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CHILTON ENGINEERING INC CAMDEN NJ
BRIDGE INSPECTION REPORT NUMBER 11C. DELAWARE CITY BRIDGE, DELA--ETC(U)
DEC 79
BRIDGE INSPECTION-11C

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DACW61-79-C-0226

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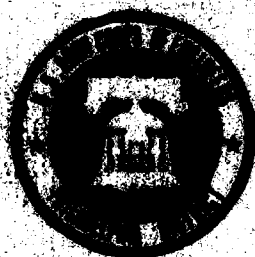


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DELAWARE CITY BRIDGE

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FOR
DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—30 & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

BY
GILTON ENGINEERING, INC.
CONSULTING ENGINEERS

510 FEDERAL STREET

CAMDEN—NEW JERSEY

DECEMBER 1970

80-5-05-033

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. <i>ADA084 391</i>	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Bridge inspection report no. 11C, Delaware City Bridge, Delaware		5. TYPE OF REPORT & PERIOD COVERED Bridge inspection report no. 11C; Contract report 1979
7. AUTHOR(s)		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS Chilton Engineering Inc. ✓ 519 Federal St. Camden, New Jersey 08103		8. CONTRACT OR GRANT NUMBER(s) DACW61-79-C-0226 <i>new</i>
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Corps of Engineers Philadelphia District 2nd & Chestnut Sts. Philadelphia, Pa. 19106		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE Dec. 1979
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents the findings and recommendations regarding the 1979 inspection report of the Delaware City Bridge, Delaware which crosses the Chesapeake and Delaware Canal. Technical information is given on the condition of the piers, fenders, and superstructure including the metal work and floor system. It is reported that the Delaware City Bridge is in good condition. The major items of maintenance and repair include the shimming or adjustment of the girder anchors, revision of hanger details and the painting of		

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

metalworks at corroded areas.

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

Chilton Engineering, Inc.

December 18, 1979

U. S. Army Engineers
Custom House - 2nd and Chestnut Sts.
Philadelphia, Pa. 19106

Re: Delaware City Bridge
Bridge Inspection Report No. 11C
Contract No. DACW61-79-C-0226

Dear Sir:

In accordance with Contract No. DACW61-79-C-0226, we submit herewith, our report in ten (10) copies covering the inspection and evaluation of the Delaware City Bridge over Branch Channel.

This report is divided in three parts - Part 1, Inspection Report; Part 2, Hydrographic Survey Report and Part 3, Structure Inventory and Appraisal Sheet.

The Delaware City Bridge was found to be in good structural condition, however, requiring repairs and maintenance as outlined in this report.

We appreciate the opportunity to perform the bridge inspection for the Corps. of Engineers, Philadelphia District. Should there be any questions regarding the work, please contact us.

Very truly yours,

CHILTON ENGINEERING, INC.

Walid Z. Dajani

WALID Z. DAJANI, P.E.

WZD/hm

Encls.

Consulting Engineers

Gene W. Chilton, President
Suite 300 Parkade Building

519 Federal Street

Telephone (609) 966-8680
Camden, New Jersey 08103

14 BRIDGE INSPECTION - 11C

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**BRIDGE INSPECTION
REPORT NO. 11 C.**

Numbers

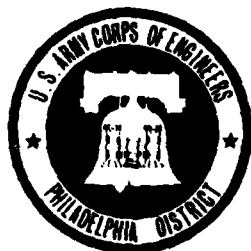
DELAWARE CITY BRIDGE,

Delaware.

11 DEC 79

1238

15 DHCW61-79-C-0226



FOR

9 Central 1002

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS

CUSTOM HOUSE—2D & CHESTNUT STREETS

PHILADELPHIA, PENNSYLVANIA 19106

BY

CHILTON ENGINEERING, INC.

CONSULTING ENGINEERS

519 FEDERAL STREET

CAMDEN—NEW JERSEY

DECEMBER 1979

411759

JB

LIST OF BRIDGE INSPECTION REPORTS
PREPARED DURING 1979

REPORT NO.

DESCRIPTION

11 A	ST. GEORGES BRIDGE
11 B	CHESAPEAKE CITY BRIDGE
11 C	DELAWARE CITY BRIDGE

Accession For	
NTIS GRA&I	☒
DDC TAB	☐
Unannounced	☐
Justification	
By _____	
Distribution/_____	
Availability Codes	
Dist	Avail and/or special
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BRIDGE INSPECTION REPORT NO. 11C

1979

DELAWARE CITY BRIDGE

INTRODUCTION

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- Drawing 1-2 Plan and Elevation
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PART 2 - HYDROGRAPHIC SURVEY REPORT

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BRIDGE INSPECTION REPORT NO. 11C

1979

DELAWARE CITY BRIDGE

1-01 GENERAL INFORMATION

The Delaware City Bridge over the Branch Channel, known locally as the Fifth Street Bridge, was designed by Ash, Howard Needles, and Tammen and was constructed during the period 1932-33. The bridge is a two-leaf bascule, two-lane highway structure with a clear span of 89 feet. Lift span service was discontinued in 1946. The length of the structure between centerline of trunnions is 102 feet and between ends of approach slabs is approximately 177 feet. Vertical clearance above mean high water at mid-span is approximately 7 feet.

Center-to-center of girders is 22 feet 6 inches. The roadway width between 10-inch high curbs is 20 feet which is divided equally into single northbound and southbound lanes. The deck, which was installed in 1966, is open steel grating. Concrete-filled grid sidewalks, 4.7 feet wide with steel railing, are provided full length of the structure on both sides.

The piers are hollow concrete caissons which the plans indicate are founded on untreated timber piles. Skewed timber fenders, providing a 60 foot clear channel width between them, protect the piers.

The structure was designed to carry either two 15-ton trucks abreast or 80 psf. Rehabilitation of the structure in 1971 to permit HS20 loadings was made in accordance with AASHO 1969 Specifications as amended in 1970. The bridge is not posted for load limit and it is part of the north approach to the Reedy Point Bridge. A location map of the structure is presented in Drawing 1-1. The bridge is posted for 25 MPH speed limit on north and south abutments.

An elevation view of the bridge is shown in Photograph 1-1 and view of the approach roadway and bridge deck is shown in Photograph 1-2. A general plan and elevation of the structure is presented in Drawing 1-2, appended.

The bridge is in good structural condition. Major items observed during the inspection requiring maintenance and repair are described in this report and summarized at the end.

1-02 INSPECTION PROCEDURE

The superstructure and substructure of the bridge were inspected from the ground, timber fenders, roadway, "snooper" truck and from inside the pier chambers.

The underwater portions of the substructure were inspected by wet-suit divers.

1-03 RESULTS OF INSPECTION

A. SUBSTRUCTURE:

1. Piers: There is no evidence of settlement or shifting of piers. Outside concrete surface at piers has spalls as shown in drawings 1-3 and 1-4. The inside concrete surface at north pier has spalls in the roof slab (See photograph 1-3). The concrete wall (well area) at west side of the north pier has a crack about 4' below top slab that runs horizontally (See photograph 1-4). The large chamber inside the pier (previously used to accommodate the counterweight) at the south pier had about 4' deep water and at the north pier about 2' deep water. This condition indicates possibility of cracks below channel water level. Access to the north pier chamber, was obtained through the abandoned operator's house at west side of bridge and to the south pier chamber through a manhole in the east sidewalk. The door in the operator's house and manhole cover are welded shut, the doors in pier channel faces are also closed, therefore preventing transients and children from gaining access to the pier chambers. Inside and outside trunnion columns are in good condition except for corrosion at lower half of the inside column. Most of the anchor bolts are rusted. The inside trunnion column support flanges

at the base are also badly rusted (See photographs 1-5 and 1-6).

2. Fenders: The timber fenders are intact. The vertical and horizontal timber members and splice connections are intact and in good weathered condition.

3. Pier and Channel Investigation (Below Water)

An underwater inspection of the piers was included in this inspection. Visual inspection at low water line and probing below water to the mud line revealed the need for subsurface repair (See Drawings 1-3 and 1-4).

