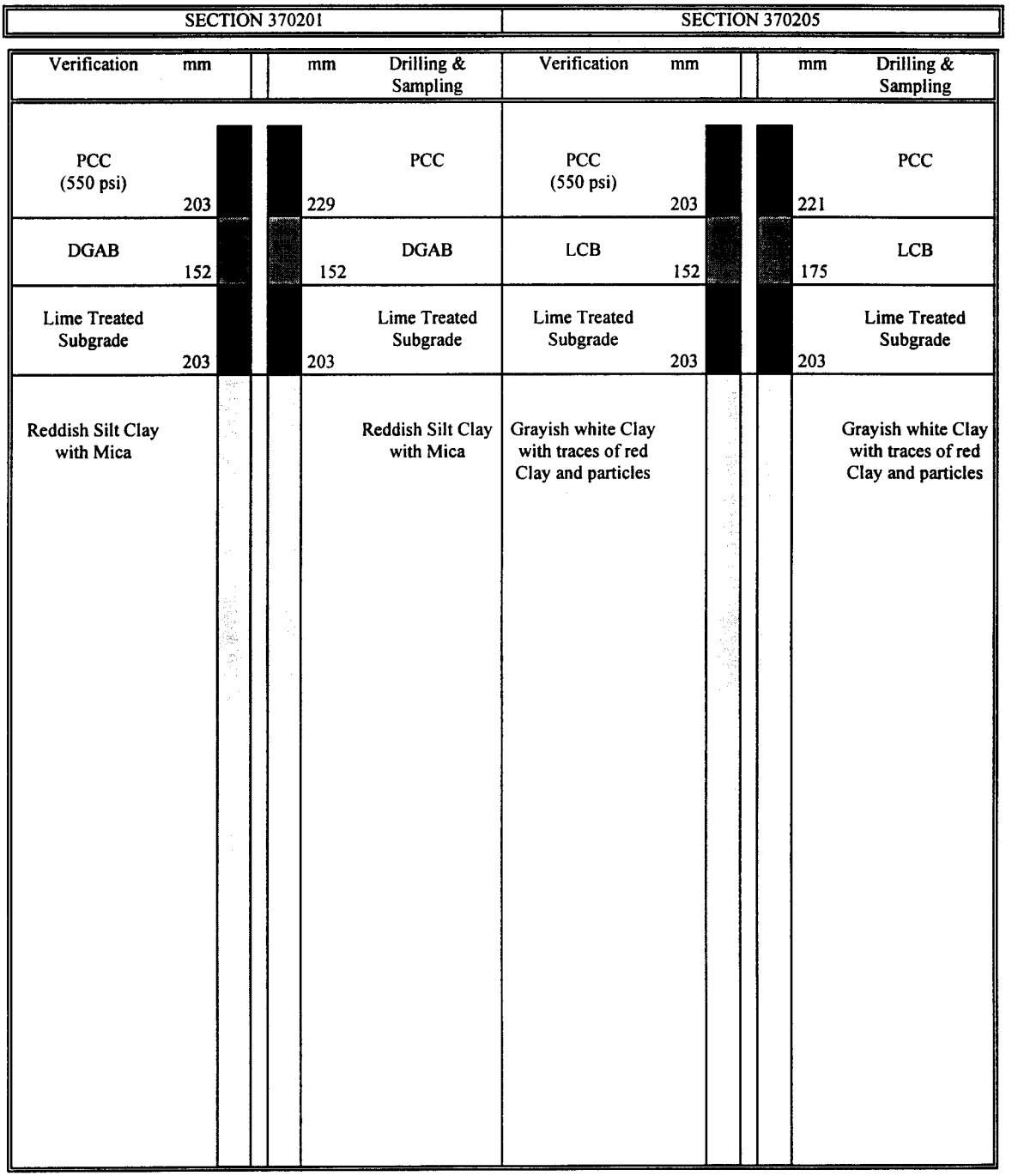


Figure A-4.1 Profile of Pavement Structure for 370201 and 370205

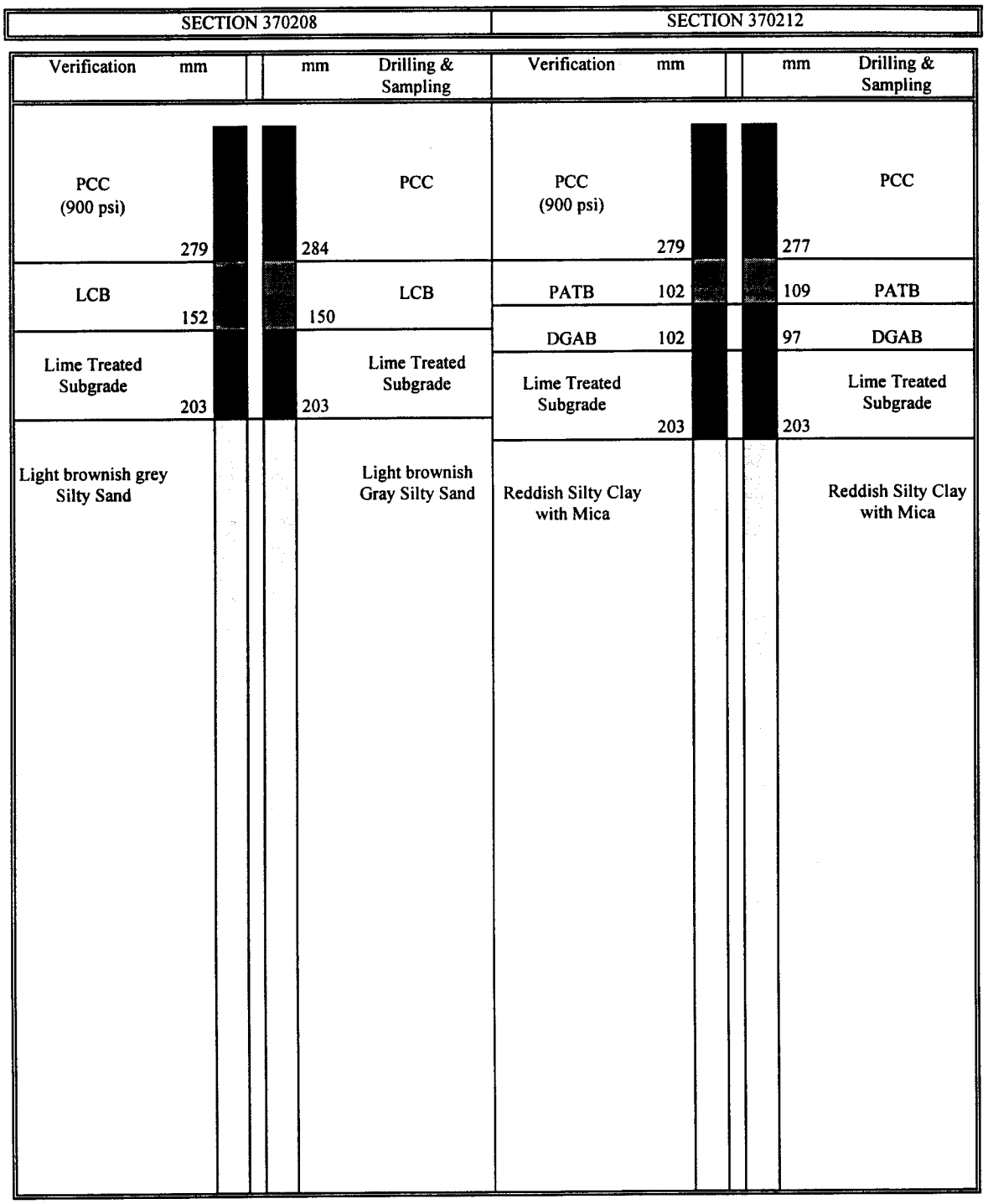


Figure A-4.2 Profile of Pavement Structure for 370208 and 370212

Table A-1.1. Site Performance Summary

Distress and Profile Summary For 370201		
Distress Summary March 10, 1997	Profile Summary	
	Date (mm-dd-yy)	IRI (in/mi)
Low Sev. Trans. Jts Seal Damage – 33 Jts	03-30-94	84.68
Low Sev. Spalling Trans. Jts – 28 Jts, 1.4m	01-06-96	86.79

Falling Weight Deflectometer Data Summary						
Date	Mean Value for Drop HT 2 (mils)					
	Sensor 1	Sensor 1 std. dev.	Sensor 7	Sensor 7 std. dev.	Mean Temp D1 (F)	Min/Max TempD1(F)
10-May-94	3.50	0.43	1.49	0.24	75	66/79
09-Dec-94	3.63	0.72	1.70	0.45	52	49/54

	Effective Thickness	Thickness Std dev	Volumetric K	Volumetric K Std dev	Test Pit Mod. (psi)	
					1	2
10-May-94	9.20	0.42	310	54		
09-Dec-94	9.30	0.49	295	80		

Table A-1.2. Site Performance Summary

Distress and Profile Summary For 370205		
Distress Summary March 10, 1997	Profile Summary	
	Date (mm-dd-yy)	IRI (in/mi)
Low Sev. Trans. Jts Seal Damage – 33 Jts	03-30-94	129.33
Long. Jts Seal Damage – 0.3 m	01-06-96	114.88
Low Sev. Spalling Long. Jts – 0.3 m		
Low Sev. Spalling Trans. Jts – 15 Jts, 1.0m		

Falling Weight Deflectometer Data Summary						
Date	Mean Value for Drop HT 2 (mils)					
	Sensor 1	Sensor 1 std. dev.	Sensor 7	Sensor 7 std. dev.	Mean Temp D1 (F)	Min/Max TempD1(F)
09-May-94	2.79	0.38	1.77	0.15	87	85/89
07-Dec-94	2.71	0.26	1.85	0.13	73	63/77

	Effective Thickness	Thickness Std dev	Volumetric K	Volumetric K Std dev	Test Pit Mod. (psi)	
					1	2
09-May-94	10.81	0.76	297	20		
07-Dec-94	11.15	0.47	288	17		

Table A-1.3. Site Performance Summary

Distress and Profile Summary For 370208		
Distress Summary March 10, 1997	Profile Summary	
	Date (mm-dd-yy)	IRI (in/mi)
Low Sev. Trans. Jts Seal Damage – 34 Jts	03-30-94	111.15
Low Sev. Spalling Long. Jts – 1.3 m	01-06-96	112.57
Low Sev. Spalling Trans. Jts – 1 Jts, 0.1 m		
Mod Sev. Spalling Trans. Jts – 1 Jts, 0.1 m		

Falling Weight Deflectometer Data Summary						
Date	Mean Value for Drop HT 2 (mils)					
	Sensor 1	Sensor 1 std. dev.	Sensor 7	Sensor 7 std. dev.	Mean Temp D1 (F)	Min/Max TempD1(F)
14-May-94	2.06	0.29	1.41	0.33	87	86/88
08-Dec-94	2.40	0.37	1.76	0.37	65	55/70

	Effective Thickness	Thickness Std dev	Volumetric K	Volumetric K Std dev	Test Pit Mod. (psi)	
					1	2
14-May-94	12.05	0.49	363	4		
	12.35	0.34	435	146		
08-Dec-94	11.68	0.58	326	75		

Note: FWD subsection boundaries at 250 ft as entered into RIMS.

Table A-1.4. Site Performance Summary

Distress and Profile Summary For 370212		
Distress Summary March 10, 1997	Profile Summary	
	Date (mm-dd-yy)	IRI (in/mi)
High Sev. Corner Breaks – 2	03-30-94	68.27
Low Sev. Trans. Jts Seal Damage – 34 Jts	01-06-96	67.05

Falling Weight Deflectometer Data Summary						
Date	Mean Value for Drop HT 2 (mils)					
	Sensor 1	Sensor 1 std. dev.	Sensor 7	Sensor 7 std. dev.	Mean Temp D1 (F)	Min/Max TempD1(F)
14-May-94	2.44	0.27	1.26	0.21	79	77/81
08-Dec-94	2.32	0.30	1.27	0.25	62	50/68

	Effective Thickness	Thickness Std dev	Volumetric K	Volumetric K Std dev	Test Pit Mod. (psi)	
					1	2
14-May-94	10.71	0.31	394	64		
08-Dec-94	11.11	0.25	407	77		

Table A-2 Uniformity Survey Results (370201)

Seasonal Uniformity Survey	Falling Weight Deflectometer
Site Number: 370201	Data Collection and
Date Surveyed: December 9, 1994	Processing Summary

Section Interval (ft)	Mean Deflection Values for HT 2 (mils) – Corrected							
	Sensor 1	Sensor 1 Std dev	Sensor 7	Sensor 7 std dev	Subg modulus (psi)	Subg Modulus std dev	Effective SN	SN std dev
379-532	4.18	0.64	2.05	0.42	240	38	8.98	0.41

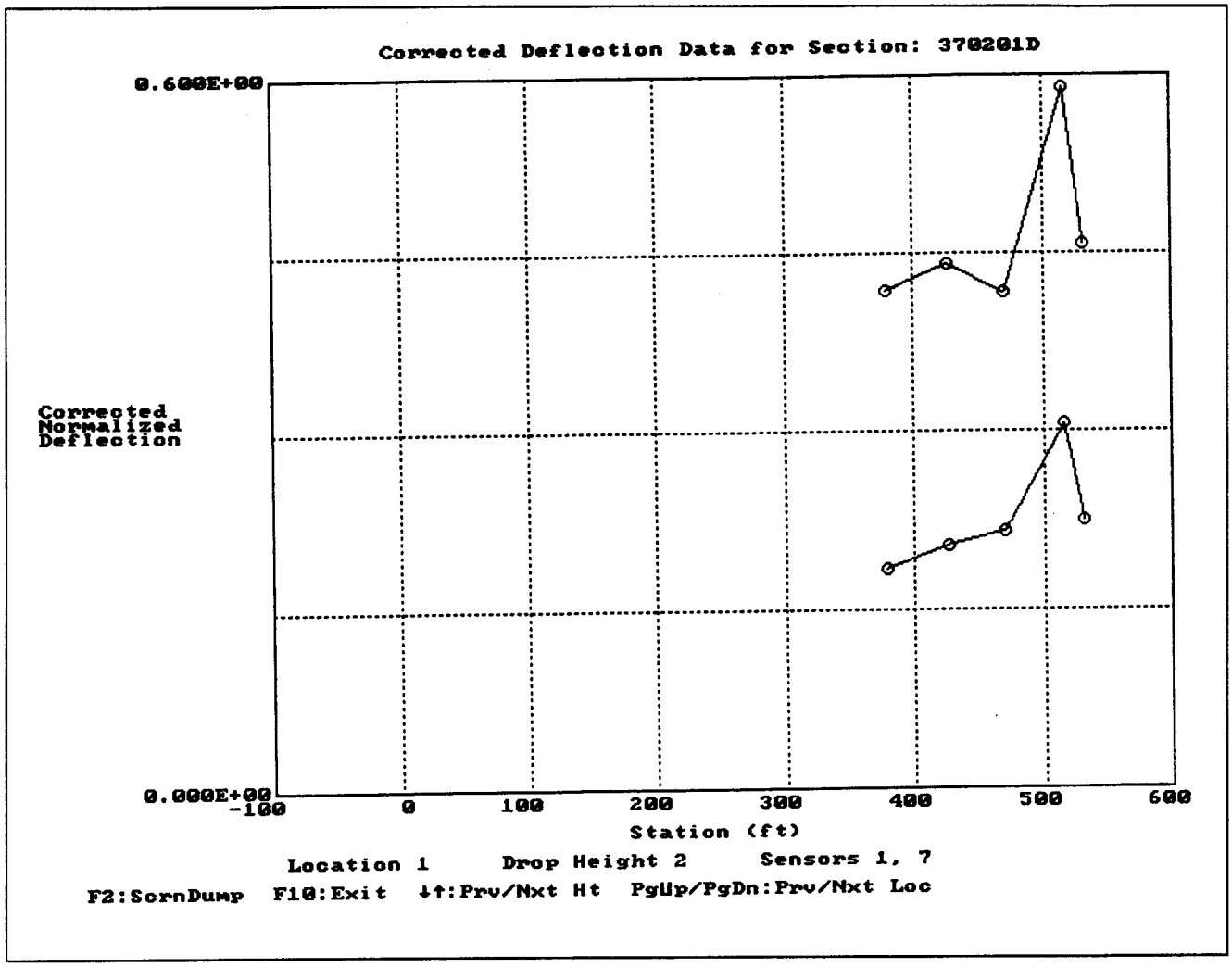


Figure A-5. Deflection Profile from FWDCHECK
(Test Date December 9, 1994)

Table A-3. Volumetric K and Effective Thickness from FWDCHECK
(Test Date December 9, 1994)

Flexible Pavement Thickness Statistics – 370201D - Drop Height 2			
Subsection	Station	Volumetric K	Effective Thickness
1	379	277	9.13
	426	256	8.94
	470	249	9.50
	516	177	8.38
	532	239	8.94
2			
(Not Done)			
Subsection 1	Overall Mean	240	8.98
	Standard Deviation	38	0.41
	Coeff of Variation	15.70%	4.53%

Note: No test pit data found, therefore no results exist.

APPENDIX B

Supporting Site Visit and Installed Instrument Information

Appendix B contains the following supporting information:

Correspondence from the Lexington SPS-2 Seasonal Site and Selection of Core Seasonal Site 370201

Figure B-1. LTPP Demo Data from a Nearby Site

Table B-1. MRC Probe Calibration

Table B-2. Description of MRC Thermistor Probe, Sensor Spacing and Thermocouples Placed in Base Layer

Table B-3. TDR Probes Calibration

Figure B-2. TDR Traces Obtained During Calibration

PAVEMENT
MANAGEMENT
SYSTEMS

March 11, 1994
50450910-13.18.2

Dr. Shie Shin-Wu
Pavement Management Section
Century Center
North Carolina Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

RE: Schedules for SPS-2 Post Construction Performance Monitoring and Environmental Conditions

Dear Dr. Shin-Wu,

It is proposed that post-construction performance monitoring of the SPS-2 at Lexington NC, be initiated in the week of March 28-31, by the placement of pavement markings delineating the test section. The crew of the profilometer, Basil Abukhater and Scott Comstock will assist your staff in layout, placement of iron bars, and painting of transverse lines, crosses at 100' intervals, and section ID numbers. The iron bars are essentially 1/2" diameter by 12" long spikes driven flush with the surface of the shoulder next to stations 0+00 and 5+00 of the test section, as permanent station markers. A hole can be pre-drilled into the concrete shoulders. Profile measurements will then be made of these test sections. The pavement surface should be swept prior to these measurements.

In the week beginning April 25, the seasonal monitoring crew (Mike Zawisa) will wire up the TDR moisture and thermistor probes to terminals and to a CR10 to be housed in a roadside (telephone) cabinet. An initial set of observations will be made using the NARO mobile instrumentation equipment.

There is space remaining in the cabinet for a terminal block for the subsurface strain gauge, if so desired. The shoulder back slopes should be finished to shape prior to installation of the cabinet.

415 LAWRENCE BELL DRIVE
UNIT #3
AMHERST, N.Y. 14221
TEL. (716) 632-0804
FAX (716) 632-4808

In the week beginning May 9, the FWD should be on-site to conduct post-construction testing of the SPS-2 test sections. This testing will take place at the rate of two test sections per day, weather permitting, and should be completed in seven (7) working days. It is proposed to carry out some FWD point testing at selected locations in conjunction with runs made with the loaded test vehicle. The NARO mobile instrumentation equipment will be available to take measurements during the load response testing, and to be a part of the Open House workshop demonstration.

Yours Sincerely,

William A. Phang

William A. Phang, D. Eng.
Program Manager, FHWA-LTPP
Pavement Management Systems Limited

WAP/tf

c.c. I.J. Pecnik
C. Richter
D. Morian
B. Henderson
G. Rada

PAVEMENT
MANAGEMENT
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July 07, 1994
50451010-12.18.2

Dr. Shie Shin-Wu
Pavement Management Section
Century Center
North Carolina Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

Dear Dr. Shin-Wu:

As a follow-up to the Load Response Instrumentation Open House you hosted in May, we at PMS would like to arrange further activities needed to carry the project forward. In order to do so there are several items which need to be coordinated between our offices.

The first item is to schedule your drilling crew concurrently with our field crew for installation of the piezometer. This can occur when the crew returns to complete drilling for installation of the load response instrumentation.

At the same time, we need to perform several other activities which we have not yet been able to complete. These include hooking up the onsite data logger, installation of the snap rings for monitoring joint movement, FWD testing, running a set of levels, and conducting a first round of seasonal data testing. Preferably, this could be scheduled in conjunction with the load response data collection this summer.

It is important that we, in order for us to proceed with other seasonal and load response installations, provide for replacement of the moisture probes which were installed at these three sites. The equipment involved consists of 3 MRC thermistor probes and 30 TDR probes. We estimate the cost of the thermistors at $1,050.00 each and of the TDR's at $160.00 each.

We recently learned that FHWA is in the process of making the funding for the Open House available to you. This includes money for the seasonal instrumentation probes already mentioned. We are willing to cooperate with you to secure the equipment, in order to insure that it will be consistent with that installed at other seasonal sites. If we can assist you in locating or securing this equipment, please let us know.

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AMHERST, N.Y. 14221
TEL. (716) 632-0804
FAX (716) 632-4808

We also need to provide you with software and documentation for the datalogging units. The current information is attached.

An issue of further concern is penetration of surface water into the pavement layers. We hope that exposure to water infiltration prior to final installation of the protective caps has not distorted the material response data to be collected. Hopefully, we can include a positive interim method for preventing water infiltration at other sites in the Installation Guidelines.

Please contact our office regarding these, or any other outstanding items related to the Open House or the SPS-2 with which we can be of assistance. We expect that we will be able to tie these loose ends up in the near future.

Yours Sincerely,

Dennis A. Morian

Dennis A. Morian
Project Engineer
Pavement Management Systems Limited

DM/tf

attachment

C.C I.J. Pecnik
B. Phang
B. Henderson

U.S. Department of Transportation
Federal Highway Administration

Memorandum

6300 Georgetown Pike
McLean, Virginia 22101-2296

COPY

Subject: Nomination of Seasonal Monitoring Sites
North Carolina SPS-2 Section

Date: July 29, 1994

From: Aramis López, Jr.
Long-Term Pavement Performance Division

Reply to Attn. of: HNR-40

To: Mr. Ivan Pecnik
~~Mr. Bill Phang~~

Reference is made to Mr. Dennis Morian letter of July 7, requesting permission to include an "SPS-2 Section" in North Carolina into the core experiment of the seasonal monitoring program (SMP). The idea of incorporating SPS-1 and SPS-2 sections into the core experiment to fill missing or incomplete cells was thought to be a good one; and everyone present at the last SMP meeting in Austin, Texas, agreed that we should do this. It was also agreed at this meeting that we would limit SPS-1 and -2 sections for inclusion into the SMP to those with unbound bases and/or subbases only (i.e., no stabilized subsurface layers) and those having the weakest (thinnest) structure.

Going back to Dennis' letter, we concur with his assessment of the benefits of including one of the SPS-2 sections in North Carolina into the SMP core experiment. However, at this point we cannot recommend that such a section be accepted into the program because a single SPS-2 section has not been formally nominated. The North Atlantic RCO needs to nominate a specific section and then to provide pertinent data for this section; i.e., the same procedure followed for nomination of other SMP sections. In addition, the North Atlantic RCO needs to verify that the section nominated will last through at least three monitoring cycles without rehabilitation, and that the North Carolina DOT will provide traffic control as required (12 times per year). Once this information is received, we will proceed with an acceptance or rejection recommendation.

Should you have any questions or require further information, do not hesitate to contact me at 703-285-2013.

PCS/LAW

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ORIGINAL

August 24, 1994
50451025-12.18

Mr. Marvin Patrick Strong
State Research Engineer
North Carolina Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 25201

Dear Mr. Strong:

The LTPP program is preparing to recruit the second round of seasonal site nominations. In accordance with your previous discussions with Brandt Henderson of our staff, we plan to perform installations at Lexington on May 15-16, 1995, and at Elizabeth City on May 17-18, 1995.

For your information we have enclosed a "Seasonal Monitoring Program Guideline" as well as a sample of one of our existing installation reports. Also enclosed is the State Participation Synopsis, with accompanying site data sheet. Please complete and return this datasheet, for both sites. We must forward this information to the FHWA as a part of the seasonal site approval process.

One change to the "Synopsis" which merits pointing out is that data is generally collected monthly; therefore, under the Core Experiment Item #2, this will be the frequency of traffic control needed. In a wet freeze environment, this would be increased to bi-weekly during the thaw period, only.

In general, the seasonal instrumentation consists of moisture, temperature, water table depth, and frost depth measurements beneath the pavement. Along with this are climatic measurements of air temperature and precipitation. Pages II-36-39 of the "Guidelines" indicate areas of responsibility for the FHWA, RCOC, and agency.

If your agency desires to collect additional data to that called for by the LTPP seasonal program, it may do so at it's own expense. For example, a wind speed indicator or a solar radiation collector can be added to the weather data collection. This additional data then can be downloaded to the datalogger, as well.

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General items required of the agency for installation are a drill rig with the capability to drill a 6" diameter hole to a 15' depth for installation of a piezometer. In addition, the cover for the observation hole, bentonite, and filter sand to fill the hole are to be provided by the agency. The agency is also to provide coring and auguring equipment for holes 10 and 12" in diameter up to a maximum depth of 7'. In addition, a concrete pavement saw must be provided to cut a trench from the observation hole to the pavement edge. This trench will carry the instrumentation cabling to the equipment cabinet adjacent to the roadway.

The agency will also be responsible for traffic control for collecting the monthly data. This will require a lane closure approximately 300' in length at the instrument hole, for essentially one day each month.

The addition of the seasonal monitoring data, at different geographical locations promises to significantly enhance the LTPP database, and increase the potential analysis of the data.

Thank you for supporting seasonal data sites.

Yours Sincerely,

Dave A. Main

Pavement Management Systems Limited

DM/tf

enclosure

C.C. I.J. Pecnik
B. Phang
B. Henderson

PAVEMENT
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ORIGINAL

September 15, 1994
50451025-13.18.2

Dr. Shie Shin-Wu
Pavement Management Section
Century Center
North Carolina Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

RE: Relocation of Environmental Instrumentation Cabinets and Data Collection at SPS-2 sites near Lexington, NC

Dear Dr. Shin-Wu:

The following is the schedule for the relocation of the cabinets for the environmental data at the NC SPS-2 site in Lexington, NC:

September 21: Relocate 370205 and 370201

September 22: Relocate 370212 and 370208

We will contact you on arrival to arrange for your technician to bring to the site the three (3) Campbell Scientific Dataloggers to be installed at the supplemental sites for data collection associated with the load instrumentation.

As discussed with you, no traffic control is required. However, it would be appropriate to place a caution sign ("WORKERS AHEAD") ahead of the vehicle parked on the shoulder and to place traffic cones at the pavement edge closer to the vehicle. Could you please arrange to let us pick up these items at the construction office?

I have selected this time frame as our profilometer crew will be in the area, and can assist in digging the trenches to run the cables to the cabinets. This will provide us with a couple of weeks of temperature data prior to the load testing scheduled for October 03-14, 1994.

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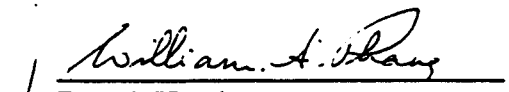
The mobile data collection unit, which contains the Tektronix cable tester and multiplexing circuitry, will not be available until the week of October 10 for moisture data collection due to other commitments. We anticipate having this equipment at the site during October 12-13 time frame to collect the moisture data and download the temperature data at each site along with the A.W.S. data.

If you have any questions or foresee some problems with the schedule, please let us know.

Yours Sincerely,



Brandt Henderson
Manager, Field and Data Operations
Pavement Management Systems Limited

BH/tf

C.C. I.J. Pecnik
B. Phang
G. Rada

PAVEMENT
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SYSTEMS

November 7, 1994

Dr. Shie Shin Wu
North Carolina Department of Transportation
Pavement Management Section
Century Center
P.O. Box 25201
Raleigh, NC 27611

Dear Dr. Shin Wu,

Enclosed please find the weather data collected from the weather station and the moisture data collected from the TDR probes at the SPS-2 sites on US 52 South Bound Lane, Lexington Bypass, during our visits on August 31, September 22-23, and October 10, 1994. The weather data, produced using the split program, consists of five separate reports, Hourly Weather Report Part 1, Hourly Weather Report Part 2, Daily Weather Report Part 1, Daily Weather Report Part 2, Daily Weather Report Part 3 (Daily System Check), and finally the Rainfall Intensity Report. The moisture data of the four seasonal sites, calculated from manual TDR traces, are presented in four spreadsheets, where the volumetric moisture content is calculated from the dielectric constant and the gravimetric moisture content is calculated using the in situ densities measured during the field sampling and testing operations at the time of construction. In hole B, site 370212, the first TDR probe is in the permeable asphalt treated layer, of which the density was not measured, thus the gravimetric moisture content could not be calculated.

If you need further assistance, please call Brandt Henderson or myself.

Yours Sincerely,
PAVEMENT MANAGEMENT SYSTEMS LTD.

Basel Abukhater
Project Engineer

Copies: I.J. Pecnik, B. Phang, Gonzala Rada (w/o attach.), B.Henderson (w/o attach.), Rich Gruel (with attachments)
Enclosures

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February 24, 1995
50451025 - 16.04/13.18.2

Dr. Shie Shin-Wu
Pavement Management Section
Century Center
North Carolina Department of Transportation
P.O. Box 25201
Raleigh, North Carolina 27611

RE: Replacement of Seasonal Instrumentation Equipment used at 3 Load-Response Instrumentation Sites at the SPS-2 Project, Lexington, North Carolina

Dear Dr. Shin-Wu:

In a recent conversation with Aramis Lopez; FHWA, it was indicated that North Carolina would be replacing the instrumentation installed at the SPS-2 load response sites. This letter is to request replacement of the items identified in the attached Figures.

In obtaining the current price information, the vendors indicated the goods could be purchased through NC DOT and forwarded to the North Atlantic Regional office in Amherst, NY, if requested.

We would appreciate your prompt attention to this matter as we are fast approaching the installation dates for this instrumentation.

If there is a problem with this request or you have any questions or need further information, please contact us at your earliest convenience.

Thank you in advance for your attention to this matter.

Yours Sincerely,

Brandt Henderson
Manager, Field and Data Operations
Pavement Management Systems Limited

BH/tf

C.C. I.J. Pecnik, W.A. Phang, A. Lopez

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COPY

MAR 2 8 1995

JOB #
FILE # 13.18.2

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT, JR.
GOVERNOR

P.O. BOX 25201, RALEIGH, N.C. 27611-5201

R. SAMUEL HUNT III
SECRETARY

Memo to: Pat Strong
D. B. Waters
Bill Phang
Gonzalo Rada
Captan M. Stabler
Tom Martin

From: Shin Wu

Date: March 23, 1995

Subject: SPS-2 Data Collection
US 52, Lexington

The spring data collection session is scheduled for the second and third week of May (from May 8 to May 19, 1995). If weather and all things go as plan, we should be able to finish one set of data collection in three days, i.e. traffic control can be removed in early Thursday morning.

The first week we will collect data from station 284 to station 312. Traffic control shall start north of SR 1457. The second week we will collect data from station 214 to station 248. Traffic control shall start from the end of the three lane section. A detail work schedule is attached. I will contact the following persons in case of any change.

Tommy Harbin	(910-896-7020)	Traffic Control
Sgt. S. Collins	(704-857-2498)	Portable Scale
John Feezor	(704-249-9461)	Trucks
Rich Gruel	(301-210-5105)	PCS/Law
Brian Henderson	(716-632-0804)	PMS

Thank you in advance for your cooperation. If you have any question, please contact me at 919-250-4094 or FAX 919-250-4098.

WORK SCHEDULE

Monday	0830	Traffic control set up completed
		Begin LVDT and strain gauge installation
		Prepare for environmental condition monitor data collection
	1300	FWD report to site
	1400	Load trucks to 18 and 32 kip
		Trucks weighted by portable scale (maintenance yard)
	1430	Truck report to site
	1500	Test begin (3 run per truck at 55mph, and 3 run at 35mph)
Tuesday	0500	Prepare equipment for testing
	0600	Begin testing (one hour)
	1000	Begin testing (one hour)
	1400	Reload truck to 20 and 38 kip
		Trucks weighted by portable scale (maintenance yard)
	1430	Trucks report to site
	1500	Begin testing
Wednesday	0500	Prepare equipment for testing
	0600	Begin testing
	1000	Begin testing
	1200	End testing
	1600	Site clean up completed
		Traffic control can be removed anytime after clean up

Brandt Henderson

MAR 31 1995

FILE # 12.18

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION

JAMES B. HUNT, JR.
GOVERNOR

DIVISION OF HIGHWAYS
P.O. BOX 25201. RALEIGH. N.C. 27611-5201

R. SAMUEL HUNT III
SECRETARY

March 27, 1995

MEMORANDUM TO: Shin Wu, Ph.D., P.E.
Jerry Blackwelder, P.E.
Jim Trogdon, P.E.
Pat Strong, P.E.

FROM: Moy Biswas

SUBJECT: LTPP Seasonal Monitoring Program

To discuss plans and procedures for upcoming activities regarding LTPP seasonal monitoring sites in North Carolina, Messrs. Bill Phang and Brandt Henderson of Pavement Management Systems, Ltd., will be here and meet with us.

The meeting is scheduled at 9:00 AM on Tuesday, April 11, 1995 in the conference facility (Room 129) of the Pavement Management Unit.

MB/adj
cc: Max Tate, P.E. (FHWA)
Bill Phang, (PMS, Ltd.)
✓ Brandt Henderson, (PMS, Ltd.), with attachment

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April 20, 1995
50451010-12.18

Dr. Mrinmay "Moy" Biswas
Pavement and Materials Research Engineer
North Carolina Department of Transportation
Division of Highways
P.O. Box 25201
Raleigh, North Carolina 27611-5201

RE: Seasonal Monitoring Program - Supplemental Monitoring

Dear Dr. Biswas:

At our Meeting of April 11, 1995 in Raleigh to discuss plans to install moisture, frost, and temperature sensors at GPS 371028, Elizabeth City, NC, the concept was discussed, of the agency carrying on the monitoring of the GPS site in Year 2, as a supplemental site.

In the normal planned sequence of seasonal monitoring at the GPS site, the data is collected monthly for twelve months of the year, and twice in the Spring months of March and April. The cycle begins in September or October of the year. At the end of the cycle, the above ground sensor connections are removed from the cabinet and the terminal strips and CR10 data recorders cleaned and stored ready for re-installation at the beginning of Year 3 for the next cycle of observations.

If however the agency intends to continue the monitoring during Year 2 as a supplemental site, then these fittings would be left in place. In order to continue the monitoring, the agency would have to acquire the hardware and software to download the CR10 datalogger, and a cable tester to carry out measurement with TDR probes. The agency would also have to have an FWD which was calibrated at the Harrisburg calibration station. The agency profilometer may be used or arrangements can be made with NARO to conduct what measurements are practical with their profilometer.

Details of what measurements and observations are to be made during this period are contained in the FHWA "LTPP Seasonal Monitoring Program: Instrumentation Installation and Data Collection Guidelines", FHWA-RD-94-110, April 1994. QA/QC software "SMPCHECK" is currently under test and review.

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It would certainly be of great value to the SMP to have continuous monitoring at a few sites, and your consideration is requested of adopting this 'supplemental' monitoring for GPS 371028 or for SPS site 370201.

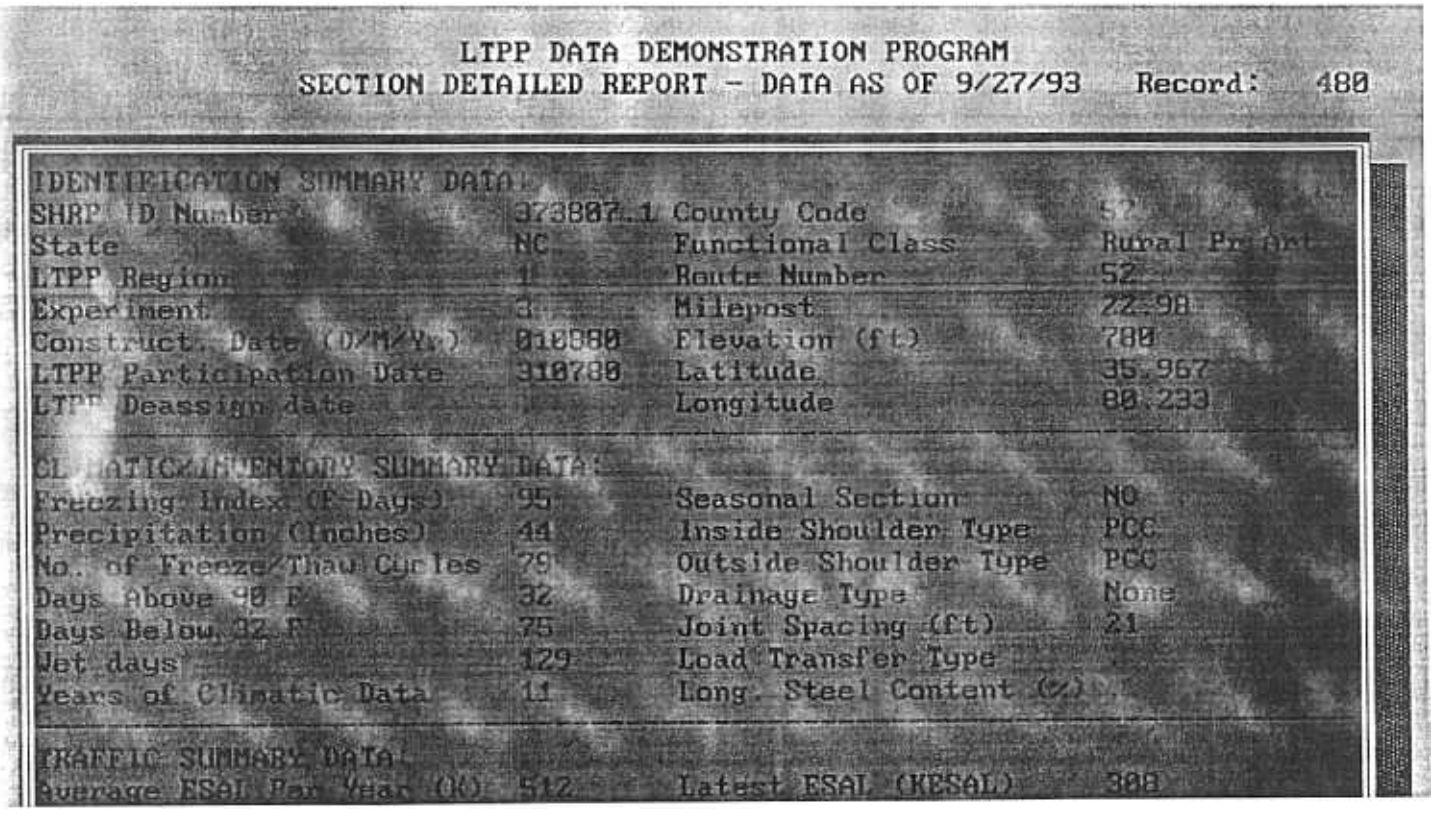
Yours Sincerely,

William A. Phang.

William A. Phang
Program Manager
Pavement Management Systems Limited

WAP/tf

C.C. I.J. Pecnik, RE, NARO
B. Henderson, PMSL
P. Strong, NC DOT



LTPP DATA DEMONSTRATION PROGRAM
SECTION DETAILED REPORT - DATA AS OF 9/27/93 Record: 480

IDENTIFICATION SUMMARY DATA:

SHRP ID Number	373807 1	County Code	52
State	NC	Functional Class	Rural Pr Art
LTPP Region	1	Route Number	52
Experiment	3	Milepost	22.98
Construct. Date (D/M/Yr)	010880	Elevation (ft)	780
LTPP Participation Date	310780	Latitude	35.967
LTPP Deassign date		Longitude	80.233

CLIMATIC/INVENTORY SUMMARY DATA:

Freezing Index (F Days)	95	Seasonal Section	NO
Precipitation (Inches)	44	Inside Shoulder Type	PCC
No. of Freeze/Thaw Cycles	79	Outside Shoulder Type	PCC
Days Above 90 F	32	Drainage Type	None
Days Below 32 F	75	Joint Spacing (ft)	21
Wet days	129	Load Transfer Type	
Years of Climatic Data	11	Long. Steel Content (%)	

TRAFFIC SUMMARY DATA:

Average ESAL Per Year (K)	512	Latest ESAL (KESAL)	308

Figure B-1. LTPP Data Demonstration Program, Environmental Data from Nearby Site

Table B-1.1 MRC Probe Calibration

LTPP Seasonal Monitoring Study	State Code	[37]
MRC Probe Calibration	Test Section Number	[0208]

Before Operation Checks	Calibration Date dd-mmm-yy	12-Oct-93
	Probe S/N	37AT
	Operator	MZ

	Mobile Datalogger (24 hour) *Data Not Available			Water Room Temp Time 10:30	Ice Bath 0°C (+/- 1°C) Time 11:25	Hot Water 50°C (+/-) Time 1:00	OK
No.	Mean	Min.	Max.	Reading	Reading	Reading	Y/N
1				22.5	1.90	49.3	Y
2				22.6	1.46	49.4	Y
3				22.3	1.90	49.5	Y
4				22.1	1.89	49.9	Y
5				22.3	0.91	50.1	Y
6				22.5	0.91	50.1	Y
7				22.6	1.35	49.6	Y
8				22.7	1.53	49.5	Y
9				22.9	1.05	49.6	Y
10				22.8	1.31	49.7	Y
11				22.9	1.20	49.7	Y
12				23.0	1.38	48.6	Y
13				23.1	1.42	48.4	Y
14				23.1	1.75	49.5	Y
15				23.1	1.53	48.1	Y
16				23.3	0.91	49.7	Y
17				23.2	1.01	48.3	Y
18				23.4	0.91	49.5	Y

Probe Accepted:	M.Z.	(Initials)
Probe Length:	1.851	(meters)

Thermistor distance from top of probe: (meters)									
4	0.022	7	0.246	10	0.627	13	1.083	16	1.537
5	0.094	8	0.325	11	0.778	14	1.232	17	1.691
6	0.170	9	0.473	12	0.929	15	1.386	18	1.845

Table B-1.2 MRC Probe Calibration

LTPP Seasonal Monitoring Study	State Code	[37]
MRC Probe Calibration	Test Section Number	[0212]

Before Operation Checks	Calibration Date dd-mmm-yy	12-Oct-93
	Probe S/N	37BT
	Operator	MZ

	Mobile Datalogger (24 hour) * Data Not Available			Water Room Temp Time 10:45	Ice Bath 0°C (+/- 1°C) Time 11:45	Hot Water 50°C (+/-) Time 1:15	Ok
No.	Mean	Min.	Max.	Reading	Reading	Reading	y/n
1				20.4	0.63	56.1	Y
2				20.3	0.59	56.0	Y
3				20.3	0.59	56.1	Y
4				19.8	1.36	55.9	Y
5				19.5	0.70	55.9	Y
6				19.8	0.70	55.9	Y
7				19.9	0.74	55.6	Y
8				20.0	0.74	55.9	Y
9				20.2	0.85	55.8	Y
10				20.3	0.93	55.5	Y
11				20.5	0.85	55.2	Y
12				20.7	0.85	55.0	Y
13				20.2	1.21	55.2	Y
14				20.4	1.29	55.1	Y
15				20.3	1.58	54.9	Y
16				21.2	1.47	55.2	Y
17				21.0	1.40	54.9	Y
18				20.9	1.42	54.9	Y

Probe Accepted:	M.Z.	(Initials)
Probe Length:	1.848	(meters)

Thermistor distance from top of probe: (meters)									
4	0.016	7	0.241	10	0.621	13	1.078	16	1.534
5	0.090	8	0.316	11	0.773	14	1.229	17	1.688
6	0.165	9	0.468	12	0.926	15	1.383	18	1.835

Table B-1.3 MRC Probe Calibration

LTPP Seasonal Monitoring Study	State Code	[37]
MRC Probe Calibration	Test Section Number	[0201]

Before Operation Checks	Calibration Date dd-mmm-yy	12-Oct-93
	Probe S/N	37CT
	Operator	MZ

	Mobile Datalogger (24 hour) * Data Not Available			Water Room Temp Time 10:55	Ice Bath 0°C (+/- 1°C) Time 12:04	Hot Water 50°C (+/-) Time 1:30	Ok
No.	Mean	Min.	Max.	Reading	Reading	Reading	Y/n
1				22.1	0.98	49.9	Y
2				22.1	0.72	49.8	Y
3				21.9	0.72	49.9	Y
4				20.9	1.75	48.6	Y
5				21.3	1.24	49.4	Y
6				21.6	1.31	49.5	Y
7				21.6	1.31	48.8	Y
8				21.7	1.20	49.5	Y
9				21.8	1.49	49.6	Y
10				21.8	1.42	49.3	Y
11				21.9	1.34	49.2	Y
12				22.1	1.27	49.2	Y
13				22.2	1.56	49.2	Y
14				22.2	1.71	49.5	Y
15				22.3	1.71	49.5	Y
16				22.5	1.34	49.9	Y
17				22.5	1.67	49.9	Y
18				22.5	0.91	49.7	Y

Probe Accepted:	M.Z.	(Initials)
Probe Length:	1.858	(meters)

Thermistor distance from top of probe: (meters)									
4	0.016	7	0.243	10	0.622	13	1.081	16	1.538
5	0.095	8	0.319	11	0.778	14	1.232	17	1.691
6	0.168	9	0.470	12	0.929	15	1.386	18	1.848

Table B-1.4 MRC Probe Calibration

LTPP Seasonal Monitoring Study	State Code	[37]
MRC Probe Calibration	Test Section Number	[0205]

Before Operation Checks	Calibration Date dd-mmm-yy	12-Oct-93
	Probe S/N	37DT
	Operator	MZ

	Mobile Datalogger (24 hour) * Data Not Available			Water Room Temp Time 11:05	Ice Bath 0°C (+/- 1°C) Time 12:20	Hot Water 50°C (+/-) Time 1:45	Ok
No.	Mean	Min.	Max.	Reading	Reading	Reading	y/n
1				21.5	1.34	45.8	Y
2				21.6	1.01	45.6	Y
3				21.6	0.61	45.6	Y
4				22.3	1.78	45.2	Y
5				22.4	1.34	44.8	Y
6				22.4	1.20	45.1	Y
7				22.5	1.34	45.0	Y
8				22.3	1.42	45.2	Y
9				22.0	1.52	45.1	Y
10				21.6	1.38	44.7	Y
11				21.7	1.42	44.3	Y
12				21.7	1.49	44.6	Y
13				21.7	1.89	44.3	Y
14				21.9	1.82	45.0	Y
15				22.3	1.82	44.8	Y
16				22.4	1.60	44.6	Y
17				22.2	1.82	45.0	Y
18				21.8	1.38	45.4	Y

Probe Accepted:	M.Z.	(Initials)
Probe Length:	1.848	(meters)

Thermistor distance from top of probe: (meters)									
4	0.016	7	0.248	10	0.627	13	1.084	16	1.540
5	0.095	8	0.322	11	0.779	14	1.235	17	1.694
6	0.171	9	0.476	12	0.932	15	1.389	18	1.846

Table B-2.1 Description of MRC Thermistor Probe (37AT), Sensor Spacing and Thermocouples Placed in Base for 370208

Unit	Channel No.	Distance from Top of Unit(m)	Remarks
1	1	0.025	0.3302 m long by 6.35 mm Stainless steel probe installed in the PCC layer.
	2	0.176	
	3	0.327	
2	TC1	0.000	4 Thermocouples installed in the base layer.
	TC2	0.051	
	TC3	0.102	
	TC4	0.152	
3	4	0.022	1.851 m long by 25.4 mm PVC tube installed in the subgrade.
	5	0.094	
	6	0.170	
	7	0.246	
	8	0.325	
	9	0.473	
	10	0.627	
	11	0.778	
	12	0.929	
	13	1.083	
	14	1.232	
	15	1.386	
	16	1.537	
	17	1.691	
	18	1.845	

Table B-2.2 Description of MRC Thermistor Probe (37BT) and Sensor Spacing for 370212

Unit	Channel No.	Distance from Top of Unit(m)	Remarks
1	1	0.025	0.3302 m long by 6.35 mm stainless steel probe installed in the PCC layer.
	2	0.176	
	3	0.327	
2	4	0.016	1.848 m long by 25.4 mm PVC tube installed in the PATB and subgrade.
	5	0.090	
	6	0.165	
	7	0.241	
	8	0.316	
	9	0.468	
	10	0.621	
	11	0.773	
	12	0.926	
	13	1.078	
	14	1.229	
	15	1.383	
	16	1.534	
	17	1.688	
	18	1.835	

Note: PATB – No Thermocouples

Table B-2.3 Description of MRC Thermistor Probe (37CT), Sensor Spacing and Thermocouples Placed in Base for 370201

Unit	Channel No.	Distance from Top of Unit(m)	Remarks
1	1	0.025	0.3302 m long by 6.35 mm Stainless steel probe installed in the PCC layer.
	2	0.176	
	3	0.327	
2	TC1	0.000	4 Thermocouples installed in the base layer.
	TC2	0.051	
	TC3	0.102	
	TC4	0.152	
3	4	0.016	1.858 m long by 25.4 mm PVC tube installed in the subgrade.
	5	0.095	
	6	0.168	
	7	0.243	
	8	0.319	
	9	0.470	
	10	0.622	
	11	0.778	
	12	0.929	
	13	1.081	
	14	1.232	
	15	1.386	
	16	1.538	
	17	1.691	
	18	1.848	

Table B-2.4 Description of MRC Thermistor Probe (37DT), Sensor Spacing and Thermocouples Placed in Base for 370205

Unit	Channel No.	Distance from Top of Unit(m)	Remarks
1	1	0.025	0.3302 m long by 6.35 mm Stainless steel probe installed in the PCC layer.
	2	0.176	
	3	0.327	
2	TC1	0.000	4 Thermocouples installed in the base layer.
	TC2	0.051	
	TC3	0.102	
	TC4	0.152	
3	4	0.016	1.848 m long by 25.4 mm PVC tube installed in the subgrade.
	5	0.095	
	6	0.171	
	7	0.248	
	8	0.322	
	9	0.476	
	10	0.627	
	11	0.779	
	12	0.932	
	13	1.084	
	14	1.235	
	15	1.389	
	16	1.540	
	17	1.694	
	18	1.846	

Table B-3.1 TDR Probes Calibration for Section 370208

LTPP Seasonal Monitoring Study	State Code	[37]
TDR Probes	Test Section Number	[0208]

Before Operation Checks		Initial	Calibration Date (mm-dd-yy)	10/9/93
			Seasonal Site	37SA

No.	Probe (S/N)	Resistance (ohms)		Probe Shorted		Air	Alcohol	Water
		Core	Shield	Begin Length	End Length	Begin Length	Begin Length	Begin Length
1	37A01	0.8	0.9	15.918	16.088	15.938	15.938	15.938
2	37A02	0.6	0.8	15.900	16.070	15.910	15.930	15.930
3	37A03	1.1	0.9	16.310	16.490	16.310	16.340	16.340
4	37A04	0.9	0.7	16.390	16.560	16.410	16.420	16.420
5	37A05	0.8	0.8	16.330	16.500	16.350	16.360	16.360
6	37A06	1.0	0.8	15.900	16.070	15.910	15.930	15.930
7	37A07	0.9	0.8	16.350	16.520	16.360	16.390	16.390
8	37A08	0.7	0.8	15.910	16.100	15.930	15.940	15.940
9	37A09	0.9	0.7	15.910	16.090	15.920	15.940	15.940
10	37A10	0.8	0.8	15.910	16.100	15.920	15.940	15.940

NOTE: Record lengths from TDR

Calculation of Dielectric Constant

$$\varepsilon = \left[\frac{TDRL}{(PL)\,(V_p)} \right]^2$$

Probe Length .203 m
Vp Setting .99 Vp

No.	Air			Alcohol			Water		
	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)
1	0.18	0.80	y	1.21	36.25	y	1.90	89.38	y
2	0.20	0.99	y	1.23	37.46	y	1.88	87.51	y
3	0.21	1.09	y	1.19	35.06	y	1.86	85.66	y
4	0.22	1.20	y	1.17	33.89	y	1.87	86.58	y
5	0.17	0.72	y	1.21	36.25	y	1.89	88.44	y
6	0.19	0.89	y	1.17	33.89	y	1.90	89.38	y
7	0.18	0.80	y	1.19	35.06	y	1.86	85.66	y
8	0.18	0.80	y	1.20	35.65	y	1.84	83.82	y
9	0.19	0.89	y	1.21	36.25	y	1.81	81.11	y
10	0.18	0.80	y	1.20	35.65	y	1.85	84.74	y

Table B-3.2 TDR Probes Calibration for Section 370212

LTPP Seasonal Monitoring Study	State Code	[37]
TDR Probes	Test Section Number	[0212]

Before Operation Checks		Initial	Calibration Date (mm-dd-yy)	10/11/93
			Seasonal Site	37SB

No.	Probe (S/N)	Resistance (ohms)		Probe Shorted		Air	Alcohol	Water
		Core	Shield	Begin Length	End Length	Begin Length	Begin Length	Begin Length
1	37B01	0.9	0.9	15.888	16.058	15.908	15.908	15.908
2	37B02	0.9	0.8	16.678	16.878	16.708	16.718	16.718
3	37B03	0.9	0.9	15.898	16.068	15.918	15.938	15.938
4	37B04	0.7	0.8	15.898	15.998	15.908	15.928	15.928
5	37B05	0.9	0.9	15.868	15.978	15.868	15.898	15.898
6	37B06	0.8	0.7	15.878	16.008	15.898	15.908	15.908
7	37B07	0.8	0.8	15.878	16.068	15.908	15.918	15.918
8	37B08	0.8	0.7	15.868	15.998	15.888	15.898	15.898
9	37B09	0.8	0.7	15.878	16.038	15.888	15.908	15.908
10	37B10	0.8	0.7	15.888	16.058	15.918	15.918	15.918

