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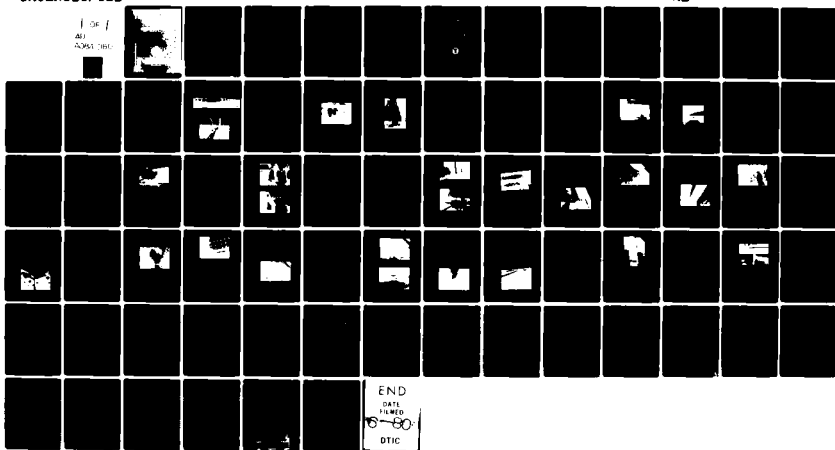
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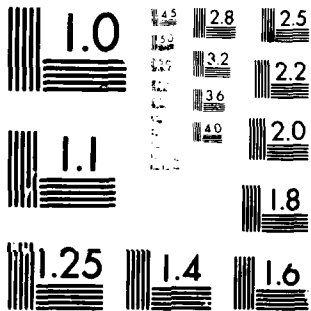


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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) - This report presents the findings and recommendations for the 1979 inspection of the St. Georges Bridge (route designation, U.S. Route 13) which crosses the Chesapeake and Delaware Canal. Technical information is given on the condition of the main and approach piers, access stairways, abutments, superstructure steelwork, paint, bridge deck, railings, drainage and general site.		

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**BRIDGE INSPECTION
REPORT NO. 11A.**

Number

② **ST. GEORGES BRIDGE.** ↓

①⑤ DACW 61-79-D-0019

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MAY 1980

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PREPARED BY

HOWARD NEEDLES TAMMEN & BERGENDOFF, New York



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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

DECEMBER 1979

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HOWARD NEEDLES TAMMEN & BERGENDOFF

December 4, 1979

Col. James G. Ton, District Engineer
U. S. Army Corps of Engineers
Custom House - 2nd & Chestnut Streets
Philadelphia, Pennsylvania 19106

(Re: St. Georges Bridge - Inspection Report 11A
Contract No. DACW61-79-D-0019, Work Order No. 2

Dear Col. Ton:

Presented herein is our 1979 report of Inspection & Evaluation of the St. Georges Bridge, crossing the Chesapeake & Delaware Canal in Delaware. The inspection and report were done in accordance with the requirements of Contract No. DACW61-79-D-0019, Work Order No. 2.

The inspection revealed the St. Georges Bridge, except for the defects discussed in the report, to be in good condition. The report described in detail the inspection findings and lists the items of maintenance and repair which we recommend for the structure. Particular emphasis should be placed upon repair of the expansion joints, cleaning and painting the adjacent steelwork, and cleaning and freeing the expansion bearings.

This report is based upon inspections at the times and in the manner described. The nature of the undertaking does not permit assurance that there may not be latent or hidden defects in the condition of the members or lack of uniformity in the quality of the materials used or occurrences subsequent to the inspections made. No responsibility can, therefore, be assumed for lack of integrity of the structure from unpredictable causes or those beyond the scope of this report.

Architects Engineers Planners

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Col. James G. Ton, District Engineer

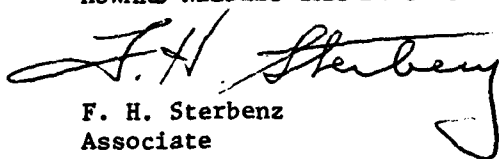
December 4, 1979

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The cooperation and assistance provided by personnel of the U. S. Army Corps of Engineers during the inspection and preparation of this report are sincerely appreciated.

Very truly yours,

HOWARD NEEDLES TAMMEN & BERGENDOFF


F. H. Sterbenz
Associate

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BRIDGE INSPECTION REPORT NO. 11A

1979

ST. GEORGES BRIDGE

over

C & D CANAL, DELAWARE

for

Department of the Army

Philadelphia District, Corps of Engineers

Philadelphia, Pennsylvania

by

HOWARD NEEDLES TAMMEN & Bergendoff
Consulting Engineers
New York, New York

December, 1979

LIST OF BRIDGE INSPECTION REPORTS
PREPARED DURING 1979

- 11A - St. Georges Bridge
- 11B - Chesapeake City Bridge
- 11C - Delaware City Bridge

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BRIDGE INSPECTION REPORT NO. 11A

1979 INSPECTION

ST. GEORGES BRIDGE OVER THE CHESAPEAKE

AND DELAWARE CANAL IN DELAWARE

for the

DEPARTMENT OF THE ARMY, U.S. CORPS OF ENGINEERS

INTRODUCTION

The findings and recommendations of the 1979 inspection of the St. Georges Bridge (Route designation, U.S. Route 13) which crosses the Chesapeake and Delaware Canal was undertaken for the Department of the Army, U.S. Corps of Engineers by Howard Needles Tammen & Bergendoff (HNTB) and are submitted herein. A location map is presented in Drawing 1-0.

The bridge substructure and superstructure were visually inspected as described hereinafter. The field inspection was made during the period of October 9 through October 19, 1979 by E.W. Krause, P.E. and C. S. Ross. The rules and provisions outlined in the AASHTO Manual for Maintenance Inspection of Bridges, 1978, and the National Bridge Inspection Standards were used as guides in performing the inspection. These bridges undergo in-depth inspections every two years. This report is the sixth in the series, since the original inspection report 1969. The bridge was analyzed for rating in 1973.

The "Snooper" truck, "Cherry picker" truck, motorized maintenance traveler located beneath the road level of the tied arch

and the boat used during the inspection were supplied by the Corps of Engineers and operated by their personnel, under the direction of the Superintendent, Cheasapeake City, Maryland.

Caldwell's Diving Co., Inc. of Toms River, New Jersey, was employed on October 10 and 11, 1979, to inspect the underwater portions of Piers 1S and 1N and to perform a hydrographic survey.

Enterprise Flasher, Inc., of Wilmington, Delaware was employed to provide traffic control.

Reference material used by our personnel included past bridge inspection reports, and "as built" contract and rehabilitation drawings. This data supplemented by the current inspection findings, field measurements and photographs pertaining to the bridge's current condition, provided the information required to complete this report and the structure inventory and appraisal form attached hereto.

1.01 GENERAL INFORMATION

The St. Georges Bridge was designed by Parsons, Klapp, Brinckerhoff and Douglas, New York City, and was constructed during the period of 1940-41. The bridge is a fixed high level, four lane highway structure. It consists of a 540 foot steel tied arch main span, flanked on the north and south sides by a series of 17 riveted plate girder spans followed by 3 and 5 stringer spans on the respective approaches. The girder spans vary in length from approximately 61 to 130 feet. Stringer spans are 54 feet in length. The total length of the structure between abutments is approximately 4,209 feet. Vertical clearance above mean high water is 133 feet through a clear channel width of 450 feet.

Center-to-center of trusses of the arch span is 57 feet 6 inches. A motorized maintenance traveler is provided under the main span. Center-to-center of girders is 42 feet and beams in the stringer spans on the north and south approaches are spaced at 5-foot 9-inch centers. The roadway width between the 12-inch high concrete curbs is 52 feet which is divided equally into 25-foot wide northbound and southbound roadways which are separated by a 2-foot wide raised concrete median with a beam type guardrail. The deck, which was replaced in 1971, is a reinforced concrete slab constructed on permanent metal deck forms. Nominal depth of the deck slab in the approach spans and the arch span is 7-1/2 inches and 8-1/2 inches, respectively. No sidewalk is provided. A stairway is attached to the east shafts of Piers 12N and 11S. Presently these staircases, which can provide only emergency exit from the bridge, are fenced off. Bridge railings are steel. There are no roadway lights on the bridge.

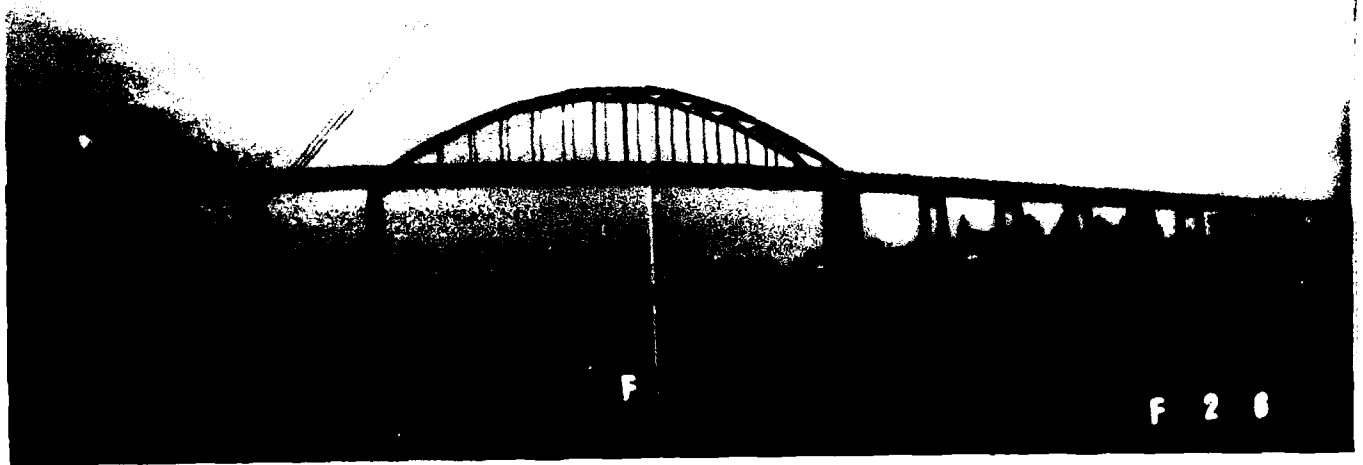
All piers and abutments are constructed of reinforced concrete. The two main piers, which are located in the Chesapeake and Delaware Canal, are faced with granite in the tidal zone. All piers and the abutments are supported on piles.

The structure was designed under AASHO 1935 Specifications for live load of H20, and was subsequently rehabilitated in 1971 to HS20-44 loading in accordance with the 1969 AASHO Specifications as amended in 1970. The bridge is posted for 55 mph speed limit on the north and south approaches, but there are no posted load limit. A general structure information sign is located at each end of the structure.

General views of the bridge are shown in Photographs 1 and 2. A general plan and elevation of the structure, with pier and panel point designations referred to in this report are shown on Drawing 1-1.

A number of items of work have been performed by Government Forces since the 1977 inspection. Stairways have been fenced off; collision damaged railings repaired and spot painted; interior of the tie girders cleaned, caulked and painted; areas of deteriorated paint cleaned and repainted; drainage outlets adjacent to houses have been extended to within a few feet of the ground; and roadway drains flushed.

One crack was observed in a gusset plate at panel point U6 of the east truss. While the crack is not considered critical, periodic close inspection is required. No major structural problems were observed during the inspection although many items are in need of repair. Description of the condition of elements of the bridge and recommendations for repairing certain items are described in the following report. A list of these items are tabulated at the end of the report for reference. Colored photographs are included to illustrate items discussed in the report. The structure inventory and appraisal sheet is included at the end of the report.



Photograph 1 - St. Georges Bridge - Elevation of tied arch span and portions of the north and south approaches looking west.



Photograph 2 - Roadway view, looking north through arch span.

1.02 INSPECTION PROCEDURESubstructure

The abutments and piers were observed from a "Snooper" truck, a "Cherry picker" truck, a maintenance traveler, a boat, and from accessible vantage points on the ground. The underwater portions of Piers 1N and 1S were inspected by a diver. A hydrographic survey of the canal bottom was made during the inspection for comparison with the channel elevations recorded during previous inspections.

Superstructure

The bottom portion of the railings, edge of roadway deck, steel work, and deck on the underside of the approach spans were inspected from a "Snooper" truck, a "Cherry picker" truck and from pier tops. The tied arch span above the roadway level was inspected from a "Cherry picker" truck and from the inspection walkway on the top chord. The tied arch below roadway level was observed from the motorized maintenance traveler and from the top and interior of the tie girders.

The top surfaces of the deck, curbs, joints and the top portion of the railings were inspected from the roadway. Measurements were made and recorded at openings between the ends of bridge railings at expansion joints for future reference and comparison.

1-03 RESULTS OF INSPECTIONSUBSTRUCTUREMain Piersa) Pier 1S

There is 2'-0" x 1'-0" x 3" spall at the upper west end of the north face of the pier cap.

There is a 6'-0" x 5" x 3" spall at the upper north end of the west face of the pier cap.

There is a 4'-0" x 10" x 2" spall at the southeast corner of the east pier shaft, 2 feet above the concrete granite interface.

There are cracks in the east and west faces of the concrete about the steel grillages under both expansion rockers for the girder span. (See Photograph 3.)



Photograph 3 - Crack in the west face of the concrete about the steel grillages located under the west expansion rocker on Pier 1S for the girder span.

The north face of the pier cap has a horizontal hairline crack with efflorescent staining which appears to be the source of wetness on this face of the pier cap. There is some surface scaling of the concrete in the area of wetness.

b) Pier 1N

The southeast corner of the east pier shaft was hit by a barge in November 1977, and the resulting damage had been repaired. The repair concrete exhibits some damp minor hairline cracking. (See Photograph 4.)



Photograph 4 - Repaired concrete on the southeast corner of the east shaft of Pier 1N.

There is a 10" x 6" x 2" spall on the northwest corner of the west pier shaft, 1 foot above the concrete-granite interface.

There is a horizontal crack with efflorescent staining on the entire length of the north face of the pier cap.