A hydrographic survey was performed in the area of the piers and timber fenders and across the channel to record existing channel bottom elevations. The fathometer readings were taken on seven range lines, consisting of four lines parallel to centerline of the bridge located in line with the ends of the fenders and 25 feet east and west, respectively, and three lines parallel to the fenders, one each along the outside of each fender and one on the channel centerline. The soundings were related to bridge elevations shown on the contract plans. The readings were taken during calm water and at an extremely low tide which enabled visual inspection of the faces of the piers. The results of the soundings are

recorded on Drawing 1-5, appended. It can be observed that some silting has taken place around bank area.

B. SUPERSTRUCTURE:

Bridge service as a lift span was discontinued in 1946. Since that time, the electrical system and drive motors were removed. In 1966, the original timber deck was replaced with an open steel grating. In 1971 additional modifications were made to the bridge that included installation of new span locks at the center of the span and at live load anchors, and the strengthening of the girders to upgrade the bridge to HS20 loading.

1. Metal work (inside the piers):

Inspection revealed corrosion of metal work at juncture of trunnion bearing and shaft (See photographs 1-7 and 1-8). The surfaces of bottom flanges of the main girders show signs of rust (See photograph 1-9). This is due to debris collected on the flanges. This can be avoided by installing a drip plate on the bottom flange in line with outside face of the piers. Paint on metal work in general appeared in good condition.

2. Metal work (outside the piers):

The main girders appeared in good structural condition, with the exception of some scattered corrosion, which should be attended to (See

photograph 1-10). The paint on the girders is generally in satisfactory condition. The welds on the pins at mid-span are cracked and rust is accumulating between the parts. Neoprene pads placed at the mid-span joint to cushion the girders, have split and are in poor condition. The locking wind device at mid-span appeared to be in good condition. All rivet and bolt connections of the girders were found to be intact. A banging noise exists at the mid-span joint due to unequal deflection of the girders caused by unbalanced live load.

3. Floor System: The floor system includes floor beams, laterals and stringers. These members appeared to be in good condition except where the stringers rest on floorbeams. There are cracks in the welds and corrosion at this juncture. Existing unused holes in top flange of stringers at mid-span are corroded. Bottom and top flanges are rusted at some stringers (See photograph 1-12).

Open grid floor allows debris to collect on floor system. Moisture absorbed by debris initiates the corrosion of metal work especially top of flanges of floor beams and stringers. Floorbeams and stringers need spot painting.

4. Roadways: The open grid deck is in good

condition. There was evidence of few cracks at grid and stringer welds. The roadway dams were found to be in good condition and there was no noticeable banging noise of the dam plate with the passage of liveload. It was learned that Government forces did repair work to eliminate this noise. This work being the welding of clip angles to the underside of the dam plate and to the backwall. Also joint caulking material was added to the gap at top of plate. The top portion of the filled-grid sidewalk is exposed and shows surface corrosion; however the concrete fill is in a fair condition. The plate on the bottom side of the grid at the east sidewalk has corroded (See photograph 1-13). It was noticed that sidewalk joint width at mid-span was not uniform. The gap was measured to be 3/16" at the east sidewalk and 1/16" at the east sidewalk (See photographs 1-14 and 1-15). Bridge steel pipe railing is cracked at several joints and should be rewelded and spot painted. Bottom pipe of railing is rusted at many places and the end post at southwest end is missing (See photograph 1-16). A short piece of guardrail at northeast end of the bridge approach is in poor condition and needs to be replaced. The concrete slabs over the north and the south piers are in good condition. Small

spalls were observed at the north end of the north slab.

1-04 SUMMARY

The Delaware City Bridge is in a good condition. The major item of maintenance and repair include the shimming or adjustment at the girder liveload anchors, adjustments to the end dam detail, the revision of hanger details and the painting of metalworks at corroded areas. Other minor items of repair work are listed under Recommendations.

1-05 RECOMMENDATIONS

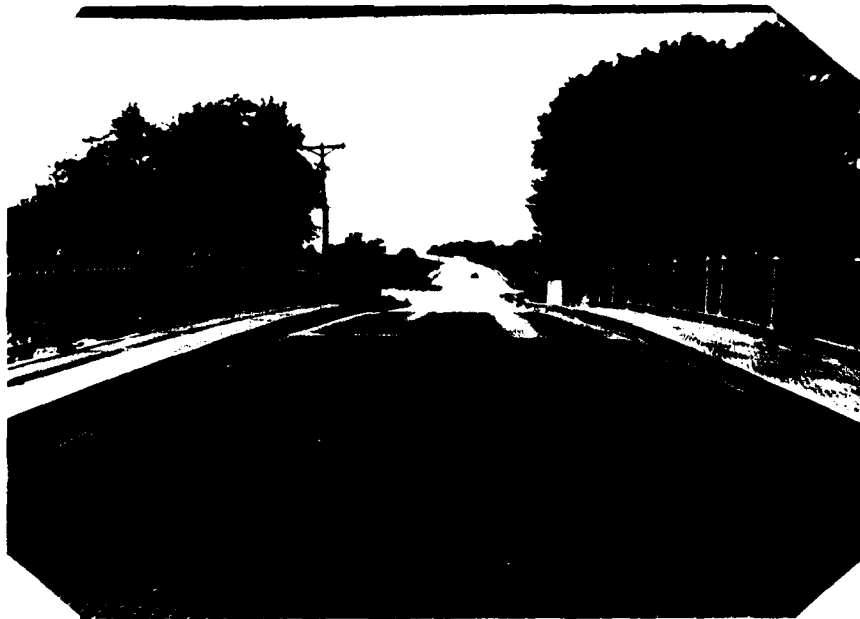
Items of maintenance and repair (those marked with an * could be done by Government forces).

- * 1. Repair broken welds at open grid deck.
- * 2. Spot paint following structural members:
 - a. Stringers and bracings
 - b. Floorbeams
 - c. Main girders
- * 3. Paint inside trunnion columns including the bases at both piers.
- * 4. Paint existing unused holes of stringers.
- * 5. Repair broken welds in bridge railing, replace southwest end-post of railing and paint the rusted area.
- 6. Repair spalls in concrete at inside and outside surfaces of piers.
- * 7. Repair east concrete sidewalk at mid-span.

- * 8. Replace section of guardrail on northeast corner of the structure.
- 9. Revise roadway dams at piers with a more permanent and stronger detail.
- 10. Revise hanger detail and wind connection detail at mid-span to effect a stronger connection that will allow for equal deflections of the girders.
- 11. Provide drip plate on bottom flange of girders.
- *12. Wash debris accumulations annually to avoid corrosion, from top surface of floor system metalwork.



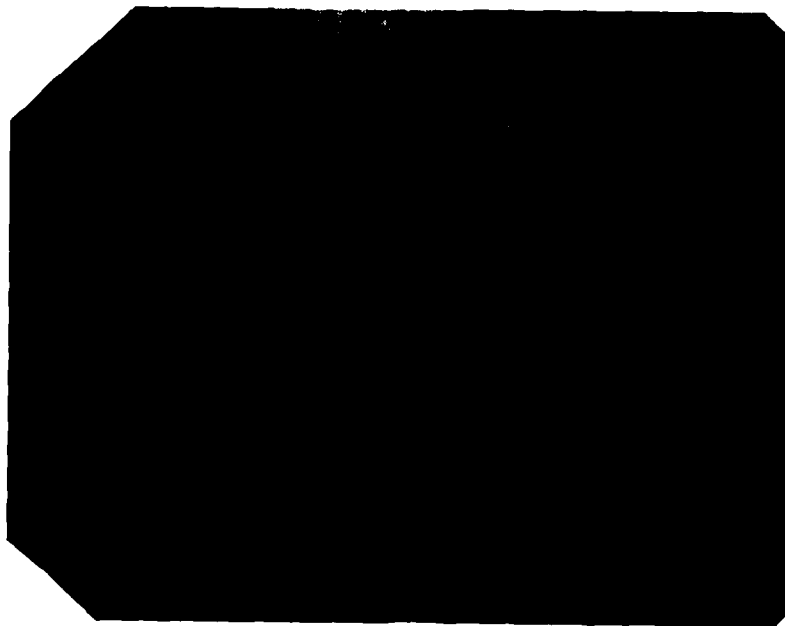
Photograph 1-1 - West elevation view.



