



# FRACTURE CRITICAL PIER CAP INSPECTION REPORT

SFN3113914 (HAM-562-0147)  
SR-562 OVER ROSS AVENUE AND  
INDIANA & OHIO RAILWAY  
HAMILTON COUNTY, OH  
DISTRICT 8

July 2023

Prepared for:



Prepared by:

**COLLINS**  
ENGINEERS INC.

4449 Easton Way, Suite 200

Columbus, Ohio 43219

614.849.2777 • [www.collinsengr.com](http://www.collinsengr.com)



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### EXECUTIVE SUMMARY

- Project:** VAR-District 8 Bridge Inspections No. 2023-4. (PID No. 105476)
- Purpose of Project:** To perform a fracture critical inspection of steel pier caps of bridges for the Ohio Department of Transportation, District 8.
- Inspection Team:** Team Leader – Michael Seal, P.E. – Collins Engineers, Inc.  
Team Member – Trent Graham – Collins Engineers, Inc.  
Team Member – Matthew McFadden, E.I.T. – Gannett Fleming, Inc.
- Inspection Date(s):** July 19, 2023

#### **Summary of Findings:**

- A new crack was observed in the vertical fillet weld connecting a cap diaphragm to the web plate at Girder 6 for Pier Cap 6. The forces and stresses at this location are unique compared to the rest of the bridge due to a longitudinal deck joint, an expansion joint in Span 7 for the south half only, etc. This location will likely require additional expertise to fully ascertain the origins of the crack and an appropriate plan for mitigation. See Section 2.1.3.1 below for specifics details.
- Corrosion has reactivated at various locations on the interior of caps. This is usually the result of water ponding within the bottom of the cap. Water enters through drilled retrofit holes that are not plugged and from cap hatches. In general, locations of section loss have not advanced since the prior inspection. Specifics for each cap are included in the appropriate sections below.
- Active corrosion and other deterioration on the cap exteriors have not increased significantly since the prior inspection. Locations where noticeable change has occurred are specifically pointed out and detailed in the appropriate section below.
- Overall, there were no major changes to typical conditions for this inspection. As stated above, changes of note are specifically called out in the appropriate section below.
- The previous rehabilitation and retrofits on this bridge still function as designed. As stated above, a new crack was observed at Pier Cap 6. This crack is not directly at a retrofit, however.

#### **Summary of Recommendations:**

- It is recommended that a steel crack/fatigue specialist be consulted to determine the exact origin of the crack observed at Pier Cap 6, so an appropriate plan of mitigation can be implemented.
- Future inspections should continue to monitor the prior rehabilitation and retrofit efforts to confirm these are functioning as designed.
- The erosion gully at the base of Pier 5 should be filled in to prevent additional loss of fill around the base of the pier column.

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**NBI Ratings:**

<b>Item ID</b>	<b>Description</b>	<b>Condition Rating</b>	<b>Summary</b>
B.C.14	NSTM	4-Poor	New weld crack, corrosion and minor section loss

**AASHTO National Bridge Element (NBE) Ratings:**

<b>Element #</b>	<b>Description</b>	<b>Units</b>	<b>Total</b>	<b>Condition State</b>			
				<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
152	Steel Floor Beam	LF	531	252	272	6	1

Note: Ratings were developed using the FHWA Specifications for the National Bridge Inventory and AASHTO Manual for Bridge Element Inspection, 2<sup>nd</sup> Edition.

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## 1.0 INTRODUCTION

### 1.1 Purpose and Scope

This report consists of the results of a detailed inspection of non-redundant steel pier caps (fracture critical) performed at the SR-562 Bridge over Ross Avenue and two (2) Indiana & Ohio Railroad lines in Hamilton County, OH. Collins Engineers, Inc. (Collins) conducted the fracture critical pier cap investigation for the Ohio Department of Transportation (ODOT), District 8 on July 19, 2023.

### 1.2 General Description of the Structure

The HAM-562-0147 Bridge is a 13-span welded steel plate girder structure with a reinforced concrete deck that carries SR-562 over Ross Avenue and two (2) Indiana & Ohio Railroad lines (Figure 1). The bridge consists of a right superstructure that carries the eastbound lanes and a left superstructure that carries the westbound lanes. The overall bridge length is 1,400 ft with 36 ft clear roadway widths in both directions. The bridge is on a horizontal and vertical curve with the eastbound and westbound lanes separated by an open joint and concrete median barrier.

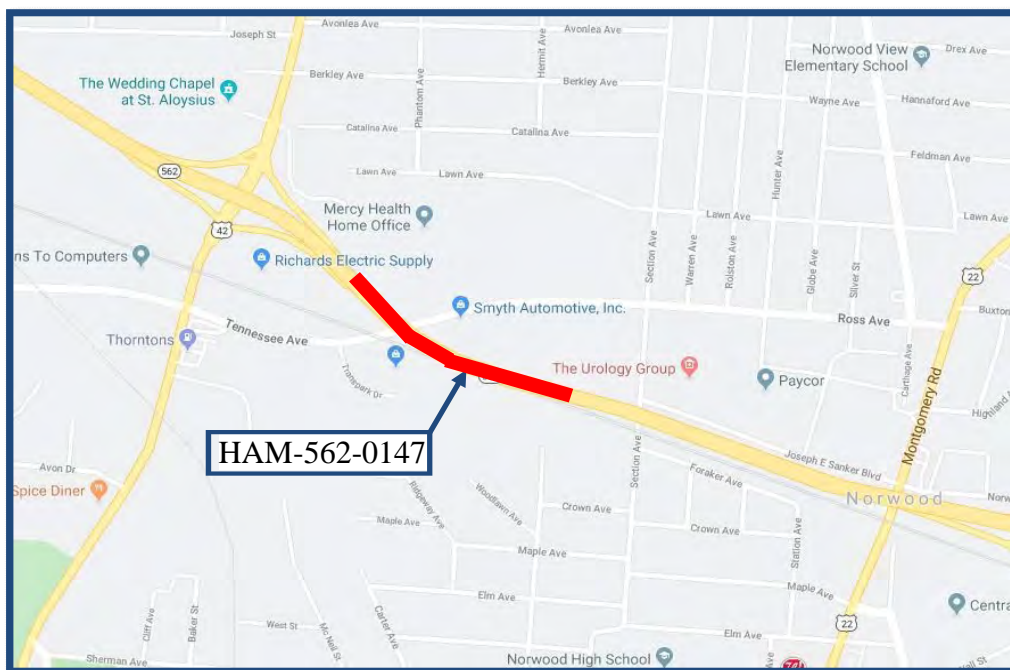


Figure 1: Bridge Location Map

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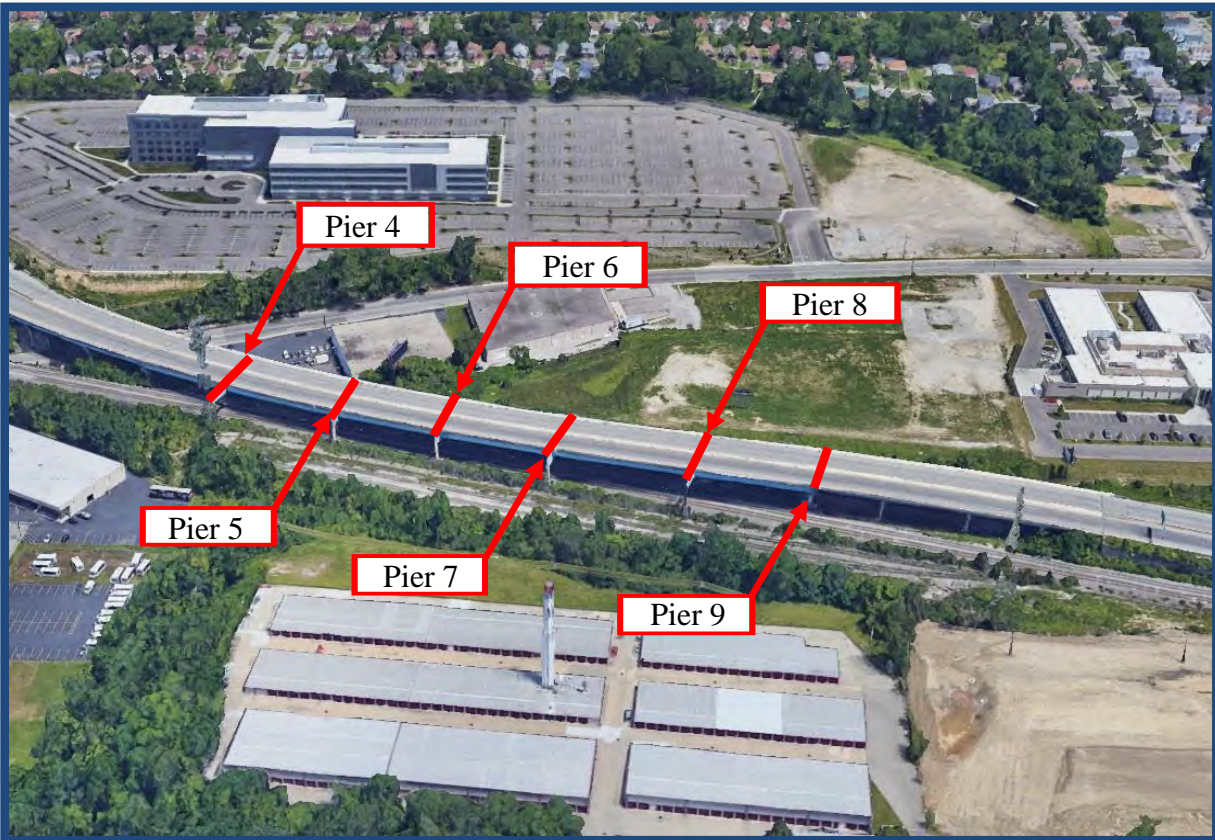
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The six (6) fracture critical pier caps of this structure are located at Piers 4 through 9 (Figure 2). At Pier 4, only the eastbound superstructure is supported while the remaining caps dually support both superstructures. All caps are welded steel plate box girders that support a varying number of welded steel plate girders. Pier Caps 4, 5, 6, 7, and 9 are simply supported with cantilevers over the left pier columns, while Pier Cap 8 is a two-span continuous unit.

The first bridge rehabilitation was performed in 1993 to address some fatigue-prone details. Girder tie plate connections to the pier caps were modified with stress relief holes or hole-and-sawcut retrofits in the pier cap web plates adjacent to filled weld intersections. Welded knee braces were removed from the pier cap web plates below every girder bottom flange tie plate. The ends of the longitudinal stiffeners were clipped and tapered in the tension zones of the pier cap webs. The ends of the longitudinal stiffener welds were ground flush with the pier cap webs; stress relief holes were drilled through the web plates near the ends of the stiffeners.

The bridge was rehabilitated again in 2015 to clean and spot paint areas exhibiting corrosion, retrofit the deck drainage system, remove extraneous welds, and regrade the embankments.



*Figure 2: Fracture Critical Pier Cap Locations*

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The bridge is inventoried in a west to east direction, and superstructure units are labeled from left to right looking east. The inspected substructure units are labeled as Piers 4 through 9.

### 1.3 Method of Investigation

On July 17-19, 2023, a three-person team consisting of a professional engineer and NBI team leader (Michael Seal, P.E.) and team members Trent Graham (Collins) and Matthew McFadden E.I.T. (Gannett Fleming) performed a fracture critical inspection of Bridge HAM-562-0147. A combination of a 46 ft bucket truck and an 80 ft aerial man-lift was used to access the fracture critical pier cap interiors (Piers 4 through 9) and perform the “arms-length” inspection of the exteriors. A railroad flagger coordinated train traffic on the Indiana & Ohio Railway Company tracks in the work zone to safely allow access to perform the inspections.

