LTPP Seasonal Monitoring Program

Site Installation Report for GPS Section 469187 (46B) Faith, South Dakota

Report No. FHWA- February 1996

LTPP Seasonal Monitoring Program

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16. Abstract

This report contains instrumentation installation details and data collection summaries for GPS test section 469187, which is a core section in the LTPP Seasonal Monitoring Program. This asphalt concrete pavement section on State Highway 73 south of Faith, South Dakota was instrumented July 18, 1994. Instrumentation included time domain reflectometry (TDR) probes to estimate moisture content in unbound pavement layers, thermistor probes to measure pavement structure thermal gradients and air temperature, electrical resistivity probe to predict frost/thaw conditions, piezometer to measure water table depth below the pavement surface, and tipping-bucket rain gauge to measure precipitation.

Monitoring data was collected the day after instrument installation and roughly on a monthly basis from July 1994 to June 1995. In addition to temperature and precipitation data that were collected continuously by a datalogger at the site, monitoring data each month usually included Falling Weight Deflectometer data, TDR probe readings, frost/thaw readings, and piezometer readings. On a less regular basis, longitudinal profile data, pavement surface elevation data, and manual distress data were collected as required by FHWA guidelines. A summary of data collected is included in the report.

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Table of Contents

Page

I. **Introduction** 1

A. Test Site Location 1

B. General Test Section Information 1

C. SMP Test Section Information 2

II. **Instrumentation Installation** 3

A. Pre-Installation Activities 3

B. Installation Activities 4

III. **SMP Data Collection** 9

A. Initial SMP Data Collection 9

B. Routine SMP Data Collection 9

IV. **Summary, Conclusions, and Recommendations** 11

A. Instrumentation Installation Highlights 11

B. Recommendations for Improving Installations 11

Appendix A-1: Test Section Background Information

Appendix A-2: Pre-Installation Monitoring Data and FWDCHECK Results

Appendix B-1: Pre-Installation Site Recruitment and Coordination Information

Appendix B-2: Pre-Installation Equipment Checks/Calibration Information

Appendix C-1: Instrumentation Installation Information

Appendix D-1: Initial SMP Monitoring Data Collection

Appendix D-2: Routine SMP Monitoring Data Collection Summary

Appendix D-3: GPS Section 469187 SHRP SMP Pilot Results

LTPP Seasonal Monitoring Program
Site Installation Report for GPS Section 469187 (46B)
Faith, South Dakota

I. Introduction

This report contains information specific to instrument installation and monitoring data collection for the Long Term Pavement Performance (LTPP) General Pavement Study (GPS) section 469187, which is part of the core Seasonal Monitoring Program (SMP) under the Federal Highway Administration (FHWA) LTPP Division. This pavement section was instrumented on July 18, 1994, and had regular data collection through June 26, 1995. The section will be monitored every other year under the LTPP Study for a ten-year period or until it is removed from the study.

A. Test Site Location

GPS section 469187 is located in the northwest quadrant of South Dakota on the southbound lane of State Highway 73 about 29 kilometers south of Faith at milepost 156.

B. General Test Section Information

This two-lane highway has a 140-mm thick asphaltic concrete surface, which consists of the original asphalt surface placed in 1989 and an aggregate surface seal placed at a later date. The rest of the pavement structure consists of a 150-mm thick uncrushed gravel base, a 75-mm thick coarse-grain subbase/soil that was a temporary surface, and a fine-grain subgrade. Additional background information about the section is located in Appendix A-1. This information includes, but is not limited to, the following items:

- SMP location map;
- Detailed section location map;
- SHRP Inventory Data Sheet - traffic, design factors, and layer information;
- SHRP Section Field Verification Form;
- IMS L05A and L05B tables - layer thickness and material type; and
- LTPP Form S04 - base and subgrade moisture data.

Relevant pre-installation monitoring data for the section located in Appendix A-2 includes the following:

- Pre-installation pavement distress data;
- Pre-installation FWD data (includes tests outside the section limits); and
- FWDCHECK program uniformity analysis results.

C. SMP Test Section Information

The geographic location and existing pavement structure place this section in Cell 3 of the SMP experiment, which is defined by the following parameters:

- Thin asphaltic concrete pavement (typically less than 127-mm thick);
- Fine-grain subgrade;
- Freezing environment; and
- Dry environment.

This was the ninth SMP installation in the LTPP North Central Region, and highlights of the installation are summarized in Section IV of this report. The people involved with the installation are listed on "Data Sheet SMP-I01: List of Installed Instrumentation," which is included in Appendix C-1 along with other SMP installation forms.

Revised data forms from the LTPP Seasonal Monitoring Program: Instrumentation and Data Collection Guidelines, April 1994, were used for this 1994 installation. However, on some forms, data are not available regarding procedure modifications adopted after the April 1994 revisions. On these forms the cells are usually blank, and a comment is included on the form to explain the missing data.

II. Instrumentation Installation

A. Pre-Installation Activities

Mr. David Huft of the South Dakota Department of Transportation (SDDOT or sometimes referred to as "the agency" in this report), was initially contacted regarding potential sections identified for the seasonal monitoring pilot activities started in 1991 under the Strategic Highway Research Program (SHRP). GPS section 469187 was included in the pilot study, and falling weight deflectometer (FWD) data was collected during seven visits to the site from the fall of 1991 through the spring of 1992 on roughly a monthly basis as weather permitted. Field notes and data analysis results from the SHRP SMP pilot monitoring are included in Appendix D-3.

In 1993, Mr. Huft was contacted to confirm continued agency support for GPS section 469187 as a core section in the SMP study administered by the FHWA LTPP Division. In addition, Special Pavement Study (SPS) sections 460803 and 460804 and GPS section 466600 were identified as potential core sections, and the agency was willing to support these sections as well. The agency agreed to defer any pavement rehabilitation at least the five years required to get three years of monitoring data that is collected every other year. In spite of the agency willingness to support the four sections, SPS 460803 and GPS 466600 were dropped from SMP because of the following circumstances:

- SPS sections 460803 and 460804 are on the same SPS-8 project, and initially, the two sections were identified for instrumentation to provide direct comparison of seasonal pavement response between a thin and thick section. However, the thin asphalt section was rejected from the SMP when FHWA LTPP Division staff asked the North Central Region Coordination Office (RCO) to eliminate one section.

- GPS section 466600, which is the control section for an SPS-4 project, was to be instrumented in 1995. However, the section was rejected from the study because of concerns identified during a site visit June 21, 1995 as part of pre-installation activities for the section. The main reasons for rejecting the section from the SMP were the retrofit pavement edge drains and pavement milling that extended into the areas where SMP instrumentation would have been placed.

Pre-installation monitoring activities for SPS section 460804 and GPS section 469187 included FWD testing and manual distress surveys completed in early June 1994. At the sites, RCO staff documented installation concerns and conditions that would influence which end of the sections to monitor. Also, information from the SHRP SMP pilot testing done in 1991 and 1992 was available to make the necessary installation decisions on GPS section 469187. Field notes from the site visit to GPS section 469187 are included in Appendix B-1.

On June 24, 1994, a pre-installation meeting was held in Pierre, South Dakota for agency staff involved with instrumentation installation and monitoring activities for both SPS section 460804 and GPS section 469187. A presentation was given on the SMP, arrangements were made for the agency to supply equipment and materials required for the installation, and installation dates were set for agency staff to verify availability of equipment and materials. The agenda, list of participants, and notes from the pre-installation meeting are included in Appendix B-1.

At the RCO, pre-installation activities included performing instrumentation checks/calibrations, and incorporating improvements to the installation process based on revised SMP guidelines from April 1994 and field notes from installations done in 1993. Recommended improvements to the installation process resulting from instrumentation of GPS section 469187 are listed in Section IV of this report, and results from instrumentation checks/calibration are included in Appendix B-2 using the following forms:

- Data Sheet SMP-C01: TDR Probe Check;
- Data Sheet SMP-C02: Thermistor and Air Temperature Probe Check;
- Data Sheet SMP-C03: Electrical Resistivity Probe Check;
- Data Sheet SMP-C04: Function Generator, Multi-meter, and Switch Box Checks; and
- Data Sheet SMP-C05: Tipping-Bucket Rain Gauge Calibration.

For the air temperature and thermistor probes, checks were done using the datalogger to monitor the 19 temperature readings for the two probes simultaneously for tests run in an ice bath and at room temperature. The two probes were left connected to the datalogger for several days to verify their continued operation and consistency among the 19 temperatures recorded.

For the resistivity probe, loose electrode wraps were tightened by twisting the lead with a needle-nose pliers, and lead wires sticking out of the potting material for the probe were covered with silicon sealant for protection during installation. Excess potting material was scrapped off the electrodes for better contact with the soil.

Pre-installation activities also included selection of the instrumentation location. Pavement distress data and FWDCHECK program analysis for FWD testing done June 9, 1994 were used to select Station 0-25 to Station 2+00 for monitoring with instrumentation to be placed at Station 0-15. Pavement distress was limited to several transverse cracks and snow plow damage to the chip seal, which had little influence on which end to monitor for SMP purposes. However, the subgrade elastic modulus results from FWDCHECK were much more uniform on the Station 0+00 end of the section. This is the same end of the section monitored in the SHRP SMP pilot study done in 1991 and 1992. This end of the section also maximizes sight visibility regarding the crest in the road south of the test section.

B. Installation Activities

The SMP instrumentation installation itinerary for South Dakota included travel, installation, and data collection time for two sites over a one-week period. On July 14, 1994, SPS section 460804 was instrumented, and RCO staff traveled to Faith on July 17, 1994, and visited GPS section 469187 to verify installation details for the next day. The chip seal covered any paint marks from the SHRP SMP pilot testing, and the only concern identified during the visit was the slight variation in lane width through the SMP monitoring area based on the edge and centerline stripes. RCO staff decided to establish a lane edge reference by pulling a string line between PK nails located 3.66 m from the centerline stripe at Station 0-25 and Station 2+00. On average, this placed the edge reference in the middle of the existing edge stripe.

Instrumentation installation was completed at GPS section 469187 on July 18, 1994, which was a very hot and windless day. Some final installation activities continued on the following day. The

following installation forms are included in Appendix C-1 along with field notes and photographs of the installation:

- Data Sheet SMP-I01: List of Installed Instrumentation;
- Data Sheet SMP-I02: Instrumentation Locations;
- Data Sheet SMP-I03: Log of Piezometer Hole;
- Data Sheet SMP-I04: Log of Instrumentation Hole;
- Data Sheet SMP-I05: Field Gravimetric Moisture Contents;
- Data Sheet SMP-I05(A): Lab Gravimetric Moisture Contents;
- Data Sheet SMP-I05(B): Gravimetric Moisture Comparison;
- Data Sheet SMP-I06: TDR Moisture Content; and
- Data Sheet SMP-I07: Representative Dry Density.

Piezometer installation was done according to protocol. A 0.6-m long access tube was set in concrete just below the existing shoulder material to protect the top of the piezometer and provide easy access for measurements. A 3.0-m long grease sleeve was used on this piezometer to isolate the piezometer from frost heave. The grease sleeve extends about 0.2 m up into the access tube with the space between the two filled with sand. Additional piezometer installation notes are included in Appendix C-1.

A 460-mm square for the instrumentation hole and a 100-mm wide trench for the conduit were marked on the pavement surface at Station 0-15 using the pavement edge reference established for a 3.66-m wide lane measured from the centerline stripe. FWD testing was done on the SMP portion of the section from Station 0-25 to Station 2+00 including a test over the instrumentation hole.

The block and conduit trench were sawed after the FWD testing over the instrumentation hole was done, and the block was lifted out using anchors tapped into the pavement. The block was washed off and set in the shade to keep it as cool as possible for later replacement. The drill rig was moved into position over the hole and material was put into buckets as it was removed from the hole in 0.15-m lifts.

TDR probes were placed according to protocol with TDR probe 1 mid-depth in the base layer and TDR probe 2 at the interface between the subbase and subgrade layers.

For installation reports from the LTPP North Central RCO, "Data Sheet SMP-I05(A): Lab Gravimetric Moisture Contents," is used to report agency laboratory moisture results. Also, "Data Sheet SMP-I05(B): Gravimetric Moisture Comparison" was created to summarize moisture data obtained from field moisture tests, laboratory moisture tests, and interpretation of TDR probe data. These forms, along with a plot of the moisture results, are included in Appendix C-1, and the following assumptions and conclusions were made regarding the moisture data:

- LTPP Directive Number: SM-13 "TDR Trace Interpretation Method for Calibration and Function Checks" dated August 17, 1995 was used to interpret the apparent length of each TDR trace obtained during installation for estimating moisture results. This method was specified for "calibration and function checks," but no other method had been distributed by FHWA LTPP staff. The interpreted apparent lengths are reported on "Data Sheet SMP-I06: TDR Moisture Content" in Appendix C-1.

- Equations on pages II-2 and II-5 of the LTPP Seasonal Monitoring Program: Instrumentation Installation and Data Collection Guidelines, April 1994 were used to convert apparent lengths to gravimetric moisture estimates for the base and subgrade materials, and the results are included on "Data Sheet SMP-I05(B): Gravimetric Moisture Comparison," located in Appendix C-1. A plot comparing the TDR probe moisture data to the field and laboratory data is also included in Appendix C-1.

- The field moisture results, excluding sample 9, averaged 1.1 percentage points greater than the laboratory moisture results. For sample 9, the laboratory results were 4.1 percentage points greater than the field. Based on the moisture data plot in Appendix C-1, the field data for sample 9 is probably suspect.

- Moisture data for TDR probe 1 in the base material are high compared to the rest of the SMP section because water from the pavement saw seeped into the base layer. The moisture estimate from TDR probe 1 is 11.4 percent compared to the average of 7.9 percent for the field and laboratory results.

- Moisture data for TDR probe 2 was calculated using a dry density for the base material because no other density data is available for the subbase/subgrade interface where SMP protocol dictated the probe be placed. The moisture estimate from TDR probe 2 is 8.7 percent compared to the average of 7.4 percent for the field and laboratory results.

- The moisture estimates from TDR probes 3 through 9 in the upper part of the subgrade are questionable because of flat traces caused by soil characteristics, typically dissolved salts, that short circuit the probe. The second inflection points on these probe traces were placed where the trace went flat, and moistures were calculated to compare with field and laboratory results. As seen on the plot included in Appendix C-1, the data for TDR probes 3 through 6 are definitely not consistent with others in the subgrade when compared to the field and laboratory results. For TDR probes 7 through 9, the traces were flat, but the data appears to be consistent with field and laboratory moisture results.

- The moisture estimates from TDR probe 10 in the lower part of the subgrade is 21.1 percent which is very consistent with the average moisture of 19.2 percent from the field and laboratory moisture results. This probe trace had a definite second inflection point unlike the flat traces for TDR probes 3 through 9.

- Answers to the following questions could help explain the differences seen in the moisture data, but they are beyond the scope of this report:

  1. Are the same equations appropriate for all materials on this site?

  2. Do estimates of dry density for the base, used to convert from volumetric to gravimetric moisture for TDR probe 2 in the subbase, seem reasonable?

  3. How much influence does compaction have on the results?

"Data Sheet SMP-I07: Representative Dry Density," was not used in 1994, but it is included in Appendix C-1 to keep the report complete and uniform with other installation reports.

Several items were changed regarding installation of the datalogger cabinet and weather pole as follows:

- RCO staff were not able to get the 9.1-m offset from the lane edge specified on page II-23 and Figure II-12 of the LTPP Seasonal Monitoring Program: Instrumentation Installation and Data Collection Guidelines, April 1994 because the TDR cables provided were too short. The cabinet at this site is offset about 7.5 m and the weather pole is offset about 7.8 m. This places the obstructions inside the normal 9.15-m safety zone for highways. However, FHWA LTPP Division staff approved the two obstructions as break-away objects (page II-32 of manual) for placement inside the safety zone.

- The bottom of the front panel on the datalogger cabinet was notched about 0.1 m so the conduit buried about 0.3 m below the shoulder was easier to get into the cabinet, and it also slightly increased the distance the cabinet could be placed from the roadway.

- The conduit for the air temperature probe and tipping-bucket rain gauge signal wires was cut into the back of the cabinet above ground instead of running the conduit underground as shown in the guidelines. If the cables were run underground, the air temperature probe signal cable would have to be extended using special wire and resistors to compensate for increased lead resistance. Also, a union coupler was used on the weather pole about 0.3 m above ground to make pole installation easier.

For pavement repairs, the base material was left slightly higher than the original, and the asphalt block was placed in the hole. A loaded truck was driven across the block several times to seat the block until it was the same height as the pavement. The trench for the conduit was patched with asphalt, and W.R. Meadows "REZI-WELD 1000" multi-purpose construction epoxy was poured into the saw cuts to bond the pavement thermistor probe and asphalt block in place. This medium-viscosity epoxy had a 45-minute pot life at room temperature, and it had been stored in a cooler to provide sufficient time to continue adding material to the saw cuts as the epoxy settled. The saw cuts were filled to within about 15 mm of the pavement surface. The epoxy was allowed to set up while other installation activities were completed.

Agency staff installed a DOT benchmark at Station 0+00 and offset -30.57 m from the driving lane. The reference rod for the benchmark extends about 6.4 m below the ditch surface, and a sketch of the installation is included in Appendix C-1. This benchmark is expected to be more stable than the piezometer as a reference for monitoring pavement surface elevation changes.

On the following day, the pavement repairs looked good, and Dow Corning 890-SL crack sealant was used to fill the saw cuts flush with the pavement surface.

Additional observations about the pavement repair at the instrumentation hole up to the completion of this installation report include the following:

- The block and trench on this site settled slightly in the first several months after installation, but have since been stable.

- By May 22, 1995, a small separation between the trench and the original pavement surface had developed. Also, a crack was developing at the end of the left saw cut towards midlane.

III. SMP Data Collection

A. Initial SMP Data Collection

On July 19, 1994, final wiring of the datalogger in the cabinet was completed, test locations were marked on the pavement using the 3.66-m lane reference established the previous day, PK nails were placed at offsets -0.16 m and 3.81 m, and the first set of SMP data was collected.

Three cycles of FWD data were collected, as well as manual data including resistivity probe data, elevation data, and piezometer data. The manual data collected are included in Appendix D-1 as follows:

- One set of contact resistance data;
- One set of four-point resistivity data;
- One ground water table measurement; and
- One set of elevation data including shots on the DOT benchmark.

Data from the piezometer should not be entered into the IMS database because low permeability for the soils on this site will require several days for piezometer readings to stabilize.

Computer data files obtained from automated data collection using the dataloggers included the following:

- Two sets of TDR traces and CRREL voltages; and
- Temperature and precipitation data collected from the datalogger to verify operation overnight.

Temperature data from the thermistor probe should not be entered into the IMS database because of heat given off by epoxy used to repair the pavement and disturbance of material around the probe. In addition, temperature data up to several days after instrument installation will have to be reviewed to determine when the disturbed materials came back to thermal equilibrium. Data affected by the installation will have to be edited from the computer files.

B. Routine SMP Data Collection

Routine data collection was done on the site from July 19, 1994 through June 26, 1995. On June 26, 1995, the datalogger and weather pole were removed, and they will be replaced when monitoring resumes on the section in the fall of 1996. LTPP's standard data tracking log, which summarizes the data collected on the site, is included in Appendix D-2.

Events that influenced the data collection and that will influence data interpretation for the site include the following:

- On February 20, 1995, the piezometer access tube was full of ice, and on April 21, 1995, water ponding on the shoulder around the piezometer access tube may have run down the pipe. This was the only visit where water was present in the piezometer.

- Unstable manual resistivity probe readings were noted for data collected February 20, 1995, March 24, 1995, and April 7, 1995. Some data forms include the range of values observed, but the database is restricted to entry of one value. For these data ranges, the average value will be entered into the database.

- Most TDR data for probes 3 through 8 are not useable, probably because of dissolved salts in the soil. On November 21, 1994, manual traces were obtained for TDR probes 3 through 6 to eliminate concerns with automated data collection procedures not capturing the entire trace. The manual TDR traces and screen prints of automatically collected TDR probe data are included in Appendix D-2. Similar conditions for groups of TDR probes are summarized below:

  - TDR probes 3 and 4 traces are only useable during the yearly cycle with material around the TDR probes in a frozen state. These conditions existed for data collection done December 19, 1994 through March 10, 1995.

  - TDR probes 5 and 6 traces obtained February 20, 1995 and March 3, 1995 are the only useable traces for these two probes. Traces collected on these two visits have defined second inflection points, and it is likely the material around the probes was either frozen or less moist than on other visits.

  - TDR probes 7, 8, and 9 traces are only useable during the yearly cycle with low moisture content in the material around the probe. These conditions existed for data collection done December 19, 1994 through April 21, 1995.

Instrumentation and equipment problems at the site include the following:

- On November 21, 1994, the BNC connector for TDR probe 3 was repaired.

- Cold temperature problems with the cable reader caused vertical shifts or spikes in some traces and general failure of the cable reader if temperatures were extremely cold. Screen prints of TDR data are included in Appendix D-2.

- The TDR probes are not compatible with soil conditions at GPS section 469187, and most of the data for TDR probes 3 through 9 cannot be used.

- Elevation difference between the piezometer and the DOT benchmark changed about 2.0 mm during the first frost/thaw cycle after installation as shown on the plot in Appendix D-2. The benchmark movement will complicate elevation data analysis for estimating frost heave.

Other problems experienced at the site include failures with switch boxes used to collect manual resistance/resistivity data and failures of the CRREL multiplexer for automated resistance data collection. Print screens showing the failure modes for the CRREL multiplexer are included in Appendix D-2.

IV. Summary, Conclusions, and Recommendations

A. Instrumentation Installation Highlights

The following items are identified by the authors as unique or particular items of interest regarding this section in the SMP.

- This was the ninth SMP installation in the LTPP North Central Region, and GPS section 469187 was one of the two South Dakota sites installed in 1994 to complete the data collection loop including sections in Minnesota, Manitoba, and Saskatchewan installed the fall of 1993. The two South Dakota sites would have been installed in 1993, but winter weather delayed the installations.

- GPS section 469187 was one of the seven sections monitored for the SHRP SMP pilot testing done the fall of 1991 through the spring of 1992.

- Dynatest FWD Serial Number 060 was used for testing done on the SHRP SMP pilot, and error 558 was consistently obtained for tests at Station 1+00. According to the Dynatest operators' manual, the error is related to the trigger proximity switch being activated when it should not have been. The cause of the error was never resolved, and no pavement distress exists at this location. Prior to SMP monitoring in 1994, the FWD was upgraded, and the error no longer occurs.

B. Recommendations for Improving Installations

In addition to previous modifications from other installations, the following procedure and equipment changes from protocol were used during this installation or are recommended for future installations:

- Duct tape was placed along the saw cuts before pouring epoxy into the cuts. The duct tape was removed after the cracks were filled. This left a neat repair, which avoided discoloring the pavement surface and changing the thermal characteristics.

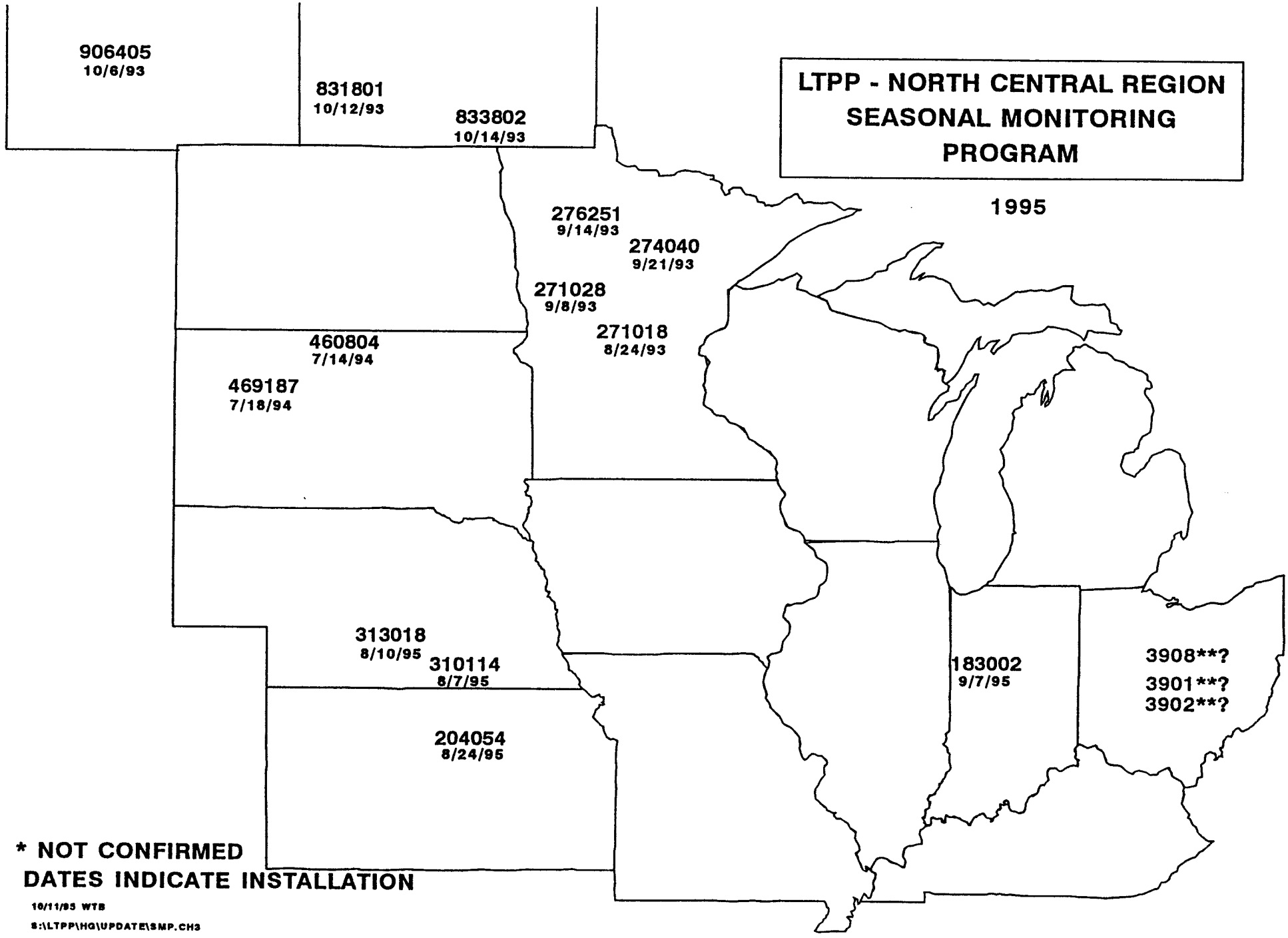
- For this installation, expanding anchors would not have worked to replace the block, because the asphalt was too soft from high ambient temperatures. Therefore, holes for the anchors were drilled through the block and nut plates were used on the bottom of the block. Threaded rods were screwed into the nut plates and extended through the block and lifting bracket. After the block height in the hole was acceptable, the threaded rods were removed and the nut plates remained under the block.

- For future installations on asphalt concrete pavements, the lane edge reference should be established based on 3.66-m wide lanes with ties to physical characteristics for the pavement instead of the paint stripes that are not always straight and tend to change location every time they are repainted. The physical characteristic could be the edge of the pavement, a longitudinal crack at the shoulder, a longitudinal cold-joint at the centerline of the highway, or any other characteristic that will remain fixed over time.

Appendix A-1: Test Section Background Information

Appendix A-1 contains the following test section background information:

- SMP location map;
- Detailed section location map;
- SHRP Inventory Data Sheet - traffic, design factors, and layer information;
- SHRP Section Field Verification Form;
- IMS L05A and L05B tables - layer thickness and material type; and
- LTPP Form S04 - base and subgrade moisture data.


LTPP - NORTH CENTRAL REGION
SEASONAL MONITORING
PROGRAM
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271018
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469187
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183002
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3908**?
3901**?
3902**?
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Hettinger
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White Butte
Lemmon
Petrified Wood Park
Thunder Hawk
Keldron
Morristown
Watauga
McIntosh
STANDING ROCK
SIOUX
CUSTER NATL. FOREST
Ludlow
Table Mtn.
Cave Hills
GRAND RIVER NATL.
Lodgepole
Ralph
Shadehill
Shadehill Res. St. Rec. Area
Shadehill Dam
Hugh Glass Monument
STANDING
INDIAN
GRASSLAND
Buffalo
Reva
Slim Buttes 30 Battle Sites (1876)
Prairie City
Bison
Meadow
PERKINS
Sorum
Glad Valley
Isabel
Firesteel
Lake Isabel
Redig
Crow Buttes
Sheep Buttes
Zeona
Usta
CHEYENNE RIVER
Thunder Butte
Iron Lightning
Green Grass
Hoover
Haystack Buttes
Castle Rock Buttes
Castle Rock
Two Top Butte
Deers Ears Butte
Mud Butte
Ben Ash Monument
Maurine
Faith
Dupree
Red Elm
Eagle Butte
Lantry
Durkee Lake
Rattlesnake Butte
INDIAN
ZIEBACH
Opal
Government Experimental Farm
Newell
Nisland
Fairpoint
Stoneville
Red Owl
Red Scaffold
Owl Butte
Vale
Marcus
Howes
RESERVATION
Cherry Creek
Union Center
Enning
White Owl
Plainview
MEADE
Whitewood
STURGIS
Bear Butte St. Pk.
V.A. Hospital
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Hereford
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Tilford
Elm Springs
Creighton
HAAKON
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Nemo
Ellsworth A. F. Base
Villa Ranchaero
Otturnwa
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Caputa
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PENNINGTON
Farmingdale
Rockerville
Keystone
Mt. Rushmore Natl. Mem.
BUFFALO
BADLANDS NAT'L PARK
Cactus Flat
Cedar Butte
Kadoka
Belvidere
Hayward
Hermosa
CUSTER STATE
GAP NATL.
Scenic
Cedar Pass
Badlands Nat'l Park Headquarters & Campground
Interior
GRASSLAND
JACKSON
Fairburn
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46B

STRATEGIC HIGHWAY RESEARCH PROGRAM
GENERAL PAVEMENT STUDIES
Long-Term Pavement Performance Monitoring
Project Information Sheet

49.42 @ STA 540
32.0 @ FAITH
MP 164 @ 41.98
156

REGION: North Central PAVEMENT TYPE: AC on Granular Base
STATE: South Dakota

SHRP Assigned ID:	469187	District:	0	Year Open:	1989
State Assigned ID:		Highway:	ST - 73	Year Traffic:	19 0
Design Cell ID:	~~1~~-104	Length:	13.0 miles	AADT:	250
	6B	Lanes:	1	Trucks:	20.1 %
		Shoulder Surface Type:	Unspecified		
		Project Status:	Selected, Not Verified		

156

DESIGN FACTORS - Moisture: Dry
Temperature: Freeze

Subgrade:	53 - Silty Clay	Fine	
Traffic:	9 KESAL/Yr	Low	(85)
AC Thickness:	4.5 in.	Med	(3.0, 8.0)
Base Thickness:	11.0 in.	High	(10.0)
AC Stiffness:	651 ksi	High	(650)

LAYER CONFIGURATION

LAYER NO.	LAYER DESCRIPTION	LAYER THICKNESS	LAYER MATERIAL TYPE
4	3 - Orig Surface	4.5	1 - HMAC, Dense Graded
3	5 - Base Layer	6.0	23 - Crushed Stone, Gravel, or Slag
2	6 - Subbase Layer	5.0	22 - Gravel (Uncrushed)
1	7 - Subgrade	.0	53 - Silty Clay

PAVEMENT LAYER INFORMATION

OD
540+00 : 49.42
564+00 : ? : 49.87

Revised July 6, 1988

JARVIS PALMER

SECTION FIELD VERIFICATION FORM

Date _____

Rater _____

State Project Code ___ ___ ___ ___
State Code 4 6
SHRP Section I.D. 9 1 8 7

Project and Section Identification

State District No. ___ ___
County or Parish _____

Route Signing (Numeric Code) 3
- Interstate 1
- Primary 2
- State 3
- Other 4

Route Number 73

LTPP Experiment Code _____

Number of Through Lanes (One Direction) 1

Direction of Travel 4
- Eastbound 1
- Westbound 2
- Northbound 3
- Southbound 4

Available Project Length (Without Discontinuities) 800

	Start Point	End Point
Test Section Milepoints	1 5 6 . 1 1	1 5 6 . 0 2

Additional Section Location Information*: STA 564 - 559
100% gravel surface (under construction) Approx. 17.87 mi S. of US12 (in Faith)

* Include distances from two landmarks (refer to specific procedures outlined in the Initial State Visit Guidelines).

Location of monument: ~4' W. of W. edge of where paved shoulder will stop, on the slope of the ditch

Geometric Information

Lane Width (Feet) ___ ___

Lane (By Number) Included in Monitoring Section ___
(Lane 1 is Outside Lane, Lane 2 is Next to Lane 1, etc.)

Shoulder Data:	Outside Shoulder	Inside Shoulder
Total Width (Feet)	___ ___.	___ ___.
Paved Width (Feet)	___ ___.	___ ___.
Surface Type		___

- Turf 1
- Granular 2
- Asphalt Concrete ... 3
- Concrete 4
- Surface Treatment 5
- Other 6

Additional Data for PCC Shoulders:

Average Joint Spacing (Feet)	___ ___ ___.	___ ___ ___.
Skewness of Joints (Feet)	___.___	___.___
Joints Match Pavement Joints? (Yes - 1; No - 2)	___	___

SHRP/LTPP LAYER THICKNESS

L05A - L05B TABLES

23-JUN-94

	E**L05A DATA**Gps Sps-- STA 0 ---------|						|- WITHIN THE SECTION -|				|-------- STA 5 -------|				**L05B**									
	- CN	L#	TYP-------		MATL	1	2	3	THICK	MATL	1	2	3	THICK	MATL	1	2	3	CN	L#	DESC	TYPE	THICK	MATL	1	2	3	COMMENT NOTE	INV
9187	1	1	SS		103	7									114	7			1	1	7	SS		102					1
	1	2	GS	3	261	7								3	211	7			1	2	6	GS	3	111					2
	1	3	GB	6	302	7								6	302	7			1	3	5	GB	6	302				BASE BEFORE 8/28/89	2
	1	4	AC	3.4	1	7								3.2	1	7			1	4	4	AC	3.3	1				BINDER 8/28/89	3
	1	5	AC	2.1	1	7								2.2	1	7			1	5	3	AC	2.2	1				SURFACE 8/28/89	4

5.5" AC

6" AGG. BASE (Uncrushed gravel)

3" ORIG. AGG. SURFACE

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 46

SD

SHRP ASSIGNED ID 469187

ERIMENT GPS # ROUTE/HIGHWAY ST 73 Lane 1 Direction S

E/TEST: (a) Before Section ____ (b) After Section ✓ FIELD SET NO. 1

IN SITU DENSITY AND MOISTURE TESTS

DCG SHEET: 24

OPERATOR N/Dangerovet NUCLEAR DENSITY GAUGE I.D. 573 SHEET NUMBER 7 OF 14
TEST DATE 6-14-89 LOCATION: STATION 5+62 TEST PIT NUMBER TP1
DATE OF LAST MAJOR CALIBRATION 4-1-89 OFFSET 3 feet from °/s
Note: Use additional sheets if necessary

DEPTH FROM SURFACE TO THE TOP OF THE LAYER, FEET (SEE S03)					3.5" FROM TOP OF GRAVEL	
TEST TYPE	PAVEMENT SURFACE (AC) Test Pit O.W.P.	Between Wheelpath	BASE COURSE TOP Result, pcf Wet	Dry	SUBBASE TOP Result, pcf Wet	Dry	SUBGRADE TOP Result, pcf Wet	Dry
IN SITU DENSITY (pcf) 1							126.9	116.4
2							126.2	115.2
3							126.8	115.2
4							125.8	115.0
AVERAGE							126.4	115.5
AASHTO T238-86 Method (A,B,C)								
Rod Depth, inches							12"	
IN SITU MOISTURE CONTENT, % 1							9.0	
2							9.6	
3							10.0	
4							9.5	
AVERAGE							9.5	
(AASHTO T239-86) MATERIAL TYPE: (Unbound-G, C Treated-AT, Other-T)								

NOT PLACED YET

NOT PLACED YET

GENERAL REMARKS:

CERTIFIED
[signature]
Chief, Contractor
Affiliation: BET

VERIFIED AND APPROVED
Ronald R Urbach
SHRP Representative
Affiliation: BPT

MONTH-DAY-YEAR
6-14-1989
Date

SHRP-LTPP
LABORATORY MATERIAL
HANDLING AND TESTING

SHRP REGIONAL LABORATORY FOR ASPHALTIC MATERIAL, AGGREGATE AND SOILS BET

LABORATORY MATERIAL TEST DATA *TEST SHEET: T44*

SAMPLES FROM: (a) SHRP REGION N Central (b) STATE SD (c) *STATE CODE* 46
(d) LTPP EXPT GPS # 9 (e) *SHRP SECTION ID* 469187 (f) *FIELD SET NUMBER* 1
SAMPLED BY: BET DATE SAMPLED: 06-14-1989
REGIONAL DRILLING AND SAMPLING CONTRACTOR

UNBOUND GRANULAR BASE/SUBBASE LAYER
MOISTURE-DENSITY RELATIONS

SHRP TEST DESIGNATION: UG05 *SHRP PROTOCOL: P44*

1. *LAYER NUMBER* (FROM LAB SHEET L04) 2

LAYER MATERIAL (CIRCLE ONE) BASE/SUBBASE

2. *SHRP LABORATORY TEST NUMBER*	1	2	
3. *LOCATION NUMBER* (Enter an asterick as the third digit)	B A *	B P *	
4. *SHRP SAMPLE NUMBER* (Enter an asterick as third and fourth digit)	B 6 * *	B 6 * *	
TEST RESULTS (SECTION 10.3 OF PROTOCOL P44)			*SECTION AVERAGE*
(a) *METHOD USED (B OR D)*	D	D	
(b) *OPTIMUM MOISTURE CONTENT (OMC)*, %	06	06	06.
(c) *MAXIMUM DENSITY (MD)*, PCF	137.	138.	137.
6. *COMMENTS* (SECTION 10.4 OF PROTOCOL P44) (a) *CODE*	75 76 78 -- -- --	75 78 -- -- -- --	
(b) *NOTE*			
7. *TYPE OF RAMMER FACE* (IF OTHER THAN THAT DESCRIBED IN SECTION 10.5 OF PROTOCOL P44)	sector	sector	
8. *TEST DATE*	04-25-90	04-23-90	

NOTE: 1. INCLUDE THE OPTIMUM MOISTURE CONTENT CURVE WITH TEST SHEET T44 (SECTION 10.3.6 OF PROTOCOL P44).

GENERAL REMARKS:

SUBMITTED BY, DATE
DAC 11-6-90
LABORATORY CHIEF
Affiliation BET

CHECKED AND APPROVED, DATE

SHRP REPRESENTATIVE
Affiliation

Appendix A-2: Pre-Installation Monitoring Data and FWDCHECK Results

Appendix A-2 contains the following pre-installation monitoring data and FWDCHECK analysis results:

- Pre-installation pavement distress data;
- Pre-installation FWD data; and
- FWDCHECK program uniformity analysis results.

1/11

Revised December 1, 1992

SHEET 1

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID

STATE CODE 46

SHRP SECTION ID 9187

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 06/09/94

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

PAVEMENT SURFACE TEMP - BEFORE 22 °C; AFTER 22 °C

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
CRACKING			
1. FATIGUE CRACKING (Square Meters)	0	0	0
2. BLOCK CRACKING (Square Meters)	0	0	0
3. EDGE CRACKING (Meters)	0	0	0
4. LONGITUDINAL CRACKING (Meters)			
4a. Wheel Path	0	0	0
Length Sealed (Meters)	0	0	0
4b. Non-Wheel Path			
Length Sealed (Meters)			
5. REFLECTION CRACKING AT JOINTS Number of Transverse Cracks	0	0	0
Transverse Cracking (Meters)	0	0	0
Length Sealed (Meters)	0	0	0
Longitudinal Cracking (Meters)	0	0	0
Length Sealed (Meters)	0	0	0
6. TRANSVERSE CRACKING Number of Cracks	3	4	0
Length (Meters)	11.0	14.7	0
Length Sealed (Meters)	0	14.7	0
PATCHING AND POTHOLES			
7. PATCH/PATCH DETERIORATION (Number)	0	0	0
(Square Meters)	0	0	0
8. Potholes (Number)	0	0	0

7/11

Revised December 1, 1992

SHEET 2

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID _ _ _ _

STATE CODE 4 6

SHRP SECTION ID 9 1 8 7

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 06/09/94

SURVEYORS: BJP. _ _ _

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES (CONTINUED)

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
SURFACE DEFORMATION			
9. RUTTING - REFER TO SHEET 3 FOR SPS-3 OR Form S1 from Dipstick Manual			
10. SHOVING (Number)			Ø
(Square Meters)			Ø
SURFACE DEFECTS			
11. BLEEDING (Square Meters)	Ø.	Ø.	Ø.
12. POLISHED AGGREGATE (Square Meters)			Ø.
13. RAVELING (Square Meters)	Ø.	Ø.	Ø.
MISCELLANEOUS DISTRESSES			
14. LANE-TO-SHOULDER DROPOFF - REFER TO SHEET 3			
15. WATER BLEEDING AND PUMPING (Number)			Ø
Length of Affected Pavement (Meters)			Ø.

16. OTHER (Describe) Plow Damage to Seal Coat SEE Sketch

Revised May 29, 1992

SHEET 3

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID _ _ _ _

STATE CODE 4 6

SHRP SECTION ID 9 1 8 7

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 0 6 / 0 9 / 9 4

SURVEYORS: B J P. _ _ _

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES (CONTINUED)

9. RUTTING (FOR SPS-3 SITE SURVEYS)

INNER WHEEL PATH Point No.	Point Distance[1] (Meters)	Rut Depth (mm)	OUTER WHEEL PATH Point No.	Point Distance[1] (Meters)	Rut Depth (mm)
1	0.	_ _ _.	1	0.	_ _ _.
2	15.25	_ _ _.	2	15.25	_ _ _.
3	30.5	_ _ _.	3	30.5	_ _ _.
4	45.75	_ _ _.	4	45.75	_ _ _.
5	61.	_ _ _.	5	61.	_ _ _.
6	76.25	_ _ _.	6	76.25	_ _ _.
7	91.5	_ _ _.	7	91.5	_ _ _.
8	106.75	_ _ _.	8	106.75	_ _ _.
9	122.	_ _ _.	9	122.	_ _ _.
10	137.25	_ _ _.	10	137.25	_ _ _.
11	152.5	_ _ _.	11	152.5	_ _ _.

N/A

14. LANE-TO-SHOULDER DROPOFF

Point No.	Point Distance[1] Meters	Lane-to-Shoulder Dropoff (mm)
1	0.	_ _ _.
2	15.25	_ _ _.
3	30.5	_ _ _.
4	45.75	_ _ _.
5	61.	_ _ _.
6	76.25	_ _ _.
7	91.5	_ _ _.
8	106.75	_ _ _.
9	122.	_ _ _.
10	137.25	_ _ _.
11	152.5	_ _ _.

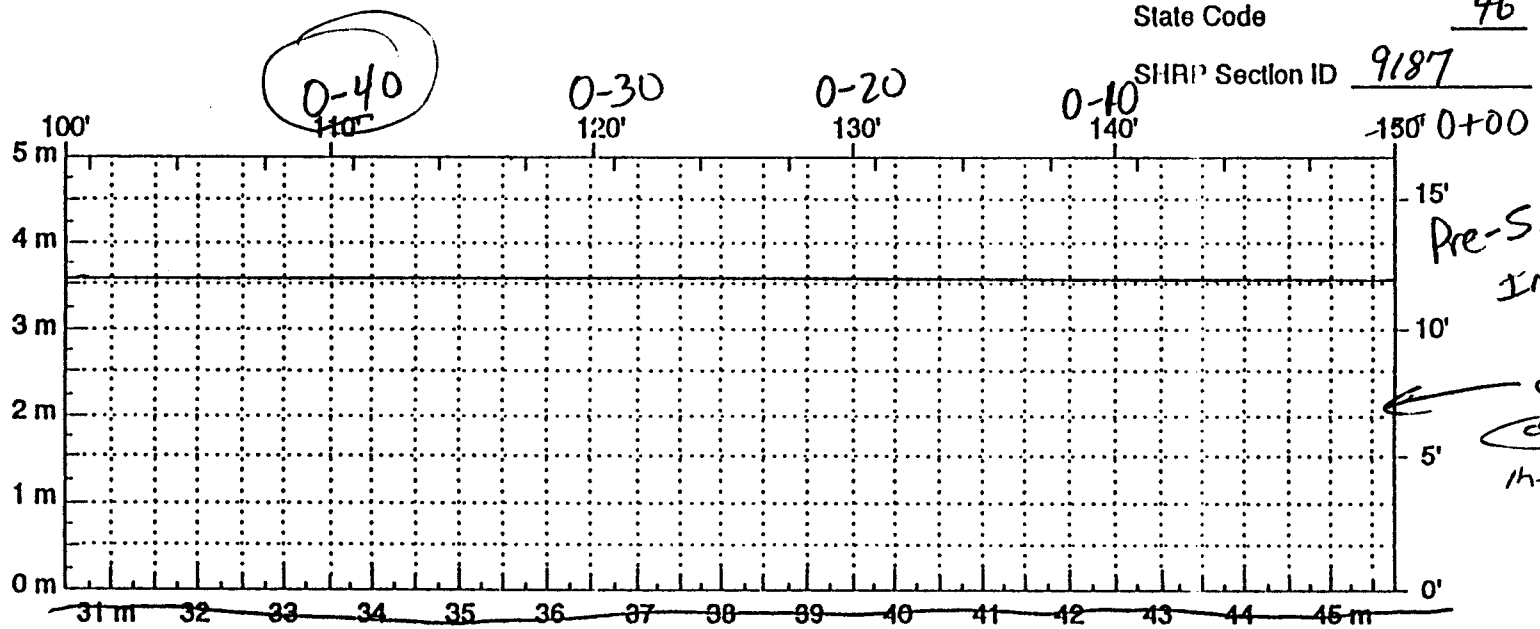
No Paved Shoulder

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

State Assigned ID 6-9-94 BJP

State Code 46

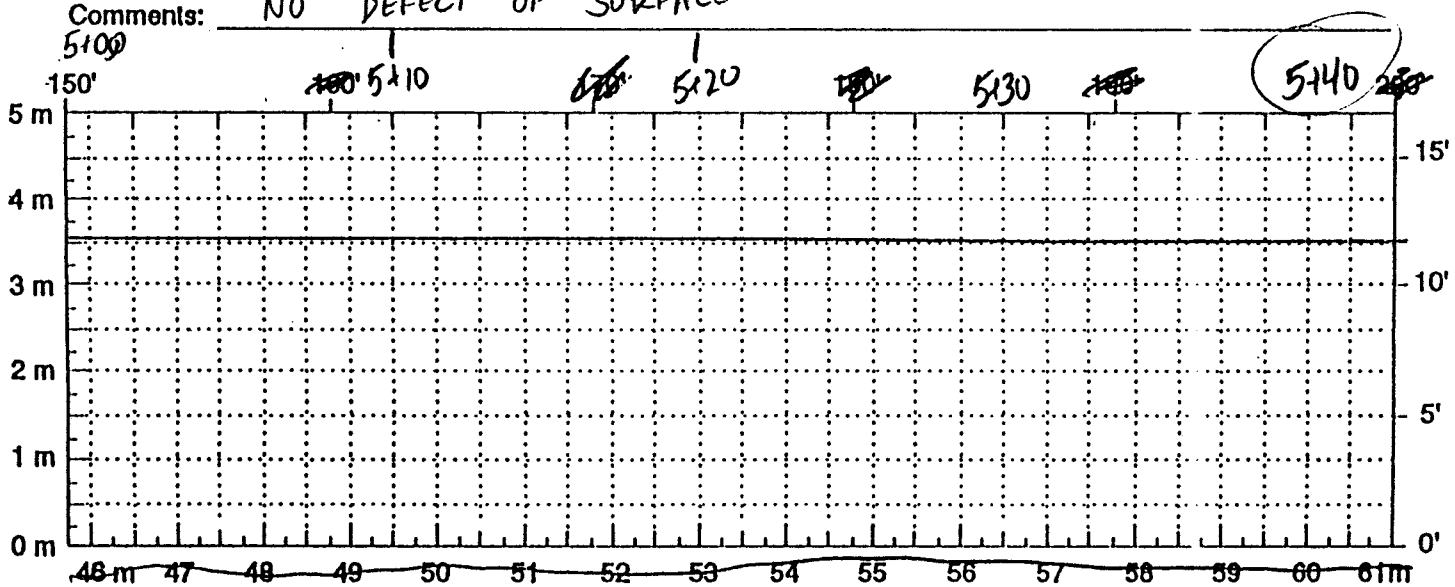
SHRP Section ID 9187



Pre-SMP INSTALL.

crack @ 0.3 m into section

Comments: NO DEFECT OF SURFACE

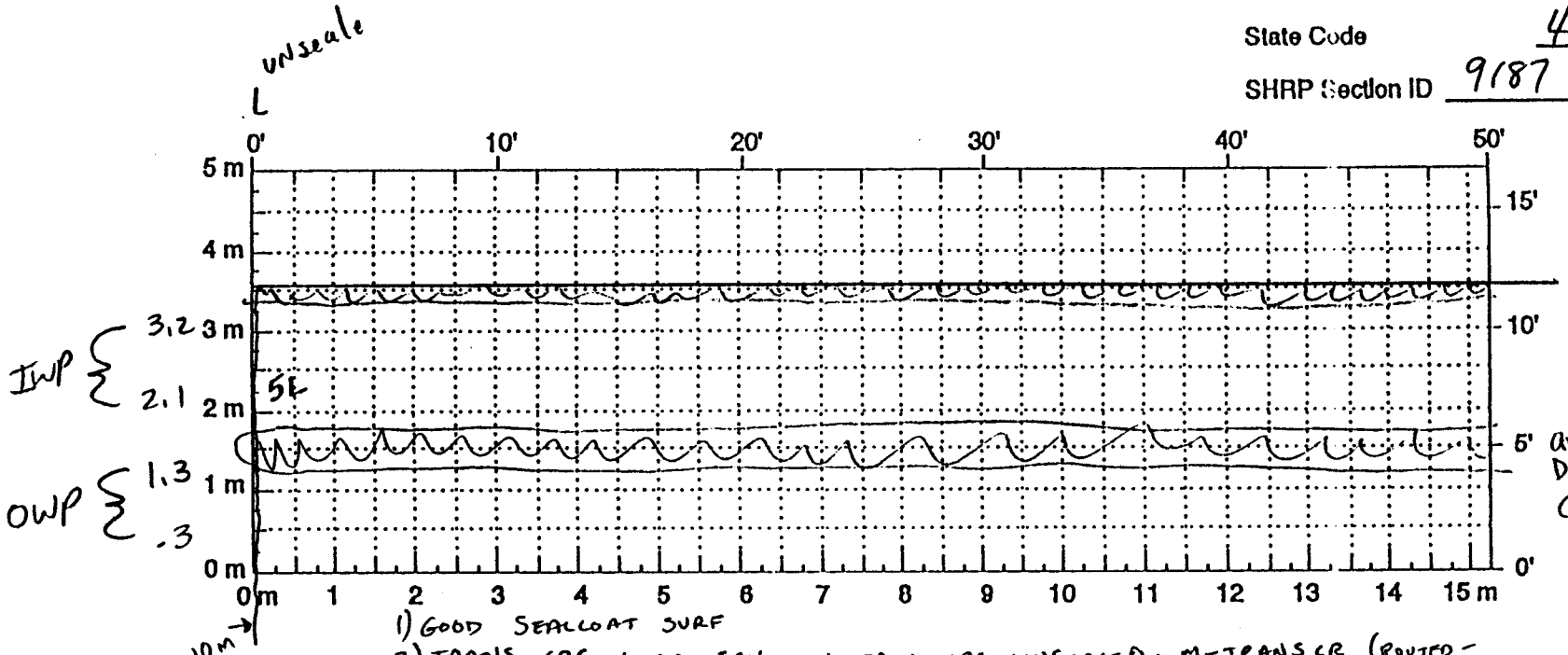


Comments: NO DEFECTS OF SURFACE

State Assigned ID 6-9-94 L P

State Code 46

SHRP Section ID 9187



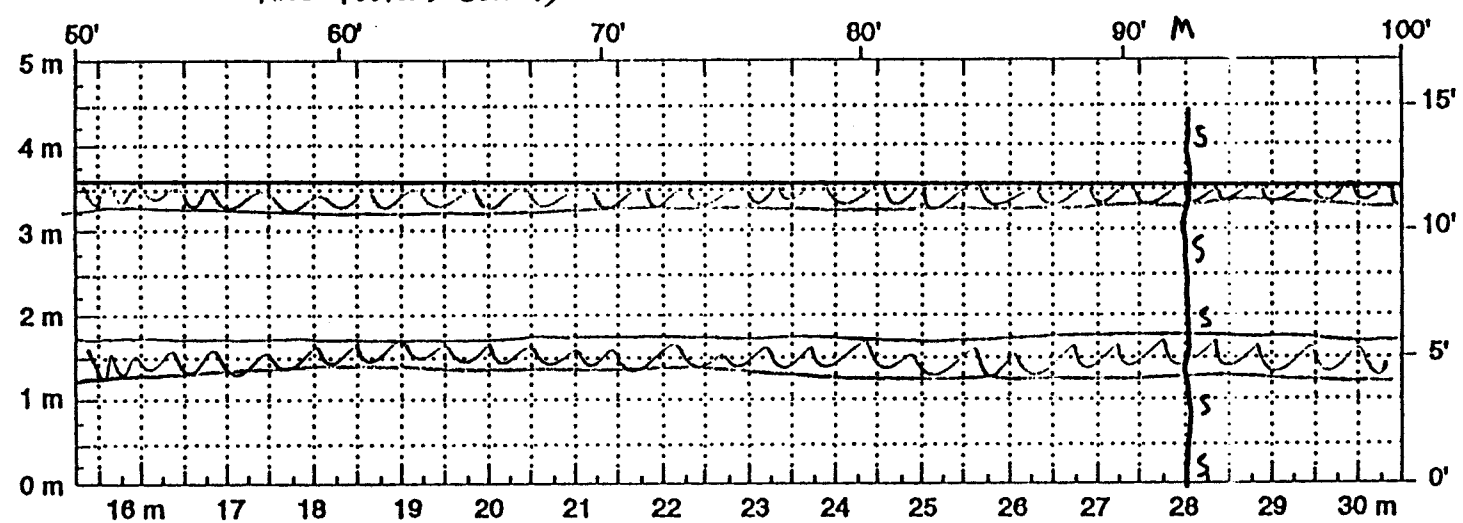
LANE WIDT 3.66M

area's of plow DAMAGE to Seal Coat

1) GOOD SEALCOAT SURF

Comments: 2) TRANS CRS L-M SEV. L-TRANS CRS UNSEALED, M-TRANS CR (ROUTED-AND POURED SEAL?)

5 L 1-3.66
5 M 1-3.66



plow damage

24.4 M²

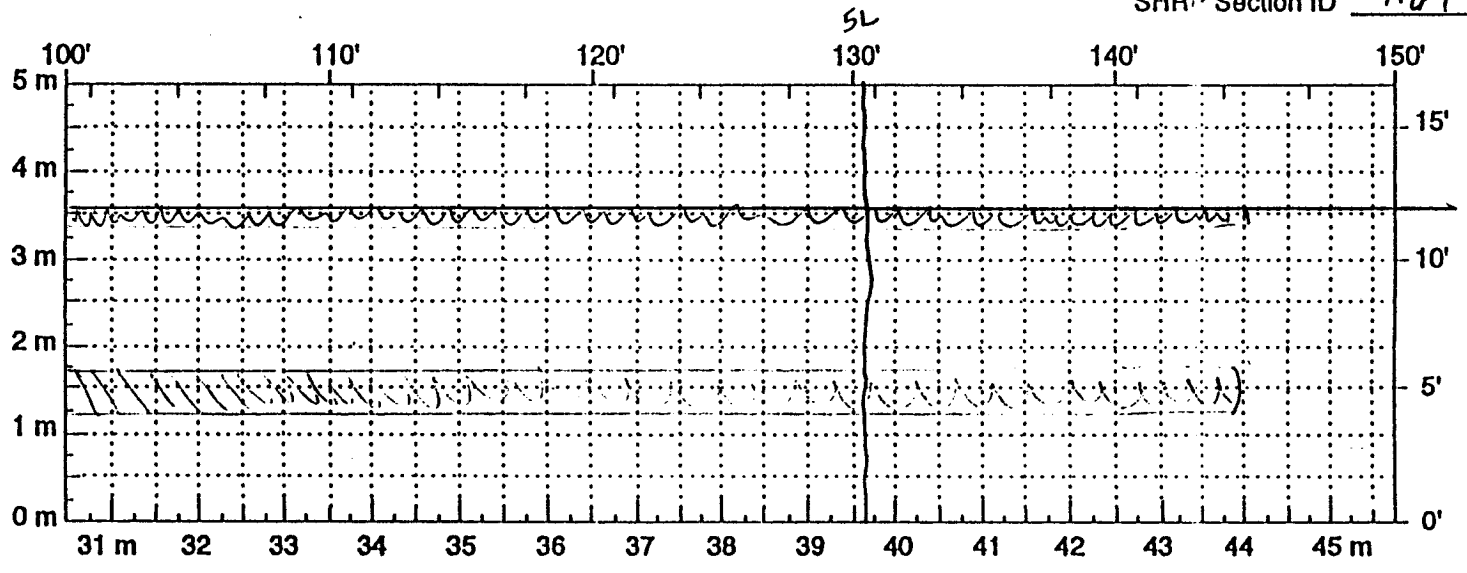
3) PLOW DAMAGE to first 43.8 m OF M10 LANE AND EDGES OF LANE

Comments:

State Assigned ID 6-9-94 UJP

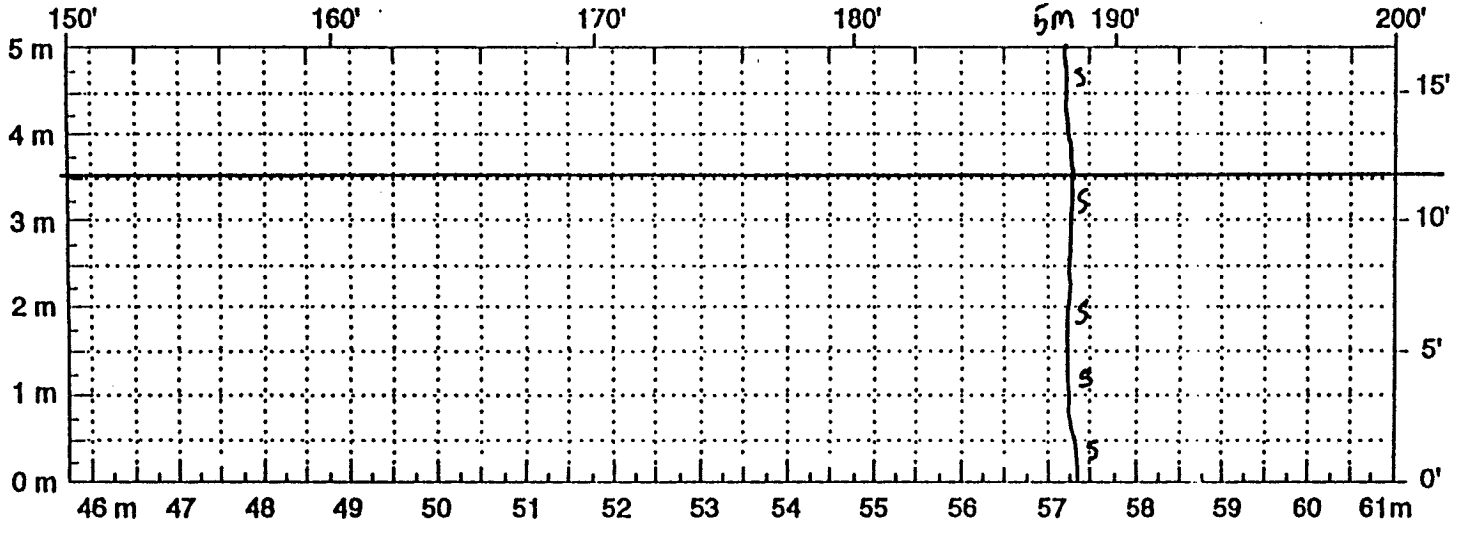
State Code 46

SHRP Section ID 9187



5L 1 -3.61
5m 1 -3.61

Comments: _____



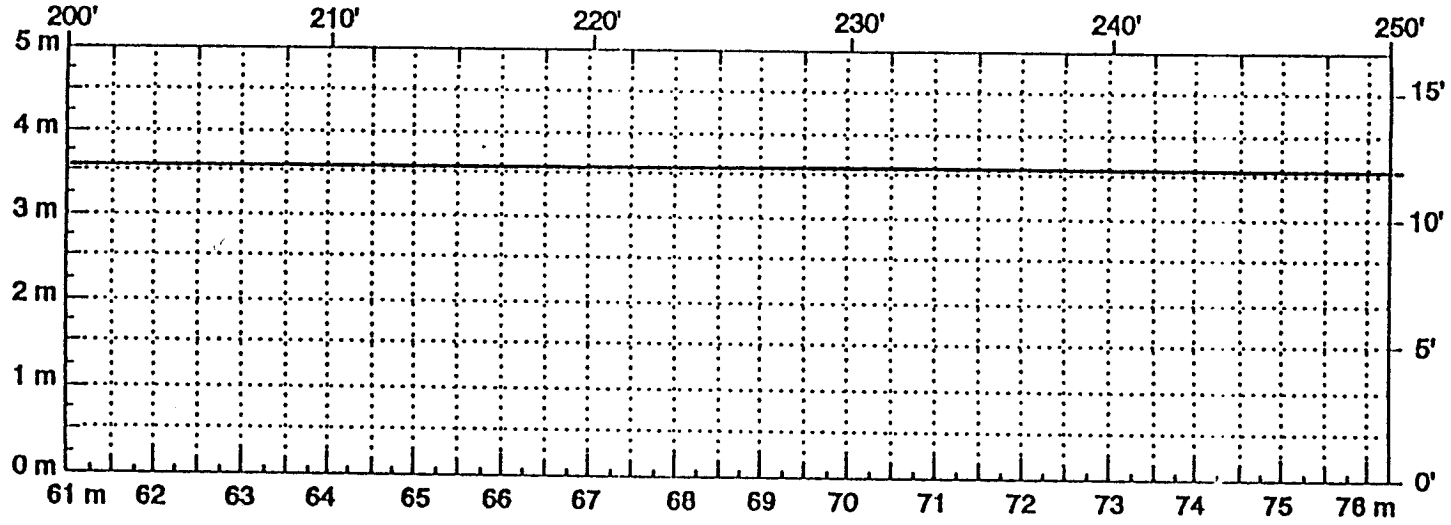
10.4² m
plowdage

Comments: _____

State Assigned ID 6-9-94 BJP

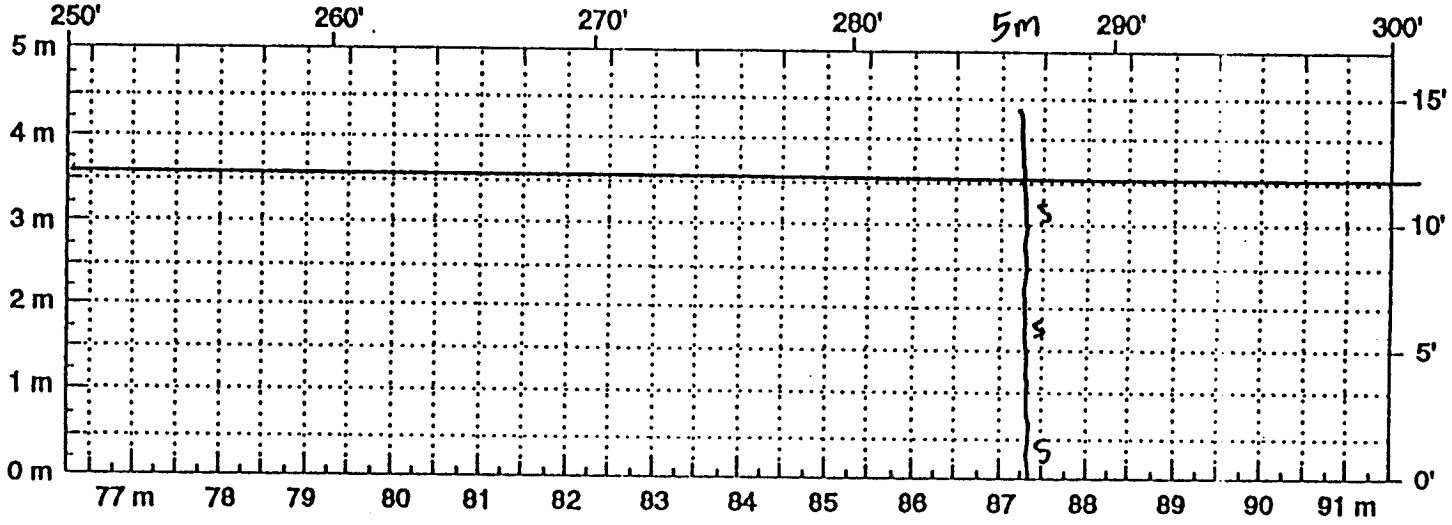
State Code 46

SHRP Section ID 9187



Comments: NICE PVMT. SURFACE.