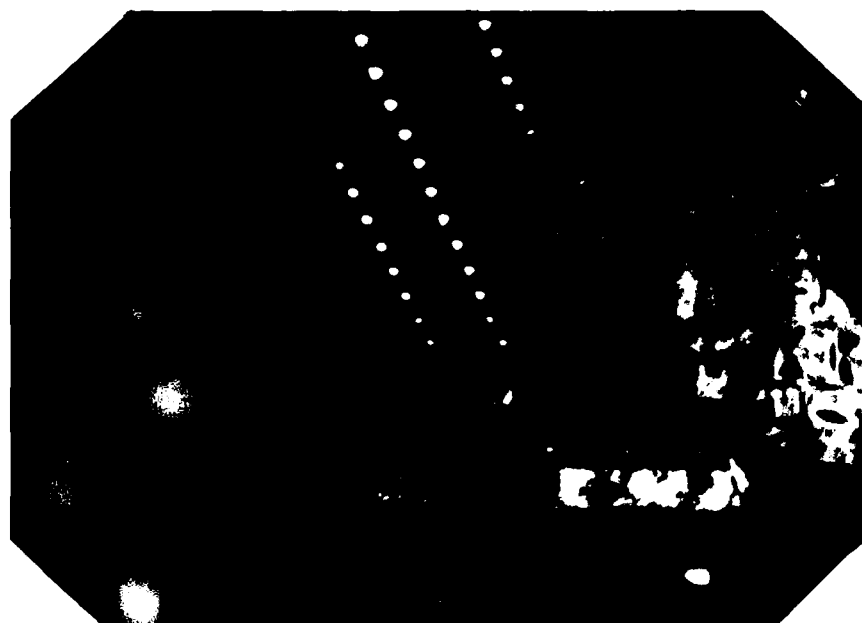
Photograph 1-2 - Roadway looking south



Photograph 1-3 - Concrete spalls and exposed reinforcement,
roadway slab, northeast side, north pier.



Photograph 1-4 - Horizontal crack west wall of well
at north pier .



Photograph 1-5 - Typical corroded flange of inside trunnion column base - west trunnion, north pier



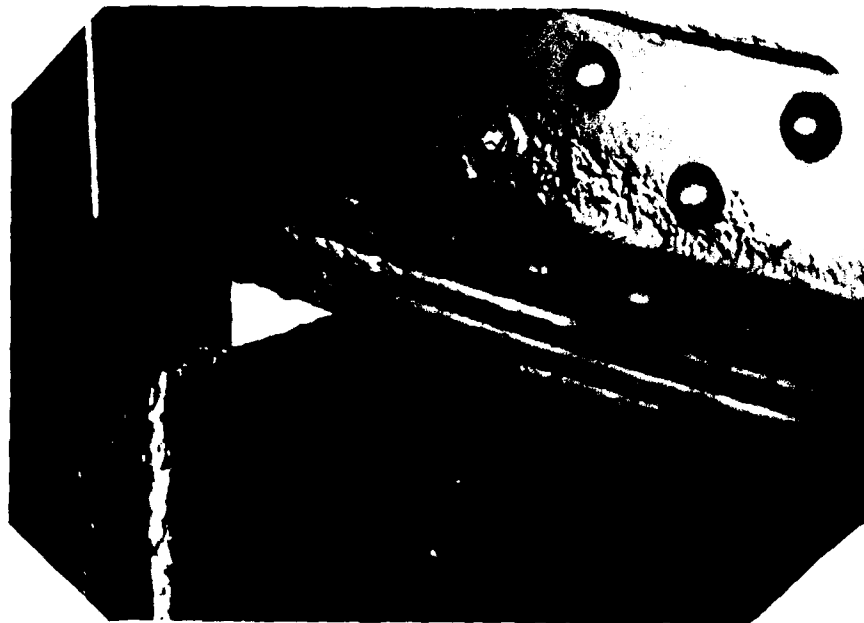
Photograph 1-6 - Typical corroded column flanges and anchor bolts of inside trunnion column, east trunnion at north pier.



Photograph 1-7 - Corroded metalwork at juncture of trunnion bearing and shaft, east trunnion at south pier.



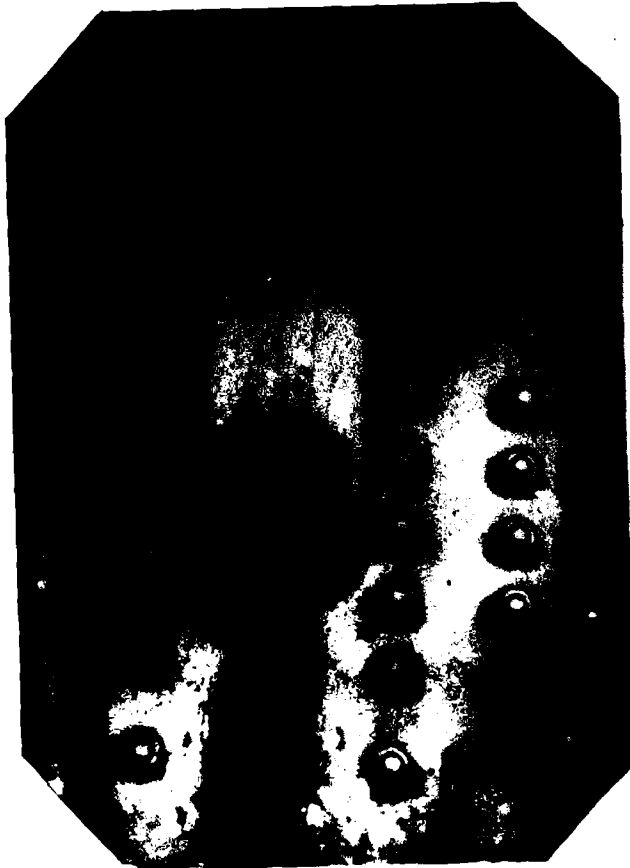
Photograph 1-8 - Corroded metalwork at juncture of trunnion bearing and shaft, east trunnion at north pier.



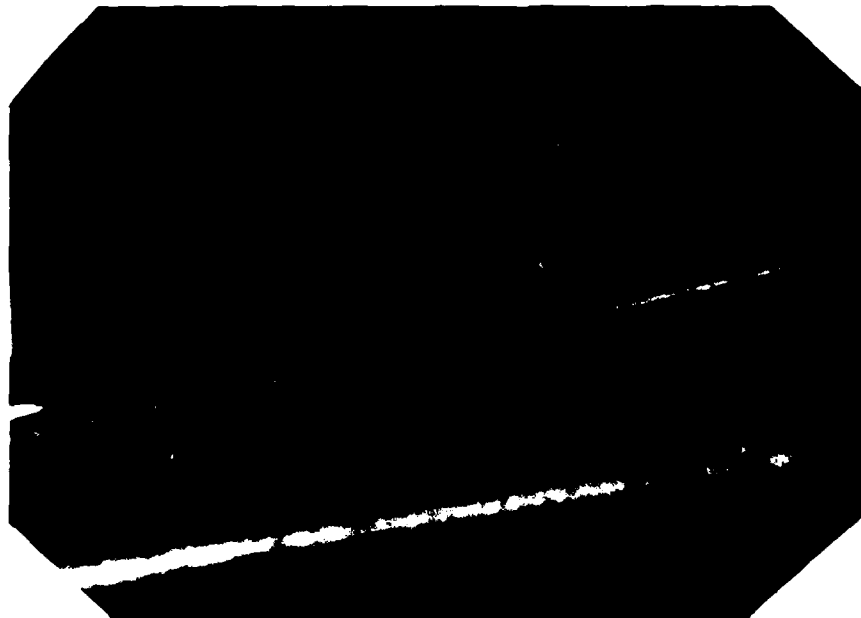
Photograph 1-9 - Rusted bottom flange, east of west girder, inside north pier.



