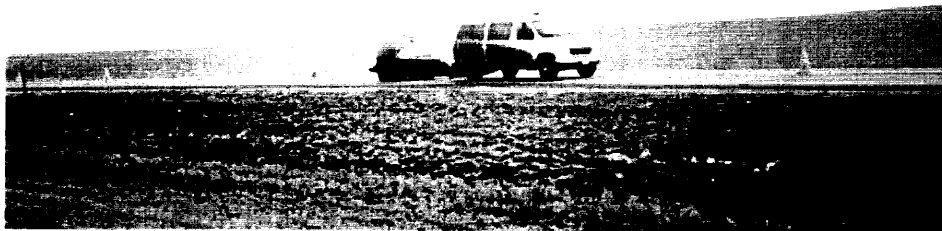


LTPP Seasonal Monitoring Program

Site Monitoring Suspension Status Draft Final Report for GPS Section 469187 (46B) Faith, South Dakota

469187



LTPP Seasonal Monitoring Program

Site Monitoring Suspension Status Draft Final Report for GPS Section 469187 (46B) Faith, South Dakota

FHWA CONTRACT No. DTFH61-96-C-00013

Prepared by

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Prepared for

Federal Highway Administration
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Turner-Fairbanks Highway Research Center
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October 1997

Technical Report Documentation Page

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16. Abstract This report contains information on instrument de-installation and monitoring data collection activities for the Long Term Pavement Performance (LTPP) General Pavement Study (GPS) section 469187 conducted on September 23, 1997. The report presents a description of the following activities: SMP data collection activities, including evaluation of instrument and equipment performance prior to de-installation; instrument de-installation activities; and instrument reinstallation schedule. Also included in the report are the color copies of site photographs taken during suspension preparation activities. The reinstallation of the instrumentation in this site is scheduled for September 20-27, 1998. All units such as the rain gauge, air temperature sensor, and the associated metal poles will be reinstalled and tested.					
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**LTPP Seasonal Monitoring Program
Site Monitoring Suspension Status
Draft Final Report for
GPS Section 469187 (46B)
Faith, South Dakota**

1.0 INTRODUCTION

The seasonal monitoring data collection for the Long Term Pavement Performance (LTPP) General Pavement Study (GPS) section 469187 has been suspended for a period of one year effective September 23, 1997. The test section, which is part of the Seasonal Monitoring Program (SMP) managed by the Federal Highway Administration (FHWA) LTPP Division, is located in the southbound driving lane of State Highway 73 at milepost 156, about 29 miles south of Faith, South Dakota. Additional background information on the test section, types of instruments installed, and the in-place pavement structure can be found in the *Site Installation Report for SPS Section 469187 (46B), Faith, South Dakota*, dated January 1996 (1).

This report contains information on instrument de-installation and monitoring data collection activities conducted on September 23, 1997. After the installation of instrumentation in the test section on July 18, 1994, the test section was visited 18 times for SMP data collection and then de-installed on

June 26, 1995. The site was re-installed on October 25, 1996, visited 13 times for SMP data collection, and again de-installed on September 23, 1997. The dates of these visits and the activities performed can be found in the SMP data collection summary table in appendix A. The instrumentation for the site is scheduled for reinstallation in September 1998 and will be monitored for another year. This section is planned to be monitored every other year for the remainder of the LTPP study or until it is removed from the study.

The report presents a description of the following activities: SMP data collection activities, including evaluation of instrument and equipment performance prior to de-installation; instrument de-installation activities; and instrument reinstallation schedule. Also included in the report are color photographs taken during suspension preparation activities.

2.0 SMP DATA COLLECTION

2.1 SMP Data Collection and Upload

Prior to de-installation of the instrumentation in this test section, the full suite of SMP monitoring measurements in the *LTPP Seasonal Monitoring Program Instrument Installation and Data Collection Guidelines (2)* was performed. These include the following:

- FWD and associated measurements.
- Elevation survey.
- Manual distress survey with transverse profile measurements.

- Manual electrical resistivity measurements (two- and four-point).
- Automated mobile data measurements (Time Domain Reflectometry [TDR] and resistivity).
- Water table measurements.