Recommendations

For surface concrete spalls, cleaning the spalled areas and patching with epoxy and mortar is recommended.

The cracks in the concrete about the steel grillages on Pier 1S should be sealed to assure that there will be no deterioration of the grillage steel.

The cracks in the north faces of the cap of Pier 1S and Pier 1N should be kept under observation.

Approach Piers

Most approach piers have surface map cracking of the concrete pier shafts. The presence of small amounts of exposed reinforcing steel or other metal and subsequent rust stains is also evident on the face of a few pier shafts and pier caps.

Unplugged construction form tie-holes were noted at random locations in the sides of pier struts and pier caps.

Several approach piers have spalls and cracks. The location and nature of these deficiencies are outlined hereinafter.

Pier 2S: There is an 8" x 3" x 1" spall with exposed reinforcing steel on the east face of the west pier shaft, 1'-6" above ground level.

Pier 6S: There is a 6" x 6" area on the south face of the west pier shaft that is starting to spall.

Pier 7S: There is a 6" x 2" x 1/2" spall on the southwest corner of the west pier shaft. There is a 6" x 6" x 1" spall on the northwest corner of the east pier shaft.

Pier 8S: There is a 4'-0" x 1'-0" x 1" vertical spall with exposed reinforcing steel on the west end of the south face of the pier cap.

Pier 9S: There is a 1'-0" x 6" x 1" spall on the west end of the south face of the pier cap. There are two 1'-0" x 6" x 1/2" spalls with exposed reinforcing steel on the east face of the east pier shaft.

Pier 10S: There is a 3'-0" x 1'-0" x 1-1/2" vertical spall with exposed reinforcing steel on the west end of the south face of the pier cap. (See Photograph 26.) There is a 6" x 4" void on the south face of the west pier shaft.

Pier 13S: There is a 1'-0" x 1'-0" x 1" spall on the north face of the west pier shaft.

Pier 20S: There is a 3 foot long 1/8" wide vertical crack with rust staining on the south face of the east pier shaft at the pier cap level.

Pier 21S: There is a 1/2" deep 6" diameter spall on the north face of the west pier shaft at the cap level.

Pier 2N: There is a 1'-6" x 6" area that is about to spall on the west face of the east pier shaft.

Pier 5N: There are three 3" x 4" x 1/2" spalls with rust staining on the south face of the west pier shaft.

Pier 6N: There is a 4'-0" x 1'-0" x 1" spall exposed reinforcing steel on the south face of the west pier shaft. There is a 10" x 10" x 1" spall on the south face of the east pier shaft.

Pier 9N: There is a 7" x 5" x 1" spall at the top of the west face of the west pier column.

Pier 10N: There is a 6" x 8" area on the south face of the pier cap that is about to spall. There is a 1'-6" long 1/8" wide vertical crack with rust staining on the top of the south face of the east pier shaft.

Pier 16N: There are 1/4" wide horizontal cracks and 1'-6" x 6" x 1" spalls at the top of the west face of the west pier shafts.

Pier 18N: The upper 6 inches of the west face of the west pier shaft is starting to spall. There are two 6" x 6" x 1/2" spalls with exposed reinforcing steel on the top of the east face of the east pier shaft.

Pier 19N: There is a 6" x 3" x 1/2" spall on the southeast corner of the east pier shaft.

Piers 11N and 17N exhibit minor hairline cracking.

Recommendations

For surface concrete spalls, cleaning the spalled surfaces and patching with epoxy and mortar is recommended.

The unplugged form tie-holes, which are of no structural significance, but are unsightly should be filled with epoxy and mortar when other work is being performed at these pier locations.

Access Stairways (at Piers 12N and 11S)

Access stairways are attached to the shafts of Piers 12N and 11S. The bridge originally had a sidewalk on the east side of the bridge which was removed when the deck was rehabilitated. Presently these staircases, which can provide only emergency exit from the bridge roadway, are fenced off to prevent access.

The portion of the stairways from the pier cap to ground level is constructed of concrete and the portion above the pier cap is constructed of steel. The railings are of steel.

The underside of each landing of both stairways is heavily spalled with exposed reinforcing steel. This spalling is continuing and is potentially dangerous to vehicles and pedestrians passing below or adjacent to these stairways. (See Photograph 5.) There is also some spalling of the concrete risers of the staircase.

The steel portion of the stairways and the railings are in good condition.



Photograph 5 - Spalled concrete with exposed reinforcing steel on the underside of the third landing of the staircase attached to the east shaft of Pier 11S.

Recommendations

All deteriorated concrete on the underside of the landings should be removed and these areas repaired with gunite or epoxy and concrete.

Spalling of the concrete risers should be patched with epoxy mortar.

Abutmentsa) South Abutment

There is a 1/8" to 1/4" wide longitudinal crack in the haunch of the backwall between the third and fifth stringers west of the east girder. Tapping of the concrete adjacent to this crack with a hammer caused a hollow sound to be emitted. The haunch of the backwall between the fifth and sixth stringer west of the east stringer has broken away from the backwall. (See Photograph 6.)



Photograph 6 - Spalled concrete in the haunch of the south abutment backwall.

The backwall exhibits 1/16" vertical cracks, at three foot on center spacing.

There is a 1/16" wide horizontal crack with efflorescent staining in the stem between the east girder and the east end of the bridge and a 1/16" wide crack with efflorescent staining in the backwall adjacent to the west wingwall.

Portions of the mortar patches on the east and west ends are spalling off or are not fully bonded to the concrete structure.

b) North Abutment

There is a 1/16" wide crack with efflorescent staining in the backwall adjacent to the east wingwall.

Recommendations

The concrete of the backwall haunch of the south abutment should be inspected from above after removing the neoprene expansion joint. All unsound concrete should be removed and replaced with concrete.

Mortar patches that are not fully bonded to the backwall of the south abutment should be removed, the condition of the concrete backing assessed and an epoxy mortar patching applied if it is found necessary to protect the concrete.

The cracks in the backwalls of the south and north abutment and in the stem of the south abutment should be kept under observation.

Pier and Channel Investigation (Below Water)

The underwater inspection of Piers 1N and 1S was made by Caldwell's Diving Company, Inc., of Toms River, New Jersey. The diver's firm furnished the necessary personnel and equipment to complete the underwater inspection work. The subsurface examination of the piers and the adjacent canal bottom was made using scuba diving equipment.

A thorough subsurface examination of the piers was made of the granite and concrete to the bottom of the canal. The piers were checked for granite and concrete damage and loss of mortar from the granite joints. The granite surface of the pier shafts was inspected by the diver moving up, down and across the pier face, following the joints in the granite block. Concrete surfaces below the granite facing and above the canal bottom were examined across each pier face in areas sized by the extent of the diver's reach. The canal bottom surrounding the piers was examined for scour.

The joint between the concrete and the granite blocks of the pier shafts, shown at Elevation +10.0 on the contract drawings, was the reference elevation used to establish M.H.W. during the diving and hydrographic survey work.

According to bridge plan, Piers 1N and 1S are founded on H-piles driven inside a stay-in-place sheet pile cofferdam and capped with a 21-foot deep tremie concrete seal. This supports an 11-foot thick distribution block with a top elevation of -18. Twin pier shafts are supported on top of a 16-foot deep concrete base, constructed on the distribution block. The pier shafts are faced with granite between Elevation -2 and Elevation +10.

The detailed findings of the underwater inspection of the piers and the channel survey soundings follow.

a) Piers 1N and 1S

The concrete bases and distribution blocks were exposed above the mud line only on the channel side of Piers 1N and 1S. Concrete surfaces and granite facings were reported to be in excellent condition except for a 1'-0" x 8" x 6" void at the southeast corner of the fifth row of granite down from the granite concrete interface of Pier 1N. This void should be filled by replacing the damaged granite block or filling the void with concrete.

There was minor erosion of the corners of the piers due to tidal action, with the corners of the piers being reasonably well defined. The erosion was no more than 1/2 inch deep.

There is interlocking steel sheeting and timber piling located south of Pier 1S that are covered at the high water stage, but exposed at low water. Consideration should be given to cutting these at the ground line since they are a hazard to small boats navigating between the pier and the channel bank.

b) Channel Survey

Fathometer readings were taken to record the existing channel bottom. The readings were taken on five range lines parallel to the bridge, including the bridge centerline, and in lines approximately 50 and 100 feet east and west of centerline. The fathometer readings were recorded on Drawing 1-2 and the elevations derived from these readings are shown on Drawing 1-3, appended. They indicate a fairly uniform bottom between Elevations -43 and -46, extending through a channel width of 450 feet. Comparison of the latest profile lines with those shown in the 1977 report shows that the present canal bottom is deeper; the canal bottom was dredged in the summer of 1979.

SUPERSTRUCTURE STEELWORKFixed Bearings

All fixed bearing assemblies were in place and secure on the pier tops.

Most pin openings are filled with pack rust, debris and paint. These materials in the pin openings should be removed, the openings thoroughly cleaned and painted. Sole plates and masonry plates exhibit surface pitting and rusting. These areas should be cleaned and spot painted with a system compatible with the existing paint system.

Expansion Bearings- Stringer Spans

The expansion bearings for the stringer spans are the sliding type consisting of sole plates, bearing on bronze base plates, with lubrite inserts.

The expansion bearings on Pier 20S and on the south side of Pier 18S are not functioning as indicated by unbroken paint across the anchor bolt nut-sole plate interface. The nuts on these bearings appear to have been tightened excessively and this may be restricting movement. Loosening these nuts is recommended. Concrete and debris in the slotted openings of the sole plates are restricting movement and should be removed.

The expansion bearings on Pier 19N are not functioning due to the presence of concrete and debris in the slotted openings of the sole plates and between the bearing units, preventing movement of the stringers. (See Photograph 7.) The concrete and debris should be removed.

The expansion bearings on the north and south abutments appear to be functioning.



Photograph 7 - Concrete between bearing units of Pier N19 that is restricting movement. Masonry plate, anchor bolts and sole plates are rusted.

Most anchor bolts, sole plates and masonry plates exhibit surface pitting and rusting. These areas should be cleaned and spot painted with a system compatible with the existing paint system.

Expansion Bearings - Girder Spans

The expansion bearings for the girder spans are the rocker type. The position of all rockers were as expected or within tolerable ranges for the temperature at the time of the inspection.

There are accumulations of pack rust, concrete, paint and debris between most rockers and their masonry plates and in most pin

openings restricting movement of these devices. (See Photographs 8 and 9.) These materials should be removed, the pin openings thoroughly cleaned, and the pins painted.

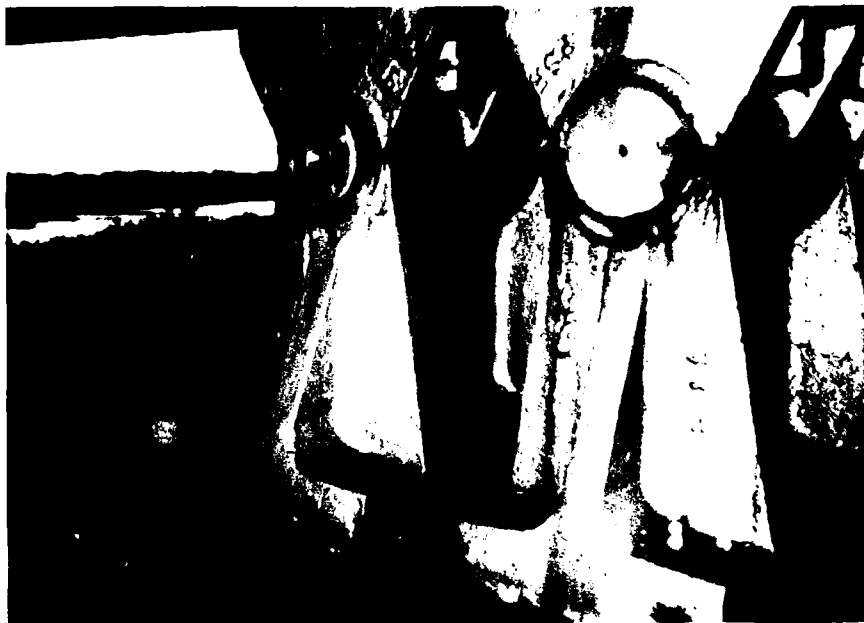
The northeast, northwest and southwest bearings at Pier 11S do not appear to be functioning; paint at the rocker-masonry plate interface and under the rocker is unbroken.

The northeast and northwest bearings at Pier 17S do not appear to be functioning; paint at the rocker-masonry plate interface and across the pin openings is unbroken.

The northeast bearing at Pier 12N does not appear to be functioning; paint drippings across the pin opening are unbroken.

The southeast bearing at Pier 8N does not appear to be functioning; paint at the rocker-masonry plate interface and across the pin opening is unbroken. After the debris and pack rust under the rockers and in the pin openings has been removed, the rockers on Piers 11S, 17S, 12N and 8N, which do not appear to be functioning, should be monitored for movement. If they are not functioning, additional remedial work may be required.

Most masonry plates exhibit surface pitting and rusting. These plates should be cleaned and spot painted with a system compatible with the existing paint system.



Photograph 8 - Pier 8N - Typical accumulation of debris and pack rust under rocker.



Photograph 9 - Pier N12 - Typical accumulation of pack rust in pin opening.

Expansion Bearings - Arch Span

The roller nests at Pier 1S show no evidence of movement. Rust at roller-masonry plate interface and debris adjacent to the edges of the nest confirm this non-working condition. We understand the Corps of Engineers' personnel have attempted to free these roller nests, but with no apparent success. We recommend monitoring the roller nests to ascertain that they are not functioning. Jacking diaphragms were provided on both sides of the main diaphragm above the roller nests when the bridge was built. Therefore, the south end of the tie girders can be raised for making adjustments and repair to the roller nests. Advantage should be taken of the jacking points to clean and free the bearings if the monitoring ascertains that they are not functioning. Jacking should only be undertaken under the supervision of experienced personnel.

