LTPP Seasonal Monitoring Program

Site Installation Report for GPS Section 271018 (27A) Little Falls, Minnesota

Report No. FHWA-

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16. Abstract

This report contains instrumentation installation details and data collection summaries for GPS test section 271018, which is a core section in the LTPP Seasonal Monitoring Program. This asphalt concrete pavement section on U.S. Highway 10 northwest of Little Falls, Minnesota, was instrumented August 24, 1993. 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 August 1993 to July 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.

17. Key Words	18. Distribution Statement		
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Site Installation Report for GPS Section 271018 (27A)
Little Falls, Minnesota

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 271018, which is part of the core Seasonal Monitoring Program (SMP) under the Federal Highway Administration (FHWA) LTPP Division. This pavement section was instrumented on August 24, 1993, and had regular data collection through July 31, 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 271018 is located in central Minnesota on the eastbound driving lane of U.S. Highway 10 about five miles northwest of Little Falls at milepost 140.1.

B. General Test Section Information

This four-lane divided highway had the original 115-mm thick asphaltic concrete surface placed in 1979. The rest of the pavement structure consists of a 150-mm thick granular base on a coarse-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 8 of the SMP experiment, which is defined by the following parameters:

- Thin asphaltic concrete pavement (less than 127-mm thick);
- Coarse-grain subgrade;
- Freezing environment; and
- Wet environment.

This was the first 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.

Data for this 1993 installation were transferred to forms from the LTPP Seasonal Monitoring Program: Instrumentation and Data Collection Guidelines, April 1994. The 1994 forms were used to keep all installation reports uniform and to facilitate data entry into the IMS database. Data transfer included conversion from English to metric units with some rounding error. On some forms, data are not available regarding procedure modifications adopted in 1994. 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

The Minnesota Department of Transportation (MnDOT) routinely monitors seasonal changes on pavement structures, especially regarding frost/thaw conditions for posting spring load restrictions. In this respect, MnDOT was very willing to participate in the SMP, and GPS sections 271018, 271028, 274040, and 276251 were included in the core SMP study.

Mr. Fred Maurer of MnDOT was initially contacted regarding potential sections for the core experiment in Minnesota. Mr. Maurer worked with district offices to evaluate potential sections with the requirement to defer rehabilitation at least five years. This is the minimum period required to get three years of monitoring data that is collected every other year.

Minnesota GPS sections 271016, 271018, and 271019 are all in SMP Cell 8. All three sections had old pavement surfaces, and sections 271016 and 271019 were rejected because they were not expected to last five years without rehabilitation. With respect to GPS section 271018, MnDOT agreed to defer rehabilitation at least long enough to get the minimum number of monitoring cycles. Mr. Ken Wasnie, MnDOT District 3A Materials Engineer, did indicate that transverse crack repairs would be done as identified in the memo dated April 1, 1993 in Appendix B-1, but this was considered routine maintenance, not rehabilitation. Also, FHWA LTPP Division staff decided to use the section because no other sections had been identified within the LTPP program as candidates for SMP Cell 8.

On July 15, 1993, Regional Coordination Office (RCO) staff met with MnDOT staff at the Materials and Research facility in Maplewood, Minnesota. This meeting was held to coordinate support from MnDOT's Geotechnical and Foundations Division regarding a drill rig and various materials that the Materials and Research facility would supply for the four installations in Minnesota. At this meeting, tentative installation dates were discussed for all four installations to enable MnDOT staff to verify availability of equipment and materials. Also, the RCO was looking at a very tight schedule to complete seven SMP installations in the region before winter weather conditions would prevent any additional installations. At this meeting, an August 12, 1993 date was set for a group pre-installation meeting for all MnDOT and RCO staff involved with the four installations. The agenda and notes from the meeting in Maplewood are included in Appendix B-1.

On August 12, 1993, the group pre-installation meeting was held in Baxter, Minnesota. The meeting agenda, list of participants, and notes from the meeting are included in Appendix B-1.

On the way to the group pre-installation meeting in Baxter, RCO staff stopped at GPS section 271018 to identify any installation concerns with the site and to select which end of the section to monitor. After the group meeting, RCO staff visited the other three SMP sites in Minnesota. Field notes from the site visit for section 271018 are included in Appendix B-1.

Two significant items identified during the site visit included concerns with the need for transverse crack repair/sealing and the 3.35-m lane width, which inventory data listed as 3.51-m lane width. The location of instrumentation and reference points on the pavement would have to be adjusted for the narrow lane, and MnDOT had already indicated "crack leveling" had been scheduled for the pavement.

At the RCO, extensive pre-installation activities were necessary because this was the first SMP installation in the region. Not only did regular instrumentation checks/calibrations have to be performed, but the entire inventory of monitoring equipment, tools, and installation supplies had to be obtained. RCO staff used field notes from the SMP pilot training, held the end of June 1993 by the LTPP Western RCO, to identify equipment needs and incorporate improvements to the installation process. Also, LTPP staff from FHWA and the Western and North Atlantic RCO arrived one day before the scheduled installation to help with final equipment preparations and instrumentation checks.

Results from instrumentation checks/calibration are included in Appendix B-2. The checks were performed according to 1993 guidelines, but the results are reported using 1994 forms, as discussed earlier. The forms include the following:

- 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.

With respect to instrument checks on the resistivity probe, Data Sheet SMP-C03 requires "distance from top of probe" for each electrode. However, procedures in 1993 recorded "spacing between electrodes" on two separate lines about 180 degrees apart on the probe. As a consequence, cumulative errors from adding the 35 "spacings" had to be accounted for to transfer the data to the 1994 form. Adjustments were performed as described below to estimate "distance from top of probe" within ± 5 mm:

1. Obtained average values for probes checked in 1994 and 1995 for the following:
   - Electrode No. 1 assigned 29 mm (± 2 mm) if not measured;
   - Electrode No. 17 in the range 840 mm $\pm$ 3 mm as a check; and
   - Electrode No. 36 assigned at 1,805 mm from the top of the probe.
   - Average electrode spacing is (1805 - 29)/35, which is 50.74 mm.

2. Added the 35 "spacings" measured for the first line, divided the value by 35 to get the average, subtracted 50.74 mm to get adjustment value, and subtracted adjustment value from each "spacing."

3. Repeated Step 2 for the second line.

4. Added two adjusted "spacings" and divided by two to get "adjusted average spacing."

5. Recorded Electrode No. 1 at 29 mm and cumulated "adjusted average spacings" to get "distance from top of probe" for the remaining 35 electrodes.

6. Checked "distance from top of probe" for Electrode No. 17 in the range 840 mm $\pm$ 3 mm and Electrode No. 36 in the range 1,805 mm $\pm$ 2 mm.

For the air temperature probe, no readout device was available while the thermistor probe was checked. Therefore, the only check possible was to compare thermistor and air temperature probe

readings obtained overnight with both probes connected to the datalogger. The air temperature probe was within ± 1.0 °C of the average reading on the thermistor probe.

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 required selection of the instrumentation location. From field observations during the August 12, 1993 site visit and FWDCHECK program analysis for the section, Station 3+00 to Station 5+30 was selected for monitoring, and instrumentation would be placed at Station 5+20, based on the following items:

- More uniform conditions regarding trees along the road;
- More uniform subgrade strength indicated by FWDCHECK program analysis;
- Less pavement distress in the instrumentation area just outside the section limit; and
- PCC footing for a large sign at Station 5+50 to use as a second benchmark.

B. Installation Activities

Instrumentation installation was completed on August 24, 1993, which was a hot, muggy 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 complicated by water encountered at a depth of 2.13 m, and the saturated sand subgrade caved in when the auger was removed from the hole. Initially, a 200-mm diameter auger was used, then a 300-mm diameter auger. However, the hole could only be kept open to a depth of about 3.2 m with water-bearing sands at a depth of 4.0 m. A 4.45-m depth was needed to place the piezometer assembly, but no additional drilling was attempted to prevent further undermining of the pavement, and the piezometer assembly was pushed in the last 1.2 m using the drill rig. Attempts were made to compact the collapsing material and bentonite seal, but the materials were saturated and very soft.

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 and the space between the two is filled with sand. Additional field notes on piezometer installation are included in Appendix C-1.

Both MnDOT and RCO staff were concerned with the piezometer stability as a reference benchmark for elevation data, and MnDOT staff offered to investigate installation of a level-one benchmark. In October 1993, MnDOT did install a benchmark at Station 5+25 and offset -7.93 m from the driving lane.

The FHWA representative at the installation recommended installing a vibrating-wire transducer in the piezometer given the shallow water table and expected fluctuations at the site because of the close proximity of the Mississippi River. However, to date, no such instrumentation has been provided for installation.

The first FWD tests were done from Station 5+00 to Station 5+30 to allow pavement sawing for the instrumentation hole and conduit trench on the shoulder. Both the FWD locations and instrumentation hole offsets were referenced using the lane edge stripe even though the lane was striped 3.51-m wide.

The pavement surface above the instrumentation location was lifted out using anchors tapped into the pavement, and it was set aside 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.

However, like the piezometer hole, water was encountered about 1.5 m below the pavement surface and the subgrade material caved in starting about 1.27 m below the pavement surface. A wet/dry vacuum cleaner was used to remove as much seepage as possible while staff scrambled to place the resistivity, thermistor, and TDR probes below the level where water was entering the hole.

TDR placement and resulting data for probes 8, 9, and 10 are questionable as these probes were placed in a slurry of sand and water. The depth recorded for these probes is strictly an estimate with probes pushed into the slurry at approximate target depths. No compaction was attempted on the material around these probes.

Installation of the remaining TDR probes and the pavement thermistor probe went as planned.

For installation reports from the LTPP North Central RCO, "Data Sheet SMP-I05(A): Lab Gravimetric Moisture Contents," is used to report DOT lab 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 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.

- For TDR probes 1 through 7, moisture estimates from TDR data were about 50 percent higher than field and lab measurements.

- Water seeping into the hole was expected to influence TDR probes 8 and 9 because the material removed from the hole was not replaced at the same moisture content as the field and lab samples taken. However, the data is not much different than the results seen for TDR probes 1 through 7.

- For TDR probe 10, moisture data should be comparable for the water-bearing subgrade material removed at the depth for this probe. However, results of the three moisture estimates are almost the same versus the 50 percent difference seen for the other probes.

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

    1. Are the equations used appropriate for coarse-grain subgrade and granular base materials?
    2. How much influence does compaction have on the results?
    3. How do over-saturated conditions (slurry of sand and water) influence TDR probe data?

"Data Sheet SMP-I07: Representative Dry Density," was not used in 1993, 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 8.2 m and the weather pole is offset about 8.5 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.

On August 25, 1993, final wiring of the datalogger in the cabinet was completed and MnDOT installed a frost-tube midlane at Station 5+52 to compare frost information with the SMP resistivity probe.

Quick-set epoxy was used to bond the pavement thermistor probe and original pavement surface material back in place. The epoxy worked very well on this thin pavement section. However, the epoxy was supplied as a sample, and it was too expensive to use on any additional installations. The trench for the conduit was patched with hot-mix asphalt.

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

- Minor cracks developed at the instrumentation area prior to blade patching done on the driving lane between August 8, 1994 and September 12, 1994. Some spalling of patch material at transverse cracks in the section has occurred, but only minor hair-line cracks were observed in the instrumentation area.

- Prior to mill and overlay rehabilitation in 1995, the instrumentation area was marked for reduced milling depth to prevent damage to the pavement thermistor probe. After milling done June 21, 1995, the site was visited to confirm operation of the pavement thermistor probe.

- The section was overlaid between June 21, 1995 and July 31, 1995, and the site was re-established for both GPS and SMP purposes on July 31, 1995. SMP monitoring was done during the visit to document post-rehabilitation conditions. No additional visits have been made to the site.

III. SMP Data Collection

A. Initial SMP Data Collection

On August 25, 1993, reference locations were established, and the first set of SMP data was collected. The reference locations for FWD testing and elevation data were established using the outside edge of the newest edge stripe. The newest stripe was shifted about 0.15 m inside the old stripe reducing the lane width to 3.51 m.

The only reference location modified from the guidelines was the offset for the inside lane edge (ILE), which was placed at 3.35 m rather than 3.51 m used for the typical 3.66-m lane. PK nails were placed at transverse offsets of 0.16 m and 3.35 m.

Three cycles of FWD data were collected, as well as, the following manual SMP data which are included in Appendix D-1:

- One set of contact resistance data;
- One set of four-point resistivity data;
- One ground water table measurement; and
- One set of elevation data, which included shots on a sign foundation as a second benchmark.

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

- Five sets of TDR traces, which included three sets from the previous day; 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 August 25, 1993 through July 31, 1995, and MnDOT has continued to collect temperature and frost data from the site. LTPP's standard data tracking log, which summarizes the data collected on the site, is included in Appendix D-2.

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

- On November 19, 1993, a relay was added to the datalogger at the site, which included a change in the data format for subsequent files.

- Between August 8, 1994 and September 12, 1994, a blade patch was placed on the section without prior notification. The blade patch influences elevation data, temperature gradient data, distress tracking data, and longitudinal profile data. In addition, loss of patch material at transverse cracks since August 8, 1993 affects the consistency of the elevation data.

- The section was milled June 21, 1995 and overlaid between June 21, 1995 and July 31, 1995. Correspondence relating to the rehabilitation is included in Appendix D-3 along with the required pre-rehabilitation manual distress survey for the section. A plot of elevation data for Station 3+00 included in Appendix D-3 shows the pavement thickness increased about 55 to 60 mm. The new pavement surface and increased pavement thickness influence SMP monitoring data including but not limited to the following: FWD data, elevation data, distress data, thermal gradient data, longitudinal profile data, and rutting data.

Most of the instrumentation and equipment problems at the site relate to the TDR probes as follows:

- TDR probe 8 data collected from March 8, 1994 up to April 25, 1994, and from March 7, 1995 up to the date of this report are bad. Print screens of this data in Appendix D-2 may indicate the cable or the BNC bulk head has pulled off the printed circuit board (PCB) for the probe, because the characteristic signal through the PCB is not visible.

- TDR probe 6 data collected starting December 5, 1994 up to the date of this report are bad. The failure is possibly related to frost penetration. The failure mode on this probe differs from that for TDR probe 8 in that the trace still shows the characteristic signal in the PCB, which may indicate a loss of continuity between the PCB and the metal rods for the probe. Print screens of the failed TDR probe 6 data are included in Appendix D-2.

- TDR probe 5 data has dips in the signal before the trace enter the PCB on the probe. This may indicate moisture is entering a damaged BNC connector to the PCB. Print screens of the dip in TDR probe 5 data are included in Appendix D-2.

Other problems experienced at the site include failures with switch boxes used to collect manual resistance and 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 first SMP installation in the LTPP North Central Region, and lack of experience may have influenced certain aspects of the installation.
- Data for this 1993 installation were transferred to forms from the LTPP Seasonal Monitoring Program: Instrumentation and Data Collection Guidelines, April 1994.
- The shallow water table affected installation of instrumentation, and must be taken into account during data analysis.

B. Recommendations for Improving Installations

The following procedure and equipment changes from protocol were used during this installation:

- Incorporated a plastic tie wrap on TDR probes to support the BNC bulkhead connection on the PCB.
- Initiated a standard plug configuration to use on the MOBILE unit, which combined connections from the SDM1502 communications interface and the PS1502B power control module from cable reader into one DB9 plug.
- Notched datalogger cabinet front panel to make conduit installation easier and provide more efficient use of the short cables on the TDR probes to maximize the distance of the cabinet from the roadway.
- Removed the cover on the resistivity probe plug to pull the cable through the conduit instead of pulling the probe through the conduit. This reduces risk of damage to the electrodes on the probe.
- Established a procedure to run air temperature and tipping-bucket rain gauge signal leads above ground to make installations easier and eliminate the need to extend air temperature probe leads. This modification also makes replacement or removal of the equipment easier.
- Included a union coupler above ground in the weather pole to make installation easier and prevent twisting of signal wires during installation.
- Used PVC tubing split in half to protect thermistor, resistivity, and TDR probes from accidental damage during compaction of material around the probes. Two lengths

were used to limit the height of tubing above ground exposed to the wind or currents created by passing vehicles.

- Built a metal compactor with three sections versus the solid wood pile listed in the guidelines. The metal compactor handle ranged from about 30-mm diameter to 65-mm diameter, and it allowed better visibility in the hole for compacting around the instrumentation. Sections of the handle were removed as the hole was filled to make the compactor safer to handle around other people involved with the installation.

- Built a special base for the compactor to use in the instrumentation hole. The base used a 150-mm diameter floor flange with a slightly larger diameter wooden base bolted to the floor flange. The wooden base was used to allow the compactor to slide on the thermistor probe and PVC tubing without damaging them. The floor flange and wooden base also had about a 50-mm radius section removed from one edge to allow the base to work around the probes placed against the side of the hole. This was done to obtain better compaction of material next to the probes.

- Built a special base for the compactor to use in the conduit trench and for final compaction below the pavement repair. The base was about 60 mm by 100 mm to fit inside the trench, and the rectangular shape allowed compaction of base material below the square block removed from the pavement surface.

- Assembled the piezometer grease slides with a special 0.3-m long sleeve over the top of the piezometer and threaded a cap with a lifting ring onto the very top of the piezometer. The sliding portion of the probe was fixed in position by wiring it to the lifting ring. This was much safer than attempting to hold the sliding portion in position during piezometer installation. It also eliminated the potential for material to fall into the piezometer, because the assembly could be left wired together until after the access tube was concreted in place.

- Marked TDR probe depths on the metal compactor handle using a permanent marker to allow continuous checks on additional material required in the hole for the next TDR probe placement. The marks on the handle were easily removed with a wire brush to prevent confusion on additional installations.

- Incorporated a 76-mm diameter swivel foot on the rod for collecting elevation data to reduce the effects of pavement surface macro texture on repeatability of the rod readings.

- Modified data forms to accommodate data collection for elevations using the Wild NA2000 level and moisture data from field tests.

- Updated equipment list to include a wet/dry vacuum and 120 VAC power source on sites with shallow water table.

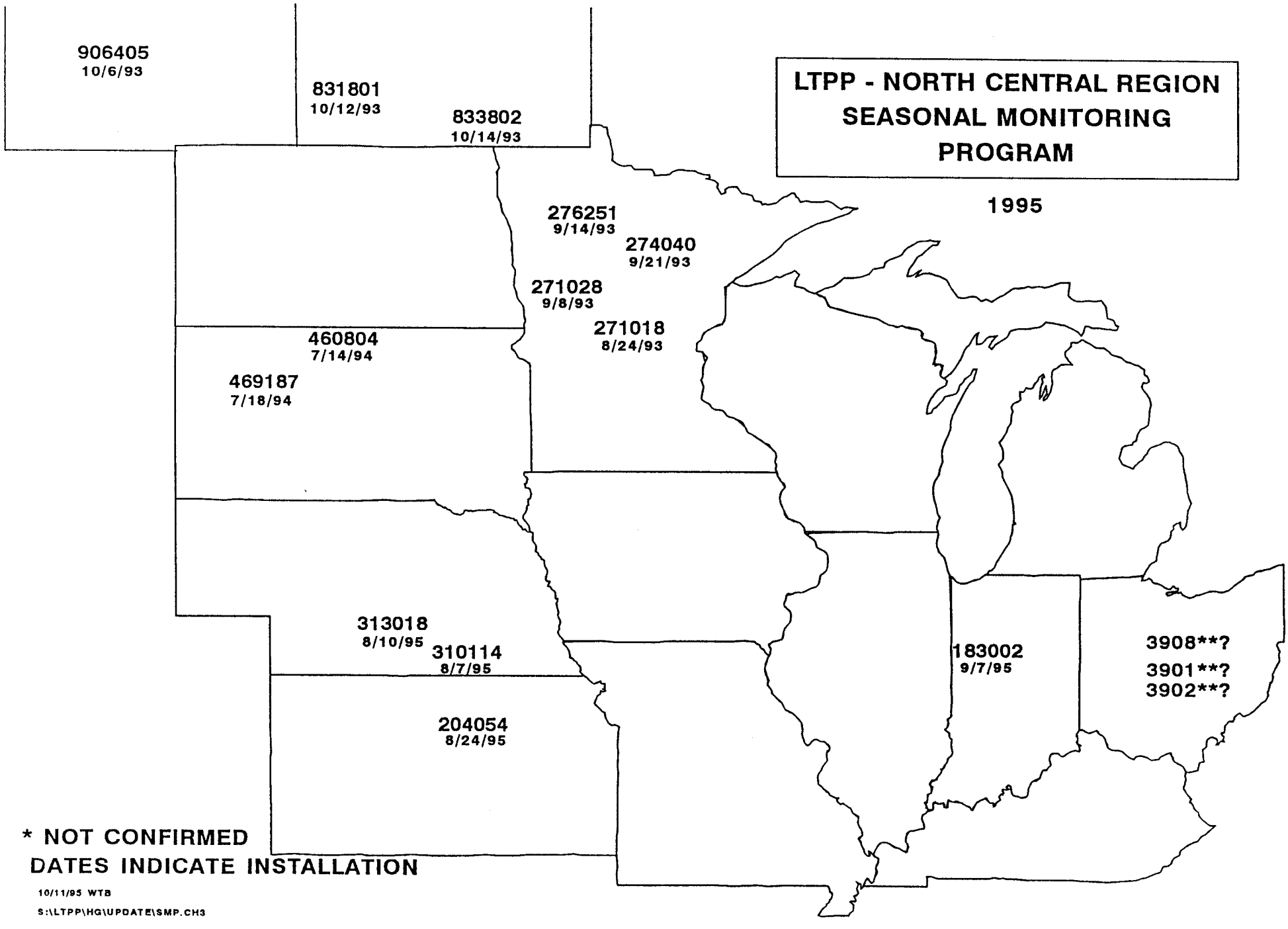
- Tie wrapped the TDR probe cables in two groups about 0.3 m from the BNC connector. The cables were placed in numeric order, with probes 1 through 7 grouped together, and probes 8 through 10 grouped together to match the two

SDMX50 multiplexer board connections. This was done to help insure proper connection of cables each time the probes were monitored.

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.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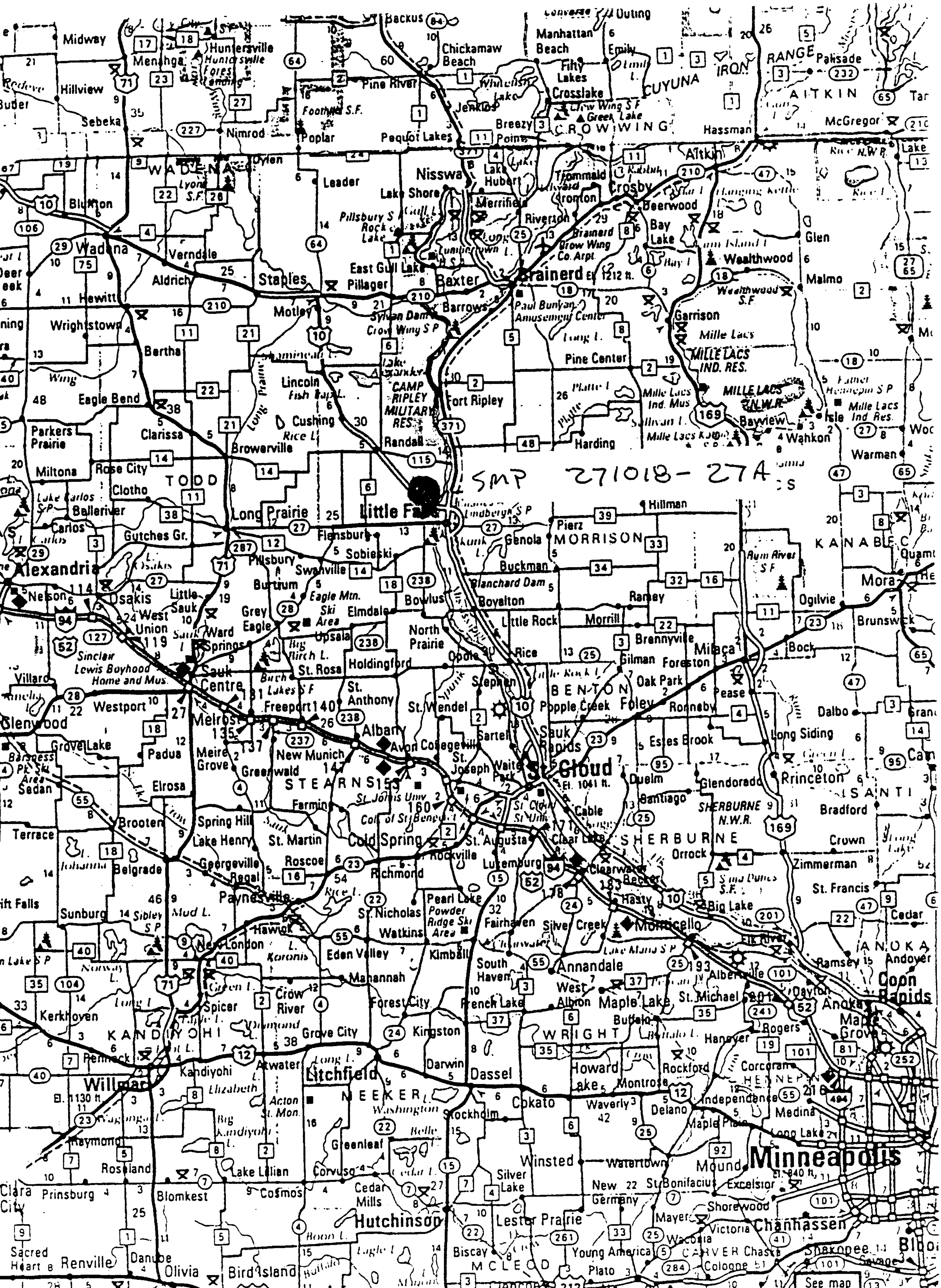
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Aldrich
Staples
East Gull Lake
Pillager
Baxter
Brainerd
Wealthwood
Malmo
Hewitt
Barrows
Paul Bunyan Amusement Center
Garrison
Motley
Sylvan Dam
Crow Wing S P
Wrightstown
Bertha
Mille Lacs
MILLE LACS IND. RES.
Pine Center
Lincoln
CAMP RIPLEY MILITARY RES.
Fort Ripley
MILLE LACS N.W.R.
Eagle Bend
Cushing
Mille Lacs Ind. Res.
Isle
Bayview
Parkers Prairie
Clarissa
Randall
Harding
Wahkon
Browerville
Warman
Miltona
Rose City
TODD
Clotho
Long Prairie
Little Falls
Hillman
Belleriver
Carlos
Pierz
MORRISON
Gutches Gr.
Flensburg
Genola
KANABEC
Sobieski
Alexandria
Pillsbury
Swanville
Buckman
Mora
Nelson
Osakis
Burtrum
Eagle Mtn. Ski Area
Bowlus
Blanchard Dam
Royalton
Ramey
Ogilvie
Little Sauk
West Union
Grey Eagle
Elmdale
Little Rock
Morrill
Brunswick
Sauk Centre
Ward Springs
North Prairie
Upsala
Brennyville
Milaca
Bock
Sinclair Lewis Boyhood Home and Mus.
Holdingford
Opole
Rice
Gilman
Foreston
Villard
St. Rosa
St. Anthony
Stephen
BENTON
Oak Park
Pease
Westport
Freeport
St. Wendel
Popple Creek
Foley
Ronneby
Dalbo
Glenwood
Melrose
Albany
Avon
Collegeville
Sartell
Sauk Rapids
Estes Brook
Long Siding
Grove Lake
Padua
Meire Grove
New Munich
St. Joseph
St. Cloud
Princeton
Greenwald
STEARNS
Duelm
Glendorado
ISANTI
Sedan
Elrosa
Farming
St. Johns Univ.
Santiago
Bradford
Brooten
Spring Hill
Cold Spring
SHERBURNE N.W.R.
Cable
Terrace
Lake Henry
St. Martin
St. Augusta
Clear Lake
SHERBURNE
Crown
Belgrade
Georgeville
Roscoe
Rockville
Richmond
Luxemburg
Orrock
Zimmerman
Regal
Clearwater
Becker
St. Francis
Sunburg
Paynesville
Pearl Lake
Fairhaven
Silver Creek
Hasty
Big Lake
Cedar
St. Nicholas
Watkins
Monticello
Hawick
New London
Eden Valley
Kimball
South Haven
Annandale
Elk River
ANOKA
Ramsey
Andover
Maple Lake
Albertville
Dayton
Coon Rapids
Mahannah
Crow River
Forest City
French Lake
West Albion
St. Michael
Anoka
Spicer
Buffalo
Rogers
Maple Grove
Kerkhoven
KANDIYOHI
Grove City
Kingston
WRIGHT
Hanover
Pennock
Darwin
Howard Lake
Rockford
Corcoran
HENNEPIN
Kandiyohi
Atwater
Litchfield
Dassel
Montrose
Willmar
MEEKER
Cokato
Waverly
Independence
Medina
Acton
Stockholm
Delano
Maple Plain
Long Lake
Raymond
Greenleaf
Winsted
Watertown
Mound
Minneapolis
Roseland
Lake Lillian
Corvuso
Silver Lake
Excelsior
Clara City
Prinsburg
Blomkest
Cosmos
Cedar Mills
New Germany
St. Bonifacius
Shorewood
Hutchinson
Lester Prairie
Mayer
Victoria
Waconia
Chanhassen
Sacred Heart
Renville
Danube
Olivia
Bird Island
Biscay
MCLEOD
Young America
CARVER
Chaska
Plato
Cologne
Shakopee
See map

STRATEGIC HIGHWAY RESEARCH PROGRAM
GENERAL PAVEMENT STUDIES
Long-Term Pavement Performance Monitoring
Project Information Sheet
March, 1988

REGION: North Central PAVEMENT TYPE: AC on Granular Base
STATE: Minnesota

SHRP Assigned ID:	271018	Year Open:	1979
State Assigned ID:	1005	Year Traffic:	1984
Design Cell ID:	1- 29	AADT:	4136
Status:	Primary	Trucks:	9.4 %
District:	3		
Highway:	U.S.- 10		
Length:	.9 miles		
Lanes:	2		

DESIGN FACTORS:
- Moisture - Wet
- Temperature - Freeze
- Subgrade - 59 = Silty Sand — Coarse
- Traffic - 50 KESAL/Yr — Low (85)
- AC Thickness - 5.0 in. — Med (3.0, 8.0)
- Base Thickness - 6.0 in. — Low (10.0)
- AC Stiffness - 374 kpsi — Low (650)

MISCELLANEOUS:
- Base Type - Granular
- AC Voids - 10.8
- Structural No. - 2.0

LAYER CONFIGURATION

LAYER NO.	LAYER DESCRIPTION	LAYER THICKNESS	LAYER MATERIAL TYPE
4	3 = Orig Surface	1.5	1 = Asphalt Concrete
3	4 = HMAC Below Surf	3.5	28 = Hot Mix Asphalt Concrete
2	5 = Base Layer	6.0	23 = Crushed Stone or Gravel or Slag
1	7 = Subgrade		59 = Silty Sand

PAVEMENT LAYER INFORMATION

ASPHALT CONCRETE LAYERS

LAY NUM	-- GRADE --- VISC	PENETR	AC CONT	AC DENS	ACVIS S	ACVIS 140	ACVIS 275	PEN 77	AC TRBF	AC VOID	AGG SPGR	AC STIFF
4		135	6.1	140	3					8.0		434
3		135	4.6	136	3					12.0		348

SECTION FIELD VERIFICATION FORM

Date 4-24-89

Rater MarTi

State Project Code 1 C C 5
State Code 2 7
SHRP Section I.D. 1 C 1 5

Project and Section Identification

State District No. ___ ___
County or Parish Morrison 3

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

Route Number US-10
LTPP Experiment Code 1
Number of Through Lanes (One Direction) 2
Direction of Travel 1
- Eastbound 1
- Westbound 2
- Northbound 3
- Southbound 4

Available Project Length (Without Discontinuities) 2700'

	Start Point	End Point
Test Section Milepoints	140.15	140.24

Additional Section Location Information*: STA 210+00 - 205+00
0' is 4.4 mi W. of Hwy 371 & 3.3 mi E of Hwy 22
1' is 25.4 mi E. of Hwy 210

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

Location of monument: 1' S. of white edge line Both ends

Geometric Information

Lane Width (Feet) 12
Lane (By Number) Included in Monitoring Section 1
(Lane 1 is Outside Lane, Lane 2 is Next to Lane 1, etc.)

Shoulder Data:	Outside Shoulder	Inside Shoulder
Total Width (Feet)	10.	03.
Paved Width (Feet)	10.	03.
Surface Type		3

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

10-AUG-93

		L05A							L05 B REPRESENTATIVE					
		CON	LAYER	DESC	TYPE	STA 0 THICK	STA 0 MATL	STA 5 THICK	STA 5 MATL	LAYER	DESC	TYPE	THICK	MATL	INVENTORY
27	1018	1	1	7	SS		204		205	1	7	SS		204	1
		1	2	5	GB	6.5	302	4	302	2	5	GB	5.2	302	2
		1	3	4	AC	2.6	1	3	1	3	4	AC	2.8	1	3
		1	4	3	AC	1.6	1	1.5	1	4	3	AC	1.6	1	4

4.2 < 4.5

4.4

Sta. 5+20 - 4.87" AC

≈ 4" BASE ok.

24-AUG-1993

SMP INSTALL

REGION N/C
STATE MN

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 27
SHRP ASSIGNED ID 270118

EXPERIMENT GPS-1 ROUTE/HIGHWAY 10 Lane 1 Direction E
SAMPLE/TEST: (a) Before Section ____ (b) After Section Y FIELD SET NO. 1

IN SITU DENSITY AND MOISTURE TESTS

DCG SHEET: 24

OPERATOR R/B NUCLEAR DENSITY GAUGE I.D. 844 SHEET NUMBER 9 OF 24
TEST DATE 8-31-90 LOCATION: STATION 5+56 TEST PIT NUMBER 1
DATE OF LAST MAJOR CALIBRATION 4-9-90 OFFSET 3 feet from °/s
Note: Use additional sheets if necessary

DEPTH FROM SURFACE TO THE TOP OF THE LAYER, INCHES (SEE S03)	4.4" (0.111m)				8"	
TEST TYPE	BASE COURSE TOP Result, pcf Wet	Dry	SUBBASE TOP Result, pcf Wet	Dry	SUBGRADE TOP Result, pcf Wet	Dry
MATERIAL TYPE: (Unbound-G Other-T)	G				G	
IN SITU DENSITY, pcf (AASHTO T238-86) 1	133.5	125.5			119.7	113.1
2	135.3	126.4			118.9	112.1
3	135.0	127.3			121.0	115.0
4	136.3	125.6			122.8	116.5
AVERAGE	135.0	127.8			120.5	114.1
Method (A,B,or C)	A				B	
Rod Depth, inches	B/S				12"	
IN SITU MOISTURE CONTENT, % (AASHTO T239-86) 1	6.4				5.8	
2	7.0				6.0	
3	6.0				5.2	
4	6.0				5.4	
AVERAGE	6.3				5.6	

GENERAL REMARKS:

CERTIFIED [signature]
Crew Chief, Contractor
Affiliation: [illegible]

VERIFIED AND APPROVED [signature]
SHRP Representative
Affiliation: SHE

MONTH-DAY-YEAR 8-31-1990
Date

3
2 4

Form S04/Issued 19 February 1990

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.

Revised December 1, 1992

SHEET 1

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID ____

STATE CODE 27

SHRP SECTION ID 1018

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 07/26/93

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

PAVEMENT SURFACE TEMP - BEFORE __41°C; AFTER __48°C

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
CRACKING			
1. FATIGUE CRACKING (Square Meters)	____.0	____.0	____.0
2. BLOCK CRACKING (Square Meters)	____.0	___15.3	____.0
3. EDGE CRACKING (Meters)	____.0	____.0	____.0
4. LONGITUDINAL CRACKING (Meters)			
4a. Wheel Path	__2.0	___15.5	____.0
Length Sealed (Meters)	____.0	____.0	____.0
4b. Non-Wheel Path	___10.0	___278.4	____.0
Length Sealed (Meters)	____.0	____.0	____.0
5. REFLECTION CRACKING AT JOINTS Number of Transverse Cracks	___0	___0	___0
Transverse Cracking (Meters)	____.0	____.0	____.0
Length Sealed (Meters)	____.0	____.0	____.0
Longitudinal Cracking (Meters)	____.0	____.0	____.0
Length Sealed (Meters)	____.0	____.0	____.0
6. TRANSVERSE CRACKING Number of Cracks	___5	___24	___10
Length (Meters)	___10.2	___67.2	___36.0
Length Sealed (Meters)	____.0	____.0	____.0
PATCHING AND POTHOLES			
7. PATCH/PATCH DETERIORATION (Number)	___0	___3	___0
(Square Meters)	____.0	___1.2	____.0
8. Potholes (Number)	___0	___0	___0
(Square Meters)	____.0	____.0	____.0

Revised December 1, 1992

SHEET 2

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID _ _ _ _

STATE CODE 2 7

SHRP SECTION ID 1 0 1 8

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 0 7 / 2 6 / 9 3

SURVEYORS: B K N, _ _ _

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)			_ _ 0
(Square Meters)			_ _ _.0
SURFACE DEFECTS			
11. BLEEDING (Square Meters)	_ _ _.0	_ _ _.0	_ _ _.0
12. POLISHED AGGREGATE (Square Meters)			_ _ _.0
13. RAVELING (Square Meters)	_ _ _.0	_ _ _.0	_ _ _.0
MISCELLANEOUS DISTRESSES			
14. LANE-TO-SHOULDER DROPOFF - REFER TO SHEET 3			
15. WATER BLEEDING AND PUMPING (Number)			_ _ 0
Length of Affected Pavement (Meters)			_ _ _.0

16. OTHER (Describe) _____

Revised May 29, 1992

SHEET 3

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID _ _ _ _

STATE CODE 27

SHRP SECTION ID 1018

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 07/26/93

SURVEYORS: BKN, _ _ _

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES (CONTINUED)

9. RUTTING (FOR SPS-3 SITE SURVEYS)

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

14. LANE-TO-SHOULDER DROPOFF

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

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

MANUAL DIPSTICK DATA COLLECTION FORM
(Transverse Profile)

TEST SITE: 271018 DATE: 07/26/93 WEATHER: _____

OPERATOR: BKN RECORDER: _____

DIPSTICK SERIAL NUMBER: BRAUN DIPSTICK

START TIME: _____ STOP TIME: _____

TRANSVERSE LINES: OUTSIDE EDGE, NEW WHITE STRIPE

LINE: 0+00 LINE: 0+50 LINE: 1+00

Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)	
	Pass 1	Pass 2		Pass 1	Pass 2		Pass 1	Pass 2
1	203	-199	1	198	-197	1	140	-135
2	214	-210	2	169	-171	2	156	-154
3	264	-261	3	286	-277	3	239	-241
4	299	-295	4	309	-309	4	333	-327
5	246	-244	5	254	-250	5	270	-268
6	086	-080	6	048	-042	6	100	-096
7	066	-066	7	022	-022	7	001	000
8	156	-156	8	163	-153	8	103	-100
9	254	-252	9	246	-235	9	269	-262
10	323	-313	10	342	-346	10	329	-323
11	249	-249	11	222	-222	11	280	-280
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
TOTALS	2.360	-2.325		2,259	-2.224		2.220	-2.186
	0.035			0.035			0.034	

COMMENTS: _____

MANUAL DIPSTICK DATA COLLECTION FORM
(Transverse Profile)

TEST SITE: 271018 DATE: 07/26/93 WEATHER: _____

OPERATOR: BKN RECORDER: _____

DIPSTICK SERIAL NUMBER: BRAUN DIPSTICK

START TIME: _____ STOP TIME: _____

TRANSVERSE LINES: OUTSIDE EDGE, NEW WHITE STRIPE

LINE: 1+50 LINE: 2+00 LINE: 2+50

Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)	
	Pass 1	Pass 2		Pass 1	Pass 2		Pass 1	Pass 2
1	088	-080	1	160	-154	1	166	-162
2	146	-138	2	133	-131	2	179	-177
3	201	-198	3	200	-192	3	243	-239
4	425	-418	4	316	-307	4	350	-341
5	286	-275	5	262	-258	5	264	-263
6	108	-103	6	052	-046	6	099	-093
7	050	-048	7	030	-023	7	078	-078
8	123	-119	8	118	-117	8	168	-161
9	232	-224	9	221	-205	9	285	-281
10	348	-347	10	312	-311	10	358	-356
11	279	-279	11	271	-271	11	251	-251
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
TOTALS	2.286	-2.229		2.075	-2.015		2.441	-2.402
	0.057			0.060			0.039	

COMMENTS: _____

MANUAL DIPSTICK DATA COLLECTION FORM
(Transverse Profile)

TEST SITE: 271018 DATE: 07/26/93 WEATHER: _____

OPERATOR: BKN RECORDER: _____

DIPSTICK SERIAL NUMBER: BRAUN DIPSTICK

START TIME: _____ STOP TIME: _____

TRANSVERSE LINES: OUTSIDE EDGE, NEW WHITE STRIPE

LINE: 3+00 LINE: 3+50 LINE: 4+00

Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)	
	Pass 1	Pass 2		Pass 1	Pass 2		Pass 1	Pass 2
1	187	-184	1	186	-190	1	162	-151
2	165	-160	2	159	-153	2	182	-172
3	207	-209	3	248	-245	3	233	-234
4	298	-291	4	280	-274	4	286	-277
5	248	-237	5	256	-251	5	238	-238
6	121	-118	6	132	-135	6	140	-135
7	037	-034	7	046	-040	7	092	-081
8	122	-118	8	117	-111	8	150	-146
9	250	-242	9	221	-219	9	227	-222
10	330	-327	10	358	-353	10	318	-312
11	252	-252	11	251	-251	11	258	-258
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
TOTALS								

COMMENTS: _____

MANUAL DIPSTICK DATA COLLECTION FORM
(Transverse Profile)

TEST SITE: 271018 DATE: 07/26/93 WEATHER: _____

OPERATOR: BKN RECORDER: _____

DIPSTICK SERIAL NUMBER: BRAUN DIPSTICK

START TIME: _____ STOP TIME: _____

TRANSVERSE LINES: OUTSIDE EDGE, NEW WHITE STRIPE

LINE: 4+50 LINE: 5+00 LINE: _____

Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)	
	Pass 1	Pass 2		Pass 1	Pass 2		Pass 1	Pass 2
1	198	-199	1	163	-164	1		
2	210	-205	2	203	-197	2		
3	253	-250	3	226	-224	3		
4	274	-271	4	270	-263	4		
5	238	-240	5	238	-239	5		
6	126	-129	6	091	-086	6		
7	092	-085	7	090	-088	7		
8	144	-142	8	146	-145	8		
9	222	-220	9	233	-222	9		
10	320	-322	10	320	-312	10		
11	253	-253	11	264	-264	11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
TOTALS								

COMMENTS: _____

MANUAL DIPSTICK DATA COLLECTION FORM
(Transverse Profile)

TEST SITE: 271018 DATE: 07/26/93 WEATHER: _____

OPERATOR: BKN RECORDER: _____

DIPSTICK SERIAL NUMBER: BRAUN DIPSTICK

START TIME: _____ STOP TIME: _____

TRANSVERSE LINES: OUTSIDE EDGE, NEW WHITE STRIPE

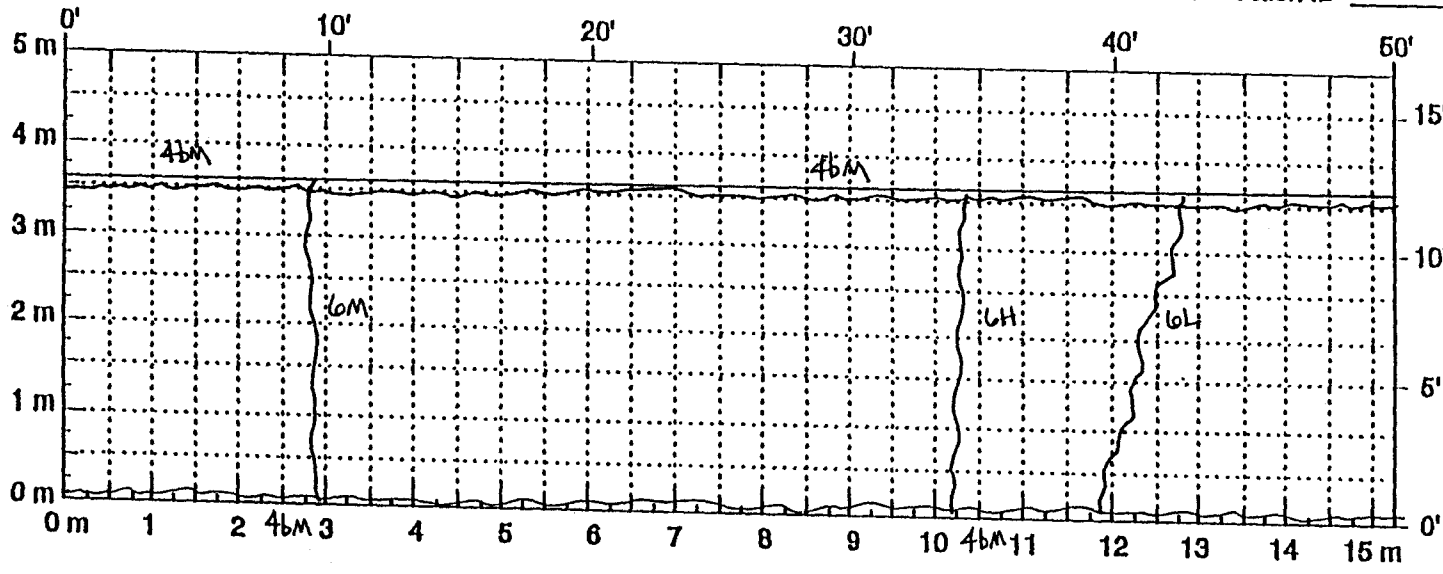
LINE: 0 - 49 LINE: @ 5+50 LINE: _____

Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)		Distance (ft.)	Elevation (in.)	
	Pass 1	Pass 2		Pass 1	Pass 2		Pass 1	Pass 2
1	150	-145	1	135	-137	1		
2	056	-063	2	190	-190	2		
3	397	-388	3	226	-222	3		
4	306	-301	4	264	-255	4		
5	262	-252	5	258	-255	5		
6	038	-039	6	081	-070	6		
7	096	-087	7	-116	+115	7		
8	146	-147	8	061	-060	8		
9	267	-261	9	282	-279	9		
10	344	-342	10	432	-423	10		
11	205	-205	11	333	-333	11		
12			12			12		
13			13			13		
14			14			14		
15			15			15		
16			16			16		
TOTALS								

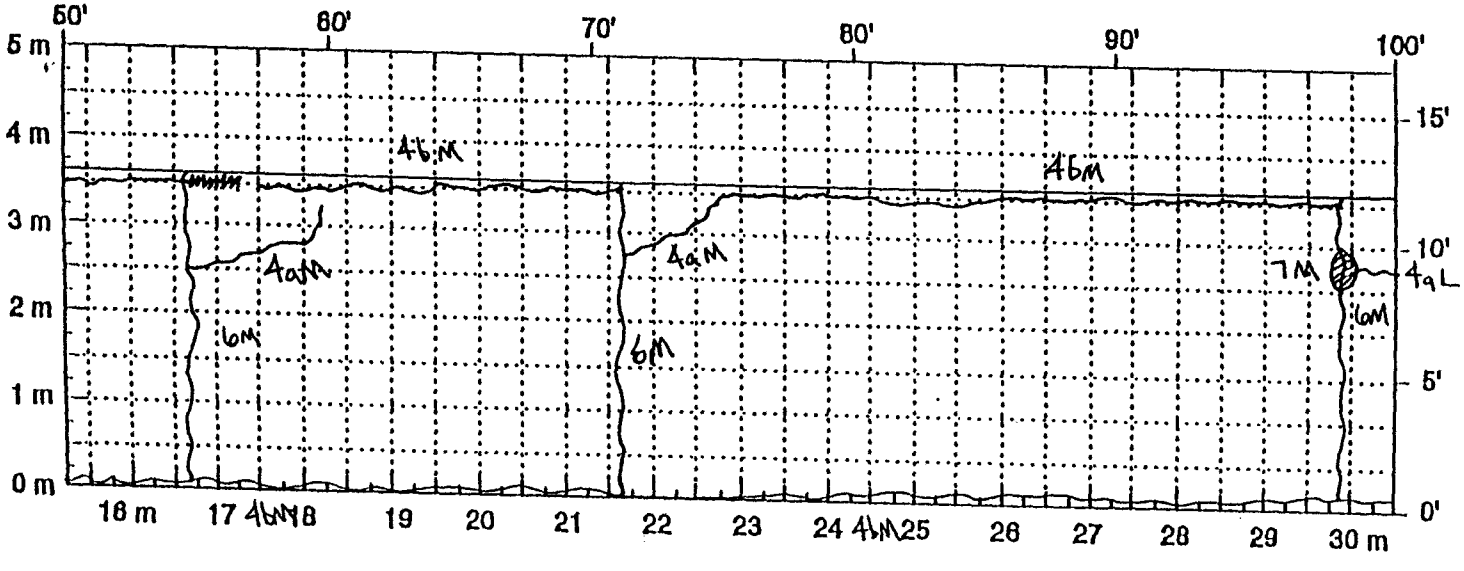
COMMENTS: _____

State Code 27

SHRP Section ID 1018



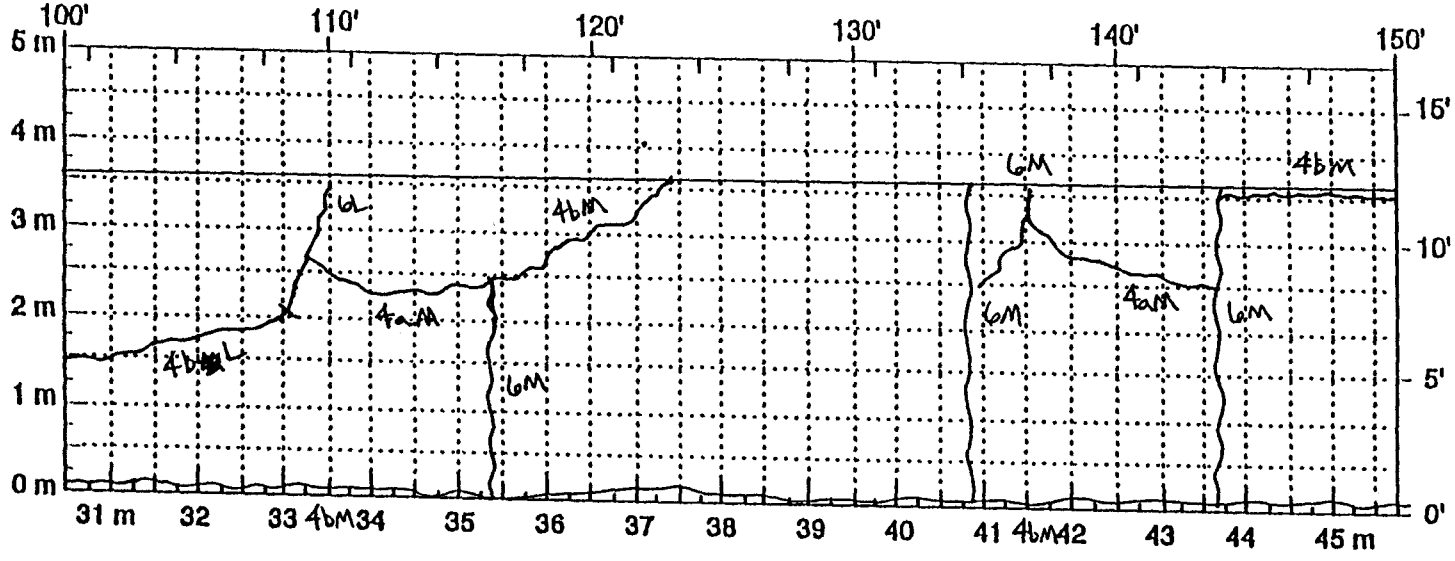
Comments: _____



Comments: _____

State Code 27

SHRP Section ID 1018



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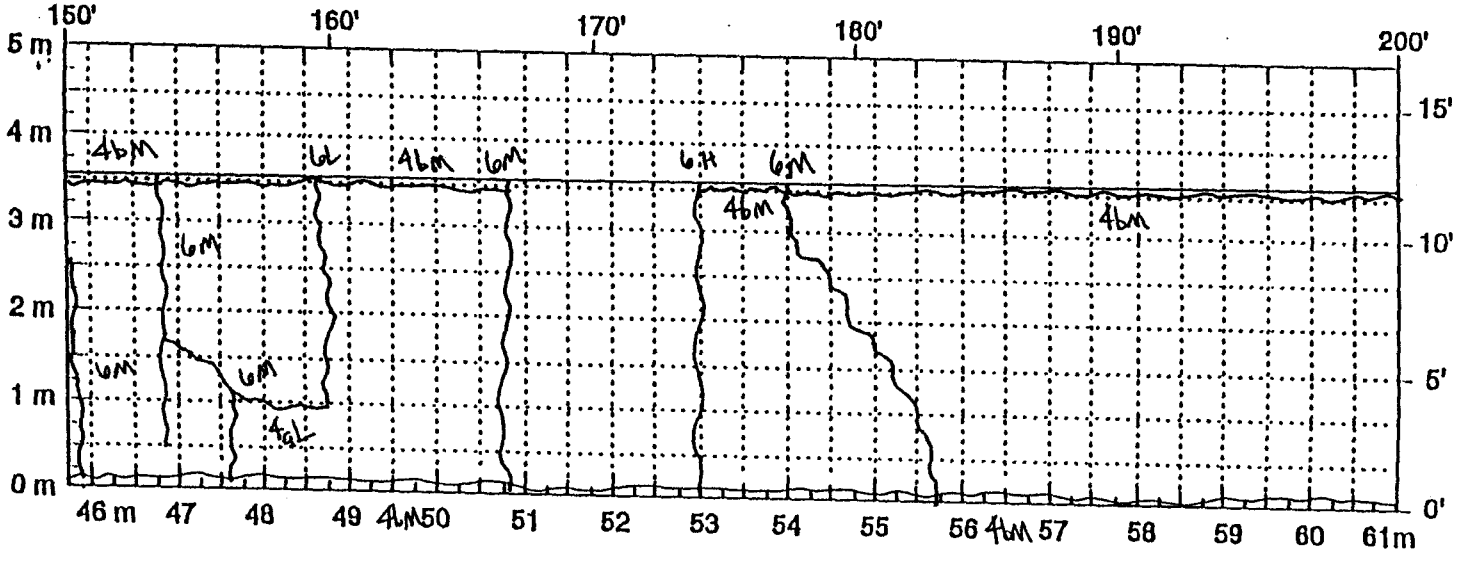
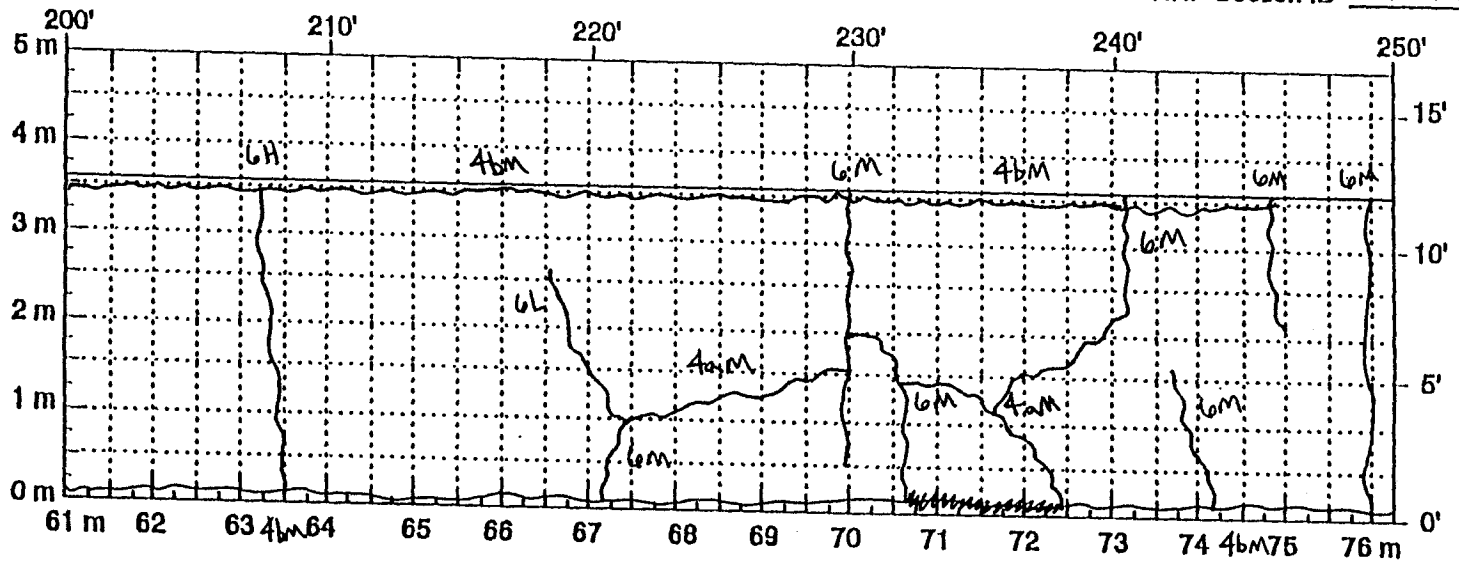