OSHA confined space entry procedures were followed while inspectors were working inside the pier caps. Entry was performed in accordance with approved confined space entry procedures per 29 CFR 1910.146. This included the use of an entry permit system, pre-entry air monitoring, continuous air monitoring, the designation of qualified entrants, attendants, and supervisor(s), and available emergency response. OSHA compliant safety harnesses and lanyards were worn by inspectors when working in the buckets. The pier cap hatch covers were removed for the entry and replaced with an impact wrench and resealed with exterior grade silicone caulk after the inspections. Various socket sizes from 1/2 in. to 15/16 in. were required to remove the hatch bolts.

Field measurements were taken using the following tools: tape measures, calipers, and an ultrasonic thickness gauge. These were used to verify the structural component dimensions. Observed deficiencies were recorded on electronic member-specific field inspection forms. Magnetic particle testing was performed at crack locations to verify crack propagation. Digital photographs were taken of the fatigue prone details and other areas of interest or concern to further document the physical condition of the pier cap.

### 1.4 Condition Ratings

State and federal guidelines for evaluating the condition of bridges have been developed to promote uniformity in the inspections performed by different teams at different times. Condition ratings are used to describe the existing, in-place bridge as compared to the as-built condition. The following table was used as a guide in evaluating the condition of the various members of the pier cap.



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CODE	CONDITION	DESCRIPTION
N	NOT APPLICABLE	Component does not exist.
9	EXCELLENT	Isolated inherent defects.
8	VERY GOOD	Some inherent defects.
7	GOOD	Some minor defects.
6	SATISFACTORY	Widespread minor or isolated moderate defects.
5	FAIR	Some moderate defects; strength and performance of the component are not affected.
4	POOR	Widespread moderate or isolated major defects; strength and/or performance of the component is affected.
3	SERIOUS	Major defects; strength and/or performance of the component is seriously affected. Condition typically necessitates more frequent monitoring, load restrictions, and/or corrective actions.
2	CRITICAL	Major defects; component is severely compromised. Condition typically necessitates frequent monitoring, significant load restrictions, and/or corrective actions in order to keep the bridge open.
1	IMMINENT FAILURE	Bridge is closed to traffic due to component condition. Repair or rehabilitation may return the bridge to service.
0	FAILED	Bridge is closed due to component condition, and is beyond corrective action. Replacement is required to restore service.

The inspection of this bridge was performed in accordance with the following documents:

1. Manual of Bridge Inspection, Ohio Department of Transportation (ODOT), 2014.
2. Manual for Bridge Element Inspection, AASHTO, 2019.
3. Bridge Inspector's Reference Manual, U.S. Department of Transportation, 2002 (rev 2012).
4. Inspection of Fracture Critical Bridge Members, U.S. Department of Transportation, 1986.
5. Specifications for the National Bridge Inventory, U.S. Department of Transportation, 2022.

## 2.0 EXISTING CONDITIONS

### 2.1 Pier Cap Conditions

#### 2.1.1 *Pier Cap 4*

Pier Cap 4 was in GOOD [7] condition (Photograph 1). Retrofits were installed in the webs of the pier cap that consist of drilled holes above and below each girder's bottom flange ends at the webs and were connected with three saw cuts. These were performed as part of a 1993 rehabilitation project. The welded knee braces were removed from the pier cap web plates below every girder bottom flange tie plate. To remove all

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welds, the surfaces were ground smooth; in the tension zones of the pier cap webs, the ends of the longitudinal stiffeners were clipped and tapered. The ends of the longitudinal stiffener welds were ground flush with the pier cap webs and stress relief holes were drilled through the web plates near the ends of the stiffeners. As part of the 2015 rehabilitation, welds between the interior backer bars and top flange or web plates were removed, and blasting and painting were performed along the interior and exterior based on limits observed in the rehabilitation plans. Drilled holes and saw cut locations were also cleaned, resealed, and expansion plugs were installed in the holes.



Photograph 1: General Elevation of Pier Cap 4, Looking West.

### 2.1.1.1 Pier Cap 4 Interior

The interior of the cap was observed to be in GOOD [7] condition, and the paint was in overall good condition as well. The following items on the interior have not changed since the previous inspection unless otherwise noted:

- Active blistering corrosion with no section loss and signs of ponding water were observed on the cap bottom flange plate on the south faces of the stiffener below Girders 1 through 4, 9A, 10, and on the south face of the north diaphragm. There was reactivated corrosion and rust staining in this area during this inspection (Photograph 2). This corrosion has recently reactivated.
- Moderate painted over pitting, typically 1/16 in. deep and up to 1/8 in. deep, was observed throughout the steel faces on the interior. The corrosion has reactivated due to water entering through the retrofit holes. Notable locations include:
  - The pitting on the lower portion of the web plates between the north end plates and Girder 9 was measured up to 1/16 in. deep with 1/8 in. near the north access hatch (Photograph 3).
  - Between the north end plate and Girder 9A, pitting up to 1/16 in. was observed across the top flange.

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- Active corrosion with no section loss and bubbling paint was observed on the south face of Girder 10 on the east web plate (Photograph 4).
  - There was a section of paint loss on the south face of the Girder 10 diaphragm.
  - An area of failing and bubbling paint was observed on the east web plate between Girders 8 and 9 due to inadequately cleaned surfaces during repainting (Photograph 5).
  - Isolated areas of peeling paint were also observed during this inspection.
  - The backer bar at the top flange plate north of Diaphragm 9 had an inward curve extruding 1/6 in. on the east web. This is likely from prior rehabilitation work but was not previously noted. This is not currently problematic.
  - Rust staining was observed extending from the top of the bottom flange plate of Diaphragm 10 to Diaphragm 9A. This is a new observation was not previously noted.
  - Throughout the interior of the pier cap, welds along the backer bars were still present between both flange plates and web plates (Photograph 6).
  - As stated above, as part of the 1993 rehabilitation project, the longitudinal stiffeners were cut and removed from the tension zones of the web plates. Stress relief holes were drilled through the web plates only at Girders 7 through 10 near the longitudinal stiffener terminations and plugged.
    - At several locations, sections of the unremoved longitudinal stiffener plates remained on the web plates adjacent to the stress relief holes. The removal of the intersections of the longitudinal and transverse stiffener welds was ineffective at both web plates and on the top and bottom halves of the web plates between Girder 6 and Girder 7 (Photograph 7).
  - During the 2015 rehabilitation, a 1/4 in. long crack was removed from the west web at the transverse stiffener on the south side of Girder 10. The crack extended from an intersection of the fillet welds connecting the longitudinal and transverse stiffeners to the west web.
    - The stiffener was clipped, and both the weld intersection and the crack were ground from the web plate, and a 1.5 in. diameter crack arrest hole was drilled during the 2015 rehabilitation.

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<p>Photograph 2: Typical Example of Ponding Water and Active Blistering Corrosion at the Bottom Flange Plate.</p>	<p>Photograph 3: Typical Example of Pitting on the Lower Portion of the Web Plates Shown between the North End Plates and Girder 9.</p>
<p>Photograph 4: Girder 10 South Face on the East Web Plate, Looking North.</p>	<p>Photograph 5: Area of Failing and Bubbling Paint on the East Web Plate between Girders 8 and 9, Looking Southeast.</p>
<p>Photograph 6: Typical Example of Weld Behind the Backer Bar Between Girders 9 and 9A, Looking West.</p>	<p>Photograph 7: Typical Ineffective Removal of the Longitudinal and Transverse Stiffener Welds from the 1993 Rehabilitation.</p>

*2.1.1.2 Pier Cap 4 Exterior*

The exterior of the cap was observed to be in GOOD [7] condition, and the paint system of the exterior was in overall good condition with minor spot corrosion along the webs and flanges throughout the pier cap. The

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paint was fading on the portion of the cap outside of the deck (Photograph 8). The following items on the exterior have not changed from the previous inspection unless otherwise noted:

- A 3/4 in. tack weld was observed on the west web plate adjacent to the south side of Girder 6.
- Five (5) 1 in. long tack welds were observed on the west web on the south side of Girder 9. (Photograph 9)
- Four (4) 1 in. long tack welds were observed on the west web on the south side of Girder 10.
- As part of the 1993 rehabilitation, the stress relief hole and sawcut retrofits were performed only at Girders 7 through 10.
  - Thin cracks and rust staining were observed in the epoxy sealant. There were also some areas missing the epoxy sealer on the east web plate at Girders 7 and 9. (Photograph 10)
  - Missing retrofit hole expansion plugs were observed between Girders 7 and 8 and on the west web at Girder 10; the missing plugs were likely the cause of the corrosion issues on the interior of pier cap (Photograph 11).
- The north access hatch was missing the neoprene gasket.
- Five out of the ten access bolts on the north access hatch cover plate were cross threaded and could not be re-installed during this inspection. The open bolt holes were covered with caulk to prevent water intrusion into the cap.
- The south access hatch was repainted during the 2015 rehabilitation and a new neoprene gasket was installed.
- Runoff has created a larger erosion gully below the abandoned railroad tracks and around the north, south, east, and west pier columns. This is an old condition that has worsened and was still present during this inspection (Photographs 12 and 13).



Photograph 8: Typical Fading Paint and Surface Corrosion at the South End of the Pier Cap, Looking West.



Photograph 9: Five 1 in. Tack Welds on the West Web at the South Face of Girder 9, Looking East.

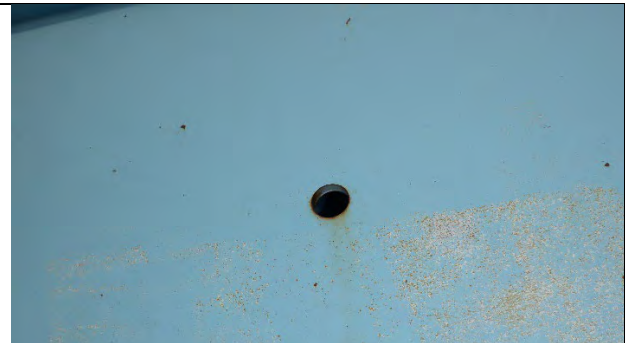
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Photograph 10: Rust Staining on the East Web Retrofit at Girder 7, Looking Northwest.



Photograph 11: Missing Expansion Plug in the West Web Retrofit Hole South of Girder 10, Looking East.



Photograph 12: Erosion at the Base of the East Column, Looking East.



Photograph 13: Erosion at the Base of the North Column, Looking East.

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### 2.1.1.3 Pier Cap 4 Fatigue Prone Details

#### *Fatigue Prone Detail 1*

Fillet welds between diaphragms or transverse stiffeners and web plates.

Category: C'

Location: All girder diaphragms and transverse web stiffeners

#### *Fatigue Prone Detail 2*

Full penetration groove weld of flange splice.

Category: B

Location: One bottom flange splice.

#### *Fatigue Prone Detail 3*

Tack weld less than 2 in. on the web plate.

Category: C

Location: One tack weld on the exterior of the west web on the south side of Girder 6; five tack welds on the exterior of the west web on the south side of Girder 9; four tack welds on the exterior of the west web on the south side of Girder 10 (10 total).

#### *Fatigue Prone Detail 8*

Intersection of fillet welds.

Category: E

Location: Fillet welds of web plates and longitudinal stiffeners intersect fillet welds of web plates and transverse stiffeners between Girders 7 and 8.

#### *Fatigue Prone Detail 9*

Drilled hole and sawcut stress relief retrofit in web plates.

Category: B

Location: Girders 7 through 10 bottom flange tie plate connections to web plates.

#### *Fatigue Prone Detail 11*

Fillet welds between longitudinal stiffeners and web plates.

