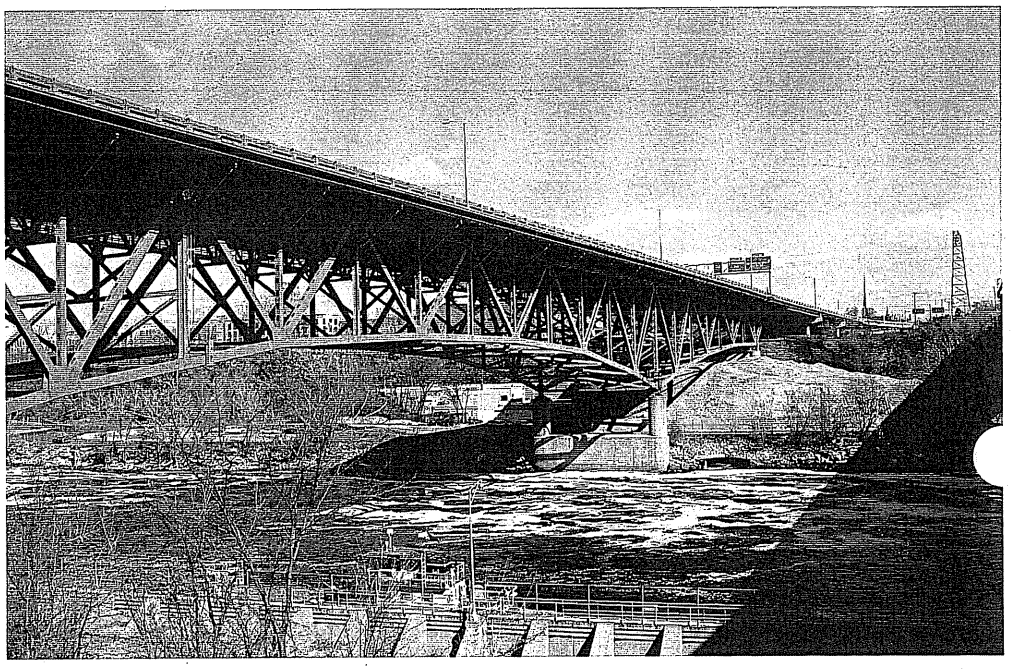
ATTACHMENT 15 – URS CORPORATION FATIGUE EVALUATION BRIDGE 9340 35W OVER MISSISSIPPI RIVER SECOND INSPECTION REPORT DATED NOVEMBER 17, 2003

(30 pages)

Second Inspection Report For:

Fatigue Evaluation
Bridge 9340
35W Over Mississippi River



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November 17th,18th, 2003

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1. INTRODUCTION

We have completed our second field inspection of the main truss section of Bridge 9340 (TH 35W over the Mississippi River). The inspection was performed utilizing MnDOT's traffic control and snooper truck on November 17th and 18th, 2003. Two members of URS's staff were assisted by MnDOT's inspection personnel to gain access to the main truss spans, concentrating the inspection at the bearings.

The purpose of the URS field inspection was to observe the current position of the finger joints, rocker bearings and roller bearings and to make measurements indicating various movements and rotations. In addition, this field inspection provided an opportunity for URS personnel from the Hunt Valley, Maryland office to view bridge conditions first hand prior to starting the analytical work.

URS was to measure the current ambient temperatures for comparison to previous temperatures. URS was to mark the bearing position for the rocker bearings on the west side of the truss that had not been previously marked and to modify the marking procedure used on the east side. URS was to create a photo log of inspection photographs to document the position of the bearings and finger joints on the inspection dates.

Information will be presented by breaking the report into major topics followed by a brief discussion of the major items in each topic. The attached photo log and image CD can be referenced for specific pictures of various areas within the truss.

2. OVERALL MOVEMENTS OF THE BEARINGS AND FINGER JOINTS

There was approximately 10 to 20 degree F temperature variation from the temperature at the time measurements were compared to the previous inspection in June of 2003. Future site visits will hopefully include a wider variation of temperatures. See the "Table of Measurements and Temperatures" for bearing movement information.

See the previous report for a detail listing of the original marking procedures. The centers of the individual rollers were scribed so that rotation of individual rollers could be determined from measurements on future site visits.

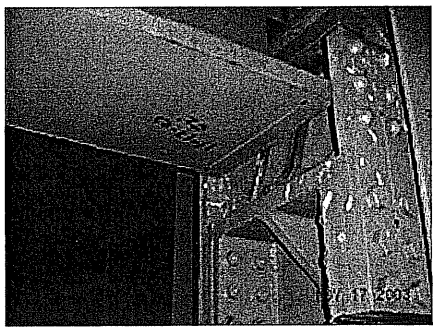
Roller Bearings:

The roller bearings did not show movement at all locations. Movement was noted at the locations as described below:

- *West Truss Movements:* The west truss showed no movement at Pier 8 and at Pier 6. At pier 5 on the west, there was about ½" movement toward the north.
- *East Truss Movements:* The east truss showed some movement at Pier 5, 6 and 8. At pier 5 on the east, there was a 9/16" movement toward the north. At pier 6 on the east, there was a 3/32" movement toward the north. At pier 8 on the east, there was a 3/32" movement toward the south.

Rocker Bearings:

The access to observe the rocker bearings was very difficult due to the construction details. The bearings are built into "pockets" in the floor beam with little clearance to the sides of the bearing.



Rocker bearing at the NW corner

The rockers on the west side of the truss had not been marked on the original visit. A new procedure was used for marking these rocker bearings as well as the east bearings, which had been previously marked. URS scribed horizontal and vertical lines across the sides of the bearing pocket and bottom flange of the approach stringer to measure future movement. See photo at the rocker bearing at the NW corner.

The rocker on the east side at location U0 moved ½" down on both sides. The rocker on the east side at location U28 moved 1 9/16" down. This distance measured was the change in the vertical distance between the scribed line on the rocker and the supporting casting.

Finger Joints:

There were measured movements at all of the finger joint locations. This movement is a combination of movement from the approach spans and the truss spans. The openings shown below were measured on the latest inspection:

- The NW joint measured 7.25".
- The SW joint measured 7.50".
- The SE joint measured 7.6875".
- The NW joint measured 5.375".

Table of Measurements and Temperatures:

See the following table for a comparison between the current and previous measurements and corresponding temperatures:

TABLE OF MEASUREMENTS AND TEMPERATURES							
Location		Initial Marking (6-9-03 to 6-13-03)			11-17-03 to 11-18-03		
		Reference Line	Measurement	Temperature	Reference Line	Measurement	Temperature
Finger Joints	NW Corner	-	6 in	70 deg F	-	7 ¼ in	52 deg F
	SW Corner	-	7 in	66 deg F	-	7 ½"	54 deg F
	SE Corner	-	7 in	62 deg F	-	7 11/16"	46 deg F
	NE Corner	-	5 in	66 deg F	-	5 3/8"	50 deg F

TABLE OF MEASUREMENTS AND TEMPERATURES (continued)

Location		Initial Marking (6-9-03 to 6-13-03)			11-17-03 to 11-18-03		
		Reference Line	Measurement	Temperature	Reference Line	Measurement	Temperature
Rocker Bearing	East Truss U0	Line 1	4 in	67 deg F	Line 1	3 5/8"	45 deg F
					Line 2	Initial marking	45 deg F
	East Truss U28	Line 1	3 15/16 in	68 deg F	Line 1	2 3/8"	50 deg F
					Line 2	Initial marking	50 deg F
	West Truss U0	Line 1	See Note		Line 1	Initial marking	53 deg F
					Line 2	Initial marking	53 deg F
	West Truss U28	Line 1	See Note		Line 1	Initial Marking	54 deg F
					Line 2	Initial marking	54 deg F
Pier 5	West Truss	Line 1	0	68 deg F	Line 1	½" North	54 deg F
		Line 2	0		Line 2		
		Line 3	0		Line 3		
	East Truss	Line 1	0	66 deg F	Line 1	9/16" North	45 deg F
		Line 2	0		Line 2		
		Line 3	0		Line 3		
Pier 6	West Truss	Line 1	0	68 deg F	Line 1	No Movement	54 deg F
		Line 2	0		Line 2		
		Line 3	0		Line 3		
	East Truss	Line 1	0	67 deg F	Line 1	3/32" North	45 deg F
		Line 2	0		Line 2		
		Line 3	0		Line 3		
Pier 8	West Truss	Line 1	0	63 deg F	Line 1	No Movement	52 deg F
		Line 2	0		Line 2		
		Line 3	0		Line 3		
	East Truss	Line 1	0	68 deg F	Line 1	3/32" South	50 deg F
		Line 2	0		Line 2	No movement on south roller	
		Line 3	0		Line 3		

Note: (June 2003 inspection) Bearing was not marked on initial visit because of the lack of access for the pre-inspection concepts. After review with office staff, an alternate marking concept was developed. Marking of the bearing on the following days would have required an additional lane closure.

Definition of Marked Line Locations

Three lines were marked on the roller bearings.

1. Line 1 was marked vertically from the upper casting across the center of one of the rollers, onto the lower bearing plate and extended onto the concrete surface. The line, however, could not be marked as plumb due to obstructions.
2. Line 2 was marked horizontally across the tooth of the rollers onto the shield/hold down plate as planned.
3. Line 3 was marked vertically from the shield/hold down plate onto the underside of the upper plate as planned.

One line was originally marked on the rocker bearing. A second line was marked during this inspection cycle. It was not possible to mark the sides of the rocker bearing.

1. Line 1 was marked on the rocker portion of the bearing a given distance up from the supporting casting. This line was also extended onto the supporting steel sole plate. The intent is to determine any change in the vertical distance between the rocker and the supporting plate and also any longitudinal displacement of the rocker in reference to the supporting steel.
2. Line 2 was marked by scribing horizontal and vertical lines across the sides of the bearing pocket and bottom flange of the approach stringer to measure future movement.

The deck joints were marked with shallow holes drilled into the joint fingers and the distance between them measured.

3. ADDITIONAL INSPECTIONS OF BEARINGS AND JOINTS

URS will monitor and record bearing and joint marks, for movement at a minimum of five additional different seasonal temperatures. URS will determine bearing and joint conditions as well as movement/temperature relationships based on these inspection records.

4. SUMMARY

See Appendix A, B, and C for photo log, inspection photographs and key plans.

Movement of the bearings was somewhat inconsistent when comparing the east truss to the west truss. Future measurements of movement will be recorded at dates with hopefully a greater amount of temperature variation from the initial readings.

Appendix A - Documented Photo Log

This photo log is a listing by photo number of the pictures taken during the inspection from Nov 17th to Nov 18th, 2003, including the location and a description. The photos can be found in Appendix B. Key plans explaining joint number descriptions in the photo log can be found in Appendix C.

A CD containing the image files has been included with this report.

PHOTO	LOCATION	DESCRIPTION
1-01	Pier 8 Bearing Assembly	West side – Looking East 52°F air temperature No Movement
1-02	Pier 8 Bearing Assembly	West side – Looking East 52°F air temperature No Movement
1-03	Joint NW Corner	-
1-04	Rocker At NW Corner U28	Scribed Vertical and Horizontal Lines for future measurement
1-05	Rocker At NW Corner	Scribed Vertical and Horizontal Lines for future measurement
1-05	Rocker At NW Corner	Scribed Vertical and Horizontal Lines for future measurement
1-07	NW Corner Finger Joint	Measured 7 ¼" at 54°
1-08	NW Corner Finger Joint	Measured 7 ¼" at 54°
1-09	Pier 6	West Side Looking East No Movement at 54°

PHOTO	LOCATION	DESCRIPTION
1-10	Pier 6	West Side Looking East No Movement at 54°
1-11	Pier 6	West Side Looking East No Movement at 54°
1-14	Pier 5	West side – Looking East ½" movement (moved north)
1-15	Pier 5	West side – Looking East ½" movement (moved north)
1-16	Pier 5	West side – Looking East ½" movement (moved north)
1-17	Pier 5	West side – Looking East ½" movement (moved north)
1-18	L1 to L2	-
1-19	SW Rocker U0	Looking North
1-20	SW Rocker	Looking North
1-21	SW Rocker	West Face Looking East
1-22	SW Rocker	West Face Looking East
1-23	SW Corner Finger Joint	Measured 7 ½" at 54°