The roadway stringers in the arch span are supported at the floorbeams by plate bearings. Provision for movement are made at one end of each stringer while the opposite end is fixed. Concrete on and behind the bearing units at floorbeams L2, L4, L5 and L6 is restricting movement and should be removed. Anchor bolts, base plates and fill plates exhibit surface pitting and rusting and should be cleaned and spot painted with a system compatible with the existing paint system.

Structural Steel - Stringer Spans

The stringer spans are in good structural condition in spite of non-movement and restriction of some expansion bearings except for minor rusting of the structural steel adjacent and under the neoprene expansion joints due to their leakage.

There is a 1" diameter hole in the web of the west girder radjacent to the north end of Pier 17S. This hole, which is just above the lower flange angle, should be repaired with a patch plate.

There is a 1-3/4" x 1-1/2" void at end of the second stringer west of the east girder at the north floorbeam of Pier 18N. The only remedial work necessary is to clean and spot paint the area adjacent this void.

Structural Steel - Girder Spans.

Alignment of individual members is good except for a few flanges of stringers, diaphragms and secondary members that exhibit minor dents or bows, which probably occurred during erection.

Heavy rusting has occurred on the floorbeam upper and lower flanges, their cover plates, lower portions of the floorbeam's web stiffeners, the upper and lower flanges of diaphragms, the lower flanges of the girders and the upper and lower flanges of stringers under or adjacent to all the neoprene expansion joints due to the joint leakage. (See Photographs 10, 11 and 12.)

Many rivet heads are starting to deteriorate in the lower flange angles of the floorbeams, and in the lower flange angles of girders and lateral connections adjacent to the end leaking joints. Moisture and sand was noted on pier tops and on the bottom flanges of many floorbeams during the inspection.

These rusted areas should be cleaned in accordance with the applicable SSPC Specifications and spot painted with a protective coating system compatible with the existing paint system. Section loss of these members should be measured and evaluated to determine if reinforcing of these deteriorated members is required.

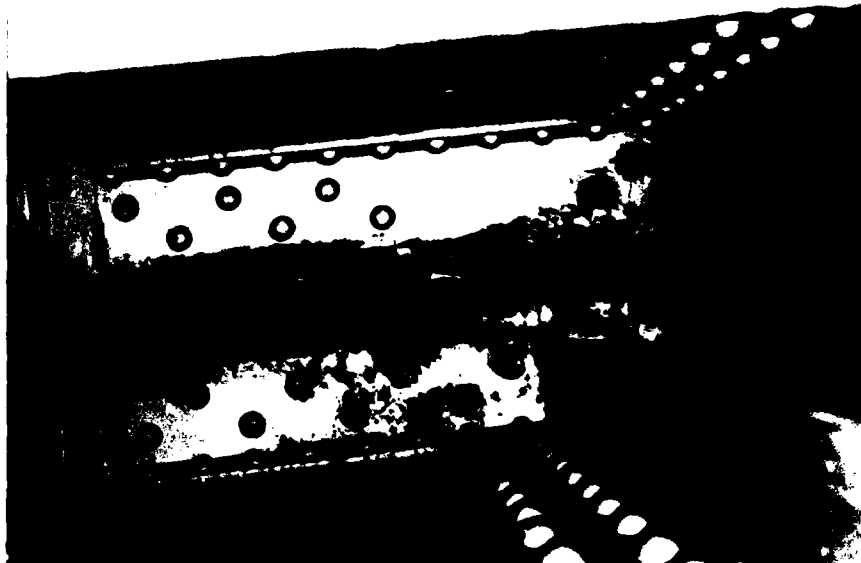
Rivets in the lower flange of floorbeams, girders and lateral connections under or adjacent the neoprene expansion joints should be cleaned and painted promptly to prevent further section loss of the rivet heads that will eventually require their replacement.



Photograph 10 - Typical deterioration of bottom flange angle and stiffeners of floorbeam located under leaking expansion joint.



Photograph 11 - Typical deterioration of bottom flange angle, its cover plate and connecting rivets on a floorbeam of a girder span located under leaking expansion joint.



Photograph 12 - Typical deterioration of upper flange angles of floorbeam of a girder span adjacent to leaking expansion joint. Plate used to form concrete at joint is severely deteriorated. Unfilled rivet holes in the flange of floorbeam are rusting.

The stiffener at the centerline of the north floorbeam of Pier 10N and the fourth stiffener east of the west bearing of Pier 16S each have a hole in their lower portion. The only remedial work necessary is to clean and paint the area adjacent to these holes as specified above.

Gaps between the flange angles and cover plates of floorbeams and girders caused by rusting should be cleaned and sealed. If this is not performed promptly, replacement of the cover plates may be required. (See Photographs 13 and 14.)

Half of the bolts connecting the lower flange angles to the cover plate of the north floorbeam at Pier 11N are missing. The missing bolts should be replaced.

Nuts are missing on two threaded fasteners on the top flange of the west girder adjacent to the south end of Pier N12. These nuts should be replaced.

A rivet has backed out of the top flange of the west girder 8 feet south of the midpoint of Piers 2N and 3N. This rivet should be removed and replaced with a high strength bolt.



Photograph 13 - Pier 2N - Rusting of flange angle and cover plate of floorbeam located under leaking expansion joint. Bottom cover plate is warped due to rusting between the members.



Photograph 14 - Pier N16 - Warped edge of cover plate connected to bottom flange angle located under leaking expansion joint due to rust between members.

There is one loose nut in the connection of the lower flange angle of the south floorbeam and its cover plate at Pier 6N. This nut should be tightened.

All missing bolts and loose nuts listed hereinabove should be replaced and tightened in accordance with the AASHTO requirements.

Structural Steel - Arch Span

a) Superstructure Below Roadway

Heavy rusting has occurred on the floorbeam upper and lower flanges, their cover plates, the upper and lower flanges and webs of stringers, the upper and lower flanges of diaphragms and the lower portions of the floorbeam web stiffeners under or adjacent to all the neoprene expansion joints due to their leakage. (See Photograph 15.)

Sand and moisture were noted on most lateral gusset plates located at the ends of the floorbeams. Rivet heads are deteriorating on the lower flanges of floorbeams and tie girders, and the laterals at these gusset plates. (See Photograph 16.)

These rusted areas should be cleaned in accordance with the applicable SSPC Specifications and spot painted with a protective coating system compatible with the existing paint system. Section loss of these members should be measured and evaluated to determine if reinforcing of these deteriorated members is required.

Rivets in the lower flange of floorbeams, tie girders and laterals at the gusset connections should be cleaned and painted promptly to prevent further section loss that will eventually require



Photograph 15 - Typical deterioration of upper and lower flanges of floorbeam and bottom flange of stringer of understructure of tied arch adjacent to leaking expansion joint.



Photograph 16 - Typical accumulation of sand on lower gusset plate of tied arch. Corrosion of floorbeam lower flange angle web and connecting rivets is evident.

their replacement. These gusset plates should be washed each spring to clean off roadway salts that splash on them from the openings between the roadway and the tie girders.

Holes were found in the webs of stringers at the following locations:

- L3' - south side - sixth stringer west of east tie girder
- L4' - south side - seventh stringer west of east tie girder
- L7' - south side - second stringer west of east tie girder
- L5 - north side - second stringer west of east tie girder
- L3 - north side - second stringer west of east tie girder
- L2 - north side - second stringer west of east tie girder

The holes in the stringers should be repaired by adding patch plates.

Loose and missing bolts at the stringer floorbeam connections were noted at the following locations:

- L1' - south side - first stringer west of tie girder
1 nut is missing
- L1' - north side - first stringer west of east tie girder
1 bolt is missing
- L2' - north side - first stringer west of east tie girder
1 nut is missing
- L3' - north side - first stringer west of east tie girder
1 bolt is missing
- L4 - south side - first stringer west of east tie girder
2 bolts are loose and the connection is
extruding rust
- L2 - south side - first stringer west of east tie girder
1 bolt is missing and the connection is
extruding rust
- L0 - first - 4 bolts are missing and 1 bolt is loose
stringer and the connection is extruding rust.
west of east
girder

There is one bolt missing in the connection of the rail support post to the plate that is connected to the first stringer west of the east tie girder at L0 and between L1' and L2'.

All missing bolts and loose nuts listed hereinabove should be replaced and tightened in accordance with AASHTO requirements.

The underside of the utility platform located on the east side of the tied arch between L0' and L1' is spalled with exposed reinforcing steel and its supporting structural steel is rusted. All deteriorated concrete should be removed and this area repaired with

guniting or epoxy and concrete. The rusted structural steel should be cleaned in accordance with the applicable SSPC Specifications and spot painted with a system compatible with the existing paint system.

b) Superstructure Above Roadway

The arch superstructure is in good condition except for areas of paint blistering and related rusting (refer to CONDITION OF PAINT AND EXTENT OF DETERIORATION).

There is a crack in the lower north edge of the east gusset plate as it enters the upper chord at Panel Point U6 on the east side of the bridge. The crack had unbroken paint across it. The extent of this crack cannot be ascertained because of the presence of an angle on the interior of the upper chord where the gusset plate enters it. (See Photograph 17.) The crack does not extend beyond the angle. An attempt should be made to determine the depth of the crack by grinding the edge of the gusset to a smooth contour and testing with a dye penetrant. If the crack still exists the gusset plate should be periodically checked to determine if any changes are occurring or if this crack is propagating past the interior angle of the upper chord.



Photograph 17 - Crack in east gusset plate of east truss of tied arch at Panel Point U6.

Rust has caused a separation of the backs of the angles supporting the upper walkway located on the east side of the bridge adjacent to Panel Point U7'. These gaps should be cleaned and sealed.

c) Interior of Tie Girder

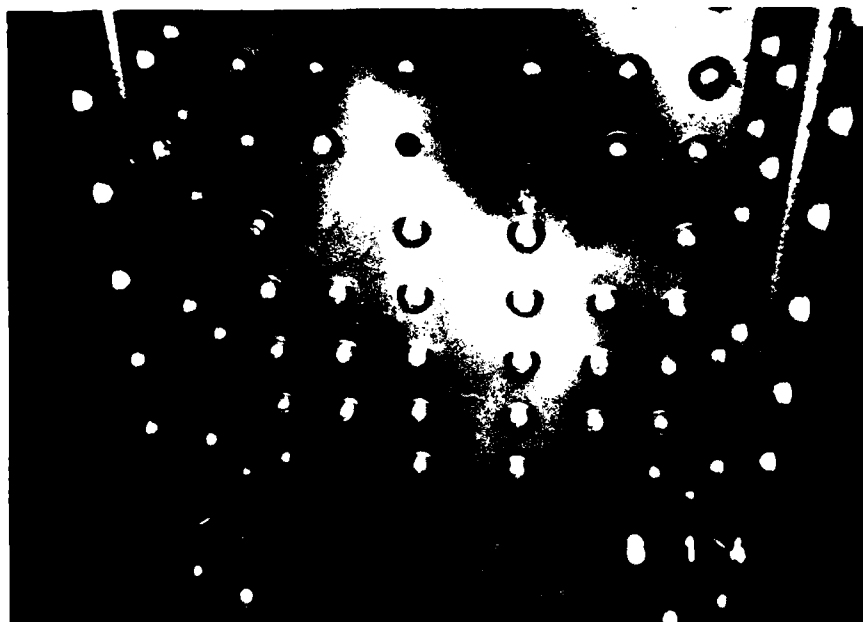
The interior of the tie girders is in very good condition.

Rivets are missing at the following locations:

- | | |
|--------------------------------|---|
| East tie girder - L4' | - 2 rivets are missing in the horizontal leg of the angle connecting the upper plate with interior diaphragm. |
| East tie girder - L6' | - 6 rivets are missing in the vertical leg of the angle connecting the bottom plate with the interior diaphragm. |
| West tie girder - L4' | - 2 rivets are missing in the vertical leg of the angle connecting the upper plate with interior diaphragm. |
| West tie girder - north of L6' | - 6 rivets are missing in the vertical leg of the angle connecting the upper plate to the interior diaphragm.
(See Photograph 18.) |
| | - 4 rivets are missing in the upper splice plate. (See Photograph 18.) |
| West tie girder - south of L6 | - 6 rivets in the vertical leg of the angle connecting the upper plate with the interior diaphragm. |
| West tie girder - L4 | - 2 rivets in vertical leg of the angle connecting the upper plate with the interior diaphragm. |

At these locations there are rivet holes only in one of the members that were to be connected.

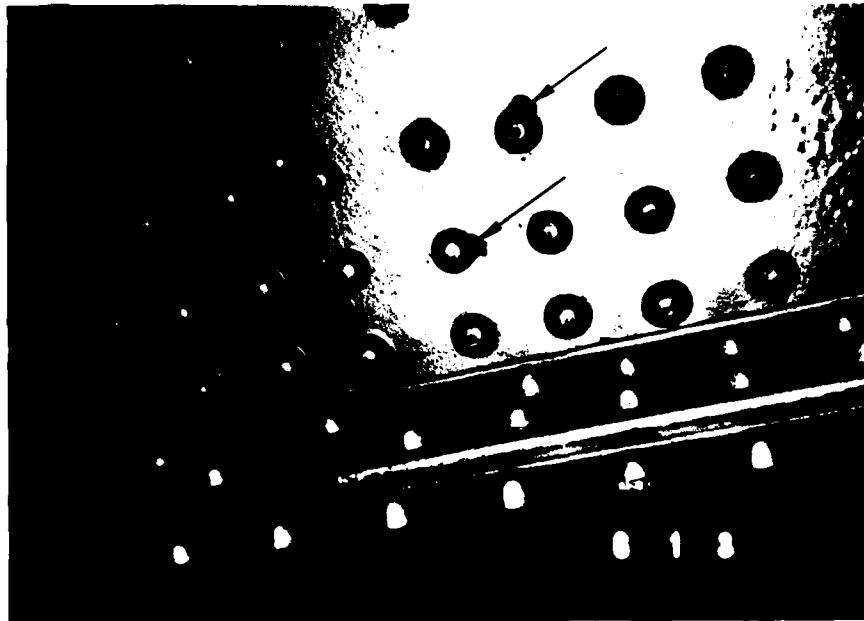
The missing rivets should be replaced with high strength bolts and tightened in accordance with the AASHTO requirements; this will require a bolt hole to be drilled in one of the members to be connected.



