REPORT
on
INSPECTION, STRUCTURAL ANALYSIS AND CLASSIFICATION FOR:

Utility Bridge No. 737

submitted to the:

DEPARTMENT OF THE NAVY

Engineering Field Activity, Midwest
Naval Facilities Engineering Command

Building 1-A
2703 Sheridan Road, Suite No. 120
Great Lakes, Illinois 60088-5600

Public Works Center

prepared by:

Rubinos & Mesia Engineers, Inc.
200 S. MICHIGAN AVENUE, SUITE 1500 CHICAGO, IL 60604-2482

February 1997

REPORT ON

INSPECTION, STRUCTURAL ANALYSIS

AND CLASSIFICATION OF

UTILITY TRESTLE NO. 737

SUBMITTED TO:

NAVAL FACILITIES ENGINEERING COMMAND

PREPARED BY: Teresa Mesia Rubinos

RUBINOS & MESIA ENGINEERS, INC.

FEB 19 1997

FEBRUARY 1997

UTILITY TRESTLE NO. 737

TABLE OF CONTENTS PAGE

1.0 INTRODUCTION AND SCOPE

This report is authorized by the Navy Public Works Center for the purpose of investigating the existing conditions of the Utility Trestle No. 737 located within the National Historic District of the Great Lakes Naval Training Center.

This report is based primarily on the findings of detailed field inspections, and contains the results of structural analysis and evaluations and corresponding remedial recommendations along with associated repair drawings, and documented pictures of our findings.

The report is submitted in fulfillment of professional engineering services to the Navy Public Works Center, Great Lakes, Facilities Inspection Program, in accordance with Contract No. N68950-95D-9041, Delivery Order No. 1, dated May 24, 1996, with Rubinos & Mesia Engineers, Inc.

2.0 INSPECTION PROCEDURE

An in-depth field inspection of Utility Trestle No. 737 was conducted in July 1996. The inspection was carried out in accordance with the procedures outlined in the American Association of State Highway and Transportation Officials "Manual for Maintenance Inspection of Bridges", dated 1994, and the procedure conformed to the National Inspection Standards of Federal Highway Administration under the direct supervision of a licensed Structural Engineer.

The inspection was carried out mainly by visual observation of the structure components and associated connections. Each component was individually examined with the use of special devices and equipment. Steel members were checked for metal loss by cleaning the area with wire brushes and recording measurements made with digital calipers and a "D" meter (electronic thickness measuring ultra-sonic device) to determine the remaining thickness of the metal. Exposed concrete elements of the substructure were probed and sounded with geologist hammers to determine the extent of damage.

All areas of the structure were physically reached , utilizing associated safety belts. Each engineer of the inspection team was equipped with safety goggles, hard hats, and clothiers as a standard part of this inspection.

All various levels of deficiencies and deterioration of the structural components based on our observation were documented and photographed with the use of a multi-lens 35mm electronic camera.

3.0 REFERENCES

The following is a list of references used throughout this report:

1. Report by Envirodyne Engineers, Inc., June 1987.
2. Report by Baker Engineers, Inc., May 1982.
3. Records of repairs.

The contents of above references including existing conditions, classifications, and structural analysis and rating were used as a basis for the evaluation in this report.

Records of repairs were reviewed and compared with the previous reports along with the field conditions to determine the recommendations contained in this evaluation.

4.0 DESCRIPTION

The Utility Trestle No. 737 was originally constructued in 1908, and is considered as a "non-contributing property within the Historic District", per the definition in the nomination form on file with the Illinois Historic Preservation Agency.

The Utility Trestle is located in grid I-20 on the U.S. Navy Public Work Command Map, just south of Farragut Street main entrance.

The Utility Trestle No. 737 is a 5-Span steel structure, carrying two insulated utility pipes and two electrical conduits over the Pettibone Creek for an overall length of 147'-0". The two utility pipes consist of an 8" diameter steam pipe, and a 3" diameter gas pipe. The utility pipes and conduits are carried by galvanized steel superstructure consisting of wide flange beams at the outside spans, and by steel truss boxes at the middle three spans.