NOTE: Record lengths from TDR

Calculation of Dielectric Constant

$$\varepsilon = \left[\frac{TDRL}{(PL)\,(V_p)} \right]^2$$

Probe Length .203 m
Vp Setting .99 Vp

No.	Air			Alcohol			Water		
	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)
1	0.18	0.80	y	1.21	36.25	y	1.87	86.58	y
2	0.20	0.99	y	1.20	35.65	y	1.88	87.51	y
3	0.18	0.80	y	1.18	34.47	y	1.88	87.51	y
4	0.22	1.20	y	1.20	35.65	y	1.89	88.44	y
5	0.20	0.99	y	1.21	36.25	y	1.90	89.38	y
6	0.19	0.89	y	1.18	34.47	y	1.90	89.38	y
7	0.18	0.80	y	1.20	35.65	y	1.88	87.51	y
8	0.20	0.99	y	1.21	36.25	y	1.89	88.44	y
9	0.21	1.09	y	1.21	36.25	y	1.88	87.51	y
10	0.18	0.80	y	1.19	35.06	y	1.89	88.44	y

Table B-3.3 TDR Probes Calibration for Section 370201

LTPP Seasonal Monitoring Study	State Code	[37]
TDR Probes	Test Section Number	[0201]

Before Operation Checks		Initial	Calibration Date (mm-dd-yy)	10/11/93
			Seasonal Site	37SC

No.	Probe (S/N)	Resistance (ohms)		Probe Shorted		Air	Alcohol	Water
		Core	Shield	Begin Length	End Length	Begin Length	Begin Length	Begin Length
1	37C01	0.9	0.8	16.690	16.850	16.710	16.730	16.730
2	37C02	0.8	0.8	16.200	16.380	16.230	16.240	16.240
3	37C03	1.3	1.1	16.190	16.370	16.200	N/A	16.220
4	37C04	0.9	0.8	16.180	16.310	16.200	16.220	16.220
5	37C05	1.0	0.8	16.170	16.300	16.190	16.210	16.210
6	37C06	0.8	0.8	16.390	16.500	16.410	16.420	16.420
7	37C07	0.9	0.9	16.410	16.540	16.450	16.450	16.450
8	37C08	1.0	0.8	16.400	16.570	16.430	16.440	16.440
9	37C09	1.0	0.8	16.420	16.540	16.440	16.460	16.460
10	37C10	0.9	0.8	16.400	16.520	16.430	16.440	16.440

NOTE: Record lengths from TDR

Calculation of Dielectric Constant

$$\varepsilon = \left[\frac{TDRL}{(PL)\,(V_p)} \right]^2$$

Probe Length .203 m
Vp Setting .99 Vp

No.	Air			Alcohol			Water		
	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)
1	0.18	0.80	y	1.19	35.06	y	1.86	85.66	y
2	0.18	0.80	y	1.17	33.89	y	1.86	85.66	y
3	0.19	0.89	y	N/A	N/A	N/A	1.87	86.58	y
4	0.20	0.99	y	1.20	35.65	y	1.88	87.51	y
5	0.21	1.09	y	1.18	34.47	y	1.85	84.74	y
6	0.19	0.89	y	1.19	35.06	y	1.86	85.66	y
7	0.18	0.80	y	1.18	34.47	y	1.85	84.74	y
8	0.18	0.80	y	1.20	35.65	y	1.86	85.66	y
9	0.19	0.89	y	1.20	35.65	y	1.85	84.74	y
10	0.20	0.99	y	1.21	36.25	y	1.84	83.82	y

Table B-3.4 TDR Probes Calibration for Section 370205

LTPP Seasonal Monitoring Study	State Code	[37]
TDR Probes	Test Section Number	[0205]

Before Operation Checks		Initial	Calibration Date (mm-dd-yy)	10/11/93
			Seasonal Site	37SD

No.	Probe (S/N)	Resistance (ohms)		Probe Shorted		Air	Alcohol	Water
		Core	Shield	Begin Length	End Length	Begin Length	Begin Length	Begin Length
1	37D01	0.6	0.7	16.290	16.470	16.310	16.320	16.320
2	37D02	0.9	0.6	16.320	16.510	16.320	16.360	16.360
3	37D03	0.7	0.8	16.330	16.470	16.360	16.370	16.370
4	37D04	0.7	0.8	16.310	16.470	16.320	16.340	16.340
5	37D05	0.7	0.7	16.320	16.500	16.340	16.360	16.360
6	37D06	3.0	0.6	16.390	16.550	16.340	16.410	16.410
7	37D07	0.7	0.6	16.350	16.510	16.360	16.380	16.380
8	37D08	0.7	0.6	16.330	16.490	16.340	16.350	16.350
9	37D09	0.7	0.7	16.290	16.480	16.310	16.320	16.320
10	37D10	1.1	0.8	16.310	16.500	16.330	16.350	16.350

NOTE: Record lengths from TDR

Calculation of Dielectric Constant

$$\varepsilon = \left[\frac{TDRL}{(PL)(V_p)} \right]^2$$

Probe Length .203 m
Vp Setting .99 Vp

No.	Air			Alcohol			Water		
	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)	TDR Length	Dielectric Constant	In Spec. (?)
1	0.20	0.99	y	1.19	35.06	y	1.86	85.66	y
2	0.19	0.89	y	1.20	35.65	y	1.85	84.74	y
3	0.18	0.80	y	1.20	35.65	y	1.88	87.51	y
4	0.20	0.99	y	1.18	34.47	y	1.85	84.74	y
5	0.19	0.89	y	1.20	35.65	y	1.88	87.51	y
6	0.21	1.09	y	1.20	35.65	y	1.88	87.51	y
7	0.21	1.09	y	1.16	33.32	y	1.87	86.58	y
8	0.20	0.99	y	1.18	34.47	y	1.85	84.74	y
9	0.21	1.09	y	1.20	35.65	y	1.86	85.89	y
10	0.18	0.80	y	1.17	33.89	y	1.89	88.44	y

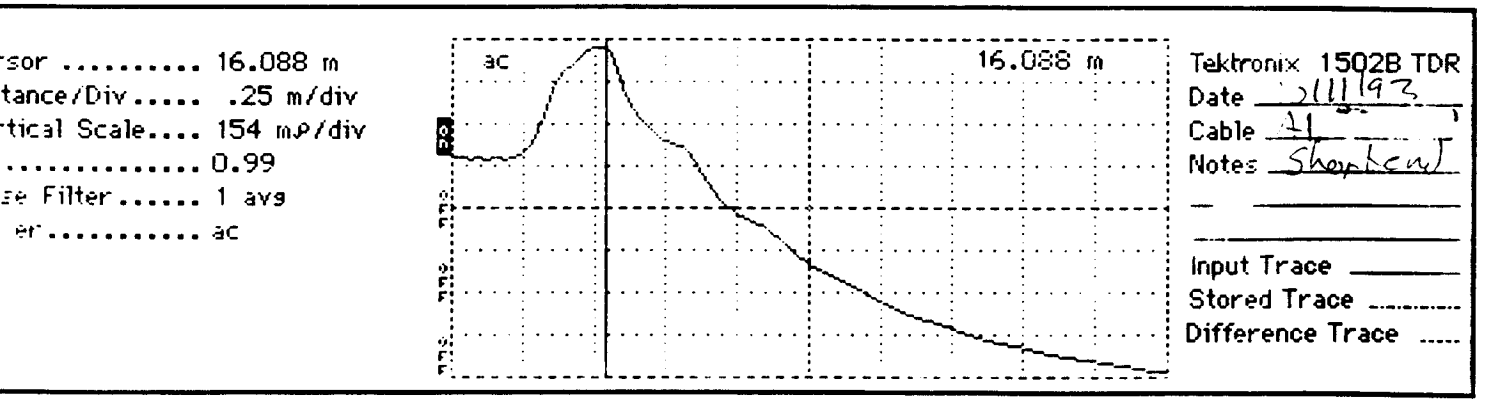
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0208]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37A01

Probe Number 1

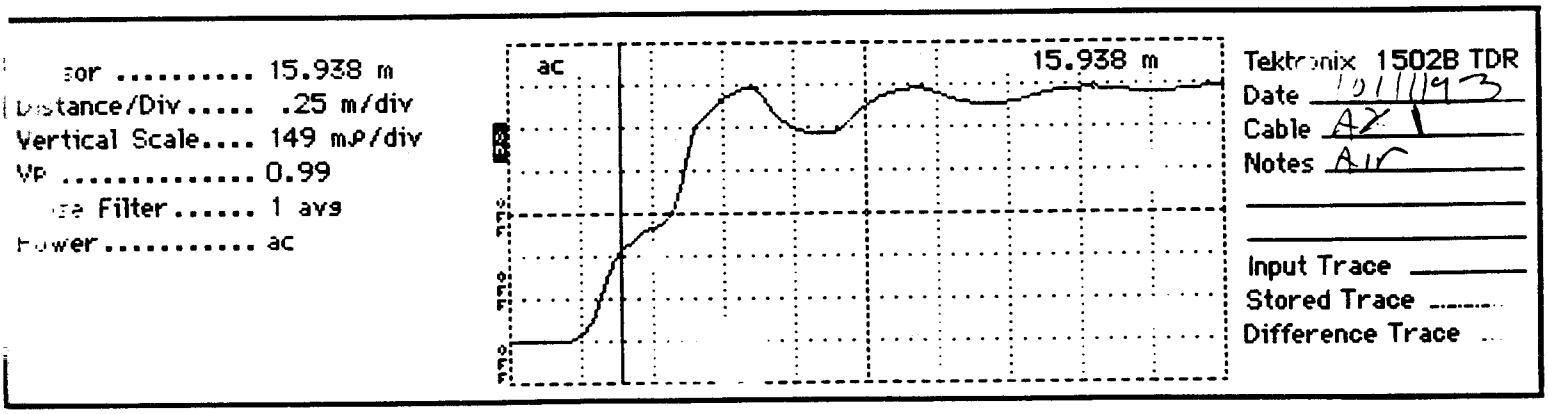
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		



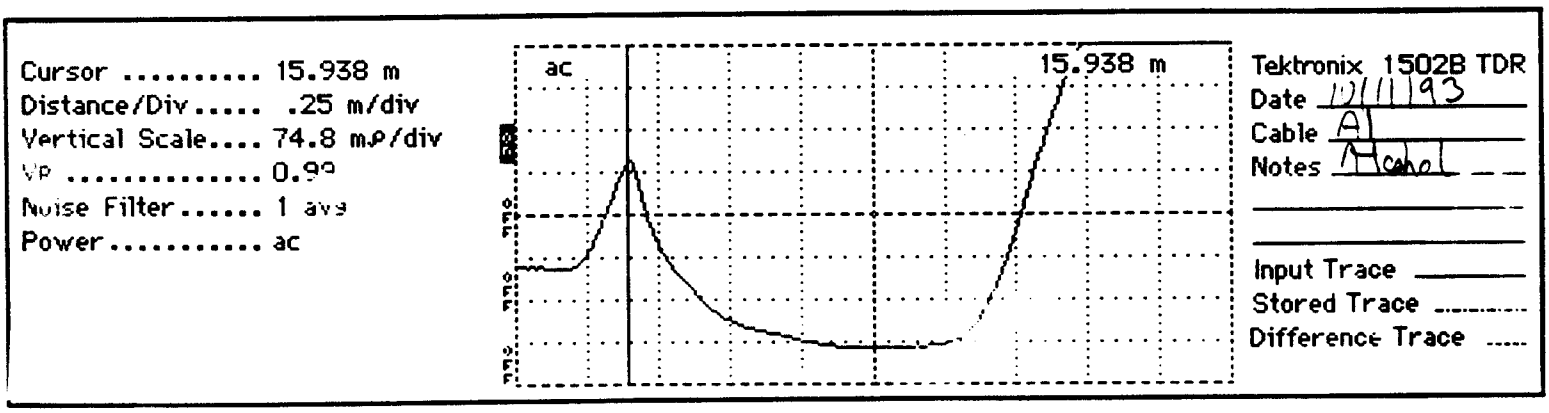
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Figure B-2. TDR Traces Obtained During Calibration

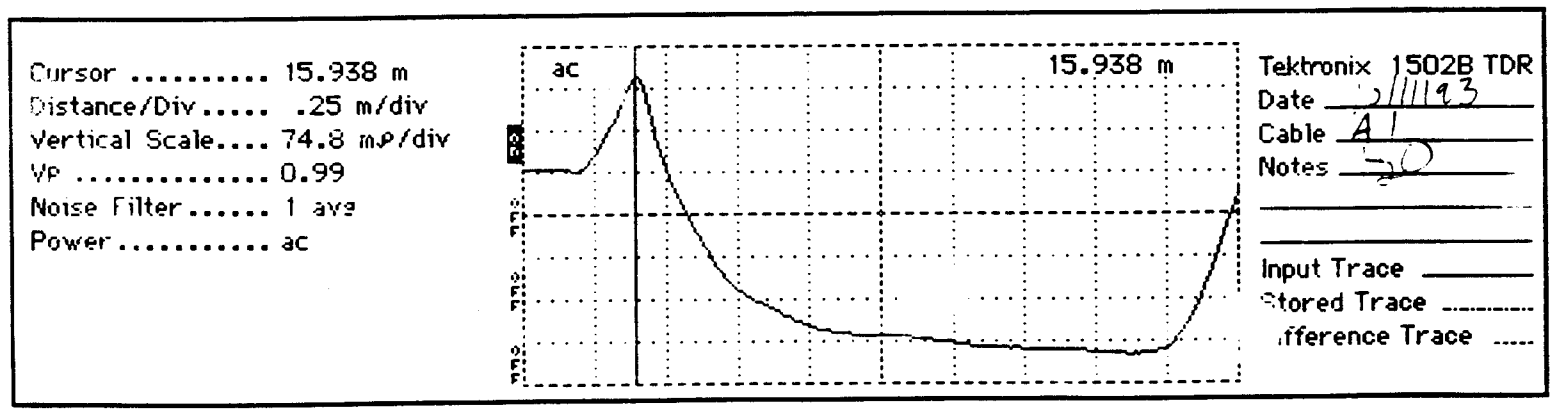
Probe Number 1 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

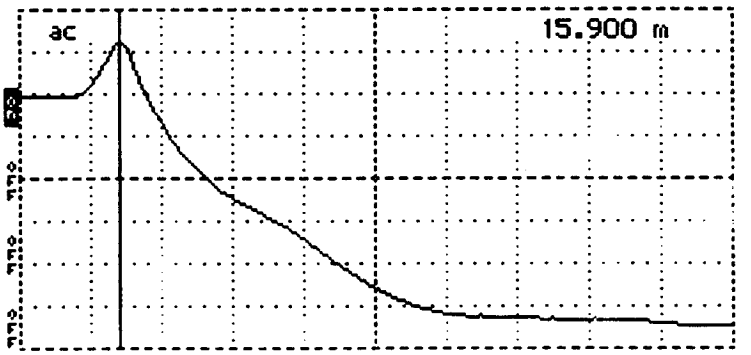
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [04208]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37A02

Probe Number 2

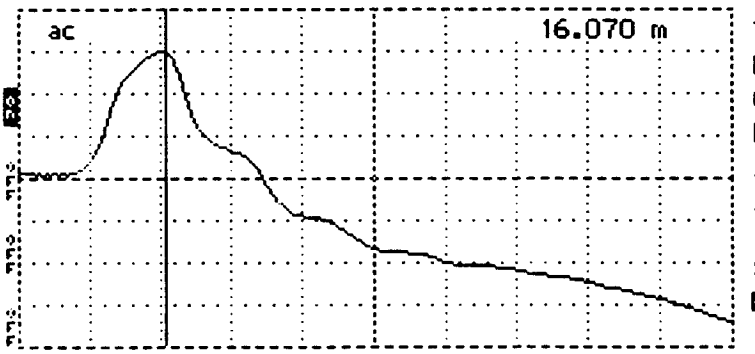
sor ..... 15.900 m
tance/Div..... .25 m/div
tical Scale.... 158 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 2
Notes Short CB
Input Trace ——
Stored Trace - - -
Difference Trace .....

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

rsor ..... 16.070 m
stance/Div..... .25 m/div
rtical Scale.... 141 mρ/div
..... 0.99
ise Filter..... 1 avg
wer..... ac

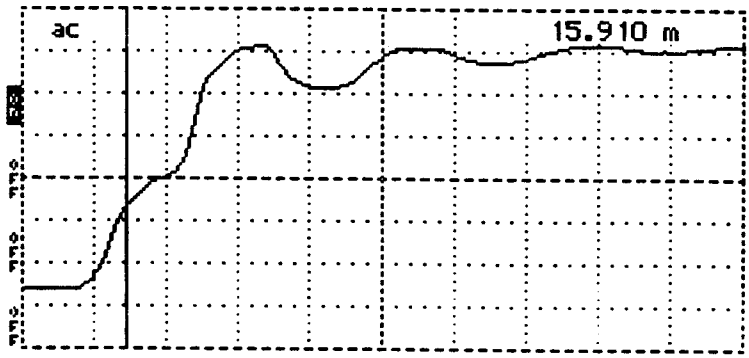


Tektronix 1502B TDR
Date 10/11/93
Cable 22
Notes Short end
Input Trace ——
Stored Trace - - -
Difference Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 2 (cont.)

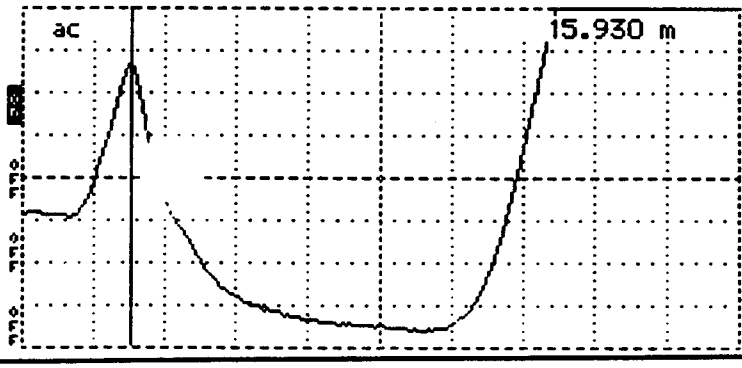
Cursor ..... 15.910 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable A2
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

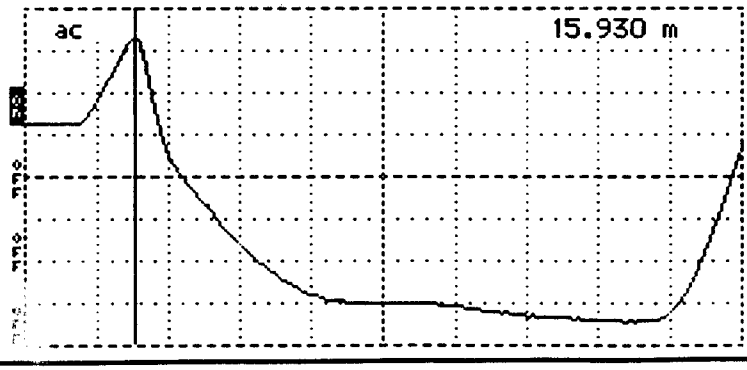
Cursor ..... 15.930 m
Distance/Div..... .25 m/div
Vertical Scale.... 53.0 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502
Date 10/11/93
Cable A2
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.930 m
Distance/Div..... .25 m/div
Vertical Scale.... 70.6 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable A2
Notes H2O
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

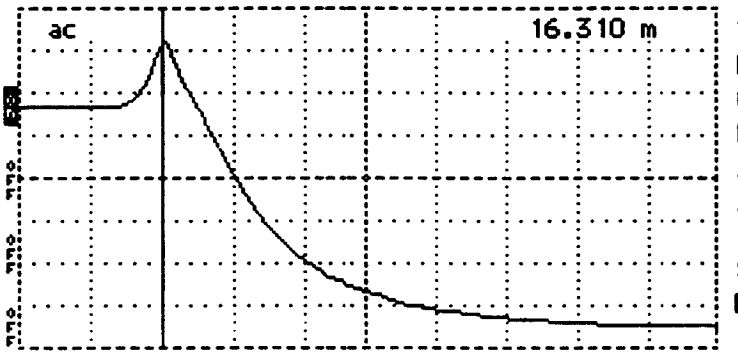
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0208]

ore Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A03

Probe Number 3

rsor ..... 16.310 m
stance/Div..... .25 m/div
rtical Scale.... 158 mρ/div
..... 0.99
ise Filter..... 1 avg
wer..... ac

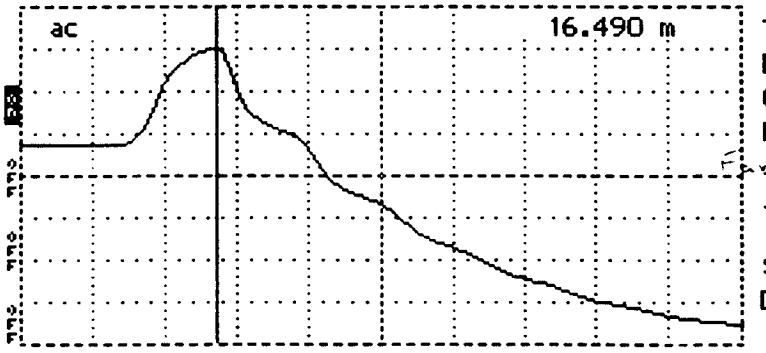


Tektronix 1502B TDR
Date 10/9/93
Cable A3
Notes Shorted at CB

Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.490 m
ance/Div..... .25 m/div
tical Scale.... 172 mρ/div
..... 0.99
ce Filter..... 1 avg
ver..... ac



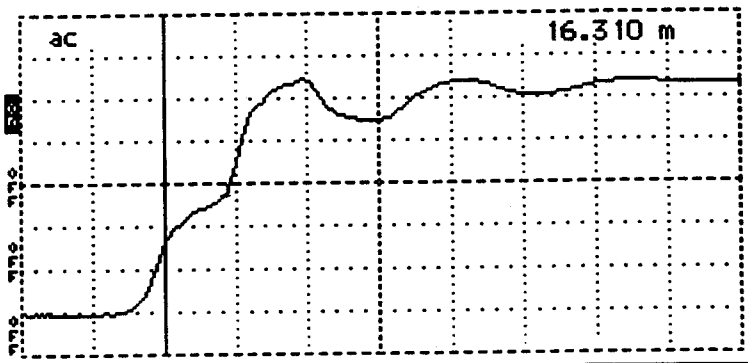
Tektronix 1502B TDR
Date 10/9/93
Cable A3
Notes Shorted at End

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 3 (cont.)

sor ..... 16.310 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A3
Notes in air

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

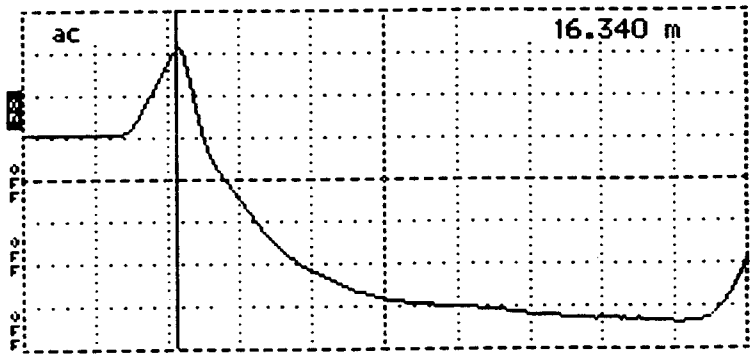
Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 45.9 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

Tektronix 1502B TDR
Date 10/9/93
Cable A3
Notes in methyl & alcohol

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 70.6 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A3
Notes in water

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

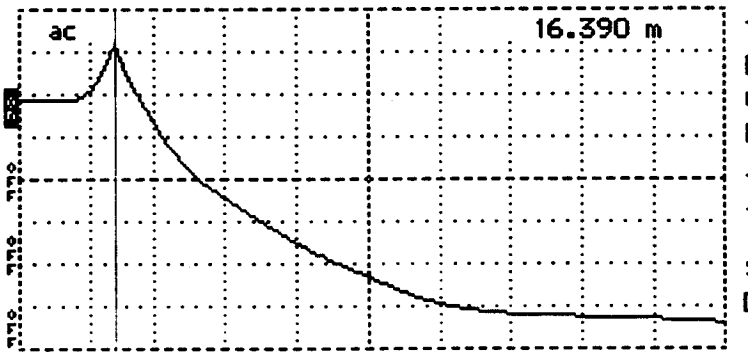
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0228]

ore Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A04

Probe Number 4

rsor ..... 16.390 m
stance/Div..... .25 m/div
rtical Scale... 158 mρ/div
..... 0.99
ise Filter..... 1 avg
wer..... ac

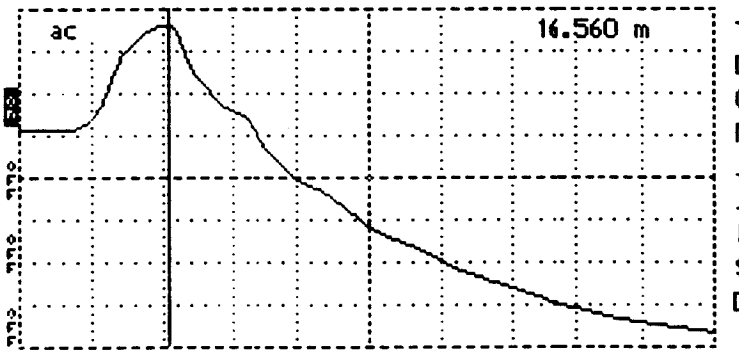


Tektronix 1502B TDR
Date 10/9/93
Cable A4
Notes Short CB

Input Trace ———
Stored Trace .....
Difference Trace - - -

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

ursor ..... 16.560 m
istance/Div..... .25 m/div
ertical Scale.... 158 mρ/div
P 0.99
oise Filter..... 1 avg
ower..... ac



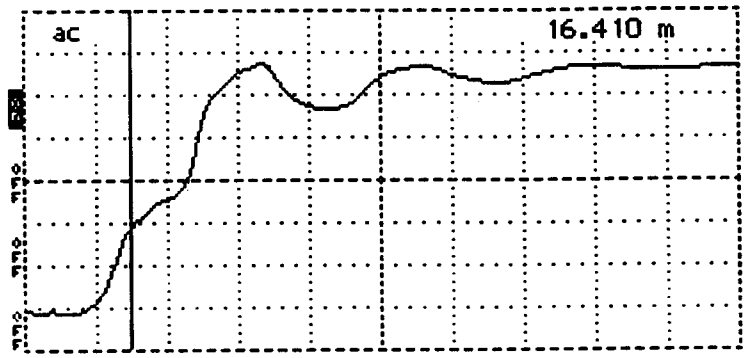
Tektronix 1502B TDR
Date 10/9/93
Cable A4
Notes Short End

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 4 (cont.)

sor ..... 16.410 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A4
Notes Air

Input Trace ———
Stored Trace - - - - -
Difference Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

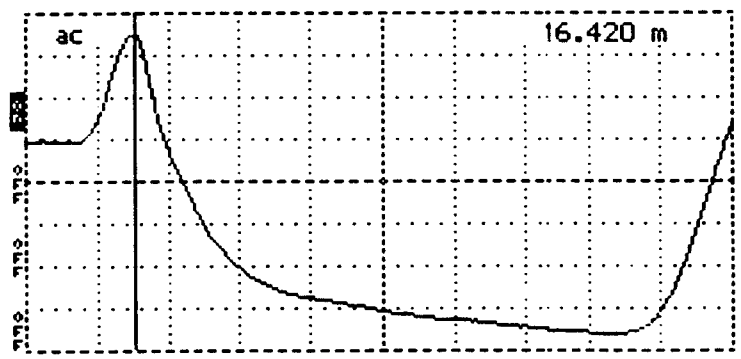
Cursor ..... 16.420 m
Distance/Div..... .25 m/div
Vertical Scale.... 64.8 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

Tektronix 1502B TDR
Date 10/9/93
Cable A4
Notes Alcohol

Input Trace ———
Stored Trace - - - - -
Difference Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor .....16.420 m
Distance/Div..... .25 m/div
Vertical Scale....68.6 mρ/div
Vp 0.99
Noise Filter.....1 avg
Power.....ac



Tektronix 1502B TDR
Date 10/9/93
Cable A4
Notes H2O

Input Trace ———
Stored Trace - - - - -
Difference Trace .....

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

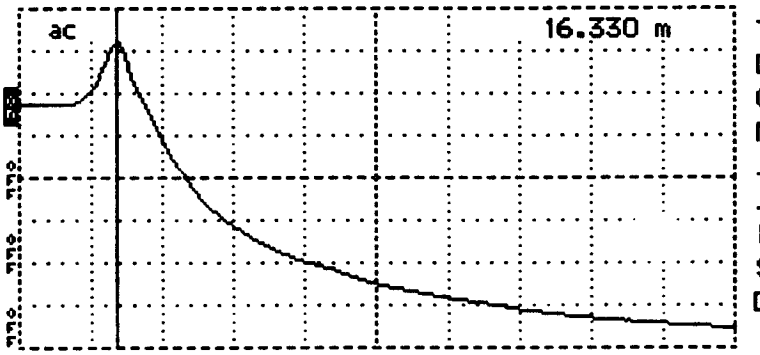
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0208]

e Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A05

Probe Number 5

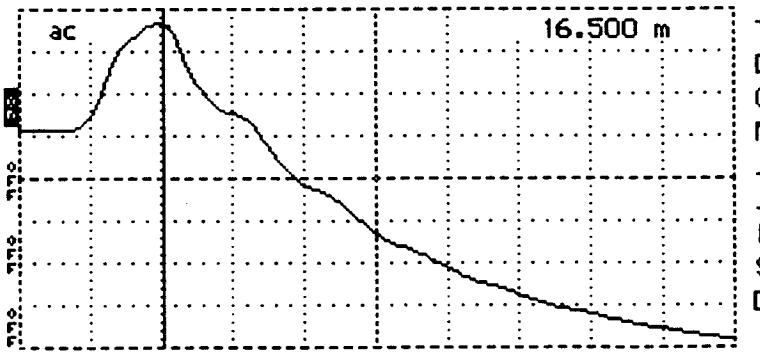
or ..... 16.330 m
nce/Div..... .25 m/div
cal Scale.... 154 mρ/div
..... 0.99
Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A5
Notes Short CB
Input Trace
Stored Trace
Difference Trace

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

or ..... 16.500 m
nce/Div..... .25 m/div
cal Scale.... 154 mρ/div
..... 0.99
Filter..... 1 avg
er..... ac

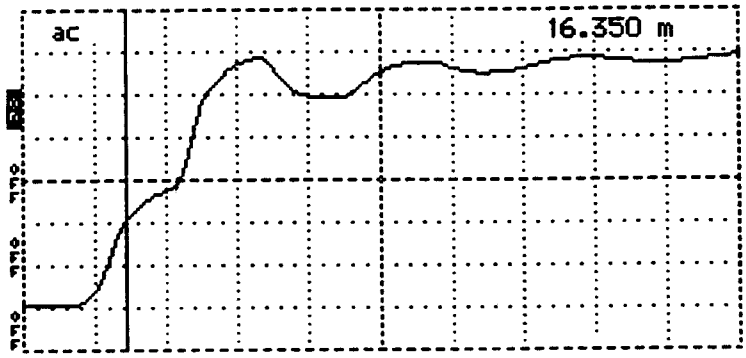


Tektronix 1502B TDR
Date 10/9/93
Cable A5
Notes Short End
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 5 (cont.)

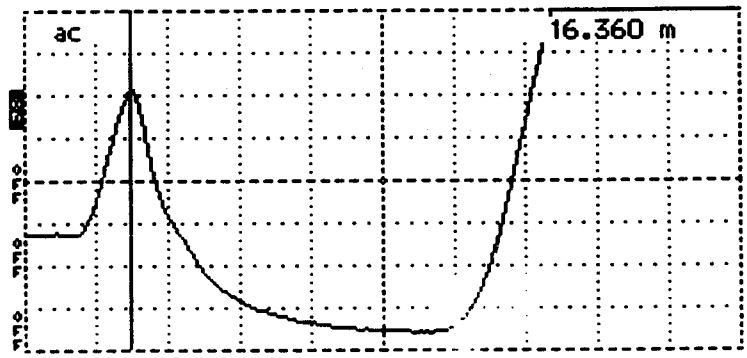
-sor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A5
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

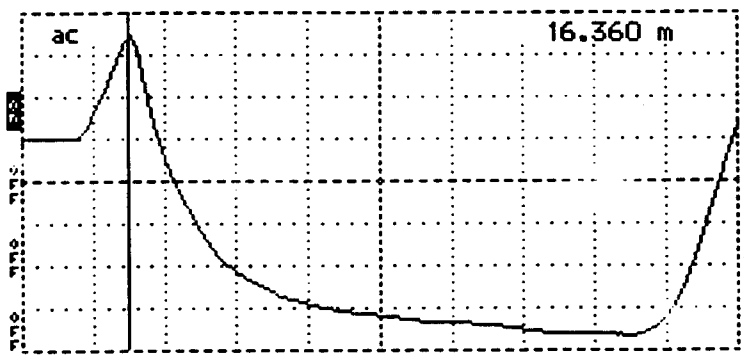
Cursor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 54.5 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A5
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 66.7 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A5
Notes H_2O
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

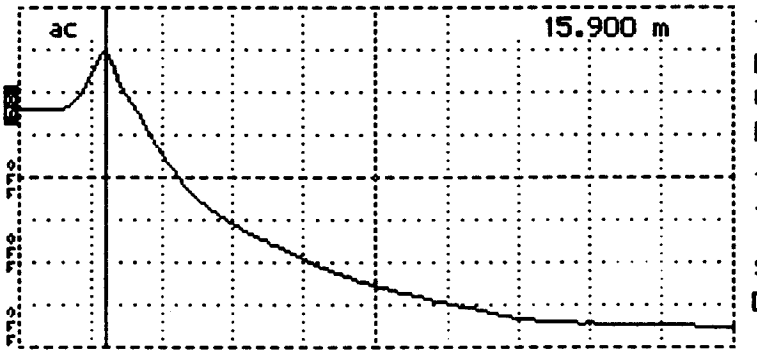
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [020B]

re Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A006

Probe Number 6

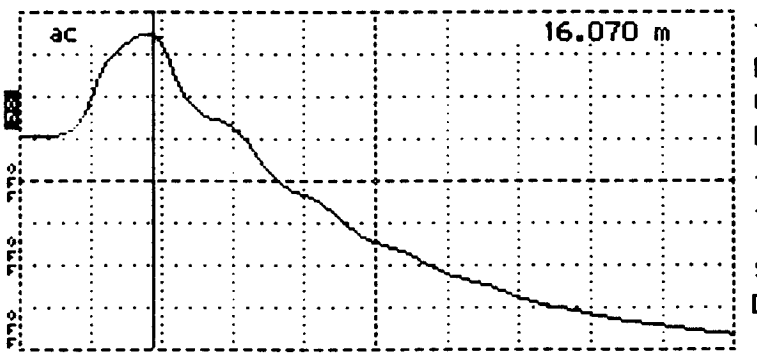
sor ..... 15.900 m
ance/Div..... .25 m/div
tical Scale.... 163 mρ/div
..... 0.99
se Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A1e
Notes Short+C5
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.070 m
tance/Div..... .25 m/div
tical Scale.... 163 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

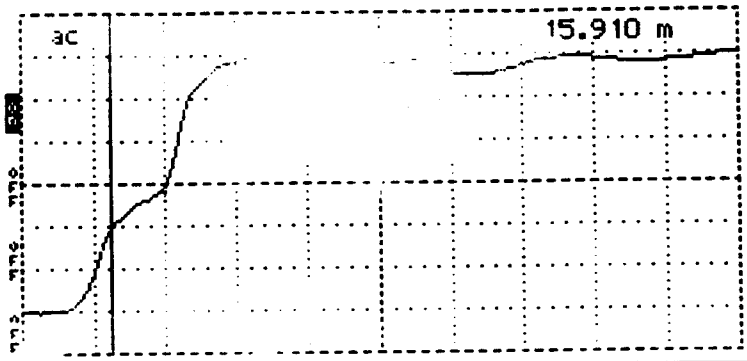


Tektronix 1502B TDR
Date 10/9/93
Cable A1e
Notes Short End
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 6 (cont.)

sor ..... 15.910 m
Distance/Div..... .25 m/div
Vertical Scale.... 145 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

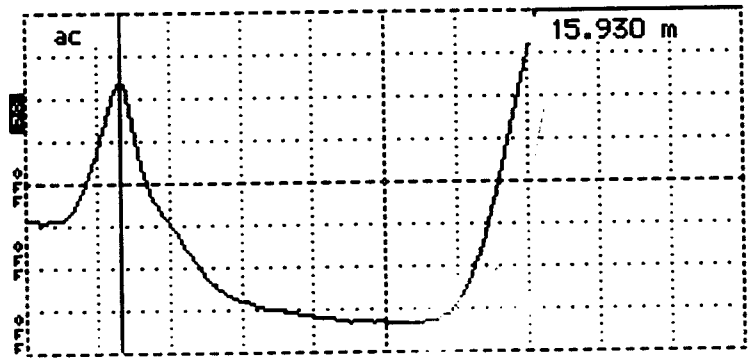


Tektronix 1502B TDR
Date 10/19/93
Cable A6
Notes Air

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.930 m
Distance/Div..... .25 m/div
Vertical Scale.... 53.0 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

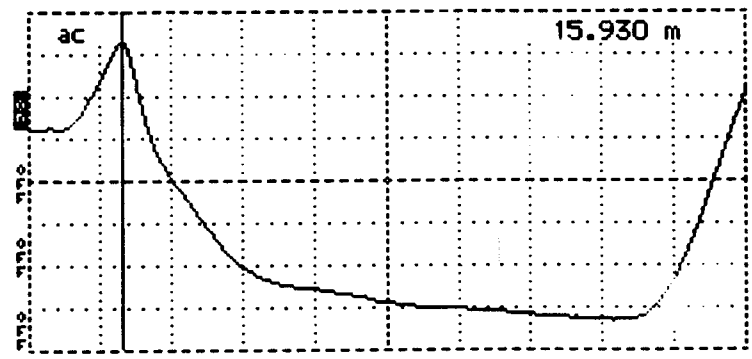


Tektronix 1502B TDR
Date 10/19/93
Cable A6
Notes Alcohol

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.930 m
Distance/Div..... .25 m/div
Vertical Scale.... 70.6 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/19/93
Cable A6
Notes H2O

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

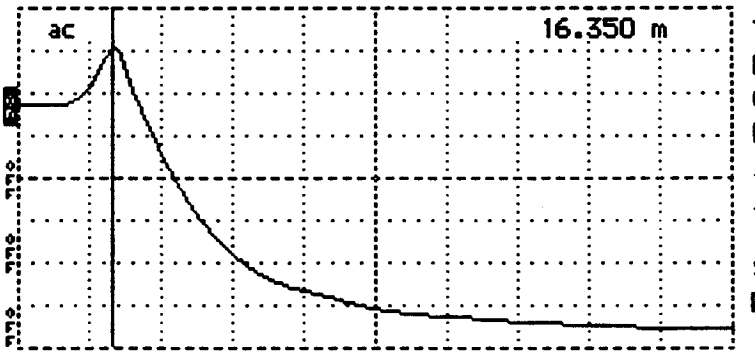
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0208]

re Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A07

Probe Number 7

sor ..... 16.350 m
ance/Div..... .25 m/div
tical Scale.... 158 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac

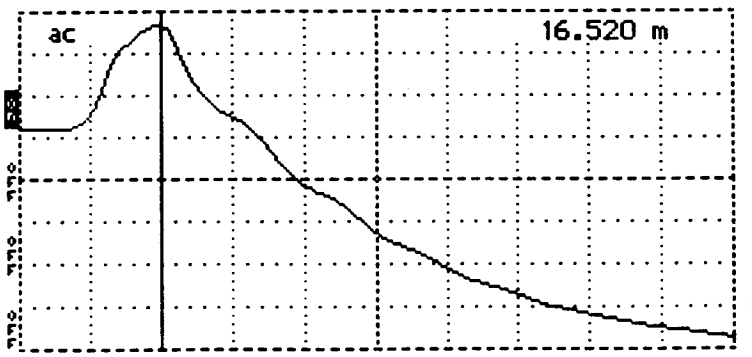


Tektronix 1502B TDR
Date 10/9/93
Cable A7
Notes Short CB

Input Trace ———
Stored Trace .....
Difference Trace - - -

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

sor ..... 16.520 m
ance/Div..... .25 m/div
tical Scale.... 158 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac



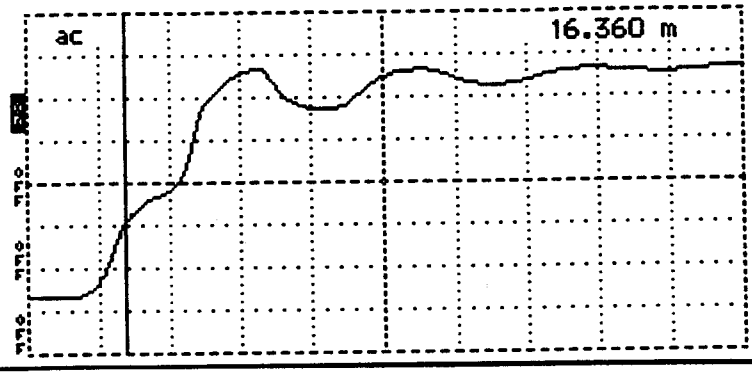
Tektronix 1502B TDR
Date 10/9/93
Cable A7
Notes Short end

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 7 (cont.)

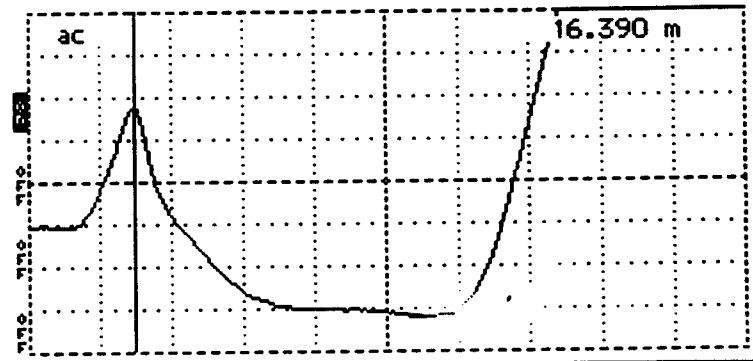
sor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 163 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A7
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

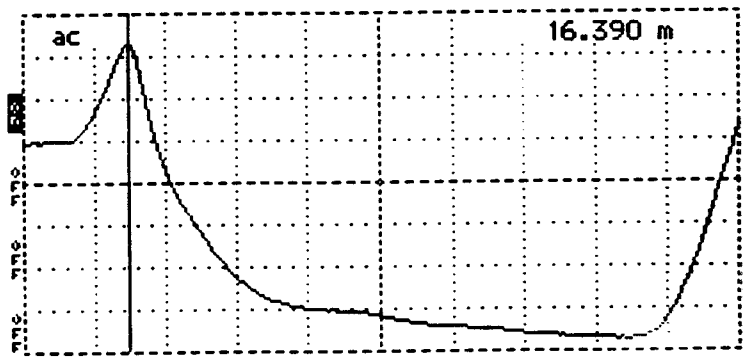
Cursor ..... 16.390 m
Distance/Div..... .25 m/div
Vertical Scale.... 61.2 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A7
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.390 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A7
Notes H2O
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

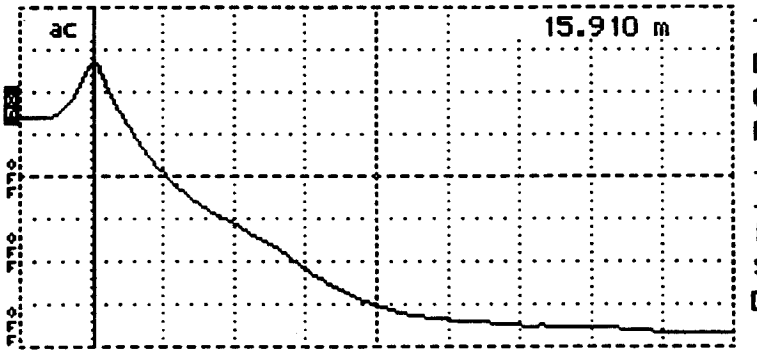
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0208]

ore Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A08

Probe Number 8

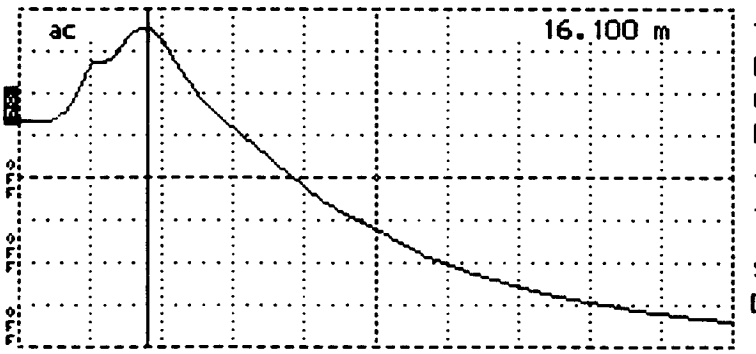
sor ..... 15.910 m
ance/Div..... .25 m/div
tical Scale.... 163 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A8
Notes Short CB
Input Trace
Stored Trace
Difference Trace

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

rsor ..... 16.100 m
stance/Div..... .25 m/div
rtical Scale.... 163 mρ/div
..... 0.99
ise Filter..... 1 avg
wer..... ac

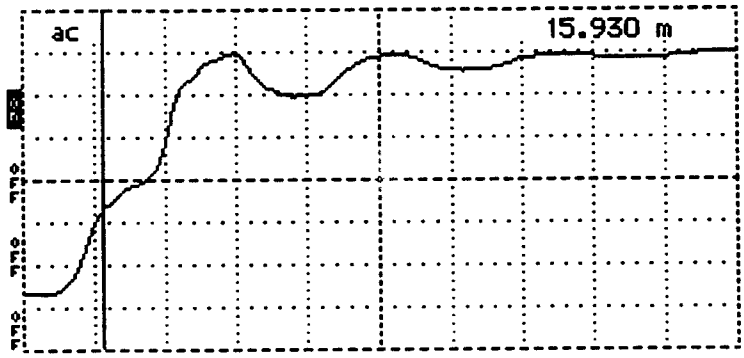


Tektronix 1502B TDR
Date 10/9/93
Cable A8
Notes Short end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 8 (cont.)

sor ..... 15.930 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

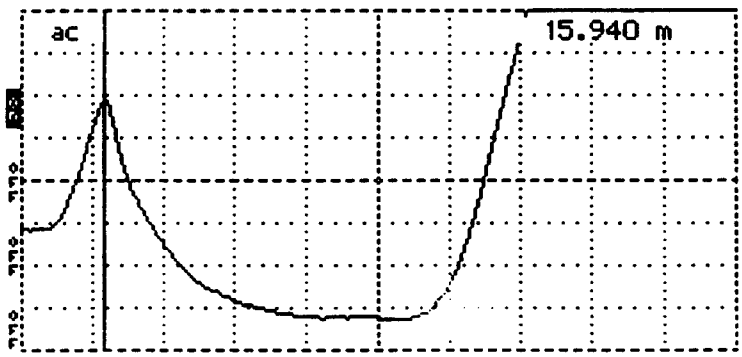


Tektronix 1502B TDR
Date 10/9/93
Cable A8
Notes Air

Input Trace ———
Stored Trace .....
Difference Trace ----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.940 m
Distance/Div..... .25 m/div
Vertical Scale.... 59.4 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

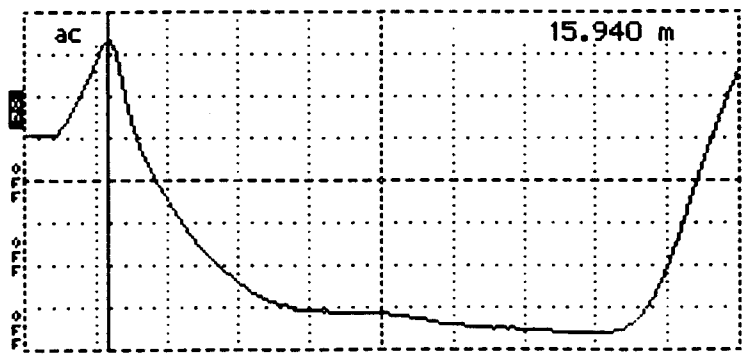


Tektronix 1502B TDR
Date 10/9/93
Cable A8
Notes Alcohol

Input Trace ———
Stored Trace .....
Difference Trace ----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.940 m
Distance/Div..... .25 m/div
Vertical Scale.... 66.7 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A8
Notes H2O

Input Trace ———
Stored Trace .....
Difference Trace ----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

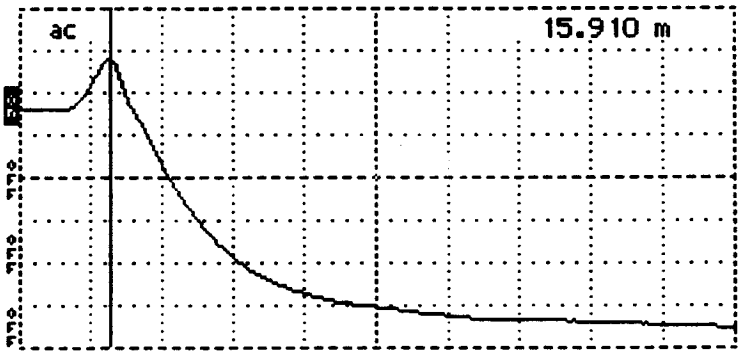
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0209]

ore Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A09

Probe Number 9

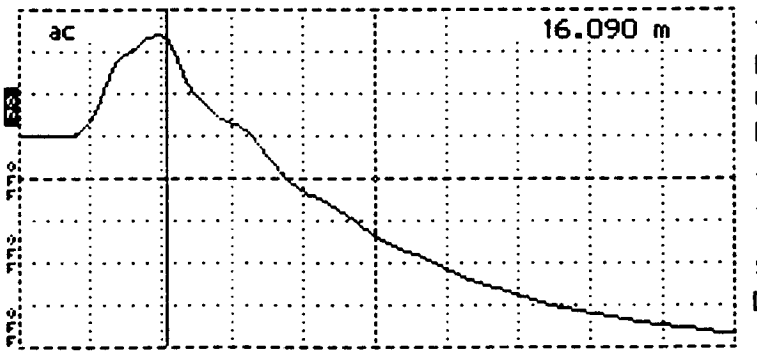
sor ..... 15.910 m
tance/Div..... .25 m/div
tical Scale.... 163 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A9
Notes ShortCB
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.090 m
tance/Div..... .25 m/div
tical Scale.... 163 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

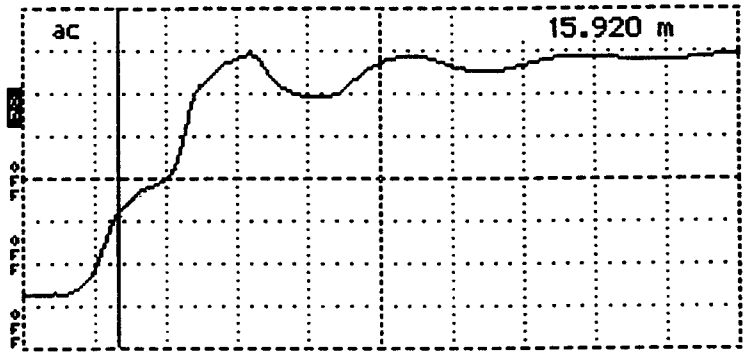


Tektronix 1502B TDR
Date 10/9/93
Cable A9
Notes Shortend
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 9 (cont.)