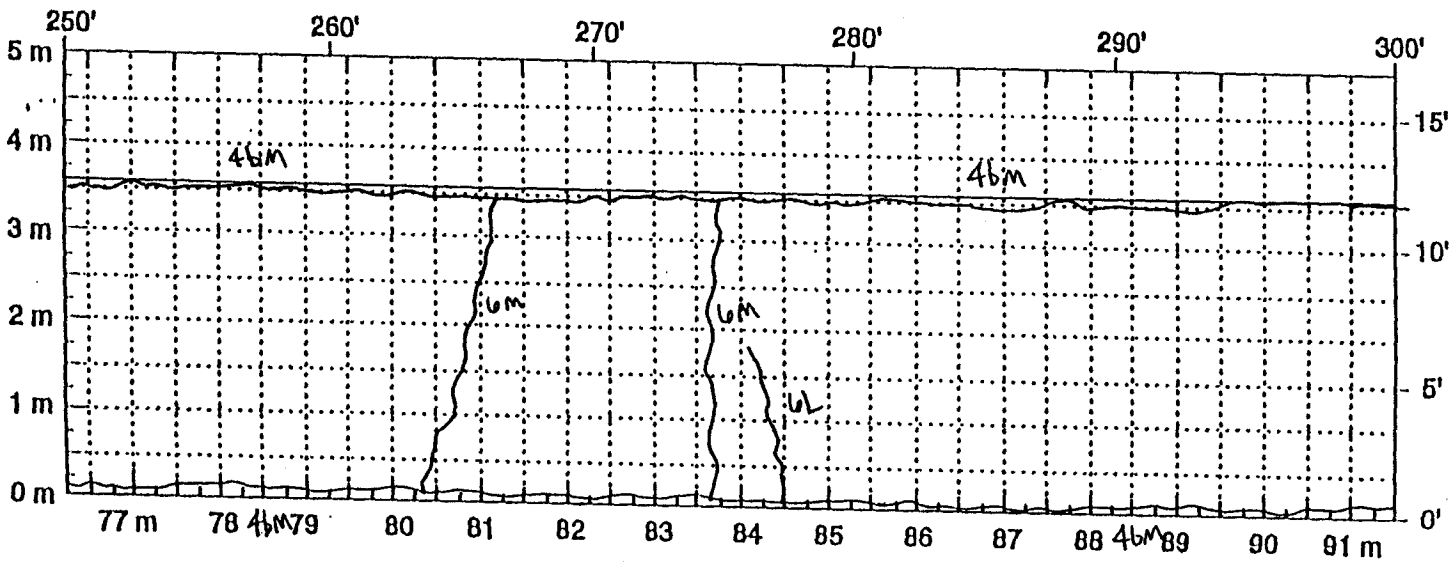
Comments: _____

State Code 41

SHRP Section ID 1018



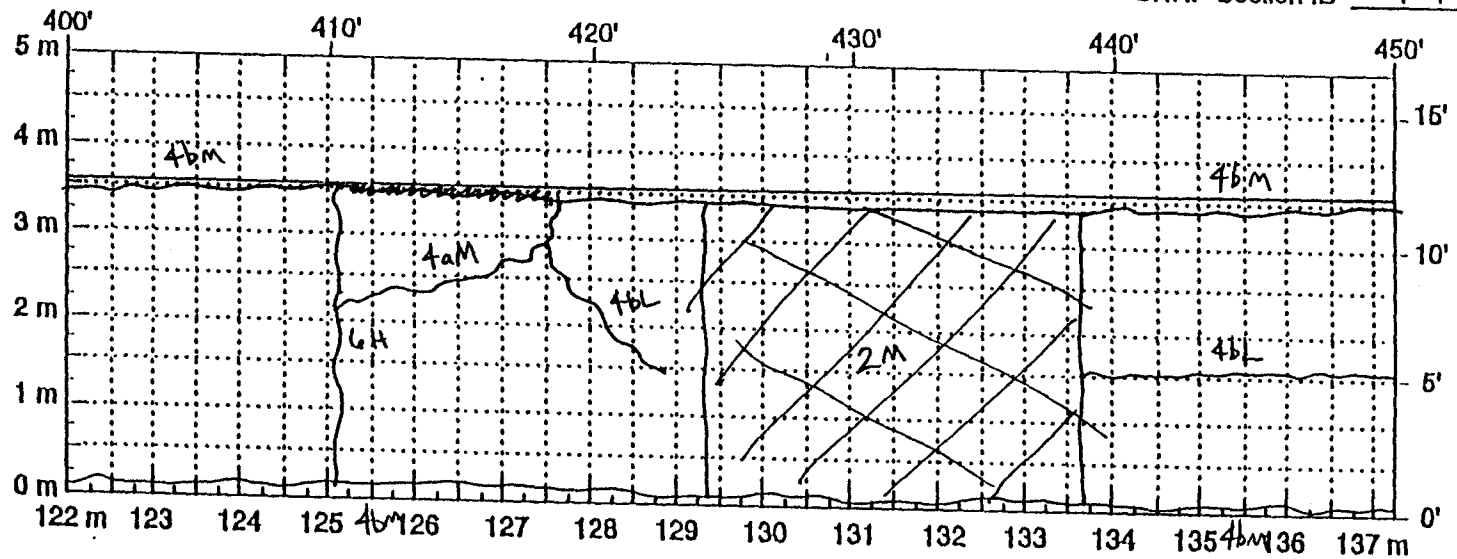
Comments: _____



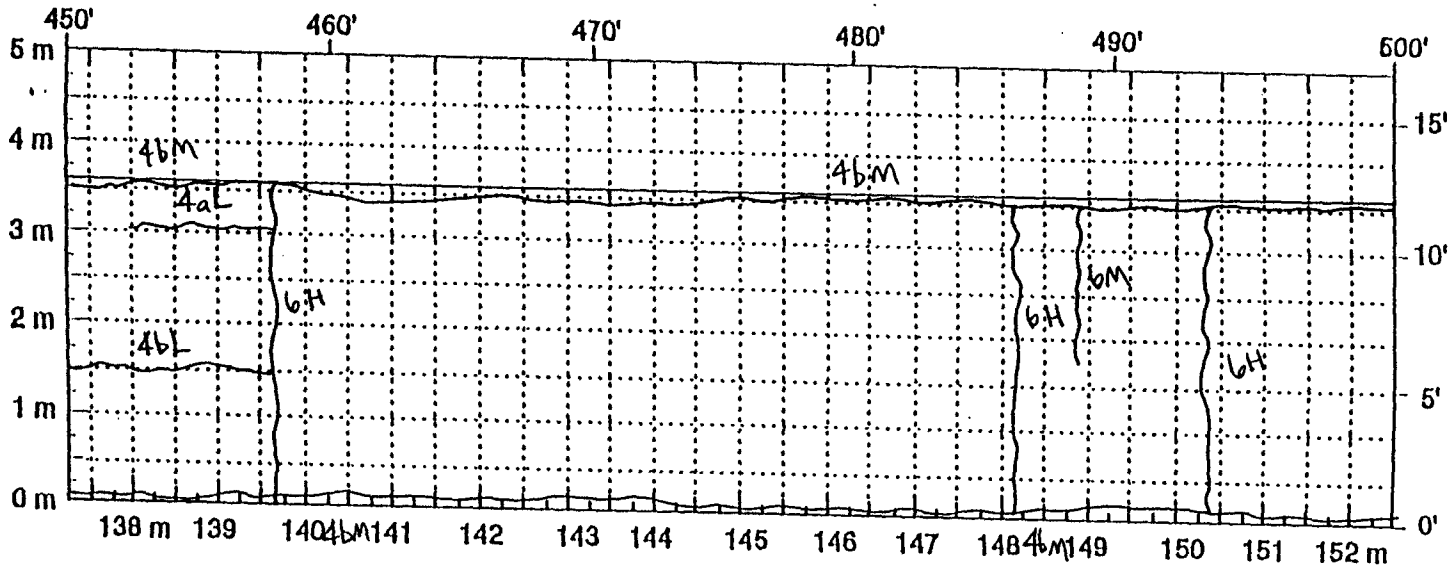
Comments: _____

State Code 27

SHRP Section ID 1018



Comments: _____

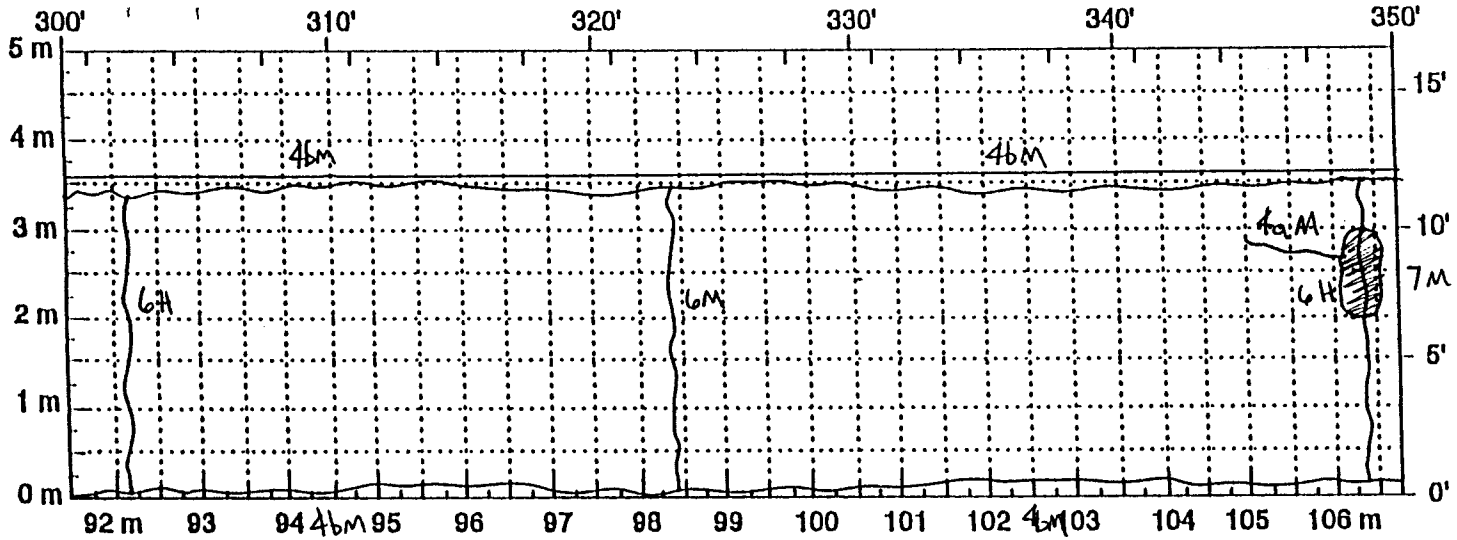


Comments: _____

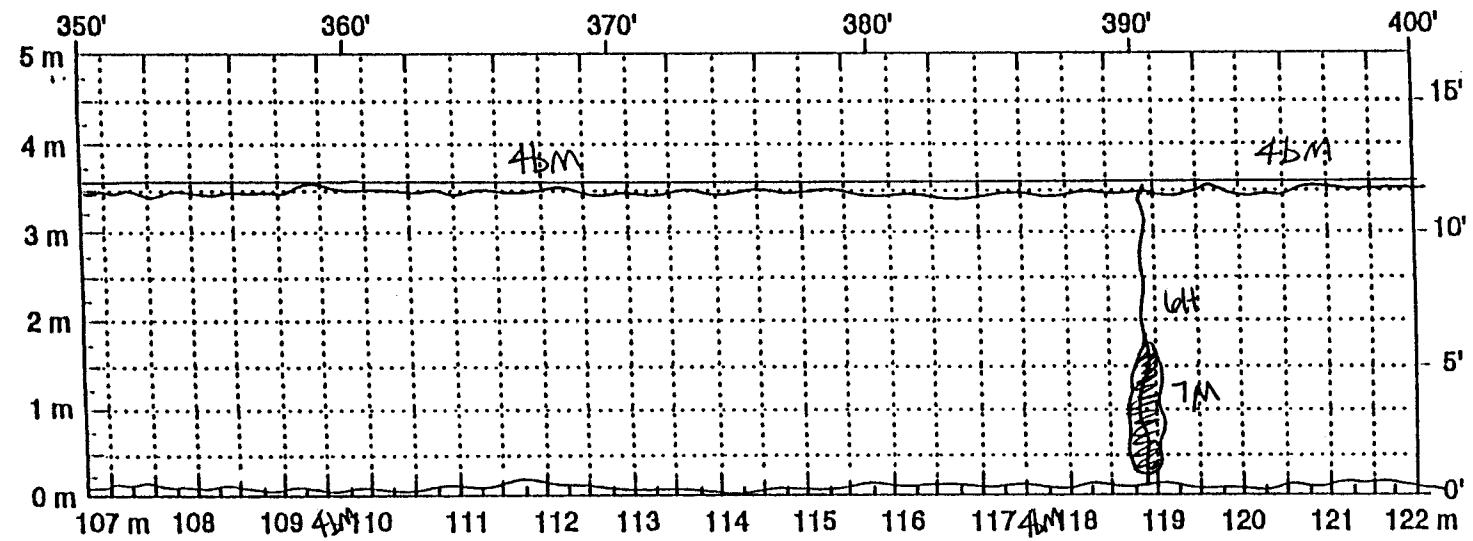
State Assigned ID _____

State Code 27

SHRP Section ID 1018



Comments: _____

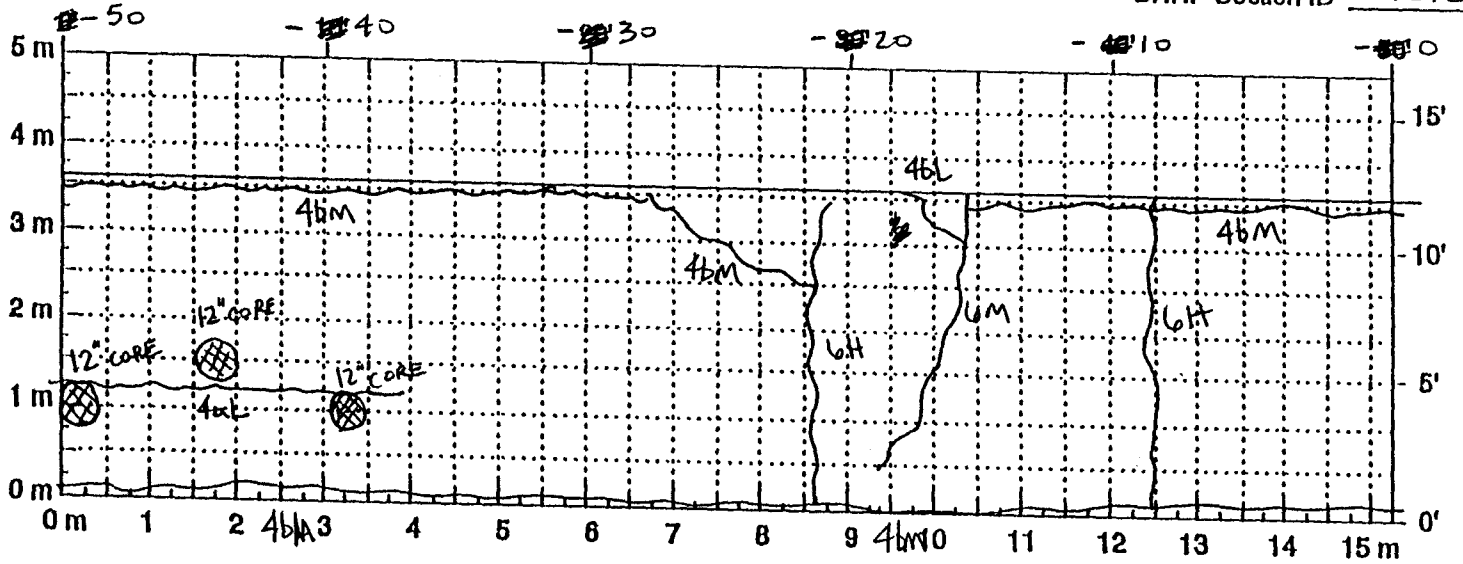


Comments: _____

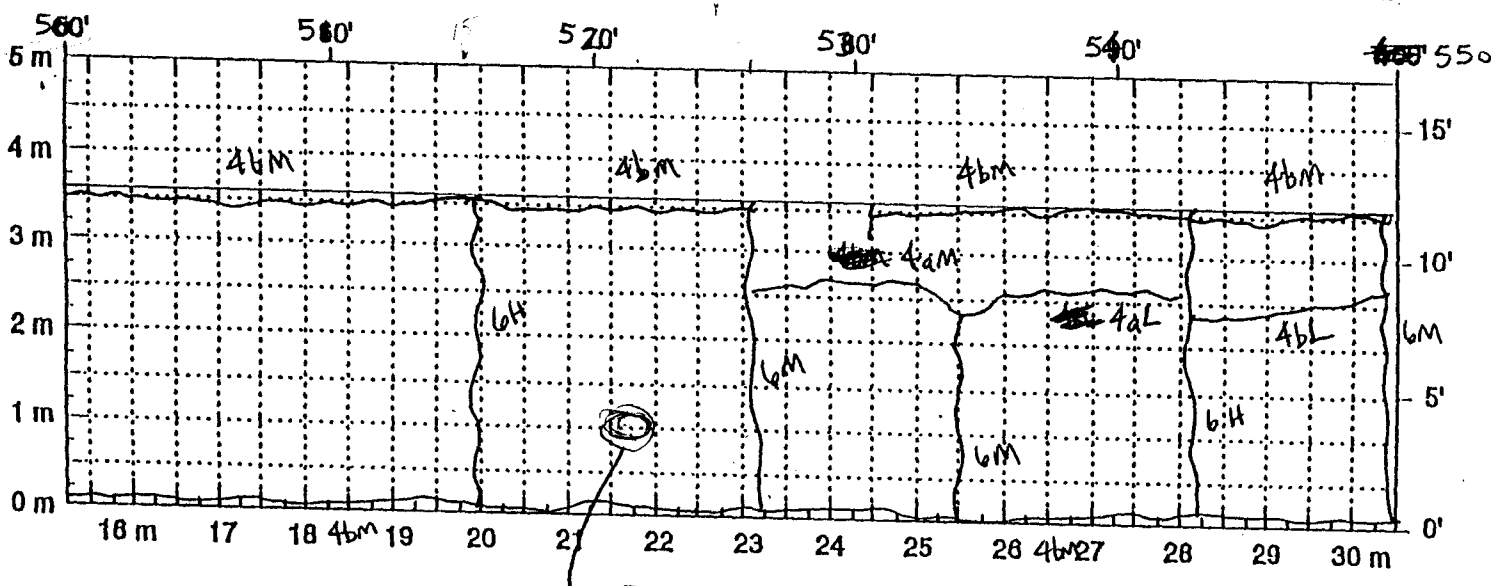
State Code 27

SHRP Section ID 1018

For SMP use only



Comments: _____



Comments: _____ INSTRUMENTATION PROPOSED

Pre-Install Field

FHWA/SHRP-LTPP GPS TEMPERATURE FORM

SHRP NORTH CENTRAL REGION

SHRP SECTION I.D. # 271018

AGENCY MINNESOTA

TESTING GPS

ROUTE/HIGHWAY # US-10

FIELD SET # B

TESTING DATE 7/26/93

SHEET # ____ OF ____

LOCATION 1 STATION 0-03

DEPTH MILTIME	D1 = 1.0	D2 = 2.5	D3 = 3.5	D4 = —	D5 = —	WEATHER CONDITIONS
1403	110.0	101.9	97.6			S
1508	111.6	103.7	98.8			S
1600	111.8	103.0	98.9			S
1700	113.6	105.4	103.6			S

COMMENTS _____

LOCATION 2 STATION 5+03

DEPTH MILTIME	D1 = ~~1.2~~ 1.2	D2 = 2.5	D3 = 3.5	D4 = —	D5 = —	WEATHER CONDITIONS
1430	113.8	104.1	98.9			S
1530	114.9	107.6	102.7			S
1630	115.1	107.9	103.8			S
1710	115.4	108.7	106.2			S

COMMENTS _____

NOTE: USE ONLY THESE WEATHER TERMS; (S)SUNNY, (PC)PARTLY CLOUDY, (C)CLOUDY, (R)RAIN

TESTING COMPLETED BY:
BRAUN INTERTEC PAVEMENT INC.
FWD S/N 8002-063 (Braun FWD)

BJP
FWD OPERATOR

7/26/93
DATE

13:39 930726

File: C:\FWD\DATA\271018B1.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

FWD S/N : 8002-063
Operator ID : PELKEY, BRUCE J.

Stationing...: Feet

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

SHRP TESTING - FLEXIBLE - BASIN TEST (F0,F1,F3)
Sequence: CCC1111222233334444

1. SMP Pre-Install FWD

F1

Extra test for SMP

Stn: -20		Lane: F1	Temp:		J/C:	Air: 85		PvT: 106		13:42
Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.0	12056	23.17	15.38	11.48	7.77	5.33	3.25	1.95
	C	110.6	12128	22.20	14.74	11.01	7.51	5.20	3.34	2.04
	C	111.2	12192	21.66	14.31	10.58	7.13	4.89	2.99	1.65
*	1	59.4	6512	12.65	8.45	6.26	4.14	2.71	1.65	1.00
*	1	59.7	6544	12.57	8.36	6.17	4.01	2.71	1.56	0.91
*	1	59.7	6552	12.61	8.49	6.26	4.18	2.80	1.73	1.08V
*	1	59.7	6552	12.69	8.53	6.26	4.14	2.80	1.60	0.91
*	2	85.1	9328	17.01	11.38	8.48	5.74	4.00	2.47	1.52
*	2	85.9	9416	17.13	11.46	8.57	5.78	4.04	2.51	1.52
*	2	85.2	9344	16.97	11.46	8.57	5.78	4.04	2.56	1.56
*	2	85.5	9384	16.97	11.46	8.53	5.78	4.04	2.51	1.52
*	3	111.2	12192	21.95V	14.69V	11.14V	7.73V	5.47V	3.68V	2.17V
*	3	111.7	12248	21.58	14.31	10.63	7.30	5.16	3.29	1.95
*	3	111.4	12224	21.53	14.31	10.67	7.30	5.11	3.34	2.04
*	3	111.6	12240	21.45	14.22	10.58	7.18V	5.02V	3.21V	1.91V
*	4	154.9	16984	27.94	18.31	13.62	9.24	6.62	4.38	2.65
*	4	155.2	17016	27.94	18.27	13.58	9.24	6.53	4.38	2.60
*	4	155.5	17048	27.90	18.23	13.50	9.20	6.53	4.38	2.60
*	4	155.5	17040	27.90	18.18	13.50	9.16	6.53	4.38	2.60

Stn: 0		Lane: F1	Temp:		J/C:	Air: 86		PvT: 111		13:46
Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.6	12008	22.12	15.38	11.78	8.06	5.69	3.42	2.00
	C	110.1	12072	21.28	14.74	11.27	7.68	5.51	3.34	1.91
	C	110.1	12072	21.07	14.56	11.14	7.60	5.47	3.38	2.00
*	1	57.0	6240	11.86	8.23	6.21	4.09	2.80	1.65	0.95
*	1	57.1	6272	11.90	8.27	6.21	4.14	2.84	1.65	0.95
*	1	57.0	6248	11.86	8.27	6.30	4.18	2.89	1.73	1.00
*	1	56.7	6216	11.86	8.23	6.26	4.14	2.89	1.69	0.95
*	2	83.0	9104	16.21	11.29	8.57	5.78	4.13	2.47	1.39
*	2	83.3	9136	16.30	11.33	8.65	5.87	4.18	2.47	1.39
*	2	83.6	9160	16.30	11.33	8.65	5.87	4.18	2.47	1.39
*	2	83.6	9176	16.26	11.33	8.65	5.87	4.18	2.47	1.39
*	3	110.4	12112	20.70	14.31	10.93	7.47	5.38	3.29	1.87
*	3	110.6	12120	20.74	14.31	10.93	7.51	5.38	3.29	1.91
*	3	110.6	12128	20.78	14.35	10.93	7.47	5.42	3.34	1.91
*	3	110.4	12112	20.78	14.35	10.97	7.51	5.47	3.38	2.00V
*	4	140.1	15368	26.31	18.05	13.75	9.50	6.89	4.29	2.47
*	4	140.6	15408	26.31	18.01	13.62	9.46	6.93	4.33	2.56
*	4	140.4	15400	26.27	17.92	13.58	9.37	6.89	4.29	2.52
*	4	140.3	15392	26.18	17.84	13.50	9.37	6.89	4.29	2.52

Stn: 25		Lane:F1	Temp:		J/C:	Air: 85		PvT: 116		13:49
Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.0	11952	23.17	15.94	12.04	8.23	5.78	3.60	2.08
	C	109.7	12032	22.33	15.25	11.53	7.94	5.64	3.51	2.04
	C	110.0	12056	22.12	15.04	11.40	7.81	5.56	3.42	2.04
*	1	56.7	6216	12.65	8.57	6.43	4.26	2.93	1.73	1.04
*	1	56.5	6192	12.53	8.57	6.38	4.22	2.93	1.73	1.00
*	1	56.7	6216	12.36	8.49	6.34	4.22	2.89	1.69	0.95
*	1	56.7	6216	12.32	8.49	6.34	4.18	2.84	1.69	1.00
*	2	82.8	9064	17.05	11.68	8.83	5.99	4.27	2.64	1.56
*	2	83.0	9104	17.13	11.68	8.83	6.04	4.27	2.64	1.52
*	2	83.0	9104	17.13	11.68	8.87	5.99	4.27	2.60	1.52
*	2	83.6	9168	17.09	11.68	8.83	5.99	4.27	2.60	1.52
*	3	110.0	12056	21.83	14.74	11.18	7.68	5.51	3.42	2.04
*	3	110.1	12072	21.95	14.82	11.23	7.77	5.56	3.51	2.08

File: C:\FWD\DATA\271018B1.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

*	3	110.1	12080	21.91	14.78	11.18	7.68	5.51	3.42	2.04
*	3	110.4	12104	21.99	14.82	11.23	7.73	5.51	3.47	2.04
*	4	140.1	15360	27.78	18.74	14.14	9.75	7.02	4.46	2.73
*	4	140.6	15416	27.82	18.74	14.14	9.75	7.07	4.51	2.82
*	4	140.3	15384	27.82	18.66	14.05	9.71	7.11	4.51	2.82
*	4	140.4	15400	27.69	18.57	13.97	9.62	7.02	4.42	2.73

Stn: 50 Lane:F1 Temp: J/C: Air: 85 PvT: 115 13:52

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.1	11960	24.42	16.72	12.60	8.36	5.91	3.64	2.13
	C	109.7	12024	23.38	15.86	11.91	7.89	5.69	3.51	2.04
	C	109.6	12016	23.08	15.73	11.83	7.85	5.60	3.51	2.04
*	1	56.1	6152	12.82	8.75	6.47	4.22	2.89	1.73	0.95
*	1	56.2	6168	12.82	8.79	6.56	4.26	2.93	1.78	1.04
*	1	56.5	6200	12.78	8.79	6.56	4.26	2.93	1.78	1.00
*	1	56.1	6152	12.74	8.75	6.51	4.22	2.93	1.78	1.00
*	2	82.9	9088	17.68	12.15	9.04	5.99	4.22	2.64	1.47
*	2	82.9	9088	17.68	12.19	9.13	6.04	4.27	2.64	1.47
*	2	82.8	9080	17.72	12.19	9.13	6.04	4.27	2.64	1.52
*	2	82.6	9064	17.68	12.15	9.13	5.99	4.22	2.64	1.47
*	3	109.7	12024	22.75	15.55	11.57	7.77	5.51	3.47	2.04
*	3	110.0	12064	22.87	15.64	11.70	7.85	5.64	3.60	2.13
*	3	110.1	12072	22.87	15.68	11.74	7.85	5.60	3.55	2.08
*	3	110.1	12072	22.87	15.64	11.65	7.81	5.60	3.51	2.08
*	4	140.3	15376	29.54	20.08	14.95	9.96	7.11	4.59	2.73
*	4	140.1	15368	29.54	20.04	14.91	10.00	7.16	4.64	2.82
*	4	140.3	15376	29.45	20.08	14.87	9.96	7.16	4.68	2.82
*	4	140.1	15368	29.45	19.99	14.82	9.84	7.02	4.59	2.73

Stn: 75 Lane:F1 Temp: J/C: Air: 85 PvT: 116 13:54

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.6	11904	24.13	16.12	12.00	7.98	5.56	3.34	1.91
	C	109.4	11992	23.13	15.36	11.35	7.60	5.38	3.29	1.95
	C	109.3	11984	22.87	15.17	11.23	7.47	5.24	3.21	1.87
*	1	57.0	6240	12.74	8.40	6.21	4.01	2.71	1.60	0.91
*	1	57.0	6240	12.69	8.40	6.21	4.05	2.76	1.65	0.91
*	1	56.4	6176	12.65	8.36	6.17	4.05	2.76	1.60	0.91
*	1	57.0	6240	12.65	8.36	6.21	4.09	2.80	1.65	1.04
*	2	82.6	9064	17.39	11.59	8.61	5.70	4.00	2.43	1.34
*	2	83.0	9104	17.47	11.63	8.65	5.78	4.04	2.47	1.43
*	2	83.5	9152	17.55	11.76	8.74	5.87	4.09	2.51	1.47
*	2	83.0	9104	17.47	11.68	8.70	5.78	4.04	2.47	1.43
*	3	109.4	12000	22.58	14.87	10.97	7.39	5.20	3.21	1.82V
*	3	109.7	12024	22.75	14.99	11.10	7.47	5.29	3.29	1.95
*	3	109.6	12016	22.75	15.04	11.10	7.51	5.29	3.29	2.00
*	3	109.7	12032	22.75	14.95	11.05	7.43	5.24	3.25	1.91
*	4	139.9	15336	29.12	19.17	14.14	9.54	6.76	4.25	2.52
*	4	139.9	15328	29.03	19.09	14.05	9.46	6.76	4.20	2.47
*	4	139.7	15312	28.95	18.96	13.97	9.37	6.76	4.20	2.52
*	4	139.9	15344	28.95	18.96	13.97	9.33	6.76	4.16	2.52

Stn: 100 Lane:F1 Temp: J/C: Air: 86 PvT: 117 13:57

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.7	11920	24.30	15.86	11.65	7.73	5.38	3.16	1.78
	C	109.7	12032	23.38	15.12	11.23	7.47	5.33	3.21	1.91
	C	109.7	12032	23.00	14.91	11.01	7.35	5.20	3.12	1.82
*	1	56.7	6216	12.74	8.27	6.00	3.84	2.53V	1.43V	0.74
*	1	57.0	6240	12.78	8.36	6.08	3.97	2.71	1.56	0.87
*	1	56.8	6224	12.69	8.32	6.08	3.93	2.67	1.52	0.82
*	1	57.2	6272	12.74	8.27	6.08	3.97	2.67	1.56	0.91
*	2	82.8	9080	17.55	11.46	8.40	5.53	3.87	2.25	1.21
*	2	83.2	9128	17.64	11.55	8.48	5.57	3.91	2.30	1.26
*	2	83.3	9136	17.68	11.55	8.48	5.61	3.91	2.30	1.26
*	2	83.3	9144	17.81	11.68	8.61	5.78V	4.04V	2.47V	1.43V
*	3	110.0	12056	22.58	14.65	10.80	7.18	5.07	3.12	1.78
*	3	110.6	12120	22.79	14.74	10.88	7.26	5.16	3.16	1.82
*	3	110.3	12096	22.71	14.69	10.80	7.18	5.11	3.08	1.73
*	3	110.4	12104	22.75	14.85	10.84	7.22	5.16	3.16	1.78
*	4	140.4	15400	29.03	18.86	13.75	9.16	6.53	4.03	2.34
*	4	140.6	15408	29.03	18.81	13.71	9.16	6.62	4.12	2.43
*	4	140.3	15392	28.95	18.48	13.62	9.12	6.62	4.07	2.39

File: C:\FWD\DATA\271018B1.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

*	4	140.3	15384	28.95	18.31	13.58	9.03	6.62	4.07	2.34

Stn: 125 Lane:F1 Temp: J/C: Air: 86 PvT: 112 14:03

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.3	12096	21.45	14.09	10.50	7.01	4.98	3.16	1.82
	C	110.7	12144	21.11	14.00	10.45	7.01	5.02	3.21	1.82
	C	110.9	12152	20.99	13.96	10.45	7.01	5.02	3.16	1.78
*	1	57.1	6264	11.94	7.93	5.87	3.76	2.58	1.52	0.87
*	1	56.8	6232	11.98	7.97	5.87	3.76	2.62	1.56	0.91
*	1	57.0	6240	11.86	7.93	5.83	3.76	2.58	1.56	0.91
*	1	57.4	6288	11.90	7.93	5.87	3.76	2.58	1.56	0.91
*	2	82.8	9072	16.21	10.82	8.05	5.32	3.78	2.30	1.26
*	2	83.6	9168	16.34	10.94	8.18	5.36	3.87	2.34	1.30
*	2	83.6	9160	16.38	10.94	8.18	5.36	3.82	2.34	1.30
*	2	82.9	9088	16.38	10.94	8.23	5.40	3.87	2.38	1.34
*	3	110.4	12112	20.65	13.79	10.37	6.92	5.02	3.12	1.78
*	3	111.0	12176	20.78	13.87	10.41	6.97	5.02	3.12	1.78
*	3	110.7	12144	20.78	13.83	10.41	6.97	4.98	3.12	1.73
*	3	110.7	12144	20.74	13.83	10.37	6.92	4.98	3.12	1.73
*	4	141.6	15520	26.14	17.45	13.11	8.86	6.49	4.12	2.38
*	4	142.0	15584	26.18	17.41	13.07	8.86	6.58	4.07	2.34
*	4	141.4	15520	26.14	17.32	13.02	8.86	6.67	4.07	2.39
*	4	141.6	15528	26.14	17.28	12.98	8.82	6.67	4.07	2.34

Stn: 150 Lane:F1 Temp: J/C: Air: 86 PvT: 121 14:06

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.6	11904	21.41	15.64	11.31	7.56	5.33	3.29	1.91
	C	109.6	12016	20.61	14.82	10.71	7.18	5.16	3.25	1.87
	C	109.7	12040	20.49	14.61	10.63	7.13	5.11	3.29	1.91
*	1	57.0	6240	11.60	8.36	5.96	3.84	2.62	1.65	1.00
*	1	57.2	6272	11.69	8.36	5.96	3.84	2.62	1.60	0.95
*	1	57.0	6248	11.52	8.23	5.83	3.80	2.58	1.60	0.91
*	1	56.7	6216	11.52	8.27	5.87	3.80	2.58	1.60	0.95
*	2	82.5	9040	15.88	11.29	8.10	5.40	3.82	2.38	1.39
*	2	83.0	9104	16.09	11.38	8.23	5.49	3.87	2.43	1.43
*	2	82.9	9096	16.00	11.29	8.18	5.40	3.82	2.43	1.39
*	2	83.0	9096	16.09	11.33	8.18	5.45	3.87	2.43	1.43
*	3	109.6	12016	20.36	14.35	10.41	7.01	5.07	3.25	1.91
*	3	110.1	12072	20.49	14.35	10.37	7.01	5.02	3.25	1.91
*	3	109.9	12040	20.44	14.26	10.33	6.97	5.02	3.21	1.87
*	3	110.0	12056	20.44	14.26	10.33	6.92	5.02	3.21	1.82
*	4	139.9	15336	25.81	17.88	12.94	8.74	6.49	4.20	2.43
*	4	140.0	15344	25.85	17.84	12.94	8.74	6.49	4.25	2.47
*	4	139.7	15320	25.77	17.75	12.85	8.74	6.40	4.25	2.52
*	4	140.3	15376	25.89	17.80	12.85	8.74	6.49	4.29	2.52

Stn: 175 Lane:F1 Temp: J/C: Air: 87 PvT: 120 14:09

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.1	11960	26.64	13.83	10.37	7.01	5.11	3.42	2.00
	C	109.6	12008	25.26	13.27	9.94	6.71	4.93	3.34	1.91
	C	109.4	11992	24.93	13.14	9.85	6.71	4.98	3.38	1.95
*	1	56.4	6184	14.03	7.33	5.31	3.50	2.44	1.65	0.95
*	1	56.5	6200	13.99	7.33	5.36	3.50	2.49	1.65	0.95
*	1	56.5	6200	13.99	7.33	5.36	3.55	2.53	1.69	1.04
*	1	56.5	6200	13.91	7.28	5.36	3.50	2.49	1.65	0.95
*	2	82.0	8984	19.10	10.13	7.54	5.11	3.73	2.56	1.47
*	2	82.5	9040	19.23	10.17	7.54	5.11	3.69	2.51	1.43
*	2	82.8	9064	19.27	10.21	7.63	5.15	3.78	2.56	1.47
*	2	82.8	9072	19.27	10.26	7.63	5.19	3.78	2.60	1.47
*	3	109.3	11992	24.55	12.97	9.77	6.67	4.93	3.38	2.00
*	3	109.9	12040	24.68	13.06	9.81	6.71	4.98	3.42	2.00
*	3	109.7	12024	24.68	12.97	9.77	6.67	4.93	3.38	1.95
*	3	109.6	12016	24.68	12.97	9.77	6.71	4.98	3.42	2.00
*	4	139.9	15328	31.25	16.59	12.42	8.53	6.36	4.42	2.56
*	4	140.0	15360	31.17	16.50	12.38	8.53	6.36	4.42	2.56
*	4	139.7	15320	31.13	16.46	12.30	8.48	6.31	4.42	2.56
*	4	140.1	15368	31.17	16.50	12.38	8.57	6.40	4.46	2.65

Stn: 200 Lane:F1 Temp: J/C: Air: 87 PvT: 125 14:12

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7

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	C	109.4	12000	25.14	17.28	13.11	9.08	6.58	4.12	2.17
	C	110.0	12064	24.22	16.63	12.60	8.82	6.44	4.12	2.26
	C	110.3	12088	24.13	16.37	12.47	8.74	6.44	4.12	2.26
*	1	56.5	6200	13.62	9.18	6.86	4.64	3.29	2.04	1.04
*	1	56.8	6232	13.66	9.18	6.90	4.69	3.38	2.12	1.13
*	1	56.4	6184	13.57	9.13	6.86	4.64	3.29	2.04	1.04
*	1	56.7	6224	13.57	9.13	6.86	4.64	3.29	2.04	1.04
*	2	81.7	8968	18.43	12.45	9.47	6.54	4.76	2.99	1.60
*	2	82.2	9016	18.52	12.54	9.55	6.59	4.80	3.03	1.60
*	2	82.0	8992	18.48	12.58	9.55	6.63	4.84	3.12	1.65
*	2	82.3	9032	18.48	12.54	9.55	6.63	4.84	3.08	1.60
*	3	110.0	12064	23.71	15.99	12.17	8.53	6.27	4.07	2.17
*	3	110.4	12112	23.84	16.03	12.21	8.57	6.36	4.12	2.21
*	3	110.3	12088	23.84	16.07	12.21	8.57	6.36	4.12	2.26
*	3	110.3	12096	23.84	15.99	12.12	8.48	6.31	4.07	2.17
*	4	141.4	15512	30.50	20.47	15.51	10.89	8.13	5.29	2.91
*	4	141.7	15536	30.46	20.38	15.38	10.81	8.09	5.33	2.95
*	4	141.7	15544	30.46	20.34	15.38	10.81	8.09	5.33	2.99
*	4	141.4	15512	30.46	20.38	15.38	10.89	8.13	5.42	3.08

Stn: 225 Lane:F1 Temp: J/C: Air: 89 PvT: 123 14:15

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.3	11976	22.50	15.17	11.48	7.98	5.91	3.86	2.08
	C	110.1	12072	21.62	14.52	11.01	7.68	5.78	3.81	2.13
	C	110.3	12096	21.45	14.43	10.93	7.64	5.73	3.86	2.13
*	1	56.5	6200	11.94	8.01	6.00	4.01	2.89	1.86	1.04
*	1	56.1	6160	11.94	8.01	6.00	4.05	2.93	1.91	1.13
*	1	56.5	6200	11.90	8.06	6.00	4.05	2.89	1.91	1.04
*	1	56.8	6224	12.07	8.14	6.13	4.14	3.02	1.99	1.21V
*	2	82.8	9080	16.30	11.03	8.31	5.74	4.22	2.82	1.52
*	2	83.0	9104	16.42	11.12	8.40	5.78	4.31	2.86	1.56
*	2	83.0	9104	16.38	11.07	8.31	5.74	4.31	2.86	1.56
*	2	82.8	9072	16.34	11.07	8.35	5.74	4.31	2.86	1.56
*	3	110.1	12080	21.03	14.13	10.67	7.47	5.64	3.81	2.08
*	3	110.6	12128	21.16	14.22	10.71	7.51	5.73	3.90	2.17
*	3	110.4	12104	21.07	14.09	10.63	7.47	5.64	3.81	2.13
*	3	110.4	12112	20.99	14.09	10.63	7.43	5.69	3.86	2.13
*	4	141.3	15496	26.73	17.88	13.45	9.50	7.29	5.03	2.82
*	4	141.2	15480	26.60	17.75	13.37	9.46	7.33	5.03	2.82
*	4	141.6	15520	26.69	17.75	13.37	9.46	7.38	5.07	2.91
*	4	141.3	15488	26.64	17.71	13.37	9.41	7.38	5.11	2.91

Stn: 250 Lane:F1 Temp: J/C: Air: 90 PvT: 126 14:18

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.3	11872	25.30	13.27	9.81	6.67	4.93	3.29	1.91
	C	109.6	12016	24.34	12.93	9.64	6.59	4.93	3.42	2.04
	C	109.7	12032	24.01	12.84	9.55	6.59	4.93	3.42	2.00
*	1	55.8	6120	13.62	7.20	5.23	3.46	2.53	1.69	1.00
*	1	56.5	6208	13.66	7.28	5.31	3.55	2.58	1.73	1.08V
*	1	56.5	6192	13.49	7.20	5.27	3.50	2.53	1.69	1.00
*	1	56.2	6168	13.49	7.20	5.23	3.46	2.49	1.65	0.95
*	2	82.5	9032	18.43	9.91	7.33	5.02	3.73	2.56	1.47
*	2	82.6	9056	18.56	9.95	7.37	5.07	3.78	2.60	1.47
*	2	82.9	9088	18.60	9.95	7.33	4.98	3.73	2.51	1.43
*	2	82.6	9064	18.52	10.00	7.37	5.07	3.78	2.60	1.52
*	3	109.7	12032	23.54	12.67	9.38	6.46	4.89	3.42	2.00
*	3	110.3	12088	23.63	12.71	9.43	6.46	4.93	3.42	2.00
*	3	110.0	12056	23.67	12.71	9.43	6.50	4.98	3.47	2.08
*	3	110.1	12072	23.63	12.71	9.47	6.50	4.98	3.51	2.08
*	4	140.1	15368	29.70	15.99	11.91	8.23	6.27	4.51	2.65
*	4	140.3	15376	29.66	15.94	11.83	8.19	6.22	4.46	2.65
*	4	140.4	15400	29.58	15.90	11.83	8.19	6.22	4.46	2.60
*	4	140.3	15376	29.54	15.90	11.78	8.15	6.22	4.51	2.65

Stn: 275 Lane:F1 Temp: J/C: Air: 90 PvT: 126 14:21

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	107.7	11808	26.48	13.96	10.20	6.92	5.11	3.42	2.00
	C	108.0	11840	24.93	13.31	9.73	6.54	4.93	3.34	1.87
	C	109.1	11960	24.89	13.36	9.85	6.67	5.02	3.47	2.00
*	1	56.1	6152	14.03	7.45	5.36	3.50	2.53	1.65	0.95
*	1	55.9	6144	14.08	7.50	5.36	3.50	2.53	1.65	0.95

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*	1	55.8	6120	13.95	7.41	5.31	3.46	2.49	1.65	0.91
*	1	56.7	6216	14.03	7.50	5.40	3.55	2.53	1.65	0.95
*	2	82.5	9032	19.15	10.30	7.50	5.07	3.73	2.51	1.39
*	2	82.5	9032	19.23	10.38	7.54	5.11	3.82	2.56	1.43
*	2	82.5	9040	19.19	10.38	7.54	5.07	3.82	2.51	1.39
*	2	82.2	9016	19.10	10.34	7.54	5.07	3.82	2.51	1.39
*	3	109.4	11992	24.26	13.19	9.64	6.59	4.98	3.38	1.91
*	3	109.7	12032	24.34	13.27	9.68	6.59	5.02	3.42	1.91
*	3	109.6	12008	24.38	13.27	9.73	6.59	5.07	3.47	1.95
*	3	109.6	12008	24.30	13.27	9.68	6.59	5.02	3.42	1.95
*	4	139.4	15288	30.46	16.72	12.21	8.40	6.36	4.46	2.56V
*	4	139.9	15336	30.58	16.89	12.34	8.57	6.62V	4.68V	2.91V
*	4	139.4	15288	30.46	16.76	12.21	8.44	6.40	4.51	2.60
*	4	139.4	15280	30.46	16.76	12.21	8.40	6.40	4.51	2.60

Stn: 275 Lane:F1 Temp: J/C: Air: 90 PvT: 122 14:24

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.1	11968	25.01	13.14	9.51	6.50	4.93	3.42	1.95
	C	109.6	12008	24.55	13.19	9.60	6.59	4.98	3.42	1.95
	C	110.0	12064	24.47	13.19	9.64	6.54	4.98	3.42	1.95
*	1	55.9	6136	14.12	7.37	5.27	3.46	2.53	1.69	1.00
*	1	56.2	6160	14.12	7.41	5.27	3.46	2.53	1.65	0.95
*	1	56.1	6152	13.99	7.37	5.23	3.46	2.53	1.65	0.95
*	1	56.1	6152	14.03	7.41	5.27	3.42	2.53	1.65	0.95
*	2	82.5	9032	18.98	10.26	7.41	4.98	3.69	2.51	1.39V
*	2	82.6	9064	19.31	10.51	7.67	5.19	3.91	2.73V	1.56V
*	2	82.8	9080	19.15	10.38	7.50	5.07	3.78	2.56	1.43
*	2	82.6	9064	19.31	10.47	7.63	5.15	3.87	2.64	1.52
*	3	109.9	12048	24.09	13.19	9.60	6.54	4.93	3.42	1.91V
*	3	109.9	12040	24.30	13.36	9.77	6.63	5.02	3.51	2.00
*	3	109.6	12016	24.30	13.36	9.73	6.67	5.02	3.51	2.00
*	3	109.9	12040	24.26	13.36	9.77	6.67	5.07	3.51	2.04
*	4	140.3	15384	30.08	16.68	12.21	8.40	6.40	4.55	2.60
*	4	140.1	15376	30.21	16.80	12.30	8.44	6.44	4.51	2.60
*	4	140.1	15360	30.16	16.80	12.30	8.40	6.40	4.51	2.60
*	4	139.9	15336	30.16	16.85	12.34	8.44	6.44	4.51	2.65

Stn: 300 Lane:F1 Temp: J/C: Air: 91 PvT: 127 14:29

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.7	11928	22.79	15.12	11.35	7.77	5.69	3.55	1.91
	C	109.3	11992	22.04	14.56	10.84	7.43	5.47	3.42	1.78
	C	109.4	12000	21.87	14.52	10.84	7.39	5.47	3.47	1.82
*	1	55.9	6136	12.32	8.19	6.04	3.97	2.76	1.69	0.87
*	1	55.8	6112	12.23	8.19	6.00	3.97	2.76	1.69	0.91
*	1	55.9	6128	12.23	8.23	6.08	3.97	2.80	1.73	0.91
*	1	55.9	6136	12.23	8.27	6.08	4.01	2.80	1.73	0.95
*	2	82.3	9024	16.76	11.16	8.31	5.57	4.04	2.47	1.21
*	2	82.2	9008	16.88	11.33	8.44	5.70	4.18	2.64	1.39
*	2	82.3	9032	16.88	11.29	8.40	5.66	4.13	2.60	1.30
*	2	82.3	9024	16.84	11.29	8.44	5.70	4.13	2.60	1.34
*	3	109.4	12000	21.45	14.35	10.67	7.35	5.42	3.47	1.82
*	3	110.3	12088	21.66	14.43	10.75	7.35	5.47	3.47	1.82
*	3	110.3	12088	21.66	14.43	10.80	7.39	5.51	3.55	1.87
*	3	110.4	12104	21.62	14.43	10.75	7.35	5.47	3.51	1.82
*	4	141.6	15520	27.44	18.23	13.58	9.37	7.02	4.59	2.47
*	4	141.6	15536	27.40	18.14	13.50	9.33	6.98	4.55	2.43
*	4	141.6	15520	27.40	18.14	13.50	9.29	6.93	4.55	2.43
*	4	141.6	15520	27.36	18.10	13.45	9.29	6.93	4.55	2.43

Stn: 325 Lane:F1 Temp: J/C: Air: 91 PvT: 130 14:32

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	107.5	11792	22.71	14.56	10.80	7.35	5.24	3.16	1.60
	C	109.0	11944	21.83	13.96	10.33	7.09	5.07	3.12	1.60
	C	109.1	11960	21.66	13.79	10.20	6.97	5.02	3.12	1.65
*	1	55.8	6120	12.32	7.93	5.74	3.76	2.58	1.56	0.82
*	1	55.9	6144	12.36	7.97	5.83	3.80	2.62	1.60	0.87
*	1	56.4	6184	12.23	7.93	5.74	3.76	2.53	1.52	0.82
*	1	56.5	6192	12.36	8.01	5.83	3.84	2.62	1.60	0.91
*	2	82.3	9024	16.84	10.77	7.97	5.36	3.82	2.34	1.21
*	2	82.6	9048	16.88	10.86	8.01	5.40	3.87	2.38	1.30

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*	2	82.3	9024	16.93	10.86	8.01	5.40	3.87	2.38	1.26
*	2	82.3	9024	16.88	10.82	8.01	5.40	3.87	2.34	1.26
*	3	110.3	12096	21.45	13.70	10.20	7.01	5.11	3.21	1.78
*	3	109.6	12016	21.49	13.62	10.15	6.97	5.11	3.21	1.73
*	3	110.4	12104	21.45	13.66	10.11	6.97	5.07	3.16	1.73
*	3	110.0	12056	21.41	13.57	10.07	6.97	5.02	3.16	1.73
*	4	142.2	15584	27.15	17.15	12.72	8.86	6.44	4.16	2.26
*	4	142.3	15608	27.15	17.06	12.64	8.78	6.49	4.16	2.30
*	4	142.5	15616	27.06	17.02	12.64	8.78	6.49	4.16	2.30
*	4	142.0	15576	27.02	16.98	12.60	8.74	6.49	4.16	2.30

Stn: 350 Lane:F1 Temp: J/C: Air: 91 PvT: 130 14:35

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.0	11832	24.55	15.60	11.65	7.98	5.69	3.51	1.87
	C	108.4	11888	23.38	14.91	11.14	7.64	5.51	3.42	1.82
	C	108.6	11904	23.04	14.69	10.97	7.51	5.38	3.34	1.73
*	1	55.7	6096	12.99	8.36	6.08	4.01	2.76	1.65	0.91
*	1	55.5	6088	12.95	8.40	6.13	4.05	2.76	1.69	0.91
*	1	55.8	6120	13.03	8.45	6.17	4.09	2.80	1.69	0.91
*	1	55.9	6128	12.95	8.40	6.13	4.05	2.76	1.65	0.87
*	2	81.7	8968	17.85	11.50	8.53	5.78	4.04	2.51	1.30
*	2	81.7	8968	17.81	11.55	8.57	5.83	4.09	2.51	1.34
*	2	82.2	9016	17.85	11.59	8.57	5.83	4.13	2.56	1.34
*	2	81.9	8984	17.81	11.50	8.53	5.78	4.09	2.51	1.30
*	3	109.6	12008	22.79	14.65	10.93	7.51	5.38	3.38	1.82
*	3	109.6	12016	22.83	14.74	10.97	7.56	5.42	3.42	1.87
*	3	109.0	11952	22.62	14.56	10.84	7.47	5.38	3.38	1.78
*	3	110.0	12072	22.79	14.65	10.93	7.47	5.42	3.38	1.82
*	4	141.4	15504	29.03	18.61	13.84	9.62	7.07	4.55	2.47
*	4	141.7	15544	28.91	18.53	13.80	9.58	7.07	4.51	2.43
*	4	141.3	15496	28.82	18.53	13.75	9.58	7.07	4.59	2.52
*	4	141.4	15512	28.82	18.48	13.75	9.58	7.07	4.55	2.47

Stn: 375 Lane:F1 Temp: J/C: Air: 90 PvT: 127 14:38

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.1	11848	20.11	14.26	10.84	7.47	5.51	3.64	1.95
	C	109.0	11952	19.52	13.66	10.50	7.26	5.42	3.55	1.95
	C	109.0	11952	19.27	13.44	10.37	7.18	5.38	3.55	1.95
*	1	56.4	6184	11.44	7.80	5.87	3.88	2.76	1.69	0.95
*	1	56.2	6176	11.35	7.80	5.83	3.80	2.71	1.69	0.95
*	1	56.7	6208	11.31	7.76	5.83	3.84	2.71	1.69	0.95
*	1	56.2	6176	11.35	7.84	5.91	3.93	2.80	1.78	1.04
*	2	81.6	8952	15.12	10.47	7.97	5.45	4.00	2.56	1.39
*	2	82.3	9032	15.17	10.51	8.01	5.45	4.04	2.56	1.43
*	2	82.8	9072	15.33	10.64	8.18	5.61	4.18	2.73	1.56V
*	2	82.3	9032	15.25	10.56	8.10	5.53	4.09	2.64	1.47
*	3	110.1	12088	19.15	13.23	10.20	7.13	5.33	3.55	1.95
*	3	109.7	12024	19.06	13.14	10.11	7.05	5.33	3.51	1.91
*	3	110.1	12080	19.23	13.19	10.20	7.18	5.42	3.60	2.04
*	3	110.0	12064	19.15	13.06	10.07	7.05	5.33	3.47	1.91
*	4	142.0	15568	24.05	16.29	12.72	9.12	7.02	4.68	2.69
*	4	141.6	15520	23.84	16.12	12.55	8.95	6.89	4.55	2.56
*	4	141.6	15528	23.80	16.03	12.51	8.91	6.89	4.59	2.56
*	4	141.4	15512	23.75	15.90	12.42	8.86	6.85	4.55	2.56