A summary of all the SMP data collected to date can be found in appendix A. The specific type and amount of data collected can be found on the SMP field activity report (data sheet SMP-D10) in appendix B. Six other SMP data sheets pertaining to the data collection activities are also in appendix B. The locations for FWD and elevation measurements can be found in the site information sheet (SIS) in appendix C. During the current instrument de-installation and data collection activities, the weather was calm and sunny.

As can be seen in appendix A, longitudinal profile measurements were recorded. All the data collected to date have been processed and uploaded into the RIMS.

2.2 Instrument and Equipment Problems

All the sensors in the test section (TDR, rain gauge, and Measurement Research Corporation [MRC]) were evaluated by reviewing the data from the onsite and mobile dataloggers using the SMPCheck 2.5c program (3). A review of the data collected during this visit indicated that all the sensors were functioning as expected. No obvious problems were noted from the data recorded from

August 24, 1997, through September 22, 1997. All the TDR traces had the maximum and minimum points on the traces that enable analysis.

3.0 INSTRUMENT DE-INSTALLATION ACTIVITIES

3.1 Suspension Preparation and Repairs to Instrumentation Hole

As required by the LTPP Seasonal Directive SM-8 (4), on the last day of monitoring, the following site preparation activities were performed:

- Application of an electronics quality, anti-corrosion compound to the TDR and BNC connectors, electrical resistivity connector, and MRC temperature lead wires.
- Disconnection and removal of the panel board containing the Onsite CR10, power supply, terminal strip, and relay. A desiccant pouch with all wires and connectors was sealed in a plastic bag. The wires were secured as high as possible in the cabinet, as shown in photograph 1 in appendix D.
- Locked and taped cabinet as shown in photograph 2 in appendix D.
- Painted the units used to protect South Dakota DOT benchmark red for easy identification.
- The edges of the instrumentation block were in excellent condition, and no resealing was needed, as shown in photograph 3 in appendix D.

The rain gauge, air temperature sensor, and the associated metal poles were labeled "46SB" and carefully stored in the North Central Regional Coordination Office (NCRCO) for reinstallation. The union was left onsite in the cabinet.

3.2 Unique Site Features

This test section is the 9th SMP installation in the LTPP North Central Region.

The TDR cable lengths (in inches) unique to this section for TDR sensors 1 through 10 are 19.00, 19.00, 19.00, 19.00, 19.00, 19.00, 19.00, 20.85, 20.85, and 20.85, respectively. These cable lengths are required to capture the maximum and minimum points on the TDR traces.

In the course of monitoring this site, a solar panel was installed on top of the cabinets to prolong the life of the battery onsite. The solar panel was found to be an effective and significant addition to the SMP onsite data collection equipment that ensured efficient storage and collection of the SMP data stored onsite.

4.0 INSTRUMENT REINSTALLATION

Reinstallation of the instrumentation at this site is scheduled for September 20-27, 1998. All units such as the rain gauge, air temperature sensor, and the associated metal poles labeled "46SB" will be reinstalled and tested.

5.0 SUMMARY

This report contains information on instrument de-installation and monitoring data collection activities for the LTPP SPS section 460804, conducted on September 23, 1997. The report presents a description of the SMP data collection activities, including an evaluation of the SMP sensors and equipment. No obvious problems were noted from the data recorded from August 24, 1997, through September 22, 1997. All the TDR traces had the required maximum and minimum points that enable analysis of the TDR data. Also included in the report are the color copies of site photographs taken during suspension preparation activities.

Reinstallation of the instrumentation at this site is scheduled for September 20-27, 1998; all units such as the rain gauge, air temperature sensor, and the associated metal poles will be reinstalled and tested. This includes the reinstallation of solar panels on the cabinets to prolong the life of the battery onsite.

LIST OF REFERENCES

1. *LTPP Seasonal Monitoring Program Site Installation Report for SPS Section 469187 (46B) Faith, South Dakota*. Federal Highway Administration, LTPP Division, HNR-40, Turner-Fairbanks Highway Research Center, McLean, Virginia. January 1996.
2. *LTPP Seasonal Monitoring Program: Instrumentation Installation and Data Collection Guideline*. FHWA-RD-94-110, Federal Highway Administration, LTPP Division, HNR-40, Turner-Fairbanks Highway Research Center, McLean, Virginia. April 1994.
3. SMPCheck, computer software version 2.5c, prepared for the Federal Highway Administration, Pavement Performance Division, HNR-30, McLean, Virginia. July 1997.
4. Lopez, Aramis, Jr. *Long Term Pavement Performance Directive for the Seasonal Monitoring Program: Directive Number SM-8, Suspension of SMP Site Monitoring Activities*. Federal Highway Administration, LTPP Division, HNR-40, Turner-Fairbanks Highway Research Center, McLean, Virginia. March 1995.