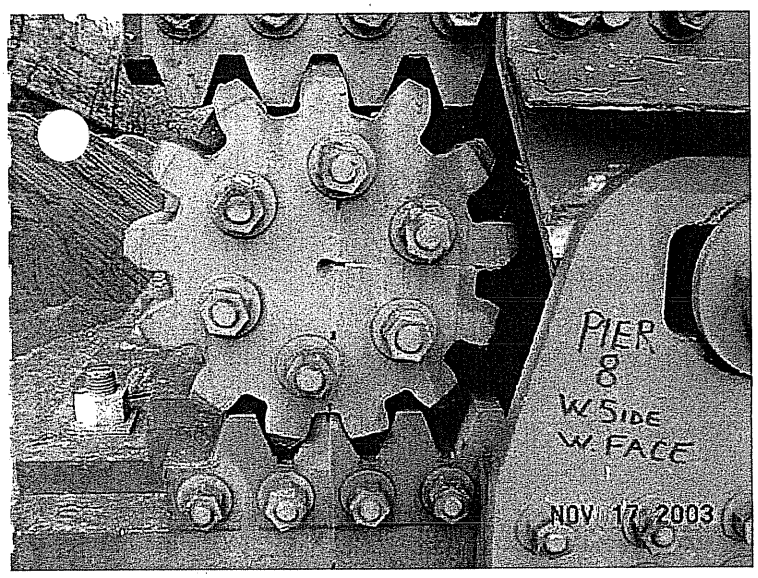
PHOTO	LOCATION	DESCRIPTION
1-24	SW Corner Finger Joint	Measured 7 ½" at 54°
1-25	Bridge Photo	-
1-26	Bridge Photo	-
1-27	Bridge Photo	-
1-28	Bridge Photo	-
2-13	SE Corner Finger Joint	Measured 7 11/16" at 46°
2-14	SE Corner Finger Joint	Measured 7 11/16" at 46°
2-15	SE Rocker U0	Measured ½" down both sides at 45°
2-16	SE Rocker	South Face Looking North
2-17	SE Rocker	East Face Looking West Scribed line at center of pin for future measurement
2-18	SE Rocker	East Face Looking West Scribed line at center of pin for future measurement

PHOTO	LOCATION	DESCRIPTION
2-19	Pier 5	East Face looking west 9/16" movement (moved north) at 45 ^{o}
2-20	Pier 5	East Face looking west Scribed lines at each roller and center of pin for future measurement
2-21	Pier 6	East Face looking west Scribed vertical line from center of pin to top of column
2-22	Pier 6	East Face looking west 3/32" movement (moved north) at 45 ^{o}
2-26	L13 to U13 South Half	-
2-27	L13 to U13 South Half	-
2-28	L14 to U13	-

PHOTO	LOCATION	DESCRIPTION
3-01	Near center span Looking NE	-
3-04	Pier 8	East Face looking west 3/32" movement (moved south) at 50 º
3-05	Pier 8	Scribed vertical line on north roller No movement noticed on south roller
3-06	NE Rocker U28	Measured 2 3/8" at 50 º
3-07	NE Rocker	Scribed horizontal line
3-08	Photo of bridge	-
3-09	Photo of bridge	-
3-10	Photo of bridge	-
3-11	Photo of bridge	-
3-12	Photo of bridge	-
3-13	Photo of bridge	-
3-14	Photo of bridge	-
3-15	Photo of bridge	-

PHOTO	LOCATION	DESCRIPTION
3-16	Photo of bridge	-
3-17	Photo of bridge	-
3-18	Photo of bridge	-
3-19	Photo of bridge	-
3-20	Photo of bridge	-
3-21	NE Finger Joint	Measured 5 3/8" at 50°
3-22	NE Finger Joint	Measured 5 3/8" at 50°

Appendix B - Inspection Photographs



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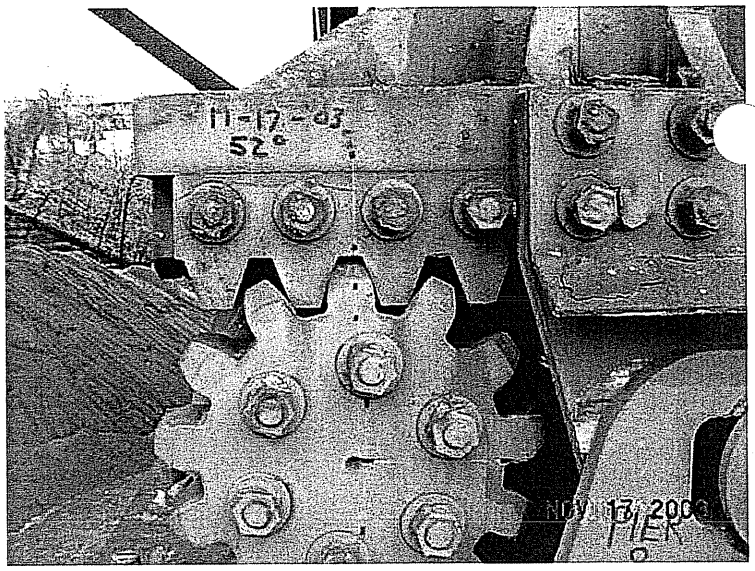

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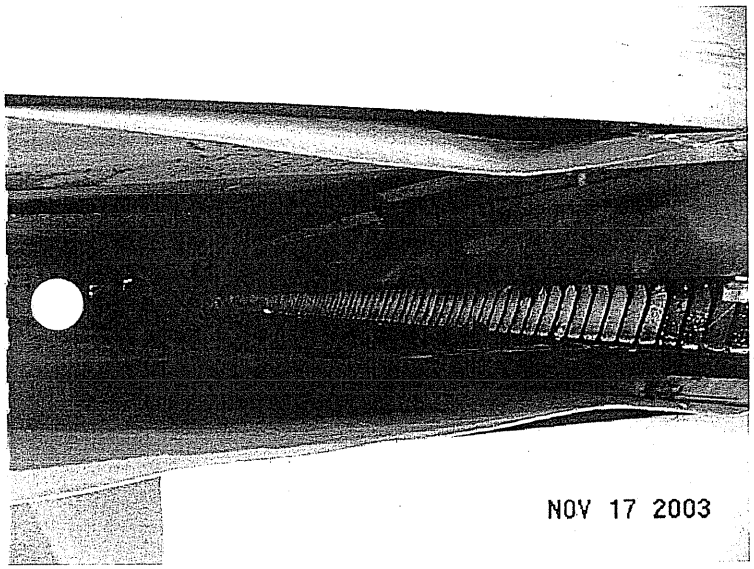

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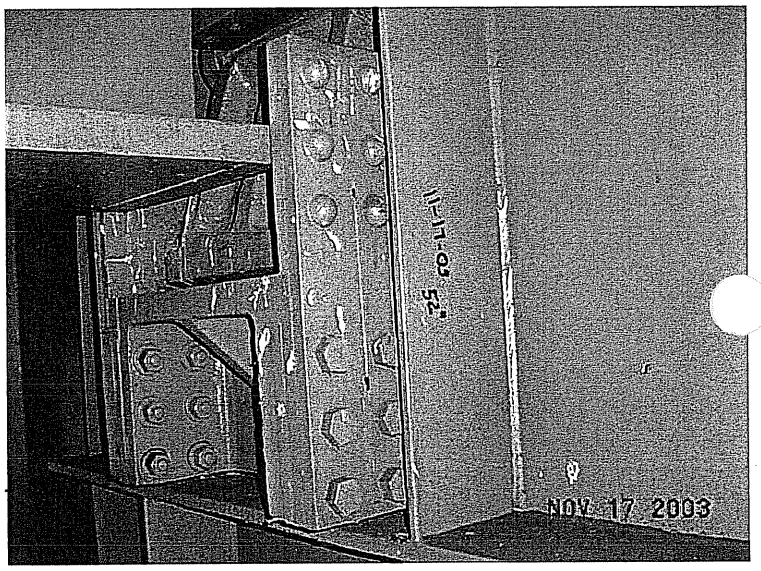

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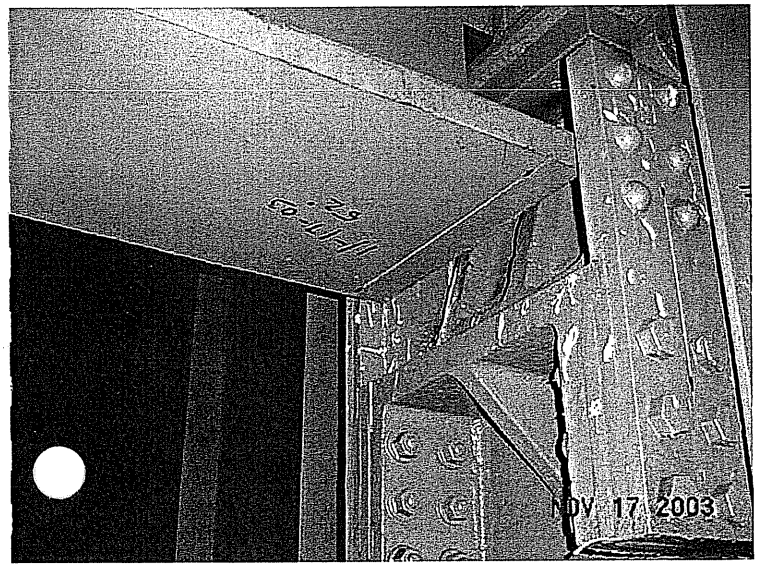

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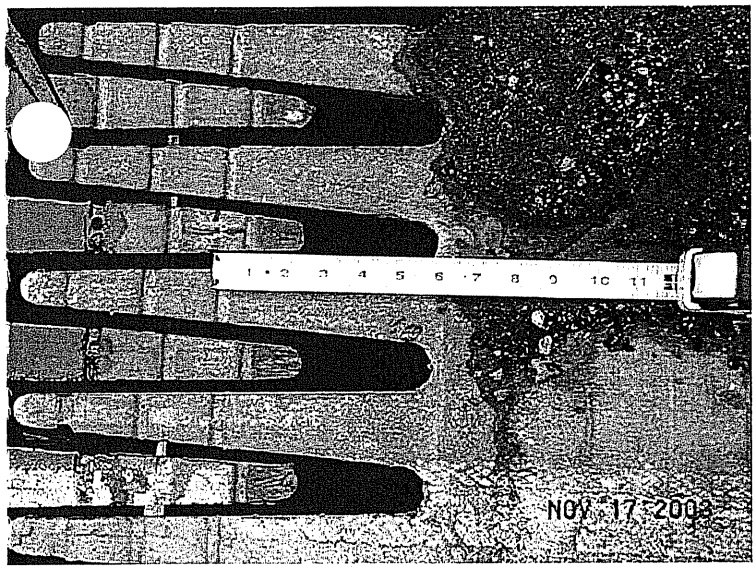

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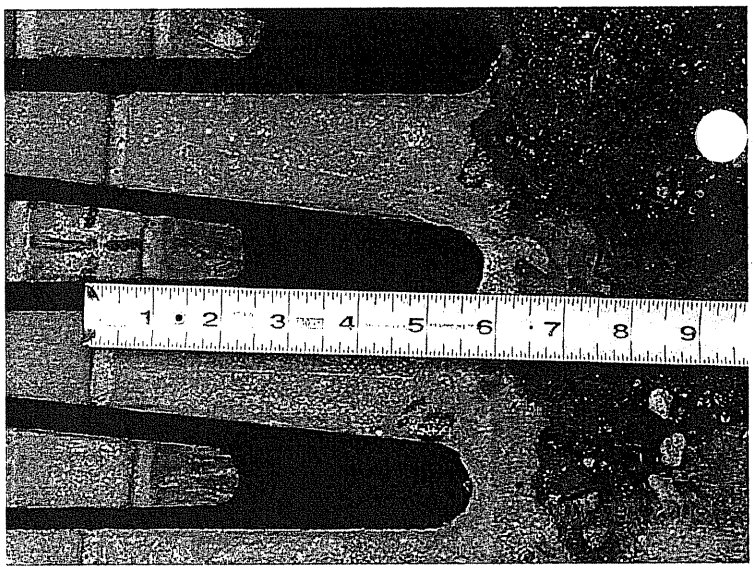

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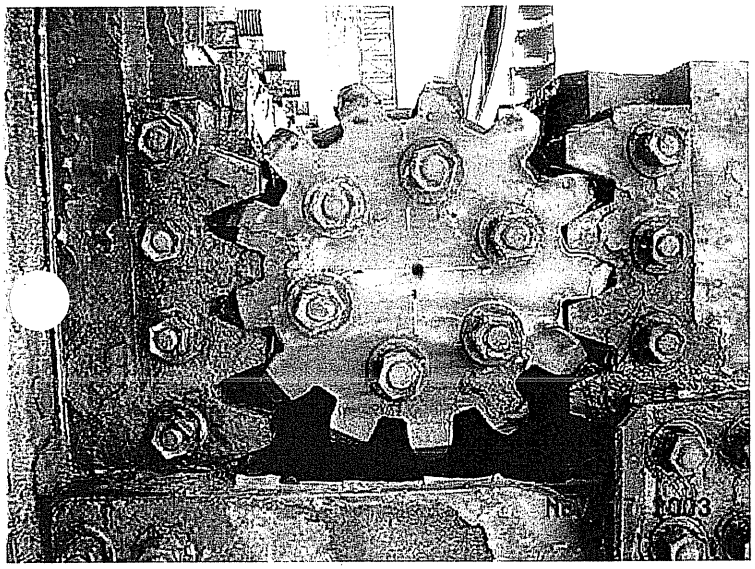