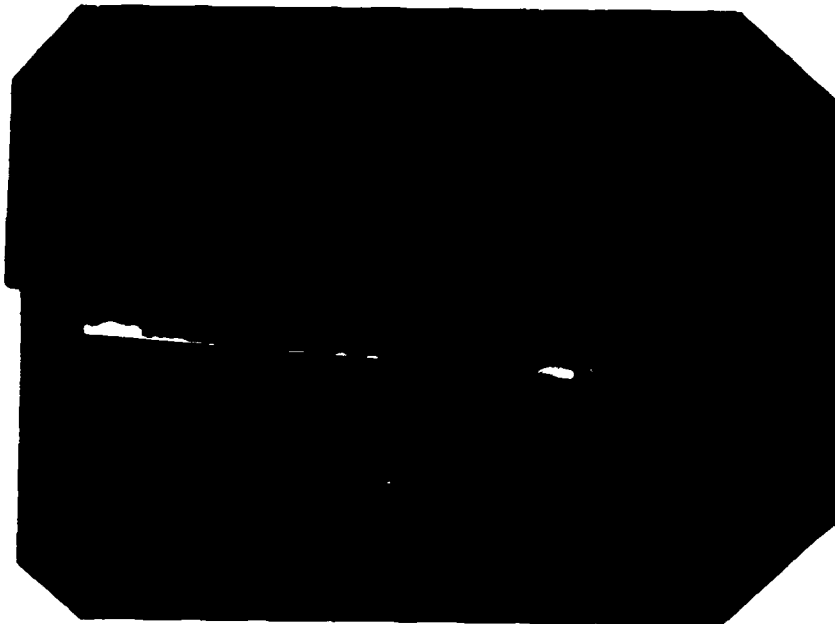
Photograph 1-10 - Corrosion of girder flange at bottom cover plate, south end of west girder.



Photograph 1-11 - Broken
weld and rust at pin
connection at mid-span.



Photograph 1-12 - Corrosion at stringer
to floorbeam connection.



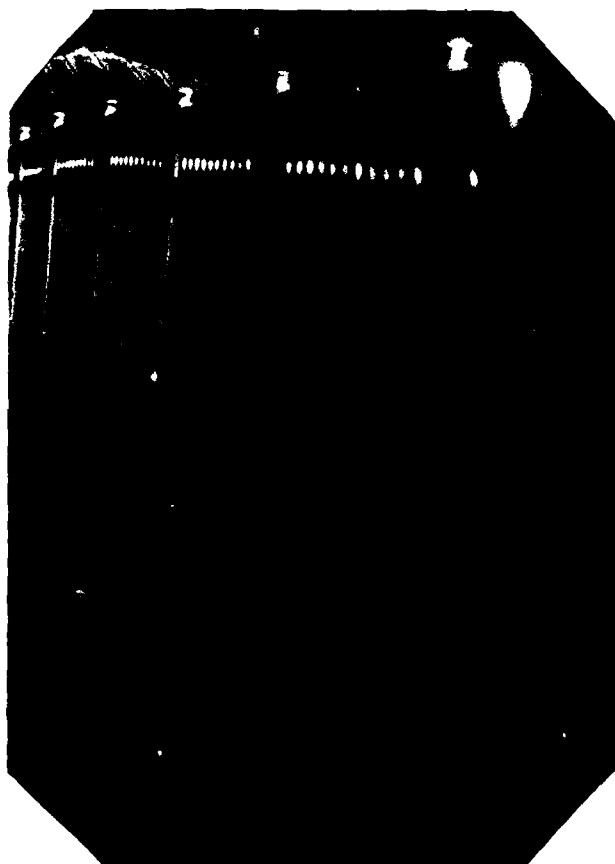
Photograph 1-13 - Corroded plate at underside of
east sidewalk at mid-span.



Photograph 1-14 - Joint opening at mid-span,
west sidewalk.



Photograph 1-15 - Joint opening at mid-span,
east sidewalk.



Photograph 1-16 -
Missing southwest corner
end section of rail,
note rust at bottom chord
of rail and sidewalk grid.

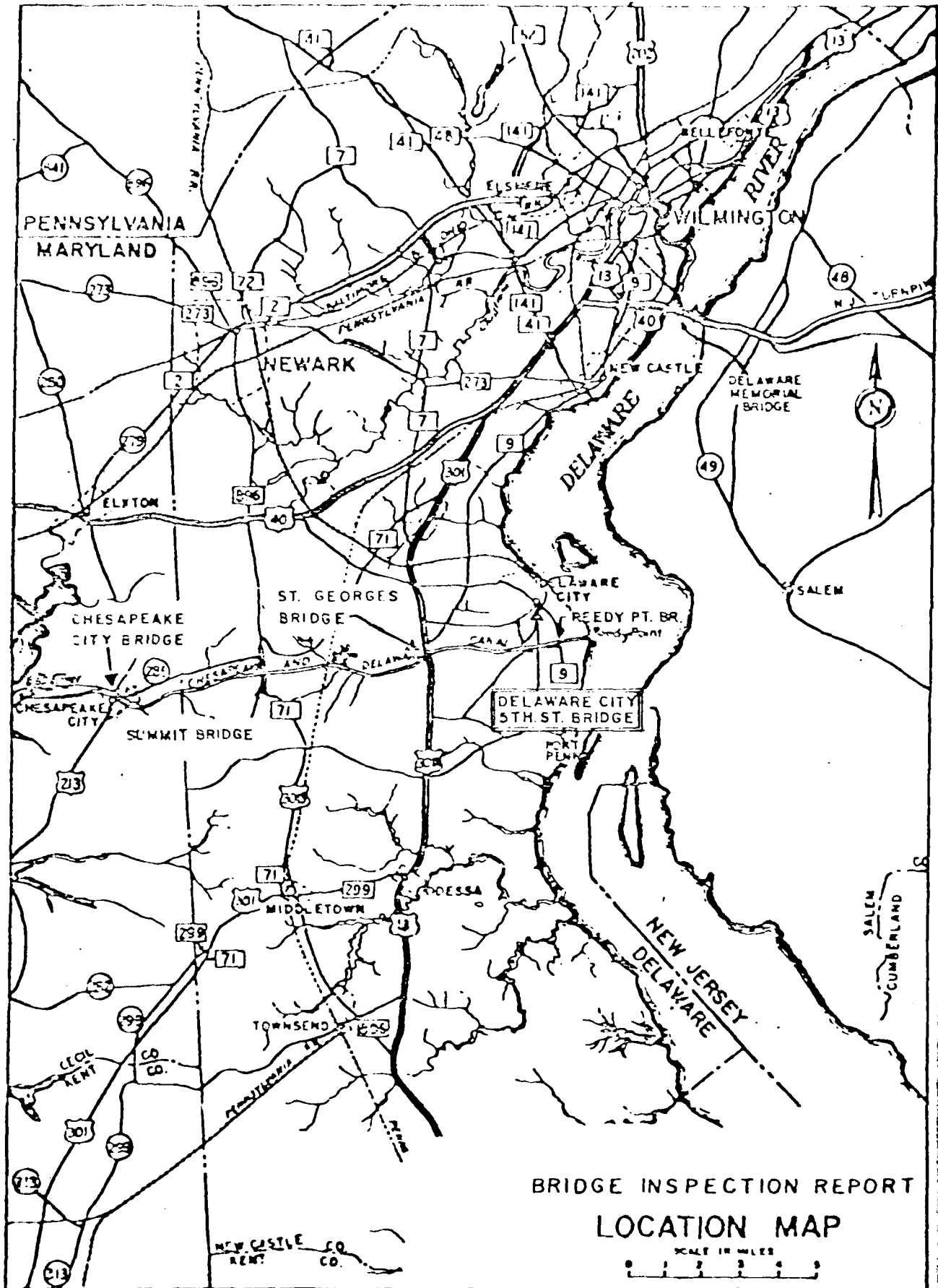
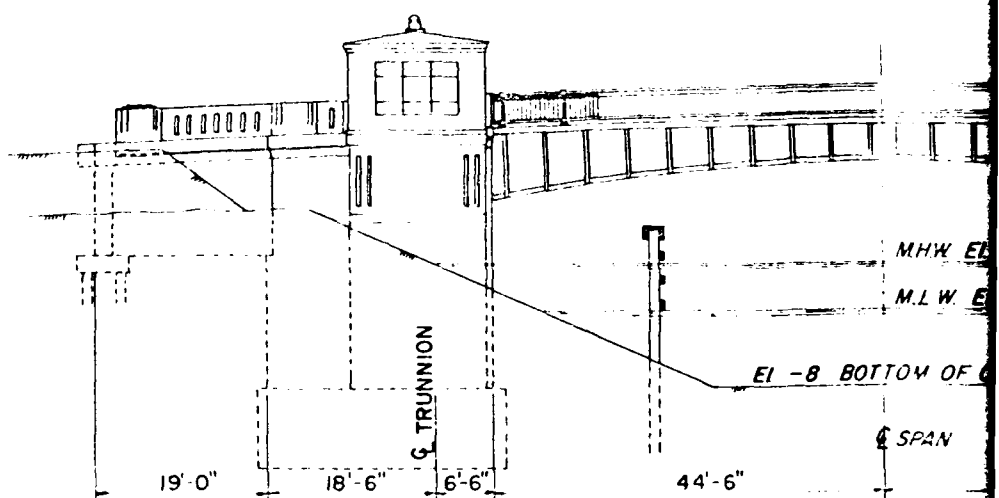