Category: B

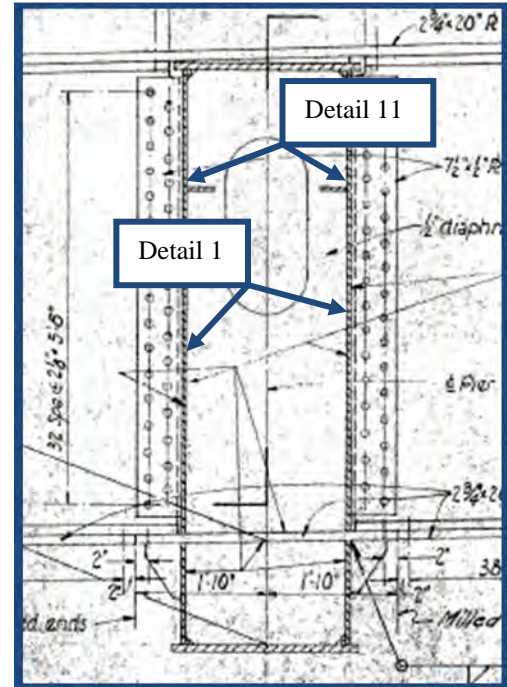


Figure 3: Section of Pier Cap 4

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Location: Upper and lower longitudinal stiffeners on the interior of the web plates.

## Fatigue Prone Detail 12

Drilled hole stress relief retrofit in web plates.

Category: D

Location: Both web plates above and below the bottom flange tie plate and on each side of the Girder 6 connection; both web plates at longitudinal stiffener terminations between the north bearing and Girder 8.

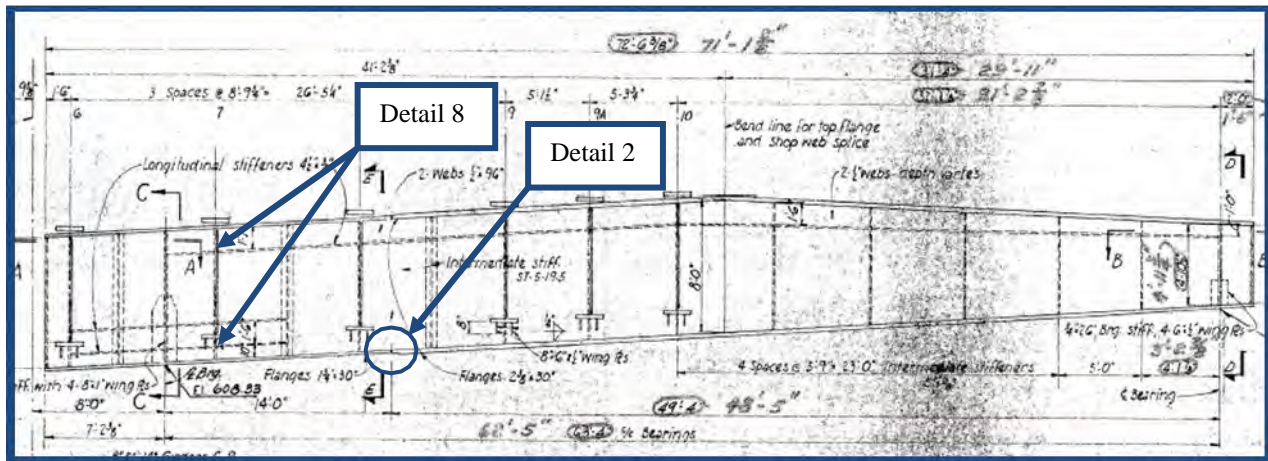


Figure 4: Elevation of Pier Cap 4

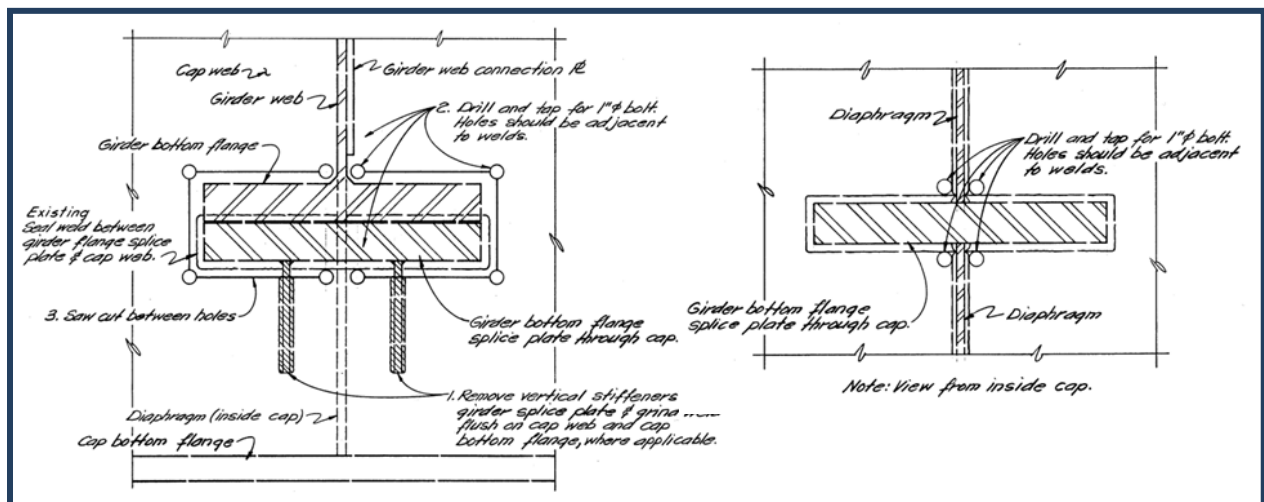


Figure 5: Web plate retrofit details from rehabilitation plans.



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### 2.1.2 Pier Cap 5

Pier Cap 5 was in GOOD [7] condition (Photograph 14). Retrofits were installed in the webs of Girder 3 and Girders 5 through 10 for the pier cap that consist of drilled holes above and below each girder's bottom flange ends at the webs and were connected with three saw cuts as part of a 1993 rehabilitation project. The welded knee braces were removed from the pier cap web plates below every girder bottom flange tie plate. To remove all welds, the surfaces were ground smooth. In the tension zones of the pier cap webs, the ends of the longitudinal stiffeners were clipped and tapered. The ends of the longitudinal stiffener welds were ground flush with the pier cap webs and stress relief holes were drilled through the web plates near the ends of the stiffeners. As part of the 2015 rehabilitation, welds between the interior backer bars and top flange or web plates were removed; blasting and painting was performed along the interior and exterior based upon limits observed in the rehabilitation plans. Drilled holes and sawcut locations were also cleaned, resealed, and had expansion plugs installed in the holes.



Photograph 14: General Elevation of Pier Cap 5, Looking West.

#### 2.1.2.1 Pier Cap 5 Interior

The interior of the cap was observed to be in GOOD [7] condition. The following items on the interior have not changed from the previous inspection unless otherwise noted:

- Ponding water evidence was observed on the bottom flange on the south sides of Girders 4 and 5 and the northernmost diaphragm (Photograph 15).
- The lower half of the pier cap interior was painted during a prior rehabilitation. Blistering and laminating corrosion were visible with little to no section loss on the south side of the cap at the bases of the diaphragms (Photograph 16).

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- A previous inspection observed that a 1-1/8 in. long vertical crack at the bottom flange fillet weld between the west web and the Girder 6 diaphragm had been removed via a retrofit that increased the size of the cope in the diaphragm. No evidence of crack propagation was observed during this inspection.
- A 1.5 in. long discontinuity was observed in the fillet welds between the west web and the top of the longitudinal stiffener on the north side of the vertical stiffener between Girders 7 and 8 (Photograph 17).
- The retrofit bolt was missing at the top drilled hole at the east web plate on the north side of Girder 3.
- The drilled retrofit and grinding performed between Girders 6 and 7 as part of the 1993 rehabilitation project was still ineffective due to the unremoved weld intersection between the longitudinal and vertical stiffener welds (Photograph 18).
- Fillet welds along the transverse web stiffeners typically exhibited rippling and an inconsistent bead cross section. Welds along the backer bars were still present between the top and bottom flanges and web plates at the following locations:
  - 33 in. long fillet weld between the top flange and east web between Girders 1 and 2.
  - 66 in. long fillet weld between the top flange and east web between Girders 2 and 3.
  - 1 in. long tack weld on east web between Girders 3 and 4.
  - Misc. tack welds south of Girder 3 at top of east web.
  - 13 in. long fillet weld between the top flange and the west web adjacent to the south side of Girder 4.
  - 6 in. long fillet weld between the top flange and the west web between Girders 5 and 6.
  - 6 in. long and 11.25 in. long fillet welds on the east web between Girders 5 and 6.
  - 5.5 in. fillet weld between the bottom flange and the east web between Girders 6 and 7.
  - 3 in. long tack weld between the top flange and east web adjacent to the north face of Girder 7.
  - Short tack welds between the south vertical face of the Girder 8 bottom flange and both web plates (Photograph 19).
  - 10.5 in. long fillet weld between the top flange and the east web between Girders 7 and 8 at the vertical web stiffener.
  - 5.25 in. long fillet weld between the bottom flange and the east web between Girders 7 and 8 (Photograph 20).
  - Misc. weld material in top west corner of Girder 8 diaphragm.
  - 6 in. long fillet weld between web and backer bar on east web, north of Girder 8.
  - 14.5 in. long fillet weld between the top flange and the east web between Girders 9 and 10.

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- 4 in. long fillet weld between the top flange and the west web between Girder 10 and the south bearing.
- 15 in. long fillet weld between top flange and east web at south bearing diaphragm.
- Small gouges were present in the web plates. These gouges appeared to have been caused during previous rehabilitations:
  - 1.5 in. long gouge in the east web near the top flange adjacent to the south face of Girder 2 (Photograph 21).
  - 1 in. long gouge in west web near top flange adjacent to the north face of Girder 4 (Photograph 22).
  - 1.5 in. long gouge in the east web near the top flange adjacent to the south face of Girder 7.
  - Numerous minor gouges were observed in the east web between Girder 5 and Girder 6 at the longitudinal stiffener retrofit locations.
- Multiple missing and incorrectly installed expansion plugs were observed in the drilled retrofit holes throughout the pier cap, but the expansion plugs did not exhibit distress or defects during this inspection.
- The north edge of the sawcut retrofit was deflected outward from the cap web up to 3/8 in. on the west web at Girder 5. This was also observed on the west web at Girder 6 which was deflected up to 1/4 in. outward; other retrofit locations exhibited minor deflections as well.



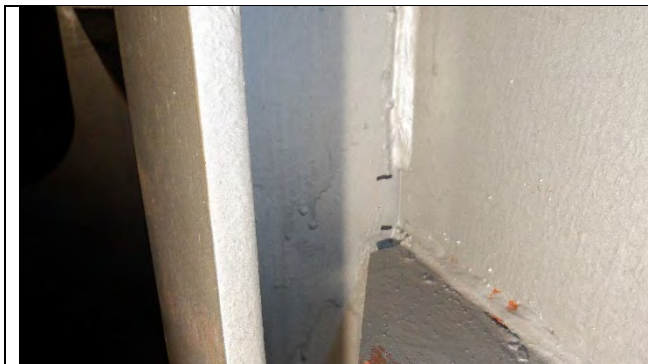
Photograph 15: Evidence of Ponding with Corrosion on the Bottom Flange on the South Side of Girder 5, Looking North.



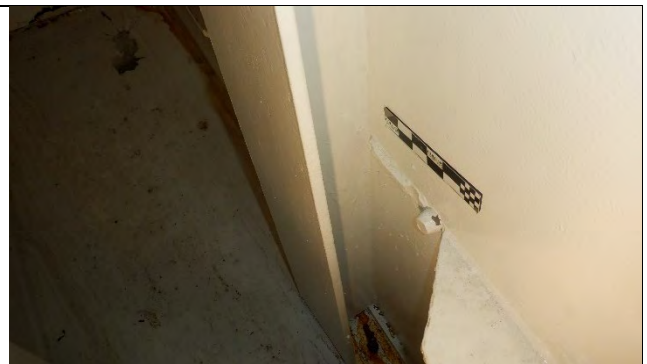
Photograph 16: Typical Corrosion on the South Side at the Bases of the Diaphragm, Looking North.

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Photograph 17: 1.5 in. Discontinuity in the Weld Between the West Web and a Web Stiffener Between Girders 7 and 8, Looking Southwest



Photograph 18: Incomplete Removal of Longitudinal Stiffener Between Girders 6 and 7, Looking East.