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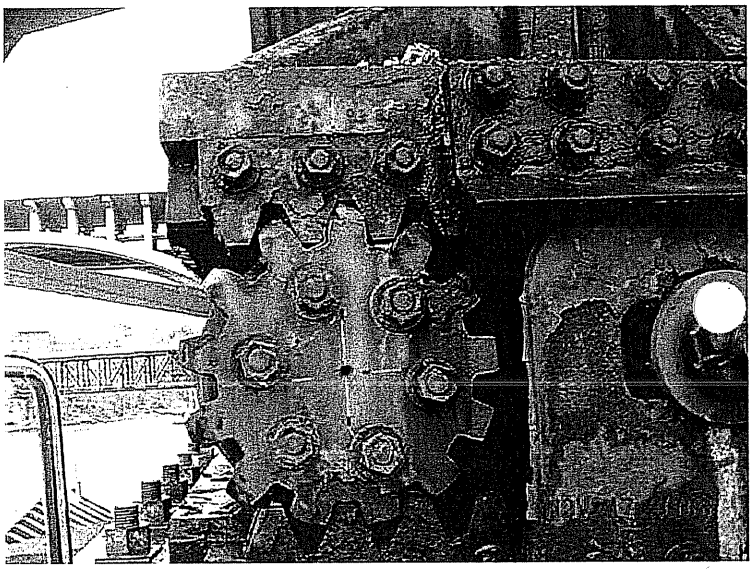

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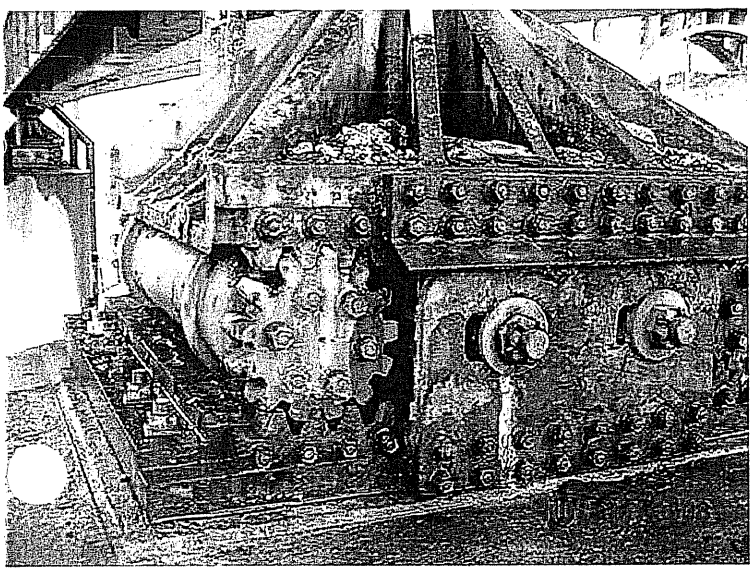

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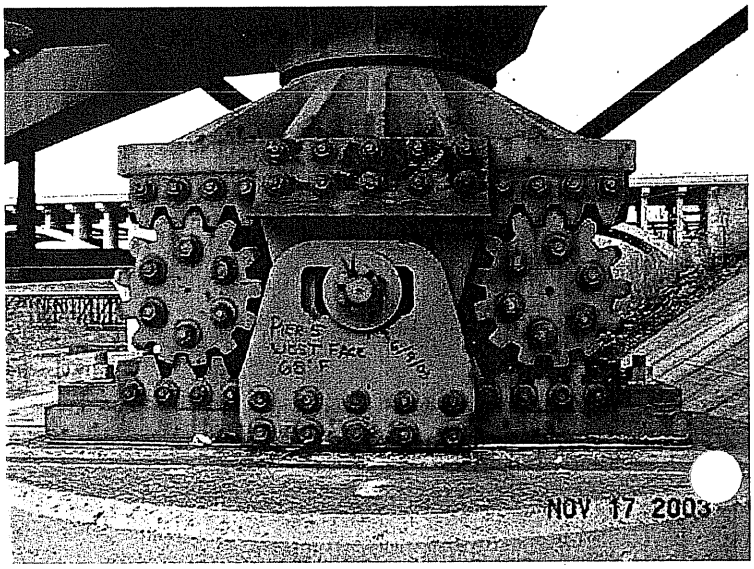

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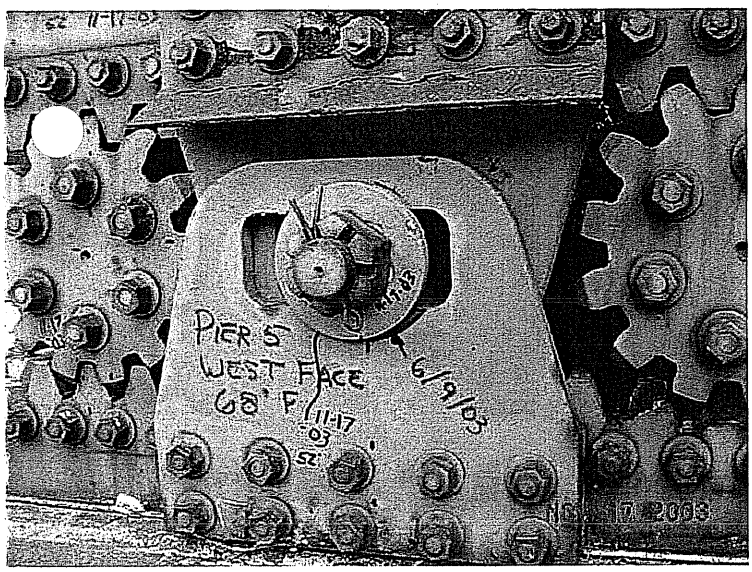

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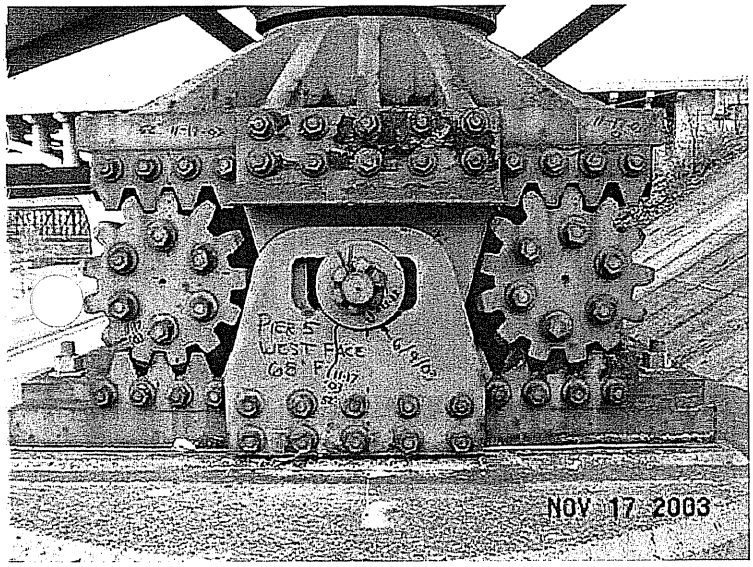

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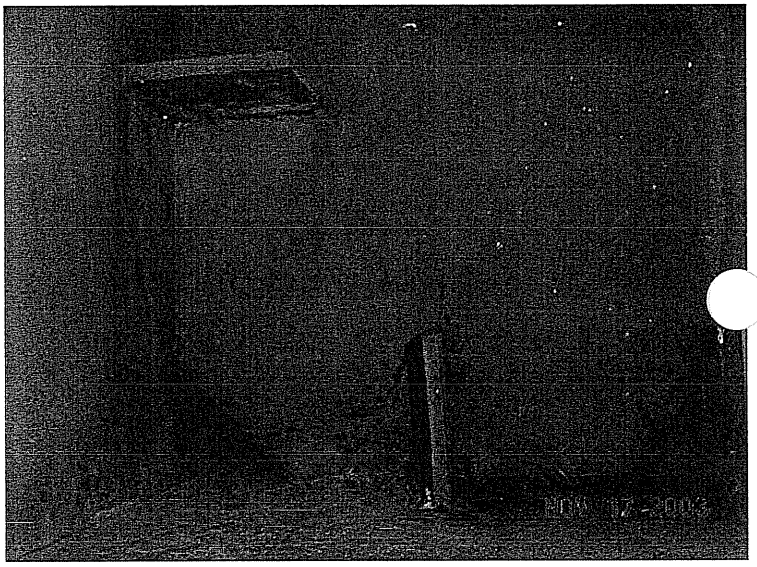

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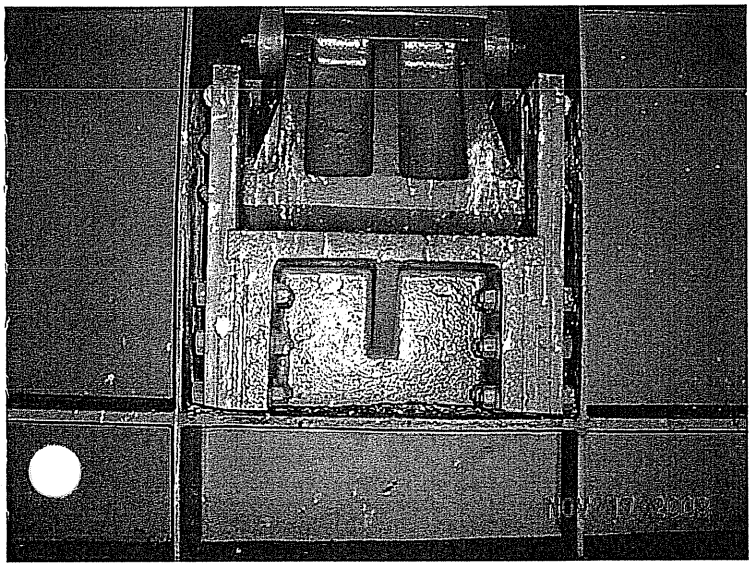

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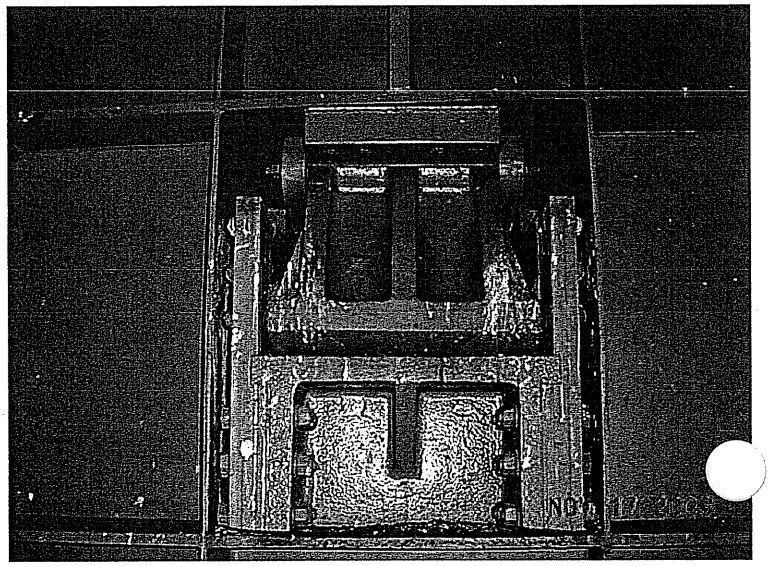

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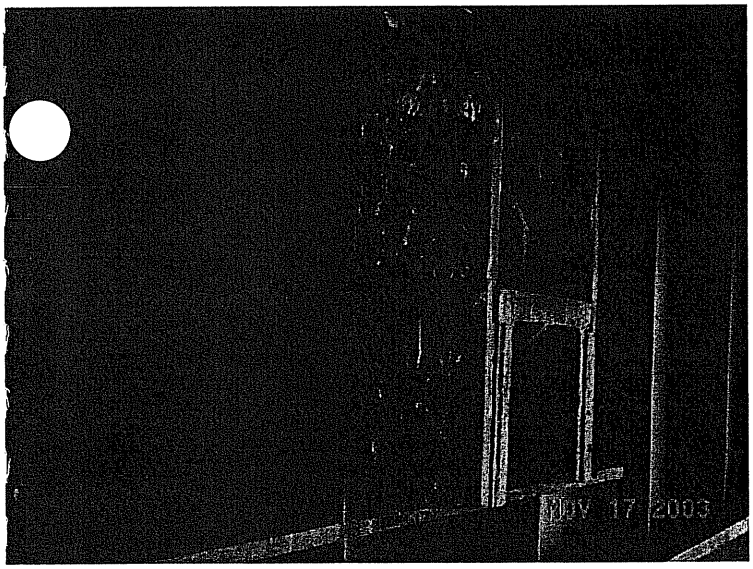