Photograph 18 - Missing rivets in upper splice plate and interior diaphragm, in the interior of tied arch located north of L6'.

There are two rivets on the upper plate of the west tie girder at L4' that are in oversized holes. (See Photograph 19.) These holes should be periodically checked for any signs of distress.

Drain holes in the east and west tie girders that were originally provided in the bottom plates had been plugged with hanger supports for the maintenance traveler. Additional drain holes have been installed. No water was noted in either tie girder. There were isolated areas of rusting rivet heads in the bottom plate, indicating that water had entered the tie girders at one time. It is suggested that the interior of these tie girders be checked periodically to insure that there is no ponding of water.



Photograph 19 - Oversized holes adjacent two rivets in upper plate of interior of tied arch at L4.

CONDITION OF PAINT AND EXTENT OF DETERIORATION

The condition of the paint on the stringer spans is good. In addition to the minor rusting of the structural steel under and adjacent to the neoprene expansion joints, there is some blistering of paint on the bottom flanges of stringers. There are some areas of peeling of new paint indicating that this paint may have been applied over improperly cleaned surfaces.

The condition of the paint on the girder spans is good, except on the structural steel under or adjacent the neoprene expansion joints (refer to Structural Steel - Girder Spans). There is pitting and blistering of paint and minor rusting of the upper and lower flanges of stringers. The heaviest rusting is between Piers 1S and 2S. There are some areas of new paint on the south side of the bridge that are peeling indicating that this paint may have been applied over improperly cleaned surfaces.

The condition of the paint on the structural steel of the arch span located below the roadway is good, except under or adjacent to the neoprene expansion joints (refer to Structural Steel - Arch Span - Superstructure Below Roadway). There is some blistering and peeling of paint on the flanges of the stringers, heaviest on the flanges of the exterior stringers adjacent to the opening between the roadway and the tie girder.

There is isolated blistering of paint and minor section loss on the superstructure of the arch span located above the roadway.

The roadway side of the exterior of the webs of the tie girders exhibit extensive blistering of paint and minor rusting. (See Photograph 20.) The web of the tie girders, opposite the roadway, exhibit blistering of paint and minor rusting, but to a much lesser degree than the web adjacent the roadway.



Photograph 20 - Typical blistering of paint and corrosion on the roadway side of the web of the tie girders.

The paint in the interior of the tie girders is in good condition. There are isolated areas of peeling paint and minor rusting of bolt heads on bottom plates.

The condition of paint on the bearing assemblies is discussed in SUPERSTRUCTURE STEELWORK - Fixed Bearings and Expansion Bearings.

The bridge railings exhibit areas of paint deterioration and minor rusting.

Rusting was also observed at the following locations on the stringer and girder spans:

1. Unfilled rivet holes in the top flange of the fascia stringers.
2. Unfilled rivet holes in the top flange of floorbeams.
3. Stay-in-place forms used for the bridge fascia.

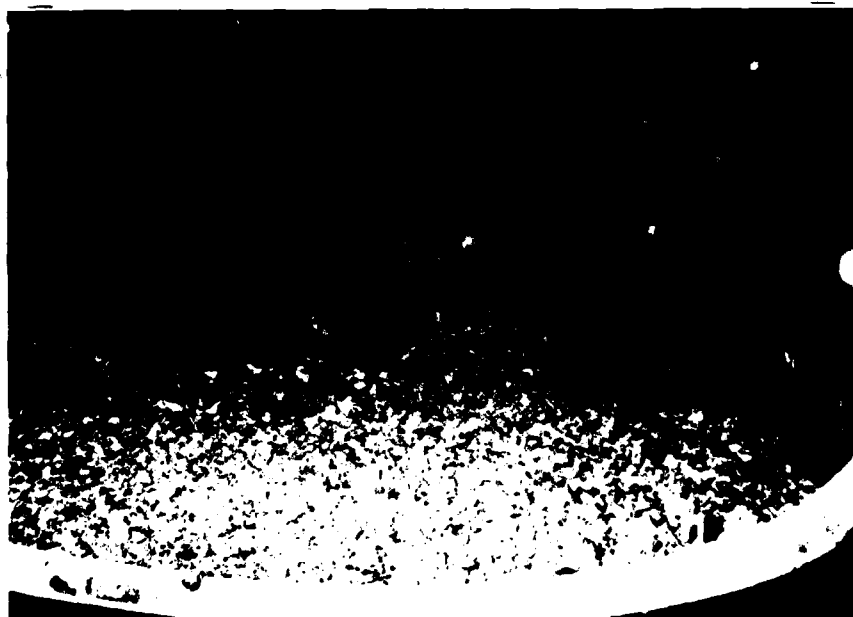
To prevent deterioration caused by rust, all rusted surfaces and all areas of peeled paint should be cleaned in accordance with the applicable SSPC Specifications and spot painted with a protective coating compatible with the existing paint system.

The following locations entrap moisture and promote rusting:

1. Under the vertical leg of upper angle located on the outside face of the tie girders. (See Photograph 21.)
2. Back to back of angles comprising lateral members of the tie arch.
3. Gaps between webs plates and legs of angles of the upper chord of the tied arch.
4. Gaps between edges of cover plates and base of hangers of the tied arch. These gaps should be cleaned and sealed to avoid extensive future repairs.



Photograph 21 - Upper angle junction with east web plate of the tied arch is warped between rivets and rust is present.



Photograph 22 - Pigeon roost in upper chord of tied arch.

Pigeon roosts were noted in the upper chords of the arch span. There is a heavy accumulation of bird excrement in these members. (See Photograph 22.) We suggest screening the openings in the upper chords to prevent access to birds, as was done to the openings in the tie girders, after the bird excrement has been removed and any subsequent paint damage repaired.

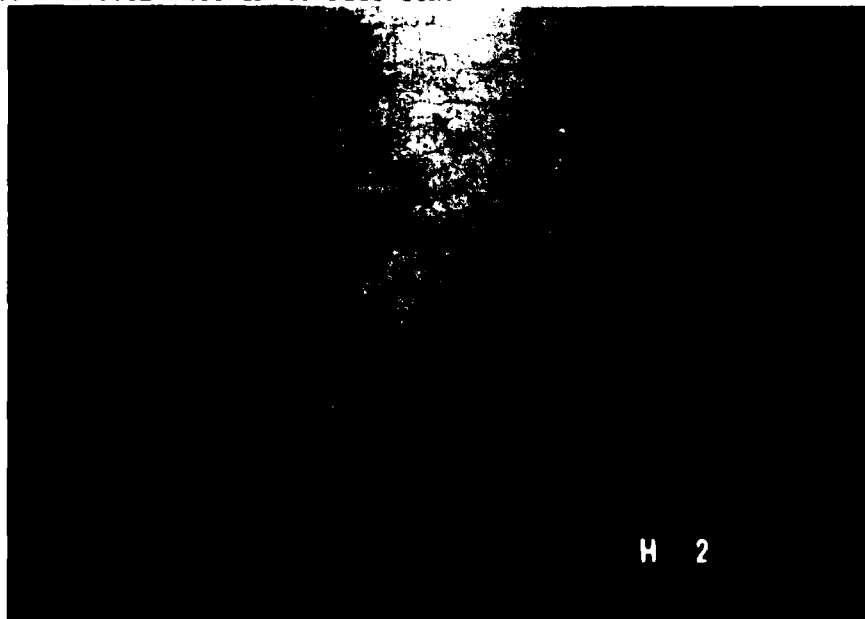
BRIDGE DECK

a) Below Deck

The stay-in-place forms used for the deck are in very good condition. There is rusting of the stay-in-place forms adjacent to many neoprene expansion joints due to their leakage.

b) Above Deck

The decks of the stringer and girder spans are in good condition. They exhibit minor transverse cracking. Minor surface map cracking has started in the left lane adjacent to the median. There is surface map cracking of the right northbound lane from Pier 13S to Pier 1S and from Pier 1N to Pier 10N.



Photograph 23 - Map cracking of right northbound lane
between L5' and L6' of arch span.

The deck of the arch span is in good condition. There is surface map cracking of the right northbound lane. (See Photograph 23.)

The inspection has revealed scattered spalls and are listed hereinbelow:

Span 17S-18S - left southbound lane - There is a 6'x 15' spalled area with exposed reinforcing steel.

Span 17S-18S - northbound lanes - There is a 10' x 15' spalled area with exposed reinforcing steel. (See Photograph 24.)

Span 3S-4S - right northbound lane - There is a 6" diameter spall which is 1/2" deep.



87 6 9

Photograph 24 - Spalled pavement with exposed reinforcing steel in the northbound lanes between Piers 17S and 18S.

c) Approach Pavements

The approach pavements are in good condition with scattered transverse cracking. There is 1' x 4" x 3" spall in the right southbound lane of the north approach pavement.

Recommendations

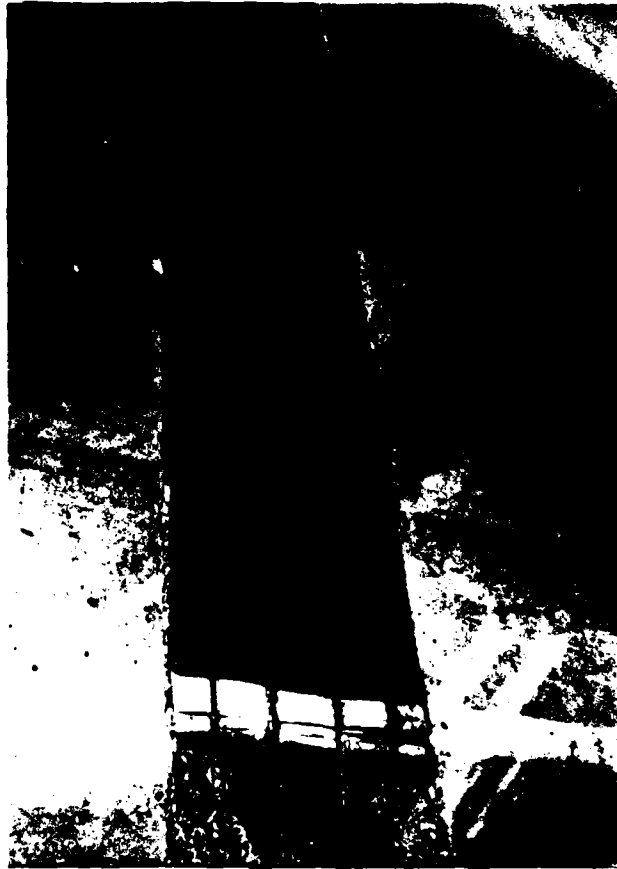
Epoxy and mortar should be used to patch spalls.

To prevent further deterioration all rusted areas of the stay-in-place forms should be cleaned in accordance with the applicable SSPC Specifications and spot painted with a protective coating system compatible with the existing protective system.

d) Roadway Joints

All the neoprene expansion joints on this bridge are allowing the passage of water beneath the joints causing the deterioration of the structural steel located beneath the joints. The non-shrink grout placed in the 3/8" opening between the roadway pavement and the neoprene expansion joints has either separated from the neoprene expansion joints or spalled at almost all joints, allowing water to seep through.

Many cavity plugs over the joint anchor bolts are missing or torn. The presence of debris and the rusting of the anchor bolts and nuts was noted in most of these uncovered openings. Sheared anchor bolts and loose and rusted nuts were observed at several of these uncovered openings. (See Photograph 25.) Vertical movement of many neoprene expansion joints under traffic loading was observed.



Photograph 25 - Typical condition of neoprene expansion joints. There are missing cavity caps, grout between joint and roadway pavement is spalled or missing, and 4 bolts are sheared.

Recommendations

It is apparent that the sheared and loose anchor bolts should be replaced or repaired and any damaged concrete adjacent to the bolts should also be repaired. Missing and torn cavity caps should be replaced. The grout in the 3/8" opening between the neoprene joint and the concrete deck should also be removed and the opening resealed. To determine the extent of the problem, it is recommended that some neoprene joint sections be removed. Moreover, a representative of the manufacturer of the joints should observe the condition of these

joints and make recommendations to produce a satisfactory and watertight installation. If a watertight joint cannot be obtained, consideration should be given to replacement of the joints with those of a different design.

RAILINGS, FENCES AND CURB

Bridge railing has impact damage at several locations. The rail sections at these locations are bent and in many cases the upper and lower welds of the pipe balusters to the railings have cracked. Impact damage should be repaired and spot painted.

In several locations bridge post caps are missing and should be replaced.

The median guiderail is in good condition.

The approach bridge guiderails are in good condition. The west guiderail of the north approach has one post that has separated from its block due to the connection hole in the block elongating to the end of the block. A new block will be required at this location.

Fencing located on the outside of the bridge rail is in good condition.

Curbing on the bridge is in good condition. There are many locations where impact damage has caused chipping and spalling of the curb edges. We recommend patching spalled areas with epoxy and mortar.

DRAINAGE

The bridge drainage system appears to be functioning properly. Many drainage outlets discharge water on the face of pier caps, in some cases causing spalling of the pier cap concrete. (See Photograph 26.) All outlets discharging water onto any components of

the piers should be extended to within a few feet of the ground and an energy dissipator placed beneath the pipe, or the drainage outlets should be directed away from the piers.



Photograph 26 - Pier 10S - Spall of south pier cap due to drainage pipe discharging onto pier cap face.

The drainage ditch located west of the bridge between Piers 8N and 11N is choked with weeds and debris. The weeds and debris should be removed to render this drainage ditch operable.

The drainage outlet under the bridge which discharges into the north side of the Chesapeake and Delaware Canal is broken, with pieces of the broken pipe lying in the invert. The damaged portion of the pipe should be replaced.

The receiving bell of the drainage pipe at the northeast corner of Pier 11S is broken and should be replaced.

Roadway gutters should be kept clean to prevent accumulation of debris and subsequent clogging of gutters.