Diagram illustrating the plan view of a bridge structure. Key components labeled include:

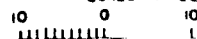
- OPERATORS HOUSE
- FENDER
- VERTICAL CURVE
- 4% GRADE UP
- BRIDGE
- PLAN

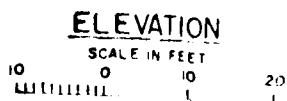
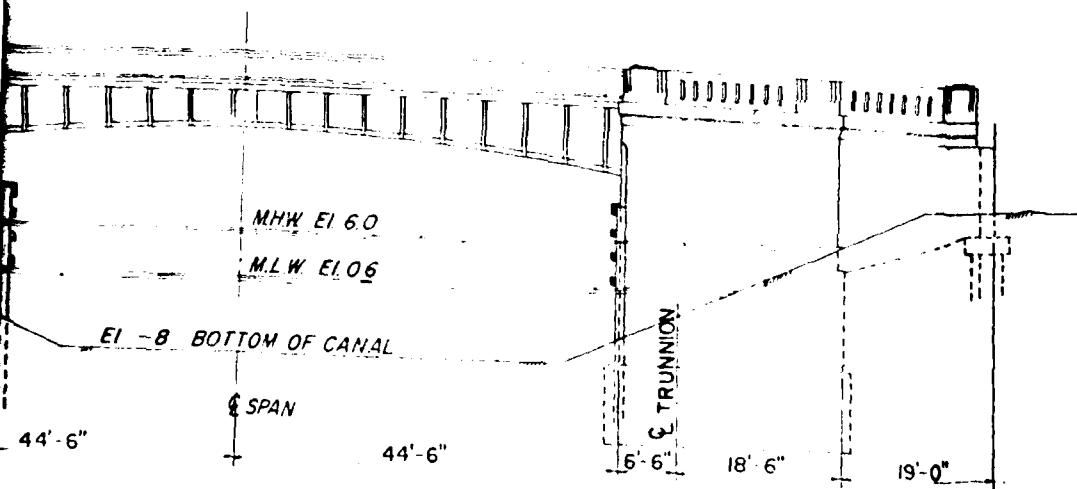
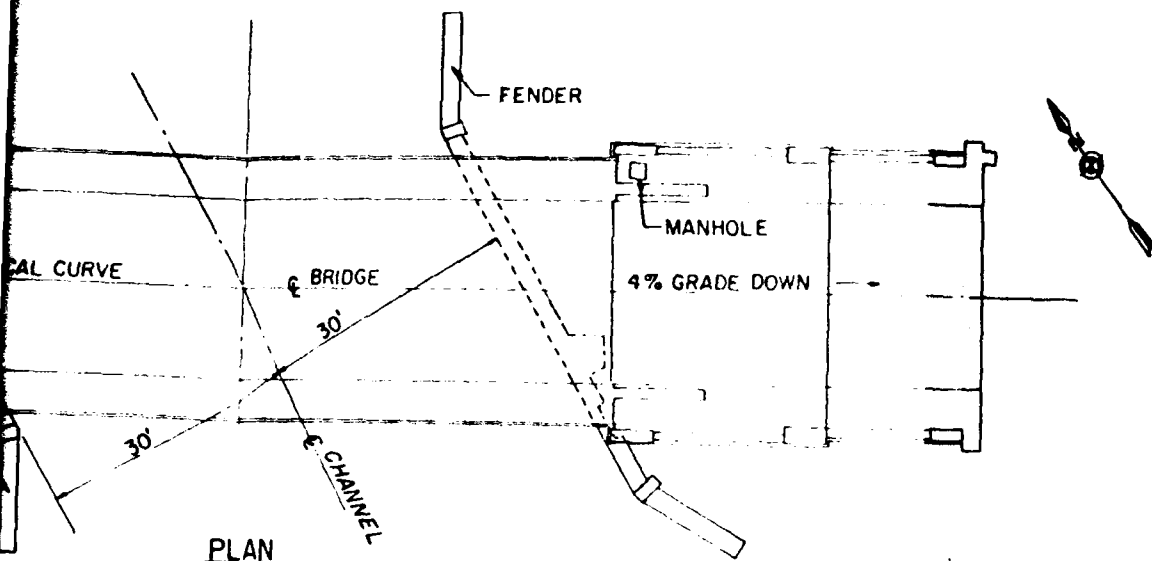
The diagram shows a cross-section of the bridge deck and approach. A vertical curve is indicated by a dashed line. A fender is shown at the edge of the deck. The approach is labeled with a 4% grade up. The bridge structure is shown with a vertical curve and a fender. The plan view is labeled PLAN.