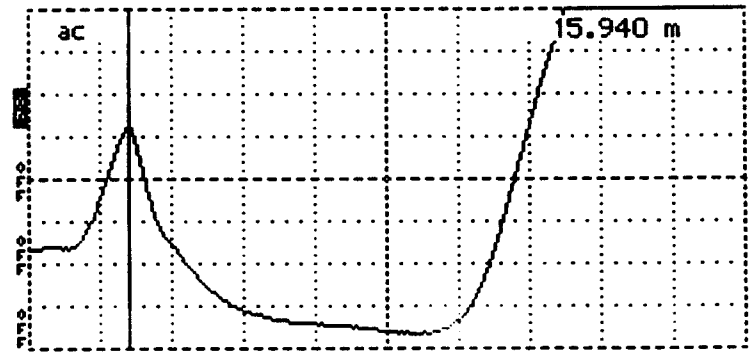
Cursor ..... 15.920 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A9
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

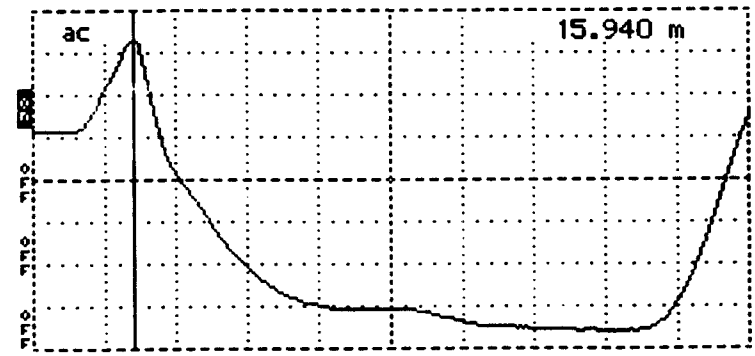
Cursor ..... 15.940 m
Distance/Div..... .25 m/div
Vertical Scale.... 64.8 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A9
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.940 m
Distance/Div..... .25 m/div
Vertical Scale.... 66.7 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A9
Notes H_2O
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

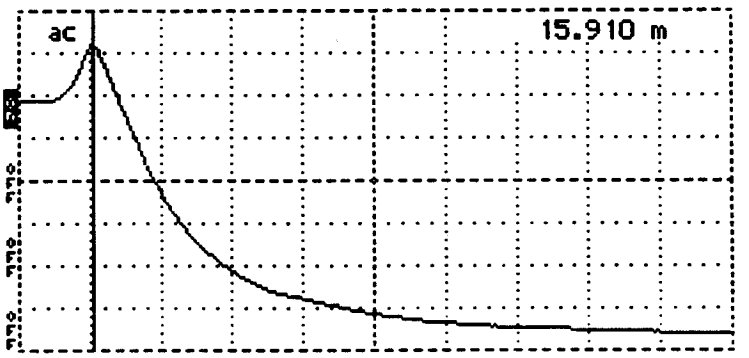
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0208]

re Operation Checks

- Calibration Date 10/9/93
- Probe S/N 37A10

Probe Number 10

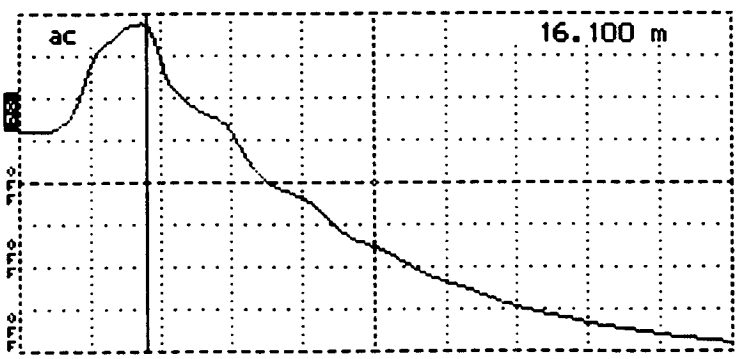
sor ..... 15.910 m
tance/Div..... .25 m/div
tical Scale.... 154 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektronix 1502B TDR
Date 10/9/93
Cable A10
Notes Short CB
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.100 m
ance/Div..... .25 m/div
tical Scale.... 154 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac

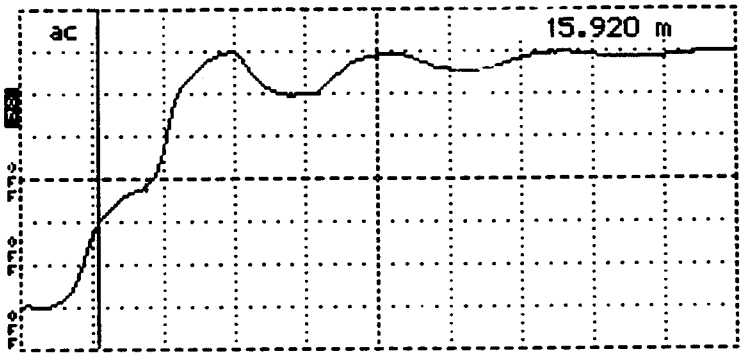


Tektronix 1502B TDR
Date 10/9/93
Cable A10
Notes Short end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 10 (cont.)

sor ..... 15.920 m
Distance/Div..... .25 m/div
Vertical Scale.... 145 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

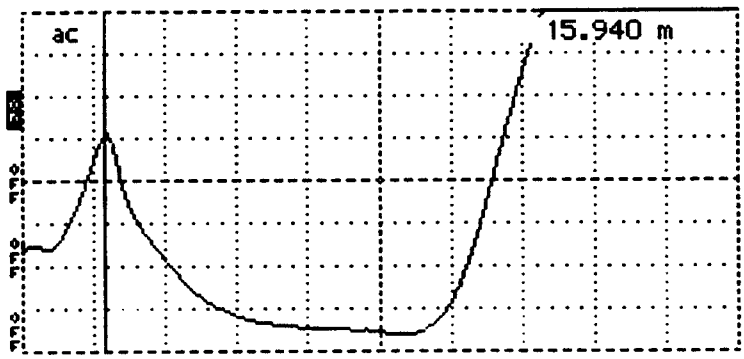


Tektronix 1502B TDR
Date 1/19/93
Cable A10
Notes Air

Input Trace ———
Stored Trace .....
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.940 m
Distance/Div..... .25 m/div
Vertical Scale.... 62.9 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

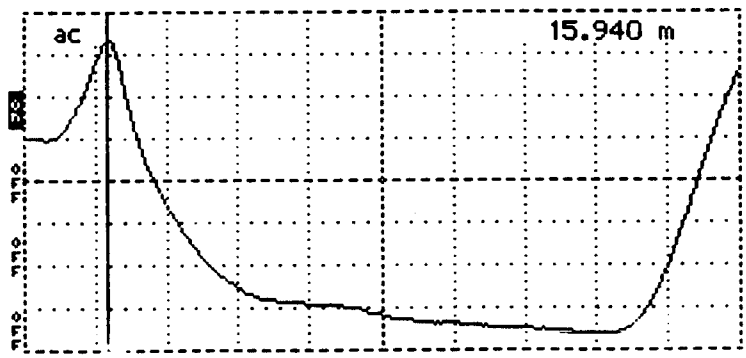


Tektronix 1502B TDR
Date 1/19/93
Cable A10
Notes Alcohol

Input Trace ———
Stored Trace .....
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.940 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 1/19/93
Cable A10
Notes H2O

Input Trace ———
Stored Trace .....
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

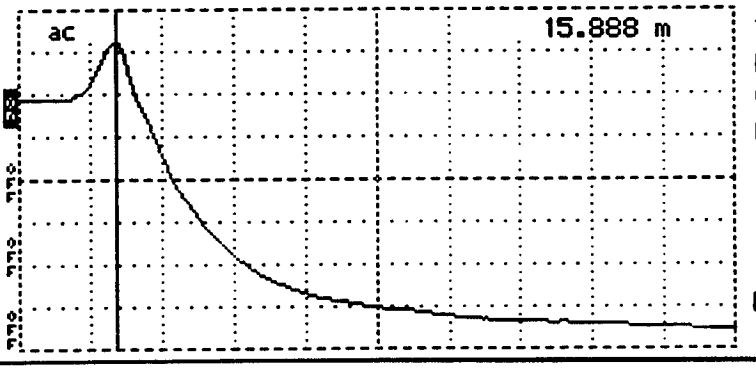
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B01

Probe Number 1

rsor ..... 15.888 m
tance/Div..... .25 m/div
rtical Scale.... 158 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

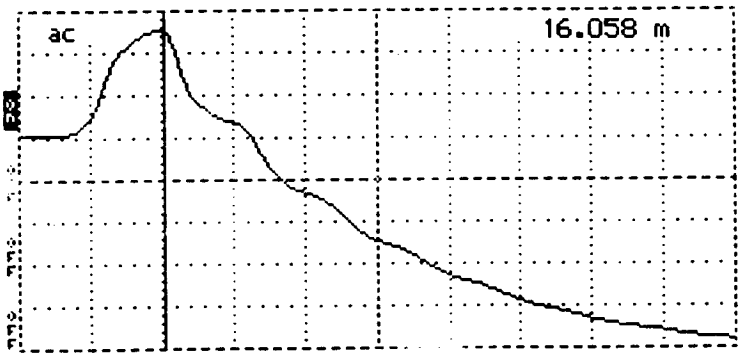


Tektronix 1502B TDR
Date 10/11/93
Cable B1
Notes Short CB

Input Trace ———
Stored Trace .....
Difference Trace - - -

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

rsor ..... 16.058 m
tance/Div..... .25 m/div
rtical Scale.... 163 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac



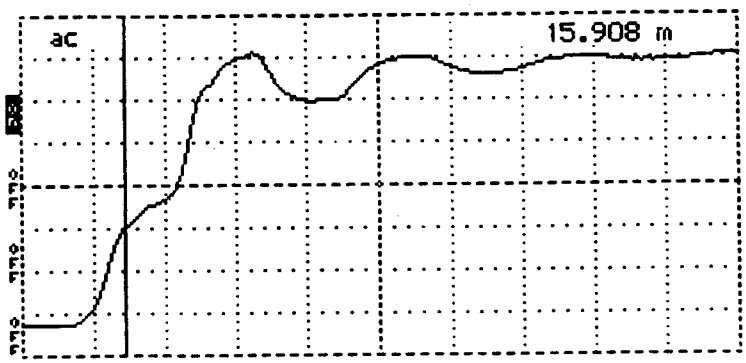
Tektronix 1502B TDR
Date 10/11/93
Cable B1
Notes Shorted end

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 1 (cont.)

sor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 141 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

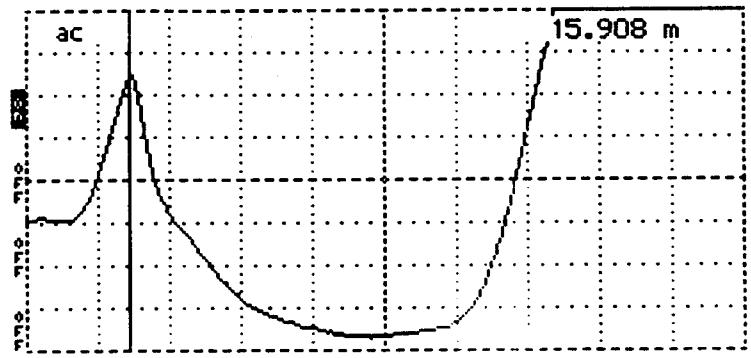


Tektronix 1502B TDR
Date 12/11/93
Cable B1
Notes Air

Input Trace ———
Stored Trace .....
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 51.5 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

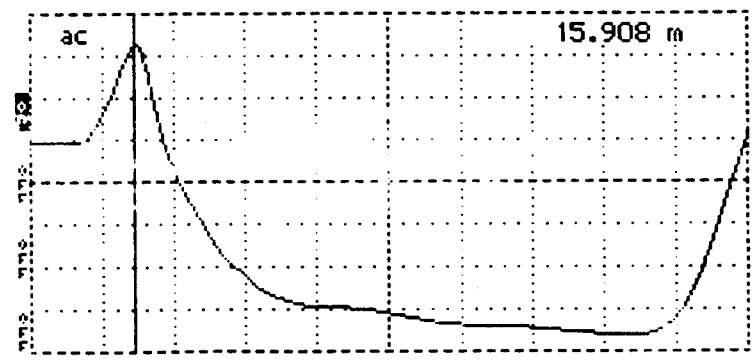


Tektronix 1502B TDR
Date 12/11/93
Cable B1
Notes Alcohol

Input Trace ———
Stored Trace .....
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 72.7 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power.....



Tektronix 1502B TDR
Date 12/11/93
Cable B1
Notes H2O

Input Trace ———
Stored Trace .....
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

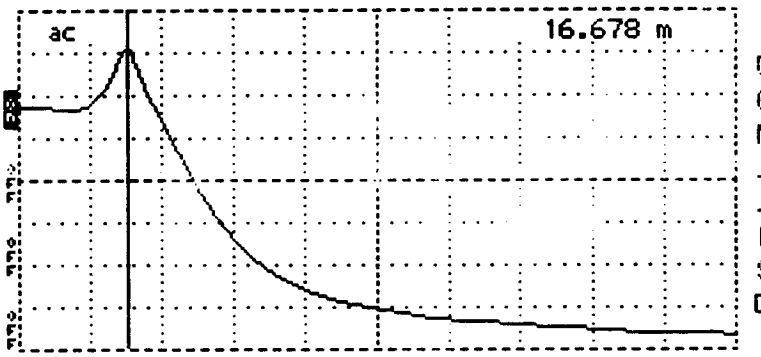
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B02

Probe Number 2

sor ..... 16.678 m
ance/Div..... .25 m/div
tical Scale.... 158 mρ/div
.... 0.99
se Filter..... 1 avg
ver..... ac

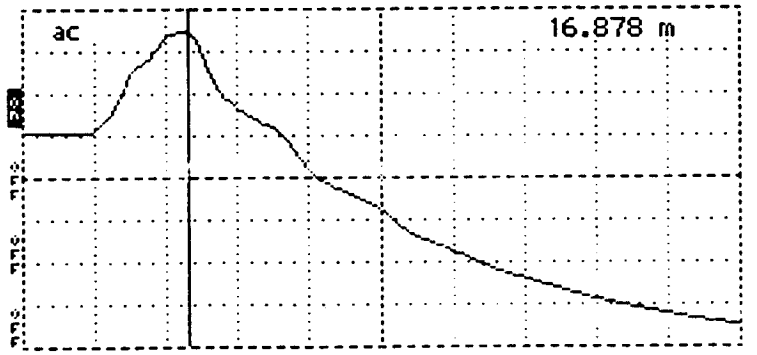


Tektronix 1502B TDR
Date 10/11/93
Cable B2
Notes Short CB

Input Trace ———
Stored Trace .....
Difference Trace -----

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

sor ..... 16.878 m
tance/Div..... .25 m/div
tical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



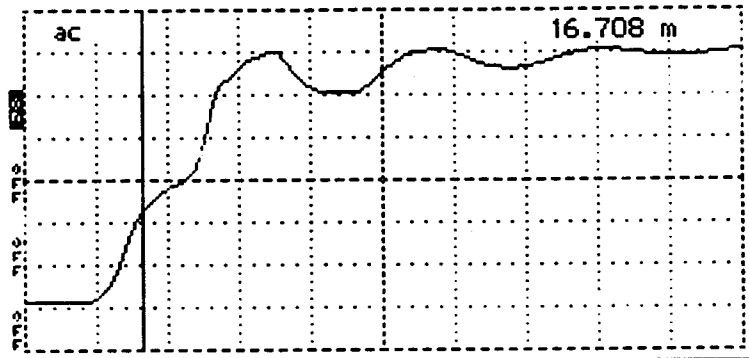
Tektronix 1502B TDR
Date 10/11/93
Cable B2
Notes Short end

Input Trace ———
Stored Trace .....
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 2 (cont.)

sor ..... 16.708 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

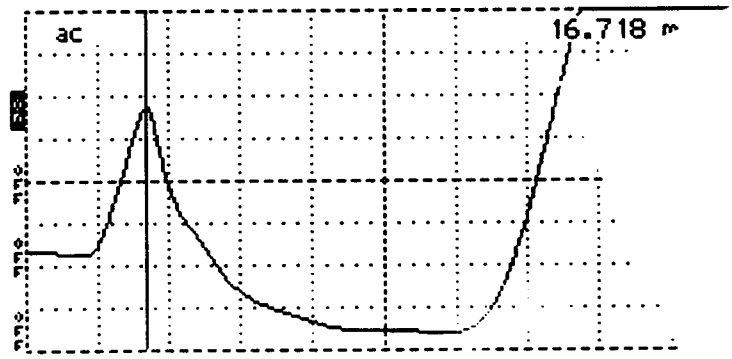


Tektronix 1502B TDR
Date 10/11/93
Cable B2
Notes Air

Input Trace
Stored Trace
Difference Trace

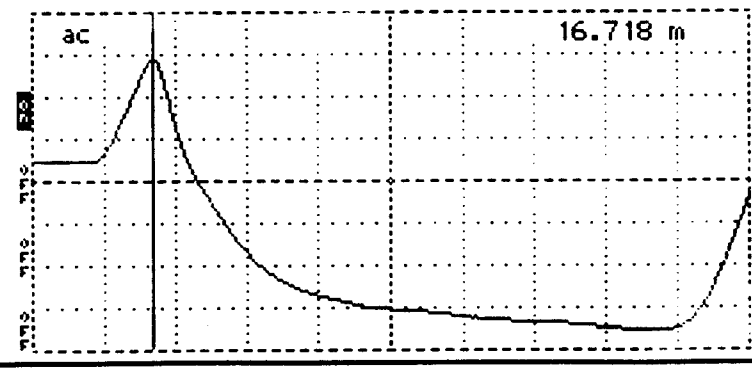
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 16.718 m
Distance/Div..... .25 m/div
Vertical Scale.... 57.7 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.718 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B2
Notes DO

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

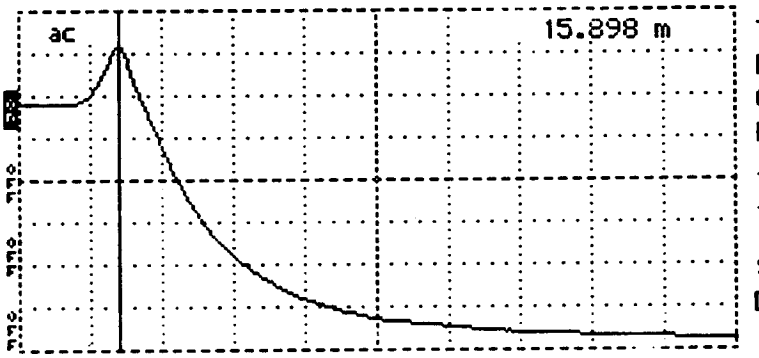
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B03

Probe Number 3

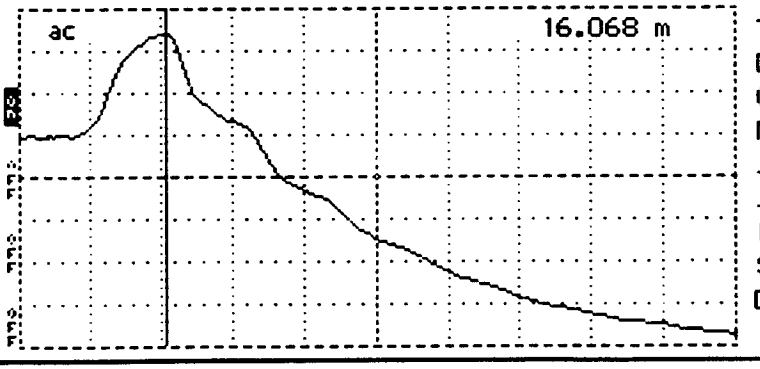
sor ..... 15.898 m
ance/Div..... .25 m/div
tical Scale.... 154 mΩ/div
..... 0.99
se Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B3
Notes Short@B
Input Trace
Stored Trace
Difference Trace

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

rsor ..... 16.068 m
tance/Div..... .25 m/div
rtical Scale.... 167 mΩ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

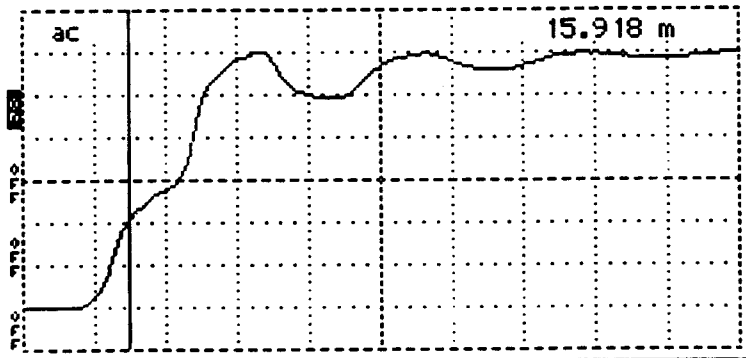


Tektronix 1502B TDR
Date 10/11/93
Cable B3
Notes Short end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 3 (cont.)

sor ..... 15.918 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

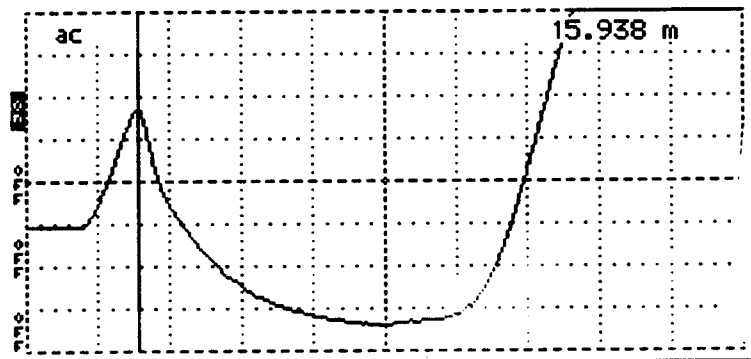


Tektronix 1502B TDR
Date 10/11/93
Cable A3
Notes Air

Input Trace ———
Stored Trace .....
Difference Trace - - -

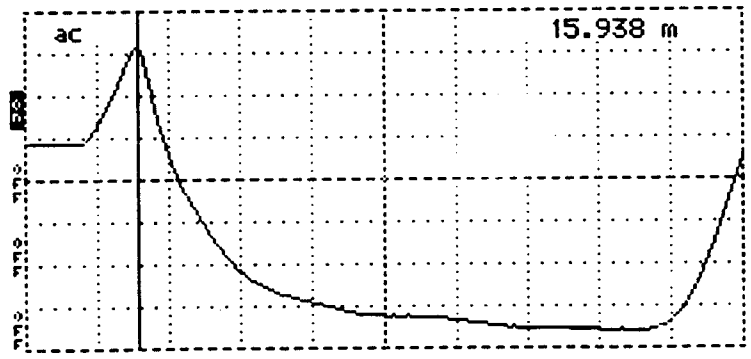
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.938 m
Distance/Div..... .25 m/div
Vertical Scale.... 62.9 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.938 m
Distance/Div..... .25 m/div
Vertical Scale.... 72.7 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable A3
Notes H2O

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

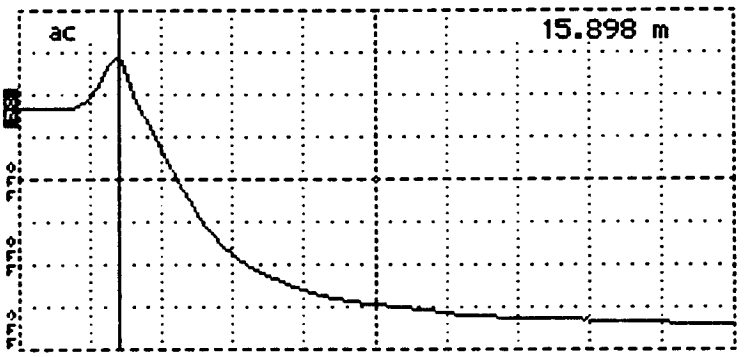
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B04

Probe Number 4

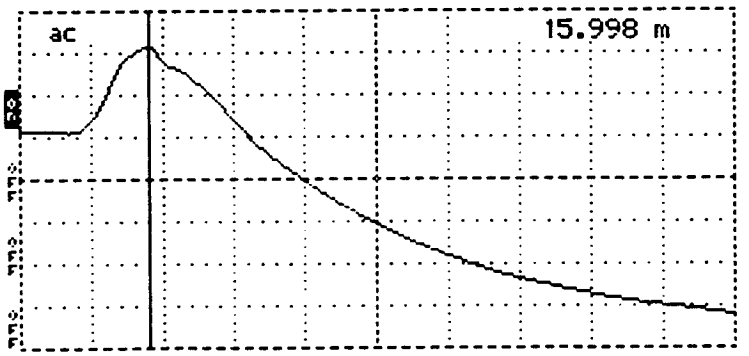
sor ..... 15.898 m
tance/Div..... .25 m/div
tical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B4
Notes Shorted
Input Trace
Stored Trace
Difference Trace

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

sor ..... 15.998 m
tance/Div..... .25 m/div
tical Scale.... 182 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

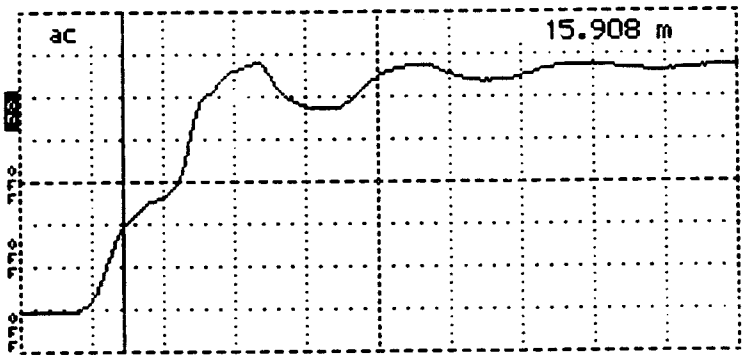


Tektronix 1502B TDR
Date 10/11/93
Cable B4
Notes Shortend
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 4 (cont.)

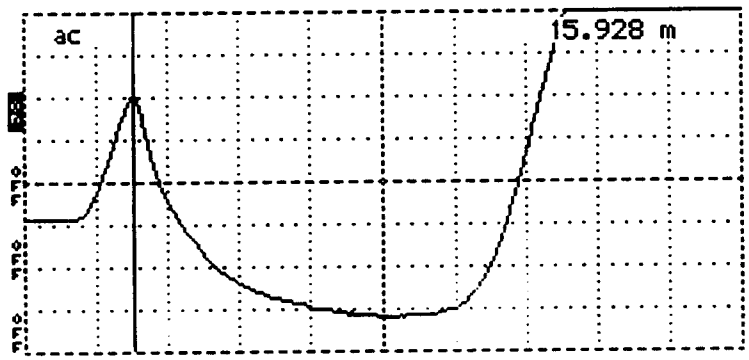
:or ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B4
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

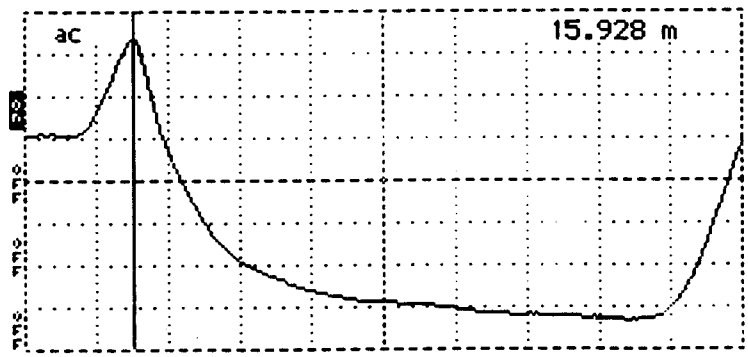
Cursor ..... 15.928 m
Distance/Div..... .25 m/div
Vertical Scale.... 62.9 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B4
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.928 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B4
Notes H2O
Input Trace
Stored Trace
Difference Trace

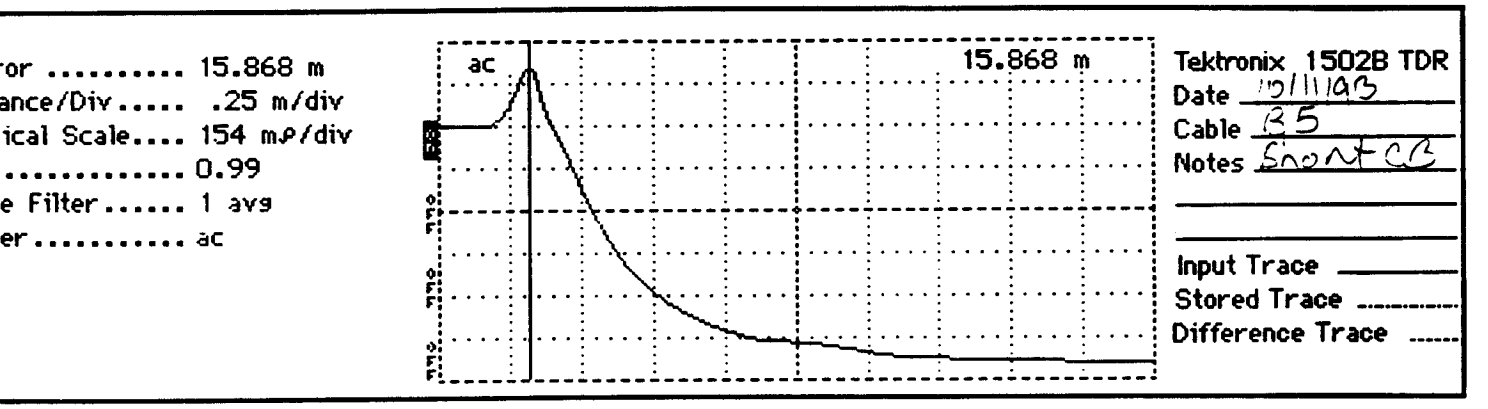
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

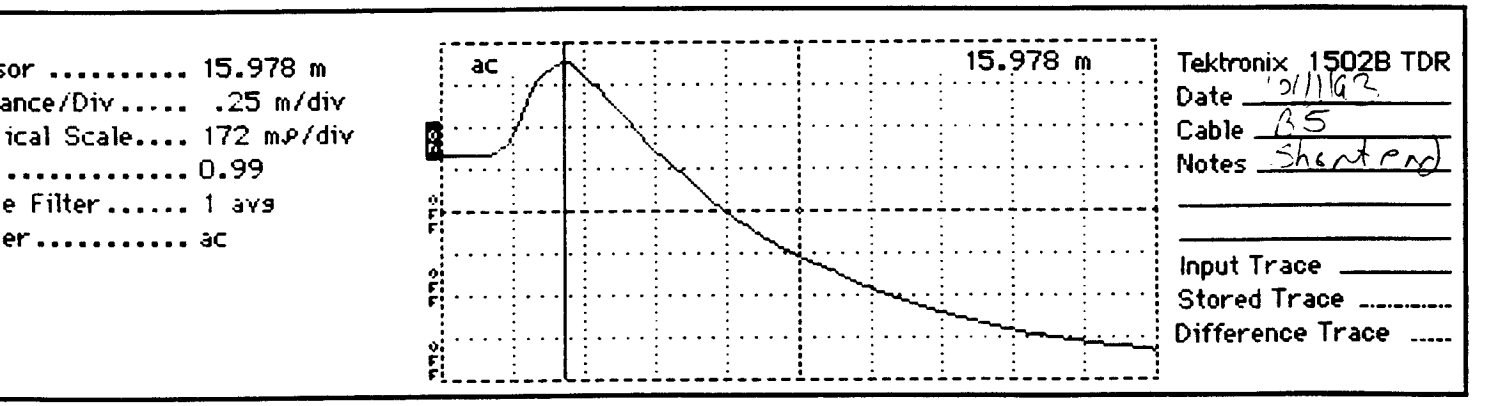
re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B05

Probe Number 5



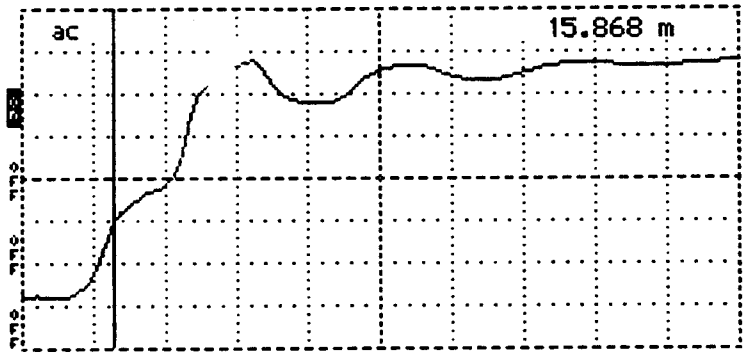
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 5 (cont.)

rsor ..... 15.868 m
Distance/Div..... .25 m/div
Vertical Scale.... 163 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

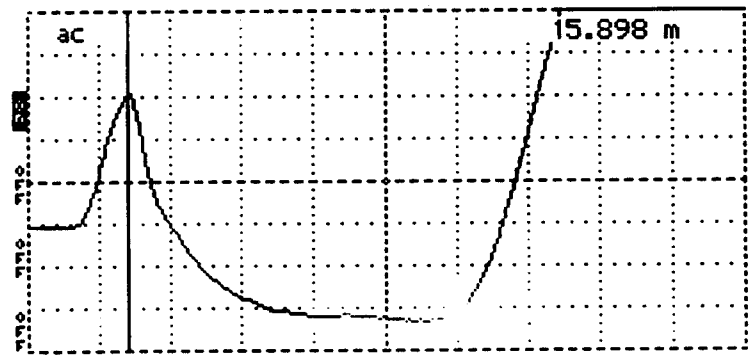


Tektronix 1502B TDR
Date 10/11/93
Cable B5
Notes Air

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.898 m
Distance/Div..... .25 m/div
Vertical Scale.... 62.9 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

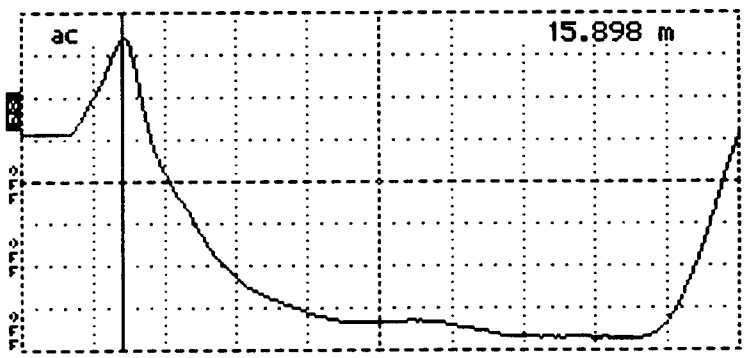


Tektronix 1502B TDR
Date 10/11/93
Cable B5
Notes Alcohol

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.898 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B5
Notes H2O

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

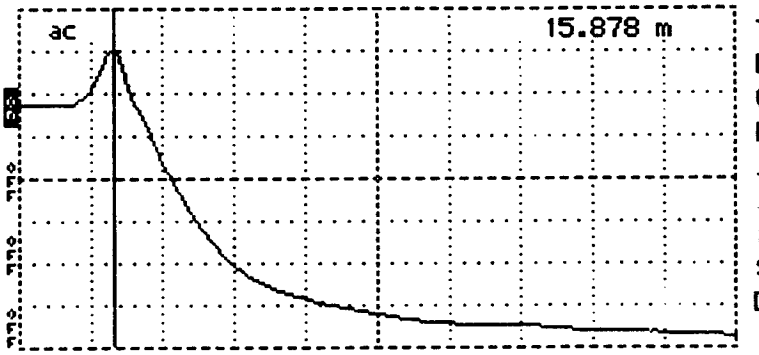
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 373006

Probe Number 6

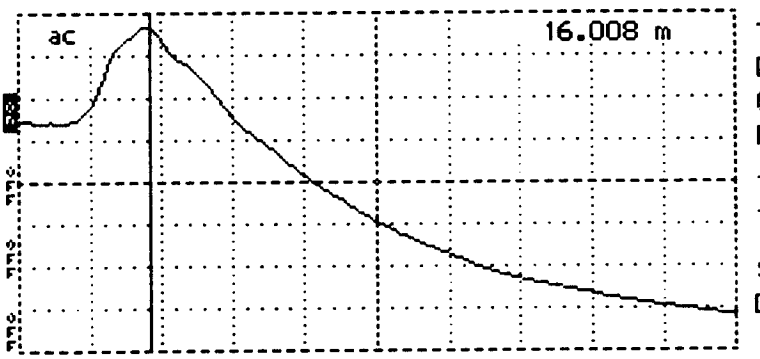
or ..... 15.878 m
ance/Div..... .25 m/div
ical Scale.... 158 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B6
Notes Short CB
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.008 m
ance/Div..... .25 m/div
ical Scale.... 172 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac

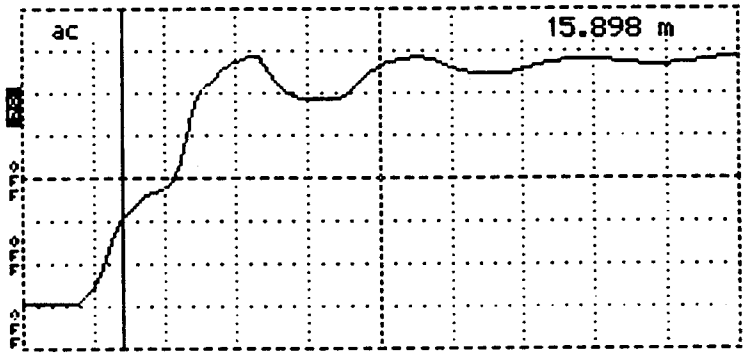


Tektronix 1502B TDR
Date 10/11/93
Cable B6
Notes Shorted
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 6 (cont.)

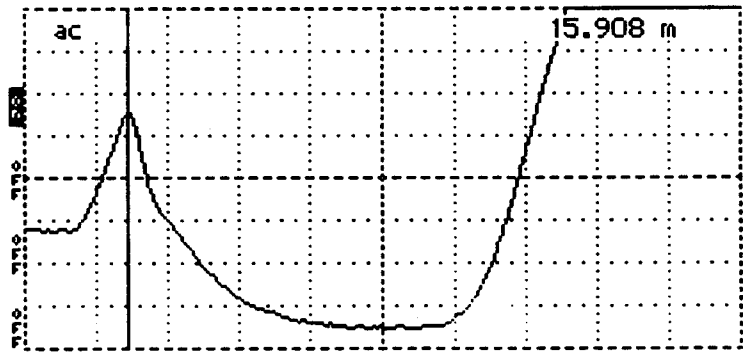
sor ..... 15.898 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B6
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

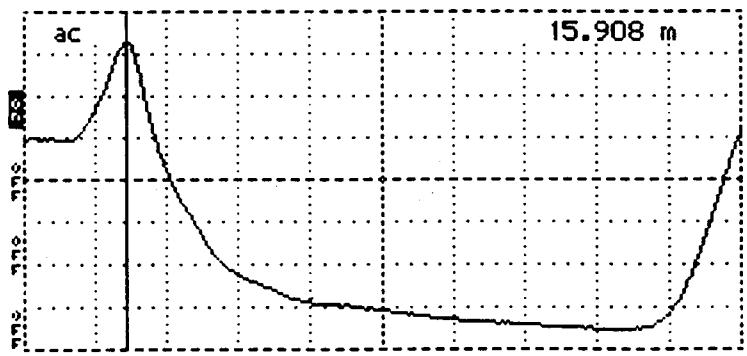
Cursor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 61.2 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B6
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 72.7 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B6
Notes 50
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

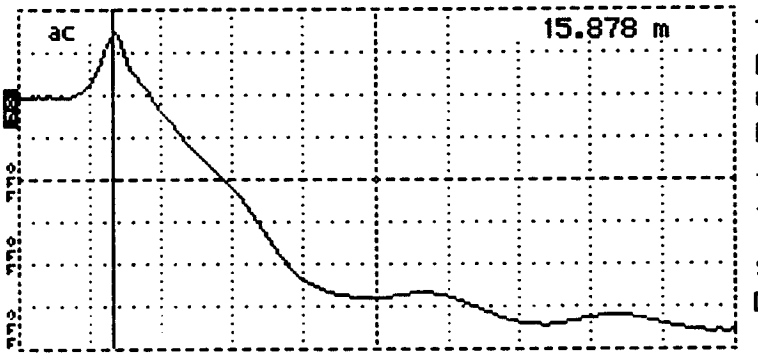
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B07

Probe Number 7

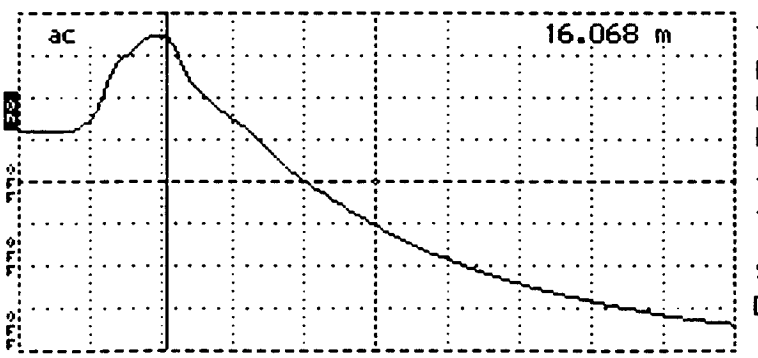
sor ..... 15.878 m
ance/Div..... .25 m/div
tical Scale.... 158 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B7
Notes Short CB
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.068 m
ance/Div..... .25 m/div
tical Scale.... 172 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac

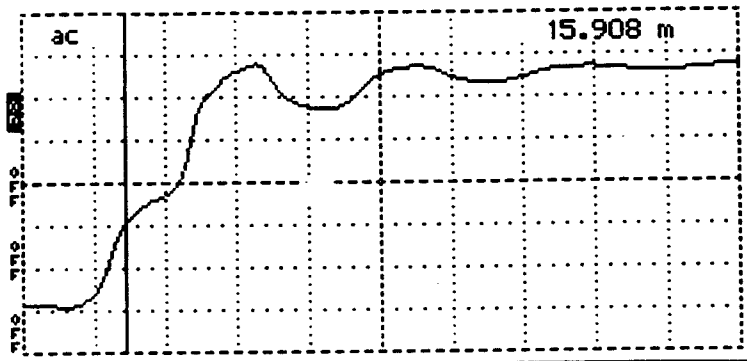


Tektronix 1502B TDR
Date 10/4/93
Cable B7
Notes Short-end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 7 (cont.)

sor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

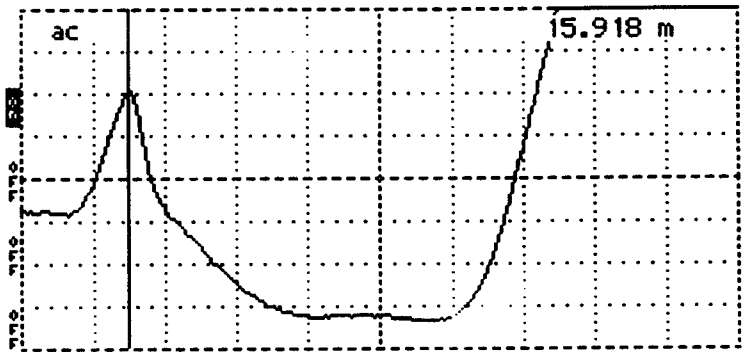


Tektronix 1502B TDR
Date 10/11/93
Cable B7
Notes Air

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.918 m
Distance/Div..... .25 m/div
Vertical Scale.... 57.7 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

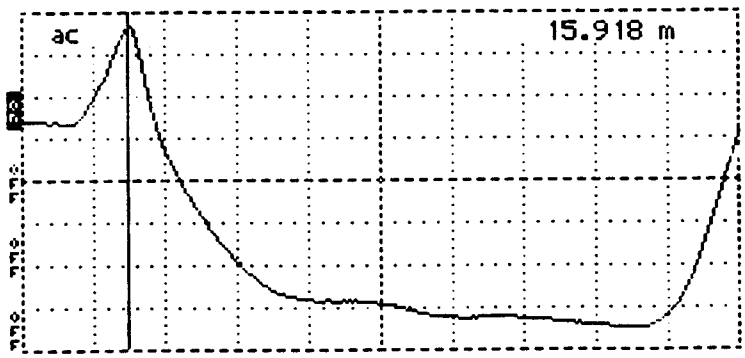


Tektronix 1502B TDR
Date 10/11/93
Cable B7
Notes Alcohol

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

ursor ..... 15.918 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B7
Notes H2O

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

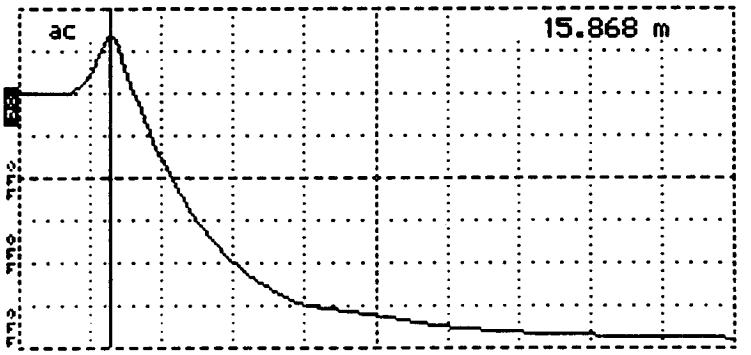
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B008

Probe Number 8

sor ..... 15.868 m
tance/Div..... .25 m/div
tical Scale.... 149 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

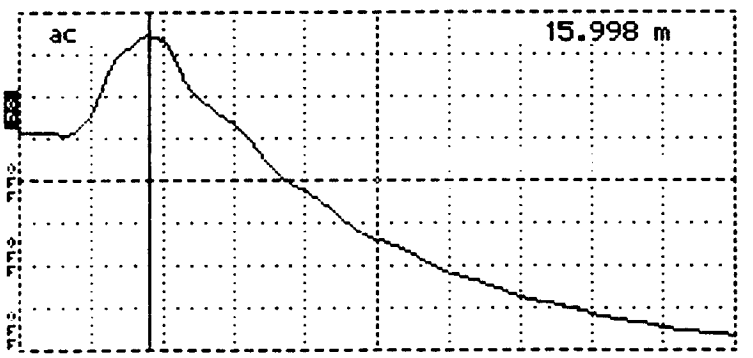


Tektronix 1502B TDR
Date 10/11/93
Cable BS
Notes Short @ B

Input Trace
Stored Trace
Difference Trace

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

sor ..... 15.998 m
tance/Div..... .25 m/div
tical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

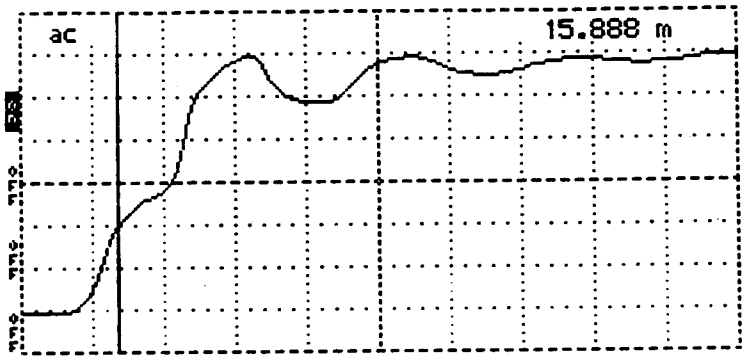


Tektronix 1502B TDR
Date 10/11/93
Cable CS
Notes Shorted

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

sor ..... 15.888 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

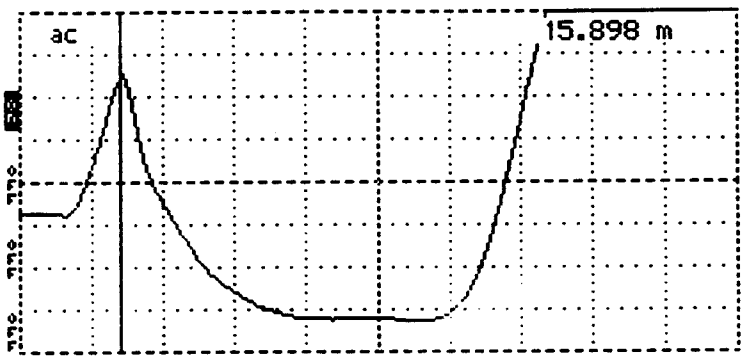


Tektronix 1502B TDR
Date 10/11/93
Cable B8
Notes Air

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.898 m
Distance/Div..... .25 m/div
Vertical Scale.... 56.1 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

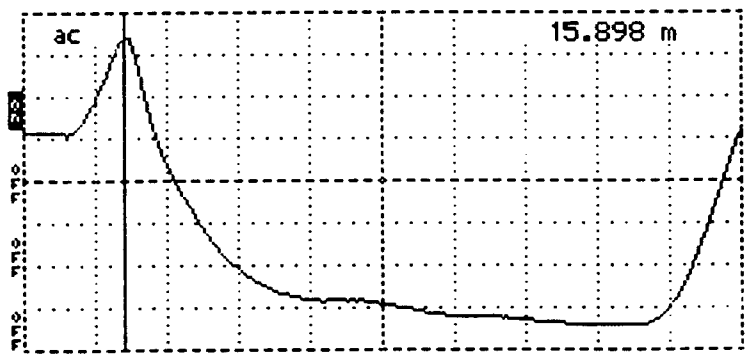


Tektronix 1502B TDR
Date 10/11/93
Cable B8
Notes Alcohol

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.898 m
Distance/Div..... .25 m/div
Vertical Scale.... 72.7 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B8
Notes H2O

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

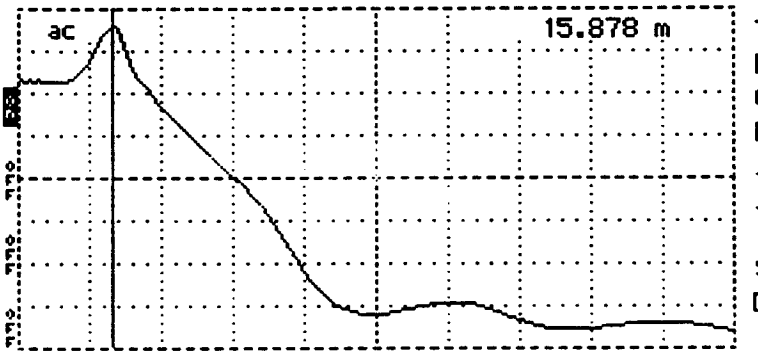
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0212]

re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B09

Probe Number 9

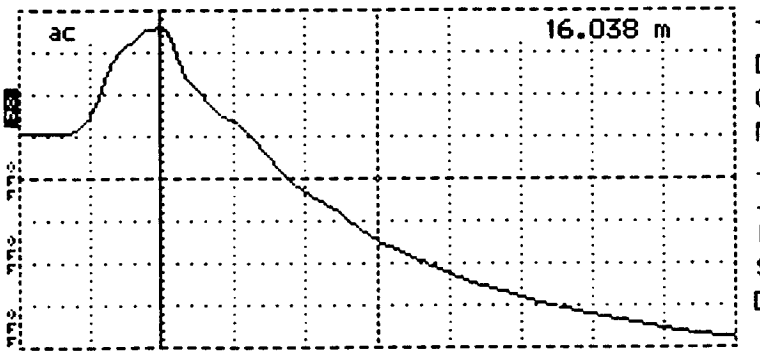
sor ..... 15.878 m
tance/Div..... .25 m/div
tical Scale.... 145 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektronix 1502B TDR
Date 10111193
Cable 69
Notes Short@3
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.038 m
ance/Div..... .25 m/div
tical Scale.... 163 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

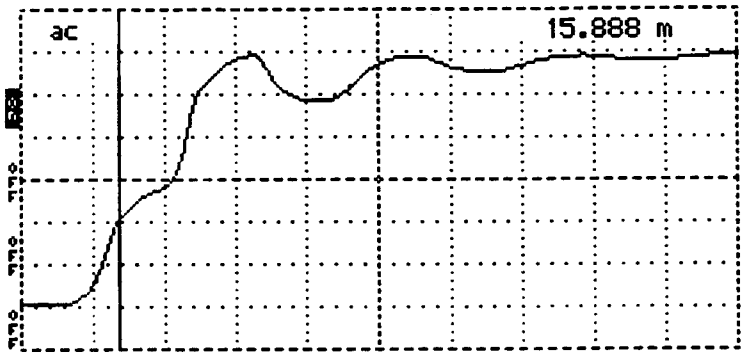


Tektronix 1502B TDR
Date 10111193
Cable 69
Notes Int end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 9 (cont.)