Photograph 19: Tack Welds on the Webs on the South Side of Girder 8 Bottom Flange, Looking West.



Photograph 20: 5.25 in. Fillet Weld Between the East Web and bottom Flange between Girders 7 and 8, Looking Southeast.



Photograph 21: 1.5 in. Gouge in the East Web on the South Side of Girder 2, Looking East.



Photograph 22: 1 in. Gouge in the West Web on the North Side of Girder 4, Looking West.

### 2.1.2.2 Pier Cap 5 Exterior

The exterior of the cap was observed to be in GOOD [7] condition, but the paint system of the pier cap exterior was in fair condition. The paint exhibited rust staining and flaking paint on the east web and top flange between Girders 5 and 6 due to leakage through the longitudinal soffit joint. This has not changed since the last

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inspection. The following items on the exterior have not changed from the previous inspection unless otherwise noted:

- Below the Girder 3 north web, minor porosity was observed in the web where knee braces were removed. This is a new finding.
- Fading paint and minor surface corrosion was observed on the portions outside of the deck area.
- Previously observed areas of painted over section loss in the web plates above the tie plate for Girders 1 and 5 were in good condition. However, the corrosion has reactivated, and the section loss has worsened. The corrosion was observed to be severe with increased section loss and is visible between the plates. There was rust staining from this area along the web plate at Girder 1 (Photograph 23).
- The south web hatch still had one stripped bolt caulked in place in the top left corner. The north access hatch was missing the middle bolt along the east edge, and the hole was still caulked over to ensure a proper seal.
- As part of the 1993 rehabilitation project, the drill and sawcut retrofits were performed at Girder 3 and Girders 5 through 10 only.
  - Gouges in the web around the sawcuts were observed in several locations.
  - The north edge of the sawcut retrofit was deflected outward from the cap web up to 3/8 in. on the west web at Girder 5. This was also observed on the west web at Girder 6 which was deflected up to 1/4 in. outward; other retrofit locations exhibited minor deflections as well.
  - No cracks were observed beyond the drilled holes in the welds.
  - The removal of the girder knee braces, as part of the 1993 rehabilitation project, resulted in over-grinding in the web plate and minor porosity in the web. There were several missing expansion plugs for the drilled retrofit holes and scattered areas of missing epoxy sealant in the sawcut retrofits (Photographs 24 through 26).
- The three downspout brackets along the east web below Girders 4 through 6 were retrofitted with bolted connections to the web plate as part of the 2015 rehabilitation project.

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Photograph 23: Reactivated Corrosion at Previously Painted Over Section Loss on the East Web at Girder 1.



Photograph 24: Typical 1993 Rehabilitation Drill and Saw Cut Retrofits with Web Deflection.



Photograph 25: Bolted Connection Between the Girder 6 Drain to the South Web Retrofit.



Photograph 26: Minor Porosity in Web Where Knee Braces Were Removed.

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### 2.1.2.3 Pier Cap 5 Fatigue Prone Details

#### *Fatigue Prone Detail 1*

Fillet welds between diaphragms or transverse stiffeners and web plates.

Category: C

Location: All girder diaphragms and transverse web stiffeners.

#### *Fatigue Prone Detail 2*

Full penetration groove weld of flange splice.

Category: B

Location: One bottom flange splice and one top flange splice.

#### *Fatigue Prone Detail 3*

Tack weld less than 2 in. on the web plate.

Category: C

Location: One tack weld on the interior of the east web plate between Girders 3 and 4.

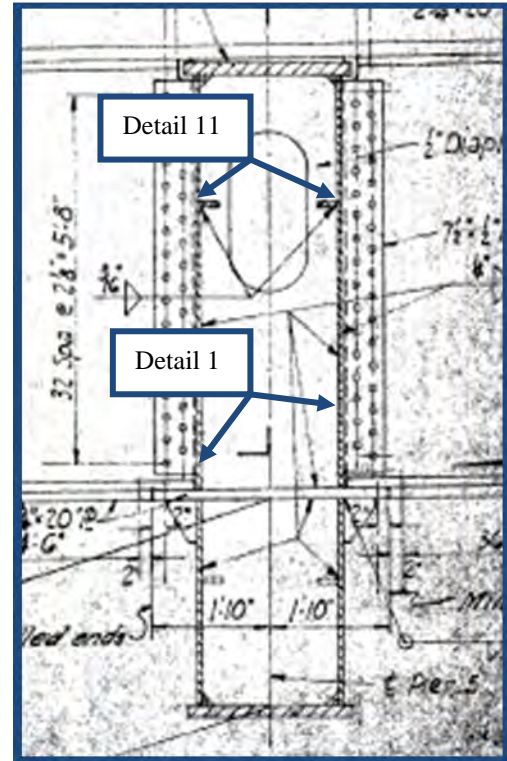


Figure 6: Section of Pier Cap 5

#### *Fatigue Prone Detail 5*

Fillet weld greater than 4 in. or 12 times the connection thickness with a connection thickness less than 1.0 in. on the web plates.

Category: E

Location: 33 in. fillet weld between the ½ in. top flange backer bar and the east web between Girders 1 and 2; 66 in. fillet weld between the ½ in. top flange backer bar and the east web on the south side of Girder 2; 13 in. fillet weld between the ½ in. top flange backer bar and the west web at Girder 4.

#### *Fatigue Prone Detail 8*

Intersection of fillet welds.

Category E

Location: Fillet welds of web plates and longitudinal stiffeners intersect fillet welds of web plates and transverse stiffeners between Girders 6 and 7.

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### *Fatigue Prone Detail 9*

Drilled hole and sawcut stress relief retrofit in web plates.

Category: B

Location: Girders 5 through 10 bottom flange tie plate connections to both web plates, and Girder 3 bottom flange tie plate connection to both web plates.

### *Fatigue Prone Detail 11*

Fillet welds between longitudinal stiffeners and web plates.

Category: B

Location: Upper and lower longitudinal stiffeners on the interior of the web plates.

### *Fatigue Prone Detail 12*

Drilled hole stress relief retrofit in web plates.

Category: D

Location: Both web plates above and below the bottom flange tie plate and on each side of the pier cap connections of Girders 1, 2 and 4; both web plates at longitudinal stiffener terminations between Girders 5 and 7.

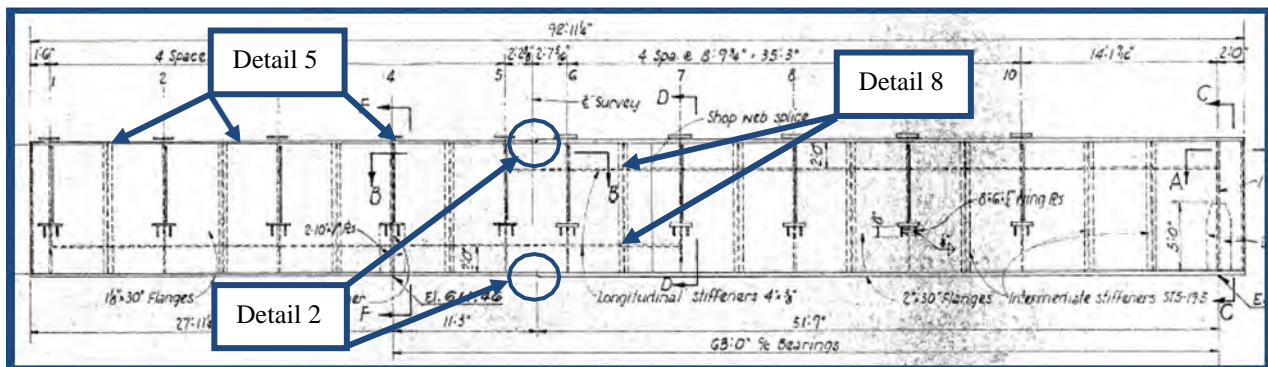


Figure 7: Elevation of Pier Cap 5



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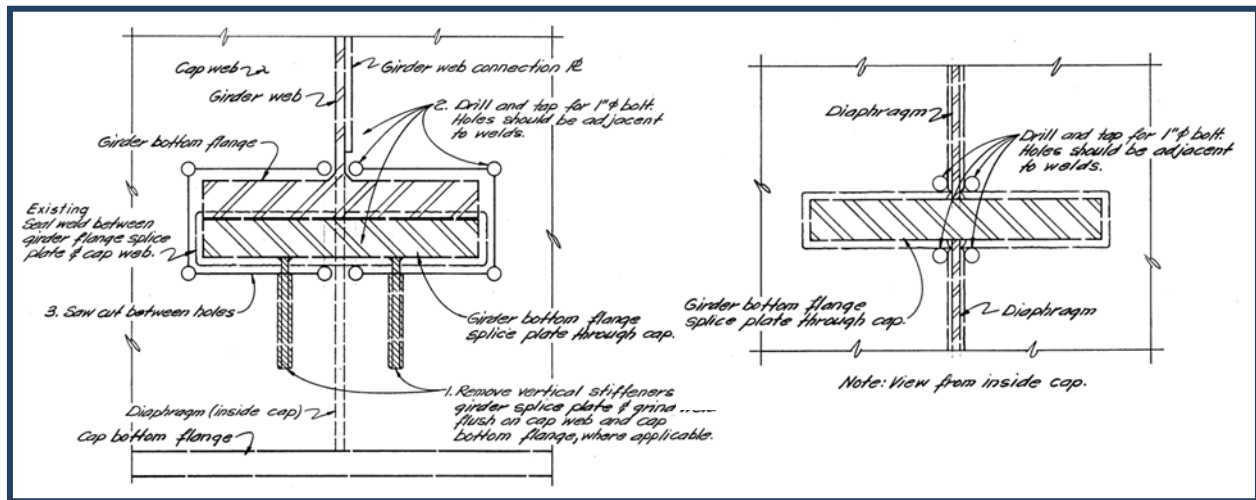


Figure 8: Web plate retrofit details from rehabilitation plans

### 2.1.3 Pier Cap 6

Pier Cap 6 was in POOR [4] condition (Photograph 27). Retrofits were installed in the webs for the pier cap that consist of drilled holes above and below each girder's bottom flange ends at the webs and were connected with three sawcuts as part of a 1993 rehabilitation project. The welded knee braces were removed from the pier cap web plates below every girder bottom flange tie plate. To remove all welds, the surfaces were ground smooth. In the tension zones of the pier cap webs, the ends of the longitudinal stiffeners were clipped and tapered. The ends of the longitudinal stiffener welds were ground flush with the pier cap webs and stress relief holes were drilled through the web plates near the ends of the stiffeners. As part of the 2015 rehabilitation, welds between the interior backer bars and top flange or web plates were removed. Blasting and painting were performed along the interior and exterior based upon limits observed in the rehabilitation plans. Drilled holes and sawcut locations were also cleaned, resealed, and had expansion plugs installed in the holes.



Photograph 27: General Elevation of Pier Cap 6, Looking West.



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### 2.1.3.1 Pier Cap 6 Interior

The interior of the cap was observed to be in POOR [4] condition. Scattered areas of surface corrosion and peeling paint was observed throughout the pier cap. The peeling paint was mainly in the upper portions of the pier cap and at the diaphragms. A significant crack was observed at the west plate at the north side of Diaphragm 6. The following items on the interior have not changed from the previous inspection unless otherwise noted:

- A new crack was observed at the top of the vertical fillet weld connecting the Girder 6 diaphragm to the west web plate. This crack measures 1.5 in. and extends downward from the end of the weld at the diaphragm cope. At this location, a backer bar is present along the top flange plate and east web plate and per design plans there is a strap plate on the girder top flanges that passes over (and is connected to) the top flange plate of the pier cap. The longitudinal deck joint between north and south halves of the bridge is present between Girders 5 and 6 (thus this girder acts as an exterior girder for the south half relative to this joint). Additionally, there is a deck expansion joint just east this area approximately 15 ft away in Span 7 for just the eastbound traffic (south half of the bridge), which causes different loads and stresses in this region for the south half compared to the north half. Combined, all these factors contribute to a complex arrangement for the forces and stresses in this region. See Photographs 28 through 30 below.
- Ponding water up to 2 in. deep was observed between the north end of the cap and the north bearing diaphragm, as well as south of Girder 3 (Photograph 31). Ponding evidence was observed on the upslope sides of remaining girder diaphragms, and surface corrosion of the bottom flange was in these areas due to the water ponding.
- Laminating corrosion and debris build up was observed on the bottom flange between the north end plate and Girder 1. Section loss measurements were still not able to be obtained due to space constraints between the end plate and the tie plate for Girder 1 but were 1/8 in. deep maximum.
- As part of the 2015 Rehabilitation Project, an attempt to remove tack welds via grinding was implemented along the web plates and the backer bars. Numerous welds were observed between the backer bars and the top flange and web plates throughout the pier cap:
  - Stitch welds were present between the north end plate and east web.
  - 13 in. long fillet weld south of north bearing diaphragm between the top flange backer bar and east web.
  - 10 in. long fillet weld south of Girder 2 along the top flange backer bar and east web.
  - Multiple fillet welds starting 18 in. north of the north bearing and ending 48 in. south of Girder 2 along the top flange backer bar and west web.