ELEVATION

SCALE IN FEET

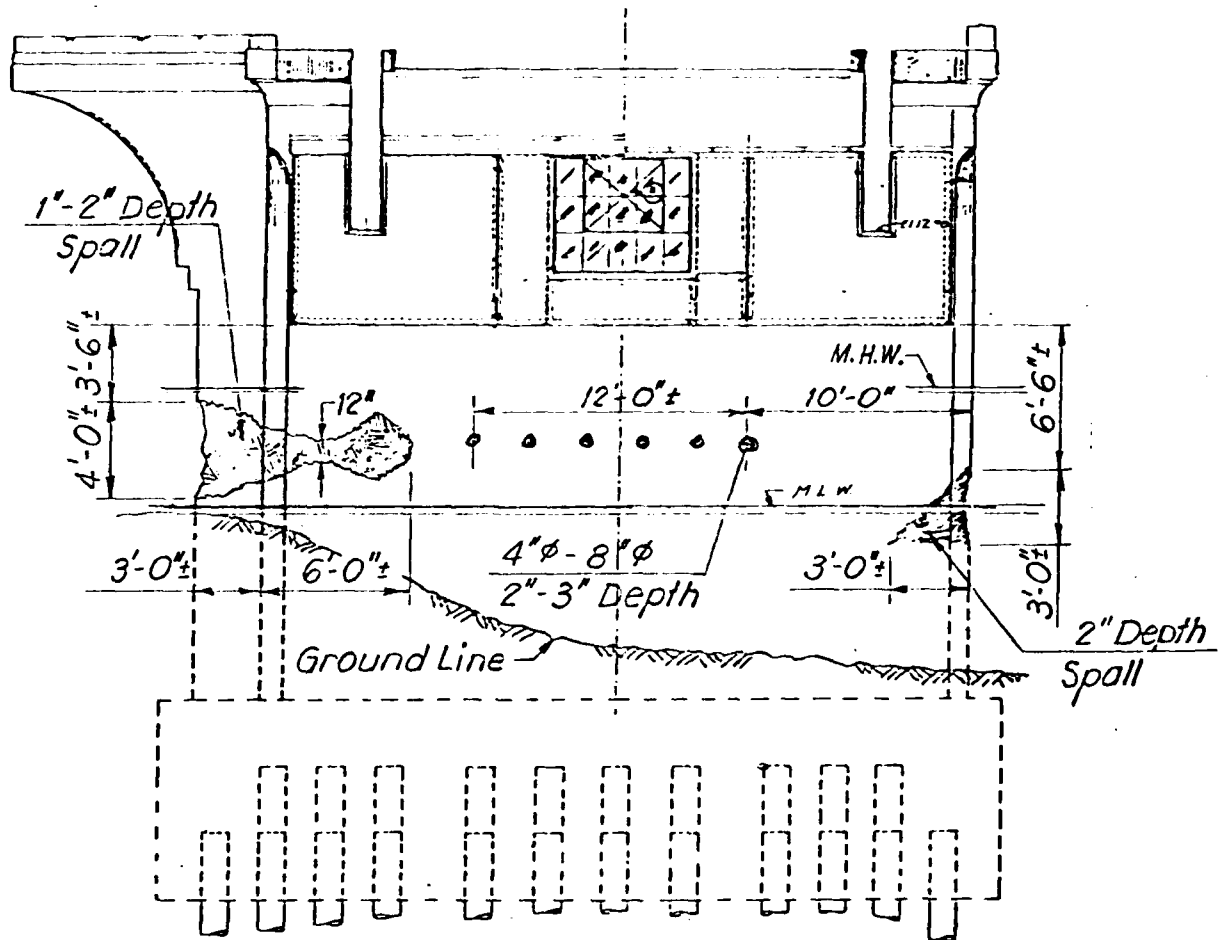




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BRIDGE INSPECTION REPORT NO. 9
5TH ST. BRIDGE DELAWARE CITY
PLAN AND ELEVATION