GENERAL SITE AREA

The land under the bridge between Piers 3N and 10N is overrun with weeds. Removal would improve the appearance of the bridge's right-of-way and prevent dumping of debris as evidenced north of Pier 6N. This debris should be removed from the bridge site.

The land under the bridge between Piers 9S and 10S, 16S and 18S, 5N and 6N and 7N and 8N have water filled holes and is very muddy due to poor runoff. Regrading would eliminate the condition.

Pier numbers which have been written on the north piers are incorrect. These should be revised. Placing the pier numbers on the railings above the piers to facilitate identification is suggested.

The cable of the guiderail located between Pier 12N and Pier 13N is sagging and should be retensioned.

EXPANSION MEASUREMENTS AT BRIDGE RAILINGS

Expansion measurements were taken between the ends of the top of handrails at the expansion joints and are appended. (See Drawing 1-4.) Generally, the rail openings appeared satisfactory.

1.04 SUMMARY

The St. Georges Bridge is in good structural condition. Major items of maintenance and repair relate to cleaning and painting of metalwork under joints in the arch span and the adjacent girder spans, making the neoprene expansion joints watertight, cleaning and freeing the restrained stringer and girder span expansion bearings, and making adjustments and repairs to roller nests of the arch span if monitoring ascertains that they are not functioning.

1.05 Recommendations

The 1979 inspection of the St. Georges Bridge revealed deficiencies, described in this report. These deficiencies and recommendations for repairing these items and for maintenance are summarized as follows:

SUBSTRUCTURESMain Piers

1. Pier 1N: Seal the cracks in the concrete about the grillages under both expansion rockers for the girder spans. Fill void in the granite at the southeast corner of the pier with new granite or concrete. Keep the crack on the north face of pier cap under observation.
2. Pier 1S: Repair spalled concrete with epoxy and mortar. Keep crack in the north face of the pier cap under observation. Cut at the ground line the steel sheet piling and timber piling located south of the pier.

Approach Piers

3. Repair spalled concrete with epoxy and mortar.
4. Fill unplugged form-tie holes with epoxy and mortar when other work is being performed at a pier location.

Access Stairways

5. Remove deteriorated concrete and repair with gunite or epoxy and concrete.

Abutments

6. South Abutment: Remove unsound concrete in backwall haunch and replace it with concrete. Remove mortar patches not fully bonded to backwall and assess concrete backing; patch with epoxy and mortar if necessary. Keep backwall cracks under observation.
7. North Abutment: Keep backwall cracks under observation; repair them if they become larger.

SUPERSTRUCTURE STEELWORK

Bearings

8. Remove debris in pin openings and repaint at all spans. Remove debris from under rockers of all spans.
9. Piers 18S and 20S: Remove debris and concrete in slotted openings of the sole plates and loosen nuts.
10. Pier 19N: Remove debris and concrete in slotted openings of the sole plates and between the bearing units.
11. Monitor rockers on Piers 11S, 17S, 12N and 8N for movement after debris has been removed from pin openings and from under rockers to ascertain if they are functioning.
12. Monitor roller nests on Pier 1S for movement. If they are not functioning, raise south end of tie girder so that adjustments and repairs can be made.
13. Remove concrete on and behind bearing units at floorbeams L2, L4, L5 and L6 of arch span.

Structural Steel

14. Install patch plate on web of west girder adjacent to the north end of Pier 17S.
15. Clean and paint rusted steel under or adjacent the neoprene expansion joints. Section loss should be measured and evaluated to determine if reinforcing of these deteriorated members is required.

16. Clean rust from and seal gaps between flange angles of floorbeams and girders and cover plates on girder spans.
17. Replace missing bolts in connection of lower flange angles to cover plate of north floorbeam at Pier 11N.
18. Remove backed out rivet in the top flange of the west girder 8 feet south of the midpoint of Piers 2N and 3N and replace with a high strength bolt.
19. Torque loose nut in the connection of the lower flange angle of the south floorbeam and its cover plate at Pier 6N.
20. Wash roadway salts and sand from lower gusset plates of the arch superstructure below the roadway each spring.
21. Repair holes in the end of stringer webs at L3', L4', L7', L5, L3, and L2 of the arch superstructure below the roadway.
22. Replace missing bolts and nuts at L1', L2', L3', L2 and L0 of the arch superstructure below the roadway.
23. Torque loose bolts at L4 and L0 of the arch superstructure below the roadway.
24. Replace missing bolts in the connectijon of the rail support post to the plate that is connected to the first stringer west of the east tie girder at L0 and between L1' and L2'.
25. Grind edge of crack in gusset plate at panel point U6 of the east side of the tied arch and check with a dye penetrant. Monitor crack if it still exists after grinding.
26. Replace missing rivets at L4' and L6' of interior of east tie girder, and at L4', L6' and L4 of interior of west tie girder with high strength bolts.
27. Remove deteriorated concrete on ur lerside of utility platform of arch span between L0' and L1' and repair with gunite or epoxy and concrete.
28. Monitor oversized holes adjacent rivets in upper plate of west tie girder at L4'.
29. Monitor interior of tie girders for ponding water.

PAINT

30. Clean and spot paint rusted surfaces and areas of peeled paint.

31. Remove bird excrement from interior of upper chords of tied arch and screen all openings.
32. Seal gaps between structural members that entrap and promote rusting.

BRIDGE DECK

33. Repair spalls with epoxy and mortar.
34. Remove some joint sections and examine their condition with a representative of the joint manufacturer to obtain recommendations for watertight installation. Repair sheared and loose anchor bolts and any damaged concrete adjacent to these bolts. Replace the grout in the 3/8" opening between the neoprene expansion joints and the pavement. Replace missing cavity caps.

RAILINGS, FENCES AND CURB

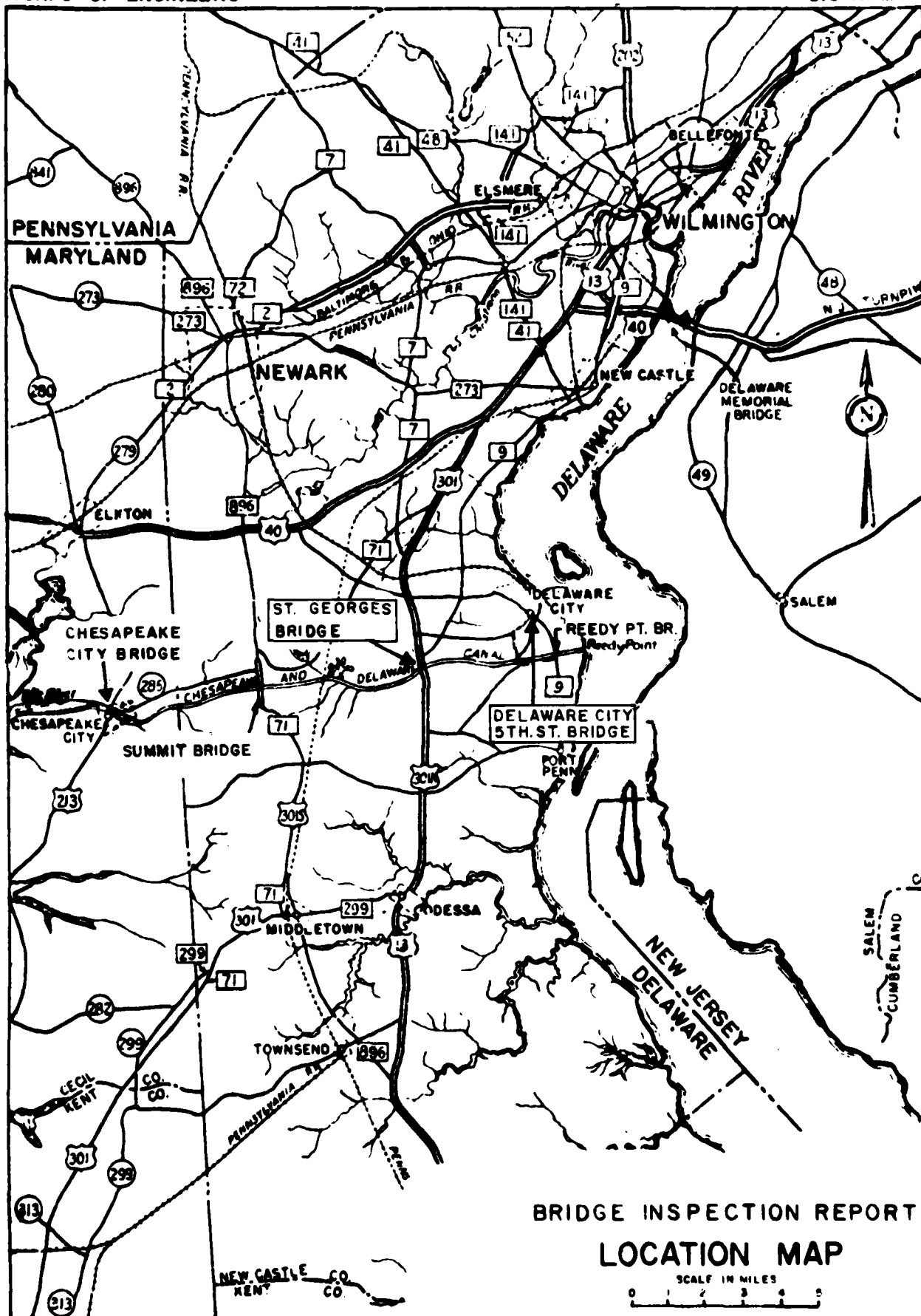
35. Repair and spot paint collision damaged railings.
36. Replace missing bridge post caps.
37. Replace damaged guiderail block on west rail of north approach.
38. Repair spalled curb with epoxy and mortar.

DRAINAGE

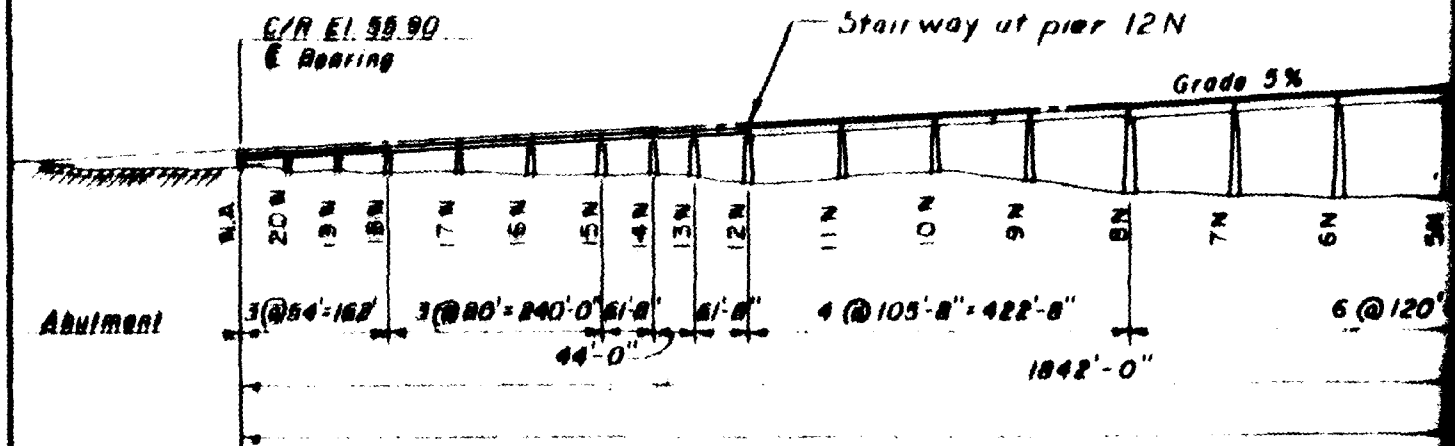
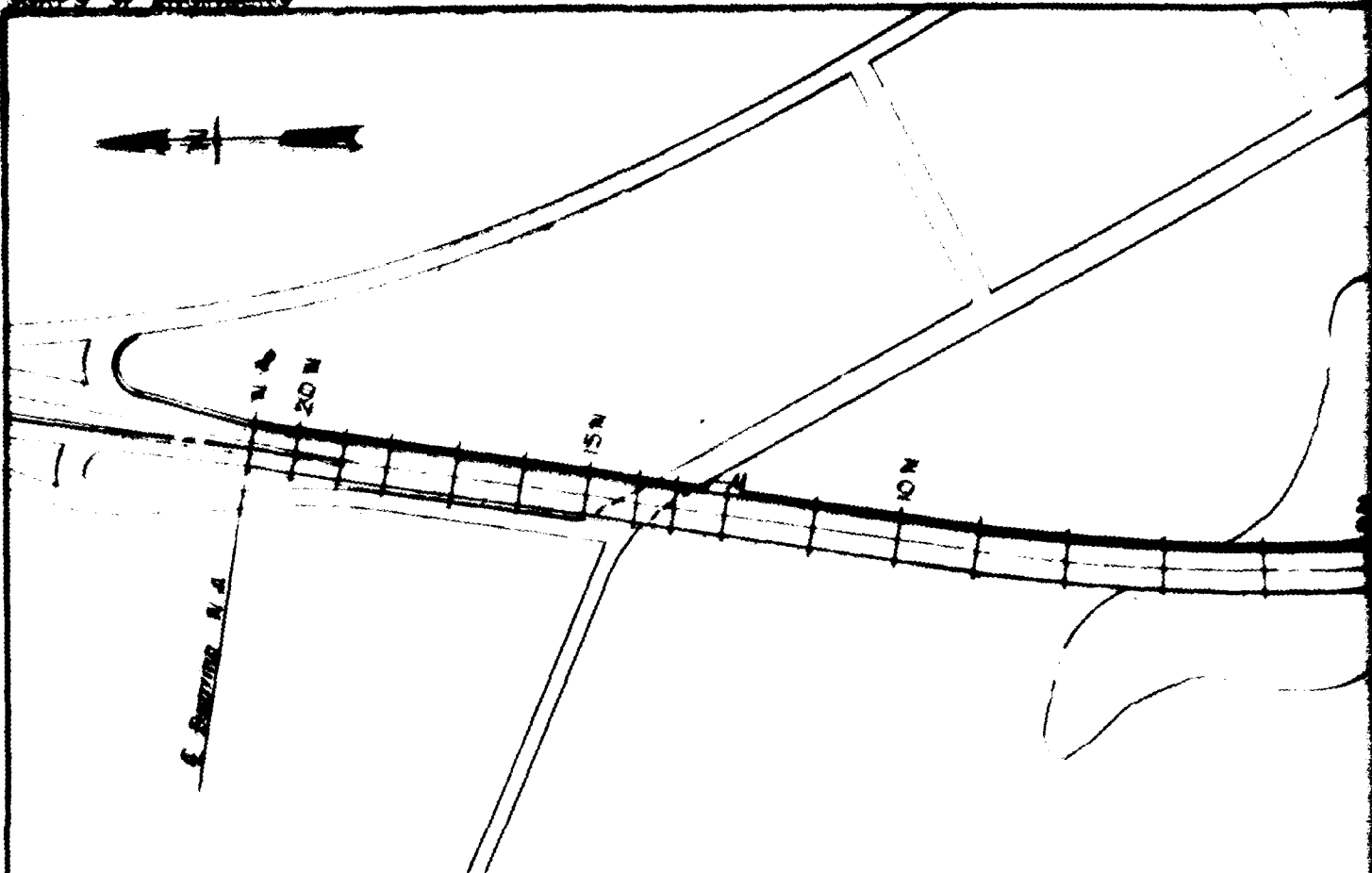
39. Extend drainage pipes discharging against the faces of pier caps to the ground, or direct them away from pier cap faces.
40. Drainage ditch located west of bridge between Piers 8N and 11N: Remove weeds and debris.
41. Drainage outlet under bridge discharging into north side of Chesapeake and Delaware Canal: Replace damaged section of pipe.
42. Drainage pipe at northeast corner of Pier 11S: Replace broken receiving belt.
43. Flush roadway drains periodically.