Appendix A - SMP Data Collection Summary Table

46SB - 469187, ST-73 SB LANE, 18 MILES SOUTH OF FAITH, SD (MP 156)

Date			ONSITE Data			MOBILE Data			Manual Data				FWD Data			Distress Profile			Comments			
dd/mm/yy	Pvmt. Temp.	Air Temp.	Rain	TDR	Frost Volts	Backup TDR	Backup TDR	Frost 2-Pt.	Frost 4-Pt.	Water Table	Pvmt. Elev.	Joint Open.	Joint Fault	Man. Temp.	OWP	ML	PE	M		P	P	D
16-Jun-93																					X	
29-Sep-93																				X		
9-Jun-94																						
18-Jul-94	94A																					
19-Jul-94	94B	P	P	P	P			P	P	P	P			X	1	1						
11-Aug-94	94C	P	P	P	P			P	P	P	P			X	3	3						
26-Sep-94	94D	P	P	P	P			P	P	P	P			X	4	4		X				
1-Oct-94														X	3	3						
24-Oct-94	94E	P	P	P	P			P	P	P	P			X	4	4						
21-Nov-94	94F	P	P	P	P			P	P	P	P			X	1	1						
19-Dec-94	94G	P	P	P	P			P	P	P	P			X	3	3						
20-Jan-95	95A	P	P	P	P			P	P	P	P				0	0						
26-Jan-95																				X		
20-Feb-95	95B	P	P	P	P			P	P	P	P				0	0						
10-Mar-95	95C	P	P	P	P			P	P	P	P			X	3	3						
24-Mar-95	95D	P	P	P	P			P	P	P	P			X	1	1		X				
7-Apr-95	95E	P	P	P	P			P	P	P	P			X	3	3						
21-Apr-95	95F	P	P	P	P			P	P	P	P			X	3	3						
25-Apr-95																						
22-May-95	95G	P	P	P	P			P	P	P	P			X	3	3				\$		
26-Jun-95																						
22-Jun-95																				\$		
26-Jun-95	95H	P	P	P	P			P	P	P	P			X	3	3		X				
30-Sep-95																				\$		
23-Sep-96																				X		
25-Oct-96	96A	P	P	P	P			P	P	P	P				3	3						
19-Nov-96	96B	P	P												0	0						
18-Dec-96	96C																					
21-Jan-97	97A																					
19-Feb-97	97B	P	P	P	P					P	P											
1-Apr-97	97C	P	P	P	P																	
14-Apr-97	97D	P	P	P	P			P	P	P	P			X	2	2						
28-Apr-97	97E	P	P	P	P			P	P	P	P			X								
14-May-97	97F	P	P	P	P			P	P	P	P			X	3	3						
97G																						
23-Jun-97	97H	P	P	P	P			P	P	P	P			X	4	4						
21-Jul-97	97I	P	P	P	P			P	P	P	P											
24-Aug-97	97J	P	P	P	P			P	P	P	P											
23-Sep-97	97K	P	P	P	P			P	P	P	P			X	3	3		X				

Notes

P Denotes data collected and processed by Braun Intertec Corp

P Denotes data collected and processed by ERES Consultants, Inc

X Denotes data collected by Braun Intertec Corp.

X Denotes data collected by ERES Consultants, Inc.

P Denotes data collected by Braun Intertec Corp. and processed by ERES Consultants, Inc.