The two utility pipes are resting on seats, with the majority consisting of metal rods bolted to longitudinal fascia wide flange beams and top chords of truss boxes. The transverse steel channels are equally spaced at 10'-0", and

span the wide flange beams and truss cords. There is a metal handrail projecting along the west fascia of the steel superstructure.

The steel trestle superstructure is supported at the ends by two concrete stub-type abutments, which encase both utility pipes. Between the abutments, there are four steel columns anchored to concrete pedestals.

There are remains of previous concrete piers which, along with the existing abutments, were part of the original structure.

5.0 EXISTING CONDITIONS

UTILITY PIPES

The two insulated metal utility pipes and the two electrical conduits are in good condition, with the exception of minor deficiencies. The minor deficiencies consist of the damage to the aluminum sheets covering both utility conduits due to commuting pedestrians, and a 3" wide open crack at the south end of the electrical conduit (See photograph No. 15).

There is a relatively small tree growing at the north end of the gas pipe.

5.1 SUPERSTRUCTURE

The steel trestle is generally in fair to good condition, with several deficiencies revealed in the course of inspection. The deficiencies found were mainly at the anchor bolt connections on both abutments, at utility pipe seats over transverse channels, and minor rust and corrosion of steel.

At the south abutments, there were (6) unused bolt holes, and four of the nine existing bolts are anchored into a relatively weak brick wall under the utility pipes (See photograph No. 3) . There are two loose bolts at the east bracket.

At the north abutment, there are four loose anchor bolts, three of which are anchored into the relatively weak brick wall under the utility pipes.

There is a 1" gap between the transverse steel channel and concrete wall of both abutments, mainly due to thermal movement of steel spans (See photograph No. 15).

The utility pipe seats are generally in fair to good condition. There are two types of seats found along the superstructure, as follows:

TYPE 1

Type 1 represents the majority, and consists of metal rods with long bolts at both ends connected to transverse steel channels. Most of these seats were found sloping to the west, due to the following:

I. Uneven lengths of bolts over transverse channels (See photograph No. 5).

II. Bolt holes, which are field flame cut, are not evenly round and relatively larger than the bolt size (See photograph No. 6). There were several of these holes unused.

TYPE 2

Type 2 consists of metal collars, bolted at the flared ends, resting on double steel angles which are welded to transverse steel channels. The steel channels typically have several flame cut holes (See photograph No.'s 8 and 9). Those seats are generally in good condition.

The 5th transverse steel channel from north has both bolts loose. The transverse channels at Span No. 1 were placed with their webs flat on top of the top flange of the fascia beam. In general, the steel trestle suffered minor corrosion with peeling paint.

There is a metal handrail along the west fascia of the trestle. The rail is generally loose and in poor condition. To prohibit access to trestle, there are also two metal posts with barbed wires connected in between, which are generally in good condition (See Photograph No. 2).

5.3 SUBSTRUCTURE

South Abutment

The concrete stub-type abutment encasing both utility pipes is generally in good condition. There are a few vertical cracks and a small spall (See Photograph No. 10).

At the bottom of the stub wall, there is about 6" of exposed concrete due to soil erosion.

There are relatively small trees growing at the inside corners, and there is a large tree just east of the abutment with roots exposed due to soil erosion.

Piers No. 1 to 4

Piers No. 1 to 4 are galvanized steel bents, each consisting of wide flange beam welded to steel pipe at the top and is anchored to concrete pedestals at the bottom. The steel bents and welds typically exhibit minor corrosion with peeling paint (See photograph No. 7).

When probed and sound tested by hammer, the concrete pedestals yielded several areas of spalls and hollow concrete (See photograph No. 's 11, 12, 13, and 14).

