

EVALUATION OF BRISCO SCOUR MONITORS

**FINAL REPORT FOR
IOWA DEPARTMENT OF TRANSPORTATION
PROJECT HR-551**

**IN COOPERATION WITH THE
FEDERAL HIGHWAY ADMINISTRATION**

NOVEMBER 1993

Highway Division



**Iowa Department
of Transportation**

Final Report
for
Research Project HR-551

EVALUATION OF
BRISCO SCOUR MONITORS

by

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8. ABSTRACT

Two Brisco Scour Monitors were installed on pier MS1 of the Mississippi River at Burlington in August 1991. No problems were encountered during the installation. The monitors consist of a probe resting on the river bottom fastened to a cable that wraps around a reel. An electrical system monitors the movement of the reel which transmits to a digital readout which shows whether scour has occurred. The intent was to monitor the digital readout twice a year during a four-year evaluation period. The scour monitor digital readouts malfunctioned frequently due to electrical storms. The scour monitor performance was completely unacceptable.

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Bridge scour Scour monitor Stream degradation Pier protection	14

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DISCLAIMER

The contents of this report reflect the views of the author and do not necessarily reflect the official views of the Iowa Department of Transportation. This report does not constitute any standard, specification or regulation.

INTRODUCTION

The current Mississippi River crossing at Burlington is a very old, obsolete toll bridge. It is being replaced by a modern cable-stayed girder bridge parallel and adjacent, just to the south of the old bridge essentially on the same alignment. In the preliminary investigations, a potential coal tar contamination of the river bottom where the western pier was to be built was identified. For this reason, the Department of Natural Resources (DNR) placed substantial restrictions on excavation or disturbance of the river bottom in this area. Generally, riprap would have been used around the pier as a safeguard against scour around the foundation. The decision by the DNR was to prohibit the placement of riprap around the pier foundation in the coal tar contaminate suspect area. This posed a greater problem in regard to the potential for scour.

OBJECTIVE

The objective of this research is to monitor and evaluate the performance of two Brisco Scour Monitors.

PROJECT INFORMATION

Two Brisco Scour Monitors were placed on pier MS1 of Des Moines County, Iowa-Henderson County, Illinois project BRF-34-9(45)--38-29 at Burlington in the extreme southeast of Iowa. The prime contractor for the bridge substructure was Johnson Brothers Corporation of Litchfield, Minnesota. The

design and special provisions for the attachment of the Brisco Scour Monitors were by Sverdrup & Parcel and Associates Inc. of St. Louis, Missouri. Installation of the monitors was by the Prepakt Concrete Company of St. Charles, Illinois.

SCOUR MONITORING SYSTEM

The Brisco Scour Monitors were developed and manufactured by Cayuga Industries Inc. of Schenectady, New York and are currently being marketed by Construction Techniques, Incorporated of Cleveland, Ohio. The system (Figure 1), very simply stated, consists of a probe resting on the river bottom connected by a cable to a reel. There is an electrical monitor of the movement of this reel which transmits to a digital readout. All mechanical underwater parts except the protection angles are galvanized to prevent corrosion. The digital readout was placed on pier 3 of the old bridge, and was later to be attached to pier MS2 of the new bridge. The attachment details are shown in Figure 2.

SCOUR MONITOR INSTALLATION

The installation of the monitors began Monday, August 26, 1991 under the direction of Russell Kozlowski of the Prepakt Concrete Company. Iowa Department of Transportation bridge inspection personnel were to inform the central Materials Office, Research Section when installation was to begin. Unfortunately, due to other activities, bridge personnel forgot to inform Materials-Research who were going to monitor the installation.