S Denotes data collected and processed by SME

Appendix B - SMP Data Sheets

- **SMP-D10: SMP Field Activity Report**
- **SMP-D03: Contact Resistance Measurements**
- **SMP-D04: Four-Point Resistivity Measurements**
- **SMP-D05: Ground Water Table Measurement**
- **SMP-D09: Elevation Measurements - AC**
- **SMP-M1: Distress Survey of Instrument Area**

LTPP Seasonal Monitoring Program Data Sheet SMP-D10 SMP Field Activity Report		Agency Code [46] LTPP Section ID [9187]
Onsite Datalogger and Instrumentation		
File Name - *.ONS	465897KI	Comments: All OK
Battery Replace	Yes - No	Voltages 13.1
Repairs/Calib.		
Other: _____		
Mobile Datalogger		
File Name - *.MOB		Comments:
TDR/Resistance Voltages	Sets (0 1)	
Other: _____		
Manual Data Collection		
Piezometer	(Yes) - No	Comments:
Resistance 2 pt.	Sets (0 1)	
Resistivity 4 pt.	Sets (0 1)	
Elevations	Sets (0 1)	
Distress Survey	(Yes) - No	
Long. Dipstick Profile	Yes - (No)	
Photos or Video	(Yes) - No	
Other: _____		
FWD and Associated Data		
FWD Testing 0.5	Sets (0.5)	Operator: DSP
JCP - Snap Rings	Sets (—)	AC
JCP - Faulting	Sets (—)	AC
Other: _____		

IF REQUIRED, ATTACH SKETCHES TO THIS DATA SHEET

Comments: _____

Prepared by: GFE Employer: ERES/NCR

Date (dd/mm/yy): 23 / SEP / 97 Daylight Savings Time (Y or N): Y

LTPP Seasonal Monitoring Program
Data Sheet SMP-D03
Contact Resistance Measurements

Agency Code

[46]

LTPP Section ID

[9187]

Start Time (military): 1 0 0 5

Test Position	Switch Settings		Voltage (ACV)		Current (ACA)		Comments
	I1 V1	I2 V2	Range Setting	Reading	Range Setting	Reading	
1	1	2	Auto	130.0	Auto	2.7	
2	2	3		104.0		3.9	
3	3	4		102.6		4.0	
4	4	5		71.9		2.3	
5	5	6		55.9		3.8	
6	6	7		39.9		3.2	
7	7	8		49.2		3.1	
8	8	9		0.1		0.5	
9	9	10		20.0		3.5	
10	10	11		23.1		3.7	
11	11	12		15.7		2.8	
12	12	13		17.5		3.7	
13	13	14		19.9		3.5	
14	14	15		22.1		3.3	
15	15	16		29.5		3.3	
16	16	17		24.1		3.4	
17	17	18		29.1		2.8	
18	18	19		40.2		2.8	
19	19	20		25.1		3.4	
20	20	21		23.7		3.8	
21	21	22		14.6		3.1	
22	22	23		20.0		3.4	
23	23	24		0.3		0.5	
24	24	25		20.3		4.1	
25	25	26		20.9		3.4	
26	26	27		34.2		2.9	
27	27	28		38.9		3.0	
28	28	29		32.4		3.5	
29	29	30		24.1		3.4	
30	30	31		37.5		2.2	
31	31	32		64.1		0.9	
32	32	33		99.3		0.4	
33	33	34		107.1		0.6	
34	34	35		77.6		1.4	
35	35	36		71.8		1.9	
36	36	37		0.1		74.3	R1 =
37	37	38		6.8		66.5	R2 =
38	38	39		22.4		37.1	R3 =
39	39	00		102.7		0.1	R4 =

Note: R = V/I, in ohms; measured resistances should be compared with known values.

Comments:

Prepared by: GFE Employer: ERES/NCR

Date (dd/mm/yy): 22 / SEP / 97

LTPP Seasonal Monitoring Program
Data Sheet SMP-D04
Four-Point Resistivity Measurements

Agency Code

[46]

LTPP Section ID

[9187]