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- 10 in. long fillet weld at the top of the east web on both sides of Girder 3.
  - 1 in. long tack welds between Girders 4 and 5 along the top flange backer bar and top flange, adjacent to the west web. The process of installing a tack weld has created a shallow divot of 1/8 in. diameter in the top flange.
  - Two 5 in. long fillet welds between Girders 5 and 6 along the top flange backer and the west web and the top flange backer bar and the top flange.
  - 10 in. long between Girders 5 and 6 along the top flange backer bar and the east web that also intersect the vertical weld connecting the web plates together.
  - 7.5 in. long fillet weld south of Girder 6 along the top flange backer bar and the west web.
  - 12.5 in. long fillet weld south of Girder 7 along the top flange backer bar and the west web.
  - 8 in. long fillet weld, top of east web, at the south edge of Girder 7.
  - 14 in. long fillet weld on the south edge of Girder 10 along the top flange backer bar and the east web.
- The 1993 drilled retrofit and grinding performed between the north bearing and Girder 3 was ineffective due to the unremoved weld intersection between the longitudinal and vertical stiffener welds. There were several locations where holes have developed in the epoxy sealant around the retrofit, allowing water to leak through the retrofit. Surface corrosion and bubbling paint on the pier cap web plates and stiffeners at Girders 2, 5, 6, 7, and 10 were caused by this leaking water (Photograph 32).



Photograph 28: View of 1.5 in. Weld Crack at the Top of the Fillet Weld for the Diaphragm to West Web Plate at Girder 6, North Side of Diaphragm. Perspective View, Looking South.



Photograph 29: View of 1.5 in. Weld Crack at the Top of the Fillet Weld for the Diaphragm to West Web Plate at Girder 6, North Side of Diaphragm. Perspective View, Looking South.

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Photograph 30: View of 1.5 in. Weld Crack at the Top of the Fillet Weld for the Diaphragm to West Web Plate at Girder 6, North Side of Diaphragm. Close-Up View, Looking South.



Photograph 31: Typical Ponding Water and Surface Corrosion on Bottom Flange.



Photograph 32: Typical Paint Defect and Surface Corrosion Due to Missing Epoxy Sealant at Retrofit.

### 2.1.3.2 Pier Cap 6 Exterior

The exterior of the cap was observed to be in GOOD [7] condition. The exterior exhibited minor freckling corrosion and areas of missing paint at the north and south ends of the cap outside of the deck limits (Photograph 33). Overall, the paint was faded aside from areas that were spot painted below each girder. At an area of painted over section loss on the east web plate on the north side of Girder 6, corrosion was beginning to reactivate (Photograph 34). The following items on the exterior have not changed from the previous inspection unless otherwise noted:

- Five of the ten bolts were missing from the south end access hatch; the holes have been caulked over to prevent water infiltration.
- As part of the 1993 rehabilitation, drill holes and sawcut retrofits were performed at all girders. During the removal of the girder knee braces, over-grinding occurred in the web plate below all girders. The area of the deepest over-grind was observed below Girders 8 on the west web (Photograph 35).
  - Several retrofit locations were missing expansion plugs.

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- The east web plate at the retrofit on the north side of Girder 5 was bowed inward (west) up to 1/8 in. out of plane.
- The west web plate at the retrofit on the south side of Girder 4 was bowed inward (east) up to 1/16 in. out of plane.
- The east web plate at the retrofit on the north side of Girder 9 was bowed inward (west) up to 1/8 in. out of plane.
- Two cracked tack welds, one newly observed, was observed on the north face of Girder 4 between the girder web and the pier cap west web connection plate (Photograph 36).
- There was one cracked tack weld and one poor quality tack weld on the north face of Girder 1 at the girder web and pier cap west web connection plate (Photograph 37).
- As part of the 2015 rehabilitation project, the six downspout brackets along the east web below Girders 6 and the north end were retrofitted with bolted connections to the web plate.



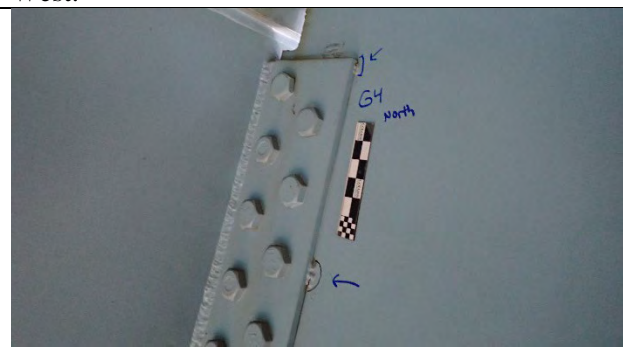
Photograph 33: Typical Condition of the Exterior of Pier 6 at the West Web Plate, Looking North.



Photograph 34: Corrosion Was Beginning to Reactivate at Previously Painted Over Section Loss at Girder 5 and Pier Cap East Web Plate, Looking West.



Photograph 35: Heavy Gouging on West Web Plate Below Girder 8 From Girder Knee Brace Removal, Looking East.



Photograph 36: Cracked Tack Welds on the North Face of Girder 4 and Pier Cap West Web Plate Connection, Looking Southeast.

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### 2.1.3.3 Pier Cap 6 Fatigue Prone Details

#### *Fatigue Prone Detail 1*

Fillet welds between diaphragms or transverse stiffeners and web plates.

Category: C

Location: All girder diaphragms and transverse web stiffeners.

#### *Fatigue Prone Detail 2*

Full penetration groove weld of flange splice.

Category: B

Location: Two bottom flange splices.

#### *Fatigue Prone Detail 8*

Intersection of fillet welds.

Category: E

Location: Fillet welds of the east web and longitudinal stiffeners intersect fillet welds of the web plate and diaphragms or transverse stiffener between the north bearing and the nearest transverse web stiffener.

#### *Fatigue Prone Detail 9*

Drilled hole and sawcut stress relief retrofit in web plates.

Category: B

Location: All girder bottom flange tie plate connections to the web plates.

#### *Fatigue Prone Detail 11*

Fillet welds between longitudinal stiffeners and web plates.

Category: B

Location: Upper and lower longitudinal stiffeners on the interior of the web plates.

#### *Fatigue Prone Detail 12*

Drilled hole stress relief retrofit in web plates.

Category: D

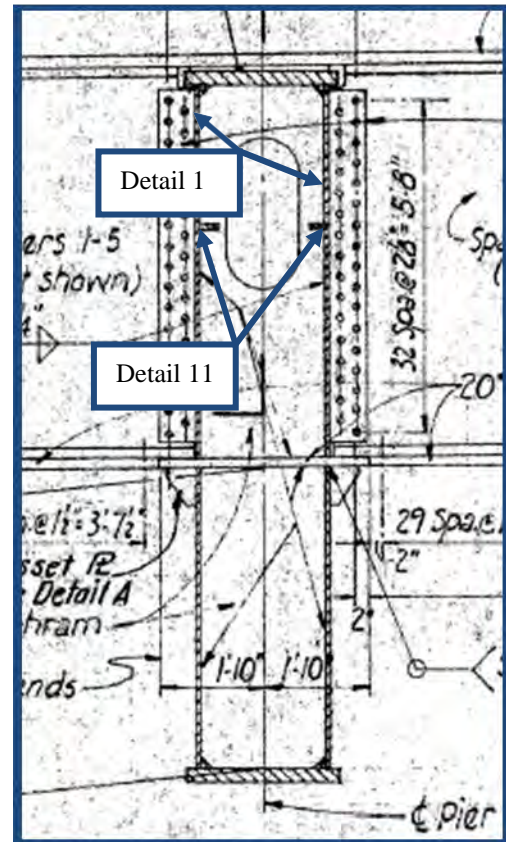


Figure 9: Section of Pier Cap 6

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Location: Both web plates at longitudinal stiffener terminations between the north bearing and the nearest transverse web stiffener.

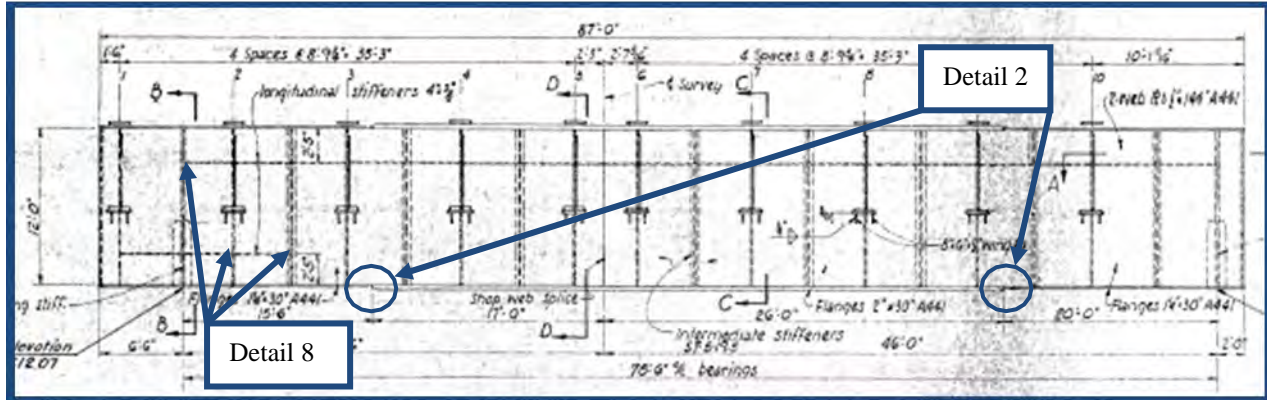


Figure 10: Elevation of Pier Cap 6

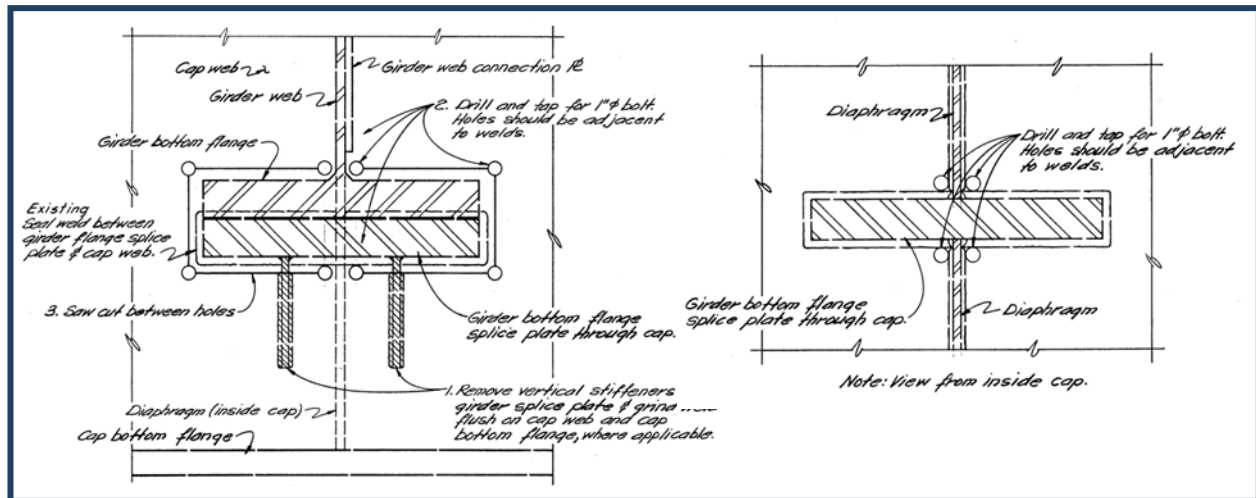


Figure 11: Web plate retrofit details from rehabilitation plans

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### 2.1.4 Pier Cap 7

Pier Cap 7 was in GOOD [7] condition (Photograph 37). As part of a 1993 rehabilitation project, retrofits were installed in the webs for the pier cap that consist of drilled holes above and below each girder's bottom flange ends at the webs and were connected with three sawcuts. The welded knee braces were removed from the pier cap web plates below every girder bottom flange tie plate. To remove all welds, the surfaces were ground smooth. In the tension zones of the pier cap webs, the ends of the longitudinal stiffeners were clipped and tapered. The ends of the longitudinal stiffener welds were ground flush with the pier cap webs and stress relief holes were drilled through the web plates near the ends of the stiffeners. As part of the 2015 rehabilitation, welds between the interior backer bars and top flange or web plates were removed. Blasting and painting was performed along the interior and exterior based upon limits observed in the rehabilitation plans. Drilled holes and sawcut locations were also cleaned, resealed, and had expansion plugs installed in the holes.