5M 1-3,66

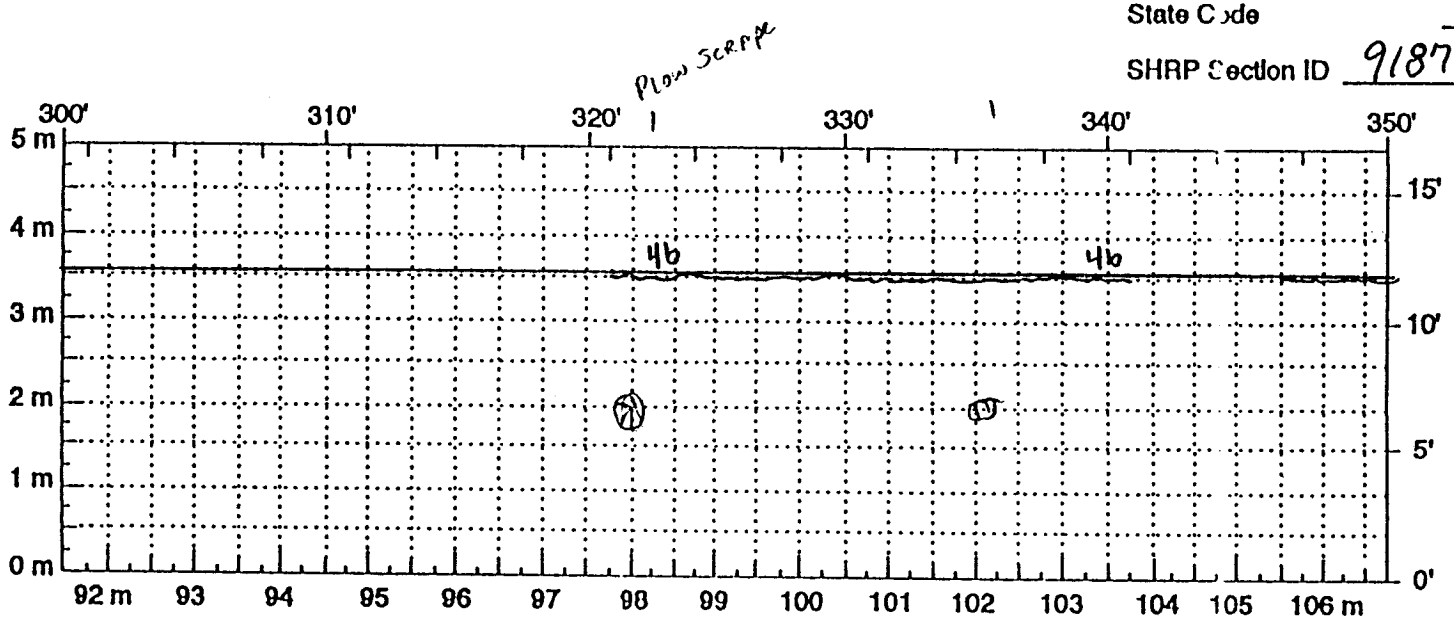


Comments:

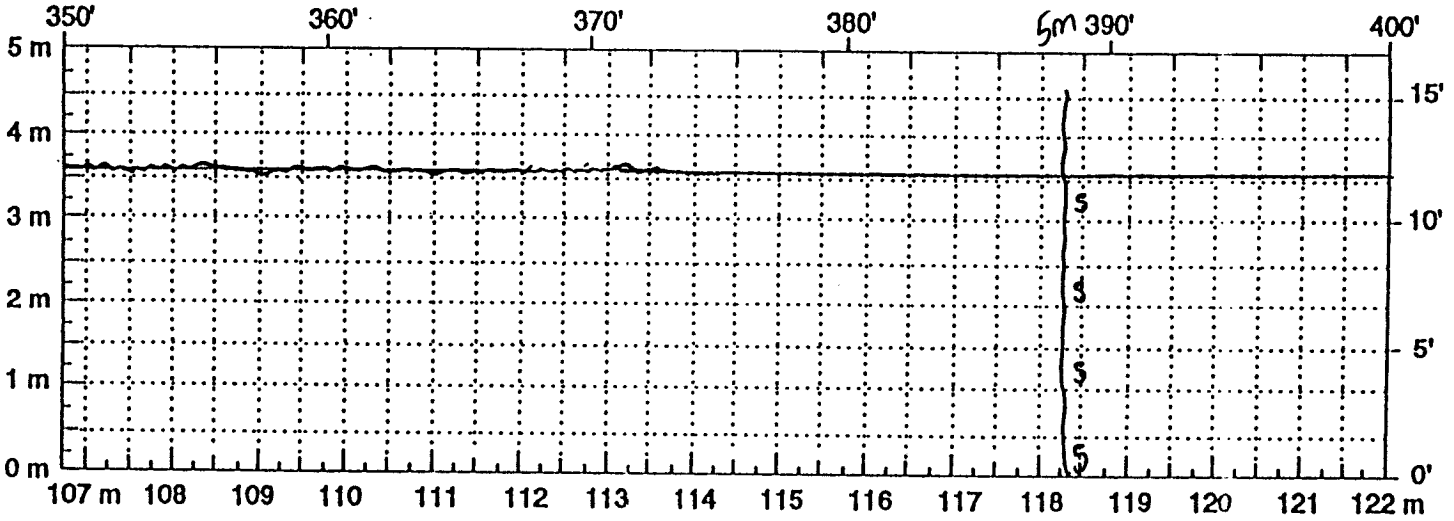
State Assigned ID 6-9-94 WP

State Code 46

SHRP Section ID 9187



Comments: _____



46 14.0

5M 1-3.65

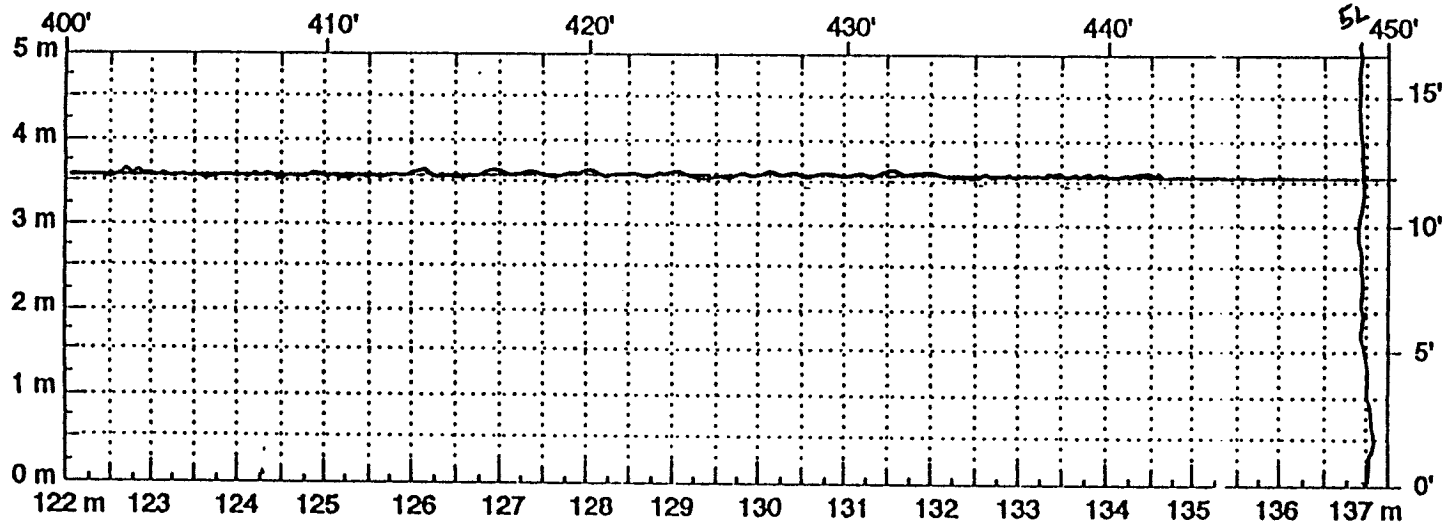
plow damag .6M²

Comments: _____

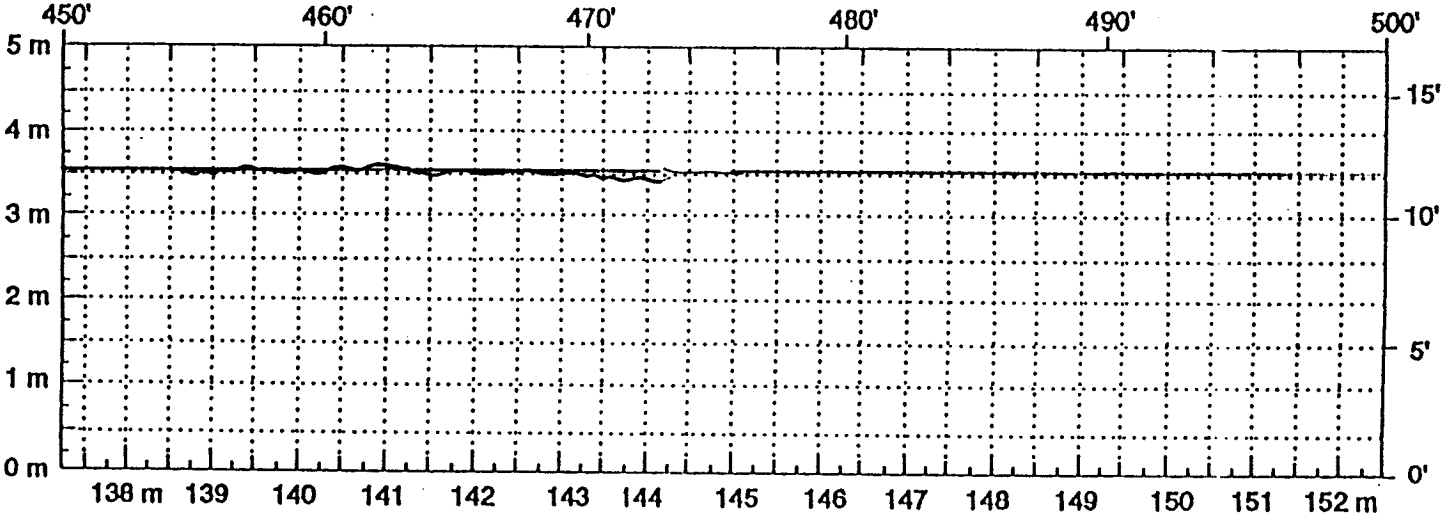
State Assigned ID 6-9-94

State Code 46

SHRP Section ID 9187



Comments: _____



46L 17.5 m

5L 1-3.65

Comments: _____

10/11

DIPSTICK FIELD ACTIVITY REPORT

SHRP REGION NCR STATE CODE 46 SHRP ASSIGNED ID 469187
STATE SD TESTING FWD DISTRICT
LTPP EXPERIMENT CODE GPS- ROUTE/HIGHWAY NUMBER
EQUIPMENT SERIAL NUMBER 30022
TESTING DATE 6-9-94 SHEET NUMBER 1/2
WEATHER SUNNY, WINDY

==========

DIPSTICK PRE-OPERATION CHECKS BJP (initials)

	TIME
READY TO TEST	1142
BEGIN TESTING	1145
END TESTING	1225
START TRAVEL	1320
END TRAVEL	1905

DOWN TIME _____ HOURS

REASONS

ADDITIONAL REMARKS

WINDY BUT NICE DAY

DIPSTICK PROFILE CREW NAMES: BRUCE PELKEY

TRAFFIC CONTROL CREW NAMES:

COPIES: RCOC

FORM F01/SEPT 1990

ZERO CHECK

First Reading .005

Rotate 180 degrees

Second Reading .005

Total, if within ±0.001 proceed or else adjust the start end pin as suggested in the manual and repeat the zero check.

CALIBRATION CHECK

First Reading ~~.005~~ .038

Place calibration block

10/11

DIPSTICK FIELD ACTIVITY REPORT

SHRP REGION NCR STATE CODE 46 SHRP ASSIGNED ID 469187
STATE SP TESTING FWD DISTRICT
LTPP EXPERIMENT CODE GPS- ROUTE/HIGHWAY NUMBER
EQUIPMENT SERIAL NUMBER 30022
TESTING DATE 6-9-94 SHEET NUMBER 1/2
WEATHER SUNNY, WINDY

==========

DIPSTICK PRE-OPERATION CHECKS BJP (initials)

	TIME
READY TO TEST	1142
BEGIN TESTING	1145
END TESTING	1225
START TRAVEL	1320
END TRAVEL	1905

DOWN TIME _____ HOURS

REASONS

ADDITIONAL REMARKS

WINDY BUT NICE DAY

DIPSTICK PROFILE CREW NAMES: BRUCE PELKEY

TRAFFIC CONTROL CREW NAMES:

COPIES: RCOC

FORM F01/SEPT 1990

ZERO CHECK

First Reading .005

Rotate 180 degrees

Second Reading .005

Total, if within ±0.001 proceed or else adjust the start end pin as suggested in the manual and repeat the zero check.

CALIBRATION CHECK

First Reading ~~.005~~ .038

Place calibration block

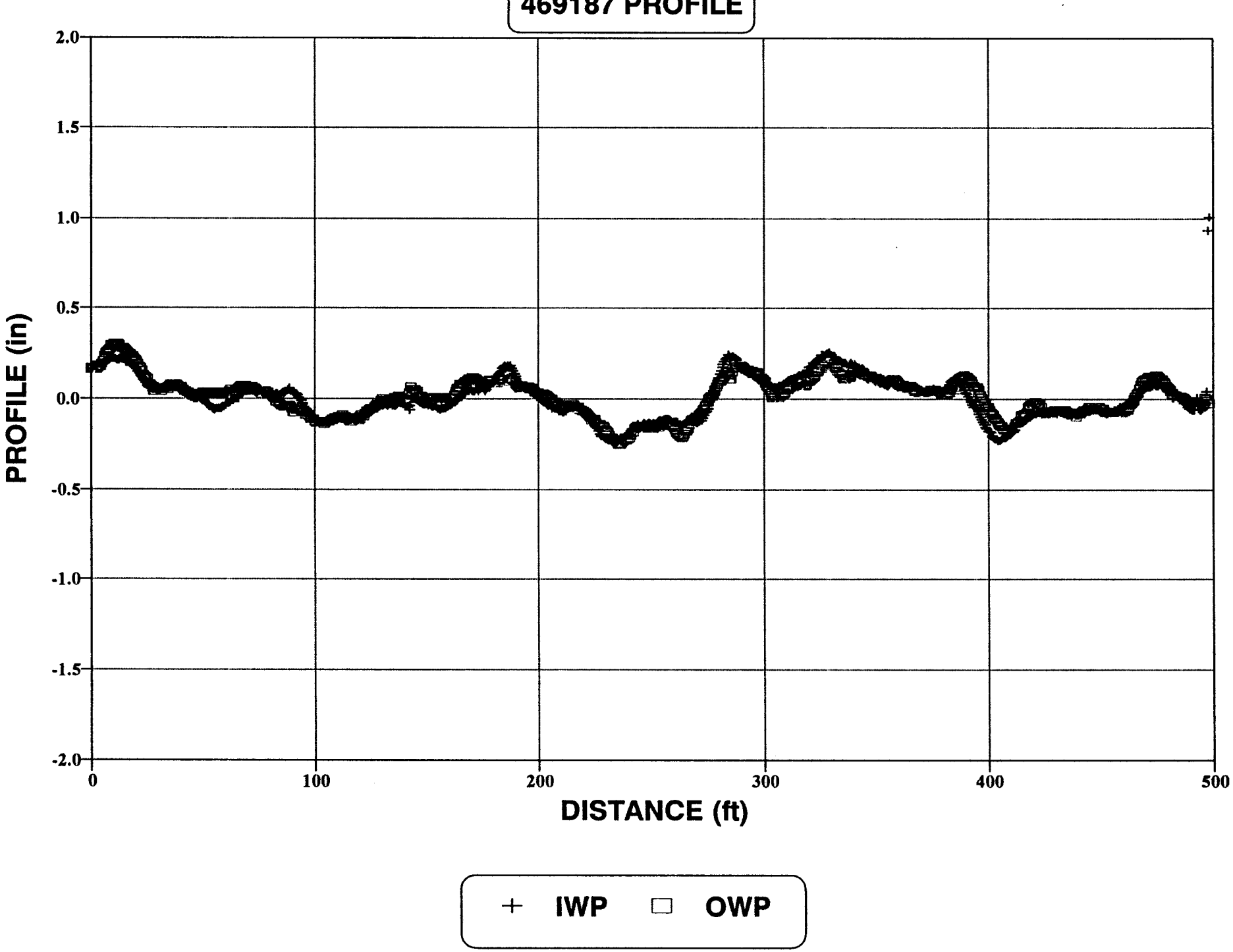
Second Reading ~~.114~~ .162 - 0.125 = First Reading ±0.003 proceed or else

OPERATOR: BJP
RECORDER: BJP
DIPSTICK SERIAL NUMBER: 30022

STATE CODE: 40
SHRP SECTION I.D.: 9187

LOCATION	DIPSTICK READING 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL	SUM
0+00	245	172	214	361	231	213	141	105	201	143	130	.038					
	-244	-180	-209	-365	-224	-208	-142	-125	-173	-125	-139	-038					
0+50 (15 m)	190	218	243	250	207	157	161	169	124	190	133	.065					
	-194	-214	-247	-240	-199	-159	-168	-154	-132	-176	-125	-065					
1+00 (30 m)	230	205	320	301	194	207	161	196	165	138	109	010					
	-222	-196	-318	-304	-183	-209	-159	-193	-173	-127	-096	-010					
1+50 (45 m)	296	238	264	313	252	181	162	144	153	145	144	-042					
	-308	-231	-265	-305	-257	-169	-166	-151	-146	-140	-144	042					
2+00 (60 m)	251	222	263	327	252	174	201	134	120	190	119	-008					
	-250	-221	-229	-349	-232	-145	-203	-133	-122	-172	-117	+008					
2+50 (75 m)	200	169	211	283	210	165	165	113	121	173	128	041					
	198	165	204	-272	-207	-162	-156	-118	-128	-164	-124	-041					
3+00 (90 m)	205	193	214	288	217	140	100	100	093	114	069	-030					
	-205	-181	-223	285	-217	-137	-100	-100	-083	-109	-067	+030					
3+50 (105 m)	220	195	216	361	235	180	105	170	172	181	147	-062					
	-223	-195	-213	-360	-230	-178	-104	-170	-170	-177	-142	062					
4+00 (120 m)	199	159	211	307	205	164	132	146	108	178	139	-007					
	-192	-166	-210	-305	-203	-160	-127	-149	-103	-170	-139	007					
4+50 (135 m)	195	181	217	306	240	194	119	184	079	200	179	062					
	-189	-184	-202	-301	-242	-201	-107	-187	-069	-200	-174	-062					
5+00 (150 m)	187	174	171	316	200	173	145	152	153	172	122	041					
	-184	-187	-162	-318	-197	-182	-140	-153	-153	-168	-120	-041					

FORM S1/December 1992


469187 PROFILE
PROFILE (in)
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
0
100
200
300
400
500
DISTANCE (ft)
IWP
OWP

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

FWD S/N : 8002-060
Operator ID : PELKEY, BRUCE J.

EXTRA TESTS FOR SMP

2@-40

Stationing...: Feet

Diameter of Plate: 11.8
Deflector distances : 8 12 18 24 36 60

SHRP TESTING - FLEXIBLE - BASIN TEST (F0,F1,F3)
Sequence: CCC111122223333444 4

Time Mountain Time OK

Stn: -40 Lane:F1 Temp: J/C: Air: 60 PvT: 53 07:32

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	107.3	11759	23.10	19.98	17.47	14.79	12.35	8.59	4.22
	C	108.2	11850	23.07	19.94	17.24	14.77	12.36	8.62	4.26
	C	108.0	11830	23.04	19.93	17.10	14.78	12.33	8.57	4.27
*	1	56.7	6209	11.66	9.95	9.37	7.32	6.16	4.34	2.12
*	1	56.9	6233	11.67	10.00	9.43	7.35	6.15	4.28	2.12
*	1	56.5	6193	11.62	9.85	9.47	7.24	6.13	4.33	2.09
*	1	56.8	6221	11.61	9.98	9.20V	7.36	6.12	4.23	2.13
*	2	82.0	8986	17.07	14.80	13.24	10.94	9.09	6.29	3.17
*	2	82.7	9061	17.20	14.89	13.35	11.01	9.16	6.35	3.17
*	2	82.6	9053	17.21	14.86	13.37	11.00	9.17	6.38	3.18
*	2	82.8	9077	17.23	14.93	13.40	11.03	9.19	6.37	3.19
*	3	107.9	11822	22.88	19.87	17.33	14.73	12.26	8.48	4.24
*	3	108.2	11858	22.98	19.94	17.33	14.78	12.31	8.53	4.26
*	3	108.2	11850	23.00	19.96	17.10	14.78	12.32	8.55	4.26
*	3	108.2	11854	23.00	19.98	17.18	14.80	12.32	8.52	4.26
*	4	143.4	15711	30.18	26.27	22.11V	19.49	16.21	11.19	5.59
*	4	142.8	15648	30.28	26.37	22.41	19.58	16.25	11.17	5.61
*	4	142.3	15596	30.30	26.38	22.60	19.59	16.25	11.18	5.59
*	4	142.2	15576	30.28	26.39	22.69V	19.60	16.24	11.15	5.59

Accept test with Var

Stn: -40 Lane:F1 Temp: J/C: Air: 60 PvT: 52 07:36

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	107.0	11719	22.94	19.98	17.80	14.78	12.19	8.40	4.24
	C	107.0	11723	23.02	20.03	17.67	14.80	12.22	8.43	4.25
	C	106.9	11711	23.00	20.01	17.69	14.79	12.22	8.43	4.22
*	1	55.4	6070	11.46	9.92	9.35	7.29	6.01	4.14	2.07
*	1	55.8	6110	11.50	9.96	9.45	7.33	6.04	4.18	2.11
*	1	55.8	6110	11.52	9.97	9.43	7.33	6.04	4.18	2.08
*	1	56.1	6149	11.53	9.99	9.40	7.35	6.04	4.16	2.11
*	2	81.1	8891	17.06	14.86	13.44	10.97	9.02	6.19	3.14
*	2	81.6	8942	17.19	14.96	13.53	11.06	9.09	6.24	3.17
*	2	81.7	8954	17.15	14.93	13.56	11.02	9.07	6.24	3.16
*	2	81.5	8926	17.14	14.94	13.54	11.04	9.07	6.23	3.14
*	3	106.8	11699	22.88	19.94	17.70	14.77	12.17	8.37	4.24
*	3	107.0	11723	22.96	20.01	17.66	14.82	12.22	8.42	4.22
*	3	107.1	11731	22.96	19.99	17.58	14.79	12.20	8.40	4.22
*	3	107.0	11719	22.94	19.98	17.60	14.80	12.22	8.40	4.26
*	4	141.5	15501	30.06	26.23	22.51	19.47	16.06	11.04	5.54
*	4	141.6	15513	30.17	26.31	22.36	19.52	16.11	11.09	5.60
*	4	141.3	15477	30.20	26.34	22.33	19.54	16.12	11.08	5.59
*	4	141.0	15449	30.21	26.35	22.37	19.55	16.11	11.06	5.59

Stn: -35 Lane:F1 Temp: J/C: Air: 60 PvT: 52 07:39

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	106.6	11679	22.48	19.59	17.57	14.52	12.30	8.40	4.18
	C	107.0	11723	22.42	19.59	17.35	14.58	12.27	8.39	4.22
	C	106.7	11691	22.36	19.52	17.39	14.50	12.22	8.35	4.18
*	1	55.7	6102	11.22	9.76	9.32	7.21	6.04	4.15	2.10
*	1	55.8	6110	11.22	9.75	9.30	7.22	6.06	4.16	2.11
*	1	55.6	6094	11.13	9.69	9.30	7.15	5.98	4.11	2.05
*	1	55.6	6090	11.14	9.66	9.26	7.12	6.00	4.12	2.09
*	2	81.0	8871	16.57	14.48	13.31	10.73	8.96	6.16	3.14
*	2	81.3	8906	16.63	14.53	13.35	10.77	9.00	6.19	3.15

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	2	81.3	8902	16.66	14.56	13.32	10.81	9.02	6.20	3.19
*	2	81.7	8946	16.72	14.60	13.46	10.83	9.09	6.23	3.14
*	3	106.8	11703	22.33	19.52	17.49	14.52	12.17	8.35	4.22
*	3	107.0	11727	22.42	19.58	17.53	14.54	12.24	8.39	4.20
*	3	107.0	11723	22.42	19.56	17.51	14.52	12.28	8.39	4.18
*	3	106.9	11711	22.44	19.58	17.56	14.54	12.27	8.39	4.20
*	4	140.9	15433	29.46	25.78	22.41	19.18	16.17	11.05	5.50
*	4	141.5	15501	29.72	26.07	22.33	19.43	16.19	11.12	5.62
*	4	141.2	15469	29.76	26.06	22.40	19.42	16.22	11.12	5.62
*	4	141.1	15461	29.79	26.02	22.50	19.34	16.32	11.15	5.55

Stn: -30 Lane:F1 Temp: J/C: Air: 60 PvT: 53 07:42

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	105.1	11520	22.93	19.85	17.69	15.11	12.31	8.63	4.20
	C	105.8	11596	22.97	19.85	17.75	15.19	12.37	8.69	4.21
	C	105.8	11592	22.97	20.03	17.71	15.04	12.34	8.59	4.29
*	1	54.7	5995	11.43	9.93	9.44	7.37	6.05	4.22	2.10
*	1	55.0	6022	11.47	9.98	9.46	7.39	6.06	4.24	2.12
*	1	54.8	6006	11.35	9.88	9.39	7.31	6.01	4.20	2.10
*	1	55.0	6022	11.39	9.92	9.39	7.33	6.04	4.20	2.10
*	2	79.9	8759	16.95	14.79	13.57	11.01	9.05	6.29	3.17
*	2	80.4	8807	17.07	14.92	13.69	11.07	9.11	6.31	3.19
*	2	80.7	8843	17.12	14.98	13.67	11.11	9.14	6.33	3.22
*	2	80.5	8819	17.01	14.89	13.61	11.06	9.09	6.31	3.19
*	3	105.8	11596	22.89	20.04	17.89	14.94	12.30	8.54	4.29
*	3	106.0	11616	22.95	20.11	17.99	14.98	12.32	8.56	4.30
*	3	105.8	11588	22.93	20.06	17.99	14.94	12.30	8.53	4.29
*	3	105.9	11604	22.98	20.15	18.02	14.98	12.33	8.55	4.30
*	4	139.9	15326	30.41	26.69	23.02	19.91	16.39	11.33	5.67
*	4	139.7	15310	30.51	26.78	22.92	19.96	16.43	11.35	5.68
*	4	139.7	15302	30.58	26.81	23.00	19.98	16.44	11.36	5.69
*	4	139.6	15290	30.63	26.84	23.00	20.00	16.47	11.37	5.69

Stn: -25 Lane:F1 Temp: J/C: Air: 61 PvT: 53 07:44

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	105.6	11568	23.87	20.85	18.84	15.50	12.86	8.72	4.31
	C	105.8	11596	23.75	20.81	18.59	15.41	12.76	8.64	4.30
	C	106.0	11616	23.79	20.85	18.68	15.46	12.82	8.68	4.31
*	1	54.6	5979	11.82	10.29	9.84	7.56	6.26	4.23	2.10
*	1	55.4	6070	11.86	10.35	9.79	7.62	6.31	4.28	2.13
*	1	55.0	6026	11.89	10.35	9.82	7.62	6.31	4.28	2.14
*	1	55.4	6074	11.85	10.31	9.81	7.59	6.28	4.26	2.12
*	2	80.1	8779	17.56	15.33	14.02	11.35	9.41	6.37	3.17
*	2	80.6	8835	17.68	15.44	14.15	11.44	9.49	6.43	3.20
*	2	80.6	8831	17.70	15.48	14.13	11.44	9.47	6.41	3.21
*	2	80.6	8835	17.74	15.48	14.23	11.48	9.52	6.46	3.21
*	3	106.1	11624	23.72	20.81	18.60	15.42	12.77	8.65	4.33
*	3	106.3	11647	23.79	20.87	18.56	15.46	12.80	8.65	4.33
*	3	106.0	11612	23.77	20.85	18.56	15.43	12.77	8.63	4.32
*	3	106.2	11632	23.79	20.87	18.61	15.46	12.81	8.67	4.33
*	4	139.4	15278	31.40	27.53	23.92	20.45	16.95	11.44	5.68
*	4	140.1	15354	31.60	27.67	23.78	20.63	17.13	11.56	5.72
*	4	139.4	15274	31.62	27.63	23.71	20.59	17.09	11.55	5.70
*	4	139.7	15306	31.75	27.78	23.89	20.66	17.14	11.57	5.73

Stn: -20 Lane:F1 Temp: J/C: Air: 61 PvT: 54 07:47

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	105.3	11532	24.87	21.71	19.38	15.77	12.96	8.72	4.36
	C	105.7	11584	24.84	21.66	19.16	15.74	12.95	8.71	4.37
	C	105.1	11520	24.66	21.52	19.04	15.63	12.86	8.65	4.35
*	1	55.0	6026	12.42	10.78	10.13	7.79	6.40	4.30	2.17
*	1	55.2	6046	12.44	10.82	10.17	7.80	6.41	4.31	2.15
*	1	54.7	5999	12.31	10.68	10.06	7.70	6.35	4.27	2.13
*	1	55.2	6050	12.40	10.76	10.10	7.76	6.38	4.30	2.16
*	2	79.5	8712	18.24	15.89	14.43	11.51	9.46	6.36	3.19
*	2	79.8	8748	18.38	16.01	14.54	11.60	9.54	6.42	3.22
*	2	79.6	8724	18.28	15.92	14.49	11.53	9.49	6.38	3.20
*	2	79.7	8736	18.34	15.97	14.53	11.57	9.52	6.39	3.21
*	3	104.8	11485	24.52	21.40	19.07	15.55	12.81	8.62	4.31
*	3	105.1	11516	24.62	21.47	19.06	15.60	12.85	8.64	4.33
*	3	105.2	11524	24.66	21.50	19.12	15.62	12.88	8.66	4.33

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	3	105.2	11528	24.67	21.48	19.13	15.62	12.89	8.66	4.33
*	4	138.2	15143	32.63	28.41	24.69	20.71	17.11	11.47	5.70
*	4	138.1	15135	32.78	28.48	24.46	20.77	17.20	11.52	5.70
*	4	138.2	15143	32.91	28.64	24.58	20.87	17.23	11.54	5.74
*	4	138.4	15167	33.03	28.67	24.76	20.95	17.30	11.59	5.72

Stn: -15 Lane:F1 Temp: J/C: Air: 61 PvT: 54 07:50

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.6	11457	25.45	22.13	19.52	16.20	13.16	8.78	4.33
	C	104.5	11453	25.32	22.00	19.31	16.13	13.11	8.76	4.32
	C	104.7	11469	25.31	22.03	19.39	16.12	13.13	8.78	4.34
*	1	54.0	5911	12.58	10.82	10.28	7.91	6.43	4.28	2.11
*	1	54.3	5947	12.58	10.85	10.26	7.94	6.45	4.31	2.10
*	1	54.4	5955	12.57	10.87	10.30	7.94	6.45	4.31	2.10
*	1	54.6	5983	12.62	10.89	10.33	7.97	6.48	4.33	2.11
*	2	79.4	8704	18.85	16.37	14.86	11.98	9.74	6.50	3.22
*	2	79.7	8736	18.88	16.39	14.68	12.00	9.75	6.51	3.21
*	2	79.7	8728	18.80	16.31	14.63	11.94	9.71	6.48	3.20
*	2	80.0	8763	18.95	16.46	14.97	12.04	9.79	6.54	3.23
*	3	104.5	11445	25.20	21.97	19.26	16.05	13.08	8.75	4.32
*	3	104.7	11477	25.30	22.07	19.24	16.11	13.12	8.78	4.33
*	3	104.9	11489	25.34	22.11	19.27	16.15	13.15	8.79	4.33
*	3	105.0	11508	25.36	22.13	19.21	16.15	13.16	8.79	4.34
*	4	137.9	15104	33.45	29.15	24.73	21.35	17.39	11.61	5.68
*	4	138.0	15119	33.68	29.34	24.82	21.49	17.51	11.68	5.72
*	4	137.9	15112	33.77	29.41	24.70	21.53	17.53	11.69	5.74
*	4	138.2	15139	33.93	29.54	24.81	21.61	17.61	11.74	5.76

Stn: -10 Lane:F1 Temp: J/C: Air: 61 PvT: 54 07:53

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.0	11393	26.28	22.91	19.93	16.43	13.31	8.83	4.31
	C	104.4	11441	26.24	22.85	19.78	16.42	13.29	8.79	4.33
	C	104.5	11449	26.25	22.88	19.72	16.44	13.31	8.81	4.34
*	1	54.6	5979	13.19	11.46	10.49	8.20	6.62	4.37	2.18
*	1	54.6	5987	13.22	11.48	10.53	8.23	6.62	4.37	2.19
*	1	55.0	6022	13.26	11.51	10.59	8.24	6.64	4.39	2.18
*	1	55.1	6034	13.23	11.50	10.58	8.23	6.62	4.38	2.18
*	2	79.0	8660	19.52	17.00	15.07	12.20	9.84	6.51	3.24
*	2	79.6	8720	19.66	17.11	15.12	12.28	9.91	6.54	3.26
*	2	79.6	8720	19.70	17.15	15.16	12.31	9.93	6.56	3.27
*	2	79.7	8728	19.68	17.13	15.18	12.30	9.91	6.55	3.26
*	3	105.3	11532	26.26	22.85	19.85	16.46	13.31	8.79	4.36
*	3	105.1	11516	26.33	22.93	19.90	16.52	13.34	8.81	4.37
*	3	105.5	11556	26.41	23.00	19.97	16.55	13.38	8.84	4.38
*	3	105.3	11540	26.43	23.00	19.96	16.56	13.39	8.84	4.38
*	4	137.9	15104	34.89	30.37	25.77	21.94	17.72	11.70	5.74
*	4	137.8	15100	35.08	30.51	25.48	22.00	17.80	11.76	5.75
*	4	137.9	15104	35.22	30.59	25.58	22.03	17.85	11.78	5.77
*	4	137.9	15104	35.34	30.69	25.71	22.12	17.88	11.80	5.79

Stn: -5 Lane:F1 Temp: J/C: Air: 61 PvT: 54 07:56

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.1	11409	27.44	23.80	21.31	17.39	14.06	9.31	4.03
	C	104.7	11477	27.36	23.70	20.90	17.34	14.02	9.31	4.02
	C	104.7	11477	27.39	23.72	20.80	17.35	14.04	9.27	4.04
*	1	54.5	5971	13.73	11.80	11.09	8.65	6.96	4.63	1.97
*	1	54.7	5999	13.78	11.83	11.18	8.67	6.98	4.65	1.98
*	1	55.0	6026	13.78	11.82	11.11	8.67	6.98	4.64	2.00
*	1	54.9	6018	13.81	11.87	11.28	8.71	7.01	4.68	2.00
*	2	79.1	8668	20.37	17.59	15.82	12.87	10.39	6.92	2.97
*	2	79.1	8664	20.39	17.64	15.94	12.89	10.41	6.93	2.98
*	2	79.3	8688	20.43	17.66	15.92	12.92	10.43	6.97	2.97
*	2	79.3	8688	20.43	17.68	15.98	12.92	10.45	6.98	2.98
*	3	104.4	11433	27.17	23.55	20.77	17.23	13.98	9.22	4.02
*	3	104.6	11461	27.26	23.63	20.91	17.28	14.03	9.29	4.01
*	3	104.8	11481	27.34	23.68	20.88	17.33	14.08	9.27	4.02
*	3	104.7	11477	27.34	23.69	20.81	17.33	14.08	9.25	4.05
*	4	136.7	14972	36.02	31.21	26.98V	22.85	18.60	12.26	5.30
*	4	137.6	15080	36.41	31.54	26.70	23.06	18.79	12.33	5.37
*	4	136.9	14996	36.42	31.54	26.48	23.08	18.81	12.33	5.35
*	4	137.6	15076	36.65	31.72	26.59	23.14	18.89	12.41	5.39

accept test with Vae

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

Stn: -5 Lane:F1 Temp: J/C: Air: 61 PvT: 54 07:59

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.2	11413	27.91	24.17	21.01	17.18	14.30	9.32	4.11
	C	105.1	11520	28.04	24.28	21.13	17.30	14.41	9.42	4.14
	C	104.6	11465	27.91	24.18	20.80	17.26	14.34	9.38	4.13
*	1	54.3	5947	13.91	11.98	11.22	8.49	7.10	4.67	2.02
*	1	54.7	5995	13.98	12.03	11.44	8.52	7.14	4.70	2.02
*	1	54.6	5979	13.94	11.99	11.37	8.50	7.12	4.74	2.03
*	1	54.8	6006	13.98	12.03	11.39	8.53	7.12	4.75	2.02
*	2	79.3	8688	20.77	17.94	16.09	12.77	10.63	6.99	3.05
*	2	79.2	8672	20.74	17.91	16.09	12.73	10.62	6.99	3.04
*	2	79.3	8692	20.79	17.98	16.13	12.79	10.66	7.02	3.07
*	2	79.3	8692	20.78	17.95	16.13	12.77	10.64	7.02	3.06
*	3	105.1	11512	27.81	24.09	20.91	17.22	14.31	9.33	4.14
*	3	105.1	11512	27.86	24.14	21.02	17.26	14.32	9.41	4.13
*	3	105.4	11548	27.95	24.21	21.15	17.33	14.37	9.43	4.14
*	3	105.2	11524	27.91	24.18	20.91	17.31	14.34	9.41	4.15
*	4	137.8	15100	36.57	31.72	27.00	22.81	18.90	12.32	5.49
*	4	137.9	15112	36.74	31.85	26.85	22.90	18.97	12.35	5.49
*	4	138.0	15115	36.86	31.92	26.73	22.93	19.01	12.35	5.51
*	4	137.7	15088	36.83	31.91	26.65	22.94	19.00	12.37	5.49

Stn: 0 Lane:F1 Temp: J/C: Air: 62 PvT: 56 08:01

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.8	11377	38.87	24.39	19.97	15.83	12.52	8.02	4.18
	C	103.5	11342	38.67	24.26	19.72	15.81	12.51	8.04	4.18
	C	103.5	11338	38.70	24.16	19.49	15.78	12.49	8.03	4.16
*	1	53.7	5883	20.91	10.88	9.79	7.29	5.91	3.87	2.02
*	1	54.0	5919	20.91	10.94	9.77	7.32	5.95	3.88	2.02
*	1	53.8	5899	20.78	10.92	9.65	7.31	5.91	3.87	2.04
*	1	54.0	5919	20.79	10.95	9.68	7.33	5.94	3.88	2.03
*	2	78.0	8545	29.31	17.29	14.43	11.38	9.04	5.86	3.07
*	2	78.4	8585	29.47	17.41	14.48	11.46	9.09	5.92	3.11
*	2	78.6	8608	29.53	17.44	14.53	11.50	9.13	5.94	3.12
*	2	78.5	8605	29.48	17.42	14.53	11.47	9.13	5.92	3.07
*	3	103.5	11342	38.23	24.02	19.47	15.72	12.44	8.00	4.17
*	3	103.7	11357	38.49	24.07	19.49	15.75	12.48	8.02	4.17
*	3	103.8	11369	38.61	24.06	19.51	15.76	12.48	8.03	4.17
*	3	103.7	11361	38.68	24.01	19.48	15.73	12.48	8.02	4.17
*	4	137.1	15020	49.87V	32.60	25.81	21.25	16.80	10.72	5.50
*	4	137.0	15008	50.40	32.37	25.71	21.07	16.98	10.69	5.47
*	4	136.6	14965	50.56	32.56	25.49	21.26	16.80	10.74	5.49
*	4	136.5	14953	50.69	32.53	25.41	21.26	16.77	10.75	5.52

'L-TRANS. CR. BETWEEN LP-D1 & Accepted test with Var.

Stn: 0 Lane:F1 Temp: J/C: Air: 63 PvT: 58 08:04

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11298	40.71	23.99	19.61	15.75	12.40	8.02	4.18
	C	103.4	11326	40.41	24.02	19.39	15.78	12.42	8.05	4.22
	C	103.9	11381	40.49	24.12	19.41	15.85	12.48	8.08	4.20
*	1	54.3	5951	21.93	10.76	9.58	7.27	5.87	3.88	2.03
*	1	53.9	5903	21.79	10.77	9.41	7.27	5.86	3.87	2.04
*	1	54.2	5943	21.76	10.76	9.45	7.25	5.87	3.86	2.02
*	1	54.0	5919	21.67	10.69	9.50	7.19	5.89	3.83	1.99
*	2	78.0	8545	30.72	16.98	14.11	11.23	8.99	5.82	3.02
*	2	78.2	8565	30.81	17.09	14.21	11.32	9.00	5.88	3.07
*	2	78.2	8573	30.85	17.13	14.26	11.35	9.01	5.90	3.08
*	2	78.2	8565	30.83	17.15	14.22	11.36	9.02	5.91	3.11
*	3	103.5	11338	39.67	23.96	19.33	15.74	12.41	8.02	4.17
*	3	103.7	11361	39.88	24.06	19.30	15.81	12.45	8.07	4.21
*	3	103.6	11350	39.86	24.00	19.38	15.77	12.46	8.04	4.18
*	3	103.7	11361	39.88	23.90	19.35	15.70	12.50	8.02	4.13
*	4	137.1	15016	50.70	32.54	25.72	21.25	16.83	10.74	5.55
*	4	137.3	15040	51.04	32.78	25.60	21.43	16.88	10.82	5.57
*	4	137.0	15012	51.13	32.78	25.55	21.43	16.83	10.83	5.59
*	4	136.6	14965	51.18	32.67	25.57	21.37	16.77	10.80	5.53

'L-TRANS. CR. BETWEEN LP-D1

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

Stn: 25 Lane:F1 Temp: J/C: Air: 62 PvT: 58 08:07

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	105.4	11552	25.40	21.78	19.09	15.43	12.50	8.43	4.25
	C	106.0	11612	25.28	21.69	18.72	15.38	12.50	8.44	4.25
	C	105.8	11592	25.26	21.65	18.59	15.36	12.48	8.45	4.26
*	1	54.6	5983	12.56	10.71	9.76	7.56	6.14	4.20	2.11
*	1	55.0	6026	12.59	10.70	9.87	7.57	6.15	4.22	2.11
*	1	55.0	6026	12.51	10.63	9.77	7.52	6.12	4.19	2.10
*	1	55.0	6026	12.56	10.69	9.82	7.55	6.15	4.21	2.11
*	2	79.4	8700	18.59	15.94	14.02	11.30	9.17	6.21	3.16
*	2	79.9	8755	18.70	16.02	14.15	11.37	9.23	6.27	3.19
*	2	79.8	8748	18.68	16.01	14.12	11.37	9.23	6.26	3.17
*	2	79.7	8736	18.65	15.97	14.21	11.33	9.21	6.24	3.17
*	3	105.9	11600	25.13	21.54	18.59	15.32	12.44	8.41	4.25
*	3	105.8	11592	25.20	21.61	18.51	15.37	12.48	8.43	4.27
*	3	105.9	11608	25.30	21.65	18.54	15.40	12.52	8.46	4.28
*	3	106.1	11620	25.30	21.70	18.61	15.42	12.53	8.46	4.30
*	4	138.9	15223	33.72	28.99	24.41	20.63	16.74	11.25	5.67
*	4	138.7	15195	33.91	29.08	24.49	20.70	16.81	11.28	5.65
*	4	138.5	15179	33.95	29.17	24.25	20.75	16.83	11.31	5.70
*	4	138.4	15163	34.05	29.22	24.52	20.81	16.86	11.31	5.70

Stn: 50 Lane:F1 Temp: J/C: Air: 63 PvT: 60 08:10

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	105.2	11524	27.07	22.76	19.45	16.01	12.82	8.45	4.19
	C	105.1	11516	26.87	22.57	19.09	15.93	12.77	8.43	4.18
	C	105.4	11548	26.86	22.57	19.26	15.96	12.80	8.43	4.19
*	1	54.2	5935	13.38	11.03	10.30	7.81	6.27	4.19	2.03
*	1	54.7	5995	13.44	11.19	10.03	7.87	6.31	4.20	2.06
*	1	54.5	5967	13.33	11.02	10.15	7.79	6.26	4.15	2.02
*	1	54.7	5999	13.40	11.04	10.23	7.83	6.30	4.19	2.07
*	2	78.9	8648	19.78	16.54	14.31	11.69	9.37	6.19	3.08
*	2	79.3	8692	19.94	16.62	14.62	11.78	9.45	6.25	3.09
*	2	79.6	8720	19.97	16.65	14.60	11.79	9.46	6.26	3.10
*	2	79.7	8732	20.02	16.75	14.69	11.84	9.50	6.26	3.12
*	3	105.4	11544	26.68	22.42	19.15	15.89	12.74	8.37	4.17
*	3	105.8	11592	26.82	22.50	19.22	15.95	12.81	8.42	4.18
*	3	105.9	11608	26.89	22.60	19.46	16.01	12.85	8.44	4.21
*	3	105.8	11588	26.89	22.61	19.39	16.02	12.85	8.43	4.21
*	4	138.0	15115	35.63	30.03	25.07	21.31	17.05	11.16	5.58
*	4	138.4	15163	35.96	30.37	25.28	21.47	17.19	11.24	5.61
*	4	137.9	15112	35.98	30.28	25.17	21.46	17.20	11.25	5.60
*	4	137.7	15084	35.99	30.29	25.35	21.45	17.18	11.24	5.58

Accept test w/var

Stn: 50 Lane:F1 Temp: J/C: Air: 63 PvT: 61 08:13

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.8	11485	27.44	22.99	19.49	16.18	12.96	8.52	4.22
	C	105.3	11532	27.41	23.02	19.35	16.23	12.99	8.53	4.25
	C	105.0	11504	27.33	22.93	19.42	16.18	12.96	8.50	4.23
*	1	54.5	5975	13.70	11.38	10.09	7.98	6.39	4.24	2.10
*	1	54.9	6010	13.74	11.40	10.27	7.98	6.41	4.24	2.11
*	1	54.5	5975	13.67	11.33	10.02	7.96	6.39	4.22	2.10
*	1	54.7	5995	13.72	11.40	10.13	8.00	6.42	4.24	2.11
*	2	79.2	8672	20.22	16.92	14.48	11.92	9.55	6.28	3.13
*	2	79.4	8700	20.34	16.98	14.69	11.96	9.59	6.31	3.15
*	2	79.6	8720	20.37	17.04	14.70	12.00	9.61	6.31	3.15
*	2	79.9	8751	20.40	17.07	14.62	12.04	9.63	6.32	3.16
*	3	105.4	11552	27.20	22.89	19.36	16.16	12.94	8.48	4.24
*	3	105.4	11552	27.24	22.92	19.46	16.19	12.96	8.50	4.24
*	3	105.5	11556	27.30	22.93	19.35	16.21	12.98	8.50	4.24
*	3	105.9	11600	27.38	23.04	19.41	16.26	13.03	8.53	4.26
*	4	137.7	15092	35.82	30.23	24.98	21.41	17.15	11.22	5.59
*	4	137.9	15104	36.03	30.39	25.09	21.54	17.24	11.28	5.61
*	4	138.3	15147	36.15	30.50	25.24	21.59	17.30	11.32	5.62
*	4	138.2	15143	36.21	30.52	25.26	21.61	17.31	11.33	5.62

Stn: 75 Lane:F1 Temp: J/C: Air: 63 PvT: 61 08:15

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.9	11489	25.48	21.50	18.15	14.86	11.85	7.97	4.06
	C	105.8	11592	25.44	21.48	18.10	14.89	11.86	8.02	4.04

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

	C	105.6	11572	25.39	21.41	17.88	14.83	11.84	8.00	3.99
*	1	54.6	5987	12.82	10.78	9.67	7.39	5.87	4.01	2.00
*	1	54.6	5979	12.81	10.78	9.55	7.42	5.90	4.01	2.04
*	1	54.4	5959	12.74	10.71	9.50	7.35	5.84	3.98	2.00
*	1	55.2	6046	12.93	10.87	9.52	7.46	5.93	4.04	2.04
*	2	79.5	8712	18.89	15.89	13.56	10.96	8.74	5.92	2.97
*	2	80.4	8807	19.07	16.04	13.68	11.06	8.82	5.98	3.00
*	2	79.9	8751	18.98	16.00	13.76	11.05	8.81	5.97	3.01
*	2	80.0	8763	19.02	16.00	13.59	11.02	8.80	5.96	3.02
*	3	105.6	11572	25.27	21.35	17.84	14.79	11.83	8.00	4.00
*	3	105.7	11584	25.35	21.38	17.89	14.80	11.85	8.00	3.97
*	3	105.9	11604	25.39	21.47	17.98	14.86	11.89	8.03	4.03
*	3	105.9	11608	25.42	21.51	18.08	14.93	11.94	8.05	4.08
*	4	137.6	15080	33.58	28.41	23.39	19.74	15.81	10.63	5.33
*	4	138.1	15127	33.86	28.62	23.49	19.87	15.94	10.70	5.36
*	4	137.9	15112	33.92	28.69	23.61	19.93	15.95	10.71	5.38
*	4	138.4	15159	33.99	28.75	23.74	19.98	16.00	10.72	5.40

Stn: 100 Lane:F1 Temp: J/C: Air: 63 PvT: 62 08:18

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	105.2	11528	25.17	21.29	18.44	14.92	12.13	7.95	4.13
	C	105.7	11576	25.04	21.20	18.13	14.83	12.09	7.94	4.13
	C	105.9	11604	25.10	21.26	18.32	14.87	12.09	7.97	4.13
*	1	54.4	5963	12.65	10.66	9.62	7.39	5.99	3.97	2.07
*	1	54.8	6006	12.61	10.62	9.69	7.38	6.00	3.96	2.07
*	1	54.9	6010	12.66	10.67	9.67	7.41	6.04	3.99	2.07
*	1	54.7	5999	12.65	10.67	9.67	7.41	6.03	3.98	2.07
*	2	79.2	8680	18.53	15.69	13.84	10.94	8.92	5.87	3.04
*	2	80.0	8763	18.69	15.78	13.80	11.01	9.02	5.92	3.06
*	2	79.7	8736	18.63	15.74	13.84	10.98	8.98	5.90	3.05
*	2	79.9	8755	18.64	15.71	13.73	10.96	8.99	5.89	3.04
*	3	105.6	11572	24.91	21.07	18.08	14.73	12.05	7.93	4.11
*	3	105.7	11580	24.97	21.09	18.13	14.73	12.10	7.94	4.09
*	3	106.0	11616	25.07	21.16	18.20	14.78	12.14	7.96	4.11
*	3	105.9	11608	25.08	21.17	18.11	14.78	12.14	7.97	4.11
*	4	137.4	15052	33.08	27.98	23.32	19.55	16.06	10.52	5.41
*	4	137.4	15056	33.24	28.17	23.51	19.69	16.03	10.55	5.44
*	4	137.4	15052	33.33	28.14	23.48	19.65	16.12	10.56	5.42
*	4	137.6	15080	33.44	28.21	23.49	19.69	16.19	10.59	5.42

Stn: 125 Lane:F1 Temp: J/C: Air: 63 PvT: 63 08:21

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	106.3	11647	24.24	20.72	17.80	14.88	11.94	8.06	3.96
	C	107.0	11727	24.19	20.67	17.63	14.87	11.93	8.09	3.98
	C	106.7	11687	24.17	20.65	17.61	14.84	11.92	8.07	4.01
*	1	55.1	6042	12.19	10.37	9.40	7.44	5.93	4.04	1.94
*	1	55.4	6074	12.15	10.35	9.37	7.42	5.92	4.03	1.94
*	1	55.3	6058	12.18	10.36	9.42	7.44	5.93	4.04	1.95
*	1	55.4	6070	12.18	10.38	9.43	7.42	5.93	4.03	1.98
*	2	80.3	8795	17.93	15.33	13.52	10.98	8.82	5.97	2.98
*	2	80.5	8823	18.02	15.37	13.54	11.04	8.83	5.99	2.93
*	2	80.5	8815	18.00	15.32	13.62	11.03	8.80	5.98	2.91
*	2	80.8	8855	18.04	15.40	13.49	11.06	8.85	6.00	2.95
*	3	106.8	11699	24.04	20.53	17.69	14.78	11.85	8.04	3.96
*	3	107.0	11723	24.13	20.54	17.53	14.82	11.87	8.06	3.98
*	3	107.1	11739	24.18	20.61	17.57	14.85	11.91	8.07	3.98
*	3	107.1	11739	24.18	20.57	17.72	14.85	11.88	8.07	3.99
*	4	138.7	15191	31.84	27.20	22.64	19.58	15.74	10.65	5.30
*	4	139.0	15235	32.07	27.40	23.26	19.74	15.85	10.72	5.35
*	4	138.8	15211	32.12	27.39	23.07	19.73	15.85	10.72	5.37
*	4	138.8	15207	32.16	27.46	23.23	19.76	15.89	10.73	5.36

'L-TRANS. CR. 1' FRONT OF D7 & Accepted test with Var

Stn: 125 Lane:F1 Temp: J/C: Air: 63 PvT: 63 08:24

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	106.4	11659	24.65	21.07	19.38	15.10	12.13	8.13	4.10
	C	106.8	11699	24.69	21.09	18.24	15.18	12.17	8.21	4.08
	C	106.7	11695	24.63	21.05	17.94	15.13	12.14	8.17	4.09
*	1	54.6	5979	12.27	10.48	9.62	7.50	6.02	4.06	1.99
*	1	55.1	6034	12.33	10.50	9.57	7.52	6.04	4.08	2.03

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	1	55.3	6058	12.43	10.59	9.67	7.57	6.08	4.11	2.02
*	1	55.1	6034	12.37	10.55	9.61	7.56	6.06	4.09	2.02
*	2	80.2	8787	18.23	15.58	13.67	11.19	8.98	6.06	2.99
*	2	80.3	8803	18.28	15.63	13.77	11.21	9.00	6.07	3.01
*	2	80.4	8811	18.31	15.64	13.70	11.22	9.01	6.09	3.01
*	2	80.5	8815	18.25	15.59	13.69	11.19	8.98	6.06	2.98
*	3	106.7	11687	24.43	20.89	17.83	15.00	12.08	8.14	4.05
*	3	106.9	11711	24.51	20.97	17.98	15.05	12.12	8.17	4.09
*	3	106.8	11699	24.50	20.95	17.92	15.04	12.11	8.17	4.07
*	3	107.2	11747	24.56	21.00	17.88	15.07	12.14	8.19	4.06
*	4	138.4	15163	32.02	27.34	22.95	19.67	15.89	10.72	5.31
*	4	139.0	15227	32.23	27.55	22.95	19.80	15.97	10.77	5.39
*	4	138.5	15171	32.20	27.56	22.98	19.80	15.98	10.75	5.44
*	4	138.5	15179	32.21	27.55	22.96	19.79	15.98	10.76	5.41

'L-TRANS. CR. 1' FRONT OF D7

Stn: 150 Lane:F1 Temp: J/C: Air: 64 PvT: 61 08:27

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	105.1	11512	21.83	18.96	16.78	13.77	11.28	7.72	4.02
	C	105.4	11548	21.73	18.91	16.30	13.72	11.23	7.71	4.04
	C	105.5	11564	21.80	18.96	16.35	13.76	11.26	7.74	4.04
*	1	54.2	5939	10.89	9.46	8.71	6.81	5.58	3.83	2.00
*	1	54.2	5935	10.88	9.44	8.73	6.81	5.58	3.84	2.00
*	1	54.3	5951	10.90	9.47	8.75	6.83	5.59	3.84	1.99
*	1	54.3	5947	10.88	9.44	8.65	6.80	5.57	3.83	1.98
*	2	79.2	8676	16.17	14.03	12.51	10.17	8.32	5.72	3.01
*	2	79.8	8744	16.24	14.11	12.59	10.21	8.36	5.75	3.01
*	2	79.3	8684	16.18	14.08	12.59	10.20	8.35	5.74	3.01
*	2	79.5	8708	16.21	14.10	12.63	10.20	8.36	5.75	3.00
*	3	105.5	11560	21.68	18.85	16.38	13.67	11.20	7.70	4.01
*	3	105.7	11584	21.76	18.93	16.43	13.74	11.26	7.73	4.04
*	3	105.7	11584	21.79	18.96	16.38	13.75	11.27	7.75	4.05
*	3	105.7	11584	21.78	18.94	16.47	13.74	11.26	7.74	4.04
*	4	137.3	15048	28.74	25.00	21.14	18.17	14.90	10.23	5.31
*	4	137.5	15064	28.85	25.10	21.36	18.22	14.93	10.24	5.32
*	4	137.3	15044	28.82	25.11	21.24	18.22	14.91	10.24	5.33
*	4	137.5	15068	28.95	25.19	21.42	18.27	14.96	10.26	5.33

Stn: 175 Lane:F1 Temp: J/C: Air: 64 PvT: 63 08:30

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.9	11493	23.00	19.88	17.62	14.44	11.85	8.02	4.16
	C	105.3	11532	22.96	19.84	17.72	14.41	11.82	8.06	4.20
	C	105.3	11540	22.98	19.93	17.52	14.47	11.83	8.01	4.23
*	1	53.8	5895	11.47	9.89	9.43	7.14	5.85	3.99	2.09
*	1	54.3	5951	11.52	9.94	9.41	7.17	5.88	4.00	2.09
*	1	53.9	5903	11.46	9.89	9.35	7.13	5.84	3.98	2.09
*	1	54.4	5963	11.50	9.89	9.42	7.15	5.86	3.99	2.09
*	2	78.6	8616	16.90	14.64	13.33	10.61	8.68	5.89	3.10
*	2	79.3	8692	17.11	14.77	13.57	10.70	8.77	5.97	3.14
*	2	79.5	8708	17.11	14.80	13.43	10.71	8.78	5.96	3.13
*	2	79.4	8704	17.11	14.82	13.51	10.74	8.78	5.96	3.15
*	3	104.4	11441	22.74	19.69	17.50	14.29	11.72	7.97	4.20
*	3	105.1	11520	22.90	19.82	17.70	14.40	11.80	8.02	4.23
*	3	105.3	11532	22.97	19.87	17.70	14.43	11.83	8.05	4.24
*	3	105.3	11532	22.94	19.87	17.64	14.42	11.82	8.03	4.24
*	4	136.5	14961	30.19	26.14	22.70	19.00	15.59	10.59	5.51
*	4	136.9	15004	30.43	26.37	22.51	19.16	15.70	10.64	5.58
*	4	137.2	15028	30.51	26.43	22.63	19.19	15.74	10.68	5.57
*	4	136.7	14980	30.49	26.41	22.71	19.19	15.71	10.65	5.58

Stn: 200 Lane:F1 Temp: J/C: Air: 64 PvT: 63 08:33

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.0	11389	23.90	20.57	18.44	14.87	12.17	8.30	4.26
	C	104.4	11437	23.85	20.54	18.22	14.86	12.16	8.30	4.28
	C	104.3	11425	23.83	20.52	18.24	14.85	12.16	8.30	4.28
*	1	53.8	5891	11.96	10.28	9.68	7.40	6.06	4.13	2.12
*	1	53.7	5883	11.87	10.21	9.62	7.33	6.01	4.11	2.10
*	1	53.6	5875	11.87	10.20	9.59	7.34	6.01	4.11	2.12
*	1	53.7	5883	11.88	10.22	9.57	7.35	6.01	4.11	2.15
*	2	78.5	8597	17.68	15.19	13.87	10.97	8.97	6.12	3.16

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	2	78.9	8648	17.81	15.30	13.85	11.06	9.04	6.17	3.19
*	2	78.6	8612	17.78	15.28	13.90	11.04	9.02	6.17	3.18
*	2	78.8	8628	17.77	15.26	13.77	11.03	9.02	6.15	3.18
*	3	103.8	11377	23.64	20.37	18.10	14.75	12.08	8.26	4.30
*	3	104.1	11401	23.75	20.46	18.19	14.81	12.13	8.28	4.29
*	3	104.0	11393	23.77	20.46	18.31	14.81	12.14	8.29	4.30
*	3	103.9	11381	23.72	20.43	18.22	14.80	12.12	8.28	4.29
*	4	135.1	14802	31.36	27.01	23.41	19.57	16.03	10.93	5.66
*	4	135.7	14869	31.69	27.24	23.46	19.74	16.16	11.02	5.69
*	4	135.6	14857	31.77	27.31	23.51	19.78	16.19	11.03	5.70
*	4	135.2	14818	31.75	27.29	23.49	19.78	16.17	11.01	5.70

Stn: 225 Lane:F1 Temp: J/C: Air: 64 PvT: 63 08:35

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.1	11401	25.76	22.01	19.06	15.58	12.57	8.37	4.37
	C	104.6	11461	25.75	21.98	19.15	15.57	12.57	8.40	4.39
	C	104.5	11449	25.76	22.01	18.94	15.60	12.59	8.40	4.39
*	1	53.8	5891	12.99	11.05	10.20	7.80	6.30	4.22	2.19
*	1	53.8	5899	13.02	11.08	10.20	7.81	6.31	4.22	2.20
*	1	54.4	5955	13.00	11.06	10.25	7.80	6.31	4.22	2.19
*	1	54.0	5911	12.91	10.98	10.16	7.75	6.27	4.19	2.19
*	2	78.7	8624	19.10	16.32	14.58	11.55	9.32	6.22	3.26
*	2	78.8	8632	19.08	16.29	14.53	11.53	9.30	6.20	3.24
*	2	79.3	8684	19.23	16.44	14.69	11.63	9.39	6.28	3.28
*	2	78.8	8632	19.09	16.32	14.56	11.56	9.33	6.23	3.25
*	3	103.7	11361	25.43	21.76	18.96	15.44	12.48	8.35	4.37
*	3	104.1	11401	25.54	21.85	19.07	15.50	12.51	8.33	4.37
*	3	103.9	11381	25.54	21.87	19.11	15.52	12.53	8.37	4.37
*	3	104.2	11417	25.62	21.91	19.16	15.54	12.55	8.37	4.38
*	4	136.2	14925	33.91	28.97	24.52	20.56	16.62	11.08	5.76
*	4	135.8	14881	34.09	29.14	24.56	20.68	16.69	11.11	5.79
*	4	137.1	15016	34.33	29.35	24.70	20.81	16.79	11.14	5.81
*	4	137.1	15024	34.42	29.44	24.75	20.87	16.82	11.17	5.83

Stn: 250 Lane:F1 Temp: J/C: Air: 64 PvT: 63 08:38

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	104.5	11445	24.95	21.16	18.55	14.74	11.66	7.70	4.03
	C	104.6	11457	24.78	21.02	18.14	14.67	11.61	7.69	4.05
	C	104.5	11445	24.78	21.02	18.11	14.67	11.63	7.70	4.03
*	1	54.2	5943	12.60	10.66	9.79	7.40	5.83	3.87	2.04
*	1	54.0	5911	12.56	10.58	9.74	7.35	5.79	3.85	2.02
*	1	54.3	5947	12.66	10.65	9.84	7.40	5.83	3.87	2.03
*	1	53.9	5907	12.54	10.57	9.74	7.35	5.80	3.85	2.04
*	2	77.9	8537	18.09	15.33	13.74	10.67	8.42	5.58	2.93
*	2	78.4	8589	18.28	15.49	13.86	10.80	8.52	5.65	2.97
*	2	78.6	8612	18.31	15.56	13.83	10.83	8.56	5.67	3.00
*	2	79.2	8672	18.47	15.73	14.10	10.96	8.67	5.74	3.01
*	3	104.5	11453	24.60	20.88	18.22	14.60	11.57	7.66	4.00
*	3	104.7	11469	24.71	21.01	18.30	14.67	11.62	7.70	4.07
*	3	104.9	11489	24.78	21.03	18.37	14.70	11.65	7.71	4.07
*	3	104.0	11389	24.60	20.91	18.30	14.61	11.57	7.67	4.03
*	4	136.4	14941	32.63	27.75	23.62	19.40	15.39	10.18	5.34
*	4	136.3	14937	32.87	27.94	23.50	19.52	15.47	10.22	5.37
*	4	135.7	14865	32.84	27.89	23.50	19.49	15.46	10.20	5.37
*	4	135.9	14889	32.93	27.95	23.59	19.52	15.46	10.22	5.36

Stn: 275 Lane:F1 Temp: J/C: Air: 66 PvT: 63 08:41

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.7	11357	24.04	20.67	18.37	14.85	12.19	8.37	4.50
	C	103.9	11381	23.86	20.49	17.99	14.76	12.13	8.37	4.49
	C	103.8	11369	23.87	20.49	17.99	14.74	12.12	8.37	4.48
*	1	52.9	5792	11.72	9.98	9.28	7.17	5.91	4.14	2.24
*	1	52.8	5788	11.68	10.03	9.26	7.19	5.93	4.11	2.26
*	1	52.8	5788	11.72	10.05	9.28	7.20	5.95	4.12	2.25
*	1	53.0	5808	11.73	10.04	9.21	7.20	5.94	4.13	2.25
*	2	78.2	8565	17.48	14.97	13.43	10.76	8.85	6.15	3.30
*	2	78.5	8601	17.64	15.12	13.50	10.85	8.94	6.19	3.35
*	2	78.5	8601	17.60	15.09	13.50	10.85	8.93	6.17	3.34
*	2	78.7	8624	17.67	15.18	13.54	10.89	8.97	6.19	3.34
*	3	103.7	11361	23.78	20.43	17.87	14.68	12.09	8.35	4.48
*	3	103.9	11385	23.87	20.52	17.94	14.74	12.14	8.37	4.49

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	3	104.1	11405	23.90	20.59	17.98	14.78	12.17	8.37	4.50
*	3	103.9	11385	23.91	20.59	17.95	14.79	12.17	8.37	4.50
*	4	135.8	14877	31.88	27.41	23.35	19.68	16.19	11.10	5.92
*	4	136.3	14937	32.14	27.59	23.23	19.81	16.27	11.16	5.95
*	4	136.0	14905	32.18	27.61	23.43	19.80	16.28	11.17	5.94
*	4	136.1	14917	32.26	27.67	23.45	19.84	16.31	11.18	5.95

Stn: 300 Lane:F1 Temp: J/C: Air: 66 PvT: 63 08:44

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.2	11306	25.69	21.85	19.31	15.48	12.44	8.34	4.37
	C	103.5	11338	25.57	21.73	19.20	15.41	12.41	8.31	4.36
	C	103.8	11369	25.65	21.82	19.13	15.48	12.46	8.35	4.37
*	1	53.0	5812	12.67	10.73	10.15	7.57	6.11	4.11	2.16
*	1	53.0	5812	12.65	10.71	10.05	7.56	6.10	4.11	2.15
*	1	52.7	5772	12.66	10.72	10.04	7.58	6.11	4.12	2.18
*	1	52.4	5740	12.48	10.59	9.90	7.48	6.04	4.06	2.13
*	2	77.6	8505	18.72	15.89	14.49	11.26	9.07	6.07	3.18
*	2	78.4	8585	18.96	16.10	14.59	11.40	9.20	6.15	3.20
*	2	78.2	8565	18.91	16.05	14.61	11.36	9.17	6.13	3.20
*	2	78.5	8597	19.01	16.15	14.65	11.43	9.22	6.17	3.22
*	3	103.2	11302	25.37	21.57	19.06	15.31	12.37	8.28	4.32
*	3	103.6	11354	25.54	21.72	19.23	15.43	12.46	8.34	4.38
*	3	103.7	11361	25.53	21.72	19.21	15.43	12.46	8.34	4.37
*	3	103.5	11342	25.55	21.74	19.31	15.43	12.46	8.34	4.35
*	4	135.4	14829	33.97	28.87	24.94	20.53	16.58	11.05	5.71
*	4	135.4	14833	34.24	29.07	24.83	20.67	16.68	11.11	5.75
*	4	135.7	14865	34.38	29.05	24.82	20.64	16.67	11.08	5.73
*	4	135.8	14881	34.41	29.09	24.69	20.67	16.70	11.08	5.72

Stn: 325 Lane:F1 Temp: J/C: Air: 65 PvT: 63 08:47

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.2	11302	26.16	22.44	19.57	15.82	12.60	8.24	4.19
	C	103.4	11326	26.00	22.37	19.56	15.74	12.57	8.21	4.20
	C	103.6	11350	26.02	22.39	19.37	15.76	12.59	8.23	4.20
*	1	52.8	5784	12.89	11.04	10.09	7.70	6.15	4.03	2.09
*	1	52.8	5788	12.84	11.00	10.11	7.67	6.12	4.01	2.07
*	1	53.0	5804	12.90	11.03	10.20	7.71	6.15	4.04	2.09
*	1	53.1	5816	12.88	11.01	10.20	7.70	6.14	4.04	2.08
*	2	78.0	8541	19.10	16.41	14.60	11.52	9.19	6.00	3.09
*	2	78.0	8545	19.21	16.48	14.70	11.57	9.23	6.04	3.10
*	2	78.5	8601	19.29	16.56	14.74	11.63	9.28	6.07	3.12
*	2	78.1	8557	19.20	16.48	14.77	11.57	9.23	6.04	3.10
*	3	103.5	11338	25.87	22.23	19.35	15.69	12.54	8.20	4.20
*	3	103.8	11377	25.97	22.33	19.48	15.75	12.59	8.24	4.22
*	3	103.8	11369	25.98	22.30	19.44	15.73	12.58	8.23	4.20
*	3	103.7	11365	25.98	22.34	19.50	15.74	12.58	8.23	4.20
*	4	135.6	14853	34.43	29.58	25.17	20.94	16.75	10.94	5.53
*	4	135.4	14837	34.64	29.77	25.05	21.05	16.84	11.00	5.57
*	4	135.4	14833	34.74	29.86	25.08	21.11	16.87	11.02	5.58
*	4	135.2	14814	34.74	29.83	25.00	21.07	16.85	11.00	5.57

Stn: 350 Lane:F1 Temp: J/C: Air: 65 PvT: 62 08:50

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.4	11334	25.05	21.33	18.75	14.84	11.89	7.65	3.85
	C	103.7	11365	24.96	21.26	18.47	14.81	11.87	7.66	3.88
	C	103.8	11377	24.94	21.25	18.44	14.82	11.88	7.67	3.89
*	1	52.5	5752	12.23	10.39	9.61	7.19	5.74	3.71	1.87
*	1	52.8	5784	12.24	10.43	9.63	7.20	5.76	3.72	1.90
*	1	52.6	5760	12.22	10.35	9.59	7.17	5.75	3.72	1.88
*	1	53.1	5820	12.29	10.44	9.69	7.23	5.78	3.75	1.91
*	2	78.1	8557	18.31	15.58	13.99	10.83	8.66	5.59	2.84
*	2	78.5	8597	18.44	15.70	14.05	10.91	8.73	5.64	2.85
*	2	78.4	8589	18.43	15.67	14.13	10.90	8.73	5.63	2.85
*	2	78.6	8612	18.46	15.70	14.10	10.92	8.76	5.65	2.84
*	3	103.5	11338	24.74	21.07	18.49	14.70	11.80	7.62	3.85
*	3	104.1	11401	24.91	21.25	18.79	14.83	11.88	7.68	3.89
*	3	103.8	11377	24.89	21.21	18.65	14.81	11.86	7.67	3.87
*	3	103.8	11373	24.91	21.24	18.63	14.82	11.86	7.67	3.89
*	4	135.8	14881	33.14	28.24	24.21	19.76	15.85	10.22	5.11
*	4	136.3	14929	33.39	28.43	24.06	19.88	15.95	10.28	5.13
*	4	136.4	14949	33.54	28.54	24.08	19.96	16.01	10.32	5.15

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	4	135.7	14873	33.50	28.52	24.15	19.93	15.98	10.30	5.14

Stn: 375 Lane:F1 Temp: J/C: Air: 64 PvT: 61 08:52

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.4	11326	25.05	21.63	19.32	15.31	12.28	8.02	3.91
	C	103.8	11377	24.98	21.57	18.93	15.28	12.27	8.03	3.90
	C	103.8	11373	24.98	21.57	18.98	15.28	12.28	8.04	3.92
*	1	53.0	5804	12.26	10.56	9.83	7.41	5.94	3.88	1.89
*	1	53.1	5820	12.31	10.59	9.82	7.44	5.96	3.90	1.90
*	1	52.9	5796	12.28	10.57	9.80	7.43	5.93	3.88	1.89
*	1	53.2	5824	12.26	10.55	9.78	7.42	5.94	3.89	1.90
*	2	78.0	8541	18.28	15.78	14.24	11.14	8.93	5.84	2.85
*	2	78.4	8593	18.50	15.98	14.43	11.28	9.06	5.92	2.88
*	2	78.5	8605	18.47	15.94	14.46	11.25	9.03	5.91	2.89
*	2	78.3	8581	18.44	15.93	14.38	11.26	9.04	5.91	2.89
*	3	103.6	11354	24.79	21.40	19.02	15.18	12.20	8.00	3.91
*	3	103.9	11381	24.87	21.47	19.09	15.23	12.24	8.01	3.92
*	3	104.0	11389	24.94	21.53	19.14	15.27	12.27	8.03	3.93
*	3	103.7	11361	24.89	21.50	19.08	15.24	12.25	8.02	3.92
*	4	135.5	14841	33.17	28.70	24.94	20.40	16.41	10.73	5.22
*	4	135.4	14837	33.33	28.83	24.47	20.48	16.47	10.78	5.25
*	4	136.2	14921	33.51	28.97	24.50	20.59	16.55	10.83	5.26
*	4	135.7	14865	33.50	28.95	24.36	20.56	16.53	10.83	5.27

Accepted test With Vars.