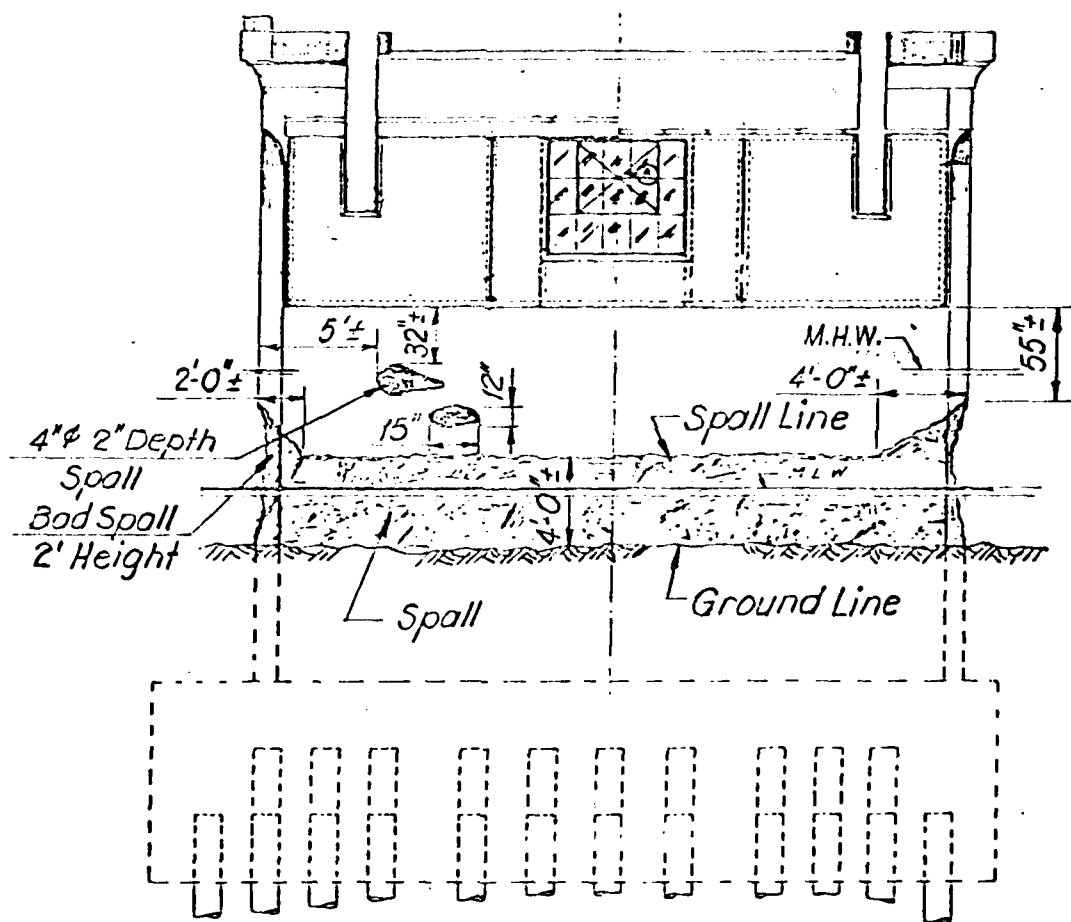
DRAWING 1-2

NORTH PIER



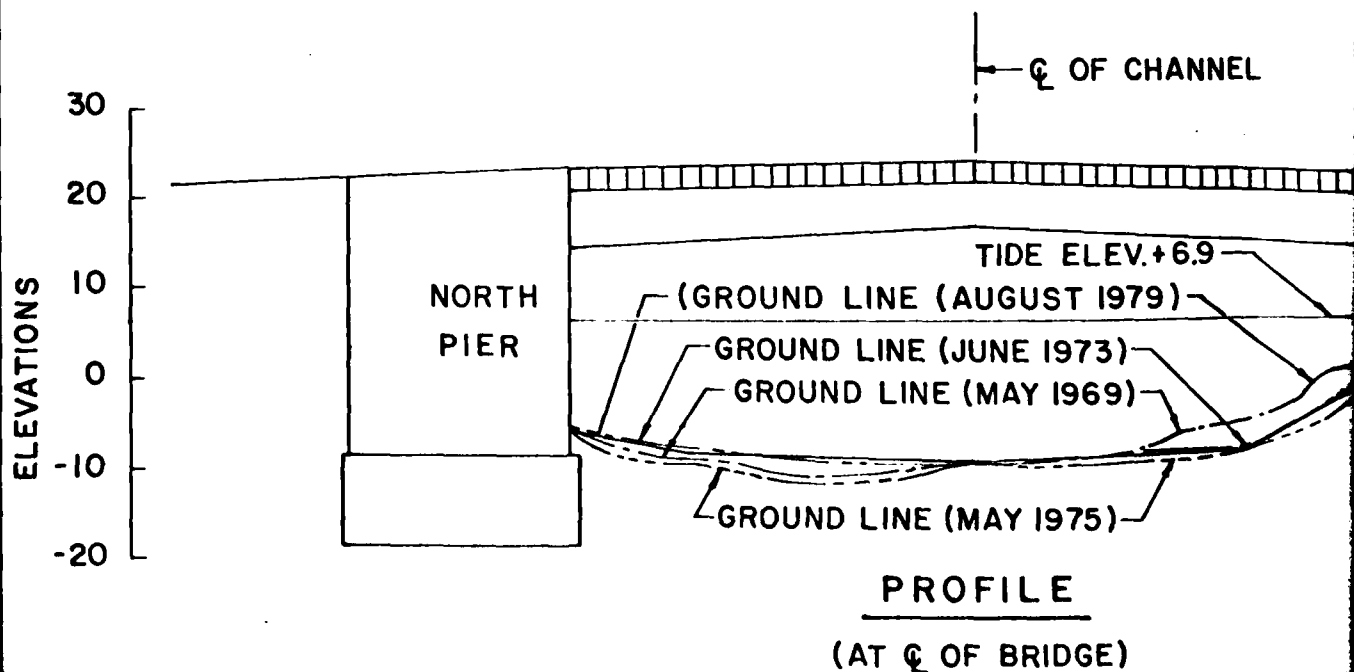
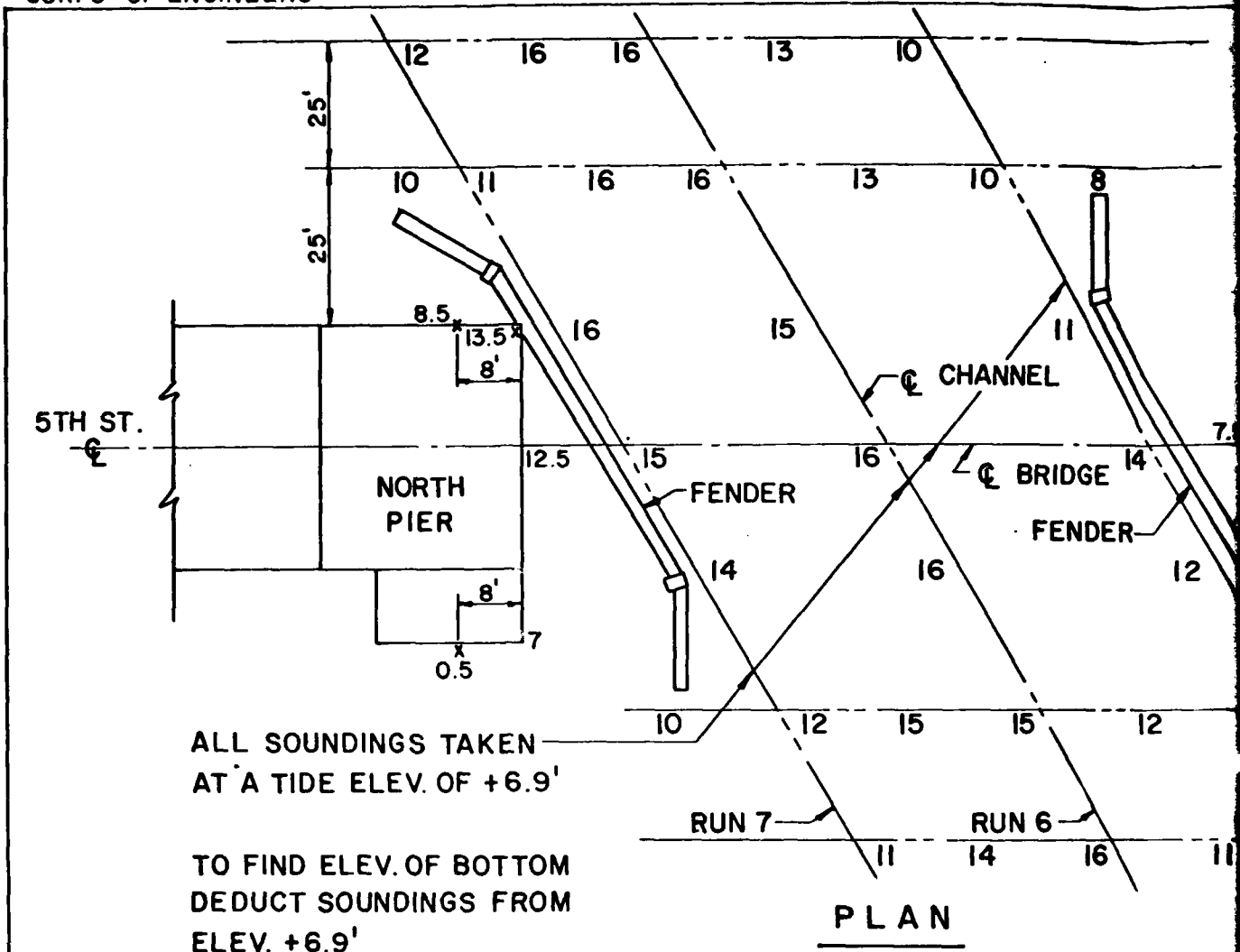
VIEW LOOKING NORTH

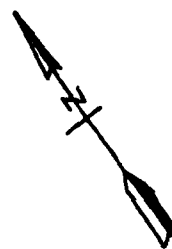
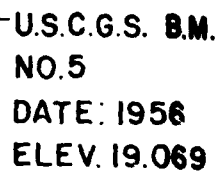
SOUTH PIER



VIEW LOOKING SOUTH

CORPS OF ENGINEERS





ELEVATIONS REFER TO
DELAWARE RIVER DATUM.

**MAY 1969 GROUND LINE
REPRODUCED FROM CORPS OF
ENGINEERS HYDROGRAPHIC SURVEY
DATA.**

**JUNE 1973 & MAY 1975 GROUND
LINES PLOTTED FROM FATHOMETER
SURVEYS BY OCEAN COUNTY DIVING,
LTD.**

**AUGUST 1979 GROUND LINES
PLOTTED FROM FATHOMETER
SURVEYS BY OCEAN COUNTY DIVING,
LTD.**



C & D CANAL
BRIDGE INSPECTION REPORT
DELAWARE CITY
HYDROGRAPH SURVEY
CHILTON ENGINEERING, INC.

DRAWING 1-5

BRIDGE INSPECTION REPORT NO. 11C

1979

PART 2

HYDROGRAPHIC SURVEY REPORT

DELAWARE CITY BRIDGE

INSPECTION REPORT

FIFTH STREET BRIDGE
Delaware City, Delaware

August 15, 1979

CALDWELL'S DIVING COMPANY, INC.

James D. Caldwell, Sr.
JAMES D. CALDWELL, Sr.
President

INSPECTION REPORT

An inspection was conducted of the north and south abutments of the Fifth Street Bridge, Delaware City, Delaware on August 15, 1979. The underwater portion of the inspection was made by a diver using self-contained air supply. Most of the inspection, however, was done in the dry because of a blow-out tide.⁽¹⁾ Fathometer soundings were also taken.

NORTH ABUTMENT

All measurements of the eroded areas are made from the bottom of the steel line (south face). Reference should be made to bridge plans for position of plate on the abutment. This pier is in generally good condition. Most of the eroded areas are concentrated along the tidal zone of the pier.

There is a spalling area at the southwest corner of the abutment. The top of the spall is 3'6" below the steel line and extends downward four (4) feet. The depth of the spall is 4" at the corner and extends 3" around the west face. This spall extends nine (9) feet horizontally along the south face where it tapers to one (1) foot in height and 1"-2" in depth. The tapered end of this spall is 6'6" below the steel plate.

Along the south face there are six round spalls. They are located along the same level of the tidal zone and are included in a area starting twelve (12) feet inside the southwest corner to ten (10) feet inside the southeast corner. These spalls are evenly spaced at three (3) feet intervals and range 4"-8" in diameter, 2"-3" in depth and are located 6'6" below the steel line.

(1) Blow out tide is an extremely low tide caused by westerly wind in conjunction with full-moon phase.

There is a spall located at the southeast corner, the top of which is 6'6" below the steel line. It extends downward three (3) feet. It is up to 2" in depth and extends from the corner along the south face a distance of three (3) feet.