'sor ..... 15.888 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

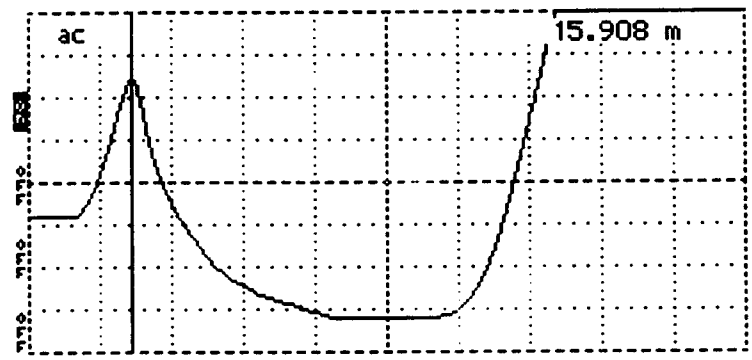


Tektronix 1502B TDR
Date 10/11/93
Cable B9
Notes Air

Input Trace ———
Stored Trace ----------
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 57.7 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

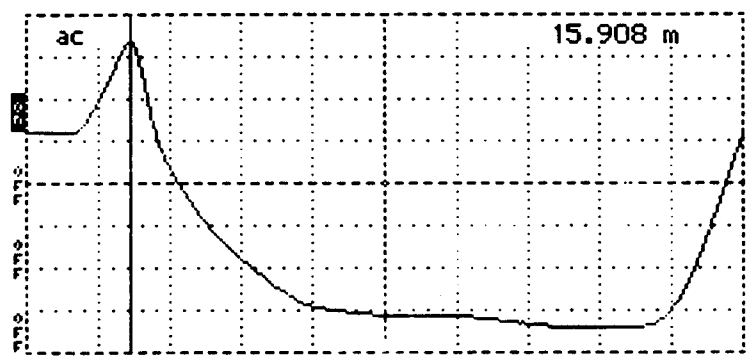


Tektronix 1502B TDR
Date 10/11/93
Cable B9
Notes Alcohol

Input Trace ———
Stored Trace ----------
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.908 m
Distance/Div..... .25 m/div
Vertical Scale.... 70.6 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B9
Notes H2O

Input Trace ———
Stored Trace ----------
Difference Trace -----

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

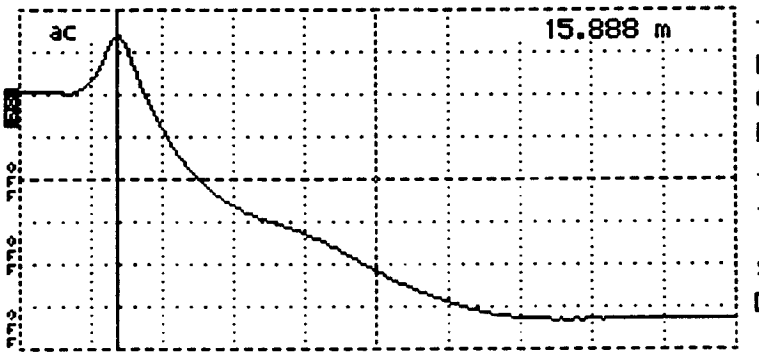
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0217]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37B10

Probe Number 10

rsor ..... 15.888 m
tance/Div..... .25 m/div
rtical Scale.... 158 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

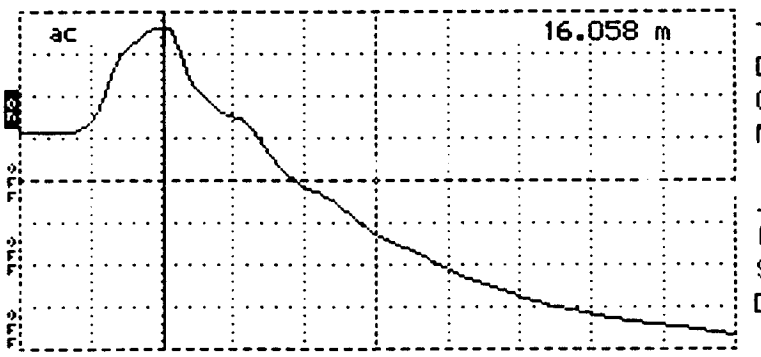


Tektronix 1502B TDR
Date 10/11/93
Cable B10
Notes Short C/B

Input Trace ———
Stored Trace .....
Difference Trace - - -

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

rsor ..... 16.058 m
tance/Div..... .25 m/div
rtical Scale.... 163 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

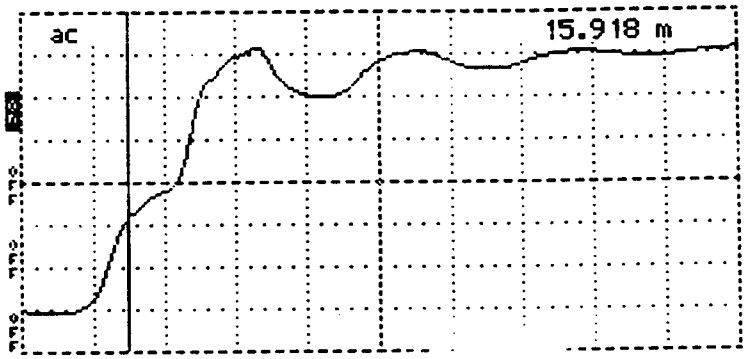


Tektronix 1502B TDR
Date 10/11/93
Cable B10
Notes Short end

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

sor ..... 15.918 m
Distance/Div..... .25 m/div
Vertical Scale.... 145 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B1D
Notes Air

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

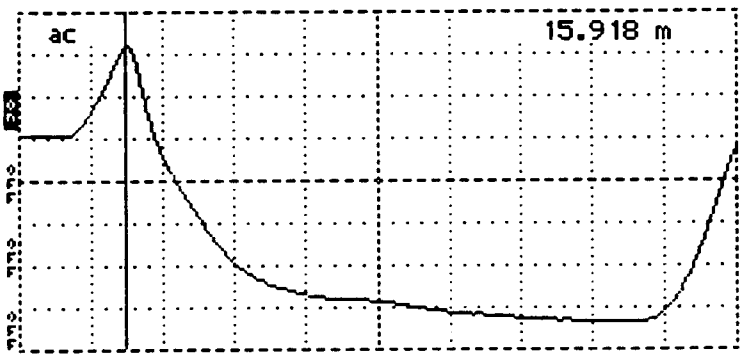
Cursor ..... 15.918 m
Distance/Div..... .25 m/div
Vertical Scale.... 64.8 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

Tektronix 1502B TDR
Date 10/11/93
Cable B1D
Notes Alcohol

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 15.918 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable B1D
Notes H2O

Input Trace
Stored Trace
Difference Trace

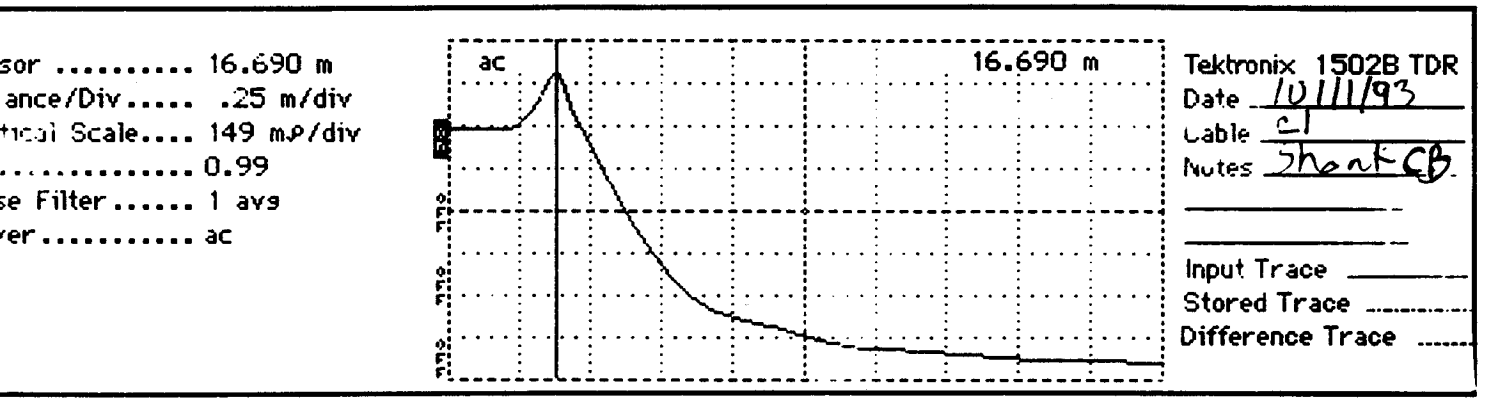
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

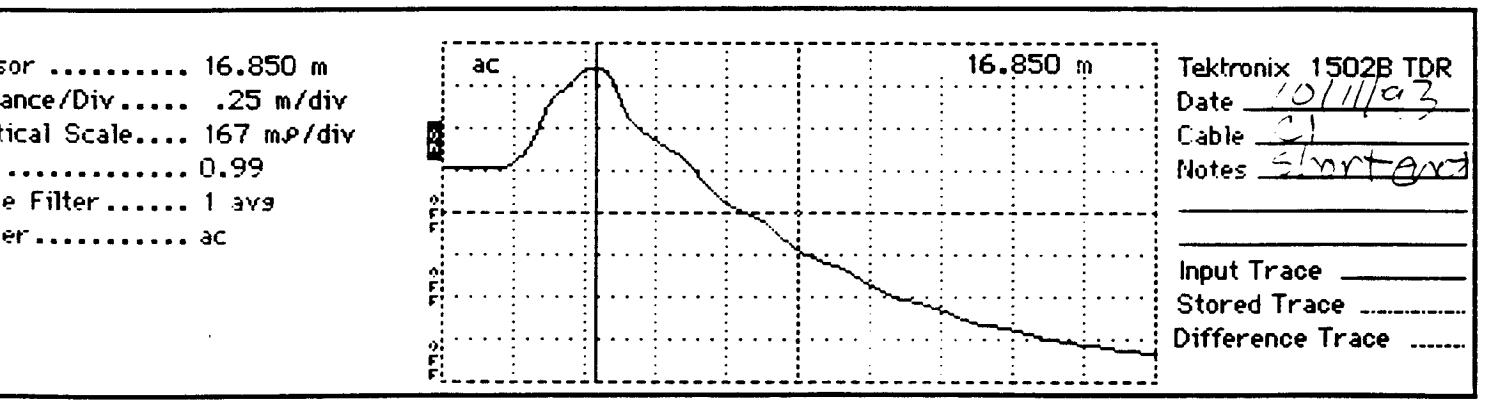
ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C01

Probe Number 1



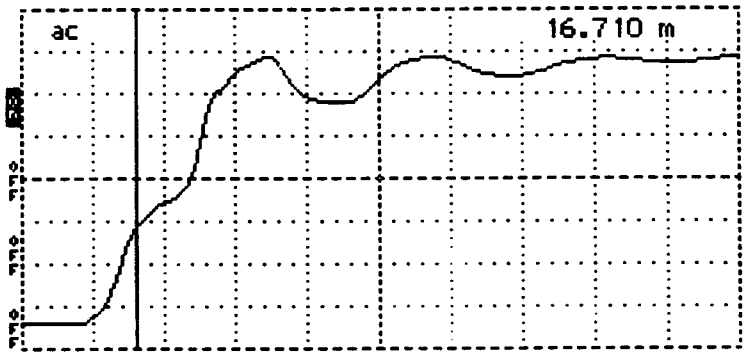
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 1 (cont.)

sor ..... 16.710 m
Distance/Div..... .25 m/div
Vertical Scale.... 137 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

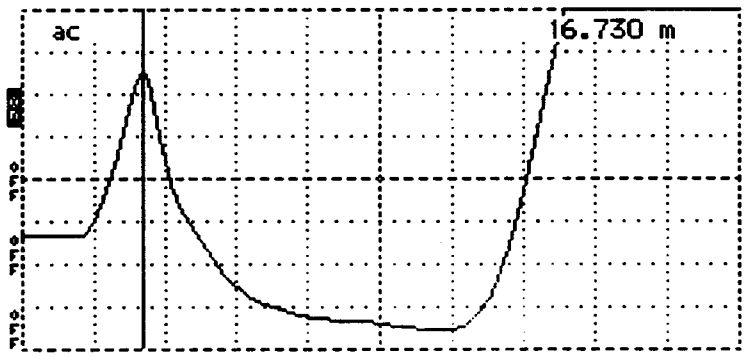


Tektronix 1502B TDR
Date 10/11/93
Cable C1
Notes Air

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 16.730 m
Distance/Div..... .25 m/div
Vertical Scale.... 50.0 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

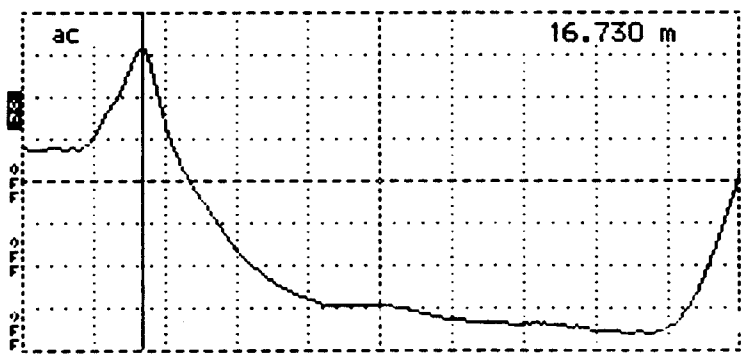


Tektronix 1502B TDR
Date 10/11/93
Cable C1
Notes Alcohol

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.730 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C1
Notes H2O

Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

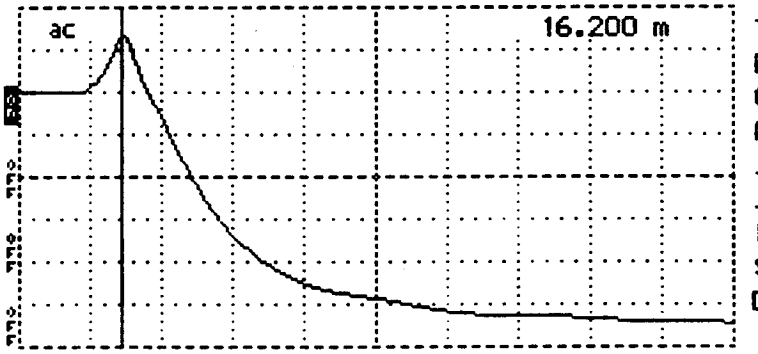
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

ore Operation Checks

- Calibration Date 10/11/96
- Probe S/N 37C02

Probe Number 2

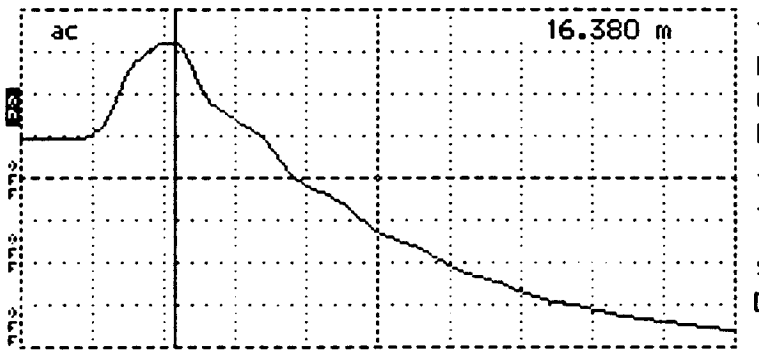
sor ..... 16.200 m
tance/Div..... .25 m/div
tical Scale.... 154 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektronix 1502B TDR
Date 12/11/93
Cable C2
Notes Short CB
Input Trace
Stored Trace
Difference Trace

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

rsor ..... 16.380 m
tance/Div..... .25 m/div
rtical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

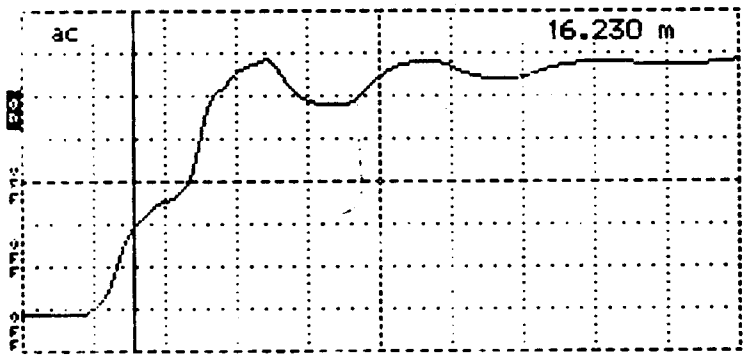


Tektronix 1502B TDR
Date 12/11/93
Cable C2
Notes Shorted end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 2 (cont.)

sor ..... 16.230 m
Distance/Div..... .25 m/div
Vertical Scale.... 145 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

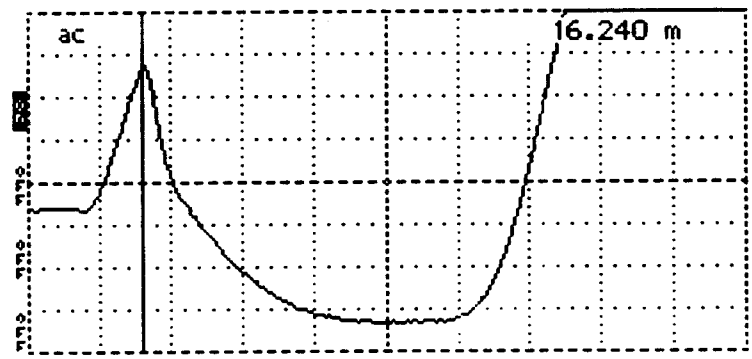


Tektronix 1502B TDR
Date 10/11/93
Cable C2
Notes Air

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

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 16.240 m
Distance/Div..... .25 m/div
Vertical Scale.... 50.0 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

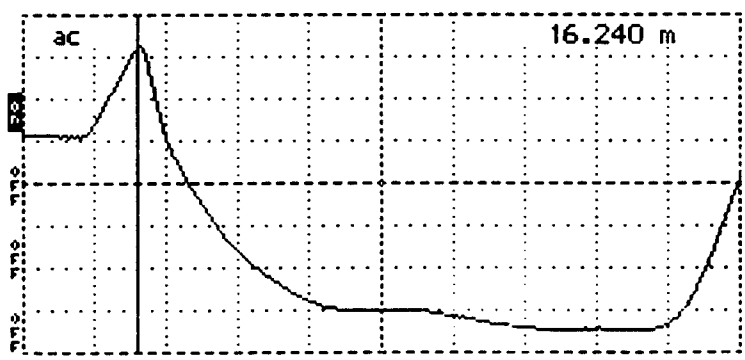


Tektronix 1502B TDR
Date 10/11/93
Cable C2
Notes Alcohol

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

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.240 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mΩ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C2
Notes H_2O

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

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

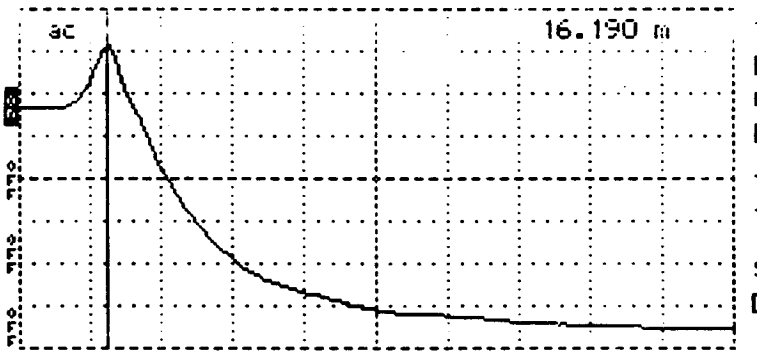
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C03

Probe Number 3

rsor ..... 16.190 m
tance/Div..... .25 m/div
rtical Scale.... 158 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

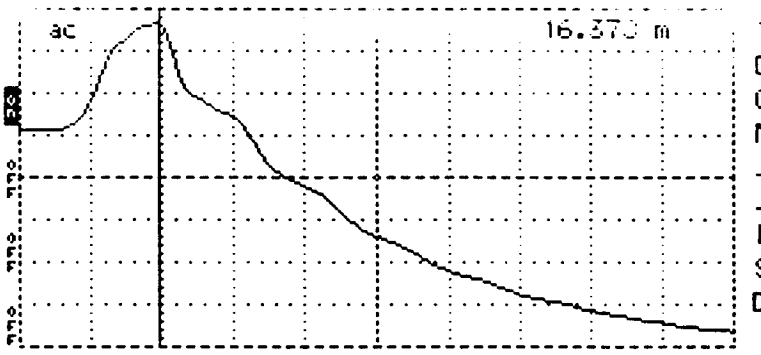


Tektronix 1502B TDR
Date 10/11/93
Cable C3
Notes Short CB

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

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

sor ..... 16.370 m
tance/Div..... .25 m/div
tical Scale.... 158 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



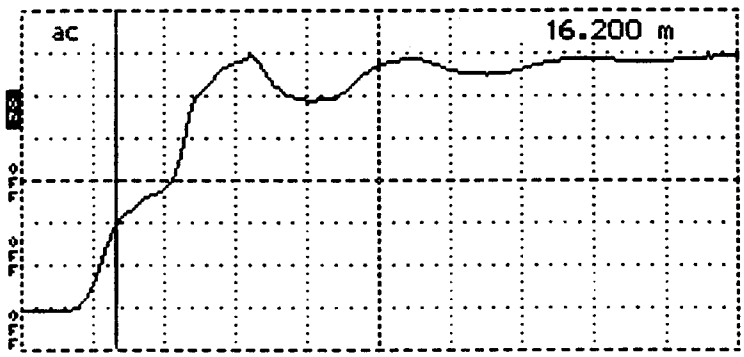
Tektronix 1502B TDR
Date 10/11/93
Cable C3
Notes Short end

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

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 3 (cont.)

sor ..... 16.200 m
Distance/Div..... .25 m/div
Vertical Scale.... 145 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

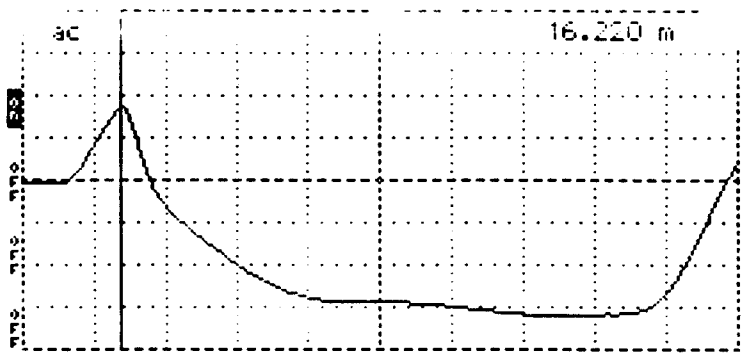


Tektronix 1502B TDR
Date 10/11/93
Cable C3
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.220 m
Distance/Div..... .25 m/div
Vertical Scale.... 86.4 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C3
Notes H2O
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

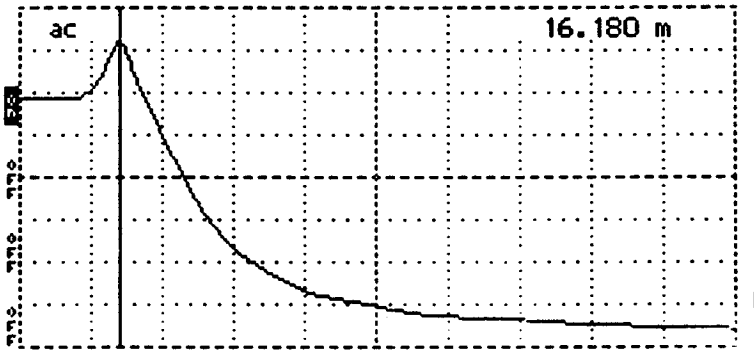
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C04

Probe Number 4

rsor ..... 16.180 m
tance/Div..... .25 m/div
rtical Scale.... 154 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

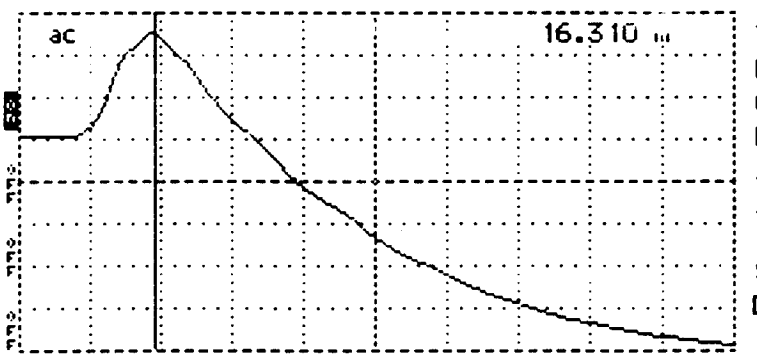


Tektronix 1502B TDR
Date 10/11/93
Cable C4
Notes Short CB

Input Trace
Stored Trace
Difference Trace

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

rsor ..... 16.310 m
tance/Div..... .25 m/div
rtical Scale.... 154 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac



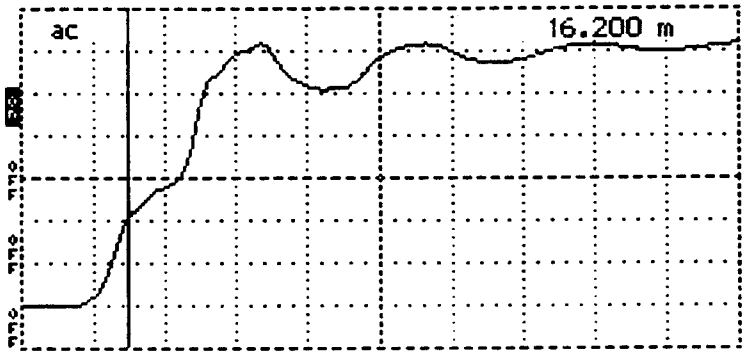
Tektronix 1502B TDR
Date 10/11/93
Cable C4
Notes Shortend

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 4 (cont.)

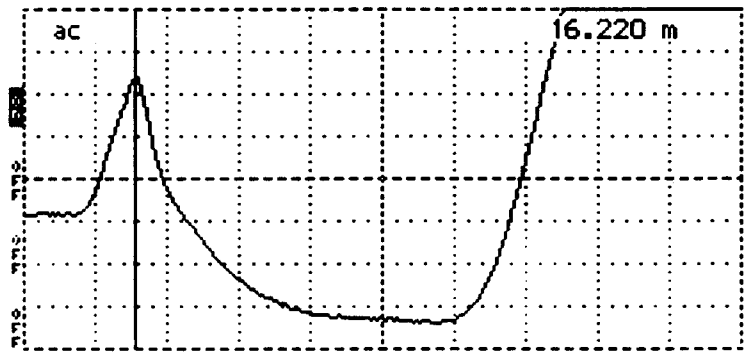
sor ..... 16.200 m
Distance/Div..... .25 m/div
Vertical Scale.... 141 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12/11/93
Cable C4
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

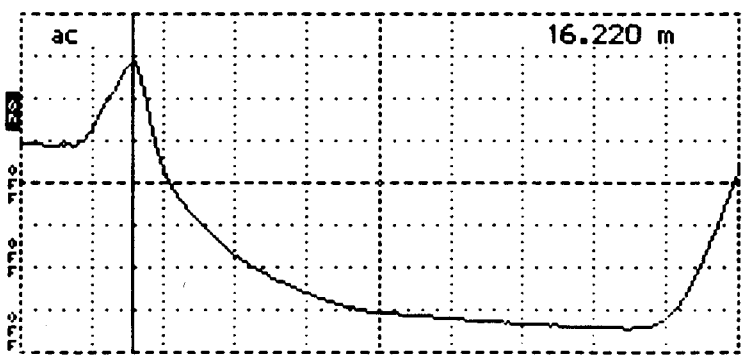
Cursor ..... 16.220 m
Distance/Div..... .25 m/div
Vertical Scale.... 53.0 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12/11/93
Cable C4
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.220 m
Distance/Div..... .25 m/div
Vertical Scale.... 72.7 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 12/11/93
Cable C4
Notes H2O
Input Trace
Stored Trace
Difference Trace

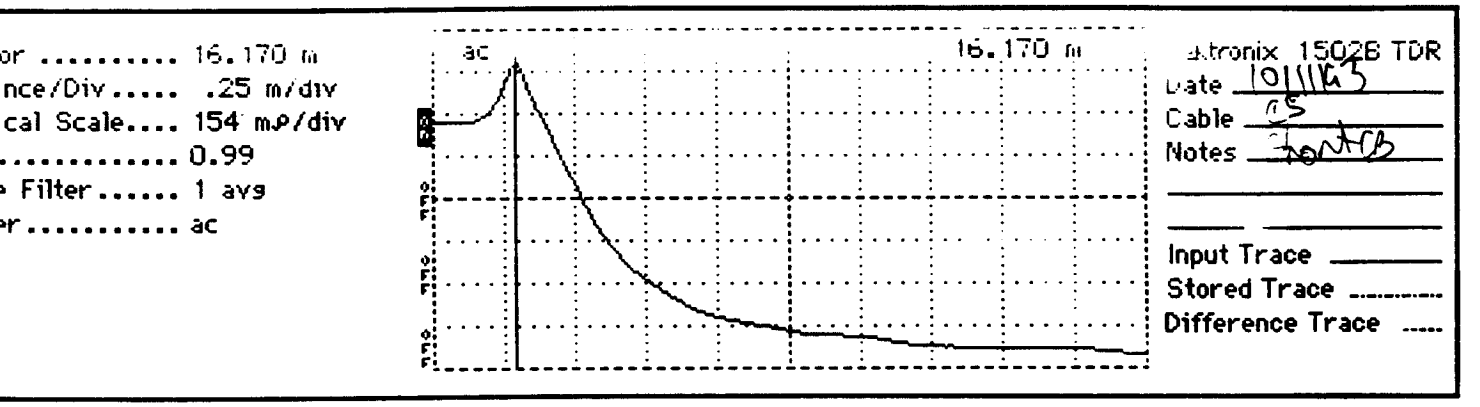
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

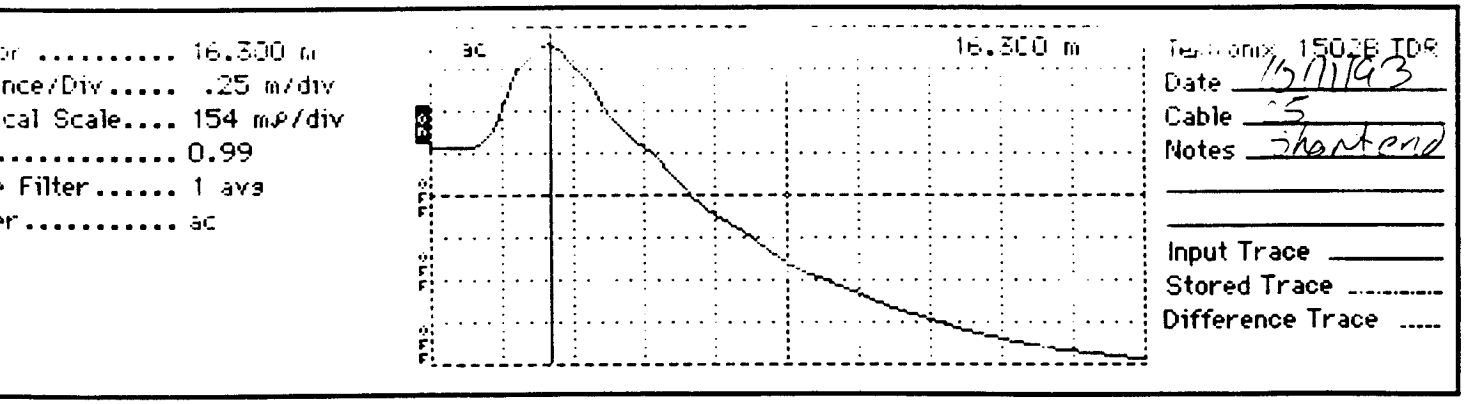
e Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C05

Probe Number 5

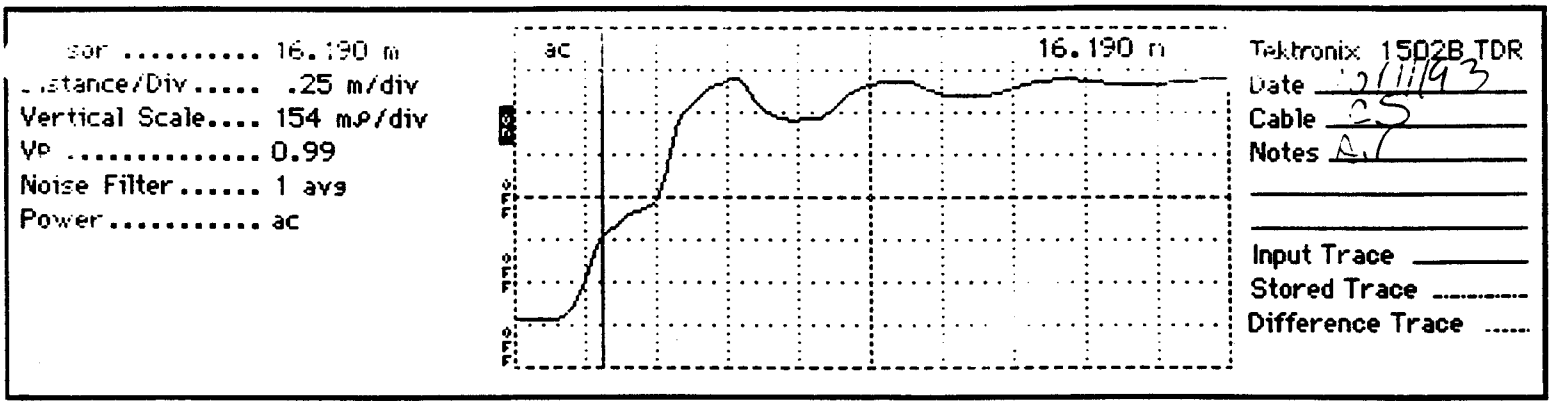


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		

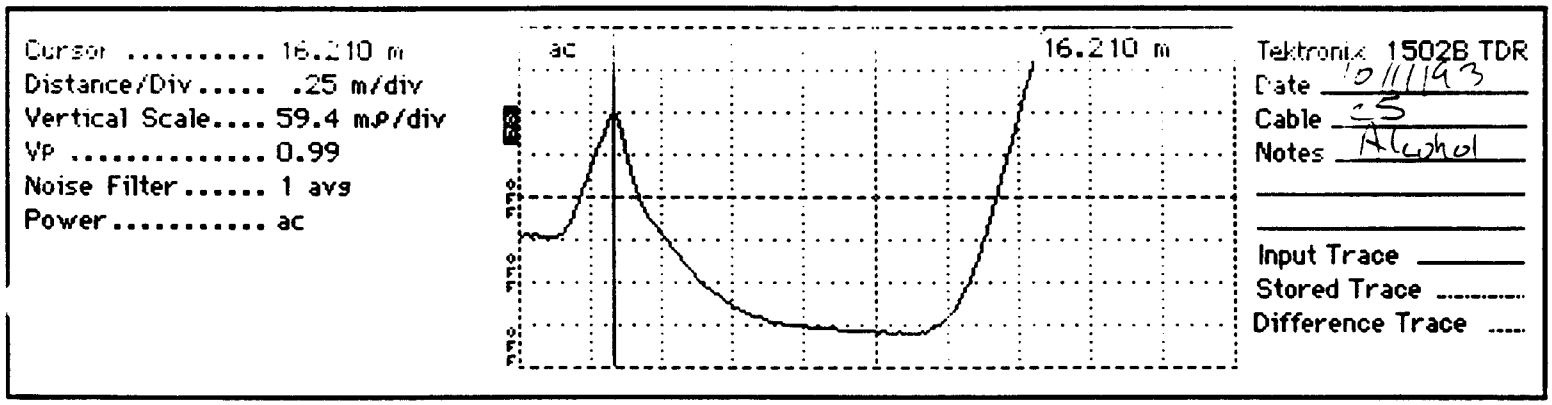


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

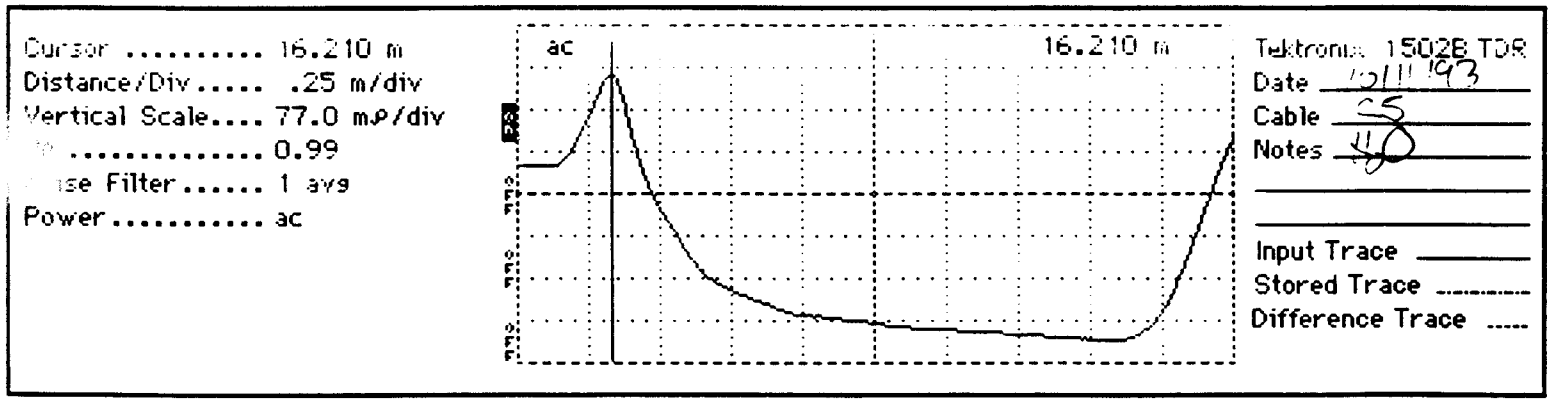
Probe Number 5 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

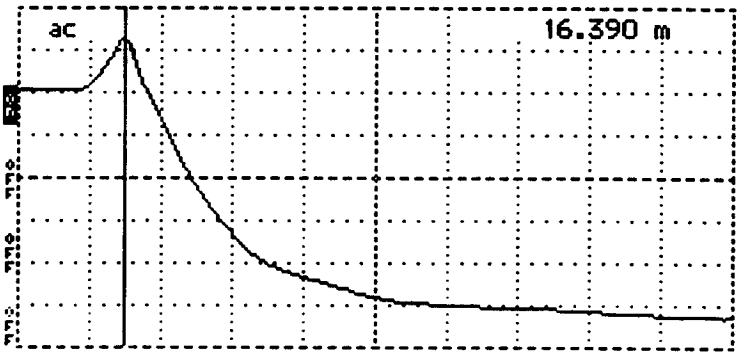
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C006

Probe Number 6

sor ..... 16.390 m
ance/Div..... .25 m/div
tical Scale.... 158 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac

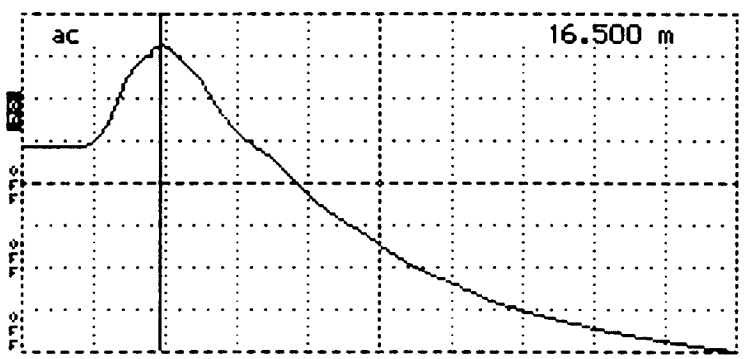


Tektronix 1502B TDR
Date 10/11/93
Cable C6
Notes Short C6

Input Trace ———
Stored Trace .....
Difference Trace - - -

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

sor ..... 16.500 m
tance/Div..... .25 m/div
tical Scale.... 158 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

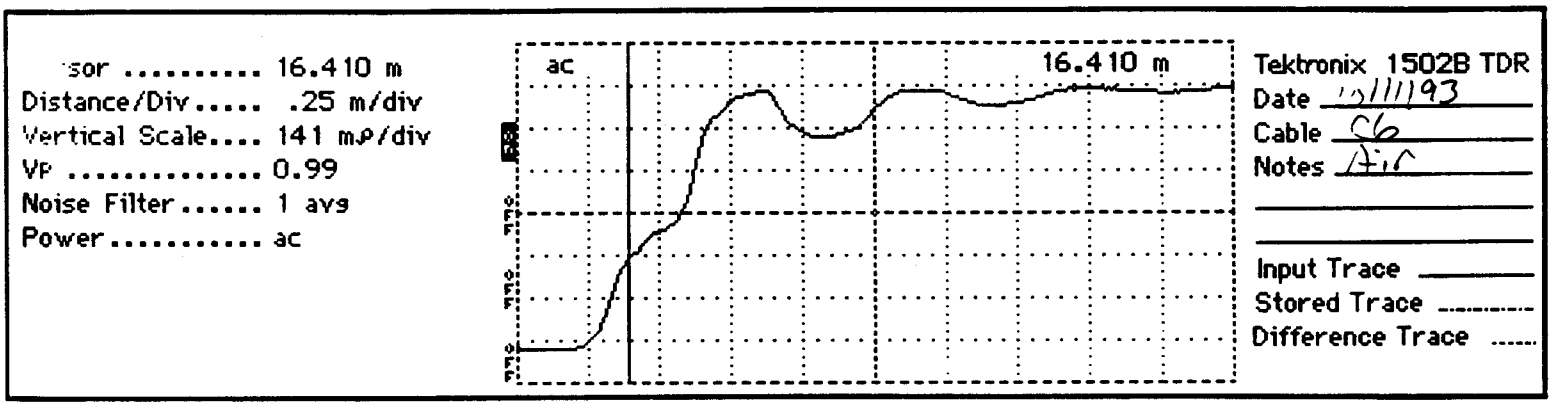


Tektronix 1502B TDR
Date 10/11/93
Cable C6
Notes Short End

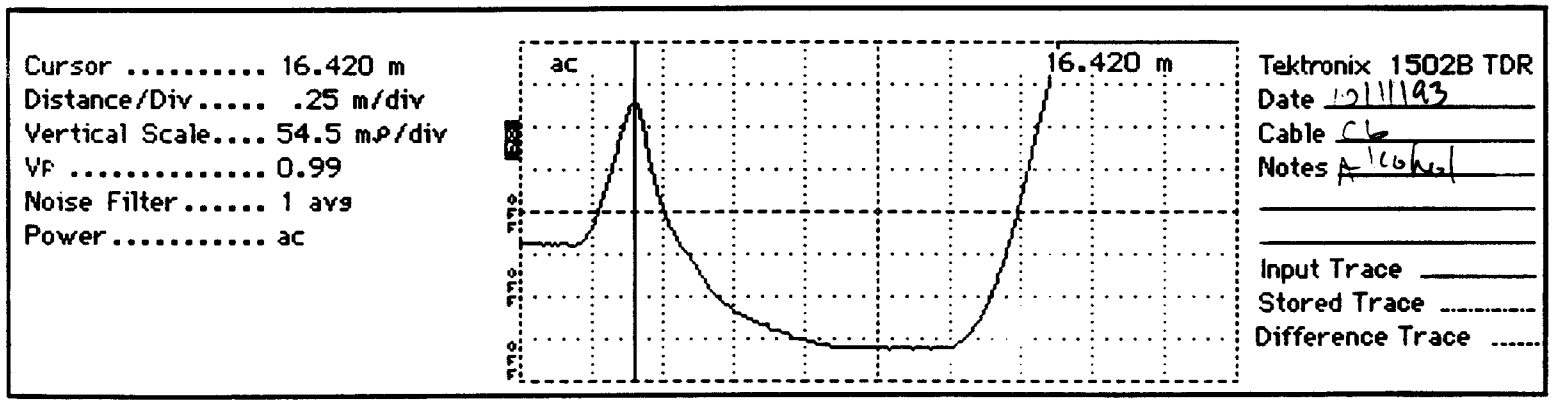
Input Trace ———
Stored Trace .....
Difference Trace - - -

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

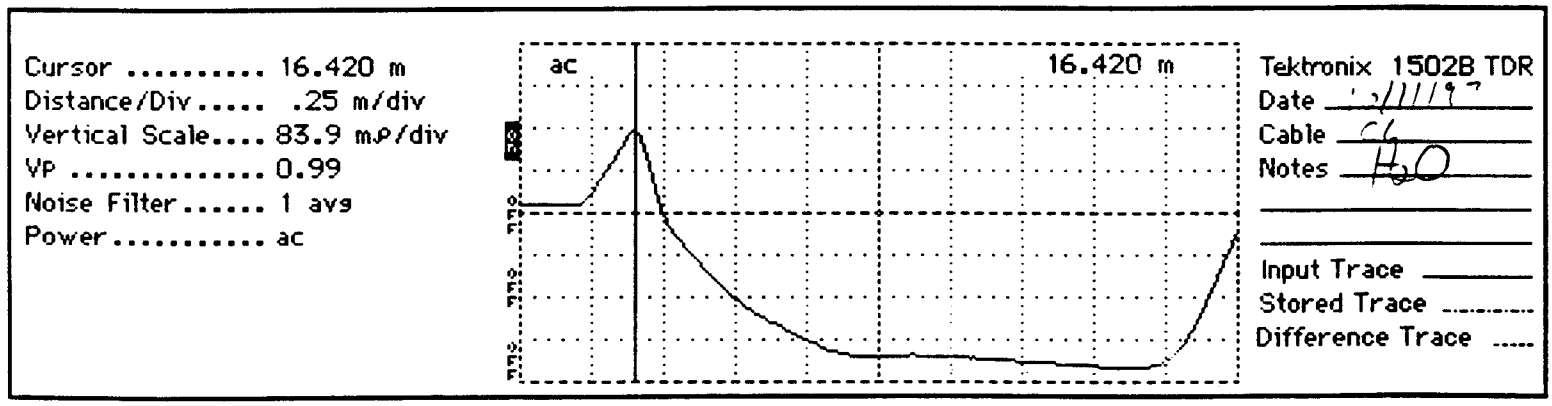
Probe Number 6 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

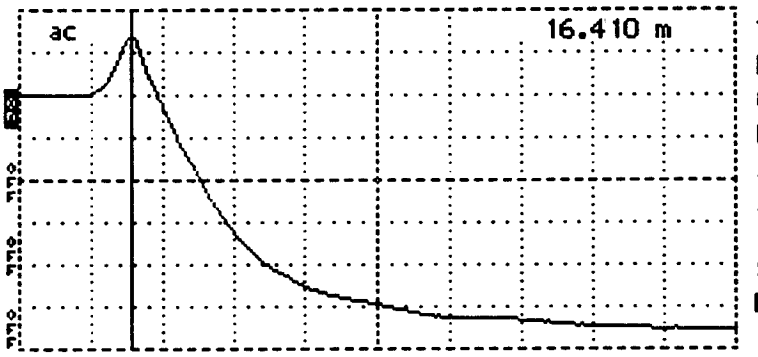
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C07

Probe Number 7

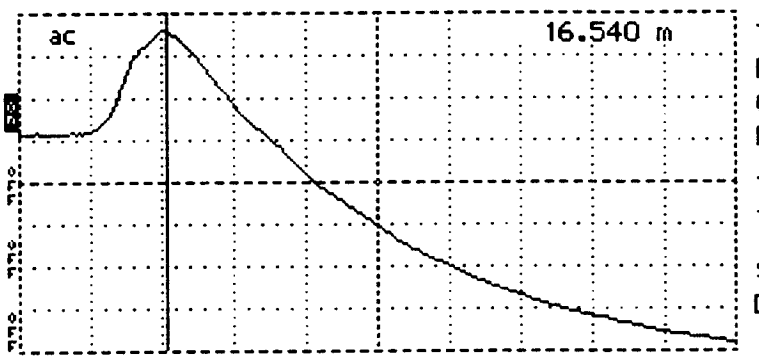
sor ..... 16.410 m
ance/Div..... .25 m/div
tical Scale.... 149 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C7
Notes Short Lab
Input Trace
Stored Trace
Difference Trace

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

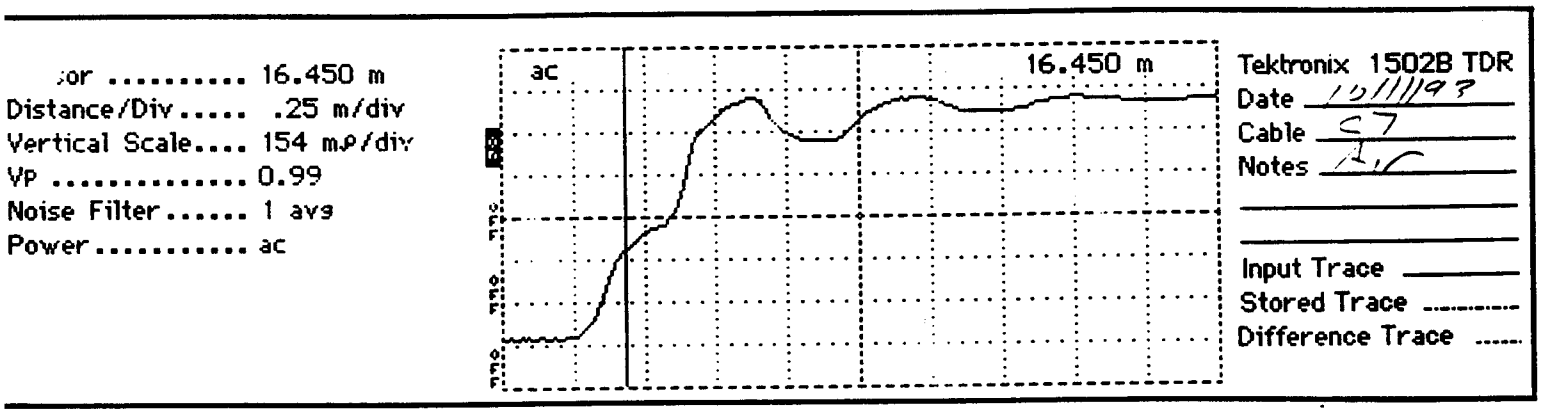
sor ..... 16.540 m
tance/Div..... .25 m/div
tical Scale.... 154 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



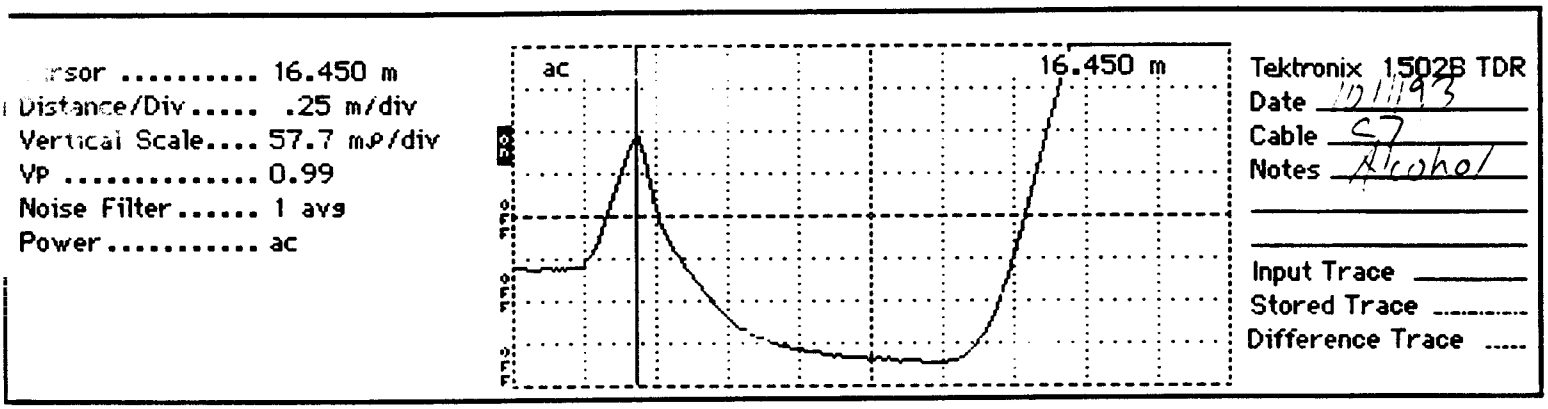
Tektronix 1502B TDR
Date 10/11/93
Cable C7
Notes Short end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

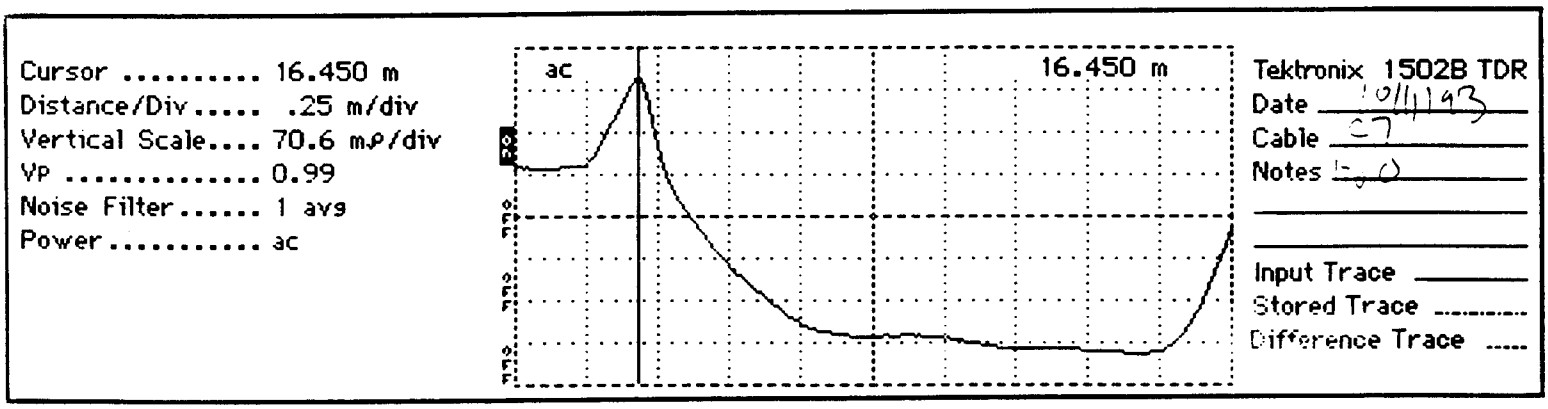
Probe Number 7 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

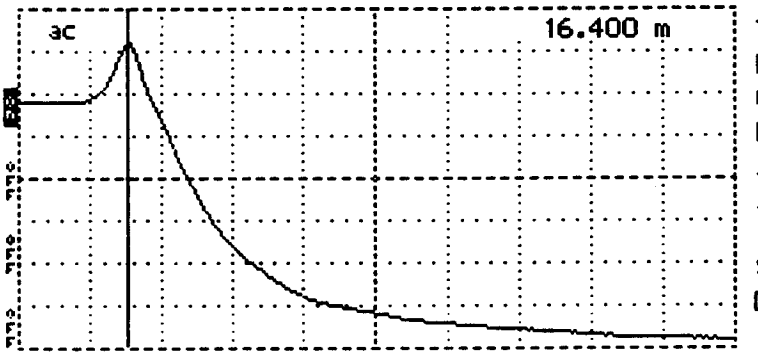
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C08