Stn: 375 Lane:F1 Temp: J/C: Air: 63 PvT: 59 08:55

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.6	11354	25.53	22.02	19.67	15.48	12.42	8.07	3.93
	C	103.9	11381	25.49	22.00	19.36	15.50	12.45	8.09	3.94
	C	103.8	11369	25.44	21.96	19.31	15.47	12.43	8.09	3.93
*	1	52.9	5792	12.54	10.79	9.98	7.54	6.04	3.91	1.90
*	1	53.0	5808	12.54	10.79	10.02	7.53	6.03	3.91	1.91
*	1	53.2	5824	12.52	10.74	9.97	7.51	6.02	3.91	1.91
*	1	53.2	5828	12.51	10.76	10.02	7.52	6.04	3.93	1.91
*	2	78.2	8573	18.63	16.12	14.61	11.32	9.08	5.90	2.86
*	2	78.1	8553	18.59	16.13	14.60	11.33	9.09	5.90	2.88
*	2	78.3	8577	18.65	16.19	14.61	11.37	9.13	5.92	2.89
*	2	78.3	8577	18.69	16.20	14.64	11.38	9.13	5.93	2.90
*	3	103.4	11330	25.16	21.70	19.28	15.32	12.31	8.02	3.91
*	3	103.9	11385	25.32	21.86	19.39	15.43	12.41	8.07	3.94
*	3	104.0	11397	25.33	21.86	19.16	15.43	12.41	8.07	3.93
*	3	103.8	11369	25.28	21.81	19.13	15.40	12.38	8.06	3.93
*	4	135.4	14837	33.33	28.85	24.75	20.44	16.46	10.72	5.24
*	4	135.9	14889	33.59	29.05	24.51	20.59	16.58	10.81	5.26
*	4	135.4	14833	33.51	29.01	24.37	20.54	16.55	10.78	5.26
*	4	135.8	14877	33.56	29.04	24.21	20.56	16.57	10.79	5.27

'ACCEPTED TEST WITH VARAINCE

Stn: 375 Lane:F1 Temp: J/C: Air: 63 PvT: 58 08:59

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.5	11338	25.58	21.97	19.32	15.50	12.43	8.09	3.95
	C	104.3	11425	25.65	22.02	19.41	15.56	12.50	8.14	3.96
	C	104.1	11401	25.56	21.96	19.34	15.52	12.46	8.12	3.95
*	1	53.3	5844	12.67	10.82	9.55	7.58	6.07	3.95	1.92
*	1	53.6	5867	12.67	10.83	9.58	7.60	6.09	3.97	1.93
*	1	53.4	5848	12.59	10.80	9.54	7.57	6.07	3.95	1.91
*	1	53.7	5879	12.63	10.81	9.55	7.58	6.07	3.96	1.92
*	2	78.2	8573	18.80	16.15	14.23	11.37	9.12	5.94	2.88
*	2	78.6	8608	18.91	16.25	14.31	11.44	9.18	5.98	2.91
*	2	78.7	8624	18.94	16.27	14.33	11.46	9.19	5.99	2.91
*	2	78.6	8608	18.91	16.24	14.31	11.45	9.18	5.98	2.91
*	3	103.7	11361	25.33	21.76	19.19	15.39	12.38	8.08	3.93
*	3	104.1	11405	25.44	21.86	19.28	15.47	12.44	8.12	3.96
*	3	104.0	11397	25.42	21.86	19.28	15.47	12.44	8.12	3.96
*	3	104.1	11401	25.46	21.89	19.29	15.48	12.45	8.12	3.96
*	4	135.7	14865	33.39	28.77	25.38	20.45	16.47	10.78	5.25
*	4	135.9	14893	33.60	28.91	25.52	20.56	16.56	10.82	5.27
*	4	135.9	14889	33.63	28.94	25.53	20.56	16.57	10.83	5.26
*	4	135.7	14873	33.65	28.99	25.54	20.62	16.58	10.83	5.30

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

Stn: 400 Lane:F1 Temp: J/C: Air: 64 PvT: 59 09:01

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11298	25.38	21.80	19.18	15.17	12.27	8.04	3.67
	C	103.4	11330	25.27	21.69	19.06	15.14	12.21	7.96	3.75
	C	103.7	11361	25.30	21.73	19.09	15.20	12.23	7.94	3.80
*	1	52.9	5792	12.55	10.70	9.40	7.45	5.96	3.84	1.84
*	1	53.3	5840	12.55	10.69	9.39	7.44	5.94	3.82	1.88
*	1	53.5	5859	12.54	10.69	9.39	7.45	5.96	3.83	1.87
*	1	53.7	5887	12.58	10.74	9.44	7.48	5.98	3.87	1.85
*	2	78.0	8541	18.58	15.96	14.01	11.16	8.94	5.78	2.78
*	2	78.1	8557	18.71	16.09	14.11	11.25	9.00	5.81	2.81
*	2	78.1	8561	18.72	16.07	14.10	11.24	9.00	5.81	2.81
*	2	78.1	8553	18.69	16.04	14.08	11.22	9.00	5.81	2.79
*	3	103.4	11334	25.10	21.57	18.93	15.14	12.14	7.85	3.79
*	3	103.7	11361	25.22	21.66	19.02	15.19	12.19	7.90	3.79
*	3	103.8	11377	25.31	21.73	19.08	15.25	12.23	7.91	3.81
*	3	104.0	11389	25.33	21.76	19.11	15.27	12.25	7.94	3.81
*	4	134.9	14778	33.63	28.92	25.41	20.37	16.35	10.55	5.07
*	4	135.1	14806	33.86	29.11	25.58	20.49	16.43	10.61	5.11
*	4	135.5	14845	34.03	29.26	25.70	20.61	16.53	10.64	5.13
*	4	135.3	14825	34.09	29.28	25.72	20.62	16.52	10.65	5.10

Stn: 425 Lane:F1 Temp: J/C: Air: 66 PvT: 60 09:04

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.3	11318	25.49	21.41	19.07	15.17	12.12	7.97	3.61
	C	103.6	11346	25.39	21.34	18.99	15.13	12.11	7.96	3.66
	C	103.2	11310	25.35	21.44	18.96	15.13	12.12	7.92	3.70
*	1	52.7	5772	12.50	10.41	9.31	7.34	5.85	3.86	1.74
*	1	52.7	5772	12.48	10.38	9.27	7.32	5.84	3.89	1.76
*	1	53.0	5812	12.53	10.43	9.33	7.36	5.87	3.90	1.75
*	1	52.6	5768	12.44	10.35	9.26	7.31	5.83	3.87	1.74
*	2	78.0	8545	18.64	15.62	13.91	11.06	8.83	5.82	2.66
*	2	78.2	8573	18.73	15.67	13.97	11.10	8.87	5.84	2.65
*	2	78.0	8545	18.74	15.68	13.98	11.11	8.87	5.86	2.59
*	2	78.2	8573	18.73	15.72	13.99	11.13	8.89	5.85	2.69
*	3	103.3	11318	25.24	21.28	18.91	15.09	12.09	7.93	3.66
*	3	103.6	11350	25.35	21.36	18.99	15.15	12.13	7.96	3.61
*	3	103.6	11350	25.35	21.37	18.99	15.15	12.14	7.96	3.61
*	3	103.5	11342	25.35	21.34	18.99	15.14	12.12	7.96	3.62
*	4	136.0	14901	33.81	28.58	25.39	20.30	16.28	10.63	4.91
*	4	136.3	14933	34.08	28.81	25.59	20.46	16.41	10.72	4.97
*	4	135.9	14893	34.17	28.81	25.63	20.47	16.40	10.70	4.94
*	4	136.2	14921	34.26	28.93	25.70	20.53	16.46	10.73	4.98

Stn: 450 Lane:F1 Temp: J/C: Air: 65 PvT: 61 09:07

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.7	11250	31.69	30.78	20.50	15.66	12.00	7.41	3.59
	C	103.0	11282	31.54	30.52	20.61	15.74	12.09	7.47	3.61
	C	102.9	11278	31.54	30.52	20.59	15.74	12.08	7.46	3.63
*	1	52.3	5732	16.08	15.77	9.58	7.35	5.69	3.59	1.70
*	1	52.1	5709	16.00	15.68	9.60	7.34	5.68	3.58	1.70
*	1	52.5	5748	15.98	15.66	9.63	7.38	5.71	3.61	1.72
*	1	52.5	5756	16.02	15.72	9.65	7.41	5.73	3.63	1.72
*	2	77.3	8473	23.35	22.70	14.85	11.35	8.72	5.42	2.63
*	2	77.4	8481	23.47	22.85	14.93	11.41	8.77	5.44	2.63
*	2	77.7	8517	23.52	22.86	15.00	11.44	8.80	5.44	2.60
*	2	77.6	8505	23.49	22.89	14.94	11.45	8.80	5.46	2.68
*	3	102.6	11242	31.21	30.12	20.61	15.74	12.09	7.46	3.62
*	3	102.9	11278	31.33	30.26	20.61	15.76	12.09	7.47	3.59
*	3	102.8	11266	31.41	30.33	20.61	15.76	12.09	7.48	3.61
*	3	102.8	11258	31.40	30.35	20.60	15.76	12.09	7.48	3.62
*	4	134.9	14778	41.26	39.61	27.77	21.23	16.27	10.03	4.86
*	4	135.9	14885	41.78	40.18	28.03	21.44	16.43	10.13	4.94
*	4	135.5	14841	41.86	40.16	28.05	21.43	16.41	10.10	4.87
*	4	135.4	14829	41.96	40.24	28.04	21.45	16.42	10.12	4.90

'L-TRANS. CR. BETWEEN D2-D3

Stn: 475 Lane:F1 Temp: J/C: Air: 64 PvT: 61 09:10

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11298	27.44	23.34	20.30	15.95	12.72	8.04	3.94

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

	C	103.1	11294	27.28	23.19	20.15	15.89	12.64	8.00	3.96
	C	103.3	11314	27.31	23.22	20.19	15.92	12.67	8.03	3.97
*	1	52.6	5764	13.50	11.44	9.94	7.76	6.19	3.93	1.93
*	1	52.8	5788	13.48	11.42	9.93	7.75	6.18	3.94	1.93
*	1	52.9	5792	13.46	11.42	9.92	7.77	6.17	3.94	1.94
*	1	52.9	5792	13.48	11.43	9.94	7.77	6.18	3.96	1.94
*	2	77.6	8497	20.00	17.00	14.76	11.63	9.24	5.91	2.91
*	2	77.8	8529	20.16	17.13	14.89	11.70	9.32	5.96	2.92
*	2	77.7	8517	20.16	17.14	14.89	11.72	9.31	5.96	2.92
*	2	78.0	8541	20.16	17.15	14.91	11.72	9.33	5.96	2.93
*	3	103.1	11298	27.13	23.09	20.09	15.86	12.63	8.09	3.98
*	3	103.3	11318	27.19	23.16	20.15	15.90	12.67	8.11	3.97
*	3	103.3	11314	27.20	23.16	20.15	15.91	12.66	8.11	3.98
*	3	103.4	11330	27.29	23.21	20.20	15.93	12.69	8.12	3.97
*	4	135.2	14818	36.20	30.84	26.84	21.24	16.91	10.81	5.29
*	4	135.9	14885	36.54	31.10	27.06	21.41	17.04	10.91	5.31
*	4	135.6	14861	36.64	31.19	27.13	21.47	17.08	10.91	5.32
*	4	136.0	14905	36.77	31.27	27.20	21.54	17.11	10.94	5.33

Stn: 500 Lane:F1 Temp: J/C: Air: 65 PvT: 60 09:14

	Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
		C	103.1	11294	26.39	21.86	19.41	15.12	12.19	8.02	4.07
		C	103.3	11322	26.26	21.80	19.27	15.06	12.15	8.02	4.13
		C	103.4	11326	26.26	21.78	19.29	15.07	12.17	8.02	4.13
*		1	52.6	5768	13.01	10.72	9.52	7.36	5.96	3.95	2.04
*		1	53.0	5804	13.04	10.75	9.52	7.39	5.96	3.97	2.06
*		1	53.0	5808	13.05	10.78	9.54	7.41	5.98	3.98	2.07
*		1	52.9	5792	12.97	10.68	9.51	7.33	5.94	3.94	2.04
*		2	77.8	8529	19.23	15.93	14.17	11.00	8.89	5.87	3.04
*		2	78.0	8541	19.32	16.02	14.26	11.06	8.95	5.91	3.04
*		2	78.2	8573	19.39	16.06	14.31	11.10	8.98	5.94	3.05
*		2	77.8	8529	19.28	15.95	14.26	11.02	8.95	5.91	3.03
*		3	103.1	11298	26.00	21.58	19.15	14.96	12.10	7.99	4.12
*		3	103.3	11314	26.16	21.67	19.27	15.04	12.16	8.02	4.12
*		3	103.5	11342	26.21	21.66	19.36	15.03	12.20	8.03	4.10
*		3	103.3	11318	26.21	21.68	19.33	15.04	12.20	8.03	4.10
*		4	135.9	14889	34.89	28.82	25.80	20.07	16.28	10.67	5.37
*		4	136.9	15000	35.24	29.28	25.83	20.31	16.33	10.74	5.48
*		4	136.1	14913	35.24	29.15	25.94	20.25	16.38	10.75	5.46
*		4	136.1	14909	35.33	29.30	25.91	20.31	16.37	10.76	5.48

Stn: 505 Lane:F1 Temp: J/C: Air: 65 PvT: 61 09:17

	Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
		C	103.2	11310	25.85	22.11	19.52	15.59	12.52	8.41	4.04
		C	103.5	11338	25.67	21.95	19.41	15.52	12.50	8.49	4.03
		C	103.4	11330	25.65	21.92	19.38	15.50	12.49	8.45	4.01
*		1	52.8	5788	12.56	10.72	9.46	7.53	5.99	4.06	2.03
*		1	52.6	5764	12.61	10.75	9.50	7.56	6.04	4.12	1.95
*		1	52.9	5792	12.64	10.78	9.53	7.58	6.07	4.14	1.91
*		1	52.5	5748	12.51	10.63	9.41	7.47	6.01	4.11	1.87
*		2	77.6	8501	18.72	15.99	14.14	11.28	9.12	6.19	2.93
*		2	78.1	8553	18.93	16.17	14.32	11.41	9.21	6.26	2.92
*		2	78.0	8549	18.89	16.13	14.30	11.39	9.20	6.25	2.92
*		2	77.9	8533	18.83	16.10	14.22	11.36	9.16	6.21	2.94
*		3	103.1	11298	25.43	21.80	19.24	15.43	12.42	8.35	4.09
*		3	103.5	11338	25.54	21.91	19.30	15.50	12.42	8.30	4.19
*		3	103.5	11338	25.60	21.96	19.35	15.54	12.44	8.29	4.24
*		3	103.6	11354	25.63	22.00	19.37	15.57	12.44	8.28	4.25
*		4	134.7	14758	34.00	29.20	25.71	20.70	16.57	11.00	5.58
*		4	134.9	14782	34.22	29.38	25.85	20.82	16.64	11.03	5.65
*		4	134.8	14766	34.28	29.42	25.88	20.83	16.65	11.02	5.67
*		4	135.2	14810	34.36	29.49	25.94	20.90	16.71	11.06	5.67

Stn: 510 Lane:F1 Temp: J/C: Air: 64 PvT: 60 09:19

	Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
		C	101.3	11103	35.72	27.52	23.48	17.55	13.56	8.32	4.15
		C	101.4	11111	35.14	27.40	23.06	17.30	13.17	8.38	4.17
		C	101.6	11127	35.07	27.40	23.09	17.39	13.20	8.41	4.19
*		1	51.3	5625	17.54	13.56	11.33	8.39	6.36	4.09	2.03
*		1	51.8	5673	17.48	13.51	11.30	8.38	6.35	4.11	2.06
*		1	51.8	5677	17.47	13.48	11.30	8.37	6.35	4.07	2.02

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	1	52.2	5724	17.49	13.53	11.34	8.40	6.38	4.11	2.06
*	2	76.3	8358	25.75	20.09	16.89	12.62	9.61	6.15	3.08
*	2	76.9	8422	26.00	20.31	17.09	12.78	9.72	6.22	3.11
*	2	76.8	8410	25.92	20.24	17.03	12.73	9.69	6.19	3.11
*	2	76.7	8406	25.96	20.27	17.06	12.76	9.71	6.22	3.11
*	3	101.5	11123	34.59	27.11	22.89	17.23	13.12	8.37	4.18
*	3	101.8	11155	34.84	27.29	23.04	17.32	13.21	8.41	4.19
*	3	101.7	11147	34.85	27.30	23.05	17.32	13.20	8.44	4.19
*	3	101.9	11163	34.96	27.36	23.10	17.35	13.24	8.43	4.20
*	4	132.0	14464	46.13	36.21	30.65	23.16	17.67	11.22	5.57
*	4	132.1	14468	46.57	36.52	30.91	23.33	17.80	11.26	5.57
*	4	132.6	14528	46.83	36.71	31.06	23.43	17.88	11.33	5.60
*	4	132.2	14480	46.89	36.73	31.07	23.44	17.88	11.33	5.61

Stn: 515 Lane:F1 Temp: J/C: Air: 65 PvT: 60 09:22

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11298	25.28	21.65	19.12	15.33	12.33	8.13	4.00
	C	103.4	11326	25.15	21.61	18.98	15.27	12.26	8.06	4.04
	C	103.5	11338	25.15	21.61	18.98	15.27	12.28	8.06	4.04
*	1	52.9	5800	12.46	10.67	9.37	7.47	6.00	3.94	2.01
*	1	53.2	5824	12.51	10.70	9.40	7.50	6.02	3.96	2.00
*	1	52.8	5788	12.46	10.68	9.37	7.48	5.99	3.94	1.99
*	1	52.8	5780	12.47	10.67	9.37	7.49	6.01	3.95	1.98
*	2	77.8	8521	18.50	15.89	13.96	11.21	8.99	5.91	2.97
*	2	78.1	8561	18.66	16.04	14.07	11.31	9.07	5.95	3.00
*	2	78.2	8573	18.67	16.05	14.08	11.31	9.07	5.96	2.99
*	2	78.4	8589	18.66	16.04	14.09	11.32	9.08	5.96	3.00
*	3	103.2	11306	25.00	21.49	18.90	15.22	12.23	8.04	4.04
*	3	103.7	11361	25.15	21.63	19.02	15.31	12.31	8.10	4.07
*	3	103.8	11369	25.18	21.64	19.02	15.32	12.30	8.08	4.05
*	3	103.8	11377	25.20	21.67	19.05	15.34	12.32	8.10	4.05
*	4	135.2	14814	33.28	28.63	25.16	20.29	16.33	10.70	5.33
*	4	135.7	14869	33.53	28.83	25.33	20.42	16.41	10.76	5.36
*	4	135.0	14794	33.59	28.84	25.37	20.43	16.43	10.78	5.35
*	4	135.6	14861	33.72	28.98	25.46	20.52	16.51	10.81	5.38

Stn: 520 Lane:F1 Temp: J/C: Air: 65 PvT: 59 09:24

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.3	11318	24.69	21.14	18.74	14.96	12.14	8.07	4.02
	C	103.3	11318	24.51	21.00	18.60	14.88	12.07	8.01	4.02
	C	103.6	11354	24.59	21.10	18.67	14.95	12.13	8.04	4.04
*	1	52.8	5788	12.16	10.37	9.20	7.29	5.91	3.93	2.00
*	1	53.3	5836	12.26	10.48	9.30	7.35	5.97	3.97	2.01
*	1	52.5	5748	12.00	10.28	9.09	7.22	5.85	3.89	1.99
*	1	52.6	5764	12.13	10.34	9.19	7.27	5.91	3.94	1.98
*	2	77.7	8517	17.99	15.40	13.65	10.89	8.83	5.87	2.95
*	2	78.2	8565	18.19	15.61	13.81	11.04	8.94	5.92	3.00
*	2	78.3	8577	18.20	15.62	13.82	11.04	8.96	5.93	3.00
*	2	78.2	8573	18.19	15.61	13.82	11.04	8.95	5.92	3.00
*	3	103.3	11322	24.39	20.91	18.53	14.83	12.04	7.99	4.02
*	3	103.6	11354	24.49	21.01	18.61	14.91	12.10	8.03	4.04
*	3	103.8	11369	24.53	21.07	18.64	14.93	12.12	8.02	4.05
*	3	103.6	11350	24.46	21.02	18.60	14.90	12.09	8.02	4.02
*	4	134.8	14770	32.37	27.79	24.58	19.77	16.02	10.60	5.32
*	4	135.4	14837	32.64	28.01	24.79	19.91	16.15	10.69	5.37
*	4	135.5	14841	32.73	28.07	24.83	19.94	16.17	10.70	5.37
*	4	135.3	14825	32.81	28.14	24.88	19.99	16.22	10.70	5.37

Stn: 525 Lane:F1 Temp: J/C: Air: 65 PvT: 59 09:27

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.0	11282	23.91	20.50	18.22	14.59	11.80	7.95	3.99
	C	103.1	11298	23.78	20.37	18.09	14.50	11.75	7.89	4.00
	C	103.4	11330	23.78	20.39	18.10	14.52	11.77	7.93	3.98
*	1	52.7	5772	11.87	10.17	9.02	7.18	5.82	3.94	1.99
*	1	52.7	5776	11.80	10.07	8.95	7.11	5.76	3.91	1.98
*	1	52.6	5768	11.82	10.07	8.99	7.13	5.77	3.91	1.99
*	1	52.9	5800	11.82	10.09	8.98	7.14	5.78	3.90	2.00
*	2	77.5	8489	17.48	15.00	13.30	10.65	8.63	5.79	2.97
*	2	77.7	8517	17.60	15.10	13.39	10.72	8.69	5.85	2.98
*	2	77.8	8525	17.57	15.08	13.38	10.70	8.68	5.84	2.97
*	2	77.7	8517	17.56	15.05	13.37	10.69	8.66	5.83	2.96

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	3	103.1	11298	23.63	20.29	17.99	14.44	11.73	7.87	4.00
*	3	103.5	11338	23.76	20.40	18.06	14.50	11.78	7.87	3.99
*	3	103.6	11346	23.77	20.39	18.10	14.52	11.78	7.91	4.00
*	3	103.5	11342	23.78	20.41	18.07	14.51	11.78	7.89	4.00
*	4	134.6	14750	31.44	27.00	23.93	19.25	15.63	10.47	5.26
*	4	135.2	14818	31.64	27.14	24.11	19.35	15.71	10.54	5.30
*	4	135.0	14786	31.74	27.21	24.17	19.42	15.75	10.57	5.27
*	4	135.0	14790	31.85	27.31	24.24	19.45	15.80	10.59	5.31

Stn: 530 Lane:F1 Temp: J/C: Air: 65 PvT: 60 09:30

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.9	11270	23.76	20.41	17.88	14.50	11.70	7.86	4.02
	C	103.5	11338	23.73	20.37	17.83	14.48	11.69	7.88	4.03
	C	103.7	11361	23.78	20.47	17.89	14.53	11.76	7.88	4.06
*	1	52.4	5740	11.82	10.09	8.83	7.11	5.76	3.87	2.00
*	1	52.2	5716	11.56	9.87	8.67	7.00	5.65	3.83	1.95
*	1	52.1	5713	11.63	9.94	8.70	7.02	5.68	3.83	1.97
*	1	52.7	5772	11.76	10.07	8.79	7.11	5.75	3.88	2.00
*	2	77.6	8501	17.42	14.92	13.07	10.60	8.57	5.76	2.95
*	2	77.9	8537	17.58	15.08	13.18	10.70	8.64	5.80	2.98
*	2	78.1	8553	17.60	15.08	13.20	10.72	8.66	5.82	2.98
*	2	78.0	8541	17.56	15.09	13.18	10.69	8.65	5.79	2.99
*	3	103.0	11286	23.53	20.22	17.70	14.40	11.65	7.82	4.02
*	3	103.7	11357	23.68	20.36	17.82	14.49	11.73	7.86	4.03
*	3	103.6	11354	23.70	20.41	17.84	14.51	11.75	7.87	4.04
*	3	103.7	11357	23.71	20.37	17.84	14.51	11.75	7.88	4.03
*	4	135.1	14802	31.44	27.03	23.67	19.29	15.61	10.44	5.32
*	4	135.0	14790	31.65	27.15	23.80	19.37	15.69	10.50	5.34
*	4	135.3	14825	31.73	27.25	23.85	19.41	15.72	10.51	5.36
*	4	135.0	14790	31.81	27.31	23.91	19.46	15.74	10.53	5.36

Stn: 535 Lane:F1 Temp: J/C: Air: 66 PvT: 61 09:32

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.3	11318	23.74	20.32	17.82	14.50	11.81	7.94	4.02
	C	103.3	11322	23.53	20.14	17.65	14.37	11.73	7.86	4.04
	C	103.2	11306	23.49	20.10	17.64	14.35	11.73	7.87	4.00
*	1	52.6	5768	11.68	9.99	8.74	7.07	5.77	3.87	1.99
*	1	52.8	5784	11.63	9.91	8.66	7.02	5.72	3.84	1.98
*	1	52.9	5800	11.64	9.94	8.68	7.03	5.73	3.83	1.99
*	1	52.6	5760	11.54	9.85	8.62	6.96	5.69	3.82	1.97
*	2	77.3	8465	17.20	14.72	12.91	10.48	8.56	5.74	2.94
*	2	77.9	8533	17.44	14.93	13.07	10.63	8.67	5.81	2.95
*	2	77.8	8521	17.38	14.90	13.06	10.62	8.66	5.81	2.96
*	2	77.7	8513	17.39	14.88	13.05	10.60	8.65	5.81	2.95
*	3	103.2	11306	23.36	20.01	17.57	14.30	11.68	7.84	4.01
*	3	103.3	11322	23.43	20.06	17.61	14.33	11.72	7.85	3.99
*	3	103.5	11338	23.49	20.11	17.66	14.37	11.74	7.87	3.99
*	3	103.6	11350	23.54	20.13	17.69	14.39	11.76	7.89	3.98
*	4	134.4	14722	31.19	26.73	23.48	19.14	15.61	10.46	5.30
*	4	134.6	14746	31.35	26.85	23.59	19.22	15.66	10.49	5.31
*	4	134.6	14746	31.45	26.95	23.65	19.26	15.72	10.51	5.32
*	4	134.4	14730	31.50	26.98	23.68	19.32	15.74	10.52	5.33

Stn: 540 Lane:F1 Temp: J/C: Air: 66 PvT: 61 09:35

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11298	23.96	20.57	18.29	14.62	11.95	8.03	4.11
	C	103.6	11354	23.90	20.66	18.20	14.64	11.91	8.00	4.16
	C	103.3	11322	23.83	20.60	18.13	14.59	11.88	8.00	4.14
*	1	52.6	5768	11.86	10.20	8.98	7.17	5.83	3.93	2.04
*	1	52.8	5784	11.81	10.17	8.96	7.15	5.81	3.92	2.04
*	1	52.4	5744	11.70	10.09	8.88	7.10	5.78	3.90	2.02
*	1	52.9	5792	11.76	10.10	8.91	7.13	5.80	3.91	2.02
*	2	77.5	8493	17.49	15.07	13.30	10.65	8.70	5.84	3.03
*	2	78.0	8549	17.67	15.24	13.44	10.78	8.79	5.89	3.07
*	2	78.1	8561	17.65	15.23	13.43	10.78	8.78	5.89	3.06
*	2	77.9	8533	17.57	15.17	13.36	10.73	8.73	5.87	3.05
*	3	103.1	11298	23.70	20.47	18.06	14.53	11.85	7.97	4.13
*	3	103.7	11361	23.80	20.54	18.13	14.59	11.89	8.00	4.14
*	3	103.3	11322	23.80	20.52	18.13	14.57	11.89	7.99	4.13
*	3	103.2	11310	23.78	20.54	18.11	14.57	11.87	7.99	4.14
*	4	134.9	14782	31.54	27.26	24.05	19.38	15.80	10.60	5.47

File: C:\FWD\DATA\469187C1.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	4	134.8	14766	31.70	27.36	24.15	19.46	15.85	10.63	5.48
*	4	134.9	14778	31.82	27.46	24.22	19.54	15.92	10.66	5.50
*	4	135.0	14790	31.91	27.56	24.28	19.59	15.96	10.68	5.52

Mileage:-.008 -> .102

09:39 940609 EXTRA TESTS FOR SMP

OK

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

Stn: -40 Lane:F3 Temp: J/C: Air: 68 PvT: 64 09:41

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.2	11306	27.60	23.91	21.19	16.93	13.60	8.83	4.28
	C	103.9	11381	27.80	24.09	21.33	17.06	13.70	8.87	4.31
	C	103.9	11385	27.84	24.12	21.37	17.09	13.73	8.89	4.32
*	1	52.9	5800	13.76	11.84	10.54	8.31	6.67	4.33	2.09
*	1	52.8	5780	13.64	11.75	10.43	8.24	6.60	4.29	2.07
*	1	53.1	5820	13.74	11.81	10.50	8.30	6.65	4.32	2.09
*	1	52.7	5776	13.62	11.72	10.41	8.23	6.60	4.29	2.07
*	2	77.9	8533	20.42	17.64	15.68	12.47	10.02	6.52	3.15
*	2	78.0	8541	20.66	17.83	15.82	12.59	10.11	6.56	3.18
*	2	78.1	8553	20.69	17.85	15.84	12.61	10.13	6.57	3.19
*	2	78.1	8557	20.67	17.85	15.82	12.61	10.12	6.55	3.18
*	3	103.4	11326	27.63	23.90	21.23	16.96	13.66	8.88	4.29
*	3	103.8	11373	27.74	24.02	21.31	17.04	13.70	8.90	4.32
*	3	103.9	11381	27.76	24.07	21.35	17.07	13.73	8.90	4.33
*	3	103.9	11385	27.83	24.07	21.42	17.10	13.79	8.97	4.32
*	4	134.0	14682	36.49	31.61	28.09	22.55	18.17	11.78	5.72
*	4	134.2	14706	36.69	31.69	28.30	22.65	18.31	11.93	5.74
*	4	134.2	14706	36.87	31.85	28.39	22.73	18.37	11.94	5.76
*	4	133.8	14659	36.83	31.79	28.33	22.70	18.35	11.92	5.73

Stn: -35 Lane:F3 Temp: J/C: Air: 67 PvT: 63 09:44

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.7	11254	28.58	24.71	21.80	17.41	13.96	9.11	4.40
	C	103.1	11294	28.50	24.65	21.77	17.39	13.96	9.11	4.40
	C	103.4	11334	28.59	24.73	21.84	17.45	14.02	9.15	4.41
*	1	52.5	5752	14.08	12.13	10.70	8.47	6.76	4.41	2.13
*	1	52.7	5772	14.09	12.12	10.69	8.45	6.76	4.41	2.15
*	1	53.0	5812	14.12	12.14	10.71	8.47	6.77	4.41	2.14
*	1	53.2	5832	14.10	12.14	10.71	8.46	6.76	4.40	2.13
*	2	77.5	8489	20.98	18.11	15.98	12.73	10.19	6.64	3.21
*	2	77.7	8517	21.15	18.26	16.11	12.85	10.29	6.70	3.24
*	2	78.0	8541	21.20	18.31	16.17	12.88	10.32	6.72	3.25
*	2	78.1	8557	21.26	18.35	16.21	12.91	10.34	6.74	3.25
*	3	103.1	11294	28.31	24.49	21.65	17.33	13.92	9.09	4.39
*	3	103.3	11318	28.42	24.59	21.73	17.39	13.98	9.13	4.40
*	3	103.3	11314	28.43	24.60	21.76	17.40	13.98	9.13	4.41
*	3	103.3	11314	28.43	24.60	21.74	17.40	13.98	9.13	4.40
*	4	132.8	14551	37.40	32.37	28.65	23.02	18.54	12.12	5.85
*	4	133.2	14595	37.57	32.52	28.78	23.15	18.63	12.19	5.86
*	4	132.8	14555	37.65	32.56	28.79	23.20	18.65	12.20	5.86
*	4	133.1	14583	37.74	32.63	28.85	23.27	18.68	12.24	5.87

Stn: -30 Lane:F3 Temp: J/C: Air: 68 PvT: 64 09:47

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.5	11230	29.66	25.72	22.55	18.22	14.45	9.26	4.43
	C	103.4	11330	29.69	25.74	22.58	18.26	14.50	9.33	4.46
	C	102.9	11274	29.59	25.64	22.51	18.21	14.47	9.30	4.44
*	1	52.9	5792	14.69	12.65	11.09	8.89	7.01	4.49	2.11
*	1	52.4	5736	14.59	12.59	11.05	8.87	7.00	4.48	2.14
*	1	52.6	5768	14.63	12.58	11.02	8.83	6.98	4.48	2.14
*	1	52.6	5768	14.62	12.60	11.05	8.86	7.00	4.50	2.15
*	2	77.7	8513	21.81	18.85	16.55	13.35	10.57	6.79	3.23
*	2	77.8	8525	21.98	19.00	16.69	13.45	10.65	6.82	3.22
*	2	77.7	8517	21.92	18.95	16.64	13.43	10.64	6.83	3.26
*	2	78.7	8624	22.31	19.29	16.94	13.67	10.83	6.97	3.31
*	3	103.3	11322	29.50	25.51	22.43	18.15	14.43	9.32	4.39
*	3	103.3	11322	29.56	25.58	22.50	18.22	14.50	9.32	4.47
*	3	103.7	11357	29.61	25.64	22.54	18.25	14.50	9.32	4.49
*	3	103.7	11361	29.66	25.63	22.56	18.25	14.52	9.33	4.48
*	4	133.2	14591	38.85	33.63	29.63	24.07	19.18	12.38	5.83
*	4	133.0	14571	39.05	33.74	29.73	24.18	19.26	12.42	5.85
*	4	133.5	14623	39.25	33.89	29.88	24.25	19.34	12.51	5.84
*	4	133.0	14567	39.21	33.80	29.83	24.23	19.32	12.45	5.93

Stn: -25 Lane:F3 Temp: J/C: Air: 68 PvT: 63 09:49

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.3	11210	30.26	25.92	22.86	18.34	14.56	9.30	4.43
	C	102.8	11258	30.21	25.87	22.85	18.35	14.59	9.32	4.44

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

	C	102.5	11234	30.17	25.85	22.79	18.31	14.55	9.32	4.45
*	1	52.3	5728	14.90	12.70	11.19	8.91	7.03	4.49	2.15
*	1	52.1	5709	14.79	12.61	11.09	8.84	6.98	4.46	2.13
*	1	52.3	5728	14.80	12.60	11.12	8.85	7.00	4.47	2.14
*	1	52.5	5748	14.89	12.70	11.19	8.91	7.04	4.50	2.15
*	2	77.2	8458	22.20	19.01	16.76	13.42	10.65	6.81	3.26
*	2	77.4	8477	22.35	19.14	16.86	13.52	10.71	6.85	3.28
*	2	77.7	8517	22.38	19.17	16.89	13.54	10.73	6.86	3.29
*	2	77.9	8537	22.41	19.19	16.93	13.57	10.76	6.87	3.28
*	3	102.8	11262	30.01	25.72	22.71	18.27	14.52	9.30	4.44
*	3	102.7	11254	30.04	25.77	22.73	18.29	14.52	9.30	4.44
*	3	102.7	11254	30.11	25.76	22.79	18.34	14.58	9.32	4.42
*	3	102.6	11242	30.05	25.77	22.75	18.31	14.54	9.32	4.44
*	4	132.8	14551	39.60	34.00	30.02	24.23	19.30	12.40	5.90
*	4	132.8	14547	39.86	34.21	30.19	24.40	19.41	12.46	5.93
*	4	132.6	14532	39.98	34.25	30.22	24.40	19.41	12.42	5.81
*	4	132.8	14551	39.97	34.27	30.24	24.42	19.45	12.48	5.92

Stn: -20 Lane:F3 Temp: J/C: Air: 68 PvT: 63 09:52

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	101.8	11159	30.77	26.54	23.27	18.40	14.57	9.37	4.39
	C	103.4	11330	31.00	26.76	23.42	18.58	14.73	9.46	4.45
	C	102.6	11246	30.75	26.49	23.20	18.41	14.59	9.40	4.42
*	1	54.0	5915	15.83	13.54	11.88	9.34	7.34	4.76	2.19
*	1	52.7	5772	15.35	13.15	11.50	9.04	7.13	4.61	2.15
*	1	53.9	5907	15.81	13.62	11.88	9.33	7.38	4.71	2.23
*	1	52.8	5788	15.26	13.09	11.46	9.00	7.10	4.59	2.13
*	2	77.7	8513	23.07	19.91	17.39	13.76	10.89	7.00	3.31
*	2	77.9	8537	23.11	19.91	17.42	13.78	10.89	7.02	3.29
*	2	77.3	8473	22.74	19.60	17.13	13.56	10.74	6.89	3.25
*	2	77.6	8505	22.85	19.72	17.24	13.65	10.80	6.95	3.27
*	3	102.5	11226	30.43	26.23	22.97	18.23	14.48	9.31	4.39
*	3	102.9	11274	30.60	26.28	23.10	18.37	14.53	9.44	4.41
*	3	102.9	11274	30.67	26.37	23.15	18.41	14.57	9.47	4.41
*	3	104.3	11425	31.09	26.85	23.49	18.67	14.82	9.50	4.49
*	4	132.2	14484	40.13	34.60	30.34	24.22	19.24	12.39	5.84
*	4	133.8	14659	40.77	35.12	30.80	24.56	19.56	12.56	5.94
*	4	134.0	14679	40.96	35.17	30.91	24.69	19.60	12.65	5.96
*	4	134.3	14710	41.07	35.23	30.99	24.75	19.63	12.70	5.96

Stn: -15 Lane:F3 Temp: J/C: Air: 69 PvT: 63 09:55

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.4	11326	31.06	27.02	23.63	18.93	14.97	9.51	4.53
	C	103.6	11354	30.96	26.90	23.58	18.89	14.94	9.54	4.50
	C	103.7	11361	31.00	26.90	23.61	18.90	14.96	9.56	4.50
*	1	54.0	5919	15.86	13.64	12.03	9.50	7.47	4.70	2.11
*	1	54.4	5963	15.81	13.63	11.98	9.46	7.44	4.67	2.13
*	1	53.9	5907	15.67	13.57	11.87	9.41	7.41	4.66	2.18
*	1	53.7	5879	15.72	13.50	11.96	9.43	7.43	4.66	2.07
*	2	77.9	8537	23.06	20.05	17.48	14.00	11.07	7.00	3.39
*	2	78.4	8585	23.22	20.15	17.65	14.11	11.15	7.08	3.43
*	2	78.3	8577	23.21	20.20	17.59	14.13	11.17	7.06	3.44
*	2	78.0	8545	23.09	20.09	17.50	14.05	11.11	6.98	3.43
*	3	103.9	11385	30.83	26.77	23.48	18.83	14.91	9.57	4.52
*	3	104.0	11389	30.94	26.93	23.50	18.92	14.99	9.48	4.58
*	3	104.1	11405	31.00	27.05	23.52	18.97	15.04	9.49	4.65
*	3	103.8	11369	30.94	26.97	23.48	18.93	15.00	9.43	4.61
*	4	134.7	14754	40.78	35.47	30.98	25.04	19.88	12.57	6.09
*	4	134.6	14742	40.98	35.61	31.14	25.13	19.96	12.69	6.00
*	4	134.5	14734	41.15	35.53	31.26	25.19	20.01	12.75	6.05
*	4	134.6	14742	41.22	35.60	31.24	25.23	20.04	12.70	6.11

Stn: -10 Lane:F3 Temp: J/C: Air: 69 PvT: 64 09:57

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.9	11270	32.53	27.76	24.06	18.96	14.98	9.46	4.45
	C	102.9	11278	32.42	27.69	23.96	18.87	14.93	9.46	4.37
	C	103.3	11318	32.50	27.73	24.01	18.91	14.98	9.48	4.52
*	1	53.3	5836	16.51	14.05	12.15	9.46	7.46	4.67	2.24
*	1	53.7	5887	16.54	14.15	12.17	9.49	7.50	4.69	2.45V
*	1	53.3	5840	16.43	14.00	12.11	9.44	7.45	4.69	2.22
*	1	53.8	5899	16.56	14.10	12.15	9.48	7.49	4.70	2.36

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	2	77.5	8493	24.20	20.53	17.86	14.02	11.04	6.97	3.30
*	2	77.5	8493	24.20	20.56	17.88	14.04	11.07	6.98	3.29
*	2	77.8	8521	24.27	20.68	17.93	14.08	11.13	7.01	3.31
*	2	77.5	8493	24.17	20.55	17.85	14.02	11.06	6.98	3.20
*	3	103.3	11318	32.25	27.48	23.89	18.83	14.89	9.45	4.39
*	3	103.6	11354	32.39	27.66	24.00	18.92	14.98	9.49	4.40
*	3	103.5	11338	32.43	27.67	24.00	18.92	14.99	9.49	4.41
*	3	103.4	11334	32.43	27.68	24.01	18.93	15.00	9.49	4.49
*	4	133.5	14631	42.59	36.39	31.54	24.96	19.81	12.54	6.04
*	4	133.2	14595	42.79	36.44	31.65	25.03	19.85	12.59	6.01
*	4	133.5	14623	43.02	36.63	31.79	25.15	19.97	12.66	5.96
*	4	133.3	14607	43.07	36.63	31.83	25.17	19.95	12.67	6.00

'ACCEPTED TEST WITH VARAINCE

Stn: -10 Lane:F3 Temp: J/C: Air: 69 PvT: 64 10:00

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11294	33.14	28.34	24.45	19.22	15.13	9.50	4.50
	C	103.4	11334	33.04	28.26	24.41	19.20	15.13	9.51	4.55
	C	103.4	11330	33.00	28.21	24.38	19.17	15.13	9.51	4.57
*	1	53.8	5891	16.71	14.31	12.33	9.59	7.53	4.67	2.26
*	1	53.6	5867	16.68	14.29	12.32	9.59	7.52	4.66	2.24
*	1	53.9	5907	16.74	14.32	12.36	9.63	7.57	4.72	2.25
*	1	53.2	5832	16.54	14.13	12.20	9.49	7.46	4.67	2.25
*	2	77.7	8509	24.59	20.96	18.09	14.18	11.14	7.04	3.34
*	2	77.7	8517	24.71	21.03	18.18	14.26	11.19	7.08	3.33
*	2	77.7	8509	24.66	20.98	18.15	14.23	11.18	7.08	3.33
*	2	77.8	8521	24.67	21.07	18.17	14.25	11.21	7.05	3.38
*	3	103.3	11318	32.76	28.02	24.22	19.07	15.04	9.44	4.54
*	3	103.6	11346	32.87	28.07	24.29	19.13	15.10	9.50	4.55
*	3	103.6	11350	32.91	28.17	24.32	19.16	15.12	9.47	4.56
*	3	103.4	11326	32.84	28.07	24.26	19.11	15.07	9.48	4.55
*	4	133.3	14607	42.74	36.60	31.67	25.04	19.83	12.47	6.03
*	4	133.6	14639	43.02	36.81	31.85	25.20	19.96	12.56	6.08
*	4	133.2	14591	43.03	36.80	31.85	25.19	19.96	12.55	6.07
*	4	133.0	14571	42.94	36.63	31.78	25.13	19.87	12.59	6.02

Stn: -5 Lane:F3 Temp: J/C: Air: 68 PvT: 64 10:03

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.4	11214	31.76	27.40	24.00	18.79	14.94	9.50	4.49
	C	102.8	11258	31.72	27.37	23.93	18.76	14.96	9.47	4.51
	C	102.6	11238	31.66	27.31	23.89	18.72	14.94	9.47	4.52
*	1	52.3	5732	15.68	13.54	11.82	9.15	7.25	4.57	2.15
*	1	51.5	5637	15.39	13.28	11.59	9.00	7.13	4.51	2.15
*	1	52.0	5697	15.41	13.30	11.59	8.99	7.15	4.49	2.18
*	1	52.0	5693	15.43	13.31	11.62	9.02	7.17	4.52	2.17
*	2	77.0	8442	23.27	20.08	17.54	13.71	10.90	6.89	3.30
*	2	76.9	8422	23.33	20.13	17.60	13.77	10.95	6.93	3.29
*	2	77.0	8442	23.30	20.11	17.57	13.74	10.93	6.90	3.28
*	2	76.9	8426	23.26	20.10	17.56	13.75	10.94	6.91	3.28
*	3	102.1	11183	31.16	26.91	23.58	18.52	14.76	9.38	4.45
*	3	102.3	11210	31.37	27.08	23.72	18.64	14.87	9.43	4.50
*	3	102.3	11207	31.37	27.10	23.72	18.64	14.88	9.43	4.51
*	3	102.3	11210	31.39	27.11	23.73	18.65	14.89	9.43	4.52
*	4	131.7	14424	41.13	35.50	31.12	24.54	19.64	12.49	5.93
*	4	132.4	14504	41.45	35.76	31.35	24.72	19.80	12.59	6.00
*	4	132.2	14488	41.63	35.90	31.49	24.83	19.85	12.64	6.01
*	4	131.7	14432	41.64	35.90	31.47	24.83	19.85	12.63	6.00

'L-TRANS.CR. 1' FRONT OF D7

Stn: 0 Lane:F3 Temp: J/C: Air: 69 PvT: 65 10:06

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	100.8	11048	39.99	24.95	21.27	16.55	12.93	8.24	4.19
	C	101.0	11064	39.34	25.20	21.50	16.72	13.06	8.33	4.17
	C	101.0	11064	39.25	25.26	21.56	16.76	13.11	8.36	4.18
*	1	51.0	5585	20.70	11.10	9.63	7.59	6.05	3.96	2.01
*	1	51.2	5609	20.62	11.10	9.62	7.56	6.00	3.91	1.96
*	1	51.3	5625	20.66	11.16	9.69	7.62	6.06	3.95	1.98
*	1	51.4	5633	20.69	11.21	9.71	7.63	6.05	3.96	2.02
*	2	76.0	8322	29.69	17.90	15.35	11.98	9.43	6.06	3.03

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	2	76.2	8350	29.91	18.12	15.52	12.13	9.52	6.11	3.08
*	2	76.3	8362	29.88	18.15	15.53	12.11	9.52	6.11	3.08
*	2	76.3	8362	29.87	18.17	15.55	12.14	9.53	6.14	3.07
*	3	100.8	11040	38.68	25.29	21.64	16.82	13.15	8.35	4.14
*	3	101.4	11107	38.96	25.46	21.76	16.93	13.22	8.42	4.20
*	3	101.5	11123	39.07	25.44	21.85	17.01	13.31	8.43	4.15
*	3	101.4	11111	39.06	25.44	21.85	17.03	13.32	8.44	4.18
*	4	131.3	14385	50.03	34.29	29.47	22.91	17.89	11.22	5.50
*	4	131.3	14381	50.43	34.51	29.56	23.00	17.94	11.31	5.61
*	4	131.8	14440	50.84	34.68	29.72	23.12	18.04	11.38	5.62
*	4	131.7	14432	50.88	34.70	29.67	23.09	18.02	11.39	5.65

'L-TRANS.CR. BETWEEN D2-D3

Stn: 25 Lane:F3 Temp: J/C: Air: 69 PvT: 69 10:09

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	101.7	11147	31.80	26.41	22.78	17.93	14.02	8.83	4.32
	C	102.3	11207	31.59	26.25	22.68	17.89	14.00	8.83	4.33
	C	102.5	11230	31.66	26.30	22.75	17.94	14.05	8.85	4.35
*	1	52.1	5705	15.68	12.92	11.18	8.71	6.78	4.22	2.07
*	1	52.7	5772	15.85	13.06	11.30	8.79	6.84	4.28	2.08
*	1	52.4	5736	15.70	12.96	11.18	8.72	6.80	4.27	2.09
*	1	52.3	5732	15.57	12.84	11.10	8.65	6.74	4.22	2.06
*	2	77.0	8442	23.22	19.27	16.67	13.09	10.22	6.42	3.14
*	2	77.4	8481	23.43	19.41	16.87	13.22	10.32	6.42	3.17
*	2	77.4	8481	23.41	19.41	16.83	13.21	10.33	6.46	3.19
*	2	77.3	8469	23.35	19.31	16.80	13.18	10.29	6.40	3.14
*	3	102.0	11179	31.20	25.95	22.48	17.75	13.91	8.80	4.32
*	3	102.7	11254	31.47	26.15	22.69	17.91	14.03	8.79	4.31
*	3	103.2	11310	31.68	26.37	22.84	18.03	14.14	8.87	4.37
*	3	102.8	11262	31.58	26.27	22.75	17.97	14.09	8.83	4.33
*	4	131.5	14408	41.46	34.54	29.93	23.73	18.65	11.81	5.82
*	4	131.7	14432	41.79	34.80	30.11	23.92	18.79	11.91	5.85
*	4	132.0	14460	41.99	34.84	30.28	23.99	18.85	11.89	5.84
*	4	131.9	14456	42.05	34.87	30.31	24.00	18.87	11.91	5.84

Stn: 50 Lane:F3 Temp: J/C: Air: 69 PvT: 69 10:12

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	101.6	11127	33.62	27.93	23.81	18.07	13.97	8.68	4.31
	C	102.0	11175	33.39	27.75	23.71	18.02	13.97	8.69	4.34
	C	102.0	11179	33.36	27.69	23.69	18.01	13.96	8.78	4.30
*	1	52.3	5728	16.69	13.69	11.69	8.69	6.69	4.31	2.03
*	1	52.4	5740	16.71	13.74	11.74	8.74	6.74	4.40	2.03
*	1	52.3	5732	16.71	13.69	11.70	8.71	6.69	4.39	2.01
*	1	52.5	5748	16.68	13.67	11.68	8.70	6.69	4.43	1.97
*	2	76.6	8394	24.56	20.33	17.40	13.13	10.12	6.51	3.09
*	2	77.0	8442	24.71	20.44	17.49	13.19	10.17	6.58	3.09
*	2	77.1	8450	24.76	20.52	17.56	13.26	10.24	6.55	3.12
*	2	77.2	8454	24.80	20.54	17.59	13.30	10.25	6.55	3.14
*	3	102.4	11222	33.09	27.46	23.57	17.94	13.89	8.83	4.30
*	3	102.4	11214	33.14	27.53	23.59	17.97	13.93	8.79	4.31
*	3	102.1	11187	33.11	27.50	23.59	17.94	13.92	8.81	4.27
*	3	102.0	11179	33.11	27.50	23.58	17.95	13.93	8.81	4.28
*	4	131.3	14381	43.41	36.12	30.99	23.73	18.47	11.54	5.75
*	4	131.1	14361	43.72	36.34	31.18	23.84	18.59	11.59	5.81
*	4	131.0	14349	43.79	36.35	31.20	23.82	18.58	11.69	5.77
*	4	131.3	14381	44.00	36.47	31.30	23.92	18.65	11.71	5.81

Stn: 75 Lane:F3 Temp: J/C: Air: 69 PvT: 69 10:14

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.1	11183	31.78	26.17	22.46	17.34	13.47	8.45	4.37
	C	102.4	11214	31.58	26.02	22.39	17.31	13.46	8.48	4.39
	C	102.7	11254	31.61	26.09	22.43	17.34	13.52	8.52	4.41
*	1	51.8	5681	15.70	12.85	11.05	8.44	6.52	4.14	2.15
*	1	52.3	5732	15.79	13.02	11.17	8.54	6.61	4.17	2.15
*	1	52.1	5709	15.72	12.92	11.08	8.48	6.56	4.14	2.15
*	1	52.2	5716	15.71	12.91	11.09	8.47	6.56	4.15	2.18
*	2	77.2	8454	23.41	19.35	16.62	12.79	9.94	6.27	3.25
*	2	77.3	8469	23.41	19.33	16.63	12.80	9.94	6.27	3.26
*	2	77.2	8458	23.42	19.35	16.63	12.81	9.94	6.26	3.24
*	2	77.4	8477	23.45	19.38	16.66	12.84	9.96	6.28	3.24

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	3	102.5	11234	31.25	25.83	22.27	17.24	13.44	8.48	4.40
*	3	102.3	11210	31.26	25.85	22.29	17.25	13.45	8.49	4.38
*	3	102.5	11230	31.34	25.94	22.36	17.32	13.50	8.53	4.40
*	3	102.6	11246	31.37	25.94	22.38	17.34	13.51	8.52	4.40
*	4	131.3	14385	41.03	33.91	29.30	22.78	17.82	11.25	5.80
*	4	131.9	14452	41.33	34.14	29.49	22.93	17.94	11.33	5.83
*	4	131.7	14424	41.41	34.21	29.54	22.98	17.98	11.35	5.83
*	4	131.7	14432	41.54	34.32	29.65	23.06	18.05	11.39	5.85

Stn: 100 Lane:F3 Temp: J/C: Air: 70 PvT: 70 10:17

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.5	11230	30.45	25.47	21.87	16.93	13.30	8.39	4.36
	C	102.8	11266	30.31	25.31	21.78	16.91	13.30	8.42	4.33
	C	102.9	11270	30.30	25.36	21.81	16.93	13.32	8.43	4.34
*	1	52.2	5716	15.11	12.61	10.81	8.29	6.48	4.09	2.13
*	1	53.3	5836	15.32	12.81	10.97	8.40	6.57	4.13	2.15
*	1	52.8	5780	15.11	12.61	10.82	8.31	6.49	4.10	2.12
*	1	53.3	5836	15.27	12.77	10.94	8.39	6.56	4.15	2.19
*	2	77.6	8501	22.57	18.93	16.26	12.59	9.88	6.24	3.24
*	2	77.6	8505	22.56	18.92	16.27	12.59	9.89	6.24	3.21
*	2	77.4	8477	22.44	18.81	16.17	12.51	9.82	6.20	3.21
*	2	77.2	8461	22.46	18.84	16.19	12.52	9.83	6.20	3.22
*	3	103.0	11286	30.03	25.20	21.69	16.85	13.27	8.40	4.35
*	3	103.1	11298	30.11	25.24	21.74	16.90	13.31	8.43	4.35
*	3	103.2	11302	30.15	25.26	21.76	16.92	13.32	8.44	4.34
*	3	103.0	11282	30.11	25.26	21.74	16.91	13.31	8.43	4.36
*	4	132.0	14460	39.39	33.05	28.52	22.27	17.60	11.17	5.75
*	4	132.8	14547	39.79	33.34	28.78	22.48	17.77	11.27	5.78
*	4	132.6	14532	39.87	33.40	28.83	22.52	17.79	11.29	5.78
*	4	132.6	14532	39.95	33.43	28.87	22.54	17.80	11.30	5.78

Stn: 125 Lane:F3 Temp: J/C: Air: 69 PvT: 69 10:20

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.1	11183	28.88	24.46	21.23	16.81	13.37	8.48	4.22
	C	102.6	11242	28.75	24.34	21.15	16.78	13.34	8.49	4.22
	C	102.5	11226	28.74	24.34	21.16	16.80	13.35	8.48	4.22
*	1	52.7	5776	14.43	12.23	10.59	8.32	6.57	4.15	2.07
*	1	53.0	5812	14.57	12.29	10.66	8.37	6.63	4.17	2.10
*	1	52.7	5772	14.45	12.20	10.59	8.32	6.60	4.16	2.07
*	1	53.0	5812	14.46	12.20	10.59	8.31	6.58	4.13	2.07
*	2	77.0	8438	21.41	18.11	15.74	12.44	9.88	6.24	3.13
*	2	77.4	8485	21.53	18.20	15.81	12.52	9.93	6.29	3.13
*	2	77.4	8481	21.54	18.22	15.83	12.53	9.94	6.30	3.14
*	2	77.4	8485	21.50	18.21	15.81	12.53	9.93	6.28	3.14
*	3	102.9	11278	28.60	24.24	21.11	16.78	13.36	8.53	4.24
*	3	102.8	11262	28.58	24.23	21.09	16.77	13.36	8.50	4.22
*	3	102.9	11270	28.63	24.28	21.13	16.80	13.37	8.51	4.24
*	3	102.5	11226	28.53	24.20	21.06	16.74	13.33	8.46	4.22
*	4	132.3	14500	37.55	31.85	27.78	22.17	17.73	11.28	5.62
*	4	132.4	14508	37.79	32.04	27.92	22.29	17.81	11.39	5.65
*	4	132.2	14480	37.75	31.99	27.87	22.26	17.78	11.34	5.63
*	4	132.2	14480	37.87	32.09	27.96	22.32	17.83	11.39	5.66

Stn: 150 Lane:F3 Temp: J/C: Air: 69 PvT: 70 10:23

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.4	11330	27.44	23.48	20.71	16.45	13.05	8.35	4.20
	C	103.5	11342	27.29	23.34	20.62	16.39	13.02	8.35	4.21
	C	103.6	11350	27.25	23.32	20.61	16.39	13.02	8.36	4.21
*	1	53.8	5891	13.97	11.83	10.46	8.22	6.48	4.13	2.07
*	1	53.7	5883	14.05	11.88	10.52	8.28	6.54	4.16	2.09
*	1	54.0	5915	14.00	11.89	10.54	8.29	6.54	4.16	2.07
*	1	53.6	5867	13.81	11.73	10.39	8.16	6.45	4.12	2.09
*	2	77.7	8517	20.32	17.33	15.35	12.17	9.64	6.17	3.11
*	2	77.7	8513	20.29	17.37	15.29	12.14	9.61	6.17	3.13
*	2	78.3	8577	20.42	17.46	15.41	12.22	9.68	6.21	3.17
*	2	77.8	8525	20.29	17.32	15.33	12.15	9.63	6.16	3.11
*	3	103.9	11381	27.09	23.20	20.53	16.35	13.00	8.35	4.20
*	3	103.9	11381	27.14	23.24	20.56	16.37	13.02	8.37	4.23
*	3	103.8	11369	27.15	23.24	20.58	16.39	13.02	8.37	4.19
*	3	103.8	11373	27.17	23.26	20.59	16.40	13.04	8.36	4.21
*	4	133.4	14611	35.48	30.41	26.94	21.56	17.17	11.05	5.56

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	4	133.6	14643	35.70	30.58	27.11	21.67	17.28	11.14	5.59
*	4	133.2	14599	35.70	30.56	27.09	21.67	17.27	11.13	5.58
*	4	133.4	14611	35.79	30.63	27.16	21.73	17.31	11.15	5.61

Stn: 175 Lane:F3 Temp: J/C: Air: 70 PvT: 71 10:25

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11298	29.39	25.09	22.05	17.32	13.70	8.81	4.48
	C	103.0	11286	29.23	24.92	21.92	17.23	13.64	8.79	4.47
	C	103.3	11318	29.20	24.94	21.97	17.26	13.66	8.81	4.45
*	1	52.9	5796	14.85	12.56	11.03	8.59	6.76	4.36	2.22
*	1	53.7	5883	15.01	12.69	11.16	8.68	6.84	4.40	2.24
*	1	54.0	5915	15.09	12.74	11.22	8.70	6.86	4.40	2.25
*	1	53.6	5875	14.78	12.56	11.04	8.61	6.78	4.38	2.24
*	2	77.7	8517	21.80	18.61	16.38	12.83	10.15	6.54	3.30
*	2	77.8	8521	21.74	18.61	16.34	12.85	10.16	6.56	3.33
*	2	78.0	8549	21.84	18.69	16.46	12.90	10.19	6.56	3.32
*	2	77.5	8493	21.67	18.56	16.32	12.81	10.11	6.52	3.30
*	3	103.3	11318	28.99	24.81	21.85	17.22	13.65	8.81	4.48
*	3	103.6	11354	29.06	24.87	21.87	17.25	13.68	8.77	4.48
*	3	103.8	11369	29.16	24.97	21.94	17.32	13.74	8.81	4.53
*	3	103.8	11369	29.15	24.94	21.94	17.29	13.72	8.84	4.48
*	4	133.1	14583	38.10	32.61	28.72	22.71	18.09	11.65	5.95
*	4	132.9	14563	38.26	32.72	28.84	22.78	18.12	11.71	5.94
*	4	133.0	14571	38.41	32.82	28.94	22.87	18.19	11.75	5.94
*	4	133.0	14571	38.42	32.83	28.96	22.87	18.20	11.76	5.93

Stn: 200 Lane:F3 Temp: J/C: Air: 71 PvT: 71 10:28

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.0	11282	29.03	24.78	21.87	17.07	13.75	8.86	4.44
	C	103.4	11326	28.95	24.65	21.85	17.08	13.78	8.86	4.44
	C	103.4	11326	28.95	24.65	21.83	17.05	13.76	8.87	4.44
*	1	53.4	5852	14.83	12.53	11.20	8.57	6.89	4.50	2.19
*	1	53.8	5899	14.89	12.54	11.20	8.59	6.90	4.51	2.20
*	1	53.9	5907	14.82	12.47	11.19	8.56	6.88	4.49	2.19
*	1	54.0	5915	14.79	12.49	11.19	8.56	6.90	4.51	2.20
*	2	78.0	8545	21.70	18.41	16.40	12.71	10.25	6.57	3.30
*	2	78.1	8561	21.75	18.48	16.42	12.75	10.27	6.61	3.31
*	2	78.4	8585	21.79	18.52	16.43	12.77	10.29	6.59	3.29
*	2	78.3	8577	21.78	18.52	16.45	12.77	10.31	6.63	3.32
*	3	103.6	11350	28.76	24.56	21.73	17.01	13.74	8.86	4.44
*	3	103.8	11373	28.87	24.72	21.81	17.11	13.81	8.91	4.47
*	3	103.8	11377	28.85	24.71	21.80	17.10	13.80	8.88	4.48
*	3	103.5	11338	28.82	24.58	21.78	17.07	13.78	8.90	4.46
*	4	133.3	14603	37.77	32.35	28.56	22.55	18.21	11.75	5.93
*	4	133.4	14615	37.98	32.42	28.73	22.64	18.28	11.83	5.94
*	4	133.0	14575	38.00	32.44	28.72	22.64	18.29	11.80	5.95
*	4	133.2	14591	38.03	32.45	28.73	22.68	18.30	11.83	5.93

Stn: 225 Lane:F3 Temp: J/C: Air: 69 PvT: 71 10:31

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.1	11191	32.66	27.33	23.76	18.39	14.54	9.24	4.70
	C	102.5	11234	32.53	27.23	23.68	18.35	14.52	9.22	4.74
	C	102.8	11266	32.58	27.26	23.73	18.39	14.57	9.26	4.74
*	1	53.0	5808	16.74	13.95	12.12	9.28	7.30	4.61	2.34
*	1	53.4	5856	16.69	13.93	12.08	9.26	7.30	4.60	2.35
*	1	53.0	5808	16.65	13.90	12.06	9.24	7.28	4.62	2.35
*	1	52.9	5800	16.65	13.88	12.06	9.24	7.28	4.61	2.34
*	2	77.1	8450	24.28	20.33	17.67	13.65	10.79	6.84	3.52
*	2	77.5	8489	24.32	20.38	17.71	13.69	10.81	6.84	3.53
*	2	77.3	8465	24.31	20.40	17.73	13.70	10.82	6.84	3.53
*	2	77.1	8450	24.23	20.30	17.64	13.63	10.79	6.84	3.50
*	3	102.6	11246	32.14	26.95	23.49	18.23	14.47	9.21	4.70
*	3	102.6	11238	32.24	27.05	23.57	18.30	14.50	9.22	4.74
*	3	102.5	11230	32.22	27.00	23.53	18.26	14.50	9.22	4.72
*	3	102.8	11262	32.30	27.12	23.62	18.35	14.56	9.25	4.75
*	4	132.5	14512	42.26	35.44	30.92	24.14	19.18	12.21	6.27
*	4	132.7	14536	42.70	35.76	31.25	24.35	19.42	12.46	6.36
*	4	132.4	14504	42.59	35.67	31.12	24.28	19.30	12.29	6.31
*	4	132.2	14488	42.67	35.73	31.16	24.30	19.33	12.32	6.29

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

Stn: 250 Lane:F3 Temp: J/C: Air: 69 PvT: 70 10:34

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.6	11246	31.66	26.69	22.83	17.94	13.77	8.66	4.47
	C	102.8	11258	31.48	26.55	22.73	17.90	13.79	8.68	4.51
	C	103.3	11314	31.56	26.63	22.80	17.98	13.82	8.73	4.50
*	1	53.4	5848	16.11	13.66	11.62	9.09	6.97	4.35	2.24
*	1	53.3	5844	16.16	13.67	11.69	9.14	6.94	4.38	2.25
*	1	53.0	5812	16.06	13.57	11.55	9.04	6.91	4.31	2.25
*	1	53.0	5812	16.02	13.52	11.55	9.03	6.88	4.33	2.26
*	2	77.2	8461	23.48	19.87	16.95	13.35	10.28	6.43	3.34
*	2	77.3	8469	23.48	19.86	16.99	13.37	10.24	6.45	3.34
*	2	77.5	8493	23.53	19.90	17.04	13.39	10.28	6.47	3.34
*	2	77.5	8493	23.54	19.90	16.99	13.39	10.30	6.45	3.35
*	3	102.9	11270	31.11	26.32	22.56	17.81	13.74	8.67	4.48
*	3	103.1	11294	31.21	26.40	22.64	17.88	13.79	8.70	4.49
*	3	103.0	11290	31.20	26.40	22.64	17.90	13.78	8.70	4.50
*	3	103.0	11282	31.23	26.40	22.67	17.89	13.77	8.71	4.50
*	4	132.9	14563	40.94	34.56	29.68	23.54	18.20	11.53	5.97
*	4	132.8	14547	41.08	34.68	29.78	23.61	18.26	11.55	5.97
*	4	133.2	14591	41.30	34.84	29.91	23.69	18.33	11.60	5.99
*	4	132.8	14547	41.22	34.77	29.88	23.68	18.28	11.58	5.96

Stn: 275 Lane:F3 Temp: J/C: Air: 70 PvT: 71 10:36

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.8	11266	29.72	25.50	22.11	17.53	13.87	9.05	4.87
	C	103.3	11318	29.65	25.40	22.07	17.51	13.89	9.10	4.89
	C	103.5	11338	29.66	25.42	22.08	17.54	13.91	9.11	4.90
*	1	53.2	5828	14.98	12.78	11.11	8.73	6.89	4.51	2.44
*	1	53.5	5859	15.01	12.85	11.15	8.78	6.94	4.58	2.47
*	1	53.4	5856	15.02	12.89	11.15	8.80	6.96	4.62	2.49
*	1	53.4	5856	15.02	12.81	11.15	8.76	6.93	4.56	2.48
*	2	77.6	8497	21.98	18.77	16.31	12.90	10.21	6.69	3.64
*	2	77.9	8537	22.12	18.91	16.46	13.01	10.28	6.74	3.65
*	2	77.9	8537	22.11	18.88	16.45	12.97	10.25	6.71	3.62
*	2	78.1	8557	22.16	19.04	16.45	13.06	10.35	6.82	3.69
*	3	103.6	11346	29.41	25.20	21.96	17.42	13.84	9.05	4.88
*	3	103.5	11342	29.46	25.24	22.00	17.45	13.85	9.07	4.88
*	3	103.7	11357	29.53	25.30	22.04	17.49	13.91	9.10	4.91
*	3	103.5	11338	29.48	25.31	22.02	17.50	13.91	9.10	4.90
*	4	133.0	14571	38.78	33.30	28.96	23.09	18.41	12.07	6.45
*	4	133.1	14579	38.92	33.38	29.03	23.15	18.44	12.10	6.48
*	4	132.6	14528	38.91	33.41	29.03	23.16	18.47	12.15	6.50
*	4	132.5	14512	38.91	33.41	29.03	23.15	18.46	12.14	6.48

Stn: 300 Lane:F3 Temp: J/C: Air: 70 PvT: 73 10:39

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.3	11210	32.22	27.09	23.36	18.24	14.31	9.07	4.64
	C	102.8	11258	32.10	27.04	23.33	18.24	14.35	9.14	4.65
	C	103.1	11294	32.17	27.07	23.37	18.28	14.39	9.14	4.67
*	1	53.3	5844	16.60	13.90	11.96	9.27	7.26	4.62	2.35
*	1	53.0	5808	16.53	13.86	11.94	9.25	7.25	4.58	2.33
*	1	52.6	5768	16.36	13.75	11.85	9.19	7.20	4.56	2.31
*	1	53.1	5820	16.40	13.74	11.85	9.19	7.20	4.58	2.33
*	2	77.0	8438	23.85	20.10	17.34	13.53	10.62	6.73	3.42
*	2	77.7	8513	24.02	20.25	17.48	13.64	10.71	6.80	3.46
*	2	77.8	8521	23.95	20.20	17.44	13.62	10.69	6.77	3.45
*	2	77.8	8521	24.06	20.26	17.51	13.65	10.73	6.79	3.45
*	3	102.9	11278	31.81	26.79	23.18	18.16	14.30	9.09	4.63
*	3	103.3	11318	31.98	26.93	23.30	18.26	14.39	9.14	4.66
*	3	103.2	11306	32.00	26.94	23.32	18.28	14.40	9.15	4.68
*	3	103.0	11290	31.94	26.90	23.30	18.26	14.39	9.13	4.66
*	4	132.2	14488	41.83	35.20	30.50	23.98	18.94	12.03	6.13
*	4	132.2	14480	42.04	35.31	30.63	24.08	19.03	12.06	6.14
*	4	132.2	14488	42.15	35.35	30.68	24.13	19.04	12.08	6.15
*	4	132.6	14528	42.30	35.46	30.78	24.22	19.11	12.13	6.16

Stn: 325 Lane:F3 Temp: J/C: Air: 70 PvT: 72 10:42

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.0	11290	31.14	26.06	22.33	17.46	13.61	8.52	4.39
	C	103.3	11314	30.95	25.90	22.22	17.41	13.60	8.55	4.44
	C	103.7	11361	30.98	25.93	22.24	17.44	13.63	8.56	4.43

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	1	53.4	5852	15.81	13.18	11.28	8.76	6.81	4.28	2.25
*	1	53.6	5875	15.80	13.17	11.28	8.76	6.81	4.28	2.25
*	1	54.1	5927	15.83	13.22	11.32	8.80	6.86	4.31	2.27
*	1	53.8	5891	15.75	13.14	11.27	8.75	6.81	4.28	2.25
*	2	77.9	8533	23.06	19.30	16.54	12.92	10.08	6.32	3.30
*	2	78.1	8557	23.19	19.41	16.63	12.99	10.15	6.36	3.31
*	2	78.0	8549	23.12	19.34	16.57	12.95	10.11	6.34	3.30
*	2	78.1	8557	23.14	19.36	16.59	12.96	10.12	6.35	3.31
*	3	103.7	11361	30.69	25.73	22.10	17.33	13.58	8.54	4.42
*	3	103.9	11385	30.83	25.81	22.18	17.40	13.64	8.57	4.44
*	3	103.9	11385	30.84	25.81	22.19	17.41	13.65	8.59	4.45
*	3	103.8	11373	30.83	25.81	22.19	17.41	13.65	8.58	4.44
*	4	133.1	14579	40.24	33.75	29.04	22.87	17.98	11.32	5.85
*	4	133.3	14607	40.52	33.95	29.21	22.99	18.09	11.39	5.89
*	4	133.1	14583	40.55	33.90	29.25	23.04	18.08	11.39	5.85
*	4	133.2	14599	40.63	33.94	29.30	23.04	18.12	11.40	5.84

Stn: 350 Lane:F3 Temp: J/C: Air: 69 PvT: 71 10:46

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.6	11346	30.25	25.43	21.69	16.80	13.15	8.02	4.07
	C	103.9	11385	30.13	25.27	21.62	16.78	13.16	8.06	4.07
	C	103.6	11346	29.93	25.13	21.51	16.71	13.10	8.03	4.06
*	1	53.9	5907	15.41	12.81	10.93	8.41	6.56	3.98	2.02
*	1	54.4	5959	15.60	12.95	11.05	8.48	6.63	4.06	2.05
*	1	54.1	5923	15.44	12.84	10.94	8.41	6.57	4.05	2.08
*	1	54.1	5931	15.40	12.78	10.93	8.37	6.54	3.94	1.97
*	2	78.2	8565	22.42	18.75	16.05	12.42	9.72	5.95	2.97
*	2	78.5	8597	22.42	18.76	16.06	12.43	9.72	5.97	3.00
*	2	78.2	8569	22.39	18.72	16.05	12.42	9.73	5.96	2.96
*	2	78.3	8577	22.35	18.74	16.08	12.48	9.75	5.96	2.98
*	3	103.7	11357	29.70	24.88	21.42	16.67	13.08	8.02	4.00
*	3	104.0	11389	29.82	24.97	21.49	16.72	13.13	8.10	4.03
*	3	104.1	11401	29.82	24.97	21.50	16.74	13.14	8.06	4.02
*	3	103.9	11381	29.78	24.94	21.50	16.74	13.15	8.03	4.00
*	4	133.8	14655	39.17	32.80	28.26	22.10	17.40	10.74	5.39
*	4	133.7	14647	39.31	32.90	28.36	22.17	17.45	10.74	5.39
*	4	133.6	14643	39.40	32.89	28.42	22.22	17.49	10.74	5.38
*	4	132.6	14532	39.18	32.74	28.26	22.09	17.41	10.70	5.37