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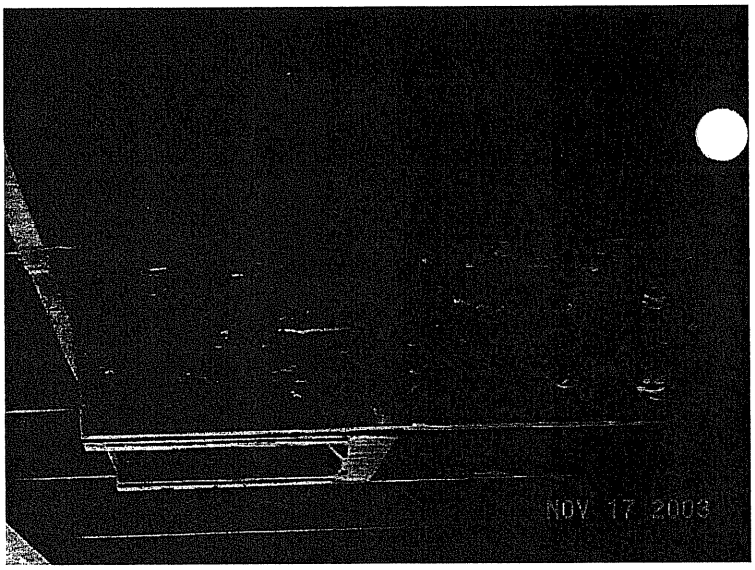

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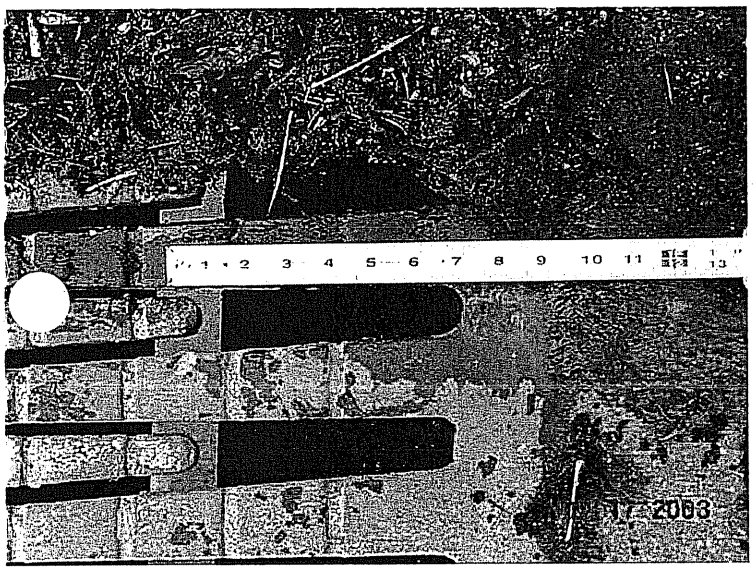

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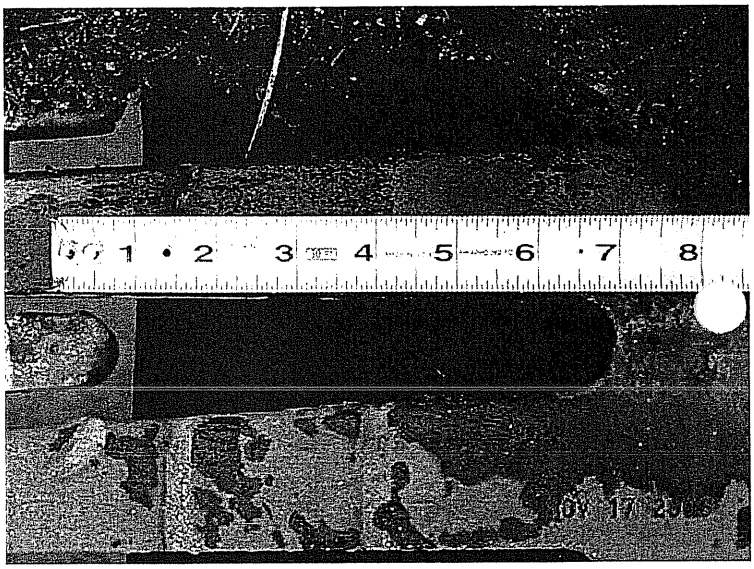

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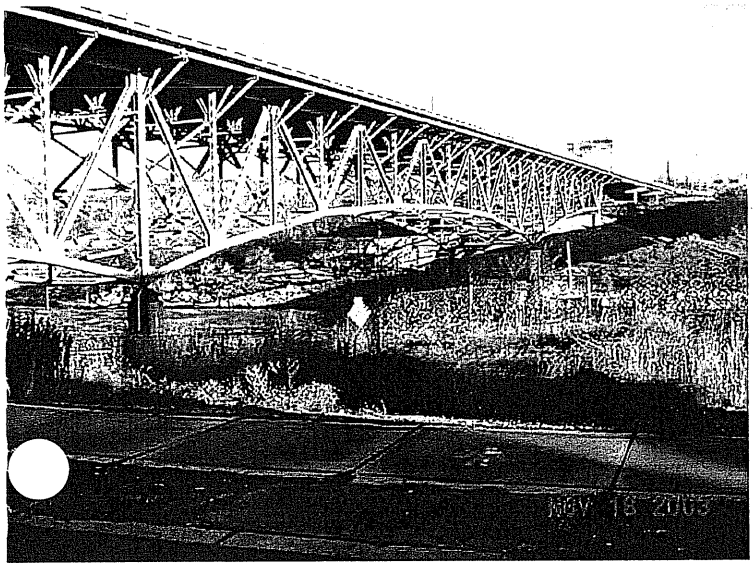

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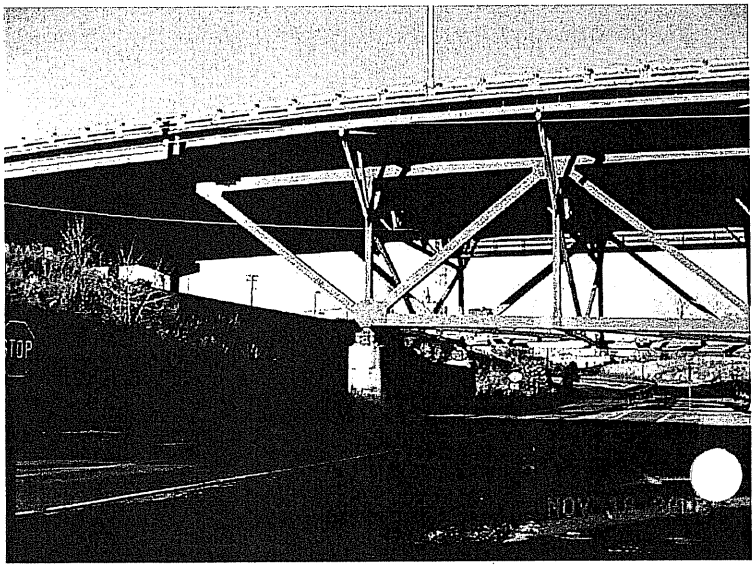

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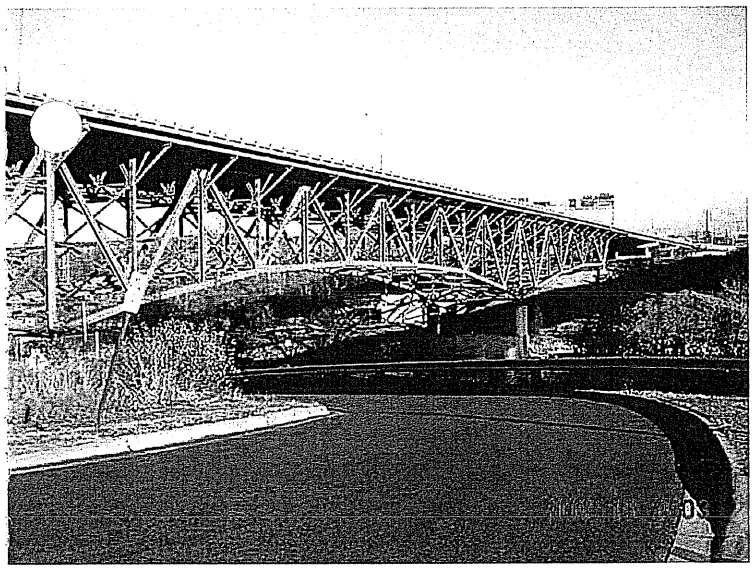

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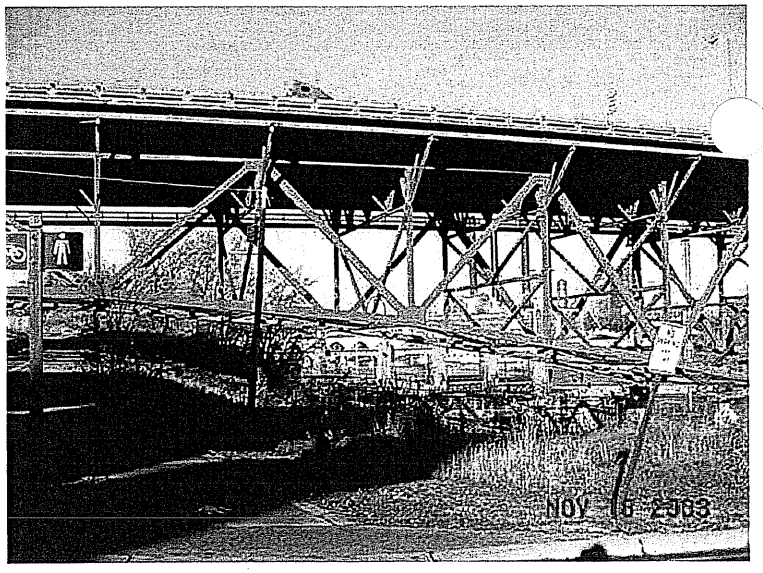

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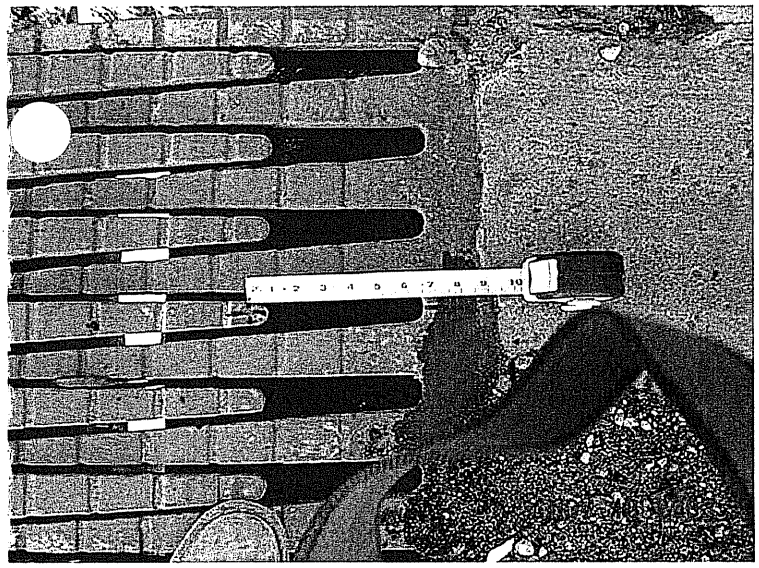

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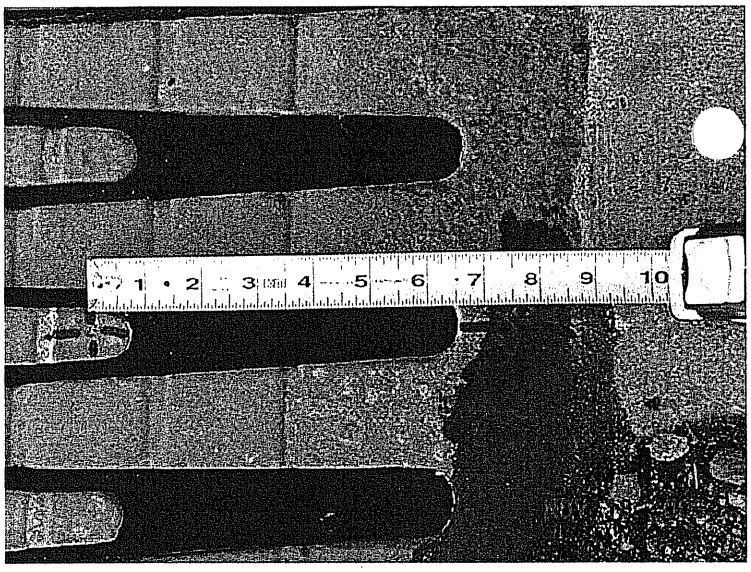