Start Time (military): 1030

Test Position	Switch Settings				Voltage (ACV)		Current (ACA)		Comments
	I1	V1	V2	I2	Range Setting	Reading (Volts)	Range Setting	Reading (Amps)	
1	1	2	3	4	4.1	2.8	4.2	0.7	
2	2	3	4	5		3.6		0.9	
3	3	4	5	6		3.6		1.0	
4	4	5	6	7		1.9		1.2	
5	5	6	7	8		1.0		1.9	
6	6	7	8	9		0.7		2.2	
7	7	8	9	10		0.6		1.9	
8	8	9	10	11		0.1		0.5	
9	9	10	11	12		0.6		2.2	
10	10	11	12	13		9.6		2.2	
11	11	12	13	14		0.6		2.4	
12	12	13	14	15		0.6		2.2	
13	13	14	15	16		0.5		2.3	
14	14	15	16	17		0.5		2.1	
15	15	16	17	18		0.5		1.8	
16	16	17	18	19		0.6		2.0	
17	17	18	19	20		0.5		2.0	
18	18	19	20	21		0.6		2.0	
19	19	20	21	22		0.7		2.0	
20	20	21	22	23		9.7		2.3	
21	21	22	23	24		0.6		2.0	
22	22	23	24	25		9.7		2.1	
23	23	24	25	26		9.1		9.4	
24	24	25	26	27		0.9		2.0	
25	25	26	27	28		0.8		2.1	
26	26	27	28	29		0.8		1.9	
27	27	28	29	30		0.7		1.8	
28	28	29	30	31		0.7		1.4	
29	29	30	31	32		0.8		0.8	
30	30	31	32	33		0.7		0.6	
31	31	32	33	34		0.6		0.8	
32	32	33	34	35		0.4 0.3		0.5	
33	33	34	35	36		0.3		0.5	
36	36	36	37	37		9.1		72.4	R1 =
37	37	37	38	38		6.6		64.8	R2 =
38	38	38	39	39		36.4		36.4	R3 =
39	39	39	00	00		97.9		0.1	R4 =

Note: $R = V/I$, in ohms; measured resistances should be compared with known values.

Comments:

Prepared by: GFE

Employer: ERES/NCR

Date (dd/mm/yyyy): 23 / SEP / 97

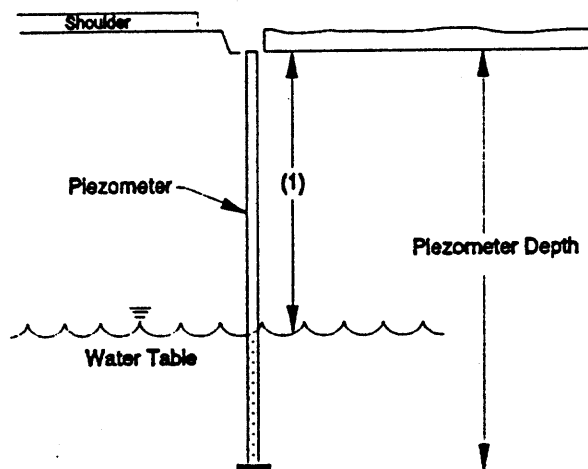
LTPP Seasonal Monitoring Program Data Sheet SMP-D05 Ground Water Table Measurement	Agency Code	[4 6]
	LTPP Section ID	[9 1 8 7]

Piezometer Depth (m): 4 . 2 8 0

Measurement Number	Time (military)	Depth to Water ^{1,2} (m)	Comments
1	<u>1 0 0 0</u>	<u> </u> . <u> </u> <u> </u> <u> </u>	<u>Pipe is dry</u>
2	<u> </u> <u> </u> <u> </u> <u> </u>	<u> </u> . <u> </u> <u> </u> <u> </u>	<u> </u>

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: Pipe is dry.Prepared by: GFEEmployer: ERES/NGRDate (dd/mm/yy): 23 / SEP / 97

LTPP Seasonal Monitoring Program Data Sheet SMP-D08 Elevation Measurements - AC	Agency Code [46] LTPP Section ID [9187]
---	--

Type of Instrument: NA 2000Start Time (military): 1150

1.4691

BM	Station	BS	HI	IES	FS	ELEV	CLOSE
Piez.	1+00	1.4691 1.0028		1.4692 1.0027			1.4691 1.0028
Other	0+00	1.3075					1.3073

Station	Offset (PE): 0.16 m	Offset (OWP): 0.76 m	Offset (ML): 1.83 m	Offset (IWP): 2.90 m	Offset (ILE): 3.51 m	Comments
-7.6 0-25	1.1953	1.1830	1.1549	1.1411	1.1346	
-4.6 0-15	1.1935	1.1892	1.1584	1.1429	1.1366	
-3.0 0-10	1.1961	1.1847	1.1580	1.1440	1.1372	
0.0 0+00	1.1968	1.1878	1.1604	1.1439	1.1385	
7.6 0+25	1.1986	1.1890	1.1635	1.1476	1.1397	
15.2 0+50	1.2057	1.1956	1.1714	1.1558	1.1472	
22.9 0+75	1.2089	1.1993	1.1748	1.1597	1.1522	
30.5 1+00	1.2190	1.2090	1.1848	1.1678	1.1603	
38.1 1+25	1.2304	1.2185	1.1927	1.1752	1.1666	
45.7 1+50	1.2373	1.2242	1.1971	1.1814	1.1739	
53.3 1+75	1.2425	1.2292	1.2048	1.1909	1.1855	
61.0 2+00	1.2501	1.2365	1.2096	1.1946	1.1892	