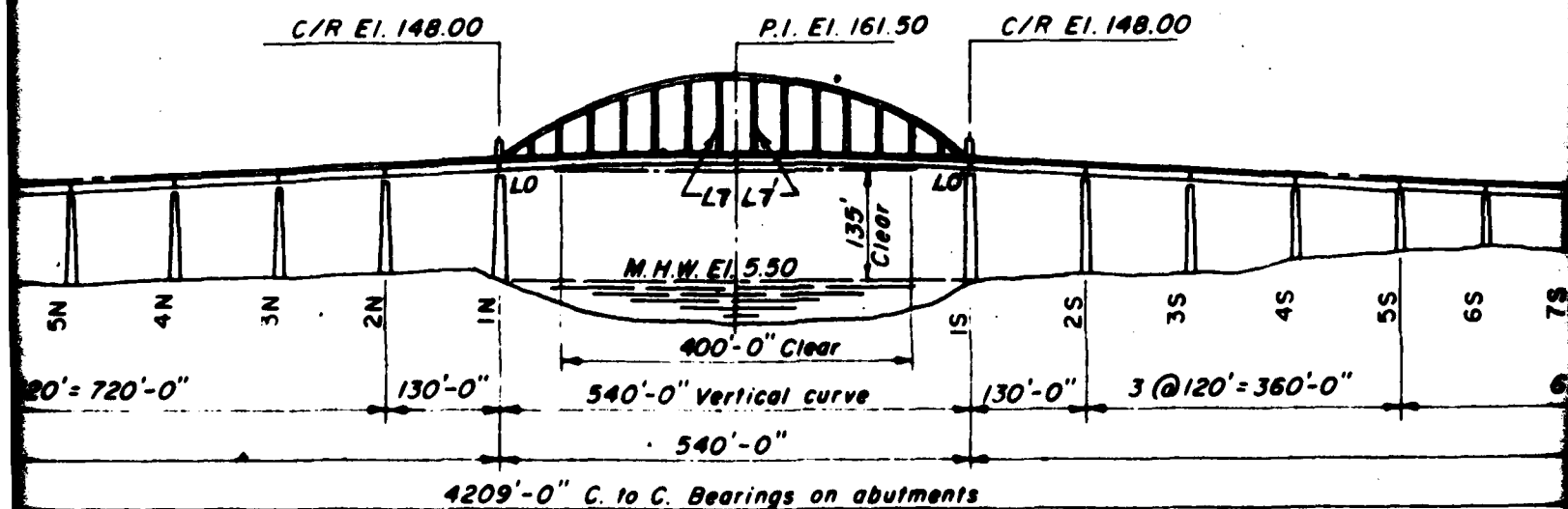
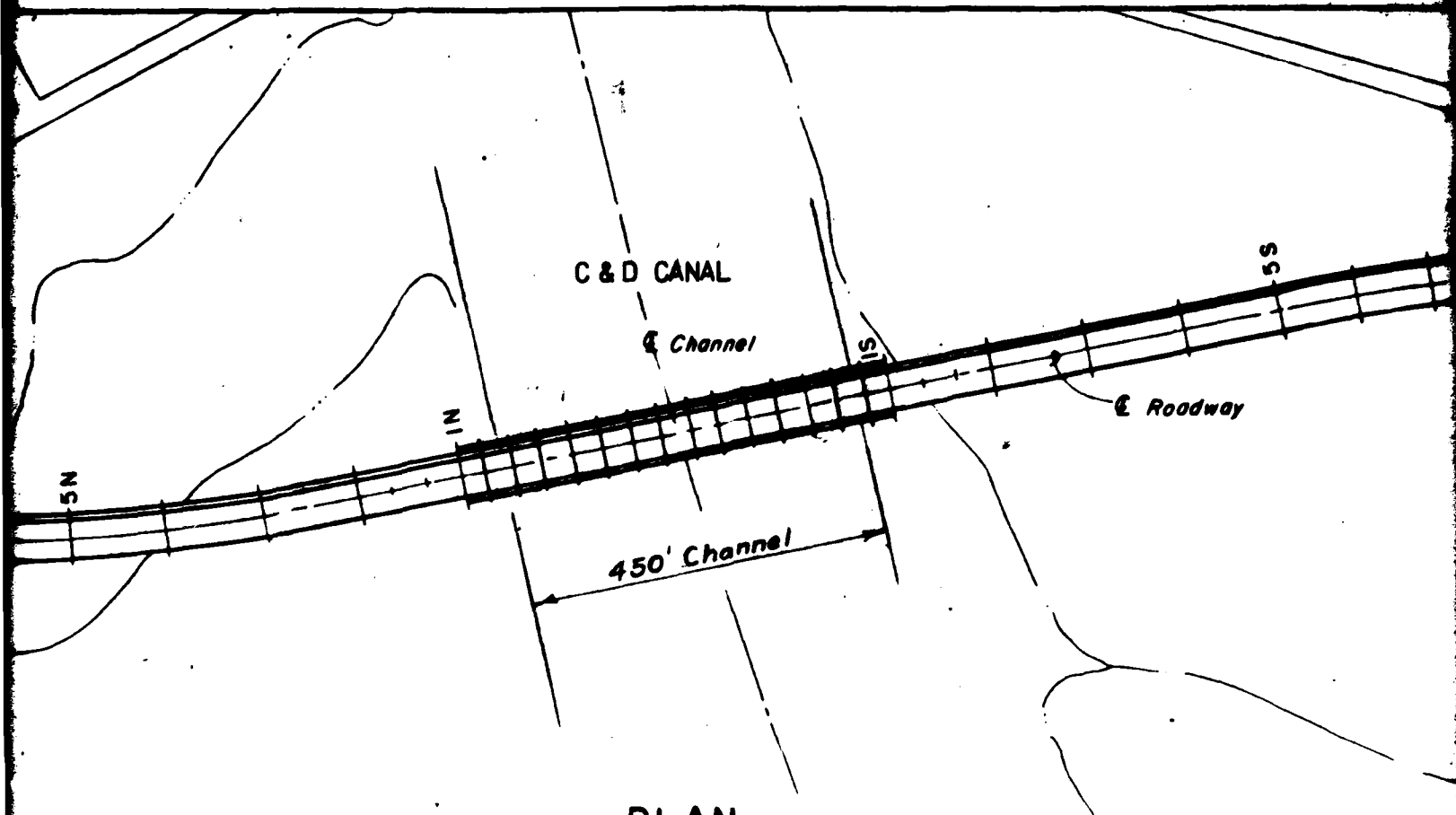
GENERAL SITE

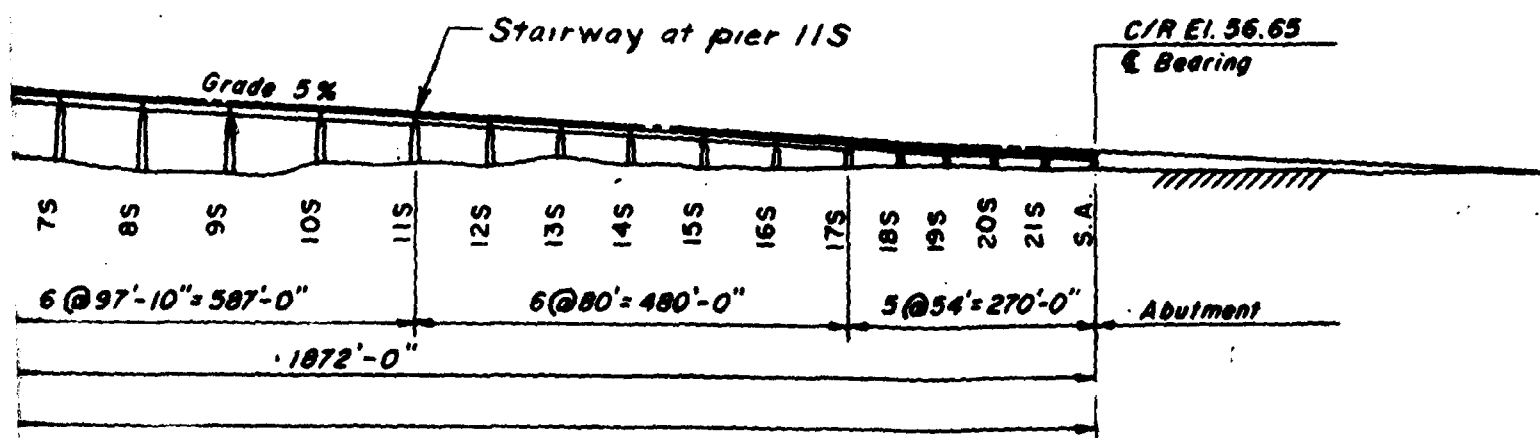
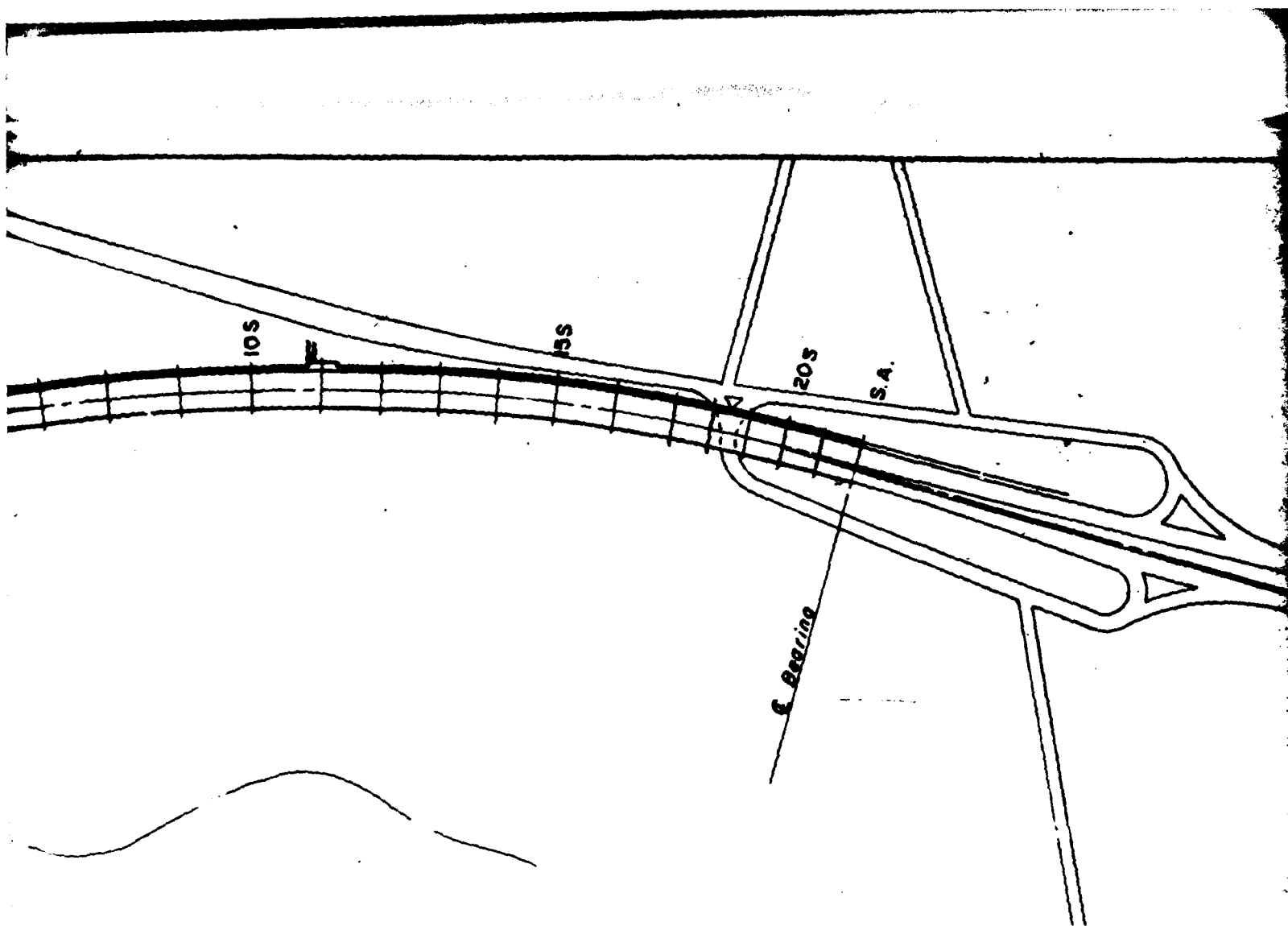
- 44. Remove weeds located between Piers 3N and 10N.
- 45. Remove debris north of Pier 6N.
- 46. Regrade land between Piers 9S and 10S, 16S and 18S, 5N and 6N, and 7N and 8N.
- 47. Place correct pier numbers on north piers.
- 48. Place pier numbers on bridge railings.
- 49. Retension cable of guiderail between Piers 12N and 13N.