North Abutment

The concrete stub-type abutment encasing both utility pipes is generally in good condition, with the exception of a few vertical cracks (See photograph No. 15).

Slopes

The slopes are generally suffering from heavy soil erosion, mainly at the south slope. This problem was mentioned in previous reports.

The south slope soil has severely eroded, mainly just east of Pier No. 1 (See Photograph No. 16). There is a hole, approximately 50 ft. wide, creating a depression about 6 ft. deep, starting midway through the slope east of the trestle, and ending at the Pettibone Creek. The soil at the depression is soft and unstable.

The soil around Pier No. 2 has settled, with noticeable separation of the soil transversely along the north face of the pedestal (See photograph No. 12).

The north slope has a similar condition, where the depression is relatively smaller, and just west of Pier No. 3 (See photograph No. 17).

There is a broken corrugated drain metal pipe to the east of Pier No. 3. There is a small wood dam between Pier No. 3 and 4, in poor condition (See photograph No. 18). At both east and west slopes, the soil is relatively spongy and erodes easily under foot traffic.

6.0 EVALUATION AND ANALYSIS

Previous reports has performed a detailed structural analysis to rate and evaluate the structure utilizing current loading conditions (See Baker Engineering Reports, dated May 1982). The analysis yielded large section capacities of the structure due to relatively small loading. The analysis and results were reviewed and we concur accordingly with the adequacy and safety of the structure.

7.0 RECOMMENDATIONS

The utility structure No. 737 is generally in fair to good condition, with the exception of localized deficiencies within the structure. The slopes have reached a level of deterioration that warrant an issue of concern to the soil stability locally, and the steel structure globally. The soil erosion problem at the slopes has been mentioned and documented in the previous report (See Envirodyne Engineers Report, dated June 1987). Furnished records of repairs reviewed did not reveal any repairs to the slopes.

Hence, we classify this problem as a top priority in our list of remedial recommendations. Soil erosion at the slope could develop into a severe problem, with considerable impact on the structural integrity, and result in more costly repairs.

We believe the following repairs are necessary to prolong the useful life of this structure and to maintain its structural integrity and operating capacity under present loading condition. The repairs are categorized under three labels, as follows:

I. Repairs required for the present time:

   1. Stabilize both south and north slopes. The work is mainly mixing dry soil with wet soil in the eroded areas, and then

backfilling. Follow this with a layer of crushed volcano stone at both slopes (Similar to "D" street bridge slopes). We recommend removing wet soil around Pier No. 2, and replacing with compacted CA-6.

2. Repair bolted connections at utility pipe seats. The work requires leveling all sloped and settled seats by means of raising associated bolts and then placing washers under the nuts at the top of transverse steel channels.

3. Repair and replace, as needed, loose anchor bolts at both abutments. New anchors should be installed with extention to allow for 1" longitudinal movement of the end spans. Also, fill unused bolt holes with non-shrink grout.

4. Tighten loose bolts at the 5th transverse steel channel from north.

5. Repair broken drain pipe east of Pier No. 4.

6. Repair small wood dam, or replace with one similar to the timber dam at Utility Structure No. 74.

7. Post caution signs at both north and south entrances and/or place a fixed barbed wire gate similar to the one at the north end.

8. Repair loose hand rail by welding posts to top chords and the top flange of the west facia beams.

II. Repairs to be completed within the next 2-4 years.

1. Repair spalled and cracked areas of concrete pedestals. Remove loose and hollow areas of concrete, clean associated areas, and then patch with non-shrink grout. Cracks need to be sealed by low pressure injected epoxy sealer.