Comments: Abnormal readings @ piezo. ??? Closure is OK, tho.Prepared by: GFEEmployer: ERES/NGRDate (dd/mm/yy): 23/SEP/97

4 6 5 B 9 7 K

LTPP Seasonal Monitoring Program Data Sheet SMP-M1 (Page Distress Survey of Instrumentation Area	Agency Code	[46]
	Test Section Number	[9187]

Rate the condition of the instrumentation area (check one):

☒

Good (little or no distress; repairs are not required in the immediate future)

☐

Poor (significant distress, repairs required now or in the immediate future)

List any repairs (type and extent) done since instrumentation installation and/or last survey of instrumentation area: None

Additional Comments: Tr crack from sawcut to ILB may need repair
within the next year.

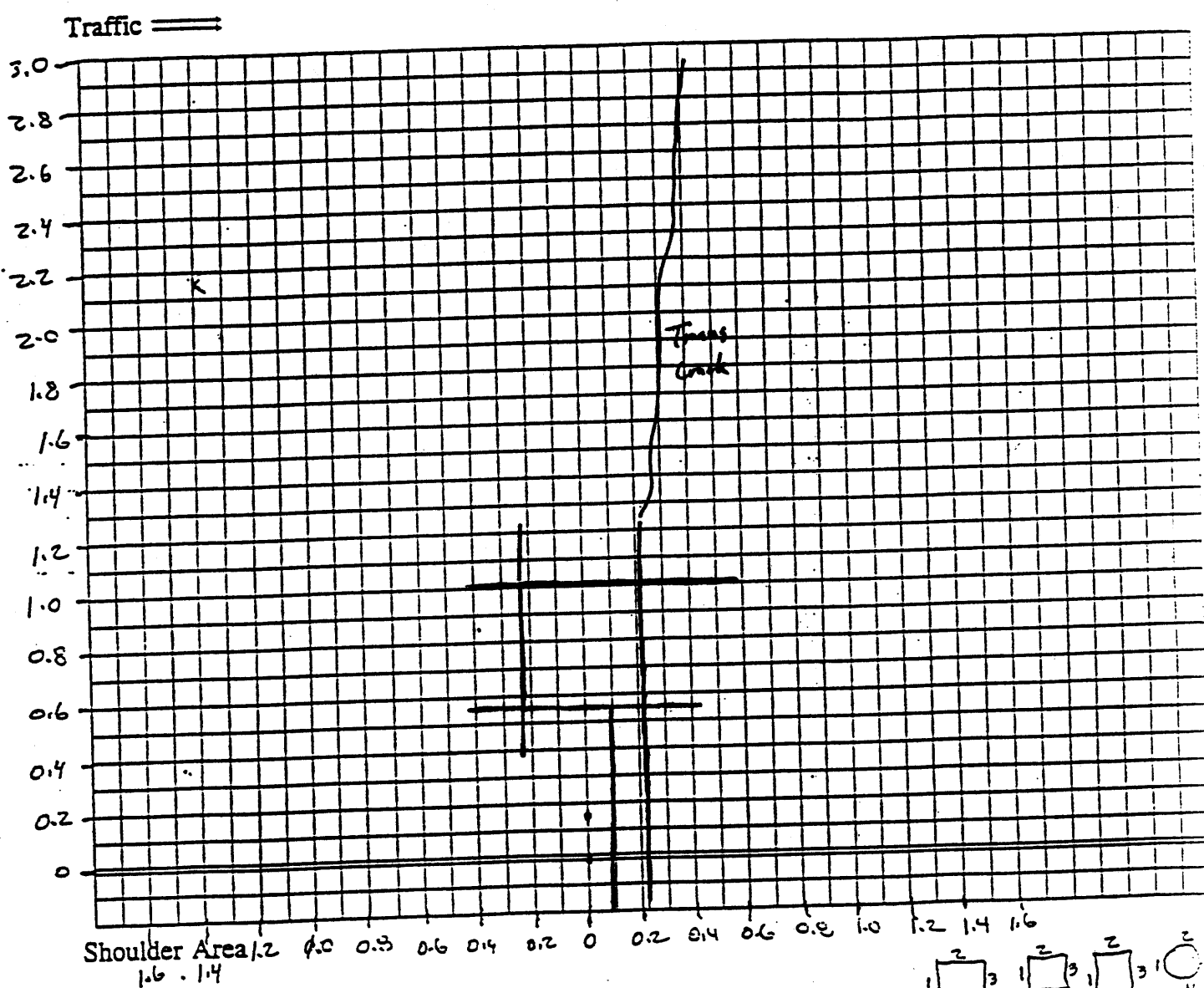
fault motor not working.