Stn: 400 Lane:F1 Temp: J/C: Air: 91 PvT: 130 14:41

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.1	11848	20.49	13.87	10.54	7.26	5.20	3.34	1.87
	C	109.0	11944	19.73	13.27	10.07	6.92	5.02	3.25	1.78
	C	109.0	11944	19.65	13.19	9.98	6.88	5.02	3.29	1.82
*	1	56.2	6168	11.48	7.67	5.61	3.67	2.53	1.56	0.87
*	1	55.9	6128	11.40	7.71	5.66	3.71	2.62	1.65	0.95
*	1	56.7	6208	11.44	7.67	5.70	3.71	2.58	1.60	0.87
*	1	56.5	6200	11.44	7.67	5.66	3.71	2.58	1.60	0.91
*	2	81.7	8960	15.29	10.21	7.67	5.19	3.69	2.38	1.26
*	2	82.6	9056	15.46	10.38	7.75	5.23	3.78	2.38	1.26
*	2	81.9	8976	15.42	10.30	7.71	5.23	3.78	2.38	1.30
*	2	82.6	9064	15.50	10.34	7.75	5.28	3.78	2.43	1.30
*	3	109.9	12048	19.40	12.93	9.77	6.80	4.98	3.25	1.82
*	3	109.4	11992	19.31	12.84	9.68	6.71	4.93	3.25	1.78
*	3	109.6	12008	19.31	12.80	9.64	6.71	4.93	3.25	1.78

File: C:\FWD\DATA\271016B1.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

*	3	109.4	12000	19.36	12.80	9.68	6.71	4.98	3.29	1.82
*	4	142.0	15568	24.22	15.86	12.04	8.48	6.36	4.29	2.43
*	4	141.3	15488	24.05	15.68	11.91	8.32	6.31	4.29	2.34
*	4	140.9	15448	24.09	15.64	11.87	8.32	6.31	4.33	2.43
*	4	141.0	15456	24.13	15.64	11.87	8.32	6.31	4.33	2.43

Stn: 425 Lane:F1 Temp: [illegible] J/C: [illegible] Air: 91 PvT: 129 14:43

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	107.4	11784	22.33	15.04	10.80	7.01	4.84	3.12	1.73
	C	108.6	11904	21.49	14.31	10.28	6.71	4.71	3.08	1.73
	C	108.6	11896	21.16	14.00	10.03	6.54	4.62	2.99	1.60
*	1	56.2	6168	12.28	8.19	5.76	3.59	2.44	1.47	0.87
*	1	56.2	6168	12.32	8.19	5.78	3.63	2.44	1.47	0.82
*	1	56.2	6168	12.19	8.14	5.74	3.59	2.40	1.47	0.82
*	1	55.9	6136	12.15	8.10	5.74	3.59	2.40	1.47	0.82
*	2	81.6	8952	16.42	10.94	7.84	5.07	3.47	2.25	1.17
*	2	81.9	8976	16.46	11.03	7.88	5.11	3.56	2.30	1.21
*	2	82.3	9032	16.51	11.03	7.93	5.11	3.56	2.30	1.21
*	2	82.2	9008	16.51	11.07	7.93	5.15	3.60	2.34	1.30
*	3	109.9	12040	20.99	13.79	9.90	6.50	4.58	3.08	1.69
*	3	109.0	11944	20.82	13.62	9.81	6.46	4.58	3.03	1.65
*	3	109.1	11976	21.03	13.87	10.03	6.67V	4.80V	3.25V	1.91V
*	3	109.0	11944	20.78	13.62	9.77	6.42	4.58	3.03	1.69
*	4	141.3	15496	26.27	17.02	12.17	8.10	5.87	4.03	2.30
*	4	140.3	15384	26.14	16.93	12.08	8.10	5.96	4.07	2.39
*	4	140.3	15392	26.06	16.76	11.87	7.98	5.82	3.94	2.26
*	4	140.3	15392	26.06	16.76	11.91	7.98	5.87	3.99	2.34

Stn: 450 Lane:F1 Temp: J/C: Air: 90 PvT: 129 14:46

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.1	11856	21.20	14.56	10.67	7.13	5.20	3.42	1.87
	C	109.1	11960	20.36	13.87	10.15	6.84	4.98	3.34	1.82
	C	110.3	12096	20.44	13.79	10.15	6.80	5.02	3.38	1.82
*	1	56.2	6168	11.86	8.01	5.74	3.63	2.53	1.65	0.95
*	1	55.9	6128	11.86	7.97	5.70	3.63	2.53	1.60	0.91
*	1	55.9	6136	11.81	7.97	5.70	3.63	2.53	1.65	0.95
*	1	55.9	6128	11.73	7.93	5.70	3.67	2.53	1.65	0.95
*	2	81.9	8984	16.00	10.73	7.84	5.15	3.73	2.43	1.34
*	2	81.9	8976	16.13	10.82	7.93	5.32	3.82	2.56	1.43
*	2	81.7	8952	16.05	10.73	7.84	5.19	3.73	2.47	1.34
*	2	82.3	9016	16.17	10.77	7.93	5.28	3.82	2.56	1.43
*	3	109.6	12008	20.36	13.44	9.94	6.71	4.93	3.34	1.87
*	3	109.1	11960	20.15	13.27	9.81	6.59	4.84	3.34	1.82
*	3	109.1	11960	20.15	13.31	9.81	6.63	4.93	3.34	1.82
*	3	109.3	11976	20.15	13.36	9.85	6.59	4.93	3.34	1.82
*	4	141.4	15504	25.30	16.63	12.30	8.36	6.31	4.38	2.43
*	4	141.0	15456	25.22	16.55	12.21	8.32	6.27	4.38	2.47
*	4	141.2	15472	25.26	16.59	12.21	8.32	6.27	4.42	2.47
*	4	140.9	15448	25.26	16.50	12.12	8.32	6.27	4.42	2.47

Stn: 475 Lane:F1 Temp: J/C: Air: 90 PvT: 130 14:49

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.8	11928	20.57	14.00	10.50	7.18	5.20	3.29	1.73
	C	109.6	12016	20.07	13.57	10.28	7.01	5.16	3.34	1.78
	C	109.6	12016	19.98	13.44	10.15	6.97	5.16	3.34	1.78
*	1	55.7	6096	11.60	7.84	5.83	3.80	2.67	1.65	0.91
*	1	55.9	6128	11.60	7.84	5.83	3.80	2.67	1.60	0.87
*	1	55.8	6120	11.65	7.89	5.91	3.84	2.71	1.69	0.95
*	1	55.5	6088	11.52	7.76	5.78	3.76	2.67	1.60	0.87
*	2	81.7	8968	15.58	10.47	7.93	5.32	3.82	2.43	1.26
*	2	81.6	8944	15.67	10.56	7.97	5.36	3.87	2.43	1.30
*	2	82.0	9000	15.75	10.56	8.01	5.36	3.91	2.47	1.30
*	2	81.2	8904	15.54	10.47	7.93	5.32	3.87	2.43	1.26
*	3	110.3	12096	19.90	13.23	10.07	6.92	5.11	3.29	1.78
*	3	110.0	12064	19.86	13.10	9.98	6.84	5.02	3.25	1.73
*	3	109.6	12016	19.82	13.14	9.98	6.88	5.07	3.34	1.78
*	3	110.1	12072	19.86	13.10	9.98	6.84	5.11	3.34	1.78
*	4	142.6	15632	24.89	16.20	12.38	8.57	6.44	4.33	2.34
*	4	141.7	15536	24.76	16.07	12.30	8.53	6.49	4.33	2.34
*	4	142.0	15576	24.80	16.07	12.30	8.48	6.49	4.38	2.39
*	4	142.0	15568	24.84	16.07	12.30	8.48	6.53	4.42	2.43

File: C:\FWD\DATA\271018B1.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

(1L) LOW SEVERITY LONGITUDINAL CRACKING

Stn: 500 Lane:F1 Temp: J/C: Air: 90 PvT: 130 14:52

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.1	11848	20.70	14.00	10.54	7.43	5.51	3.55	1.95
	C	109.1	11960	20.36	13.75	10.41	7.47	5.56	3.68	2.13
	C	109.1	11968	20.11	13.66	10.20	7.43	5.60	3.60	2.04
*	1	55.8	6120	11.56	7.89	5.78	4.05	2.93	1.73	0.95
*	1	56.5	6200	11.56	7.89	5.74	4.05	2.93	1.69	0.95
*	1	56.2	6176	11.56	7.93	5.83	4.09	2.93	1.78	1.04
*	1	55.5	6088	11.31	7.71	5.66	3.93	2.80	1.65	0.91
*	2	82.0	9000	15.63	10.64	8.01	5.74	4.27	2.69	1.52
*	2	81.3	8912	15.58	10.64	8.01	5.74	4.22	2.64	1.47
*	2	82.2	9008	15.75	10.77	8.05	5.87	4.31	2.69	1.56
*	2	81.9	8984	15.63	10.64	8.01	5.74	4.27	2.64	1.47
*	3	110.3	12096	19.86	13.36	10.11	7.26	5.56	3.60	2.04
*	3	109.6	12016	19.77	13.27	10.11	7.18	5.42	3.51	1.95
*	3	109.9	12040	19.82	13.31	10.03	7.26	5.51	3.60	2.04
*	3	109.7	12024	19.77	13.23	9.98	7.18	5.51	3.55	2.00
*	4	142.6	15632	24.84	16.42	12.42	9.08	7.02	4.64	2.60
*	4	142.0	15568	24.80	16.42	12.38	9.08	7.07	4.68	2.65
*	4	142.3	15600	24.84	16.37	12.34	9.08	7.11	4.64	2.65
*	4	142.0	15576	24.80	16.29	12.30	9.03	7.07	4.64	2.65

Stn: 520 Lane:F1 Temp: J/C: Air: 90 PvT: 130 14:55

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.0	11840	21.24	14.74	11.31	7.94	5.87	3.68	1.91
	C	109.0	11944	20.70	14.26	10.97	7.77	5.73	3.64	1.87
	C	109.1	11976	20.61	14.22	10.97	7.77	5.73	3.68	1.95
*	1	55.9	6144	11.65	8.14	6.08	4.14	2.93	1.78	0.95
*	1	55.8	6112	11.69	8.10	6.13	4.18	2.93	1.82	1.04
*	1	55.9	6144	11.77	8.19	6.17	4.22	2.93	1.82	1.00
*	1	55.9	6136	11.65	8.10	6.13	4.14	2.89	1.78	0.95
*	2	81.6	8944	16.05	11.16	8.57	6.04	4.36	2.73	1.47
*	2	81.3	8912	16.00	11.07	8.53	5.99	4.36	2.73	1.43
*	2	82.0	8984	16.13	11.16	8.57	5.99	4.40	2.73	1.47
*	2	81.9	8976	16.05	11.12	8.57	5.99	4.36	2.73	1.43
*	3	110.1	12072	20.53	14.00	10.75	7.73	5.73	3.68	1.95
*	3	109.6	12008	20.49	14.05	10.80	7.73	5.73	3.73	1.95
*	3	109.6	12008	20.44	13.87	10.71	7.68	5.73	3.64	1.91
*	3	109.4	12000	20.40	13.83	10.67	7.60	5.69	3.64	1.87
*	4	142.6	15640	25.85	17.45	13.45	9.71	7.29	4.77	2.52
*	4	142.3	15608	25.89	17.41	13.50	9.71	7.38	4.85	2.56
*	4	141.9	15560	25.89	17.28	13.45	9.71	7.42	4.85	2.60
*	4	141.9	15560	25.89	17.24	13.41	9.67	7.38	4.85	2.60

Mileage:-.004 -> .098

EXTRA TEST FOR SMP

File: C:\FWD\DATA\271018B3.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

FWD S/N : 8002-063
Operator ID : PELKEY, BRUCE J.

Stationing...: Feet

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

SHRP TESTING - FLEXIBLE - BASIN TEST (F0,F1,F3)
Sequence: CCC1111222233334444

Stn: -30		Lane:F3	Temp:		J/C:		Air: 87	PvT: 125		15:01
Sto	Hgt psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7	
	C 108.3	11864	19.19	13.53	10.37	7.09	4.98	3.03	1.78	
	C 109.0	11952	18.52	13.10	9.98	6.88	4.89	3.03	1.82	
	C 109.1	11968	18.43	12.97	9.94	6.84	4.93	3.08	1.87	
*	1 56.7	6216	10.93	7.71	5.74	3.76	2.58	1.52	0.95	
*	1 56.2	6160	10.93	7.76	5.78	3.80	2.58	1.56	1.00	
*	1 56.2	6160	10.93	7.71	5.74	3.76	2.58	1.60	1.04	
*	1 55.9	6144	10.85	7.71	5.74	3.76	2.58	1.60	1.00	
*	2 81.6	8952	14.58	10.26	7.80	5.28	3.73	2.34	1.39	
*	2 82.3	9024	14.66	10.26	7.80	5.28	3.69	2.25	1.30	
*	2 82.5	9032	14.66	10.30	7.80	5.32	3.73	2.34	1.39	
*	2 82.2	9016	14.70	10.34	7.88	5.40	3.82	2.43V	1.43	
*	3 109.9	12048	18.31	12.80	9.81	6.80	4.89	3.08	1.87	
*	3 109.4	11992	18.22	12.75	9.77	6.80	4.89	3.12	1.87	
*	3 109.1	11968	18.14	12.62	9.68	6.71	4.80	3.03	1.82	
*	3 109.4	12000	18.14	12.58	9.68	6.71	4.84	3.03	1.82	
*	4 142.3	15600	22.62	15.77	12.08	8.53	6.18	4.03	2.47	
*	4 142.3	15608	22.62	15.73	12.08	8.53	6.22	4.12	2.47	
*	4 142.8	15656	22.75	15.73	12.08	8.57	6.27	4.16	2.56	
*	4 142.3	15608	22.66	15.60	12.00	8.48	6.18	4.07	2.47	

Stn: -25		Lane:F3	Temp:		J/C:		Air: 87	PvT: 126		15:03
Sto	Hgt psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7	
	C 108.3	11872	19.52	13.70	10.50	7.09	4.93	2.95	1.73	
	C 108.8	11928	18.85	13.19	10.07	6.84	4.80	2.95	1.78	
	C 109.3	11984	18.64	12.97	9.98	6.75	4.71	2.90	1.73	
*	1 56.2	6160	10.93	7.71	5.78	3.71	2.44	1.43	0.91	
*	1 56.2	6160	10.93	7.67	5.78	3.67	2.44	1.43	0.87	
*	1 56.1	6152	10.85	7.67	5.74	3.67	2.44	1.43	0.91	
*	1 56.1	6152	10.93	7.71	5.78	3.76	2.49	1.47	0.95	
*	2 82.0	8984	14.66	10.34	7.84	5.28	3.60	2.17	1.34	
*	2 82.3	9032	14.79	10.34	7.93	5.32	3.64	2.21	1.39	
*	2 82.8	9072	14.79	10.34	7.88	5.32	3.64	2.21	1.34	
*	2 82.5	9032	14.70	10.26	7.84	5.23	3.60	2.17	1.30	
*	3 110.0	12064	18.48	12.88	9.90	6.75	4.76	2.99	1.87	
*	3 110.0	12056	18.43	12.80	9.81	6.67	4.67	2.90	1.69	
*	3 109.7	12032	18.35	12.80	9.81	6.67	4.67	2.90	1.73	
*	3 109.6	12016	18.27	12.71	9.73	6.67	4.62	2.90	1.73	
*	4 142.0	15568	22.96	15.94	12.21	8.48	6.09	3.94	2.43	
*	4 142.5	15616	23.00	15.81	12.21	8.48	6.09	3.94	2.43	
*	4 142.3	15608	22.96	15.81	12.17	8.40	6.04	3.94	2.43	
*	4 142.2	15592	22.87	15.77	12.08	8.40	6.04	3.90	2.39	

Stn: -20		Lane:F3	Temp:		J/C		Air: 87	PvT: 123		15:06
Sto	Hgt psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7	
	C 108.1	11856	20.99	12.71	9.55	6.50	4.71	3.03	1.87	
	C 108.0	11848	19.86	12.24	9.30	6.37	4.67	2.99	1.82	
	C 108.1	11856	19.65	12.15	9.25	6.37	4.67	3.03	1.82	
*	1 55.9	6128	11.44	7.20	5.31	3.42	2.40	1.56	1.00	
*	1 55.5	6088	11.48	7.20	5.31	3.42	2.44	1.56	1.00	
*	1 55.7	6104	11.48	7.24	5.31	3.42	2.44	1.52	0.95	
*	1 55.4	6072	11.44	7.20	5.27	3.42	2.44	1.56	1.00	
*	2 81.9	8976	15.54	9.69	7.28	4.90	3.51	2.30	1.34	
*	2 81.7	8968	15.79	9.82	7.37	4.98	3.56	2.34	1.39	
*	2 82.5	9040	15.84	9.82	7.41	4.98	3.60	2.34	1.39	
*	2 82.5	9040	15.79	9.82	7.37	4.98	3.60	2.38	1.43	
*	3 109.1	11976	19.31	12.15	9.25	6.33	4.67	3.08	1.87	

ALL (-) STA.'s ARE EXTRA TESTS FOR SMP

File: C:\FWD\DATA\271018B3.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

*	3	109.3	11984	19.40	12.24	9.25	6.42	4.76	3.12	1.87
*	3	109.3	11984	19.36	12.24	9.25	6.42	4.71	3.08	1.87
*	3	109.1	11960	19.19	12.19	9.25	6.42	4.76	3.12	1.87
*	4	140.3	15384	24.13	14.99	11.48	8.10	6.09	4.12	2.52
*	4	140.4	15400	24.30	14.95	11.44	8.10	6.09	4.07	2.47
*	4	139.9	15344	24.13	14.99	11.40	8.10	6.04	4.12	2.43
*	4	140.3	15392	24.09	15.04	11.44	8.10	6.04	4.12	2.52

Stn: -15 Lane:F3 Temp: J/C: Air: 87 PvT: 122 15:09

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.0	11952	19.73	13.87	10.58	7.22	5.16	3.21	1.87
	C	108.8	11936	19.02	13.31	10.24	7.05	5.07	3.16	1.91
	C	110.0	12056	18.98	13.31	10.20	7.09	5.11	3.25	2.00
*	1	56.2	6176	11.06	7.84	5.87	3.84	2.62	1.65	1.04
*	1	56.1	6152	11.02	7.80	5.83	3.84	2.62	1.60	1.00
*	1	56.2	6160	10.98	7.76	5.78	3.80	2.58	1.56	1.00
*	1	56.1	6144	10.93	7.76	5.78	3.80	2.58	1.56	1.00
*	2	81.9	8968	14.79	10.38	7.86	5.36	3.82	2.38	1.39
*	2	82.8	9072	14.91	10.47	7.97	5.40	3.87	2.38	1.43
*	2	82.5	9040	14.87	10.43	7.93	5.40	3.82	2.38	1.43
*	2	82.3	9016	14.91	10.43	7.97	5.40	3.87	2.38	1.43
*	3	110.0	12056	18.56	12.97	9.94	6.92	5.02	3.21	1.91
*	3	110.3	12096	18.56	13.01	9.98	6.97	5.02	3.21	1.91
*	3	110.0	12056	18.60	12.97	9.98	6.97	5.02	3.21	1.95
*	3	110.0	12064	18.60	13.01	9.98	6.97	5.07	3.25	1.95
*	4	141.9	15552	23.00	15.94	12.30	8.70	6.40	4.20	2.56
*	4	142.0	15576	23.08	15.94	12.34	8.70	6.44	4.25	2.56
*	4	141.9	15560	23.04	15.94	12.25	8.65	6.40	4.25	2.56
*	4	140.1	15360	23.00	15.90	12.21	8.65	6.40	4.25	2.56

Stn: -10 Lane:F3 Temp: J/C: Air: 86 PvT: 122 15:12

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.4	11880	20.65	14.69	10.11	7.05	5.11	3.34	2.30
	C	109.0	11952	19.77	14.09	9.68	6.71	4.80	2.95	1.43
	C	109.1	11968	19.31	13.75	9.51	6.63	4.84	3.16	1.95
*	1	55.7	6096	11.23	7.97	5.27	3.38	2.31	1.43	0.82
*	1	55.7	6104	11.19	8.01	5.31	3.42	2.36	1.47	0.91
*	1	55.9	6128	11.31	8.14	5.40	3.55	2.44	1.52	0.95
*	1	56.4	6176	11.19	8.06	5.31	3.46	2.40	1.47	0.91
*	2	81.9	8984	15.04	10.77	7.37	4.98	3.51	2.25	1.30
*	2	82.5	9032	15.21	10.90	7.45	5.07	3.60	2.30	1.39
*	2	82.5	9040	15.21	10.86	7.41	5.07	3.60	2.34	1.39
*	2	82.6	9056	15.25	10.94	7.45	5.07	3.64	2.34	1.43
*	3	110.0	12064	19.10	13.57	9.47	6.54	4.84	3.16	1.91
*	3	110.3	12096	19.23	13.62	9.51	6.63	4.84	3.21	1.91
*	3	110.4	12104	19.19	13.62	9.51	6.63	4.89	3.21	1.95
*	3	110.1	12080	19.10	13.66	9.47	6.63	4.89	3.21	1.95
*	4	141.4	15512	23.59	16.59	11.78	8.36	6.22	4.20	2.56
*	4	141.9	15552	23.54	16.63	11.63	8.36	6.22	4.16	2.56
*	4	141.7	15544	23.50	16.55	11.78	8.32	6.18	4.16	2.52
*	4	141.3	15496	23.46	16.55	11.70	8.32	6.22	4.20	2.52

'M/TRANS BETWEEN DF2-DF3

Stn: -5 Lane:F3 Temp: J/C: Air: 87 PvT: 122 15:15

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	107.7	11816	19.40	13.96	10.80	7.30	5.24	3.21	1.78
	C	108.6	11896	18.73	13.49	10.45	7.13	5.16	3.21	1.91
	C	108.6	11904	18.43	13.19	10.24	6.92	4.98	3.03	1.65
*	1	55.5	6088	10.89	7.84	5.96	3.80	2.62	1.52	0.82
*	1	55.7	6104	10.81	7.84	5.96	3.80	2.62	1.56	0.91
*	1	55.8	6112	10.85	7.84	6.00	3.88	2.67	1.60	0.95
*	1	55.5	6080	10.77	7.80	5.91	3.80	2.58	1.52	0.87
*	2	82.0	8992	14.62	10.51	8.14	5.40	3.82	2.34	1.30
*	2	82.2	9008	14.75	10.60	8.18	5.53	3.96	2.43	1.43
*	2	82.6	9056	14.75	10.60	8.18	5.49	3.91	2.38	1.34
*	2	82.3	9032	14.70	10.56	8.14	5.49	3.87	2.43	1.43
*	3	109.4	12008	18.27	13.01	10.11	6.88	4.98	3.08	1.69
*	3	109.6	12016	18.39	13.14	10.20	7.01	5.07	3.16	1.78
*	3	109.3	11984	18.35	13.10	10.20	7.01	5.07	3.21	1.82
*	3	109.6	12016	18.31	13.01	10.11	6.97	5.02	3.12	1.78

File: C:\FWD\DATA\271018B3.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

*	4	141.4	15512	22.75	16.12	12.64	8.82	6.53	4.20	2.52
*	4	141.4	15512	22.66	16.03	12.51	8.74	6.44	4.16	2.43
*	4	141.3	15488	22.71	15.99	12.55	8.78	6.53	4.20	2.47
*	4	141.4	15512	22.66	15.94	12.51	8.78	6.49	4.20	2.43

Stn: 0 Lane:F3 Temp: J/C: Air: 87 PvT: 122 15:18

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.0	11952	19.48	14.09	10.93	7.56	5.29	3.25	1.95
	C	109.0	11960	18.77	13.53	10.58	7.39	5.29	3.29	1.95
	C	110.1	12080	18.60	13.44	10.50	7.30	5.16	3.25	1.87
*	1	55.9	6144	10.85	7.89	6.00	3.97	2.67	1.60	0.95
*	1	55.8	6112	10.81	7.84	5.96	3.97	2.67	1.56	0.95
*	1	56.2	6168	10.98	8.01	6.08	4.09	2.76	1.69	1.08V
*	1	55.9	6128	10.89	7.93	6.04	4.01	2.67	1.60	1.04
*	2	81.9	8968	14.66	10.56	8.18	5.61	3.96	2.47	1.43
*	2	82.3	9024	14.70	10.56	8.14	5.57	3.91	2.38	1.34
*	2	82.3	9024	14.75	10.60	8.27	5.70	4.00	2.47	1.43
*	2	82.2	9008	14.66	10.56	8.18	5.61	3.96	2.43	1.39
*	3	110.1	12072	18.27	13.19	10.28	7.22	5.16	3.21	1.87
*	3	110.0	12064	18.31	13.19	10.28	7.22	5.20	3.25	1.87
*	3	109.3	11976	18.27	13.14	10.28	7.22	5.20	3.25	1.91
*	3	109.4	11992	18.27	13.14	10.28	7.22	5.20	3.25	1.95
*	4	142.0	15576	22.79	16.33	12.77	9.12	6.62	4.29	2.52
*	4	142.5	15616	22.75	16.24	12.72	9.12	6.58	4.25	2.47
*	4	142.3	15600	22.75	16.24	12.72	9.08	6.62	4.29	2.56
*	4	142.5	15616	22.71	16.16	12.72	9.08	6.58	4.25	2.47

Stn: 25 Lane:F3 Temp: J/C: Air: 86 PvT: 126 15:23

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.6	12024	20.74	14.31	10.93	7.68	5.56	3.51	2.04
	C	109.6	12024	20.53	14.22	10.93	7.68	5.51	3.47	2.00
	C	109.6	12016	20.57	14.22	10.93	7.68	5.56	3.47	2.04
*	1	55.5	6088	11.90	8.23	6.17	4.14	2.84	1.69	1.00
*	1	55.4	6064	11.81	8.19	6.17	4.09	2.80	1.73	1.04
*	1	55.5	6080	11.81	8.23	6.17	4.14	2.80	1.73	1.00
*	1	55.7	6104	11.90	8.27	6.17	4.14	2.80	1.73	1.00
*	2	80.9	8864	15.96	11.12	8.48	5.87	4.13	2.51	1.43
*	2	81.3	8912	16.05	11.25	8.57	5.91	4.18	2.56	1.43
*	2	81.7	8952	16.13	11.29	8.61	5.99	4.22	2.64	1.47
*	2	81.9	8984	16.13	11.25	8.61	5.91	4.22	2.60	1.47
*	3	109.4	11992	20.36	14.13	10.84	7.60	5.47	3.42	1.95
*	3	109.3	11976	20.36	14.13	10.84	7.64	5.47	3.42	1.95
*	3	109.1	11968	20.36	14.13	10.84	7.64	5.51	3.42	1.95
*	3	109.0	11952	20.40	14.13	10.84	7.68	5.56	3.47	2.00
*	4	142.0	15568	25.47	17.67	13.62	9.71	7.11	4.55	2.65
*	4	142.0	15568	25.51	17.71	13.62	9.71	7.11	4.59	2.73
*	4	141.6	15520	25.47	17.67	13.58	9.67	7.07	4.55	2.69
*	4	141.6	15528	25.51	17.67	13.58	9.71	7.11	4.55	2.69

Stn: 50 Lane:F3 Temp: J/C: Air: 87 PvT: 119 15:25

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.1	11856	20.65	14.65	11.27	7.68	5.56	3.29	1.78
	C	108.7	11920	19.86	14.00	10.80	7.39	5.33	3.29	1.87
	C	108.7	11920	19.69	13.96	10.75	7.43	5.33	3.29	1.78
*	1	55.8	6112	11.10	7.89	5.96	3.97	2.71	1.60	0.87
*	1	55.7	6104	11.19	7.89	5.96	3.93	2.71	1.60	0.87
*	1	55.8	6120	11.19	7.93	6.00	3.97	2.76	1.69	0.91
*	1	55.5	6088	11.06	7.84	5.91	3.93	2.71	1.60	0.87
*	2	81.4	8928	15.42	10.77	8.27	5.61	4.00	2.47	1.30
*	2	82.3	9024	15.58	10.86	8.40	5.74	4.09	2.51	1.30
*	2	81.9	8984	15.50	10.86	8.35	5.70	4.04	2.47	1.30
*	2	82.3	9024	15.54	10.86	8.35	5.70	4.04	2.47	1.30
*	3	109.9	12040	19.65	13.83	10.67	7.35	5.29	3.34	1.82
*	3	110.0	12064	19.69	13.87	10.71	7.39	5.38	3.38	1.82
*	3	110.1	12072	19.77	13.92	10.75	7.43	5.42	3.42	1.87
*	3	110.1	12072	19.77	13.87	10.67	7.39	5.33	3.38	1.87
*	4	141.9	15552	25.22	17.54	13.50	9.37	6.85	4.38	2.43
*	4	142.5	15616	25.39	17.58	13.54	9.46	6.89	4.51	2.52
*	4	142.3	15600	25.30	17.49	13.45	9.37	6.85	4.46	2.47
*	4	142.5	15624	25.26	17.49	13.41	9.37	6.85	4.46	2.52

File: C:\FWD\DATA\271018B3.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

'M/TRANS BETWEEN DF6-DF7

Stn: 75		Lane:F3	Temp:		J/C:	Air: 87		PvT: 124		15:28
Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.9	12040	20.24	14.13	10.84	7.30	5.16	3.03	1.73
	C	110.4	12112	19.48	13.57	10.41	7.05	4.98	3.03	1.73
	C	110.4	12104	19.27	13.40	10.33	7.01	4.98	3.03	1.73
*	1	57.0	6240	11.02	7.76	5.83	3.80	2.62	1.52	0.91
*	1	57.0	6248	11.06	7.76	5.87	3.84	2.62	1.56	0.95
*	1	56.5	6192	11.02	7.71	5.83	3.80	2.58	1.52	0.91
*	1	57.0	6248	11.06	7.76	5.87	3.84	2.62	1.52	0.91
*	2	82.5	9040	15.00	10.47	8.01	5.36	3.78	2.30	1.30
*	2	82.9	9080	15.08	10.56	8.10	5.45	3.87	2.30	1.30
*	2	82.8	9072	15.00	10.47	8.01	5.36	3.78	2.25	1.26
*	2	82.8	9072	15.00	10.51	8.10	5.45	3.87	2.34	1.34
*	3	110.3	12096	18.98	13.23	10.15	6.97	4.98	3.08	1.82
*	3	110.6	12120	19.06	13.23	10.20	6.97	4.98	3.08	1.82
*	3	110.7	12136	19.02	13.19	10.11	6.92	4.93	3.03	1.73
*	3	110.6	12128	19.02	13.19	10.15	6.92	4.93	3.03	1.78
*	4	142.6	15632	24.17	16.55	12.68	8.78	6.40	3.99	2.34
*	4	142.6	15640	24.17	16.50	12.72	8.78	6.40	4.07	2.43
*	4	142.5	15616	24.17	16.46	12.68	8.78	6.40	4.07	2.43
*	4	142.8	15648	24.26	16.50	12.68	8.82	6.44	4.12	2.43

Stn: 100		Lane:F3	Temp:		J/C:	Air: 86		PvT: 122		15:32
Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.9	12048	20.15	13.79	10.54	7.01	4.93	2.86	1.56
	C	110.6	12120	19.40	13.27	10.20	6.88	4.89	2.95	1.69
	C	110.7	12136	19.15	13.10	10.11	6.80	4.80	2.90	1.60
*	1	57.0	6240	11.02	7.63	5.74	3.67	2.49	1.43	0.78
*	1	56.7	6216	11.02	7.63	5.74	3.67	2.53	1.43	0.82
*	1	56.2	6176	10.98	7.58	5.70	3.63	2.44	1.43	0.78
*	1	56.8	6232	11.06	7.63	5.74	3.71	2.53	1.47	0.87
*	2	82.8	9064	14.91	10.30	7.88	5.19	3.64	2.12	1.17
*	2	83.0	9104	15.04	10.38	7.97	5.28	3.69	2.21	1.21
*	2	82.9	9088	14.91	10.34	7.93	5.23	3.69	2.17	1.21
*	2	82.9	9080	14.91	10.30	7.88	5.19	3.64	2.12	1.17
*	3	110.3	12088	18.73	12.88	9.90	6.67	4.80	2.90	1.60
*	3	110.7	12136	18.89	12.93	9.94	6.71	4.84	2.90	1.65
*	3	110.7	12144	18.89	12.97	9.98	6.80	4.89	2.95	1.69
*	3	110.7	12136	18.89	12.88	9.90	6.71	4.84	2.90	1.65
*	4	142.6	15632	23.46	15.94	12.34	8.48	6.16	3.81	2.21
*	4	142.9	15664	23.46	15.94	12.30	8.48	6.22	3.90	2.21
*	4	142.8	15656	23.42	15.90	12.25	8.48	6.18	3.86	2.21
*	4	143.0	15688	23.38	15.81	12.25	8.44	6.18	3.86	2.21

Stn: 125		Lane:F3	Temp:		J/C:	Air: 87		PvT: 126		15:35
Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.9	12048	19.10	13.53	10.33	7.13	5.07	3.03	1.73
	C	110.4	12112	18.35	13.01	9.94	6.88	4.89	3.03	1.69
	C	110.7	12144	18.27	12.97	9.94	6.92	4.98	3.08	1.78
*	1	57.2	6272	10.77	7.58	5.66	3.76	2.53	1.52	0.82
*	1	57.1	6256	10.73	7.54	5.66	3.76	2.53	1.52	0.91
*	1	57.1	6264	10.68	7.58	5.66	3.80	2.58	1.52	0.91
*	1	57.1	6256	10.81	7.67	5.74	3.88	2.67V	1.65	1.00
*	2	82.6	9056	14.33	10.17	7.71	5.32	3.73	2.30	1.30
*	2	83.2	9120	14.45	10.26	7.80	5.32	3.82	2.34	1.30
*	2	83.3	9136	14.41	10.26	7.75	5.28	3.78	2.34	1.26
*	2	83.2	9128	14.45	10.26	7.80	5.36	3.78	2.38	1.30
*	3	110.4	12104	17.97	12.62	9.68	6.80	4.84	2.99	1.69
*	3	110.7	12144	18.01	12.71	9.73	6.80	4.84	2.99	1.73
*	3	110.7	12144	18.06	12.67	9.77	6.80	4.93	3.08	1.78
*	3	110.9	12152	18.06	12.67	9.73	6.80	4.89	3.03	1.73
*	4	142.2	15584	22.54	15.64	12.12	8.57	6.27	3.99	2.30
*	4	142.3	15608	22.50	15.64	12.12	8.57	6.27	4.07	2.34
*	4	142.9	15664	22.58	15.68	12.08	8.57	6.31	4.07	2.34
*	4	142.9	15664	22.66	15.88	12.08	8.61	6.36	4.12	2.43

Stn: 150		Lane:F3	Temp:		J/C:	Air: 86		PvT: 126		15:38
Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7

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	C	110.1	12080	20.15	13.36	10.07	6.63	4.80	3.03	1.78
	C	110.4	12112	19.23	12.75	9.51	6.37	4.76	3.08	1.78
	C	110.4	12104	19.02	12.58	9.47	6.37	4.71	3.08	1.82
*	1	56.5	6200	11.27	7.45	5.36	3.38	2.40	1.52	0.91
*	1	56.2	6176	11.14	7.41	5.31	3.33	2.40	1.52	0.91
*	1	56.5	6200	11.14	7.41	5.27	3.33	2.44	1.52	0.91
*	1	57.1	6264	11.19	7.45	5.36	3.38	2.44	1.56	0.95
*	2	82.5	9040	14.96	9.87	7.28	4.81	3.47	2.25	1.26
*	2	83.0	9104	15.17	10.00	7.37	4.85	3.56	2.30	1.30
*	2	82.8	9072	15.12	10.00	7.33	4.85	3.56	2.30	1.30
*	2	83.3	9136	15.38	10.17	7.54	5.02V	3.73V	2.47V	1.52V
*	3	110.1	12080	18.81	12.41	9.30	6.29	4.67	3.08	1.78
*	3	110.7	12144	18.94	12.54	9.34	6.33	4.76	3.16	1.82
*	3	110.7	12136	18.89	12.58	9.38	6.37	4.76	3.21	1.87
*	3	110.6	12128	18.85	12.50	9.25	6.33	4.71	3.12	1.82
*	4	142.3	15608	23.46	15.47	11.61	8.10	6.13	4.16	2.47
*	4	142.2	15592	23.50	15.34	11.53	8.02	6.09	4.12	2.43
*	4	142.3	15608	23.46	15.38	11.53	8.02	6.09	4.12	2.43
*	4	142.5	15624	23.42	15.34	11.48	8.02	6.09	4.12	2.39

'L/TRANS BETWEEN DF6-DF7 AND M/TRANS AT DF3

Stn: 175 Lane:F3 Temp: J/C: Air: 87 PvT: 128 15:41

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	106.7	11688	18.98	16.33	11.87	7.98	5.60	3.34	1.82
	C	107.7	11800	18.52	15.99	11.70	7.94	5.73	3.55	1.95
	C	107.5	11792	18.18	15.64	11.40	7.73	5.51	3.42	1.87
*	1	57.0	6240	10.43	9.31	6.56	4.22	2.84	1.73	1.00
*	1	56.5	6200	10.43	9.22	6.51	4.18	2.89	1.73	1.00
*	1	56.7	6216	10.43	9.18	6.51	4.18	2.84	1.69	0.95
*	1	57.1	6256	10.52	9.22	6.51	4.18	2.89	1.69	0.95
*	2	82.6	9064	14.29	12.24	8.83	5.83	4.13	2.51	1.34
*	2	83.5	9152	14.58	12.50	8.95	5.99	4.27	2.60	1.43
*	2	84.1	9216	14.62	12.50	8.95	5.99	4.22	2.56	1.39
*	2	83.5	9152	14.58	12.50	9.00	5.99	4.27	2.60	1.43
*	3	107.5	11792	17.89	15.30	11.14	7.60	5.47	3.42	1.87
*	3	107.8	11816	18.01	15.47	11.23	7.68	5.51	3.42	1.87
*	3	107.7	11800	17.93	15.47	11.18	7.64	5.51	3.42	1.87
*	3	107.8	11824	17.89	15.47	11.18	7.73	5.56	3.47	1.91
*	4	139.7	15320	21.95	19.05	13.84	9.71	7.16	4.59	2.56
*	4	140.0	15352	22.08	19.13	13.84	9.71	7.16	4.59	2.56
*	4	140.0	15344	22.16	19.09	13.84	9.67	7.16	4.55	2.56
*	4	140.0	15352	22.25	19.17	13.84	9.71	7.20	4.64	2.60

Stn: 200 Lane:F3 Temp: J/C: Air: 86 PvT: 131 15:44

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.1	12080	20.95	15.30	12.04	8.61	6.27	4.03	2.13
	C	110.7	12136	20.19	14.69	11.57	8.32	6.09	3.99	2.17
	C	110.7	12144	19.98	14.48	11.40	8.15	6.00	3.90	2.00
*	1	56.8	6232	11.94	8.53	6.56	4.47	3.16	1.99	1.08
*	1	57.0	6248	11.94	8.53	6.51	4.43	3.20	1.99	1.04
*	1	57.0	6248	11.94	8.53	6.51	4.43	3.16	1.99	1.08
*	1	56.8	6224	11.90	8.49	6.51	4.43	3.16	1.99	1.04
*	2	82.9	9096	15.75	11.38	8.83	6.21	4.53	2.86	1.47
*	2	82.9	9096	15.75	11.42	8.87	6.25	4.53	2.90	1.52
*	2	83.3	9136	15.79	11.42	8.91	6.25	4.58	2.90	1.52
*	2	83.0	9104	15.79	11.42	8.87	6.29	4.53	2.90	1.52
*	3	110.7	12144	19.73	14.22	11.23	8.06	6.00	3.94	2.13
*	3	111.0	12168	19.86	14.26	11.23	8.10	6.00	3.94	2.08
*	3	111.3	12200	19.86	14.26	11.23	8.10	6.00	3.90	2.08
*	3	111.0	12168	19.77	14.22	11.23	8.10	6.00	3.90	2.08
*	4	142.6	15632	24.51	17.67	13.92	10.22	7.78	5.16	2.86
*	4	143.2	15696	24.51	17.62	13.92	10.17	7.69	5.16	2.82
*	4	142.5	15624	24.47	17.54	13.84	10.17	7.69	5.16	2.82
*	4	143.0	15688	24.51	17.54	13.80	10.13	7.73	5.16	2.82

Stn: 225 Lane:F3 Temp: J/C: Air: 87 PvT: 131 15:47

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.9	12048	20.95	14.65	11.31	8.10	6.00	3.94	2.08
	C	110.4	12112	20.28	14.05	10.93	7.89	6.09	3.99	2.17
	C	110.4	12104	20.03	13.83	10.71	7.77	5.96	3.90	2.04

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*	1	57.1	6256	11.86	8.14	6.13	4.22	3.16	1.99	1.08
*	1	57.2	6280	11.86	8.10	6.13	4.18	3.11	1.95	1.04
*	1	57.8	6336	11.86	8.14	6.13	4.18	3.16	1.91	1.04
*	1	57.0	6240	11.69	8.10	6.08	4.14	3.07	1.95	1.00
*	2	82.5	9040	15.58	10.77	8.27	5.87	4.40	2.86	1.52
*	2	83.5	9160	15.88	10.90	8.40	5.95	4.44	2.95	1.56
*	2	83.5	9160	15.71	10.77	8.27	5.87	4.36	2.86	1.56
*	2	83.8	9184	15.84	10.86	8.35	5.95	4.40	2.95	1.52
*	3	110.4	12112	19.77	13.53	10.50	7.64	5.82	3.90	2.08
*	3	110.7	12144	19.90	13.57	10.54	7.68	5.87	3.94	2.17
*	3	110.7	12144	19.90	13.49	10.50	7.64	5.87	3.94	2.13
*	3	110.9	12160	19.86	13.49	10.54	7.68	5.87	3.99	2.17
*	4	142.0	15568	24.59	16.63	13.02	9.67	7.56	5.11	2.86
*	4	142.6	15640	24.59	16.50	12.98	9.62	7.56	5.16	2.86
*	4	142.3	15608	24.51	16.46	12.90	9.58	7.56	5.16	2.86
*	4	142.5	15624	24.55	16.46	12.94	9.58	7.65	5.20	2.91

'L/TRANS BETWEEN DF6-DF7

Stn: 250 Lane:F3 Temp: J/C: Air: 88 PvT: 131 15:49

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.0	12056	20.49	14.18	11.05	7.94	5.73	3.64	1.95
	C	110.7	12136	19.77	13.62	10.67	7.73	5.69	3.64	2.00
	C	110.6	12120	19.65	13.57	10.63	7.73	5.73	3.68	2.08
*	1	57.0	6240	11.56	7.93	6.04	4.14	2.93	1.86	1.00
*	1	57.2	6280	11.69	8.01	6.08	4.18	2.93	1.86	1.00
*	1	57.2	6280	11.65	7.97	6.04	4.18	2.93	1.86	1.00
*	1	57.2	6272	11.69	8.06	6.13	4.26	3.02	1.95	1.13V
*	2	82.5	9040	15.38	10.56	8.23	5.87	4.27	2.69	1.47
*	2	83.3	9136	15.50	10.64	8.27	5.87	4.27	2.69	1.43
*	2	83.6	9168	15.54	10.69	8.31	5.91	4.27	2.69	1.47
*	2	83.3	9128	15.54	10.60	8.27	5.87	4.27	2.69	1.43
*	3	110.6	12128	19.36	13.27	10.41	7.56	5.60	3.64	2.04
*	3	110.9	12160	19.19	13.06	10.28	7.43	5.42	3.47V	1.82V
*	3	111.2	12184	19.36	13.23	10.41	7.56	5.60	3.64	1.95
*	3	111.3	12208	19.40	13.19	10.41	7.60	5.64	3.68	2.04
*	4	142.2	15592	23.96	16.24	12.90	9.50	7.16	4.77	2.65
*	4	142.5	15616	23.96	16.20	12.85	9.50	7.20	4.77	2.69
*	4	142.9	15664	23.96	16.16	12.81	9.54	7.20	4.77	2.65
*	4	142.9	15672	24.01	16.16	12.85	9.58	7.29	4.85	2.73

Stn: 275 Lane:F3 Temp: J/C: Air: 90 PvT: 130 15:52

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.0	12064	20.19	14.48	11.40	7.85	5.56	3.47	1.82
	C	110.6	12128	19.36	13.83	10.84	7.56	5.47	3.47	1.82
	C	111.0	12168	19.19	13.66	10.71	7.47	5.47	3.47	1.91
*	1	56.5	6200	11.14	8.01	6.13	3.97	2.76	1.69	0.91
*	1	57.2	6288	11.31	8.06	6.17	4.01	2.80	1.73	0.95
*	1	56.7	6216	11.27	7.97	6.08	3.97	2.76	1.69	0.91
*	1	57.1	6256	11.35	8.01	6.13	4.01	2.80	1.73	0.91
*	2	82.9	9088	15.04	10.69	8.35	5.70	4.09	2.56	1.34
*	2	83.5	9152	15.04	10.77	8.44	5.78	4.13	2.60	1.39
*	2	83.0	9112	15.04	10.69	8.35	5.70	4.09	2.56	1.34
*	2	83.3	9144	15.08	10.77	8.40	5.74	4.13	2.60	1.39
*	3	110.1	12080	18.77	13.31	10.50	7.39	5.47	3.51	1.91
*	3	110.9	12152	18.89	13.44	10.56	7.47	5.51	3.60	1.95
*	3	110.9	12160	18.85	13.31	10.54	7.43	5.51	3.55	1.91
*	3	110.9	12160	18.81	13.27	10.50	7.39	5.47	3.55	1.91
*	4	142.2	15584	22.92	16.20	12.90	9.29	6.98	4.59	2.52
*	4	142.6	15632	23.04	16.20	12.90	9.29	7.02	4.64	2.52
*	4	142.9	15672	23.04	16.20	12.90	9.33	7.07	4.68	2.56
*	4	142.9	15672	23.00	16.12	12.81	9.29	7.02	4.64	2.56

Stn: 300 Lane:F3 Temp: J/C: Air: 88 PvT: 128 15:58

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.9	12152	18.98	13.44	10.45	7.26	5.11	3.29	1.91
	C	111.0	12176	18.81	13.36	10.45	7.26	5.11	3.29	1.87
	C	110.9	12160	18.77	13.36	10.45	7.26	5.11	3.29	1.91
*	1	57.1	6256	11.27	8.01	6.13	4.01	2.71	1.69	0.95
*	1	57.1	6256	11.19	7.97	6.04	3.93	2.67	1.60	0.95

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*	1	56.8	6224	11.23	7.97	6.08	3.97	2.71	1.69	1.00
*	1	57.1	6264	11.27	7.97	6.08	3.97	2.67	1.65	0.95
*	2	82.3	9032	14.83	10.47	8.10	5.45	3.78	2.34	1.30
*	2	83.0	9096	15.08	10.64	8.23	5.57	3.82	2.38	1.34
*	2	83.2	9120	15.12	10.73	8.27	5.61	3.82	2.43	1.34
*	2	83.2	9128	15.17	10.73	8.31	5.61	3.87	2.47	1.34
*	3	110.4	12112	18.60	13.19	10.33	7.09	5.02	3.21	1.82
*	3	111.0	12176	18.73	13.36	10.45	7.26	5.16	3.29	1.91
*	3	111.4	12216	18.77	13.31	10.41	7.22	5.07	3.25	1.87
*	3	111.2	12184	18.73	13.27	10.37	7.18	5.02	3.21	1.82
*	4	142.8	15656	23.00	16.24	12.77	8.99	6.49	4.25	2.47
*	4	143.6	15752	23.21	16.29	12.77	8.99	6.44	4.20	2.43
*	4	143.5	15736	23.21	16.33	12.81	9.03	6.49	4.25	2.47
*	4	143.3	15712	23.17	16.29	12.77	8.95	6.44	4.25	2.47

'M/TRANS BETWEEN DF4-DF5

Stn: 325 Lane:F3 Temp: J/C: Air: 90 PvT: 130 16:02

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.4	12112	20.28	14.43	11.10	7.68	5.47	3.25	1.73
	C	111.2	12192	19.56	13.92	10.75	7.47	5.33	3.25	1.78
	C	111.0	12176	19.40	13.79	10.67	7.43	5.33	3.21	1.73
*	1	57.1	6256	11.81	8.40	6.26	4.14	2.80	1.65	0.91
*	1	56.8	6232	11.77	8.36	6.26	4.09	2.76	1.60	0.91
*	1	56.8	6224	11.73	8.32	6.17	4.05	2.71	1.60	0.87
*	1	57.1	6256	11.77	8.36	6.21	4.05	2.76	1.60	0.87
*	2	82.3	9032	15.38	10.99	8.40	5.74	4.04	2.43	1.30
*	2	83.3	9136	15.63	11.16	8.53	5.83	4.09	2.47	1.30
*	2	83.3	9136	15.58	11.12	8.48	5.78	4.09	2.47	1.34
*	2	83.5	9160	15.58	11.07	8.48	5.78	4.04	2.43	1.30
*	3	110.3	12096	19.02	13.49	10.50	7.35	5.29	3.25	1.78
*	3	111.3	12200	19.15	13.57	10.50	7.39	5.29	3.25	1.78
*	3	111.2	12192	19.19	13.62	10.54	7.43	5.33	3.29	1.82
*	3	111.2	12192	19.10	13.49	10.50	7.35	5.29	3.25	1.78
*	4	142.8	15656	23.13	16.37	12.77	9.12	6.76	4.25	2.34
*	4	143.5	15736	23.25	16.33	12.77	9.16	6.76	4.29	2.39
*	4	143.5	15728	23.17	16.33	12.77	9.16	6.80	4.29	2.39
*	4	143.6	15744	23.17	16.24	12.68	9.12	6.76	4.25	2.39

Stn: 350 Lane:F3 Temp: J/C: Air: 90 PvT: 117 16:05

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.7	12032	22.12	15.43	11.78	8.10	5.64	3.38	1.78
	C	110.0	12064	21.24	14.87	11.40	7.89	5.51	3.38	1.82
	C	110.3	12096	21.07	14.78	11.27	7.81	5.51	3.38	1.78
*	1	56.7	6208	12.86	8.96	6.60	4.26	2.89	1.69	0.91
*	1	56.5	6200	12.82	8.92	6.56	4.26	2.93	1.69	0.95
*	1	56.1	6160	12.69	8.83	6.47	4.18	2.89	1.69	0.91
*	1	56.5	6200	12.78	8.92	6.56	4.22	2.84	1.69	0.91
*	2	81.9	8976	16.76	11.72	8.83	5.91	4.13	2.51	1.34
*	2	82.8	9080	16.93	11.89	9.00	6.04	4.22	2.60	1.39
*	2	82.6	9048	16.84	11.72	8.87	5.95	4.18	2.47	1.30
*	2	82.8	9072	16.88	11.85	9.00	5.99	4.22	2.56	1.34
*	3	109.9	12056	20.65	14.39	11.10	7.64	5.51	3.42	1.78
*	3	110.4	12112	20.78	14.48	11.10	7.64	5.47	3.38	1.82
*	3	110.9	12160	20.86	14.52	11.18	7.73	5.51	3.47	1.87
*	3	110.7	12144	20.78	14.43	11.05	7.64	5.56	3.42	1.82
*	4	142.2	15592	25.22	17.54	13.58	9.58	7.02	4.46	2.47
*	4	142.8	15656	25.05	17.36	13.45	9.46	6.93	4.38	2.39
*	4	142.5	15616	25.09	17.36	13.45	9.54	7.02	4.46	2.43
*	4	142.9	15656	25.14	17.41	13.54	9.58	7.02	4.55	2.47

Stn: 375 Lane:F3 Temp: J/C: Air: 91 PvT: 128 16:09

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.3	12088	19.73	14.52	11.23	7.94	5.73	3.68	2.00
	C	110.7	12144	19.19	14.05	10.88	7.73	5.60	3.60	1.95
	C	110.9	12152	19.06	13.87	10.80	7.68	5.56	3.60	2.00
*	1	57.0	6240	11.65	8.40	6.26	4.18	2.89	1.78	0.95
*	1	56.5	6208	11.81	8.49	6.34	4.26	2.93	1.86	1.00
*	1	57.0	6240	11.77	8.45	6.30	4.22	2.93	1.82	0.95
*	1	57.0	6248	11.73	8.40	6.26	4.22	2.93	1.82	0.95
*	2	83.2	9120	15.38	11.12	8.53	5.91	4.18	2.69	1.47

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*	2	83.6	9168	15.42	11.20	8.57	5.99	4.27	2.73	1.52
*	2	83.0	9104	15.38	11.07	8.57	5.99	4.31	2.82V	1.65V
*	2	83.8	9184	15.38	11.07	8.53	5.95	4.22	2.69	1.47
*	3	110.6	12120	18.68	13.53	10.54	7.51	5.47	3.55	1.95
*	3	110.7	12144	18.81	13.57	10.58	7.56	5.51	3.60	2.00
*	3	111.2	12184	18.81	13.53	10.58	7.60	5.51	3.60	2.00
*	3	111.2	12192	18.73	13.53	10.54	7.56	5.51	3.60	2.00
*	4	142.6	15640	22.66	16.29	12.90	9.41	7.02	4.68	2.60
*	4	142.9	15672	22.66	16.29	12.85	9.46	7.07	4.72	2.69
*	4	143.2	15688	22.58	16.12	12.77	9.33	6.98	4.64	2.52
*	4	142.9	15672	22.62	16.20	12.81	9.46	7.07	4.77	2.69

Stn: 400 Lane:F3 Temp: J/C: Air: 91 PvT: 129 16:12

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.6	12016	19.77	14.22	10.97	7.64	5.47	3.38	1.82
	C	110.6	12128	19.31	13.87	10.71	7.51	5.38	3.42	1.82
	C	110.9	12160	19.23	13.79	10.67	7.51	5.42	3.51	1.91
*	1	56.8	6232	11.73	8.32	6.17	4.05	2.76	1.69	0.91
*	1	57.1	6264	11.81	8.40	6.21	4.14	2.80	1.73	0.95
*	1	57.4	6296	11.73	8.36	6.21	4.09	2.76	1.69	0.91
*	1	57.1	6256	11.69	8.32	6.21	4.09	2.76	1.69	0.91
*	2	83.0	9104	15.42	10.94	8.35	5.74	4.04	2.51	1.34
*	2	83.2	9128	15.46	10.99	8.40	5.78	4.09	2.51	1.34
*	2	83.3	9144	15.50	10.99	8.44	5.78	4.09	2.56	1.34
*	2	83.5	9152	15.42	10.90	8.35	5.74	4.04	2.51	1.34
*	3	110.4	12112	18.81	13.40	10.37	7.35	5.29	3.42	1.82
*	3	111.2	12192	18.81	13.44	10.45	7.35	5.38	3.42	1.82
*	3	111.2	12184	18.81	13.40	10.41	7.39	5.38	3.38	1.87
*	3	110.7	12144	18.73	13.36	10.33	7.35	5.33	3.42	1.87
*	4	142.5	15624	22.79	16.07	12.68	9.16	6.89	4.51	2.47
*	4	142.9	15664	22.87	16.12	12.72	9.24	6.93	4.59	2.56
*	4	142.9	15672	22.75	16.03	12.60	9.16	6.85	4.55	2.52
*	4	143.0	15680	22.75	15.94	12.60	9.16	6.85	4.55	2.52