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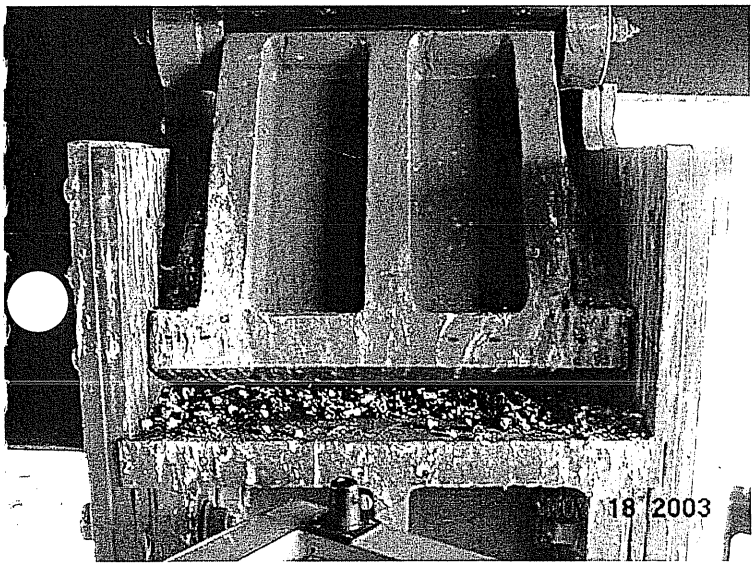

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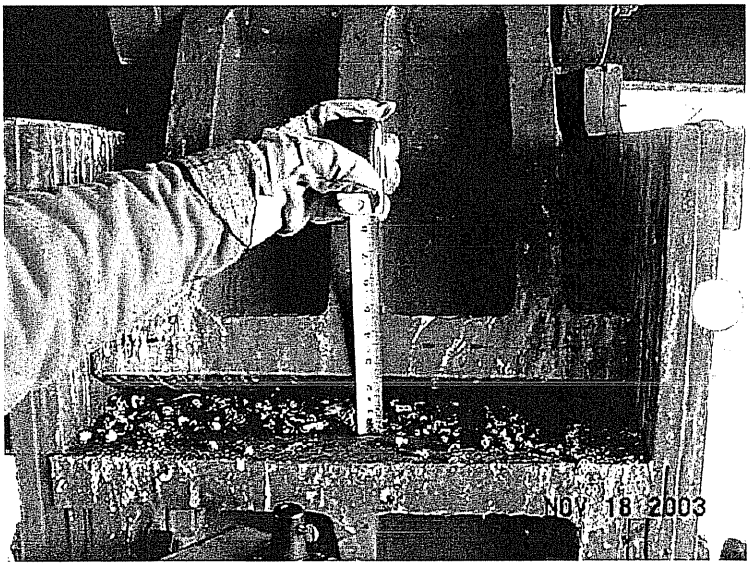

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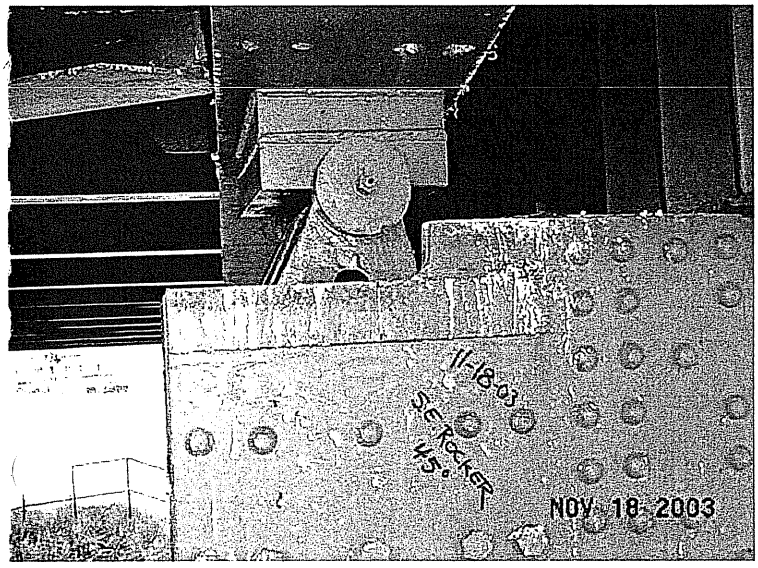

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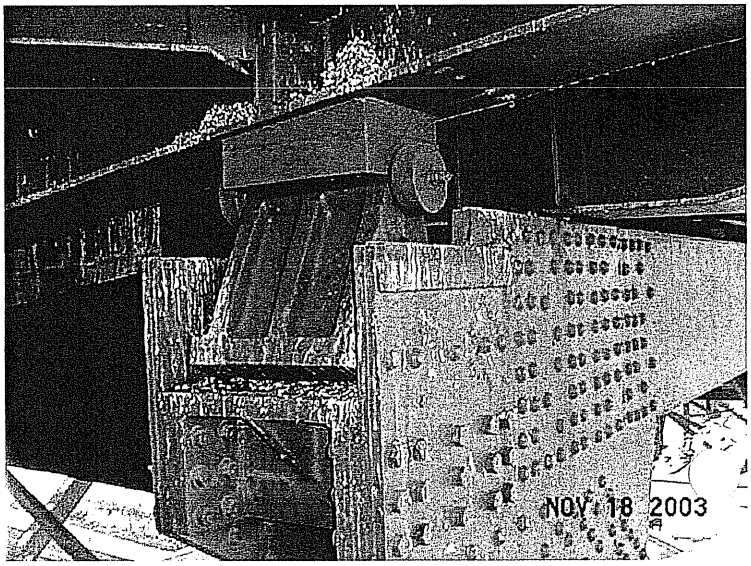

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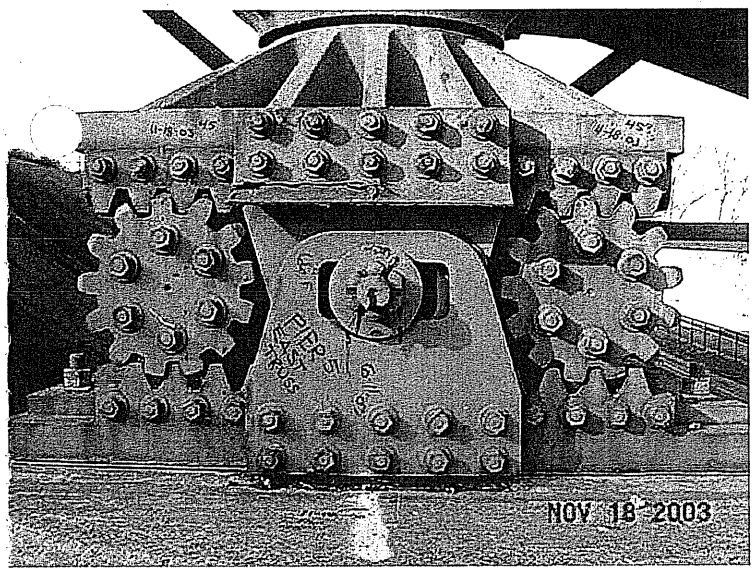

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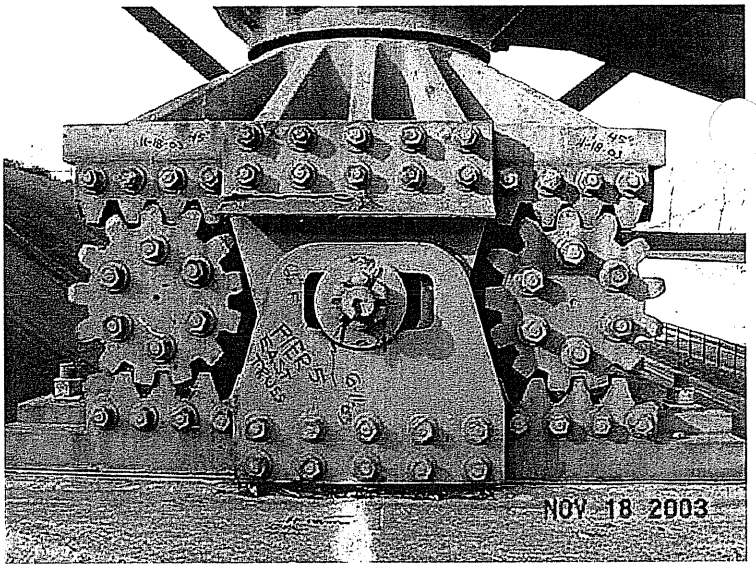

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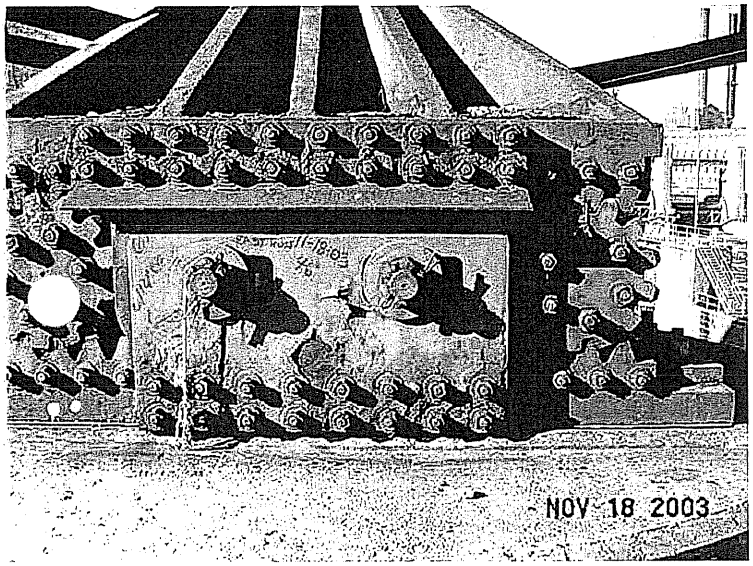

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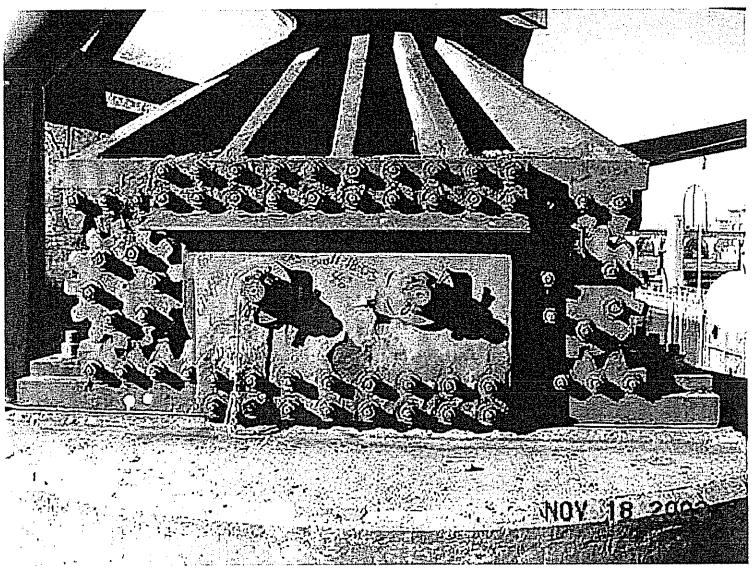

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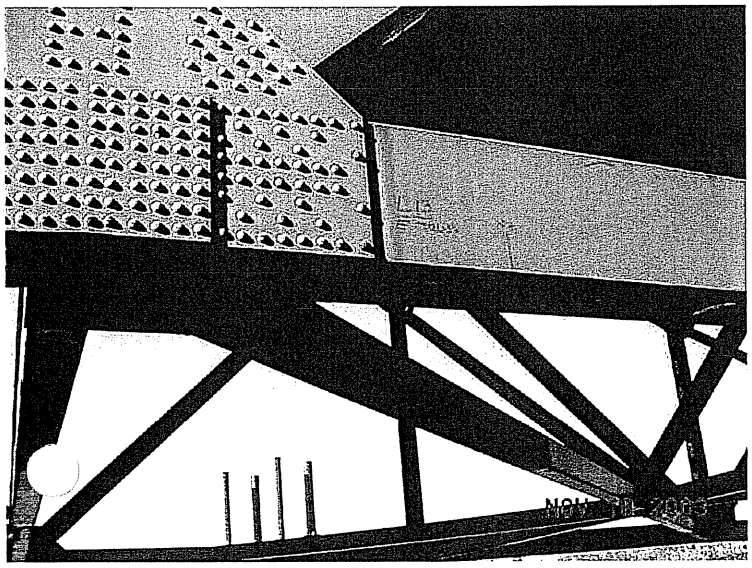