Prepared by: GFE Employer: ERES/NCR
Date: 20 / Sep / 97

4 6 S B 9 7 K

LTPP Seasonal Monitoring Program Data Sheet SMP-M1 (Page Distress Survey of Instrumentation Area	Agency Code	[46]
	SHRP Section ID	[9187]
	Survey Date	[23] / [SEP] / [97]

Use grid below to sketch distresses within 1.5 m (5 ft) of instrumentation block/hole and trench.
Use LTPP Distress Identification Manual to extent possible. (Note: each square in grid equals 0.1 m by 0.1 m area)



Use table below to record settlement of pavement in instrumentation area.

Measurement Device: DIPSTICK / STRAIGHT EDGE

Location	Settlement, mm			
	Location 1	Location 2	Location 3	Location 4
Instrumentation block/hole	___	___	___	___
Trench	___	___	n/a	n/a

Appendix C- Site Information Sheet (SIS)

Updated October 21, 1997

469187 - 46SB

LOCATION - ST-73 SB Lane, 18 Miles South of Faith, SD (MP 156)

CONTACTS -Lyle Hake (605) 892-2872, Dan Strand (605) 773-3871

TEMP HOLES - Sta 0+03, Depths are about 0.9", 2.8", and 5.1" (AC thickness = 5.25").

DISTRESS COMMENTS:

Sta E1 - Tests at Sta 0-15, and at 25 foot intervals from Sta 0+00 to Sta 2+00.

-15 LP ADJACENT TO INSTRUMENTATION HOLE

-15 L-TRANS.CR. UNDER D2

0 H-TRANS.CR. BETWEEN LP AND D2

125 H-TRANS.CR. 3" IN FRONT OF D7

Sta E3 - Tests at Sta 0-25, 0-10, and at 25 foot intervals from Sta 0+00 to Sta 2+00.

0 H-TRANS.CR. UNDER D2

125 H-TRANS.CR. 3" IN FRONT OF D7

PIEZOMETER - Sta 1+00, at edge of shoulder, depth = 4.285M.

ELEVATIONS - SD/DOT BM at Sta 0+00, 97 feet from the edge of the paved shoulder (at edge of ROW).

<u>Offsets:</u>	<u>PE</u>	<u>OWP</u>	<u>ML</u>	<u>IWP</u>	<u>ILE</u>	
(M)	0.16	0.76	1.83	2.90	3.51	
(ft)	-0.5	.05	2.5	9.5	11.5	12.5
(nail)						(nail)

Note: Offsets are based on 12 foot lane measured from the centerline for the road.
Outside edge of lane strip is not at exactly 12 foot.

Note: PK nails are 13 feet apart and elevations between nails are at 1.0'(LE),
3.0'(WP), 6.5'(ML), 10.0'(WP), and 12.0'(LE). Latest guidelines require nails
be 0.5 feet outside the section.

Sta: Transverse profiles are at Sta 0-25, 0-15, 0-10, and every 25 feet from Sta
0+00 to Sta 2+00.

COMMENTS

- Prairie Vista Inn in Faith (605) 967-2343.
- Make sure to set computers to MOUNTAIN time.
- Need locking collar (spacer) on DOT BM for elevation survey.

Appendix D - Photographs



Photograph # 1



Photograph # 2

Photograph # 3