Stn: 425 Lane:F3 Temp: J/C: Air: 91 PvT: 130 16:16

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.9	12048	20.99	14.91	10.93	7.13	5.02	3.16	1.65
	C	110.6	12120	20.07	14.22	10.41	6.92	4.93	3.12	1.69
	C	110.7	12136	19.86	14.05	10.37	6.92	4.98	3.16	1.73
*	1	56.7	6208	11.90	8.53	6.08	3.80	2.62	1.56	0.82
*	1	56.7	6216	11.90	8.53	6.08	3.84	2.58	1.56	0.82
*	1	56.8	6224	11.86	8.53	6.08	3.84	2.58	1.56	0.82
*	1	56.4	6184	11.81	8.53	6.04	3.80	2.53	1.56	0.78
*	2	82.9	9096	15.75	11.20	8.18	5.32	3.78	2.30	1.21
*	2	83.0	9104	15.75	11.25	8.18	5.40	3.82	2.30	1.21
*	2	82.6	9056	15.79	11.29	8.27	5.45	3.91	2.43V	1.30
*	2	82.8	9072	15.71	11.20	8.18	5.36	3.82	2.34	1.26
*	3	110.1	12072	19.44	13.75	10.11	6.84	4.93	3.16	1.73
*	3	110.7	12136	19.40	13.75	10.15	6.84	4.98	3.16	1.73
*	3	110.7	12136	19.40	13.70	10.11	6.80	4.93	3.16	1.69
*	3	110.7	12136	19.40	13.75	10.11	6.88	4.98	3.21	1.78
*	4	142.2	15584	23.59	16.46	12.17	8.44	6.22	4.12	2.26
*	4	142.6	15640	23.59	16.42	12.17	8.44	6.27	4.12	2.26
*	4	142.6	15632	23.50	16.37	12.12	8.44	6.31	4.16	2.30
*	4	142.6	15632	23.46	16.29	12.12	8.40	6.27	4.16	2.26

'M/TRANS BETWEEN DF2-DF3

Stn: 450 Lane:F3 Temp: J/C: Air: 91 PvT: 128 16:20

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.0	12056	20.07	14.13	10.97	7.60	5.56	3.47	1.87
	C	110.9	12160	19.40	13.62	10.63	7.39	5.42	3.47	1.87
	C	110.9	12152	19.23	13.53	10.54	7.35	5.42	3.51	1.87
*	1	56.7	6216	11.60	8.14	6.17	4.05	2.80	1.65	0.91
*	1	56.7	6216	11.52	8.10	6.13	4.01	2.76	1.65	0.87
*	1	56.5	6200	11.56	8.14	6.17	4.05	2.80	1.65	0.91
*	1	56.8	6224	11.52	8.14	6.13	4.01	2.76	1.65	0.87
*	2	82.3	9024	15.25	10.69	8.27	5.61	4.09	2.47	1.34
*	2	83.0	9104	15.38	10.82	8.35	5.70	4.13	2.56	1.39
*	2	83.0	9104	15.33	10.77	8.27	5.66	4.09	2.47	1.34
*	2	83.2	9120	15.38	10.73	8.31	5.66	4.09	2.51	1.34

File: C:\FWD\DATA\271018B3.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
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*	3	110.4	12112	18.81	13.14	10.24	7.18	5.33	3.38	1.82
*	3	110.9	12152	18.94	13.19	10.28	7.22	5.33	3.42	1.82
*	3	111.0	12168	18.89	13.19	10.28	7.22	5.38	3.42	1.82
*	3	110.9	12160	18.94	13.19	10.28	7.22	5.42	3.47	1.91
*	4	142.2	15592	22.87	15.77	12.34	8.86	6.71	4.42	2.39
*	4	142.8	15648	22.87	15.73	12.34	8.86	6.67	4.42	2.43
*	4	142.9	15664	22.92	15.73	12.30	8.82	6.71	4.42	2.43
*	4	142.8	15640	22.92	15.77	12.34	8.86	6.71	4.51	2.47

Stn: 475 Lane:F3 Temp: J/C: Air: 90 PvT: 128 16:22

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.4	12104	19.56	14.18	10.97	7.51	5.47	3.38	1.82
	C	110.9	12160	19.06	13.79	10.71	7.35	5.38	3.38	1.82
	C	110.9	12152	19.02	13.75	10.67	7.39	5.42	3.42	1.87
*	1	56.4	6184	11.44	8.32	6.26	4.05	2.76	1.65	0.87
*	1	56.7	6208	11.44	8.36	6.30	4.09	2.84	1.69	0.91
*	1	56.7	6216	11.48	8.36	6.30	4.14	2.84	1.73	0.95
*	1	57.1	6264	11.52	8.36	6.26	4.09	2.80	1.65	0.91
*	2	82.5	9040	15.12	10.94	8.40	5.66	4.04	2.47	1.30
*	2	82.8	9080	15.17	10.99	8.44	5.74	4.09	2.51	1.34
*	2	82.9	9096	15.21	11.03	8.48	5.74	4.13	2.51	1.34
*	2	83.0	9096	15.25	11.03	8.48	5.78	4.09	2.51	1.39
*	3	110.9	12152	18.64	13.44	10.45	7.26	5.33	3.38	1.78
*	3	111.3	12200	18.81	13.53	10.50	7.30	5.33	3.42	1.82
*	3	111.7	12248	18.85	13.57	10.54	7.35	5.42	3.47	1.91
*	3	111.3	12200	18.81	13.49	10.50	7.35	5.38	3.47	1.87
*	4	143.0	15680	22.75	16.16	12.60	8.99	6.71	4.42	2.39
*	4	143.6	15752	22.87	16.20	12.72	9.08	6.85	4.51	2.47
*	4	143.3	15720	22.79	16.12	12.60	8.99	6.76	4.42	2.39
*	4	143.5	15728	22.83	16.16	12.60	8.99	6.80	4.46	2.43

Stn: 500 Lane:F3 Temp: J/C: Air: 90 PvT: 124 16:25

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	110.1	12072	20.15	14.39	11.23	7.98	5.82	3.77	2.04
	C	110.7	12144	19.65	14.09	11.01	7.89	5.82	3.77	2.08
	C	111.0	12168	19.56	13.96	10.97	7.85	5.82	3.77	2.04
*	1	56.7	6216	11.69	8.27	6.34	4.26	2.98	1.86	1.00
*	1	56.1	6152	11.69	8.32	6.30	4.26	3.02	1.86	1.00
*	1	56.8	6224	11.73	8.36	6.34	4.22	3.02	1.82	1.00
*	1	56.8	6224	11.73	8.32	6.34	4.26	3.07	1.86	1.04
*	2	82.5	9040	15.54	11.07	8.57	5.99	4.36	2.73	1.47
*	2	83.0	9096	15.63	11.16	8.70	6.08	4.44	2.77	1.47
*	2	82.8	9080	15.67	11.16	8.70	6.08	4.49	2.82	1.52
*	2	83.3	9136	15.67	11.16	8.70	6.04	4.44	2.77	1.47
*	3	110.4	12112	19.23	13.66	10.80	7.68	5.78	3.73	2.00
*	3	111.9	12264	19.48	13.79	10.88	7.81	5.87	3.81	2.08
*	3	110.7	12144	19.36	13.70	10.84	7.77	5.82	3.77	2.08
*	3	109.9	12040	19.23	13.53	10.71	7.68	5.73	3.73	2.00
*	4	142.5	15624	23.38	16.46	13.02	9.54	7.29	4.81	2.69
*	4	142.0	15584	23.42	16.46	13.07	9.58	7.38	4.90	2.69
*	4	141.7	15544	23.46	16.46	13.07	9.58	7.33	4.90	2.69
*	4	141.9	15560	23.50	16.42	13.02	9.58	7.33	4.85	2.69

Stn: 505 Lane:F3 Temp: J/C: Air: 90 PvT: 126 16:30

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.3	11992	19.19	13.57	10.67	7.73	5.60	3.64	2.00
	C	110.3	12088	19.15	13.62	10.71	7.77	5.69	3.73	2.04
	C	110.1	12072	19.10	13.62	10.75	7.81	5.69	3.73	2.08
*	1	55.5	6096	11.40	8.06	6.13	4.26	2.89	1.78	0.95
*	1	55.4	6072	11.31	7.97	6.08	4.14	2.84	1.73	0.95
*	1	56.1	6160	11.52	8.23	6.26	4.31	2.98	1.86	1.04
*	1	55.4	6072	11.31	8.06	6.13	4.22	2.84	1.78	0.95
*	2	82.5	9040	15.42	10.90	8.53	6.04	4.31	2.73	1.52
*	2	81.9	8976	15.42	10.90	8.48	5.99	4.27	2.69	1.47
*	2	81.7	8960	15.46	10.94	8.53	6.04	4.36	2.77	1.52
*	2	83.5	9160	15.63	11.12	8.65	6.16	4.40	2.82	1.52
*	3	110.3	12088	19.02	13.53	10.63	7.73	5.64	3.68	2.00
*	3	110.1	12072	19.02	13.53	10.67	7.77	5.69	3.68	2.04
*	3	110.4	12120	19.10	13.57	10.67	7.77	5.64	3.68	2.00
*	3	109.9	12040	19.10	13.57	10.71	7.73	5.69	3.68	2.00

ALL 5+ TESTS ARE FOR SMP

File: C:\FWD\DATA\271018B3.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

*	4	142.9	15664	23.34	16.46	13.07	9.67	7.20	4.85	2.73
*	4	142.2	15592	23.34	16.46	13.02	9.62	7.20	4.81	2.69
*	4	142.5	15624	23.38	16.50	13.07	9.67	7.20	4.81	2.73
*	4	142.6	15632	23.46	16.46	13.02	9.62	7.25	4.85	2.69

Stn: 510 Lane:F3 Temp: J/C: Air: 91 PvT: 126 16:33

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.8	11936	20.61	14.52	11.44	8.06	5.91	3.68	1.87
	C	109.7	12032	19.94	14.09	11.18	7.89	5.82	3.64	1.95
	C	110.0	12056	19.77	13.96	11.05	7.85	5.82	3.64	1.95
*	1	55.4	6064	11.56	8.19	6.30	4.22	2.98	1.82	0.95
*	1	55.9	6128	11.69	8.32	6.43	4.31	3.07	1.86	1.00
*	1	55.7	6096	11.52	8.19	6.30	4.22	2.98	1.78	0.95
*	1	55.9	6136	11.69	8.32	6.43	4.35	3.11	1.91	1.04
*	2	81.4	8936	15.58	11.03	8.65	6.08	4.31	2.69	1.43
*	2	82.3	9024	15.79	11.20	8.74	6.16	4.40	2.77	1.47
*	2	81.9	8984	15.67	11.07	8.65	6.08	4.36	2.69	1.43
*	2	81.7	8960	15.71	11.20	8.78	6.21	4.44	2.77	1.52
*	3	110.0	12056	19.36	13.66	10.84	7.77	5.73	3.64	1.91
*	3	110.7	12136	19.48	13.79	10.88	7.81	5.82	3.68	1.95
*	3	110.3	12088	19.44	13.66	10.84	7.77	5.78	3.68	1.95
*	3	110.0	12064	19.40	13.66	10.84	7.73	5.78	3.68	1.95
*	4	143.0	15680	24.01	16.68	13.28	9.71	7.33	4.77	2.60
*	4	142.2	15592	24.01	16.68	13.24	9.58	7.56	4.77	2.60
*	4	142.6	15632	24.01	16.59	13.20	9.62	7.38	4.81	2.60
*	4	142.6	15640	24.05	16.55	13.20	9.58	7.47	4.81	2.60

Stn: 515 Lane:F3 Temp: J/C: Air: 90 PvT: 122 16:36

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	108.4	11888	21.70	15.12	11.61	8.27	6.04	3.81	2.04
	C	109.1	11960	20.91	14.65	11.40	8.10	5.96	3.73	1.95
	C	109.0	11944	20.70	14.56	11.35	8.10	6.00	3.81	2.08
*	1	54.6	5992	11.98	8.45	6.34	4.31	3.02	1.82	0.95
*	1	55.7	6112	12.15	8.66	6.51	4.47	3.16	1.99	1.04
*	1	54.8	6008	11.94	8.49	6.43	4.39	3.07	1.86	1.04
*	1	55.1	6032	12.02	8.57	6.47	4.47	3.16	1.99	1.08
*	2	81.3	8920	16.34	11.50	8.78	6.21	4.49	2.73	1.43
*	2	81.0	8880	16.30	11.46	8.87	6.21	4.49	2.69	1.43
*	2	81.6	8944	16.38	11.55	8.91	6.25	4.49	2.77	1.43
*	2	81.3	8912	16.38	11.59	8.91	6.29	4.58	2.82	1.52
*	3	110.0	12064	20.40	14.35	11.10	8.02	5.91	3.73	1.95
*	3	110.3	12096	20.49	14.39	11.18	8.06	5.96	3.73	1.95
*	3	109.3	11976	20.36	14.31	11.14	8.02	5.91	3.73	1.95
*	3	109.7	12024	20.36	14.26	11.14	8.02	5.91	3.73	1.95
*	4	142.5	15624	24.97	17.41	13.62	9.96	7.47	4.85	2.56
*	4	142.2	15584	24.97	17.41	13.71	10.00	7.56	4.94	2.65
*	4	142.2	15592	24.93	17.36	13.67	10.00	7.51	4.85	2.60
*	4	142.5	15624	24.89	17.32	13.67	10.00	7.56	4.90	2.65

Stn: 520 Lane:F3 Temp: J/C: Air: 90 PvT: 122 16:40

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.1	11960	19.82	14.82	11.57	8.32	6.00	3.68	1.91
	C	109.7	12024	19.36	14.39	11.31	8.10	5.87	3.60	1.87
	C	109.6	12016	19.19	14.26	11.27	8.06	5.91	3.60	1.87
*	1	55.8	6120	11.27	8.45	6.43	4.43	3.07	1.86	1.08
*	1	55.5	6096	11.23	8.36	6.43	4.39	3.11	1.86	1.04
*	1	55.5	6080	11.19	8.32	6.38	4.35	3.02	1.78	0.95
*	1	55.4	6064	11.10	8.27	6.38	4.31	3.07	1.82	1.00
*	2	81.7	8960	15.17	11.29	8.83	6.21	4.53	2.73	1.47
*	2	81.6	8952	15.21	11.29	8.78	6.25	4.40	2.69	1.39
*	2	81.9	8984	15.25	11.25	8.83	6.21	4.49	2.69	1.39
*	2	82.6	9056	15.38	11.38	8.87	6.25	4.53	2.73	1.43
*	3	110.3	12088	19.02	14.05	11.05	7.98	5.87	3.64	1.91
*	3	110.3	12096	18.98	14.05	11.10	8.02	5.91	3.64	1.91
*	3	110.3	12088	18.98	13.96	11.01	7.98	5.87	3.60	1.87
*	3	110.4	12104	18.89	13.96	11.01	7.98	5.87	3.64	1.87
*	4	142.2	15592	23.29	17.06	13.58	9.96	7.42	4.72	2.47
*	4	142.0	15576	23.38	17.06	13.58	10.00	7.51	4.77	2.52
*	4	142.3	15608	23.38	17.02	13.54	9.96	7.47	4.81	2.52
*	4	142.6	15648	23.38	16.98	13.54	9.96	7.51	4.77	2.52

File: C:\FWD\DATA\271018B3.FWD
Road: US-10 EASTBOUND LANES, 5 MILES NORTH OF LITTLE FALLS, MN.
Subsection: 271018

Stn: 525 Lane:F3 Temp: J/C: Air: 90 PvT: 122 16:42

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	107.7	11808	21.32	15.90	11.91	8.10	5.82	3.68	1.95
	C	108.4	11880	20.65	15.47	11.61	7.98	5.78	3.68	2.00
	C	108.3	11864	20.49	15.43	11.53	7.98	5.78	3.73	2.00
*	1	55.5	6088	12.15	8.92	6.51	4.22	2.93	1.86	1.04
*	1	55.7	6104	12.19	8.96	6.51	4.22	2.98	1.91	1.08
*	1	55.8	6120	12.15	8.96	6.51	4.22	2.93	1.86	1.00
*	1	56.1	6144	12.32	9.01	6.51	4.22	2.98	1.86	1.00
*	2	82.2	9016	16.59	12.15	9.04	6.08	4.40	2.77	1.47
*	2	82.2	9016	16.59	12.15	9.04	6.12	4.36	2.77	1.43
*	2	82.2	9008	16.59	12.11	9.00	6.12	4.36	2.77	1.47
*	2	82.3	9024	16.67	12.15	9.04	6.12	4.40	2.82	1.52
*	3	109.0	11952	20.19	15.08	11.35	7.85	5.78	3.73	2.00
*	3	108.1	11856	20.15	15.04	11.35	7.85	5.82	3.73	2.04
*	3	109.0	11944	20.19	15.08	11.35	7.89	5.82	3.73	2.00
*	3	109.1	11968	20.15	15.08	11.31	7.85	5.78	3.73	2.00
*	4	139.4	15280	24.76	18.36	13.88	9.84	7.38	4.85	2.60
*	4	139.6	15296	24.80	18.40	13.97	9.92	7.47	4.98	2.73
*	4	139.4	15288	24.76	18.31	13.92	9.92	7.42	4.94	2.65
*	4	139.6	15296	24.80	18.31	13.92	9.92	7.47	4.98	2.69

'M/TRANS AT D1

Stn: 530 Lane:F3 Temp: J/C: Air: 90 PvT: 118 16:48

Sto	Hgt	psi	lbf	Df1	Df2	Df3	Df4	Df5	Df6	Df7
	C	109.6	12016	20.15	14.61	11.18	7.94	5.78	3.81	2.08
	C	109.6	12024	19.86	14.56	11.23	7.98	5.78	3.86	2.08
	C	110.1	12080	19.90	14.56	11.27	8.02	5.87	3.86	2.08
*	1	56.1	6152	11.60	8.49	6.34	4.22	2.89	1.86	1.04
*	1	55.4	6072	11.48	8.45	6.30	4.22	2.84	1.91	1.13
*	1	55.7	6112	11.52	8.45	6.30	4.22	2.89	1.86	1.08
*	1	55.5	6080	11.52	8.49	6.34	4.22	2.93	1.91	1.13
*	2	81.6	8952	15.38V	11.25V	8.48V	5.87V	4.04V	2.60V	1.43V
*	2	81.9	8976	15.75	11.63	8.87	6.16	4.36	2.90	1.60
*	2	81.7	8968	15.75	11.59	8.83	6.12	4.31	2.82	1.52
*	2	81.9	8976	15.84	11.59	8.87	6.12	4.36	2.90	1.56
*	3	110.3	12088	19.77	14.52	11.23	8.02	5.82	3.90	2.13
*	3	109.9	12048	19.73	14.43	11.14	7.94	5.78	3.81	2.04
*	3	110.1	12080	19.77	14.43	11.18	7.98	5.87	3.86	2.08
*	3	110.0	12064	19.77	14.43	11.18	7.98	5.87	3.86	2.08
*	4	142.9	15664	24.34	17.75	13.84	10.05	7.47	4.98	2.73
*	4	143.5	15736	24.34	17.80	13.84	10.09	7.56	5.03	2.78
*	4	143.3	15720	24.38	17.84	13.92	10.13	7.60	5.11	2.86
*	4	143.2	15704	24.38	17.75	13.88	10.09	7.60	5.07	2.78

Mileage:-.006 -> .1

Summary of Data for section 271018B
Analyzed by: ROBERT VAN SAMBEEK on 08-11-1993

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	1.8501	1.3176	0.9829	0.6486	0.4485	0.2736	0.1549
	2	1.6988	1.2059	0.9187	0.6291	0.4486	0.2795	0.1537
	3	1.5825	1.1208	0.8627	0.6053	0.4417	0.2815	0.1565
	4	1.5130	1.0613	0.8220	0.5879	0.4383	0.2873	0.1625

Standard Deviations

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	0.0814	0.0729	0.0567	0.0463	0.0359	0.0252	0.0116
	2	0.0678	0.0646	0.0512	0.0429	0.0331	0.0227	0.0096
	3	0.0583	0.0621	0.0481	0.0411	0.0333	0.0239	0.0094
	4	0.0588	0.0596	0.0449	0.0387	0.0331	0.0233	0.0099

Coefficient of Variation

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	4.40%	5.53%	5.77%	7.15%	8.01%	9.21%	7.51%
	2	3.99%	5.35%	5.57%	6.81%	7.39%	8.11%	6.27%
	3	3.68%	5.54%	5.57%	6.78%	7.55%	8.48%	5.99%
	4	3.89%	5.61%	5.46%	6.59%	7.56%	8.12%	6.07%

Flexible Pavement Deflection Statistics - 271018B
Subsection 1
Subsection begins at station 0
Subsection ends at station 180

Mean Values (mils/kip)

;st)c.	Drop Ht	CORRECTED Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	1.2857	1.2736	0.9405	0.6144	0.4195	0.2552	0.1572
	2	1.1830	1.1668	0.8790	0.5972	0.4220	0.2633	0.1544
	3	1.1051	1.0882	0.8270	0.5743	0.4147	0.2633	0.1555
	4	1.0627	1.0378	0.7933	0.5605	0.4116	0.2701	0.1622

Standard Deviations

;st)c.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	0.0466	0.0503	0.0517	0.0404	0.0244	0.0146	0.0088
	2	0.0464	0.0498	0.0469	0.0358	0.0250	0.0132	0.0041
	3	0.0462	0.0486	0.0421	0.0331	0.0229	0.0126	0.0063
	4	0.0476	0.0485	0.0409	0.0313	0.0219	0.0117	0.0053

Coefficient of Variation

est oc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	3.62%	3.95%	5.50%	6.58%	5.81%	5.74%	5.62%
	2	3.92%	4.27%	5.33%	5.99%	5.93%	5.01%	2.63%
	3	4.18%	4.47%	5.09%	5.76%	5.52%	4.78%	4.08%
	4	4.48%	4.67%	5.16%	5.58%	5.33%	4.34%	3.28%

Flexible Pavement Deflection Statistics - 271018B
Subsection 2
Subsection begins at station 180
Subsection ends at station 500

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	1.2786	1.3318	0.9965	0.6596	0.4578	0.2795	0.1542
	2	1.1713	1.2185	0.9315	0.6393	0.4572	0.2847	0.1535
	3	1.0887	1.1312	0.8742	0.6152	0.4503	0.2874	0.1568
	4	1.0383	1.0689	0.8311	0.5967	0.4469	0.2927	0.1626

Standard Deviations

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	0.0491	0.0741	0.0521	0.0433	0.0343	0.0252	0.0125
	2	0.0423	0.0645	0.0465	0.0404	0.0311	0.0228	0.0109
	3	0.0415	0.0631	0.0448	0.0388	0.0318	0.0238	0.0103
	4	0.0478	0.0616	0.0429	0.0372	0.0318	0.0236	0.0110

Coefficient of Variation

Test Loc.	Drop Ht	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7
3	1	3.84%	5.56%	5.23%	6.56%	7.49%	9.00%	8.09%
	2	3.61%	5.29%	4.99%	6.31%	6.81%	8.00%	7.10%
	3	3.81%	5.58%	5.12%	6.31%	7.06%	8.28%	6.54%
	4	4.60%	5.77%	5.16%	6.23%	7.12%	8.05%	6.77%

Outlier Statistics - 271018B

Subsection 1

Station	Height	Sensor	Number of Std. Dev.
25	1	1	2.06
25	3	1	2.14
25	4	1	2.04
25	4	2	2.05
25	4	4	2.03
25	4	5	2.06
25	4	7	2.04

Subsection 2

Station	Height	Sensor	Number of Std. Dev.
50	4	1	2.25
100	2	6	-2.08
100	2	7	-2.06
100	3	7	-2.05
150	1	3	-2.67
150	1	4	-2.76
150	2	3	-2.57
150	2	4	-2.53
150	2	5	-2.03
150	3	3	-2.36
150	3	4	-2.40
150	4	3	-2.14
150	4	4	-2.19
175	1	2	2.03
175	2	2	2.19
175	3	2	2.78
175	4	2	2.87
350	1	1	2.56
350	2	1	2.21
525	3	2	2.09
525	4	2	2.12
530	1	7	2.02

Pavement Construction Information - 271018B

Material Code	Material Name	Layer Thickness
700	Asphaltic Concrete	4.4
302	Uncrushed Gravel	5.2

Depth to rigid foundation: 100.0 ft.

FLEXIBLE Pavement Thickness Data - 271018B
(comparison of each calculation to the expected value)

Minimum expected SN value: 1.90
Maximum expected SN value: 2.86

Height	Station	Effective SN
1	-30	2.90
2	-30	3.00
3	-30	3.20
4	-30	3.35
2	-25	2.95
3	-25	3.10
4	-25	3.30
3	-20	3.05
4	-20	3.20
1	-15	2.90
2	-15	3.05
3	-15	3.20
4	-15	3.35
2	-10	2.95
3	-10	3.15
4	-10	3.30
2	-5	3.00
3	-5	3.10
4	-5	3.35
1	0	2.90
2	0	3.05
3	0	3.25
4	0	3.35
3	25	3.00
4	25	3.15
2	50	2.95
3	50	3.05
4	50	3.10
2	75	2.90
3	75	3.05
4	75	3.15
2	100	2.90

FLEXIBLE Pavement Thickness Data - 271018B

Height	Station	Effective SN
3	100	2.95
4	100	3.10
2	125	3.00
3	125	3.15
4	125	3.30
2	150	2.90
3	150	3.10
4	150	3.25
1	175	2.95
2	175	3.15
3	175	3.25
4	175	3.45
2	200	3.05
3	200	3.25
4	200	3.40
2	225	3.10
3	225	3.25
4	225	3.35
1	250	2.90
2	250	3.10
3	250	3.30
4	250	3.45
1	275	2.90
2	275	3.15
3	275	3.35
4	275	3.50
1	300	2.90
2	300	3.05
3	300	3.25
4	300	3.40
2	325	3.05
3	325	3.20
4	325	3.35
2	350	2.90
3	350	3.05
4	350	3.20
2	375	3.15
3	375	3.35
4	375	3.60
2	400	3.05
3	400	3.30
4	400	3.50
2	425	2.95
3	425	3.10
4	425	3.30
2	450	3.05
3	450	3.30
4	450	3.45
2	475	3.10

FLEXIBLE Pavement Thickness Data - 271018B

Height	Station	Effective SN
3	475	3.30
4	475	3.50
1	500	2.90
2	500	3.15
3	500	3.35
4	500	3.55
1	505	2.90
2	505	3.15
3	505	3.35
4	505	3.55
1	510	2.90
2	510	3.10
3	510	3.30
4	510	3.45
2	515	3.05
3	515	3.20
4	515	3.40
1	520	3.00
2	520	3.25
3	520	3.40
4	520	3.55
2	525	3.00
3	525	3.25
4	525	3.40
1	530	3.00
2	530	3.15
3	530	3.35
4	530	3.50

FLEXIBLE Pavement Thickness Statistics - 271018B

Drop height 1

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-30	24945	2.90
	-25	27280	2.80
	-20	24904	2.75
	-15	24589	2.90
	-10	27525	2.70
	-5	27626	2.75
	0	24631	2.90
	25	24293	2.70
2	50	25801	2.80
	75	27316	2.80
	100	28968	2.70
	125	27749	2.85
	150	27220	2.75
	175	25760	2.95
	200	22686	2.85
	225	23265	2.85
	250	24014	2.90
	275	25947	2.90
	300	26186	2.90
	325	26209	2.80
	350	24665	2.65
	375	24539	2.85
	400	26222	2.80
	425	26755	2.75
	450	25569	2.85
	475	25484	2.85
	500	24123	2.90
	505	24578	2.90
	510	23214	2.90
	515	22699	2.85
	520	23521	3.00
	525	23575	2.80
	530	22483	3.00
Subsection 1 Overall Mean:		25724	2.80
Standard Deviation:		1468	0.09
Coeff Of Variation:		5.71%	3.17%
Subsection 2 Overall Mean:		25142	2.85
Standard Deviation:		1742	0.08
Coeff Of Variation:		6.93%	2.91%

FLEXIBLE Pavement Thickness Statistics - 271018B

Drop height 2

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-30	26365	3.00
	-25	27124	2.95
	-20	26175	2.85
	-15	25628	3.05
	-10	26430	2.95
	-5	26460	3.00
	0	25988	3.05
	25	24831	2.85
2	50	25164	2.95
	75	28122	2.90
	100	28571	2.90
	125	27827	3.00
	150	27248	2.90
	175	25236	3.15
	200	22802	3.05
	225	22756	3.10
	250	24421	3.10
	275	25417	3.15
	300	27073	3.05
	325	25607	3.05
	350	24578	2.90
	375	24128	3.15
	400	25782	3.05
	425	26955	2.95
	450	25669	3.05
	475	25601	3.10
	500	23662	3.15
	505	23691	3.15
	510	23730	3.10
	515	22624	3.05
	520	22708	3.25
	525	23406	3.00
	530	23112	3.15
Subsection 1 Overall Mean:		26125	2.96
Standard Deviation:		676	0.08
Coeff Of Variation:		2.59%	2.67%
Subsection 2 Overall Mean:		25036	3.05
Standard Deviation:		1814	0.10
Coeff Of Variation:		7.24%	3.17%

FLEXIBLE Pavement Thickness Statistics - 271018B

Drop height 3

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-30	26233	3.20
	-25	27669	3.10
	-20	25827	3.05
	-15	25217	3.20
	-10	25254	3.15
	-5	27338	3.10
	0	25525	3.25
	25	24602	3.00
2	50	25636	3.05
	75	27342	3.05
	100	29645	2.95
	125	28247	3.15
	150	26822	3.10
	175	24764	3.25
	200	22481	3.25
	225	22308	3.25
	250	24312	3.30
	275	24606	3.35
	300	26461	3.25
	325	26748	3.20
	350	25322	3.05
	375	24421	3.35
	400	25614	3.30
	425	27336	3.10
	450	25506	3.30
	475	25521	3.30
	500	23327	3.35
	505	23694	3.35
	510	23766	3.30
	515	23315	3.20
	520	23331	3.40
	525	23121	3.25
	530	22648	3.35
Subsection 1 Overall Mean:		25958	3.13
Standard Deviation:		1069	0.08
Coeff Of Variation:		4.12%	2.69%
Subsection 2 Overall Mean:		25052	3.23
Standard Deviation:		1917	0.12
Coeff Of Variation:		7.65%	3.71%

FLEXIBLE Pavement Thickness Statistics - 271018B

Drop height 4

Subsection	Station	Subgrade Modulus	Effective SN
No test pit data found, therefore no results exist...			
1	-30	25270	3.35
	-25	25989	3.30
	-20	24960	3.20
	-15	24437	3.35
	-10	24651	3.30
	-5	25394	3.35
	0	25118	3.35
	25	23308	3.15
2	50	25192	3.10
	75	26188	3.15
	100	28574	3.10
	125	26793	3.30
	150	25902	3.25
	175	24075	3.45
	200	22005	3.40
	225	21918	3.35
	250	23530	3.45
	275	24305	3.50
	300	25760	3.40
	325	26393	3.35
	350	25188	3.20
	375	24029	3.60
	400	24776	3.50
	425	27020	3.30
	450	25304	3.45
	475	25378	3.50
	500	23146	3.55
	505	23258	3.55
	510	23570	3.45
	515	23096	3.40
	520	23632	3.55
	525	22427	3.40
	530	22529	3.50
Subsection 1 Overall Mean:		24891	3.29
Standard Deviation:		795	0.08
Coeff Of Variation:		3.20%	2.36%
Subsection 2 Overall Mean:		24559	3.39
Standard Deviation:		1707	0.14
Coeff Of Variation:		6.95%	4.19%

UBSECTION AT STA.180 EVEN THOUGH STATS INDICATED UNIFORM SUBSECTIONS
HOULD NOT HAVE BROKEN INTO SUBSECTIONS

Summary of Results

Section uniformity:
  Subsections were identified within the section.
    Subsection 1 boundaries occur at   0 ft. and 180 ft.
    Subsection 2 boundaries occur at 180 ft. and 500 ft.

  Comparing subsections:
    Subsections 1 and 2: EQUAL means and EQUAL variances.

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

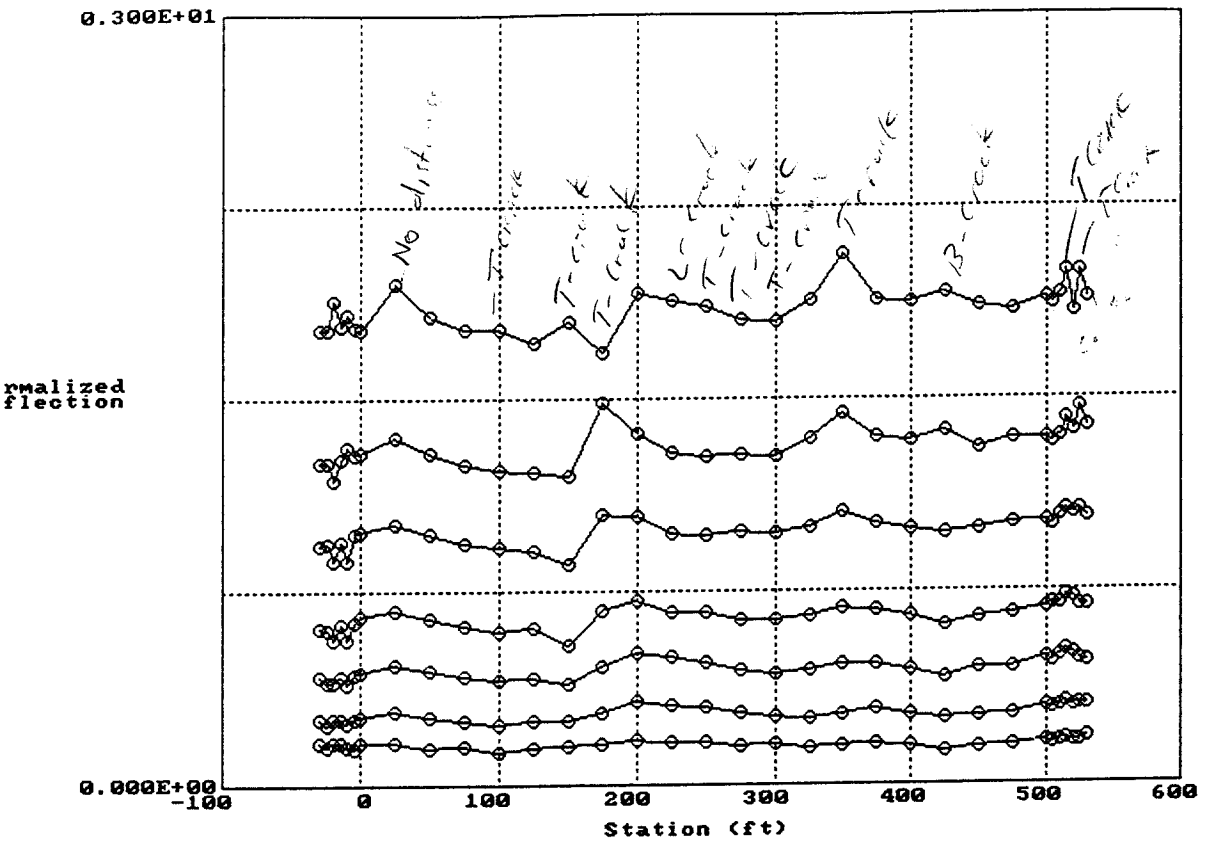
Outliers - Section data: 924 total combinations within the section
    7 height/sensor/station combinations are data outliers in subsection 1.
   22 height/sensor/station combinations are data outliers in subsection 2.

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: 132 total combinations within the section
  %109 height/station combinations are NOT within the range of expected values

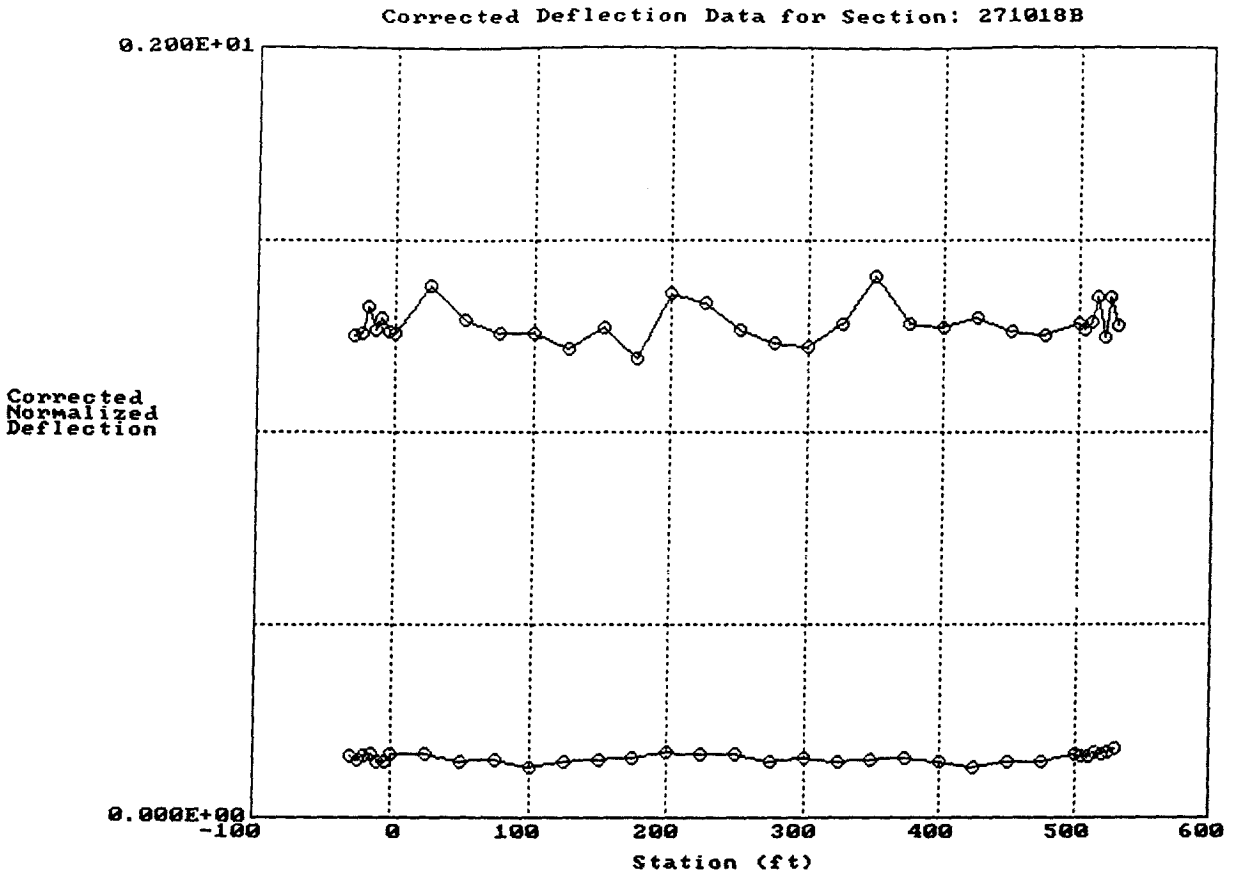
Subgrade response:
  132 height/station combinations exhibit linear response.

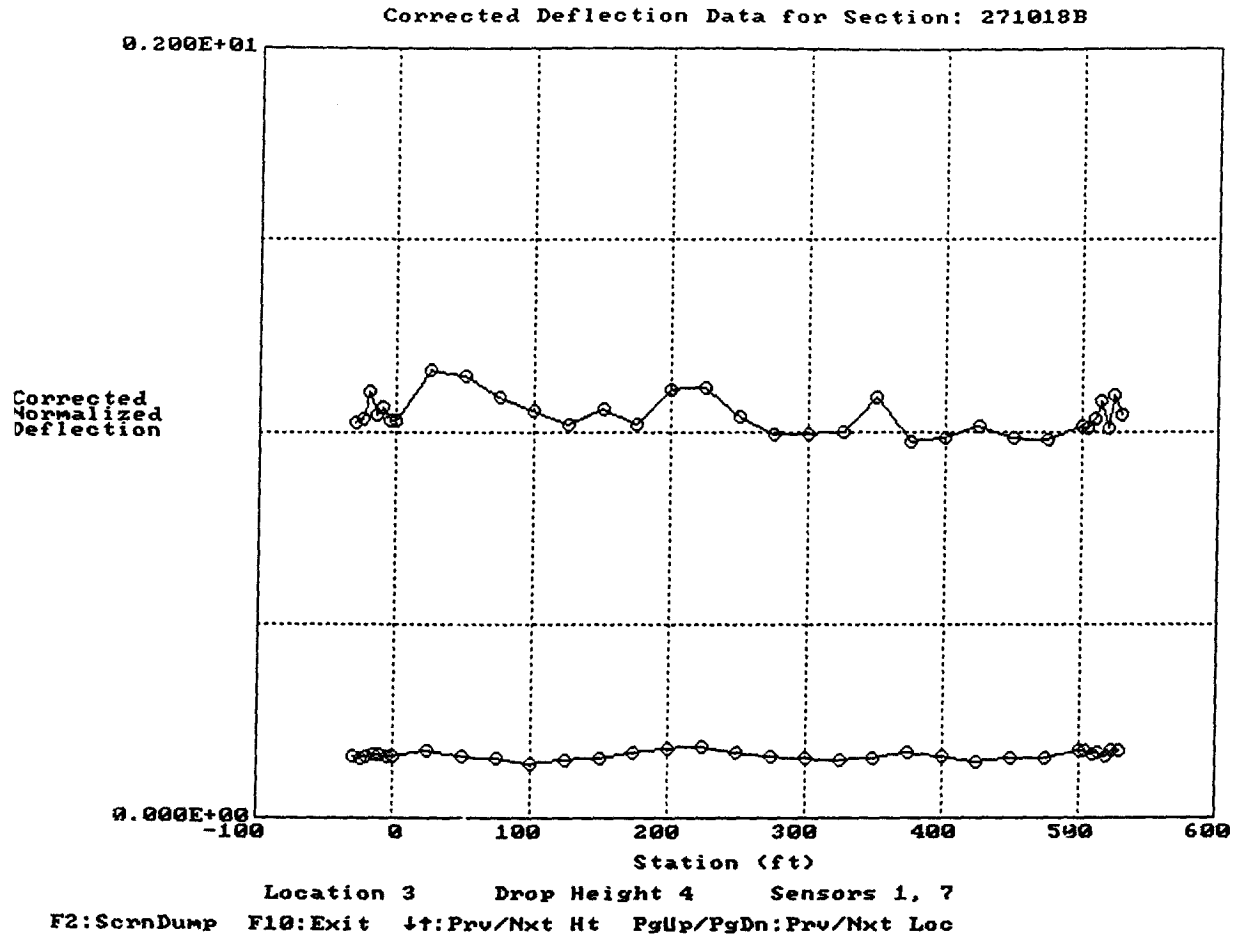
Deflection Data for Section: 271018B

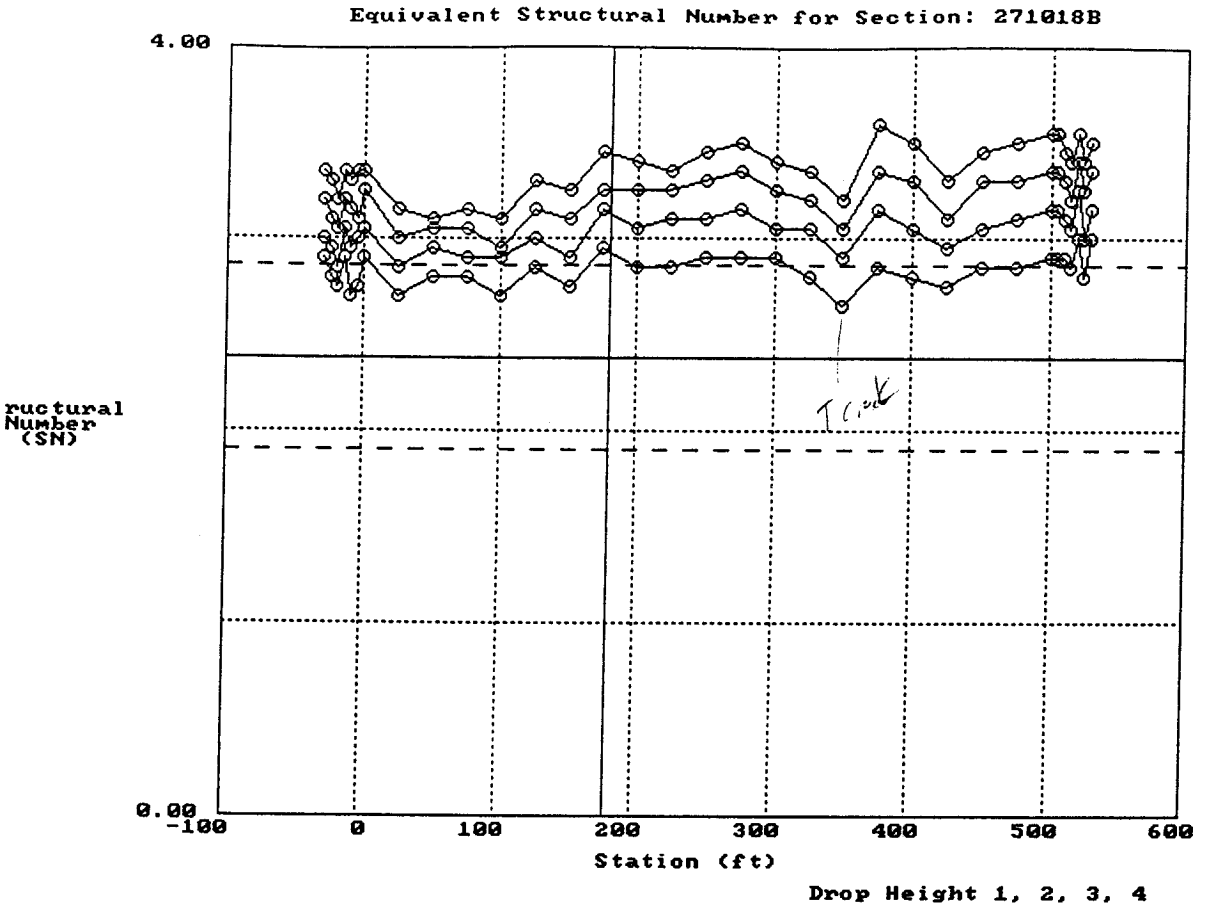


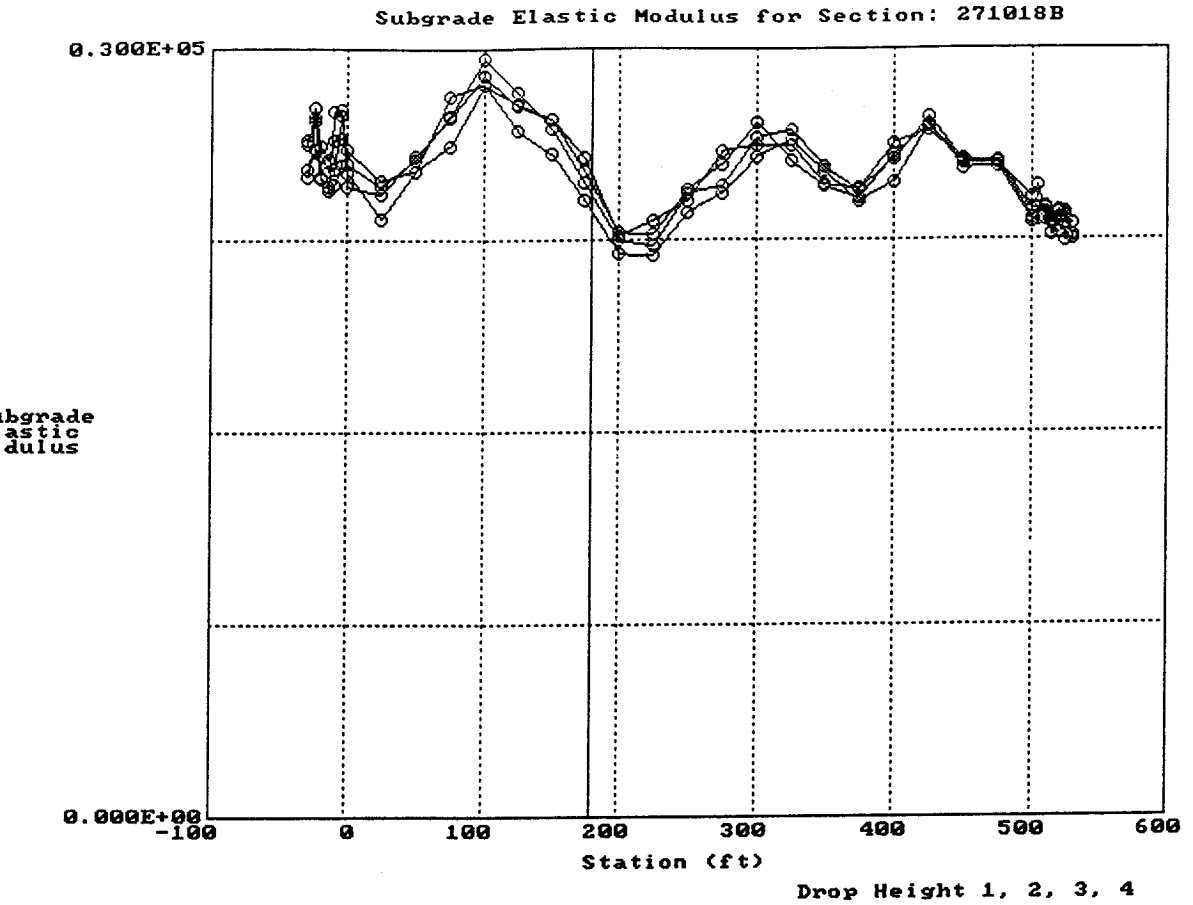
Location 3 Drop Height 1 Sensors 1, 2, 3, 4, 5, 6, 7

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


Corrected Deflection Data for Section: 271018B
0.200E+01
Corrected
Normalized
Deflection
0.000E+00
-100
0
100
200
300
400
500
600
Station (ft)
Location 3
Drop Height 1
Sensors 1, 7
F2:ScrnDump F10:Exit ↓↑:Prv/Nxt Ht PgUp/PgDn:Prv/Nxt Loc


Corrected Deflection Data for Section: 271018B
0.200E+01
Corrected
Normalized
Deflection
0.000E+00
-100
0
100
200
300
400
500
600
Station (ft)
Location 3 Drop Height 4 Sensors 1, 7
F2:ScrnDump F10:Exit ↓↑:Prv/Nxt Ht PgUp/PgDn:Prv/Nxt Loc


Equivalent Structural Number for Section: 271018B
4.00
ructural
Number
(SN)
0.00
-100
0
100
200
300
400
500
600
Station (ft)
Drop Height 1, 2, 3, 4
F10:ExitPlots



10:ExitPlots

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;
- MnDOT Materials and Research meeting agenda and notes;
- Site visit field notes; and
- Pre-installation meeting agenda and notes.

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 1

To KEN WASNIE	From ROBERT VANSAMBEEK
Co. MN/DOT DIST. 3	Co. BRAUN INTERTEC
Dept. MATLS / MAINT.	Phone # 612 776 7522
Fax # 218 828 2544	Fax # 7201

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

Memorandum

Date: August 17, 1993

To: Ken Wasnie - District Materials Engineer
Lee Purdham - District Maintenance Superintendent

From: Robert J. Van Sambeek RV

Re: Instrument Installation and Monitoring Activities for GPS Section 271018 on US-10 Eastbound MP 140.

This letter is a follow up to District level responsibilities discussed at the August 12, 1993 meeting in Baxter, MN. Also, Fred Maurer asked that all work related to the FHWA-LTPP project be billed to charge I.D. 00 310 ####, where #### represents the four digit work item.

* Utility Clearance
  - MP 140.1 to MP 140.3 of eastbound US-10.
    - 700 feet total from 100 feet west of Sta.0+00 to 100 feet east of Sta.5+00.
    - Stations marked on right edge of driving lane with white paint.
    - Clear driving lane and 40 feet south of section into the ditch.

* If possible, mow grass in area identified for utility clearance, or bring weed whip to site on August 24th.

* Traffic Control August 24th and 25th (Schedule August 26th as contingency day for weather delays or equipment break down).
  - Full lane closure MP 140.1 to MP 140.3 in the eastbound driving lane.
  - Traffic control in-place by 7:30 AM both days.

* Pavement Saw and Operator on August 24th.
  - Able to saw about 5.5 inch depth.
  - Cut 14 inch square block out of the pavement in the outer wheel path.
    - Remove block in one piece to bond back in-place later in the day.
  - Cut four inch wide trench from outer wheel path across 11 foot paved shoulder.

* Materials for Equipment Installation and Pavement Repairs.
  - Four bags sackcrete.
  - 500 pounds 3/8 inch pea gravel or trap rock.
  - 500 pounds asphalt patch.
  - Water for sackcrete and equipment clean-up (Not more than 30 gallons).

* Patch four inch wide trench and assist with block replacement in the outer wheel path.

BRAUN SM
INTERTEC

8/31/93

Mn/DOT

BM

Dickson Hoile
296-1542
- locations to shoot in later on

- Surplus rod + pvc from Mn/ROAD

- Look @ ALL 4 SITES

John Zollers
- Caps for BM

- EQUIPMENT
  - Power hammer
  - Grinder
  - etc.

} Geo. crew. ~~tool~~ Loan

- Warren still looking into caps for BM.
  - will talk to Harland with Lir about installing.

WIN II

271018

BRAUN SM INTERTEC

Description: SEASONAL - MN

Project No: DRLx92700

Date: 3/4/93 By: RV

FRED MAURER - 779-5568

Dec - 274040 → Dist-1 ⊗ okay with this section for traffic control and no scheduled maintenance
US-2 - Grand Rapids

AC - 271028 → ⊗ Fergus Falls (Detroit Lakes) Dist. is willing to delay any work on the section as long as condition is not a safety concern.
US-10

AC - 271018 → ⊗ Little Falls/BRAINERD Dist. going to look @ section on 3/17
- 7/4/93 - Can use section - maybe repairing trans. cracks.
- Engineer indicated two sections laid out?

- 273003 → ⊗ still checking on - Steve O.
ST15
~2147 AADT - metro
Okay, very interested in participating!

- 276251 → ⊗ - Dist. is willing to make exception to defer any rehab.
US 2 (WB)

GRAIG GILBERTSON 218/755-3807

- 271016 → ⊗ already delayed work on section in 92
US-71-58
- tough stripe
- out
- will look @ overlay when SP-3 ends.

TEL: Apr 07 93 13:38 No.012 P.01

FAX MESSAGE

FOR IMMEDIATE ATTENTION

TAL PAGES TRANSMITTED = 2
ng this sheet)

DATE 4/7/93

☞ : Bob Van Sonkeek
Braun Pavement
776-7522

OM : FRED MAURER - MN/DOT
1400 GERVAIS AVENUE NORTH
MAPLEWOOD, MINNESOTA 55109

☎ . PHONE: 612/779-5568
FAX: 612/779-5616 or 779-5580

ESSAGE: ☐ AS WE DISCUSSED ☐ CALL ME FOR MORE INFORMATION

F.Y.I.
Please call if you have any concerns.
Fred

SF-00006-05 (4/86)

STATE OF MINNESOTA

Office Memorandum

DEPARTMENT : Mn/DOT Field Operations Division

DATE : April 1, 1993

TO : File

FROM : Ken Wasnie - Brainerd
District Materials Engineer

PHONE : 828-2481

SUBJECT : C.S. 4902 (T.H. 10 EB)
SHRP/GPS Section
M.P. 140.1 South of Randall

On March 16, 1993, I was contacted by Fred Mauer concerning the above referenced section. The concern at hand was SHRP personnel have suggested to instrument this research section and due to lacking of numbers of similar research sections, has high importance to SHRP. This project is also one of our top priorities to be worked on in the near future. (No. 2 priority in last year's RS candidate submittal category).