2. Spot clean and galvanize paint localized corroded areas in the steel structure.

3. Remove small trees at the inside walls of south abutment, and one at the north end of the gas pipe.

III. The following repairs are suggested to be accomplished within the next 7-10 years:

Due to the numerous bolt holes in the north and south transverse steel channels, we recommend the following at each abutment:

1. Remove 3" (Min.) of concrete from bottom half of the concrete wall facing the trestle. Remove the brick wall covering the wall opening under the utility pipes and 8" (Min.) of the three edges of the opening in the concrete wall. Place new rebars at the opening. New rebars should be spliced with existing exposed rebars of the wall opening. We recommend placing anchor bolts (minimum of 5) at the opening (only). Place concrete up to the bottom level of utility pipes. This work will require shoring and jacking of both utility pipe.

2. Replace transverse steel channels with new steel channels. Channels should be fabricated with holes and two new brackets at both ends.

COST ESTIMATE

Date Prepared: June/July 1996 | SHEET 1 OF 2

Activity and Location: Utility Structure No. 737

Construction Contract No.:

Identification Number:

Project Title: Bridge Inspection-Public Works Center, Great Lakes

Estimated by: RUBINOS & MESIA ENGINEERS, INC.

Category Code Number:

Status of Design: PED 90% 100% FINAL

Job Order Number:

ITEM DESCRIPTION	QUANTITY Number	QUANTITY Unit	MATERIAL COST Unit Cost	MATERIAL COST Total	LABOR COST Unit Cost	LABOR COST Total	ENGINEERING ESTIMATE Unit Cost	ENGINEERING ESTIMATE Total
Recommended repairs for the present time:								
1) Stabilize both north and south slopes.	1000	S.Y.					30	30,000
2) Repair bolting connections at utility pipe seats.	8	Each	30	30	8	320	44	350
3) Replace loose anchor bolts and connection bolts at both abutments.	7	Each	10	70	12	480	79	550
4) Tighten loose bolts at 5th transverse steel channel from north.	1	M.H.			1	40		40
5) Repair broken drain pipe at north slope.	4	L.F.	10	40	2	80	30	120
6) Replace wood dam at north slope.	10	L.F.	8	80	4	160	24	240
7) Post caution signs at both entrances.	2	Each	40	80	1	40	60	120
8) Install barbed wire gate at north end.	1	Each	30	30	1	40	70	70
TOTAL REPAIRS IN DOLLAR FIGURES								31,490

COST ESTIMATE

Date Prepared: June/July 1996 | SHEET 2 OF 2

Activity and Location: Utility Structure No. 737

Construction Contract No.