Stn: 375 Lane:F3 Temp: J/C: Air: 70 PvT: 71 10:48

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.7	11254	30.83	25.99	22.91	17.73	13.80	8.63	4.08
	C	103.1	11298	30.69	25.89	22.79	17.69	13.81	8.65	4.14
	C	103.3	11314	30.71	25.93	22.82	17.73	13.85	8.68	4.17
*	1	53.2	5832	15.54	13.02	11.48	8.80	6.79	4.24	2.02
*	1	53.7	5887	15.67	13.15	11.58	8.88	6.88	4.29	2.04
*	1	53.7	5883	15.58	13.08	11.53	8.84	6.84	4.26	2.03
*	1	53.7	5883	15.57	13.10	11.53	8.85	6.86	4.26	2.06
*	2	77.9	8537	22.93	19.30	17.02	13.17	10.23	6.41	3.06
*	2	78.1	8553	22.97	19.33	17.06	13.18	10.25	6.42	3.07
*	2	78.3	8581	23.03	19.40	17.11	13.24	10.29	6.44	3.07
*	2	78.0	8545	22.93	19.34	17.02	13.19	10.27	6.41	3.07
*	3	102.6	11246	30.19	25.48	22.52	17.49	13.64	8.57	4.10
*	3	103.9	11381	30.68	25.87	22.86	17.78	13.88	8.72	4.18
*	3	103.9	11381	30.70	25.96	22.87	17.80	13.91	8.74	4.21
*	3	103.9	11381	30.67	25.95	22.83	17.80	13.92	8.73	4.22
*	4	132.8	14547	40.05	33.82	29.85	23.31	18.27	11.50	5.54
*	4	133.4	14619	40.41	34.15	30.07	23.52	18.47	11.61	5.60
*	4	133.3	14603	40.48	34.20	30.20	23.60	18.49	11.65	5.60
*	4	133.6	14639	40.68	34.29	30.27	23.64	18.54	11.67	5.60

Stn: 400 Lane:F3 Temp: J/C: Air: 70 PvT: 72 10:51

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.9	11270	32.11	27.31	23.49	18.12	14.03	8.67	4.10
	C	103.3	11318	31.98	27.21	23.42	18.11	14.04	8.69	4.10
	C	103.3	11318	31.97	27.22	23.44	18.15	14.07	8.70	4.10
*	1	53.3	5840	16.27	13.70	11.76	8.98	6.91	4.23	1.99
*	1	53.4	5852	16.27	13.70	11.75	8.98	6.92	4.25	2.00
*	1	53.3	5844	16.28	13.71	11.77	9.01	6.93	4.26	1.99
*	1	53.8	5895	16.30	13.69	11.76	8.95	6.92	4.25	2.00
*	2	77.6	8497	23.69	20.17	17.35	13.37	10.35	6.39	3.01

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	2	77.9	8537	23.78	20.26	17.43	13.44	10.39	6.41	3.02
*	2	78.2	8569	23.88	20.34	17.50	13.50	10.44	6.45	3.06
*	2	78.3	8577	23.92	20.37	17.52	13.51	10.46	6.45	3.03
*	3	102.7	11250	31.50	26.82	23.11	17.90	13.90	8.61	4.05
*	3	103.8	11373	31.93	27.20	23.44	18.19	14.12	8.75	4.11
*	3	103.4	11334	31.84	27.13	23.39	18.11	14.08	8.72	4.11
*	3	103.4	11330	31.85	27.16	23.41	18.15	14.12	8.74	4.14
*	4	132.1	14476	41.65	35.50	30.63	23.87	18.57	11.54	5.46
*	4	133.0	14575	42.09	35.85	30.93	24.10	18.77	11.66	5.53
*	4	132.6	14528	42.12	35.86	30.94	24.09	18.78	11.67	5.52
*	4	133.1	14587	42.30	36.00	31.05	24.19	18.86	11.71	5.53

Stn: 425 Lane:F3 Temp: J/C: Air: 71 PvT: 72 10:54

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.8	11258	31.25	26.26	22.66	17.56	13.52	8.25	3.93
	C	103.0	11282	31.07	26.08	22.53	17.48	13.49	8.27	3.93
	C	103.0	11290	31.09	26.11	22.56	17.55	13.53	8.29	3.93
*	1	52.9	5792	15.59	13.04	11.22	8.61	6.59	4.04	1.91
*	1	52.8	5784	15.50	12.94	11.17	8.56	6.56	4.00	1.89
*	1	53.4	5852	15.71	13.14	11.34	8.71	6.68	4.09	1.93
*	1	53.7	5883	15.69	13.13	11.33	8.69	6.67	4.07	1.93
*	2	77.7	8517	23.16	19.39	16.77	12.96	9.98	6.10	2.91
*	2	78.0	8549	23.19	19.45	16.80	12.99	10.01	6.13	2.93
*	2	78.2	8569	23.26	19.52	16.85	13.03	10.04	6.15	2.92
*	2	78.1	8557	23.23	19.50	16.86	13.06	10.05	6.14	2.93
*	3	103.2	11306	30.84	25.93	22.42	17.43	13.48	8.28	3.92
*	3	103.4	11330	30.94	26.00	22.49	17.51	13.53	8.30	3.93
*	3	103.5	11338	30.98	26.02	22.52	17.52	13.55	8.30	3.94
*	3	103.2	11310	30.94	26.02	22.51	17.51	13.54	8.30	3.94
*	4	132.9	14563	40.69	34.24	29.65	23.17	17.97	11.06	5.25
*	4	132.8	14547	40.96	34.44	29.83	23.30	18.08	11.13	5.27
*	4	132.6	14528	41.02	34.46	29.85	23.33	18.10	11.13	5.26
*	4	132.9	14563	41.12	34.54	29.92	23.40	18.15	11.17	5.26

Stn: 450 Lane:F3 Temp: J/C: Air: 70 PvT: 72 10:57

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.2	11195	37.22	33.80	31.61	15.86	12.22	7.57	3.94
	C	102.4	11218	36.98	33.56	31.42	15.91	12.29	7.61	3.91
	C	102.6	11246	36.95	33.62	31.54	15.92	12.31	7.66	3.96
*	1	53.1	5816	19.31	17.85	17.02	7.65	5.96	3.76	1.92
*	1	53.1	5820	19.16	17.66	16.83	7.58	5.90	3.72	1.94
*	1	53.3	5836	19.15	17.67	16.83	7.63	5.94	3.74	1.96
*	1	53.7	5883	19.15	17.67	16.84	7.65	5.96	3.75	1.98
*	2	77.4	8481	27.79	25.48	24.10	11.65	9.03	5.66	2.89
*	2	77.4	8481	27.79	25.48	24.13	11.65	9.04	5.67	2.94
*	2	77.7	8517	27.87	25.56	24.21	11.69	9.07	5.69	2.96
*	2	77.7	8513	27.85	25.56	24.21	11.69	9.08	5.70	2.94
*	3	102.6	11238	36.55	33.31	31.30	15.91	12.30	7.64	3.97
*	3	102.9	11278	36.72	33.50	31.50	15.95	12.34	7.67	3.98
*	3	102.9	11274	36.75	33.54	31.56	15.93	12.33	7.67	3.98
*	3	102.9	11278	36.84	33.59	31.64	15.94	12.35	7.70	4.00
*	4	131.9	14456	47.70	43.14	40.35	21.31	16.48	10.24	5.24
*	4	132.5	14516	48.16	43.50	40.72	21.40	16.55	10.30	5.27
*	4	132.0	14464	48.29	43.52	40.79	21.37	16.60	10.37	5.33
*	4	131.6	14420	48.33	43.56	40.76	21.36	16.58	10.41	5.22

'L-TRANS.CR. BETWEEN D3-D4

Stn: 475 Lane:F3 Temp: J/C: Air: 71 PvT: 72 11:00

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.1	11294	33.74	28.19	24.15	18.66	14.25	8.64	4.30
	C	102.5	11234	33.35	27.86	23.91	18.50	14.16	8.60	4.26
	C	103.0	11282	33.43	27.95	23.96	18.57	14.21	8.64	4.30
*	1	53.3	5836	17.08	14.23	12.15	9.35	7.10	4.30	2.13
*	1	53.7	5887	17.07	14.19	12.13	9.31	7.08	4.28	2.11
*	1	53.6	5867	16.95	14.11	12.07	9.28	7.07	4.28	2.15
*	1	53.5	5863	16.99	14.12	12.09	9.29	7.06	4.28	2.09
*	2	77.6	8505	24.83	20.80	17.80	13.76	10.51	6.37	3.17
*	2	77.6	8497	24.90	20.84	17.85	13.81	10.54	6.40	3.17
*	2	77.6	8497	24.72	20.88	17.83	13.83	10.54	6.39	3.22
*	2	77.7	8517	24.86	20.87	17.87	13.82	10.56	6.42	3.18

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	3	103.3	11318	33.27	27.79	23.87	18.52	14.19	8.66	4.29
*	3	103.7	11357	33.44	27.98	24.01	18.65	14.29	8.71	4.33
*	3	103.1	11298	33.30	27.88	23.93	18.58	14.25	8.68	4.30
*	3	103.2	11302	33.28	27.89	23.94	18.61	14.25	8.69	4.31
*	4	132.4	14504	43.65	36.59	31.41	24.49	18.81	11.49	5.70
*	4	132.8	14551	44.03	36.88	31.65	24.69	18.96	11.58	5.79
*	4	132.6	14528	44.09	36.87	31.69	24.69	18.98	11.58	5.79
*	4	132.5	14520	44.14	36.94	31.74	24.76	19.02	11.59	5.81

Stn: 500 Lane:F3 Temp: J/C: Air: 71 PvT: 73 11:03

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.6	11242	32.70	26.76	23.04	17.69	13.88	8.64	4.46
	C	102.9	11278	32.50	26.65	22.95	17.67	13.87	8.67	4.47
	C	102.8	11258	32.39	26.56	22.92	17.65	13.87	8.67	4.47
*	1	53.2	5832	16.50	13.49	11.58	8.85	6.90	4.33	2.24
*	1	53.0	5812	16.38	13.39	11.54	8.81	6.89	4.31	2.22
*	1	53.2	5828	16.36	13.37	11.52	8.79	6.87	4.29	2.22
*	1	53.3	5836	16.35	13.38	11.52	8.80	6.88	4.31	2.22
*	2	77.4	8477	24.07	19.73	17.03	13.06	10.25	6.39	3.30
*	2	77.6	8505	24.17	19.83	17.12	13.14	10.32	6.43	3.32
*	2	77.5	8489	24.11	19.78	17.08	13.11	10.28	6.42	3.32
*	2	77.6	8497	24.13	19.79	17.08	13.11	10.28	6.43	3.32
*	3	103.0	11286	32.11	26.41	22.83	17.59	13.85	8.65	4.44
*	3	103.0	11290	32.17	26.44	22.85	17.63	13.87	8.68	4.46
*	3	103.0	11290	32.16	26.45	22.87	17.65	13.88	8.69	4.47
*	3	103.3	11318	32.24	26.51	22.92	17.69	13.91	8.71	4.46
*	4	133.5	14631	42.44	34.93	30.19	23.41	18.44	11.56	5.91
*	4	133.5	14623	42.64	35.05	30.30	23.50	18.52	11.60	5.93
*	4	133.4	14611	42.74	35.11	30.37	23.54	18.54	11.63	5.94
*	4	133.0	14571	42.71	35.09	30.35	23.53	18.55	11.62	5.94

Stn: 505 Lane:F3 Temp: J/C: Air: 70 PvT: 72 11:05

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.8	11262	32.25	27.39	23.52	18.42	14.38	9.04	4.52
	C	103.1	11294	32.07	27.19	23.42	18.36	14.35	9.11	4.54
	C	103.1	11298	32.09	27.21	23.42	18.40	14.37	9.11	4.53
*	1	53.0	5808	16.15	13.61	11.75	9.13	7.08	4.51	2.24
*	1	53.2	5824	16.22	13.69	11.86	9.19	7.13	4.57	2.21
*	1	53.4	5852	16.25	13.72	11.84	9.22	7.17	4.56	2.21
*	1	53.0	5812	16.19	13.64	11.76	9.13	7.09	4.51	2.22
*	2	77.4	8481	23.69	20.16	17.41	13.60	10.60	6.74	3.36
*	2	77.4	8485	23.70	20.25	17.40	13.64	10.65	6.69	3.38
*	2	77.6	8497	23.78	20.25	17.45	13.67	10.67	6.74	3.35
*	2	77.7	8517	23.78	20.30	17.49	13.70	10.70	6.76	3.38
*	3	102.9	11278	31.80	26.96	23.27	18.30	14.31	9.09	4.51
*	3	103.3	11314	31.91	27.09	23.39	18.39	14.39	9.13	4.56
*	3	103.3	11314	31.94	27.06	23.35	18.36	14.37	9.10	4.56
*	3	103.1	11298	31.89	27.12	23.40	18.40	14.42	9.13	4.56
*	4	132.3	14500	41.91	35.65	30.76	24.32	19.06	12.02	6.07
*	4	132.0	14460	42.10	35.75	30.88	24.37	19.13	12.09	6.08
*	4	132.1	14476	42.24	35.81	30.96	24.43	19.17	12.14	6.05
*	4	132.0	14460	42.27	35.83	30.99	24.47	19.19	12.15	6.13

Stn: 510 Lane:F3 Temp: J/C: Air: 71 PvT: 72 11:08

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.1	11187	38.10	30.26	25.06	18.96	14.57	9.02	4.58
	C	102.5	11230	37.79	30.06	24.99	18.97	14.62	9.05	4.51
	C	102.5	11230	37.75	30.01	24.95	18.98	14.63	9.06	4.50
*	1	53.2	5828	19.70	15.43	12.74	9.57	7.31	4.52	2.24
*	1	53.2	5824	19.58	15.35	12.66	9.53	7.28	4.51	2.24
*	1	53.4	5848	19.55	15.32	12.68	9.54	7.30	4.54	2.22
*	1	53.4	5852	19.53	15.31	12.67	9.53	7.31	4.54	2.23
*	2	77.1	8450	28.28	22.43	18.58	14.07	10.81	6.70	3.35
*	2	77.5	8489	28.44	22.56	18.67	14.15	10.87	6.76	3.39
*	2	77.5	8489	28.46	22.61	18.71	14.17	10.90	6.75	3.35
*	2	77.5	8493	28.46	22.50	18.67	14.15	10.89	6.73	3.33
*	3	102.7	11254	37.54	29.83	24.81	18.90	14.57	9.04	4.55
*	3	102.9	11278	37.69	29.96	24.94	19.00	14.67	9.09	4.52
*	3	102.9	11278	37.73	30.00	25.00	19.07	14.72	9.12	4.51
*	3	102.8	11262	37.79	30.01	25.04	19.10	14.76	9.13	4.49
*	4	131.8	14444	49.52	39.42	32.92	25.21	19.53	12.11	5.96

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

*	4	131.8	14444	49.79	39.62	33.10	25.35	19.65	12.19	6.04
*	4	131.5	14412	49.91	39.70	33.17	25.41	19.70	12.20	5.98
*	4	131.5	14412	50.03	39.77	33.22	25.44	19.71	12.22	6.00

Stn: 515 Lane:F3 Temp: J/C: Air: 71 PvT: 70 11:11

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.0	11175	33.94	27.81	23.52	18.32	14.07	8.84	4.39
	C	102.6	11242	33.78	27.76	23.50	18.34	14.11	8.88	4.41
	C	102.6	11246	33.77	27.64	23.48	18.36	14.14	8.86	4.40
*	1	53.3	5840	17.26	14.17	11.94	9.24	7.05	4.44	2.21
*	1	53.3	5840	17.22	14.13	11.94	9.26	7.07	4.42	2.20
*	1	53.0	5812	17.03	13.91	11.78	9.13	6.98	4.35	2.17
*	1	53.3	5840	17.14	14.02	11.87	9.22	7.04	4.39	2.17
*	2	76.9	8426	25.06	20.57	17.39	13.56	10.41	6.54	3.27
*	2	77.0	8438	25.15	20.69	17.51	13.66	10.49	6.59	3.30
*	2	77.5	8489	25.26	20.80	17.58	13.68	10.53	6.60	3.29
*	2	77.7	8513	25.30	20.78	17.59	13.71	10.53	6.63	3.32
*	3	103.6	11350	33.66	27.61	23.40	18.31	14.11	8.90	4.44
*	3	102.9	11274	33.53	27.55	23.39	18.32	14.12	8.87	4.41
*	3	102.8	11262	33.54	27.59	23.39	18.32	14.12	8.90	4.43
*	3	102.8	11266	33.57	27.59	23.40	18.32	14.12	8.89	4.43
*	4	132.6	14528	44.20	36.31	30.83	24.21	18.76	11.78	5.87
*	4	132.3	14500	44.45	36.47	30.96	24.31	18.81	11.83	5.89
*	4	132.4	14504	44.53	36.54	31.02	24.34	18.84	11.85	5.88
*	4	132.3	14496	44.62	36.56	31.04	24.36	18.84	11.87	5.90

Stn: 520 Lane:F3 Temp: J/C: Air: 71 PvT: 70 11:13

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.2	11306	30.76	25.87	22.59	17.71	13.73	8.70	4.41
	C	103.4	11330	30.61	25.75	22.52	17.72	13.77	8.70	4.42
	C	103.4	11334	30.61	25.79	22.51	17.71	13.80	8.72	4.41
*	1	53.0	5812	15.62	13.05	11.40	8.90	6.85	4.33	2.17
*	1	53.8	5891	15.61	13.03	11.40	8.91	6.85	4.34	2.19
*	1	53.7	5887	15.60	13.06	11.38	8.85	6.83	4.33	2.20
*	1	53.5	5863	15.47	12.94	11.30	8.82	6.79	4.29	2.17
*	2	77.8	8529	22.77	19.16	16.75	13.13	10.17	6.44	3.26
*	2	77.7	8509	22.74	19.17	16.74	13.13	10.17	6.44	3.26
*	2	77.7	8517	22.74	19.18	16.76	13.15	10.19	6.44	3.27
*	2	77.9	8537	22.77	19.19	16.78	13.16	10.19	6.45	3.27
*	3	103.2	11302	30.27	25.50	22.32	17.59	13.67	8.67	4.39
*	3	103.6	11346	30.43	25.62	22.44	17.67	13.76	8.71	4.42
*	3	103.4	11326	30.38	25.61	22.40	17.64	13.72	8.71	4.42
*	3	103.5	11342	30.46	25.67	22.45	17.69	13.76	8.73	4.41
*	4	132.2	14480	39.67	33.44	29.27	23.14	18.06	11.46	5.79
*	4	133.3	14603	40.11	33.80	29.56	23.35	18.25	11.60	5.87
*	4	133.4	14611	40.16	33.87	29.63	23.41	18.29	11.62	5.88
*	4	133.2	14591	40.20	33.87	29.63	23.41	18.28	11.61	5.86

Stn: 525 Lane:F3 Temp: J/C: Air: 71 PvT: 70 11:16

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.7	11254	30.22	25.81	22.35	17.64	13.78	8.88	4.39
	C	103.0	11290	30.09	25.69	22.26	17.61	13.78	8.90	4.39
	C	103.3	11318	30.07	25.69	22.26	17.63	13.79	8.91	4.40
*	1	53.5	5859	15.33	13.05	11.28	8.87	6.87	4.42	2.17
*	1	53.3	5844	15.28	12.98	11.23	8.83	6.84	4.41	2.16
*	1	53.6	5867	15.30	13.01	11.25	8.85	6.87	4.43	2.17
*	1	53.2	5828	15.20	12.91	11.17	8.79	6.82	4.39	2.15
*	2	77.6	8501	22.34	19.12	16.56	13.07	10.19	6.57	3.25
*	2	77.6	8501	22.35	19.14	16.57	13.09	10.20	6.58	3.25
*	2	77.7	8509	22.31	19.13	16.57	13.07	10.20	6.57	3.26
*	2	77.6	8501	22.34	19.13	16.57	13.08	10.20	6.59	3.25
*	3	102.5	11230	29.58	25.35	21.97	17.44	13.67	8.83	4.35
*	3	103.3	11318	29.89	25.56	22.17	17.59	13.79	8.90	4.38
*	3	103.4	11334	29.93	25.61	22.21	17.61	13.80	8.90	4.41
*	3	103.3	11318	29.90	25.56	22.17	17.63	13.82	8.92	4.39
*	4	131.8	14440	39.00	33.36	28.97	23.05	18.14	11.71	5.77
*	4	133.2	14599	39.50	33.79	29.35	23.35	18.37	11.87	5.85
*	4	132.9	14559	39.51	33.78	29.35	23.35	18.35	11.85	5.86
*	4	132.9	14559	39.57	33.81	29.38	23.36	18.37	11.87	5.85

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

Stn: 530 Lane:F3 Temp: J/C: Air: 71 PvT: 70 11:18

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.7	11250	30.32	25.75	22.29	17.75	14.00	8.90	4.42
	C	103.3	11318	30.28	25.64	22.22	17.72	14.00	8.91	4.44
	C	103.6	11350	30.27	25.72	22.23	17.76	14.04	8.95	4.44
*	1	53.6	5871	15.33	13.03	11.28	8.92	7.00	4.43	2.20
*	1	53.3	5836	15.27	12.99	11.25	8.91	6.98	4.41	2.19
*	1	53.2	5828	15.20	12.91	11.11	8.83	6.93	4.41	2.19
*	1	53.3	5840	15.20	12.92	11.19	8.87	6.95	4.40	2.19
*	2	77.3	8473	22.39	19.10	16.47	13.14	10.37	6.59	3.28
*	2	77.6	8497	22.47	19.11	16.50	13.17	10.39	6.62	3.29
*	2	77.7	8509	22.47	19.15	16.51	13.18	10.40	6.63	3.30
*	2	77.4	8481	22.35	19.06	16.45	13.13	10.35	6.59	3.28
*	3	102.4	11214	29.71	25.29	21.91	17.52	13.85	8.83	4.39
*	3	103.2	11306	29.98	25.53	22.08	17.68	13.98	8.92	4.44
*	3	103.3	11318	30.01	25.53	22.13	17.69	13.98	8.93	4.44
*	3	103.2	11302	30.04	25.54	22.13	17.69	13.98	8.92	4.43
*	4	132.5	14512	39.31	33.46	29.02	23.26	18.45	11.79	5.86
*	4	132.7	14539	39.57	33.63	29.21	23.40	18.55	11.85	5.88
*	4	132.8	14551	39.72	33.76	29.28	23.47	18.62	11.90	5.89
*	4	132.6	14528	39.73	33.75	29.25	23.44	18.61	11.88	5.89

Stn: 535 Lane:F3 Temp: J/C: Air: 71 PvT: 69 11:21

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.0	11282	29.76	25.43	22.03	17.44	13.89	8.86	4.36
	C	103.8	11377	29.74	25.38	22.02	17.44	13.91	8.87	4.42
	C	103.6	11346	29.68	25.33	21.98	17.43	13.89	8.87	4.41
*	1	53.3	5836	15.09	12.82	11.09	8.70	6.88	4.43	2.19
*	1	53.0	5808	14.99	12.75	11.05	8.67	6.88	4.39	2.19
*	1	53.4	5848	15.07	12.83	11.13	8.72	6.91	4.43	2.20
*	1	53.8	5895	15.09	12.82	11.12	8.72	6.91	4.42	2.20
*	2	77.8	8525	22.12	18.88	16.38	12.93	10.30	6.58	3.28
*	2	77.9	8537	22.14	18.89	16.39	12.94	10.31	6.60	3.30
*	2	78.1	8557	22.17	18.93	16.42	12.97	10.33	6.60	3.28
*	2	77.9	8533	22.19	18.93	16.41	12.96	10.32	6.58	3.29
*	3	103.5	11342	29.43	25.14	21.84	17.31	13.84	8.83	4.40
*	3	103.9	11381	29.52	25.25	21.93	17.39	13.89	8.88	4.43
*	3	103.7	11361	29.53	25.26	21.93	17.40	13.90	8.91	4.43
*	3	103.8	11377	29.56	25.26	21.94	17.40	13.90	8.90	4.42
*	4	132.5	14512	38.52	32.91	28.61	22.78	18.23	11.65	5.77
*	4	133.3	14603	38.92	33.21	28.88	22.98	18.39	11.74	5.81
*	4	133.5	14623	39.04	33.26	28.95	23.03	18.46	11.77	5.80
*	4	133.4	14615	39.11	33.33	29.00	23.07	18.48	11.83	5.83

Stn: 540 Lane:F3 Temp: J/C: Air: 71 PvT: 70 11:23

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	102.9	11274	30.40	25.56	22.29	17.50	14.03	8.93	4.41
	C	103.3	11318	30.22	25.22	22.28	17.30	14.15	8.87	4.30
	C	103.4	11334	30.24	25.31	22.34	17.38	14.17	8.95	4.35
*	1	52.8	5784	15.23	12.54	11.26	8.50	7.11	4.35	1.98V
*	1	53.4	5856	15.34	12.69	11.32	8.62	7.12	4.39	2.03
*	1	53.6	5875	15.32	12.82	11.28	8.69	7.04	4.43	2.13
*	1	53.0	5812	15.26	12.89	11.15	8.75	6.91	4.42	2.22V
*	2	77.7	8517	22.56	18.78	16.70	12.85	10.56	6.63	3.12V
*	2	77.7	8509	22.54	18.91	16.62	12.93	10.48	6.62	3.26
*	2	78.3	8577	22.69	19.06	16.72	13.05	10.54	6.67	3.28
*	2	77.7	8513	22.52	18.91	16.61	12.94	10.48	6.62	3.25
*	3	102.5	11234	29.73	24.92	22.00	17.16	14.01	8.83	4.33
*	3	103.6	11354	30.04	25.22	22.27	17.37	14.17	8.95	4.39
*	3	103.8	11373	30.11	25.23	22.32	17.39	14.22	8.94	4.26
*	3	103.6	11346	30.09	25.24	22.32	17.39	14.20	8.95	4.35
*	4	133.5	14631	39.63	33.25	29.34	22.98	18.77	11.90	5.85
*	4	133.1	14583	39.67	33.37	29.29	23.06	18.70	11.89	5.92
*	4	133.1	14583	39.74	33.37	29.38	23.07	18.75	11.91	5.87
*	4	133.3	14603	39.89	33.56	29.48	23.19	18.81	11.96	5.92

'ACCEPTED TEST WITH VARAINCE

Stn: 540 Lane:F3 Temp: J/C: Air: 72 PvT: 70 11:27

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	103.0	11290	30.74	25.81	22.49	17.64	14.16	8.99	4.45

File: C:\FWD\DATA\469187C3.FWD
Road: ST-73, SOUTHBOUND LANE, 17 MILES SOUTH OF FAITH, SD
Subsection: 469187

	C	103.7	11361	30.70	25.83	22.51	17.70	14.20	9.04	4.50
	C	103.6	11354	30.61	25.78	22.48	17.70	14.19	9.05	4.50
*	1	53.6	5871	15.49	12.99	11.36	8.81	7.07	4.45	2.17
*	1	53.6	5875	15.53	12.83	11.47	8.70	7.19	4.38	2.02
*	1	53.6	5875	15.51	12.96	11.40	8.79	7.11	4.44	2.12
*	1	53.1	5820	15.41	12.78	11.41	8.66	7.19	4.37	1.97
*	2	77.5	8493	22.71	18.94	16.82	12.94	10.64	6.59	3.08
*	2	78.1	8553	22.86	19.12	16.91	13.06	10.69	6.65	3.16
*	2	77.8	8521	22.77	18.98	16.85	12.97	10.67	6.60	3.10
*	2	77.9	8537	22.80	19.07	16.88	13.04	10.65	6.61	3.21
*	3	103.0	11290	30.15	25.27	22.35	17.38	14.19	8.84	4.22
*	3	103.7	11361	30.37	25.43	22.52	17.47	14.31	8.91	4.22
*	3	103.4	11326	30.28	25.36	22.46	17.42	14.29	8.87	4.21
*	3	103.9	11381	30.44	25.48	22.58	17.52	14.37	8.92	4.27
*	4	132.8	14547	39.54	33.21	29.31	22.95	18.74	11.84	5.75
*	4	133.2	14591	39.72	33.32	29.46	23.01	18.84	11.81	5.82
*	4	133.0	14575	39.76	33.43	29.42	23.10	18.79	11.89	5.81
*	4	133.4	14619	39.83	33.68	29.38	23.32	18.71	11.99	5.98

Mileage:-.008 -> .102

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Summary of Data for section 469187C
Analyzed by: ROBERT VAN SAMBEEK on 06-23-1994

UNCORRECTED Overall Deflection Statistics

Mean Values (mils/kip)

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	2.7308	2.2728	1.9771	1.5108	1.1840	0.7489	0.3697
	2	2.7502	2.3063	2.0062	1.5474	1.2161	0.7692	0.3811
	3	2.7602	2.3213	2.0219	1.5687	1.2365	0.7831	0.3876
	4	2.8304	2.3815	2.0758	1.6188	1.2789	0.8114	0.4016

Standard Deviations

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	0.2549	0.1790	0.1764	0.0733	0.0552	0.0360	0.0191
	2	0.2365	0.1659	0.1628	0.0686	0.0529	0.0355	0.0176
	3	0.2266	0.1586	0.1530	0.0664	0.0517	0.0357	0.0170
	4	0.2262	0.1593	0.1498	0.0673	0.0517	0.0355	0.0167

Coefficient of Variation

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	9.33%	7.88%	8.92%	4.85%	4.66%	4.80%	5.16%
	2	8.60%	7.19%	8.11%	4.43%	4.35%	4.62%	4.63%
	3	8.21%	6.83%	7.57%	4.23%	4.18%	4.56%	4.40%
	4	7.99%	6.69%	7.21%	4.16%	4.04%	4.37%	4.17%

Flexible Pavement Deflection Statistics - 469187C

Mean Values (mils/kip)

Test Loc.	Drop Ht	CORRECTED Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	2.7215	2.2728	1.9771	1.5108	1.1840	0.7489	0.3697
	2	2.7408	2.3063	2.0062	1.5474	1.2161	0.7692	0.3811
	3	2.7508	2.3213	2.0219	1.5687	1.2365	0.7831	0.3876
	4	2.8209	2.3815	2.0758	1.6188	1.2789	0.8114	0.4016

Standard Deviations

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	0.2543	0.1790	0.1764	0.0733	0.0552	0.0360	0.0191
	2	0.2360	0.1659	0.1628	0.0686	0.0529	0.0355	0.0176
	3	0.2264	0.1586	0.1530	0.0664	0.0517	0.0357	0.0170
	4	0.2258	0.1593	0.1498	0.0673	0.0517	0.0355	0.0167

Coefficient of Variation

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	9.34%	7.88%	8.92%	4.85%	4.66%	4.80%	5.16%
	2	8.61%	7.19%	8.11%	4.43%	4.35%	4.62%	4.63%
	3	8.23%	6.83%	7.57%	4.23%	4.18%	4.56%	4.40%
	4	8.00%	6.69%	7.21%	4.16%	4.04%	4.37%	4.17%

Outlier Statistics - 469187C

Station	Height	Sensor	Number of Std. Dev.
0	1	1	3.78
0	1	4	-2.14
0	2	1	3.53
0	3	1	3.36
0	4	1	3.04
150	4	4	-2.04
275	1	7	2.76
275	2	7	2.65
275	3	7	2.56
275	4	7	2.61
350	1	6	-2.03
350	2	6	-2.09
350	3	6	-2.12
350	3	7	-2.06
350	4	6	-2.18
425	1	7	-2.15
425	2	7	-2.22
425	3	7	-2.36
425	4	7	-2.39
450	1	1	2.15
450	1	2	4.25
450	1	3	5.18
450	1	4	-2.79
450	1	5	-3.02
450	1	6	-3.00
450	2	1	2.18
450	2	2	4.20
450	2	3	5.14
450	2	4	-2.54
450	2	5	-2.84
450	2	6	-2.84
450	2	7	-2.04
450	3	1	2.16
450	3	2	4.10
450	3	3	5.06
450	3	4	-2.33
450	3	5	-2.75
450	3	6	-2.87
450	3	7	-2.01
450	4	1	2.15
450	4	2	3.90
450	4	3	4.91
450	4	4	-2.11
450	4	5	-2.60
450	4	6	-2.74
450	4	7	-2.24
510	1	1	2.41
510	2	1	2.50
510	2	2	2.11

Outlier Statistics - 469187C

Station	Height	Sensor	Number of Std. Dev.
510	3	1	2.53
510	3	2	2.12
510	4	1	2.71
510	4	2	2.29
510	4	4	2.06

Pavement Construction Information - 469187C

Material Code	Material Name	Layer Thickness
700	Asphaltic Concrete	2.1
700	Asphaltic Concrete	3.4
302	Uncrushed Gravel	6.0

Depth to rigid foundation: 16.5 ft.

FLEXIBLE Pavement Thickness Data - 469187C
(comparison of each calculation to the expected value)

Minimum expected SN value: 2.35
Maximum expected SN value: 3.49

Height	Station	Effective SN
1	0	2.30

FLEXIBLE Pavement Thickness Statistics - 469187C

Drop height 1

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-40	7566	3.25
	-35	7376	3.20
	-30	7353	3.10
	-25	7286	3.10
	-20	7321	3.00
	-15	7571	2.95
	-10	6927	2.95
	-10	7128	2.90
	-5	7179	3.00
	0	7645	2.30
	25	7513	2.90
	50	7738	2.75
	75	7217	2.95
	100	7344	3.05
	125	7573	3.20
	150	7680	3.25
	175	7157	3.15
	200	7314	3.15
	225	6801	2.95
	250	7077	3.00
	275	6516	3.30
	300	6832	2.95
	325	7127	3.05
	350	7905	2.95
	375	7806	2.95
	400	7942	2.80
	425	8208	2.85
	450	8086	2.45
	475	7516	2.80
	500	7148	2.95
	505	7159	2.95
	510	7138	2.55
	515	7268	2.80
	520	7318	3.05
	525	7364	3.05
	530	7265	3.10
	535	7261	3.10
	540	7578	3.00
	540	7680	3.00
Subsection 1 Overall Mean:		7382	2.97
Standard Deviation:		350	0.20
Coeff Of Variation:		4.75%	6.90%

FLEXIBLE Pavement Thickness Statistics - 469187C

Drop height 2

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-40	7331	3.25
	-35	7185	3.20
	-30	7164	3.10
	-25	7082	3.10
	-20	7085	3.00
	-15	6852	3.05
	-10	7089	2.90
	-10	6963	2.90
	-5	7013	3.00
	0	7412	2.40
	25	7301	2.95
	50	7382	2.80
	75	7117	2.95
	100	7190	3.05
	125	7358	3.20
	150	7417	3.30
	175	7030	3.20
	200	7081	3.20
	225	6607	3.00
	250	6941	3.00
	275	6438	3.30
	300	6765	3.00
	325	7067	3.05
	350	7803	3.00
	375	7574	2.95
	400	7652	2.85
	425	7914	2.90
	450	7847	2.50
	475	7277	2.80
	500	7004	2.95
	505	6906	3.00
	510	6918	2.60
	515	7024	2.85
	520	7127	3.05
	525	7137	3.10
	530	7057	3.10
	535	7093	3.15
	540	7208	3.05
	540	7395	3.00
Subsection 1 Overall Mean:		7174	2.99
Standard Deviation:		309	0.19
Coeff Of Variation:		4.30%	6.44%

FLEXIBLE Pavement Thickness Statistics - 469187C

Drop height 3

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-40	7186	3.25
	-35	7026	3.20
	-30	6960	3.10
	-25	6943	3.05
	-20	6984	3.00
	-15	6800	3.05
	-10	7008	2.90
	-10	6827	2.90
	-5	6829	3.00
	0	7257	2.45
	25	7093	2.95
	50	7128	2.80
	75	6988	2.95
	100	7090	3.05
	125	7256	3.20
	150	7361	3.30
	175	6917	3.20
	200	6964	3.20
	225	6541	3.00
	250	6878	3.00
	275	6391	3.30
	300	6661	3.00
	325	7009	3.05
	350	7694	3.00
	375	7393	3.00
	400	7501	2.85
	425	7799	2.90
	450	7675	2.55
	475	7170	2.80
	500	6935	2.95
	505	6811	3.00
	510	6834	2.60
	515	6974	2.85
	520	7022	3.05
	525	7046	3.10
	530	6975	3.10
	535	7028	3.15
	540	7137	3.05
	540	7303	3.00
Subsection 1 Overall Mean:		7061	3.00
Standard Deviation:		290	0.18
Coeff Of Variation:		4.11%	6.17%

FLEXIBLE Pavement Thickness Statistics - 469187C

Drop height 4

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-40	7000	3.20
	-35	6815	3.20
	-30	6819	3.10
	-25	6772	3.05
	-20	6772	3.00
	-15	6677	3.05
	-10	6684	2.90
	-10	6630	2.90
	-5	6637	2.95
	0	7039	2.50
	25	6782	2.90
	50	6807	2.80
	75	6786	2.95
	100	6887	3.05
	125	7024	3.20
	150	7143	3.25
	175	6731	3.15
	200	6743	3.20
	225	6344	3.00
	250	6693	3.00
	275	6205	3.25
	300	6492	3.00
	325	6826	3.00
	350	7392	3.00
	375	7137	2.95
	400	7199	2.85
	425	7518	2.85
	450	7470	2.55
	475	6890	2.80
	500	6757	2.90
	505	6544	2.95
	510	6613	2.60
	515	6761	2.80
	520	6826	3.05
	525	6831	3.10
	530	6777	3.10
	535	6884	3.10
	540	6795	3.10
	540	6841	3.05
Subsection 1 Overall Mean:		6834	2.98
Standard Deviation:		267	0.18
Coeff Of Variation:		3.90%	5.92%

A.-5 L-TRANS.CR. IN FRONT OF D7
A. 0 L-TRANS.CR. BETWEEN D2 AND D3
A.450 L-TRANS.CR. BETWEEN D3 AND D4

CTION UNIFORM EXCEPT AT TRANSVERSE CRACKS - NO SUBSECTIONS

Summary of Results

Section uniformity:
NO Subsections were identified within the section.

Outliers - Test pits: 28 combinations at each test pit
NO Test pit data was present.

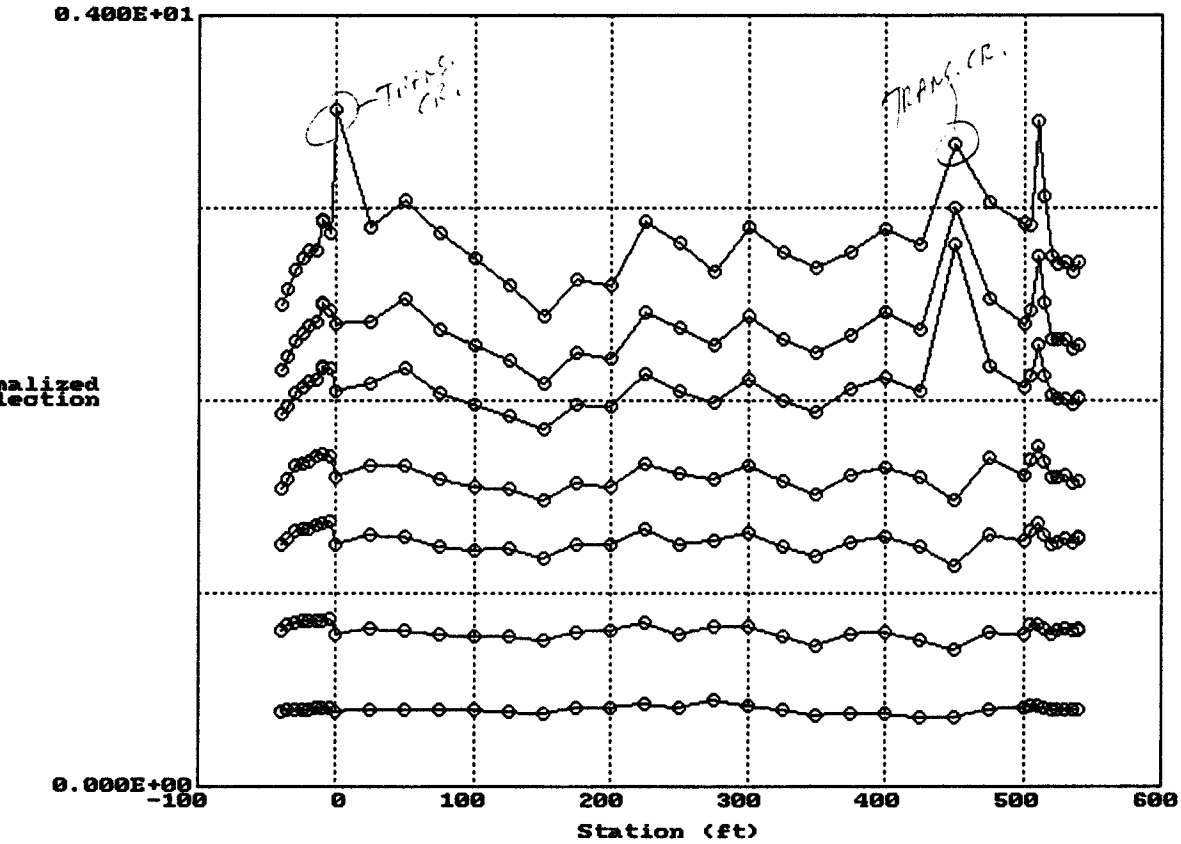
Outliers - Section data: %1092 total combinations within the section
54 height/sensor/station combinations are data outliers in subsection 1.

Structural capacity - Test pits: 4 combinations at each test pit
All results for TP 1 are within the range of expected values.
All results for TP 2 are within the range of expected values.

Structural capacity - Section data: 156 total combinations within the section
1 height/station combinations are NOT within the range of expected values.

Subgrade response:
156 height/station combinations exhibit linear response.

Deflection Data for Section: 469187C (1994)



Location 3 Drop Height 4 Sensors 1, 2, 3, 4, 5, 6, 7

F2:ScrnDump F10:Exit ↓↑:Prv/Nxt Ht PgUp/PgDn:Prv/Nxt Loc

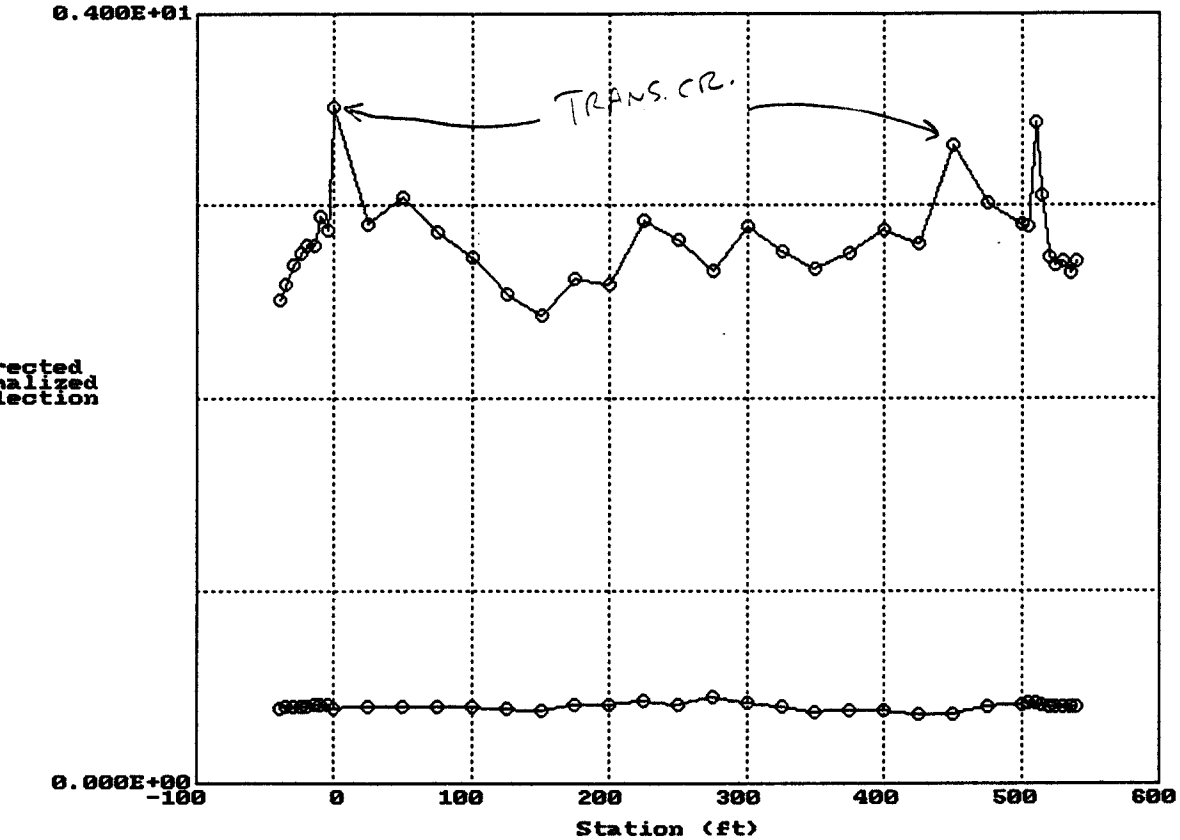
TRACKS OF CONCERN

5L @ 0.1 Meters (L-TRANS. CR. @ STA. 0)

5L @ 39.6 M (Sta. 130)

5L @ 137 M (Sta. 449)

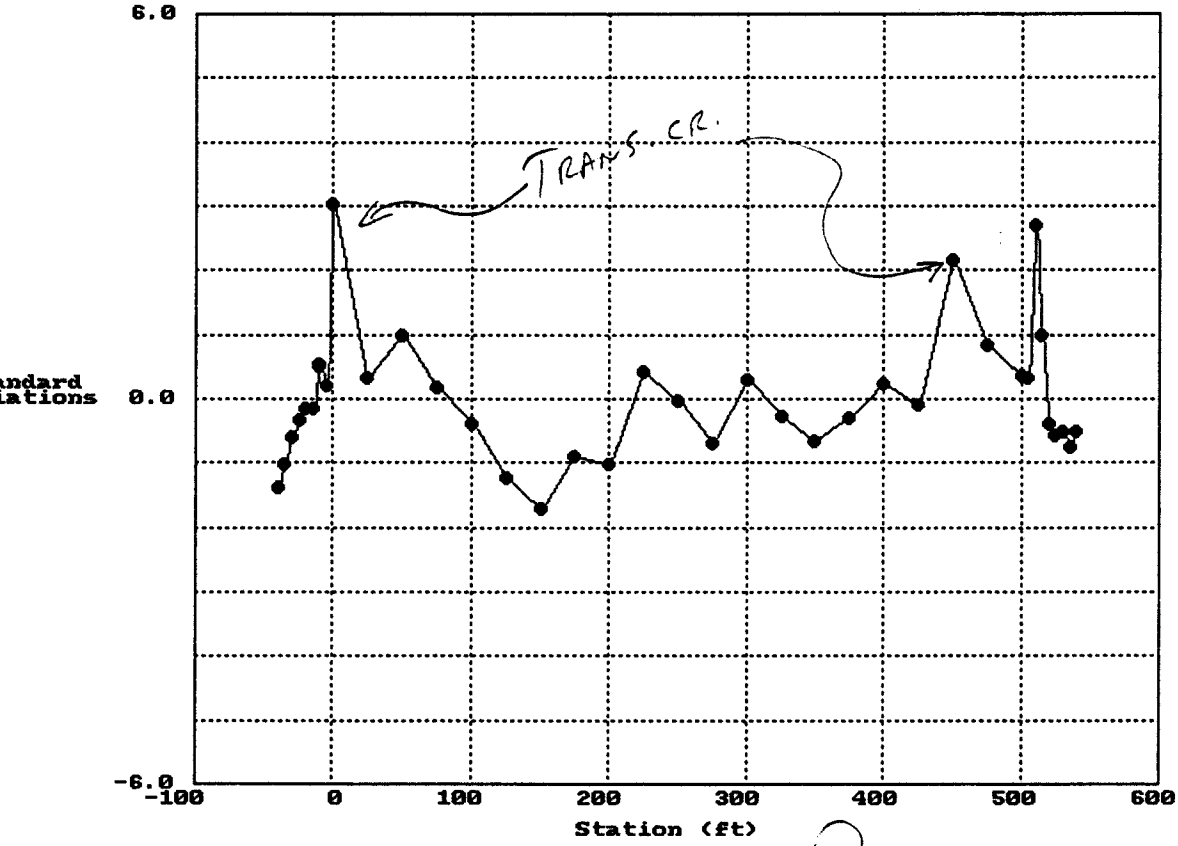
Corrected Deflection Data for Section: 469187C



Location 3 Drop Height 4 Sensors 1, 7

F2:ScrnDump F10:Exit ↓↑:Prv/Nxt Ht PgUp/PgDn:Prv/Nxt Loc

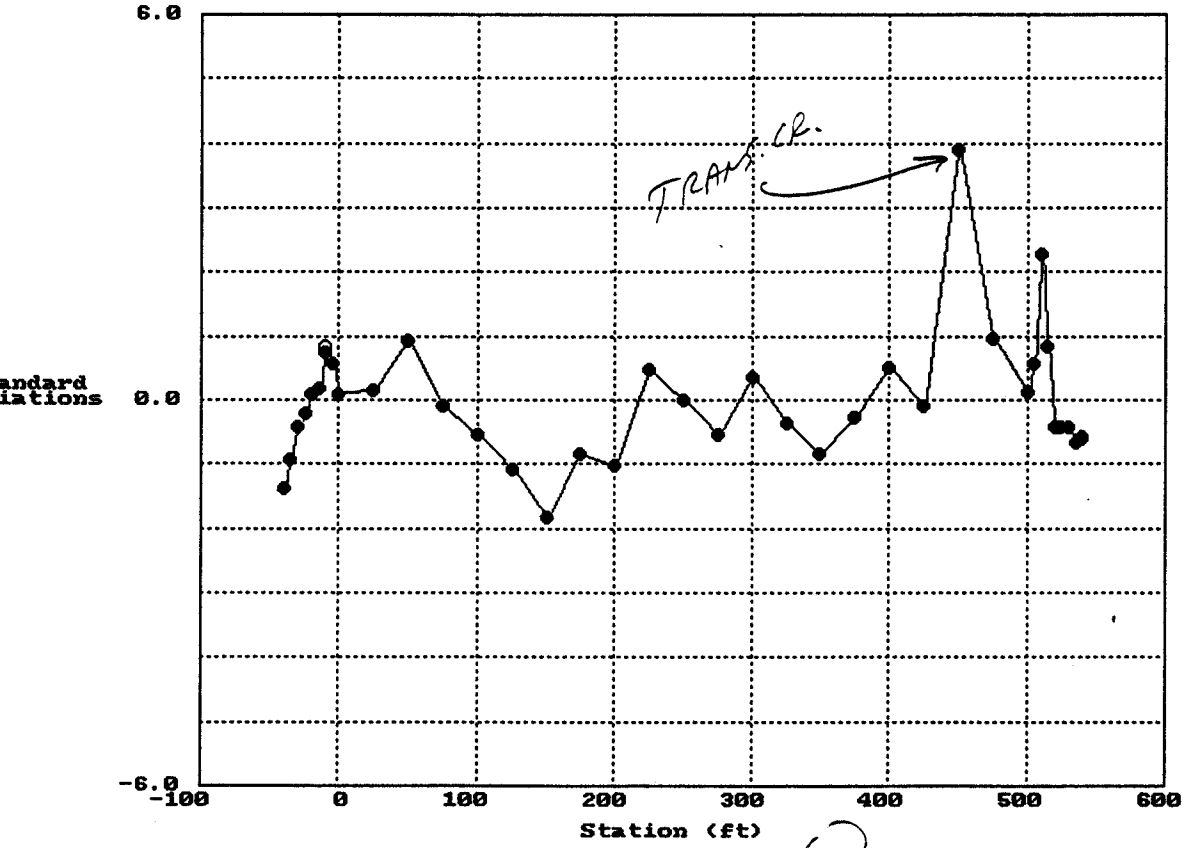
Deflection Deviation Data for Section: 469187C



Location 3 Drop Height 4 Sensor 1

F2:ScrnDump F10:Exit ↓↑:Prv/Nxt Ht ←→:Prv/Nxt Defl PgUp/PgDn:Prv/Nxt Loc

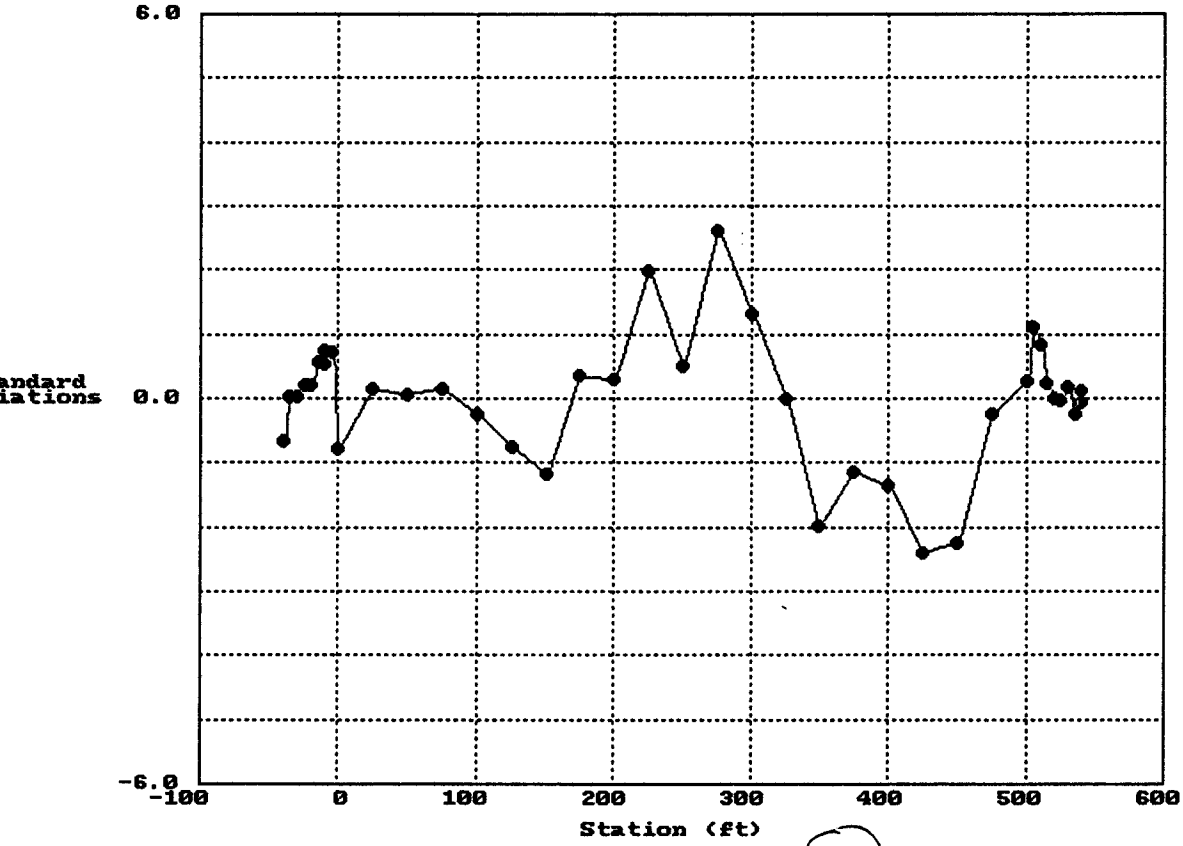
Deflection Deviation Data for Section: 469187C



Location 3 Drop Height 4 Sensor 2

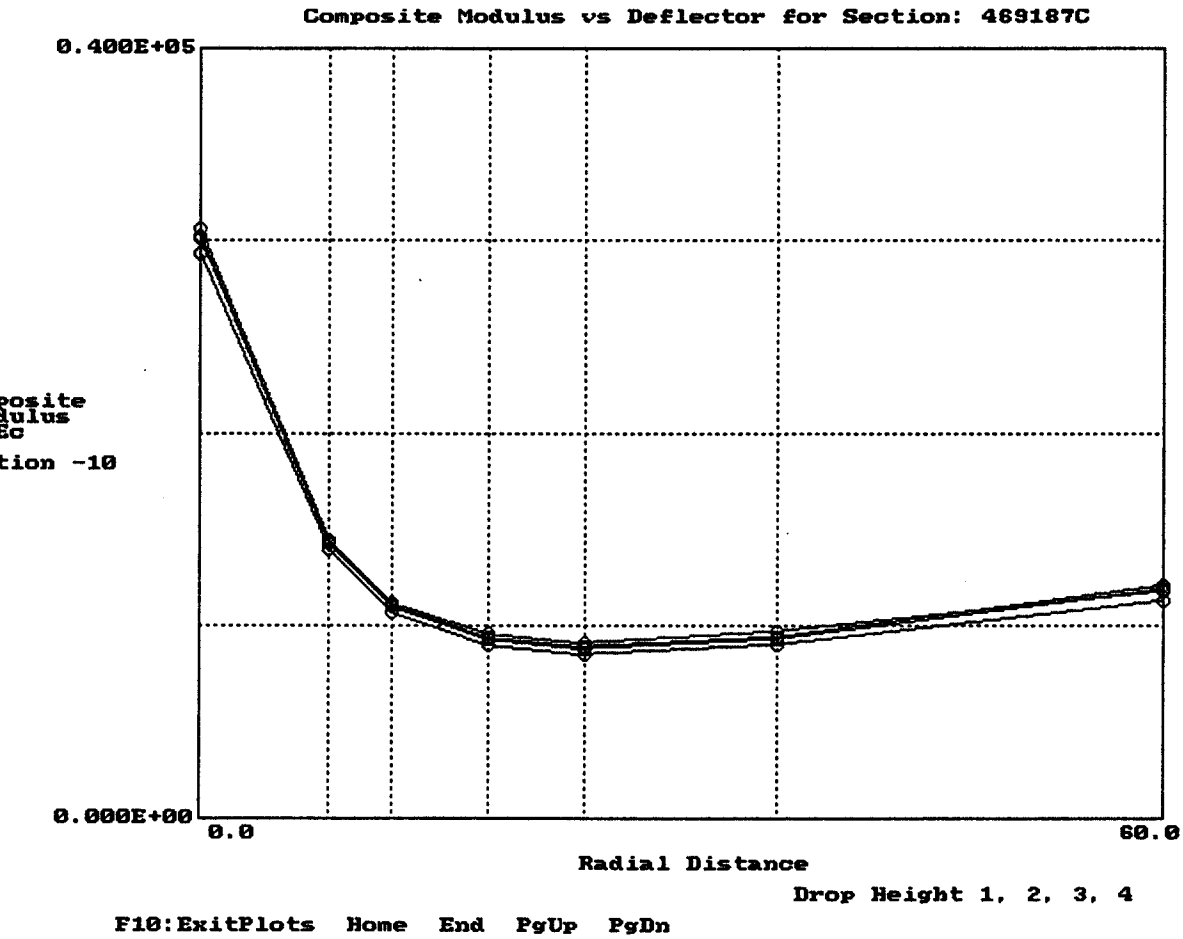
F2:ScrnDump F10:Exit ↓↑:Prv/Nxt Ht ←→:Prv/Nxt Defl PgUp/PgDn:Prv/Nxt Loc

Deflection Deviation Data for Section: 469187C



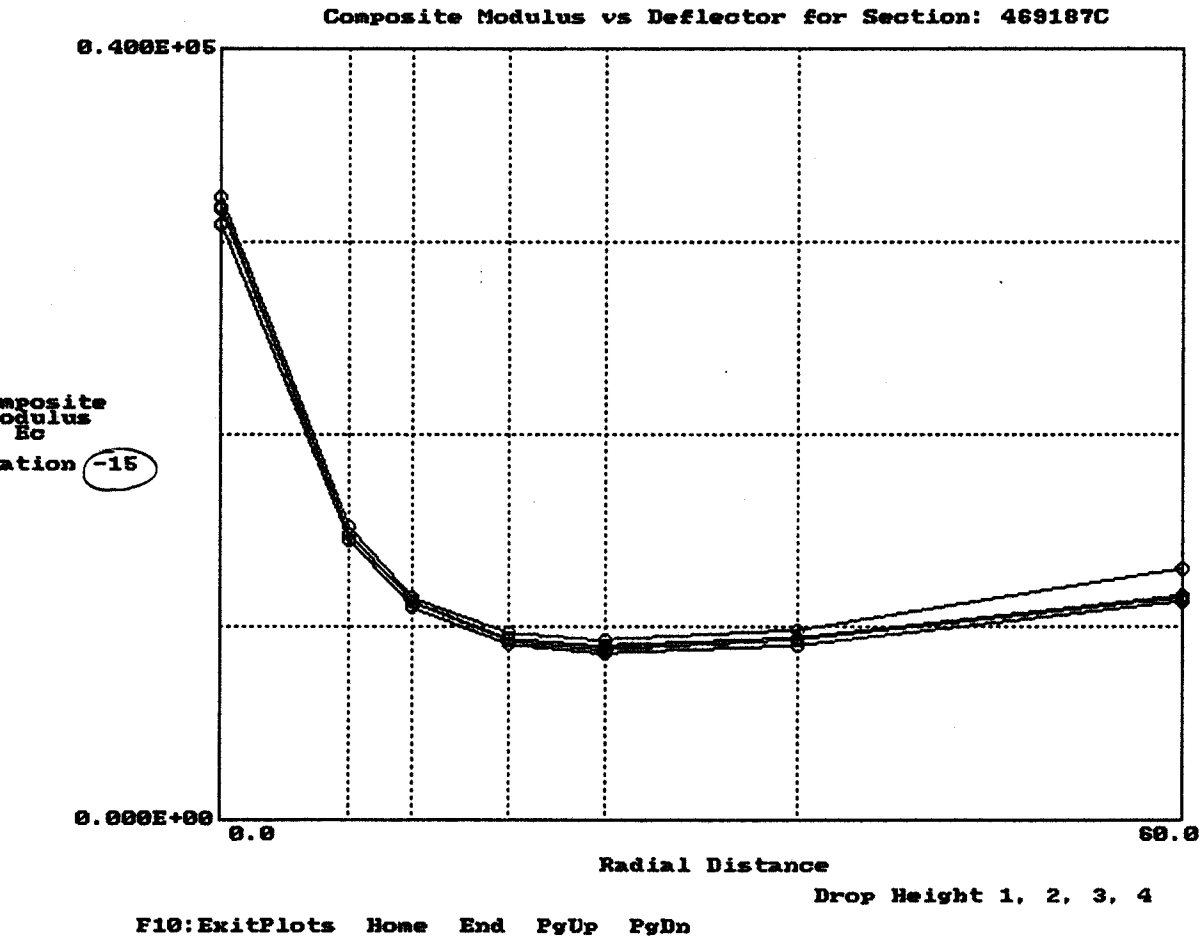
Location 3 Drop Height 4 Sensor 7

F2:ScrnDump F10:Exit ↓↑:Prv/Nxt Ht ←→:Prv/Nxt Defl PgUp/PgDn:Prv/Nxt Loc

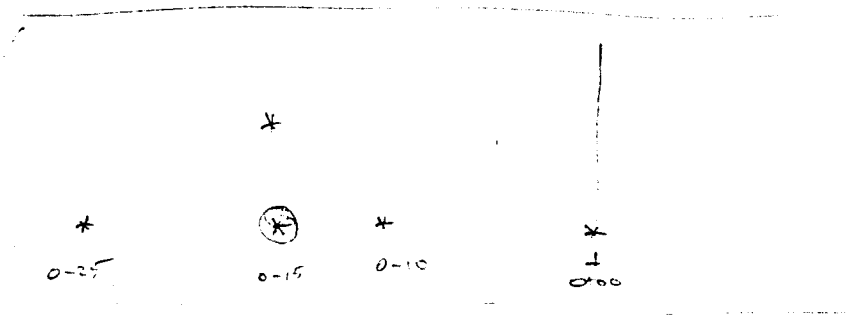


Sta. 0-10 Initr. location?

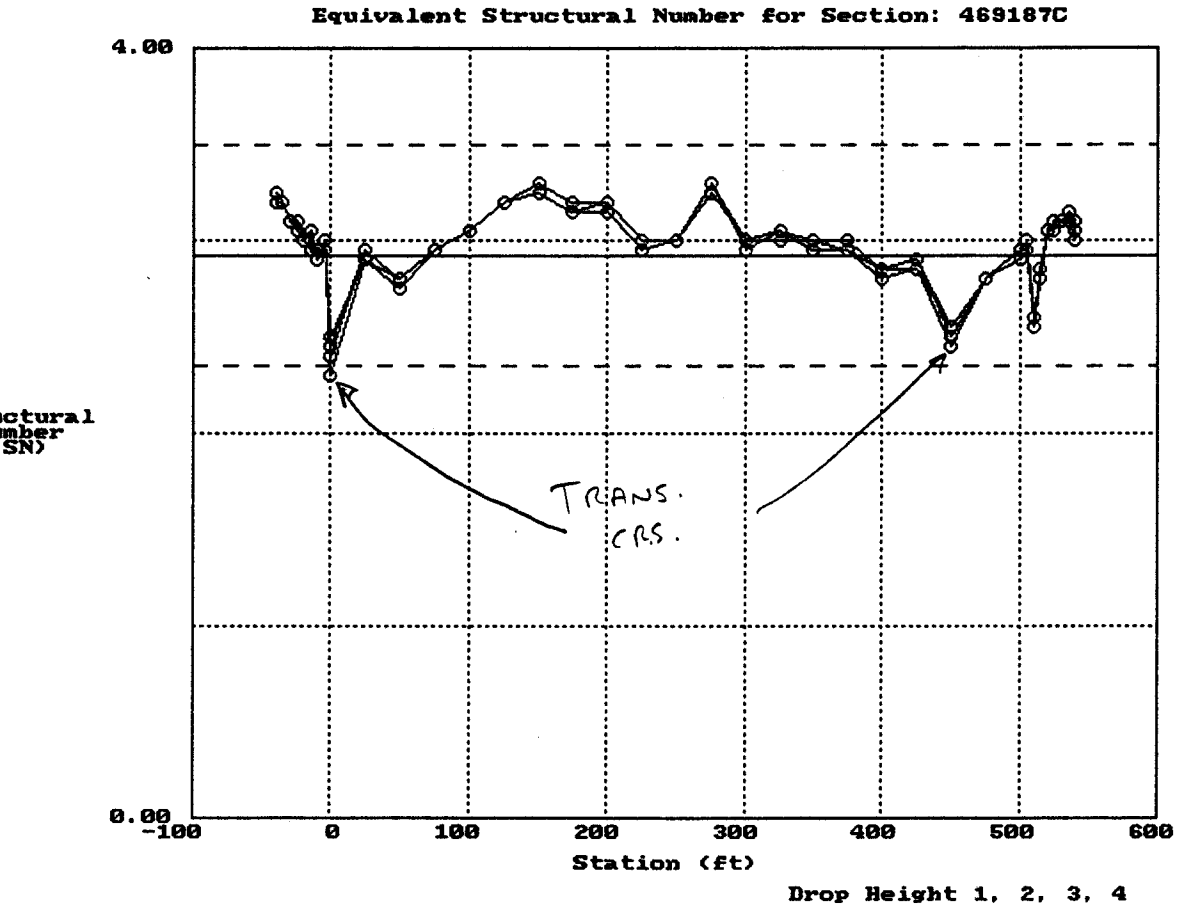
Use sta. 0-15 (fwd e sta. 0-10)



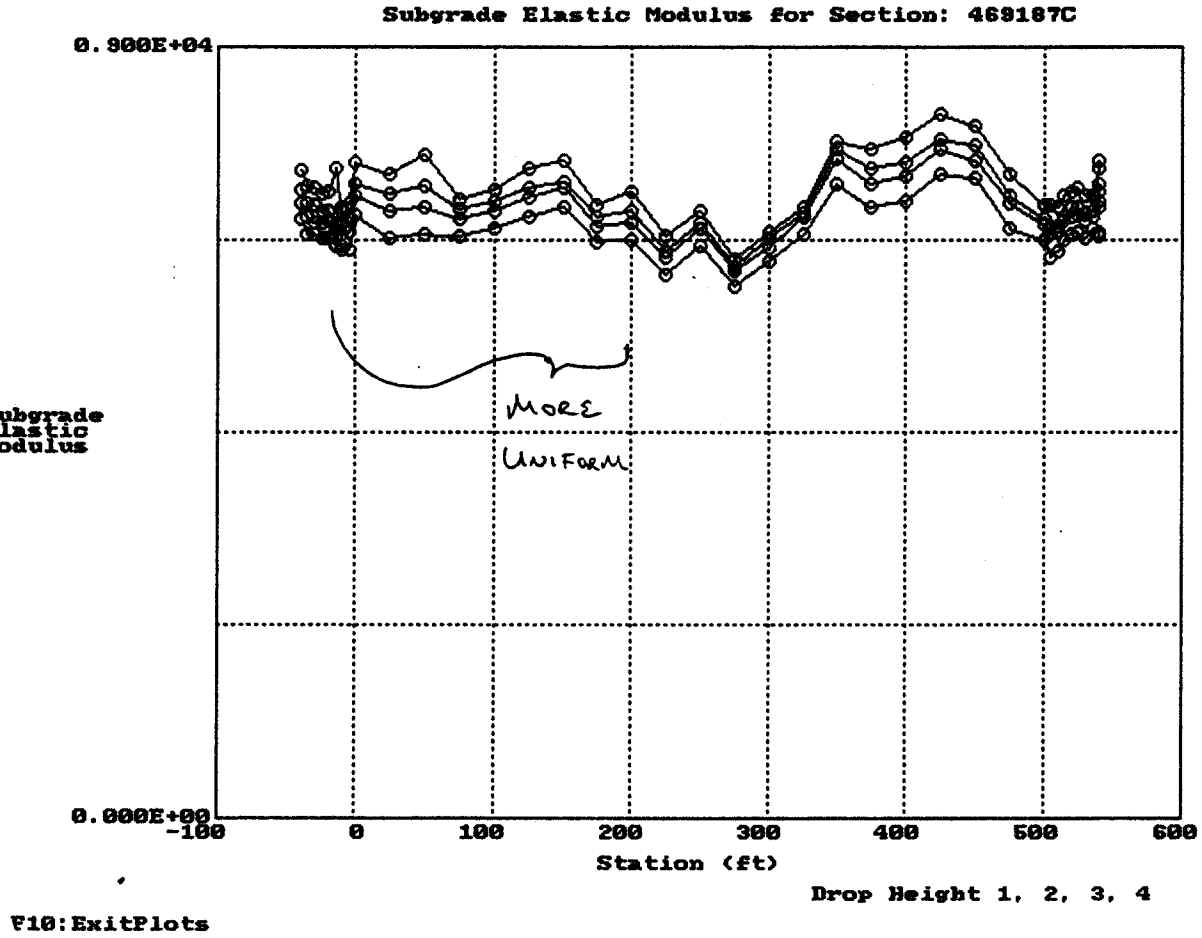
Sta. 0-15 - Instr. location?



Owl - 0-25 and 0-10 match previous points (1991/1992)



10:ExitPlots



- Better to use Sta. 0-25 to Sta. 2+00
  - More uniform subgrade
  - also, this is the part monitored during the Pilot in the NCR.

- instr. @ Sta. 0-15
  other tests @ 0-25 and 0-15
  OWP outside the section @

Appendix B-1: Pre-Installation Site Recruitment and Coordination Information

Appendix B-1 contains the following pre-installation site recruitment and coordination information:

- SMP site recruitment notes;
- Site visit field notes; and
- Pre-installation meeting agenda, list of participants, and notes.

469187

BRAUN INTERTEC

Braun Intertec Pavement, Inc.
1983 Sloan Place
St. Paul, Minnesota 55117-2004
612-776-7522 Fax: 776-7201

Engineers and Scientists Serving the Built and Natural Environments

DATE: October 31, 1991

TO: Cheryl Richter, SHRP

FROM: Erland Lukanen

RE: SEASONAL MONITORING SECTIONS

In previous discussions you have told us that we can begin scheduling the deflection testing part of the seasonal monitoring. We may be able to do that very soon now. I would like to confirm that this is in fact do-able and provide the status of the sections that have been identified.