Probe Number 8

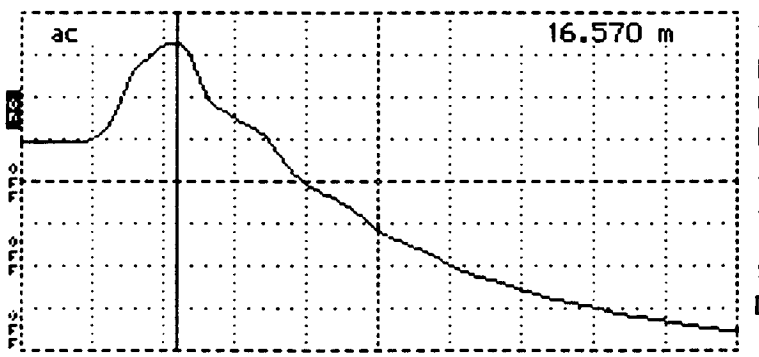
sor ..... 16.400 m
ance/Div..... .25 m/div
tical Scale.... 149 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C8
Notes Short@B
Input Trace
Stored Trace
Difference Trace

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

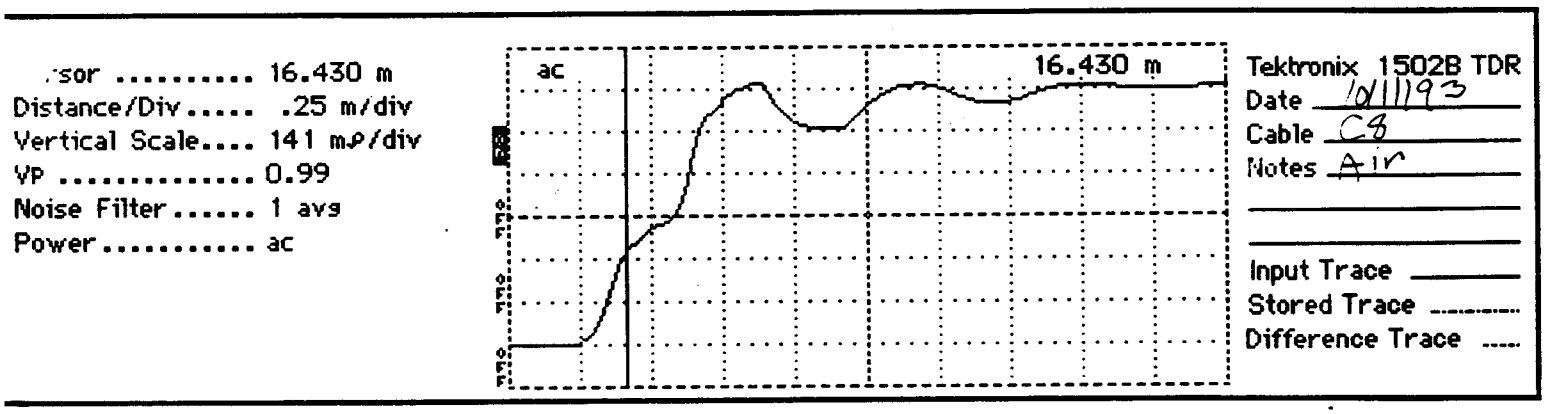
sor ..... 16.570 m
tance/Div..... .25 m/div
tical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



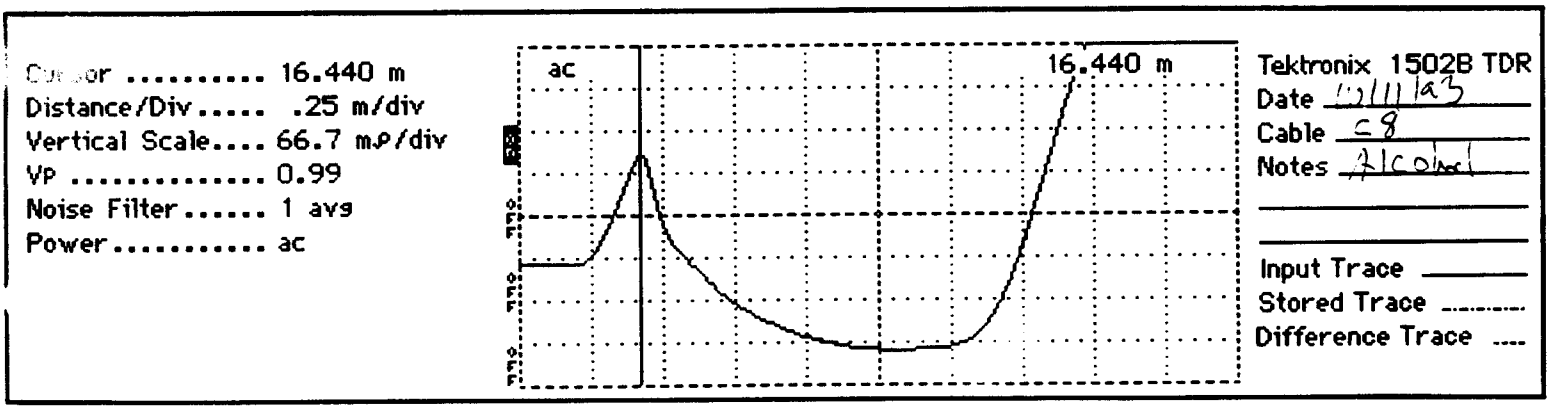
Tektronix 1502B TDR
Date 10/11/93
Cable C8
Notes Shortend
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

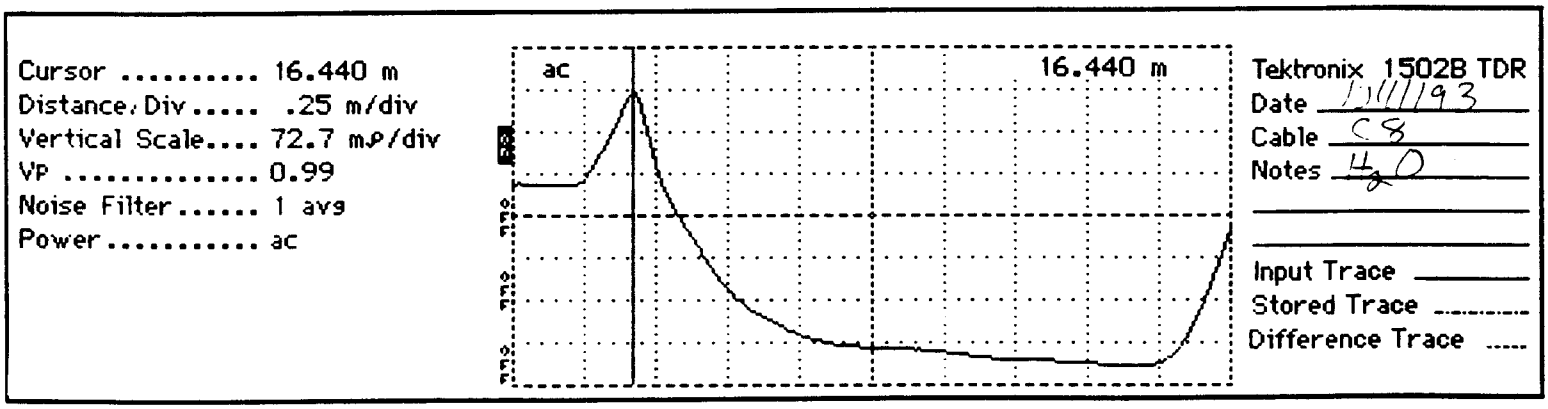
Probe Number 8 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

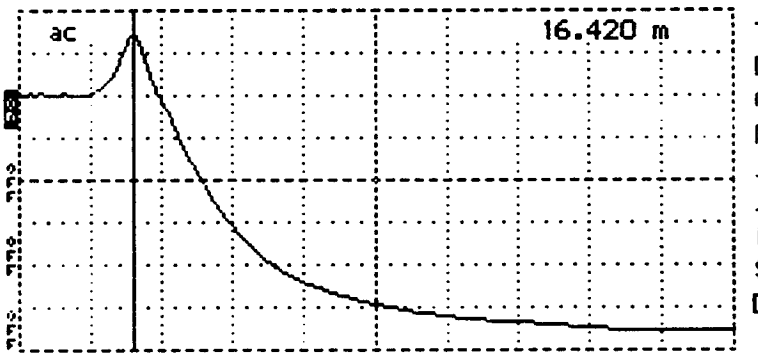
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C09

Probe Number 9

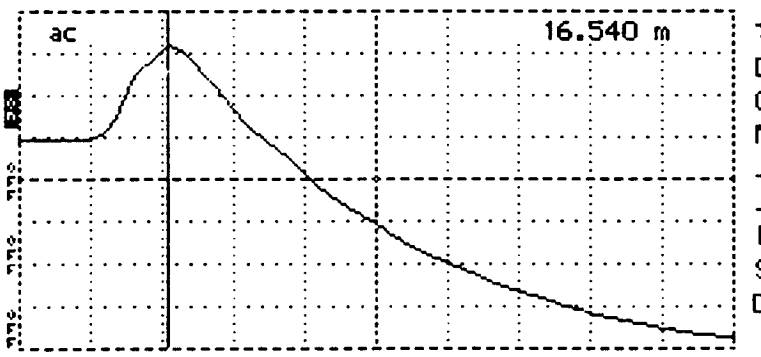
sor ..... 16.420 m
ance/Div..... .25 m/div
tical Scale.... 149 mρ/div
..... 0.99
ce Filter..... 1 avg
er..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C9
Notes Short-CB
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.540 m
ance/Div..... .25 m/div
ical Scale.... 163 mρ/div
..... 0.99
e Filter..... 1 avg
er..... ac

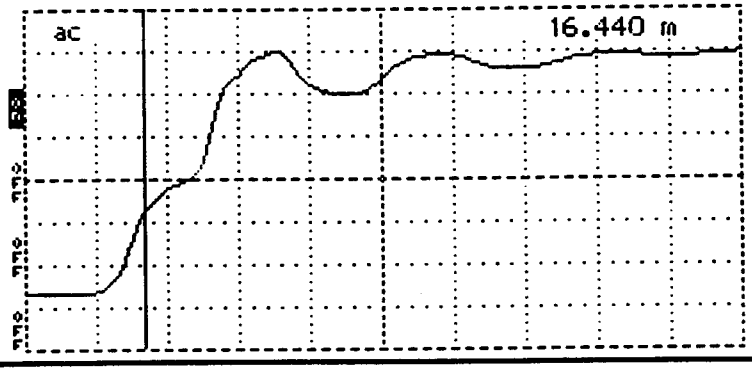


Tektronix 1502B TDR
Date 10/11/93
Cable C9
Notes Short end
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 9 (cont.)

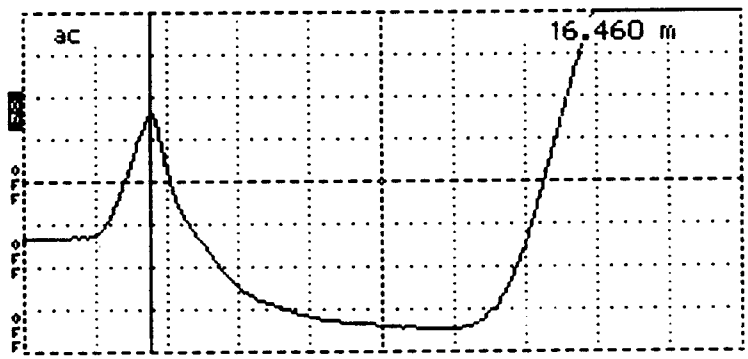
Cursor ..... 16.440 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C9
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

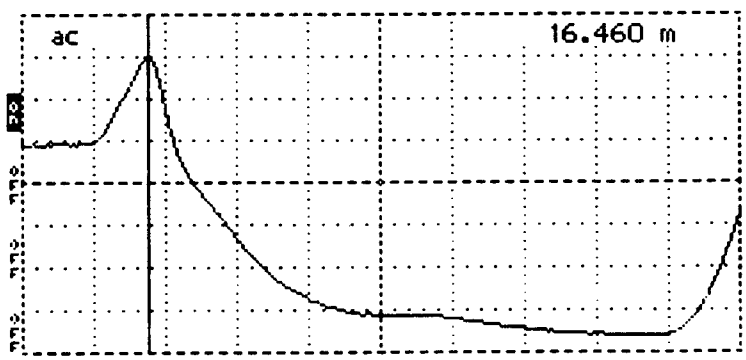
Cursor ..... 16.460 m
Distance/Div..... .25 m/div
Vertical Scale.... 62.9 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C9
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.460 m
Distance/Div..... .25 m/div
Vertical Scale.... 70.6 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C9
Notes 11:00
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

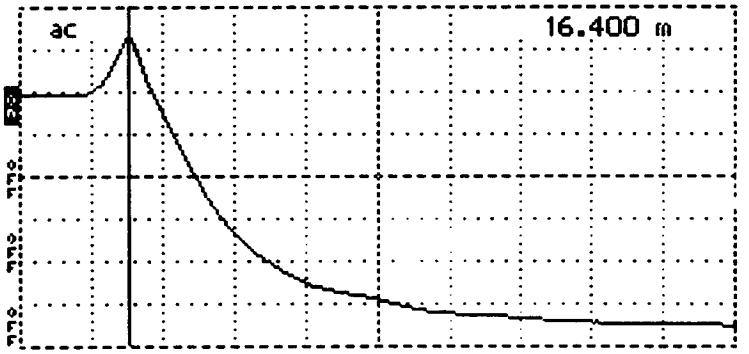
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0201]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37C10

Probe Number 10

sor ..... 16.400 m
tance/Div..... .25 m/div
tical Scale.... 154 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

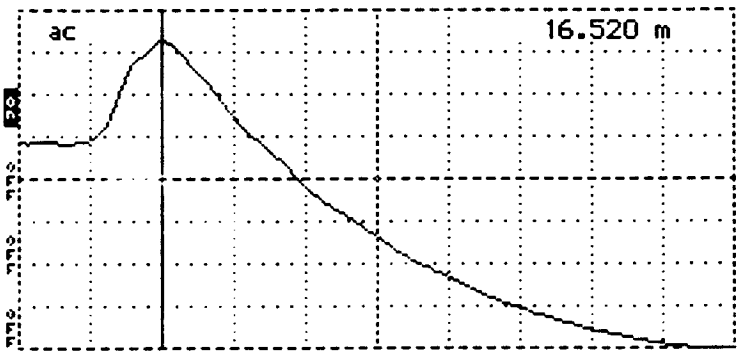


Tektronix 1502B TDR
Date 10/11/93
Cable C10
Notes Short CB

Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.520 m
tance/Div..... .25 m/div
tical Scale.... 154 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



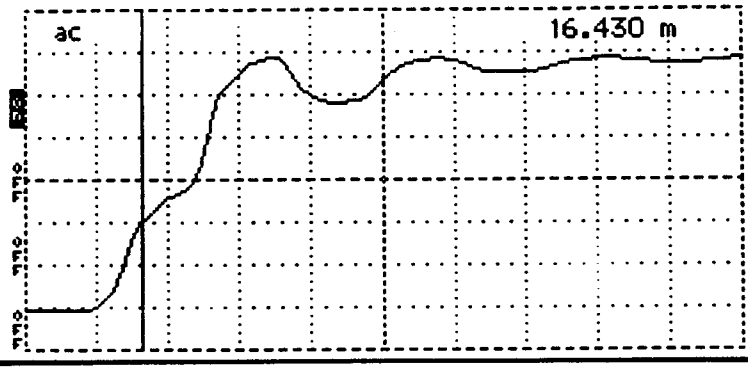
Tektronix 1502B TDR
Date 9/11/93
Cable C10
Notes Shorted end

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 10 (cont.)

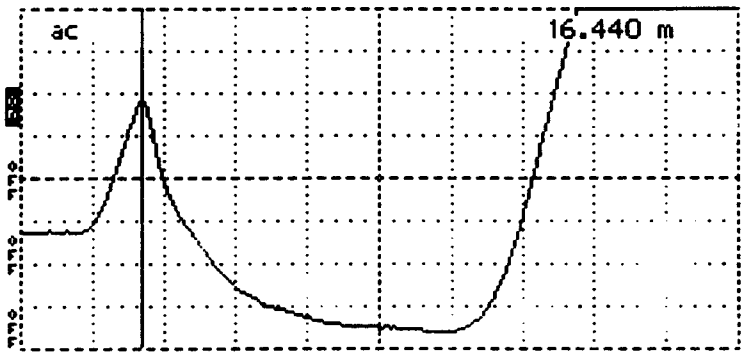
Cursor ..... 16.430 m
Distance/Div..... .25 m/div
Vertical Scale.... 145 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C10
Notes Air
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

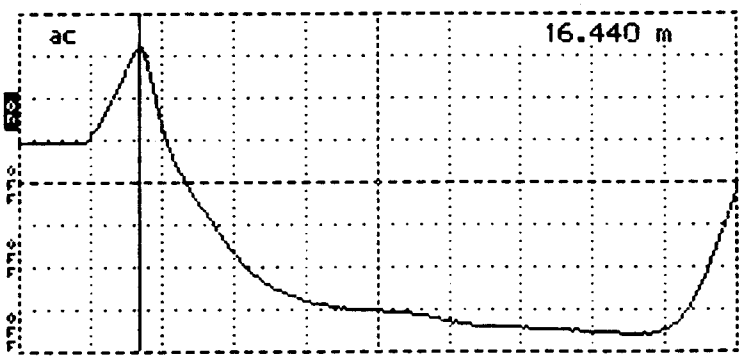
Cursor ..... 16.440 m
Distance/Div..... .25 m/div
Vertical Scale.... 57.7 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C10
Notes Alcohol
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.440 m
Distance/Div..... .25 m/div
Vertical Scale.... 70.6 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable C10
Notes H2O
Input Trace
Stored Trace
Difference Trace

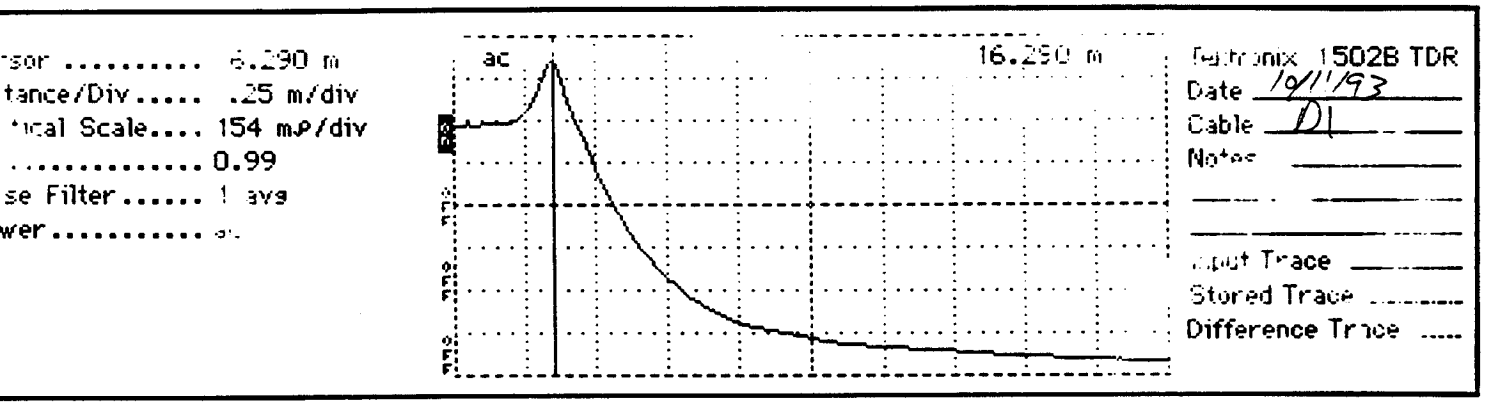
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

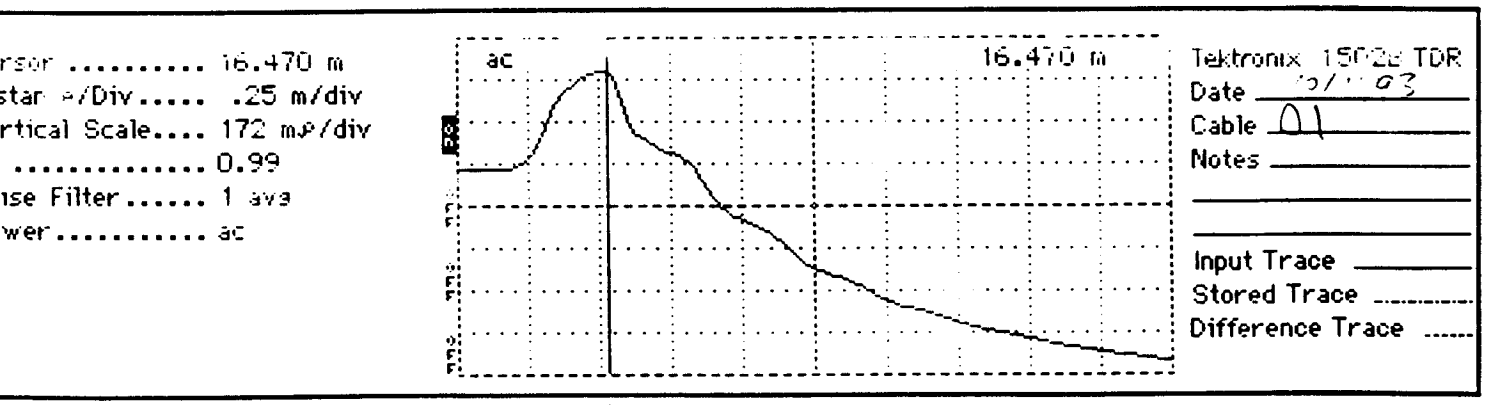
ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37D01

Probe Number 1

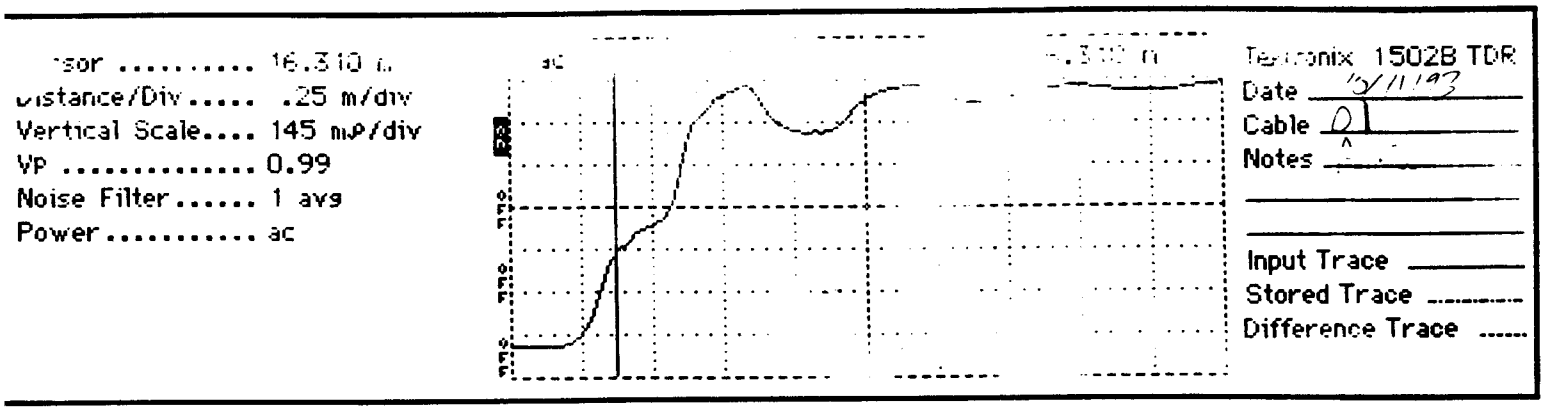


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		

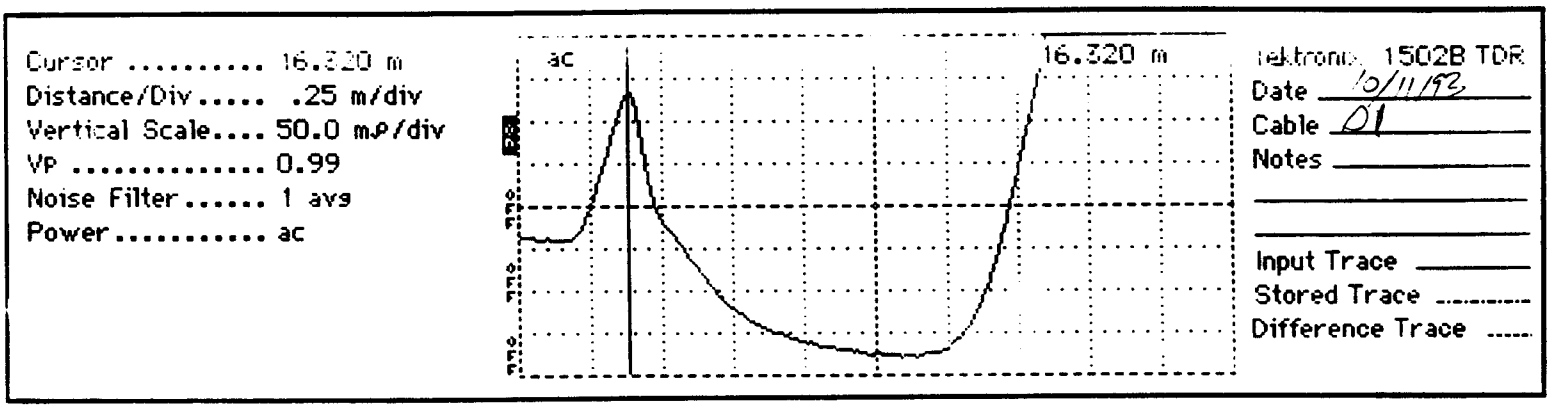


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

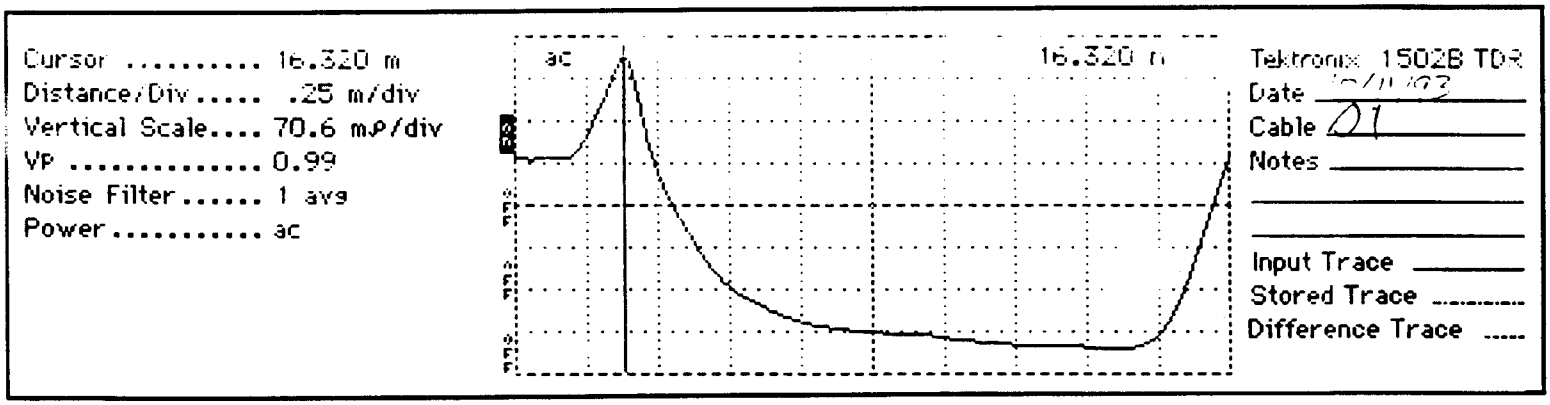
Probe Number 1 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

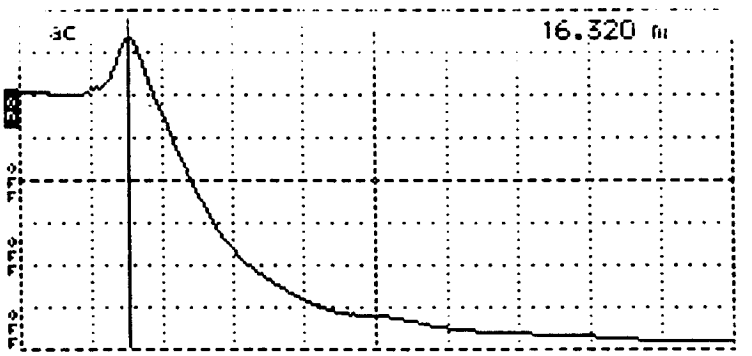
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37002

Probe Number 2

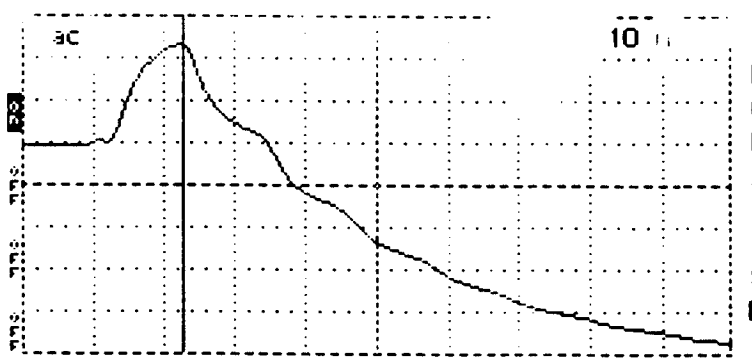
sor ..... 16.320 m
tance/Div..... .25 m/div
tical Scale.... 145 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektron... 1502B TDR
Date 10/11/93
Cable 02
Notes
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.510 m
tance/Div..... .25 m/div
rtical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac

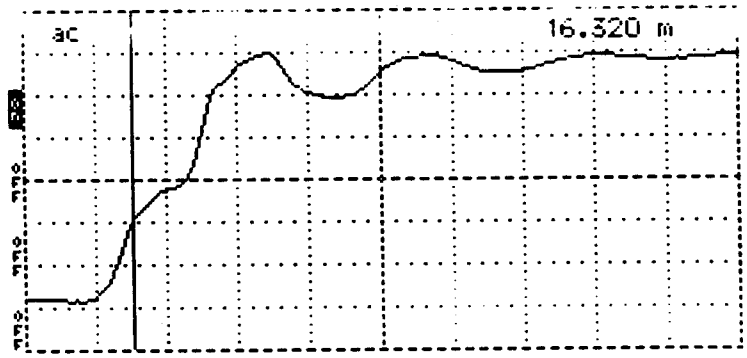


Tektronix 1502B TDR
Date 10/11/93
Cable 02
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 2 (cont.)

sor ..... 16.320 m
Distance/Div..... .25 m/div
Vertical Scale.... 154 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable D2
Notes
Input Trace
Stored Trace
Difference Trace

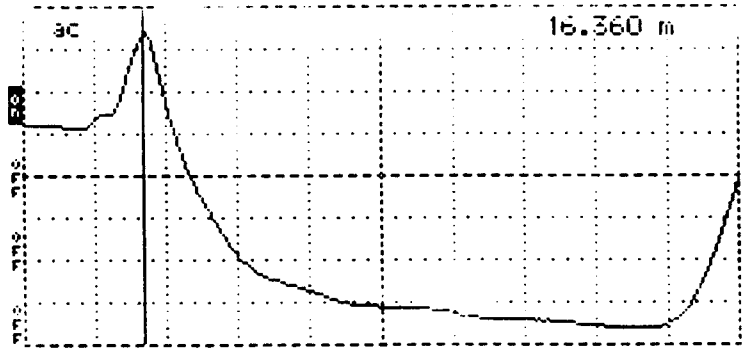
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 51.5 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

Tektronix 1502B TDR
Date 10/11/93
Cable D2
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

sor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable D2
Notes
Input Trace
Stored Trace
Difference Trace

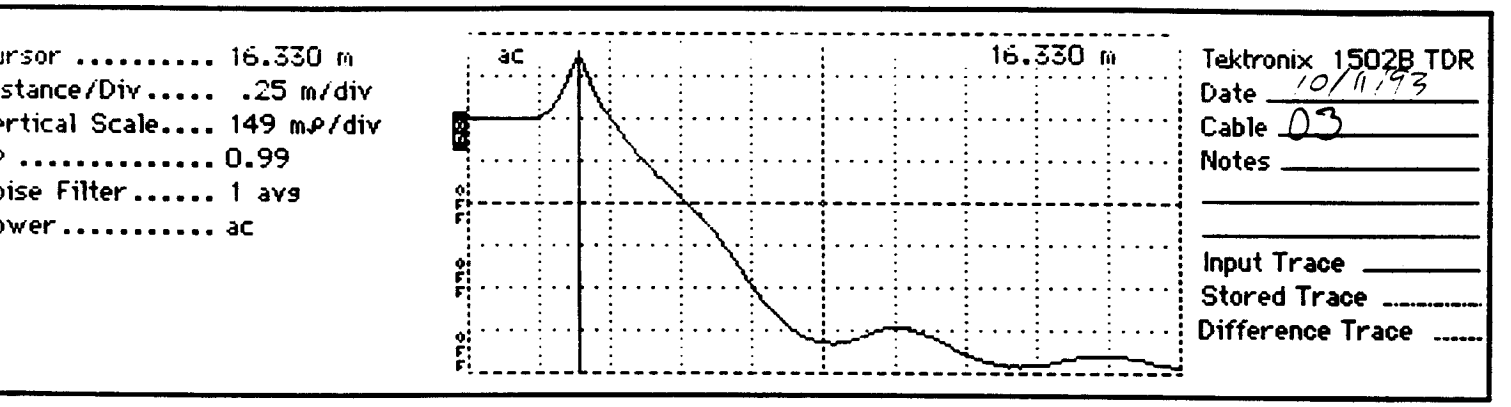
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

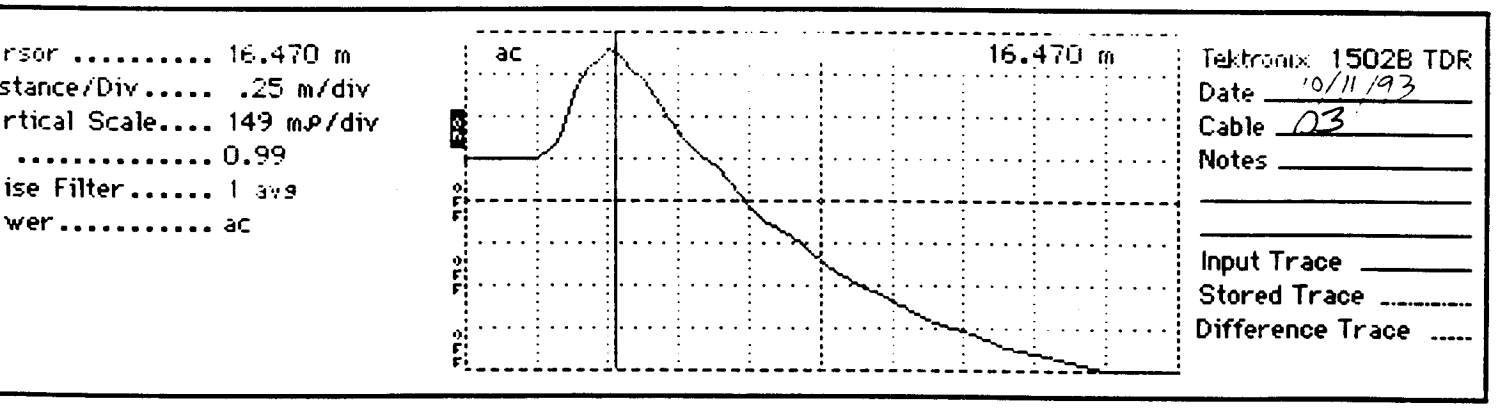
fore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 39D03

Probe Number 3



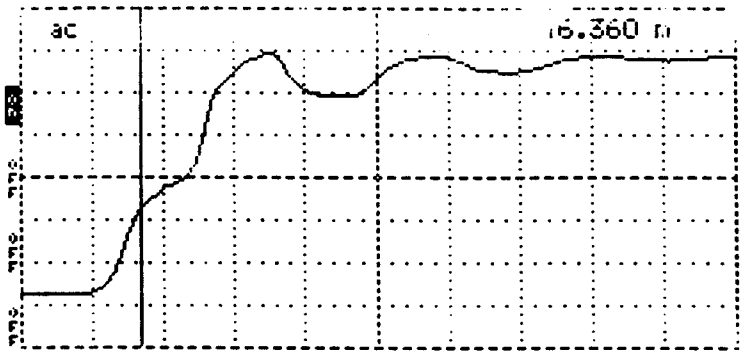
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 3 (cont.)

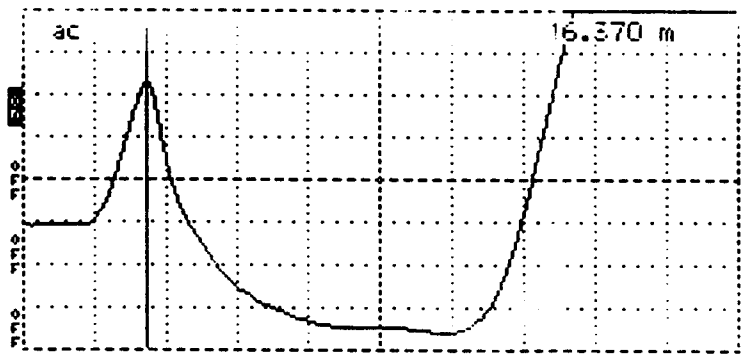
sor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 03
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

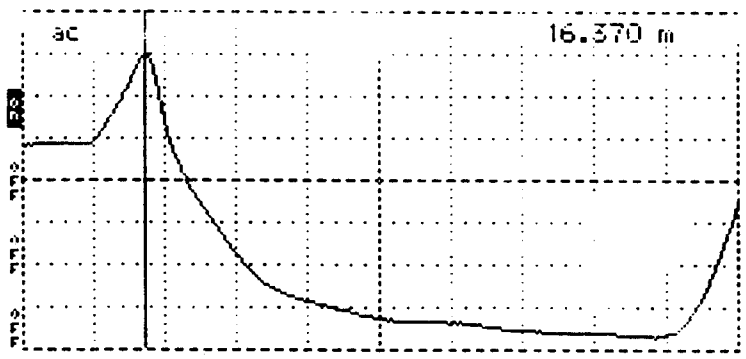
Cursor ..... 16.370 m
Distance/Div..... .25 m/div
Vertical Scale.... 56.1 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 03
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.370 m
Distance/Div..... .25 m/div
Vertical Scale.... 72.7 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date
Cable 03
Notes
Input Trace
Stored Trace
Difference Trace

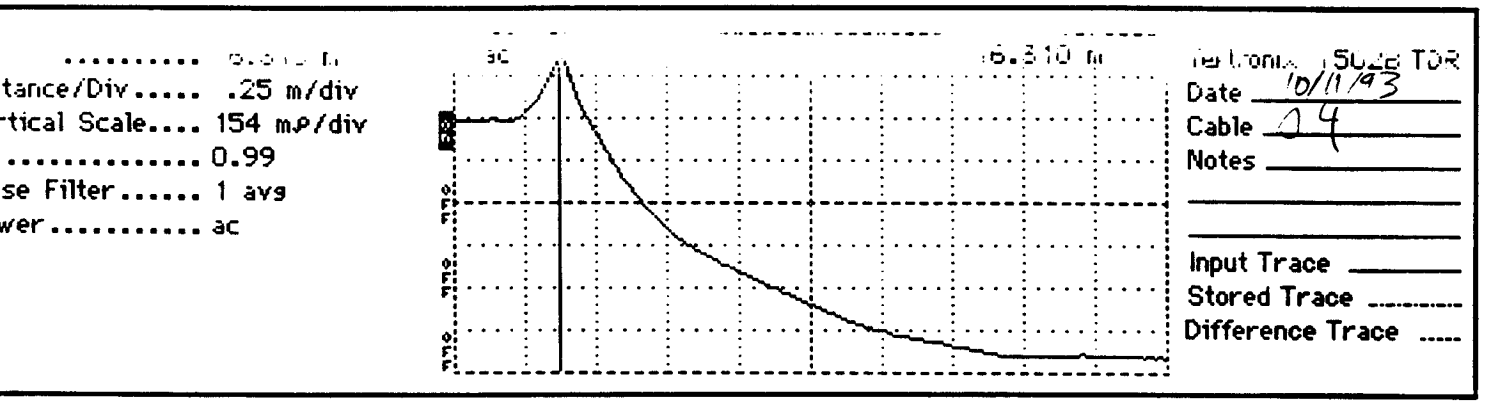
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

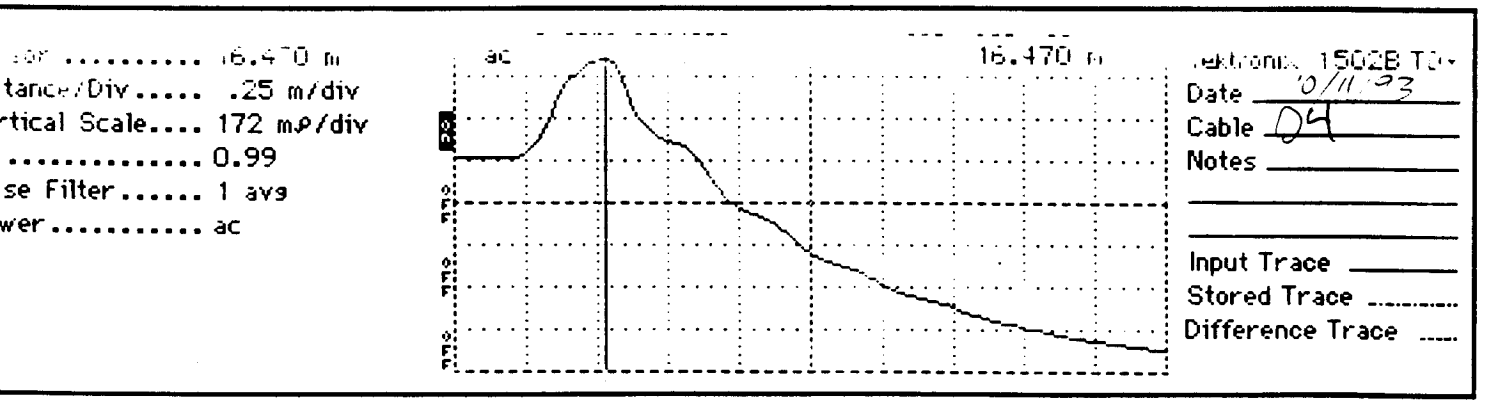
ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 3700

Probe Number 4

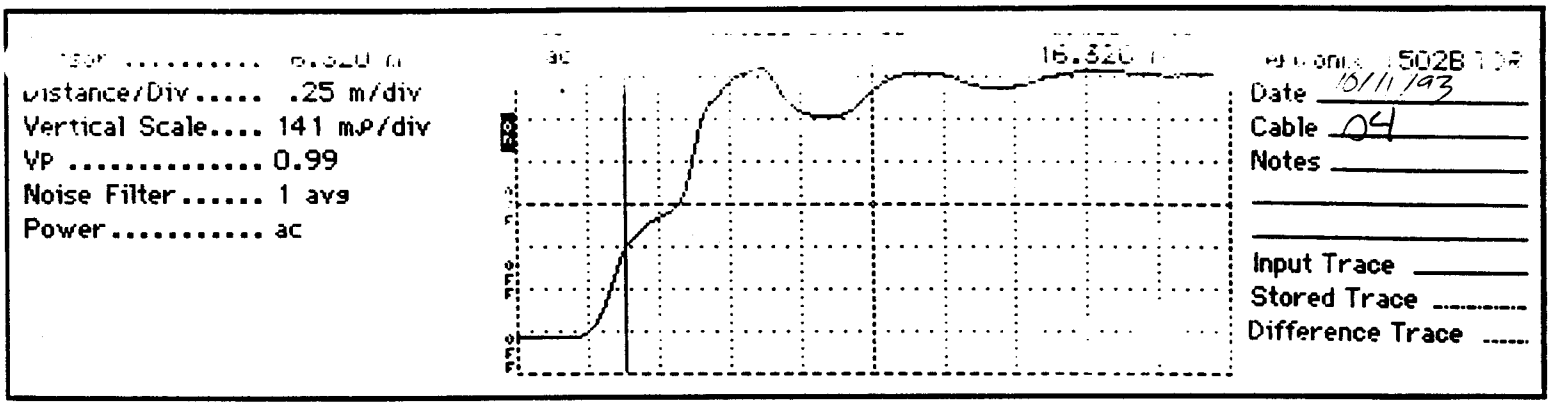


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		

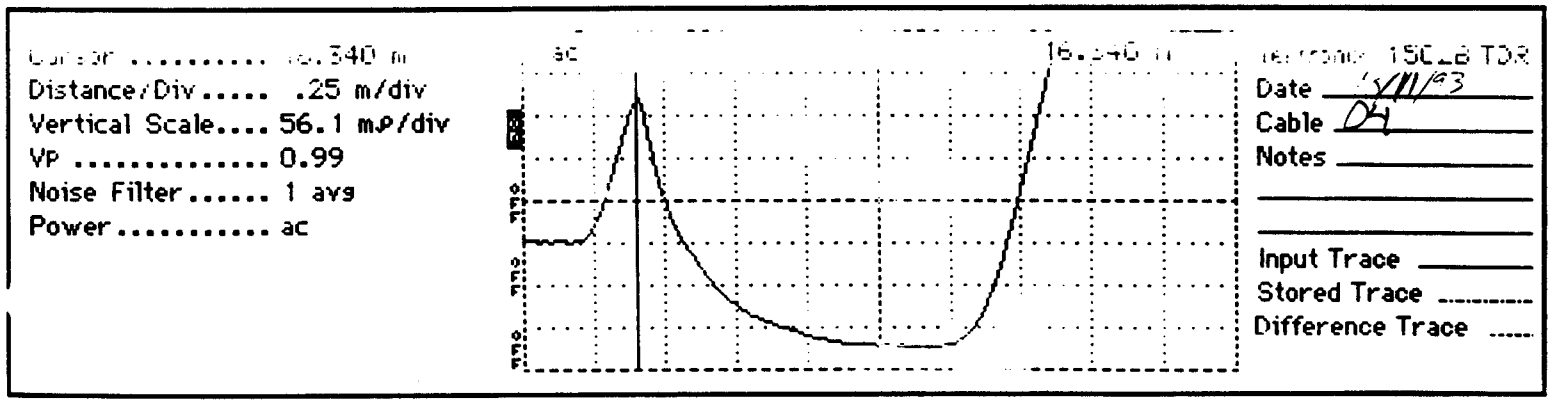


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

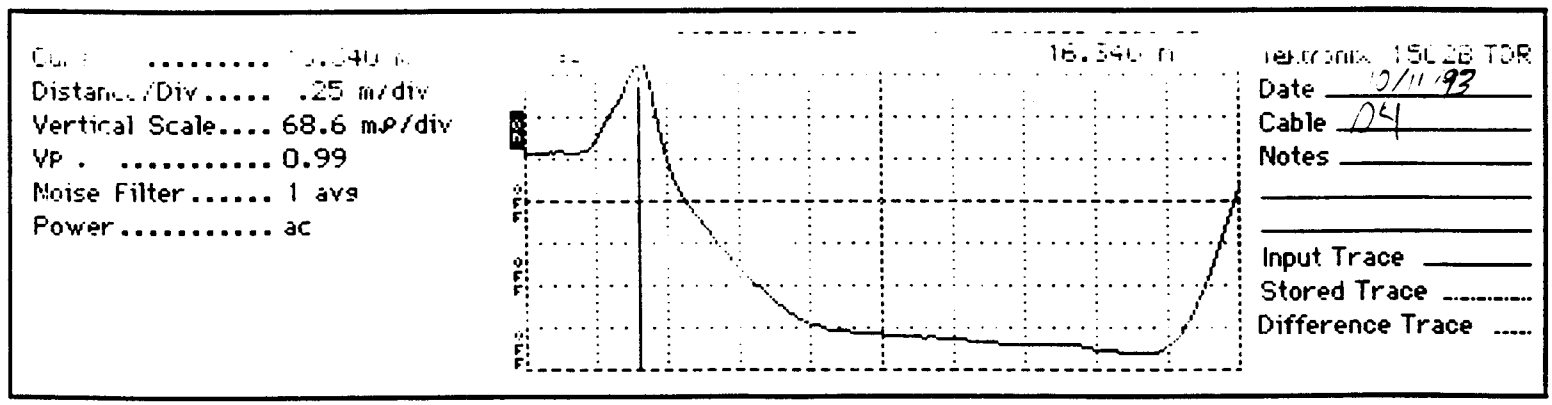
Probe Number 4 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

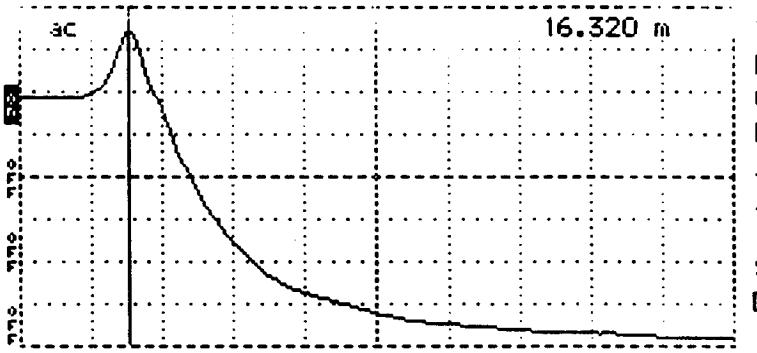
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37005

Probe Number 5

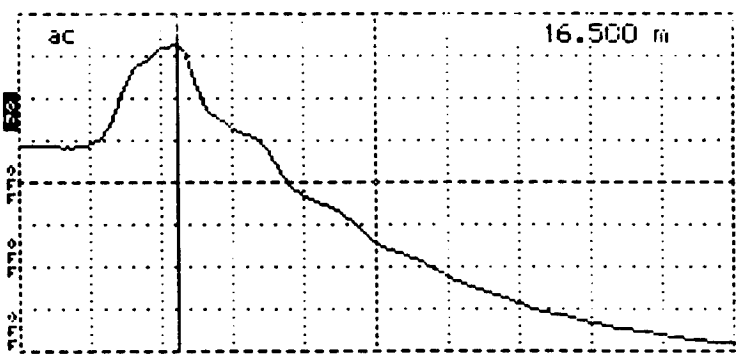
sor ..... 16.320 m
tance/Div..... .25 m/div
tical Scale.... 149 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 05
Notes
Input Trace
Stored Trace
Difference Trace

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

sor ..... 16.500 m
tance/Div..... .25 m/div
tical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
ver..... ac

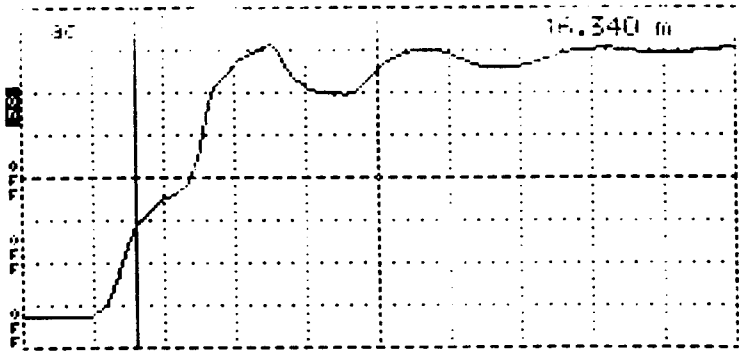


Tektronix 1502B TDR
Date 10/11/93
Cable 05
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 5 (cont.)