Identification Number

Project Title: Bridge Inspection-Public Works Center, Great Lakes

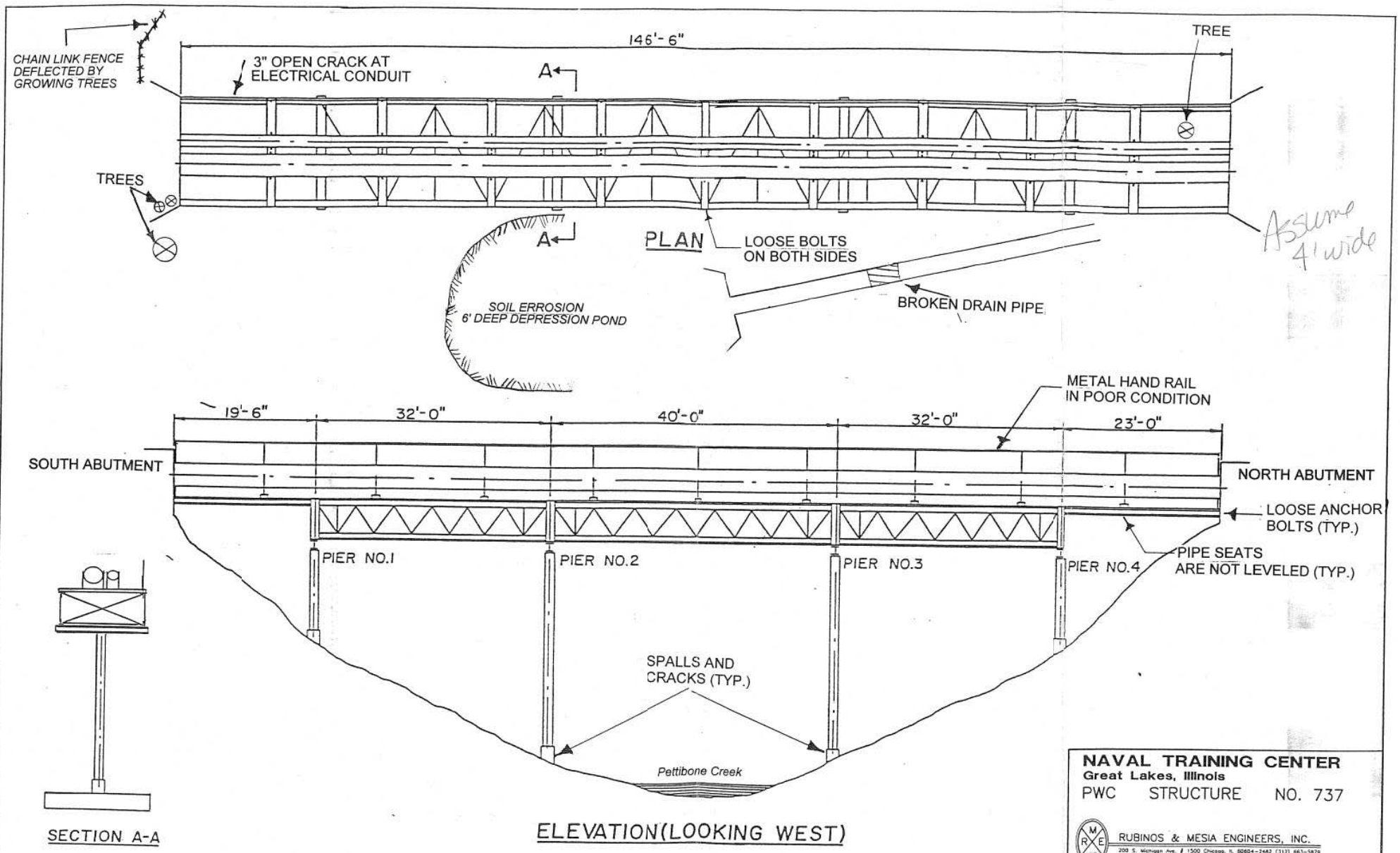
Estimated by: RUBINOS & MESIA ENGINEERS, INC.

Category Code Number

Status of Design: PED 60% 100% FINAL

Job Order Number

ITEM DESCRIPTION	QUANTITY		MATERIAL COST		LABOR COST		ENGINEERING ESTIMATE	
	Number	Unit	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total
Recommended repairs to be accomplished within 2-4 years:								
1) Repair spalled concrete areas.	0.6	S.Y.	60	60	3	120	300	180
2) Clean and galvanize paint localized areas of corroded steel.	1	L.S.						800
3) Remove small trees at south and north abutments.	1	M.H.			1	40	40	40
TOTAL REPAIRS IN DOLLAR FIGURES								1,020
Recommended repairs to be accomplished within 7-10 years:								
1) Reface bottom halfs of both abutments.	8	S.Y.					100	800
2) Replace brick walls with reinforced concrete.	.5	C.Y.	50	50	8	320	740	370
3) Replace both end transverse steel channels and associated end brackets.	600	lbs.					4	2,400
TOTAL REPAIRS IN DOLLAR FIGURES								3,570



NAVAL TRAINING CENTER
Great Lakes, Illinois
PWC STRUCTURE NO. 737

RUBINOS & MESIA ENGINEERS, INC.
200 S. Michigan Ave. / 1500 Chicago, IL 60604-2482 (312) 663-3878

Elevation view looking Northeast.

Photograph No. 1

Photograph No. 2

Top view of utility pipes looking South.
Note deflected handrail and barbed wire gate.