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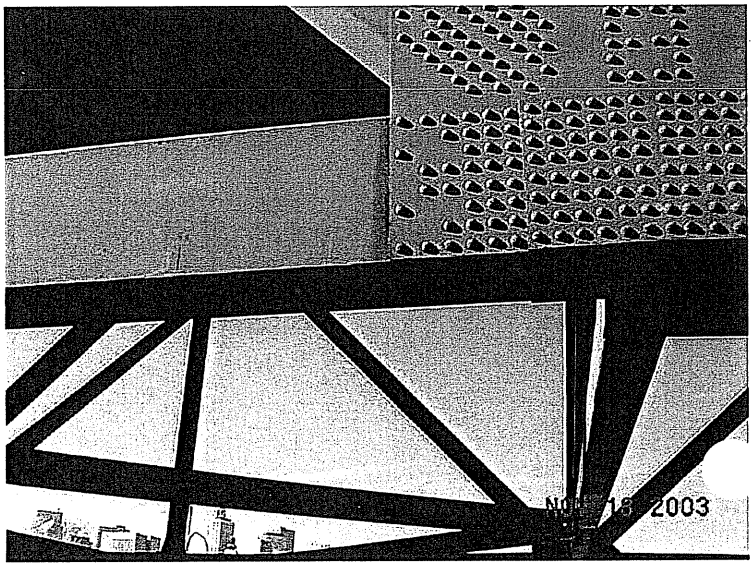

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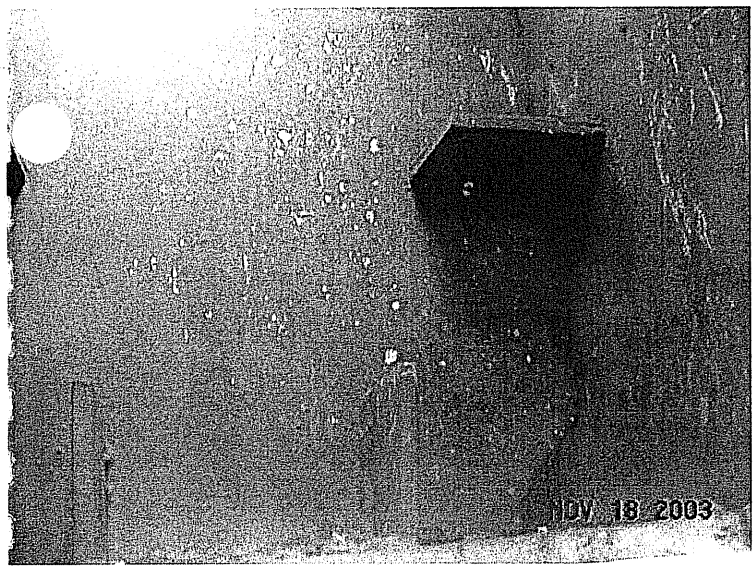

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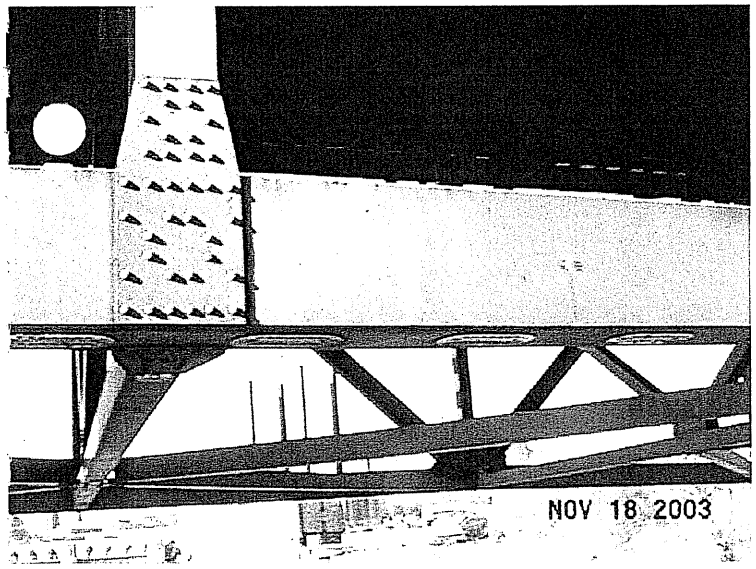

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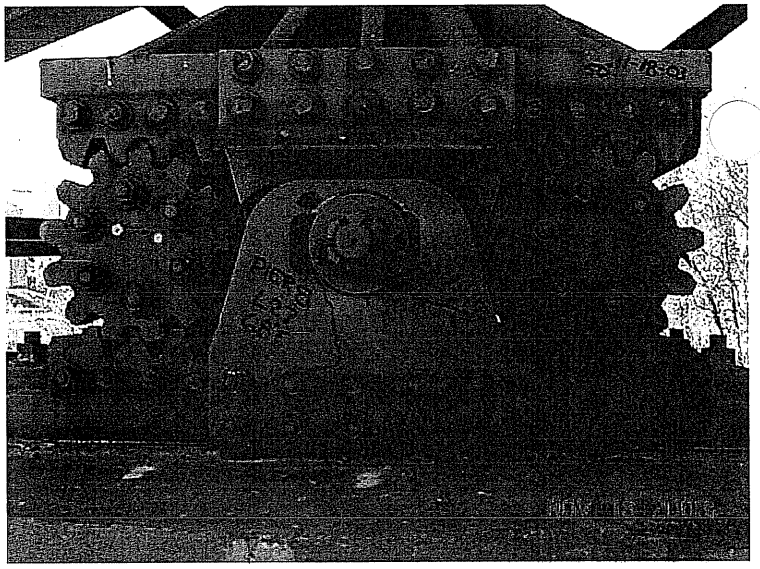

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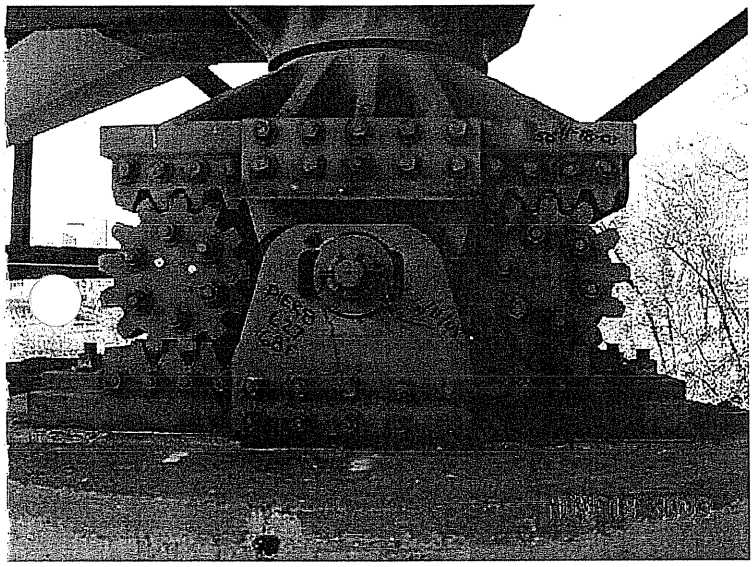

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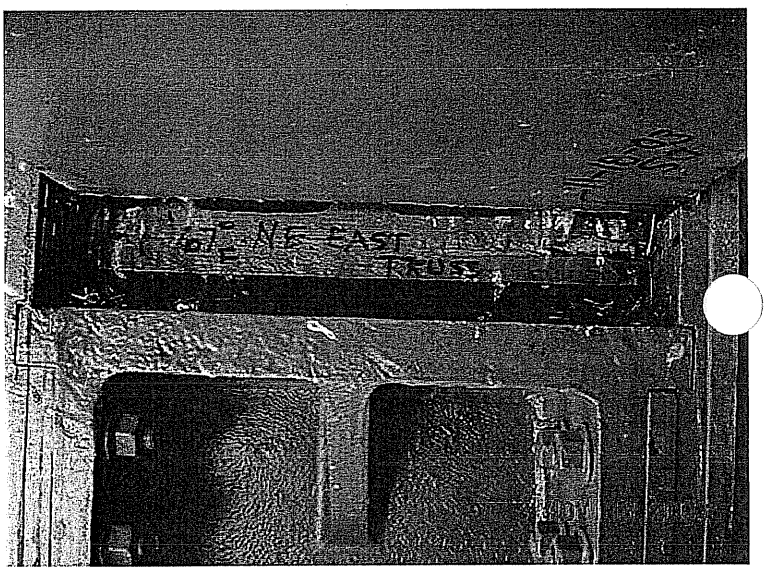

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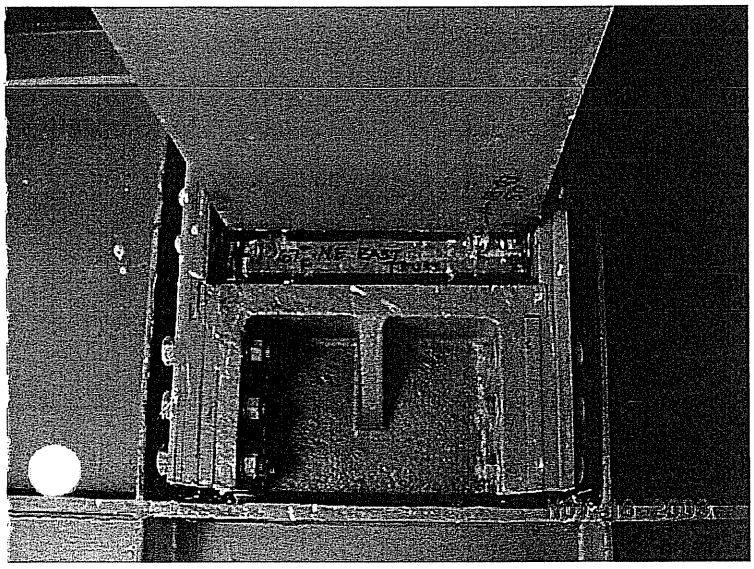

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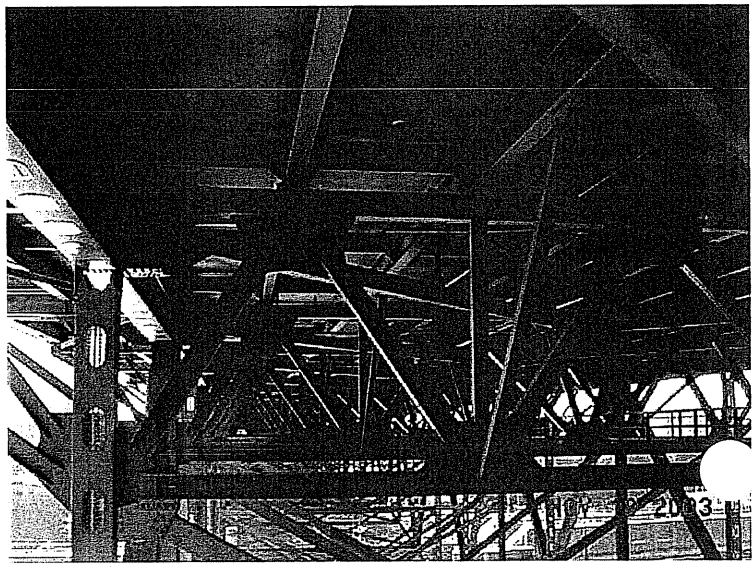

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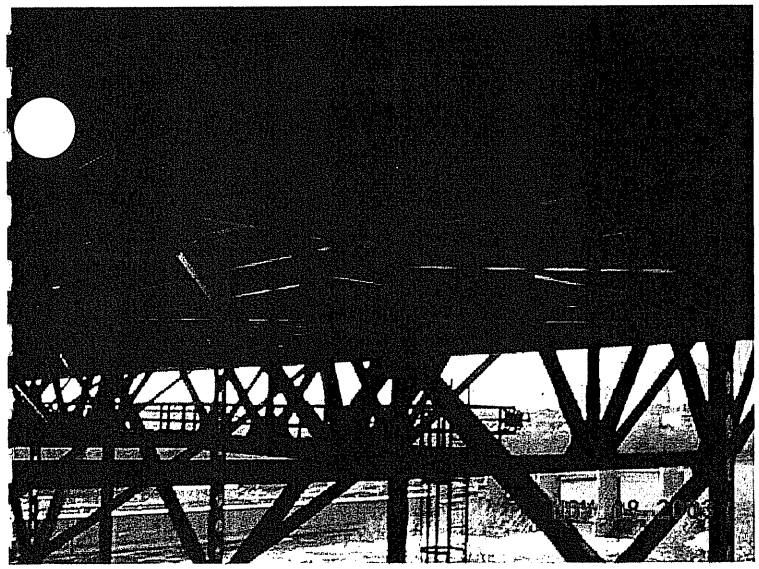