Our first year route will be along the western tier of the region involving Manitoba, Saskatchewan, North Dakota, South Dakota, Nebraska, and Kansas. The second year route would involve the rest of the agencies that are participating. The status of all of the section in our first year route are as follows:

831801 Manitoba	OK
906405 Saskatchewan	OK
383005 North Dakota	Waiting for information on instrumentation requirements before agreeing to participate
469187 South Dakota	OK
311030 Nebraska	OK
201005 Kansas	OK
201009 Kansas	OK
201010 Kansas	OK

We only have one section identified by PCS Law in the western tier that is still in question and that is the rigid pavement section in North Dakota. Gonzalo has indicated another section is available in a different region.

The eastern route, however, is not fairing nearly as well. The current status is as follows:

271016 Minnesota	OK
276251 Minnesota	OK
261004 Michigan	HOLD: No budget
261001 Michigan	HOLD: No budget
261010 Michigan	HOLD: No budget
394031 Ohio	OUT: Cannot close lane due to heavy traffic
184042 Indiana	UNKNOWN
171003 Illinois	Waiting for instrumentation requirements before giving approval

To: Cheryl Richter, SHRP
FROM: Erland Lukanen

October 31, 1991

So as you can see we have a reasonably filled western route but a very small eastern route at this time. Since we are proposing to conduct a western route in year one or odd number years and an eastern route in even number years, that gives us more time to work out problems and establish replacement sections if necessary before year two starts. However, if replacement sections end up in the midst of a year one route, we may eventually have to evaluate changing our route for purposes of efficiency. If we can get information on the agency requirements for instrumentation installation we amy be able to include the North Dakota section in the year one testing route. Wisconsin has expressed an interest in participating in the seasonal monitoring, particularly with the 556351-55 section. One of these may be a replacement for 383005 but I have not reviewed the drilling and sampling data yet.

cc. Gonzalo Rada, PCS Law

469187

BRAUN SM
INTERTEC

Description: SD – SM (1/2)

Project No: FHWA – LTPP SM

Date: 3/17/93 By: RV

DAVE HUFT @ 605 – 773 – 3358

ble sections will check w/ district

*GPS – 469187 by Faith (Was in Pilot)

*GPS – 466000 by Yankton (SPS-4 project)

Most likely will not be needed (use sections in ND + MANITO)

Not looking for sections in this call @ this time

GPS – 463009 by Watertown – – older w/ faulting

GPS – 463010 by Sisseton –

GPS – 463052 by Desmet – one lane

will check w/ district

*SPS – 8 { 460801 / 460802 } – look @ using both sections!

ill use 469187? ~~for~~ Traffic Control?

– Some concern w/ refusal @ depth < 20'

ate willing to include 466000 by YANKTON

– would allow increased monitoring of SPS-4?

–

– this time FHWA not wanting to use SPS; however, AC < 5" is a problem. May want to use SPS-8 by Pollock! Could end up using ~~both~~ two sections on SPS-8!

? State willing to provide traffic control?

BRAUN℠
INTERTEC

Description: SD - SM (2/2)

Project No: FHWA - LTPP SM

Date: 3/93 By: RV

/93 - Call Dave - out; Mat called back - Dave will call on 3/25

/93 - Called Dave

Working on ~~three~~ four step process

I. Start with all { GPS 1, 2, 3+4 / SPS, 1, 2+8 }

II. Elliminate sections that have potential problems based on condition, age, refusal, traffic, etc.

III Of sections remaining Agency elliminate -

- Agency consider any problems
  - construction
  - rehab. plans
  - traffic control
  - etc.
  - Agency not participate

IV Make selections from remaining sections

- submit sections to PCS/LAW for selection of two groups of 8 sections.

- Dave indicated Friday mtg. w/ tech group.
  - will discuss using SPS-8 and SPS4 in addition to current section by Faith

/7/93 - Call from Dave

- Agency willing to use SPS-8 (HWY 1804) and GPS w/ SPS-4 (Hwy 50)
  (still including Faith site)

Copy - Ben
- Bruce

FACSIMILE MEMORANDUM

Braun Intertec Corporation
1983 Sloan Place, St. Paul, MN 55117-2004
(612) 776-7522 FAX: (612) 776-7201 1-800-344-7477

TO: David L. Huft
South Dakota Department of Transportation
FAX (605) 773-3921

Pages 1

FROM: Robert J. Van Sambeek

DATE: June 1, 1994

SUBJECT: Traffic Control for FWD Testing and Seasonal Monitoring Program Activities

Dave, please set up traffic control (lane closure) for the sections listed below for FWD testing. Set up start times as early in the morning as the Districts are comfortable with. The order can be reversed if the Districts have conflicts with the dates below. Call if you have any questions.

Section and Location	Date	Time	Traffic Control Contact	Phone Number
460601 SPS-6 Groton	6/7			
460804 SPS-8 Pollock	6/8			
469187 GPS Faith	6/9			

Please let me know what you have found regarding installation activities for the seasonal monitoring sections as listed below. (At this point, we are not able to have everything ready for installation the week of June 13th when you indicated a drill rig was scheduled in the area.)

- Availability of a drill rig and pavement saw. Possible installation dates of July 14th for 460804 and July 18th for 469187 for this equipment? Other dates?

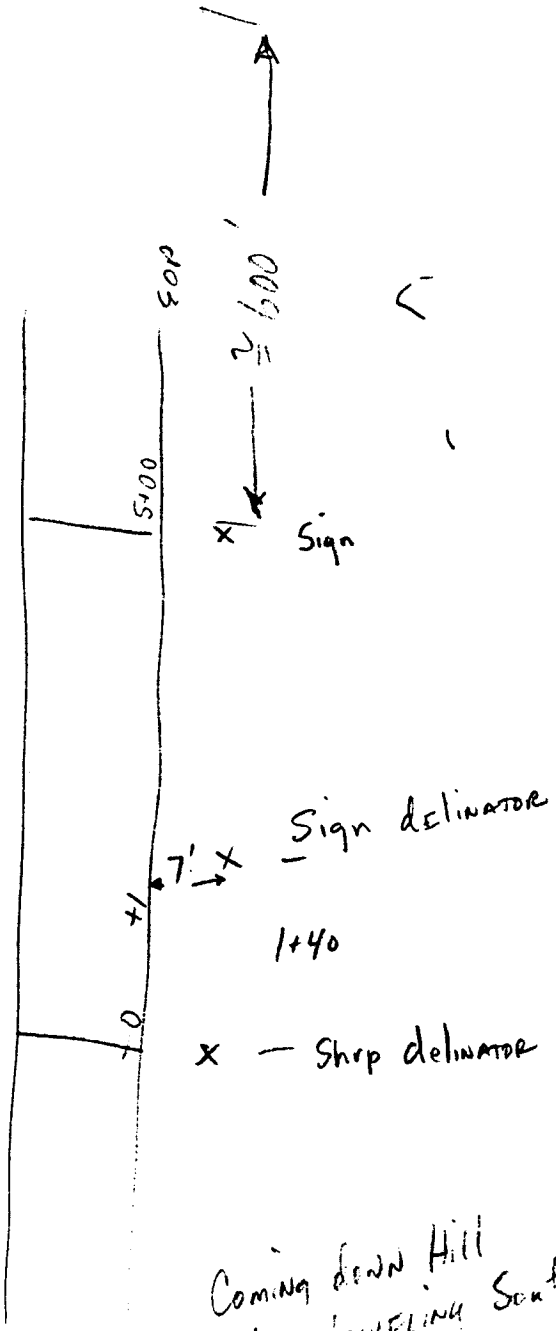
- Possible dates and location for a pre-installation meeting to introduce the seasonal monitoring program, and coordinate responsibilities and material requirements for the installation. The meeting typically takes three to four hours with the LTPP contact, drill rig operator, saw operator, traffic control coordinator, and others interested in the program attending.

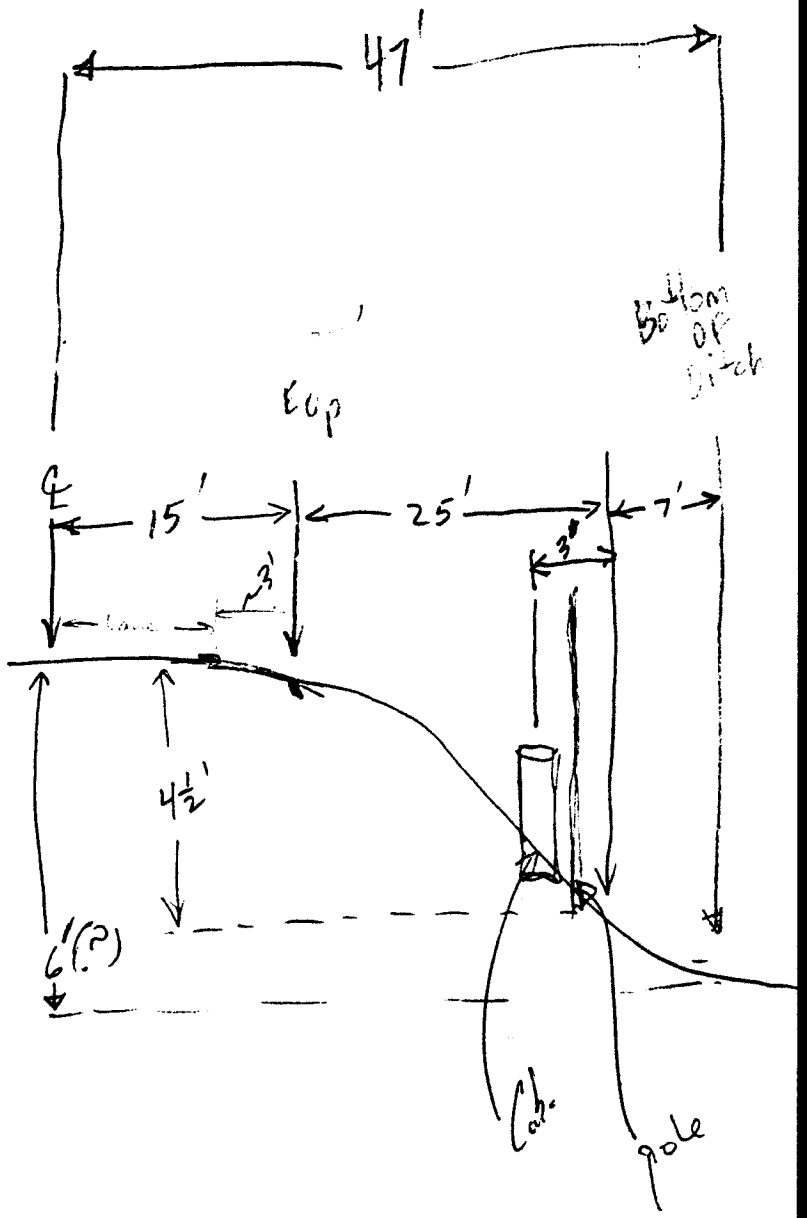
  Possible dates: Best dates are June 28th, 29th, or 30th. Other possible dates are June 10th or July 1st. If none of these work let me know.

  Location: Pierre, Mobridge, or other?

OVER HEAD UTILS.
Signs for BURIED UTILITYS
Structures Within 300' of Section
ns KNEE High
ces BOTH SIDES TO WEST 100'
D & SUN UNIFORM (BLOWS + GETS HOT)

469187 SMP-PRE 6/9/94
DBNX92-700 BJP
Good Striping 4" Edge





Coming down Hill
When traveling South
GOOD VISIBILITY
you Can get van off to Side of Rd
1' from edge strip
Pull off Room

/ — SD Proj. # HP5842 → CHANGED →

FACSIMILE MEMORANDUM

Braun Intertec Corporation
1983 Sloan Place, St. Paul, MN 55117-2004
(612) 776-7522 (800) 344-7477 FAX: (612) 776-7201

TO: Dave Huft
Dan Strand
South Dakota Department of Transportation
FAX (605) 773-3921

Pages 13

FROM: Robert J. Van Sambeek RV

DATE: June 16, 1994

SUBJECT: Seasonal Monitoring Pre-Installation Meeting Agenda

Braun Intertec, under contract with the Federal Highway Administration (FHWA), is responsible for the Seasonal Monitoring Program initiated by the Strategic Highway Research Program (SHRP). Under SHRP, section 469187 on ST-73 18 south of Faith was selected for monitoring. Under FHWA the section will remain in the study, and it will be instrumented this summer along with SPS section 460804 on ST-1804 northwest of Pollock. GPS section 466600 on ST-50 east of Gayville is also in the study, but will not be instrumented until 1995.

A meeting with appropriate agency people involved with instrument installation is required to coordinate activities. Attached is the meeting announcement and agenda. Please make arrangements for people identified in the meeting announcement to attend the meeting. It is very important that people in charge of traffic control, drill rig, pavement saw, and maintenance attend at least the planning part of the meeting.

If you have any questions, need additional information, or would like any changes to the agenda, please call me at 1-800-344-7477 or 612-776-7522.

Ramkota Inn — Gov. Rate $39 — June 27th.
— Con. # 8GWL703642040
— Loc. 1mi. w. on Hwy. 14 + 83 — 605-224-6877
920 W. Sioux

Car — Budget — one day.

Airline — 6/27 — NW 1:15 PM Gate 15 — Ar. 3:05 (Pierre)

BRAUN℠
INTERTEC

Description: SMP – SD PRE-INSTALL. MTG.

Project No: DBNX92700 B5

Date: JUNE 28, 94 By: ROBERT VANSAMBEEK

NAME	TITLE	TELEPHONE #
Daniel Strand (Coord.)	Eng. – Research	(605)-773-3871
en Marks (FWD)	Planning – NPT	773-2270 (3370
Dennis Schneider (MAINT. SPS-8)	Maint. Coordinator	845-3844
Davis Palmer (MAINT. 469187)	Foreman Field (469187) GPS-1 SBST-73 18 mile S. [illegible]	967-2182
IS ORMESHER (Coord. SMP)	RESEARCH	773-6234
n Ingle {SAW}	Pierre Region – D.O.T.	773-5290
Calkins	Pierre Bridge Foreman	773-5290
ve Huff (LTPP Contact)	Research Engr.	773-3358
EVIN GRIESE {Drill Rig)	GEOTECHNICAL ENGINEERING	773-3870

MEETING ANNOUNCEMENT

Topic: Coordinate Instrumentation Installation for GPS section 469187 and SPS section 460804 for the Seasonal Monitoring Program

When: June 28, 1994 from 9:00 AM to 12:00 Noon

Where: South Dakota Department of Transportation - Secretary Office Small Meeting Room
700 East Broadway
Pierre, South Dakota 57501

Who: Agency Level

SHRP Representative
LTPP Contact

District Level

Materials Engineer and/or Soils Engineer

Maintenance Superintendent or Maintenance Area Supervisor

Other Interested Parties

Department of Transportation staff involved with instrumentation, deflection testing, or spring recovery studies

University professors and students

Agenda: See next page

FHWA-LTPP SEASONAL MONITORING PROGRAM IN SOUTH DAKOTA

MEETING AGENDA

June 28, 1994 from 9:00 AM to 12:00 Noon

South Dakota Department of Transportation - Secretary Office Small Meeting Room

700 East Broadway, Pierre, South Dakota 57501

Introductions

FHWA-LTPP Seasonal Monitoring Program in South Dakota

- Introduction
- Test Sections
- Sensor Description and Installation Procedures

(Break)

Planning Session for Agency Staff Involved with Instrumentation and Monitoring

- Installation and Monitoring Schedule
- Special Concerns
- South Dakota Department of Transportation Responsibilities
- NCRCO and FHWA Staff Responsibilities
- Closing Comments

FHWA-LTPP Seasonal Monitoring Program in South Dakota

Introduction

Objectives of the Seasonal Monitoring Program

- Collect and analyze data to better understand the short and long term impacts of environmental factors including temperature, moisture, and frost/thaw depth on a pavement structure for improving pavement design.

- Factors defined in the core experiment monitored by FHWA-LTPP include
  - wet or dry climate
  - freeze or no freeze climate
  - pavement surface type (AC or PCC)
  - pavement surface thickness
  - original construction

SPR. RECOVERY
- thermistor string
by Pierre

- Factors not defined in the core experiment include
  - pavement edge drains
  - recycled materials
  - CRCP
  - shallow water table
  - shallow bedrock
  - etc

- Agencies are encouraged to monitor supplemental sections to study factors not included in the core experiment
  - reduced monitoring requirements
  - use existing GPS or SPS sections

Overview of Sensor Installation and Monitoring Activities

- Two days for initial instrumentation installation and monitoring

- About $10,000 of equipment installed at each site

- Monitor sections every other year (70 days over a 10 year period)

- Relate environmental variations to changes in pavement performance
  - pavement, base and subgrade strength calculated from deflection data
    - collected monthly most of year and bi-weekly in the spring
  - ride quality determined from profile data
    - collected five times per year
  - pavement distress documented using detailed distress surveys
    - collected two times per year in addition to PASCO photo logging
  - frost heave/swelling soil monitored using elevation data
    - collected five times in the first year and two times per year after that

Test Sections

Section Location

- 64 sections in the Core Experiment for the United States and Canada monitored under FHWA-LTPP contract

- 16 sections in the North Central Region
  - three core section in South Dakota
    - 460804 (SPS-8), EB ST-1804, nine miles northwest of Pollock (Sta. 140+50 to 145+50)
    - 469187 (GPS-1), SB ST-73, 18 miles south of Faith (mp 156.11 – 156.02)
    - 466600 (SPS-4), EB ST-50, three miles east of Gayville (≅ mp 398)

- install 460804 and 469187 in 1994

- install 466600 in 1995

- no supplemental sections identified in the North Central Region at this time

- see map of core sections in the North Central Region (next page)

Allowable Maintenance

- routine maintenance
  - any scheduled? — Crack Sealing on 469187 THIS SUMMER
  - shoulder work? — No

- no structural rehabilitation preferred for ten years

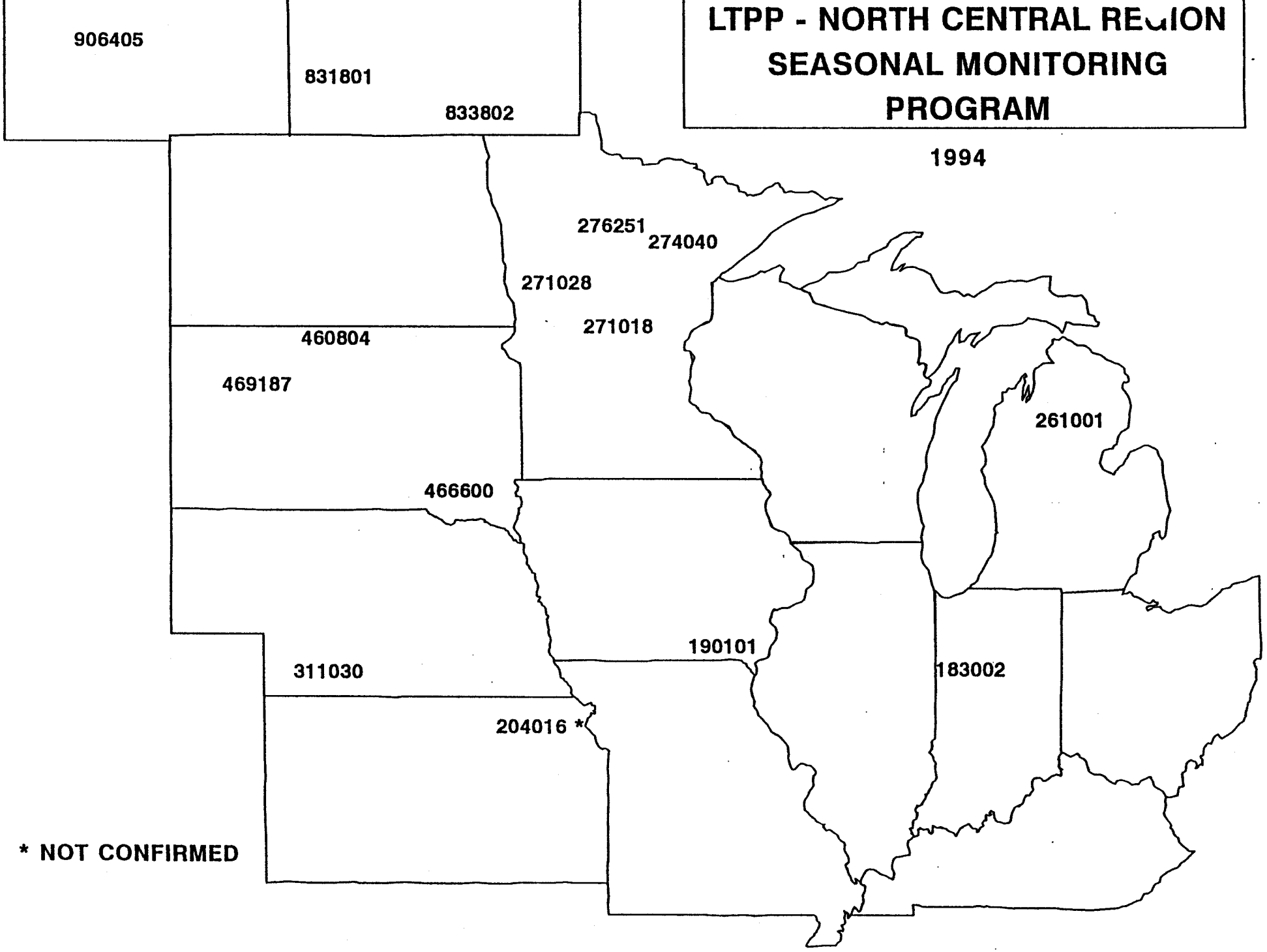
- safety is primary concern

- careful around buried cables and equipment
  - temperature probe one inch below pavement surface
  - piezometer cover four inches below the shoulder material
  - conduit one foot below surface from pavement edge to the cabinet — Buried Utility Sign

- careful plowing heavy snow and slush into the equipment cabinet

LTPP - NORTH CENTRAL REGION SEASONAL MONITORING PROGRAM

1994



* NOT CONFIRMED

F:\USERS\SHP\UPDATE\GM_SITES.CH3

SMP MANUAL - V2.01 _____ 1994

Sensor Description and Installation Procedure

TDR (Time Domain Reflectometry) Probes

(1) TDR w/ 40'
(2) TDR "S" Loop
(3) TDR # Cable
(4) Cable Reader
(5) Mobile
(6) Mobile (gents)

- FHWA design and manufacture for Seasonal (Available through Campbell Scientific)
  - three prong
  - $60.00 each

- measure dielectric of material between probes and relate to moisture content
  - air = 1.0
  - dry soil = 3 to 4
  - water = 80

- calibration
  - laboratory in air, water, and shorted
  - field moisture test on material placed on probes
  - retain soil samples for additional laboratory calibration

DOT
UN

- 10 probes per installation
  - one mid-depth in the base
  - seven at six inch intervals in the top of the subgrade
  - two at 12 inch intervals approximately seven feet below the surface

Thermistor Probe

(7) MRC IN ICE

- Measurement Research Corporation (MRC)
  - $1000.00

- thermistors change resistance with change in temperature

- built in multiplexer for automated readings

- two part
  - stainless steel section (13 inches long)
    - monitor temperature gradient through the pavement surface
      - one inch deep
      - mid depth in the surface
      - one inch above bottom of pavement

  - plexiglass section (72 inches long)
    - monitor temperatures at 15 points along probe
      - three inch intervals to 12 inch depth
      - six inch intervals from 18 inch to 72 inch depth

- laboratory calibration (check) at three temperatures
  - ice bath
  - room temperature
  - warm water bath

Resistivity Instrumentation

- CRREL design
  - PVC probe with 36 electrodes at two inch intervals
  - $800.00

- large increase in resistance when moisture in the soil freezes
  - determine both frost and thaw depth

- require signal generator and multimeters for manual readings
  - compute AC resistance between electrodes

- require CRREL multiplexer for automated readings

- Also look @ moisture levels

(8) Resistivity (unpacked)

(9) Closeup

(10) Sig. Gen + Multimeters

Air Temperature

- Campbell Scientific
  - $150.00

- air probe and radiation shield

- mount on instrument pole nine feet above the ground

(11) Air + Rain @ Little Falls.

(12) Closeup of Air

Rain Gauge/Tipping Bucket

- Texas Electronics
  - $255.00

- 0.1 mm (0.004 inches) liquid precipitation per tip

- mount on instrument pole nine feet above the ground

(13) Parts of Rain

(14) INSIDE RAIN

Equipment Cabinet and Instrument Pole

- telephone pedestal
  - break away classification
  - contain power supply, data logger, sensor connections for mobile reader
  - conduit runs into cabinet from instrumentation hole
  - pea rock inside base to prevent condensation
  - located about 26 feet off edge of driving lane (limited by cable length)

- instrument pole
  - two inch diameter galvanized pipe
  - break away classification
  - extend below frost line
  - holds rain gauge and air temperature probe
  - located about 27 feet off edge of driving lane behind equipment cabinet

(15) Cabinet w/ panel

Interface/Communications Equipment

- mobile unit
  - used each site visit to read TDR probes and resistivity probe
  - multiplexers for automated readings

- cable reader
  - Tektronics model 1502
    - $8000.00
  - generates signal and monitors reflected energy from TDR probes
  - relate time for pulse to travel through probe to dielectric constant
    - relate dielectric constant to moisture content

- computer and software
  - "onsite" used to monitor temperatures and rainfall continuously
  - "mobile" used to monitor resistivity probe and TDR probes during site visits

Observation Piezometer

- monitor depth to ground water table

- designed to act as frost free bench mark
  - Dave Esch design
  - anchor at 14 foot depth
  - sliding section extends eight feet below the surface
    - filled with water proof grease

(16) Parts
(17) Greasing
(18) MnDOT Cover
(19) Utah Cover
(20) Colorado Cover

Measuring Points for Joint Movement on PCC Pavements (Section 466600 near Gayville)

- install three sets of snap rings on each joint monitored
  - located at one, six and eleven feet from edge of slab
  - bonded 0.3 inches deep in the pavement

- measure distance between rings
  - nearest 0.001 inch with digital caliper
  - use "hot" measurement as zero opening on the joint

Order of Installation

Piezometer
(21) FWD
(22) SAW BLOCK, (23) CORE, (24) TRENCH
(25) Auger inst. hole, (26) Solid stem,
(27) Hand sample base, (28) many 5 gal. pails.
(29) Equip Cab. + base of inst. pole
(30) MnDot drill rig (31) Colorado Rig.
(32) start installing probes. (Top side)
(Back)

Planning Session for Staff Involved with Instrumentation and Monitoring

Installation and Monitoring Schedule

Instrumentation Installation and Initial Monitoring

- two days required with third day as contingency
  - first day complete instrument installation
  - second day collect data

- tentative schedule
  - July 14 & 15 - 460804, EB ST-1804, nine miles northwest of Pollock
  - July 18 & 19 - 469187, SB ST-73, 18 miles south of Faith

Long Term Monitoring

- one day every month with the exception of two times per month in the spring

- every other year for 10 years

- obtain about 70 days of FWD monitoring data

Special Concerns

Safety

- Agency Requirements
  - clothing and safety shoes
  - bring up any safety concerns during installation

RMAL
TEMS

Other

- Hazard markers for cabinet and instrument pole?
  - Snowmobiles?

— buried utility signs? — DOT will bring to site

South Dakota Department of Transportation Responsibilities

Project Contacts for Maintenance Activities and Traffic Control
- will set up traffic control directly with district if desired — Yes. - See attend. List for two Contacts.

Public Relations
- coordinate with FHWA representative on-site regarding any news coverage — None

Utility Clearance
- 700 foot section (extend 100 foot outside both ends of 500 foot test section)
- sections marked on right edge of driving lane with white paint
- clear driving lane and 40 feet into the ditch on the right side

Traffic Control for Full Lane Closure
- two days for initial installation and monitoring in July
- lane closure for 700 foot section
  - signs, cones, etc
- set up ~~as early as~~ possible
  - 7:30 AM? ALL 4 DAYS.
- may ~~want to mark~~ locations for placing construction signs in the future

Establish Elevation Reference for Piezometer or Install Local Bench Mark
- not affected by frost
- actual elevation not required (local reference)
- check piezometer elevation every other year?

NOT

Equipment
- pavement saw and operator
  - only required for first day during instrument installation at each site
  - saw 18 inch square block out of the pavement surface
    - located in the outer wheel path
    - will epoxy block back in-place
  - equipment capable of cutting one inch deeper than estimated pavement thicknesses
    - 460804 7.0 inches asphalt (cut 8.0 inches deep)
    - 469187 4.5 inches asphalt (cut 5.5 inches deep)

    will rent saw
  - saw four inch wide trench for conduit
    - extend from outer wheel path to edge of paved shoulder
  - saw 13 inch slot for temperature probe
    - extend longitudinal cut for the block in the outer wheel path

- drill rig and operator
  - only required for first day during instrument installation at each site

  - able to reach location for instrument pole 27 feet off edge of driving lane — able to drive in ditch!

  - bore one ~~six~~ 7¼ inch diameter hole for piezometer
    - 14 foot depth
    - located on shoulder
      - location may depend on cap used for piezometer

  - bore one 12 inch diameter hole for instrumentation
    - solid stem auger preferred
      - continuous flighting not required
    - eight foot depth
    - located in outer wheel path
    - NCRCO has 12 inch diameter auger with 1-5/8 inch male hex drive — BRING

  - bore one 12 inch diameter hole for equipment cabinet (or will dig by hand)
    - two feet deep
    - located about 26 feet outside the driving lane in the ditch

  - bore one ~~six inch~~ 7¼ diameter hole for the instrumentation pole
    - 10 feet deep
    - located one foot behind the equipment cabinet in the ditch

- small portable generator (only if readily available) — Saw Crew bring.
  - may not be needed

Materials for Each Site

- cover assembly for piezometer — NCR ~~[illegible]~~ provide ~~it also~~
  - must function for ten years
  - able to open in the winter
  - minimum four inch inside diameter
  - 18 inches to 24 inches long

NCR

- sackcrete for piezometer cover and instrumentation pole
  - estimate six bags (60# bags)

- bentonite pellets for sealing piezometer (will order and bring to site
  - five gallon bucket

- filter sand for piezometer
  - 400 pounds (four bags)
  - particle size not critical (silica sand will work) — DIST.

- pea gravel or trap rock for equipment cabinet
  - 500 pounds
  - 3/8 inch or 1/2 inch size preferred

— will be smaller size than 3/8" (Mobridge)

...ing
...RA PAILS
...R MATLS. FOR
4658.

- asphalt patch for conduit trench
  - estimate 300 pounds 4"x6'x ? (COLD MIX)

- water for mixing sackcrete and equipment clean-up
  - estimate 30 gallons (available on drill rig?) — SAW TRUCK HAVE

- hazard markers for cabinet and instrument pole (if required by the agency) — DOT

Pavement Repairs
- patch conduit trench with asphalt material

- assist with block replacement

Miscellaneous Activities
- mow grass in area identified for utility clearance or bring weed whip to the site — will mow

<u>NCRCO (Braun Intertec) and FHWA Staff Responsibilities</u>

Instrumentation
- provide all instrumentation + piez. CAP.

- install all instrumentation
  - may ask anyone on-site for assistance +

- monitoring activities
  - will collect all required monitoring data

- NCRCO phone 1-800-344-7477 or 612-776-7522
  - main contacts for Seasonal Monitoring
    - Bob Van Sambeek (Coordination and instrumentation)
    - Ron Urbach (Geotechnical and materials)

<u>Closing Comments</u>

Questions or Concerns?

Sturgis EXIT. 30

7/18 → 3 RMS. (NS) Super 8 (605-347-4447)

MOTEL — Mobridge — Weds 7/13
Thurs. 14
Fri. 15
Sat. 16 (Depart 17)

3 ROOMS (NS)

WRANGLER MOTOR INN
605-845-3641
½ MI. W. on TH12

Faith — Sun. 7/17 (3 RMS) { DEEDEE
Vista (2343) Mon. 7/18 NONE — FULL

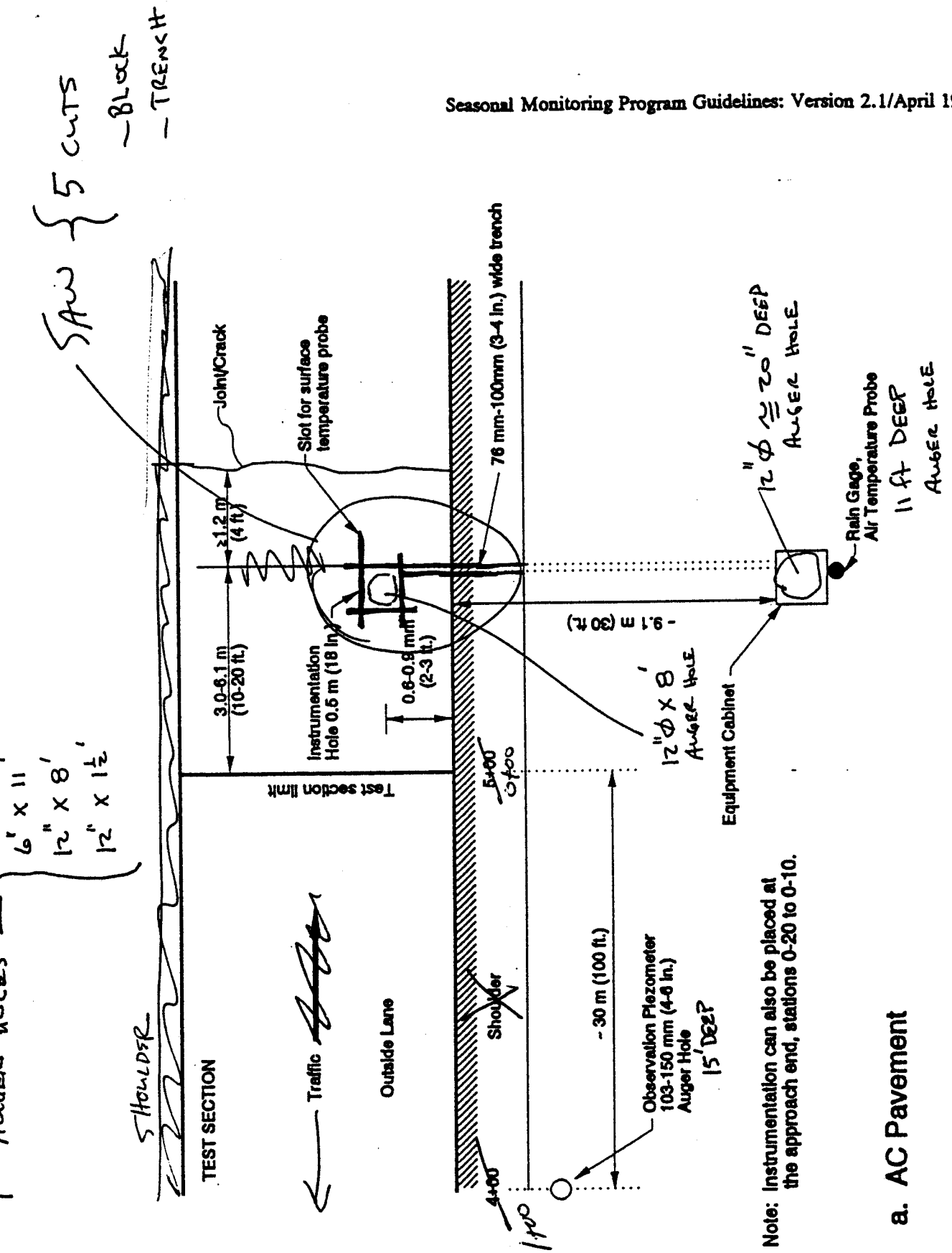


Figure II-12 - Typical Instrumentation Layout

Adjust for Sta. 0+00 vs 5+00

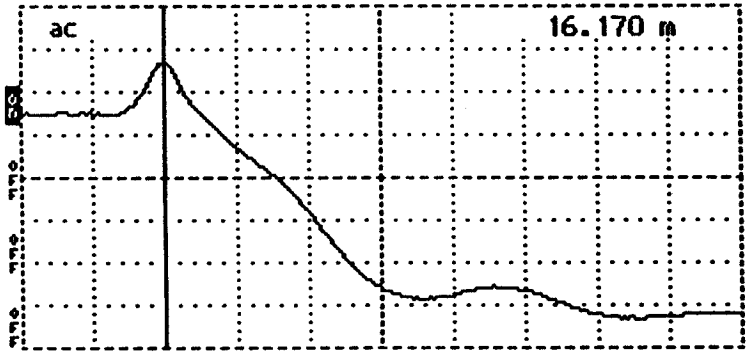
Appendix B-2: Pre-Installation Equipment Checks/Calibration Information

Appendix B-2 contains the following data sheets for the pre-installation equipment checks/calibration:

- Data Sheet SMP-C01: TDR Probe Check;
- Data Sheet SMP-C02: Thermistor and Air Temperature Probe Check;
- Data Sheet SMP-C03: Electrical Resistivity Probe Check;
- Data Sheet SMP-C04: Function Generator, Multi-meter, and Switch Box Checks; and
- Data Sheet SMP-C05: Tipping-Bucket Rain Gauge Calibration.

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

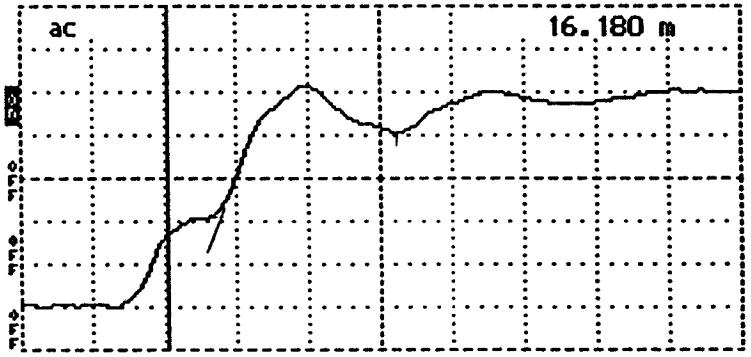
Cursor ..... 16.170 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 6-27-94
Cable 46SB 01
Notes SHORTED
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.180 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

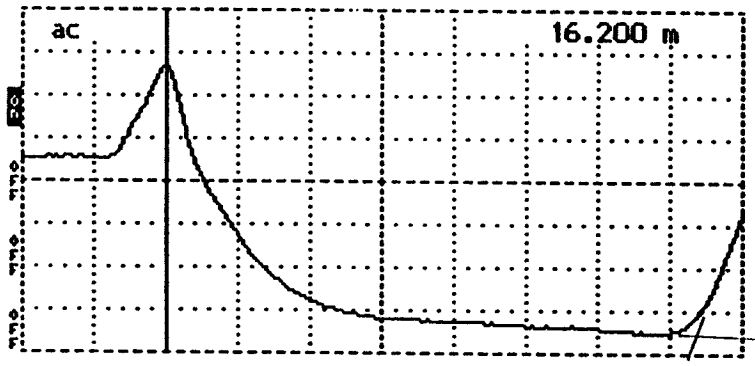


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB 01
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.20	0.99

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.200 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 6-27-94
Cable 465B 01
Notes
1N H_2O Temp 24.2°C

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.92

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B01 Measured Length of Coax Cable: 12.20m

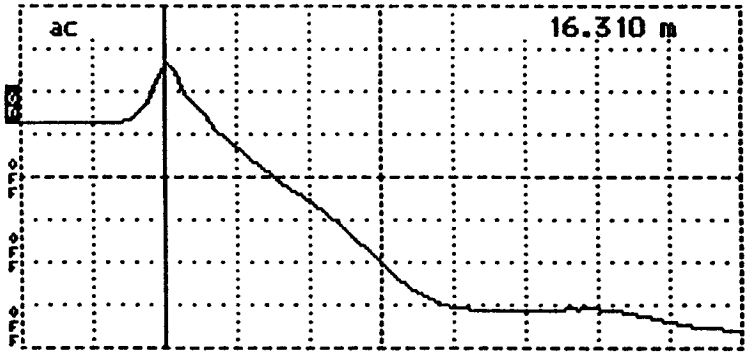
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.310 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

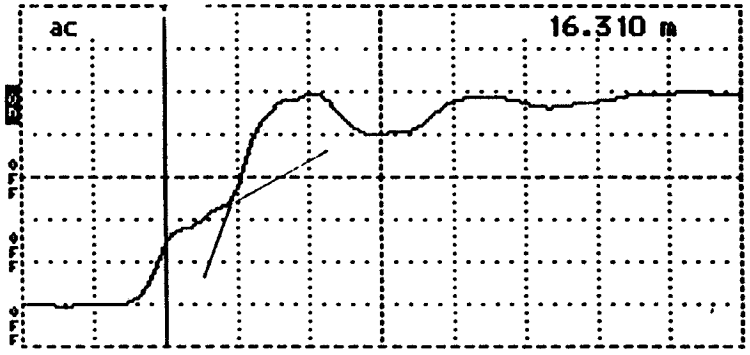


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB 02
Notes SHORTED

Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.310 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 6-27-94
Cable 46SB 02
Notes IN AIR

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.22	1.20

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.360 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 6-27-94
Cable 46SB A2
Notes
IN H_2O Temp 24.2°C

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.84	83.82

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B02 Measured Length of Coax Cable: 12.20m

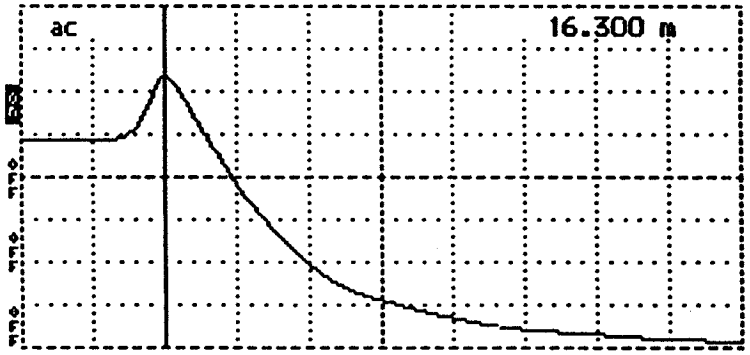
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

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

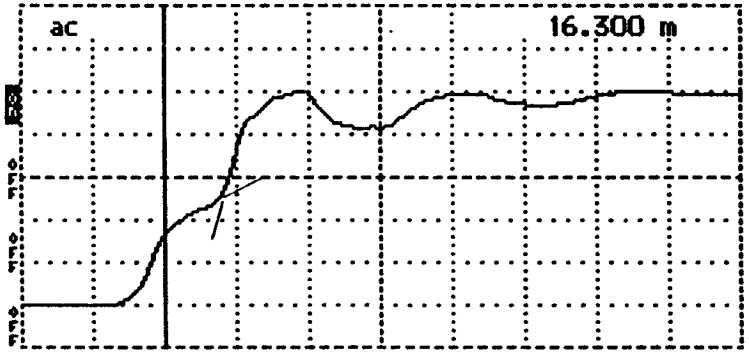


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB 03
Notes SHORTED

Input Trace
Stored Trace
Difference Trace

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

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



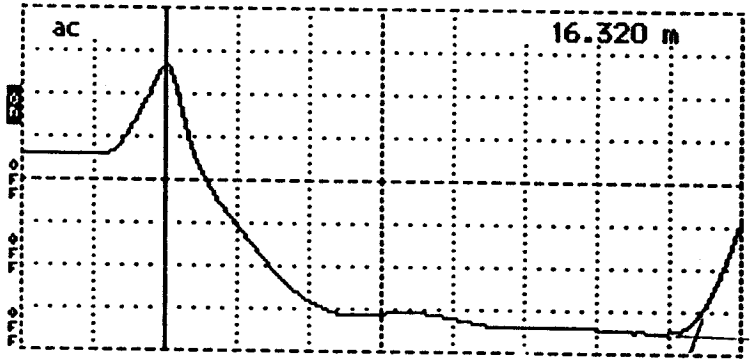
Tektronix 1502B TDR
Date 6-27-94
Cable 46SB 03
Notes IN AIR

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.20	0.99

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.320 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 6-27-94
Cable 46SB 03
Notes
1N H_2O Temp 24.2°C

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.92

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B03 Measured Length of Coax Cable: 12.20m

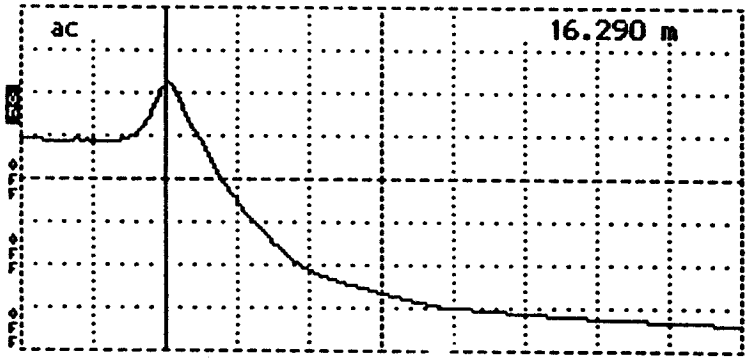
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.290 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

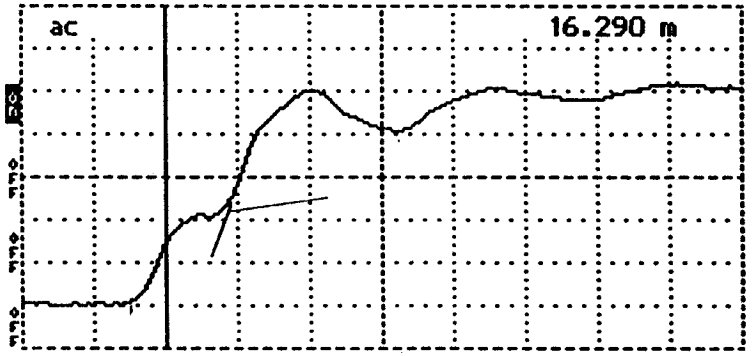


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB D4
Notes SHORTED

Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.290 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



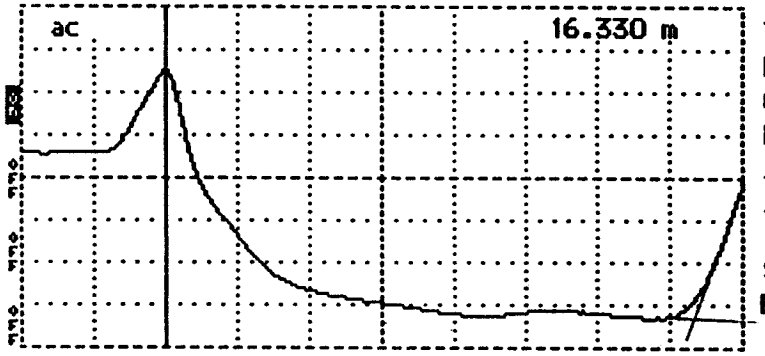
Tektronix 1502B TDR
Date 6-27-94
Cable 46SB D4
Notes IN AIR

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.22	1.20

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.330 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 6-27-94
Cable 46SB 04
Notes
1N H_2O Temp 24.2°C

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.92

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B04 Measured Length of Coax Cable: 12.20m

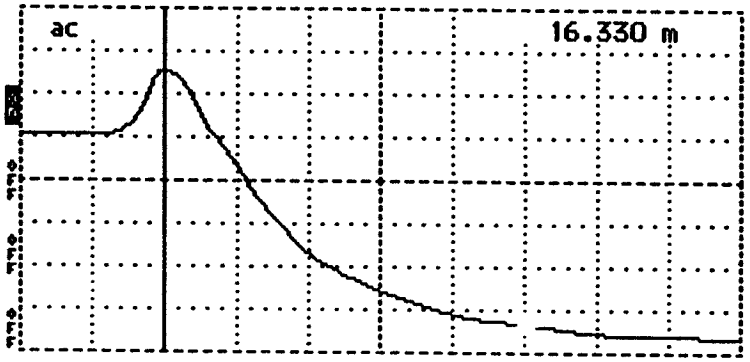
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

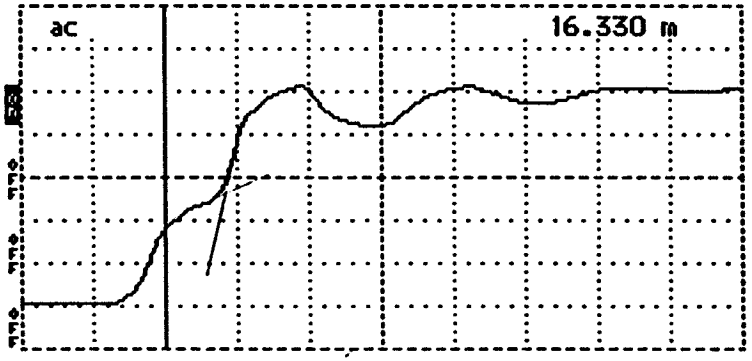
Cursor ..... 16.330 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #5
Notes SHORTED
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.330 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

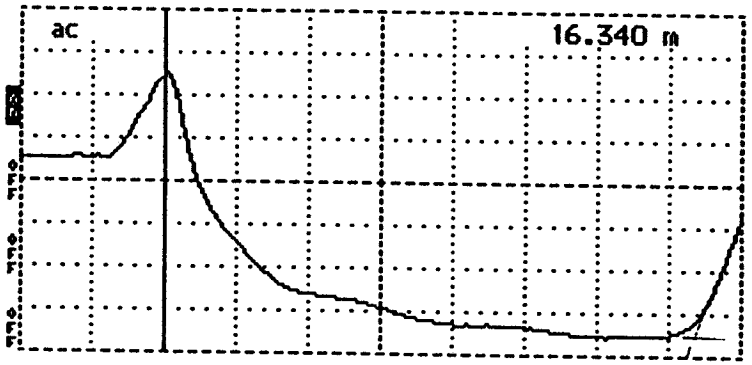


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #5
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.20	0.99

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.340 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 6-27-94
Cable 46SB 05
Notes
IN H_2O Temp 24.2°C

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.92

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B05 Measured Length of Coax Cable: 12.20m

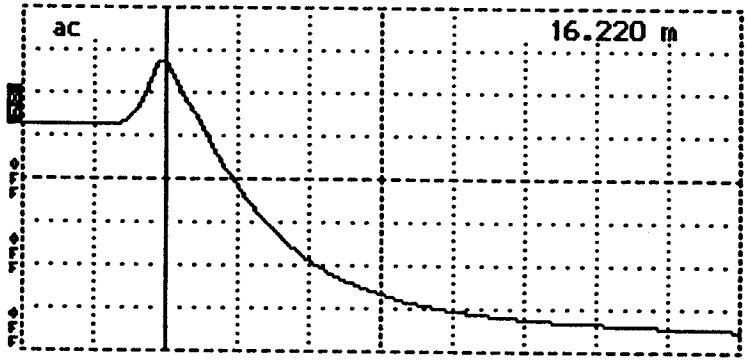
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.220 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

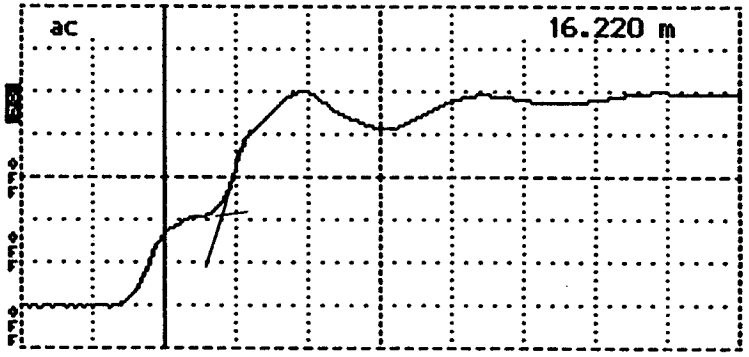


Tektronix 1502B TDR
Date 7-5-94
Cable 46SB 06
Notes SHORTED

Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.220 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



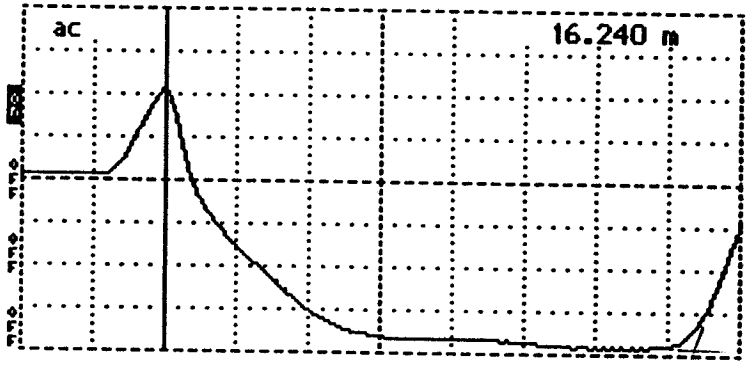
Tektronix 1502B TDR
Date 7-5-94
Cable 46SB 06
Notes AIR

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.20	0.99

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.240 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 7-5-94
Cable 46SB 06
Notes
IN WATER Temp 24.7°C

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.92

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B06 Measured Length of Coax Cable: 12.20 m

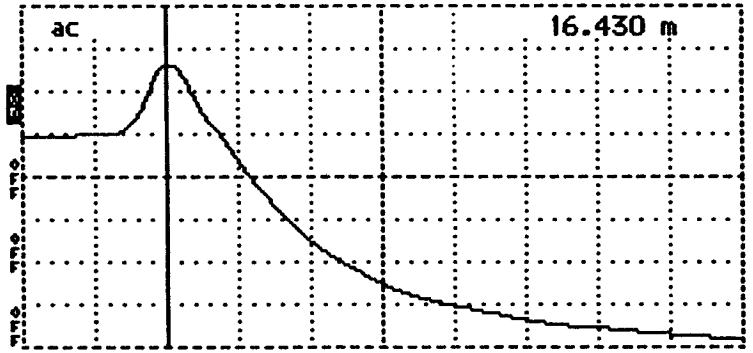
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

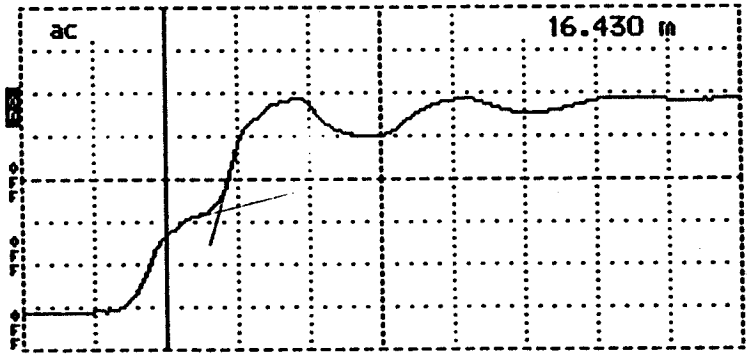
Cursor ..... 16.430 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 7-7-94
Cable 46B07
Notes
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.430 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

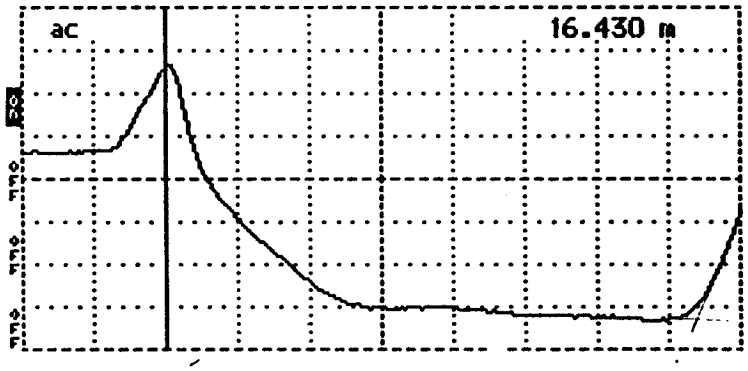


Tektronix 1502B TDR
Date
Cable 46B07
Notes
IN AIR
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.18	0.80

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.430 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 7-7-94
Cable 46B07
Notes IN WATER
Temp 27.4 C
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.92

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B07 Measured Length of Coax Cable: 12.20 m

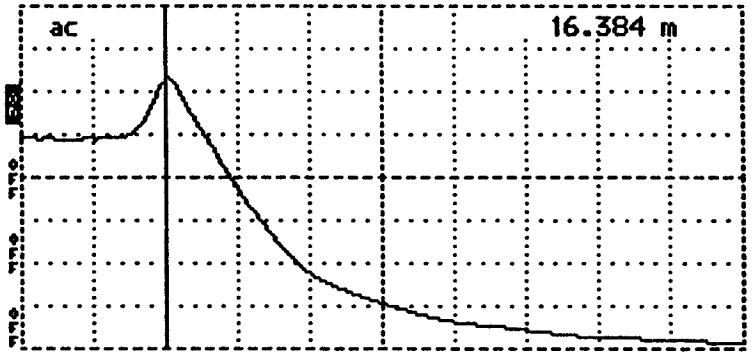
Comments: FIRST CHECK HAD L_A = 1.65 IN H_2O. WHAT CAN CAUSE THE BIG CHANGE?

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.384 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

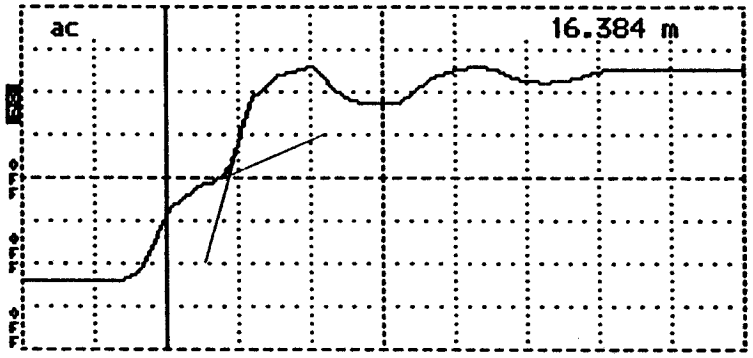


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #8
Notes SHORTED

Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.384 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



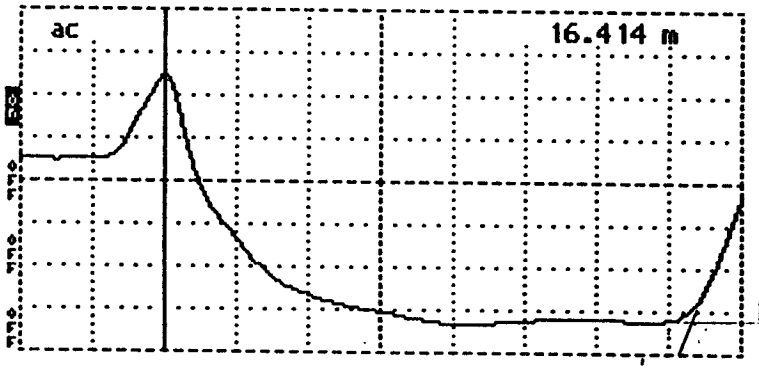
Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #8
Notes IN AIR

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.21	1.09

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.414 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 6-22-94
Cable 46SB #08
Notes IN H_2O
Temp 24.22 C

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.80

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B08 Measured Length of Coax Cable: 12.20 m

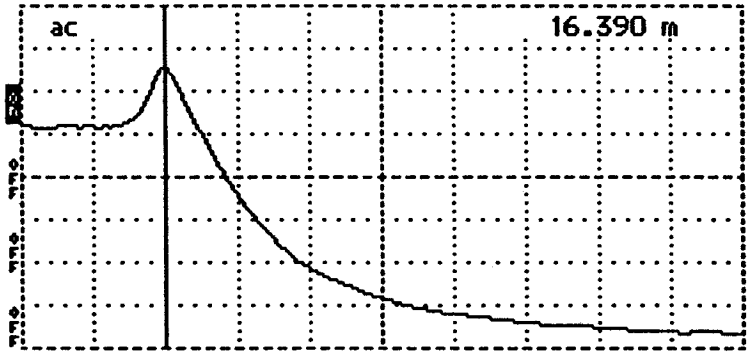
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

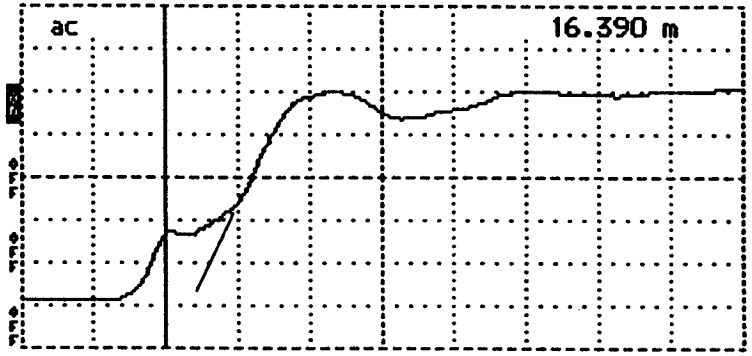
Cursor ..... 16.390 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #09.
Notes SHORTED
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.390 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

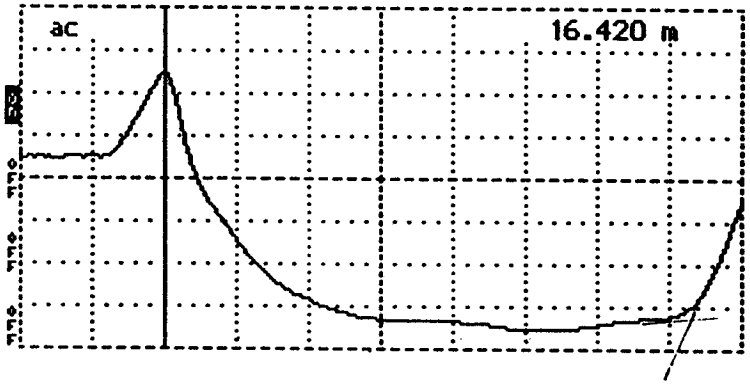


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #09
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.23	1.31

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.420 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 6-27-94
Cable 46SB 09.
Notes
1N H_2O Temp 24.2°C
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.82	81.90

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B09 Measured Length of Coax Cable: 12.20m

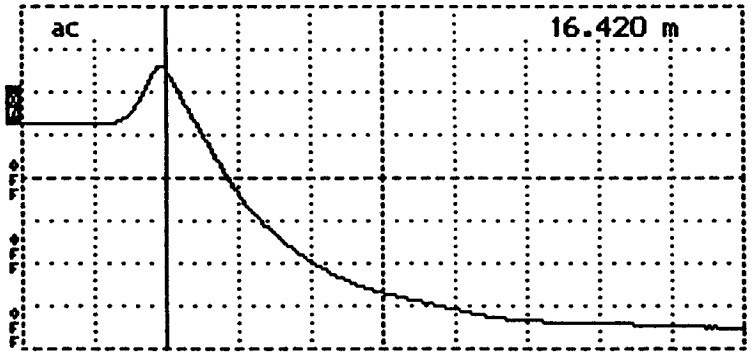
Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.420 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac

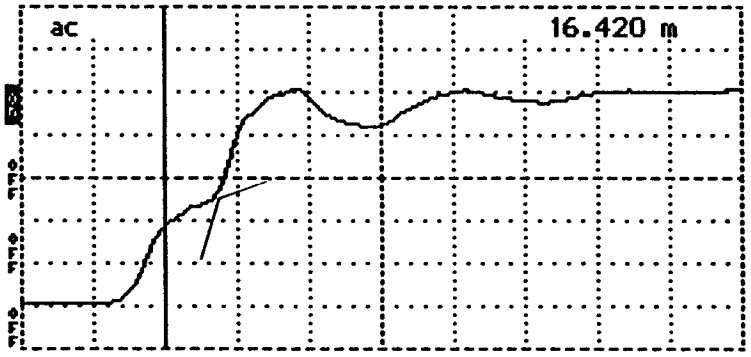


Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #10
Notes SHORTED

Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.420 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
Vp 0.99
Noise Filter..... 1 avg
Power..... ac



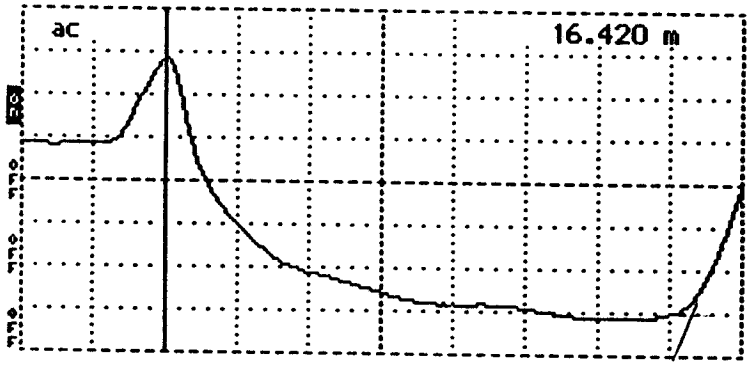
Tektronix 1502B TDR
Date 6-27-94
Cable 46SB #10
Notes IN [redacted] AIR

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[1]
"In Air"	0.19	0.89

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 2) TDR Probe Check	Agency Code [46] LTPP Section ID [9187]

Cursor ..... 16.420 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 6-27-94
Cable 46SB #10
Notes 1N H_2O Temp 24.2°
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.83	82.92

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Assigned Serial Number: 46B10 Measured Length of Coax Cable: 12.20 m

Comments: _____

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/07/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C02 Thermistor Probe Check	Agency Code [46] LTPP Section ID [9187]

Thermistor Probe Assigned Serial Number : [46B T]

Air Temperature Probe Assigned Serial Number: [46B A T]

Thermistor Number	Distance from Top (m)	Temperature (°C) – Calibration in: Ice-Bath; T = 0.9°C	Other AIR; T = 21.8°C	Comments
1	0.000	0.0	22.5	✓
2	0.152	0.0	22.3	✓
3	0.305	-0.1	22.2	✓
4	0.019	1.2	21.8	✓
5	0.095	0.5	21.5	✓
6	0.172	0.3	21.6	✓
7	0.248	0.5	21.4	✓
8	0.323	0.5	21.4	✓
9	0.477	1.0	21.6	✓
10	0.629	0.5	21.4	✓
11	0.783	0.9	21.5	✓
12	0.934	1.2	21.4	✓
13	1.087	1.7	21.3	✓
14	1.237	1.1	21.3	✓
15	1.393	1.1	21.3	✓
16	1.543	0.6	21.7	✓
17	1.695	0.5	21.9	✓
18	1.847	0.3	22.0	✓
End	1.854	n/a	n/a	
Air Probe	n/a	1.3	22.5	✓

Comments: _____

Prepared by: D. L. M Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/05/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C03 Resistivity Probe Check	Agency Code [46] LTPP Section ID [9187]

Electrical Resistivity Serial Number: 46BR

DB37 Connector Pin Number	Electrode Number	Distance from Top (m) Line 1	Line 2	Avg	Continuity ✓	Spacing (m)	Comments
36	1	0.025	0.026	0.0255	✓	N/A	
35	2	0.080	0.078	0.079	✓	0.0545	
34	3	0.128	0.127	0.1275	✓	0.0525	
33	4	0.178	0.178	0.178	✓	0.0515	
32	5	0.230	0.228	0.229	✓	0.051	
31	6	0.280	0.278	0.279	✓	0.050	
30	7	0.331	0.329	0.330	✓	0.051	
29	8	0.381	0.381	0.381	✓	0.049	
28	9	0.433	0.432	0.4325	✓	0.0515	
27	10	0.483	0.483	0.483	✓	0.0505	
26	11	0.534	0.534	0.534	✓	0.051	
25	12	0.585	0.585	0.585	✓	0.051	
24	13	0.637	0.635	0.636	✓	0.051	
23	14	0.685	0.687	0.686	✓	0.050	
22	15	0.737	0.738	0.7375	✓	0.0515	
21	16	0.787	0.788	0.7875	✓	0.050	
20	17	0.838	0.836	0.837	✓	0.0495	
19	18	0.889	0.887	0.888	✓	0.051	
18	19	0.939	0.937	0.938	✓	0.050	
17	20	0.990	0.988	0.989	✓	0.051	
16	21	1.042	1.042	1.042	✓	0.053	
15	22	1.092	1.094	1.093	✓	0.051	
14	23	1.143	1.145	1.144	✓	0.051	
13	24	1.195	1.197	1.196	✓	0.052	
12	25	1.243	1.244	1.2435	✓	0.0475	
11	26	1.295	1.297	1.296	✓	0.0525	
10	27	1.347	1.347	1.347	✓	0.051	
9	28	1.396	1.398	1.397	✓	0.050	
8	29	1.447	1.449	1.448	✓	0.051	
7	30	1.499	1.498	1.4985	✓	0.0505	
6	31	1.549	1.551	1.550	✓	0.0515	
5	32	1.601	1.601	1.601	✓	0.049	
4	33	1.651	1.653	1.652	✓	0.051	
3	34	1.702	1.702	1.702	✓	0.050	
2	35	1.752	1.754	1.753	✓	0.051	
1	36	1.804	1.804	1.804	✓	0.049	
	Bottom	1.829	1.829	1.829	n/a	n/a	

Comments:

Prepared by: D. L. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 06/28/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C04 Function Generator, Multimeter, and Switch Box Checks	Agency Code	[46] AND [46]
	LTPP Section ID	[9187] [0804]

Start Time (military): 1100 +1400 +1500

	Test Position	Switch Settings I_1 V_1	Switch Settings I_2 V_2	Voltage (ACV) Range Setting	Voltage (ACV) Reading (Volts)	Current (ACA) Range Setting	Current (ACA) Reading (Amps)	Measured Resistance R = V/I (ohms)	Known Resistance (ohms)
1100	36	36	37	MILLI	0.022 E-1	MICRO	0.384 E-2	R1 = 0.573 E--	R1 = 0.97 E--
	37	37	38	MILLI	3.359 E-1	MICRO	0.335 E-2	R2 = 1.003 E2	R2 = 1.007 E2
	38	38	39	VOLTS	1.976 E--	MICRO	0.197 E-2	R3 = 1.003 E3	R3 = 1.004 E3
	39	39	00	VOLTS	0.048 E2		0.049 E-4	R4 = 9.796 E5	R4 = 9.94 E5
1400	36	36	37	MILLI	0.016 E-1	MICRO	2.395 E-3	R1 = .668 E--	R1 = .97 E1
	37	37	38	MILLI	2.272 E-1	MICRO	2.265 E-2	R2 = 1.003 E2	R2 = 1.007 E2
	38	38	39	VOLTS	1.533 E--	MICRO	1.527 E-3	R3 = 1.003 E3	R3 = 1.004 E3
	39	39	00	VOLTS	0.567 E1	MICRO	0.006 E-4	R4 = 0.945 E6	R4 = 9.94 E5
1500	36	36	37	MILLI	0.020 E-1	MICRO	3.063 E-3	R1 = .653 E--	R1 = .97 E--
	37	37	38	MILLI	2.796 E-1	MICRO	2.788 E-2	R2 = 1.003 E2	R1 = 1.007 E2
	38	38	39	VOLTS	1.846 E--	MICRO	1.835 E-3	R3 = 1.006 E3	R1 = 1.004 E3
	39	39	00		0.521 E1		0.058 E-4	R4 = 8.983 E5	R2 = 9.94 E5

Note: Voltage and current readings are recorded using scientific notation; E refers to base 10 exponent

Comments: _____

Prepared by: D. C. MILLER Employer: BRAUN INTERTEC

Date (dd/mm/yy): 07/08/94

LTPP Seasonal Monitoring Program Data Sheet SMP-C05 Rain Gage Calibration	Agency Code [46] LTPP Section ID [9187]

General Information:

Manufacturer: TEXAS INST

Model Number: TRP-525M

Serial Number: 12048

Note: The screen should be tacked inside the funnel using silicon at three to four points to prevent loss from wind.