Several unused bolt holes at South abutment steel channel.
Note exposed bottom of wall due to soil erosion.

Photograph No. 3

Photograph No. 4

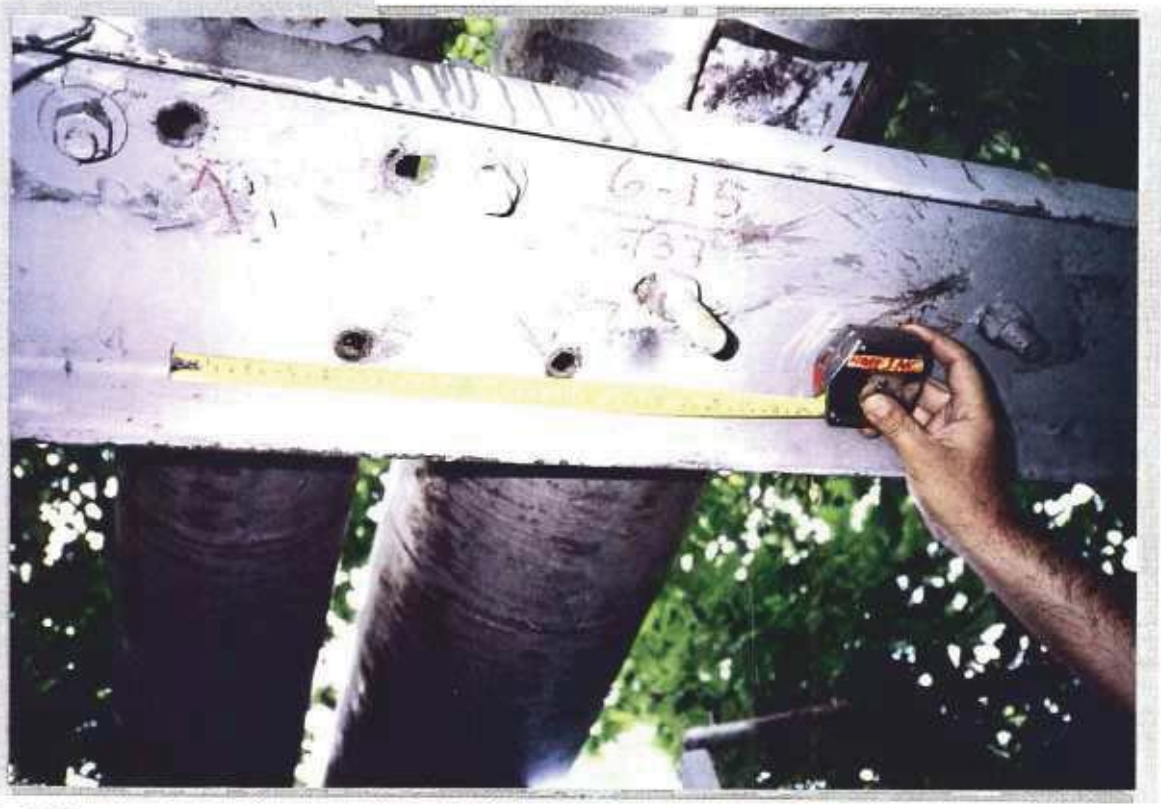
Four loose anchored bolts at North abutment steel channel.
Note 3 bolts are anchored to brick wall.

Typical sloped pipe seat at span No.5.
Note nuts without base washers.

Photograph No. 5

Photograph No. 6

Several different size holes unused, typical at transverse steel channels.



Typical corrosion and peeling of paint.
Looking South at inside of box truss.