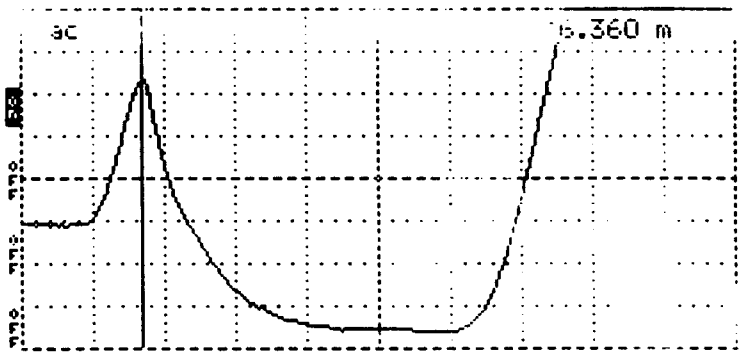
Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 141 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 5/11/93
Cable 25
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

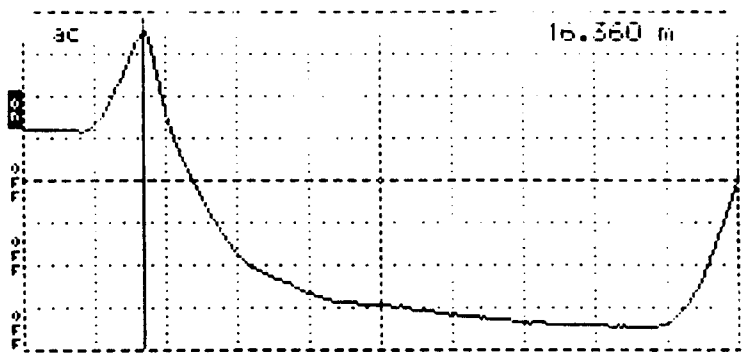
Cursor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 54.5 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 5/11/93
Cable 25
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 70.6 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 5/11/93
Cable 25
Notes
Input Trace
Stored Trace
Difference Trace

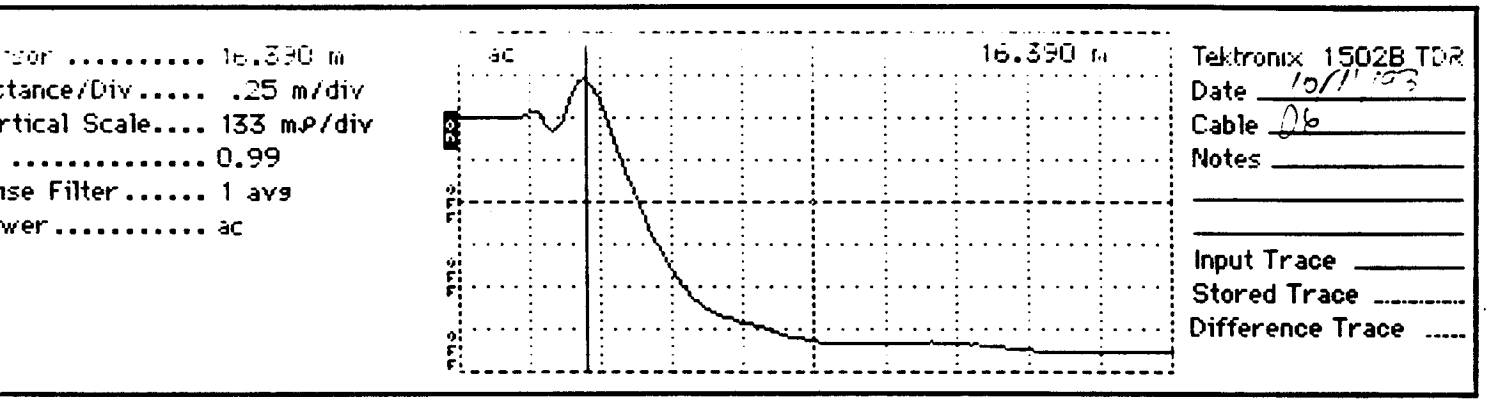
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

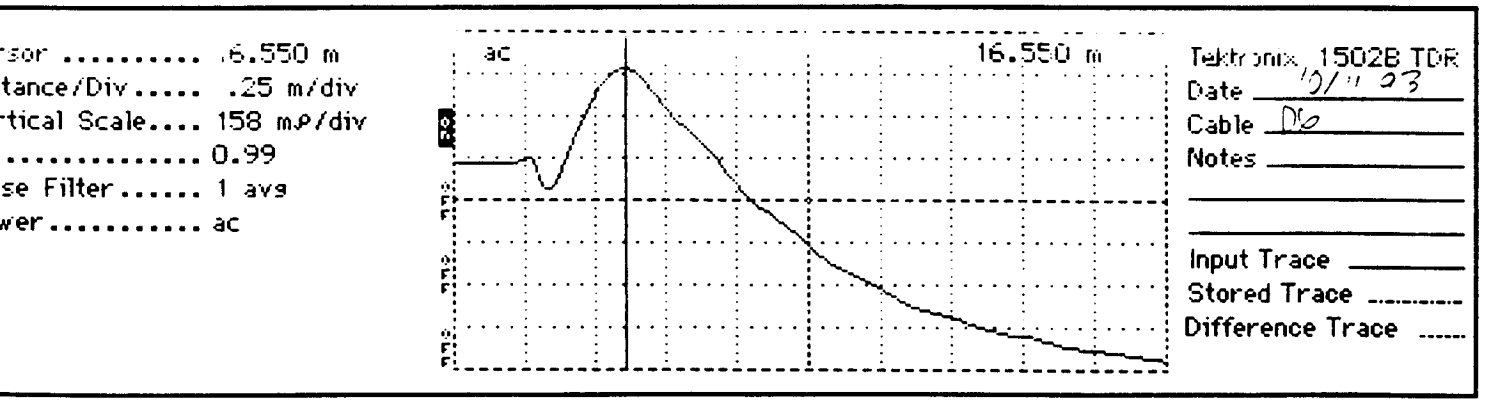
ore Operation Checks

- Calibration Date 10/11/03
- Probe S/N 37D06

Probe Number 6



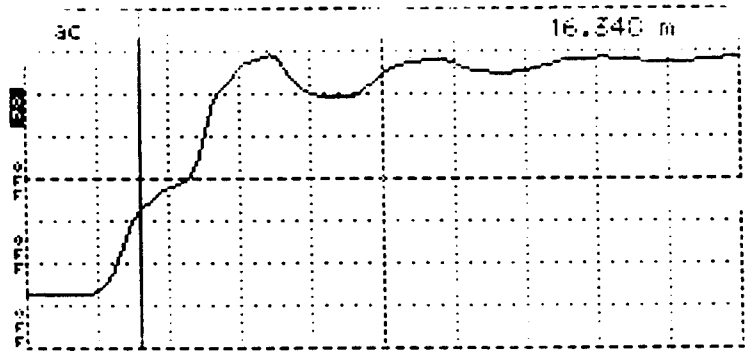
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 6 (cont.)

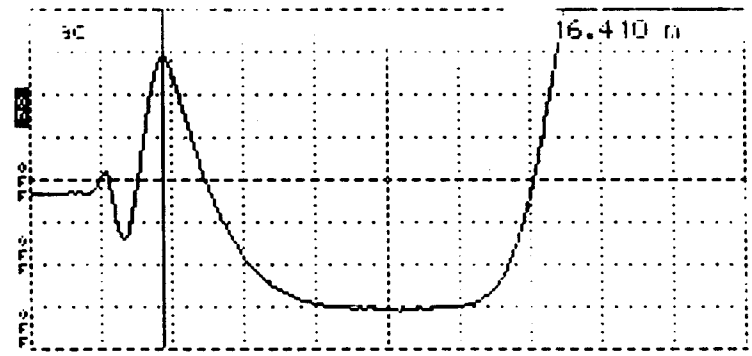
Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 6/11/93
Cable DC6
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

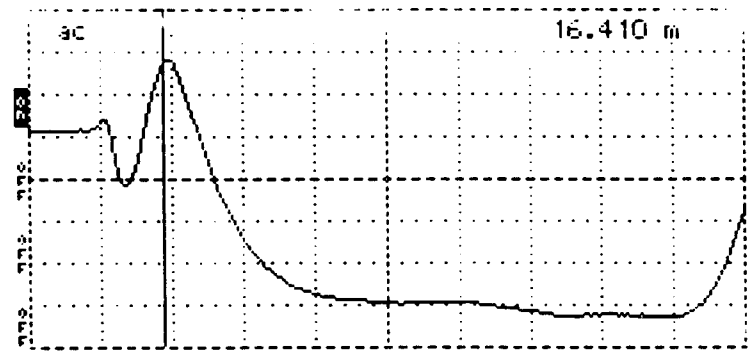
Cursor ..... 16.410 m
Distance/Div..... .25 m/div
Vertical Scale.... 39.7 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 6/11/93
Cable DC6
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.410 m
Distance/Div..... .25 m/div
Vertical Scale.... 62.9 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 6/11/93
Cable DC6
Notes
Input Trace
Stored Trace
Difference Trace

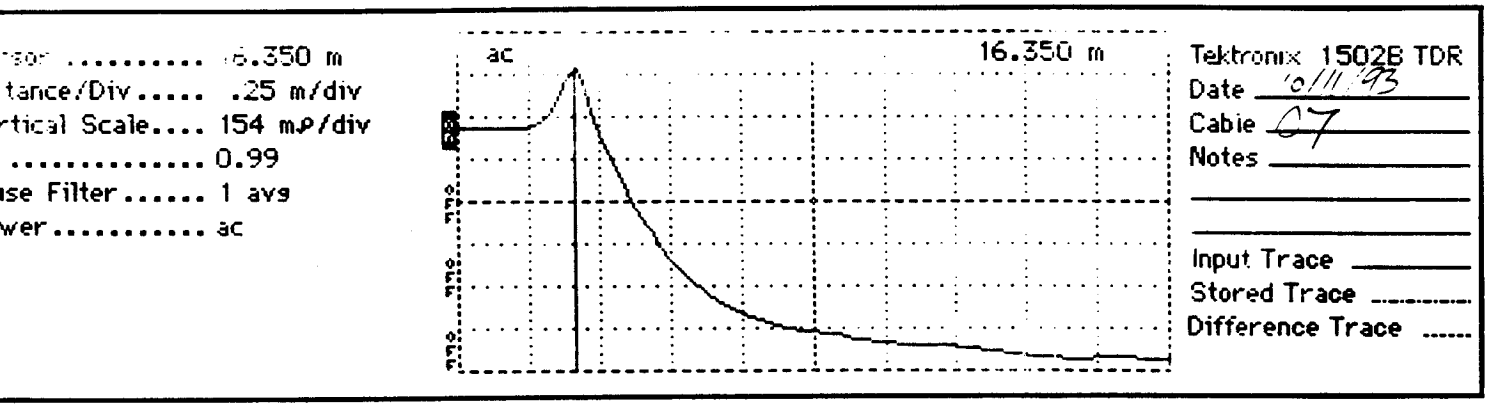
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

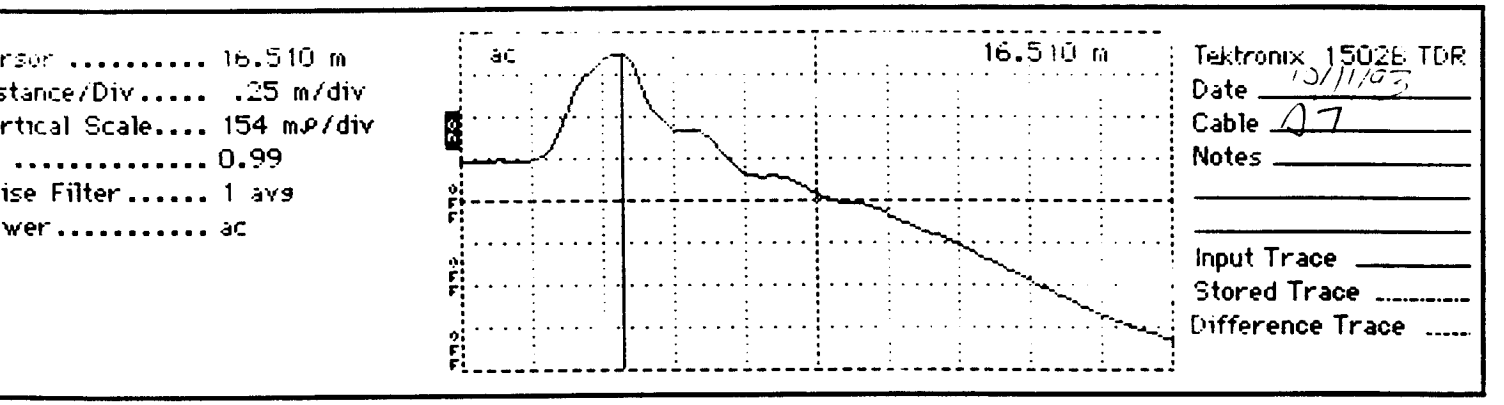
ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37D07

Probe Number 7



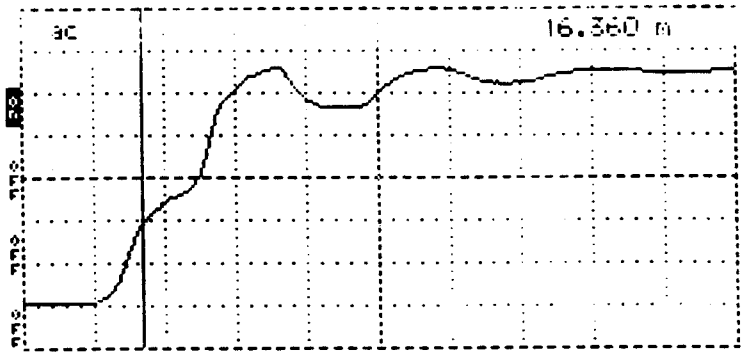
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 7 (cont.)

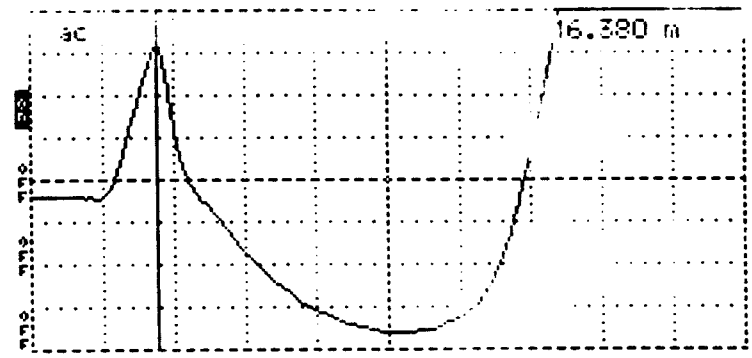
sor ..... 16.360 m
Distance/Div..... .25 m/div
Vertical Scale.... 158 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 07
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

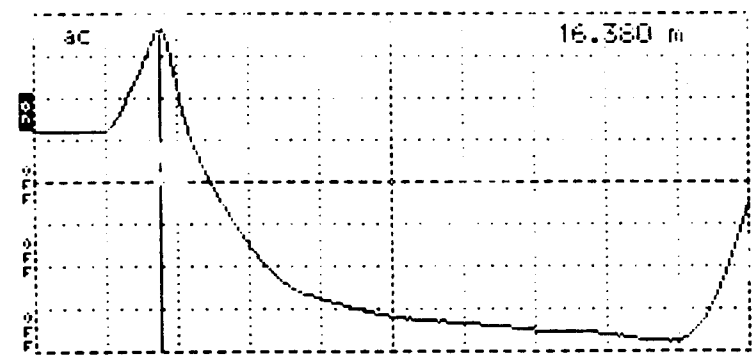
Cursor ..... 16.380 m
Distance/Div..... .25 m/div
Vertical Scale.... 44.6 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 07
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.380 m
Distance/Div..... .25 m/div
Vertical Scale.... 64.8 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 07
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

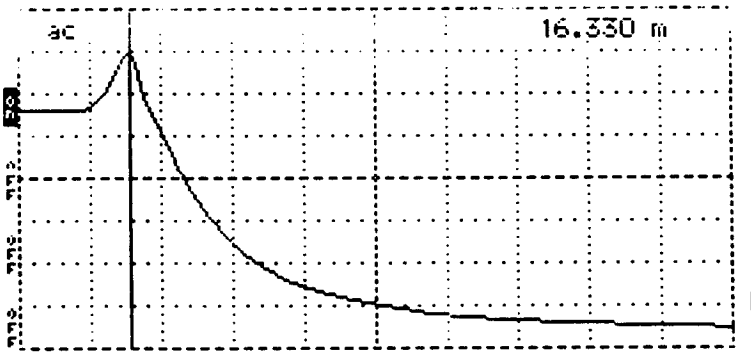
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

ore Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37D03

Probe Number 8

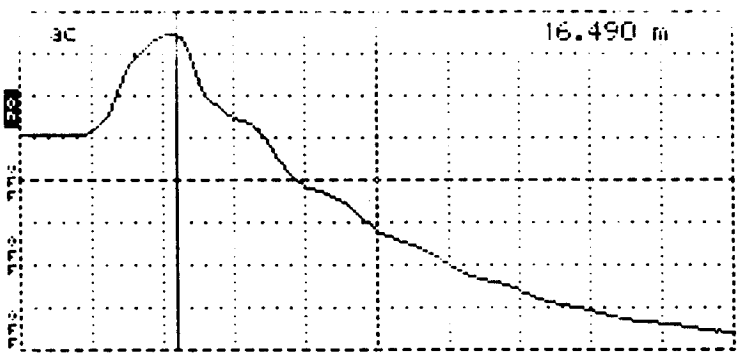
```
sor ..... 16.330 m
tance/Div..... .25 m/div
rtical Scale.... 167 mρ/div
..... 0.99
se Filter..... 1 avg
wer..... ac
```



Tektronix 1502B TDR
Date 10/11/93
Cable D8
Notes
Input Trace
Stored Trace
Difference Trace

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

```
rsor ..... 16.490 m
tance/Div..... .25 m/div
rtical Scale.... 167 mρ/div
..... 0.99
ise Filter..... 1 avg
wer..... ac
```

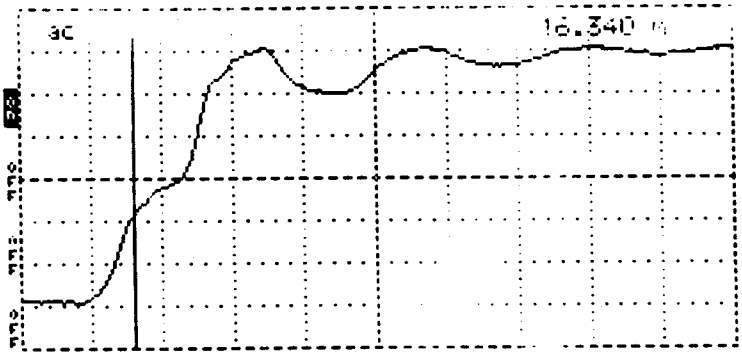


Tektronix 1502B TDR
Date 10/11/93
Cable D6
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 8 (cont.)

Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 149 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 08
Notes
Input Trace
Stored Trace
Difference Trace

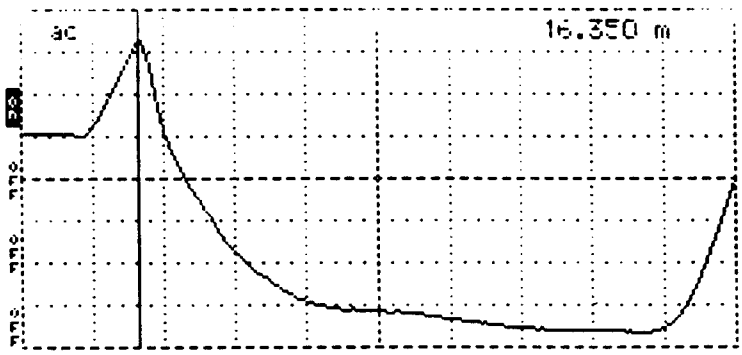
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 53.0 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac

Tektronix 1502B TDR
Date 10/11/93
Cable 08
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.350 m
Distance/Div..... .25 m/div
Vertical Scale.... 68.6 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable 08
Notes
Input Trace
Stored Trace
Difference Trace

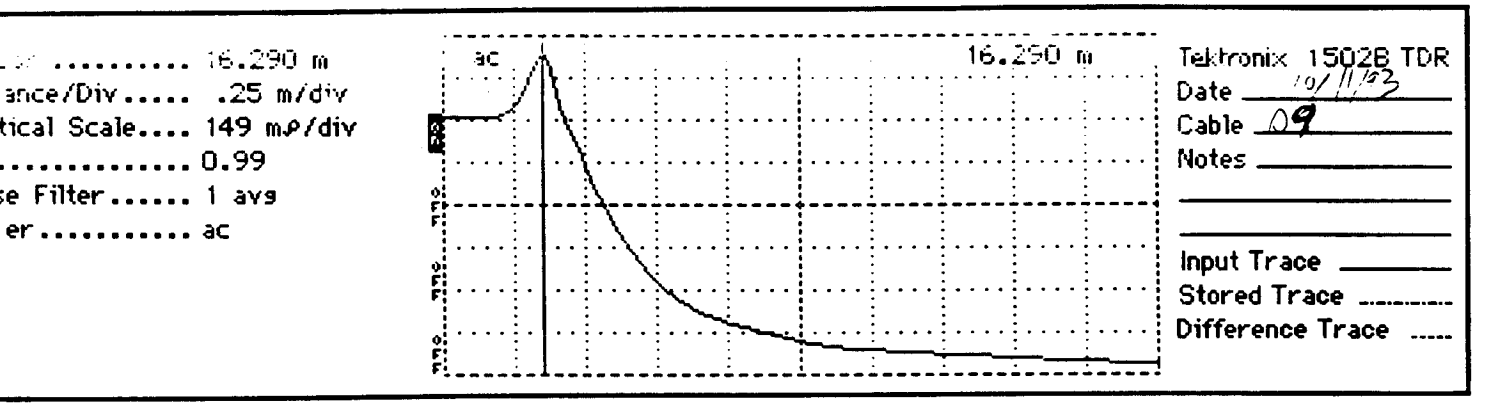
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

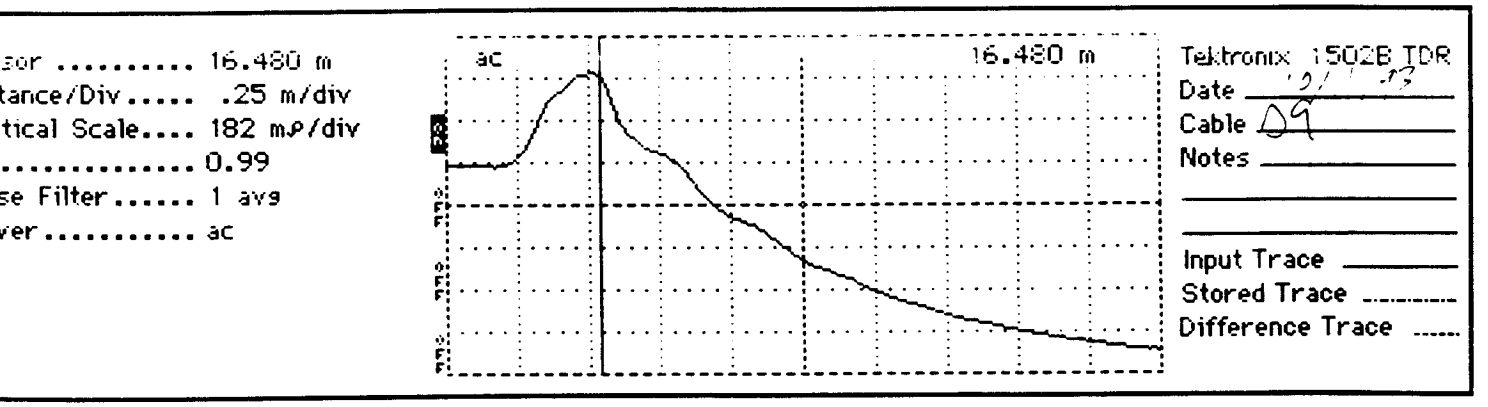
re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37D09

Probe Number 9



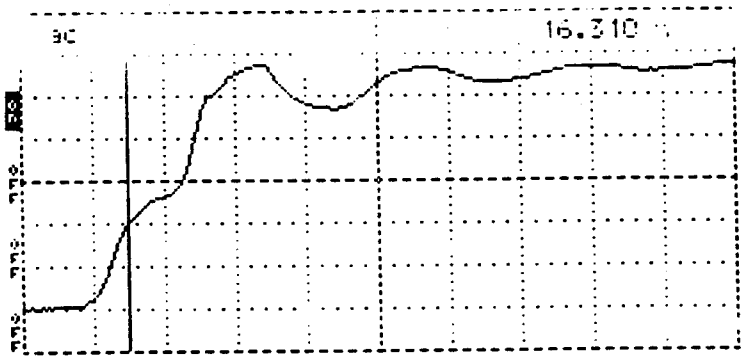
TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

Probe Number 9 (cont.)

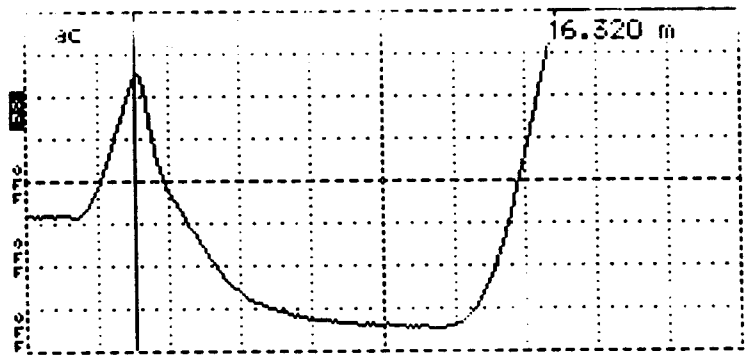
Distance/Div..... .25 m/div
Vertical Scale.... 158 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable D9
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		

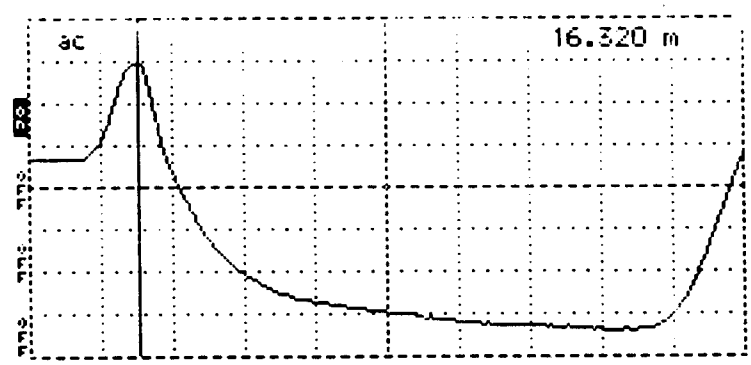
Cursor ..... 16.320 m
Distance/Div..... .25 m/div
Vertical Scale.... 53.0 mρ/div
VP 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 10/11/93
Cable D8
Notes
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		

Cursor ..... 16.320 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 10/11/93
Cable D8
Notes
Input Trace
Stored Trace
Difference Trace

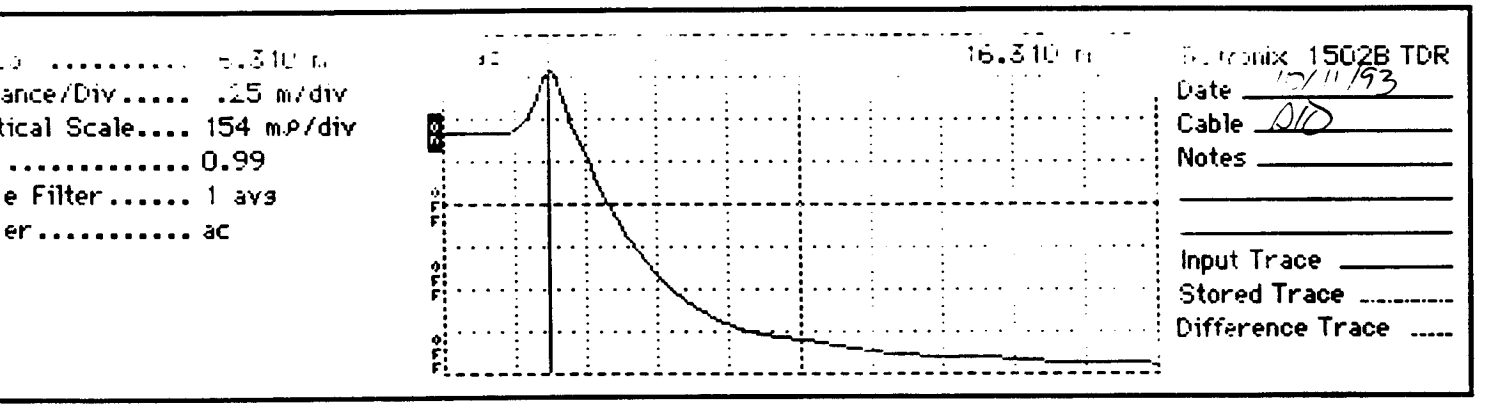
TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 TDR Probe Check	Agency Code [37] Test Section Number [0205]

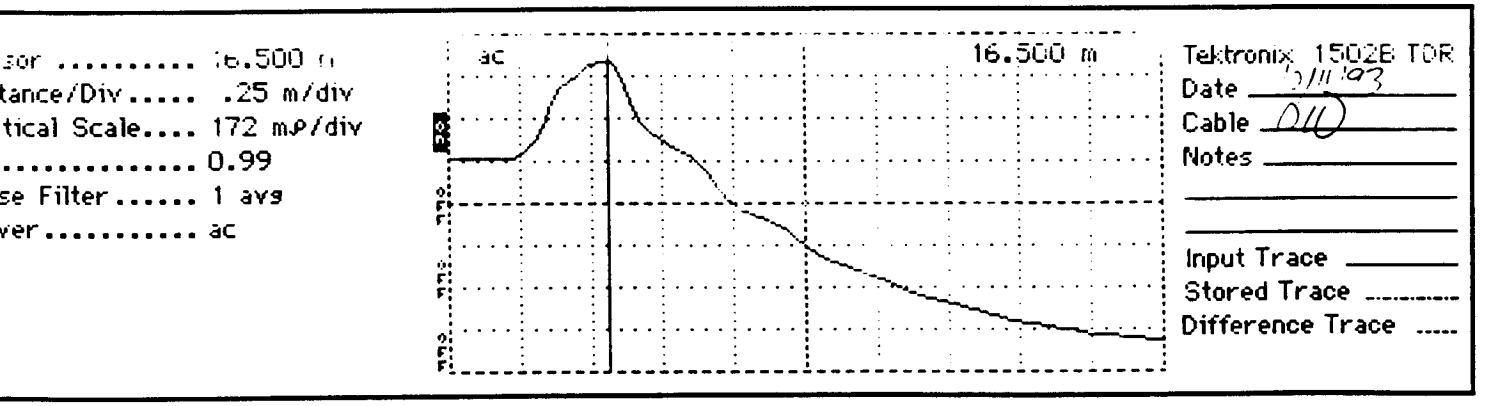
re Operation Checks

- Calibration Date 10/11/93
- Probe S/N 37D10

Probe Number 10

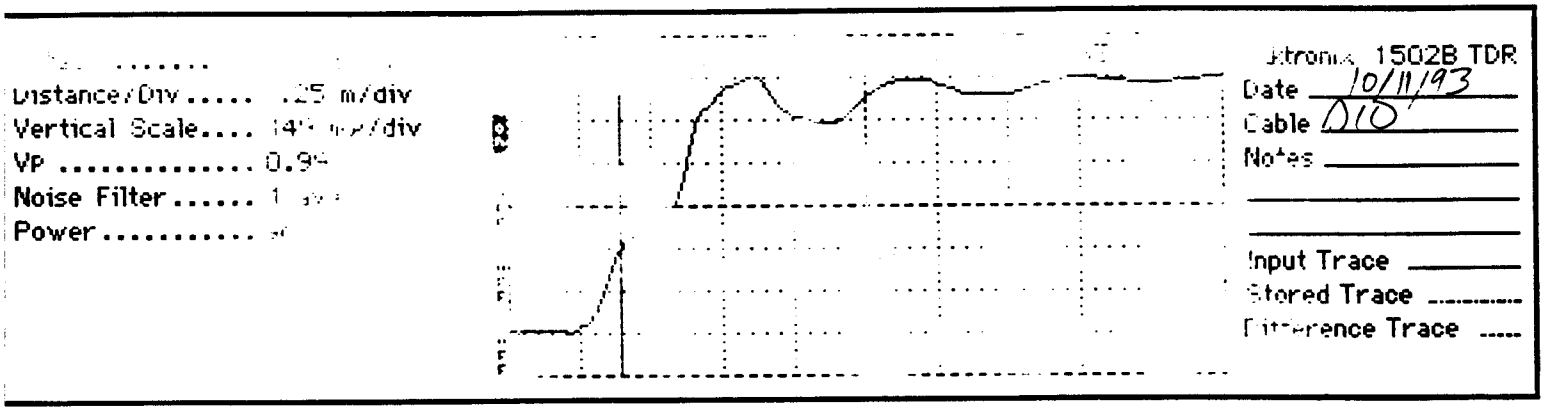


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at Start"		

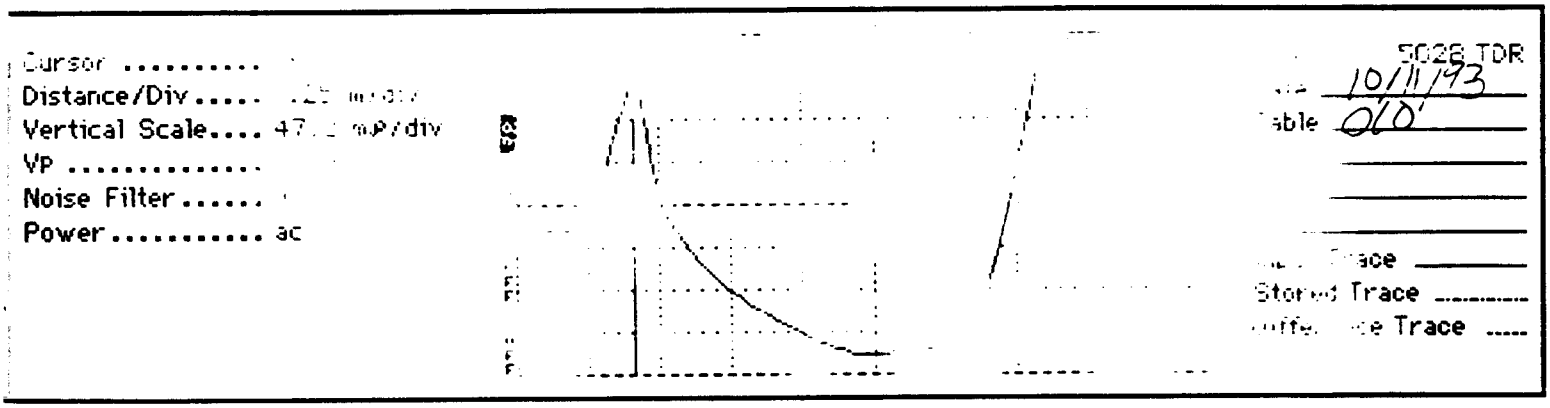


TDR Trace	Apparent Length, (m)	Dielectric Constant
"Shorted at End"		

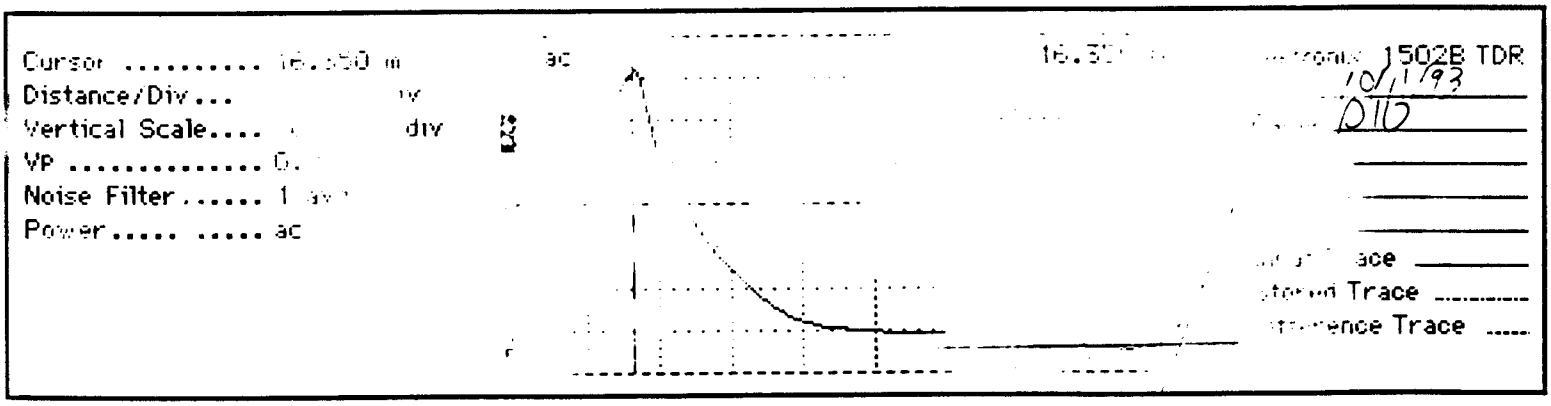
Probe Number 10 (cont.)



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Air"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Alcohol"		



TDR Trace	Apparent Length, (m)	Dielectric Constant
"In Water"		

APPENDIX C

Supporting Instrumentation Installation Information

Appendix C contains the following supporting information:

Figure C-1 TDR Traces Measured Manually During Installation

Table C-1 TDR Moisture Content During Installation

Table C-2 Field Measured Moisture Content During Installation

Laboratory Moisture Samples' Results as Received from the State

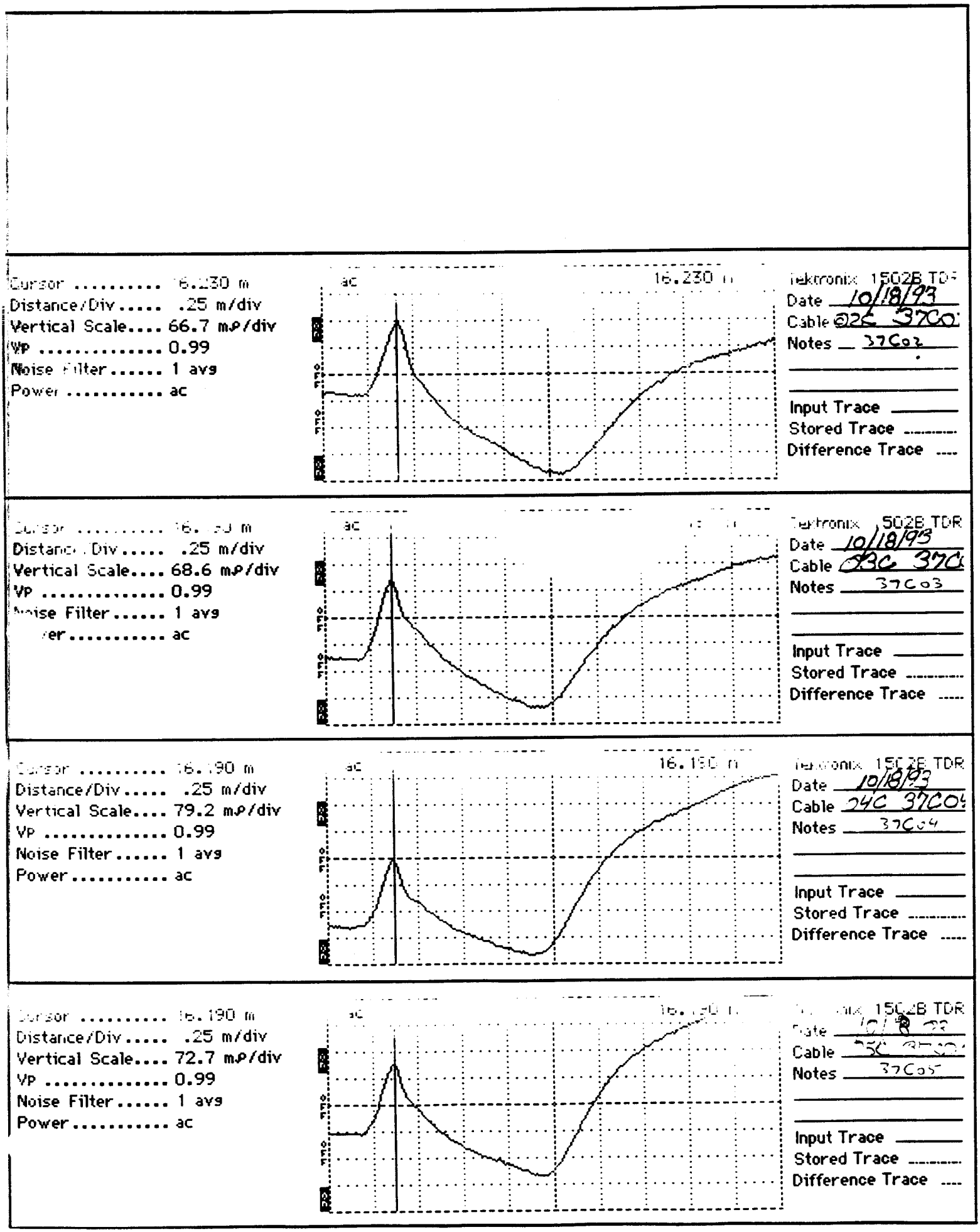


Figure C-1. TDR Traces Measured Manually During Installation

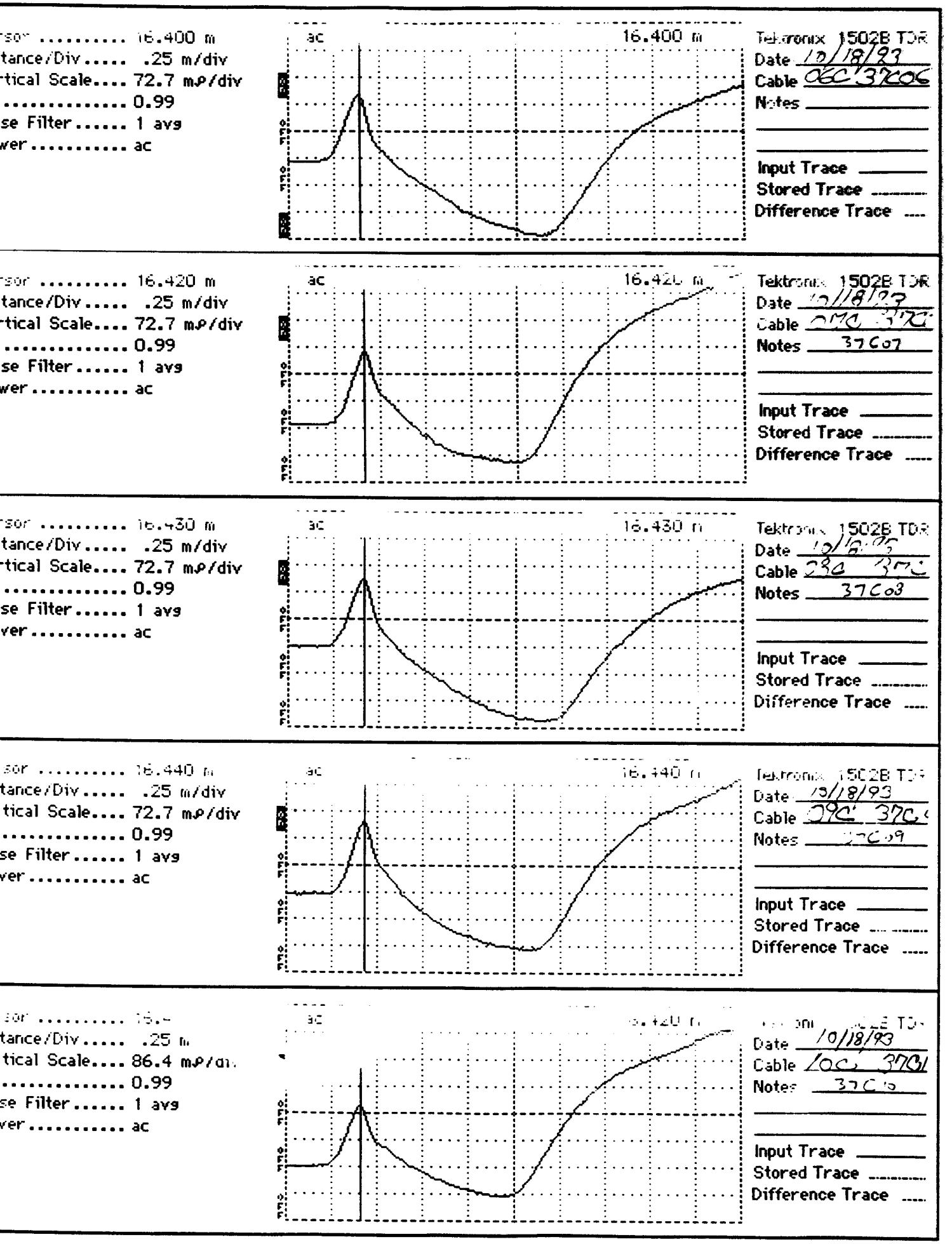


Figure C-1 (cont.). TDR Traces Measured Manually During Installation

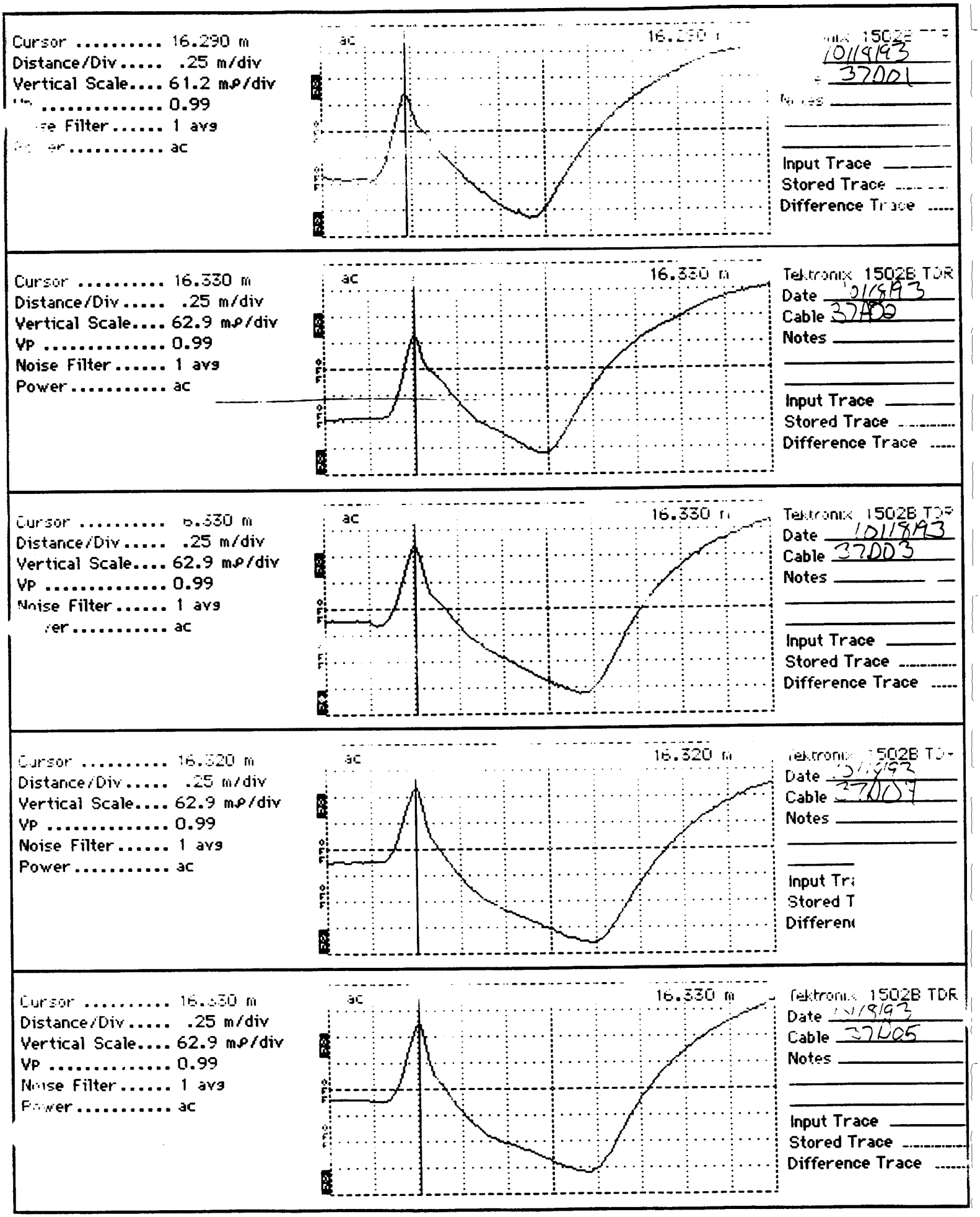


Figure C-1 (cont.). TDR Traces Measured Manually During Installation

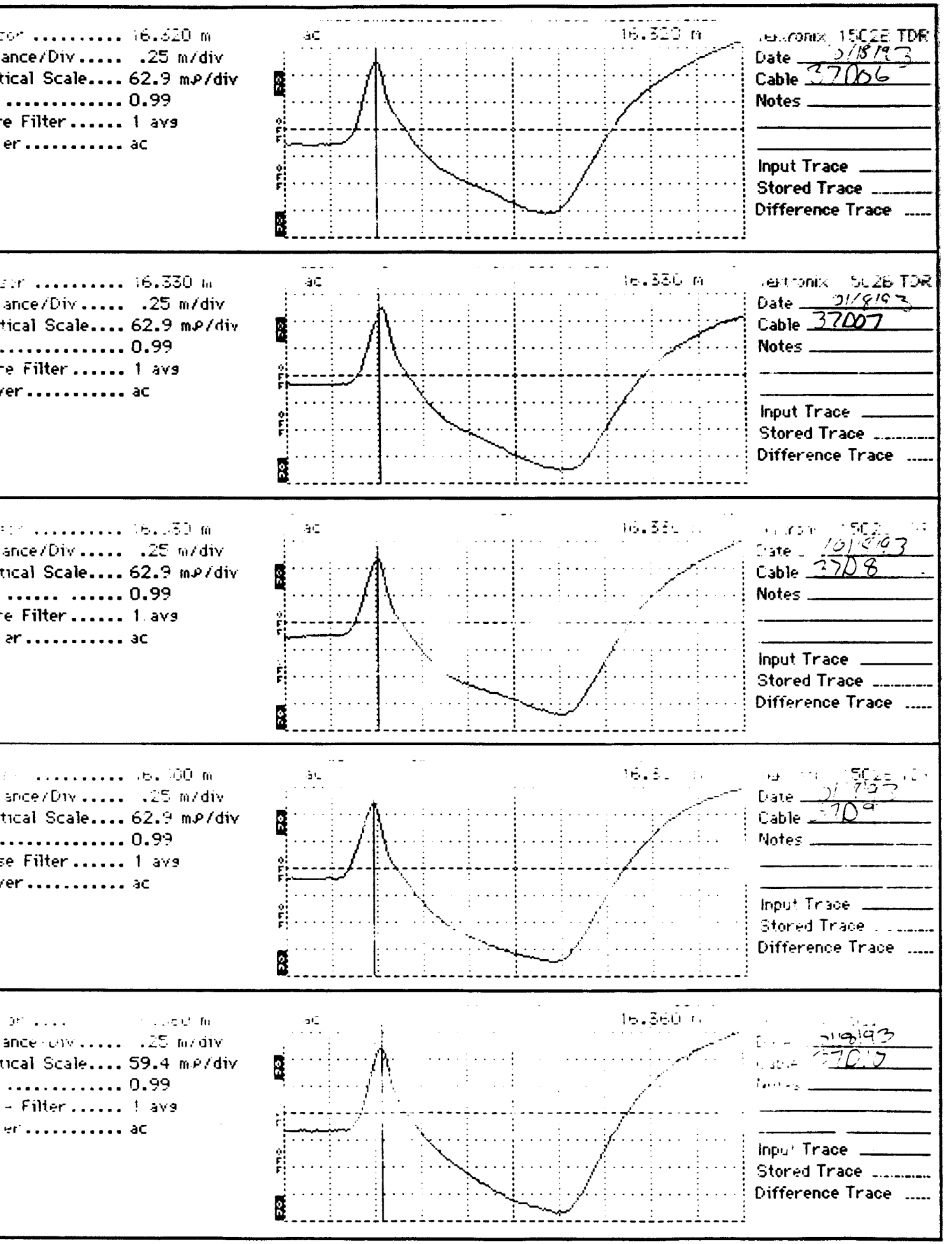
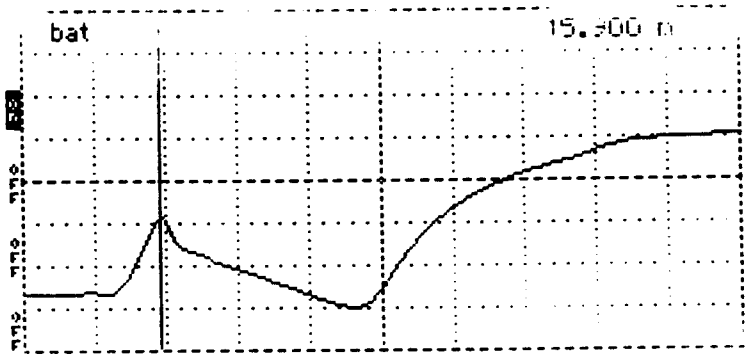


Figure C-1 (cont.). TDR Traces Measured Manually During Installation

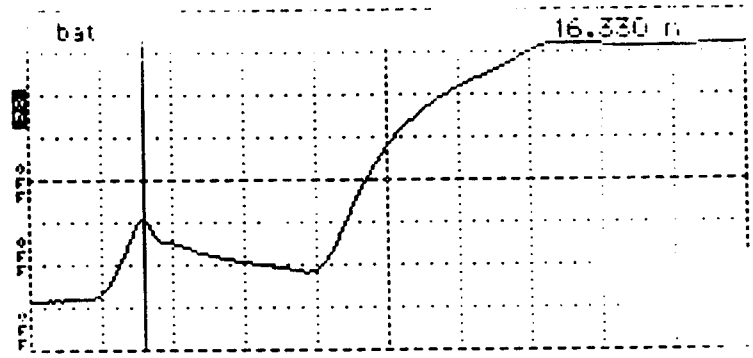
Cursor ..... 15.900 m
Distance/Div..... .25 m/div
Vertical Scale.... 109 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 10/17/93
Cable 02 37A0
Notes 37A02A

Input Trace ———
Stored Trace .....
Difference Trace -----

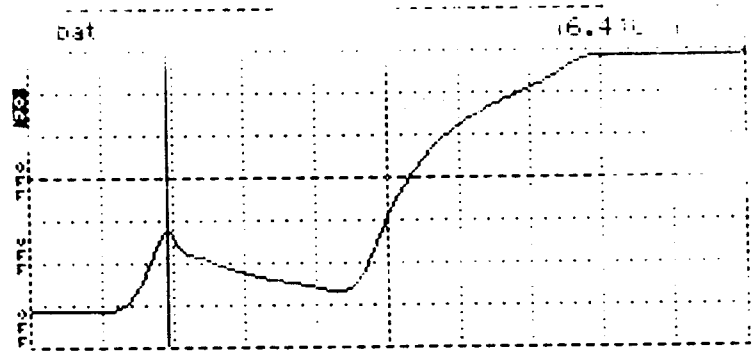
Cursor ..... 16.330 m
Distance/Div..... .25 m/div
Vertical Scale.... 109 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 10/17/93
Cable 03A 37A
Notes 37A03A