Fred's concern was that the amount of dollars on instrumentation and follow-up FWD tests would be high and not worthwhile if D-3 were to rehabilitate shortly.

On March 18, Ken and Galen Bottemiller reviewed this section in detail. We felt the 500' test section was approximately a 2.6 to 2.7 section with major deficiencies as severe transverse cracking. The area is also rutted and distorted. The area was signed by SHRP and the signings also included an additional area 500' to the east. Maintenance's main concern was crack leveling of severe transverse cracks. If this can be done, then there was no objection to exempting this section from future program work.

Ken relayed this information to Fred on March 23 and Fred OK'd this in concept and later checked and verified that the crack leveling maintenance operation was appropriate. It was also discussed that when SHRP comes in to do instrumentation work, that Maintenance would be contacted to help with traffic control and help backfill test holes. This appears to be a minor inconvenience.

After this was all said and done, Bob Nibbe approached Ken about a SHRP weigh-in-motion scale that is supposed to go in the area. This item is still being discussed as to location, need, smooth ride, etc. More information will be coming later.

cc:
G.N.Kreutzer/D.L.Raisanen
Bob Nibbe
Tony Kempenich
Fred Mauer - Maplewood
G.Niemi/G.Bottemiller

KW:mc

(1/2)

BRAUNSM
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

Memorandum

Date: July 15, 1993

To: Fred Maurer

From: Robert J. Van Sambeek RV

Re: Discussion Topics for July 15, 1993 Meeting

Drill Rig

The specific sites in Minnesota for the Seasonal Monitoring Program sponsored by FHWA-LTPP Division are listed below along with tentative dates for the installations.

2" AGG. + 4.4" AC ▷ GPS 271018 on US-10 two miles northwest of Little Falls, AC, 8/24 and 8/25 — Ken Wasmund Dist. 3 Matl. Eng

AGG. + 9.6" AC ▷ GPS 271028 on US-10 ten miles east of Detroit Lakes, AC, 9/8 and 9/9 — Bud Wyborny 218-847-5562

10" AGG. + 7.1" AC ▷ GPS 276251 on US-2 bypass in Bemidji, AC, 9/14 and 9/15 — Greg Thertson Dist. Matl

6" AGG. + 8.1" PC ▷ GPS 274040 on US-2 five miles west of Grand Rapids, PCC, 9/21 and 9/22 — Equip. 218-755-3807

The dates listed above are dependant on FHWA-LTPP Division office having someone available for each installation, and Mn D.O.T. having personnel and equipment available.

Items that need to be addressed prior to installation activities are listed on the attached sheet. For some of the items only a contact name and phone number is needed at this time. For other items, several people will need to be involved regarding schedules and equipment availability.

Phone # list.

Dick Rudd 779-1110 — Dist 9

~~FRED MAURER 612-779-5568~~ — LTPP CONTACT

~~KELVIN HOUTEKOO 218-828-2240~~ (Dist 3 Soils Eng.)

~~Jerry Dempsey 612-779-5560~~

~~MARK~~ BLAKE 612-779-5599 ⇒ ~~JERRY~~ DEMPSEY — 5560

NELSON

CRAMALLY IN CHARGE

Mn/DOT BILLING CODE
00310

Meet w/ BLAKE + JERRY 7/23/93

(2/2)

ITEMS TO ADDRESS PRIOR TO SITE INSTALLATIONS

- Set date for meeting centrally located for all people involved in the four installations.
  - Brainard area? ~~218-828-2481 Matt Eng~~ Ask Ken Wasniz
  - Kelvin ~~Howieson~~ (Soils Engineer with District 3) help organize?
  - August ~~10th or 11th~~? Thurs Better
  - Maybe visit four sites after meeting? 8/12

8/12

  - Include following personnel?
    - LTPP contact? → FHWA
    - Maintenance supervisor? person in charge of traffic control
    - Drill rig operator? Matl. Eng. from each Dist.
    - FHWA Division personnel?
    - Other?

~~BJØRKLUND = MTR 612 779 5565~~
BLAKE NELSON AND JERRY DEMPSEY.

- Option for highway agency to establish permanent bench mark at each site. — if Lit post

- Equipment requirements.
  - Drill rig
    - 12 inch core? — See if Eng. still has 12" auger
    - 10 inch minimum diameter hole required (solid stem auger?).
    - 6 inch diameter hole located about 30 feet off roadway. —
    -
    -
  - Pavement saw.
    - 10 inch cut depth maximum required for all four sites.

- Supplies
  - See listings from installation guide.
  -

- SHIFT SITES #3 AND #4 TO MONDAY? — Jerry decide

FRED MAURER - 612-779-5568
JOE KORZILIUS - 779-5565 (INSTR.)
DAVE BULLOCK - 779-5542

MN CONTACTS

— DRILL RIG

WARREN O. PLADSEN, P.E.
Aggregate Engineer
Geotechnical Engineering Sect.

Materials & Research Laboratory
1400 Gervais Avenue
Maplewood, MN 55109

612-779-5612
FAX 612-779-5616

JERRY L. DEMPSEY
Field Operations Supervisor
Foundation Unit

Blake Nelson - 5599

Materials & Research Laboratory
1400 Gervais Avenue
Maplewood, MN 55109

612-779-5600
FAX 612-779-5616

— Filter Sand
— Piezometer caps
— Bentonite pellets

Quality Service Through Individual Commitment

KELVIN D. HOWIESON, P.E.
District Soils Engineer

For District Three
1991 Industrial Pk. Rd.
Baxter, MN 56401

(218) 828-2240
Fax (218) 828-2210

SURVEY IN BM ? — DAVE BORG.

DICK RUDD - DIST 9 - 779-1110

BRAUN SM
INTERTEC

BOB V

7-22-93 2.50 PM

KEN WASNIE SAID OK FOR THE MEETING ON AUG 12 FOR SEASONAL.

IT WILL IN THE DOT BLDG.

LIBRARY CONFERENCE ROOM
1991 INDUSTRIAL PARK RR. ROAD
BAXTER MN 56401

SUBURB OF BRAINERD

ABOUT 1/4 MILE ~~NORTH~~ South OF PAUL BUNYAN

WILL HAVE TO SET TIME FOR MEETING.

ROOM CAN HANDLE 20+

RRY

9/27/93
- set time for 9:30 to ≈ 12:00 of coffee.
- check into availability
- maybe bring rolls?
RV

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

July 29, 1993

Mr. Fred Maurer
Mn/DOT Materials and Research Laboratory
1400 Gervais Avenue
Maplewood, MN 55109

Dear Mr. Maurer:

Re: Group Meeting Announcement for Activities in FHWA's Seasonal Monitoring Program in Minnesota

A tentative meeting agenda and list of who should attend the meeting is attached. The same information, along with a cover letter, was sent to the four District Materials Engineers involved. The meeting objectives as stated in the cover letter include;

* Inform involved parties about the Seasonal Monitoring Program
* Assign and coordinate responsibilities for installation and monitoring
* Finalize schedules for equipment and traffic control requirements, and
* Address any questions or concerns about the Seasonal Monitoring Program.

Please make arrangements for people from the Materials & Research Laboratory to attend. Some names, other than yourself, that have come up in previous meetings include;

Richard Sullivan - SHRP Representative
Warren Pladsen - in charge of drilling operations on the four sections,
Blake Nelson - initial planning of installations,
Joe Korzilius - involvement with instrumentation, and
Dave Bullock - involvement with instrumentation and FWD Spring Recovery testing.

Please give copies of the meeting announcement and agenda to the people you think need to attend. It is very important that someone in charge of drilling operations attend the meeting. If you have any questions or need additional information, please call me or Ron Urbach at 800-344-7477 or 612-776-7522.

Sincerely,

Robert Van Sambeek
Project Engineer
s:\wp\bob_v\mnmtg1.sm

What: Meeting Announcement for Activities in LTPP's Seasonal Monitoring Program in Minnesota

When: August 12, 1993 from 9:30 AM to 12:00 Noon

Where: Mn/DOT Library Conference Room
1991 Industrial Park Road
Baxter, MN

(0.25 miles south of Paul Bunyan in Brainerd)

Who: State Level

SHRP Representative
LTPP Contact

District Level

Materials Engineer and/or Soils Engineer

Maintenance Superintendent or Maintenance Sub Area Supervisor

Other Interested Parties

DOT staff involved with instrumentation or spring recovery study

University students

Agenda: See next page

FHWA-LTPP SEASONAL MONITORING PROGRAM IN MINNESOTA

MEETING AGENDA

- Introduction
  - Review of LTPP Program and Activities
  - Objectives of the Seasonal Monitoring Program
  - Overview of Sensor Installation and Monitoring Activities
- Test Sections
  - Section Location
  - Allowable Maintenance
- Sensors, Sensor Layout, and Installation
  - TDR Probes
  - Thermistor Probe
  - Resistivity Instrumentation
  - Air Temperature
  - Rain Gauge
  - Equipment Cabinet and On-Site Instrumentation
  - Observation Piezometer
- Schedule
  - Installation
  - Monitoring
- Responsibilities
  - Mn/DOT State Level
    - Project contacts
  - Mn/DOT District Level
    - Traffic control
    - Utility clearance
    - Pavement saw and operator
    - Filter sand
    - Bentonite pellets
    - Sac-crete
    - Pavement repairs
  - Mn/DOT Materials and Research Laboratory
    - Drill rig and operator
    - Access cover for piezometer
  - NCRCO and FHWA Staff
    - Instrumentation
    - Monitoring activities
- Closing Comments

271018

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

July 29, 1993

Mr. Ken Wasnie
Minnesota Department of Transportation
1991 Industrial Park Road
Baxter, MN 56401

Dear Mr. Wasnie:

Re: Group Meeting Announcement for Activities in FHWA's Seasonal Monitoring Program in Minnesota

Thanks again for agreeing to host the meeting for coordinating activities for FHWA-LTPP Seasonal Monitoring Program in Minnesota.

Braun Intertec, under contract with FHWA LTPP Division, has responsibility for the Seasonal Monitoring Program initiated by SHRP. Earlier this year, we worked together with Fred Maurer to contact the Districts regarding sections to include in the program, and GPS section 271018 on US TH-10 northwest of Little Falls in District 3A was approved for use in the program. In addition, sections by Bemidji, Detroit Lakes, and Grand Rapids were approved.

With the four sites in Minnesota relatively close together, only one group meeting is planned for the Districts involved. A tentative meeting agenda and who should attend the meeting is attached. The meeting objectives include;

* Inform involved parties about the Seasonal Monitoring Program
* Assign and coordinate responsibilities for installation and monitoring
* Finalize schedules for equipment and traffic control requirements, and
* Address any questions or concerns about the Seasonal Monitoring Program.

Please make arrangements for appropriate district people to participate in the meeting. It is very important someone in charge of traffic control and maintenance attend the meeting. If you have any questions or need additional information, please call me or Ron Urbach at 800-344-7477 or 612-776-7522.

Sincerely,

Robert Van Sambeek

Robert Van Sambeek
Project Engineer
s:\wp\bob_v\mnmtg3a.sm

BRAUN SM
INTERTEC

45-10 EB
mp 140.15 – 140.24
north of Little Falls.

271018
SITE VISIT
8/12/93

CONCERNS

- Trees on South side start @ about sta. 0+75
  – scattered trees in median
- More DISTRESS on sta. 3400 to 5700
- Lane stripe shifted in (11' lane)
- Exit sign for Little Falls @ ~~sta.~~ 5+50 – Concern?
- Power line to farmyard @ sta. 6+50 – Concern?
  – Pole may work as 2nd Bench mark (~250' away)
- Need to cut grass/weeds for instr. cabinet location
- CRACK REPAIR NEEDED

COMMENTS

- 11' shoulder AC
- Drill rig able to back up to instr. pipe location and piezometer
- markers for section @ 27' to 28' off white line
  * locate instr. cabinet in line w/ markers.
- Inst. hole @ sta. 0-30 or sta. 5+21
- EXIT SIGN WORK AS 2nd BM!

CONCLUSIONS

- USE sta. 3400 to sta. 5700 ← FLD CHECK SUBGRADE AVOID TREES!

S:\LWD\BOB-V\AGNMTG.SAM? BOB V.

NOTES

~~Sign up sheet~~ ?

FHWA-LTPP SEASONAL MONITORING PROGRAM IN MINNESOTA
MEETING AGENDA

August 12, 1993 from 9:30 AM to 12:00 Noon
Mn/DOT Library Conference Room
1991 Industrial Park Road, Baxter, MN

Send letter to follow w/ dist. as follows
1 revised responsibilities
locations for utility clearance?
sketch of area?
- MP's
- Maint.
cc - Matl + Maint.

Introduction
- Review of LTPP Program and Activities
- Objectives of the Seasonal Monitoring Program
- Overview of Sensor Installation and Monitoring Activities

Test Sections
- Section Location
- Allowable Maintenance

Sensors, Sensor Layout, and Installation
- TDR Probes
- Thermistor Probe
- Resistivity Instrumentation
- Air Temperature
- Rain Gauge
- Equipment Cabinet and Instrument Pole
- Interface/Communications Equipment
- Observation Piezometer

Schedule
- Instrumentation Installation and Initial Monitoring
- Long Term Monitoring

Responsibilities
- Mn/DOT State Level
  - Project contacts — PR ?
- Mn/DOT District Level
  - Traffic control
  - Equipment
  - Materials
  - Pavement repairs — Mow GRASS? utility clearance
- Mn/DOT Materials and Research Laboratory
  - Drill rig and operator
  - Materials
- NCRCO and FHWA Staff — PR?
  - Instrumentation
  - Monitoring activities

Closing Comments

SAFETY

?s for Dist/Agency

Cabinet location - not 30'
- any problem

Piezometer location
- outside paved should

Maintenance activities
- before install?

Snow plow concerns?

BM install or not?

Safety requirements
- clothes
-

SITE VISIT

BM - 2nd alt.
Utilities - Powerlines, Culverts
Drill rig in ditch
Any Rock
Distress @ instr. hole
Required Maintenance
Trees, wind consistent
Drifting snow?

Introduction

Review of LTPP Program and Activities

- see handout

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

- 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, base and subgrade strength
        - deflection data collected 14 times per year
            - monthly most of year, and bi-weekly in the spring
    - ride quality
        - profile data collected five times per year
    - pavement distress
        - detailed pavement distress surveys two times per year
    - frost heave/swelling soil
        - elevation data collected five times in first year
        - elevations two times per year after the first year

Test Sections

Section Location

- 64 sections in the Core Experiment monitored under FHWA-LTPP contract

- 16 sections in the North Central Region
  - four core sections in Minnesota
    - 271018, EB US-10, MP 140, North of Little Falls
    - 271028, EB US-10, MP 58, East of Detroit Lakes
    - 274040, WB US-2, MP 173, West of Grand Rapids
    - 276251, WB US-2, MP 113, By pass in Bemidji

  - supplemental sections in Minnesota
    - none identified at this time

Allowable Maintenance

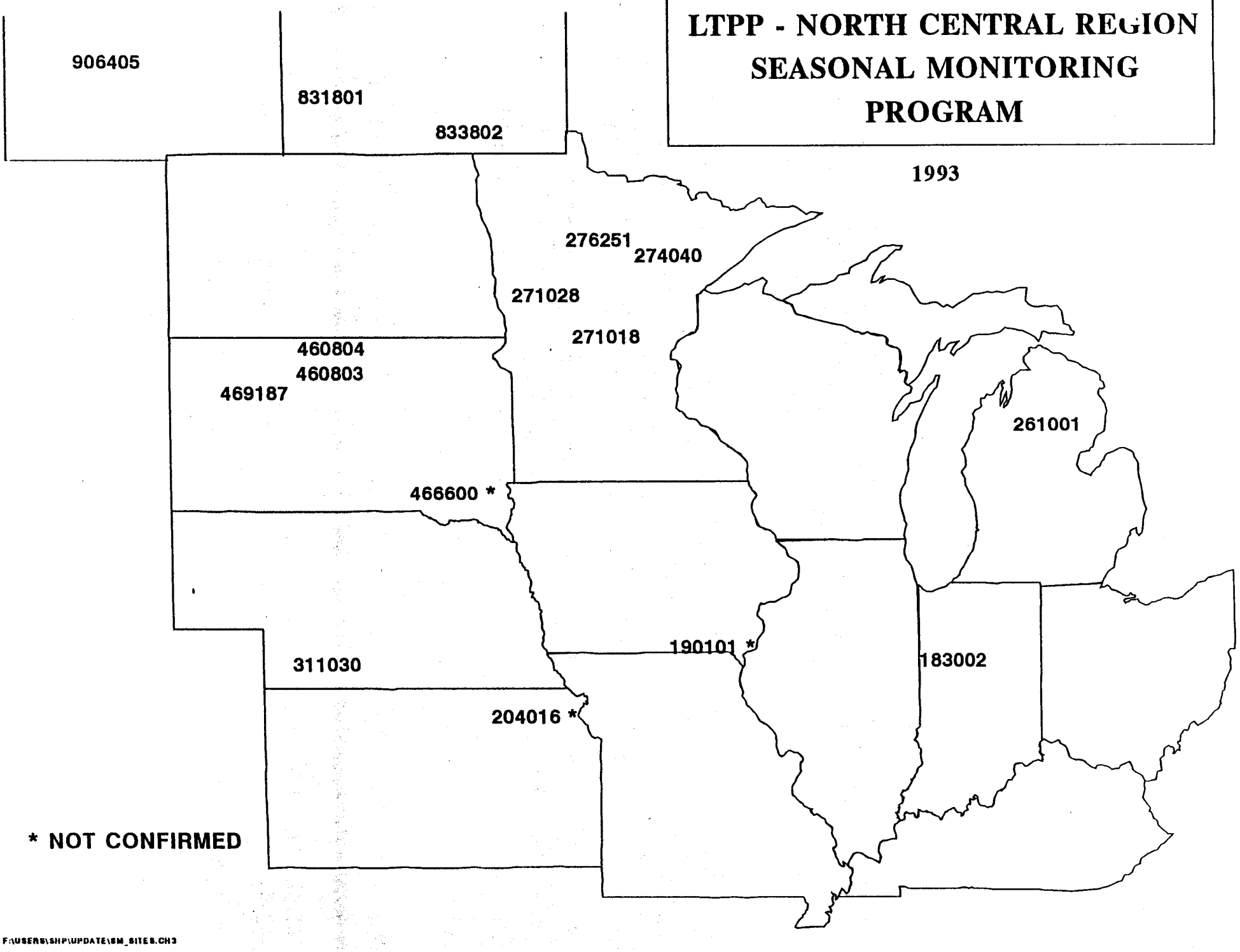
- routine maintenance

- no structural rehab preferred for ten years

- safety is primary concern

LTPP - NORTH CENTRAL REGION SEASONAL MONITORING PROGRAM

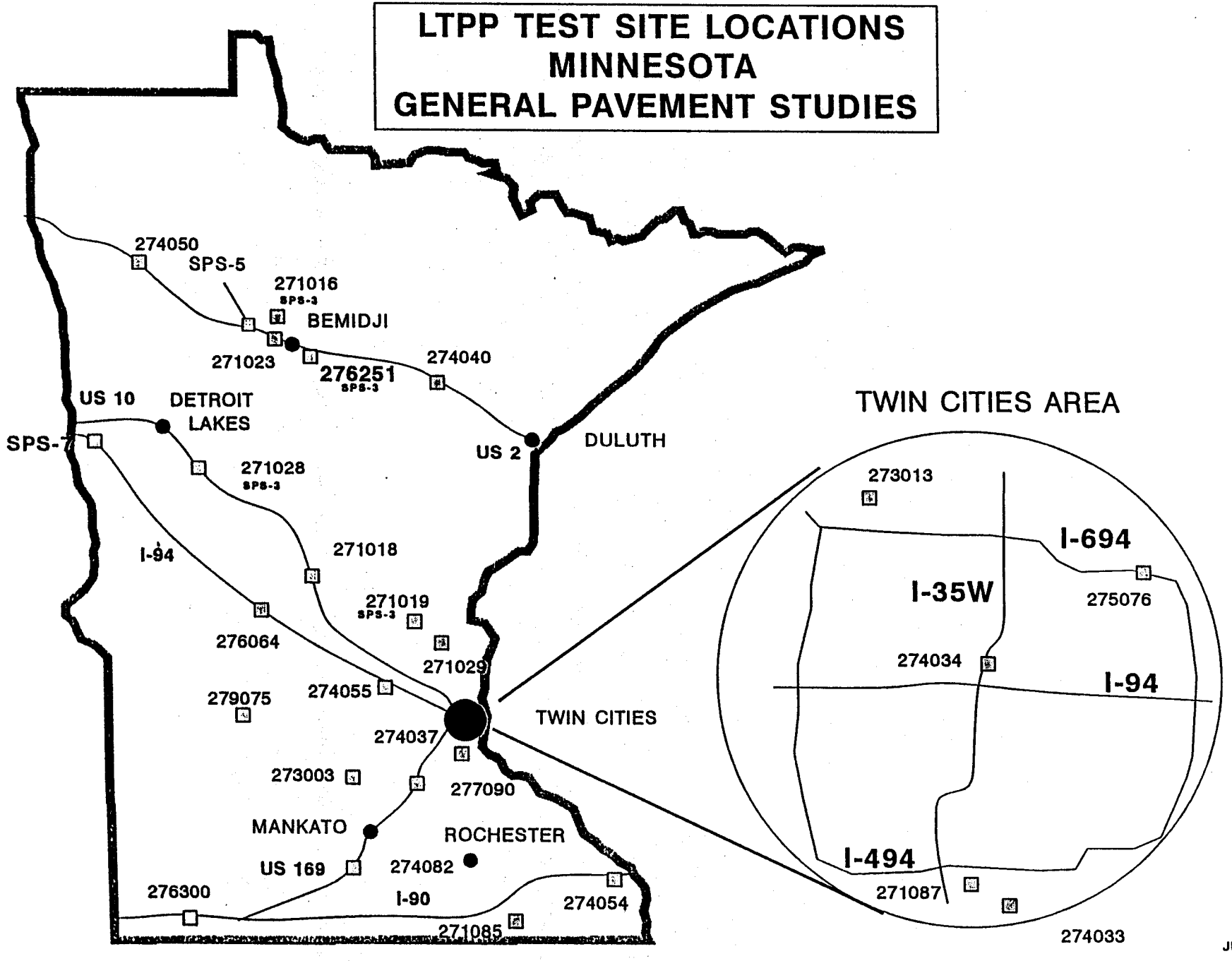
1993



* NOT CONFIRMED

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

LTPP TEST SITE LOCATIONS
MINNESOTA
GENERAL PAVEMENT STUDIES



JUNE 1992

Sensors, Sensor Layout, and Installation

TDR (Time Domain Reflectometry) Probes

- FHWA design and manufacture
  - 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 and water
  - field moisture test on material placed on probes
  - retain soil samples for additional laboratory calibration

- 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

- cable reader
  - generate signal for cable
  - monitor return signal
  - $8000.00

Thermistor Probe

- Measurement Research Corporation (MRC)
  - $1000.00 each

- thermistors change resistance with change in temperature

- built in multiplexer for automated readings

- two part
  - stainless steel section
    - monitor temperature gradient through the pavement surface
      - one inch deep
      - mid depth
      - one inch from bottom of pavement

  - plexiglass section
    - monitor 15 temperatures at six inch intervals

- laboratory calibration at three temperatures

Resistivity Instrumentation

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

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

- require signal generator and multimeters
  - compute AC resistance between electrodes

- both manual measurement and automated

Air Temperature

- Campbell Scientific
  - $150.00 each

- Air probe and radiation shield

- mount on instrument pole

Rain Gauge/Tipping Bucket

- Texas Electronics
  - $255.00 each

- 0.1 mm (0.004 inches) precipitation per tip
  - liquid precipitation only

- mount on instrument pole

Equipment Cabinet and Instrument Pole

- telephone pedestal
  - break away classification
  - contain power supply, CR10 data logger, terminal strip for sensor connections, and cables for mobile reader
  - conduit runs into cabinet from instrumentation hole
  - pea rock inside base to prevent condensation

- instrument pole
  - break away classification
  - extend below frost line
  - holds rain gauge and air temperature probe

Interface/Communications Equipment

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

- cable reader
  - Tectronics model 1502
  - required for reading TDR probes

- computer and software
  - "onsite" used to record data everyday
  - "mobile" used to record data monthly

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 six feet below the surface
    - filled with water proof grease

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
  - Aug. 23 & 24 - 271018, EB US-10, MP 140, North of Little Falls
  - Sept. 8 & 9 - 271028, EB US-10, MP 58, East of Detroit Lakes
  - Sept. 21 & 22 - 274040, WB US-2, MP 173, West of Grand Rapids
  - Sept. 14 & 15 - 276251, WB US-2, MP 113, By pass in Bemidji

Long Term Monitoring

- one day every month

- every other year for 10 years

Responsibilities

Mn/DOT State Level

- project contacts for maintenance activities and traffic control

Mn/DOT District Level

- traffic control for full lane closure
  - two days for initial installation and monitoring
  - lane closure for 500 foot section
    - signs, cones, and arrow board
- equipment
  - pavement saw and operator
    - if drill rig not able to core 12 inch diameter, then saw 14 inch square block out of the pavement
      - located in the outer wheel path
      - will put core back in-place on AC sections
    - equipment capable of cutting one inch deeper than estimated pavement thicknesses below
      - 271018 4.5 inch AC
      - 271028 9.6 inch AC
      - 274040 8.2 inch PCC
      - 276251 7.9 inch AC
    - saw three to four inch wide trench for conduit
      - from outer wheel path to outside pavement/shoulder
- materials
  - coordinate with Materials and Research Laboratory
  - asphalt patch for conduit trench
    - estimate 500 pounds
  - water for mixing sackcrete and equipment clean-up
    - estimate 30 gallons
- pavement repairs
  - patch conduit trench on AC shoulders with asphalt patch
  - assist with core or block replacement on AC sections
  - assist with rapid set concrete patch for instrumentation hole and conduit trench on PCC pavements

Mn/DOT Materials and Research Laboratory

- drill rig and operator
  - only required for instrument installation (first day)

  - if possible, cut 12 inch core for instrumentation
    - 12 inch inside diameter core barrel required
    - core located in outer wheel path

  - bore one six-inch diameter hole for piezometer
    - 14 foot depth
    - located on shoulder

  - bore one 12 inch diameter hole for instrumentation
    - solid stem auger preferred
    - eight foot depth
    - located in outer wheel path
    - NCRCO has 12 inch diameter auger with two-inch hex drive

  - bore one 12 inch diameter hole for equipment cabinet
    - two feet deep
    - located about 26 feet outside the driving lane in the ditch

  - bore one six-inch diameter hole for the instrumentation pole
    - 10 feet deep
    - located adjacent to the equipment cabinet in the ditch

- materials

  - cover assembly for piezometer
    - must function for ten years
    - able to open in the winter

  - sackcrete for piezometer cover and instrumentation pole
    - estimate four bags required

  - quick set concrete to repair PCC sections
    - only for 274040 by Grand Rapids
    - estimate three to four cubic feet

  - bentonite pellets for sealing piezometer
    - five gallon bucket

  - filter sand for piezometer
    - 400 pounds (four bags)
    - particle size not critical

  - pea gravel for equipment cabinet
    - 500 pounds
    - 3/8 inch size preferred

NCRCO (Braun Intertec) and FHWA Staff

- instrumentation
  - provide all instrumentation
  - install all instrumentation
    - may ask DOT people for assistance

- monitoring activities
  - will collect all required monitoring data

Closing Comments

71018 – WHEN CRACK REPAIR? PROCEDURE?
– REPAIR PRIOR TO INSTALLATION?

– Cut grass

– Report to Dist. in Spring for load restricti

MP. 114 frost tube

Charge ID. (MN) → Charge Identifier 00y 310y ###

#–four digit work item

– Gopher One Call – Utility Clearance

– PR – FHWA ON SITE

– SAFETY

– Utility to K.O.W – permits for tents

* Primary Contacts in Dist. for SMP

fax 327 4500

LTPP Seasonal Monitering Meeting

Aug 12, 1993 Brainerd

	Name	Aff: / Office	Dist	Phone No.
*	Andy Istvanovich	Grand Rapids Sup.	1B	(218) 327-4493
	Harland Vitalis	Maplewood Lab		(612) 779-5610
	Eugene Tormonen	" "		" " "
	John Savaloja	Materials	3A	218/828-2271
	Bob Matthews	Materials	3A	218 828-2231
*	Tom Stanko	Maint	2	218-755-3799
*	Lee Furdham	Maint.	3A	218-828-2472
	Don Hardy	Maint.	3A	218-828-2478
	Greig Gilbertson	Materials	2	218-755-3807
	Pat Huston	**Soils**	**1**	**218. 723-4883**
	Kelvin Howieson	Soils	3	218-828-2240
	Robin Allen	Materials	3A	218-828-2768
	Fred Maurer	Pav't Mgt.	C.O. MR&E	(612) 779-5568
✓	Ron Urbach	Braun Intertec		612-776 7522
	Joseph Korzilius	MN/DOT Pvmt Dgn.		612-779-5565
✓	William Lohr	FHWA (~~Loan~~ Trainee)		612 776 7522
	Ken Watnick	MnDOT	3A	218-828-2481
	Warren Pladsen	**MnDOT**	**MR&T**	**612-779-5612**
*	Bud Wyberny	MnDOT	4A	218-847-1562
	Tom Swenson	MnDOT	4	218-846-0743
✓	Bob Van Sambeek	Braun Intertec		1-800-344-7477 612-776-7522
✓	Gene Skok	"	"	" " "

ASPHALT INSTITUTE

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

Memorandum

Date: August 16, 1993

To: Aramis Lopez
Gary Elkins
Brandt Henderson
Ron Urbach

From: Robert J. Van Sambeek RV

Re: Seasonal Monitoring Section 271018 Installation Activities

The following schedule has been set up regarding installation activities for seasonal monitoring section 271018 on US 10 near Little Falls, MN.

8/21/93 - Brandt fly in.
- Room reserved at Sheraton Midway in St. Paul (Two nights).
- Room under FHWA/Brandt Henderson.
- No airport shuttle; expect $15.00 taxi fare.
- Phone number 612-642-1234.

22
8/22/93 - Aramis and Gary fly in.
- Room reserved at Sheraton Midway in St. Paul (One night).
- Rooms under FHWA; confirmation number 218375.
- Phone number 612-642-1234.

- Begin instrumentation and equipment checks.

23
8/23/93 - Finish instrumentation and equipment checks.
- Ron Urbach meet with Mn/DOT district personnel mid afternoon.
- Drive up (about two hours) and visit site.
- Eight rooms reserved at Super 8 in Little Falls, MN (Two nights).
  - Exit 27 off US-10.
  - Phone number 612-632-2351.

24
8/24/93 - Installation day.

8/25/93 - Finish installation and monitor site.
25 - Drive back.

If anyone has questions about the schedule or accommodations, I can be reached at work (800-344-7477 or 612-776-7522), and if needed at home (612-780-0648). The attached map shows the Sheraton Midway motel and Braun Intertec office location on Sloan Place.

SECTION ID	HIGHWAY	MILEPOINT	CONTROL SECTION	DISTRICT	DISTRICT MAINTENANCE SUPERINTENDANT	MAINTENANCE SUB AREA SUPERVISOR	DISTRICT MATERIALS ENGINEER	DISTRICT SOILS ENGINEER
271018	US 10 EB	140.15	4902	3A	LEE PURDHAM (218) 828-2472 BRAINERD	GARY LOUDAN (612) 632-6116 LITTLE FALLS	KEN WASNIE (218) 828-2481 BRAINERD for 3544	KEVIN HOWIESON (218) 828-2240 BRAINERD
271028	US 10 EB	58.28	5607	4A	DENNIS REDIG (218) 847-1575 DETROIT LAKES	JOE STEGMAIER (218) 847-1500 DETROIT LAKES	BUD WYBORNY (218) 847-1562 DETROIT LAKES	TOM SWENSON (218) 846-0743 DETROIT LAKES
276251	US 2 WB	113.00	0406	2A	LARRY SCHANUS (218) 755-2943 BEMIDJI	TOM STANKO (218) 755-3799 BEMIDJI	GRAIG GILBERTSON (218) 755-3807 BEMIDJI	TODD VONASEK (218) 755-3992 BEMIDJI
274040	US 2 WB	173.21	3103	1B	WOODIE CRAIG (218) 749-7793 VIRGINIA	ANDY ISTANOVICH (218) 327-4493 GRAND RAPIDS	ROD GARVER (218) 723-4835 DULUTH	PAT HUSTON (218) 723-4883 DULUTH

if not in call 749-7793

Post-It™ brand fax transmittal memo 7671 | # of pages ▸ 1

To BOB VAN SAM BEEK	From DANE BULLOCK
Co. BRAUN	Co. MnDOT
Dept.	Phone # 779-5942
Fax # 776-7201	Fax # 779-5616

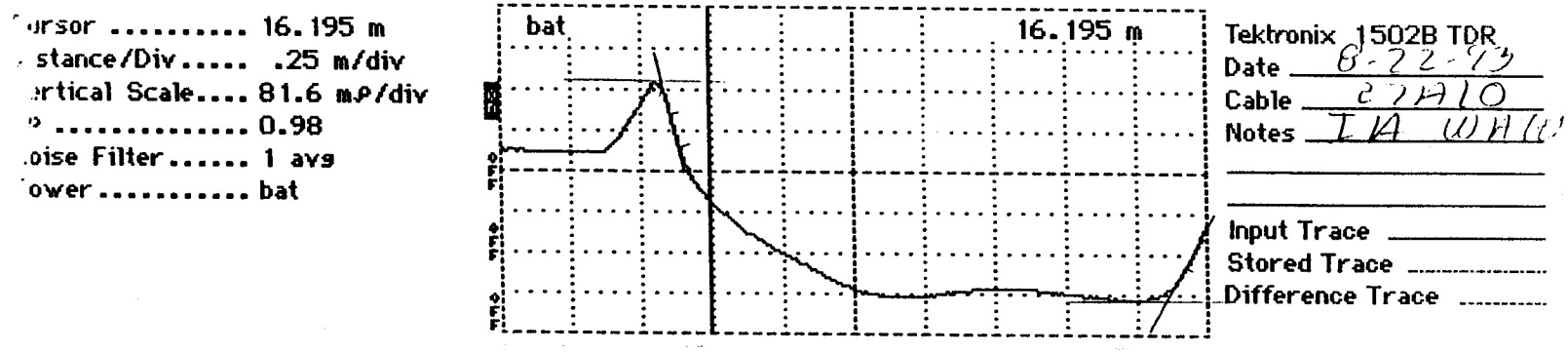
Traffic Control Contacts

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 2) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]



TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.52

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A10 TDR Probe Length, L: .(1) m Length of Coax Cable: (1) m

Comments: (1) Not measured in 1993, used 0.203 M for "L".
Pilot installation - Calibration procedure done with help from WRCO.

Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (installed 1993)

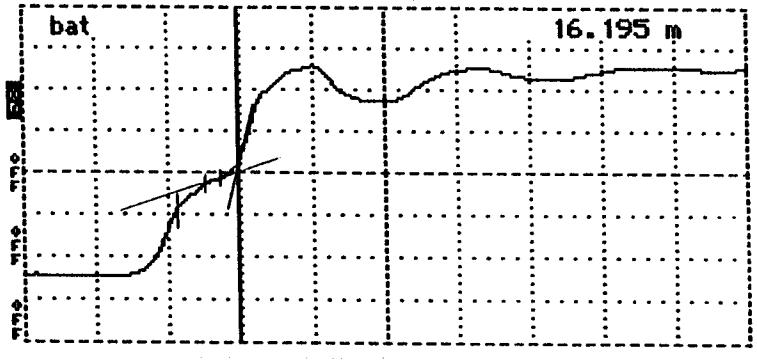
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

Tektronix 1502B TDR
Date 8-22-13
Cable 27A10
Notes SHORTED
IN AIR
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

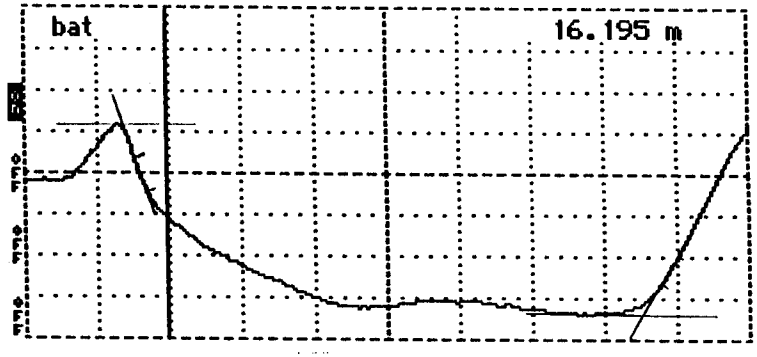


Tektronix 1502B TDR
Date 8-22-13
Cable 27A10
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

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 [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 100 mV/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-94
Cable 27A09
Notes TN 10776 K
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.28	78.45

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A09 TDR Probe Length, L: __.(1)___ m Length of Coax Cable: (1) __.__ m

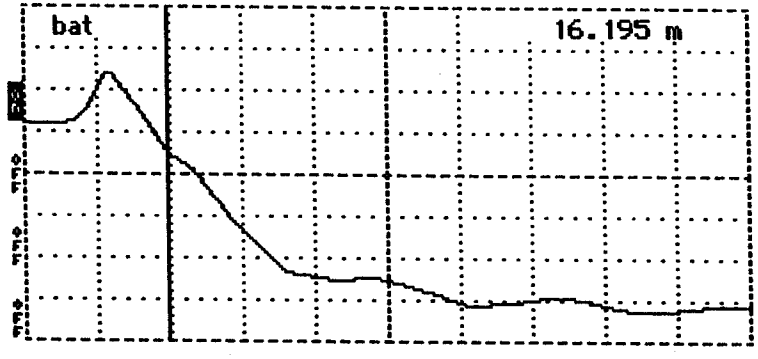
Comments: (1) Not measured in 1993, used 0.203 m for "L"
Pilot installation - Calibration procedure done with help from WRCO

Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (Installed 1993)

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

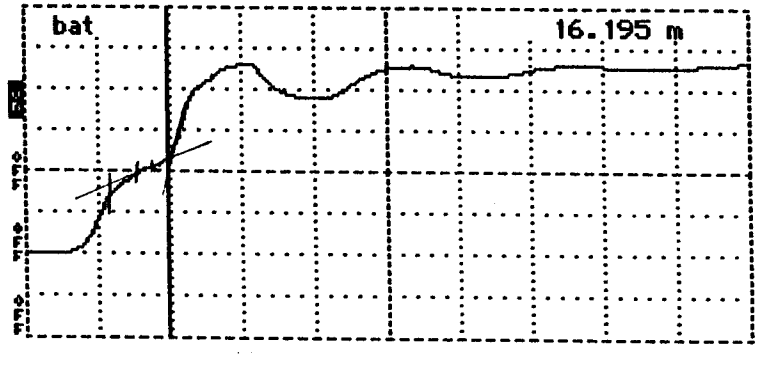
Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 188 mρ/div
ρ 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-13
Cable 27A09
Notes SHORTED IN AIR
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 188 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-13
Cable 27A09
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 [27] LTPP Section ID [1018]

Cursor ..... 16.085 m
Distance/Div..... .25 m/div
Vertical Scale.... 77.0 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

Tektronix 1502B TDR
Date 8-22-93
Cable 27A08
Notes IN WATER

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

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.22	77.57

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A08 TDR Probe Length, L: .(1) m Length of Coax Cable: (1). m

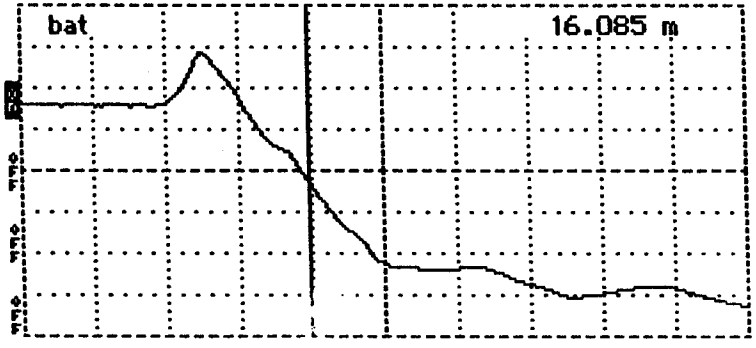
Comments: (1) Not measured in 1993, used 0.203 M for "L".
Pilot installation Calibration procedure done with help from WRCO.

Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (installed 1993)

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

Cursor ..... 16.085 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

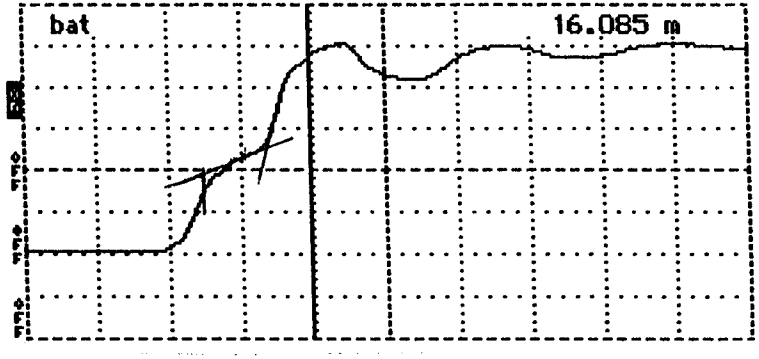


Tektronix 1502B TDR
Date 8-22-95
Cable 27A08
Notes SHORTED IN AIR.

Input Trace _____
Stored Trace _____
Difference Trace _____

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

Cursor ..... 16.085 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



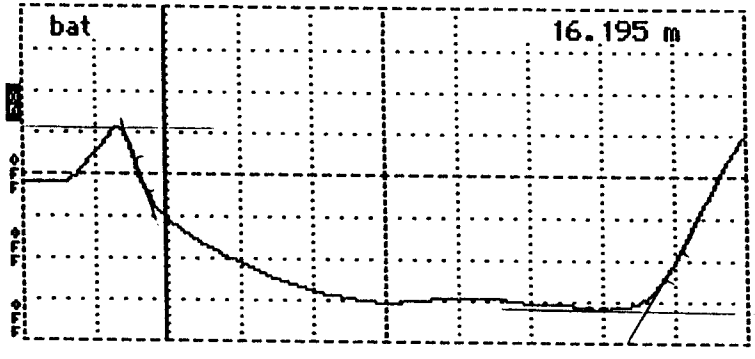
Tektronix 1502B TDR
Date 8-22-95
Cable 27A08
Notes IN AIR

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 [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 106 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-93
Cable 27A07
Notes IN WATER

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

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.78	78.45

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A07 TDR Probe Length, L: (1) m Length of Coax Cable: (1) m

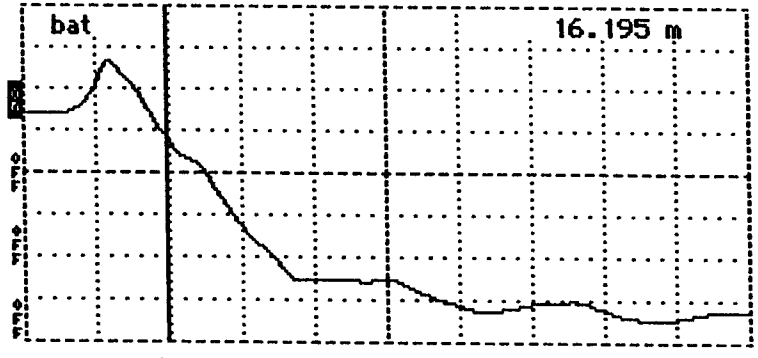
Comments: (1) Not measured in 1993, used 0.203 M for "L"
Pilot installation - Calibration procedure done with help from WRCO.

Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (installed 1993)

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

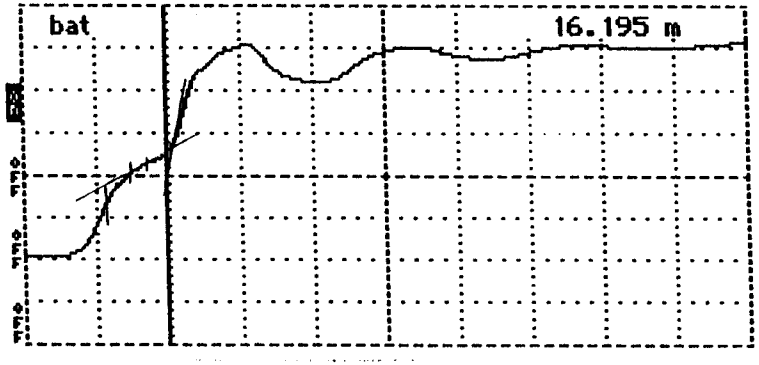


Tektronix 1502B TDR
Date 8-22-93
Cable 27A07
Notes SHORT IN AIR.

Input Trace _____
Stored Trace _____
Difference Trace _____

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



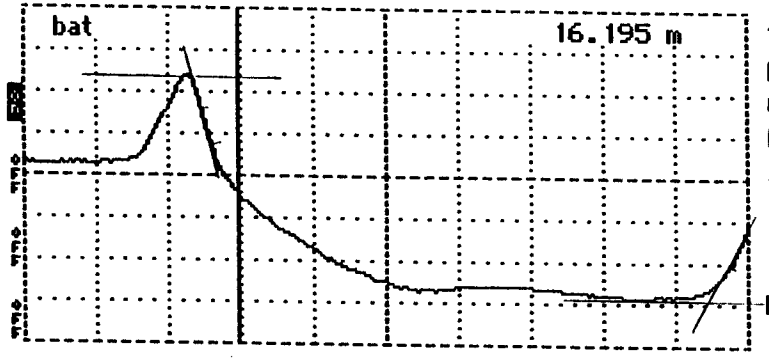
Tektronix 1502B TDR
Date 8-2-93
Cable 27A07
Notes IN AIR

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 [27] LTPP Section ID [10 18]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-93
Cable 27A06
Notes FM WATER
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.26	76.69

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A06 TDR Probe Length, L: (1) m Length of Coax Cable: (1) m

Comments: (1) Not measured in 1993, used 0.203 m for "L"
Pilot installation - Calibration procedure done with help from WRCO.

Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (installed 1993)

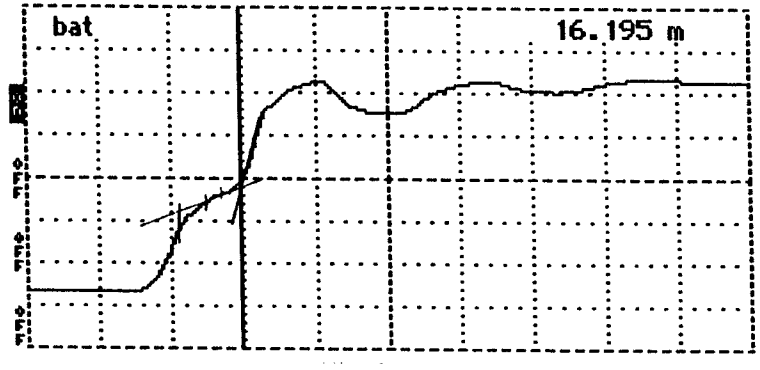
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat

Tektronix 1502B TDR
Date 8-22-93
Cable 27A06
Notes SHORTED IN AIR
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat

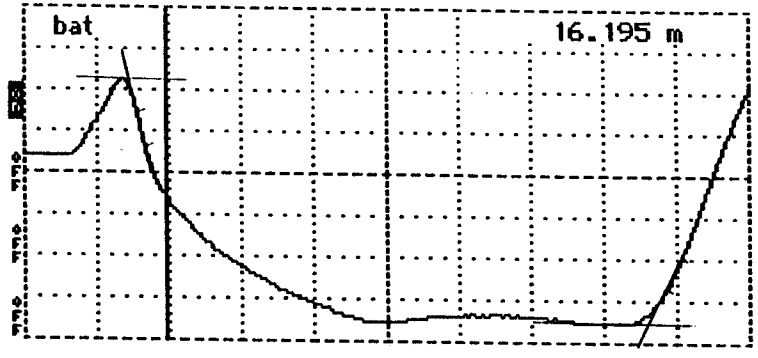


Tektronix 1502B TDR
Date 8-22-93
Cable 27A06
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

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 [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-93
Cable 27405
Notes IN WATER
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.78	78.45

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27405 TDR Probe Length, L: __.(1)___ m Length of Coax Cable: (1).__ m

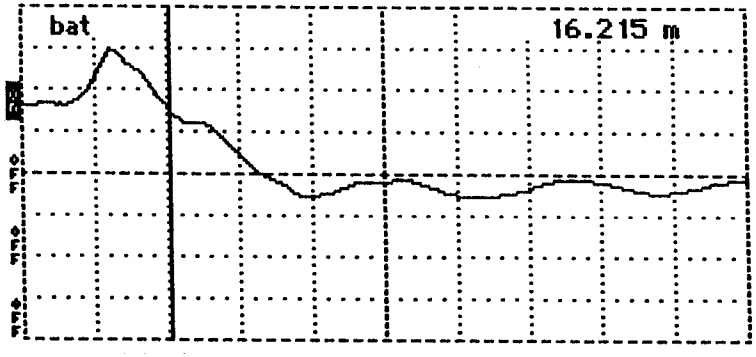
Comments: (1) Not measured in 1993, used 0.203 m for "L".
Pilot installation - Calibration procedure done with help from WRRC.

Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (Installed 1993)

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

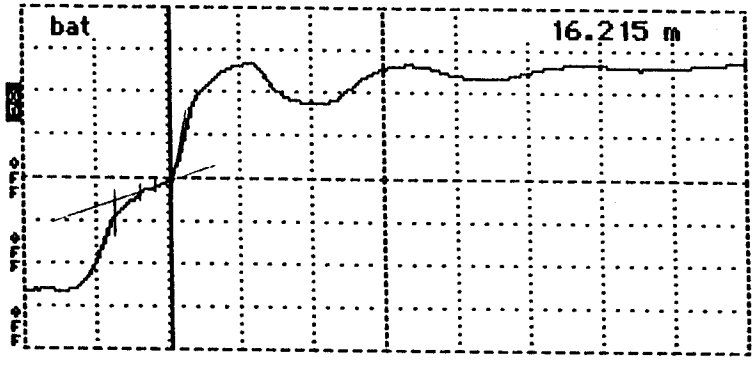
Cursor ..... 16.215 m
Distance/Div..... .25 m/div
Vertical Scale.... 163 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-95
Cable 27A05
Notes SHORTED IN AIR.
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.215 m
Distance/Div..... .25 m/div
Vertical Scale.... 163 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat

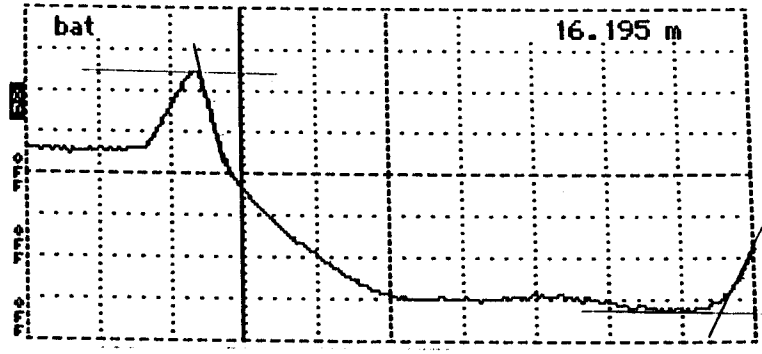


Tektronix 1502B TDR
Date 8-22-95
Cable 27A05
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

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 [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-13
Cable 27A04
Notes ~~ENTER~~ WATER

Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.78	78.45

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A04 TDR Probe Length, L: .(1) m Length of Coax Cable: (1). m

Comments: (1) Not measured in 1993 used 0.203 M for "L"
Pilot installation - Calibration procedure done with help from WRCO

Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (installed 1993)

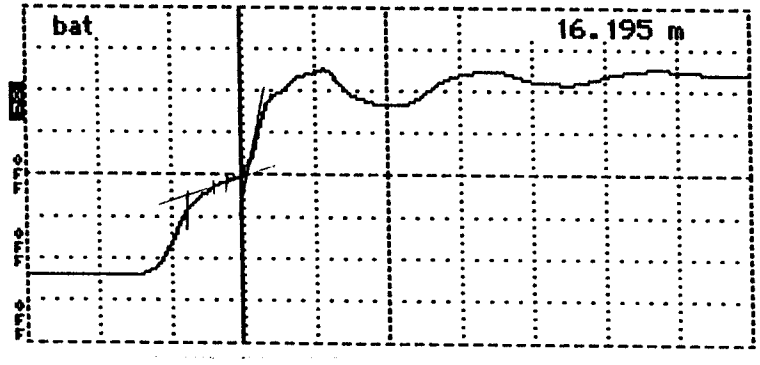
LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

Tektronix 1502B TDR
Date 8-22-93
Cable 27A04
Notes SHORTED IN AIR
Input Trace _____
Stored Trace _____
Difference Trace _____

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

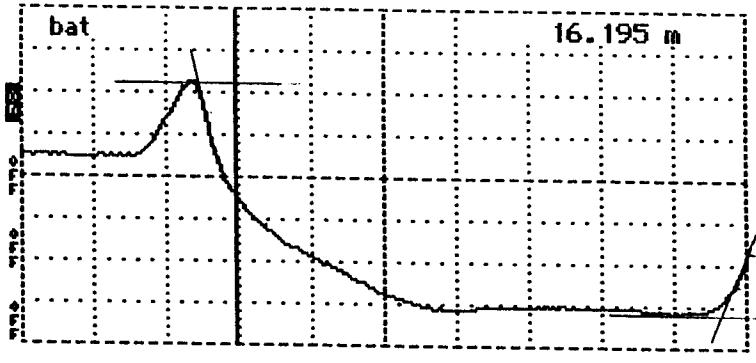


Tektronix 1502B TDR
Date 8-22-93
Cable 27A04
Notes IN AIR
Input Trace _____
Stored Trace _____
Difference Trace _____

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 [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 77.0 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-93
Cable 27403
Notes IN WATER
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.29	79.33

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27403 TDR Probe Length, L: .(1) m Length of Coax Cable: (1). m

Comments: (1) Not measured in 1993 used 0.203 M for "L"
Pilot Installation - Calibration procedure done with help from WRCO

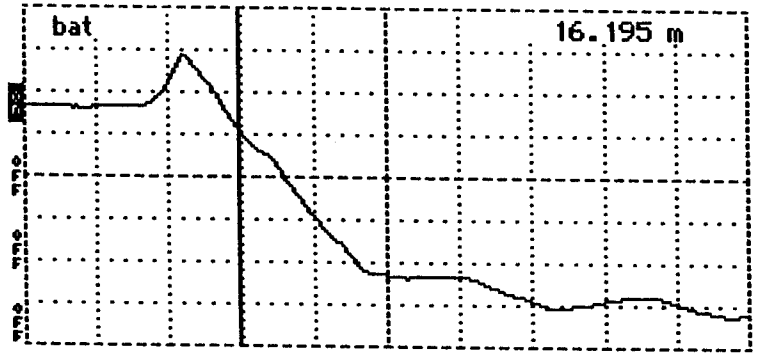
Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (installed 1993)

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

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

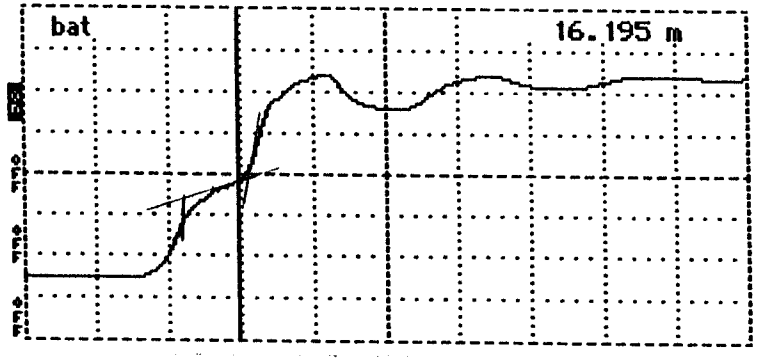


Tektronix 1502B TDR
Date 8-22-93
Cable 27A03
Notes SHORTED IN AIR.