CONSTRUCTION DETAIL

INSTALLATION TO EXISTING STRUCTURE

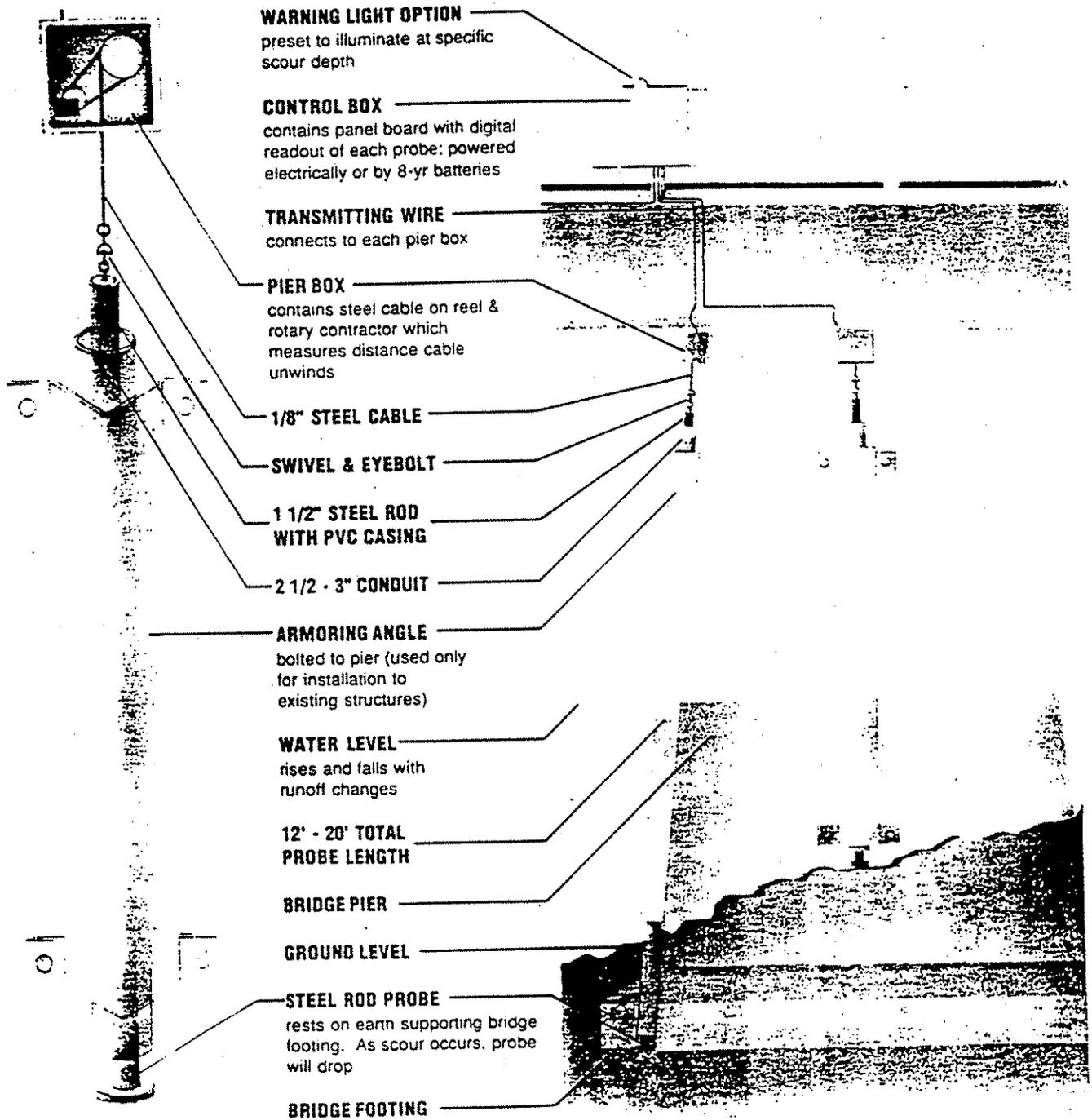
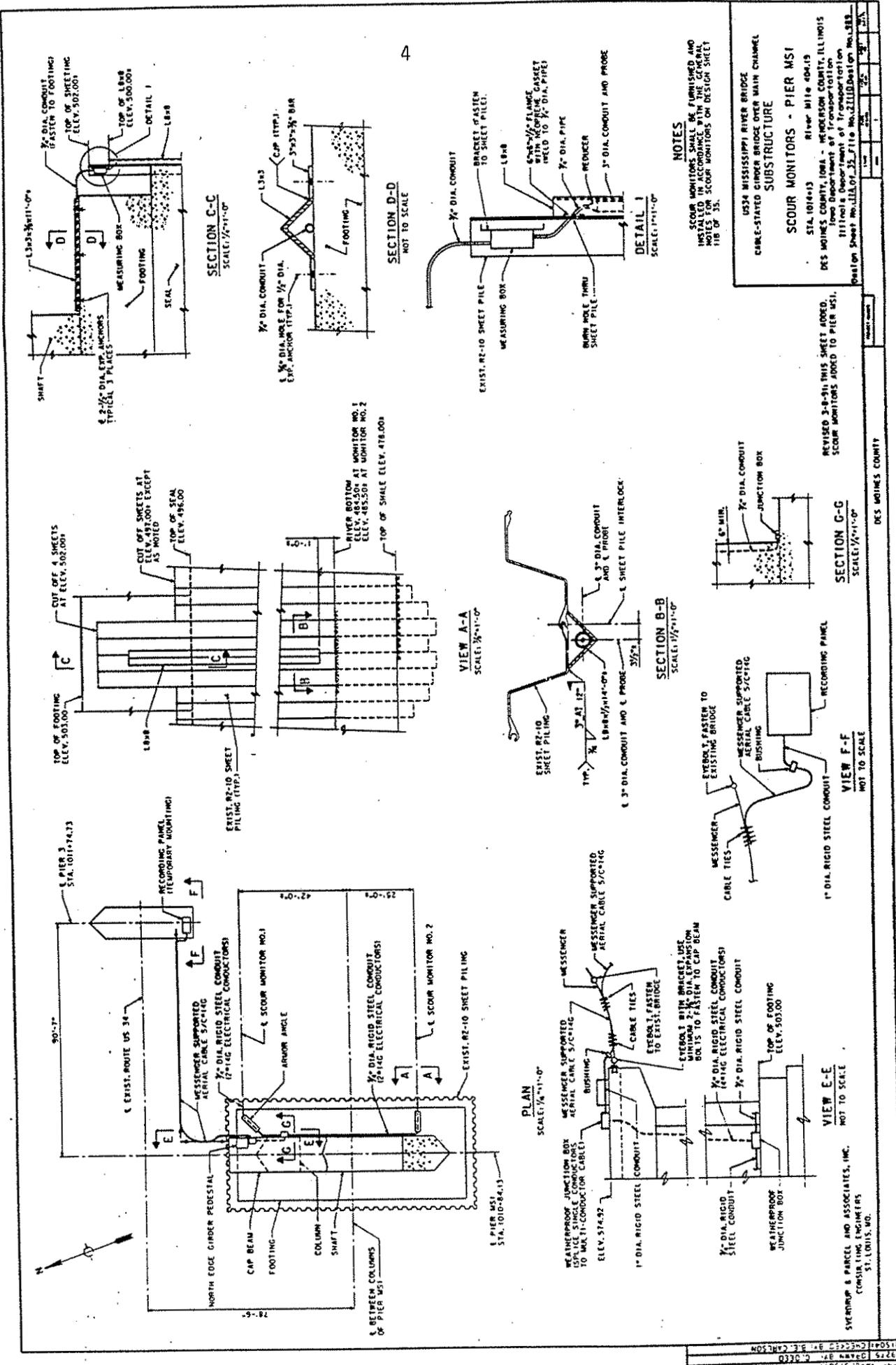