SOUTH ABUTMENT

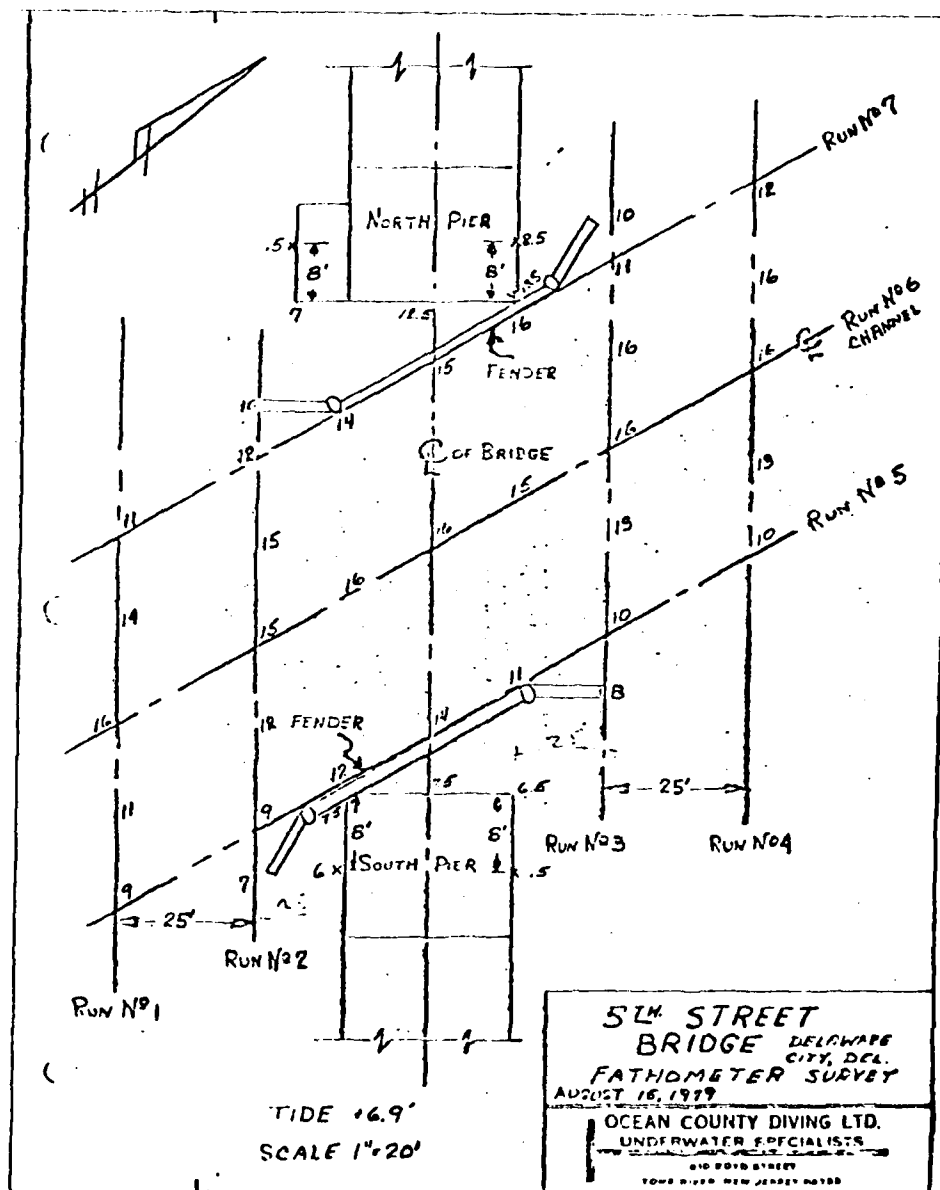
All measurements of eroded areas are made from the bottom of the steel line (north face).

A spall is located on the north face five (5) feet from the northeast corner and 2'8" below the steel line. It consists of a round depression 4" in diameter and 2 $\frac{1}{4}$ " in depth. This spall then tapers horizontally to the west for one (1) foot and shallows to a depth of 1".

Another spall is located on the north face 4'2" below the steel line and ten (10) feet from the northwest corner. It measures 12" high, 15" horizontally and 1" in depth.

A spall is located at the northeast corner starting at approximately seven (7) feet below the steel line and extends down two (2) feet. The spall is 4" in depth at the corner. The depth of the spall shallows as it extends one (1) foot along the east face and two (2) feet along the north face.

Also noted was a spall located at the northwest corner. It begins 4'7" below the steel line and extends down 5'6". It is 6" in depth at the corner exposing steel re-bar. The depth of the spall shallows as it extends four (4) feet along the north face and one (1) foot along the west face. There is a superficial spall line located along the north face. This line is four (4) feet above the ground line exposing only the concrete aggregate.



BRIDGE INSPECTION REPORT NO. 11C

1979

PART 3

STRUCTURE INVENTORY AND APPRAISAL SHEET

DELAWARE CITY BRIDGE

STRUCTURE INVENTORY & APPRAISAL SHEET

Revised 12-78

IDENTIFICATION		CLASSIFICATION		By	Date
1 State	DELAWARE	24 Highway System	05	Transfer of Data	
2 Hwy District	CR9	25 Administrative	2	Maintenance Insp	
3 County	001 Delaware City	26 Functional	02	Condition Analysis	
4 Inventory Route	131000090 On ☒ Under ☐			Appraisal	
5 Features Intersected	C & D Canal			Cost Estimate	
6 Facility Carried by Structure	Del. Rt. 9			General Review	
7 Structure No	2	STRUCTURE DATA		27 Type Service	115
8 Location	1-8 mi. NW Reedy Pt	28 Year Built	3371	28 Structure Type - Main	13116
9 Min. Vert Clearance Inv. Rte		29 Lanes on Str	02 under 00	29 Approach	10100
10 Milepoint	00777	30 ADT	004200	30 No of Spans - Main	0001
11 Road Section No	0000	31 Design Load	5	31 Approach	0000
12 Defense Bridge Description	000	32 Appr Rdwy Width - Std	038	32 Total Horiz. Clearance	029 29 ft
13 Defense Milepoint	00000	33 B. Median	☒ None ☐ Open ☐ Closed	33 Max Span Length	0089 (cir) 89 ft
14 Defense Sect. Length	000	34 Slew	00	34 Structure Length	00136 136 ft
15 Latitude	39 34.2' 39342	35 Structure Flared	☐ Yes ☒ No	35 Side Walk	046046 ft, ft 4.6 ft
16 Longitude	-75 35.4' 075354	36 Traffic Safety Features	1101	36 B. Roadway Width (lurb. curb)	0200 200 ft
17 Physical Vulnerability	0	37		37 Deck Width (out)	0300 300 ft
18 By pass, Detour Length	3	38 Navigation Control	1 ☒ Yes ☐ No	38 Vert Clearance over Deck	9999
19 Toll		39 Vertical	007 ft	39 Underclearance - Vertical	0000
20 Custodian	U.S.A. C of E 5	40 Horizontal	0050 ft	40 Lateral - Right	999
21 Owner	U.S.A. C of E 5	41 Open Posted, or Closed	P	41 Lateral - Left	999
22 FAP No		42 Wearing Surface	4		
CONDITION		Rating		Rating	
23 Deck	STEEL GRATING	GOOD CONDITION	7		
24 Superstructure	STRUCTURAL STEEL	GOOD CONDITION	8		
25 Substructure	CONCRETE	Generally Good Condition	7		
26 Channel & Channel Protection			8		
27 Culvert & Retaining Walls			N		
28 Estimated Remaining Life	40	29 Approach Roadway Alignment	6		
29 Operating Rating	243	30 Inventory Rating	228		
APPRAISAL		Deficiencies		Rating	
31 Structural Condition			6		
32 Deck Geometry			6		
33 Underclearance - Vertical/Lateral			N		
34 Safe Load Capacity			8		
35 Waterway Adequacy			5		
36 Approach Roadway Alignment	Poor sight distance on north approach		4		
PROPOSED IMPROVEMENTS		Describe (Item #)		Rating	
37 Year Needed	Completed				
38 Type of Service					
39 Type of Work					
40 Improvement Length	ft				
41 Design Loading					
42 Roadway Width	ft				
43 Number of Lanes		44 Prop Rdwy Improvement - Year			
45 ADT		45 Type			
46 Cost of Improvements		\$	000	Reports	
47 Prof Engr		\$	000	The leaves of the Bascule Bridge were	
48 Operation		\$	000	joined and the girders were strengthened	
49 Substructure		\$	000	to upgrade the bridge,	
50 Superstructure		\$	000	(1971 Rehabilitation). Bridge	
51 Insp Date				metal work was painted in 1973-1974.	
				Repairs are proposed to eliminate	
				noise at mid-span due to unequal deflection.	
				Improvements at roadway dams	
				are recommended. Soot painting required.	

Chilton Engineering, Inc.
 Delaware City Bridge
 Bridge Inspection Report No. 11C