Input Trace _____
Stored Trace _____
Difference Trace _____

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 172 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-93
Cable 27H03
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 [27] LTPP Section ID [1018]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 79.2 mρ/div
Vp 0.98
Noise Filter..... 1 avg
Power..... bat

Tektronix 1502B TDR
Date 8-22-95
Cable 27A02
Notes IN WATER
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.78	78.45

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A02 TDR Probe Length, L: (1) m Length of Coax Cable: (1) m

Comments: (1) Not measured in 1993, used 0.203 m for "L".
Pilot installation - Calibration procedure done with help from WRCO

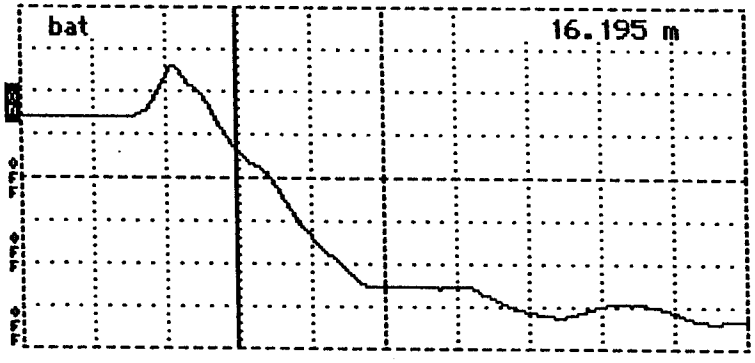
Prepared by: JAH Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (installed 1993)

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

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

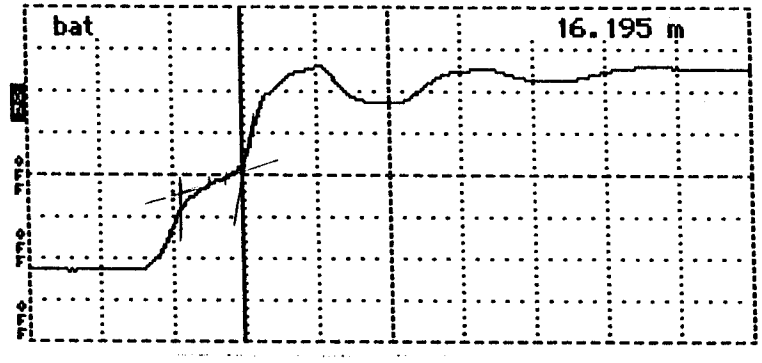
Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-13
Cable 27A02
Notes SHORTED IN AIR
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat

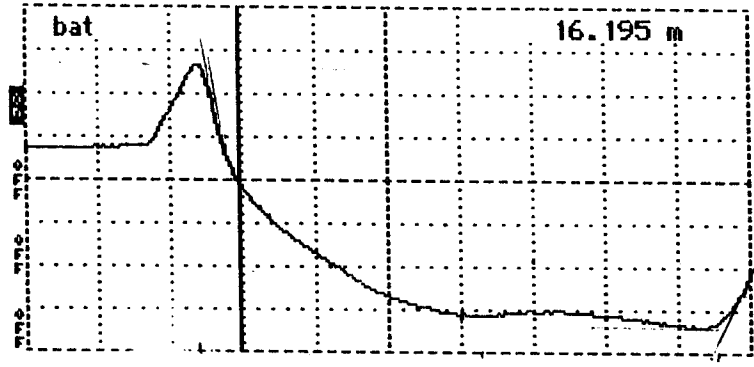


Tektronix 1502B TDR
Date 8-22-13
Cable 27A02
Notes IN AIR
Input Trace
Stored Trace
Difference Trace

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 [27] LTPP Section ID [1012]

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 74.8 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat/low



Tektronix 1502B TDR
Date 8/27/96
Cable 27A01
Notes IN WATER
Input Trace
Stored Trace
Difference Trace

TDR Trace	Apparent Length, (m)	Dielectric Constant[2]
"In Water"	1.77	77.57

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

Note: Dielectric constant is determined as follows:

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

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

TDR Probe Serial Number: 27A01 TDR Probe Length, L: .(1) m Length of Coax Cable: (1) m

Comments: (1) NOT MEASURED IN 1993 USED 0.203M FOR "L".
PILOT INSTALLATION - CALIBRATION PROCEDURE DONE WITH HELP FROM MEC.

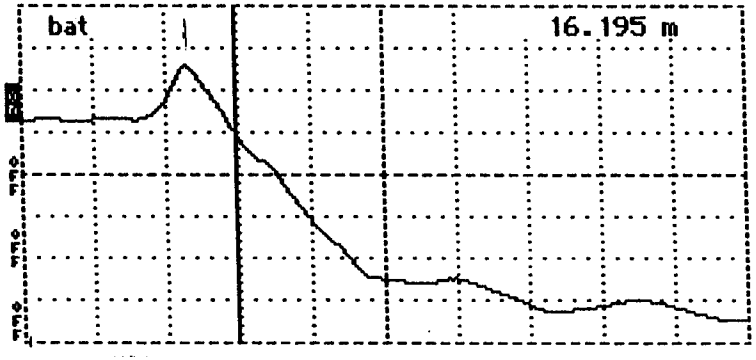
Prepared by: RSV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 14/NOV/95 (INSTALLED 1993)

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

LTPP Seasonal Monitoring Program Data Sheet SMP-C01 (Page 1) TDR Probe Check	Agency Code [27] LTPP Section ID [1018]

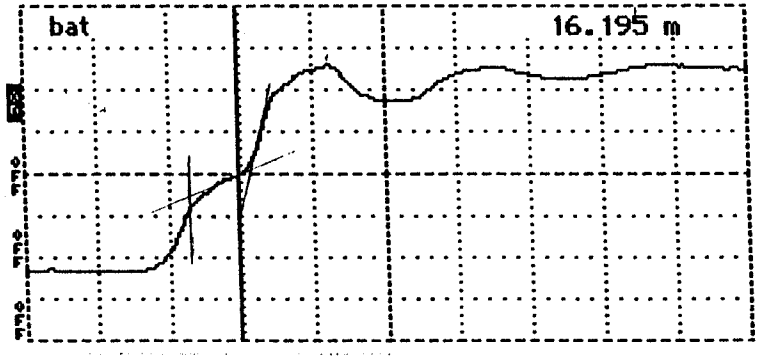
Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-13
Cable 27A01
Notes SHORTED AT START
Input Trace
Stored Trace
Difference Trace

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

Cursor ..... 16.195 m
Distance/Div..... .25 m/div
Vertical Scale.... 177 mρ/div
VP 0.98
Noise Filter..... 1 avg
Power..... bat



Tektronix 1502B TDR
Date 8-22-13
Cable 27A01
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-C02 Thermistor Probe Check	Agency Code [27] LTPP Section ID [10 18]

Thermistor Probe Assigned Serial Number : [27A T]

Air Temperature Probe Assigned Serial Number: [27A A T]

Thermistor Number	Distance from Top (m)	Temperature (°C) – Calibration in: Ice Bath; T = (1) °C	Other Water bath; T = (1) °C	Comments
1	0.000	~~-2.5~~	10.7	IN SS PART
2	0.152	~~-2.9~~	10.7	of PROBE
3	0.305	-3.2	10.7	
4	0.021	-2.2	11.1	
5	0.092	-2.4	11.1	
6	0.172	-2.7	11.1	
7	0.247	-2.6	10.0	
8	0.323	-2.8	11.0	
9	0.478	-2.9	11.0	
10	0.632	-3.1	11.0	
11	0.783	-3.2	11.0	
12	0.935	-2.8	10.9	
13	1.090	-3.1	11.0	
14	1.240	-2.8	10.9	
15	1.394	-2.4	10.9	
16	1.545	-2.7	10.9	
17	1.695	-2.7	10.9	
18	1.845	-2.3	10.9	
End	(1)	n/a	n/a	
Air Probe	n/a	(1)	(1)	

Comments: (1) NOT MEASURED IN 1993. ALL DATA TRANSFERRED FROM OLD SHEETS / INFO

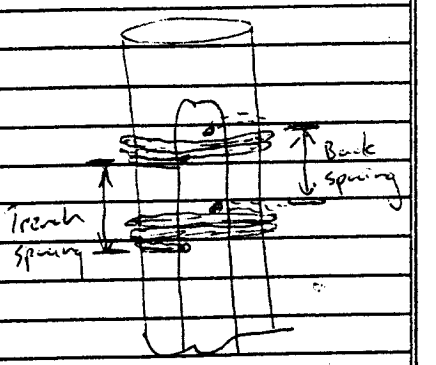
Prepared by: RSV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 14/NOV/95 (1993 INSTALL)

LTPP Seasonal Monitoring Program Data Sheet SMP-C03 Resistivity Probe Check	Agency Code [27] LTPP Section ID [1018]

Electrical Resistivity Serial Number: 27 A R

DB37 Connector Pin Number	Electrode Number	Distance from Top (m) Line 1	Line 2	Avg	Continuity ✓	Avg Spacing (m)	Comments
36	1	_.____	_.____	0.030		_.____	- Two lines on probe
35	2	_.____	_.____	0.081		0.051	for spacings in
34	3	_.____	_.____	0.133		0.053	1993 data.
33	4	_.____	_.____	0.182		0.049	
32	5	_.____	_.____	0.232		0.050	- Guessing "trench" line
31	6	_.____	_.____	0.284		0.052	lead outside to
30	7	_.____	_.____	0.335		0.051	outside on wires
29	8	_.____	_.____	0.386		0.051	into probe for
28	9	_.____	_.____	0.438		0.052	large cumulative
27	10	_.____	_.____	0.489		0.051	error.
26	11	_.____	_.____	0.539		0.050	
25	12	_.____	_.____	0.590		0.051	- Adjusted values
24	13	_.____	_.____	0.640		0.050	to obtain #36
23	14	_.____	_.____	0.692		0.052	@ 1805 mm
22	15	_.____	_.____	0.744		0.052	
21	16	_.____	_.____	0.794		0.050	- See Raw data
20	17	_.____	_.____	0.844		0.051	sheet for
19	18	_.____	_.____	0.896		0.052	adjustment
18	19	_.____	_.____	0.947		0.051	calculations.
17	20	_.____	_.____	0.997		0.050	
16	21	_.____	_.____	1.048		0.051	
15	22	_.____	_.____	1.100		0.052	
14	23	_.____	_.____	1.149		0.050	
13	24	_.____	_.____	1.200		0.051	
12	25	_.____	_.____	1.251		0.051	
11	26	_.____	_.____	1.301		0.051	
10	27	_.____	_.____	1.352		0.051	
9	28	_.____	_.____	1.403		0.051	
8	29	_.____	_.____	1.454		0.051	
7	30	_.____	_.____	1.502		0.048	
6	31	_.____	_.____	1.554		0.051	
5	32	_.____	_.____	1.604		0.051	
4	33	_.____	_.____	1.657		0.053	
3	34	_.____	_.____	1.707		0.050	
2	35	_.____	_.____	1.757		0.049	
1	36	_.____	_.____	1.808		0.052	
	Bottom	_.____	_.____	*1.830	n/a	n/a	* Estimated - not measured in 1993



Comments: Data from 1993 had "spacing" vs. Dist. from top. - Values adjusted to get #36 @ about 1805 ± 03 using weighted adjustment

Prepared by: RSV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15 NOV 95 (for 1993 install)

Data Sheet SMP-C03: Electrical Resistivity Probe Check

LTPP Seasonal Monitoring Program Data Sheet SMP-C04 Function Generator, Multimeter, and Switch Box Checks	Agency Code [27] LTPP Section ID [1 0 1 8]

Start Time (military): _ _ _ _

Test Position	Switch Settings		Voltage (ACV)		Current (ACA)		Measured Resistance R = V/I (ohms)	Known Resistance (ohms)
	I_1, V_1	I_2, V_2	Range Setting	Reading	Range Setting	Reading		
36	36	37					R1 =	R1 =
37	37	38					R2 =	R2 =
38	38	39					R3 =	R3 =
39	39	00					R4 =	R4 =
36	36	37					R1 =	R1 =
37	37	38					R2 =	R2 =
38	38	39					R3 =	R3 =
39	39	00					R4 =	R4 =
36	36	37					R1 =	R1 =
37	37	38					R2 =	R1 =
38	38	39					R3 =	R1 =
39	39	00					R4 =	R2 =

Comments: NOT PART OF PROCEDURE IN 1993

Prepared by: RSV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/Nov/95 (for 1993 INSTALLATION)

LTPP Seasonal Monitoring Program Data Sheet SMP-C05 Rain Gauge Calibration	Agency Code [27] LTPP Section ID [1018]

General Information:

Manufacturer: TEXAS ELECTRONICS INC.

Model Number: TRP-525M

Serial Number: 12068

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

Rain Gauge Calibration Data					
Trial	Start Time (Military)	End Time (Military)	Volume (ml)	Number of Tips	Adjustment[1] No. of Turns
1	*	_____	_____.	_____.	__.__
2	_____	_____	_____.	_____.	__.__
3	_____	_____	_____.	_____.	__.__

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

Comments: * Data not recorded in 1993 check procedures. Gauge was calibrated prior to installation

Prepared by: RJV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/95 (1993 INSTALL)

Appendix C-1: Instrumentation Installation Information

Appendix C-1 contains the following installation data sheets and associated field notes, as well as, 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; and
- Installation Photographs.

27 S A 93.

LTPP Seasonal Monitoring Program Data Sheet SMP-I01 Instrumentation Installed and Participants	Agency Code [27] LTPP Section ID [1018]

List of Equipment:

Equipment	Quantity	Serial Number(s)
Instrument Hole:		
Thermistor Probe	01	27•AT
Resistivity Probe	01	27AR
TDR Sensors	10	27A01 to 27A10
Equipment Cabinet:		
Campbell Scientific CR10 Datalogger	01	16525
Battery Package	01	5532
Weather Station:		
Rain Gauge	01	12068
Air Temperature Probe	01	27AAT
Radiation Shield	01	27A—
Observation Piezometer/Bench Mark:	01	n/a

List of Participants:

Name of Participant	Agency/Employer
Robert Van Sambeek	Braun Intertec
Ron Urbach	" "
Dana Miller	" "
Aramis Lopez	FHWA-LTPP
Gary Elkins	WRCO
Brandt Henderson	NARCO
Harland Vitalis (Drilling)	MN DOT
Eugene Tormoen (")	"
Lee Purdham	"
Richard Ingberg (stop by)	FHWA-LTPP
Ben Worel	Braun Intertec

Prepared by: RJV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 15/NOV/93 (For 1993 install)

27 SA 45 A

LTPP Seasonal Monitoring Program Data Sheet SMP-I02 Installed Instrument Location	Agency Code [27] LTPP Section ID [1018]

Longitudinal and Transverse Location of Instrumentation:

Instrument	Station (Customary Units)		Offset (m)[1]	
	Planned	Actual	Planned	Actual
Instrumentation Hole	5+20	5+20	+0.76	+0.76
Observation Piezometer	4+00	4+02	−3.66	−3.96
Equipment Cabinet	5+20	5+20	−8.23	−8.23
Weather Station	5+20	5+20	−8.54	−8.54
DOT BM (≈ 20-OCT-93)	—	5+25	—	−7.93

[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	*0.025	* ESTIMATED (NOT RECORDED)
	Metal Bottom	0.090	*0.100	AC THICKNESS = 125mm
	PVC Top	0.165	0.178	
Resistivity Probe		0.165	0.187	

PIEZ IS 0.3008 M BELOW PE @ STA. 400 on AUG. 25, 1993.

TDR Number	Depth from Pavement Surface to Probe (m)		Comments
	Planned Location	Actual Location	
1	0.178	0.180	ALL DEPTHS ±0.005M (MEASURED TO 0.25 INCHES IN 1993)
2	0.330	0.330	
3	0.483	0.485	
4	0.635	0.635	
5	0.787	0.785	
6	0.940	0.940	
7	1.092	1.090	
8	1.245	* 1.245	* ESTIMATED DEPTH.
9	1.550	* 1.550	TDR'S PLACED IN SLURRY
10	1.854	* 1.855	OF SAND AND WATER (CAVE IN @ ≈ 1.27 M)

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: RSV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 16/NOV/95 (FOR 24-AUG-1993 INSTALL)

27 S A 9 3 A

Seasonal Monitoring Program Guidelines: Version 2.1a/March 1995

LTPP Seasonal Monitoring Program Data Sheet SMP-I03 Log of Piezometer Hole	Agency Code [27] LTPP Section ID [1018]

Operator: H. VITALIS Equipment Used: MOBILE CME/DRILL

Location: Station: 4+02 Offset: −3.66 m (from lane edge)

Bore Hole Diameter: 305 mm Auger Type: SOLID STEM

Scale (m)	Depth from Surface[1] (m)	Material Description	Material Code[2]
	0.3	SAND TR FINE GRAVEL DK BROWN	202
0.5			
1.0		SAND TR FINE GRAVEL	202
1.5		LT BROWN	
2.0	2.13	← ENCOUNTERED WATER	
2.5			
3.0			
3.5	3.66		
	3.96	SILTY CLAY LT BROWN	131
4.0		SAND WITH A TRACE OF FINE GRAVEL.	202
4.5	4.57	WATER BEARING	
5.0			

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

Prepared by: RJV FROM 1993 DATA BY R. URBACH (OLD DATA SHEET ON FILE) Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 16/NOV/95 (FOR 24-AUG-93 INSTALL)

BRAUN[SM]
INTERTEC 271018

8-24-93
Aug

PIEZOMETER/BENCHMARK.

STARTED TO DRILL HOLE WITH 8" SOLID STEM AUGER. BUT HOLE KEPT CAVEING IN. CREW THEN USED THE 11¼ AUGER, TO TRY TO GET A OPEN HOLE TO INSTALL THE PIEZOMETER/BENCHMARK. THE BEST THAT COULD BE DONE WAS TO HAVE A OPEN HOLE TO ABOUT 10-11 FOOT DEPTH.

THE PIEZOMETER/BENCHMARK WAS 14 FEET 2 INCHES LONG TIP TO TIP.

THE DRILL RIG WAS USED TO PUSH THE PIEZOMETER/BENCHMARK PIPE. THE TOP OF THE PIPE WAS ABOUT 6 INCHES BELOW GROUND SURFACE.

THE EXISTING SAND COLLAPSED AROUND THE PIPE. THE CAVE IN WAS AT ABOUT 10 FOOT DEPTH. A LITTLE FILTER SAND WAS ADDED. THE SOILS WERE SATURATED AND LIKE MUSH. COULD NOT COMPACT.

A 5 GALLON PAIL OF BENTONITE PELLETS WERE PUT INTO THE HOLE. BECAUSE OF THE SATURATED SOILS PELLETS COULD NOT BE COMPACTED EATHER. THE TOP OF THE BENTONITE PELLETS WERE ABOUT 9 FEET BELOW GROUND SURFACE.

SOME OF THE DRIER SANDY SOILS REMOVED FROM THE BORE HOLE, WAS USED AS BACKFILL ABOVE THE BENTONITE LAYER. THIS WAS BACKFILLED UP TO ABOUT 2 FEET BELOW GROUND SURFACE.

BRAUN[SM]
INTERTEC 271018

Piez/BM
2 OF 2

Aug 8-24-93

THE STEEL PROTECTIVE SLEEVE WAS PLACED ABOUT THE BOTTOM 4 INCHES WAS BACKFILLED WITH SAND. SAKRETE WAS USED AS BACKFILL ABOVE THE SAND TO ABOUT 3 INCHES BELOW THE TOP OF THE STEEL SLEEVE.

FILTER SAND WAS PLACED BETWEEN THE INSIDE THE STEEL SLEEVE AND THE PIEZOMETER PIPE. THIS WAS PLACED TO ABOUT 3 INCHES BELOW THE PIEZOMETER PIPE.

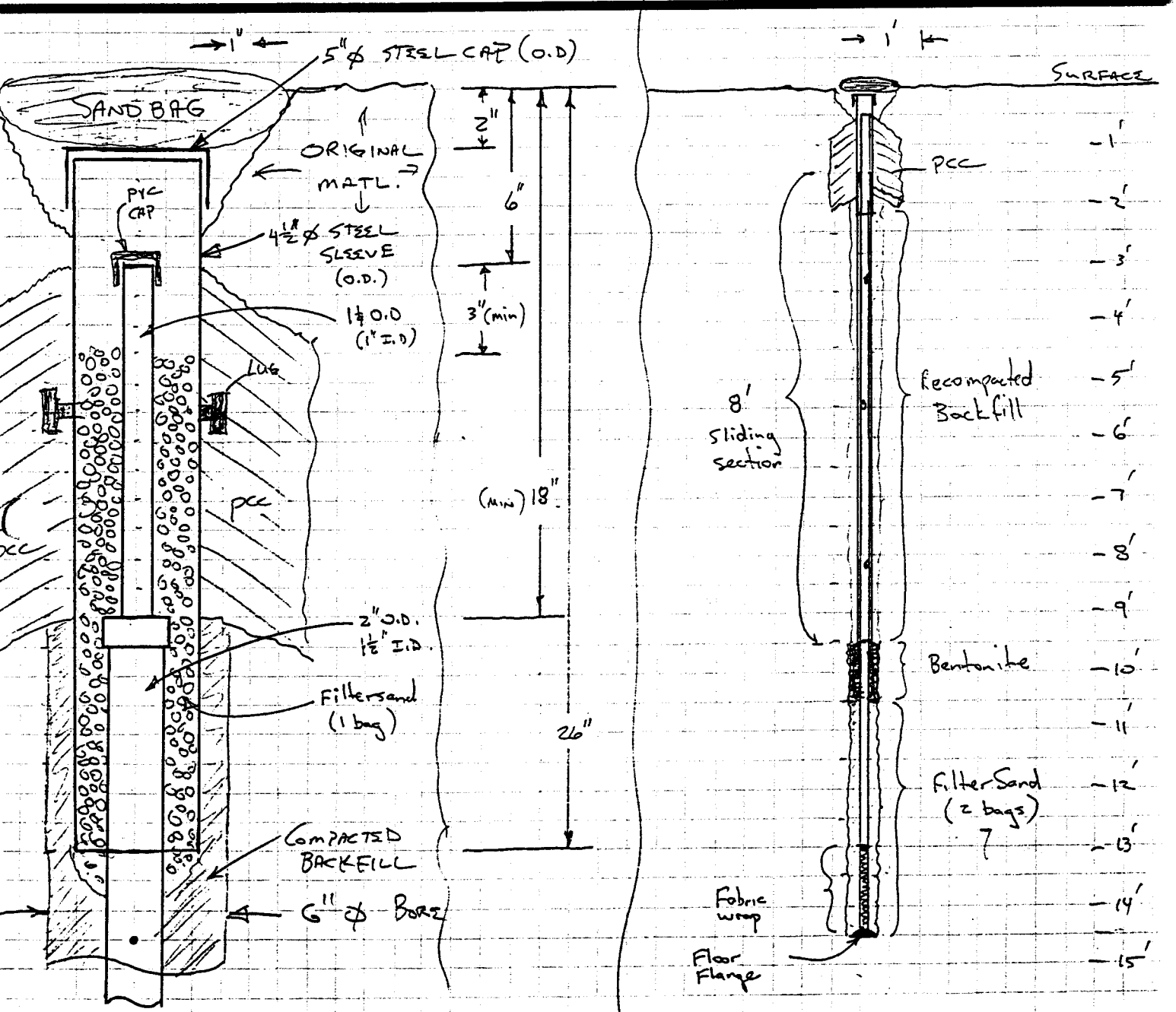
A 5 GALLON PAIL OF SOIL WAS TAKEN OF SANDY SOILS. THIS MAY BE USED AT LATER DATE FOR LABORATORY TESTING.

BRAUN SM
INTERTEC

Description: PLANNED OBSERVATION PIEZOMETER

Project No:

Date: 8/20/93 By: RV



27 5A 93 A

Seasonal Monitoring Program Guidelines: Version 2.1a/March 1995

LTPP Seasonal Monitoring Program Data Sheet SMP-I04 Log of Instrumentation Hole	Agency Code [27] LTPP Section ID [1018]

Operator: H. VITALIS Equipment Used: MOBILE CORE/DRILL

Location: Station: 5+20 Offset: +0.76 m (from lane edge)

Bore Hole Diameter: 290. mm

Scale (m)	Strata Change[1] (m)	Material Description	Material Code[2]
0.10	0.124	AC	700
0.20	0.222	GRAVEL BASE (PAIL 1)	302
0.30		SAND BROWN	202
0.40		(Pail 2 and 3)	
0.50	0.533		
0.60	0.673	(Pail 4)	
0.70			
0.80	0.832	(Pail 5)	
0.90	0.990	(Pail 6)	
1.00			
1.10	1.130	(Pail 7)	
1.20	1.245	(Pail 8)	
1.30	1.320	(Pail 9) Silty Sand Gray	214
1.40	1.372	(Pail 10)	
1.50	1.524	(Pail 11)	
1.60	1.689	(Pail 12)	
1.70			
1.80	1.816	(Pail 13)	
1.90	1.930	(Pail 14)	
2.00			
2.10	2.108	(Pail 15)	
2.20		- ENCOUNTERED WATER AT ABOUT 1.52 METERS	
2.30		- CAVE IN BELOW 1.27 M.	
2.40			
2.50			

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

Prepared by: RJV FROM 1993 DATA BY R. URBACH (OLD DATA SHEET ON FILE) Employer: Braun Intertec Corporation

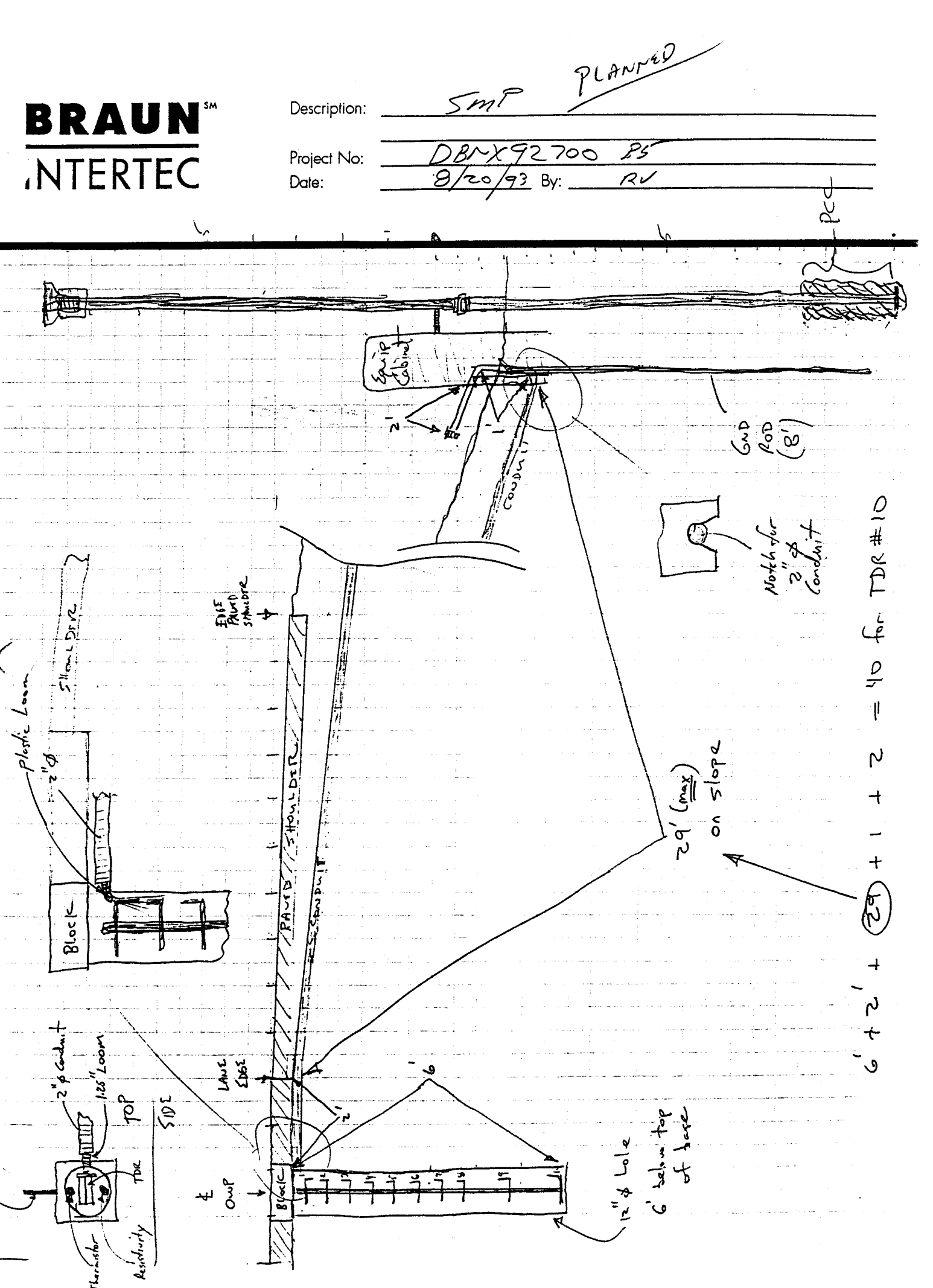
Date (dd/mmm/yy): 16/NOV/95 (FOR 24-AUG-1993 INSTALLATION)

BRAUN SM
INTERTEC

Description: SMP PLANNED

Project No: DBMX92700 PS

Date: 8/20/93 By: RV



LTPP Seasonal Monitoring Program Data Sheet SMP-I05 Field Gravimetric Moisture Content	Agency Code [27] LTPP Section ID [1018]

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	0.180		4	221.6	492.0	477.5	255.9	14.5	5.7
2	0.330		1	223.2	409.5	399.9	176.7	9.6	5.5
3	0.485		2	222.9	404.1	388.2	165.3	15.9	9.6
4	0.635		4	221.6	498.8	471.3	249.7	27.5	11.0
5	0.785		3	224.4	554.0	521.3	296.9	32.7	11.0
6	0.940		1	223.2	488.6	455.7	265.4	32.9	12.4
7	1.090		4	221.6	557.8	517.3	295.7	40.5	13.7
8	1.245		3	224.4	524.2	500.0	275.6	24.2	* 8.8
9	1.550		2	222.9	566.1	522.3	299.4	43.8	*14.6
10	1.855		1	223.2	508.5	460.9	237.7	47.6	*20.0

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

Comments: *TDRS 8, 9, and 10 were placed in a slurry of sand/water. Do not expect MANUAL TDR READINGS TO MATCH MOISTURE CONTENT. (EXPECT TDRS TO BE HIGHER MOISTURE CONTENT)

Prepared by: RJV (FROM 24-AUG-1993 DATA SHEETS ON FILE) Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 16/NOV/95 (FOR 24-AUG-1993 INSTALLATION)

LTPP Seasonal Monitoring Program Data Sheet SMP-I05A LAB ~~Field~~ Gravimetric Moisture Content	Agency Code [27] LTPP Section ID [1018]

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	0.180								5.3
2	0.330								5.8
3	0.485								9.7
4	0.635								10.3
5	0.785								16.7
6	0.940								13.8
7	1.090								13.2
8	1.245								12.0
9	1.550								16.4
10	1.855								18.6

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

Comments: MNDOT MATLS. AND RESEARCH MOISTURE TEST REPORT RECEIVED 08-OCT-1993. ORIGINAL DATA SHEET ON FILE

Prepared by: RJV (FROM MNDOT DATASHEET) Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 16/NOV/95 (FOR 24-AUG-1993 INSTALL)

Data Sheet SMP-I05: Field Gravimetric Moisture Contents

SEASONAL
LITTLE FALLS MN 8-24-93

ASONAL

A MN 93

Nia 1

FM

SEASONAL
LITTLE FALLS MN 8-24-93

SAN
TITLE FALL 8

SEASONAC
LITTLE FALLS MN 8-24-93

SEASONAL
LITTLE FALLS MN 8-2473

LTPP Seasonal Monitoring Program Data Sheet SMP-I05 (B) Gravimetric Moisture Comparison	Agency Code [27] LTPP Section ID [10 18]

TDR	SMP-I02 TDR Depth (m)	SMP-I04 Material Code	Lab Data Dry Density (pcf) (STA. 5156)	TDR Installation Data		Gravimetric Moistures		Comments
				SMP-106 La (m)	Calculated Gravimetric (percent)	SMP-105 Field (percent)	SMP-I05A Lab (percent)	
1	0.180	302	127.0	0.58	7.6	5.7	5.3	
2	0.330	202	114.1	0.61	9.5	5.5	5.8	
3	0.485	202	114.1	0.65	10.8	9.6	9.7	On average, TDR values
4	0.635	202	114.1	0.83	16.8	11.0	10.3	are 50% higher than
5	0.785	202	114.1	0.88	18.4	11.0	16.7	Field and Lab.
6	0.940	202	114.1	0.86	17.8	12.4	13.8	
7	1.090	202	114.1	0.95	20.5	13.1	13.2	
8	1.245	202	114.1	0.95	20.5	8.8	12.0	TDRs PLACED IN
9	1.550	214	114.1	1.01	22.1	14.6	16.4	SLURRY OF SAND
10	1.855	214	114.1	1.00	21.9	20.0	18.6	AND WATER.

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 → Base @ 0.11 meter depth → 127.0 pcf
→ Subgrade @ 0.20 meter depth → 114.1 pcf.

Expect poor comparison for TDR # 8, 9, and 10 unless sand removed was at maximum moisture content.

Prepared by: RV Employer: Braun Intertec Corporation Date (dd/mmm/yy): 08/JAN/96

$$w = \left(-330.72 + 4526.78\,La^2 - 2103.88\,La^4 + 402.25\,La^6\right)/\gamma_d$$; La (meters), γ_d (pcf), w (%)

2 7 S A 9 3 A

LTPP Seasonal Monitoring Program Data Sheet SMP-I06 TDR Moisture Content	Agency Code [27] LTPP Section ID [1018]

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	0.180	1235	0.58	8.33	
2	0.330	1225	0.61	9.21	
3	0.485	1220	0.65	10.46	
4	0.635	1210	0.83	17.05	
5	0.785	1205	0.88	19.17	
6	0.940	1200	0.86	18.31	
7	1.090	1155	0.95	22.34	
8	1.245	1150	0.95	22.34	PLACED IN SLURRY OF
9	1.550	1145	1.01	25.25	SAND AND WATER.
10	1.855	1140	1.01	24.75	(SATURATED SAND

[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 TDR TRACES TO THIS DATA SHEET.

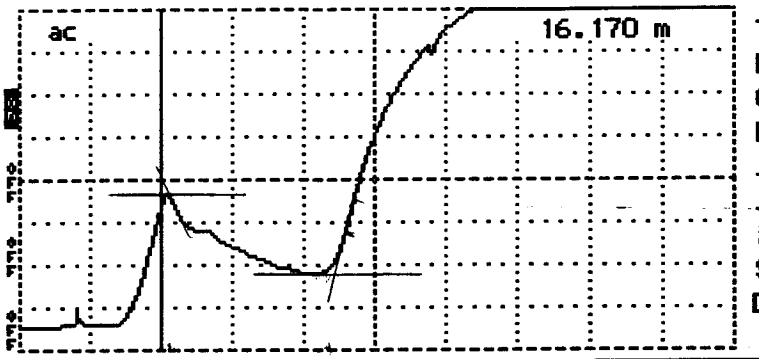
Comments: DO NOT EXPECT FIELD MOISTURE FOR 8,9, AND 10 TO MATCH TDRS BECAUSE OF WATER COMING INTO THE HOLE (HIGH WATER TABLE)

Prepared by: RJV From TRACES RECORDED 24-AUG-1993 DURING INSTALLATION Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 16 / NOV / 95

24-AUG-1993 | DBNX92700 BG | 271018 TDR INSTALL (1/2)

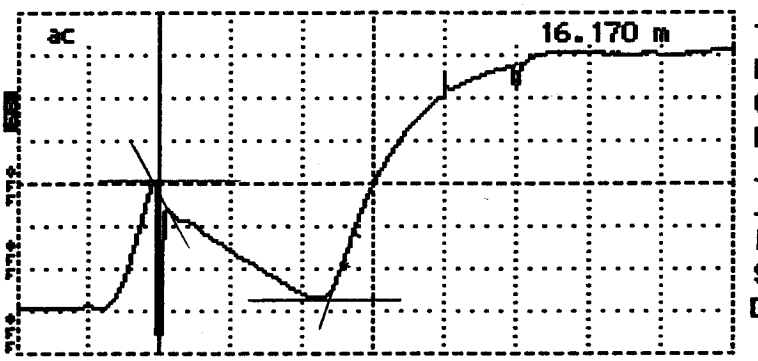
..... 16.170 m
Div..... .25 m/div
Scale.... 66.7 mΩ/div
..... 0.99
ter..... 1 avg
..... ac



Tektronix 1502B TDR
Date 8-24-93
Cable #1 27A01
Notes GENERL.
12:35
Input Trace
Stored Trace
Difference Trace

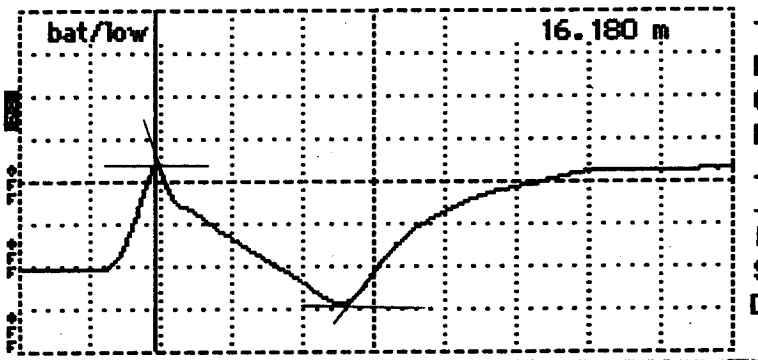
22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS
AMPAD

..... 16.170 m
Div..... .25 m/div
Scale.... 66.7 mΩ/div
..... 0.99
ter..... 1 avg
..... ac



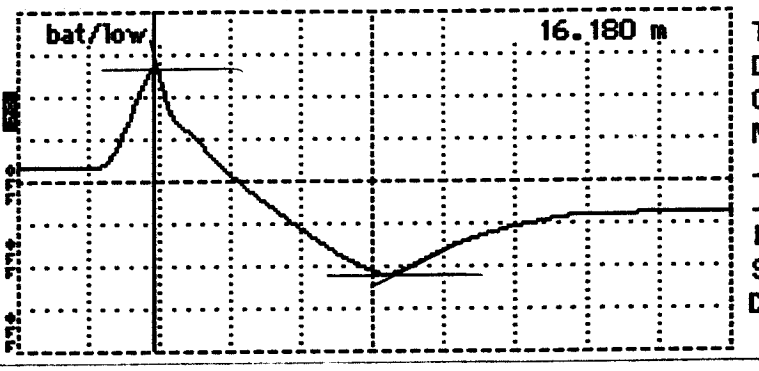
Tektronix 1502B TDR
Date 8-24-93
Cable TDR 27A02
Notes WET SAND
VOLTAGE SPIKES
FROM INVERTER PWR
Input Trace Supply
Stored Trace
Difference Trace

..... 16.180 m
Div..... .25 m/div
Scale.... 79.2 mΩ/div
..... 0.99
ter..... 1 avg
..... bat/low



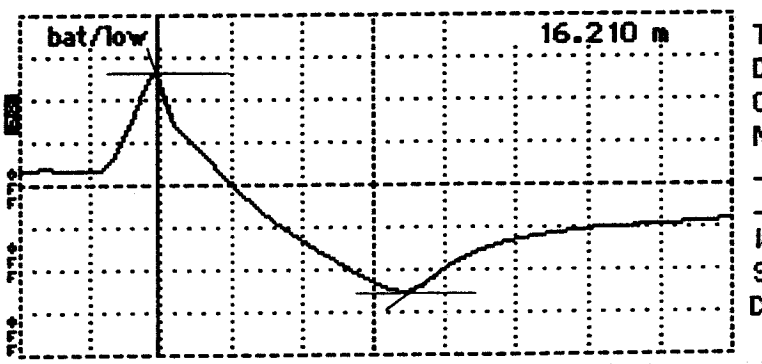
Tektronix 1502B TDR
Date 8-24-93
Cable TDR #3 27A03
Notes SAND
Input Trace
Stored Trace
Difference Trace

..... 16.180 m
Div..... .25 m/div
Scale.... 79.2 mΩ/div
..... 0.99
ter..... 1 avg
..... bat/low



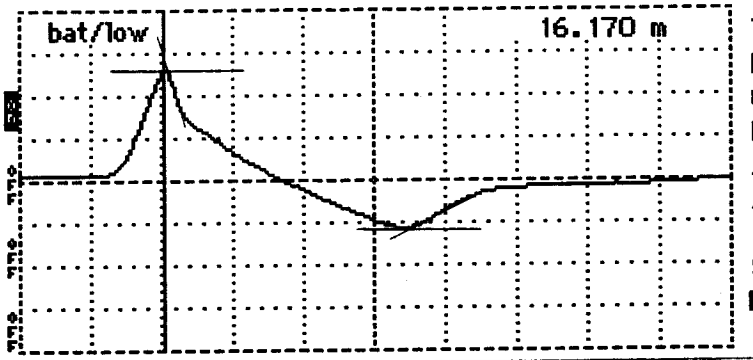
Tektronix 1502B TDR
Date 8-24-93
Cable 27A04
Notes SAND
(1210)
Input Trace
Stored Trace
Difference Trace

..... 16.210 m
Div..... .25 m/div
Scale.... 79.2 mΩ/div
..... 0.99
ter..... 1 avg
..... bat/low



Tektronix 1502B TDR
Date 8-24-93
Cable TDR #3 (27A05
Notes SAND
Input Trace
Stored Trace
Difference Trace

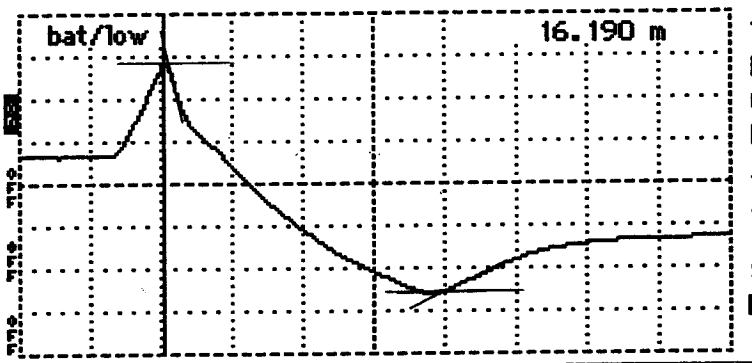
16.170 m
.25 m/div
79.2 mΩ/div
0.99
1 avg
bat/low



Tektronix 1502B
Date 8-24-93
Cable TDR #6 (27A06)
Notes SAND

Input Trace
Stored Trace
Difference Trace

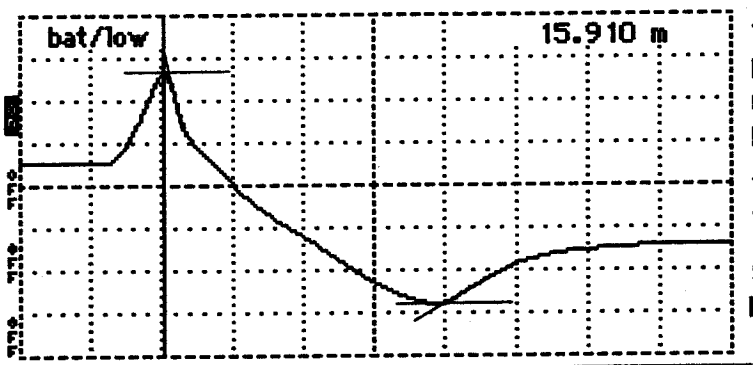
16.190 m
.25 m/div
79.2 mΩ/div
0.99
1 avg
bat/low



Tektronix 1502B TDR
Date 8-24-93
Cable #7 (27A07)
Notes Wet Sand.
11:55

Input Trace
Stored Trace
Difference Trace

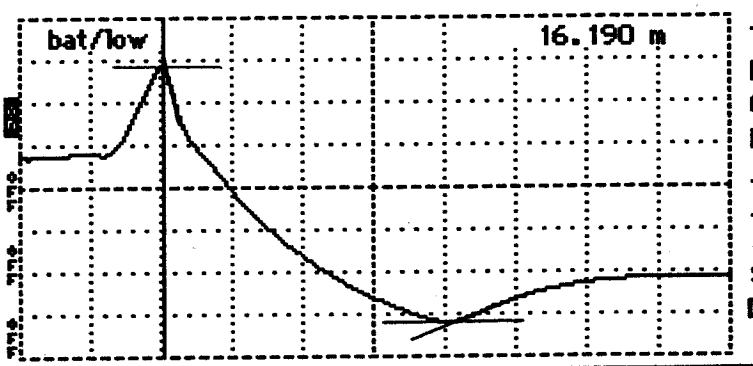
15.910 m
.25 m/div
79.2 mΩ/div
0.99
1 avg
bat/low



Tektronix 1502B TDR
Date 8-24-93
Cable TDR #8
Notes (27A08)
SAND

Input Trace
Stored Trace
Difference Trace

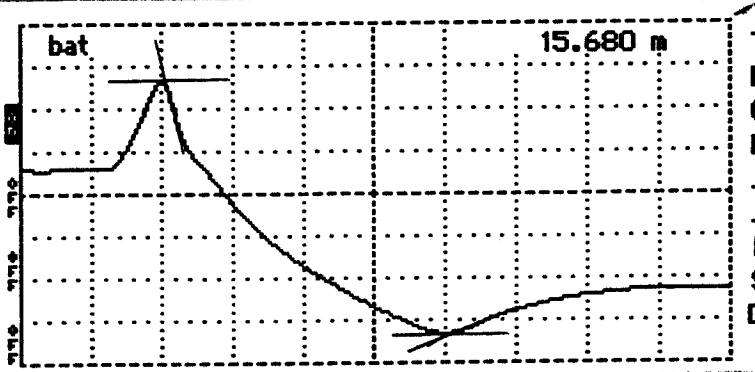
16.190 m
.25 m/div
79.2 mΩ/div
0.99
1 avg
bat/low



Tektronix 1502B TDR
Date 8-24-93
Cable TDR #9 (27A09)
Notes Wet brown sand.

Input Trace
Stored Trace
Difference Trace

15.680 m
.25 m/div
79.2 mΩ/div
0.99
1 avg
bat/low



Tektronix 1502B TDR
Date 8-24-93
Cable TDR #10 (27A10)
Notes Very wet brown sand.

Input Trace
Stored Trace
Difference Trace

27 S493 A

LTPP Seasonal Monitoring Program Data Sheet SMP-I07 Representative Dry Density	Agency Code [27] LTPP Section ID [1018]

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 Sample (b - a): _____ g (__.__ lb)

d. Unit Weight of Compacted Soil = [(b - a) / 943.0] = __.__ g/cm³

[(b - a) * 30] = ____.__ lb/ft³)

e. Dry Density of Compacted Soil = [d / (100 - r)] = __.__ g/cm³

(____.__ lb/ft³)

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 / (p + q) * 100] = ___.__ %

Comments: NOT PART OF PROCEDURE IN 1993

Prepared by: RJV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 16 / NOV / 95 (FOR 1993 INSTANCE.

BRAUN SM
INTERTEC 271018

VERY HOT!!! (1/2)

Aug
8-24-93

TIPPING BUCKET RAIN GAGE/ AIR TEMPERATURE PROBE

DRILLED INSTRUMENTATION HOLE WITH 8 INCH SOLID STEM AUGER.

THE BOTTOM SECTION OF THE 2 INCH PIPE WAS 10' 4 INCHES LONG.

THE BOTTOM OF THE HOLE WAS AT ABOUT 9 ½ FEET BELOW GROUND SURFACE.

THE BOTTOM WAS WET BUT HOLE STATED OPEN.

DRY PACK SAKRETE WAS PLACED AROUND THE 2 INCH PIPE. THE DRY PACK WAS PLACED UP TO ABOUT 3 FEET BELOW GROUND SURFACE. DRYER SAND REMOVED DURING THE DRILLING WAS USED AS BACKFILL ABOVE THE SAKRETE TO THE SURFACE.

THE SAKRETE AND THE SAND BACKFILL WAS COMPACTED AS IT WAS PLACED.

THE PIPE WAS WITHIN 6 INCHES OF THE EQUIPMENT CABINET.

6" flange on bottom of pipe

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.

Entered: 9/10

2-pt.

27SA93B

Seasonal Monitoring Program Guidelines: Version 1.1/June 1993

LTPP Seasonal Monitoring Study Data Sheet ~~ED~~ D03 Contact Resistance Measurements	* State Code [27] 51A * Test Section Number [1018]

1. Date (Month - Day - Year) [08-25-93]
2. Time Measurements Began (Military) Aug [1100]
3. Comments SECOND SET OF READINGS W/ METER SET TO AC FOR CURRENT

Test Position	Connections I_1 V_1	Connections I_2 V_2	Voltage (ACV) Range Setting	Voltage (ACV) Reading	Current (ACA) Range Setting	Current (ACA) Reading	Notes
1	1	2	V	1.81	μA	1730	
2	3	2	V	1.79	μA	1840	
3	3	4	V	1.70	μA	1921	
4	5	4	V	1.71	μA	1876	
5	5	6	V	1.69	μA	2011	
6	7	6	V	1.69	μA	2016	
7	7	8	V	1.77	μA	2156	
8	9	8	V	1.85	μA	1577	
9	9	10	V	1.81	μA	1916	
10	11	10	V	1.76	μA	2240	
11	11	12	V	1.77	μA	2119	
12	13	12	V	1.76	μA	2107	
13	13	14	V	1.48	μA	2136	
14	15	14	V	1.44	μA	2295	
15	15	16	V	1.31	μA	2399	
16	17	16	V	1.37	μA	1959	
17	17	18	V	1.61	μA	1898	
18	19	18	V	1.59	μA	2006	
19	19	20	V	1.46	μA	2073	
20	21	20	V	1.44	μA	2179	
21	21	22	V	1.31	μA	2320	
22	23	22	V	1.34	μA	2014	
23	23	24	V	1.73	μA	1940	
24	25	24	V	1.72	μA	1928	
25	25	26	V	1.84	μA	1994	
26	27	26	V	1.83	μA	1999	
27	27	28	V	2.88	μA	1735	
28	29	28	V	2.97	μA	835	
29	29	30	V	4.75	μA	693	
30	31	30	V	4.74	μA	679	
31	31	32	V	5.09	μA	727	
32	33	32	V	5.09	μA	545	
33	33	34	V	5.54	μA	580	
34	35	34	V	5.52	μA	769	
35	35	36	V	5.31	μA	914	
36	37	38	V	11.08	~~μA~~	12.3	1000 KΩ
37	38	39	~~V~~	6.05	1 mA	6.07	1kΩ
38	39	40	mV	20.6	mA	18.78	1 Ω

1Ω

Preparer RV/GE Employer Braun Intertec

Figure III-5 - Contact Resistant Measurements - Data Sheet R1

Entered: 9/10

4-pt

27SA93B

LTPP Seasonal Monitoring Study Data Sheet ~~R2~~ D04 Four-Point Resistivity Measurements	* State Code [2 7] SA Set A * Test Section Number [1 0 1 8]

1. Date (Month - Day - Year) [~~08~~ 25-93]

2. Time Measurements Began (Military) Aug [11:25]

3. Comments

Test Position	Connections				Voltage (ACV)		Current (ACA)		Notes
	I_1	V_1	V_2	I_2	Range Setting	Reading	Range Setting	Reading	
1	1	2	3	4	mV	140.7	μA	1088	
2	2	3	4	5	mV	141	auto	1092	
3	3	4	5	6	"	152	"	1147	
4	4	5	6	7	"	137.1	"	1168	
5	5	6	7	8	"	153.1	"	1200	
6	6	7	8	9	"	1394	"	994	
7	7	8	9	10	"	-209.5	"	1142	
8	8	9	10	11	"	151.3	"	1147	
9	9	10	11	12	"	177.7	"	1177	
10	10	11	12	13	"	189.1	"	1271	
11	11	12	13	14	"	182.9	"	1323	
12	12	13	14	15	"	176.5	"	1395	
13	13	14	15	16	"	166.6	"	1377	
14	14	15	16	17	"	145.0	"	1255	
15	15	16	17	18	"	149.1	"	1301	
16	16	17	18	19	"	134.1	"	1313	
17	17	18	19	20	"	135.1	"	1264	
18	18	19	20	21	"	134.4	"	1358	
19	19	20	21	22	"	139.3	"	1380	
20	20	21	22	23	"	118.6	"	1256	
21	21	22	23	24	"	1453	"	1207	
22	22	23	24	25	"	139.7	"	1205	
23	23	24	25	26	"	143.5	"	1111	
24	24	25	26	27	"	144.0	"	1111	
25	25	26	27	28	"	151.5	"	785	
26	26	27	28	29	"	158.0	"	501	
27	27	28	29	30	"	168.8	"	430	
28	28	29	30	31	"	189.7	"	355.0	
29	29	30	31	32	"	205.0	"	264.8	
30	30	31	32	33	"	220.5	"	193.5	
31	31	32	33	34	"	255.1	"	239.6	
32	32	33	34	35	"	291.1	"	288.9	
33	33	34	35	36	"	299.2	"	264.6	

Preparer RV/GE Employer Brown Interface

Figure III-6 - Four-Point Resistivity Measurements - Data Sheet R2

Back to Two PT

mV 20.4 mA 18.6 1sr

Entered: 9/10

27 S A 9 3 B

Seasonal Monitoring Program Guidelines: Version 2.1a/March 1995

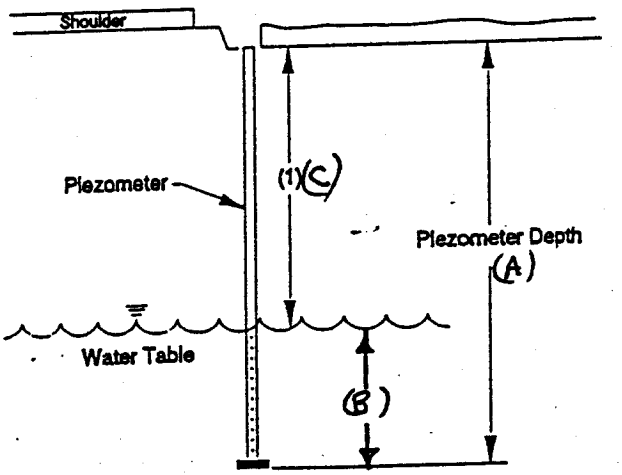
LTPP Seasonal Monitoring Program Data Sheet SMP-D05 Ground Water Table Measurement	Agency Code [27] LTPP Section ID [1018]

Piezometer Depth (m): (A) 4.287

Measurement Number	Time (military)	(C) Calculated (A−B) Depth to Water[1,2] (m)	(B) Measure Depth of Water (m)	Comments
1	0950	1.23	3.061	Day after install.
2	____	___	____	

[1] Distance from top of piezometer pipe to top of ground water table; to an accuracy of ±10 mm (0.4 in)

[2] If piezometer pipe is dry or frozen, enter "time" when observation was made, leave "depth to water" field blank, and enter "pipe is dry" or "pipe is frozen" under comments column.