Input Trace ———
Stored Trace .....
Difference Trace -----

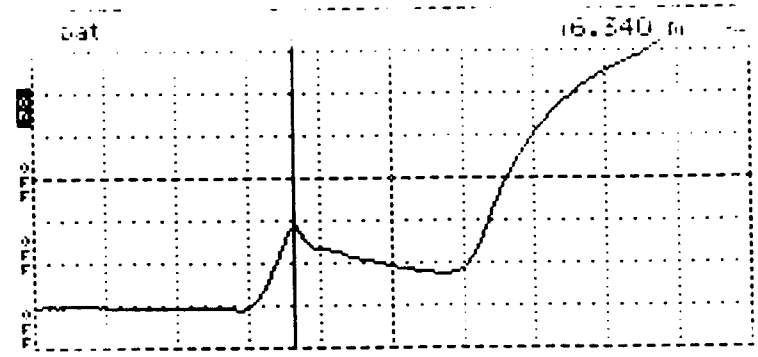
Cursor ..... 16.410 m
Distance/Div..... .25 m/div
Vertical Scale.... 109 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 10/17/93
Cable 04A 37A
Notes 37A04A

Input Trace ———
Stored Trace .....
Difference Trace -----

Cursor ..... 16.340 m
Distance/Div..... .25 m/div
Vertical Scale.... 109 mΩ/div
VP 0.99
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 10/17/93
Cable 05A 37A
Notes 37A05A

Input Trace ———
Stored Trace .....
Difference Trace ----

Figure C-1 (cont.). TDR Traces Measured Manually During Installation

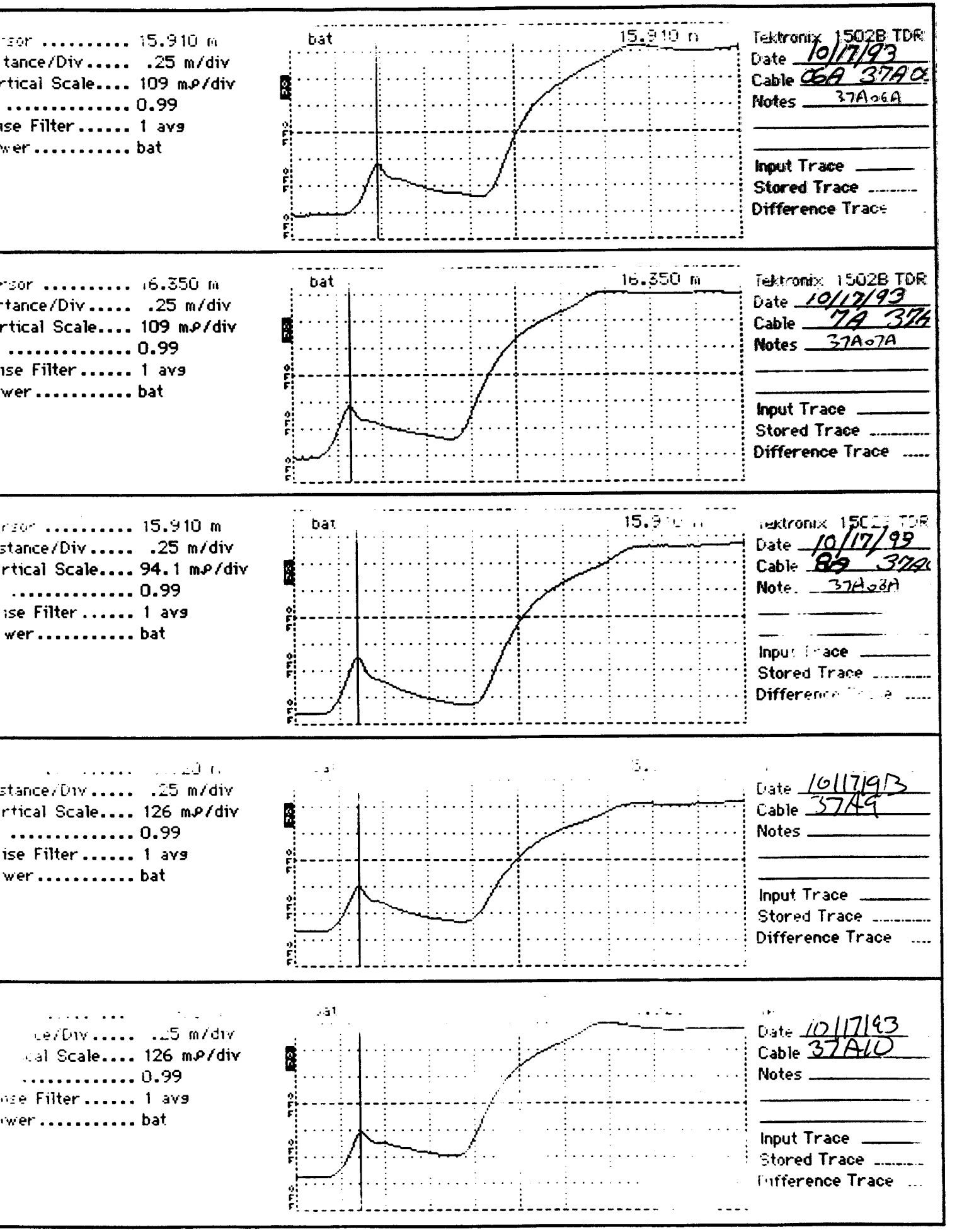
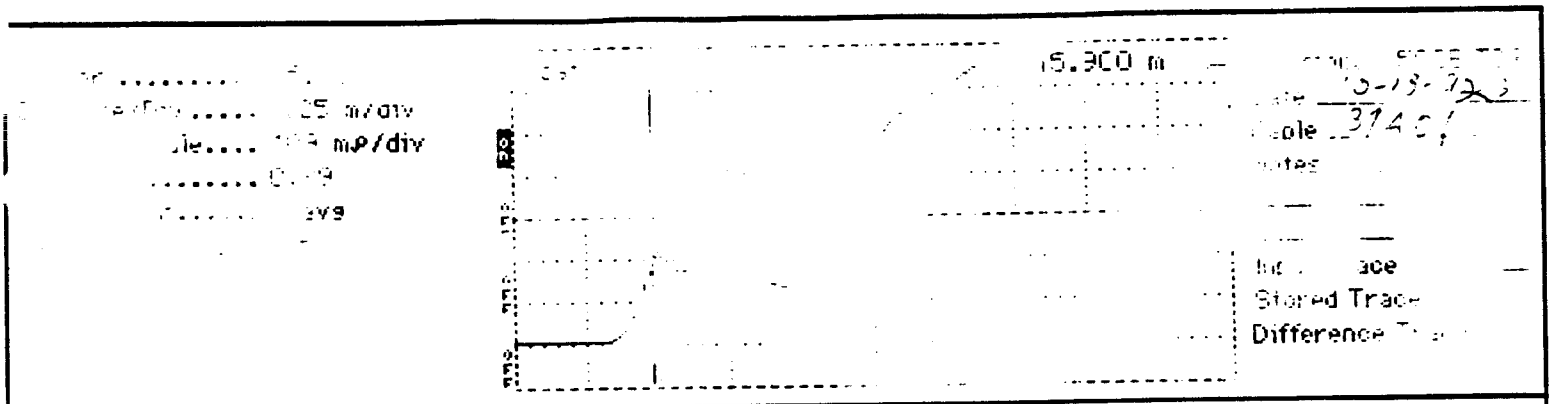


Figure C-1 (cont.). TDR Traces Measured Manually During Installation



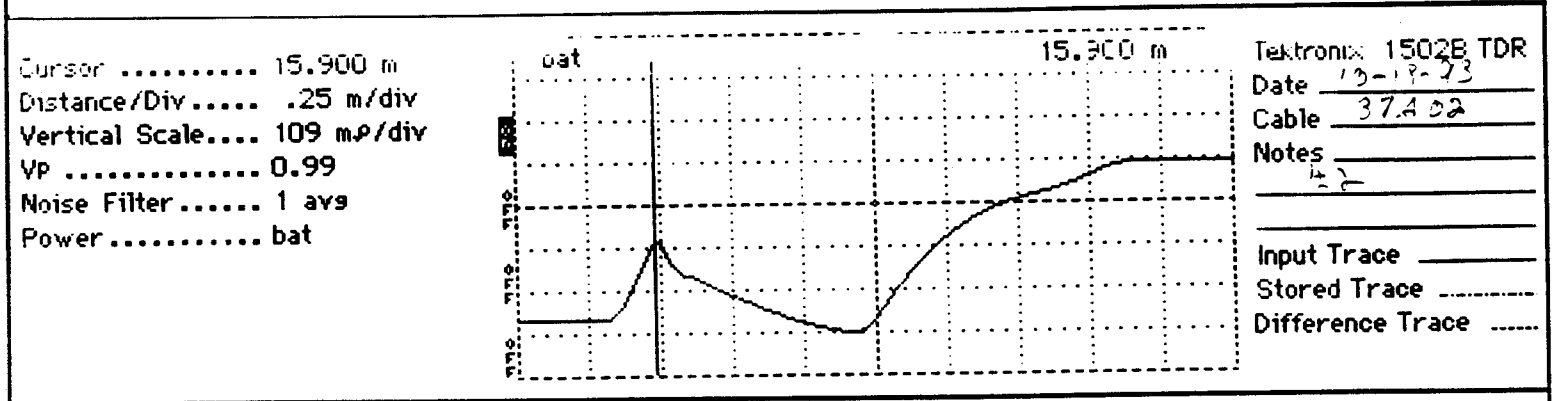
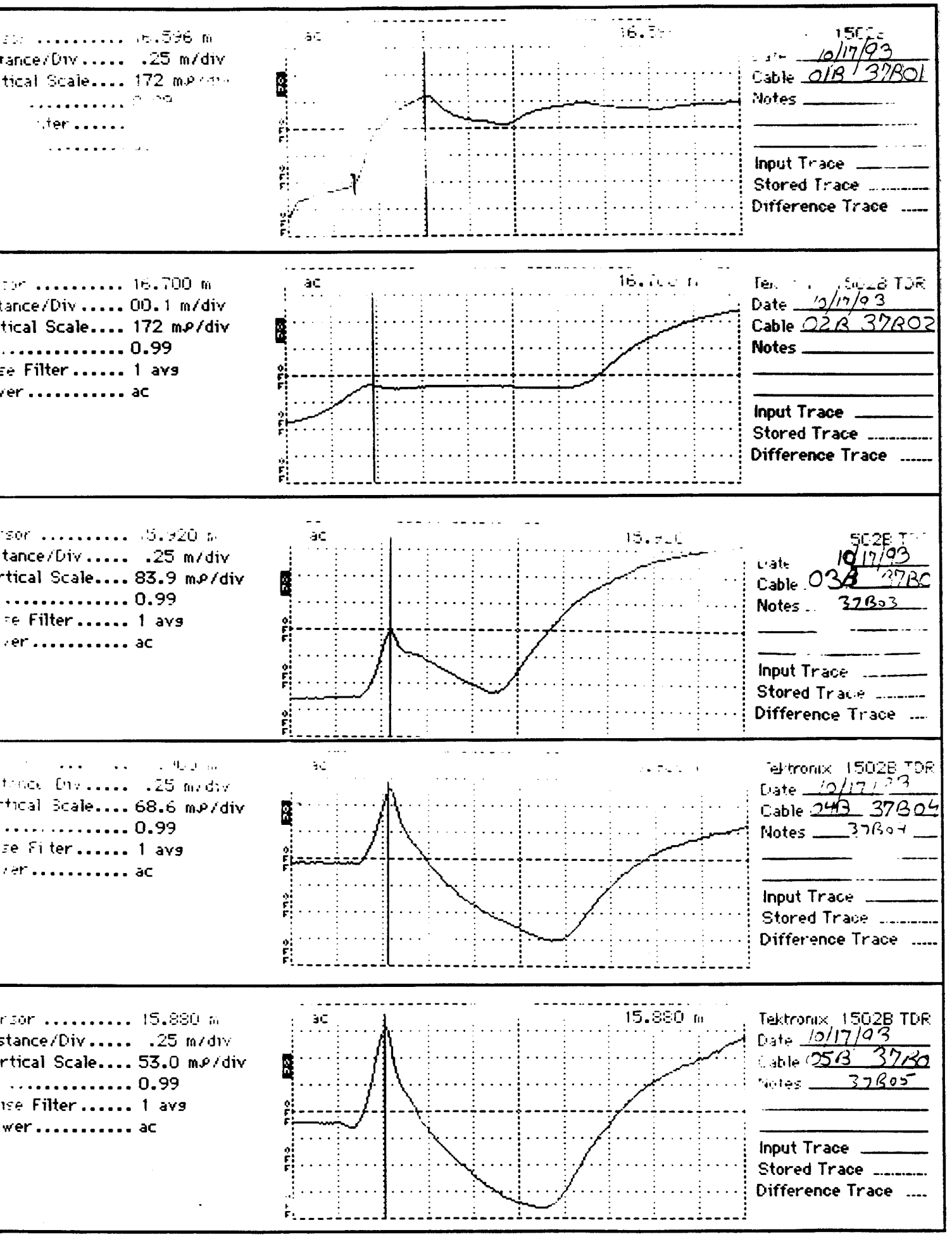


Figure C-1 (cont.). TDR Traces Measured Manually During Installation


ac
Date 10/17/93
Cable 01B 37B01
Notes
Input Trace
Stored Trace
Difference Trace
ac
Date 10/17/93
Cable 02B 37B02
Notes
Input Trace
Stored Trace
Difference Trace
ac
Date 10/17/93
Cable 03B 37B03
Notes 37B03
Input Trace
Stored Trace
Difference Trace
ac
Tektronix 1502B TDR
Cable 04B 37B04
Notes 37B04
Input Trace
Stored Trace
Difference Trace
ac
15.880 m
Tektronix 1502B TDR
Date 10/17/93
Cable 05B 37B05
Notes 37B05
Input Trace
Stored Trace
Difference Trace

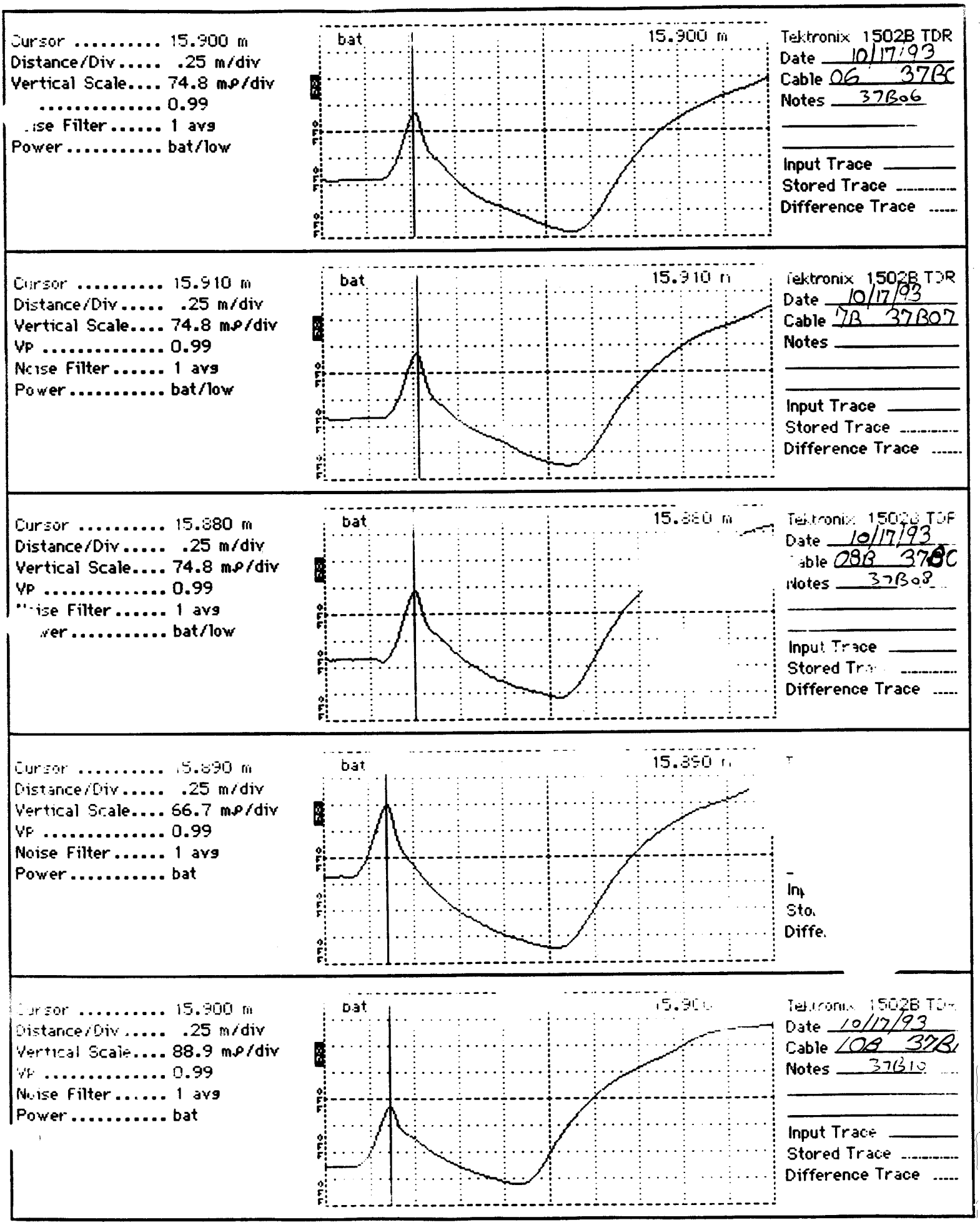


Figure C-1 (cont.). TDR Traces Measured Manually During Installation

Table C-1.1 TDR Moisture Content for 370201

TDR No.	TDR Length (m)	Dielectric Constant (ε)	Volumetric Moisture Content (%)	In-Situ Dry Density (kg/m³)	Gravimetric Moisture Content (%)
37C01	0.51	6.44	11.40	2355	4.84
37C02	1.04	26.78	41.98	1352	31.05
37C03	0.75	13.93	26.00	1352	19.23
37C04	0.92	20.96	35.91	1352	26.56
37C05	0.87	18.74	33.12	1352	24.50
37C06	1.02	25.76	41.03	1352	30.35
37C07	0.85	17.89	31.97	1352	23.65
37C08	1.02	25.76	41.03	1352	30.35
37C09	0.87	18.74	33.12	1352	24.50
37C10	0.83	17.06	30.81	1352	22.79

Table C-1.2 TDR Moisture Content for 370205

TDR No.	TDR Length (m)	Dielectric Constant (ε)	Volumetric Moisture Content (%)	In-Situ Dry Density (kg/m³)	Gravimetric Moisture Content (%)
37D01	0.85	17.89	31.97	1415	22.60
37D02	0.80	15.85	29.03	1415	20.52
37D03	0.93	21.41	36.45	1415	25.76
37D04	1.00	24.76	40.05	1415	28.31
37D05	0.90	20.05	34.81	1415	24.60
37D06	0.97	23.30	38.54	1415	27.24
37D07	0.97	23.30	38.54	1415	27.24
37D08	0.97	23.30	38.54	1415	27.24
37D09	0.87	18.74	33.12	1415	23.41

Table C-1.3 TDR Moisture Content for 370208

TDR No.	TDR Length (m)	Dielectric Constant (ε)	Volumetric Moisture Content (%)	In-Situ Dry Density (kg/m³)	Gravimetric Moisture Content (%)
37A01	0.60	8.91	16.75	1418	11.81
37A02	0.76	14.30	26.61	1418	18.77
37A03	0.65	10.46	19.82	1418	13.98
37A04	0.65	10.46	19.82	1418	13.98
37A05	0.62	9.52	17.97	1418	12.68
37A06	0.63	9.83	18.59	1418	13.11
37A07	0.66	10.79	20.44	1418	14.42
37A08	0.73	13.19	24.77	1418	17.47
37A09	0.70	12.13	22.92	1418	16.16

Table C-1.4 TDR Moisture Content for 370212

TDR No.	TDR Length (m)	Dielectric Constant (ε)	Volumetric Moisture Content (%)	In-Situ Dry Density (kg/m³)	Gravimetric Moisture Content (%)
37B01	0.50	6.19	10.83	N/A	N/A
37B02	0.35	3.03	3.09	2164	1.43
37B03	0.90	20.05	34.81	1460	23.84
37B04	0.98	23.78	39.05	1460	26.75
37B05	0.97	23.30	38.54	1460	26.40
37B06	1.00	24.76	40.05	1460	27.43
37B07	0.92	20.96	35.91	1460	24.59
37B08	0.88	19.17	33.69	1460	23.08
37B09	1.02	25.76	41.03	1460	28.10

Table C-2.1 Field Measured Moisture Content for 370201

LTPP Seasonal Monitoring Study	State Code	[37]
In-Situ Moisture Tests	Test Section Number	[0201]

Weight (gm)	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5
Weight of Pan + Wet Soil	N/A	246.50	236.55	246.98	301.20
Weight of Pan + Dry Soil	N/A	212.90	206.79	213.35	253.00
Weight of Pan	N/A	120.0	121.3	120.0	121.3
Weight of Dry Soil	N/A	92.90	85.49	93.35	131.70
Weight of Wet Soil	N/A	125.50	115.25	126.98	179.90
Weight of Moisture	N/A	32.60	29.76	33.63	48.20
Wt of Moisture/Dry Wt x 100	N/A	35.1	34.8	36.0	36.6

Weight (gm)	Probe 6	Probe 7	Probe 8	Probe 9	Probe 10
Weight of Pan + Wet Soil	240.30	250.60	255.05	280.25	238.08
Weight of Pan + Dry Soil	207.69	214.38	216.90	238.05	203.13
Weight of Pan	120.0	121.3	120.0	121.3	120.0
Weight of Dry Soil	87.69	93.08	96.90	116.75	83.13
Weight of Wet Soil	120.30	129.30	135.05	158.95	118.08
Weight of Moisture	32.61	36.22	33.15	42.20	34.95
Wt of Moisture/Dry Wt x 100	37.2	38.9	34.2	36.1	42.0

Table C-2.2 Field Measured Moisture Content for 370205

LTPP Seasonal Monitoring Study	State Code	[37]
In-Situ Moisture Tests	Test Section Number	[0205]

Weight (gm)	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5
Weight of Pan + Wet Soil	235.50	253.50	273.45	265.20	255.60
Weight of Pan + Dry Soil	213.20	227.27	237.90	232.53	223.19
Weight of Pan	121.3	120.0	121.3	120.0	121.3
Weight of Dry Soil	91.90	107.27	116.60	112.53	101.89
Weight of Wet Soil	114.20	133.50	152.15	145.20	133.70
Weight of Moisture	22.30	26.23	35.55	32.67	31.81
Wt of Moisture/Dry Wt x 100	24.3	24.5	30.5	29.0	31.2

Weight (gm)	Probe 6	Probe 7	Probe 8	Probe 9	Probe 10
Weight of Pan + Wet Soil	316.33	307.83	252.31	293.52	233.30
Weight of Pan + Dry Soil	270.20	261.31	220.49	250.92	206.30
Weight of Pan	120.0	121.3	120.0	121.3	120.0
Weight of Dry Soil	150.20	140.01	100.49	129.62	86.30
Weight of Wet Soil	196.33	186.53	131.31	172.22	113.30
Weight of Moisture	46.13	46.52	30.82	42.60	27.00
Wt of Moisture/Dry Wt x 100	30.7	33.2	30.7	32.9	31.3

Table C-2.3 Field Measured Moisture Content for 370208

LTPP Seasonal Monitoring Study	State Code	[37]
In-Situ Moisture Tests	Test Section Number	[0208]

Weight (gm)	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5
Weight of Pan + Wet Soil	247.10	238.79	263.19	252.79	279.90
Weight of Pan + Dry Soil	229.31	220.69	248.65	239.83	262.60
Weight of Pan	120.0	120.5	120.0	120.5	120.0
Weight of Dry Soil	109.31	100.19	128.65	119.33	142.60
Weight of Wet Soil	127.10	118.29	143.19	132.29	159.90
Weight of Moisture	17.79	18.10	14.54	12.96	17.30
Wt of Moisture/Dry Wt x 100	16.3	18.0	11.3	10.9	12.1

Weight (gm)	Probe 6	Probe 7	Probe 8	Probe 9	Probe 10
Weight of Pan + Wet Soil	227.93	245.92	285.60	387.00	242.70
Weight of Pan + Dry Soil	218.36	234.00	268.15	357.50	229.70
Weight of Pan	120.5	120.0	120.5	120.5	120.5
Weight of Dry Soil	97.86	114.00	147.65	266.50	122.20
Weight of Wet Soil	107.43	125.92	165.10	237.00	109.20
Weight of Moisture	9.57	11.92	17.45	29.50	13.00
Wt of Moisture/Dry Wt x 100	9.8	10.5	11.8	11.1	10.6

Table C-2.4 Field Measured Moisture Content for 370212

LTPP Seasonal Monitoring Study	State Code	[37]
In-Situ Moisture Tests	Test Section Number	[0212]

Weight (gm)	Probe 1	Probe 2	Probe 3	Probe 4	Probe 5
Weight of Pan + Wet Soil	N/A	361.02	274.41	273.72	242.71
Weight of Pan + Dry Soil	N/A	354.70	257.50	234.91	211.50
Weight of Pan	N/A	120.0	120.5	120.0	120.5
Weight of Dry Soil	N/A	234.70	137.00	114.91	91.00
Weight of Wet Soil	N/A	241.02	153.91	153.72	122.21
Weight of Moisture	N/A	6.32	16.91	38.81	31.21
Wt of Moisture/Dry Wt x 100	N/A	2.7	12.3	33.8	34.3

Weight (gm)	Probe 6	Probe 7	Probe 8	Probe 9	Probe 10
Weight of Pan + Wet Soil	213.90	233.72	307.81	235.78	239.80
Weight of Pan + Dry Soil	190.70	206.00	259.80	206.30	210.00
Weight of Pan	120.0	120.5	120.0	120.5	120.0
Weight of Dry Soil	70.70	85.50	139.80	85.80	90.00
Weight of Wet Soil	93.90	113.22	187.81	115.28	119.80
Weight of Moisture	23.20	27.72	48.01	29.48	29.80
Wt of Moisture/Dry Wt x 100	32.8	32.4	34.3	34.3	33.1

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DIVISION OF HIGHWAYS
MATERIALS & TESTS UNIT
SOILS LABORATORY 6

NOV 08 1993

JOB #
FILE #

I.P. No. .....

REPORT ON SAMPLES OF Soil For Moisture

Project B-1760040 County DAVIDSON Owner

Date: Sampled 10/12/93 Received 10/20/93 Reported

Sampled from RDWY By

Submitted by SHIN WV 19 90 Standard Specifications

575299 - 575336 **TEST RESULTS**

Proj. Sample No.	1A	1D	2A	2B	2C	2D	3A	3B
Lab. Sample No. 575	299	300	301	302	303	304	305	306
Retained #4 Sieve %								
Passing #10 Sieve %								
Passing #40 Sieve %								
Passing #200 Sieve %								
Minus #10 Frac — Soil Mortar—100% — Coarse Sand—2.0 to 0.25 mm. Ret. #60 %								
Minus #10 Frac — Soil Mortar—100% — Fine Sand—0.25 to 0.05 mm. Ret. #270 %								
Minus #10 Frac — Soil Mortar—100% — Minus #270 — Silt—0.05 to 0.005 mm. %								
Minus #10 Frac — Soil Mortar—100% — Minus #270 — Clay—Less than 0.005 mm. %								
Minus #10 Frac — Passing #40 Sieve %								
Minus #10 Frac — Passing #200 Sieve %								
L. L.								
P. I.								
AASHO Classification								
Texture								
Station	37A01A	37D01	37A02A	37B02	37C02	37D02	37A03A	37B03
Hole No.								
Depth (ft.)								
MOISTURE	17.9	22.1	15.2	2.9	33.0	24.5	10.0	10.2

cc:
SHIN WV
FILE

Soils Engineer

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11-16-90

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

MATERIALS & TESTS UNIT

SOILS LABORATORY

I.P. No. .....

REPORT ON SAMPLES OF Soil For moisture

Project B-1702.00406 County ..... Owner .....

Date: Sampled ..... Received ..... Reported .....

Sampled from RDWY By .....

Submitted by ..... 19 ..... Standard Specifications

575299 - 575336

TEST RESULTS

Proj. Sample No.		3C	3D	4A	4B	4C	4D	5A	5B
Lab. Sample No. 575		307	308	309	310	311	312	313	314
Retained #4 Sieve	%								
Passing #10 Sieve	%								
Passing #40 Sieve	%								
Passing #200 Sieve	%								
Minus #10 Fract. — Soil Mortar—100% — Coarse Sand—2.0 to 0.25 mm. Ret. #60	%								
Minus #10 Fract. — Soil Mortar—100% — Fine Sand—0.25 to 0.05 mm. Ret. #270	%								
Minus #10 Fract. — Soil Mortar—100% — Minus #270 — Silt—0.05 to 0.005 mm.	%								
Minus #10 Fract. — Soil Mortar—100% — Minus #270 — Clay—Less than 0.005 mm.	%								
Minus #10 Fract. — Passing #40 Sieve	%								
Minus #10 Fract. — Passing #200 Sieve	%								
L. L.									
P. I.									
AASHO Classification									
Texture									
Station		37C03	37D03	37A04A	37B04	37C04	37D04	37A05A	37B05
Hole No.									
Depth (ft.)									
MOISTURE		14.9	28.5	10.4	32.1	34.2	28.6	10.0	19.6

cc:

Soils Engineer

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS
MATERIALS & TESTS UNIT

SOILS LABORATORY

I.P. No. .....

REPORT ON SAMPLES OF Soil for moisture

Project 81T600406 County ..... Owner .....

Date: Sampled ..... Received ..... Reported .....

Sampled from NAWY By .....

Submitted by ..... 19 90 Standard Specifications

575299 - 575336 **TEST RESULTS**

Proj. Sample No.	5C	5D	6A	6B	6C	6D	7A	7B
Lab. Sample No. 575	315	316	317	318	319	320	321	322
Retained #4 Sieve %								
Passing #10 Sieve %								
Passing #40 Sieve %								
Passing #200 Sieve %								
Minus #10 Frac. — Soil Mortar — 100% — Coarse Sand—2.0 to 0.25 mm. Ret. #60 %								
Minus #10 Frac. — Soil Mortar — 100% — Fine Sand—0.25 to 0.05 mm. Ret. #270 %								
Minus #10 Frac. — Soil Mortar — 100% — Minus #270 — Silt—0.05 to 0.005 mm. %								
Minus #10 Frac. — Soil Mortar — 100% — Minus #270 — Clay—Less than 0.005 mm. %								
Minus #10 Frac. — Passing #40 Sieve %								
Minus #10 Frac. — Passing #200 Sieve %								
L. L.								
P. I.								
AASHO Classification								
Texture								
Station	37C05	37D05	37A06	37B06	37C06	37D06	37A07	37B07
Hole No.								
Depth (ft.)								
moisture	34.6	30.6	9.4	30.9	34.5	30.3	9.3	30.5

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DIVISION OF HIGHWAYS

MATERIALS & TESTS UNIT

SOILS LABORATORY

I.P. No. .....

REPORT ON SAMPLES OF Soil for moisture

Project 8.T600406 County ..... Owner .....

Date: Sampled ..... Received ..... Reported .....

Sampled from NAWY By .....

Submitted by ..... 19 ..... Standard Specifications

575299 - 575336 **TEST RESULTS**

Proj. Sample No.		7C	7D	8A	8B	8C	8D	9A	9B
Lab. Sample No. 575		323	324	325	326	327	328	329	330
Retained #4 Sieve	%								
Passing #10 Sieve	%								
Passing #40 Sieve	%								
Passing #200 Sieve	%								
Minus #10 Fracth. — Soil Mortar—100% — Coarse Sand—2.0 to 0.25 mm. Ret. #60	%								
Minus #10 Fracth. — Soil Mortar—100% — Fine Sand—0.25 to 0.05 mm. Ret. #270	%								
Minus #10 Fracth. — Soil Mortar—100% — Minus #270 — Silt—0.05 to 0.005 mm.	%								
Minus #10 Fracth. — Soil Mortar—100% — Minus #270 — Clay—Less than 0.005 mm.	%								
Minus #10 Fracth. — Passing #40 Sieve	%								
Minus #10 Fracth. — Passing #200 Sieve	%								
L. L.									
P. I.									
AASHO Classification									
Texture									
Station		37C07	37D07	37A08	37B08	37C08	37D08	37A09	37B09
Hole No.									
Depth (ft.)									
moisture		34.8	30.6	11.0	30.1	35.8	29.7	11.7	30.2

cc:

Soils Engineer

M&T Form 503
11-16-90

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

MATERIALS & TESTS UNIT

SOILS LABORATORY

I.P. No. .....

REPORT ON SAMPLES OF Soil For Moisture

Project B-T600406 County ..... Owner .....

Date: Sampled ..... Received ..... Reported .....

Sampled from ROW By .....

Submitted by ..... 19 ..... Standard Specifications

575299 - 575336

TEST RESULTS

Proj. Sample No.		9C	9D	10A	10B	10C	10D		
Lab. Sample No. 575		331	332	333	334	335	336		
Retained #4 Sieve	%								
Passing #10 Sieve	%								
Passing #40 Sieve	%								
Passing #200 Sieve	%								
Minus #10 Fract. — Soil Mortar — 100% — Coarse Sand—2.0 to 0.25 mm. Ret. #60	%								
Minus #10 Fract. — Soil Mortar — 100% — Fine Sand—0.25 to 0.05 mm. Ret. #270	%								
Minus #10 Fract. — Soil Mortar — 100% — Minus #270 — Silt—0.05 to 0.005 mm.	%								
Minus #10 Fract. — Soil Mortar — 100% — Minus #270 — Clay—Less than 0.005 mm.	%								
Minus #10 Fract. — Passing #40 Sieve	%								
Minus #10 Fract. — Passing #200 Sieve	%								
L. L.									
P. I.									
AASHO Classification									
Texture									
Station		37C9	37D09	37A10	37B10	37C10	37D10		
Hole No.									
Depth (ft.)									
MOISTURE		35.2	31.6	10.3	29.6	37.5	29.6		

cc:

Soils Engineer

APPENDIX D

Initial Data Collection

Appendix D contains the following supporting information:

Table D-1. Sample Data from the Onsite Datalogger Collected During Initial Data Collection, May 15, 1995

5,1995,134,1600,11.21,32.54,22.43,22.31,22.17,22.12
6,1995,134,1600,28.33,26.09,24.78,21.43,21.3
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5,1995,134,1900,11.21,25.96,22.91,22.49,22.29,22.01
6,1995,134,1900,27.23,27.02,26.24,21.41,21.2
5,1995,134,2000,11.2,21.66,23.17,22.72,22.49,22.17
6,1995,134,2000,25.44,26.12,25.98,21.45,21.18
5,1995,134,2100,11.2,18.79,23.42,22.97,22.8,22.43
6,1995,134,2100,23.81,25.05,25.45,21.5,21.19
5,1995,134,2200,11.2,17.44,23.56,23.15,23.02,22.65
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5,21.65,1144,22.47,23.23,7,21.78,1432,22.4,23.16,3,21.75,1429,1023
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7,15.02
3,1995,134,2400,29.78,1642,27.53,1731,26.28,1808,22.19,15,21.67,13,21.13,706,20.64,1306,20.17,1622,19.3,1703,18.4,
1617,17.69,1702,17.11,1647,16.65,1655,16.13,1650,15.76,1614,15.61,1607,15.37,1639,15.12,1636
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17.41,5,16.84,9,16.41,4,15.94,5,15.56,2,15.45,5,15.19,439,14.92,11
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6,1995,135,100,20.28,21.75,22.98,21.74,21.3
5,1995,135,200,11.19,16.28,23.2,23.03,23.06,22.86
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6,1995,135,1200,27.65,22.09,19.28,16.64,16.42
5,1995,135,1300,11.17,37.37,-6999,21.23,21.42,21.66
6,1995,135,1300,36.06,29.86,26.16,21.53,21.38
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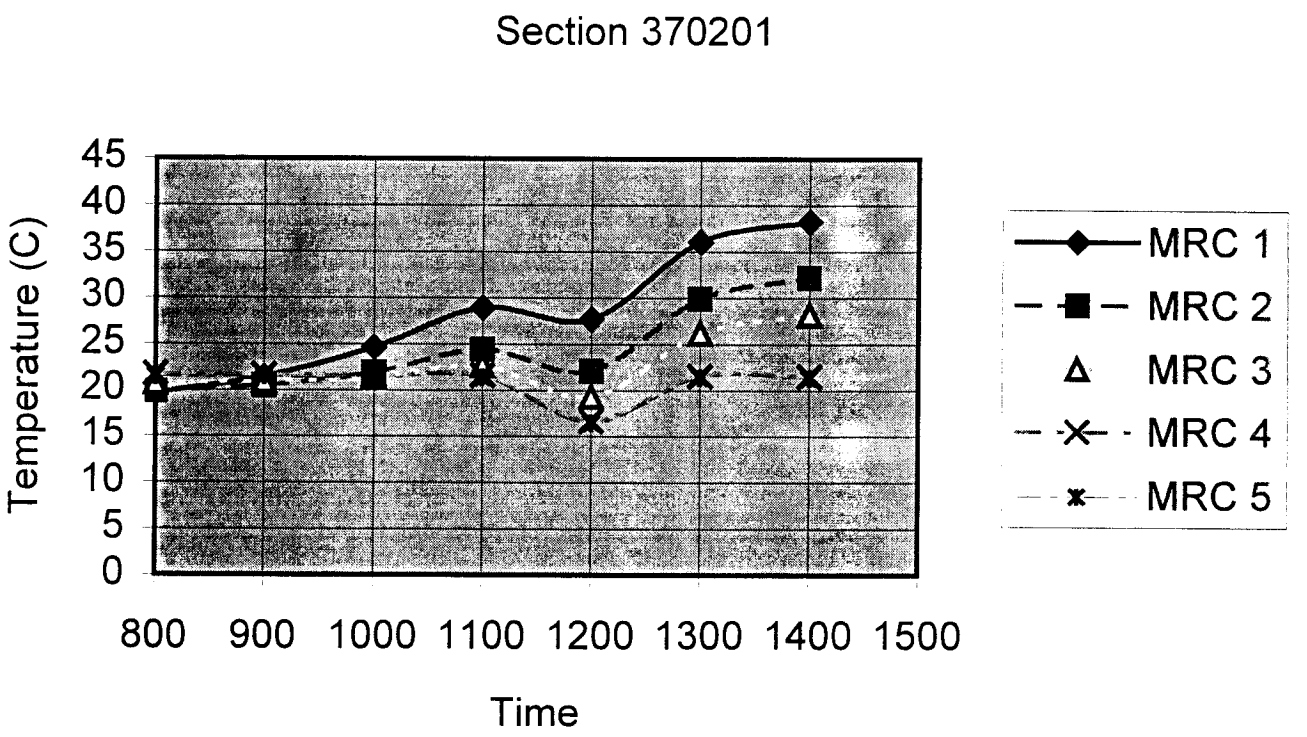


Figure D-1. First Five Sub-Surface Temperatures
From Initial Data Collection, May 15, 1995

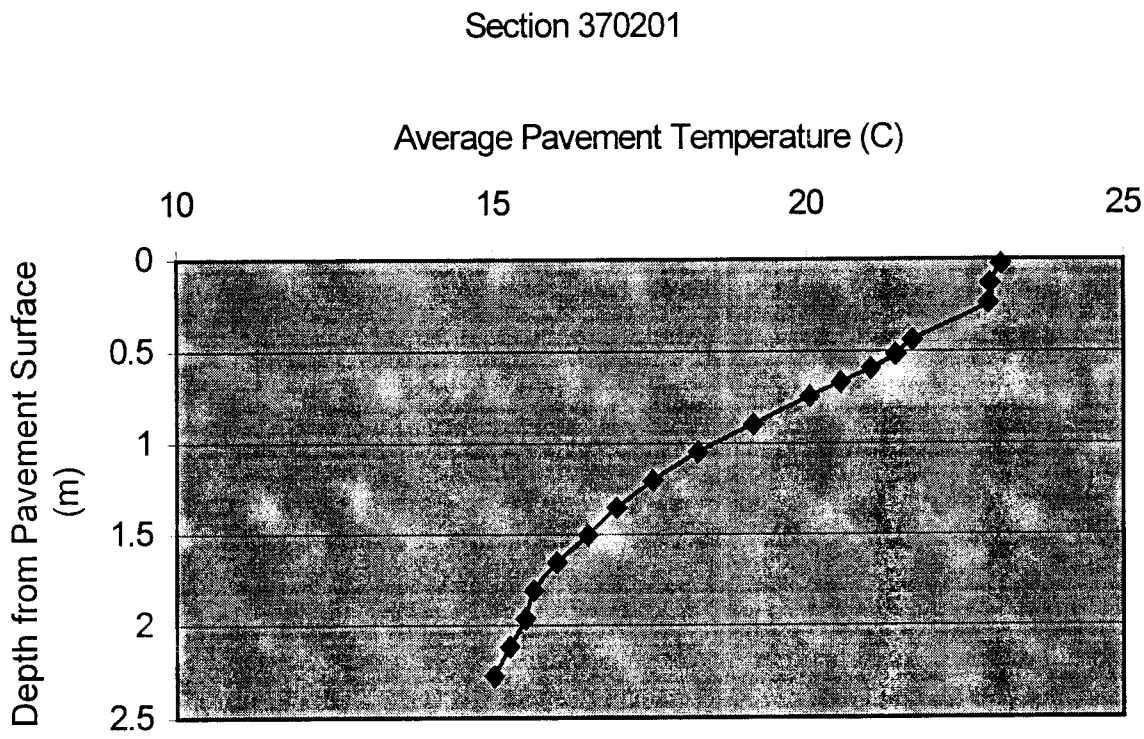


Figure D-2. Average Sub-surface Temperature for all 18 Sensors From Initial Data Collection, May 14, 1995