Rain Gage Calibration Data					
Trial	Start Time (Military)	End Time (Military)	Volume (ml)	Number of Tips	Adjustment[1] No. of Turns
1	1000	1100	473.	93.	1.0
2	1300	1400	473.	105.	0.5
3	1400	1500	473.	100.	0.3

[1] Adjust gage to obtain 100 tips ± 3 for 473 ml of water.

Comments: _____

Prepared by: D.L. MILLER Employer: BRAUN INTERTER

Date (dd/mm/yy): 07/01/94

Appendix C-1: Instrumentation Installation Information

Appendix C-1 contains the following installation data sheets and associated field notes, as well as, certificate of registration for instrumentation, and photographs documenting the installation:

- Data Sheet SMP-I01: List of Installed Instrumentation;
- Data Sheet SMP-I02: Instrumentation Locations;
- Data Sheet SMP-I03: Log of Piezometer Hole;
- Data Sheet SMP-I04: Log of Instrumentation Hole;
- Data Sheet SMP-I05: Field Gravimetric Moisture Contents;
- Data Sheet SMP-I05(A): Lab Gravimetric Moisture Contents;
- Data Sheet SMP-I05(B): Gravimetric Moisture Comparison;
- Data Sheet SMP-I06: TDR Moisture Content;
- Data Sheet SMP-I07: Representative Dry Density;
- Plot of Gravimetric Moisture Results; and
- Installation Photographs.

465594A

LTPP Seasonal Monitoring Program Data Sheet SMP-D10 SMP Field Activity Report	Agency Code [46] LTPP Section ID [9187]

Onsite Datalogger and Instrumentation		
File Name - *.ONS	INSTALL	Comments: DOWNLOAD ONLY
Battery Replace	(Yes - No)	Voltages 13.0 V (INSTALL)
Repairs/Calib.	INSTALL	
Other:		

Mobile Datalogger		
File Name - *.MOB	NO	Comments: MANUAL (INSTALL)
TDR/Resistance Voltages	Sets (0)	
Other:		

Manual Data Collection		
Piezometer	(Yes) - No	Comments: DRY — 9.99
Resistance 2 pt.	Sets (0)	
Resistivity 4 pt.	Sets (0)	
Elevations	Sets (0)	
Distress Survey	Yes - (No)	
Long. Dipstick Profile	Yes - (No)	
Photos or Video	(Yes) - No	INSTALLATION
Other:		

FWD and Associated Data		
FWD Testing	Sets (01)	Operator: D. C. M
JCP - Snap Rings	Sets (0)	
JCP - Faulting	Sets (0)	
Other: FWD REPAIR	BRAKES LOCKED UP ON TRAILER.	

IF REQUIRED, ATTACH SKETCHES TO THIS DATA SHEET

Comments: VERY HOT, CALM DAY.

Prepared by: D. C. M Employer: BRAUN INTERTEC

Date (dd/mm/yy): 21/JUL/94

LTPP Seasonal Monitoring Program Data Sheet SMP-I01 Instrumentation Installed and Participants	Agency Code [46] LTPP Section ID [9187]

List of Equipment:

Equipment	Quantity	Serial Number(s)
Instrument Hole:		
Thermistor Probe	01	46BT
Resistivity Probe	01	46BR
TDR Sensors	10	46B01 to 46B10
Equipment Cabinet:		
Campbell Scientific CR10 Datalogger	01	16543
Battery Package	01	5626
Weather Station:		
Rain Gage	01	12037
Air Temperature Probe	01	46BAT
Radiation Shield	01	N/A
Observation Piezometer/Bench Mark:	01	n/a
D.O.T. B.M	01	N/A

List of Participants:

Name of Participant	Agency/Employer
ROBERT VAN SAMBEEK	BRAUN INTERTEC
RON URBACH	BRAUN INTERTEC
DANA MILLER	BRAUN INTERTEC
DAN STRAND	SD DOT
DARIS ORMESHER	SD DOT
RON CALKINS	SD DOT
JARVIS PALMER	SD DOT
RON INGLE	SD DOT

Prepared by: ROBERT VAN SAMBEEK Employer: BRAUN INTERTEC

Date (dd/mm/yy): ~~07~~ Jul / 17 / 94

465894A

LTPP Seasonal Monitoring Program Data Sheet SMP-I02 Installed Instrument Location	Agency Code [46] LTPP Section ID [9187]

Longitudinal and Transverse Location of Instrumentation:

Instrument	Station (Customary Units)		Offset (m)[1]	
	Planned	Actual	Planned	Actual
Instrumentation Hole	0-15	0-15	+0.76	+0.76
Observation Piezometer	1+00	1+00	-1.52	-1.30
Equipment Cabinet	0-15	0-15	-7.60	-7.50
Weather Station	0-15	0-15	-7.90	-7.80
DOT BM	—	0+00	—	-30.57

[1] Transverse distance in meters from pavement edge (see LTTP Manual for FWD Testing) with (+) values toward mid-lane and (-) towards shoulder

Depth Location of Instrumentation:

Instrument		Depth from Pavement Surface to Top of Probe (m)		Comments
		Planned	Actual	
Thermistor Probe	Metal Top	0.025	0.023	
	Metal Bottom	0.114	0.113	
	PVC Top	0.190	0.195	50 mm below AC
Resistivity Probe		0.190	0.190	50 mm below AC

AC 5.5 7.5

PIEZ. IS 0.2451 meters below the AC surface @ sta. 1+00

TDR Number	Depth from Pavement Surface to Probe (m)		Comments
	Planned Location	Actual Location	
1	0.216	0.210	WET FROM CORING/SAW
2	0.368	0.370	ESTIMATED DEPTH
3	0.521	0.510	
4	0.673	0.681	
5	0.826	0.833	
6	0.978	0.970	
7	1.131	1.125	
8	1.283	1.278	
9	1.588	1.580	
10	1.893	1.905	Drill to 1.940 M (max)

5+3 14.5 20.5 26.5 32.5 38.5 44.5 50.5 62.5 74.5

ATTACH TOP-VIEW SKETCH OF INSTRUMENTATION HOLE SHOWING DIRECTION OF TRAFFIC AND LOCATION OF THERMISTOR AND RESISTIVITY PROBES. LABEL PROBES "T" AND "R", RESPECTIVELY

Prepared by: Robert Van Sambeek Employer: Braun Intertec

Date (dd/mm/yy): 07/18/94

465894B

LTPP Seasonal Monitoring Program Data Sheet SMP-I03 Log of Piezometer Hole	Agency Code [46] LTPP Section ID [9187]

Operator: INGLE/CALKINS Equipment Used: CME 55

Location: Station: 1+00 Offset: -1.30 m (from lane edge)

Bore Hole Diameter: 140 mm (5.5") Auger Type: SOLID STEM

Scale (m)	Depth from Surface[1] (m)	Material Description	Material Code[2]
0.5 1.0	1.40±	SILTY CLAY GRAY MOIST	131
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	4.44	SILTY CLAY LT GRAY MOIST	131
	FILTER SAND FROM 4.44M TO 3.04M BENTONITE 3.04M TO 2.59M SILTY CLAY 2.59M TO 0.69±M CONCRETE 0.69 TO 5" FROM TOP OF PROT. PIPE PAIL SAMPLE TAKEN		

[1] Format: __ . __ __ __ m; [2] Format: __ __ __

Prepared by: R. URBACH Employer: BRAUN INTERTEC

Date (dd/mm/yy): 18/07/94 (Jul)

465894B

LTPP Seasonal Monitoring Program Data Sheet SMP-I04 Log of Instrumentation Hole	Agency Code [4 6] LTPP Section ID [9 1 8 7]

Operator: INGLE/ CALKINS Equipment Used: CME 55

Location: Station: 1+00 Offset: 0.76 m (from lane edge)

Bore Hole Diameter: 305 mm (12")

Scale (m)	Strata Change[1] (m)	Material Description	Material Code[2]
0.10	0.130	ASPHALT SURFACE w/ ONE SEALCOAT	730
0.20			
0.30	.29 1	GRAVEL BASE	
0.40	.40 2	GRAVEL BASE	
0.50	.56 3	SILTY CLAY GRAY MOIST	131
0.60			
0.70	.70 4		131
0.80	.83 5		
0.90			
1.00	.98 6		
1.10	1.10 7		
1.20	1.22 8		
1.30			
1.40	1.40 9		
1.50	1.51 10		
1.60	1.66 11	SILTY CLAY LT GRAY MOIST	
1.70			
1.80	1.79 12		
1.90	1.86 13		
2.00	1.96 14		
2.10			
2.20			
2.30			
2.40			
2.50		PLANNED BOTTOM 1.94 m	

[1] Format: __.____ m; [2] Format: ____

Prepared by: Ron Urbach Employer: BRAUN INTERTEC

Date (dd/mm/yy): 18/07/94 (JUL)

LTPP Seasonal Monitoring Program Data Sheet SMP-I05 Field Gravimetric Moisture Content	Agency Code [46] LTPP Section ID [9187]

TDR Probe	Probe Depth[1] (m)	Moisture Sample No.	Pan No.	Wt. of Pan (gms) = A	Wt. of Pan + Wet Soil (gms) = B	Wt. of Pan + Dry Soil (gms) = C	Wt. of Dry Soil (gms) = D = C - A	Wt. of Water (gms) = E = B - C	Moisture Content (%) = w = E/D * 100
1	0.210	1	2	223.6	770.9	728.5	504.9	42.4	8.4
2	0.370	2	1	222.6	530.6	509.0	286.4	21.6	7.5
3	0.510	3	4	222.0	520.7	464.8	242.8	55.9	23.0
4	0.681	4	3	223.9	538.7	470.9	247.0	67.8	27.5
5	0.833	5	2	223.6	591.6	506.0	282.4	85.6	30.3
6	0.970	6	1	222.6	529.1	468.6	246.0	60.5	24.6
7	1.125	7	4	222.0	564.9	502.7	280.0	62.2	22.2
8	1.278	8	3	223.9	582.4	513.9	290.0	68.5	23.6
9	1.580	9	2	223.6	595.9	542.9	319.3	53.0	16.6
10	1.905	10	1	222.6	519.0	469.1	246.5	49.9	20.2

[1] Distance in meters from pavement surface to TDR probe

Comments: FIELD – #9 SEEMS LOW

Prepared by: D.O. Employer: SD DOT

Date (dd/mm/yy): 18/07/94 Jul

LAB

LTPP Seasonal Monitoring Program
Data Sheet SMP ~~105~~ J05(A)
Field Gravimetric Moisture Content

Agency Code [46]

LTPP Section ID [9187]

TDR Probe	Probe Depth[1] (m)	Moisture Sample No.	Pan No.	Wt. of Pan (gms) = A	Wt. of Pan + Wet Soil (gms) = B	Wt. of Pan + Dry Soil (gms) = C	Wt. of Dry Soil (gms) = D = C - A	Wt. of Water (gms) = E = B - C	Moisture Content (%) = w = E/D * 100
1	_.___	1	21	221.9	896.2	849.8	627.9	46.4	7.4
2	_.___	2	22	226.0	746.7	711.3	485.3	35.4	7.3
3	_.___	3	23	239.4	716.9	631.2	391.8	85.7	21.9
4	_.___	4	24	223.3	558.9	487.5	264.2	71.4	27.0
5	_.___	5	25	227.0	605.3	521.3	294.3	84.0	28.5
6	_.___	6	26	226.3	568.3	500.6	274.3	67.7	24.7
7	_.___	7	27	227.7	647.5	574.8	347.1	72.7	20.9
8	_.___	8	28	223.3	643.3	566.5	343.2	76.8	22.4
9	_.___	9	29	228.2	656.4	582.9	354.7	73.5	20.7
10	_.___	10	30	232.6	577.2	524.5	291.9	53.2	18.2

[1] Distance in meters from pavement surface to TDR probe

Comments: SD DOT LAB

Prepared by: ?

Employer: SD DOT

Date (dd/mm/yy): 7/20/94
JUL

LTPP Seasonal Monitoring Program Data Sheet SMP-I05 (B) Gravimetric Moisture Comparison	Agency Code [46] LTPP Section ID [91 87]

TDR	SMP-I02 TDR Depth (m)	SMP-I04 Material Code	Lab Data Dry Density (pcf)	TDR Installation Data		Gravimetric Moistures		Comments
				SMP-I06 La (m)	Calculated Gravimetric (percent)	SMP-I05 Field (percent)	SMP-I05A Lab (percent)	
1	0.210	303	115.5	0.62	11.4	8.4	7.4	wet from sawing the AC
2	0.370	303	115.5	0.59	8.7	7.5	7.3	Subbase to Subgrade interface
3	0.510	131	115.5	+2.00	+85.4	23.0	21.9	
4	0.681	131	115.5	+2.00	+85.4	27.5	27.0	
5	0.833	131	115.5	+2.00	+85.4	30.3	28.5	TDR TRACES FLAT
6	0.970	131	115.5	+2.00	+85.4	24.6	24.7	AT SECOND INFLECTION
7	1.125	131	115.5	1.50	32.8	22.2	20.9	POINT
8	1.278	131	115.5	1.45	31.4	23.6	22.4	
9	1.580	131	115.5	1.08	23.6	16.6	20.7	
10	1.905	131	115.5	0.98	21.1	20.2	18.2	

TDR Gravimetric moistures calculated using equations on pages II-2 and II-5 of FHWA-RD-94-110 with La = 0.203 m, and Vp = 0.99.

Comments: Dry Density from Form 504 tested at sta. 5+62 ~~Sm~~ Test done before AC surface placed with 3.5" gravel base removed.

Prepared by: RJV/JJD Employer: Braun Intertec Corporation Date (dd/mmm/yy): 27/DEC/95

$$\omega = \left(-330.72 + 4526.78\,La^2 - 2103.88\,La^4 + 402.25\,La^6\right)/\gamma_d \quad ; \quad La \text{ (meters)},\ \gamma_d \text{ (pcf)},\ \omega \text{ (\%)}$$

LTPP Seasonal Monitoring Program Data Sheet SMP-I06 TDR Moisture Content	Agency Code [46] LTPP Section ID [9187]

Required Settings:

Dist./Division: 0.25 m
Phase Velocity: 0.99
Noise Filter: 1 average

Probe Number	Probe Depth[1] (m)	Time (military)	Apparent Length (m)	Dielectric Constant[2]	Comments
1	0.210	*	0.67	11.11	wet from Coring/Saw
2	0.370	*	0.59	8.62	Subbase to Subgrade Interface
3	0.510	*	+2.00	+99.04	NOTE: DATA
4	0.681	*	+2.00	+99.04	FROM NEXT DAY
5	0.833	*	+2.00	+99.04	ALSO THE SAME
6	0.970	*	+2.00	+99.04	MOBILE DATA
7	1.125	*	1.50	55.71	ATTACHED
8	1.278	*	1.45	52.06	
9	1.580	*	1.08	28.88	
10	1.905	*	0.98	23.78	

[1] Distance in meters from pavement surface to TDR probe
[2] Dielectric constant is determined as follows:

$$\varepsilon = \left[\frac{(L_a)}{(L)(V_p)}\right]^2 = \left[\frac{(D_2 - D_1)}{(L)(V_p)}\right]^2 = \frac{(L_a)^2}{(0.203)^2(0.99)^2} = 24.759\,L_a^2$$

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

ATTACH TDR TRACES TO THIS DATA SHEET.

Comments: * TIME NOT RECORDED

Prepared by: Robert Van Sambeek Employer: Brown Inertec

Date (dd/mm/yy): 07/18/94

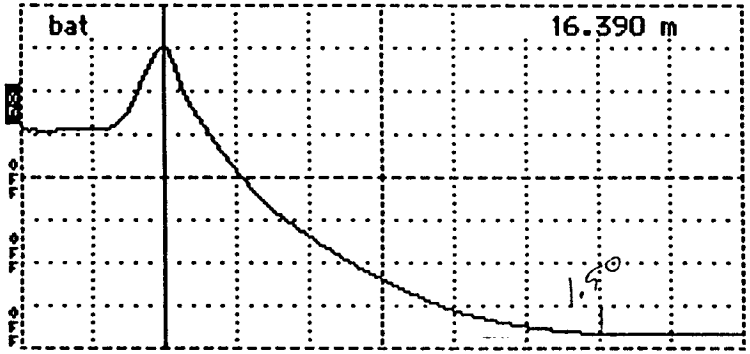
BRAUN INTERTEC

Description: SMP 4658 TDR INSTALL ATTON

Project No: DBNX 92 700 B5

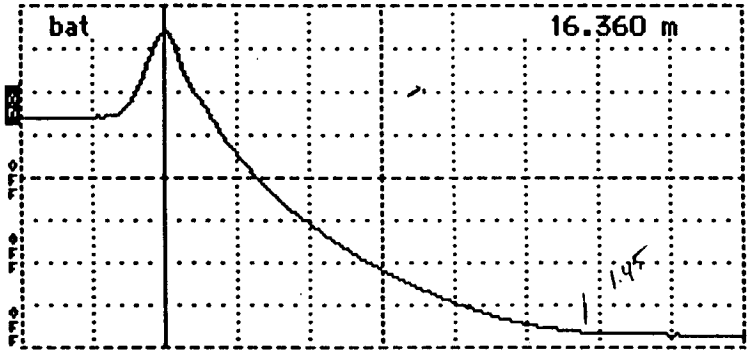
Date: 7/18/94 By: RV

Cursor ..... 16.390 m
Distance/Div ..... .25 m/div
Vertical Scale .... 94.1 mρ/div
Vp 0.99
Noise Filter ..... 1 avg
Power ..... bat



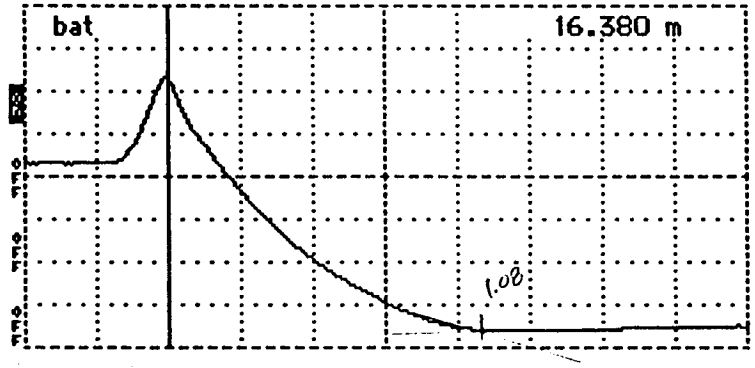
Tektronix 1502B TDR
Date 7-18-94
Cable 46B 07
Notes
Input Trace
Stored Trace
Difference Trace

Cursor ..... 16.360 m
Distance/Div ..... .25 m/div
Vertical Scale .... 94.1 mρ/div
Vp 0.99
Noise Filter ..... 1 avg
Power ..... bat



Tektronix 1502B TDR
Date 7-18-94
Cable 46B 08
Notes
Input Trace
Stored Trace
Difference Trace

Cursor ..... 16.380 m
Distance/Div ..... .25 m/div
Vertical Scale .... 94.1 mρ/div
Vp 0.99
Noise Filter ..... 1 avg
Power ..... bat



Tektronix 1502B TDR
Date 7-18-94
Cable 46B 09
Notes
Input Trace
Stored Trace
Difference Trace

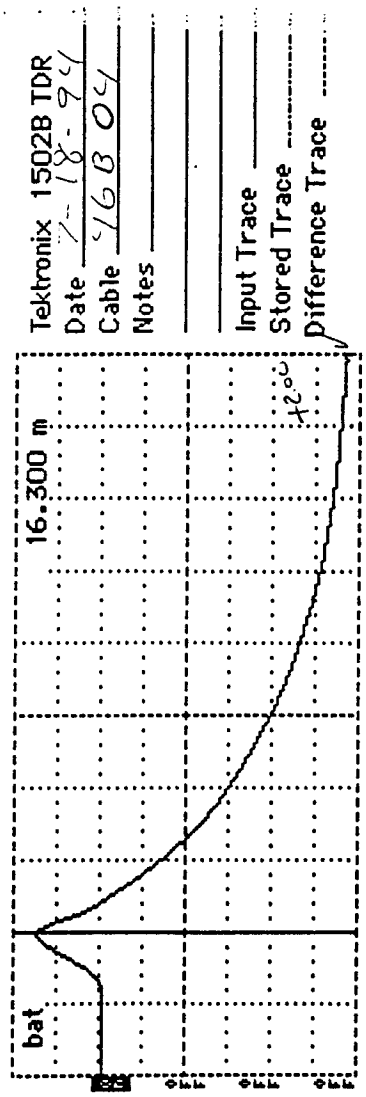
Cursor ..... 16.380 m
Distance/Div ..... .25 m/div
Vertical Scale .... 74.8 mρ/div
Vp 0.99
Noise Filter ..... 1 avg
Power ..... bat

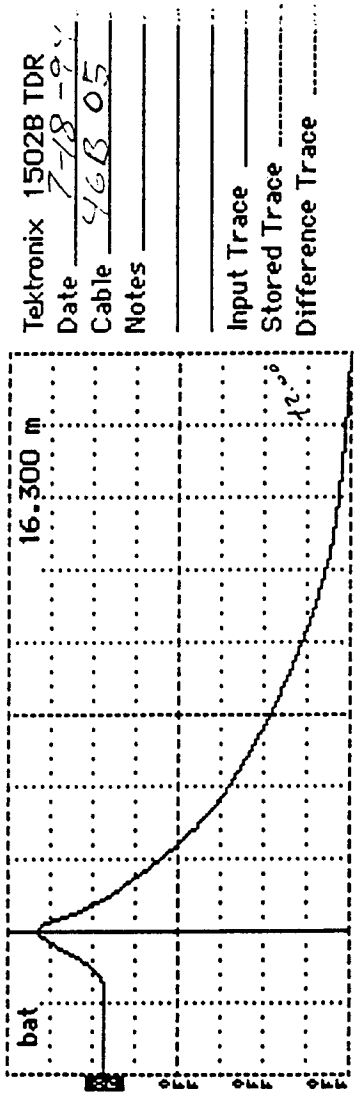
Tektronix 1502B TDR
Date 7-18-94
Cable 46B 10
Notes
Input Trace
Stored Trace
Difference Trace

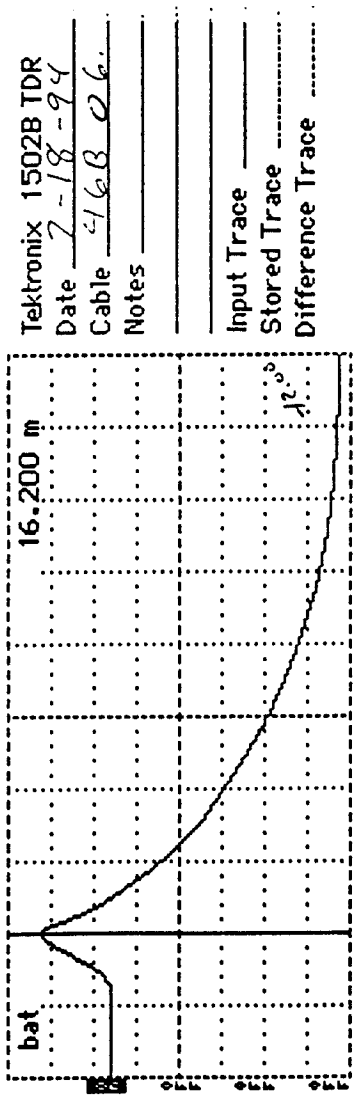
3/3

BRAUN[SM]
INTERTEC

Description: SMP - 46SB
TDR INSTALLATION
Project No: DBN-X92 700 B5
Date: 7/18/94 By: RV

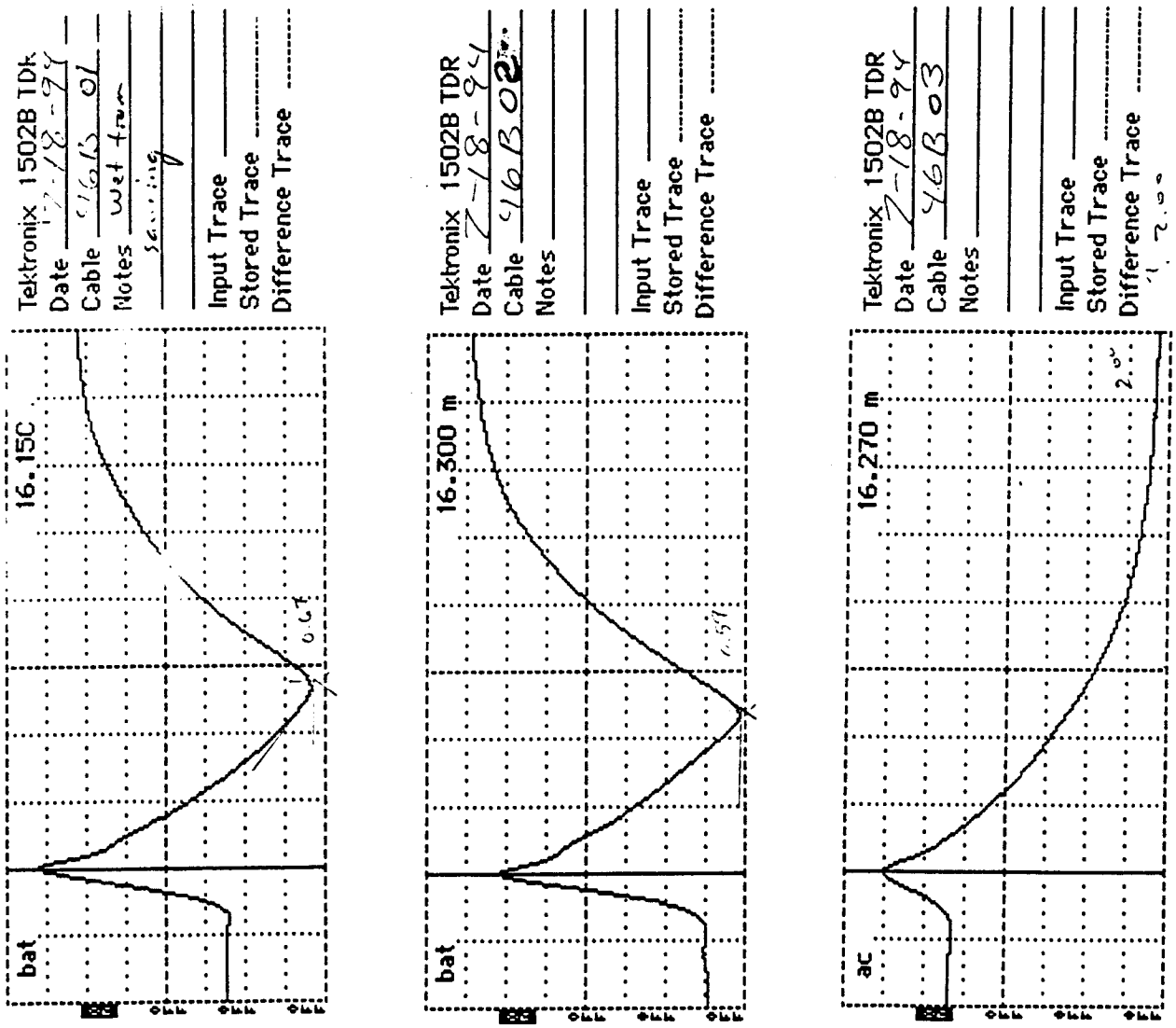






BRAUNSM
INTERTEC

Description: SMP – 465B
TDR INSTALLATION
Project No: DBNX92700 B5
Date: 7/18/94 By: RV



16.150 m
.25 m/div
43.3 mρ/div
0.99
1 avg
bat

16.300 m
.25 m/div
39.7 mρ/div
0.99
1 avg
bat

16.270 m
.25 m/div
106 mρ/div
0.99
1 avg
ac

465894 A

LTPP Seasonal Monitoring Program Data Sheet SMP-I07 Representative Dry Density	Agency Code [46] LTPP Section ID [9187]

Depth of Representative Sample (from pavement surface): __. __ m

Dry Density Determination:

a. Tare Weight of Empty Mold: ____ g (__.__ lb)

b. Weight of Mold and Compacted Soil: ____ g (__.__ lb)

c. Weight of Compacted Soil (b - a): ____ g (__.__ lb)

d. Unit Weight of Compacted Soil = (c / 943.0) = __.__ g/cm^3

([c / (1 / 30)] = ___.__ lb/ft^3)

e. Dry Density of Compacted Soil = [d / (1 + r/100)] = __.__ g/cm^3

(___.__ lb/ft^3)

Moisture Content Determination:

m. Tare Weight of Pan: ___.__ g

n. Weight of Pan and Moisture Sample: ___.__ g

o. Weight of Pan and Dry Sample: ___.__ g

p. Weight of Moisture (n - o): ___.__ g

q. Weight of Dry Sample (o - m): ___.__ g

r. Moisture Content by Weight = [(p / q) * 100] = __.__ %

Comments: NOT PART OF PROCEDURE IN 1994.

Prepared by: RJV Employer: BRAUN INTERTEC

Date (dd/mmm/yy): 27/DEC/95

BRAUNSM
INTERTEC

Description: SMP – 46SB (MP 156)

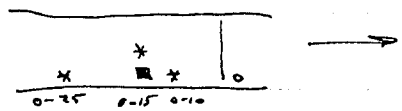
Project No: DBNX 92700 B6
Date: 7/17/94 By: RV

Monitor Sta. 0+00 to Sta. 2+00

Structure? 5.5" AC (~~Some listings @ 4.5~~)
6" Gravel (Crushed Stone)
5" Gravel (Uncrushed) (Some listings @ 3")
– Silty/clay subgrade

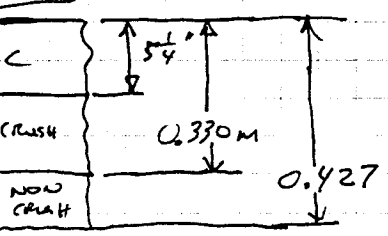
T – Low (250)

Install instr. @ 0-15
Fwd tests @ ML → 0-15
Out 0-25, 0-10, (*0-15 First set only)



Visit * look for holes @ sta. 0+00 and sta. 2+00 – Sealcoat!
* look for distress @ sta 1+00 (SSD gaskets) – nothing!
* AC DEPTH?
*

94



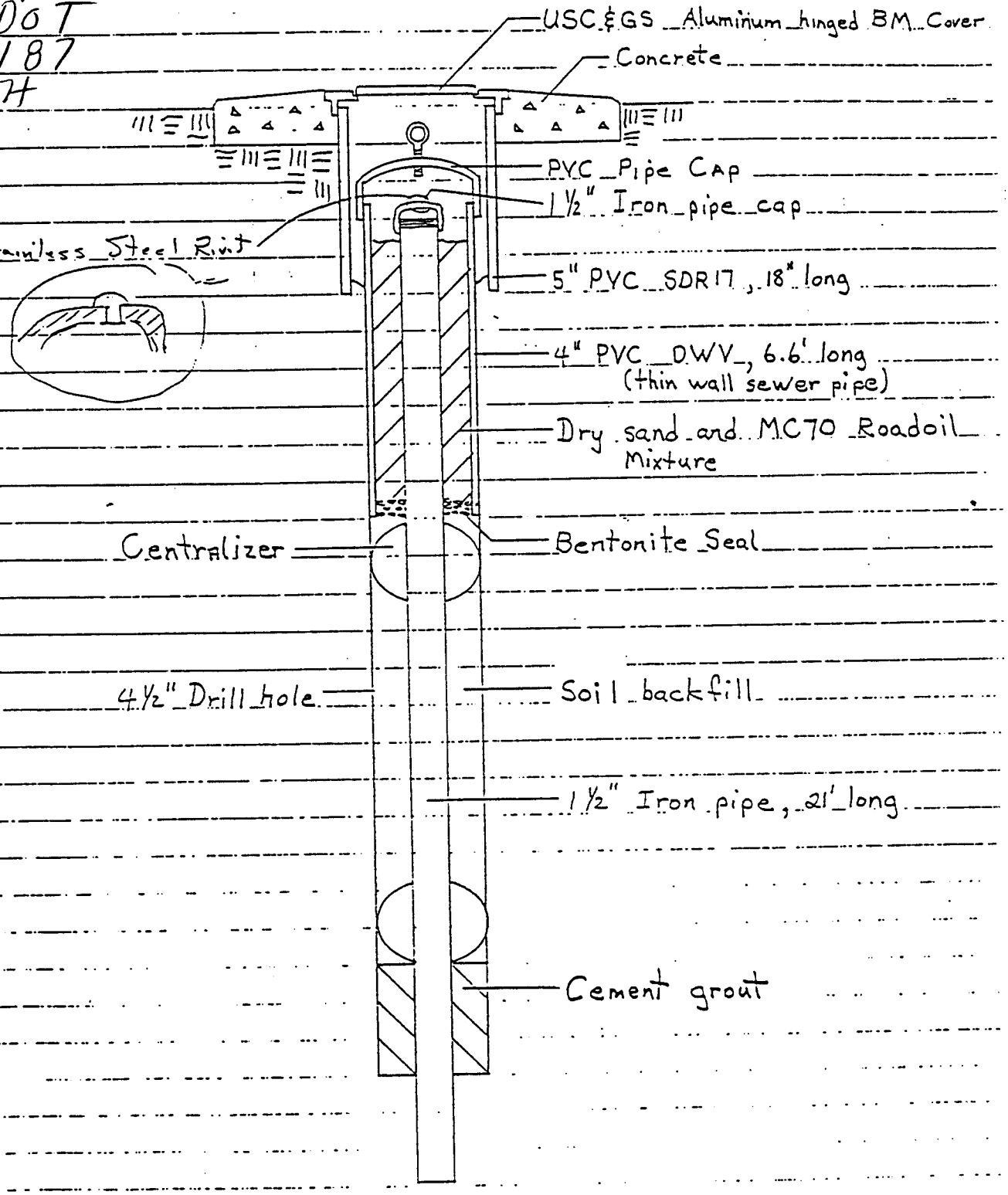
plott. thicknesses
– AC ~ 5" plus seal coat add ¼"

HOT ≅ 95°F

BLOCK SPLIT WHILE RESTING ON GROUND FROM HEAT
NO EPOXY UNDER BLOCK

EDGE REF. midway through white edge stripe (12' from cracks @ ℄) – white stripe not straight.

BM PUT IN
BY DOT
469187
FAITH



I-29 Benchmarks
Installed Sept. & Oct. 1989
Geotechnical Activity
SD DOT

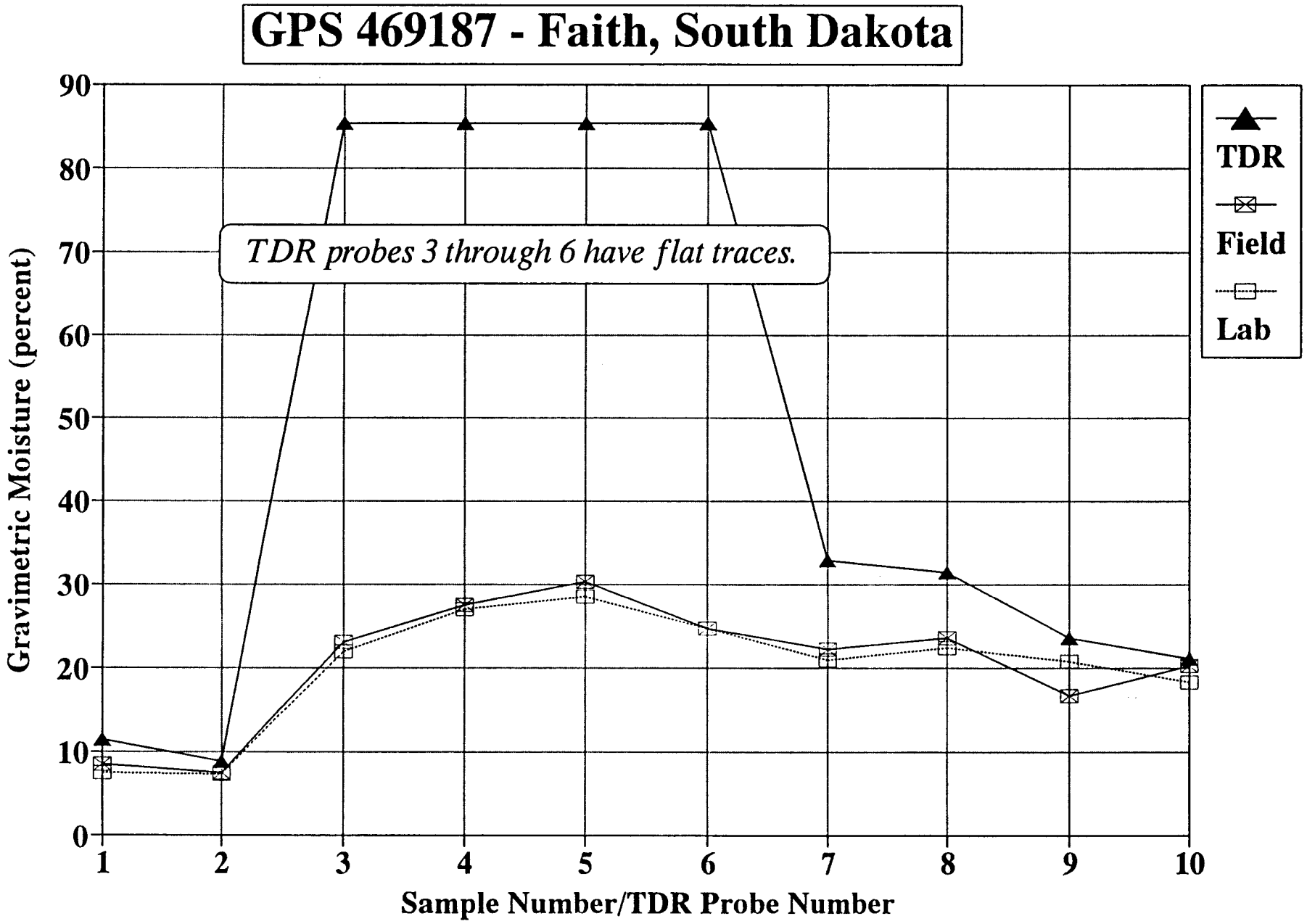
SDDOT BM

- SET & LEVEL R.C
- DRILL 20½ FT. OF 4" HOLE
- REMOVE 1-5' AUGER, ADD SMART 3" AUGER
- DRILL 1½' OF BIG HOLE
- SET PIPE w/ CENTRALIZER (USE PUSH PIPE TO SET TO EXACT DEPTH)
- ~~BACK~~ POUR BOTTOM CEMENT
- BACKFILL TO 6' BELOW TOP
- SET 4" PIPE
- ADD BENTONITE
- SET TOP CENTRALIZER
- SET 5" PIPE & PACK
- SET & LEVEL FORM
- PUT ON CAPS (4" & FLIP-LID)
- POUR & FINISH CONCRETE TOP
- DRIVE CARSONITE (DO NEXT DAY)
- DRIVE STEEL POST (DO NEXT DAY)

— NEXT DAY —

NEXT DAY

- REMOVE FORM
- POUR OIL & SAND
- CLEAN-UP SITE
- REMOVE LATHE MARKER


GPS 469187 - Faith, South Dakota
TDR probes 3 through 6 have flat traces.
Gravimetric Moisture (percent)
Sample Number/TDR Probe Number
TDR
Field
Lab
0
10
20
30
40
50
60
70
80
90
1
2
3
4
5
6
7
8
9
10

469187

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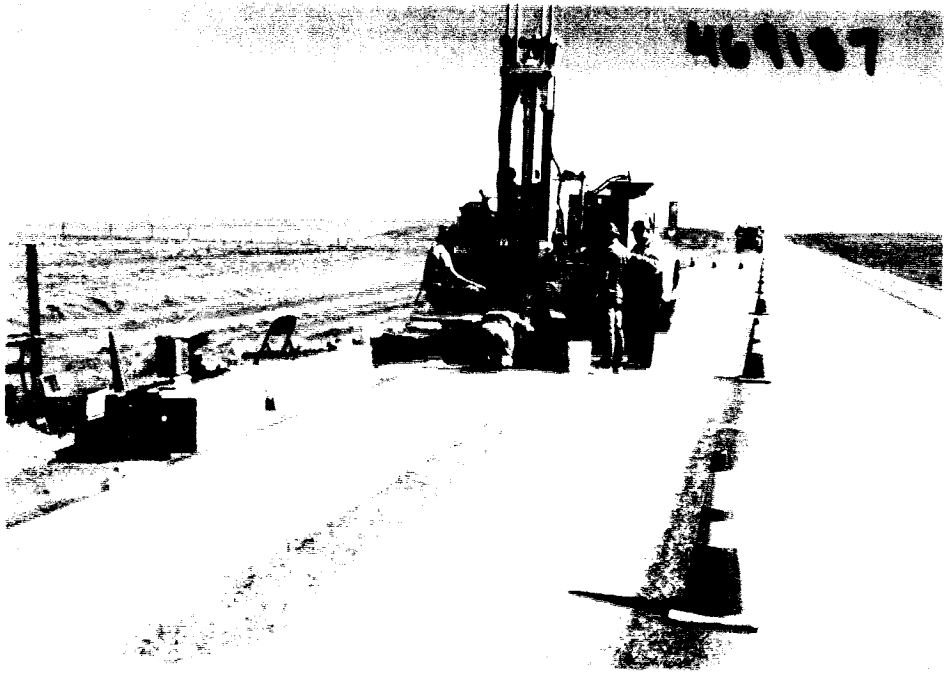
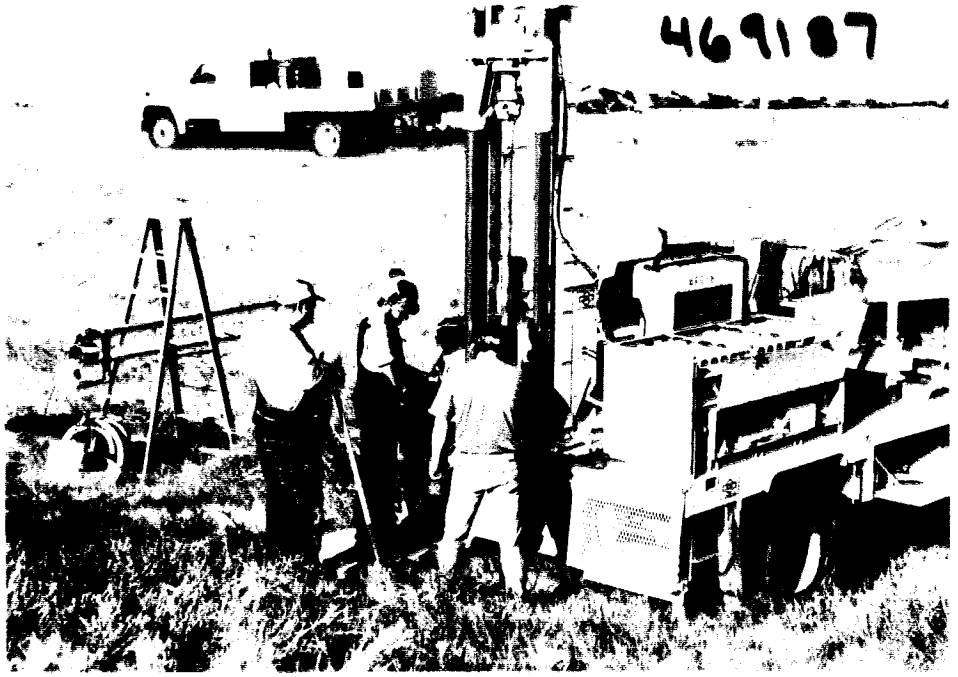
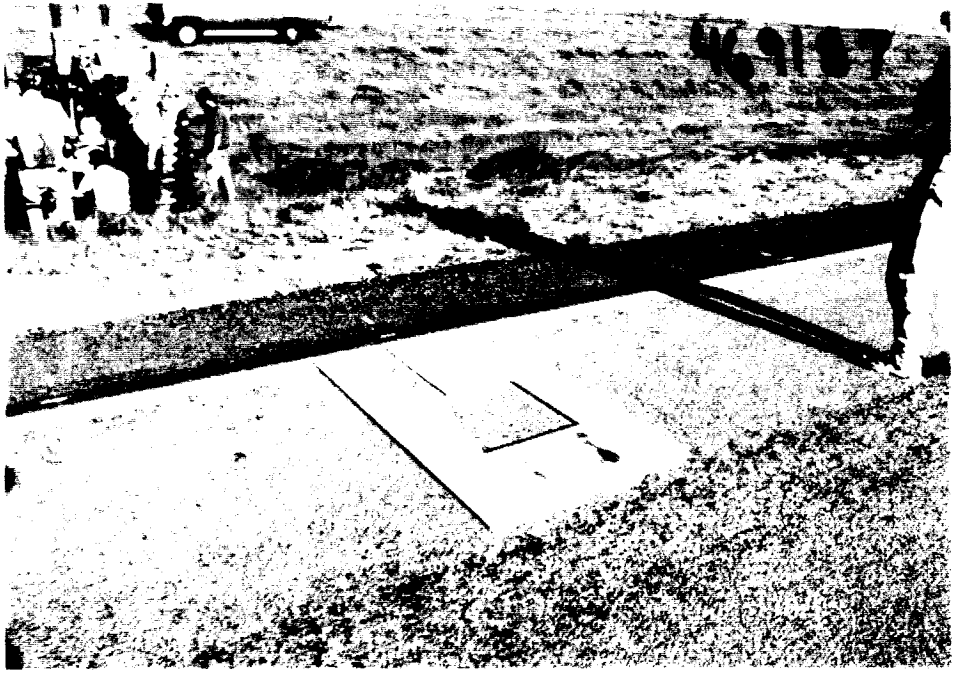
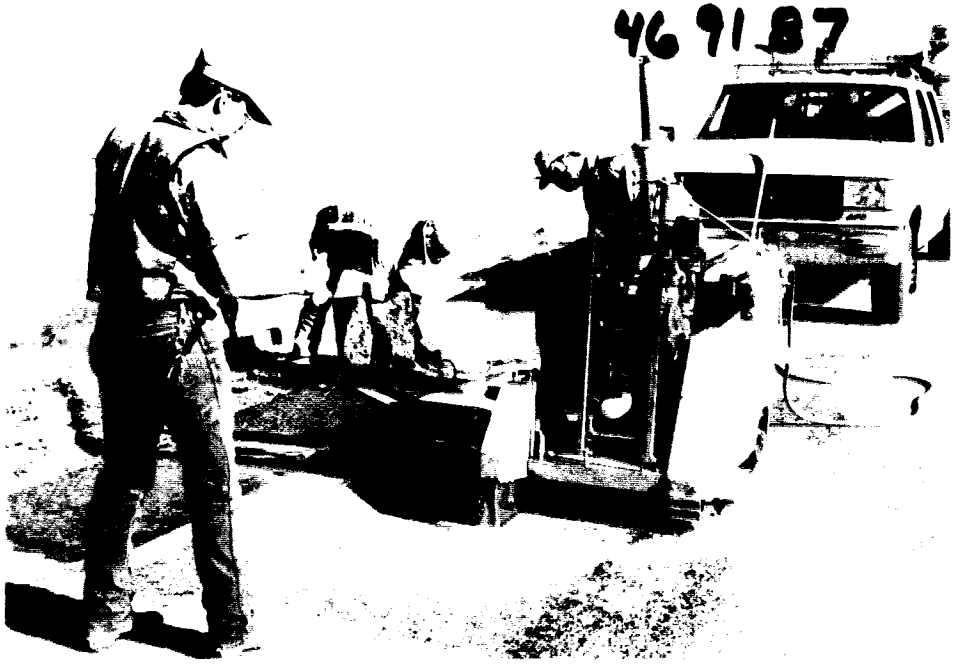


469187

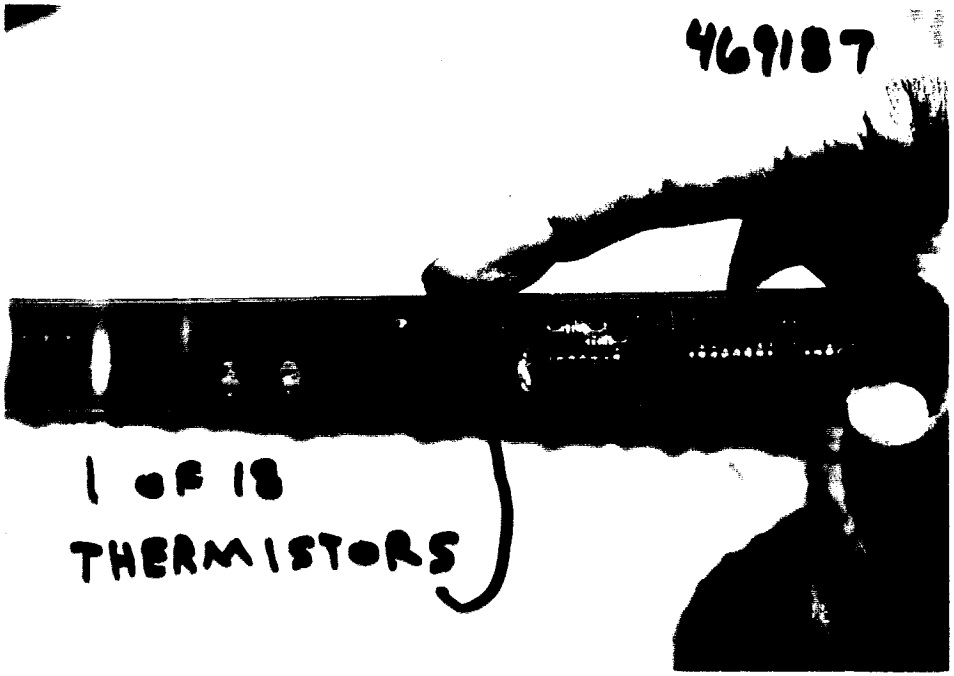


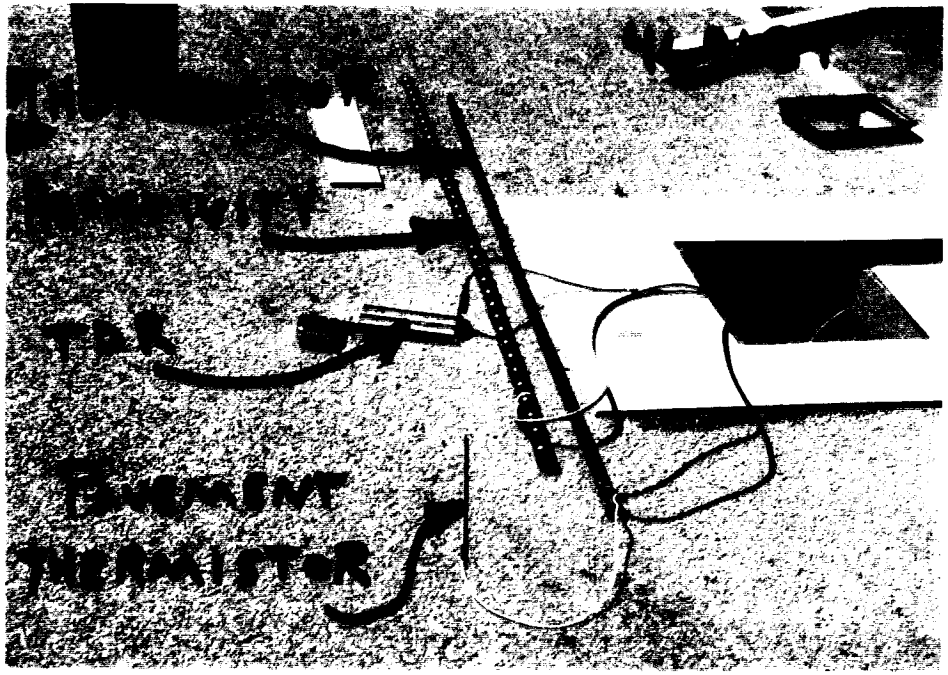


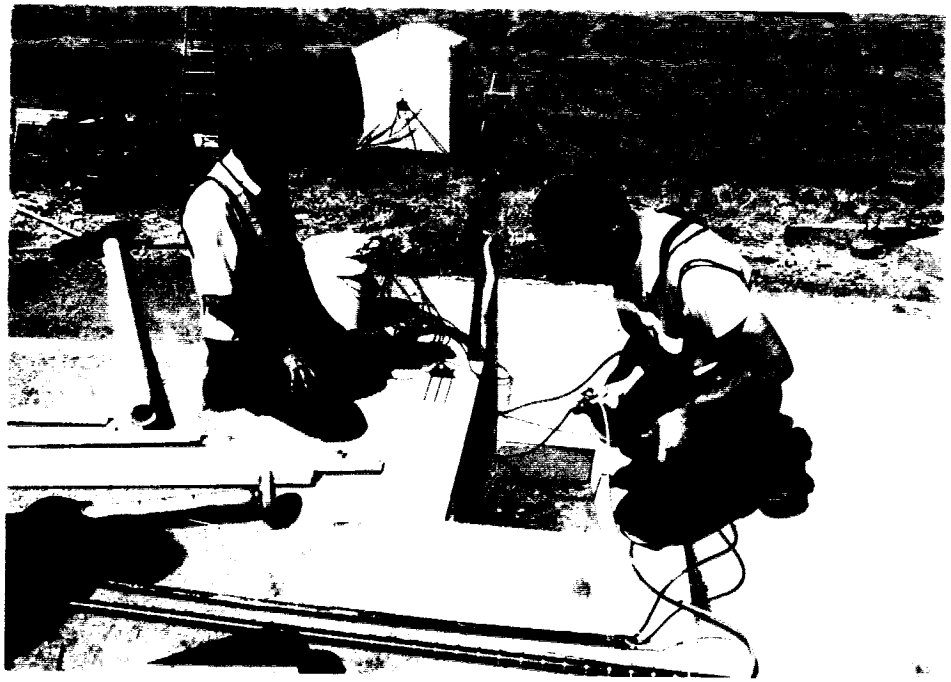
MANUAL TEMPERATURE HOLES

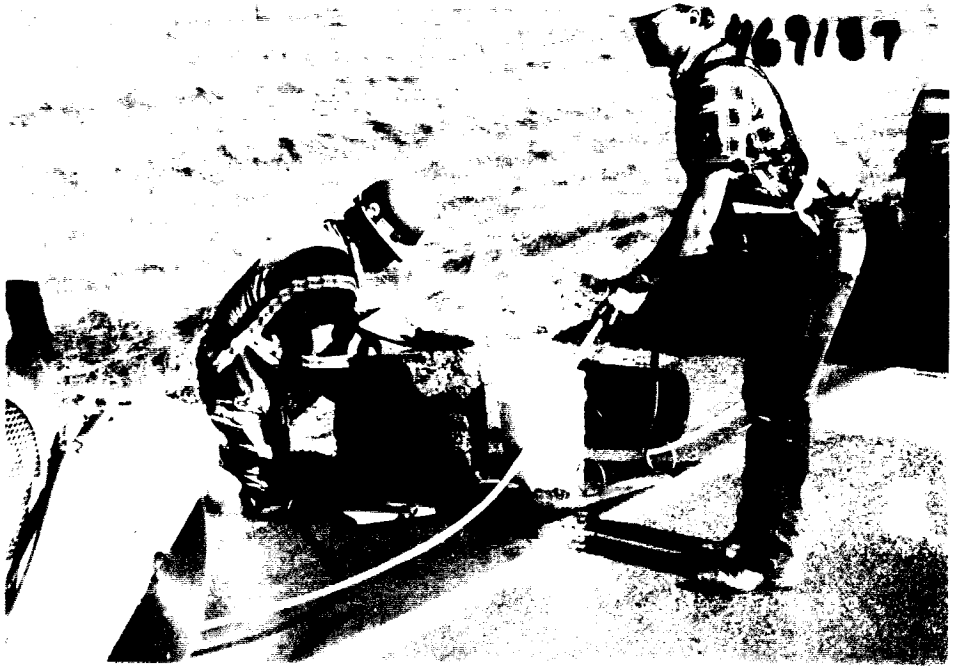


469187
TUBE


469187
1 OF 18
THERMISTORS


THERMISTOR

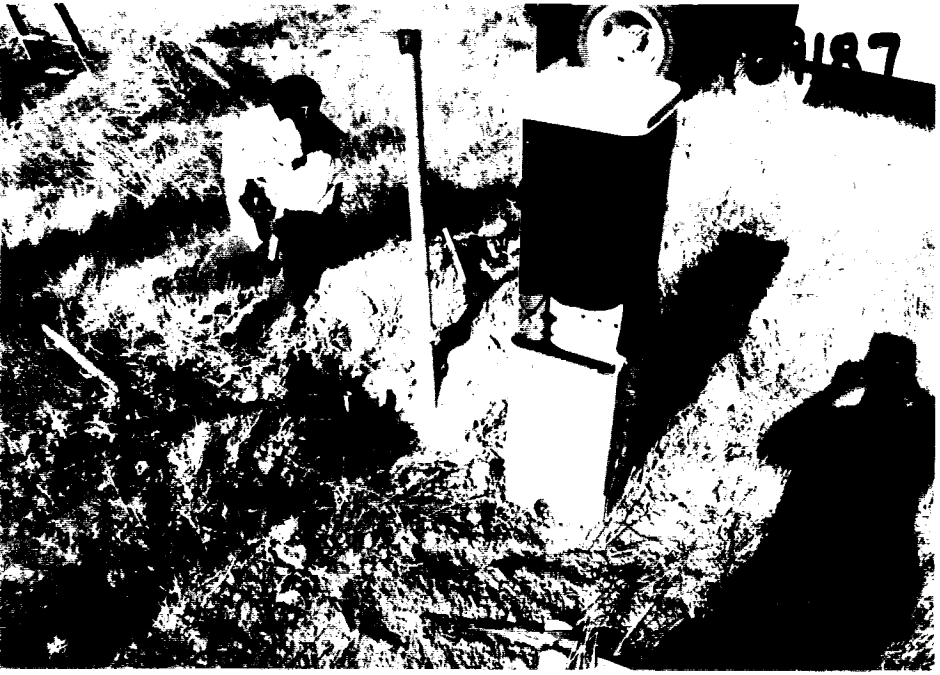



469187

REPLACE BLOCK

DAY
AFTER
INSTALL

469187



CONDUIT

Appendix D-1: Initial SMP Monitoring Data Collection

Appendix D-1 contains the following data sheets with information collected the day after instrumentation installation:

- Data Sheet SMP-D03: Contact Resistance Measurements;
- Data Sheet SMP-D04: Four-Point Resistivity Measurements;
- Data Sheet SMP-D05: Ground Water Table Measurements; and
- Data Sheet SMP-D08: Surface Elevation Measurements - AC Pavements.

LTPP Seasonal Monitoring Program Data Sheet SMP-D10 SMP Field Activity Report	Agency Code [46] LTPP Section ID [9187]

Onsite Datalogger and Instrumentation		
File Name - *.ONS	465B94BG	Comments: —
Battery Replace	Yes - (No)	Voltages 13.0
Repairs/Calib.	—	
Other: —	—	

Mobile Datalogger		
File Name - *.MOB	465B94BG	Comments:
TDR/Resistance Voltages	Sets (2)	—
Other: —	—	

Manual Data Collection		
Piezometer	(Yes) - No	Comments: DRY 9.99
Resistance 2 pt.	Sets (1)	—
Resistivity 4 pt.	Sets (1)	—
Elevations	Sets (1)	—
Distress Survey	Yes - (No)	—
Long. Dipstick Profile	Yes - (No)	—
Photos or Video	(Yes) - No	—
Other: —	—	

FWD and Associated Data		
FWD Testing	Sets (3)	Operator: D.C.M
JCP - Snap Rings	Sets (0)	—
JCP - Faulting	Sets (0)	—
Other: —	—	

IF REQUIRED, ATTACH SKETCHES TO THIS DATA SHEET

Comments: —

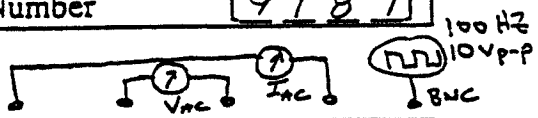
Prepared by: D.L M Employer: BRAUN INTERTEC

Date (dd/mm/yy): 7/19/94 (Jul)

DATA SET : 4 6 3 D 1 1 =

LTPP Seasonal Monitoring Program Data Sheet SMP-D03 Contact Resistance Measurements	Agency Code [46] Test Section Number [9187]

Start Time (military): 8:25



Test Position	Connections I.Y.	Connections V.Y.	Voltage (ACV) Range Setting	Voltage (ACV) Reading	Current (ACA) Range Setting	Current (ACA) Reading	Comments
1	1	2	Volts	1.336	Micro	1148 milli	
2	2	3		1.335	milli	1.135	
3	3	4		1.256		1.178	Change current readings from 1*** micro to 1*** milli for entry into the data base.
4	4	5		0.775		1.383	
5	5	6		0.263		1.577	
6	6	7		0.285		1.621	
7	7	8		0.254		1.642	
8	8	9		0.248		1.658	
9	9	10		0.335		1.639	
10	10	16		0.338		1.634	
11	11	12		0.252		1.709	
12	12	13		0.276		1.704	
13	13	14		0.579		1.555	
14	14	15		0.510		1.598	
15	15	16		0.318		1.689	
16	16	17		0.403		1.652	
17	17	18		0.745		1.498	
18	18	19		0.805		1.479	
19	19	20		0.579		1.568	
20	20	21		0.353		1.679	
21	21	22		0.367		1.668	
22	22	23		0.423		1.639	
23	23	24		0.436		1.617	
24	24	25		0.446		1.629	
25	25	26		0.556		1.592	
26	26	27		0.710		1.504	
27	27	28		0.600		1.543	
28	28	29		0.448		1.624	
29	29	30		0.533		1.587	
30	30	31		1.252		1.318	
31	31	32		1.200		1.339	
32	32	33		1.8160		1.061	
33	33	34		1.344		1.264	
34	34	35		1.122		1.342	
35	35	36		0.990	milli	1.376	
36	36	37	milli	1.0		1530	R1 = E/I = 0.97 0.7Ω
37	37	38		450.0		1510	R2 = E/I = 100.7
38	38	39	Volts	1.090		1100	R3 = E/I = 1004
39	39	00		4.65		5.5	R4 = E/I = 0.994 M 0.846M

Comments (FHWA SWITCH BOX FROM 4/1/94 WITH BNC)

w/ DOT

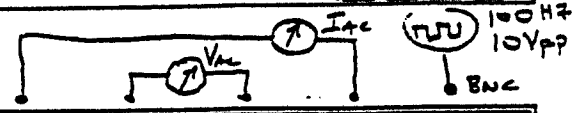
Prepared by: D.S. / BOB V Employer: BRAUN INTERTEC CORP.

Date: 7/19/1994

DATA SET: 4 6 2 B 7 7 E

LTPP Seasonal Monitoring Program Data Sheet SMP-D04 Four-Point Resistivity Measurements	Agency Code [46] Test Section Number [9187]

Start Time (military): 8:39



Test Position	Connections I_1	V_1	V_2	I_2	Voltage (ACV) Range Settin	Reading	Current (ACA) Range Settin	Reading	Comments
1	1	2	3	4	Milli	55.5	~~Micro~~	1,224 milli	
2	2	3	4	5		46.1	milli	1,340	
3	3	4	5	6		41.3		1,316	
4	4	5	6	7		7.7		1,380	
5	5	6	7	8		12.0		1,630	
6	6	7	8	9		7.7		1,616	
7	7	8	9	10		7.7		1,572	
8	8	9	10	11		7.6		1,658	
9	9	10	11	12		7.8		1,660	
10	10	11	12	13		6.9		1,590	
11	11	12	13	14		6.2		1,492	
12	12	13	14	15		9.0		1,617	
13	13	14	15	16		7.4		1,587	
14	14	15	16	17		8.6		1,500	
15	15	16	17	18		8.6		1,440	
16	16	17	18	19		8.2		1,492	
17	17	18	19	20		11.3		1,594	
18	18	19	20	21		10.0		1,537	
19	19	20	21	22		10.6		1,532	
20	20	21	22	23		13.8		1,606	
21	21	22	23	24		11.8		1,590	
22	22	23	24	25		15.0		1,599	
23	23	24	25	26		12.0		1,554	
24	24	25	26	27		15.7		1,471	
25	25	26	27	28		14.7		1,500	
26	26	27	28	29		15.0		1,483	
27	27	28	29	30		13.9		1,403	
28	28	29	30	31		12.6		1,269	
29	29	30	31	32		17.9		1,413	
30	30	31	32	33		8.3		1,025	
31	31	32	33	34		12.4		1,256	
32	32	33	34	35		13.0		1,189	
33	33	34	35	36		9.4	milli	1,142	
36	36	36	37	37		1.0		1,485	$R_1 = E/I = ?$ 0.97
Comments 37	37	37	38	38		142.7		1420	$R_2 = E/I = ?$ 100.7
38	38	38	39	39	Volts	1.060		1060	$R_3 = E/I = ?$ 1004
39	39	39	00	.00		4.60		5.4	$R_4 = E/I = ?$ 0.994 M

Changed 1.xxx micro to 1.xxx milli for database entry.

ENTERED JAN 8 1996 BRAUN INTERTEC BY:

ENTERED JAN 18 1996 BRAUN INTERTEC BY:

(EHWA BOX FROM 4/1/94 WITH BNC)

Prepared by: D.S. / ROB V Employer: BRAUN INTERTEC CORP.

Date: 7/19/1994 w/ D.O.T.

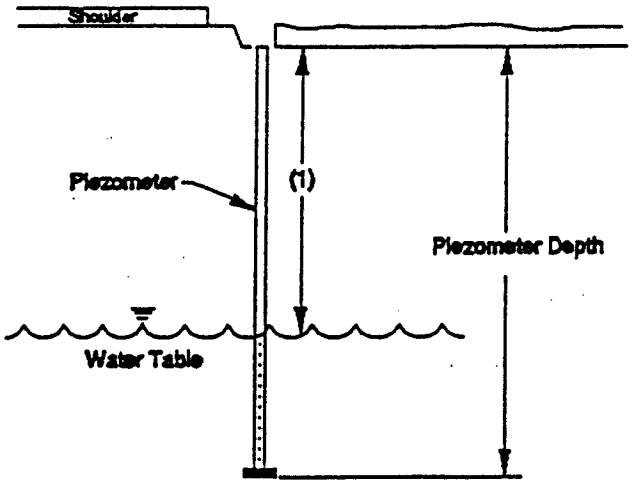
Comments:

LTPP Seasonal Monitoring Program Data Sheet SMP-D05 Ground Water Table Measurement	Agency Code [46] LTPP Section ID [9187]

Piezometer Depth (m): 4.285

Measurement Number	Time (military)	Depth to Water[1,2] (m)	Comments
1	0745	~~9.99~~ DRY	DRY HOLE
2	1000	~~9.99~~ DRY	" "
3	1200	~~9.99~~ DRY	" "
4			
5			

[1] Distance from top of piezometer pipe to top of ground water table; to an accuracy of ±1 mm (0.04 in)
[2] If piezometer pipe is dry, specify depth of 9.99 m



INTERE
JAN 8 1996
BRAUN INTERTEC
BY:

Comments: _____

Prepared by: D. C M Employer: BRAUN INTERTEC

Date (dd/mm/yy): 7/19/94
Jul

10UN170

LTPP Seasonal Monitoring Program Data Sheet SMP-D08 Elevation Measurements - AC	Agency Code [46] Test Section Number [9187]

JAN 18 1993
BRAUN INTERTEC
BY:

Type of Instrument: WILD NA 2000

Start Time (military): 0900

BM	Station	BS	HI	IFS	FS	ELEV	CLOSE	Comments
PIEZOMETER	1+00	0.9473					0.9475	
OTHER	0+00	0.7863					~~0.7869~~	0.7867/0.7867

WINDY - Multiple shots

Station	Offset (PE): 0.15 (m)	Offset (OWP): 0.76 (m)	Offset (ML): 1.83 (m)	Offset (IWP): 2.89 (m)	Offset (ILE): 3.55 (m)	Comments
0+25	0.6749	0.6612	0.6382	0.6259	0.6195	
0+15	0.6730	0.6657	0.6405	0.6279	0.6225	* BLOCK
0+10	0.6770	0.6646	0.6413	0.6264	0.6227	
0+00	0.6780	0.6668	0.6429	0.6282	0.6212	
0+25	0.6800	0.6698	0.6468	0.6323	0.6270	
0+50	0.6882	0.6771	0.6558	0.6413	0.6343	
0+75	0.6912	0.6812	0.6600	0.6458	0.6395	
1+00	0.7022	0.6913	0.6688	0.6523	0.6463	
1+25	0.7131	0.7009	0.6779	0.6613	0.6549	
1+50	0.7206	0.7067	0.6827	0.6681	0.6609	
1+75	0.7236	0.7101	0.6884	0.6745	0.6690	
2+00	0.7296	0.7174	0.6924	0.6779	0.6717	
+						
+						
+						
+						
+						
+						
+						
+						

Prepared by: D. CM Employer: BRAUN INTERTEC

Date: 7-19-94

JUL

DAY AFTER INSTALL

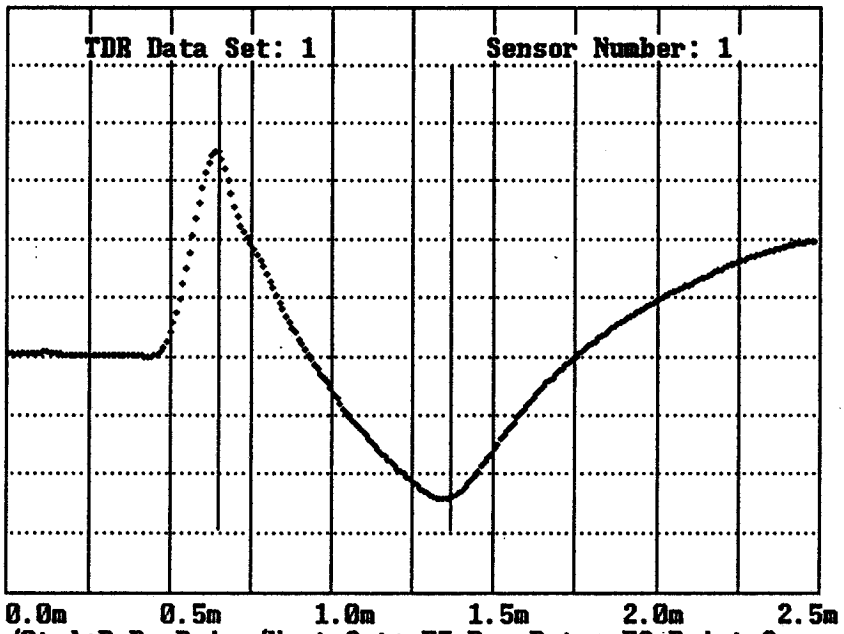
DR RESULTS

'le: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:16
ist → Curs (m): 18.3
ist btn WvFm (m):.01
ain: 85
ffset: 53875
ample No: 1

1 (m) = 0.65
2 (m) = 1.37
race Length (m)=0.72
iele. Const.= 12.8
olumetr MC (%)= 24.0

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

- Look @ #3 to #6
  - Something odd about the soil?
    - trace length (La) very long.
      - off screen.
  - Some results from manual readings.