Photograph 37: General Elevation of Pier Cap 7, Looking East.

#### 2.1.4.1 Pier Cap 7 Interior

The interior of the pier cap was in overall good condition. Painting was performed as part of the 2015 rehabilitation project throughout portions of the interior of the cap and was in overall good condition with scattered areas of peeling paint and exposed primer in the portions that were not painted in 2015; surface corrosion was observed randomly at some repainted locations. The following items on the interior have not changed from the previous inspection unless otherwise noted:

- Painted over pitting up to 1/16 in. deep was observed along the bottom flange at both the north and south ends of the pier cap.
- As part of the 1993 rehabilitation project, the ends of the longitudinal stiffeners were cut and removed from the tension zones of the web plates. At Girder 2, stress relief holes were drilled through the weld



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at the cut end of the longitudinal stiffener (Photograph 38). The expansion plugs were missing at the upper stiffener retrofit hole.

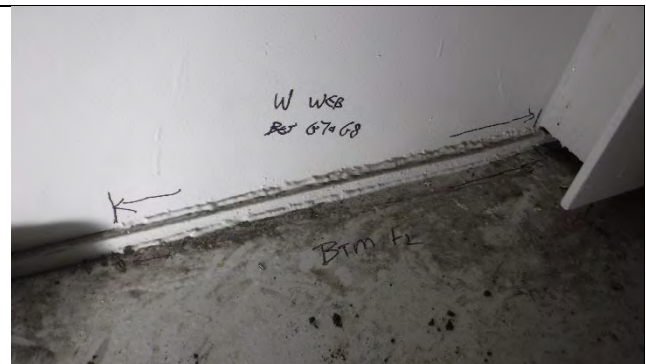
- As part of the 2015 rehabilitation project, an attempt to remove tack welds via grinding was implemented along the web plates and the backer bars. Multiple welds were observed between the backer bars and the top flange and web plates throughout the pier cap. Locations include:
  - 5.5 in. long fillet weld between bottom flange backer bar and east web between south bearing diaphragm and south end plate.
  - Multiple fillet welds between 4 in. to 6 in. long between Girders 1 and 2 at east web and top flange backer bar and the top flange backer bar and the top flange plate.
  - Fillet welds were present between Girders 2 and 3, 3 and 4, 4 and 5, 5 and 6, 8 and 9, and 9 and 10 along the top flange backer bar and top flange and top flange backer bar and east web.
  - 24 in. long fillet weld between Girders 7 and 8 along the west web and bottom flange backer bar and bottom flange backer bar and the bottom flange (Photograph 39).
  - Numerous 4 to 6 in. long fillet welds between Girders 7 and 8 along the east web and top flange backer bar and the top flange backer bar and the top flange plate.
  - Four fillet welds between 4 in. to 6 in. long between south bearing stiffener and south end plate along the top flange and top flange backer bar and the top flange backer bar and the east web.
  - Fillet welds measuring 4 in. to 6 in. long run along both top and bottom flanges on the east web between Diaphragm 10 and the south bearing stiffener. Corrosion has reactivated between the backer bar and east web near welds as well. This has occurred since the prior inspection (Photograph 40).
- A 1/4 in. long discontinuity was observed in the fillet weld of the west web and top weld along the transverse stiffener between Girders 7 and 8 (Photograph 41).
- Isolated locations of overlapping passes and porosity in the welds were found in the transverse stiffeners throughout the pier cap.

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Photograph 38: Typical Longitudinal Stiffener Retrofit Detail.



Photograph 39: 24 in. Fillet Weld Between the West Web and Bottom Flange Between Girders 7 and 8, Looking Southeast.



Photograph 40: Corrosion Has Reactivated Between Backer Bar and East Web Near Welds, Looking West.



Photograph 41: 1.25 in. Discontinuity in the Transverse Stiffener Weld on West Web Between Girders 7 and 8, Looking East.

### 2.1.4.2 Pier Cap 7 Exterior

The exterior of the pier cap was in overall good condition with areas of peeling paint and surface corrosion observed throughout. The primary locations of paint defects were at the edges and corners of the pier cap (Photograph 42). The following items on the exterior have not changed from the previous inspection unless otherwise noted:

- Rust staining was observed along the east and west webs between Girder 5 and Girder 6. This was caused by the leaking soffit longitudinal joint. The top flange exhibited peeling paint and surface corrosion along the east and west webs between Girder 5 and Girder 6.
- There was surface corrosion with areas of bubbling and peeling paint on the edges of the bottom flange.
- The south bearing masonry plate exhibited surface corrosion (Photograph 43). This has reactivated since the last inspection.
- Six (6) tack welds between 2 in. to 5 in. long and in random orientations were observed near the south end of the top flange. Adjacent to these welds, a 3 in. wide by 5.5 in. long lifting plate was welded to

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the top flange. A previously observed tack weld exhibiting a 1 in. long crack in one of the top flange tack welds had broken off prior to the previous inspection; the tack weld no longer exists. No evidence of cracking into the base metal was observed.

- An 8 in. long steel rod and nut was welded to the pier cap below the north access hatch.
- As part of the 2015 rehabilitation project, drill hole and sawcut retrofits were installed at all girders. There were scattered minor offsets in the web plates at some of these retrofits. There were also scattered areas of missing epoxy sealant and holes in some of the expansion plugs at the retrofits.



Photograph 42: Typical Pier 7 Paint Condition.



Photograph 43: South Bearing Masonry Plate Corrosion, Looking West.

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### 2.1.4.3 Pier Cap 7 Fatigue Prone Details

#### *Fatigue Prone Detail 1*

Fillet welds between diaphragms or transverse web stiffeners and web plates.

Category: C

Location: All girder diaphragms and transverse web stiffeners.

#### *Fatigue Prone Detail 2*

Full penetration groove weld of flange splice.

Category: B

Location: Two bottom flange splices.

#### *Fatigue Prone Detail 3*

Tack welds less than 2 in.

Category: C

Location: Tack welds along the bottom flange backer bar and the east web at Girders 6 and 7, between Girders 7 and 8, and between Girders 9 and 10 (ground, but not completely removed).

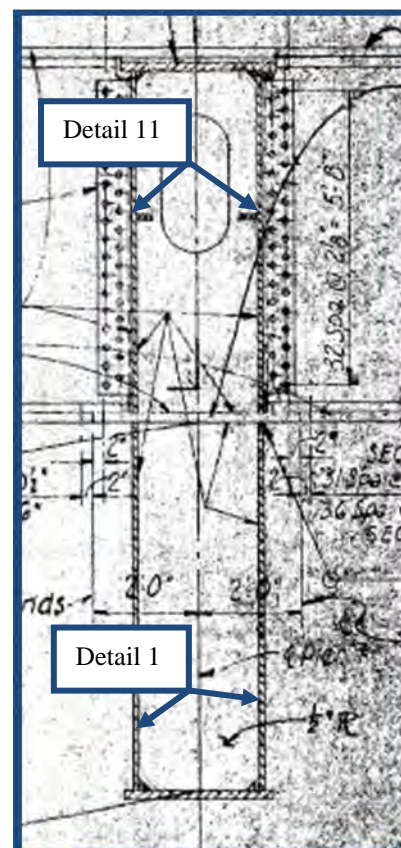


Figure 12: Section of Pier Cap 7

#### *Fatigue Prone Detail 5*

Fillet welds greater than 4 in. or 12 times the connection thickness with a connection thickness less than 1.0 in. on the web and flange plates.

Category: E

Location: Intermittent fillet welds 4 in. to 6 in. in length along the 1/2 in. east web backer bar and both the web and top flange plates between Girders 1 and 2; Intermittent fillet welds 4 in. to 6 in. in length along the 1/2 in. east web backer bar and both the web and bottom flange plates between Girder 10 and the south bearing; One 24 in. fillet weld along the 1/2 in. west web backer bar and bottom flange plate between Girders 7 and 8.

#### *Fatigue Prone Detail 9*

Drilled hole and sawcut stress relief retrofit in web plates.

Category: B

Location: All girder bottom flange tie plate connections to the web plates.

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## Fatigue Prone Detail 11

Fillet welds between longitudinal stiffeners and web plates.

Category: B

Location: Upper and lower longitudinal stiffeners on the interior of the web plates.

## Fatigue Prone Detail 12

Drilled hole stress relief retrofit in web plates.

Category: D

Location: Both web plates at longitudinal stiffener terminations at Girder 2.