FIGURE 1
Schematic of the Brisco Scour Monitor



NOTES
 SCOUR MONITORS SHALL BE FURNISHED AND
 INSTALLED IN ACCORDANCE WITH THE GENERAL
 NOTES FOR SCOUR MONITORS ON DESIGN SHEET
 118 OF 35.

US24 MISSISSIPPI RIVER BRIDGE
 CABLE-STAYED GIRDER BRIDGE OVER MAIN CHANNEL
 SUBSTRUCTURE
SCOUR MONITORS - PIER MSI
 STA. 1014+13 River Mile 404.19
 DES MOINES COUNTY, IOWA - WOODRUM COUNTY, ILLINOIS
 Iowa Department of Transportation
 Illinois Department of Transportation
 Design Sheet No. 118 OF 35 File No. 2113 Design No. 118

REVISED 3-8-91 THIS SHEET ADDED.
 SCOUR MONITORS ADDED TO PIER MSI.

SECTION G-G
 SCALE: 1/2"=1'-0"

VIEW F-F
 NOT TO SCALE

SECTION C-C
 SCALE: 1/2"=1'-0"

SECTION D-D
 NOT TO SCALE

VIEW A-A
 SCALE: 1/2"=1'-0"

SECTION B-B
 SCALE: 1/2"=1'-0"

VIEW E-E
 NOT TO SCALE

DES MOINES COUNTY

FIGURE 2
 Design Details for Installation
 of the Bridge Scour Monitors

REVISED 12/15/01
 1725 DOWMAN BL. B.E. CHILSON
 C. G. DEER

SHERROD & PARCEL AND ASSOCIATES, INC.
 CONSULTING ENGINEERS
 ST. LOUIS, MO.

readings was initiated until December 3, 1992. The field book log of readings is given in Appendix A.

Initially, the readout control box was not locked and both readouts could easily have been reset to zero by anyone who pushed the two reset buttons. A keyed padlock was used to restrict access to the control box.

On February 24, 1993, both digital readouts registered extremely large numbers. It was obvious that the numbers were in error as the river bottom could not have lowered by the amount indicated. By this time, it had become apparent that the malfunctions of the readouts were immediately following rainstorms with substantial lightening. In Iowa, the summer of 1993 was the wettest on record. There were numerous electrical storms and the Mississippi River was above flood stage for a long period of time. There were repeated malfunctions yielding unbelievable numbers on the digital readouts.

The scour monitor designers were contacted to correct the problem a number of times. One effort to correct the problem was to operate the readouts on batteries. The readouts still malfunctioned. Through October 1993, the readouts continued to have problems.

Observation of the installation by Iowa Department of Transportation bridge inspection personnel was minimal.

On August 26, the sheet piling at both locations where the protection angle was to be welded on were unloaded and pulled. The angles were welded to the sheet piling. On Tuesday, August 27, both monitor boxes were installed. The electrical conduits were installed on Wednesday, August 28. On August 29, the sheet piling were redriven and both probes were dropped. A diver was used to place a one foot square plate beneath the probe on the soft muck river bottom. The probes rest on the plates, but they are not fastened together in any way. In earlier installations, the probe had penetrated the river bottom and indicated scour that had not occurred. The plate beneath the probe was an effort to prevent the false indication of scour. Russell Kozlowski said that no problems were encountered during the installation which was completed on August 29. The electrical connections to temporarily install the digital readouts on a walkway on the old bridge were completed in May 1992.

EVALUATION OF THE SCOUR MONITORS

The scour monitor readouts functioned for only a short time after May 1992 and malfunctioned. The designer repaired the readouts, but they quit working after another very short period of time. It was quite awhile before the designer again got the digital readouts working. Due to the repeated malfunctions, no log of

DESIGNERS EXPLANATION OF THE PROBLEM

A November 5, 1993 letter from the designer (Appendix B) noted that the measuring cable was acting as a conduit for power surges from the electrical storms. It was also noted that the recording panel being mounted on the steel bridge without grounding compounded the problem.

TERMINATION OF THE EVALUATION

The DNR has now granted the Iowa Department of Transportation permission to use riprap around pier MS2. The riprap will be placed soon burying the probes resting on the river bottom. This will terminate the evaluation of the scour monitors.