ONLY #1, 2, and 10 provide good info?

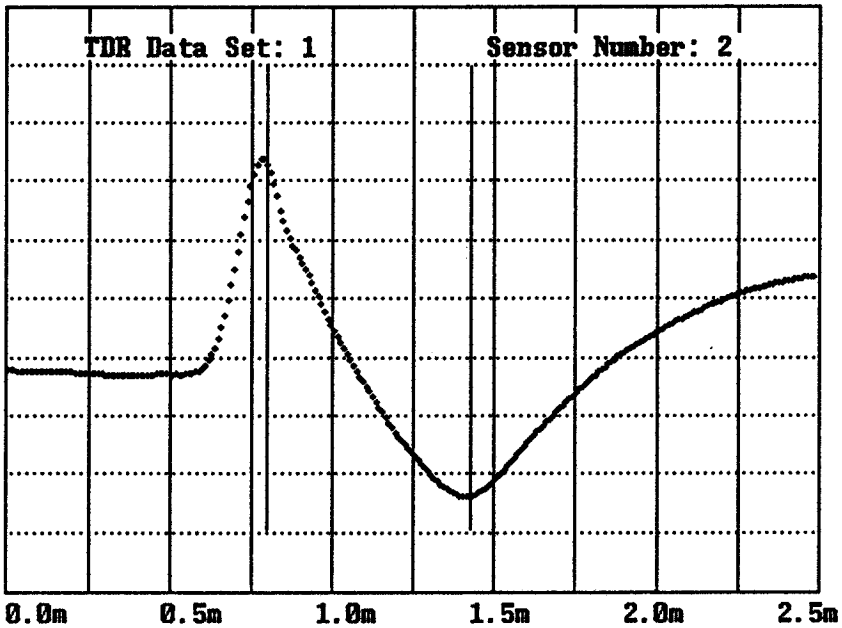
DR RESULTS

''e: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:17
ist → Curs (m): 18.3
ist btn WvFm (m):.01
ain: 87
ffset: 53878
ample No: 1

1 (m) = 0.80
2 (m) = 1.43
race Length (m)=0.63
iele. Const.= 9.8
olumetr MC (%)= 18.5

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

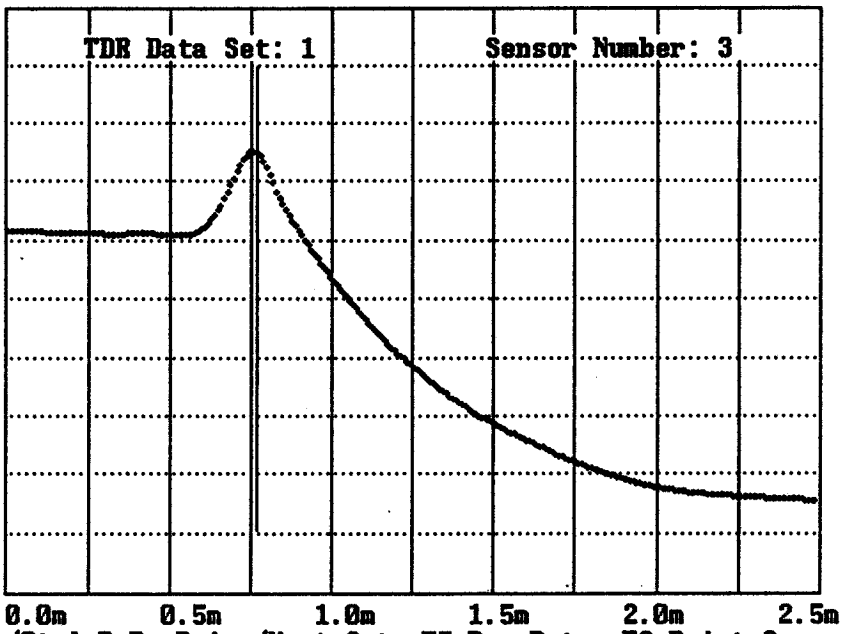
DR RESULTS

'le: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:17
ist → Curs (m): 18.3
ist btn WvFm (m):.01
ain: 58
ffset: 54216
ample No: 1

1 (m) = 0.77
2 (m) = 2.51
race Length (m)=1.74
iele. Const.= 74.8
olumetr MC (%)= 85.4

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

↑

$L_a > 1.75$

$\theta > 76$

with H_2O @ 80

?

DISSOLVED SALTS?

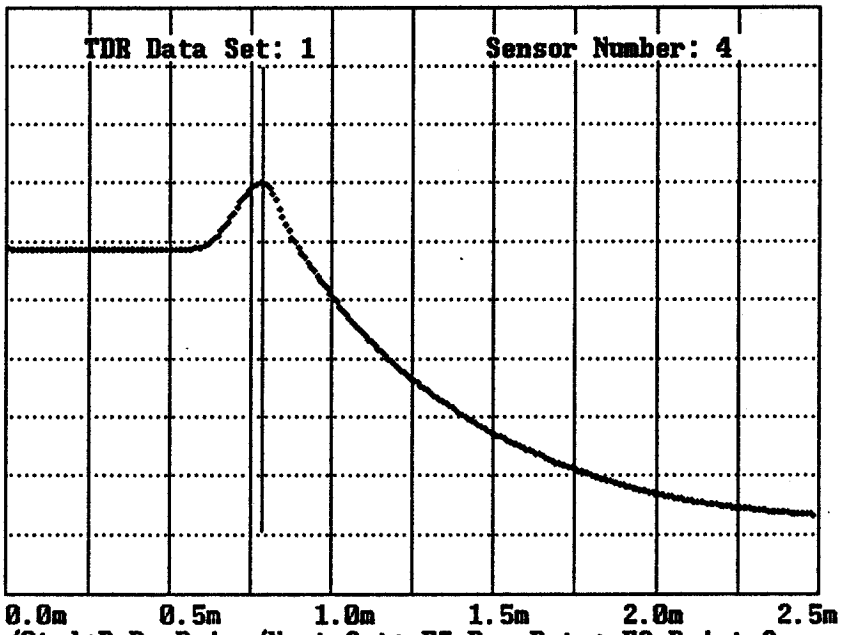
DR RESULTS

'''a: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:18
ist → Curs (m): 18.3
ist btn WvFm (m):.01
ain: 53
ffset: 53914
ample No: 1

1 (m) = 0.79
2 (m) = 2.51
race Length (m)=1.72
iele. Const.= 73.1
olumetr MC (%)= 82.2

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

Same as #3

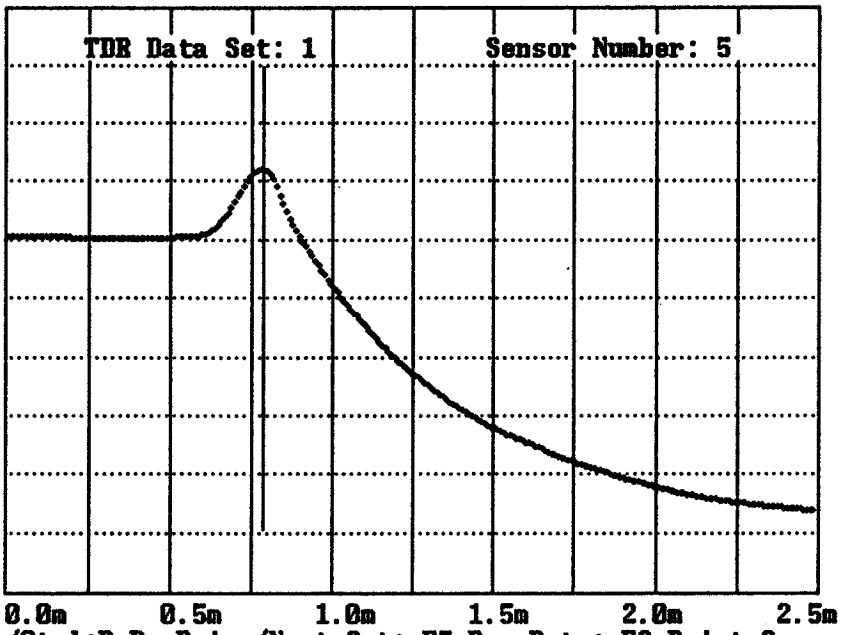
DR RESULTS

...n: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:19
ist → Curs (m): 18.3
ist btn WvFm (m):.01
ain: 54
ffset: 54003
ample No: 1

1 (m) = 0.79
2 (m) = 2.51
race Length (m)=1.72
iele. Const.= 73.1
olumetr MC (%)= 82.2

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

1.75

Same as #3

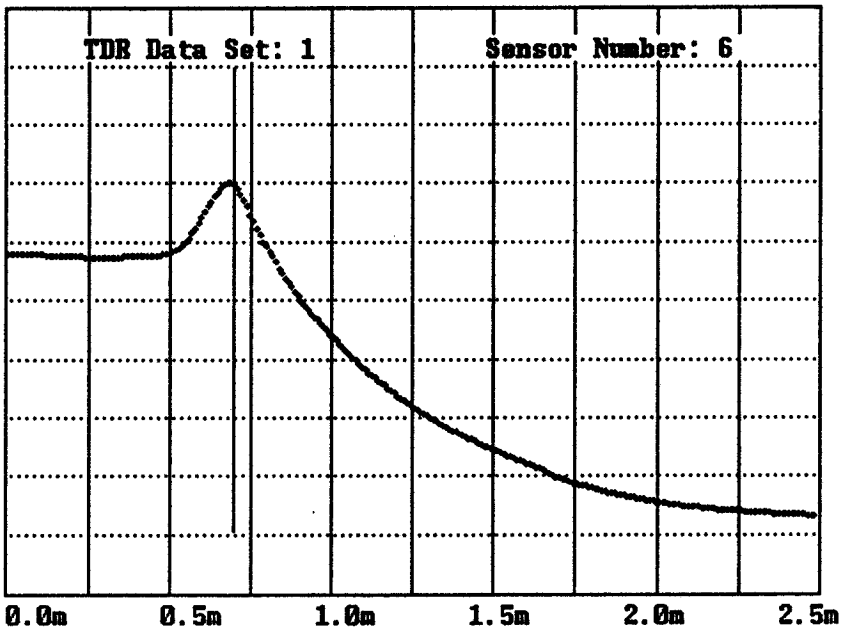
DR RESULTS

...e: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:19
ist → Curs (m): 18.3
ist btn WvFm (m):.01
ain: 54
ffset: 53752
ample No: 1

1 (m) = 0.70
2 (m) = 2.51
race Length (m)=1.81
iele. Const.= 81.0
olumetr MC (%)= 98.8

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

Same as #3

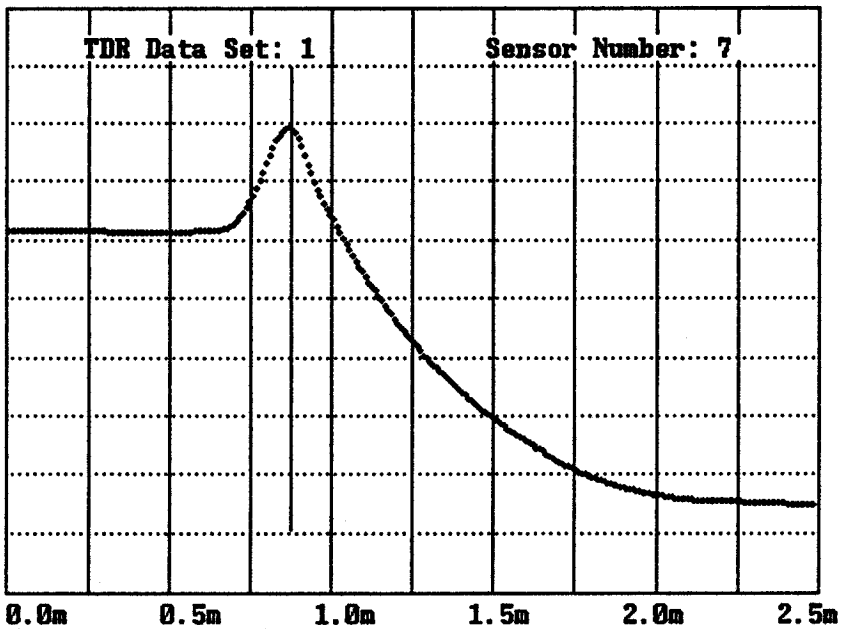
DR RESULTS

): 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:20
ist → Curs (m): 18.3
ist btn WvFm (m):.01
ain: 65
ffset: 54055
ample No: 1

1 (m) = 0.88
2 (m) = 2.51
race Length (m)=1.63
iele. Const.= 65.7
olumetr MC (%)= 71.0

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

Same as #3

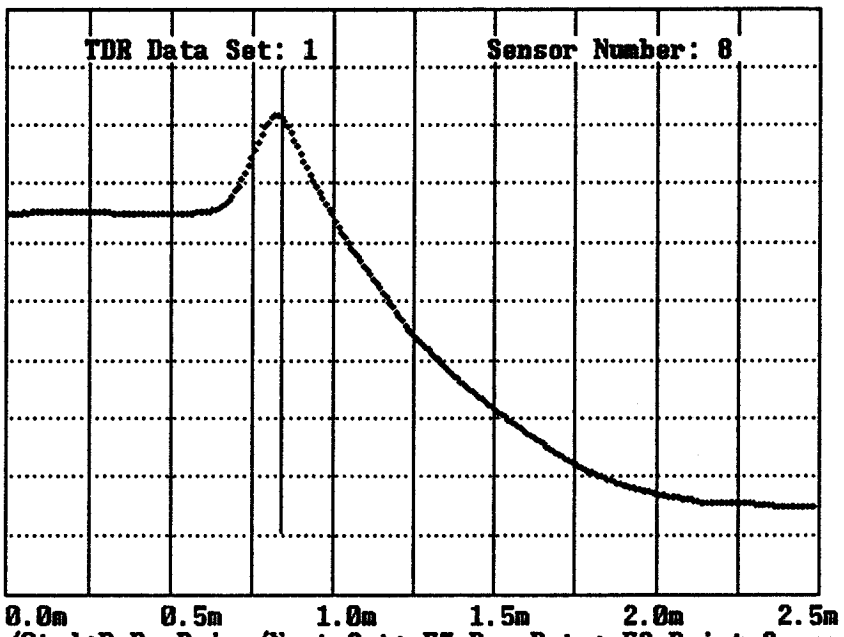
DR RESULTS

: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:20
ist → Curs (m): 20.1
ist btn WvFm (m):.01
ain: 66
ffset: 54275
ample No: 1

1 (m) = 0.84
2 (m) = 2.51
race Length (m)=1.67
iele. Const.= 68.9
olumetr MC (%)= 75.5

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

Sample #3

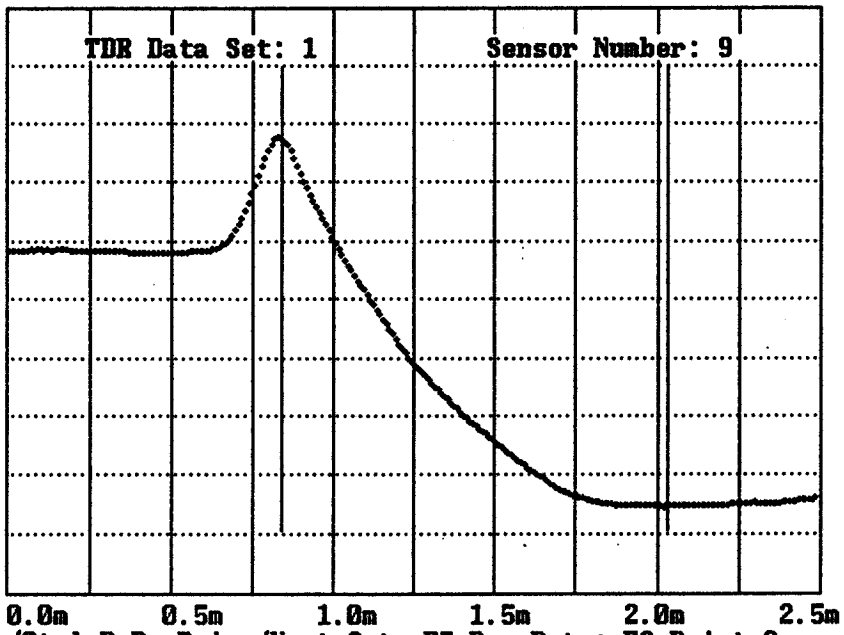
DR RESULTS

: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:21
ist → Curs (m): 20.1
ist btn WvFm (m):.01
ain: 71
ffset: 54040
ample No: 1

1 (m) = 0.84
2 (m) = 2.04
race Length (m)=1.20
iele. Const.= 35.6
olumetr MC (%)= 48.3

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

FLAT

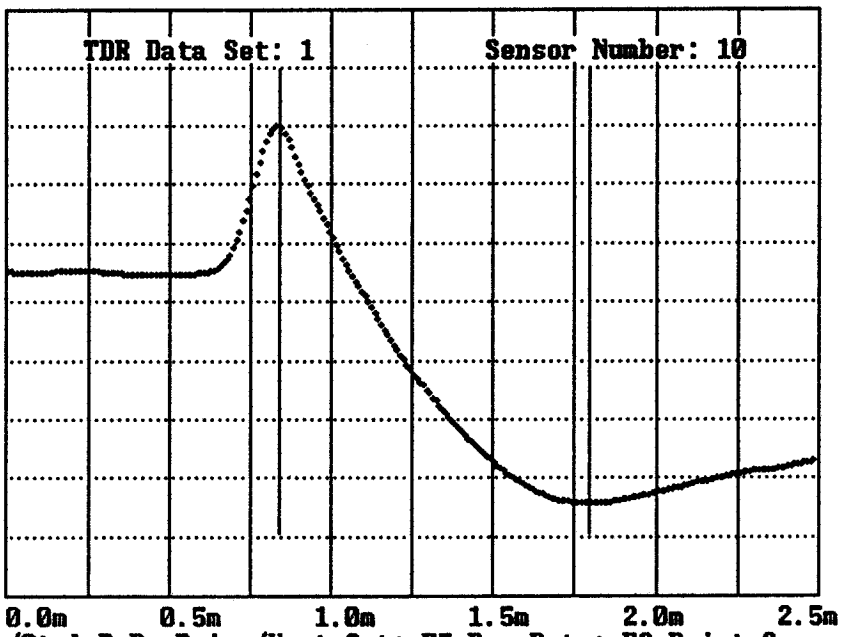
DR RESULTS

: 46SB94BG.MOB

ate: Jul 19, 1994
ime of Day: 7:21
ist → Curs (m): 20.1
ist btn WvFm (m):.01
ain: 78
ffset: 54125
ample No: 1

1 (m) = 0.84
2 (m) = 1.80
race Length (m)=0.96
iele. Const.= 22.8
olumetr MC (%)= 37.8

otal 2 Set Data



sc=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

Appendix D-2: Routine SMP Monitoring Data Collection Summary

Appendix D-2 contains the following information:

- Standard LTPP SMP data tracking log;
- Field testing information sheet; and
- Screen prints documenting equipment problems.

46SB - 469187, ST-73 SB LANE, 18 MILES SOUTH OF FAITH, SD (MP 156)

Date dd/mmm/yy (ctrl+shft+d)	Visit ID	ONSITE Data			MOBILE Data		Manual Data								FWD Data				Distress		Profile		Comments
		Pvmt. Temp.	Air Temp.	Rain	TDR	Frost Volts	Backup Temp	Backup TDR	Frost 2-Pt.	Frost 4-Pt.	Water Table	Pvmt. Elev.	Joint Open.	Joint Fault	Man. Temp.	No. of Cycles/Visit OWP	ML	PE	M	P	P	D	
16-Jun-93																					X		
29-Sep-93																				X			
09-Jun-94																			X				
18-Jul-94	94A														X	1	1						INSTALLATION, MANUAL TDR DATA
19-Jul-94	94B	X	X	X	X	X			X	X	X	X			X	3	3						
11-Aug-94	94C	X	X	X	X	X			X	X	X				X	4	4		X				
26-Sep-94	94D	X	X	X	X	X			X	X	X	X			X	3	3						
01-Oct-94																					X		
24-Oct-94	94E	X	X	X	X	X			X	X	X	X			X	4	4						
21-Nov-94	94F	X	X	X	X	X			X	X	X				X	1	1						REPAIRED TDR#3 CONNECTOR, FIRST MOBILE DATA HAS FLAT TRACE
19-Dec-94	94G	X	X	X	X	X			X	X	X	X			X	3	3						WEATHER CONDITIONS LIMITED TESTING ON 21NOV94.
20-Jan-95	95A	X	X	X	X	X			X	X	X					0	0						WEATHER CONDITIONS LIMITED TESTING.
26-Jan-95																					X		PROFILE DATA NOT RECIEVED BY RCO.
20-Feb-95	95B	X	X	X	X	X			X	X						0	0						UNSTABLE RESISTIVITY READINGS, WATER RAN INTO PIEZ.
10-Mar-95	95C	X	X	X	X	X			X	X	X	X			X	3	3						
24-Mar-95	95D	X	X	X	X	X			X	X	X				X	1	1		X				UNSTABLE RESISTIVITY READINGS, GROUND LOOP FIXED.
07-Apr-95	95E	X	X	X	X	X			X	X	X	X			X	3	3						WEATHER CONDITIONS LIMITED TESTING ON 24MAR95.
21-Apr-95	95F	X	X	X	X	X			X	X	X				X	3	3						
22-May-95	95G	X	X	X	X	X			X	X	X	X			X	3	3						
26-Jun-95	95H	X	X	X	X	X			X	X	X	X			X	3	3		X				ONSITE PANEL AND INSTRUMENT POLE REMOVED.

469187 - 46SB

Updated 5-May-95

LOCATION - ST-73 SB Lane, 18 Miles South of Faith, SD (MP 156)
CONTACTS - Jarvis Palmer (605) 967-2182, Jarvis in Faith phone book also.
TEMP HOLES - Sta 0-03, Depths are about 0.9", 2.5", and 5.1" (AC thickness = 5.25").

DISTRESS COMMENTS:

Sta F1 - Tests at Sta 0-15, and at 25 foot intervals from Sta 0+00 to Sta 2+00.

-15 LP ADJACENT TO INSTRUMENTATION HOLE
0 H-TRANS.CR. BETWEEN LP AND D2
125 H-TRANS.CR. 3" IN FRONT OF D7

Sta F3 - Tests at Sta 0-25, 0-10, and at 25 foot intervals from Sta 0+00 to Sta 2+00.

0 H-TRANS.CR. UNDER D2
125 H-TRANS.CR. 3" IN FRONT OF D7

PIEZOMETER - Sta 1+00, at edge of shoulder, depth = 4.285M.

ELEVATIONS - SD/DOT BM at Sta 0+00, 97 feet form the edge of the paved shoulder (at edge of ROW).

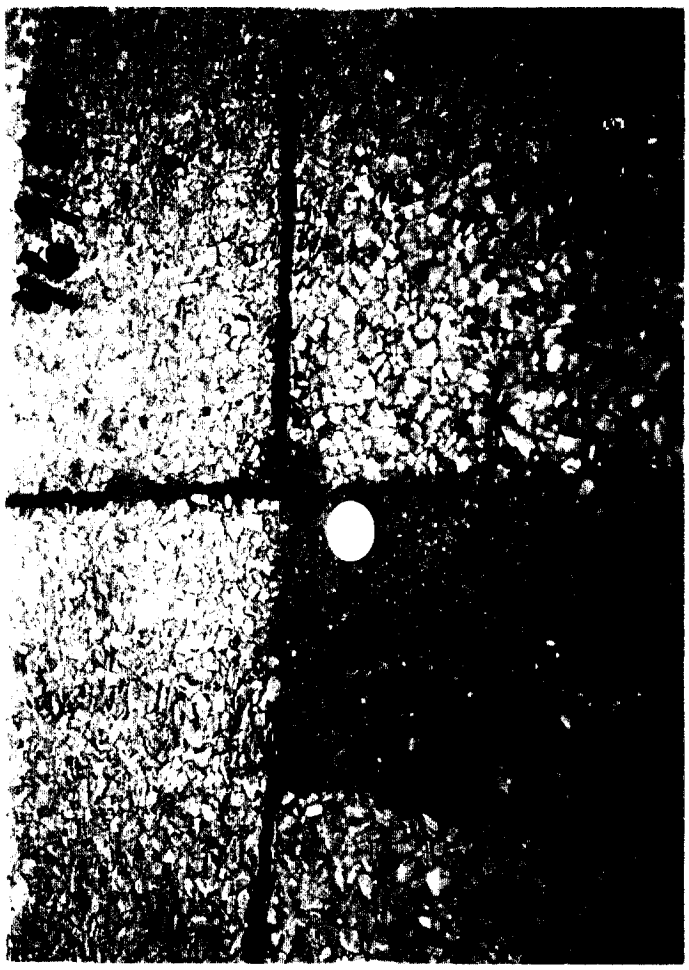
Offsets:		PE	OWP	ML	IWP	ILE	
(M)		0.16	0.76	1.83	2.90	3.51	
(ft)	-0.5 (nail)	0.5	2.5	6.0	9.5	11.5	12.5 (nail)

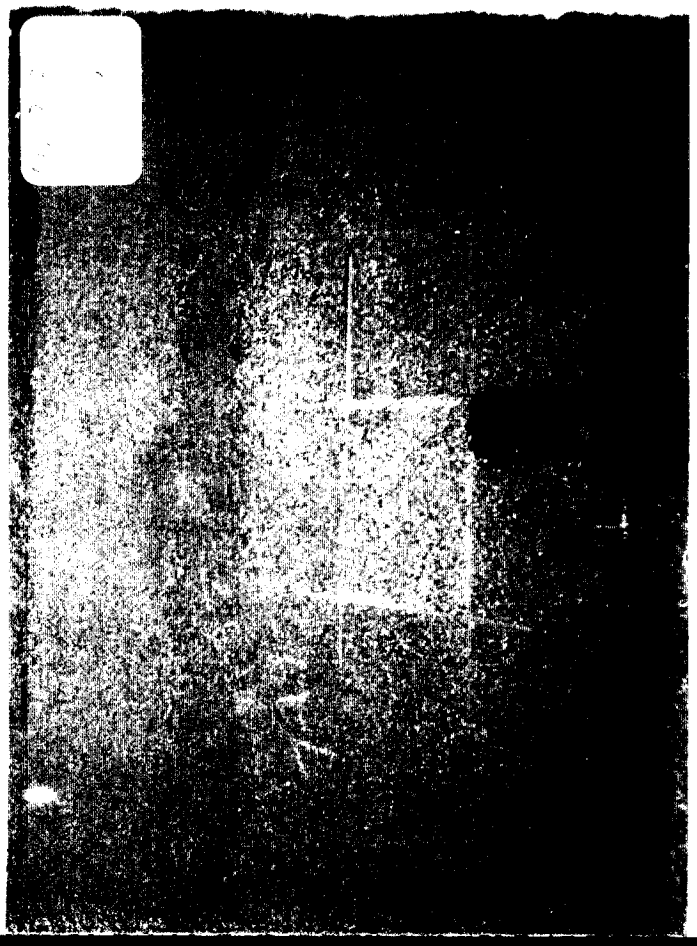
Note: Offsets are based on 12 foot lane measured from the centerline for the road. Outside edge of lane stripe is not at exactly 12 foot.

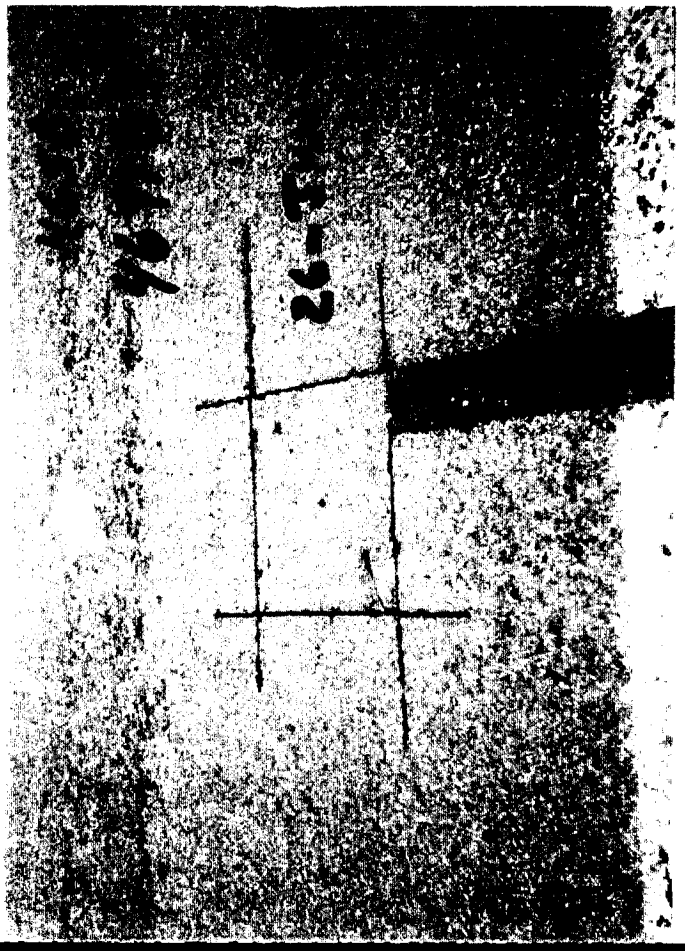
Note: PK nails are 13 feet apart and elevations between nails are at 1.0'(LE), 3.0'(WP), 6.5'(ML), 10.0'(WP), and 12.0'(LE). Latest guidelines require nails be 0.5 feet outside the section.

Sta: Transverse profiles at Sta 0-25, 0-15, 0-10, and every 25 feet from Sta 0+00 to Sta 2+00.

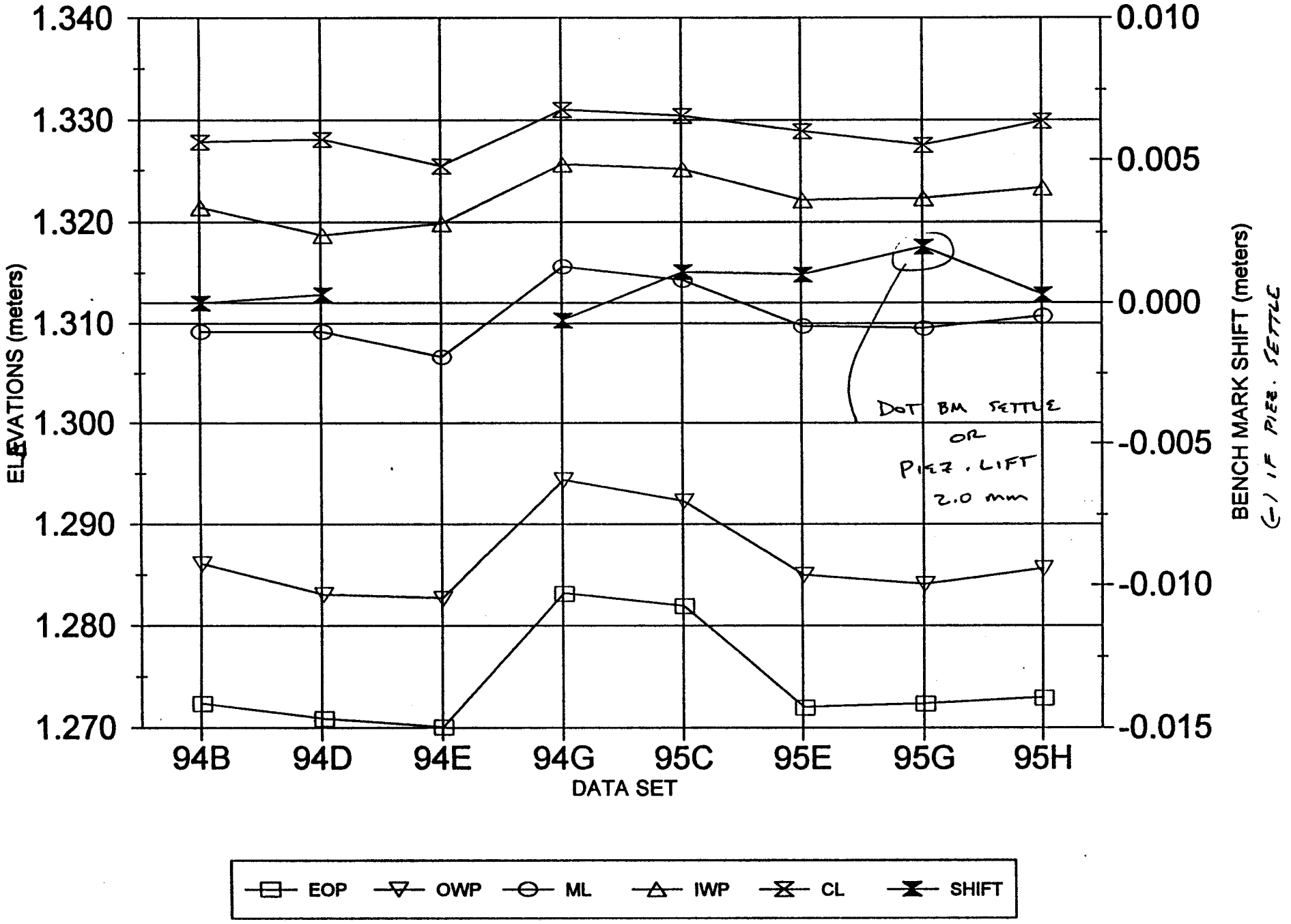
COMMENTS:
- Prairie Vista Inn in Faith (605) 967-2343.
- Make sure to set computers to MOUNTAIN time.
- Need locking collar (spacer) on DOT BM for elevation survey.







469187 (station 3+00)



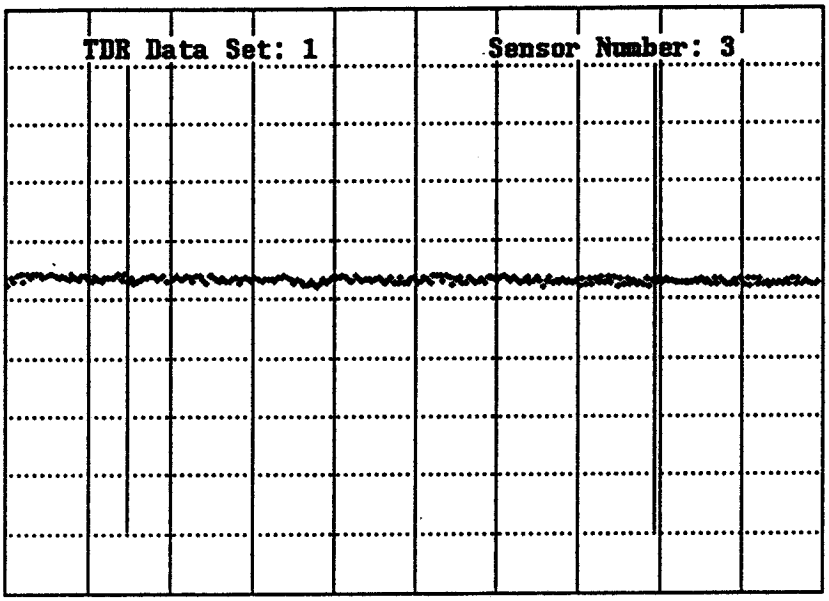
R RESULTS

: 46SB94FK.MOB

te: Nov 21, 1994
me of Day: 7:42
st → Curs (m): 18.3
st btn WvFm (m):.01
in: 160
fset: 51486
mple No: 1

(m) = 0.37
(m) = 1.99
ace Length (m)=1.62
ele. Const.= 64.9
lumetr MC (%)= 70.0

tal 2 Set Data



0.0m 0.5m 1.0m 1.5m 2.0m 2.5m

c=Menu; ↑ ↓; Ctrl+PgUp/Ctrl+PgDn=Prior/Next Set; F5=Res Data; F2=Print Screen

Repaired connector. See next set.

LTPP Seasonal Monitoring Program Data Sheet SMP-D01 Manual Moisture Measurements	Agency Code [46] LTPP Section ID [9187]

Required Settings:

Dist./Division: 0.25 m
Phase Velocity: 0.99
Noise Filter: 1 average

Probe Number	Probe Depth[1] (m)	Time (military): ____		Time (military): ____	
		Apparent Length (m)	Dielectric Constant[2]	Apparent Length (m)	Dielectric Constant[2]
1					
2					
3		1.15	32.74		
4		1.22	36.85		
5		1.50	55.71		
6		1.35	45.12		
7					
8					
9					
10					

[1] Distance in meters from pavement surface to TDR probe
[2] Dielectric constant is determined as follows:

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

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

ATTACH ~~ALL~~ EP TDR TRACES TO ~~THIS DATA~~ NEXT SHEET.

Comments: PROBES 3, 4, 5 and 6 – MANUAL TO LOOK AT SECOND INFLECTION POINT (FLAT TRACE)

Prepared by: RJV Employer: BRAUN INTERTEC

Date (dd/mm/yy): ~~11~~ / 21 / 94
NOV (Prepared 11/30/94)

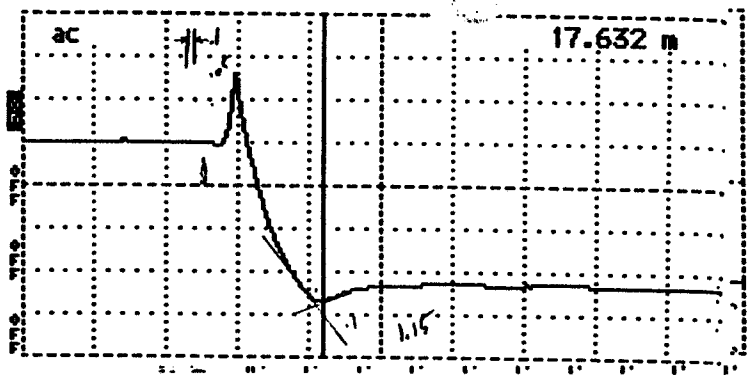
LTPP Seasonal Monitoring Program
Data Sheet SMP-D01
Manual Moisture Measurements

Agency Code [46]
LTPP Section ID [9187]

Seasonal Monitoring Program Guidelines: Version 2.1/April 1994

Required Settings:

ursor ..... 17.632 m
stance/Div ..... 1 m/div
ertical Scale.... 100 mρ/div
ρ 0.99
oise Filter ..... 1 avg
ower ..... ac



Tektronix 1502B TD
Date 11-21-94
Cable 3
Notes 469187

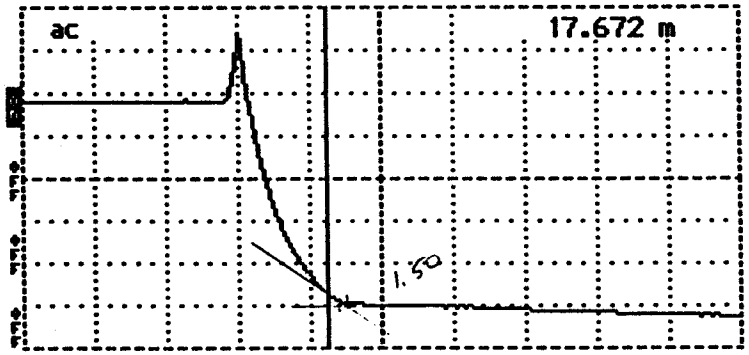
Input Trace
Stored Trac
Difference Trace

ursor ..... 17.672 m
stance/Div ..... 1 m/div
ertical Scale.... 100 mρ/div
ρ 0.99
oise Filter ..... 1 avg
ower ..... ac

Tektronix 1502B
Date 11-21-94
Cable 4
Notes 469187

Input Trace
Stored Trace
Difference Trace

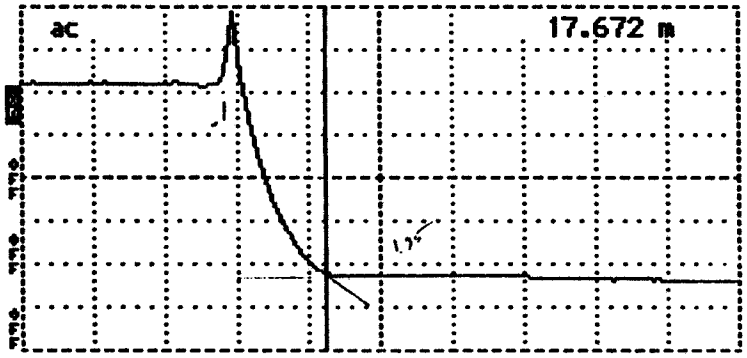
ursor ..... 17.672 m
istance/Div ..... 1 m/div
ertical Scale.... 100 mρ/div
ρ 0.99
oise Filter ..... 1 avg
ower ..... ac



Tektronix 1502B
Date 11-21-94
Cable 5
Notes 469187

Input Trace
Stored Trace
Difference Trace

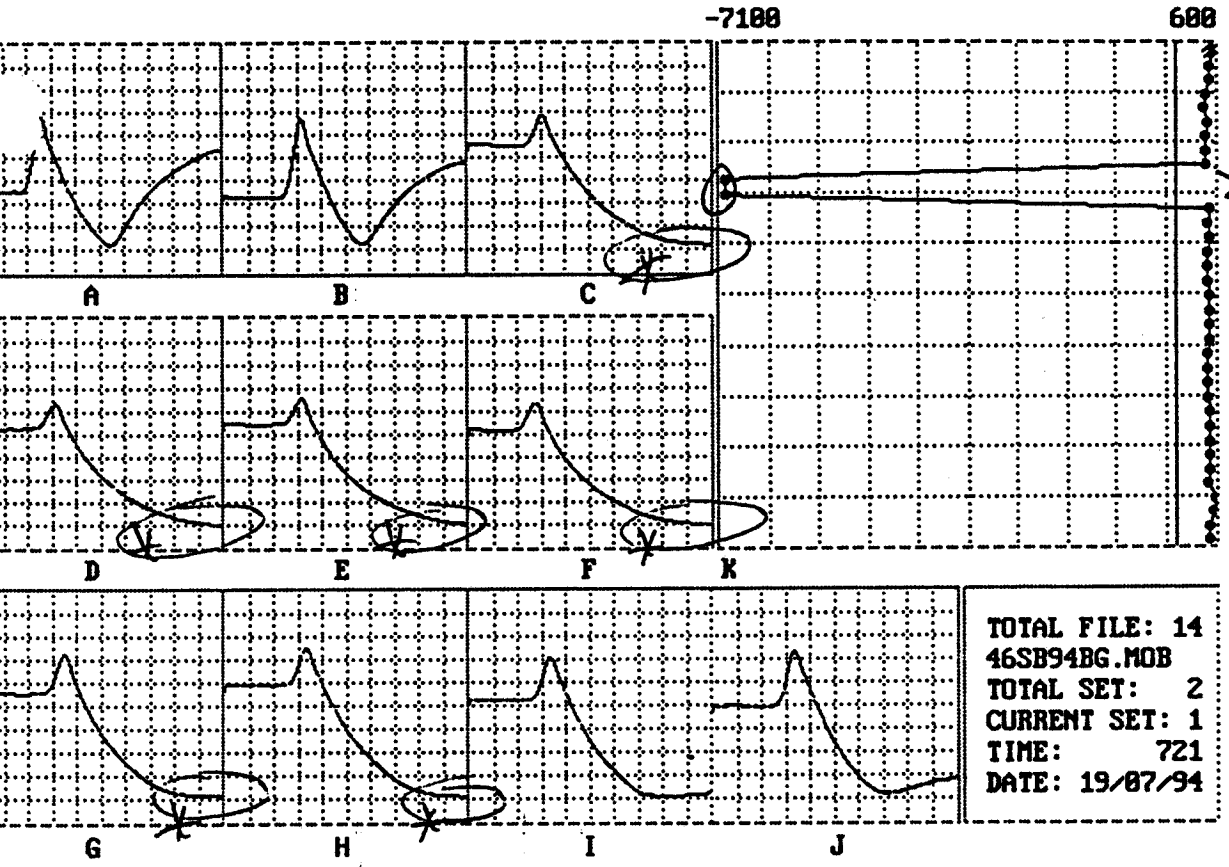
ursor ..... 17.672 m
stance/Div ..... 1 m/div
ertical Scale.... 100 mρ/div
ρ 0.99
oise Filter ..... 1 avg
ower ..... ac



Tektronix 1502B
Date 11-21-94
Cable 6
Notes 469187

Input Trace
Stored Trace
Difference Trace

469394



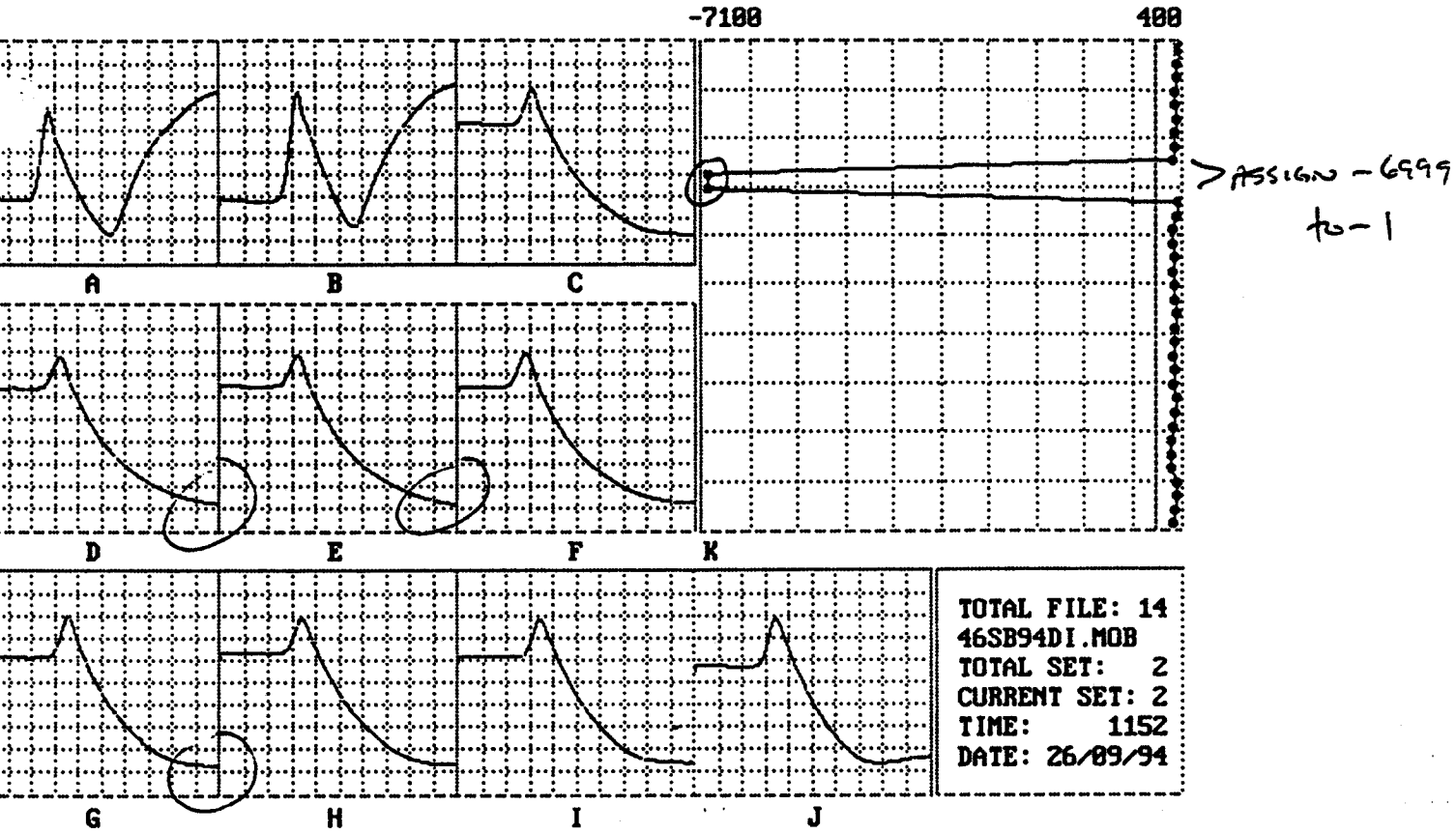
CREEL PROBLEM ON POSITION 10/11.

ASSIGN -6999 to -1

ENTER LANGUAGE=PCL PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

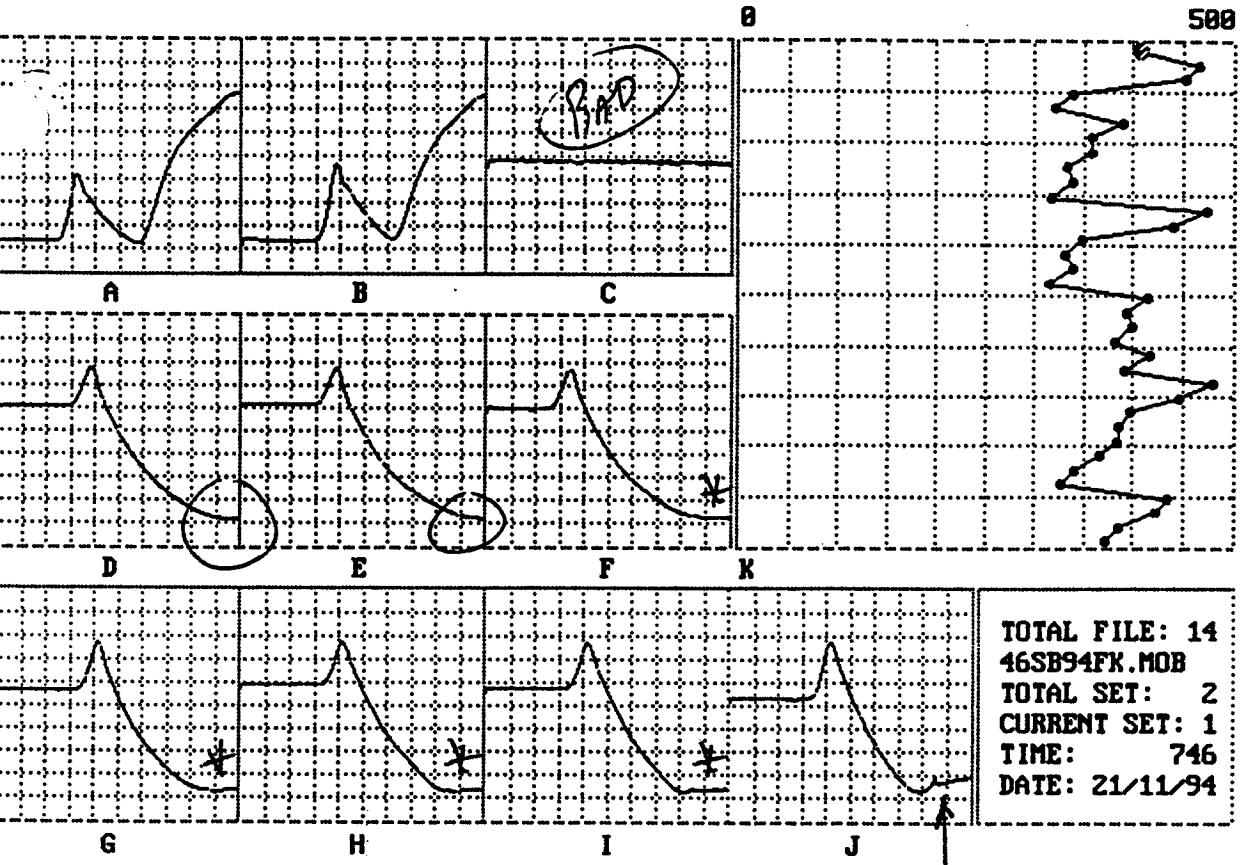
* FHWA/TAC ADVISE GOOD/BAD FOR TDR #3 THROUGH #8

- NO SECOND INFLECTION POINTS
- DISSOLVED SALTS?
- MANUAL TRACES FROM THE DAY BEFORE ARE THE SAME.



er=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

- TDR #3, #6, #8, #9 FLAT
- TDR #4, #5, #7 NO SECOND INFLECTION POINT



TOTAL FILE: 14
46SB94FK.MOB
TOTAL SET: 2
CURRENT SET: 1
TIME: 746
DATE: 21/11/94

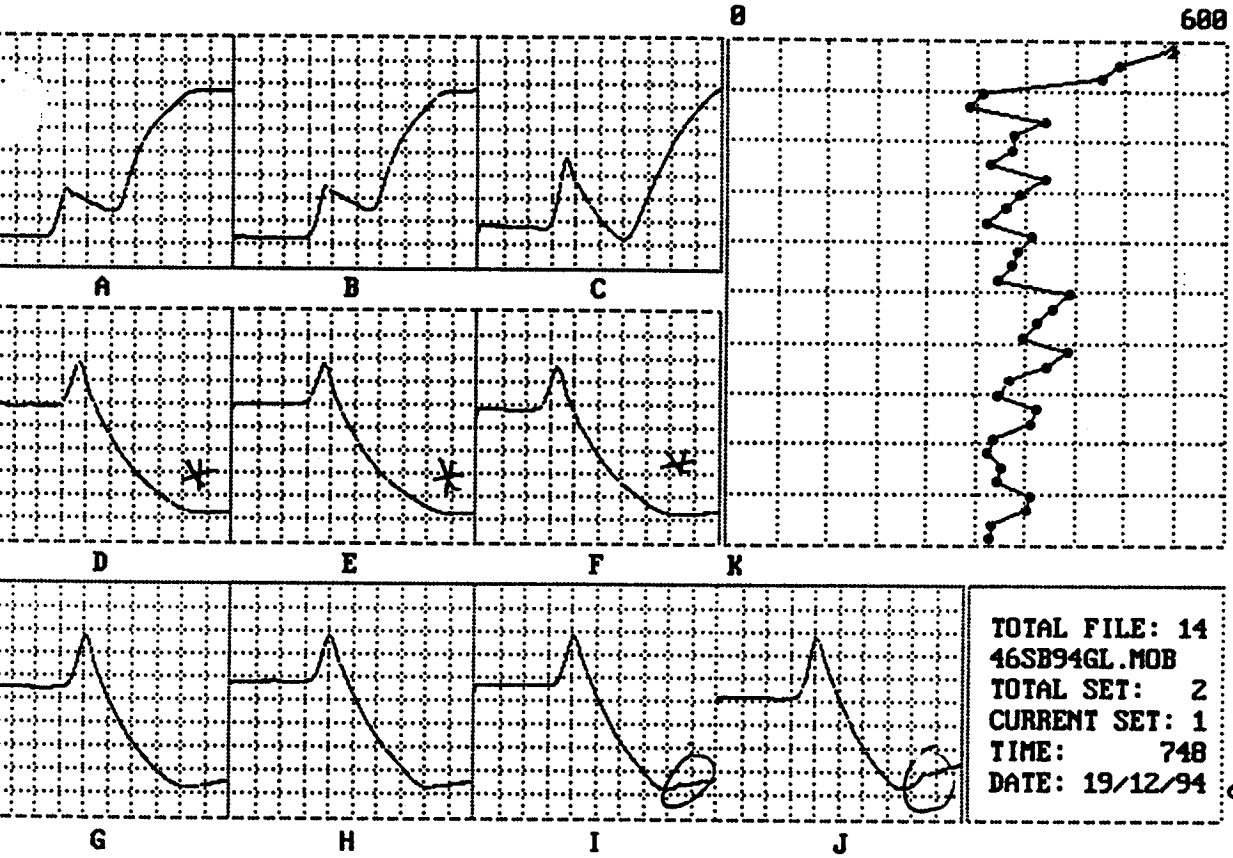
ter=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

SPIKE FROM COLD CABLE READER

BNC CONNECTOR ON TDR#3 REPAIRED

* = FLAT TRACES - FITWIT/TAC ADVISE GOOD/BAD

O - NO SECOND INFLECTION



> FROST

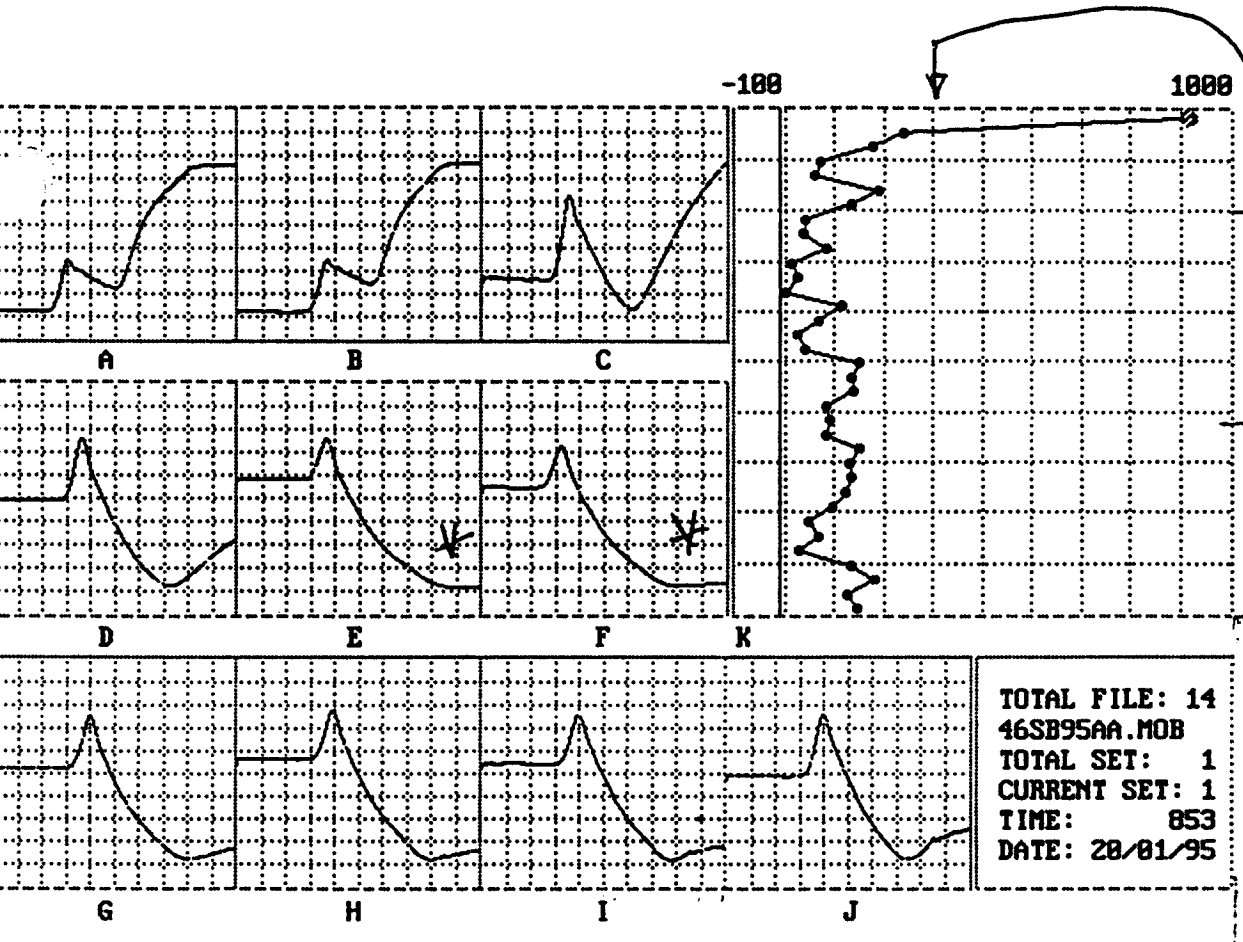
d - is correct site

ter=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

- ESTIMATE TDR PROBES #1 AND #2 IN FROZEN BASE
  - SHAPE CHANGE ON TDR #3 MAY ALSO INDICATE FROST

* FLAT TRACES

- SPIKE FROM COLD CABLE READER ON TDR #9 AND #10



ter=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

TYPICAL VOLTAGE ON PREVIOUS VISITS IS 300 to 400 mV

- FHWA/TAC ADVISE GOOD/BAD !

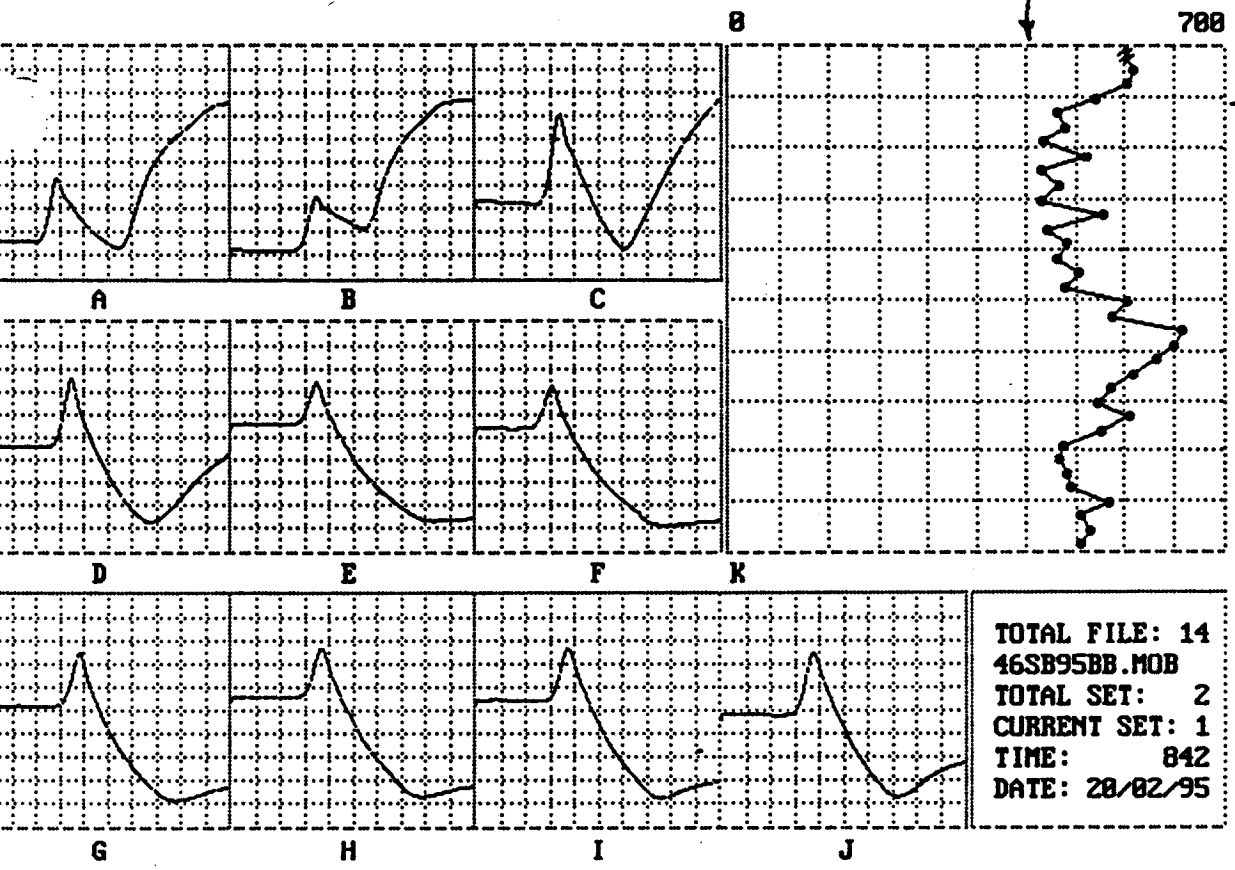
- CRREL SHIFT OR CAN RESISTANCE DECREASE ?

SEE SET 46SB95B

- NOTE CHANGE FOR TDR#4 - IN FROST ?

* FLAT TRACES

UNFROZEN VOLTAGE!

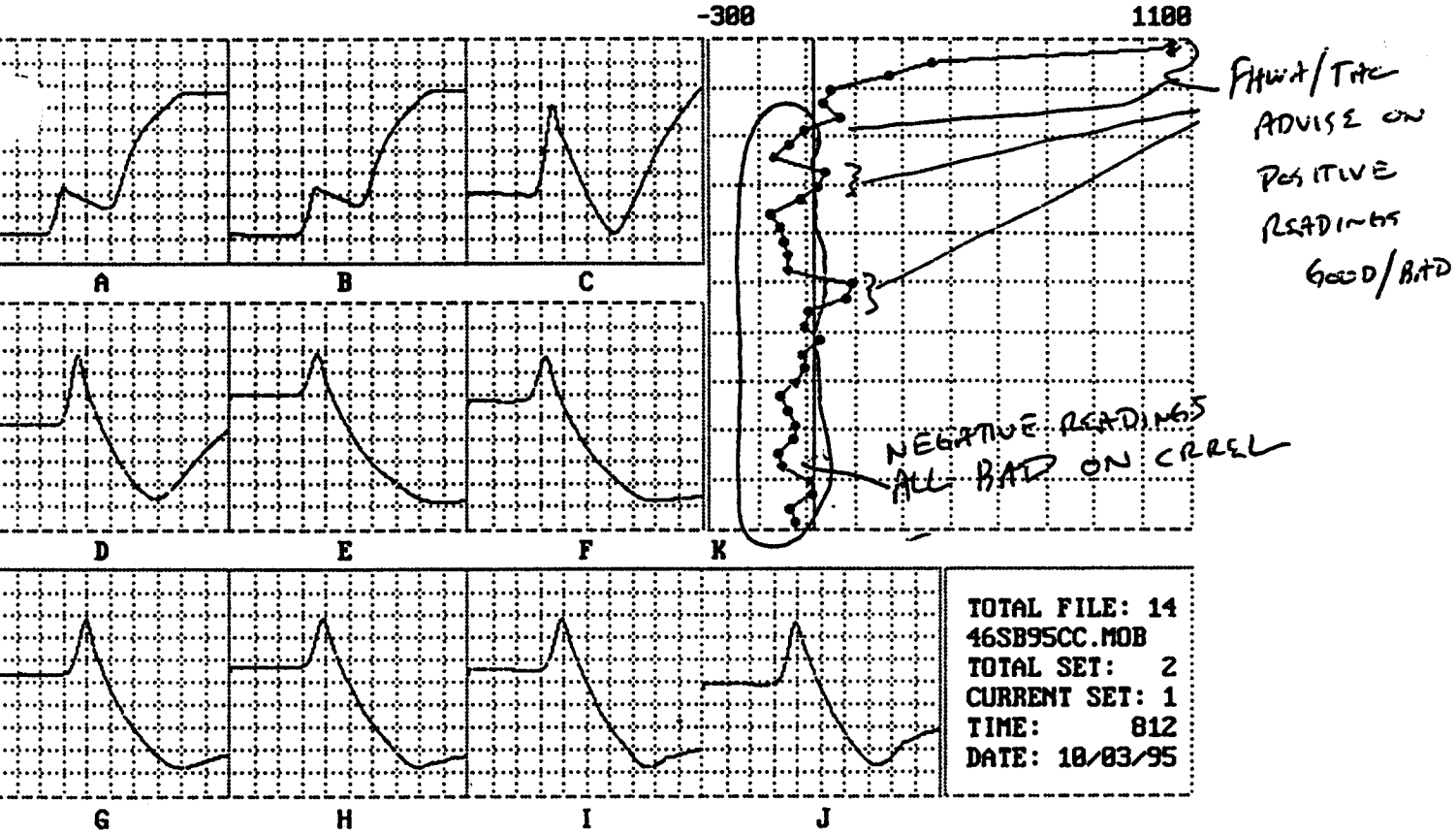


TOTAL FILE: 14
46SB95BB.MOB
TOTAL SET: 2
CURRENT SET: 1
TIME: 842
DATE: 28/02/95

er=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

- COMPARE TO SET 46SB95A
- VOLTAGES SHIFTED HIGH ON THIS VISIT
- CREEL PROBLEM ?
- WILL HAVE TO CHECK AGAINST MANUAL READINGS.

FIRST SET WITH ALL TDRS USEABLE?