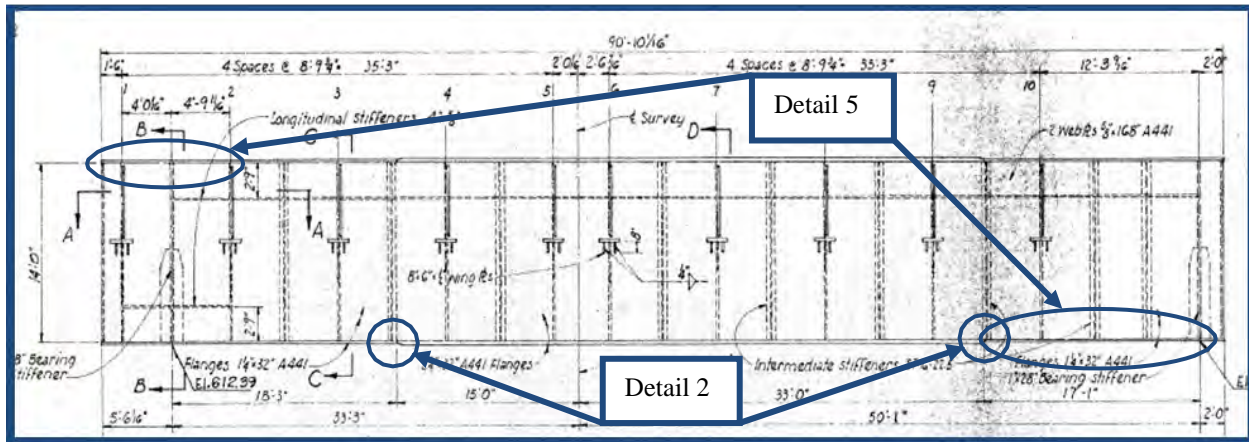


Figure 13: Elevation of Pier Cap 7

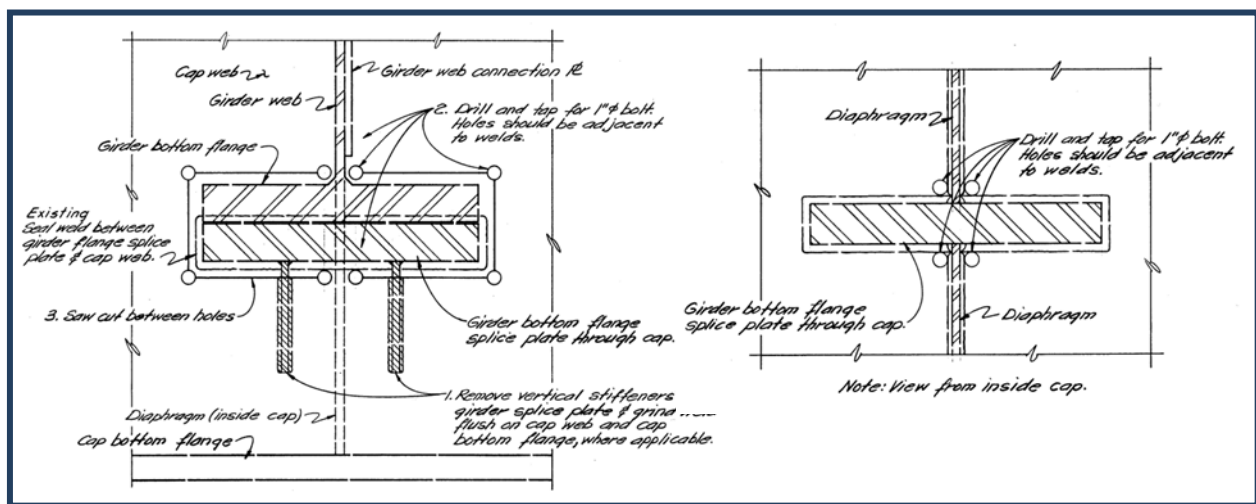


Figure 14: Web plate retrofit details from rehabilitation plans

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### 2.1.5 Pier Cap 8

Pier Cap 8 was in GOOD [7] condition (Photograph 44). Retrofits were installed in the webs for the pier cap that consist of drilled holes above and below each girder's bottom flange ends at the webs and were connected with three sawcuts as part of a 1993 rehabilitation project. The welded knee braces were removed from the pier cap web plates below every girder bottom flange tie plate. The surfaces were ground smooth to remove all welds. In the tension zones of the pier cap webs, the ends of the longitudinal stiffeners were clipped and tapered. The ends of the longitudinal stiffener welds were ground flush with the pier cap webs and stress relief holes were drilled through the web plates near the ends of the stiffeners. As part of the 2015 rehabilitation, welds between the interior backer bars and top flange or web plates were removed. Blasting and painting was performed along the interior and exterior based upon limits observed in the rehabilitation plans. Drilled holes and sawcut locations were also cleaned, resealed, and had expansion plugs installed in the holes.



Photograph 44: General Elevation of Pier Cap 8, Looking East.

#### 2.1.5.1 Pier Cap 8 Interior

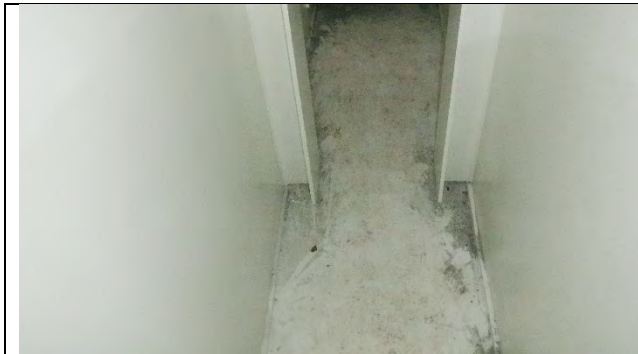
The interior of the pier cap was overall in good condition. The paint was still in good condition with a few minor areas of peeling paint and paint chipping along the bottom flange (Photograph 45). The following items on the interior have not changed from the previous inspection unless otherwise noted:

- An area of bubbling paint and rust staining was observed on the web plates, bottom flange, and stiffeners on both sides of Girder 10. This was caused by the seepage through retrofit holes (Photograph 46).
- Multiple fillet welds were observed between the backer bars at both the top and bottom flanges and both web plates. These fillet weld locations and lengths are noted in Table 1 below. These locations are in a tension zone.
- A 20 in. long by up to 1/16 in. deep cut was observed in the girder bottom flange strap plate on the south side of Girder 9.

**FRACTURE CRITICAL INSPECTION**

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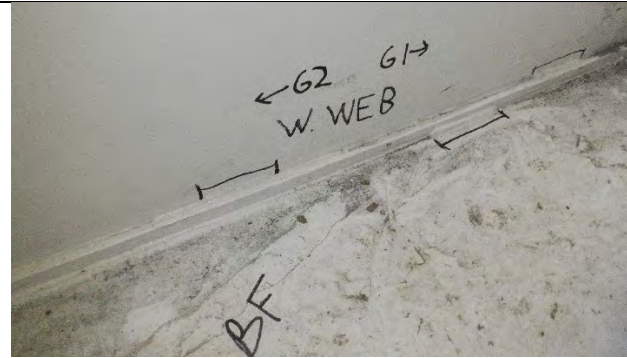
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Photograph 45: Typical Bottom Flange Paint Condition.



Photograph 46: Rust Staining from Retrofit Holes at Girder 10.



Photograph 48: Tack Welds in the West Web Between Girders 1 and 2, Looking East.



Photograph 49: Weld Extending Through Web Cope at Girder 8, Looking Southeast.

**FRACTURE CRITICAL INSPECTION**

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TABLE 1 – Pier Cap 8 Interior Fillet Welds (Tension Zones)					
Location	Web	Flange	Plate	Weld Length(s) (in)	Notes
Girder 1 to Girder 2	West	Bottom	Web	(2) 3.5 in., (2) 4.5 in., 5.5 in.	Photograph 47
			Flange	4 in., 4.5 in.	
Girder 2 to Girder 3	West	Bottom	Web	3.5 in., (3) 4 in., 4.75 in., 5 in.	
			Flange	5 in., 4 in.	
Girder 3 to Girder 4	West	Bottom	Web	3.5 in., (2) 4 in., (2) 4.5 in., 5 in.	
			Flange	4 in., 4.25 in.	
Girder 4 to Girder 5	West	Bottom	Web	2.5 in., (2) 3.5 in., 4.5 in., 5 in.	
			Flange	4 in., 5 in.	
Girder 5 to Girder 6	West	Top	Web	3.5 in., (2) 4 in.	
			Flange	4.25 in.	
Girder 6 to M Bearing	West	Top	Web	(2) 4 in., 4.5 in.	Between interior bearing and Girder 6 west web bottom flange
			Flange	5 in.	
		Bottom	Flange	5 in.	
M Bearing to Girder 7	West	Top	Web	(3) 4.25 in.	
			Flange	4.5 in.	
Girder 7 to Girder 8	West	Top	Web	(2) 3.5 in., (2) 4 in., 4.5 in., 5 in.	
			Flange	3.5 in., 5 in.	
Girder 8 to Girder 9	West	Bottom	Web	(2) 3.25 in., 3.5 in., 4 in., 4.25 in., 4.5 in., 5 in.	
			Flange	4 in., 5 in.	
	East	Top	Flange	4 in.	Weld extends through web cope (Photograph 48)
Girder 9 to Girder 10	West	Bottom	Web	(2) 3 in., 3.5 in., 4 in., (2) 4.5 in.	
			Flange	(2) 5 in.	
	East	Flange	5.5 in.		
Girder 10 to S Bearing	West	Bottom	Web	3.25 in., (3) 3.5 in., (3) 4 in., (2) 4.25 in., 4.5 in., (5) 5 in., 5.25 in., 6.25 in.	
			Flange	4.25 in., (2) 4.75 in., (3) 5 in., 5.25 in., 5.5 in.	
	East	Flange	5.5 in.	Welds located in tension zone	





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### 2.1.5.2 Pier Cap 8 Exterior

The exterior of the pier cap was in overall Satisfactory condition with flaking paint and surface corrosion on the top and bottom flanges throughout the length of the pier cap. The surface corrosion was heavier at the exposed southern end of the pier cap and along the lower corner of the cap on the east face (Photograph 49). The following items on the exterior have not changed from the previous inspection unless otherwise noted:

- A lifting hook was welded to the top flange at the south end of the cap. This was most likely installed during construction. No cracks were observed at or around the three random 3-inch-long welds around the hook.
- The longitudinal joint between the decks of the east and west bound lanes was leaking. This resulted in rust staining along both edges of the top flange and both east and west web plates between Girders 5 and 6.
- Reactivated corrosion was observed at an area of painted over 1/16 in. section loss on the west web on the south side of Girder 10 (Photograph 50).
- An area of surface corrosion was observed on the east and west webs on the north side of Girder 1 and along the lower corner of the cap on the east face.
- As part of the 1993 rehabilitation project, the drill hole and sawcut retrofits were performed at all girders.
  - At the west web of Girder 5, a partially miss-drilled hole was observed at the top right corner, but the correct hole was drilled closer to the weld intersection.
  - The east web retrofit on the south side of Girder 7 was bowing inward up to 1/16 in. out of plane (Photograph 51).
  - The top corner of the east and west web retrofits on the south side of Girder 6 were bowing outward up to 1/8 in. out of plane.
  - Areas of missing epoxy sealant were observed at the sawcut retrofits at Girder 10.
- As part of the 2015 rehabilitation project, knee braces were removed from the webs below all the girders. Remnants of the fillet welds for the knee braces remained and intersected the weld between bottom flange plate and web plate on each side of the girder.
- The end hatches were in overall good condition; the south end hatch had one stripped bolt along the east edge and was caulked in place.

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Photograph 49: Surface Corrosion with No Section Loss Along the Lower Corner of the Cap on the East Face, Looking Southwest.



Photograph 50: Reactivated Corrosion at Girder 10, Looking Southeast. No Change Since the Last Inspection.



Photograph 51: No Change to 1/16 in. Bow/Indentation Previously Observed, Looking Northwest.

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### 2.1.5.3 Pier Cap 8 Fatigue Prone Details

#### *Fatigue Prone Detail 1*

Fillet welds between diaphragms or transverse web stiffeners and web plates.

Category: C

Location: All girder diaphragms and transverse web stiffeners.

#### *Fatigue Prone Detail 2*

Full penetration groove weld of flange splice.

Category: B

Location: Two bottom flange splices and two top flange splices.

#### *Fatigue Prone Detail 5*

Fillet welds greater than 4 in. or 12 times the connection thickness with a connection thickness less than 1.0 in. on the web and flange plates.

Category: E

Location: Intermittent fillet welds 4 in. to 6 in. in length along the 1/2 in. west web backer bar and both the web and top flange plates between Girders 4 and 9; Intermittent fillet welds 4 in. to 6 in. in length along the 1/2 in. west web backer bar and both the web and bottom flange plates between the north bearing and Girder 5 and between Girder 8 and the south bearing; One 5.5 in. fillet weld along the 1/2 in. east web backer bar and the bottom flange plate between Girders 9 and 10.

#### *Fatigue Prone Detail 8*

Intersection of fillet welds.

Category: E

Location: Remnants of two knee brace fillet welds intersect the full penetration groove welds between the bottom flange and both web plates below Girders 1, 2, 3, 4, 8, 9, and 10 (28 total).