CORPS OF ENGINEERS



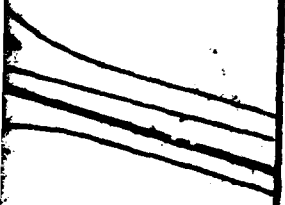




C & D CANAL
BRIDGE INSPECTION REPAIR
ST. GEORGE'S BRIDGE
PLAN AND ELEVATION

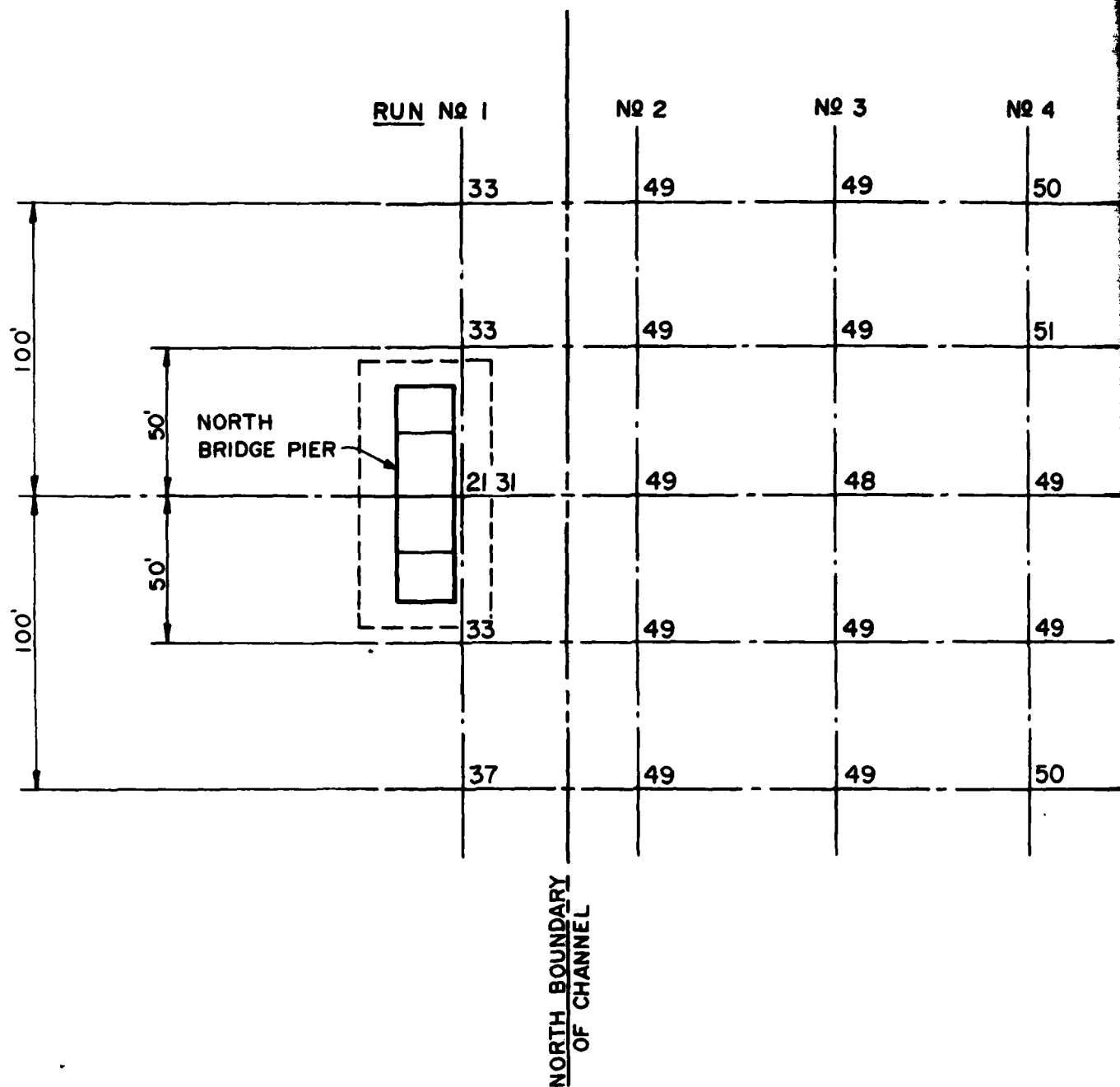
DRAWING F-1

U. S. ARMY



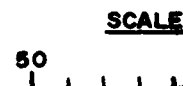
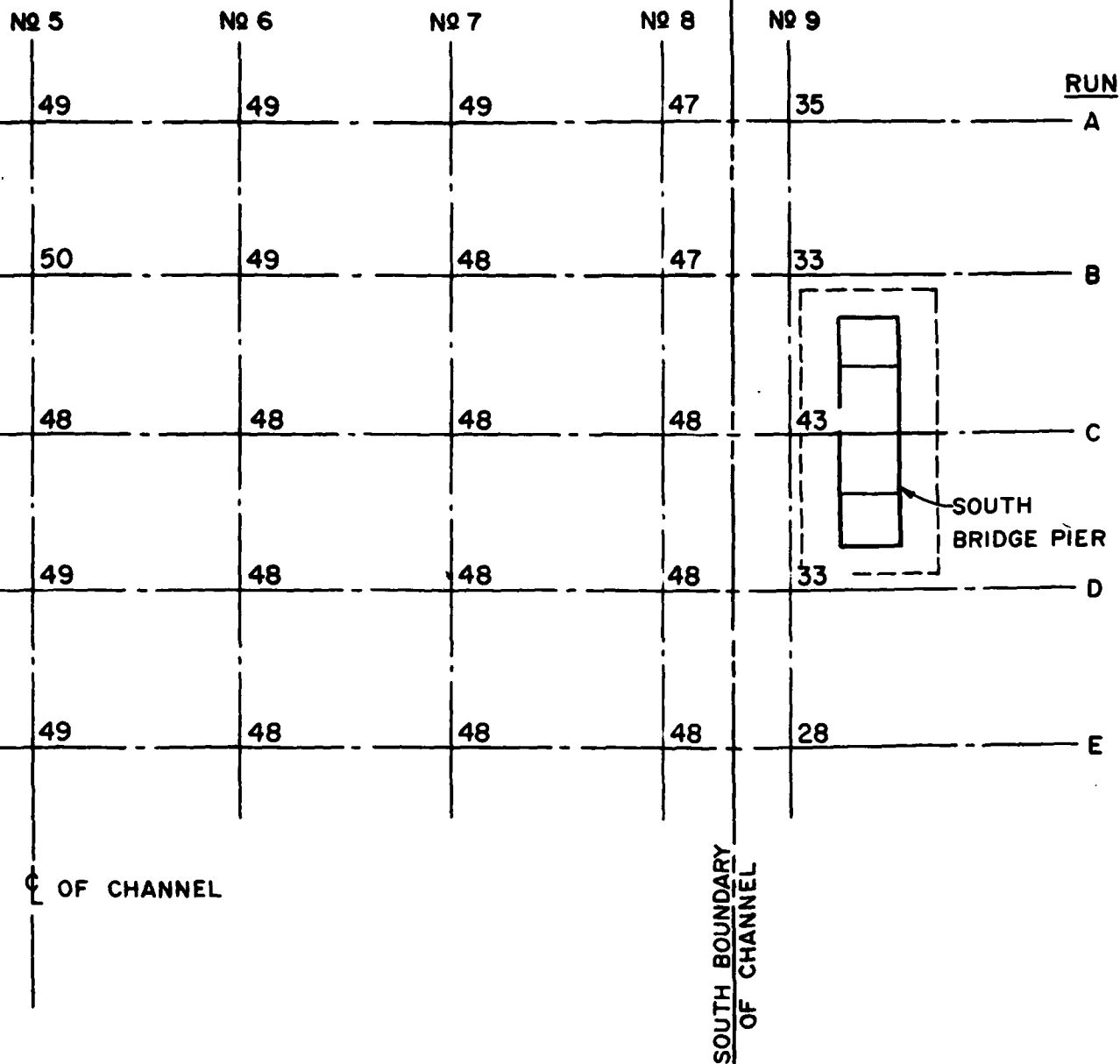
AL
SERIES NO. 11A
PAGE
NATION

CORPS OF ENGINEERS



NOTES:

1. FATHOMETER SURV. DIVING CO., INC. OCT.
2. ALL DEPTHS IN FEET TO M.H.W. EL. 5.50



VEY PERFORMED BY CALDWELL'S
T. II, 1979
ET FROM THE CANAL BOTTOM

C & D
BRIDGE INSPECT
ST. GEORGE
FATHOMET

U. S. ARMY

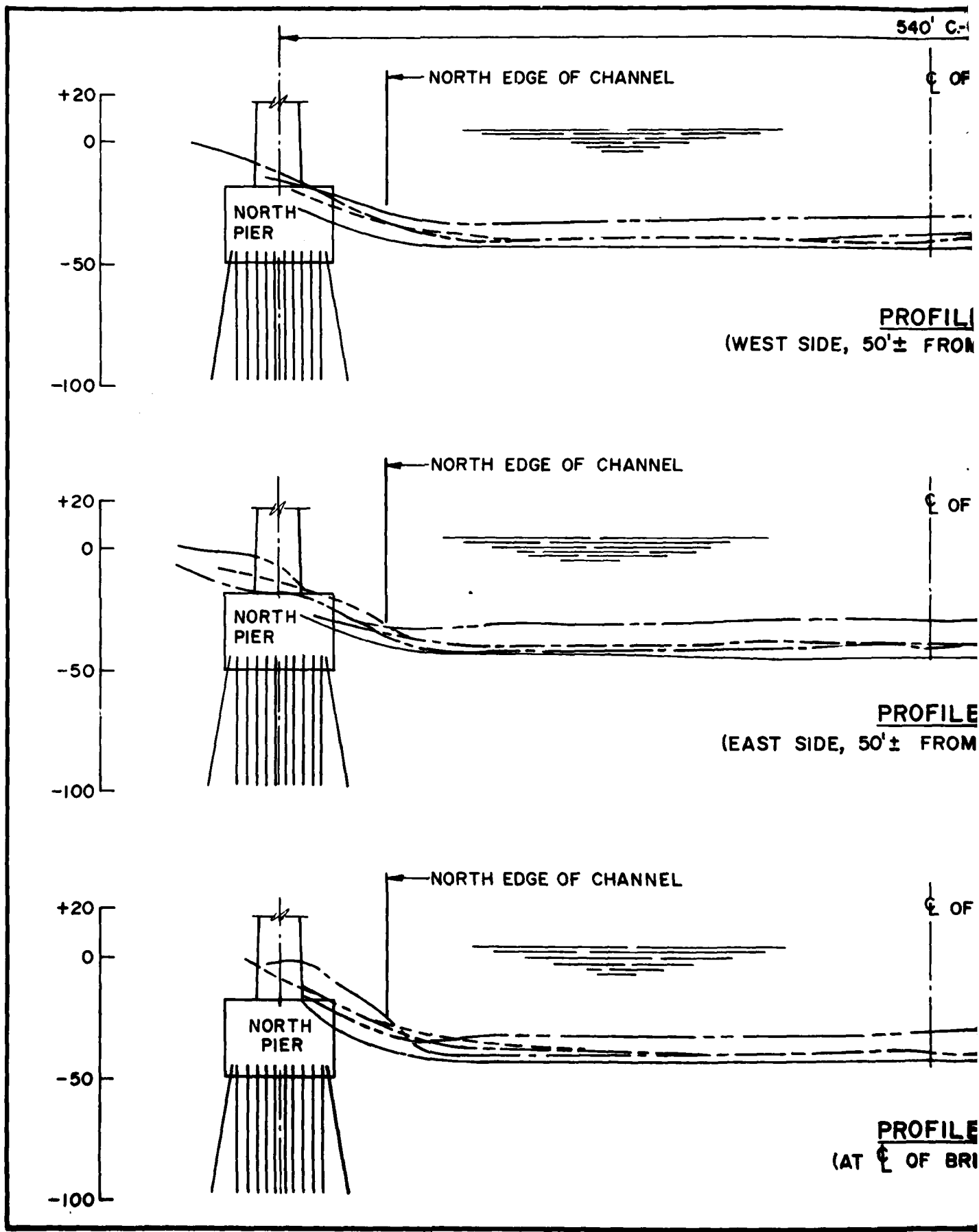
F BRIDGE

E IN FEET

0 50

D CANAL
CTION REPORT NO.11A
GES BRIDGE
TER SURVEY

WING 1-2



540' C-

NORTH EDGE OF CHANNEL

C- OF

NORTH
PIER

PROFILE
(WEST SIDE, 50'± FROM

NORTH EDGE OF CHANNEL

C- OF

NORTH
PIER

PROFILE
(EAST SIDE, 50'± FROM

NORTH EDGE OF CHANNEL

C- OF

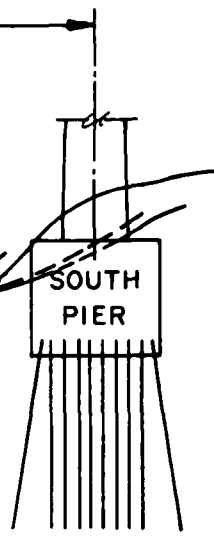
NORTH
PIER

PROFILE
(AT C- OF BRI

C-C.