Comments: Data from old data sheet

Prepared by: RJV Employer: Braun Intertec Corporation

Date (dd/mmm/yy): 25 / AUG / 93

27SA93B

Assumed Time: 1100

LTPP Seasonal Monitoring Study Form ~~E2~~ D08 Transverse Profile Measurements-AC	State Code GPS Section No. 271018 (__) Test Section Number (___) Sheet 1 of 2

STA	BS	HI	IFS	TFS	ELEV	REMARKS
PI2X	1.3033	~~1.3033~~	ck-close ↓		~~10.0000~~	PI2
			1.3032	18-DEC-93		CHECK BACK
Temp: DoT				Donut enter into		SMPcheck Rev
@ BM 5150			~~2.1803~~		~~9.1890~~	MARK ON SIGN

TYPE OF INSTRUMENT

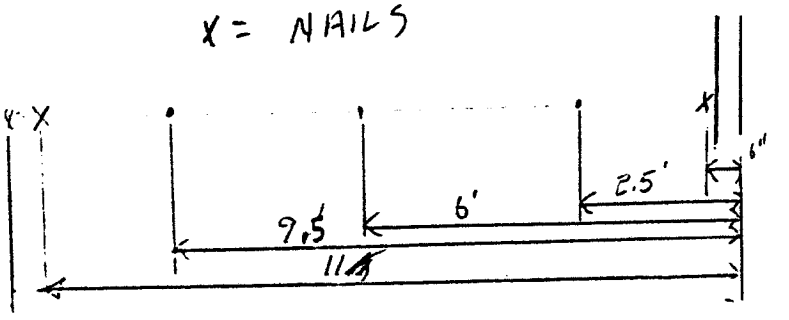
STA	EOP	OWP	MID	IWP	CL	REMARKS
3+00 ELEV	.9439 ~~10.3394~~	.9329 ~~10.3704~~	.9140 ~~10.3893~~	.9035 ~~10.3998~~	.8883 ~~10.4150~~	
3+25 ELEV	.9674 ~~10.3359~~	.9550 ~~10.3483~~	.9349 ~~10.3684~~	.9246 ~~10.3787~~	.9082 ~~10.3951~~	
3+50 ELEV	.9818 ~~10.3215~~	.9714 ~~10.3319~~	.9513 ~~10.3520~~	.9414 ~~10.3619~~	.9250 ~~10.3783~~	
3+75 ELEV	.9960 ~~10.3073~~	.9843 ~~10.3190~~	.9658 ~~10.3376~~	.9540 ~~10.3493~~	.9351 ~~10.3652~~	
4+00 ELEV	1.0025 ~~10.3008~~	.9890 ~~10.3143~~	.9713 ~~10.3320~~	.9556 ~~10.3407~~	.9434 ~~10.3599~~	
4+25 ELEV	1.0048 ~~10.2985~~	.9915 ~~10.3788~~	.9719 ~~10.3314~~	.9605 ~~10.3428~~	.9449 ~~10.3584~~	
4+50 ELEV	1.0132 ~~10.2901~~	.9998 ~~10.3033~~	.9814 ~~10.3219~~	.9687 ~~10.3346~~	.9536 ~~10.3497~~	
4+75 ELEV	1.0184 ~~10.2849~~	1.0068 ~~10.2965~~	.9890 ~~10.3143~~	.9780 ~~10.3253~~	.9629 ~~10.3404~~	

Prepared by: PRU/DM Employer: BRAUN INTERTEC Date: Aug. 8-25-93

Transverse Profile Measurements: AC Pavements - Data Sheets E2

X = NAILS

4" OUTSIDE EDGE STRIPE SHOULDER



27SA93B

LTPP Seasonal Monitoring Study Form E2 Transverse Profile Measurements-AC			State Code GPS Section No. 271018 Test Section Number Sheet 2 of 2		(__) (___)	
STA	BS	HI	IFS	TFS	ELEV	REMARKS
		11.3033				

TYPE OF INSTRUMENT

STA	EOP	OWP	MID	IWP	CL	REMARKS
5+00	1.0319	1.0207	1.0023	.9903	.9748	
ELEV	~~10.2774~~	~~10.2831~~	10.3010	10.3130	~~10.3285~~	
5+10	1.0371	1.0245	1.0060	.9938	.9781	
ELEV	~~10.2662~~	~~10.2788~~	~~10.2973~~	10.3095	~~10.3252~~	
5+15	~~1.0403~~	~~1.0343~~	~~1.0206~~	~~.9946~~	~~1.9801~~	
ELEV	~~10.2630~~	~~10.2690~~	~~10.2911~~	~~10.3117~~	~~10.3232~~	
5+20	1.0402	AVE.	1.0106	.9986	.9834	1.0216 UP 10.2757 1.0280 DOWN 10.2753
ELEV	~~10.2631~~	~~10.2755~~	~~10.2927~~	~~10.3097~~	~~10.3197~~	
5+25	1.0429	1.0313	1.0124	1.0015	.9843	
ELEV	~~10.2604~~	~~10.2720~~	~~10.2909~~	10.3018	10.3190	
5+30	1.0447	1.0330	1.0152	1.0033	.9895	
ELEV	~~10.2586~~	~~10.2720~~	~~10.2881~~	~~10.3000~~	~~10.3138~~	
+						
ELEV						
+						
ELEV						

BY INST. HOLE

Prepared by: RRH/ DM Employer: BRAUN INTERTEC Date: Aug 8-25-93

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.

27SA - 271018, US-10 EB LANES, 5 MILES NORTH WEST OF LITTLE FALLS, MN (MP 140.1)

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	
10-Aug-91																					X		PROFILE DATA NOT RECIEVED BY RCO.
02-Jun-93																				X			
26-Jul-93																			X				
24-Aug-93	93A														X	1	1						INSTALLATION, MANUAL TDR DATA.
25-Aug-93	93B	X	X	X	X	X			X	X	X	X			X	3	3						
23-Sep-93	93C	X	X	X	X	X					X				X	3	3						HAIRLINE CRACKS FORMING IN BLOCK.
20-Oct-93	93D	X	X	X	X	X					X				X	1	1						
19-Nov-93	93E				X	X			X	X	X	X			X	2	2						TWO ONSITE FILES, ADDED RELAY TO PANEL
21-Nov-93																					X		
07-Dec-93	93F	X	X	X	X	X					X	X			X	1	1						
11-Jan-94	94A	X	X	X	X	X					X				X	3	3						PROBLEM WITH CABLE READER, TWO OF THREE FILES BAD.
08-Feb-94	94B	X	X	X	X	X			X	X	X					0	0						SNOWPACK ON ROAD, NO FWD TESTING.
17-Feb-94																					X		
08-Mar-94	94C	X	X	X	X	X			X	X	X	X			X	2	2		X				MANUAL READINGS ON TDR#8, FAILED PROBE OR PROBE IN VOID?
22-Mar-94	94D	X	X	X	X	X					X	X			X	3	3						MANY REPEAT FWD TESTS.
04-Apr-94	94E	X	X	X	X	X			X	X	X				X	2	2						
20-Apr-94																					X		
20-Apr-94																					X		PROFILE DATA NOT RECIEVED BY RCO.
25-Apr-94	94F	X	X	X	X	X			X	X	X				X	1	1						
09-May-94	94G	X	X	X	X	X			X	X	X	X			X	4	4						
13-Jun-94	94H	X	X	X	X	X			X	X	X				X	4	4						
11-Jul-94	94I	X	X	X	X	X			X	X	X				X	4	4						
27-Jul-94																					X		PROFILE DATA NOT RECIEVED BY RCO.
27-Jul-94																					X		
08-Aug-94	94J	X	X	X	X	X			X	X	X				X	3	3		X				
09-Aug-94																							BLADE PATCH PLACED ON SECTION WITHOUT NOTIFICATION.
12-Sep-94	94K	X	X	X	X	X			X	X	X				X	1	1						
29-Sep-94																					X		

27SA - 271018, US-10 EB LANES, 5 MILES NORTH WEST OF LITTLE FALLS, MN (MP 140.1)

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	
10-Oct-94	94L	X	X	X	X	X			X	X	X				X	3	3						
07-Nov-94	94M	X	X	X	X	X			X	X	X	X			X	3	3						
05-Dec-94	94N	X	X	X	X	X			X	X	X				X	3	3						
09-Jan-95	95A	X	X	X	X	X			X	X	X				X	1	1						WEATHER REDUCE AMOUNT OF TESTING.
19-Jan-95																					X		
06-Feb-95	95B				X	X			X	X	X				X	2	2						ONSITE "STUCK", NO DATA SINCE LAST VISIT.
07-Mar-95	95C	X	X	X	X	X			X	X	X					0	0						
20-Mar-95	95D	X	X	X	X	X			X	X	X	X			X	2	2		X				
03-Apr-95	95E	X	X	X	X	X			X	X	X				X	2	2						
17-Apr-95	95F	X	X	X	X	X			X	X	X	X			X	3	3						
08-May-95	95G	X	X	X	X	X			X	X	X				X	3	3						
13-Jun-95	95H	X	X	X	X	X			X	X	X	X			X	2	2		X				BAD CABLE FROM CABLE READER TO MOBILE UNIT REPLACED.
21-Jun-95																							SECTION MILLED TODAY AND OVERLAYED LATER.
31-Jul-95	95I	X	X	X							X	X			X	1	1		X				PK NAILS PLACED ON NEW OVERLAY FOR 12FT. LANE VERSUS 11FT.

271018 - 27SA

Updated 31-Oct-95

LOCATION - US-10 EB Lanes, 5 Miles Northwest of Little Falls, MN (MP 140.1)
CONTACTS - Gary Loudan (612) 632-6116, Lee Purdham (218) 828-2472
TEMP HOLES - Sta 5+03, Depths are about 1.0", 3.2", and 5.5" (AC thickness = 6.5")

DISTRESS COMMENTS:

Sta F1 - Tests at 25 foot intervals from Sta 3+00 to Sta 5+00, and at Sta 5+20.

520 LP ADJACENT TO INSTRUMENTATION HOLE

Sta F3 - Tests at 25 foot intervals from Sta 3+00 to Sta 5+00, and at Sta 5+10, and 5+25.

PIEZOMETER - Sta 4+02, 0.5 feet off paved shoulder, Depth = 4.285M (17-Apr-95)

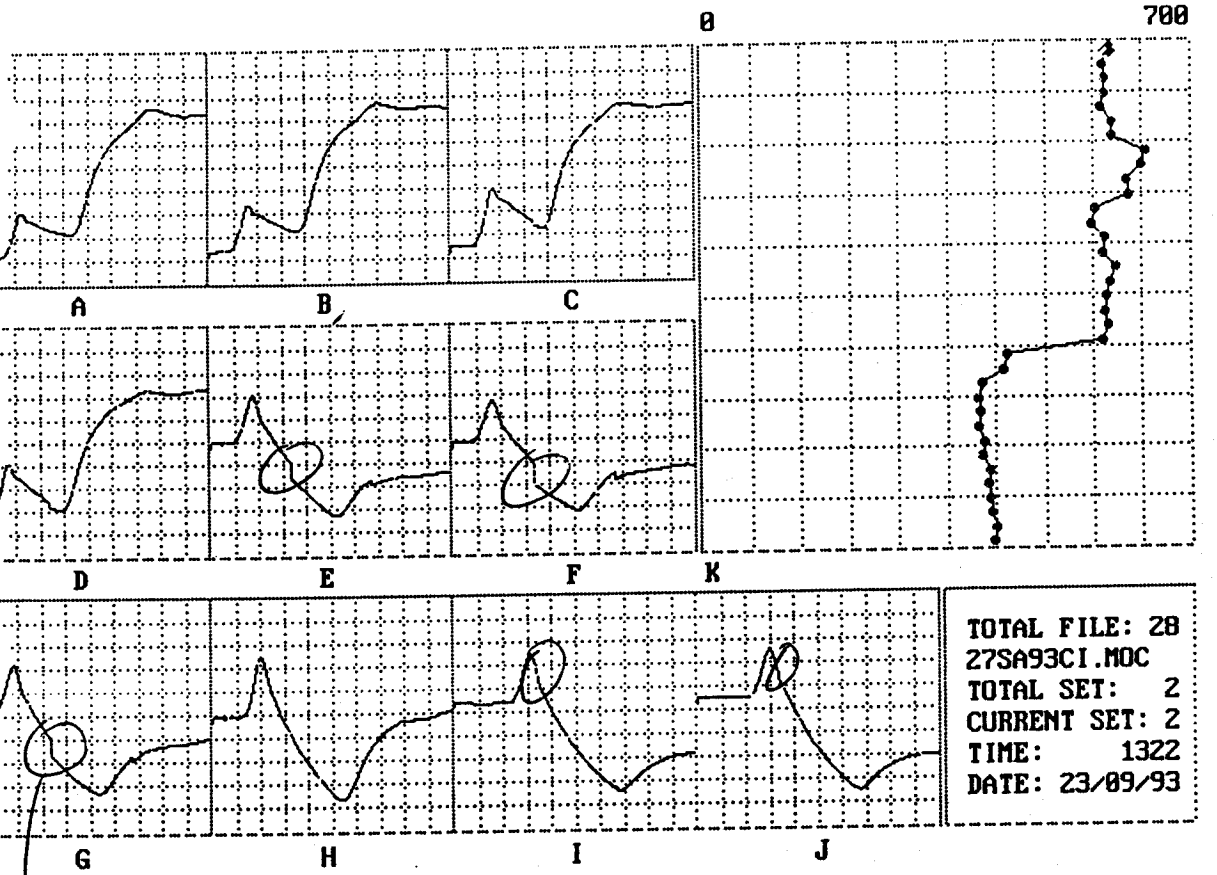
FROST TUBE - Removed 22-Jun-1995.

ELEVATIONS - Mn/DOT BM at Sta 5+00, 10? feet from edge of paved shoulder.

Offsets:		PE	OWP	ML	IWP	ILE	
(M)	-0.16	0.16	0.76	1.83	2.90	3.51	3.81
(ft)	-0.5	0.5	2.5	6.0	9.5	11.5	12.5
	(nail)	—	—	—	—	—	(nail)

Sta: Transverse profiles every 25 feet from Sta 3+00 to Sta 5+00, and at Sta 5+10, 5+20, and 5+25.

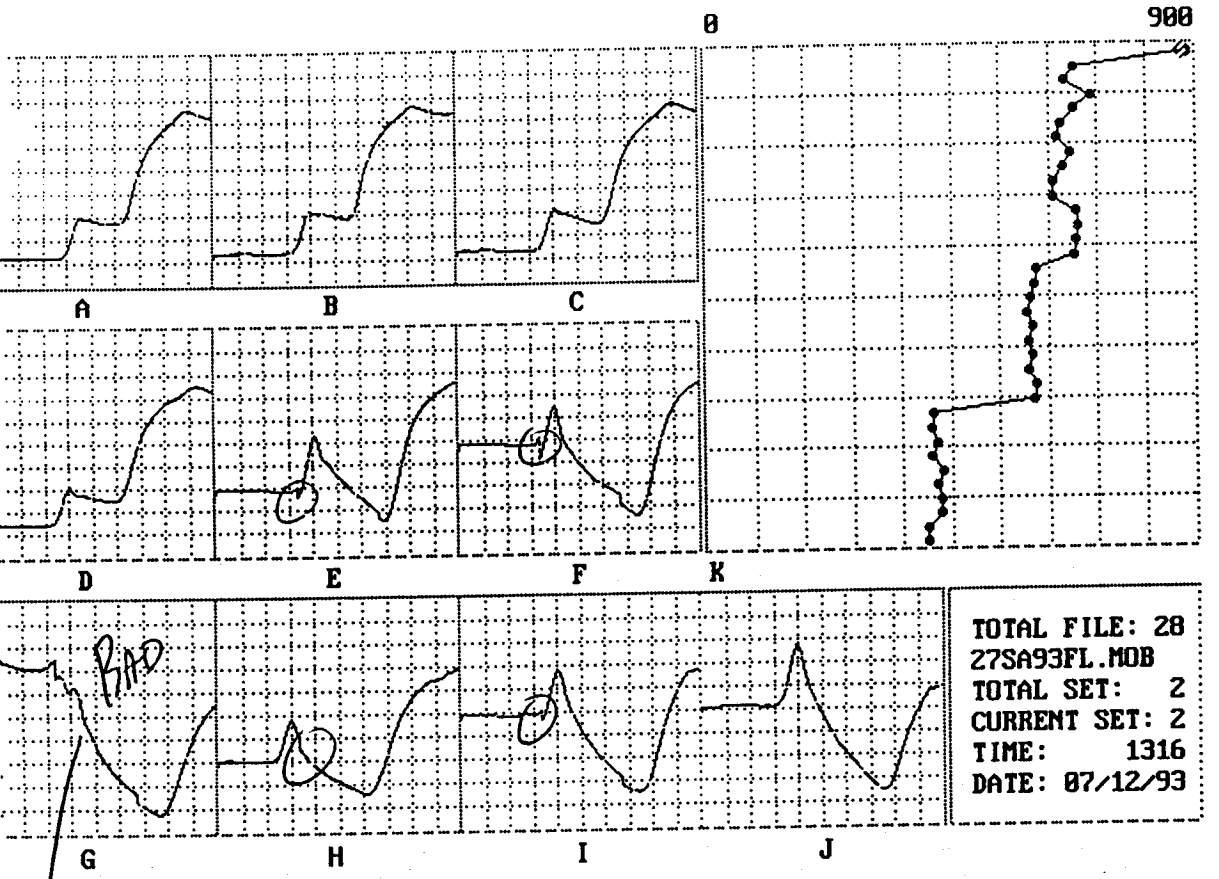
COMMENTS - Lane width changed from 11.5 feet to 12.0 feet after overlay in 1995.



ter=Curve to select (↵): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

Equipment Problem, always @ some location

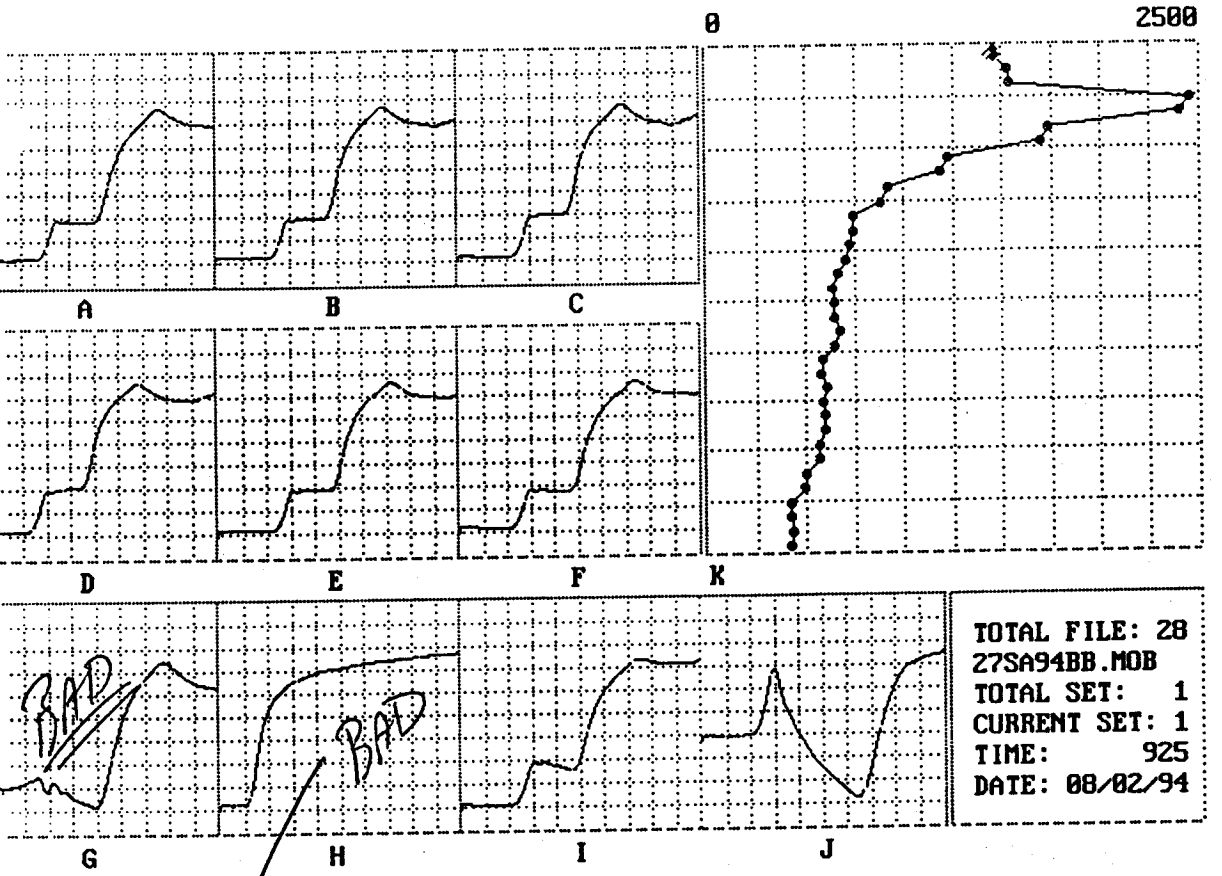
- All traces are still okay regarding La
- Cold temperature related
- Refer to as ' Vertical Shifts '



TOTAL FILE: 28
27SA93FL.MOB
TOTAL SET: 2
CURRENT SET: 2
TIME: 1316
DATE: 07/12/93

ttar=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

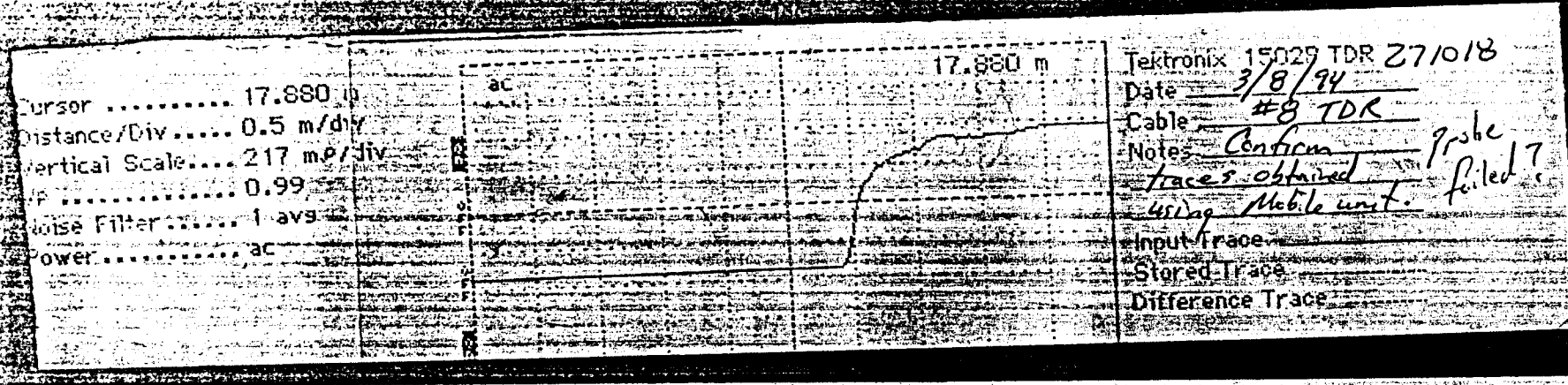
CASE WHERE VERTICAL SHIFT MAKES TRACE UNUSABLE

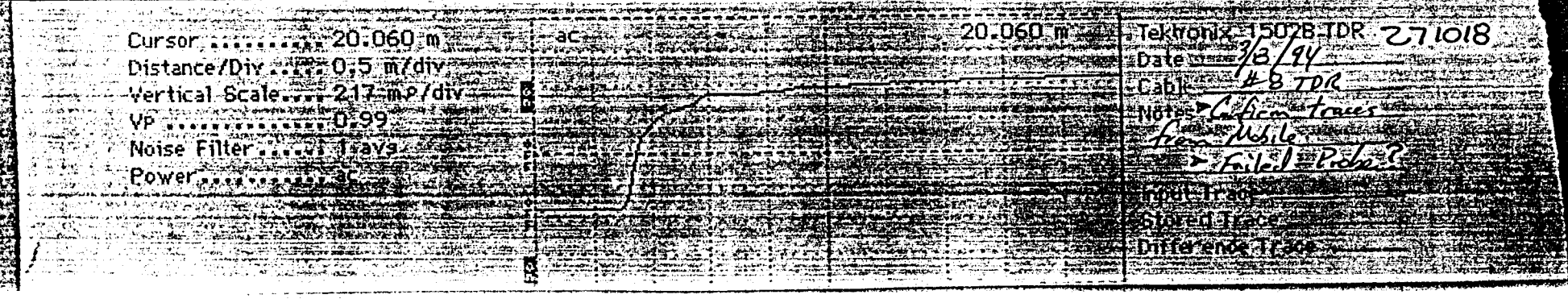


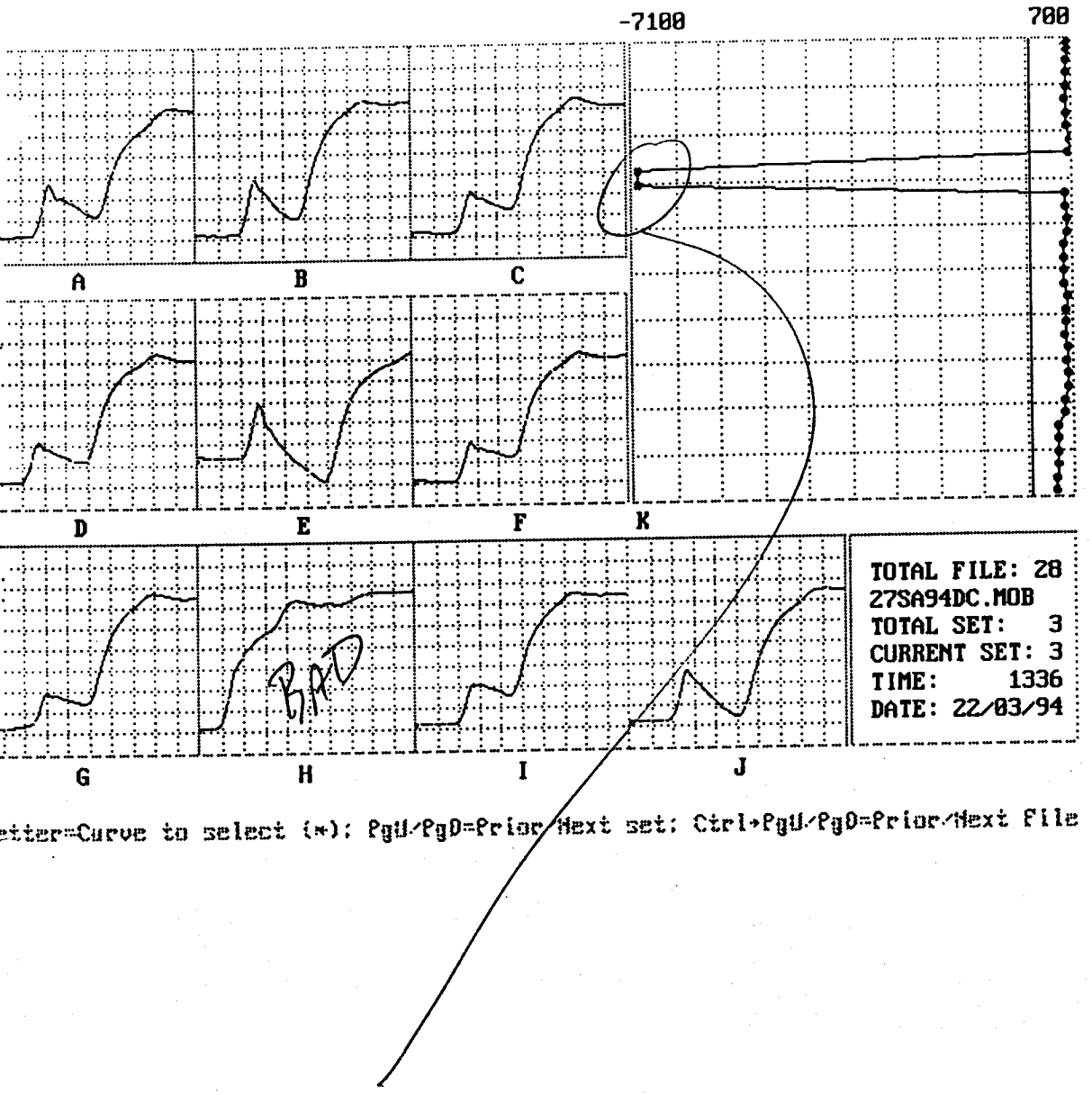
etter=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next file

FIRST FAILURE OF TDR # 8

08-FEB-94

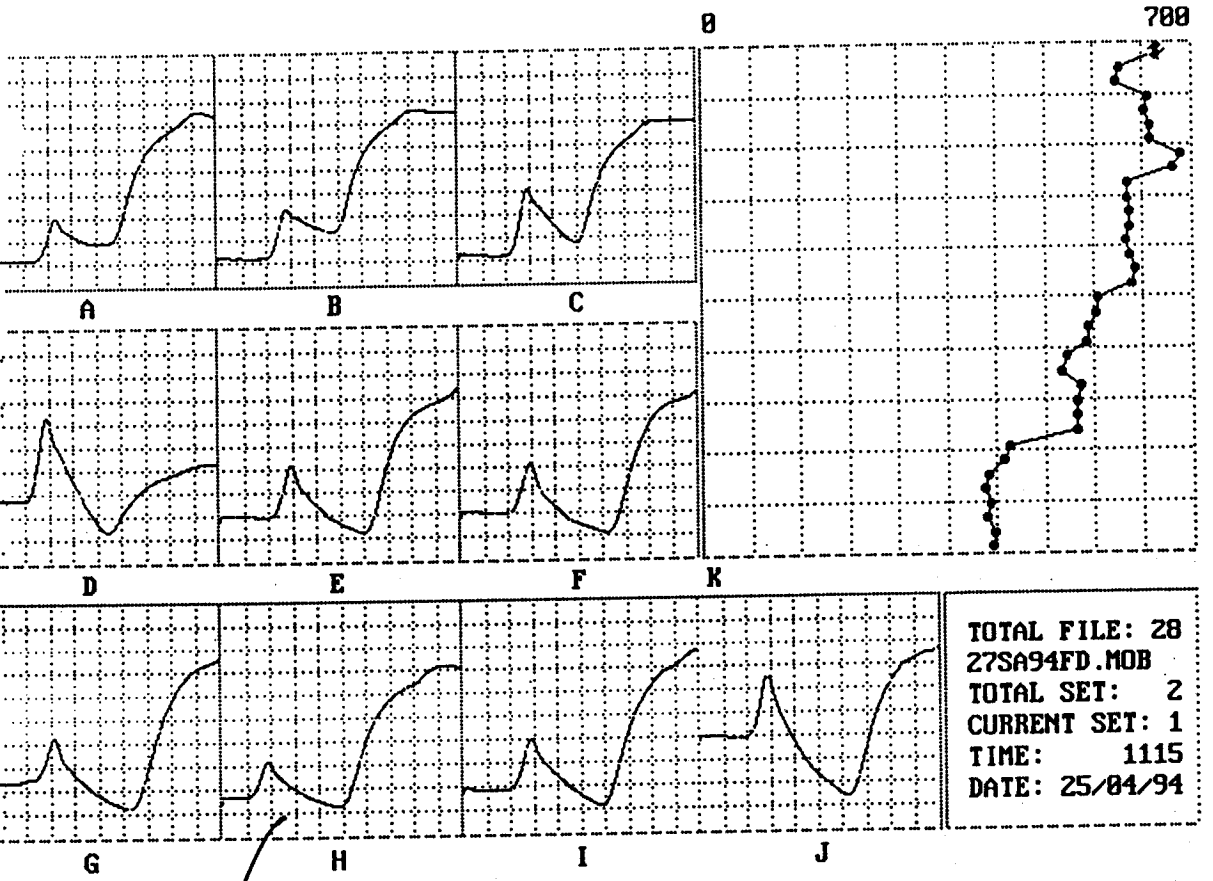

Cursor ..... 17.880 m
Distance/Div ..... 0.5 m/div
Vertical Scale.... 217 mΩ/div
VP 0.99
Noise Filter ..... 1 avg
Power ..... ac
ac
17.880 m
Tektronix 1502B TDR 271018
Date 3/8/94
Cable #8 TDR
Notes Confirm probe failed?
traces obtained
using Mobile unit.
Input Trace
Stored Trace
Difference Trace


Cursor ..... 20.060 m
Distance/Div ..... 0.5 m/div
Vertical Scale.... 217 mΩ/div
VP 0.99
Noise Filter ..... 1 avg
Power ..... ac
ac
20.060 m
Tektronix 1502B TDR 271018
Date 3/8/94
Cable #8 TDR
Notes Confirm traces
from Mobile
Unit. Failed Probe?
Input Trace
Stored Trace
Difference Trace



etter=Curve to select (*); PgU/PgD=Prior/Next set; Ctrl+PgU/PgD=Prior/Next File

Common problem w/ CRREL MULTIPLEXER
– channel 10 and 11 failures!
refer to as "CRREL 10/11"



TOTAL FILE: 28
27SA94FD.MOB
TOTAL SET: 2
CURRENT SET: 1
TIME: 1115
DATE: 25/04/94

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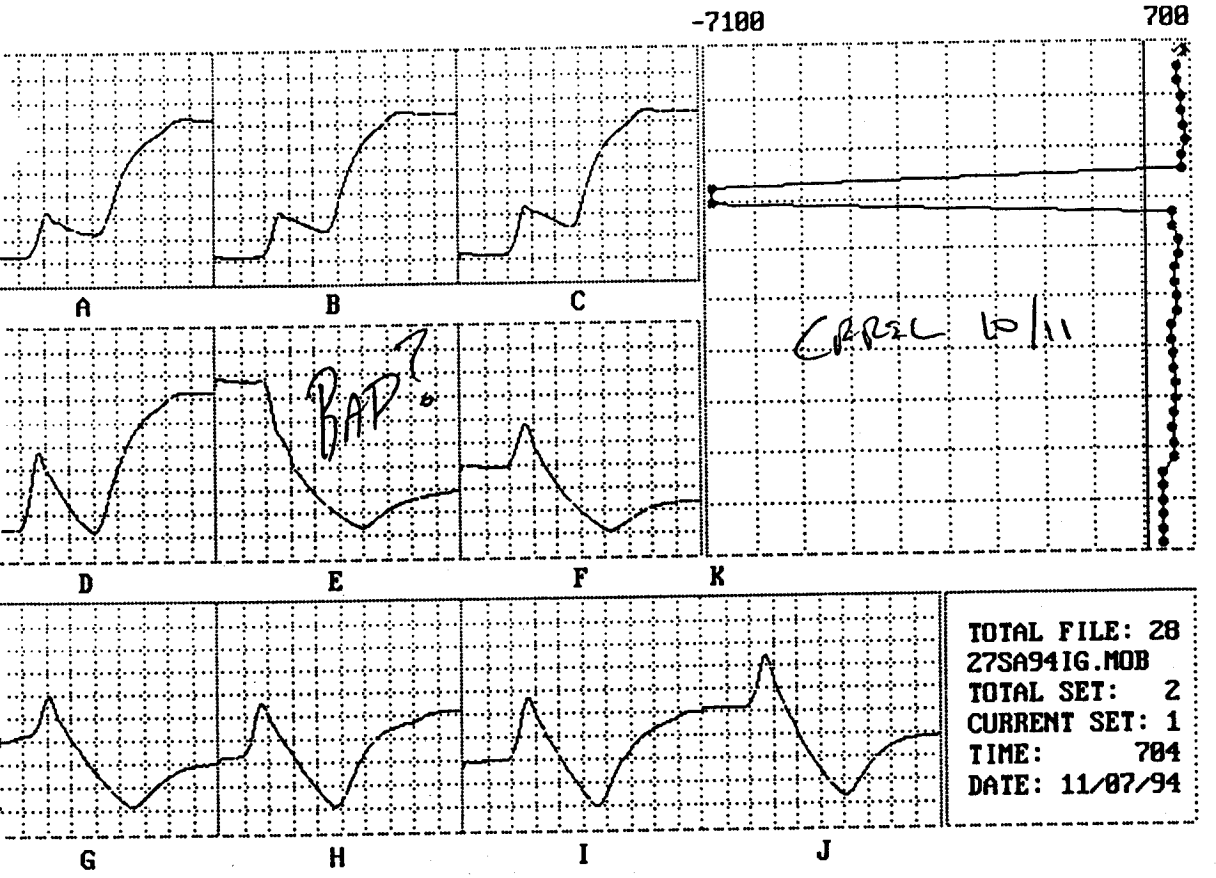
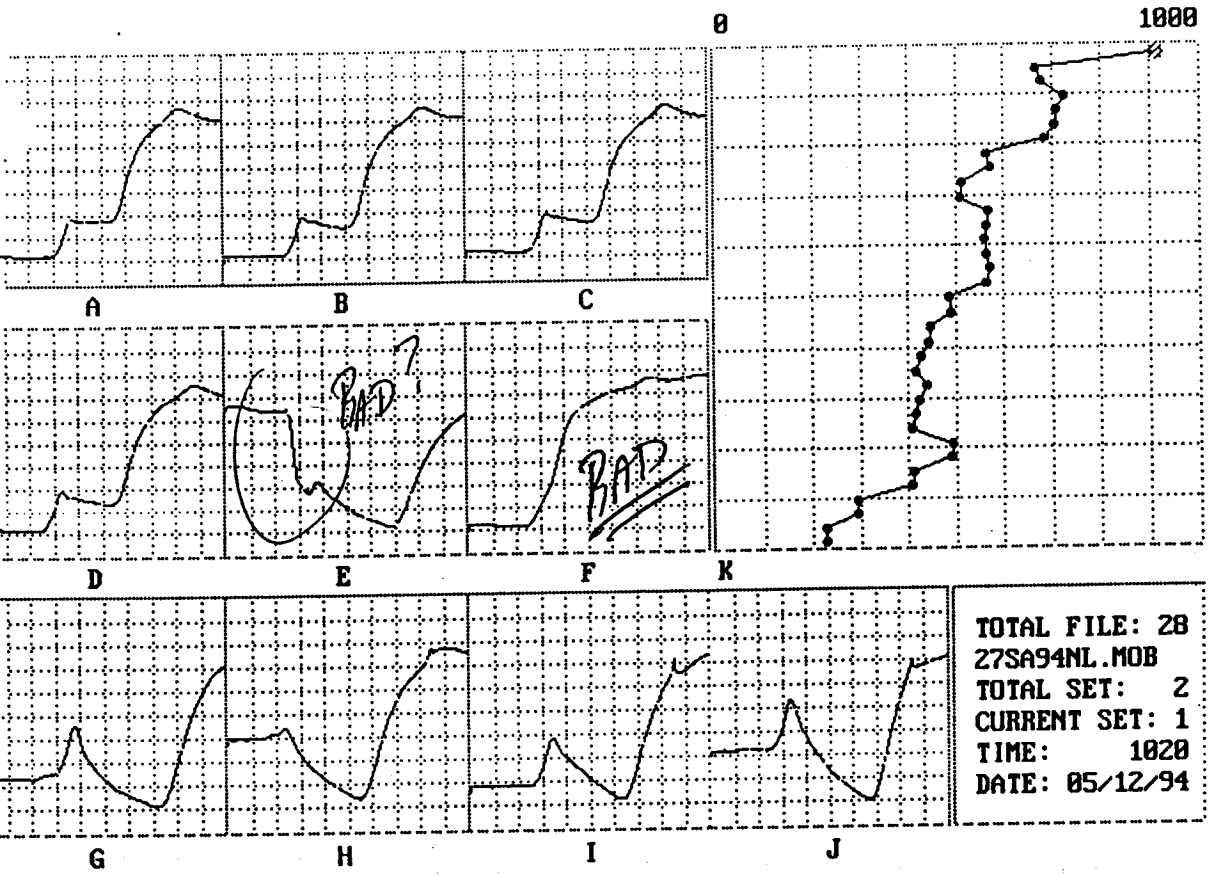
TDR #8 STARED WORKING AGAIN

25- Apr - 94



tter=Curve to select (↑↓): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next file

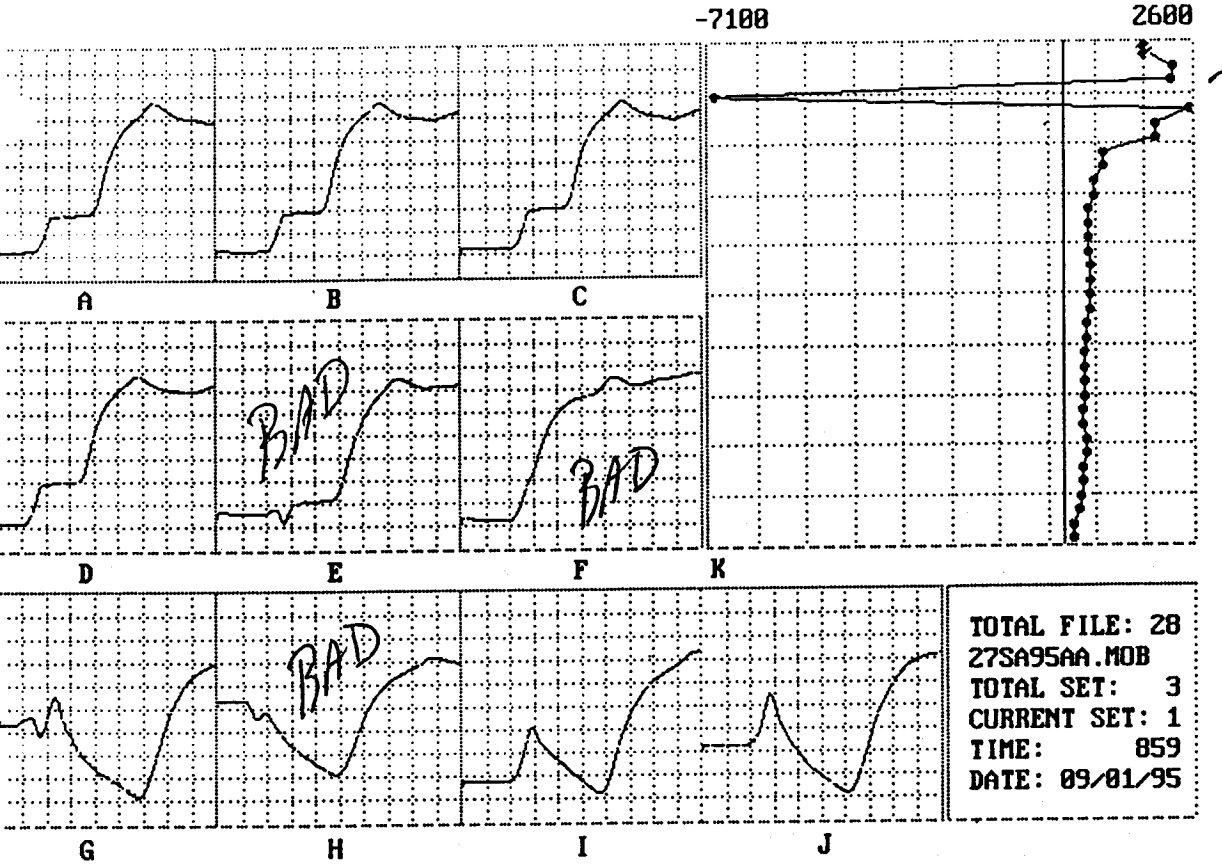
TDR #5 ? - GOOD OR BAD ?



Enter=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

— FIRST FAILURE OF TDR#6

— TDR#5 GOOD OR BAD?

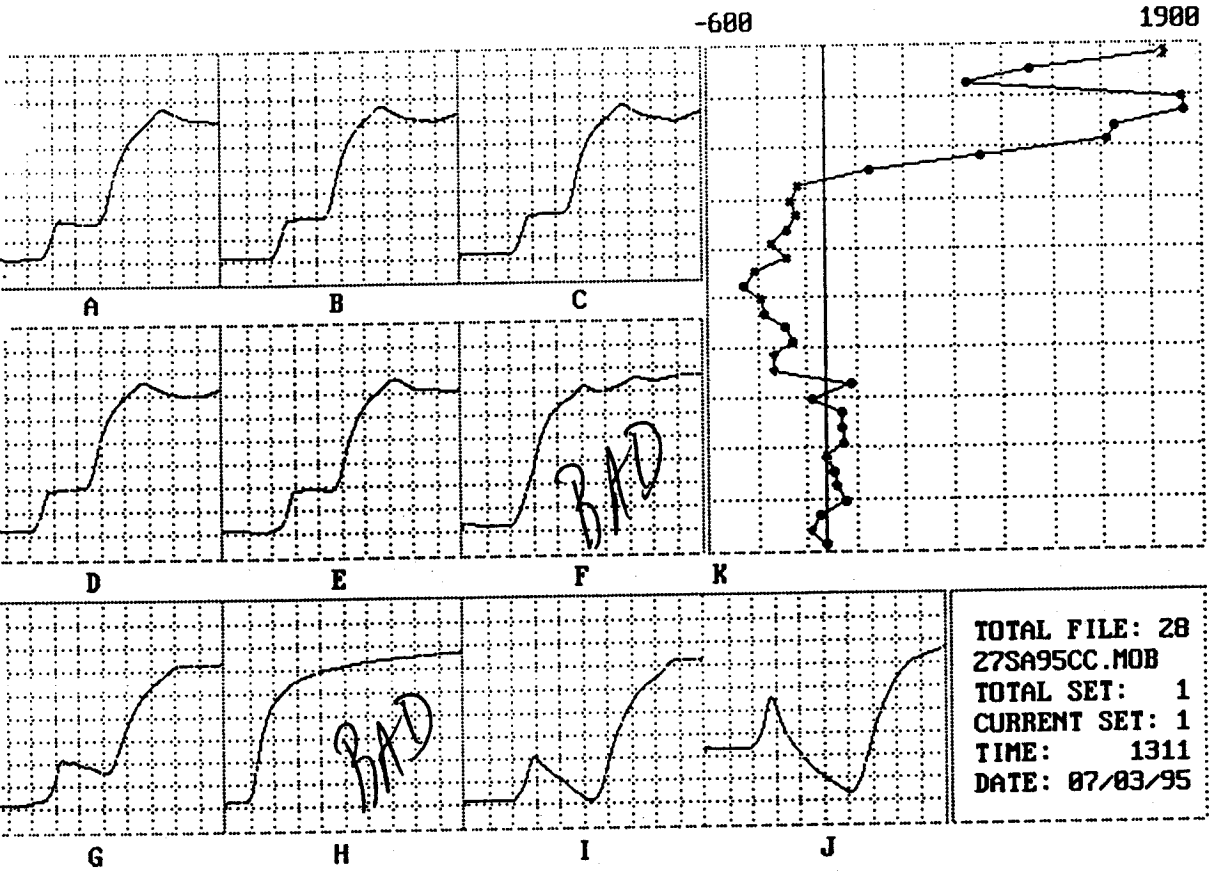


} OVERRANGE

- Assign to "3000"

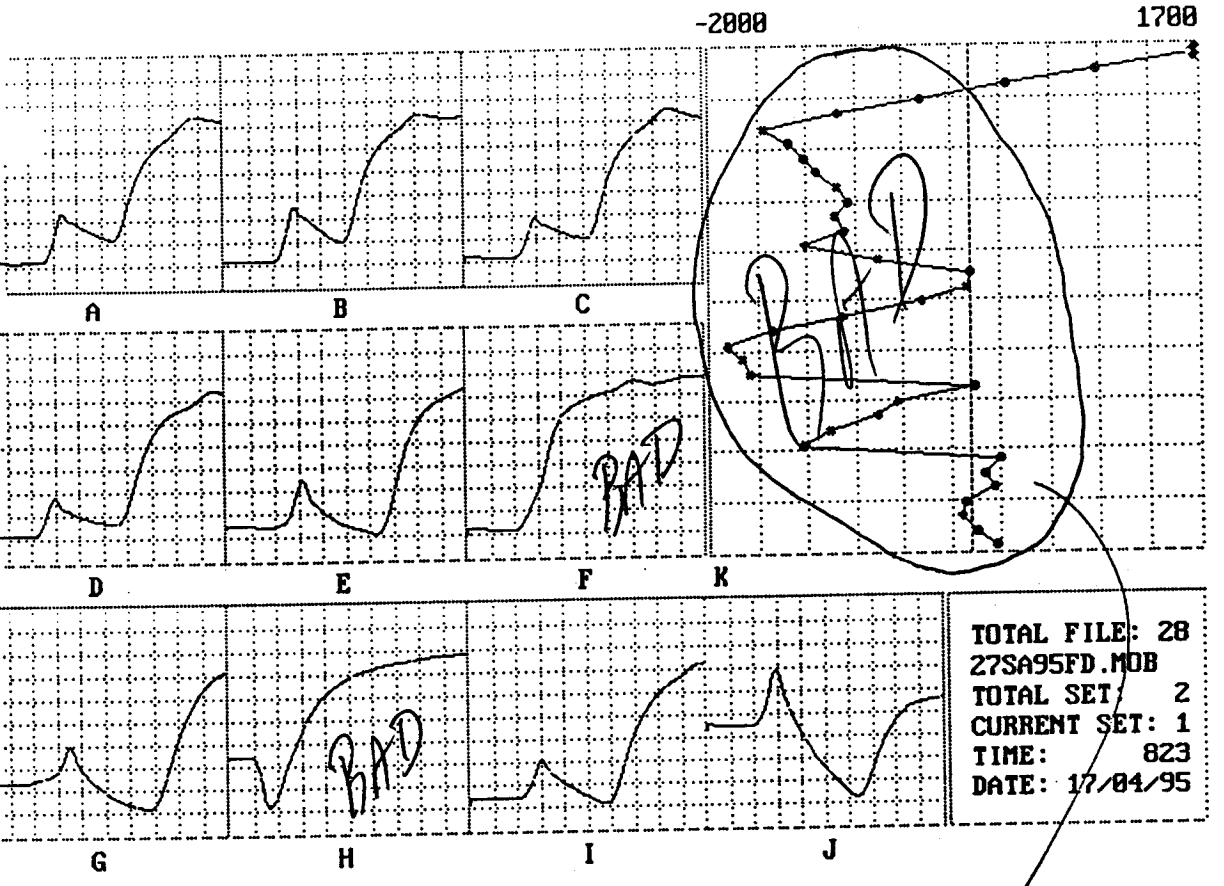
+ter=Curve to select (↵); PgU/PgD=Prior/Next set; Ctrl+PgU/PgD=Prior/Next File

CREL > 2500 mV — assign to "3000" in SMPCheck.



etter=Curve to select (*); PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

TDR # 8 FAILED FOR SECOND TIME!

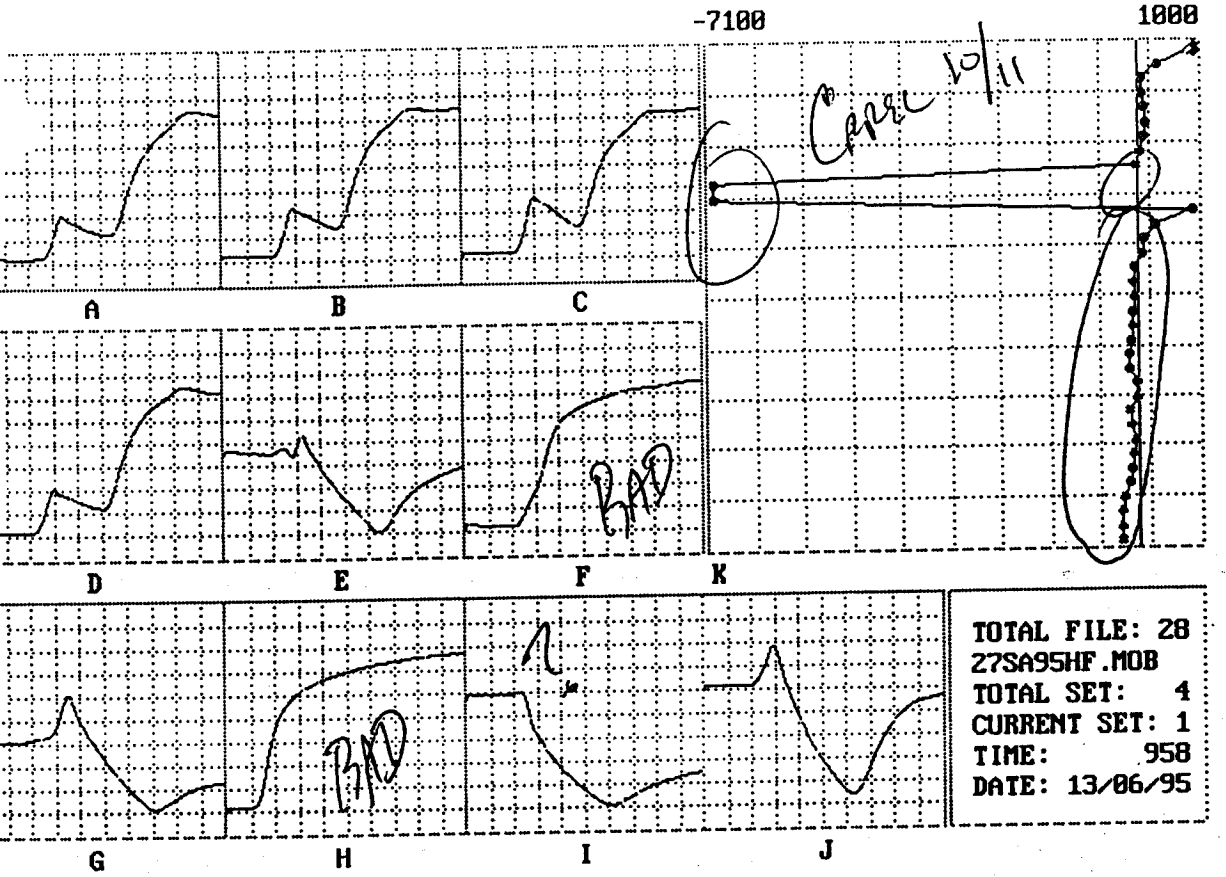


etter=Curve to select (*): PgU/PgD=Prior/Next set: Ctrl+PgU/PgD=Prior/Next File

BAD

CREL VOLTAGES ARE NEGATIVE

— Refer to as (CREL(-)



CREEC 10/11

CREEC (-)

ter=Curve to select (*); PgU/PgD=Prior/Next set; Ctrl+PgU/PgD=Prior/Next File

MULTIPLE CREEC FAILURES

Appendix D-3: GPS Section 271018 Mill and Overlay Information

Appendix D-3 contains the following information related to rehabilitation of GPS section 271018:

- June 13, 1995 pre-rehabilitation manual distress survey;
- May 11, 1995 to July 7, 1995 documents about rehabilitation decisions;
- Elevation plot for Station 3+00 from August 1993 to July 1995; and
- Photographs documenting rehabilitation.