CONCLUSIONS

The Brisco Scour Monitor never operated in a manner capable of indicating the scour of the river bottom. It was completely unacceptable for scour monitoring of the MS2 pier of the Burlington Bridge.

Appendix A
Monitoring Log

Bottom Elevation October 1991
 @Scour Monitor #1 = 487±
 @Scour Monitor #2 = 485±

DATE	TIME	GAUGE READINGS		RIVER ELEV.	INSP.	REMARKS
		LEFT	RIGHT			
12-03-92	-----	0	0			
12-12-92	-----	0	0	523.5		
12-16-92	9:30 AM	0	0	524.5	GRD	New gauge installed -- set to zero Read by Jim Webb
12-18-92	9:35 AM	0	0	523.5	GRD	No additional soundings
12-22-92	9:45 AM	0	0	521.3	GRD	
12-29-92	9:30 AM	0	0	525.7	GRD	
01-06-93	2:30 PM	0	0	521.7	GRD	
01-22-93	1:35 PM	0	0	522.3	GRD	
01-28-93	1:05 PM	0	0	521.3	GRD	
02-01-93	10:50 AM	0	0	520.7	GRD	
02-09-93	10:50 AM	0	0	520.5	GRD	
02-15-93	1:20 PM	0	0	520.7	GRD	
02-24-93	10:35 AM	118860	684800	520.5	GRD	
02-25-93	10:40 AM	118860	684800	520.6	GRD	
02-26-93	10:40 AM	118860	684800	520.5	GRD	
03-01-93	9:40 AM	118860	684800	523.9	GRD	
03-04-93	9:45 AM	118860	684800	526.0	GRD	
03-08-93	9:30 AM	118860	684800	522.0	GRD	
03-11-93	11:30 PM	118860	684800	521.8	GRD	
03-15-93	2:50 PM	118860	684800	524.2	GRD	
03-18-93	11:00 AM	118860	684800	526.2	GRD	
03-23-93	10:30 AM	118860	684800	526.5	GRD	
03-25-93	2:10 PM	118860	55E176			
04-02-93	9:40 AM	-----				X Storm with lightning-March 30, 1993

DATE	TIME	GAUGE READINGS		RIVER ELEV.	INSP.	REMARKS
		LEFT	RIGHT			
04-06-93	10:30 AM	Blank	55E177	529.0	GRD	Company here insulating monitor box and installing new gauges.
04-07-93	10:30 AM			529.8	GRD	
04-09-93	9:45 AM	0	0	530.4	GRD	New gauges installed and reset to zero 4-8-93.
04-14-93	9:50 AM	0	10	529.0	GRD	Had thunderstorms last eve.
04-15-93	1:30 AM	0	11	528.9	GRD	
04-19-93	8:25 AM	Blank	111150	530.0	GRD	Thunderstorms this AM.
04-20-93	10:45 AM	Blank	111150	530.5	GRD	
04-26-93	1:30	Blank	111150	532.2	GRD	
04-28-93	1:30	0	2	531.76	GRD	Millards put new relays & counters on.
04-29-93	2:35	0	4	531.7	GRD	
04-30-93	2:30	0	5	531.64	GRD	
05-01-93	8:45	0	9	531.35	GRD	
05-03-93	2:25	0	9	530.7	GRD	
05-04-93	10:00	0	9	530.3	GRD	
05-05-93	10:15	0	9	530.0	GRD	
05-07-93	1:20	0	9	530.5	GRD	
05-12-93	7:45	1	9	529.5	GRD	Storm last eve - lots of lightning.
05-18-93	10:50	1	9	529.0	GRD	Storm over weekend.
05-24-93	10:45	1	9	527.0	GRD	
05-28-93	11:00	1	9	525.8	GRD	
06-02-93	8:00	1	9	523.3	GRD	
06-08-93	2:20	1	9	526.3	GRD	Storm last eve.
06-05-93	8:30	1	9	525.7	GRD	
06-08-93	2:20	1	9	526.3	GRD	