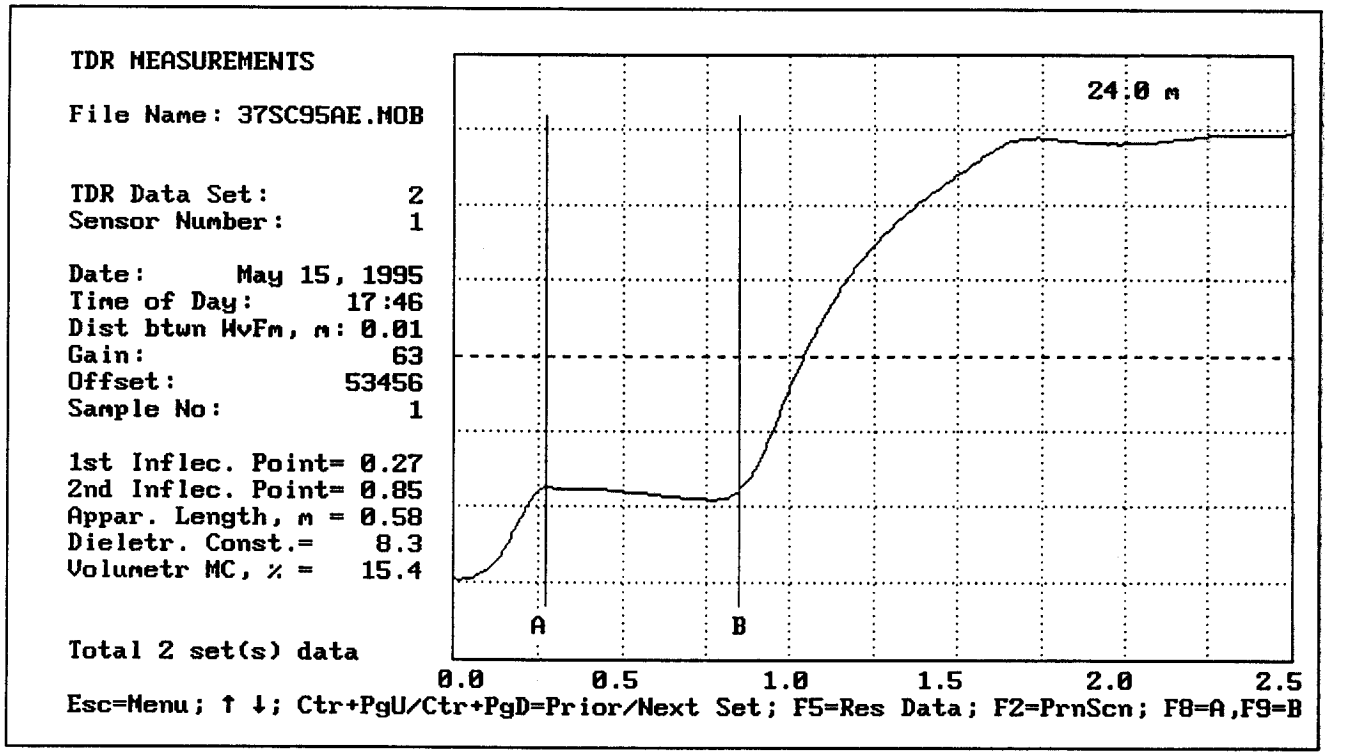


Figure D-3. Initial Second Set of TDR Traces Measured with the Mobile Unit

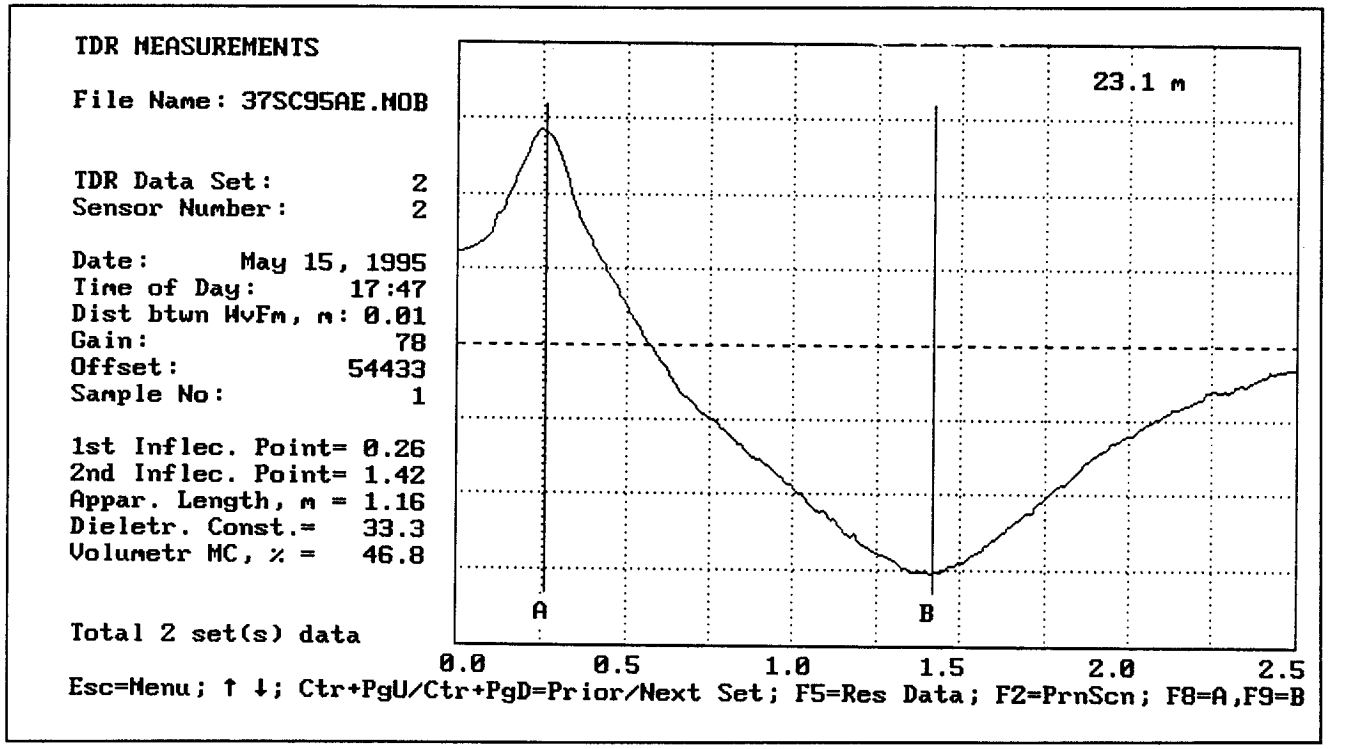


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

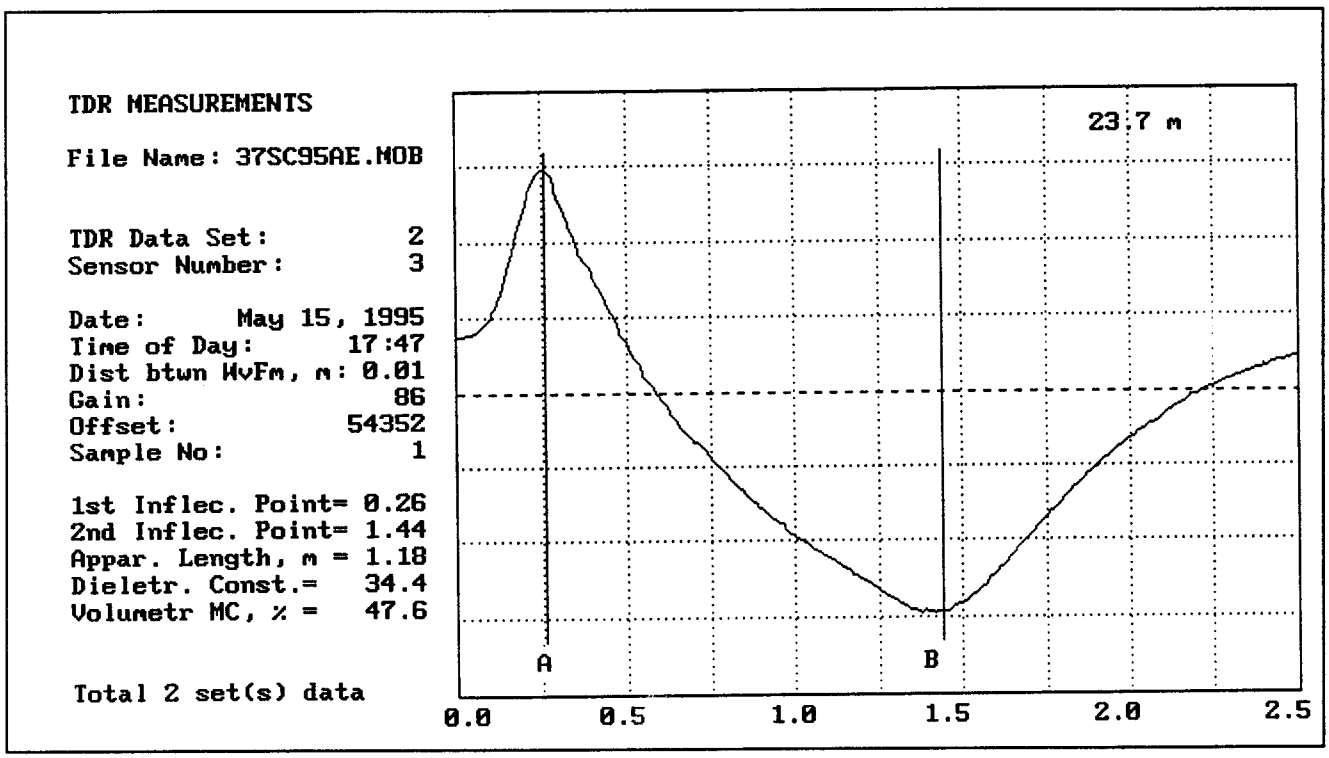


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

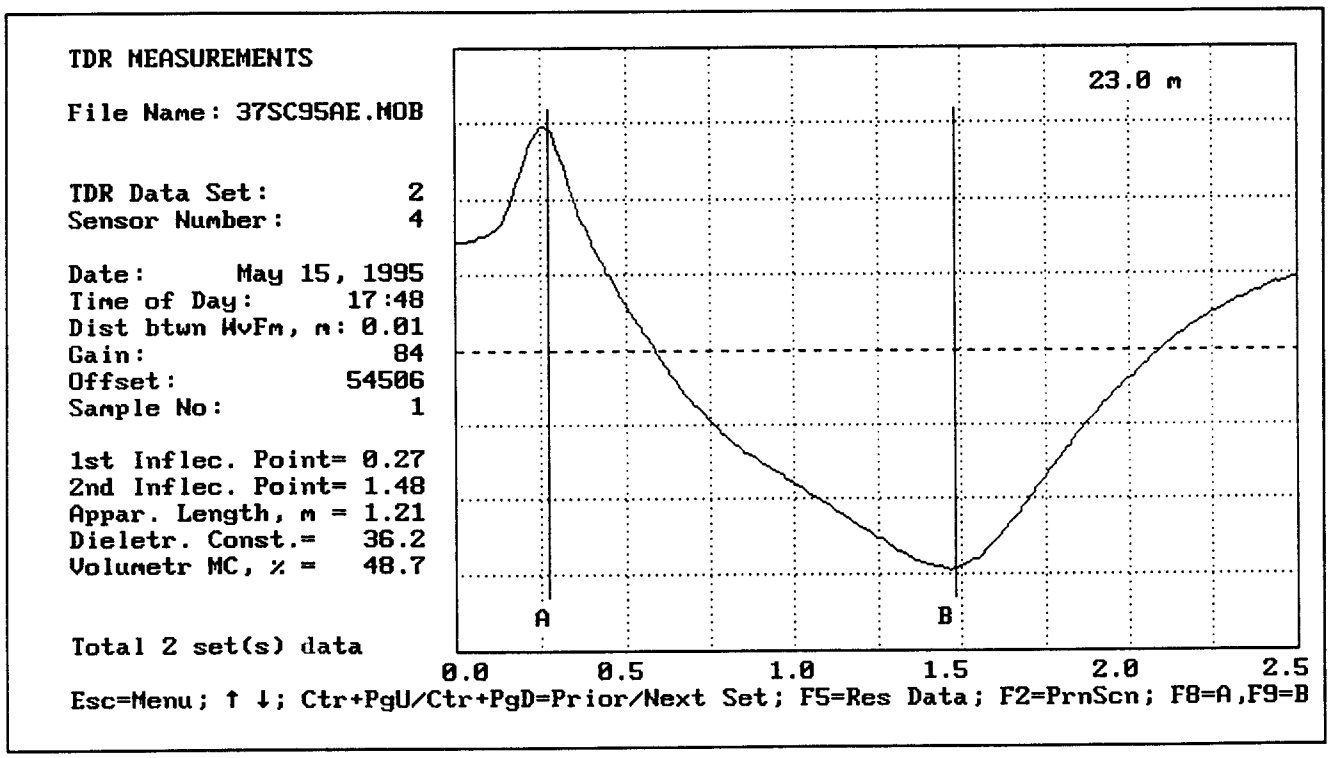


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

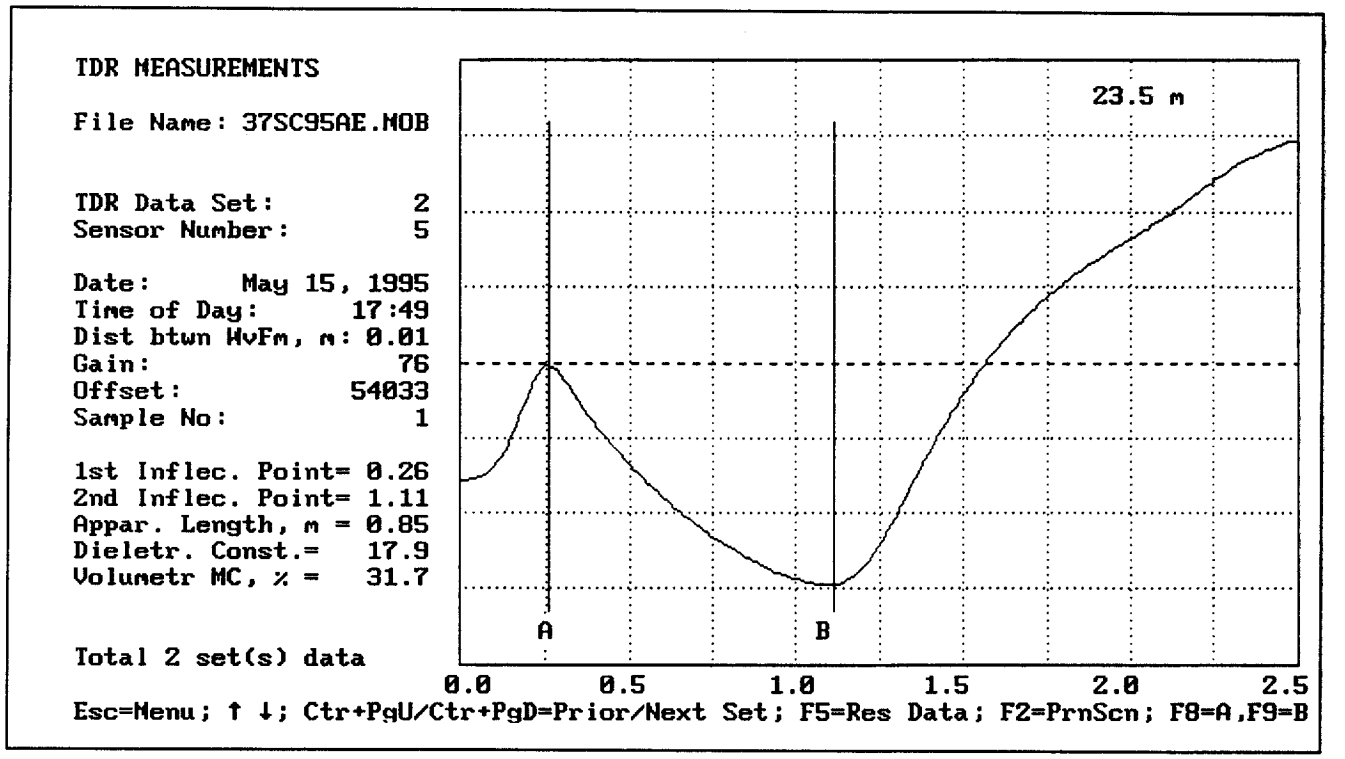


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

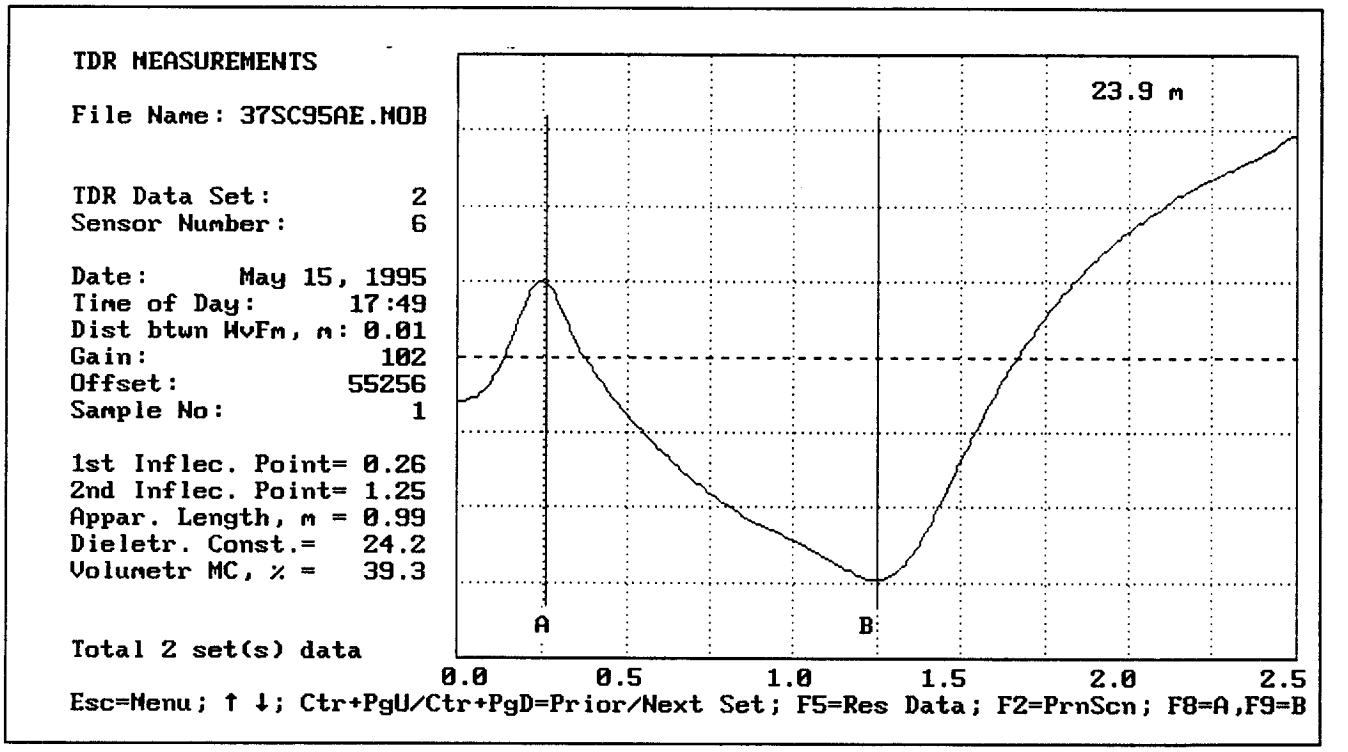


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

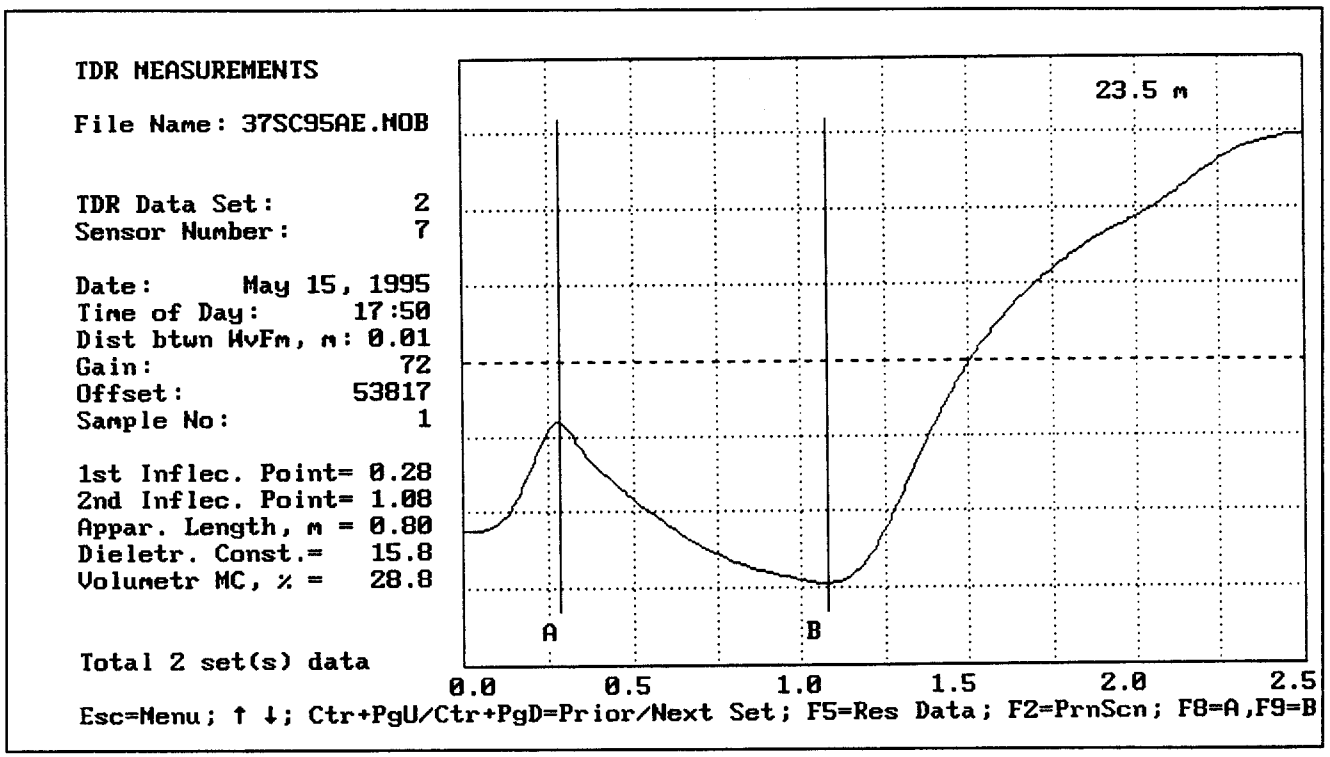


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

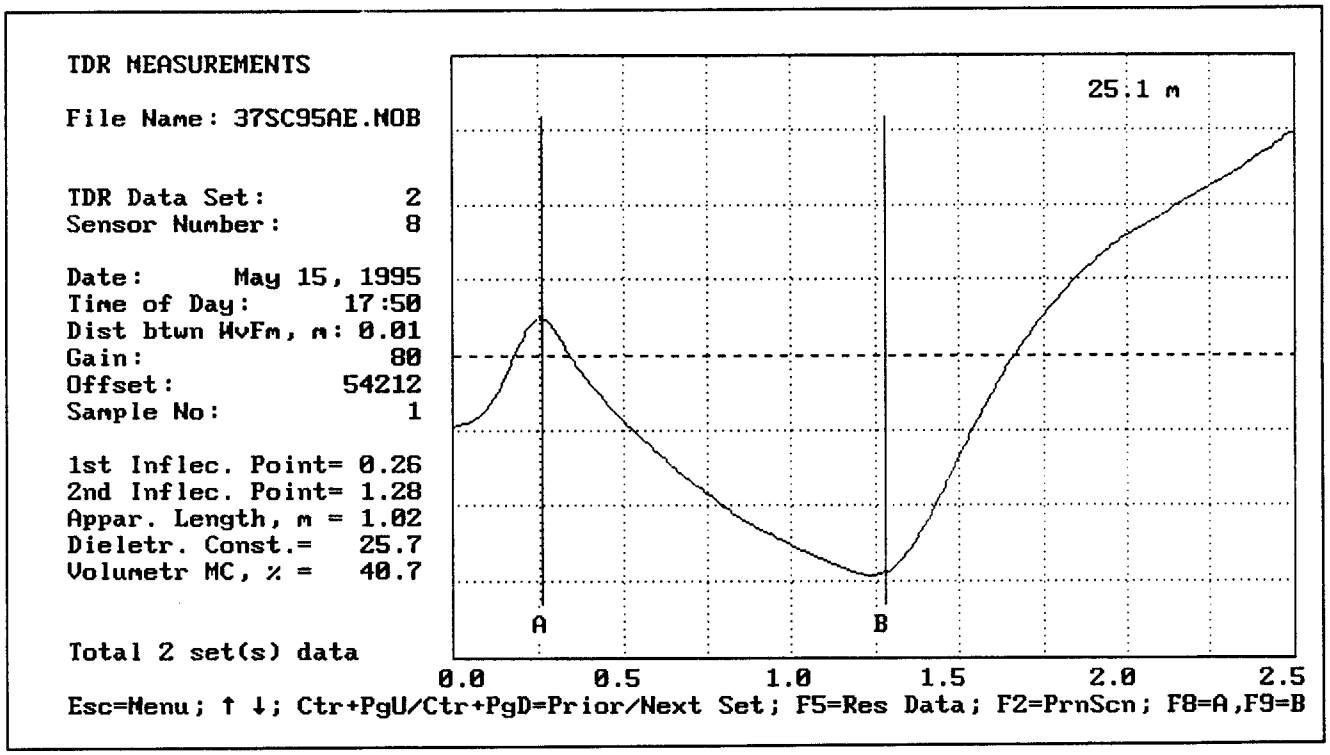


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

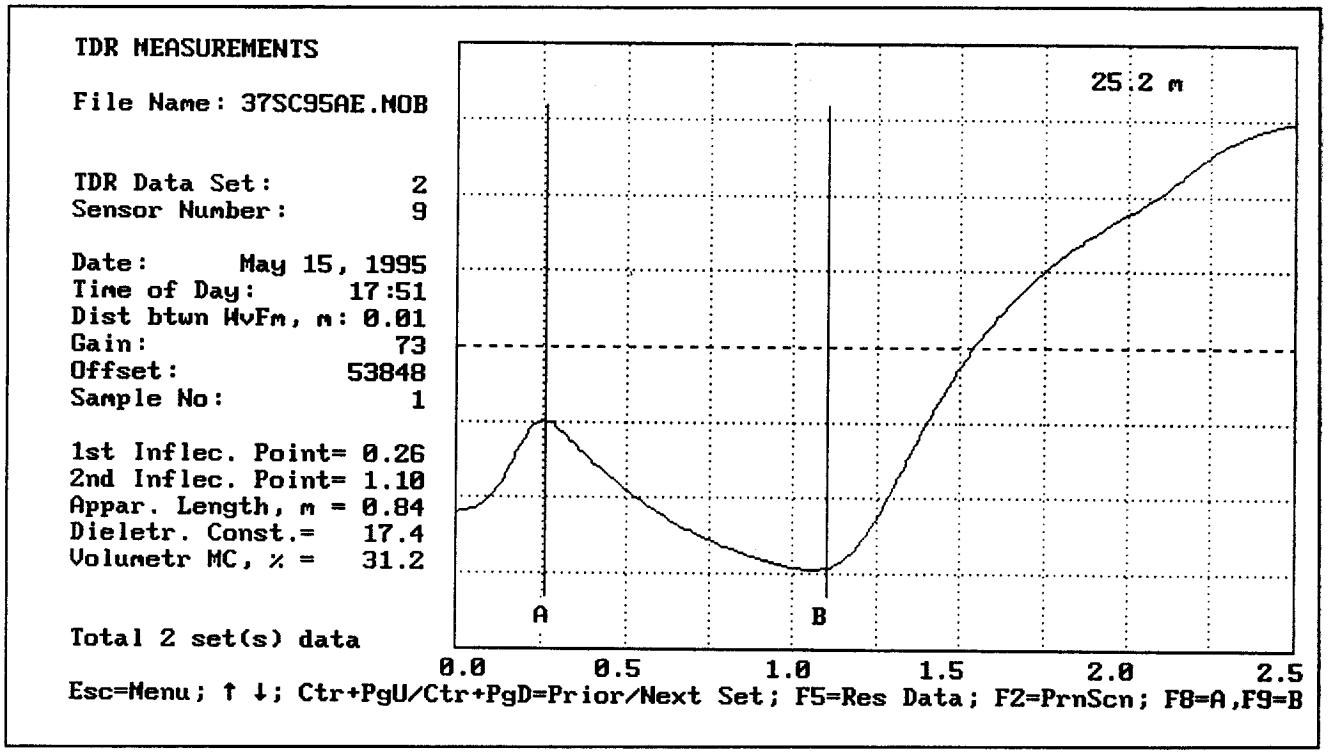


Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

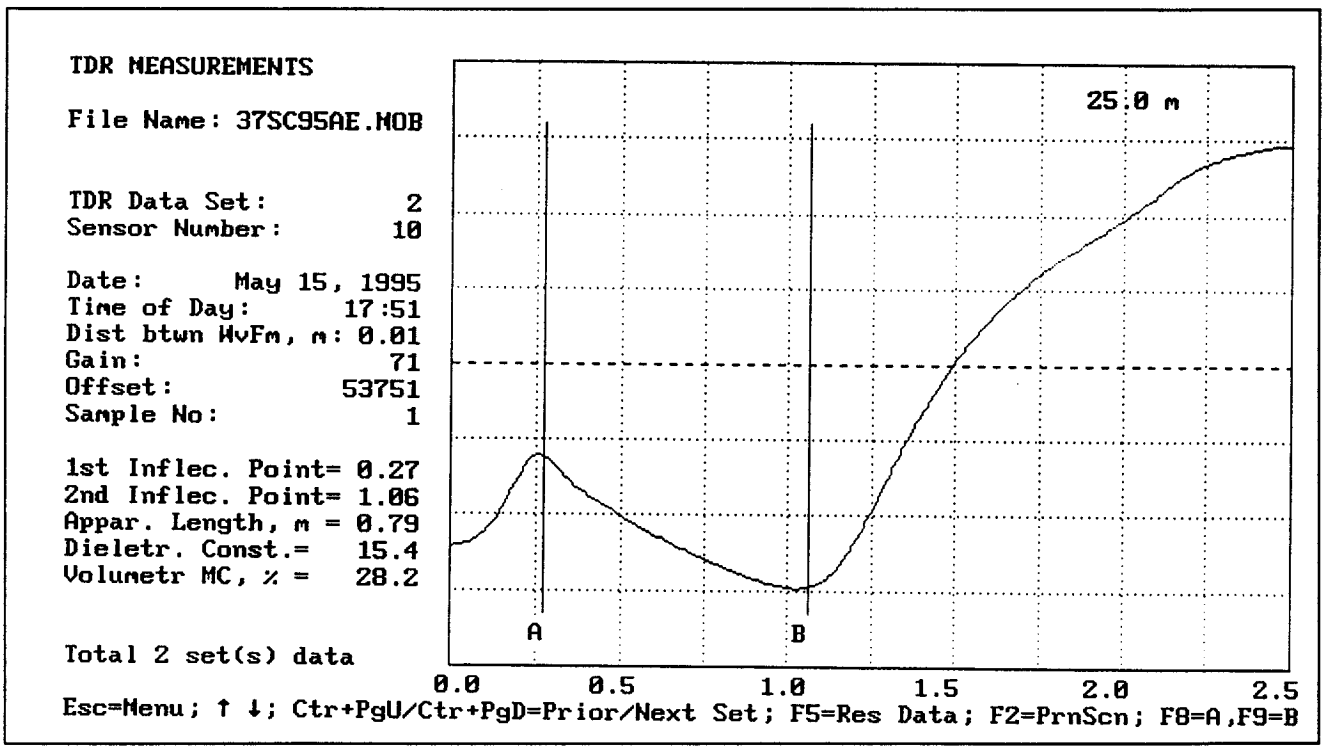
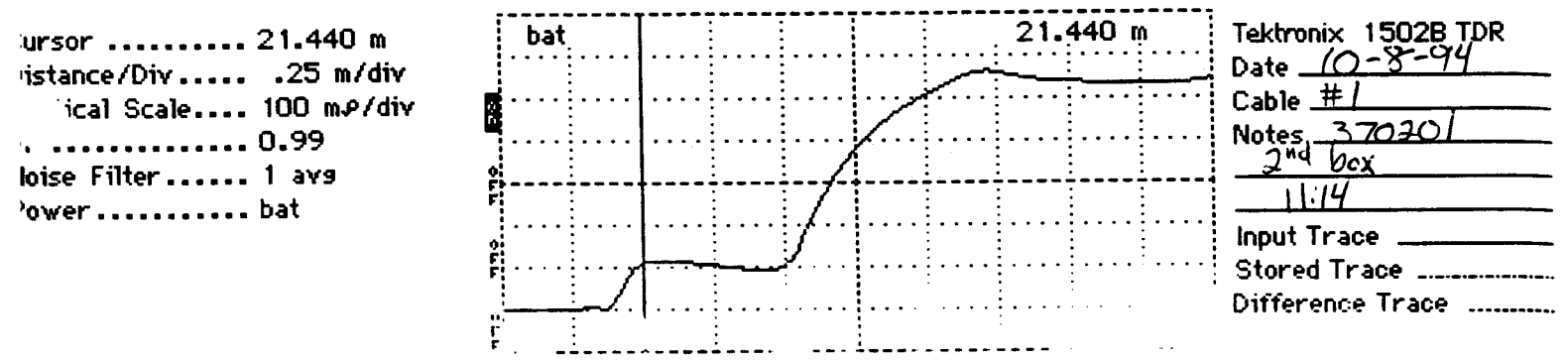
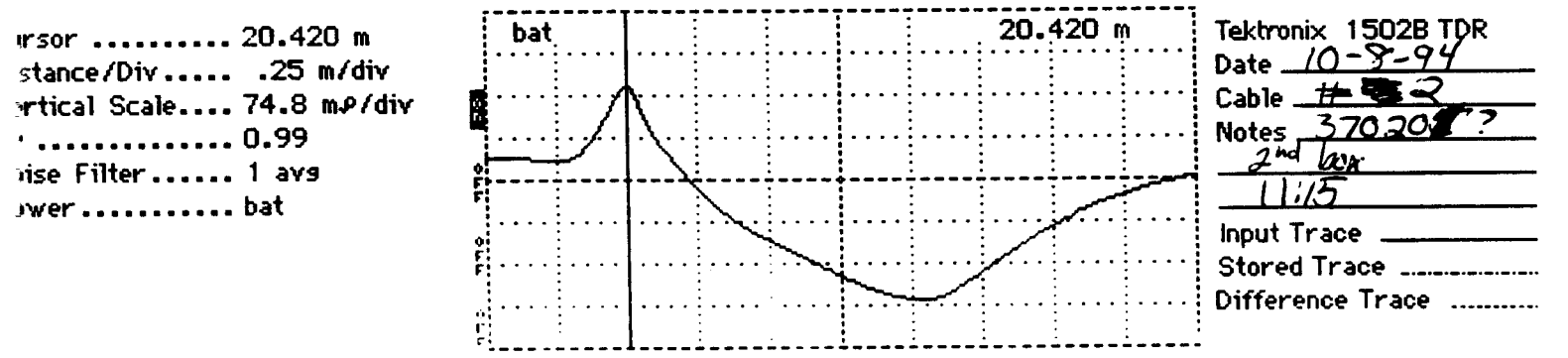
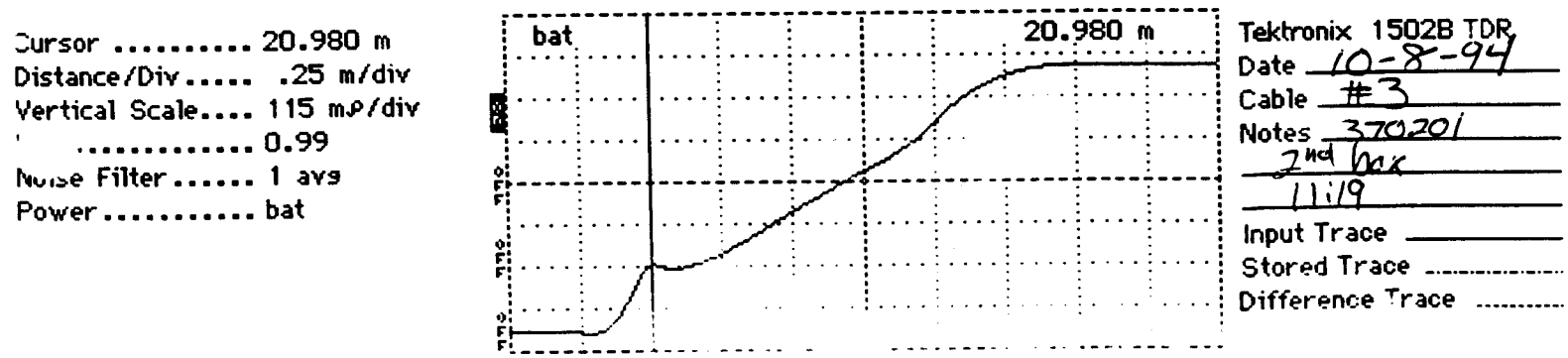


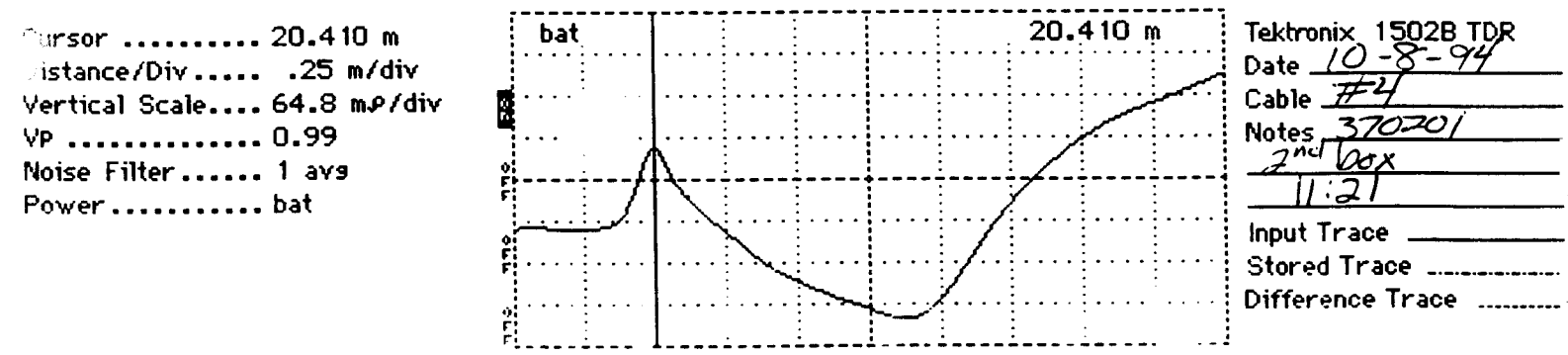
Figure D-3(cont.). Initial Second Set of TDR Traces Measured with the Mobile Unit

2nd box on 52 south, Box 'C'









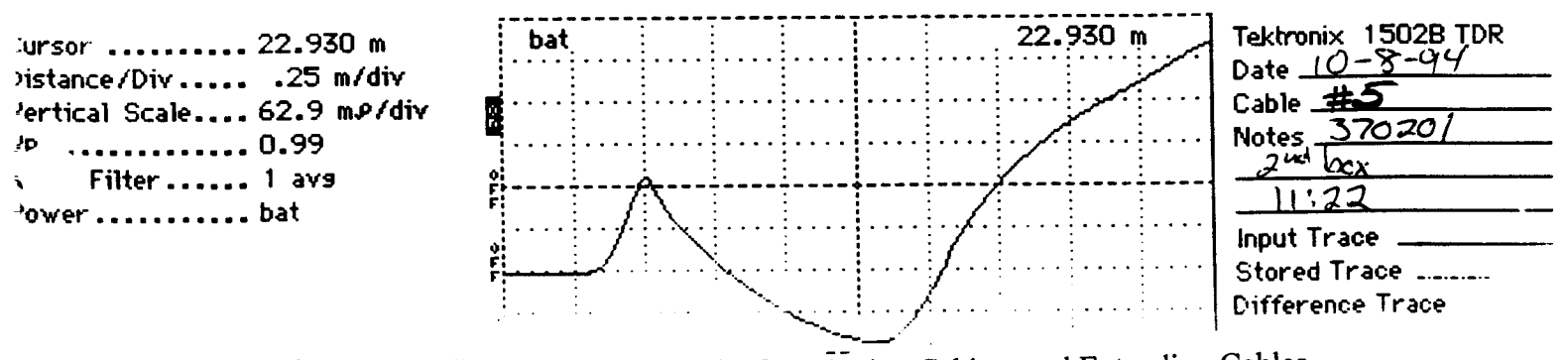
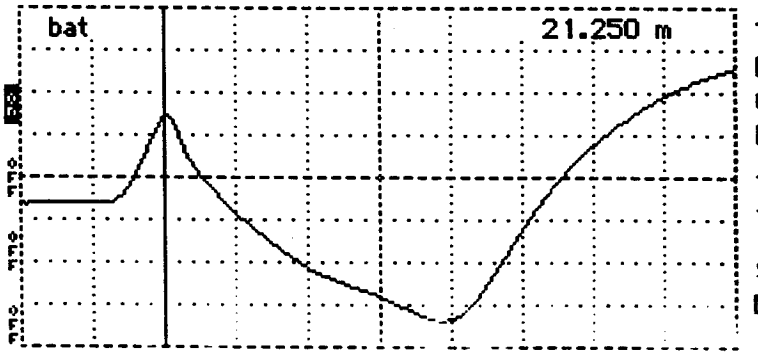


Figure D-4. TDR Traces Measured After Moving Cabinet and Extending Cables

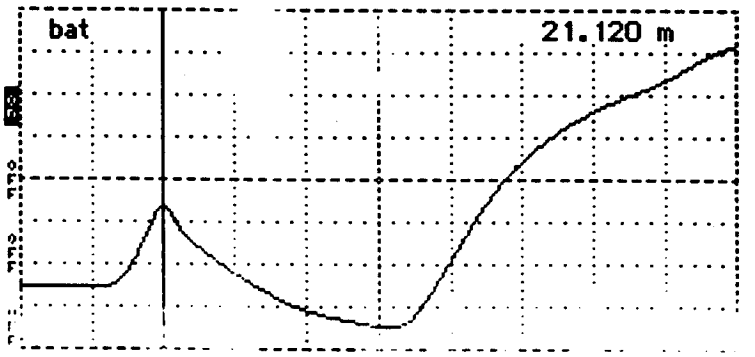
2nd box on 52 south, Box 'C'

or ..... 21.250 m
nce/Div..... .25 m/div
cal Scale.... 62.9 mρ/div
..... 0.99
Filter..... 1 avg
er..... bat



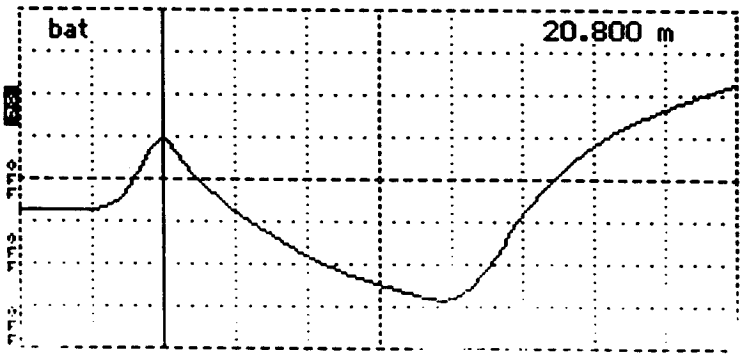
Tektronix 1502B TDR
Date 10-8-94
Cable #6
Notes 370201
2nd box
11:24
Input Trace
Stored Trace
Difference Trace

sor ..... 21.120 m
ance/Div..... .25 m/div
ical Scale.... 74.8 mρ/div
..... 0.99
e Filter..... 1 avg
er..... bat



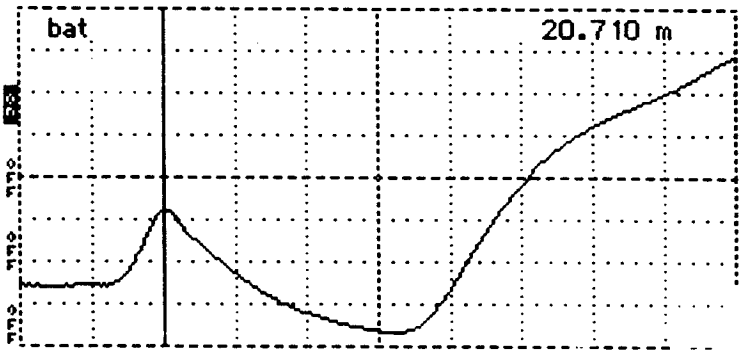
Tektronix 1502B TDR
Date 10-8-94
Cable #7
Notes 370201
2nd box
11:25
Input Trace
Stored Trace
Difference Trace

or ..... 20.800 m
nce/Div..... .25 m/div
cal Scale.... 74.8 mρ/div
..... 0.99
Filter..... 1 avg
er..... bat



Tektronix 1502B TDR
Date 10-8-94
Cable #8
Notes 370201
2nd box
11:29
Input Trace
Stored Trace
Difference Trace

or ..... 20.710 m
nce/Div..... .25 m/div
cal Scale.... 74.8 mρ/div
..... 0.99
Filter..... 1 avg
er..... bat



Tektronix 1502B TDR
Date 10-8-94
Cable #9
Notes 370201
2nd box
11:28
Input Trace
Stored Trace
Difference Trace

or ..... 20.740 m
nce/Div..... .25 m/div
cal Scale.... 74.8 mρ/div
..... 0.99
Filter..... 1 avg
r..... bat

Tektronix 1502B TDR
Date 10-8-94
Cable #10
Notes 370201
2nd box
11:31
Input Trace
Stored Trace
fference Trace

Figure D-4. TDR Traces Measured After Moving Cabinet and Extending Cables

Table D-2. Uniformity Survey Results Before and After Installation

Seasonal Uniformity Survey	Falling Weight Deflectometer
Site Number: 370201	Data Collection and
Date Surveyed: May 15, 1995	Processing Summary

Section Interval (ft)	Mean Deflection Values for HT 2 (mils) Corrected								Mean Temp D1 (F)
	Sensor 1	Sensor 1 std dev	Sensor 7	Sensor 7 std dev	Volumetric K	Volumetric K std dev	Effective Thick.	Thick. std dev	
32 to 466 **May 15** @ 0830	3.33	0.46	1.49	0.29	321	73	9.44	0.38	81.8
438 to 483 **May 15** @ 1242	4.20	0.29	1.93	0.13	238	17	8.84	0.24	102.0
438 to 483 **May 15** @1716	3.97	0.22	1.94	0.07	231	29	9.22	0.36	98.0

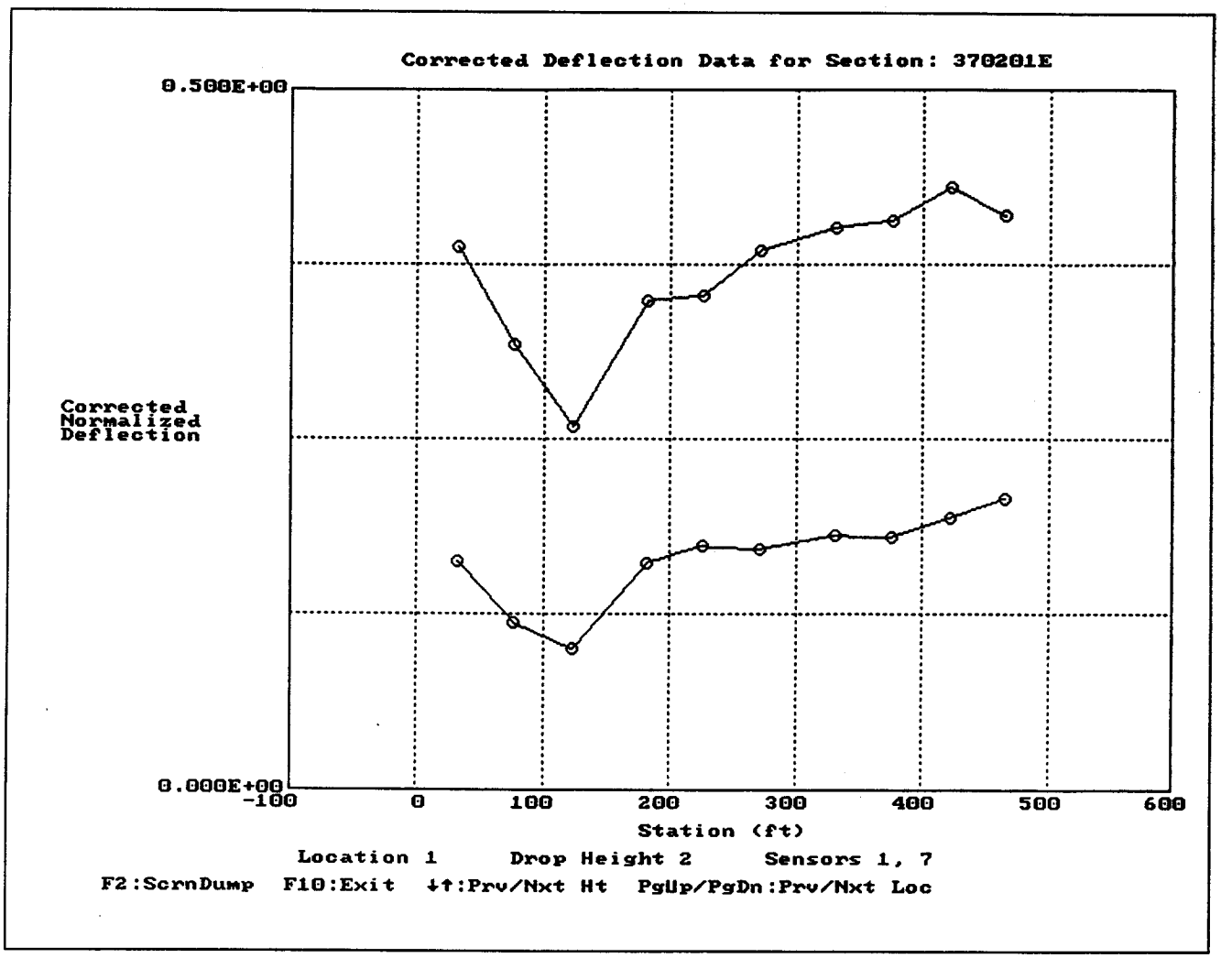


Figure D-5. Deflection Profiles from FWDCHECK
(Test Date and Time May 15, 1995 @ 0830)

Table D-3. Volumetric K and Effective Thickness from FWDCHECK
(Test Date and Time May 15, 1995 @ 0830)

Flexible Pavement Thickness Statistics - 37SC95E - Drop Height 2			
Subsection	Station	Volumetric K	Effective Thickness
1	32	307	9.13
	77	397	9.50
	122	495	10.25
	182	321	9.50
	226	303	9.88
	271	298	9.31
	331	284	9.13
	376	284	9.13
	422	261	9.13
	466	257	9.50
Subsection 1	Overall Mean	321	9.44
	Standard Deviation	73	0.38
	Coeff of Variation	22.62%	3.98%

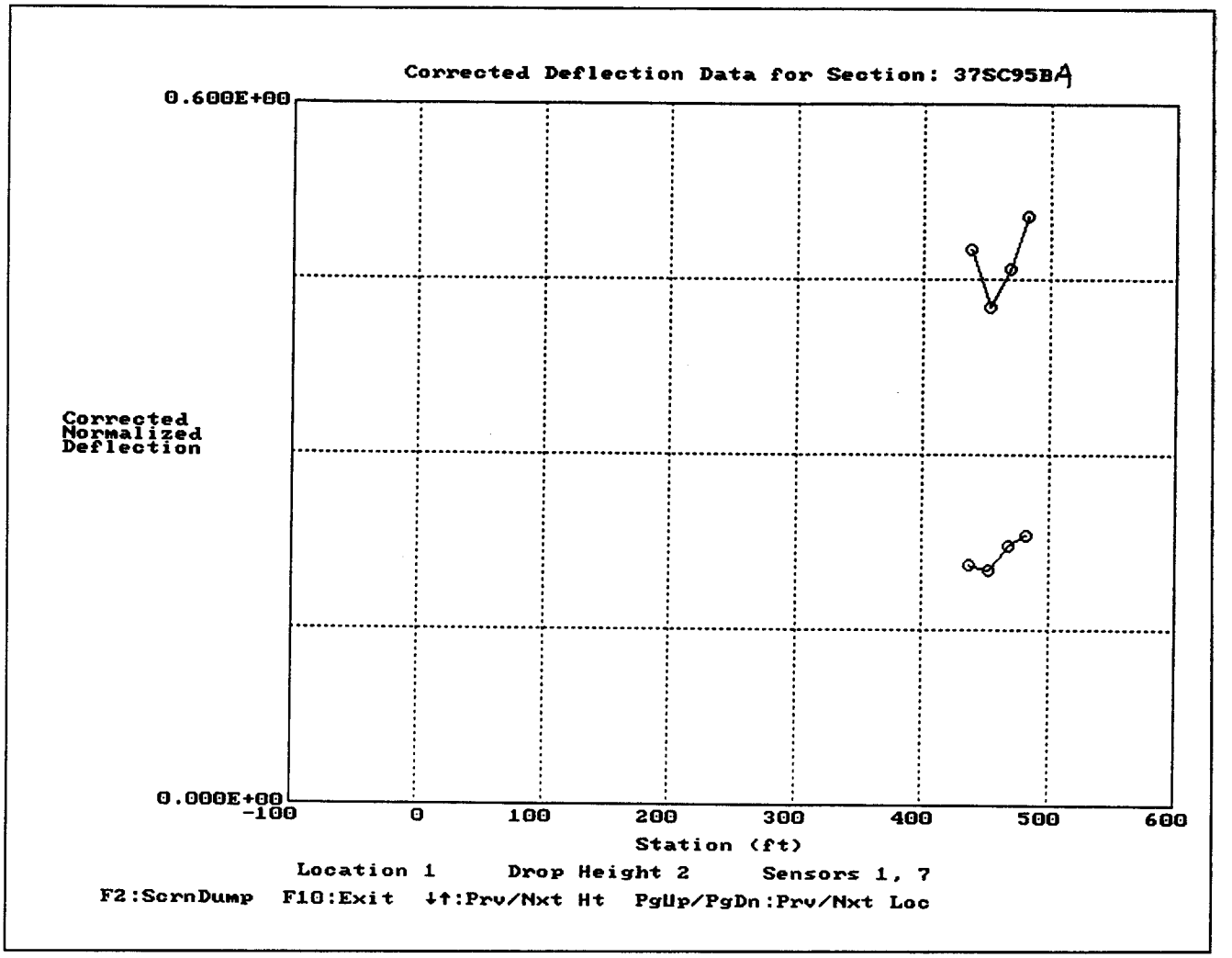


Figure D-6. Deflection Profiles from FWDCHECK
(Test Date and Time May 15, 1995 @ 1242)

Table D-4. Volumetric K and Effective Thickness from FWDCHECK
(Test Date and Time May 15, 1995 @ 1242)

Flexible Pavement Thickness Statistics - 37SC95BA – Drop Height 2			
Subsection	Station	Subgrade Modulus	Effective SN
1	438	242	8.75
	453	259	9.13
	468	233	8.94
	483	219	8.56
Subsection 1	Overall Mean	238	8.84
	Standard Deviation	17	0.24
	Coeff of Variation	6.94	2.74

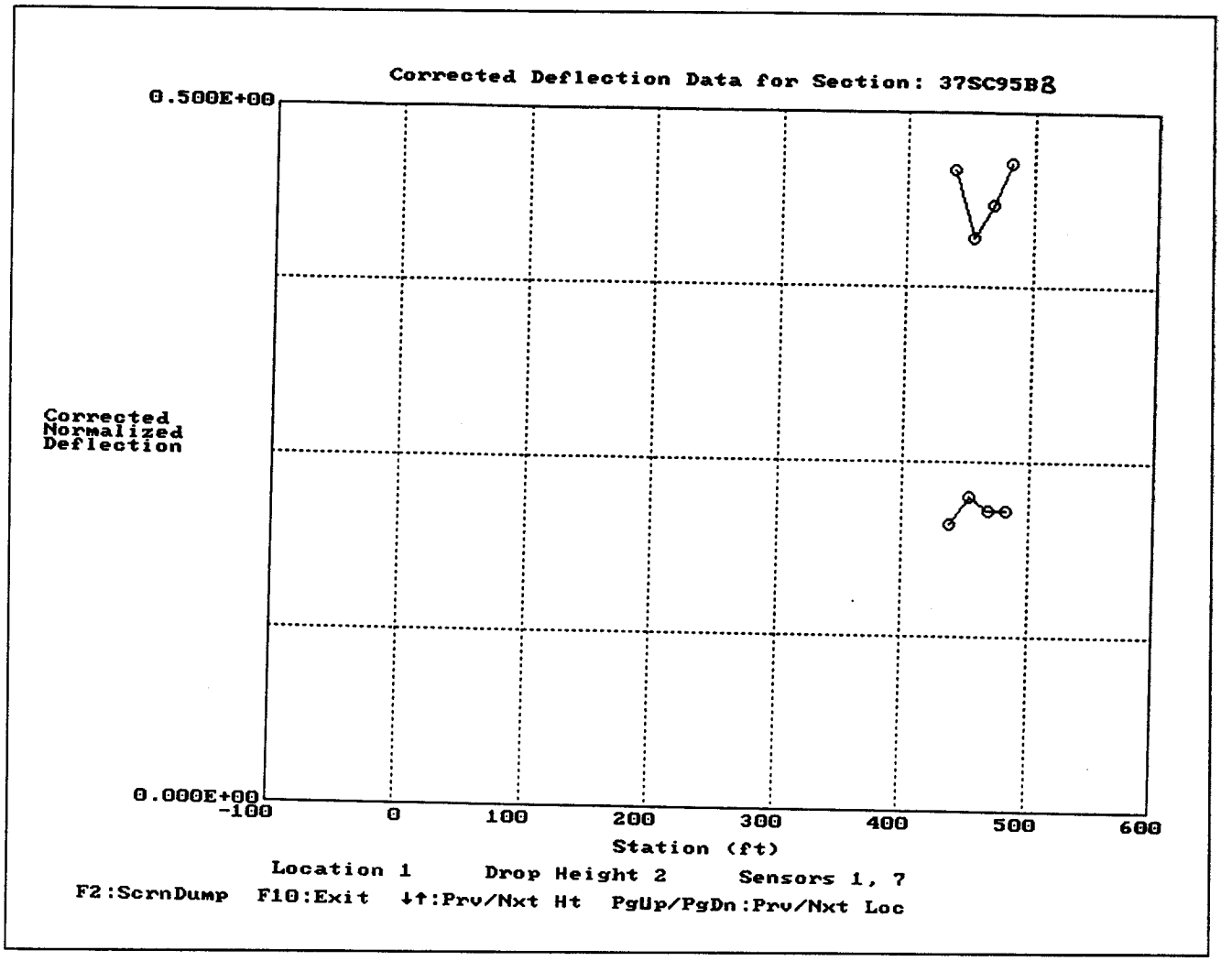


Figure D-7. Deflection Profiles from FWDCHECK
(Test Date and Time May 15, 1995 @ 1716)

Table D-5. Volumetric K and Effective Thickness from FWDCHECK
(Test Date and Time May 15, 1995 @ 1716)

Flexible Pavement Thickness Statistics - 37SE95BB - Drop Height 2			
Subsection	Station	Subgrade Modulus	Effective SN
1	438	243	8.75
	453	251	9.50
	468	243	9.13
	483	188	9.50
Subsection 1	Overall Mean	231	9.22
	Standard Deviation	29	0.36
	Coeff of Variation	12.67	3.89

Table D-6. Surface Elevation Measurements

LTPP Seasonal Monitoring Study	State Code	[37]
Surface Elevation Measurements	Test Section Number	[0201]

Survey Date	May 15, 1995
Surveyed By	DS
Surface Type	PCC
Benchmark	Observation Piezometer - 1.000 meters - assumed

1+31	[redacted]	1.3100	1.3325	1.3575
1+33.5	[redacted]	1.3125	1.3350	1.3625
1+35.6	[redacted]	1.3100	1.3425	1.3625
1+35.6	[redacted]	1.3100	1.3400	1.3625
1+37.9	[redacted]	1.3125	1.3350	1.3625
1+40.2	[redacted]	1.3150	1.3350	1.3525
1+40.2	[redacted]	1.3125	1.3350	1.3525
1+42.5	[redacted]	1.3150	1.3350	1.3575
1+44.8	[redacted]	1.3100	1.3325	1.3525
1+44.8	[redacted]	1.3100	1.3325	1.3525
1+47.1	[redacted]	1.3075	1.3300	1.3575
1+49.4	[redacted]	1.3100	1.3375	1.3550
1+49.4	[redacted]	1.3100	1.3375	1.3550
1+51.6	[redacted]	1.3050	1.3300	1.3525
1+53.9	[redacted]	1.3000	1.3250	1.3450

PE	Pavement Edge
ML	Mid Lane
ILE	Inner Lane Edge

APPENDIX E

Photographs

Figure E-1. Auguring the Instrument Hole, Section 370212, PATB in place, October 17, 1993

Figure E-2. Installing the TDR Sensors on Section 370201, October 17, 1993

Figure E-3. Compaction of the Instrumentation Hole on Section 370201, October 17, 1993

Figure E-4. Preparing top TDR for placement in DGAB layer (Section 370201), Oct. 17, 1993

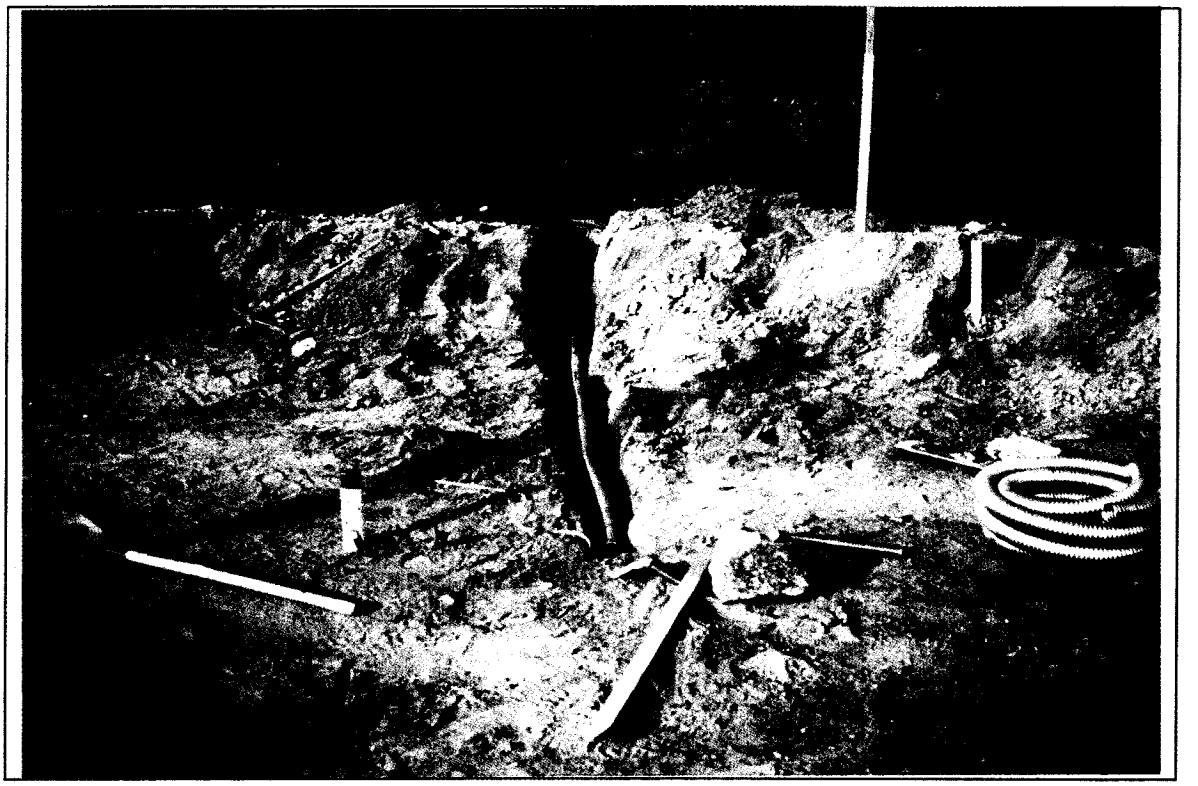


Figure E-5. Trench and Conduit for Instrument Cabling on Section 370205, October 18,1993

Figure E-6. MRC Stainless Steel Probe and Thermocouples (Section 370208), October 17, 1993

Figure E-7. Installation of Equipment Cabinet and Datalogger on Section 370201, May 05, 1994

Figure E-8. Piezometer after Completion, August 05, 1994