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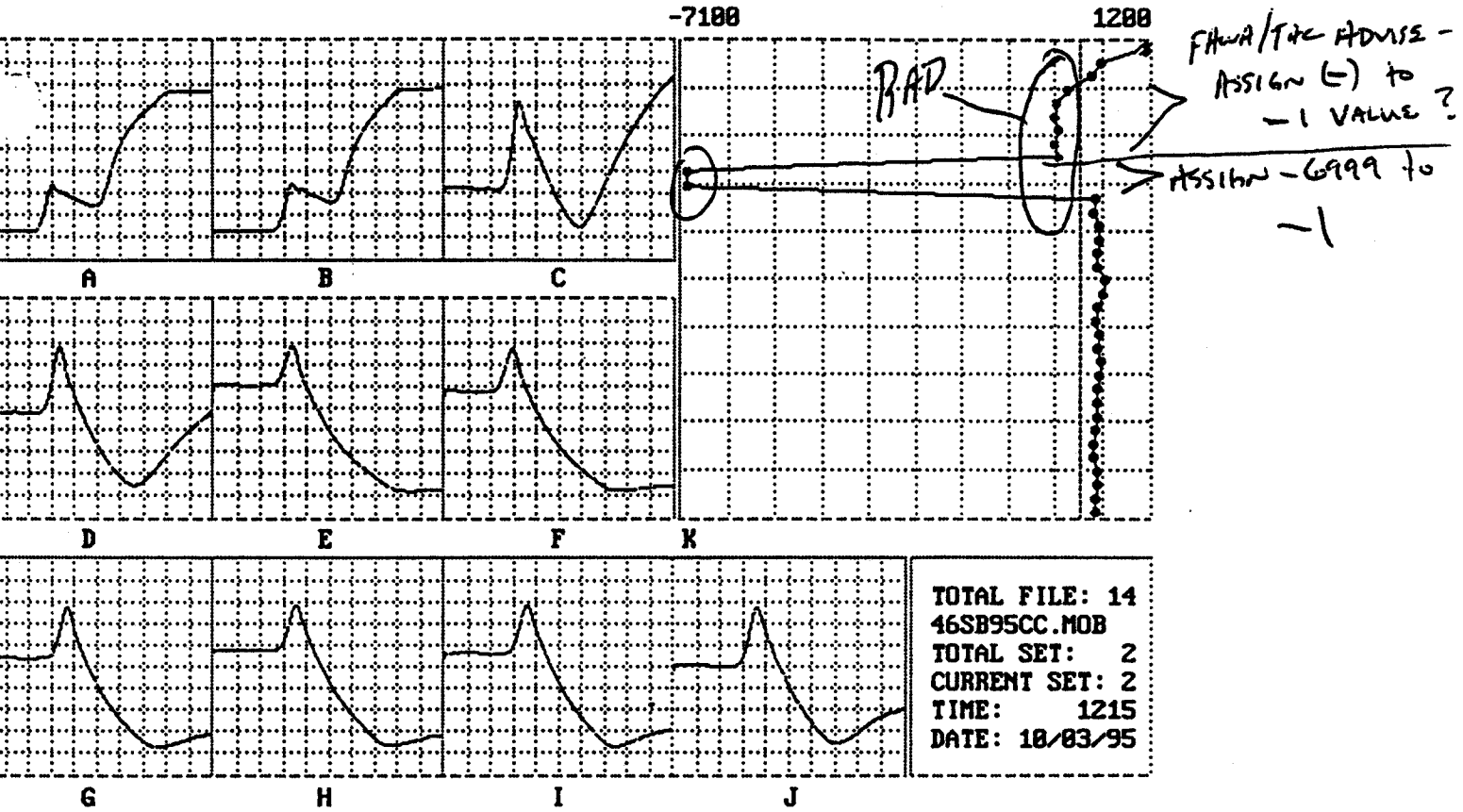
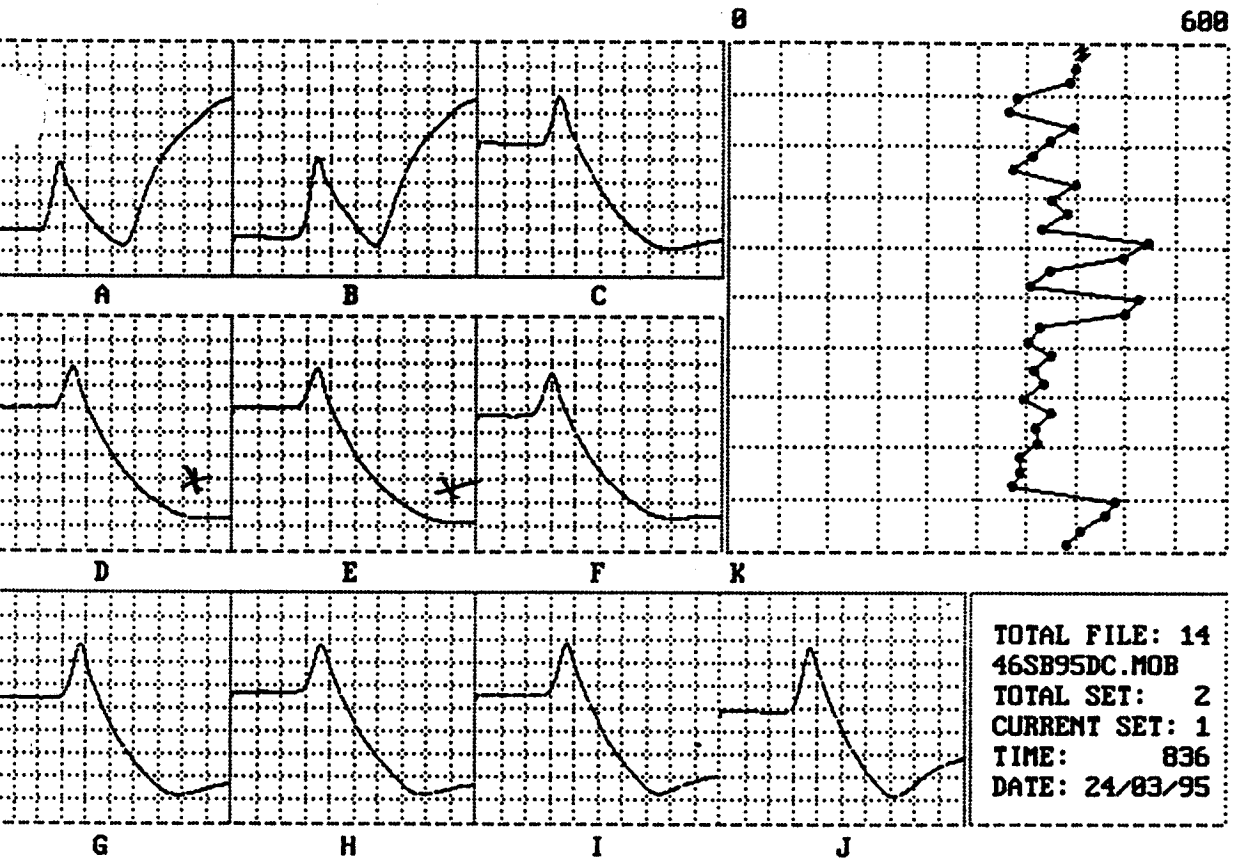


'er=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File



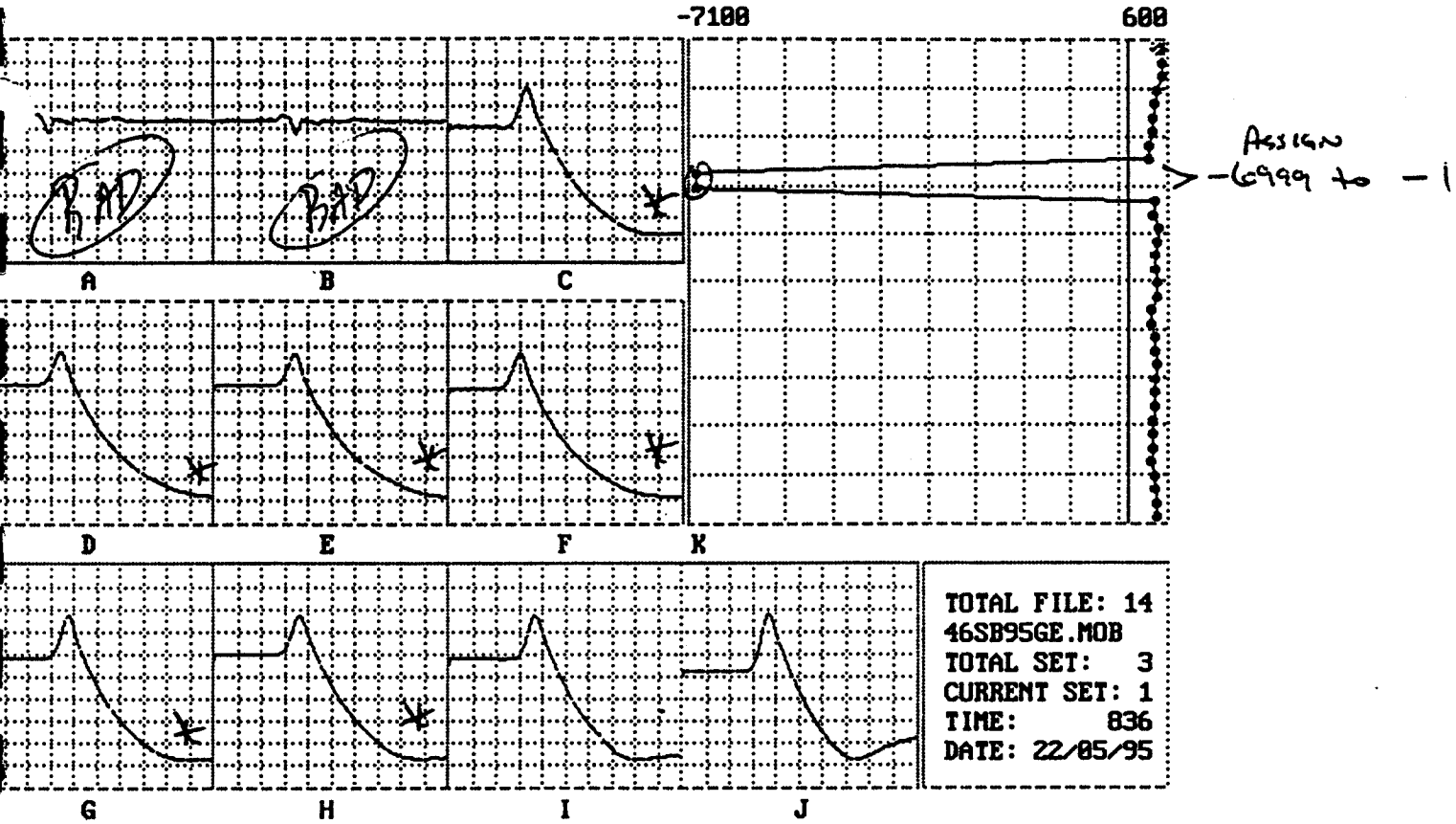
er=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

SHAPE CHANGE FOR TDR #1 to #4

— NO LONGER IN FROST ?

— CREEL VOLTAGE AT PRE-FROST LEVELS.

* FLAT TRACES



+ter=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

* FLAT TRACES

NOT SURE WHAT HAPPENED TO TDR #1 AN #2

Appendix D-2: Routine SMP Monitoring Data Collection Summary

Appendix D-2 contains the following information:

- Standard LTPP SMP data tracking log;
- Field testing information sheet; and
- Screen prints documenting equipment problems.

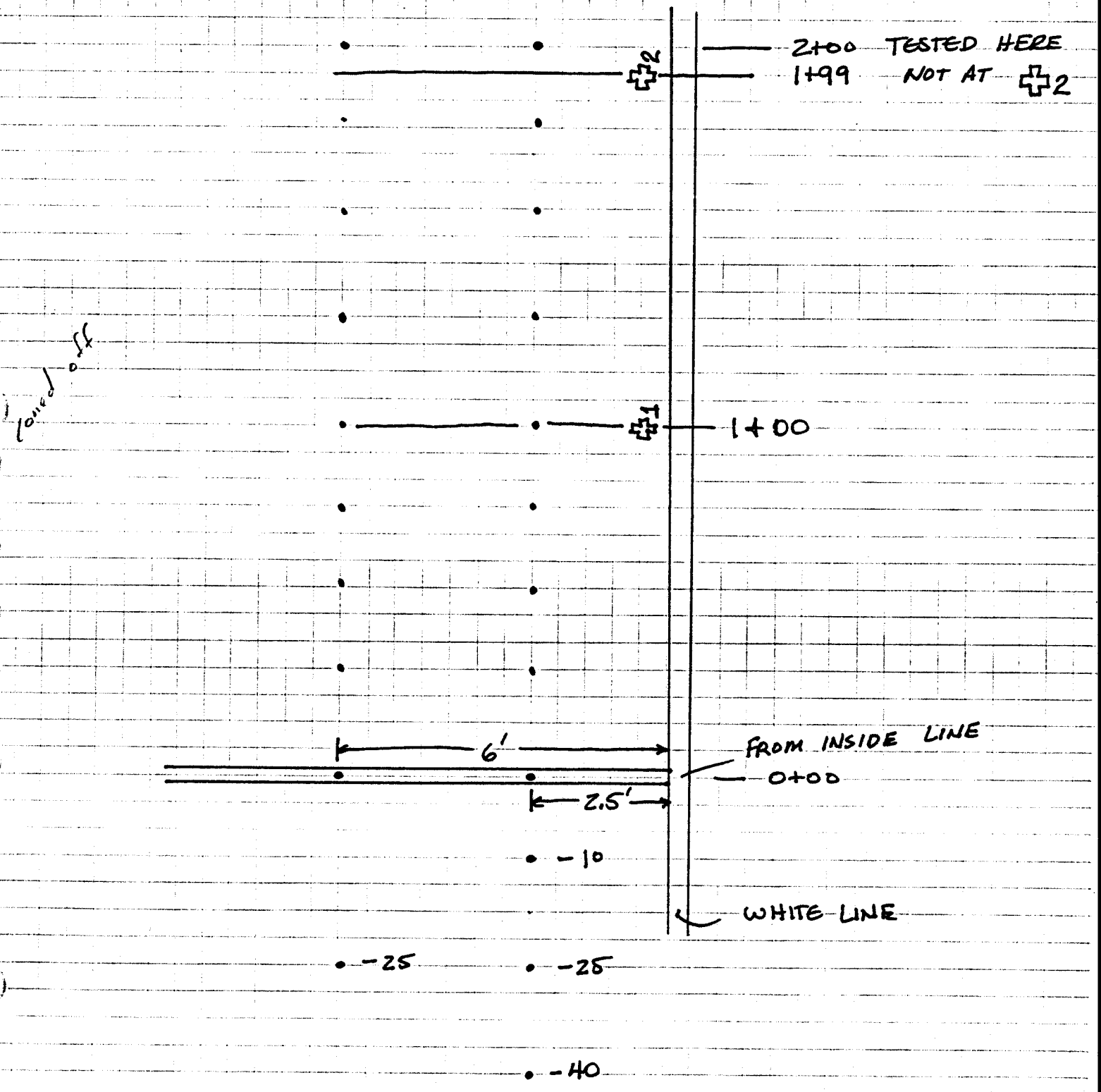
1991

BRAUNSM
INTERTEC

Description: 469187 SOUTH DAKOTA
SEASONAL FWD LAYOUT

Project No:

Date: 1991 By:



SHRP-LTPP FIELD ACTIVITY REPORT

SHRP NORTH CENTRAL REGION

SHRP SECTION I.D. # 469187

STATE SOUTH DAKOTA

TESTING FWD

ROUTE/HIGHWAY # ST-73

FIELD SET # SEASONAL

TESTING DATE 3/24/92

SHEET # 1 OF 3

FWD AND TOW VEHICLE BEFORE OPERATION CHECKS BKN (INITIAL)

	MILITARY TIME	ODOMETER READING
START TRAVEL	0845	89460
END TRAVEL	0903	89478
READY TO TEST	0915	–
TRAFFIC CONTROL READY	0920	–
BEGIN TESTING	0930	–
END TESTING	1630	–
START TRAVEL	1700	89478
END TRAVEL	1843	89566

DOWN TIME — HOURS

REASON(S)

NUMBER OF TESTS:	BASIN	JT/CRACK
TP		
OWP		
PE		
ML		

ADDITIONAL REMARKS REGARDING TESTING: COMPLETED 4 PASSES
– HAD "558" ERRORS AT STATION 100 AGAIN, AS IN PREVIOUS TRIP
– PERFORMED 31 RETESTS –

TESTING COMPLETED BY:

BRAUN INTERTEC PAVEMENT INC. BKN (FWD OPERATOR) 3/24/92 (DATE)

SHRP-LTPP FIELD ACTIVITY REPORT

SHRP NORTH CENTRAL REGION

SHRP SECTION I.D. # 469187

STATE SOUTH DAKOTA

TESTING SEASONAL

ROUTE/HIGHWAY # ST-73

FIELD SET # *.210

TESTING DATE 7/28/92

SHEET # 1 OF 2

FWD AND TOW VEHICLE BEFORE OPERATION CHECKS BKN (INITIAL)

	MILITARY TIME	ODOMETER READING
START TRAVEL	0905	109483
END TRAVEL	0935	109499
READY TO TEST	1015	
TRAFFIC CONTROL READY	1015	
BEGIN TESTING	1025	
END TESTING	1604	
START TRAVEL	1635	109499
END TRAVEL	1830	109616

DOWN TIME _____ HOURS

REASON(S) **

NUMBER OF TESTS:	BASIN	JT/CRACK
TP		
OWP		
PE		
ML		

ADDITIONAL REMARKS REGARDING TESTING: ** 558 ERRORS ARE DEFINITELY LOCATION RELATED!! ** @ STATION 100 AGAIN; SAME LOCATION AS LAST ROUND OF TESTING.

TESTING COMPLETED BY:

BRAUN INTERTEC PAVEMENT INC. BKN (FWD OPERATOR) 7/28/92 (DATE)

Paper No. 940903

PREPRINT

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Title: Seasonal Characterization and Fatigue Damage of Flexible Pavements in the North Central Region of FHWA-LTPP Study

Author(s): Chunhua Han

Erland O. Lukanen

Robert Van Sambeek

Transportation Research Board
73rd Annual Meeting
January 9-13, 1994
Washington, D.C.

SEASONAL CHARACTERIZATION AND FATIGUE DAMAGE OF FLEXIBLE PAVEMENTS IN THE NORTH CENTRAL REGION OF FHWA-LTPP STUDY

by

Chunhua Han, Erland O. Lukanen, and Robert Van Sambeek

Braun Intertec Corporation
St. Paul, MN 55117-2004

ABSTRACT

This paper contains analysis results of Falling Weight Deflectometer (FWD) data that was collected on a monthly basis for seven General Pavement Studies (GPS) sections in the North Central Region of the Federal Highway Administration Long-Term Pavement Performance (FHWA-LTPP) study. All seven sections had an asphaltic concrete surface, each with different structural designs. About 1400 tests were run on each section during a test day. The testing was on a monthly basis over a one-year period according to the "SHRP LTPP Seasonal Monitoring Program." The paper examines daily, seasonal and spatial variation in pavement deflection, as well as, daily variation in temperature for selected test sections.

Layer modulus values were backcalculated using the LTPP study procedure and WESDEF. The results indicate that the backcalculated modulus values of the asphaltic concrete surface layer are mainly dominated by the pavement temperature and the logarithms of the modulus values are linearly related to the mid-depth pavement temperature. The seasonal variation of the backcalculated modulus of the supporting layers was also examined and characterized. This shows that the monthly backcalculated modulus of the subgrade strongly depend on the local climate conditions such as freezing and thawing.

Fatigue damage over the year was estimated for two typical sections based on the available field instrumentation data. A monthly damage percentage was than developed which shows the variation in structural capacity over that particular year. To do this, the horizontal tensile strain at the bottom of the asphalt layer was obtained using a forward calculation technique. Witczak's fatigue failure criterion was used to sum monthly damage in each season assuming a constant monthly cumulative 18,000 pound (80 kN) Equivalent Single Axle Load (ESAL). A probability distribution of pavement temperature was used to weigh the monthly fatigue damage. The results show that, with the in-field testing data and developed methodology, the fatigue damage can be quantified and the period or season with the most damage can be identified.

INTRODUCTION

Nondestructive testing (NDT), along with temperature, moisture and frost/thaw depth instrumentation, provides data to evaluate the long-term structural performance of pavements. In the Federal Highway Administration Long Term Pavement Performance (FHWA-LTPP) study, 64 carefully selected pavement test sections will be monitored *(1)*. These sections, called seasonal monitoring sections, include four pavement categories, two subgrade soil types, and four climat iczones. In a pavement service life cycle, each climate (yearly) cycle is different from another and produces different impacts on pavement structures. In each climate cycle, seasonal variation in environmental conditions may dramatically change pavement support and material properties. Seasonal characterization, therefore, is a crucial step toward the analysis of the environmental effect on structural characteristics of pavements. The seasonal monitoring program of LTPP will be the first national study on the effects seasons have on pavement performance.

Distresses induced by fatigue damage are sensitive to climate conditions. Various fatigue criteria were developed using laboratory and field measurements and expressed by a general logarithmic relation between the tensile strain at the bottom of the asphalt layer and the number of load repetitions at a standard temperature, 70°F (21°C). In Witczak's fatigue failure criterion *(2)*, pavement temperature is included as a variable rather than a standard condition after the strain-modulus relations at different temperatures were idealized. This generalization by Witczak made it practical to estimate pavement fatigue damage using only field-testing data.

This paper deals with the seasonal characterization of seven General Pavement Studies (GPS) pilot sections monitored in the North Central Region of the FHWA-LTPP study prior to installation of instrumentation. The sections are asphalt pavements on fine-grained subgrades. The analysis results were based on falling-weight-deflectometer (FWD) data collected on a monthly basis. Results of a comprehensive study on the seasonal characteristics of selected flexible pavements and the relative seasonal fatigue damage are presented. The study focused on deflection results. However, other data such as Drilling and Sampling data, Laboratory Testing data, pavement temperature data, and frost tube data were also used to obtain layer structure and thermal gradient information. Data from the instrumented sections will be more complete and the results presented in this paper indicate the importance of understanding the effects seasonal variation have on the performance of pavements. Such understanding will be valuable in scheduling routine data collection, such as weigh-in-motion and deflection. Factors to adjust measurments made during non-critical times could also be developed based on seasonal sensitivities.

FIELD TESTING

FWD testing in the pilot phase only included seven asphalt pavement sections built on fine-grained subgrade in the dry-freeze climate of the North Central Region. Adequate structural data was collected for all seven sections. One section was instrumented with a frost tube by the highway agency. Currently, the second phase of seasonal field testing is underway. Sixteen test sections including four pavement types (thin asphalt, thick asphalt, jointed plain concrete, and jointed reinforced concrete), two subgrade soil types (fine and coarse), and two climate zones (dry-freeze and wet-freeze) will be monitored in the North Central Region. Instrumentation for measuring temperature, moisture, and frost/thaw depth have been installed on seven of these sixteen sections to date *(1)*. The field testing described in this paper, however, is limited to the pilot phase without the benefit of instrumentation.

Regional Layout of Test Sections

Seven pilot test sections were monitored from November 1991 to August 1992 for studying the seasonal performance of asphalt concrete pavements (Figure 1). Of these seven sections, five were used in the study because these five are geographically representative of the North Central Region. These include Site 201009 in Kansas, Site 311030 in Nebraska, Site 469187 in South Dakota, Site 831801 in Manitoba, and Site 906405 in Saskatchewan. Consequently, only one section was selected from three in Kansas.

Falling Weight Deflectometer (FWD)

A Dynatest Model 8000E FWD was used for testing the seasonal sections. FWD calibration was maintained according to procedures established by FHWA-LTPP Study for yearly reference calibration and monthly relative calibrations *(3)*.

Testing Program

FWD testing was done according to the Strategic Highway Research Program LTPP guidelines *(3)*. However, not all of the procedures in the guidelines were applicable because instrumentation was not installed on the sections.

The following points summarize the FWD testing that was done:

- only asphaltic concrete pavements were monitored,
- FWDCHECK *(4)* results and distress data from earlier testing were used to select which end of the sections to monitor,
- 1/2 inch (1.27 cm) diameter holes, one inch deep, were drilled at 2.5 feet (0.76 m) and 6.0 feet (1.83 m) from the edge at either station 0 or 5 to serve as reference points for positioning the FWD load plate,
- test locations were measured out with a tape and marked with paint on the first round of testing and remarked as needed on subsequent visits,
- the "FLEX" Testing Plan *(3)* was used for the sensor spacing, drop sequence, load levels, data stored, test checks, etc.,
- testing was done both in the midlane and the outer wheel path at 25 foot (7.62 m) intervals for 200 feet (61 m) of the section plus at four additional locations outside the section limits in the area for future instrumentation (Figure 2),
- efforts were made to test within two inches of the original test point locations,
- testing was repeated on a monthly cycle unless other testing took priority,
- efforts were made to collect four sets of data at two hour intervals for each visit unless equipment problems or weather delays prohibited,
- temperature gradient measurements were recorded hourly at three depths for each section during the testing.

Surface condition and layer structure

A condition survey was conducted on Nov.29, 1990. The survey results are shown in Figure 3b along with the layer structure. No other distress, except simple cracks, were observed.

Deflection and temperature

Sensor 1, 4, and 7 deflections measured at the midlane at station 150 are plotted against the time in Figure 5a. The deflections are the lowest in January and highest in August. The biggest daily variation occurred in August; the corresponding spatial deflection variation is shown in Figure 5b. The four deflection basins measured that day are shown in Figure 5c. The daily variation in temperature is shown in Figure 5d.

Site 469187 in South Dakota

Site 469187 is 0.11 miles (0.18 km) north of reference post 156 on south bound ST 73 in South Dakota. The road has one 12-foot (3.66 m) wide lane in each direction. It is geographically at latitude 45°00', longitude 102°09', and elevation 2360 ft (719 m). The site was constructed in 1989 and is in a Dry-Freeze Region.

Surface condition and layer structure

The Pavement surface is in excellent condition and has the structure shown in Figure 3c.

Deflection and temperature

The seasonal deflections have minimal change from November to April, as shown in Figure 6a, with maximum deflection in August. Spatial and daily variation in deflection is relatively small as shown in Figures 6b and 6c. The daily variation in temperature is shown in Figure 6d.

Site 831801 in Manitoba

Site 831801 is on west bound Highway 1 west of Oak Lake, Manitoba. This road is a divided four-lane road with two lanes in each direction. It is located geographically at latitude 49°50', longitude 100°30', and elevation 1400 ft (427 m). The road was constructed in 1984. The site is in a Dry-Freeze zone.

Surface condition and layer structure

The condition survey from May 9, 1992 is illustrated on Figure 3d, including the layer structure.

FIELD DATA INTERPRETATION

In the analysis, a typical station and a typical date were selected to show seasonal and daily variation in deflection and pavement temperature respectively. For a clear graphical interpretation, the deflection data at the sensor offsets of 0 in. (0 cm, Sensor 1), 18 in. (46 cm, Sensor 4), and 60 in. (152 cm, sensor 7) were included in the figures. All plotted points represent the average of four drops at each point. Multiple points plotted at any station represent additional passes at approximate two hour intervals.

Site 201009 in Kansas

Site 201009 is 0.65 miles (1.05 km) north of reference post 78 on south bound US 281 in Kansas. The road has one 12-foot (3.66 m) wide lane in each direction. It is located geographically at latitude 37°59', longitude 98°45', and elevation 1922 feet (586 m) above sea level. The road was constructed in 1985.

Surface condition and layer structure

A condition survey was conducted on Nov.19, 1991 when the seasonal monitoring program was started. The survey results and layer structure are shown in Figure 3a.

Deflection and temperature

Figure 4a shows the seasonal deflection variation by date for the midlane test location at station 300, for about 6,000 lbs (26.7 kN) or 55 psi (379 kPa) plate pressure. On a test day, each test location was tested two to four times. Sensor 7 deflection shows little change with time of year. However, over the year, Sensor 1 and Sensor 4 deflection vary by 2 mils and 1 mil (0.050 and 0.025 mm), respectively. The lowest deflection occurred in January. Spatial (longitudinal) and daily deflection variation on April 14, 1992 are shown in Figure 4b. Again, Sensor 7 deflection fluctuates within a small range. Four deflection basins measured at station 300 on Apr.14, 1992 are shown in Figure 4c. The daily variation in temperature is shown in Figure 4d.

Site 311030 in Nebraska

Site 311030 is 0.89 mile (1.43 km) east of reference post 129 on west bound US 6 in Nebraska. The road has one 12-foot (3.66 m) wide lane in each direction. It is geographically at latitude 40°19'20", longitude 99°50'02", and elevation 2300 ft (701 m). The road was constructed in 1982 and opened to traffic in 1986. The section is located in an area classified as a dry-freeze.

Deflection and temperature

Figure 7a shows the seasonal variation in the deflection. The deflections clearly define a pattern, with a minimum in February and a maximum in May. In contrast to other sites, this site has a shorter time between the minimum and the maximum deflection. However, the spatial and daily variations remain relatively small (Figures 7b and 7c). The daily change in temperature is shown in Figure 6d.

Site 906405 in Saskatchewan

Site 906405 is on east bound Highway 16 near Plunkett, Saskatchewan. This road is an undivided two-lane road with one lane in each direction. It is located geographically at latitude 51°54', longitude 105°19', and elevation 1785 ft (544 m). The road was constructed in 1969.

Surface condition and layer structure

The condition survey from May 9, 1992 is illustrated on Figure 8; also included is the layer structure with thaw/frozen/unfrozen subgrade. Climatic effects on soils in this section introduces additional layers with different properties into the pavement layer structure, as defined by the frost tube data.

Deflection and temperature

Figure 9a shows the seasonal variation in deflection. The deflections clearly define a pattern, with a minimum in February and a maximum in May. This site, similar to 831801 in Manitoba, has a shorter time between the minimum and the maximum deflection. However, the spatial and daily variation still remains relatively small (Figure 9b and 9c). The daily variation in temperature is shown in Figure 9d.

SEASONAL CHARACTERIZATION

The deflection data were analyzed using two methods of layer moduli backcalculation: the SHRP procedure *(5)* which is based on MODULUS *(6)*, and WESDEF *(7)*. Four sections shown in Figure 3 were analyzed using the SHRP method. Different weight factors were applied to deflections from these four sections according to the layer information and sensor offset locations. The center deflection weight factor was 1.0 while the other deflections had lower weight factors.

The frost tube instrumentation in Saskatchewan allowed four different seasonal layer structures to be used as shown in Figure 8. For this particular case, the WESDEF program was used to backcalculate layer moduli in each seasonal structure *(8)* because the SHRP process would not run the layer configurations and low deflections during the frozen periods.

Asphalt Layer

For each test section, all the backcalculated asphalt modulus values at a fixed testing spot or station were correlated to the mid-depth pavement temperature. The relationship between these two attributes was determined from linear regressions based on the following equation:

$$E_{ac} = 10^{(\log_{10}E_0 - \alpha T)} \quad \text{(ksi)} \tag{1}$$

where E_{ac} is asphalt modulus in ksi; T is the mid-depth temperature (°F); $\log_{10}E_0$ and α are regression coefficients. The regression results for all selected five sections are listed in Table 1.

Subgrade

The backcalculated subgrade modulus are hardly related to the pavement temperature and are characterized against the month. Monthly variations in subgrade modulus for each section are shown in Figure 10, where the subgrade modulus in ksi were plotted against the numbered month. Some data points in this figure were interpolated when testing data was not available. There are two different seasonal patterns in subgrade modulus identified by the pilot testing program which show if a freeze-thaw period is included in the climatic cycle. As expected, when subgrade is frozen, the modulus is dramatically increased, and during the thaw, the modulus is significantly decreased. It should be noted that the subgrade moduli for Site 831801 in Manitoba were backcalculated based on a fixed pavement layer structure because no frost/thaw depth data was collected at this site; frost /thaw depth data will be available at this site for the current round of testing.

FATIGUE DAMAGE

The stiffness properties of the in-situ pavement materials needed for the structural analysis, were evaluated through the field nondestructive testing program discussed above. The seasonal variation in these properties results in different seasonal fatigue damage. Two major dominating factors are considered: the temperature of the asphalt surface layer and the stiffness of the supporting layers.

Theory of Relative Fatigue Damage

Theoretically, for an infinitesimal time period dt, the temperature distribution can be expressed by a probability density function f(T):

$$\int_{T_0}^{T_1} f(T)\,dT = 1 \tag{2}$$

where function f(T) statistically describes the variation in temperature over the period of dt. The function f(T) is useful as a weighting function of a fatigue failure function. Based on Minor's hypothesis, Witczak's failure function *(2)* is used and has the following form:

$$N(T,\varepsilon_t) = ab^{T^d}\left(\frac{1}{\varepsilon_t}\right)^c \tag{3}$$

Where $N(T,\varepsilon_t)$ is the equivalent number of 18-kip (80-kN) axle loads to 10% Class 2 fatigue cracking (slightly spalled alligator cracking); T is the pavement temperature (°F); ε_t is the critical horizontal

strain at the bottom of the asphalt layer; a, b, c and d are fatigue coefficients and equal 1.86351×10^{-17}, 1.01996, 4.995, and 1.45, respectively. Equation 3 resulted from the idealization of Kingham's tensile strain criteria that were derived directly from the results of flexible pavements at the AASHO Road Test *(9)*. It is seen from Equation 1 that $N(T,\varepsilon_t)$ depends only upon the temperature T for the period of dt if moduli of supporting layers are constant in the period of dt. Therefore, it follows that the fatigue damage in the period of dt has the form as:

$$d_t = P_t \int_{T_0}^{T_1} \frac{f(T)}{N_t(T)} dT \tag{4}$$

where P_t is the actual equivalent number of 18-kip (80-kN) axle loads applied over the period of dt. For a longer time period with t_0 and t_1 as the starting and ending time, the total damage can be obtained by integrating Equation 4:

$$d = \int_{t_0}^{t_1} \int_{T_0}^{T_1} \frac{f(T)}{N(T,t)} dT \; P(t) dt \tag{5}$$

With the help of Equations 4 and 5, the relative fatigue damage in the period of dt to the period of $(t_1 - t_0)$ is estimated using the ratio in percentage:

$$d_r = \frac{d_t}{d} \tag{6}$$

Analysis Method

The analysis process involved the discretization of Equations 4 and 5, forward calculation of the tensile strain ε_t, and estimation of the relative fatigue damage. The discretization is based on the variation in temperature for a month and the variation in material properties of supporting layers for a year. Due to lack of continuous temperature measurements, and for illustration sake, it is assumed that the variation in temperature during a testing day is representative for the month. In addition, the monthly projection of annual ESAL is assumed to be constant and evenly distributed for a year. When more data are available, these two assumptions can be eliminated. Steps to carry out the analysis process are as follows:

1. determine the discrete probability distribution of daily temperature using 10°F as the bin size.
2. calculate the asphalt moduli from Equation 1 using the central value temperature of each bin and use constant moduli of supporting layers for each month.
3. Calculate the tensile strain ε_t using the WESLEA layered elastic program and in turn the critical load repetition $N(T,\varepsilon_t)$ for the same central value temperature.
4. Sum the division of temperature frequency by the critical load repetition bin by bin.
5. Repeat above steps for every month and sum the results for the whole year.
6. Determine the relative fatigue damage in percentage (yearly damage percentage) from the ratio of the month sum and year sum.

Analysis Results

Two sections were selected since they represent two completely different climate cycles. Other conditions such as construction and instrumentation were also considered in the section selection for analysis. The sections selected are Site 311030 in Nebraska with no freeze-thaw period and Site 906405 in Saskatchewan with a freeze-thaw period. Figures 11 and 12 show the analysis results of relative fatigue damage for these two test sections. In terms of yearly damage percentage, the relative fatigue damage is plotted against the numbered month for one year in these two figures. It is clear from the figures that, as indicated by the model, the most fatigue damage occurs in winter if there is no freeze-thaw and if there is freeze-thaw, the most fatigue damage occurs when thawing starts, as is expected.

CONCLUSIONS

The following conclusions were reached on the basis of the results presented in this paper:

1. Practically, the FWD testing, along with field instrumentation, is effective in seasonally monitoring the long-term structural performance of pavements. The results presented could facilitate better performance prediction of flexible pavements, depending on the climate zone in question, regardless of when FWD testing is conducted. As long as the seasonal variation of subgrade in thaw/frozen state is known, adjustments, season by season, can be made, analytically.

2. On a semilog scale, backcalculated elastic modulus of asphalt surface is linearly dependent upon mid-depth temperature in the asphalt surface layer.

3. In a climate cycle, the period when the most fatigue damage to flexible pavements occurs depends the existance of a significant freeze-thaw period. The most fatigue damage occurs when thawing just starts. If no significant freeze-thaw period exists, the most fatigue damage is limited to colder temperature period such as winter.

4. This primary data analysis may help scheduling future FWD testing by highlighting periods when more tests are needed and when fewer tests are needed to define changes in moduli. It confirms that additional tests may be needed in the spring in the frost zones but may not be needed in the southern states in the North Central Region. It also may allow seasonal adjustment factors to be developed/refined to increase the value of deflection data colleted at non-critical times of the year.

5. It also may be very useful in collecting truck loading information if seasonal weigh-in-motion is used.

ACKNOWLEDGEMENTS

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DISCLAIMER

The contents of this study reflect the views of the authors who are solely responsible for the facts and accuracy of the material presented. The contents do not necessarily reflect the official views or policy of the FHWA. The study does not constitute a standard, specification, or regulation.

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Table 1 Regression Results

Section	Agency	$\log_{10}E_0$	α	R^2
201009	Kansas	3.70	-0.013	0.94
311030	Nebraska	3.92	-0.017	0.98
469187	South Dakota	3.53	-0.011	0.95
831801	Manitoba	3.64	-0.012	0.95
906405	Saskatchewan	3.41	-0.010	0.96

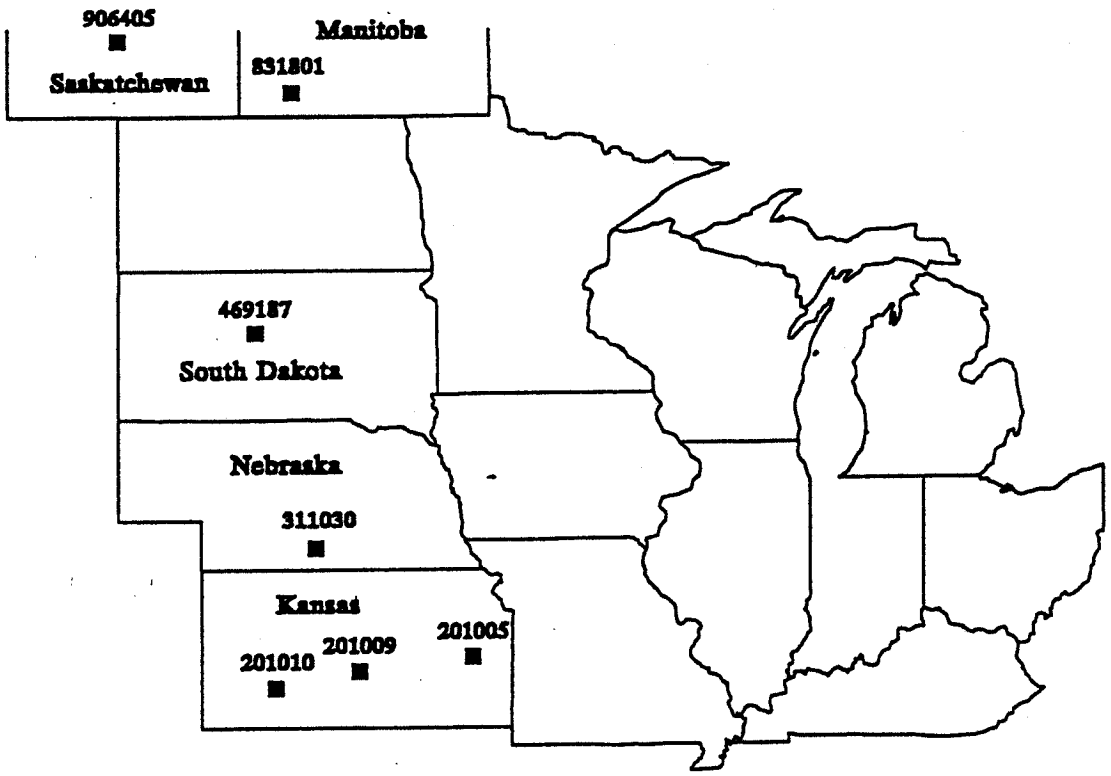


Figure 1 Testing Section Layout

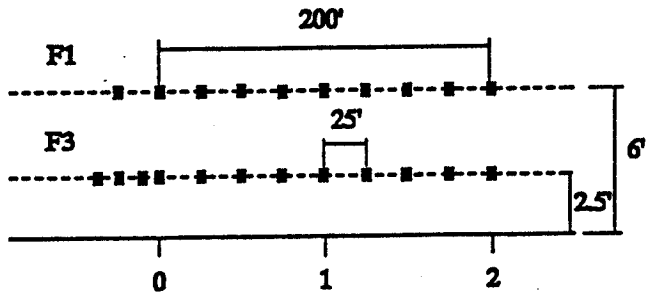


Figure 2 Testing Location Layout

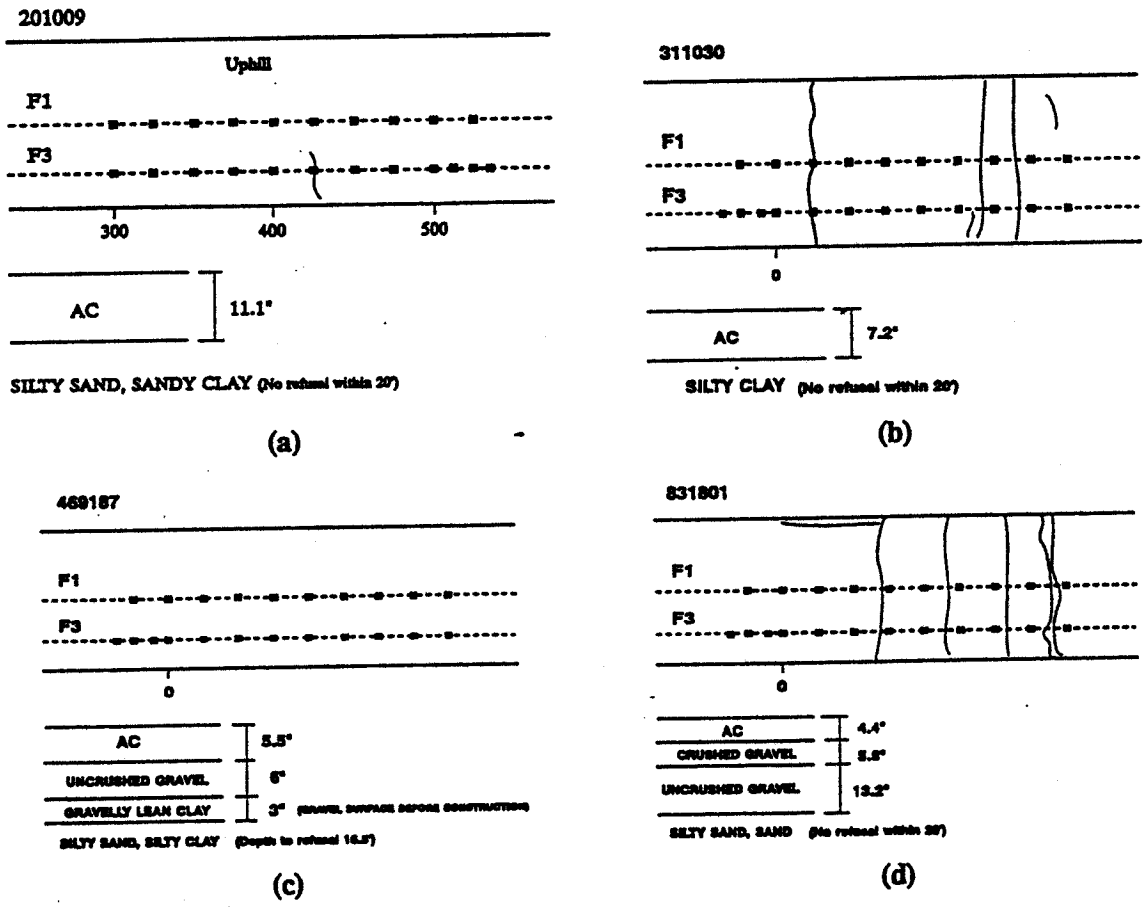


Figure 3 Survey Results and Layer Structures

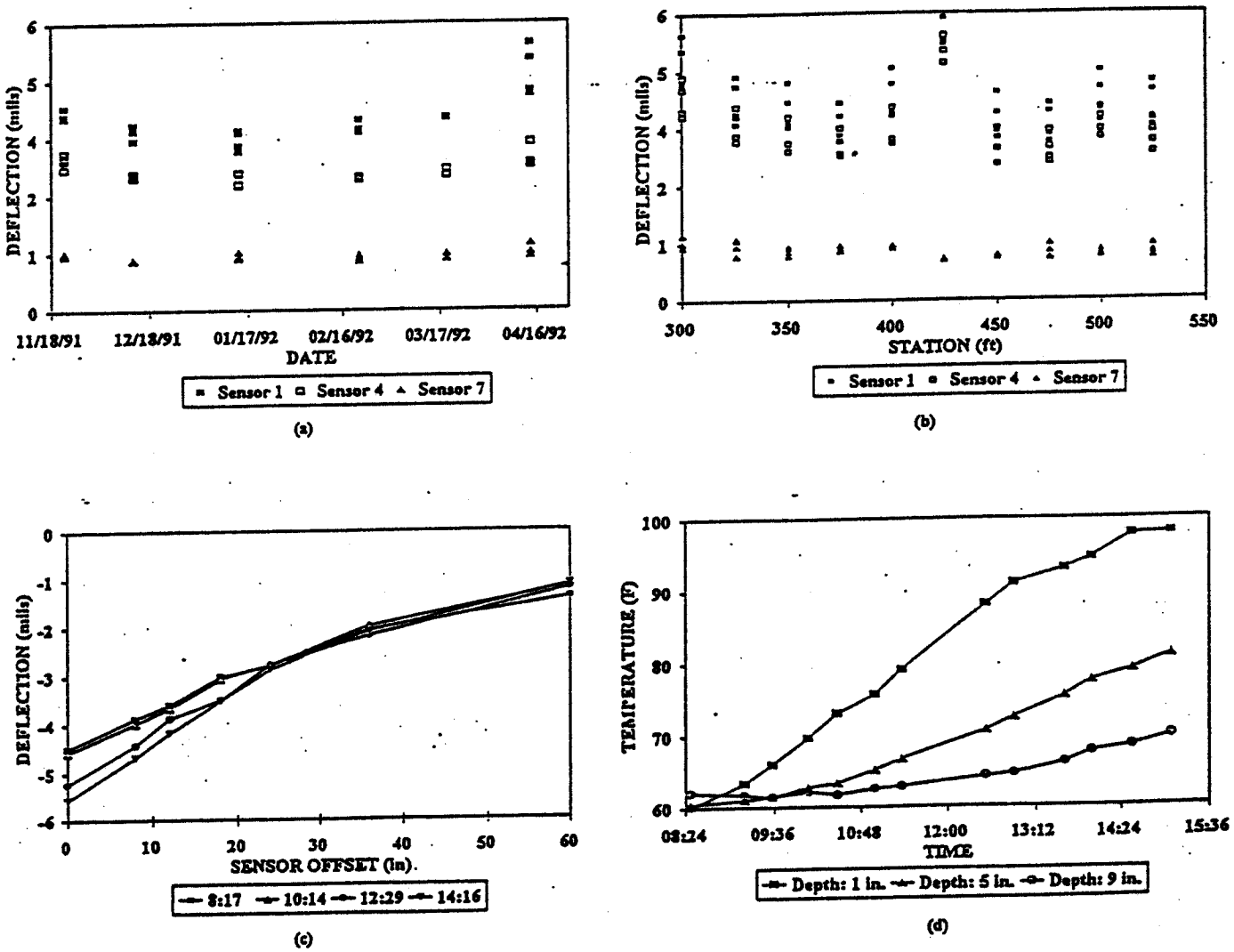


Figure 4. Measured midlane deflections and pavement temperatures (6,000 lbs load), GPS Test Section 201009 in Kansas: (a) deflections vs. testing date at Station 300; (b) deflections across test section on April 4, 1992; (c) deflection basins; (d) pavement temperature vs. time.

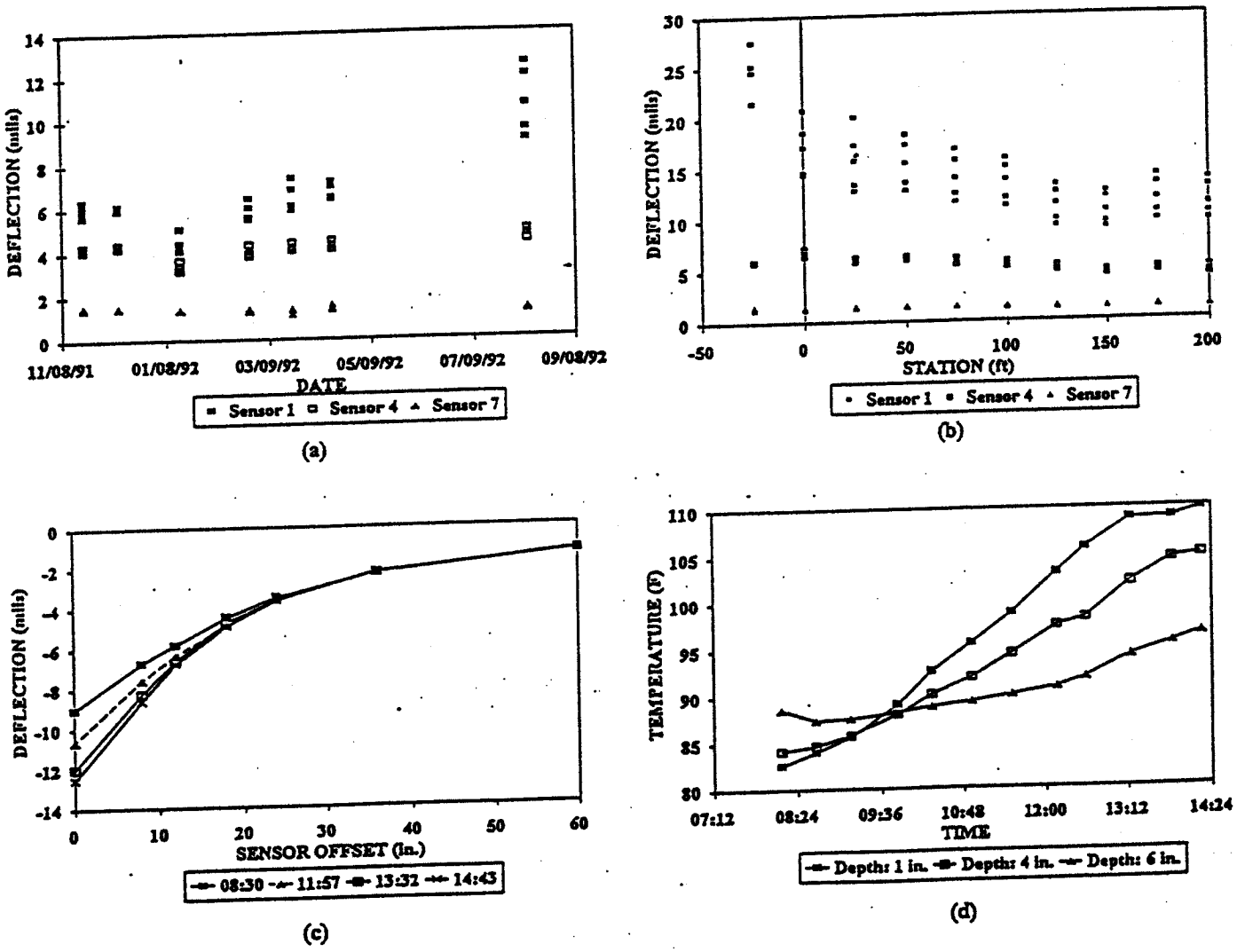


Figure 5 Measured midlane deflections and pavement temperatures (6,000 lbs load), GPS Test Section 311030 in Nebraska: (a) deflections vs. testing date at Station 150; (b) deflections across test section on August 10, 1992; (c) deflection basins; (d) pavement temperature vs. time.

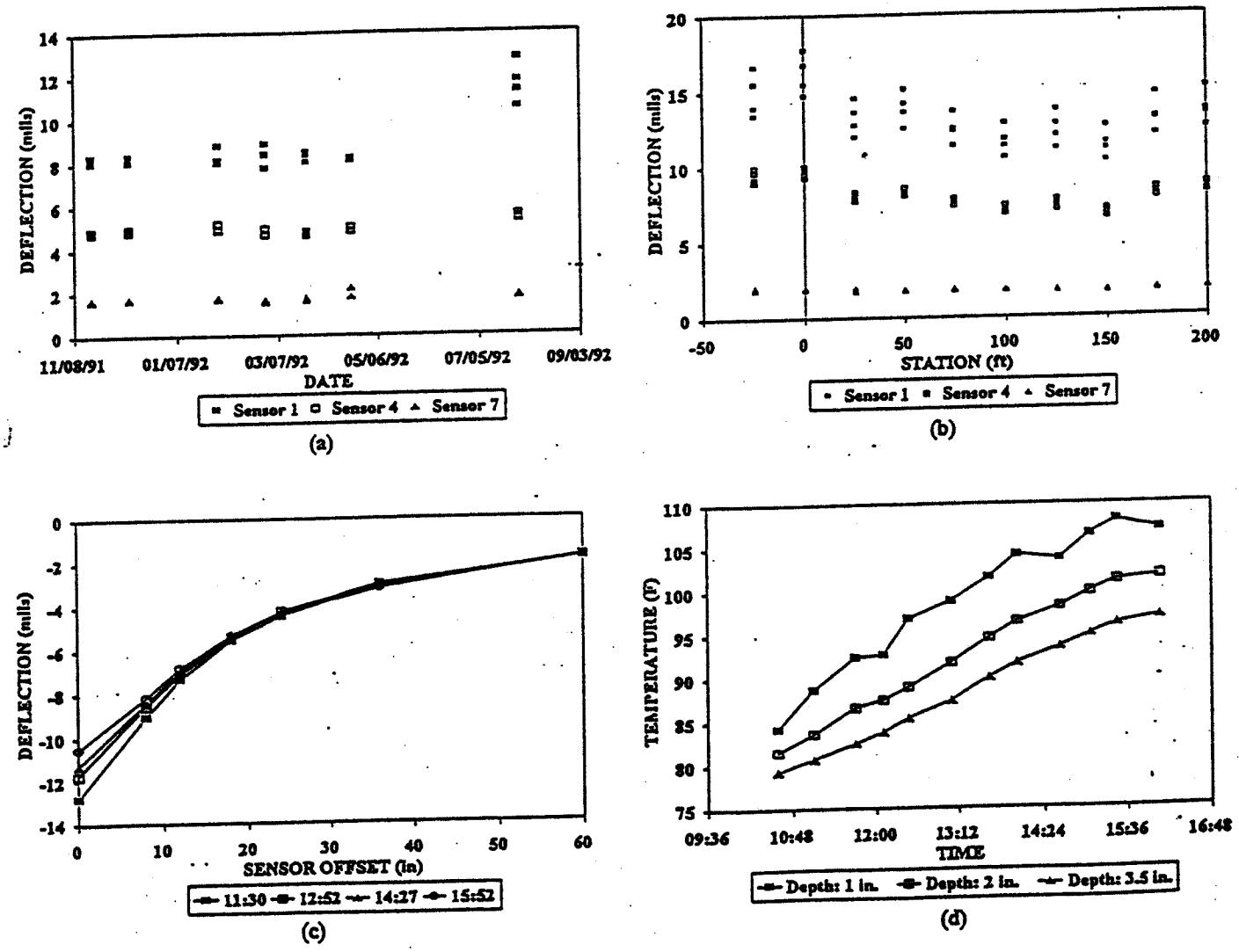


Figure 6 Measured midlane deflections and pavement temperatures (6,000 lbs load), GPS Test Section 469187 in South Dakota: (a) deflections vs. testing date at Station 100; (b) deflections across test section on July 28, 1992; (c) deflection basins; (d) pavement temperature vs. time.

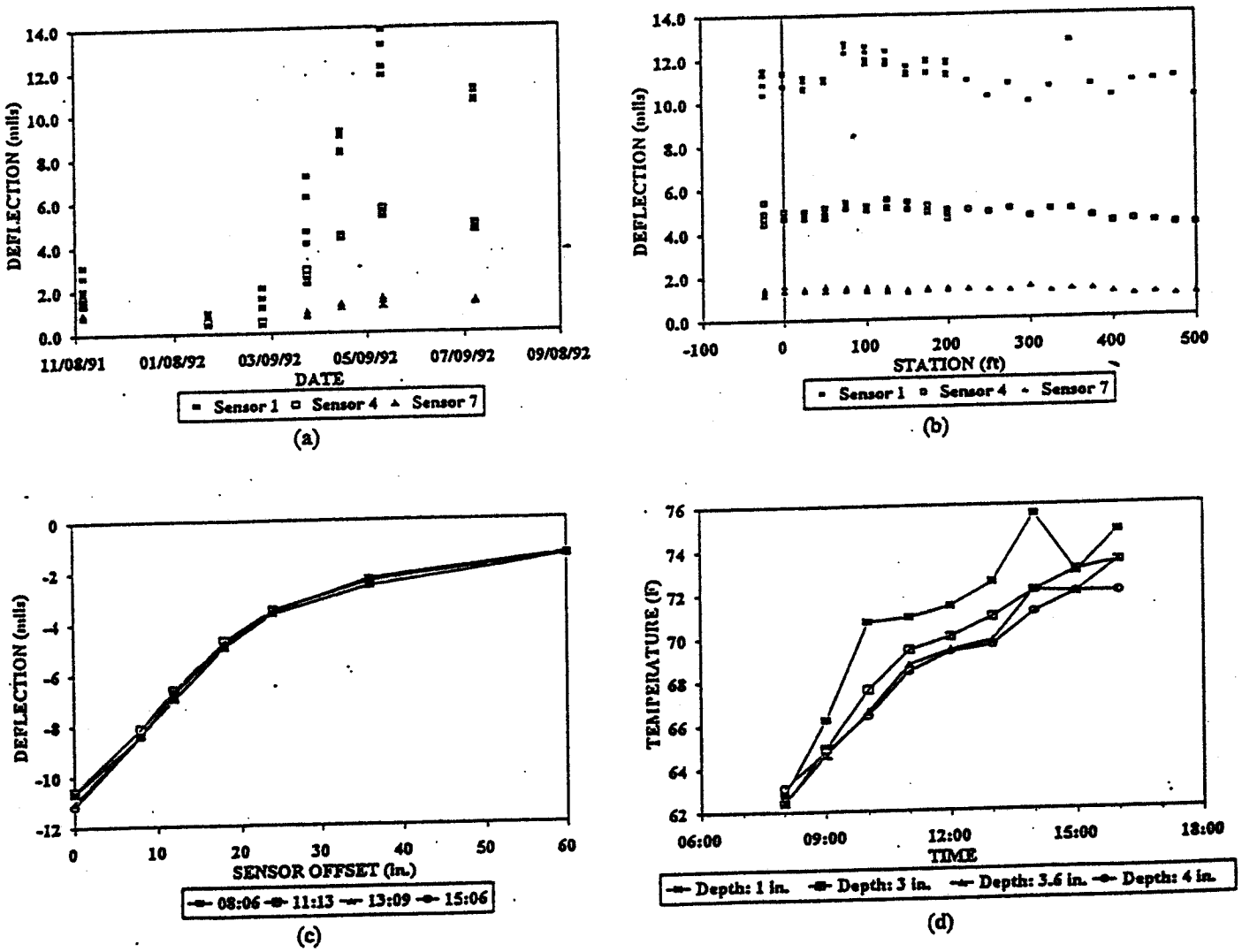
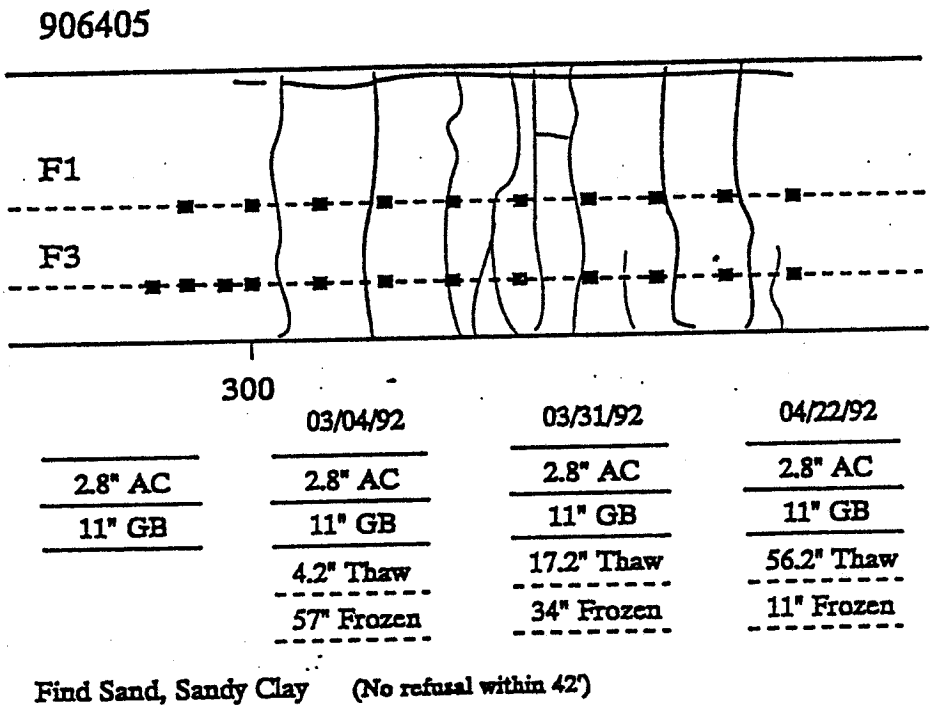


Figure 7 Measured midlane deflections and pavement temperatures (6,000 lbs load), GPS Test Section 831801 in Manitoba: (a) deflections vs. testing date at Station 25; (b) deflections across test section on July 16, 1992; (c) deflection basins; (d) pavement temperature vs. time.



Find Sand, Sandy Clay (No refusal within 42')

Figure 8 Survey Results and Layer Structures

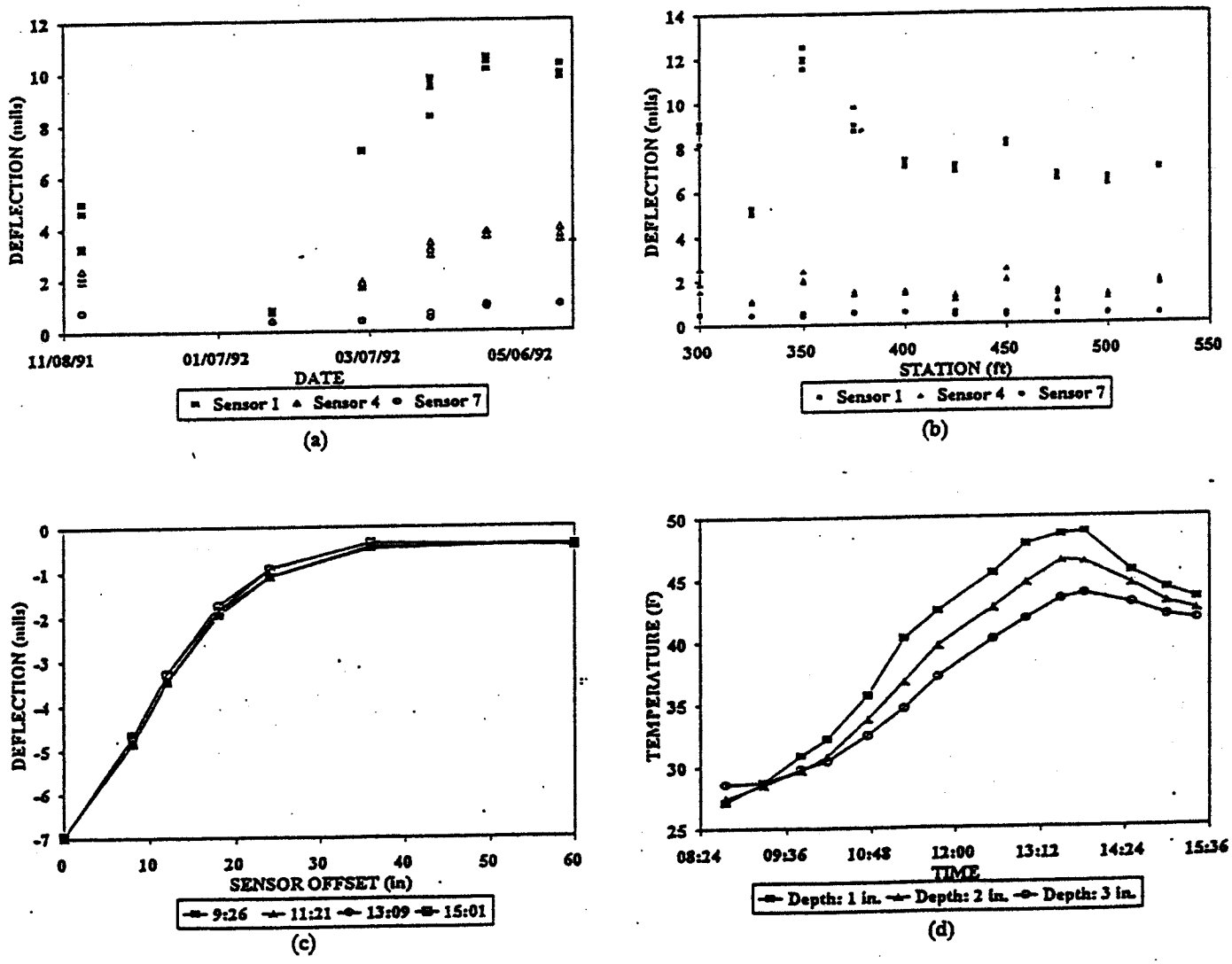


Figure 9 Measured midlane deflections and pavement temperatures (6,000 lbs load), GPS Test Section 906405 in Saskatchewan: (a) deflections vs. testing date at Station 525; (b) deflections across test section on March 4, 1992; (c) deflection basins; (d) pavement temperature vs. time.

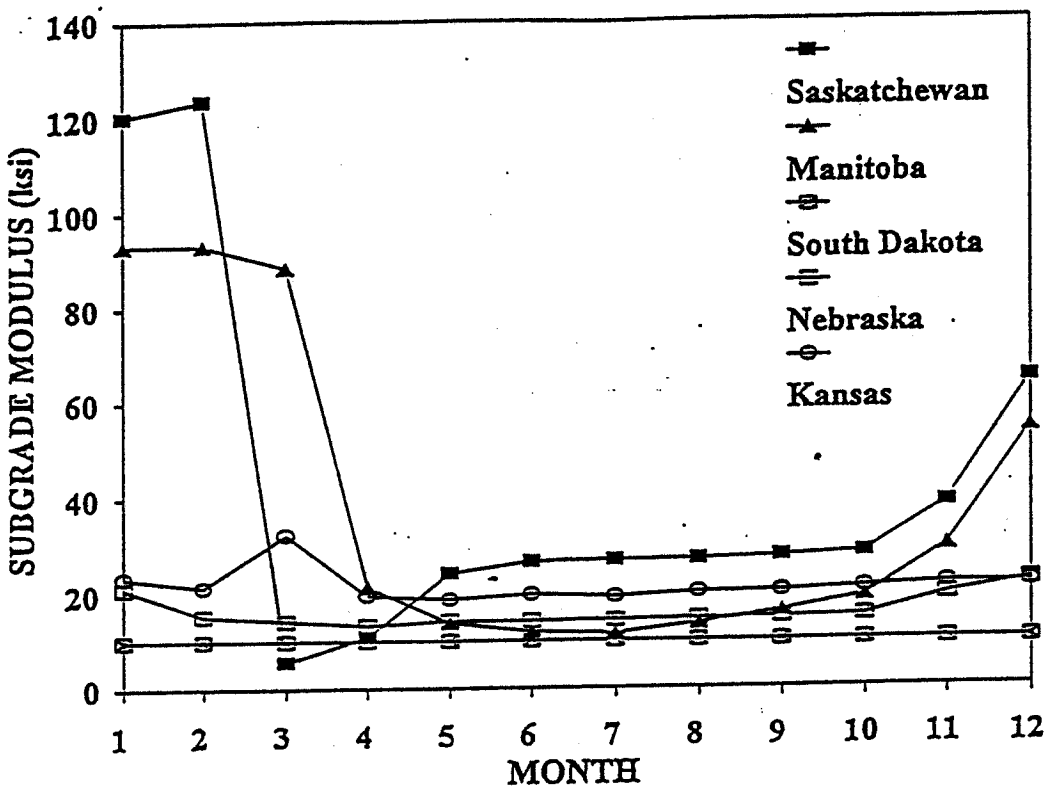


Figure 10 Monthly variation of subgrade moduli

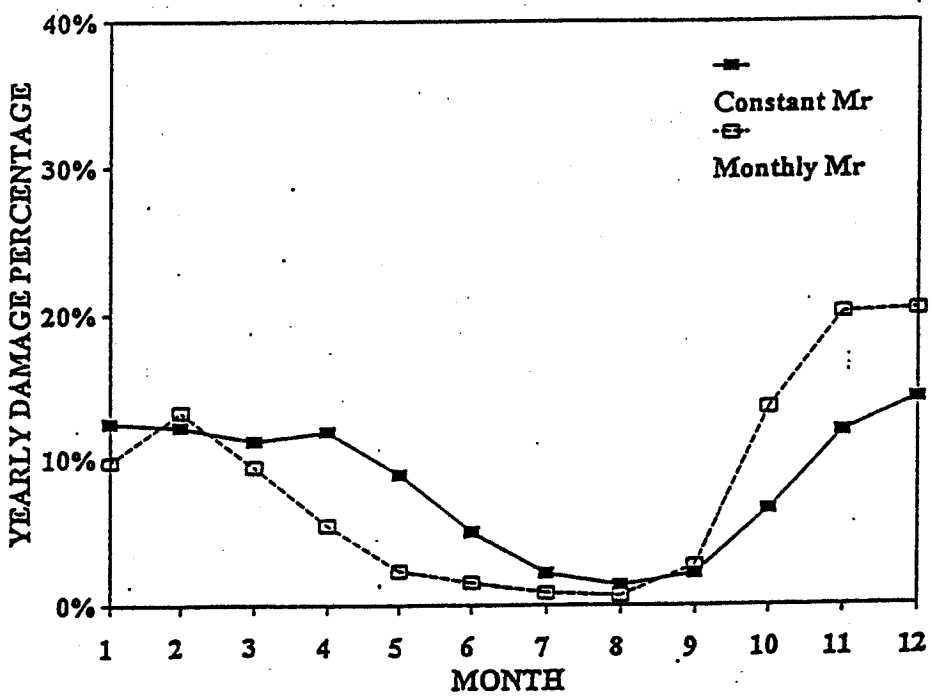


Figure 11 Yearly damage percentage in each month (GPS Section 311030 in Nebraska)

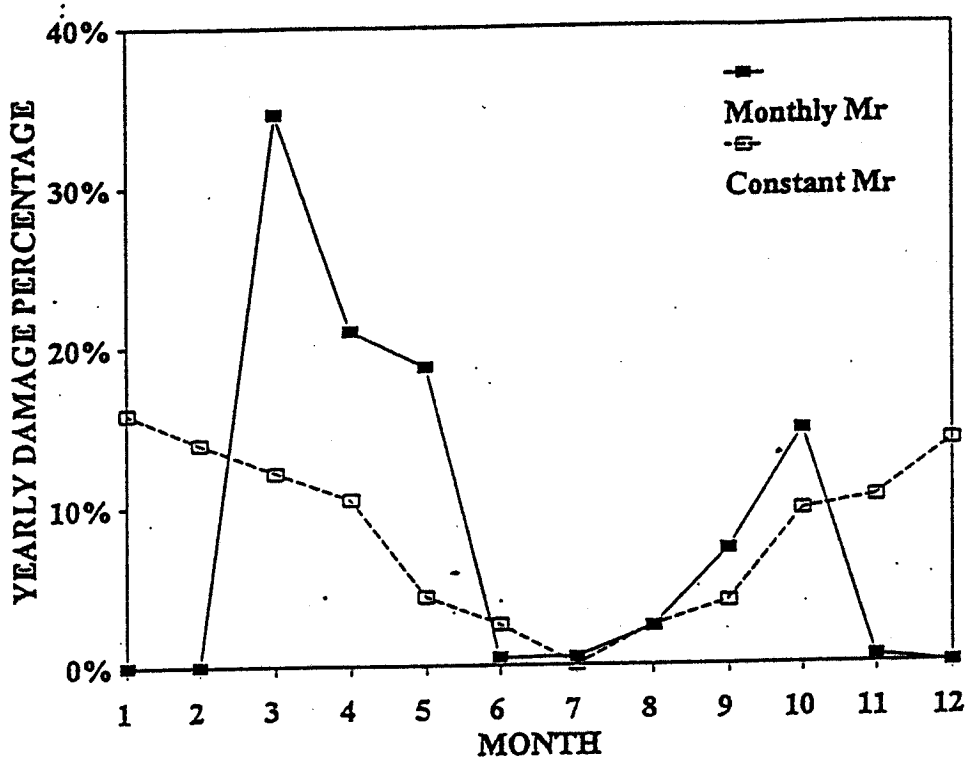


Figure 12 Yearly damage percentage in each month (GPS Section 906405 in Saskatchewan)