DATE	TIME	GAUGE READINGS		RIVER ELEV.	INSP.	REMARKS
		LEFT	RIGHT			
06-11-93	3:45	1	100009	529.1	GRD	
06-23-93	1:30	3	9	529.8	GRD	Lightning hit tower, checked monitor immediately after. Millards fixed monitor - battery dead. Storm last evening.
06-24-93	1:25	3	134	529.9	GRD	
06-25-93	8:00	3	352	529.9	GRD	
06-28-93	2:00	3	1496	532.2	GRD	
06-30-93	3:30	3	3173	533.1	GRD	
07-01-93	9:30	3	3590	533.5	GRD	
07-02-93	2:45	3	3590		GRD	Corps of Engineers say 21.9
07-08-93	10:30	3	3590		GRD	
07-13-93	9:05	3	3590		GRD	
07-21-93	10:15	3	3590		GRD	River at 22.4.
08-02-93	2:30	3	4127	530.2	GRD	
08-10-93	8:15	3	4128	527.5	GRD	Storm last eve - lots of lightning. Storms the last 2 days.
08-18-93	2:30	3	6530	529.5	GRD	
08-27-93	10:07	3	116530	529.3	GRD	
09-08-93	11:17	3	116530	527.6	GRD	
10-07-93	8:25	3	116530	522.6	GRD	

Appendix B
Manufacturer's Explanation of the Problem

CAYUGA INDUSTRIES INC.

2302 CAYUGA ROAD

SCHENECTADY, NEW YORK 12309

JOHN V. CINQUINO, P. E.
PRESIDENTTELEPHONE
(518) 372-8627

November 5, 1993

Iowa Dept. of Transportation
800 Lincoln Way
Ames, Iowa 52001

REF: US 34 Mississippi Bridge
Burlington, Iowa

Attention: Mr. Bruce Brakee

Dear Sir:

I want to take this opportunity to thank you for your telephone call concerning the Brisco Scour Monitors installed on the above referenced bridge and I would also like to clarify my conversation with you.

As I stated in our conversation, we have several successful installations of the scour monitor in the United States. In all of these installations, the probe is attached to the pier with a measuring box at the top of the installation. The wire from the measuring box is installed in a conduit and attached to the bridge fascia. This conduit runs to the recording panel which is usually located at the bridge abutment. The recording panel contains the digital counter which measures in inches.

As you know, the installation on the Burlington Bridge was different from the other installations. The probe was attached to the pier foundation and then the wires ran up the pier and a messenger cable carried the wires to the recording panel attached to the existing steel structure.

I believe that the messenger cable and the location of the recording panel were the cause of the problems with the digital counters.

Whenever there was a severe electrical storm in the area the measuring cable acted as a conduit for power surges which burned out the digital counters. The location of the recording panel on the steel bridge without grounding compounded the problem.

Mr. Bruce Brakee
Iowa Dept. of Transportation
November 5, 1993
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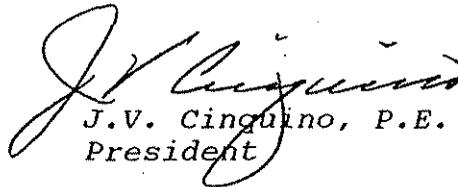
As I stated in our telephone conversation, we replaced the counters three times. I returned one of these counters to the manufacturer and they stated that the counter was burned out and it was probably caused by a power surge.

Obviously, I am very disappointed that the electrical storms and susceptibility of the recording panel location affected the performance of the monitors. If I had known more about the severe electrical storms and the intended location of the recording panel, I would have recommended a different type of installation.

Again, I want to thank you for your interest and I hope I have clarified our position in this matter.

If you have any questions, or require additional information, please contact me at your convenience.

Very truly yours,


J.V. Cinguino, P.E.
President