SURVEY DONE PRIOR TO MILL AND OVERLAY

Revised December 1, 1992

SHEET 1 — 9691 91 [illegible]

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID

STATE CODE 27

SHRP SECTION ID 1018

DISTRESS SURVEY FOR PAVEMENTS WITH ASPHALT CONCRETE SURFACES

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 06/13/95

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

PAVEMENT SURFACE TEMP - BEFORE 32 °C; AFTER 37 °C

DISTRESS TYPE	SEVERITY LEVEL LOW	MODERATE	HIGH
CRACKING			
1. FATIGUE CRACKING (Square Meters)	0	0	0
2. BLOCK CRACKING (Square Meters)	0	550	0
3. EDGE CRACKING (Meters)	0	0	0
4. LONGITUDINAL CRACKING (Meters)			
4a. Wheel Path	432	0	0
Length Sealed (Meters)	0	0	0
4b. Non-Wheel Path	656	1196	0
Length Sealed (Meters)	0	0	0
5. REFLECTION CRACKING AT JOINTS			
Number of Transverse Cracks			
Transverse Cracking (Meters)			
Length Sealed (Meters)			
Longitudinal Cracking (Meters)			
Length Sealed (Meters)			
6. TRANSVERSE CRACKING Number of Cracks	20	28	7
Length (Meters)	291	755	271
Length Sealed (Meters)	0	0	0
PATCHING AND POTHOLES			
7. PATCH/PATCH DETERIORATION (Number)	0	0	0
(Square Meters)	0	0	0
8. Potholes (Number)	1	0	0
(Square Meters)	0	0	0

Revised December 1, 1992

SHEET 2

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID ____

STATE CODE 27

SHRP SECTION ID 1018

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) 06/13/95

SURVEYORS: BJW, 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)			0
(Square Meters)			0.0
SURFACE DEFECTS			
11. BLEEDING (Square Meters)	0.0	0.0	0.0
12. POLISHED AGGREGATE (Square Meters)			0.0
13. RAVELING (Square Meters)	0.0	0.0	0.0
MISCELLANEOUS DISTRESSES			
14. LANE-TO-SHOULDER DROPOFF - REFER TO SHEET 3			
15. WATER BLEEDING AND PUMPING (Number)			0
Length of Affected Pavement (Meters)			0.0

16. OTHER (Describe) AREA OF BLOCK CRS = 0/L COLD JT +4BL +4bM +4AL+6M

Revised May 29, 1992

SHEET 3

DISTRESS SURVEY

LTPP PROGRAM

STATE ASSIGNED ID _ _ _ _

STATE CODE 27

SHRP SECTION ID 1018

DATE OF DISTRESS SURVEY (MONTH/DAY/YEAR) _ _/_ _/_ _

SURVEYORS: BIW _ _ _

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	_ _ _. SEE	3	30.5	_ _ _.
4	45.75	_ _ _. DIPSTICK	4	45.75	_ _ _.
5	61.	_ _ _. DATA	5	61.	_ _ _.
6	76.25	_ _ _.	6	76.25	_ _ _.
7	91.5	_ _ _.	7	91.5	_ _ _.
8	106.75	_ _ _.	8	106.75	_ _ _.
9	122.	_ _ _.	9	122.	_ _ _.
10	137.25	_ _ _.	10	137.25	_ _ _.
11	152.5	_ _ _.	11	152.5	_ _ _.

14. LANE-TO-SHOULDER DROPOFF

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

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

DIPSTICK FIELD ACTIVITY REPORT

SHRP REGION NCR STATE CODE 27 SHRP ASSIGNED ID 271018
STATE MN TESTING DIPSTICK DISTRICT LITTLE FALLS
LTPP EXPERIMENT CODE GPS-1 (SMP 27SA) ROUTE/HIGHWAY NUMBER US-10
EQUIPMENT SERIAL NUMBER 30022
TESTING DATE 6/13/95 (JUNE) SHEET NUMBER 1
WEATHER PC

==========

DIPSTICK PRE-OPERATION CHECKS BJW (initials)

	TIME
READY TO TEST	
BEGIN TESTING	
END TESTING	
START TRAVEL	
END TRAVEL	

DOWN TIME — HOURS

REASONS

ADDITIONAL REMARKS

LAST DIPSTICK BEFORE MILL & AC overlay

DIPSTICK PROFILE CREW
NAMES: BEN
BOB

TRAFFIC CONTROL CREW
NAMES: MARK

COPIES: RCOC

FORM F01/SEPT 1990

ZERO CHECK

First Reading -69 OK ⇒ 3 ADJUSTMENTS

Rotate 180 degrees

Second Reading +70

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 +70

Place calibration block OK

Second Reading +196

0.125 = First Reading ±0.003 proceed or else contact FACE through RCO

DATE: 13/JUNE/95
OPERATOR: BEN WOLEL
RECORDER: JEROME DICKS
DIPSTICK SERIAL NUMBER: 30022

STATE CODE: 27
SHRP SECTION I.D.: 10T8

LOCATION	DIPSTICK READING															TOTAL	SUM
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
0+00	60	159	189	269	208	165	165	91	113	289	277						
	-57	-155	-193	-260	-207	-160	-160	-87	-92	-294	-277						
0+50 (15 m)	100	119	225	216	188	147	130	20	109	174	288						
	-95	-109	-221	-213	-178	-142	-122	-21	-103	-165	-288						
1+00 (30 m)	158	111	117	207	199	180	102	-21	154	251	202						
	-146	-115	-108	-202	-193	-166	-98	+30	-148	-247	-202						
1+50 (45 m)	89	86	125	340	261	127	116	-21	45	221	271						
	-82	-82	-128	-333	-254	-121	-106	+22	-38	-207	-271						
2+00 (60 m)	-8	-3	+22	191	160	113	50	-19	+38	230	317						
	+6	+7	-22	-190	-152	-107	-38	+24	-32	-224	-317						
2+50 (75 m)	116	71	144	210	227	140	128	44	133	252	312						
	-108	-71	-132	-206	-220	-182	-119	-88	-127	-240	-312						
3+00 (90 m)	-3	62	99	175	204	182	104	19	149	262	284						
	+7	-60	-94	-165	-198	-180	-100	-12	-144	-259	-284						
3+50 (105 m)	64	180	186	247	215	217	136	16	204	228	137						
	-63	-67	-190	-239	-220	-209	-133	-2	-196	-213	-137						
4+00 (120 m)	92	178	164	237	238	240	136	38	155	200	284						
	-91	-174	-162	-231	-233	-236	-132	-36	-158	-194	-284						
4+50 (135 m)	112	162	195	263	205	151	31	88	147	291	290						
	-112	-158	-201	-262	-197	-43	-23	-88	-133	-291	-290						
5+00 (150 m)	44	155	231	210	231	204	150	127	74	244	178						
	-42	-156	-231	-205	-233	-190	-155	-119	-73	-235	-178						

DATE	~~03/30/95~~ 6/95
RATER	BSW
TEMP (C)	~~26C~~ 90°F = 29C

N

3/95
NONE

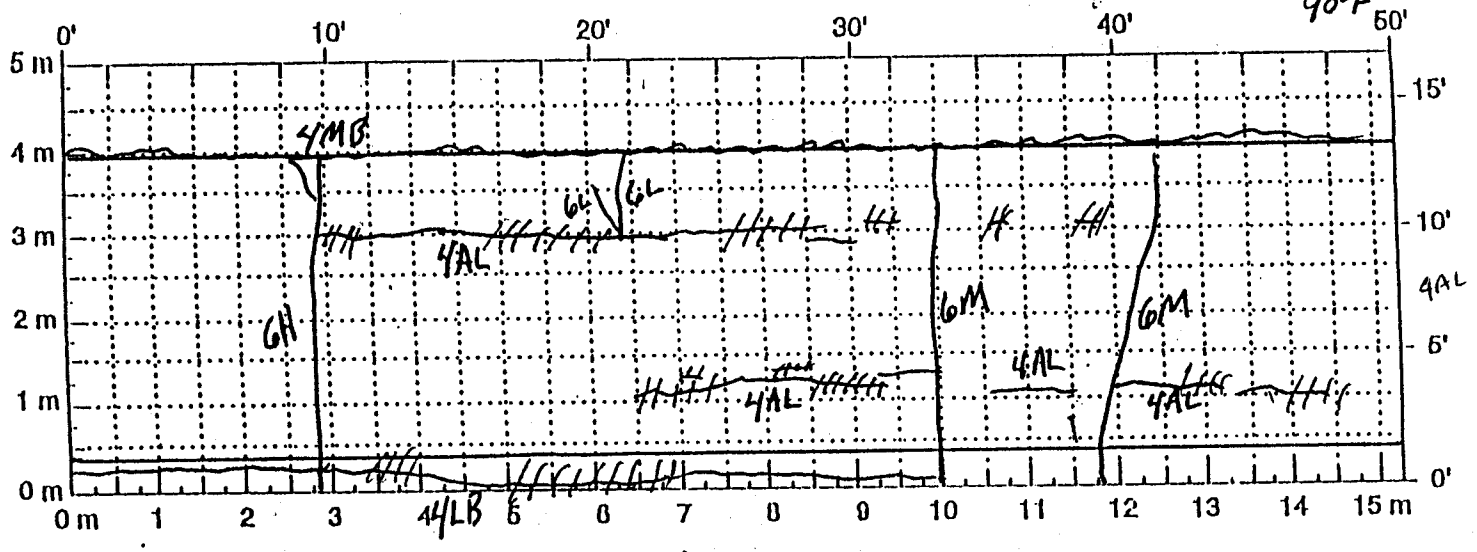
N

N

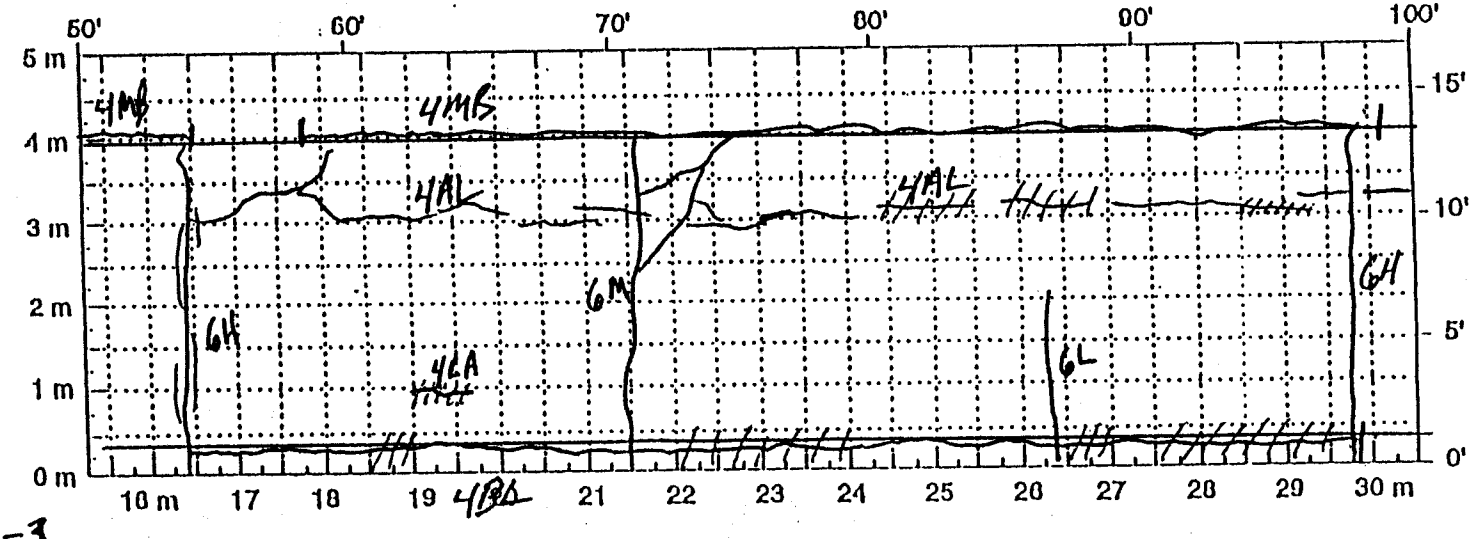
YAL = 26.6
LB
4BL = 13.3
4BM = 39.5

NONE

6M #=3
L=12
6H #=3
L=12
6L #=3
L=2.4



Comments: (NO SEALANT Present)



Comments: _____

6/95

4AL 6.7

4AL 16.7/0
4BL 17.75/0
4bM 29.0/0

6L 3/3.1/0
6M 3/11.1/0
6H 2/8.0/0

DATE	3/20/95

6/13/95

BTP

6/95

4A 20.0/0

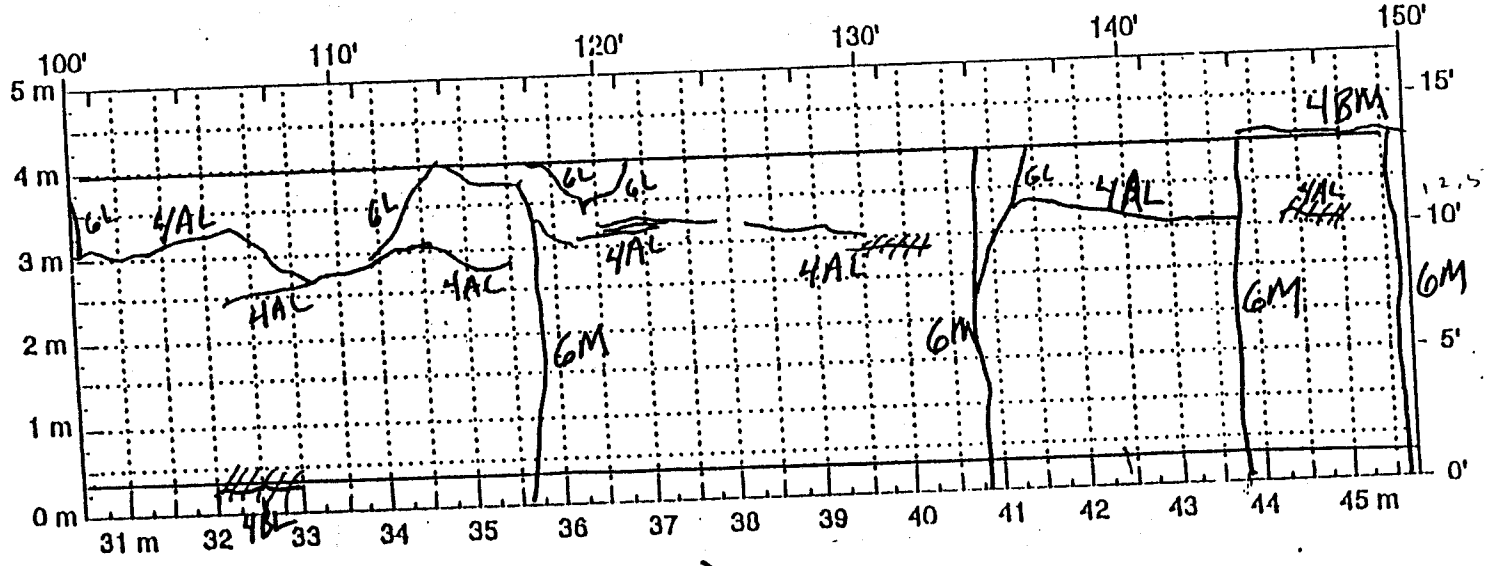
4BL 9.8/0

4bm 15.8/0

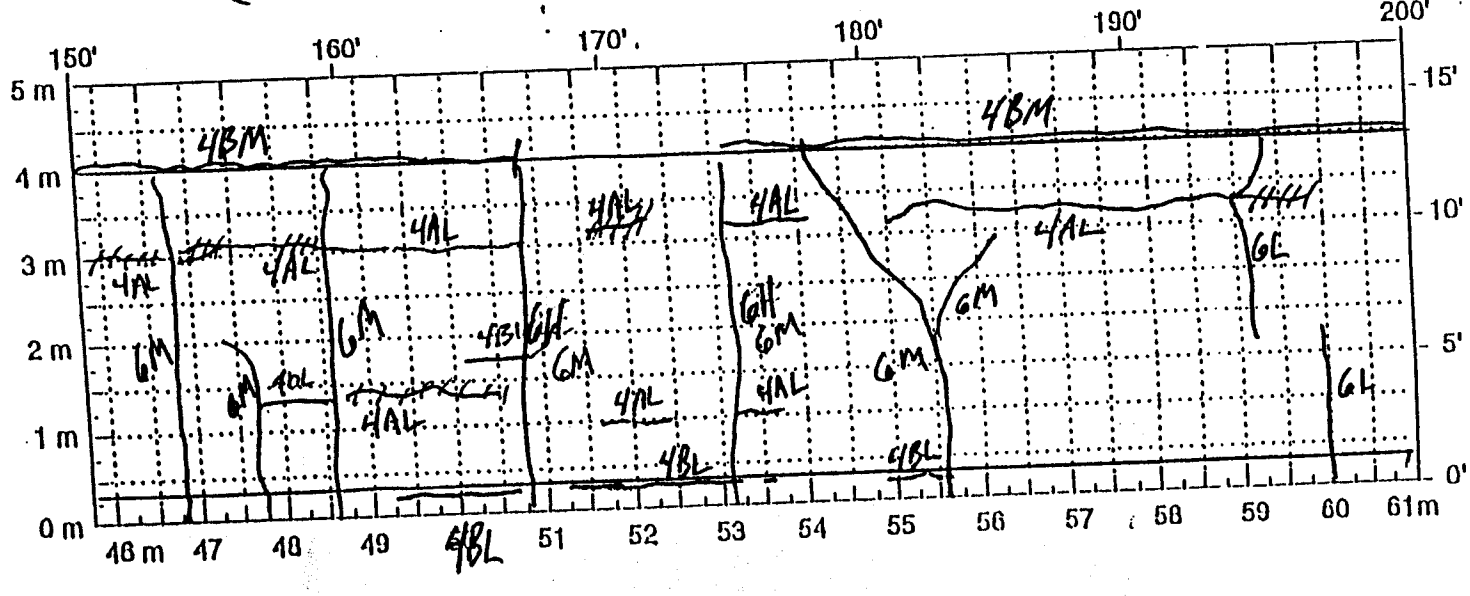
6L 6/5.0/0

6m 11/36.2/0

6H



Comments: (No SEALANT present)



Comments:

1	
2	
3	
4	L = 27.0 L = 3.4 3M = 13.6
5	L# = 4 L = 5.4
6	3M# = 9 L = 31.9 6H# = 2 L = 8

SECTION	271018
DATE	3/20/95

6/13/95

1M = 1.1 M^2

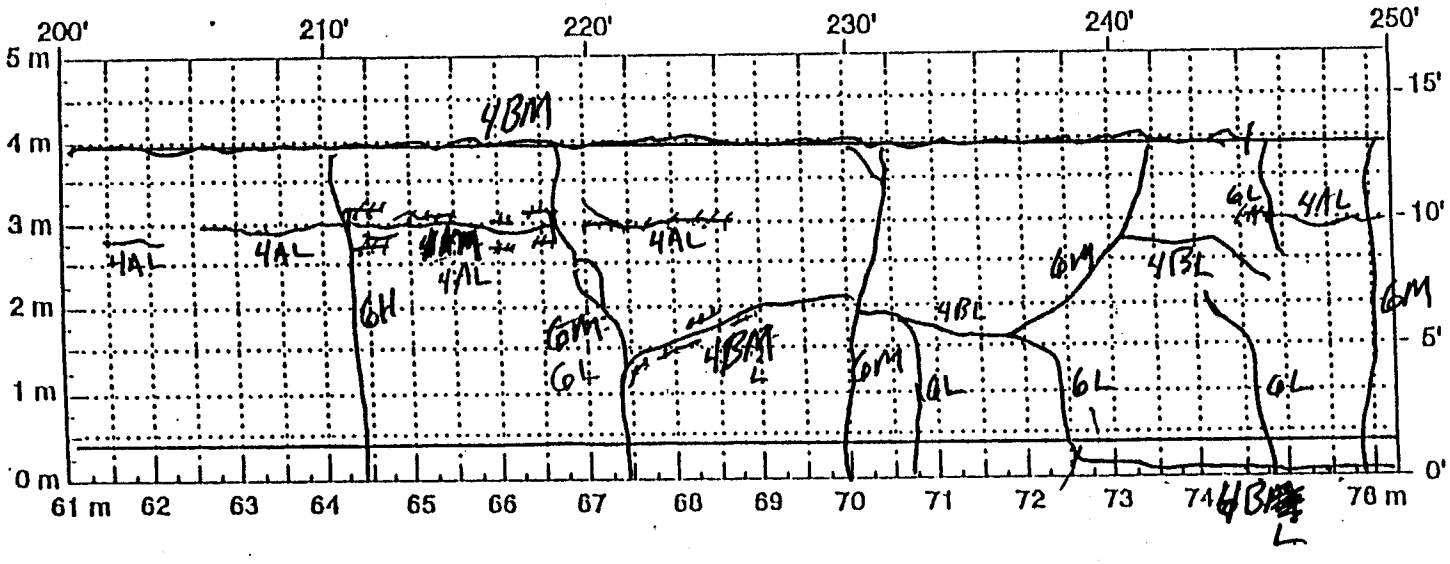
2 —

3 —

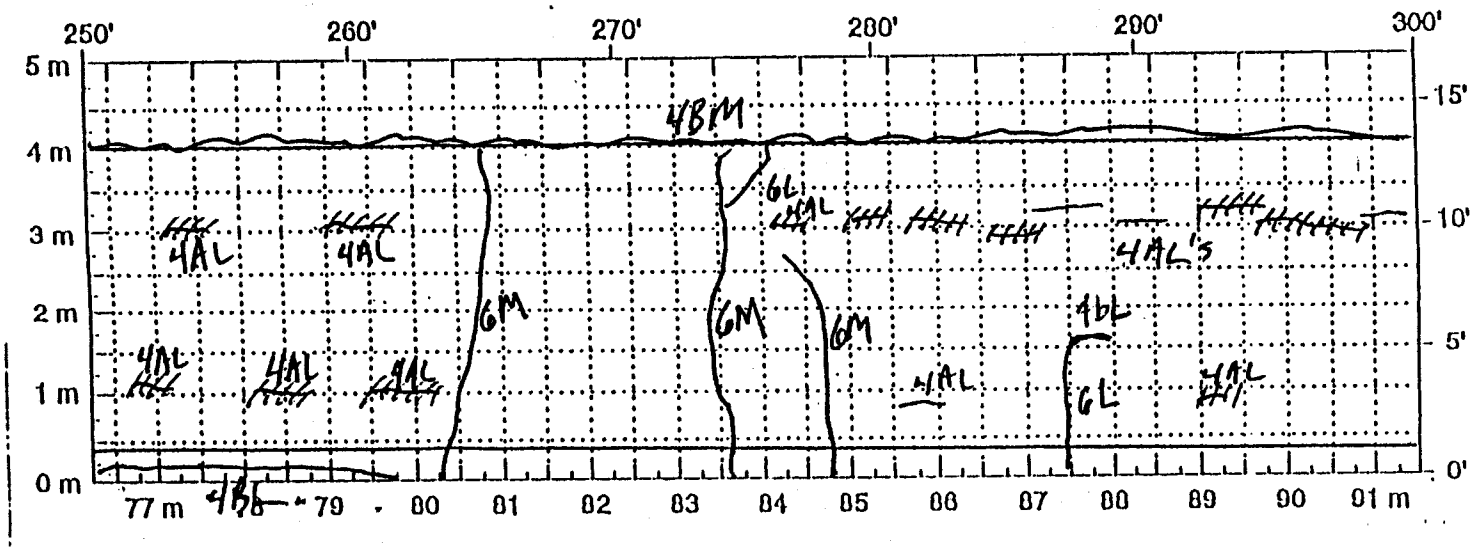
1AL = 15.5
1AM = —
4BL = 7.2
4BM = 30.8

5

6L# = 6
L = 9.8
6M# = 7
L = 25.6
6H# = 1
L = 40



Comments: _____



Comments: _____

BP
6/95

4AL 8.0/0
4BL 13.2/0
4BM 29.3/0
6L 7/14.1/0
6M 6/19.2/0
6H 1/9.0/0

SECTION	27/018
DATE	~~3/20/95~~ 6/13/95

1 —

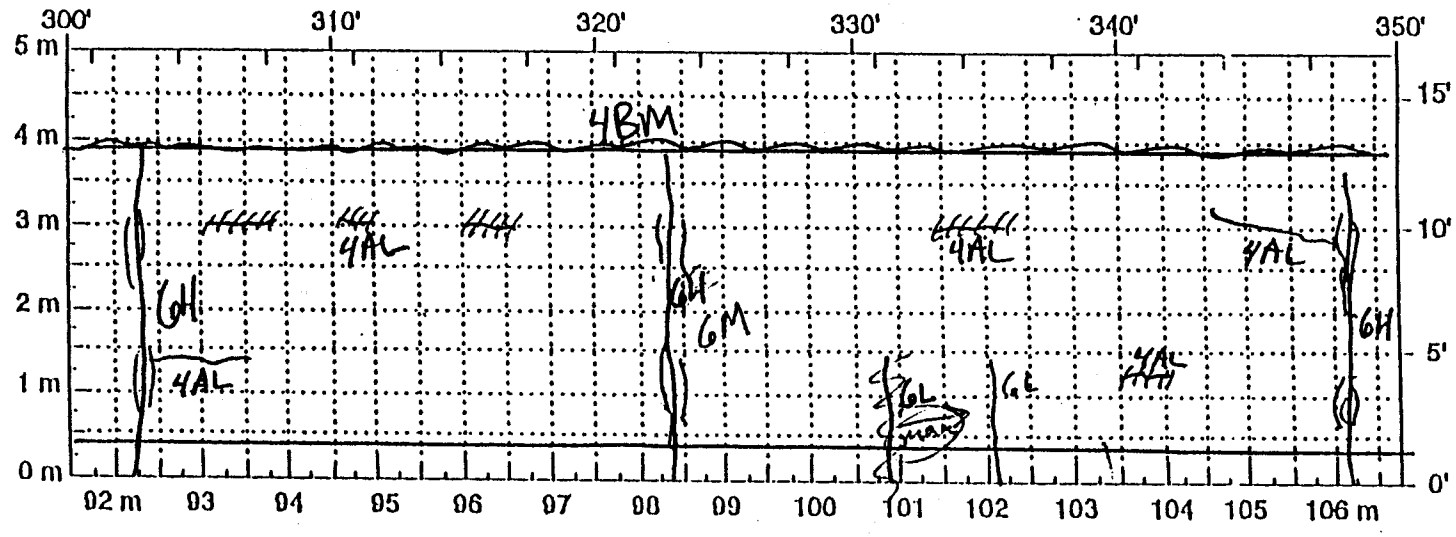
2 —

3 —

4 4AL = 13.1
4CB = 15.3
4MB = 15.3 30.

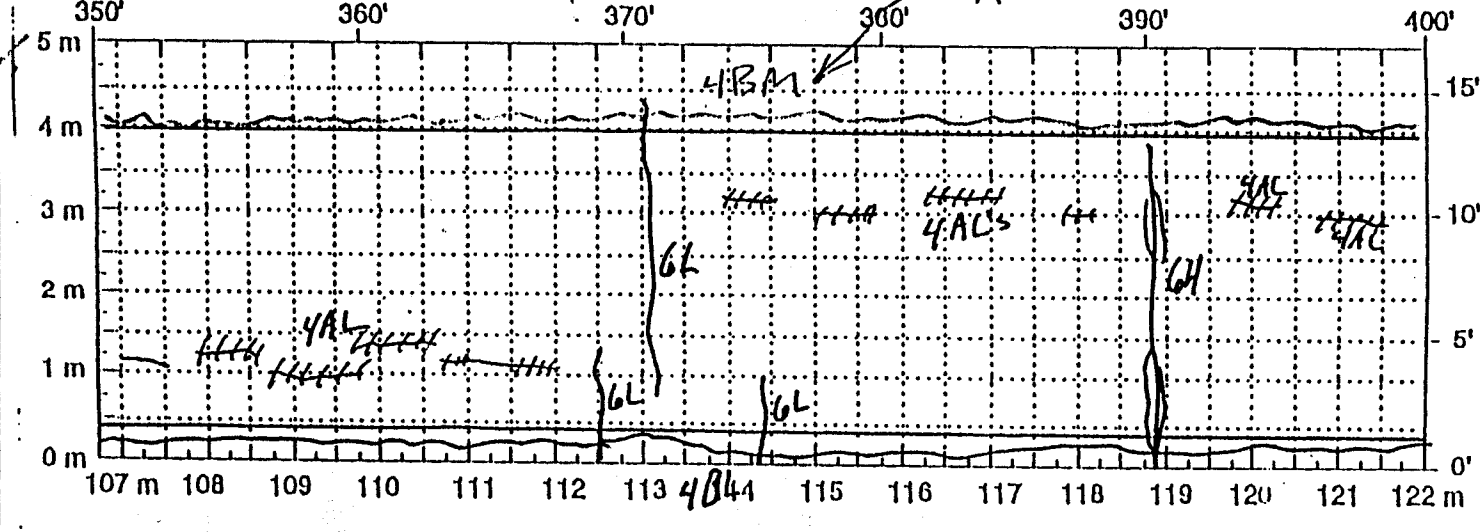
5 —

6 L # = 3
L = 5.3
6H # = 4
L = 15.7



AGL 3.5/0
4bL 15.3/0
4bM 30.5/0

Comments: IN } FIX RIMS.



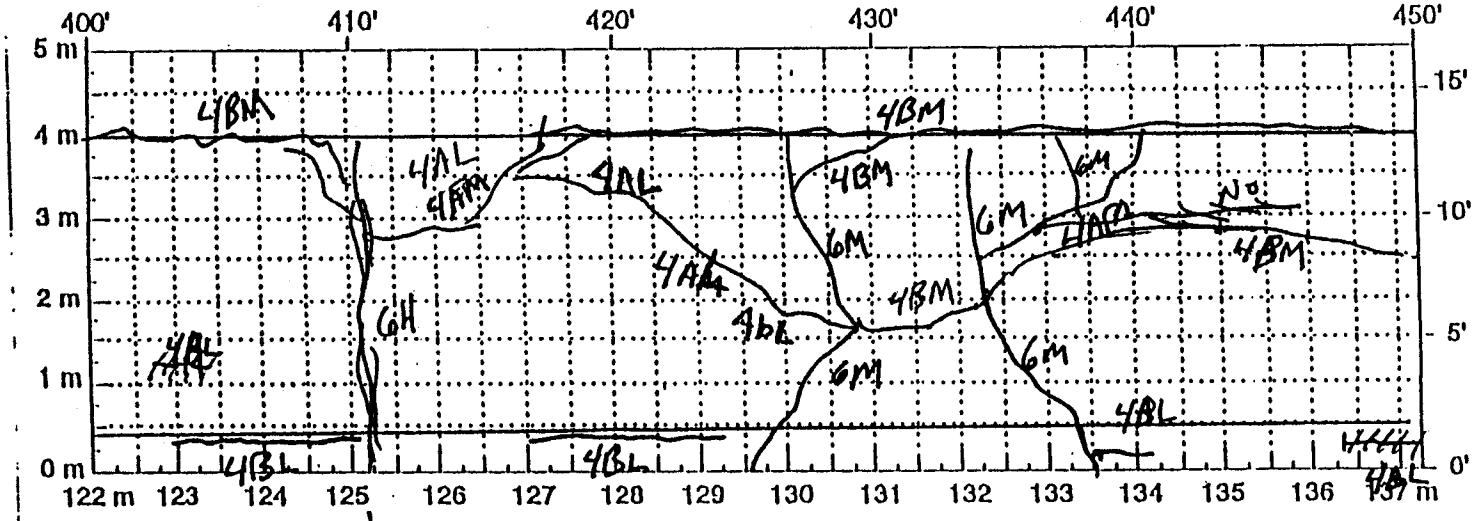
6L 4/5.7
6M 1/9.0/0
6H 3/11.1/0

Comments:

DATE	~~3/20/95~~

6/13/95

→ M-BLOCK CRS-TO STA 139.8m



6/95

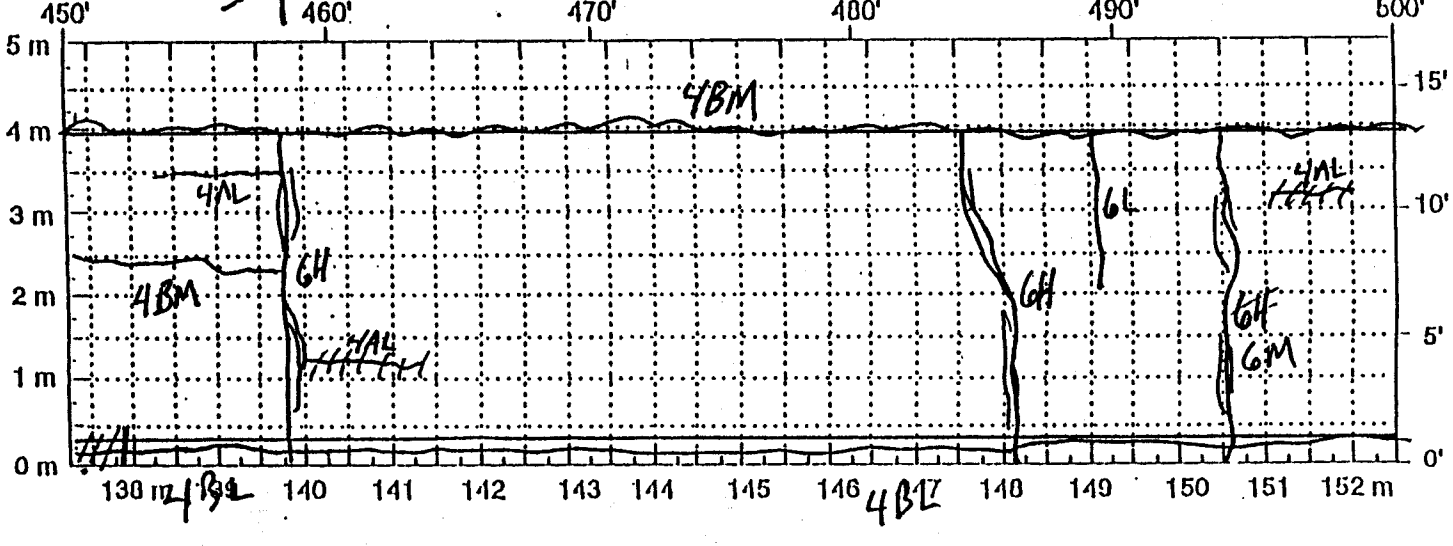
2M 53.0/0

4bL 19.5/0

4bm 15.0/0

→ BLOCK M-BLOCK

Comments:



6L 1/2.0/0

6m 1/11.0/0

6+1/11.0/0

1 4AL = 3.1
2 4AM = 15.2
3 4BL = 20.5
4 4BM = 22.1
5 6L # = 1, L = 2
6 6M # = 3, L = 10.5; 6H # = 4, L = 16

Comments:

1.3
5.2

BRAUN[SM]
INTERTEC

Braun Intertec Corporation
6875 Washington Avenue South
P.O. Box 39108
Minneapolis, Minnesota 55439-0108
612-941-5600 Fax: 942-4844

Engineers and Scientists Serving the Built and Natural Environments[®]

Memorandum

Date: May 11, 1995

To: Ken Wasnie and Robin Allen, MnDOT District 3A
Lee Purdham, MnDOT District 3A (Maintenance)
Dick Sullivan and Fred Maurer, MnDOT MRL
Gene Skok and Ben Worel, Braun Intertec Corp.
Richard Ingberg, SHRP/FHWA/LTPP
Gonzalo Rada, PCS Law Engineering, Inc.
Monte Symons and Aramis Lopez, FHWA-LTPP Division

From: Robert J. Van Sambeek RJVS

Re: Rehabilitation of SHRP Pavement Test Section 271018 on US-10
C:\SMP\WP\REHAB27A.MEM

The attached letter to Mr. Harvey Allen of the Minnesota DOT concerns rehabilitation of SHRP section 271018 on US-10 between Randall and Little Falls. This section is a core section in the Seasonal Monitoring Program for FHWA, and the rehabilitation alternative used this summer will affect the status of the section in the Program.

If you have comments on rehabilitation of this section, please call me at 800-344-7477.

BRAUN[SM]
INTERTEC

Braun Intertec Corporation
6875 Washington Avenue South
P.O. Box 39108
Minneapolis, Minnesota 55439-0108
612-941-5600 Fax: 942-4844

Engineers and Scientists Serving the Built and Natural Environments[SM]

May 11, 1995

Mr. Harvey Allen
Minnesota Department of Transportation
1991 Industrial Park Road
Baxter, MN 56401

Re: Rehabilitation of SHRP Pavement Test Section 271018 on US-10

Dear Mr. Allen:

SHRP pavement test section number 271018 on US-10 between Randall and Little Falls is inside the limits of a construction project scheduled for 1995. The test section, located in the east bound lane from MP 140.1 to MP 140.3, is included in the Seasonal Monitoring Program under FHWA's Long Term Pavement Performance Study (Formerly known as the Strategic Highway Research Program or SHRP).

For the Seasonal Monitoring Program, instrumentation was installed August 1993 to monitor environmental changes in temperature, moisture, and frost/thaw conditions. Additional data are being collected regarding changes in pavement strength, longitudinal and transverse profiles, surface elevations, and pavement distress. The data will ultimately be used to improve pavement design to account for environmental factors.

Sections in the seasonal study were only to receive "routine maintenance" for at least six years. Unfortunately, this section was blade patched in 1994, and to complicate the matter, the patch material is breaking away at the transverse cracks. We would really like to keep the section in the study given the time and money invested already. However, the blade patch is a real problem for several data elements being collected.

Therefore, we would like the DOT to consider <u>including</u> the test section in the construction project this summer. From discussions with Ken Wasnie, it appears the asphalt surface will be milled in the driving lanes and a new surface will be placed on both the driving lanes and shoulder (inlay on driving lanes and overlay on the shoulder).

The main concern is what rehabilitation to use in the test section. Ken indicated the DOT is willing to arrange test section rehabilitation for almost any possible combination of mill and overlay. In this respect, three possible alternatives are presented. However, any additional alternatives can be discussed.

<u>Mill Driving Lanes 2.0 in. and Inlay 3.5 in., Overlay Shoulder 1.5 in.</u>

> Ken indicated this is the current construction plan for the project. If this was done through the test section, it would keep the rehabilitation consistent and provide a surface that should last 10 years without significant maintenance.

On the down side, the pavement temperature sensor destroyed by milling will require a retrofit probe prior to monitoring the section in 1996. Probe retrofit will involve sawing a slot in the new surface for the probe and lead wire.

The additional 1.5 in. of pavement thickness will move this section to a different experimental cell (from Cell 8 with a surface thickness requirement less than 5.0 in. into Cell 16 with a surface thickness requirement greater than 5.0 in.). This is not a big concern with the final surface thickness expected to be about 6.0 in.

Mill Driving Lanes 1.0 in. and Inlay 2.5 in., Overlay Shoulder 1.5 in.

This alternative may prevent damage to the pavement temperature probe, if depth control on the milling operation is closely monitored.

The main concern is the expected years of service without maintenance as compared to the above alternative.

Mill Driving Lanes 1.0 in. and Inlay 1.0 in., No Work on Shoulder.

Again, this may prevent damage to the pavement temperature probe during milling. With the inlay depth the same as the milled depth, the status of the section is relatively the same in the study. Also, the driving lane currently only 11 ft. wide, could be increased to 12 ft.

However, Ken indicated the rehabilitation would only last about five years before additional work is required, and this would not improve the shoulder. Therefore, this is probably not the best alternative.

Regardless of the rehabilitation alternative used, pre-construction monitoring activities are required for the study. Therefore, could you please keep myself or Ben Worel informed of the construction schedule, so these activities can be completed. Also, we would like to have someone at the site to monitor construction activity near the instrumentation, and also to help re-establish the section after the overlay.

If you have any questions or suggestions about rehabilitation of the test section, please call me at 800-344-7477.

Sincerely,

Robert J. Van Sambeek
Project Engineer

cc. Ken Wasnie and Robin Allen, MnDOT District 3A
Lee Purdham, MnDOT District 3A (Maintenance)
Dick Sullivan and Fred Maurer, MnDOT MRL
Gene Skok and Ben Worel, Braun Intertec Corp.
Richard Ingberg, SHRP/FHWA/LTPP
Gonzalo Rada, PCS Law Engineering, Inc.
Monte Symons and Aramis Lopez, FHWA-LTPP Division

May 23, 1995

BRAUN SM
INTERTEC

271018 Rehab. (SHRP 275A)

[redacted]

(612) 218 — 828-2465

F — Colvin Howieson of MnDot
(works w/ Harvey Allen)

— also Paul Koenig will be project Supervisor — 828-2487

Colvin
- Prefers "normal" rehab through section — easy.

- 18.125 km project (12 miles) w/ WIM removed from rehab. (exempt)

Construction meeting this week w/ contractor.

— expect to mill June 15 to June 17

plans have 3.6 m lane re-established. (12'-lane)

Draft Memo to FHWA & PCS LAW

BRAUN SM
INTERTEC

Braun Intertec Corporation
6875 Washington Avenue South
P.O. Box 39108
Minneapolis, Minnesota 55439-0108
612-941-5600 Fax: 942-4844

Engineers and Scientists Serving the Built and Natural Environments®

Memorandum

Date: May 25, 1995

To: Aramis Lopez and Monte Symons - FHWA LTPP
Gonzalo Rada and Gary Elkins - PCS Law

FILE

cc: Gene Skok, Richard Ingberg, Erland Lukanen

From: Robert J. Van Sambeek RJV

Re: Rehabilitation Plans and Post Rehab. Monitoring of SMP Section 271018
C:\SMP\WP\27A_EXT.SMP

June 12, 1995 is our last scheduled monitoring date for SMP section 271018 near Little Falls, MN, and the section is scheduled to be milled and overlaid June 15-17. Possible alternatives regarding the rehabilitation were listed in the May 11, 1995 memo/letter distributed to interested parties. In the memo/letter, some of the good and bad points for the different alternatives were identified.

Rehabilitation Plans.

On May 23, 1995, I received a call from Calvin Howieson of MnDOT regarding which rehabilitation alternative to use so it could be discussed at the pre-construction meeting with the contractor. At that time, the only comments I had received were from Gene Skok and Erland Lukanen regarding using the same rehabilitation planned for the rest of the 18.125 Km project. Calvin was also in favor of this selection to keep things simple in the field.

Therefore, I informed Calvin to use the same mill and overlay plans used on the rest of the project for the test section. I also asked Calvin about the WIM site, and he indicated it was exempt from the project. This pavement was placed as part of the WIM installation several years ago. At this point, it may still be possible to change the rehabilitation used if sufficient concerns warrant trying to get construction plans revised.

What is the status with the retrofit temperature probe? Will it be available to install as part of the overlay or shortly there after to make pavement repairs easy? Should any attempt be made to salvage the existing probe?

Calvin Howieson can be reached at 612-828-2481. If he is not available, Paul Koenig, who is the project supervisor, can be reached at 612-828-2487.

Post Rehabilitation Monitoring.

Post construction monitoring will be done in July to re-establish the section. This monitoring

will include SMP data collection to the extent possible with SMP monitoring equipment available between actual SMP installations and sensor calibration/checks being done for additional installations. Therefore, SMP instrumentation will not be removed from this site in June on the last monitoring cycle.

However, I would like to know if we should continue to monitor this section several months after the overlay to document changes in thermal properties and pavement strength due to the overlay to provide "transition" data between the 1994/1995 and 1996/1997 SMP data.

The concept of monitoring overlay sections was identified in the SMP data analysis plan, and only a limited number of sections will be available to obtain this type of data. Section 271018 provides the easiest opportunity the NCRCO will have to collect this data with the site only 90 minutes away and the SMP monitoring equipment available between additional installations.

If anyone has comments or concerns with the rehabilitation and proposed monitoring of SMP section 271018, please call me at 612-942-3047.

BRAUNSM
INTERTEC

Description: 27C12

Project No: DBUXQ2700 B5

Date: May 31, 1995 By: RJV

ssage from Aramis

- "upset that Section is going to be rehabilitated"

Note - No response ever received from May 11 Memo

— No response to concerns brought up at the Coordinators Mtg.

— indicated retro-fit probe soon to be available!

—

— Had also brought this subject up at the Regional Mtg. in Ohio in combination w/ the Instr. mtg.

ll Aramis

— Memo from Gonzalo — will fax to Gene / Dick / Bob V.

— lists Gonzalos "items" (and movement to Supplemental studies area to be developed?)

— I indicated my concerns regarding rebab choices & effects regarding data in the next years.

— Aramis' final words were to "save the probe" by only milling ≈1" over the instr. area. — will require someone at the site.

— Call the DOT on Thursday.

BRAUN INTERTEC

Description: 271018

Project No: DBNX92700 B5

Date: ~~May~~ June 1, 95 By: RJV

Additional notes

(Cell 8)

3/3/93 - notes from conversation w/ Araujo
- concern w/ cell for AC < 5", Coarse Subgrade, wet, freeze.
"All sections older and distressed in their cell"
"- none left more than maybe 5 years!"
271018 was "3" for condition rating in 1993.

4/93 - notes from Conversation w/ Fred Maurer
- Dist. will look @ Sect. 271018

4/93 - Fred Maurer
- Can use section - maybe repairing trans. cracks.

3/95 - 271018 is still the only instrumented section in Cell 8.
- NAVCO has one additional SPS-1 section planned. (Expected life?)

FYI
1) Ingberg
2) Skok
3) Van Sambeek
From: A Lopez
5/31/95

PCS/LAW ENGINEERING
(A Division of Law Engineering)
12104 Indian Creek Court, Suite A
Beltsville, Maryland 20705
FON 301-210-5105--FAX 301-210-3052

MEMORANDUM

May 25, 1995

To: Aramis Lopez, Jr. and Monte Symons

From: Gonzalo R. Rada GRR

Subject: Rehabilitation of LTPP Test Section 271018 in Minnesota
PCS/LAW Reference No. 792-92-03751

cc: G.E. Elkins

We are in receipt of Bob Van Sambeek's memorandum dated May 11, 1995 concerning the rehabilitation of LTPP Test Section 271018 on US-10 between Randall and Little Falls, Minnesota. This section is also part of the SMP core experiment.

Our first reaction to Bob's letter is one of total disappointment. LTPP's intentions have been very clear from the start; it has been emphasized throughout the section selection process that only sections that were going to last through at least two monitoring cycles, but preferably three cycles, would be included in the SMP core experiment. Once a section was accepted, we requested that the RCOCs obtain a commitment from the highway agency to the effect that no major maintenance nor rehabilitation would be applied to the section over the prescribed period of time in order to achieve the targeted number of monitoring cycles.

Why are we making such a big deal out of this? The answer is very simple. Resources available to the SMP have been limited since the beginning; were it not so, we would have included many more sections in the program and would have addressed many more issues related to the seasonal behavior of pavements. Because of these limitations, the total number of SMP sections was limited to 64, which were strategically selected to address a few key factors.

The rehabilitation of the Minnesota section not only eliminates an important section from the core experiment (hence associated monitoring data), but it introduces a whole new set of factors that cannot be covered under the core experiment nor were they envisioned as part of this experiment. In addition, to turn our (FHWA, TAC, RCOCs) attention from the more important LTPP issues currently facing us to address a whole new set of studies dealing with the rehabilitation of SMP test sections so that monitoring can be continued does not seem to be justified.

Having said all of this, and especially in view of the fact that more than $100,000 have probably been spent to date on the section, our recommendations in response to Bob's memorandum are as follows:

- Perform a complete suite of monitoring measurements on the site prior to the rehabilitation to get terminal conditions.

- Rehabilitate the section according to the highway agency's construction practices (i.e., Option 1 in Bob's letter), but keep the mill depth to 0.5 in at the instrumentation hole so that the temperature probe is not destroyed.

- Drop the section from the SMP core experiment (keeping the data from the first monitoring cycle) and include it in a new experiment under the supplemental studies which looks at pavements rehabilitated with AC overlays.

- Continue monitoring of the test section if the full instrumentation is still working, but not worry about the storage of these data in the IMS until other more important IMS issues have been resolved.

Notes: (1) Monitoring may be limited to instrumentation measurements only if the section does not meet the desired criteria which needs to be developed; i.e., no FWD testing, profile surveys, distress surveys, etc.

(2) May want to consider retrofitting the section with a surface thermistor probe in accordance to the guidelines we provided to you for use with SPS-9A sections; however, this decision should be delayed until such time as we have a more clear picture of the new SMP overlay experiment.

In addition, to prevent or minimize the likelihood of the problem occurring again in the future, especially on new (Round 2) sections, we would recommend that the RCOCs obtain a letter from the highway agency stating that major maintenance or rehabilitation will not be performed, or is not envisioned at the current time. The LTPP Regional Engineers should also be involved to ensure that this action (i.e., letter) is taken. Furthermore, the RCOCs must ensure that the pavements nominated for inclusion into the SMP core experiment be in good to excellent condition - little or no distress, smooth surface, etc.

We apologize for the tone of this memorandum, but quite honestly we are very disappointed with what is happening. Too much money and effort goes into each of the SMP test sections, and to lose one after the agency has agreed to monitor for a specified period of time is not easy to swallow. We also recognize that it is probably nobody's fault, but it is still very frustrating.

Should you have any questions or would like to discuss the above matters further, please do not hesitate to contact us.

Best Regards.

(1) - Ben. need Dipstick
- High priority for 271018.
(2) - check on profilometer - when last here?

Memorandum

Date: June 1, 1995

To: Gene Skok

cc: ?

From: Robert Van Sambeek

Re: Previous Notes on GPS Section 271018 for the SMP
C:\SMP\WP\27SAREH.SMP

Gene below is information from various notes starting in 1993 for section 271018.

3/3/93 Telephone conversation with Aramis.

- concern with cell 8 (AC<5", coarse subgrade, wet, freeze) that all sections in the NCR are "... older and distressed ... and not expected to last more than five years ..."
- at that time the pavement condition on 271018 was listed as "3".

3/4/93 Telephone conversation with Fred Maurer.

- District will look at section regarding deferred maintenance.

3/24/93 Telephone conversation with Fred Maurer.

- District will defer rehabilitation of the section. However, they will be doing transverse crack repair.

Regional meeting in Ohio.

- Brought up concerns over the blade patch with Aramis.

SMP Coordinators Meeting.

- Brought up concerns with the section at the meeting, as well as, provided information on this section in the written reports required to Gonzalo and Aramis for the meeting.

5/11/95 Letter to Harvey Allen.

5/23/95 Telephone Conversation with Calvin Howieson.

- inquiring about rehab alternative to discus at the pre-construction meeting for the

project.

5/25/95 Memo to Aramis/Gonzalo regarding rehabilitation discussed with the DOT.

5/31/95 Message from Aramis.

- "... upset that section is being rehabilitated ...."

- Called Aramis to find out what triggered the interest in changing the rehab plan two weeks prior to the scheduled work.

- Aramis referred to a fax from Gonzalo, which he agreed to fax to me. I asked him to include Gene and Dick on the distribution.

Alternatives?

I. defer any work on the section
- DOT may monitor in 95/96
  - Third cycle of data.
- What is data worth as far as tracking roughness, distress, frost heave, etc. with the blade patch failing.
- will ~~the~~ DOT Defer - too rough, not able to plow snow?, will have to come back in one or two years for repairs?

II. decide on a rehab alternative
- will how much? 1"?, 2"?, other?
- OL how much? 1"?, 2", other?

BRAUN INTERTEC

Description: 310114 & 271018

Project No: DB-92720 BS

Date: June 1, 1995 By: RJV

T – Gonzalo
– Bob + Steve conference call

Discussion regarding 271018 – final decision is to rehab and monitor site if instrumentation functioning

– need to perform monitoring prior to rehab (mon. scheduled for June 12)

– need to monitor w/in one month for post-construction.

– Continue to monitor monthly if FHwA approve until Mn DoT starts monitoring activities on the four mn road sites.

– will require someone at the site during milling operation to advise on the location of instrumentation

10114

– Concerns w/ Construction traffic while existing roadway is reconstructed.

– DOT will provide traffic control when able to get monitoring data

– expect to miss some cycles when traffic is too heavy

– also will look @ getting one or two FWD cycles then lift lane closure

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To Gonzalo Rada	From Rob V.
Co. PCS Ltd	Co. Brigham Int. Tech
Dept.	Phone # 617-942-3047
Fax #	Fax #

Gonzalo, I talked to Gene. He is okay with "points" below. Are you? Rob V.

Date: June 1, 1995

To: Gene Skok

cc: ?

From: Robert Van Sambeek

Re: Summary of Conversation with Gonzalo Rada and Following Discussion Regarding 271018 Rehabilitation and Concerns with 310114 SMP Monitoring.
C:\SMP\WP\GONZALO.27A

Gene, below are the critical points from our conversation with Gonzalo and the following discussion that will decide matters on 271018 and 300114. If you do not agree with what was discussed, please let me know.

271018

1. Decision is to mill and overlay the section to obtain a surface that will last 15 years regarding monitoring of overlay sections with instrumentation (supplemental section?).

2. In the construction process have someone at the site to instruct crews where the temperature probe is located, so the milling depth can be adjusted to about one inch to miss the probe and still remove the blade patch.

3. Proceed with post construction monitoring including the SMP data collection activities. This monitoring is currently scheduled for July 7, 1995. The actual monitoring requirements for the "supplemental overlay study" have not been identified, but they are not expected to exceed the requirements for the SMP.

I will contact the DOT regarding the construction schedule and arrangements to adjust the milling depth near the temperature probe. I will not be available during the construction, and someone else will need to be at the site. This person will have to be familiar with the SMP monitoring to use the computer to monitor the instrumentation during the milling. ?

310114

1. Discussed concern with construction traffic that may limit lane closures as the old roadway is reconstructed. It is possible that lane closures may limit FWD testing to one or two cycles each visit until the construction is complete.

2. Gonzalo indicated some missed monitoring with the FWD would be acceptable, but instrumentation date should always be collected.

TT - Calvin @ 218-828-2465
- June 19 start job north of Randall. (45 day project)
- Head Insp. - Craig Walls will show up on June 12th to visit the site while monitoring with the FWD. Will instruct Craig what we want in the area of the probe.

BRAUN INTERTEC

Description: 275A Rehab

Project No: DBMX92700 85

Date: June 20, 1995 By: RV

- Calvin Howieson 218 - 828 - 2465
(Ken Carson - inspector)

- Expect milling in section on weds or Thurs.
- will call weds. a/ update - expect Thursday

June 22, 1995	DBNX92700 B5	271018 VISIT

- Call from Ken Larson 6/21/95 – estimated section would be milled 6/21/95 (very short notice)

- plan visit for 6/22 – Jeff along?

- Take
  - Camera
  - video
  - opt. iso?
  - RD100?
- vest
  - Tape
  - paint
  - Screwdriver
- Computer
  - inverter

- stop @ Jeff Doughty ~~6:30 AM~~

? Jeff p.u. @ home & after p.u. Trailer and drive home

June 22, 1995 | DFAIX9-700 B5 | 271018-275A Unit

275A – Mill inspection

Sta. offset	PE	LE
	1/4 *	1/2
0+50	1	1 1/4
1+00	1	1 1/2
1+50	1	1 1/2
2+00	3/4	1 1/2
2+50	3/4	1 1/2
3+00	1	1 1/2
3+50	1	1 1/4
4+00	1	1 1/4
4+50	1	1 1/4
5+00	1/2	1 1/2
5+10	1/2	1/4
5+15	1/2	0
5+20	0	0
5+25	0	0
5+30	1/2	1/4
5+35	1/2	3/4

* after peeling blade platform
* depths measured to original surface

Front Tube @ Sta. 5+55.5 – pulled tube out
However, CFP milled off tube – must repair

Photos @ each station

BRAUN℠
INTERTEC

Memorandum

To: Kelvin Howieson — Mn/Dot
Ken Larson — Mn/Dot
Paul Koenig — Mn/Dot

From: Benjamin Worel

Re: SHRP Section 271018 Rehabilitation

Date: July 7, 1995

Test section 271018 is located on US-10 Southbound driving lane, milepost 140.2, North of Little Falls, Minnesota.

This test section, due to the mill, recycle overlay, and virgin overlay FHWA/SHRP requires documentation on the work that has and will be done for its database. I am faxing up the required datasheets for the work for you to look over and fill out. I am willing to meet you any day of the week of July 17th to help you with these datasheets.

Please call me at (612) 942-3057 to set up a time or to ask questions. I will be out of the office the week of July 10th but I have voice mail and you can leave a message.

CC: Fred Maurer — Mn/Dot Maplewood
Richard Ingberg — FHWA
Gene Skok — Braun Intertec
Robert Van Sambeek — Braun Intertec

271018 (station 3+00)

SAND SUBGRADE WITH HIGH WATER TABLE