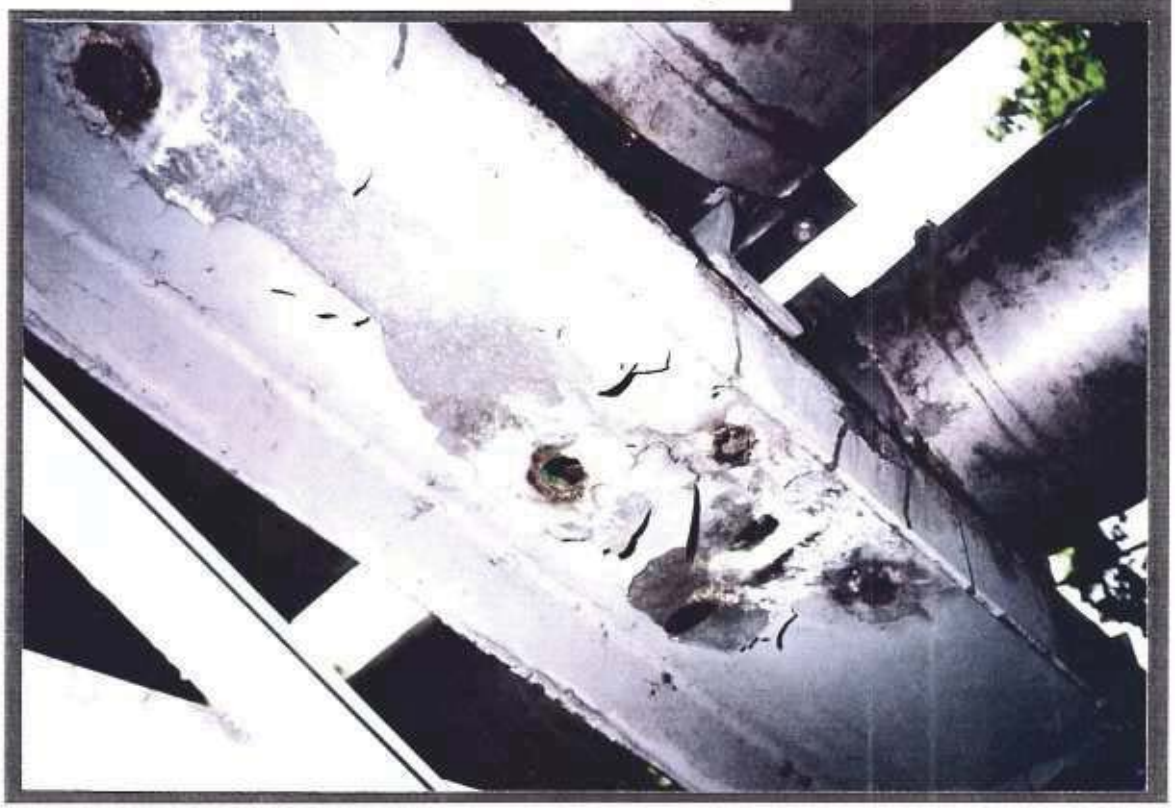
Photograph No. 7

Photograph No. 8

Underside of box truss.

Close-up view showing unused holes.
Note steel collars seated at welded angles.

Photograph No. 9



Photograph No. 10

Vertical crack at south abutment.
Note growing trees and soil erosion.

Photograph No. 11

Left:
Spalls at all four corners of pier No.1 pedestal. Note crack radiating from base plate.

Bottom:
Hollow concrete at top of pier No. 2 pedestal. Note transverse crack due to settlement of soil .

Photograph No. 12

Spall along North upper edge of pier No. 3 pedestal.
Note steep slope on the South of pedestal.

Photograph No. 13

Photograph No. 14

Minor Deterioration at pier No. 4 pedestal.
Note broken metal drain pipe to the East of structure

Vertical cracks at North abutment.
Note 1" gap and damaged aluminum cover.

Photograph No. 15

6' deep depression hole at South slope Just East of pier No. 2

Photograph No. 16

General view at North slope. Note soil erosion, drain pipe, and remains of original construction.

Photograph No. 17

Photograph No. 18

Deflected wood dam between piers No.3 and 4, at North slope.