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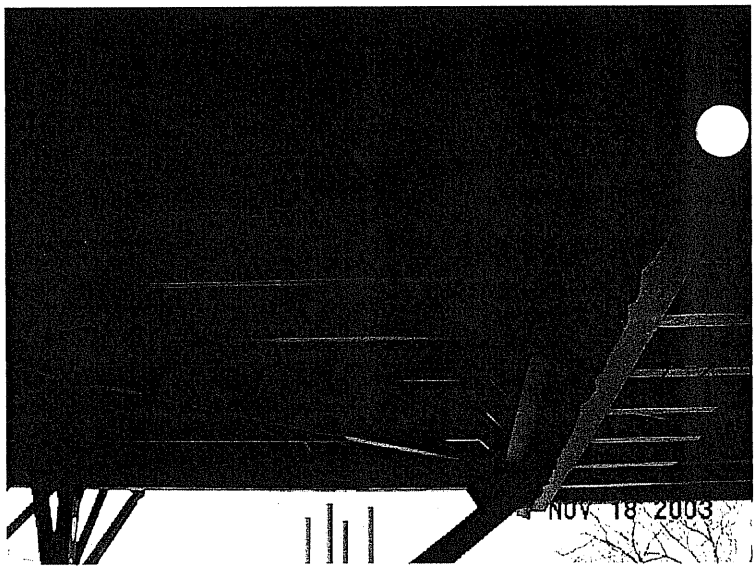

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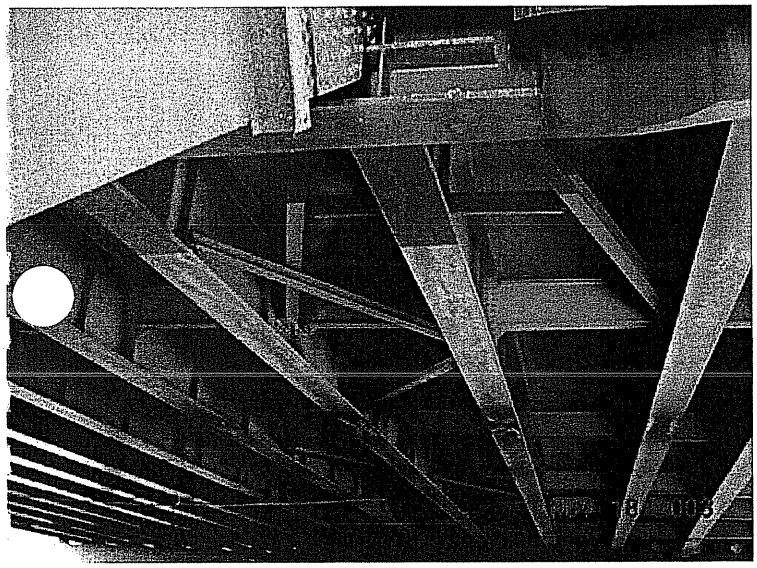

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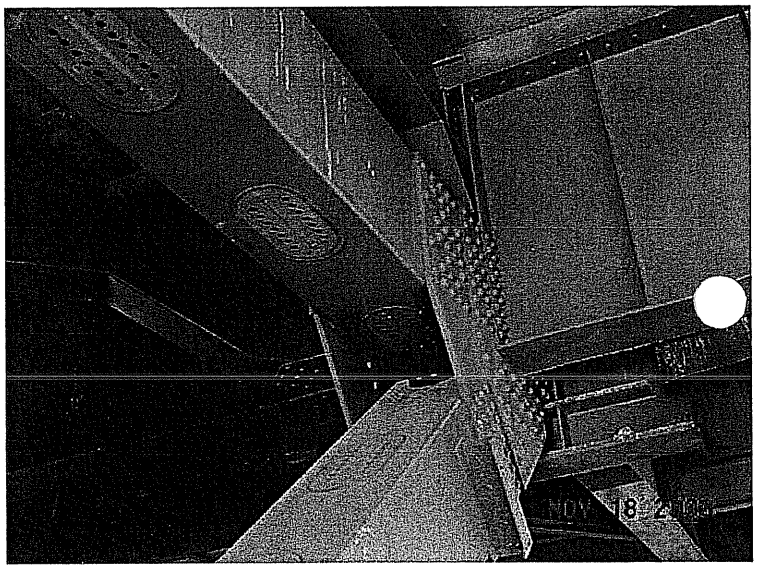

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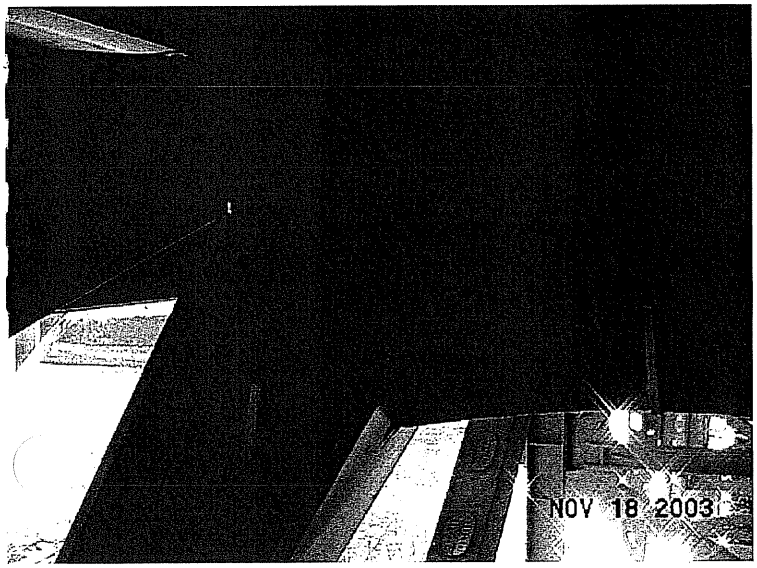

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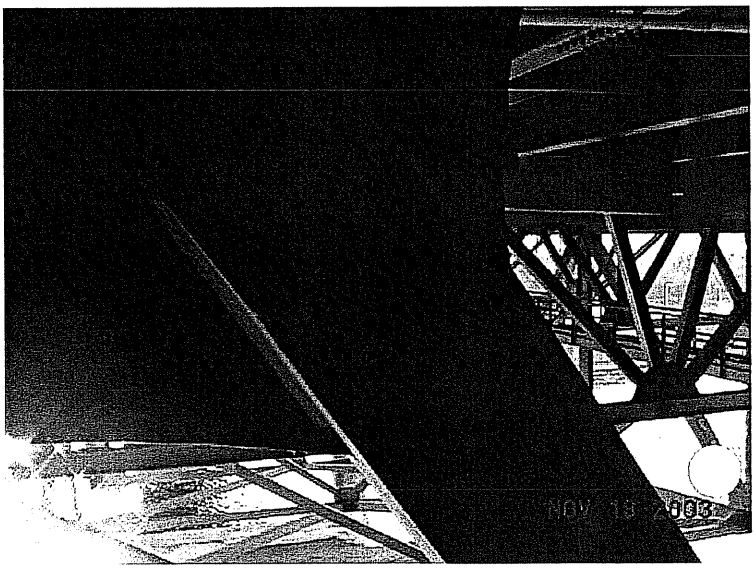

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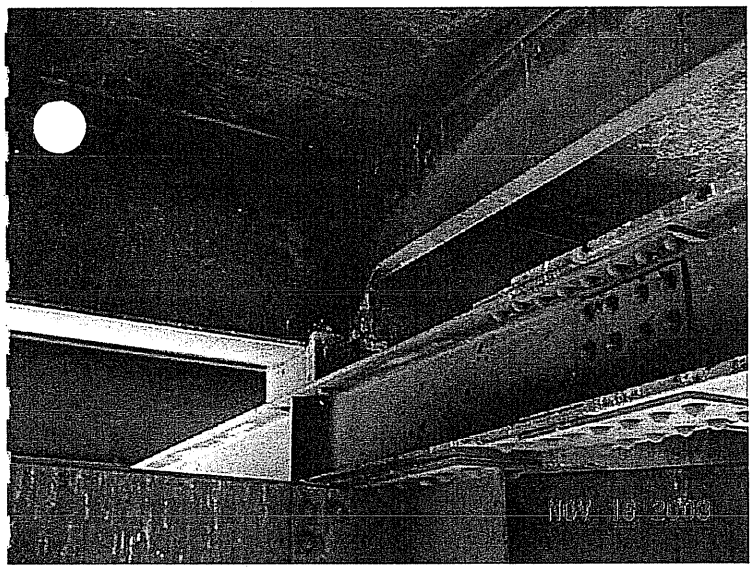

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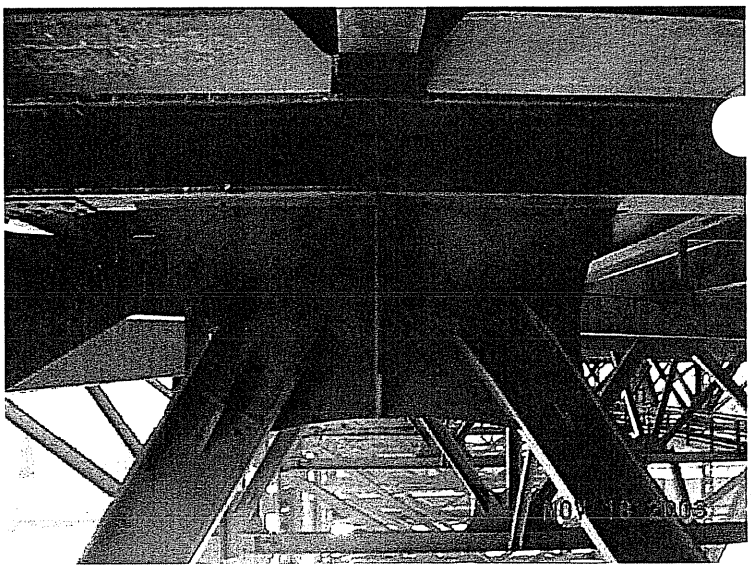

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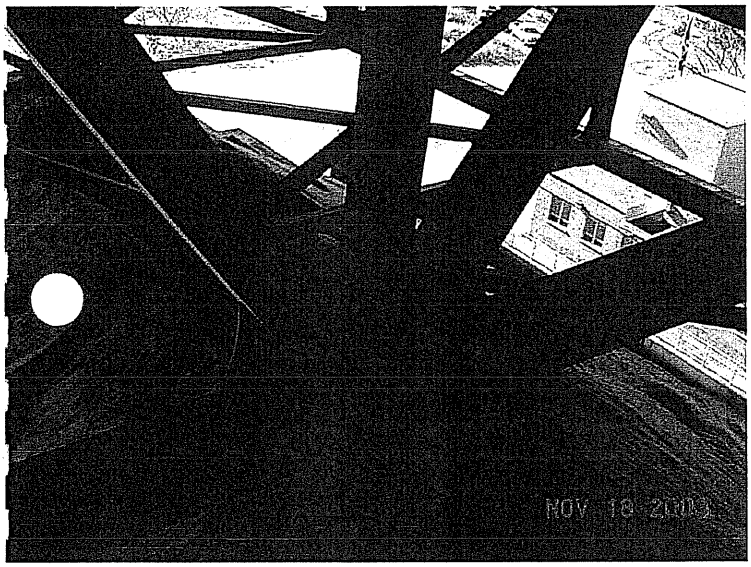

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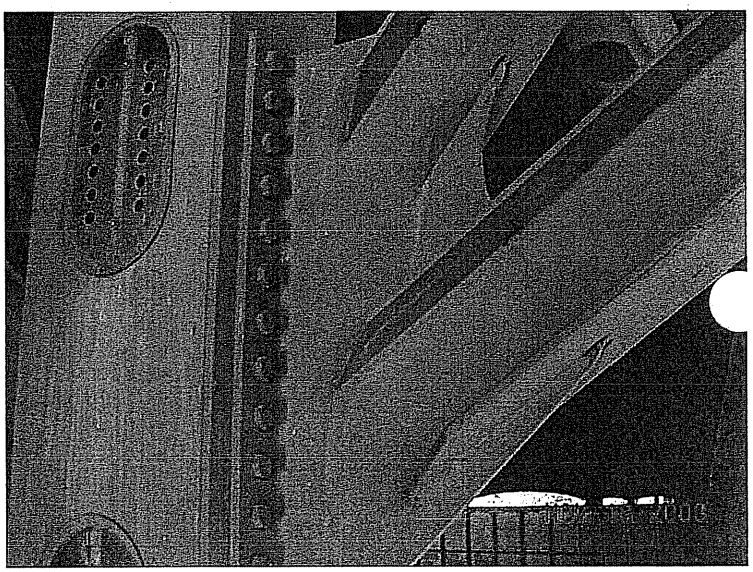