OF CHANNEL

SOUTH EDGE OF CHANNEL



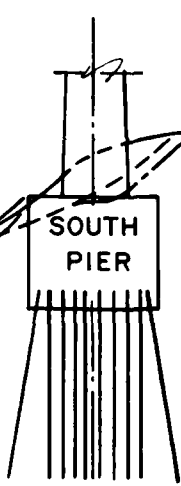
LEGEND

- GROUND LINE
- GROUND LINE
- GROUND LINE
- GROUND LINE
- GROUND LINE

FILE
FROM (OF BRIDGE)

OF CHANNEL

SOUTH EDGE OF CHANNEL



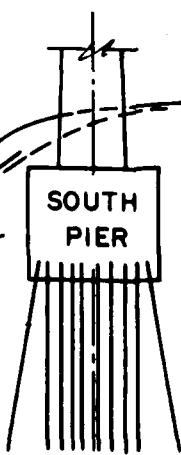
NOTES:

- 1. ELEVATIONS REFER TO CONTRACT PLANS.
- 2. MAY, 1969 GROUND LINE CORPS OF ENGINEERS HY
- 3. JUNE, 1973; MAY, 1975; SEP GROUND LINES PLOTTED SURVEYS BY OCEAN CO

FILE
FROM (OF BRIDGE)

OF CHANNEL

SOUTH EDGE OF CHANNEL



SCALE



FILE
(BRIDGE)

C &
BRIDGE INSPE
ST. GEO
HYDROGR

LEGEND

GROUND LINE (OCT 1979)
GROUND LINE (SEP 1977)
GROUND LINE (MAY 1975)
GROUND LINE (JUN 1973)
GROUND LINE (MAY 1969)

R TO DATUM SHOWN ON

LINES PLOTTED FROM
S HYDROGRAPHIC SURVEY.

, SEPT, 1977 AND OCT, 1979
TED FROM FATHOMETER
COUNTY DIVING, LTD.

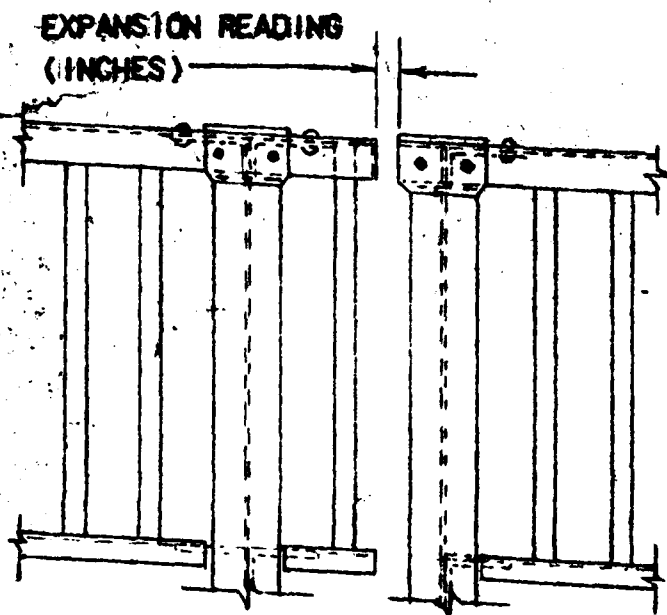
SCALE IN FEET



C & D CANAL
PECTION REPORT NO. 11A
GEORGES BRIDGE
GRAPHIC SURVEY

DRAWING 1-3

CORPS OF ENGINEERS



APPROACH ROADWAY RAILING

NOTE:

ALL MEASUREMENTS TAKEN
ALONG SIDE OF RAILING TOWARD
C. OF BRIDGE.

THIS PAGE IS BEST QUALITY PRACTICABLE
FROM COPY FURNISHED TO DDG

PIER	DATE	TEMP.	
		TEMP.	
MASS.	JULY '73	85°	
19N	1	86°	
16N		86°	
12N		85°	
10N		88°	
8N		84°	
6N		82°	
4N		82°	
2N		82°	
1S		84°	
3S		86°	
5S		85°	
7S		86°	
9S		85°	
11S		86°	
13S		86°	
15S		85°	
18S		85°	
20S	1	86°	
S. ABUT.	JULY '73	86°	

ST. GEORGES BRIDGE

EXPANSION MEASUREMENTS AT BRIDGE RAILINGS

DISTANCE (INCHES)			DATE	DISTANCE (INCHES)				DATE	DISTANCE (INCHES)	
E. RAIL	TEMP.	W. RAIL		TEMP.	E. RAIL	TEMP.	W. RAIL		TEMP.	E. RAIL
17 ₈	72°	1 ₂	MAY '75	69°	2	87°	1 ₃	SEP 77	64°	2
21 ₆	72°	21 ₆	↑	69°	3	90°	2 ₄	↑	64°	3
1 ₂	72°	2 ₃		69°	11 ₃	93°	2 ₈		64°	1
25 ₆	72°	2 ₂		87°	2	95°	21 ₆		64°	2
2	72°	21 ₆		87°	2	95°	2		64°	2
21 ₄	72°	2 ₄		87°	21 ₆	95°	2 ₂		61°	2
1 ₂	72°	3		87°	13 ₄	95°	21 ₆		61°	1
1 ₄	72°	5 ₈		87°	1 ₄	91°	7 ₁₆		61°	7
21 ₈	72°	39 ₁₆		87°	21 ₄	90°	33 ₈		76°	2
5 ₄	72°	5 ₈		87°	51 ₃	88°	51 ₆		76°	6
13 ₆	76°	11 ₆		87°	1 ₈	90°	5 ₈		76°	1
15 ₈	76°	2 ₄		87°	11 ₆	91°	21 ₆		76°	1
1 ₂	76°	11 ₆		87°	1 ₆	91°	1 ₄		76°	1
15 ₆	76°	21 ₆		87°	1 ₈	91°	11 ₆		73°	1
35 ₆	76°	27 ₁₆		87°	31 ₄	92°	21 ₆		73°	3
1 ₂	76°	21 ₄		87°	1 ₂	92°	21 ₆		73°	1
15 ₈	76°	13 ₄		87°	11 ₃	92°	1 ₈		73°	
11 ₆	76°	1 ₄		87°	1 ₄	92°	11 ₆		73°	
21 ₆	76°	13 ₄	↓	87°	21 ₄	93°	19 ₁₆	↓	73°	
21 ₆	76°	21 ₄	MAY '75	87°	2 ₈	93°	21 ₄	SEP 77	73°	

DISTANCE (INCHES)			DATE	DISTANCE (INCHES)			
E. RAIL	TEMP.	R. RAIL		TEMP.	E. RAIL	TEMP.	R. RAIL
2	71°	1 ⁵ / ₁₆	OCT '79	72°	2	75°	1 ¹ / ₄
3	71°	2 ¹⁵ / ₁₆		72°	2 ¹⁵ / ₁₆	75°	2 ⁷ / ₈
1 ⁷ / ₈	71°	2 ¹ / ₄		72°	1 ¹⁵ / ₁₆	75°	2 ¹ / ₈
2 ¹ / ₂	62°	2 ³ / ₈		72°	2 ⁷ / ₁₆	75°	2 ¹ / ₈
2 ³ / ₈	65°	2 ³ / ₁₆		72°	2 ⁵ / ₁₆	75°	2 ¹ / ₆
2 ⁵ / ₈	65°	2 ¹ / ₂		72°	2 ⁹ / ₁₆	75°	2 ³ / ₈
1 ³ / ₄	69°	2 ¹¹ / ₁₆		72°	1 ⁵ / ₈	75°	2 ¹ / ₂
7 ⁷ / ₈	69°	7 ¹ / ₁₆		72°	3 ³ / ₄	75°	4
2 ⁵ / ₈	70°	3 ⁷ / ₁₆		72°	3 ¹ / ₈	75°	3 ⁵ / ₁₆
6 ⁵ / ₁₆	71°	5 ⁵ / ₈		71°	6 ¹¹ / ₁₆	75°	4 ³ / ₈
1 ⁵ / ₁₆	71°	1 ⁵ / ₁₆		71°	1 ⁹ / ₁₆	75°	1 ¹ / ₁₆
1 ⁷ / ₈	74°	2 ¹ / ₂		71°	2 ¹ / ₁₆	75°	2 ⁵ / ₁₆
1 ¹³ / ₁₆	74°	2		71°	1 ¹⁵ / ₁₆	75°	1 ¹⁵ / ₁₆
1 ⁵ / ₈	75°	2 ¹ / ₈		71°	1 ¹³ / ₁₆	75°	1 ¹⁵ / ₁₆
3 ⁷ / ₁₆	80°	2 ⁵ / ₁₆		71°	3 ¹ / ₂	75°	2 ¹ / ₄
1 ³ / ₄	80°	2 ¹ / ₈		71°	1 ¹⁵ / ₁₆	75°	2 ¹ / ₄
2	80°	1 ³ / ₄		71°	2 ⁵ / ₁₆	75°	1 ¹¹ / ₁₆
2 ¹ / ₈	80°	1		71°	1 ⁷ / ₈	75°	1 ¹ / ₄
2 ⁷ / ₁₆	80°	1 ⁵ / ₈		71°	2 ³ / ₈	75°	1 ¹ / ₄
2 ¹³ / ₁₆	80°	2 ³ / ₁₆		71°	2 ¹⁵ / ₁₆	75°	2 ¹ / ₄

C & D CANAL
 BRIDGE INSPECTION REPORT NO. 11A
 ST. GEORGES BRIDGE
 TABULATION OF JOINT MEASUREMENTS

THIS PAGE
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STRUCTURE INVENTORY & APPRAISAL SHEET

Revised 4-77

IDENTIFICATION		CLASSIFICATION		By	Date
1 State <u>Delaware</u> - 212		2 Fed Aid System <u>01</u>		Transfer of Data	
3 Hwy District <u>U. S. 13</u>		3 Administrative <u>2</u>		Maintenance Insp	
4 County <u>001</u> 5 City/Town <u>St. Georges</u>		4 Functional <u>01</u>		Condition Analysis	
6 Inventory Route <u>121000130</u> Principal ☐ Other ☐				Appraisal	
7 Features Intersected <u>C & D Canal - over</u>				Cost Estimate	
8 Facility Carried by Structure <u>U. S. 13</u>				General Review	
9 Structure No. <u>4</u> of <u>5</u>		STRUCTURE DATA		10 Type Service <u>1-5</u>	
11 Location <u>4.5 mi W-Reedy Pt.</u>		12 Year Built <u>4272</u>		13 Structure Type - Main <u>St. tied arch</u>	
14 Milepoint <u>00000</u>		15 Lanes on Str <u>04</u> under <u>00</u>		16 Approach girder flbm <u>30</u>	
17 Road Section No. <u>056</u>		18 ADT on Str <u>022127</u> Year <u>1978</u>		19 No of Spans - Main <u>001</u>	
19 Defense Bridge Letter <u>B</u>		20 Design Load <u>5</u>		21 Approach <u>0041</u>	
22 Defense Milepoint <u>6.91 00069</u>		23 Appr Rdwy Width "Std" <u>064</u>		24 Max Span Length <u>0540</u> <u>540</u> ft	
23 Defense Section Length <u>9.68 097</u>		24 Br Median ☐ None ☐ Open ☒ Closed		25 Structure Length <u>004209</u> <u>4209</u> ft	
24 Latitude <u>39° 33.1' 39331</u>		25 Skew <u>00</u>		26 Sidewalk <u>00000</u> ft <u>0.0</u> ft Lt <u>0.0</u> ft	
25 Longitude <u>75° 39.0' 075390</u>		26 Structure Flared ☐ Yes ☒ No		27 Br Roadway Width (curb-curb) <u>0520</u> <u>52.0</u> ft	
26 Physical Vulnerability <u>4</u>		27 Navigation Control ☒ Yes ☐ No		28 Deck Width (out-out) <u>0540</u> <u>54.0</u> ft	
27 By-pass, Detour Length <u>11</u>		28 Vertical <u>133</u> ft		29 Vert Clearance over Deck <u>1710</u> <u>17.10</u> ft	
28 Toll Bridge ☐ On Toll Road ☐ On Free Road ☒		29 Horizontal <u>0450</u> ft		30 Underclearance - Vertical <u>0000</u> ft	
29 Custodian <u>U.S. ARMY CE 5</u>		30 Wearing Surface <u>1 (concrete)</u>		31 Lateral - Right <u>999</u> ft	
30 Owner <u>U.S. ARMY CE 5</u>				32 Lateral - Left <u>999</u> ft	
31 FAP No					
CONDITION		Material		Condition Analysis	
32 Deck <u>Concrete</u>		<u>Good Cond.</u>		<u>- Patch Spalls</u>	
33 Superstructure <u>Structural Steel</u>		<u>*</u>		<u>6</u>	
34 Substructure <u>Concrete</u>		<u>Good Cond.</u>		<u>- Patch Spalls</u>	
35 Channel & Channel Protection <u>Rip Rap</u>		<u>Good Cond.</u>		<u>- No Repair</u>	
36 Culvert & Retaining Walls				<u>8</u>	
37 Estimated Remaining Life <u>50</u>		38 Approach Roadway A' inment <u>Good Cond.</u>		<u>- No Repair</u>	
38 Operating Rating <u>247</u>		39 Inventory Rating <u>227</u>		<u>8</u>	
APPRAISAL		Deficiencies		Rating	
40 Structural Condition				<u>8</u>	
41 Deck Geometry <u>5% Grade on Approach Spans</u>				<u>5</u>	
42 Underclearances - Vertical & Lateral				<u>8</u>	
43 Safe Load Capacity				<u>8</u>	
44 Waterway Adequacy				<u>8</u>	
45 Approach Roadway Alignment				<u>7</u>	
PROPOSED IMPROVEMENTS		Year Needed		Completed	
46 Year Needed <u>00</u>				Describe (Item 75)	
47 Type of Service					
48 Type of Work					
49 Improvement Length				ft	
50 Design Loading					
51 Roadway Width				ft	
52 Number of Lanes				Prep Rdwy Improvement - Year	
53 ADT				Type	
COST OF IMPROVEMENTS				\$,000.	
Remarks <u>*Clean and paint rusted steel under joints, clean and free bearing devices and make expansion joints watertight.</u>					