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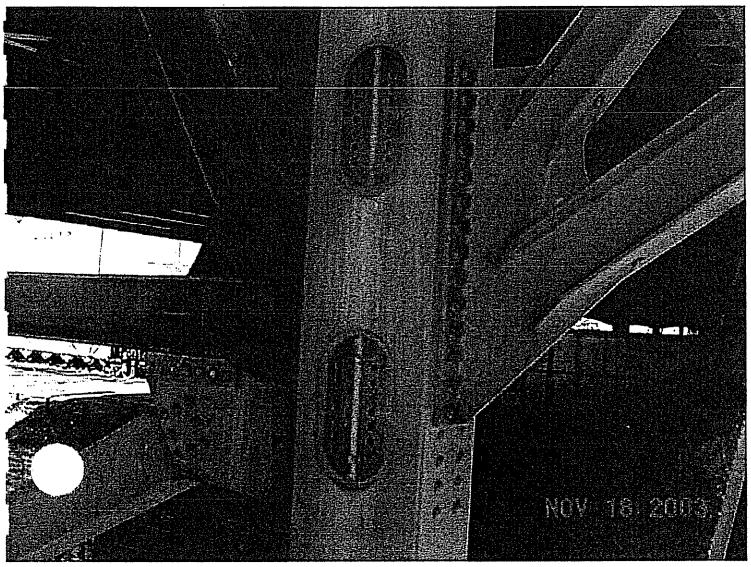

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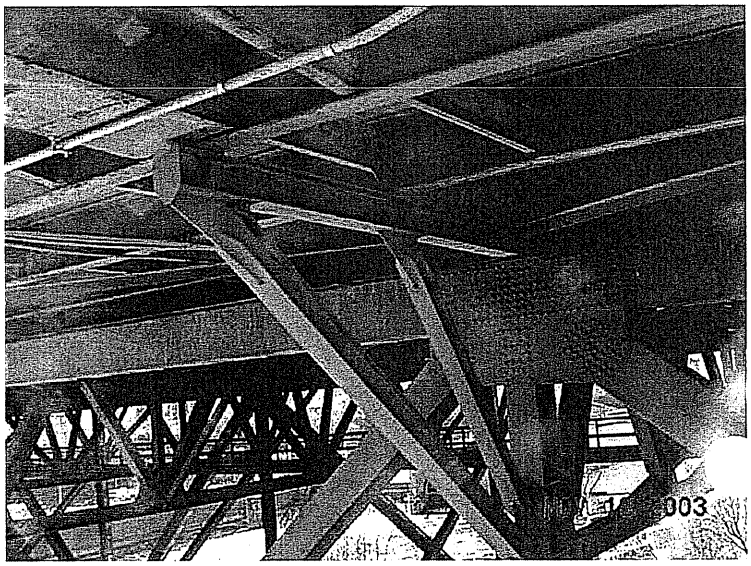

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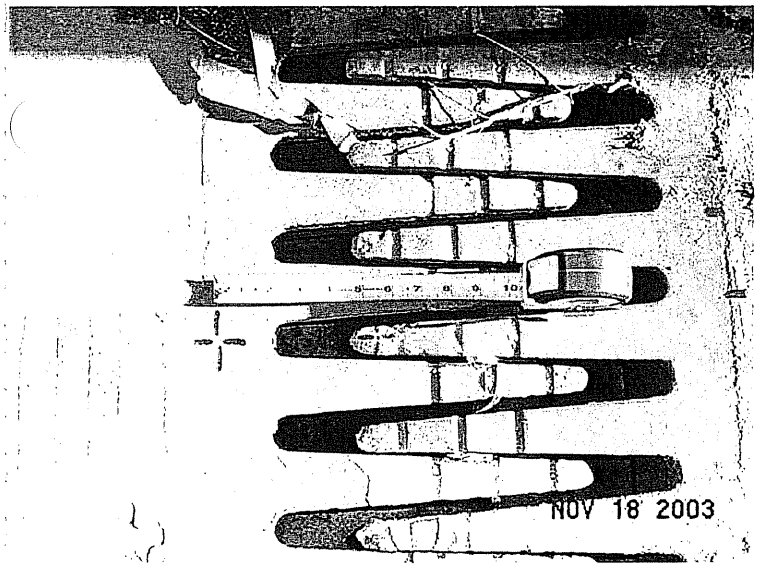

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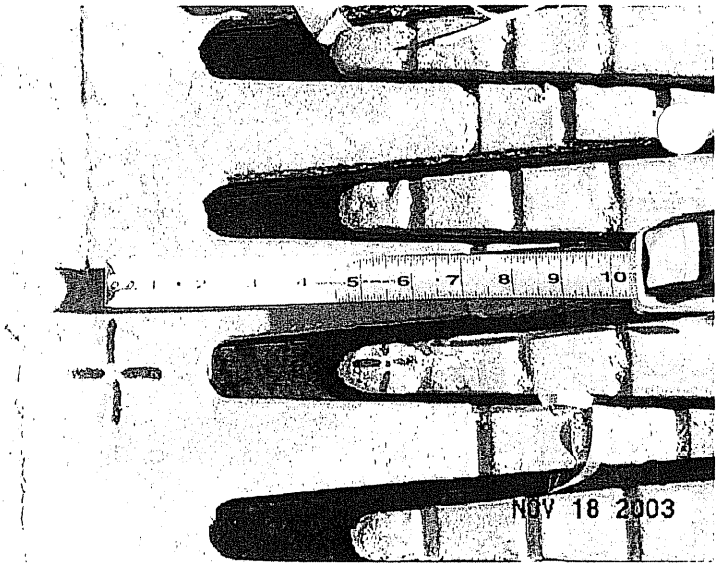
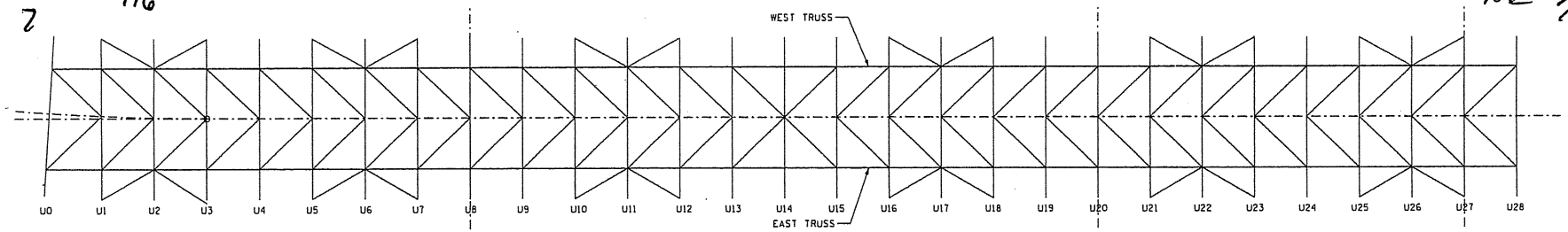


3-22

Appendix C - Key Plans

SW 1/2
SE 11/16

NW 1 1/4
NE 3/8

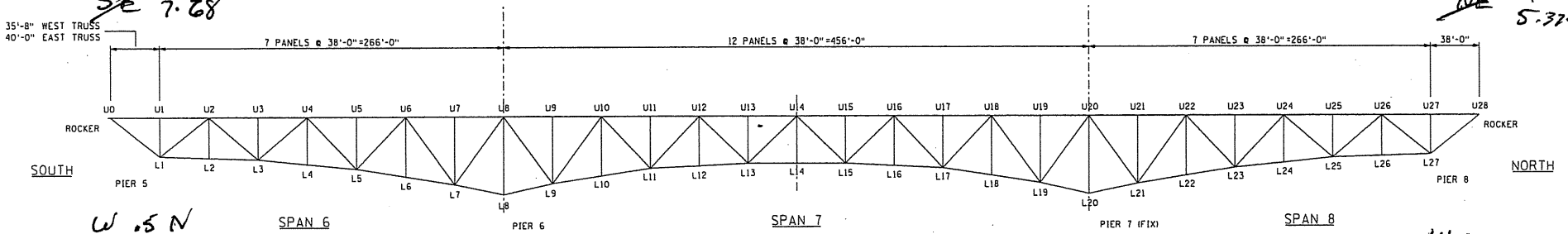


PLAN OF UPPER LATERALS

SCALE: 0 40'

~~SW 7.5~~
~~SE 7.68~~

~~NW 7 1/4~~
~~NE~~ 5.325



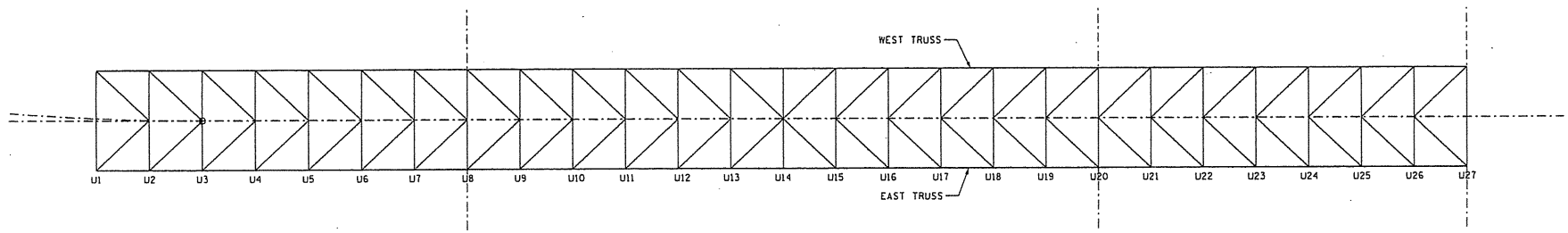
ELEVATION OF TRUSS

SCALE: 0 40'

W .5 N
E 9/16 N

W 0
E 3/32 N

W 0
E 3/32 S



PLAN OF LOWER LATERALS

SCALE: 0 40'

URS Thrasher Square 700 South Third Street Minneapolis, MN 55415	SIGNATURE: PRINTED NAME: DATE: , 2003 REG. NO.	TITLE: DECK TRUSS KEY PLAN	DES: CHK:	DR: CHK:	APPROVED:
			SHEET NO. OF SHEETS		BRIDGE NO. 9340

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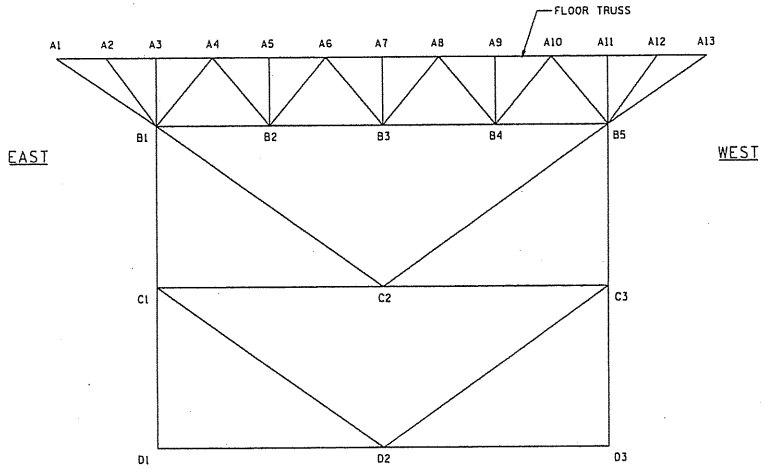
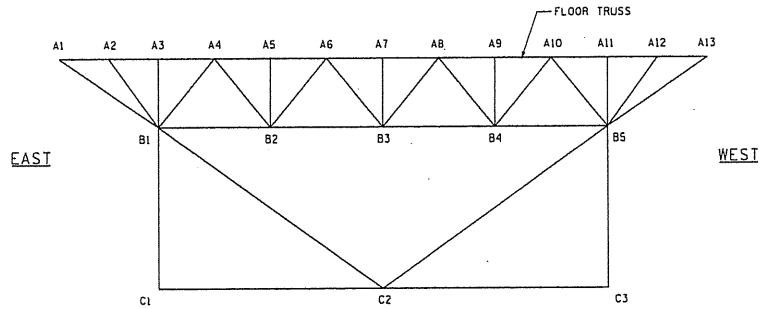


FLOOR BEAM

L6 THRU L10 AND L19 THRU L22

SCALE: 0 10'



FLOOR BEAM

L1 THRU L5, L11 THRU L18 AND L23 THRU L27

SCALE: 0 10'

URS Thrasher Square 701 South Third Street Minneapolis, MN 55415	SIGNATURE: PRINTED NAME: DATE: , 2003 REG. NO.	TITLE: FLOOR TRUSS KEY PLAN	DES: CHK:	DR: CHK:	APPROVED:	BRIDGE NO. 9340
			SHEET NO.	OF	SHEETS	

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