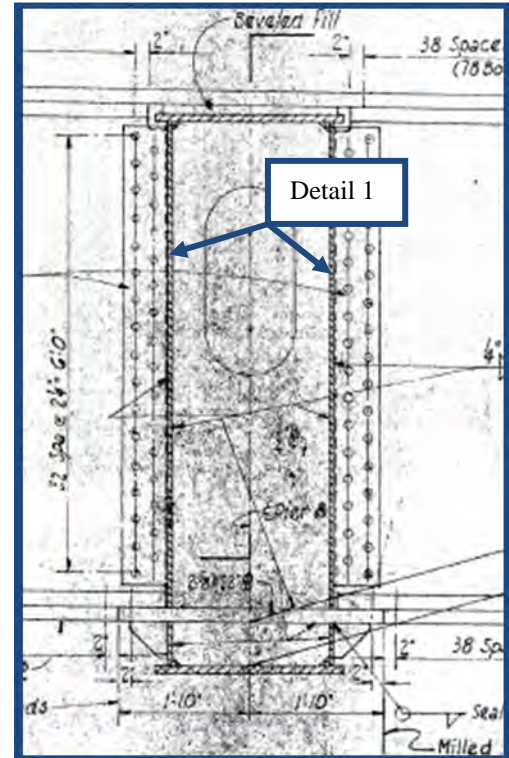


Figure 15: Section of Pier Cap 8

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## Fatigue Prone Detail 9

Drilled hole and sawcut stress relief retrofit in web plates.

Category: B

Location: All girder bottom flange tie plate connections to the web plates.

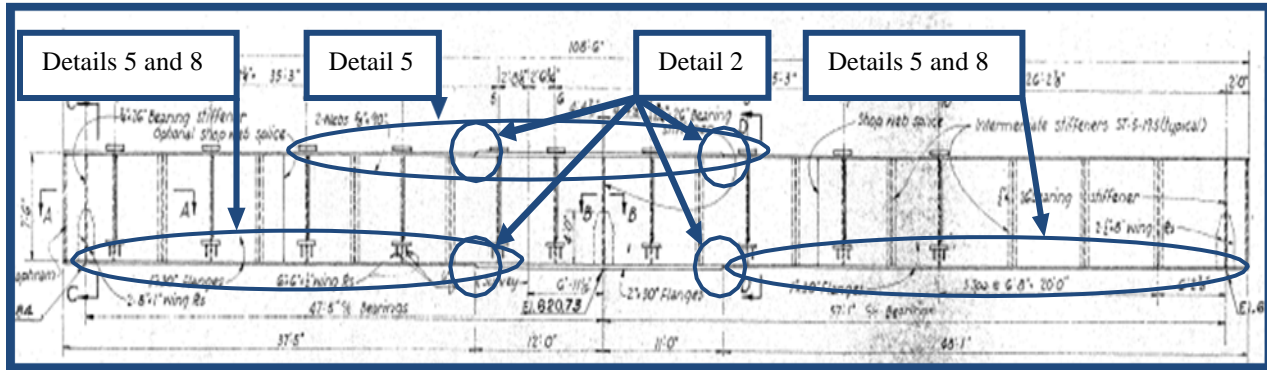


Figure 16: Elevation of Pier Cap 8

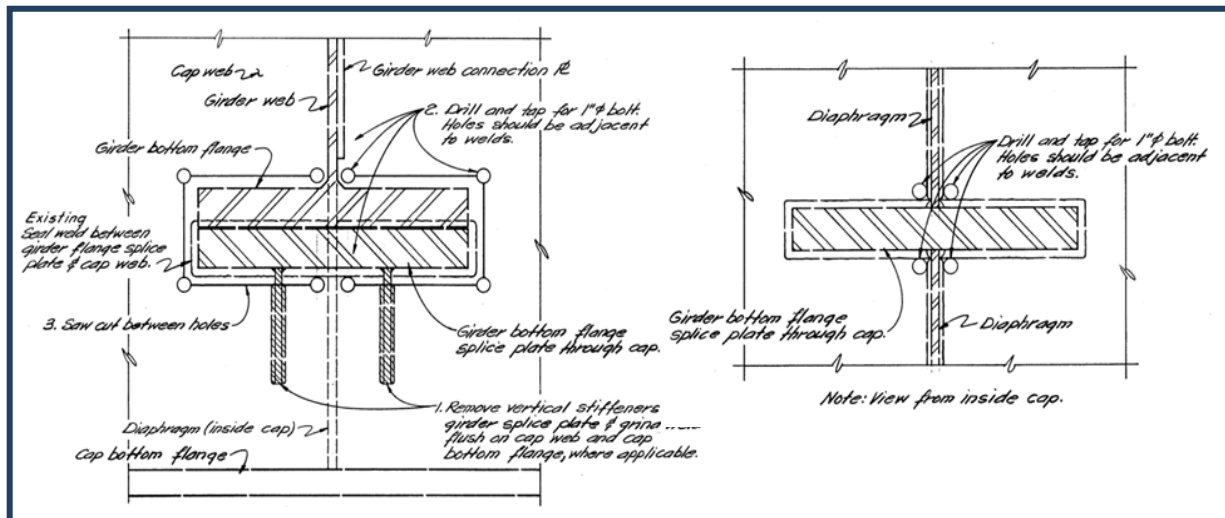


Figure 17: Web plate retrofit details from rehabilitation plans

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### 2.1.6 Pier Cap 9

Pier Cap 9 was in GOOD [7] condition (Photograph 52). As part of a 1993 rehabilitation project, retrofits were installed in the webs of Girders 4 through 8 for the pier cap that consist of drilled holes above and below each girder's bottom flange ends at the webs and were connected with three sawcuts. Girders 1 and 2 and Girders 9 and 10 received retrofits consisting only of drilled holes. The welded knee braces were removed from the pier cap web plates below every girder bottom flange tie plate. To remove all welds, the surfaces were ground smooth. In the tension zones of the pier cap webs, the ends of the longitudinal stiffeners were clipped and tapered. The ends of the longitudinal stiffener welds were ground flush with the pier cap webs and stress relief holes were drilled through the web plates near the ends of the stiffeners. As part of the 2015 rehabilitation, welds between the interior backer bars and top flange or web plates were removed. Blasting and painting was performed along the interior and exterior based upon limits observed in the rehabilitation plans. Drilled holes and sawcut locations were also cleaned, resealed, and had expansion plugs installed in the holes.



Photograph 52: General Elevation of Pier Cap 9, Looking East.

#### 2.1.6.1 Pier Cap 9 Interior

The interior of the pier cap was overall in good condition, and the interior was dry at the time of the inspection (Photograph 53). The paint was also overall in good condition. Many partial length fillet welds were present between the backer bars at both the top and bottom flanges and both web plates. A list of current fillet welds and their locations are included in Table 2 below, and some of these welds were partially removed as part of the 2015 rehabilitation.

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Photograph 53: Typical Interior Condition of Pier Cap 9, Looking South.



Photograph 54: Typical Fillet Welds Along Backer Bar Between Girders 5 and 6, Looking Southeast.



Photograph 55: Typical Fillet Welds Along Backer Bar Between Girders 5 and 6, Looking Northeast.



Photograph 56: Newly Observed 4.5 in. Fillet Weld Along the Lower Corner of Diaphragm 6, Looking East.

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TABLE 2 – Pier Cap 9 Interior Fillet Welds					
Location	Web	Flange	Plate	Weld Length(s) (in)	Notes
Girder 1 to Girder 2	East	Top	Flange	2 in., (2) 4.5 in.	2 in. weld partially ground, 2 in. remain
		Bottom	Web	4.25 in., 4.5 in.(new)	An addition 4.5 in. just south of stiffener.
			Flange	3.75 in., 4.5 in., 5 in.(new)	An addition 5 in. south of stiffener.
Girder 2 to Girder 3	East	Top	Flange	5 in.	6 in. weld partially removed, 2 in. remain
			Web	3.25 in., 3.75 in., 5.5 in., (2) 6 in.	
		Bottom	Flange	2.5 in., (2) 3.75 in., 5.5 in.	
	West	Bottom	Flange	6 in.	
Girder 3 to Girder 4	West	Bottom	Flange	6 in.	North of bearing
	East		Web	(2) 5.5 in.	
			Flange	2.5 in.	North of bearing
Girder 4 to Girder 5	East	Top	Web	4 in., 6 in.	Under Girder 5; 6 in. weld partially removed
Girder 5 to Girder 6	East	Top	Flange	5.5 in., 5 in.	Photographs 54 and 55
			Web	3.5, 4 in., 4.5 in., 5 in.	
Girder 6 to Girder 7	East	Top	Web	(6) up to 6 in.	
			Flange	5.5 in., 10 in.	
		Bottom	Web	2 in., 3.5 in., 4.5 in.	Under Girder 7 and Girder 6, respectively. A newly observed 4.5 in. was located just south of Girder 6 (Photograph 56)
Girder 7 to Girder 8	East	Top	Flange	5 in. and 6 in.	
		Bottom	Web	3.5 in., (2) 4 in., 5 in., 5.5 in.	Under Girder 7
	West	Bottom	Web	9 in.	Centered on stiffener
Girder 8 to Girder 9	East	Bottom	Web	(2) 3 in., (2) 4.5 in.	Between Girder 9
Girder 9 to Girder 10	East	Bottom	Web	(4) 3.5 in., 4.5 in.	



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### 2.1.6.2 Pier Cap 9 Exterior

The exterior of the pier cap was in overall good condition as well. The following items on the exterior have not changed from the previous inspection unless otherwise noted:

- Between the end of Girders 1, 6 and 7 and the west pier cap web, corrosion has begun to reactivate at previously noted painted over 1/16 in. section loss. (Photograph 57).
- Painted over pitting up to 1/16 in. deep around the edge of Girder 1 on the cap web plate was observed.
- Pack rust up to 1/2 in. thick was observed between the girder bottom flanges and the tie plates.
- On the west side between Girders 1 and 8, corrosion was observed on the top corner of the cap and caused the deck haunch to spall at isolated areas along the top flange edge. No exposed rebar from the spalls and no section loss on the steel was observed. (Photograph 58).
- Corrosion was observed on the top flange, and rust staining was observed on the east and west web plates between Girders 5 and 6 due to leakage through the longitudinal deck joint (Photograph 59). The rust staining was observed on the east face, and corrosion was only observed along the top corner of the west face.
- As part of the 1993 rehabilitation project, the drill hole and sawcut retrofits were only performed at Girders 4 through 8. Girders 1 and 2 and Girders 9 and 10 received retrofits consisting only of drilled holes. These drilled holes were installed below the tie plates at roughly the edges of the girder webs. At several locations, the epoxy sealant was partially missing from the sawcuts. At Girders 5 and 8 (west side only), there were missing expansion plugs (Photograph 60).
- Minor surface corrosion was observed at the base of the masonry plate on both bearings, with the north bearing exhibiting more corrosion than the south bearing.
- The north bearing was missing two out of four anchor rods.
- Surface corrosion was typical on the pot bearings along the bottom edges of all masonry plates and at random locations on the sole plates. No significant deterioration was observed during this inspection.



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Photograph 57: Pack Rust Up To 1/2 in. Between Girder and Tie Plate and Painted Over Pitting to 1/16 in. on Cap Web, Looking Southeast.



Photograph 58: No Change to Spall Along Haunch, Looking East.



Photograph 59: View of Surface Corrosion on Top Flange Plate Edge and Rust Staining on Cap Web Plate, Looking West.



Photograph 60: Typical Example of Missing Expansion Plugs, Looking East.

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### 2.1.6.3 Pier Cap 9 Fatigue Prone Details

#### *Fatigue Prone Detail 1*

Fillet welds between diaphragms or transverse web stiffeners and web plates.

Category: C

Location: All girder diaphragms and transverse web stiffeners.

#### *Fatigue Prone Detail 5*

Fillet welds greater than 4 in. or 12 times the connection thickness with a connection thickness less than 1.0 in. on the web and flange plates.

Category: E

Location: One 7 in. fillet weld along the 1/2 in. top flange backer bar and the east web plate between Girders 1 and 2; Intermittent fillet welds 4 in. to 6 in. in length along the 1/2 in. bottom flange backer bar and the east web plate between Girders 5 and 8; Three fillet welds 4 in. to 6 in. in length along the 1/2 in. top flange backer bar and both the flange and east web plates between Girder 8 and the south bearing (ground, but not completely removed); One 9 in. fillet weld along the 1/2 in. bottom flange backer bar and the west web plate between Girders 7 and 8.

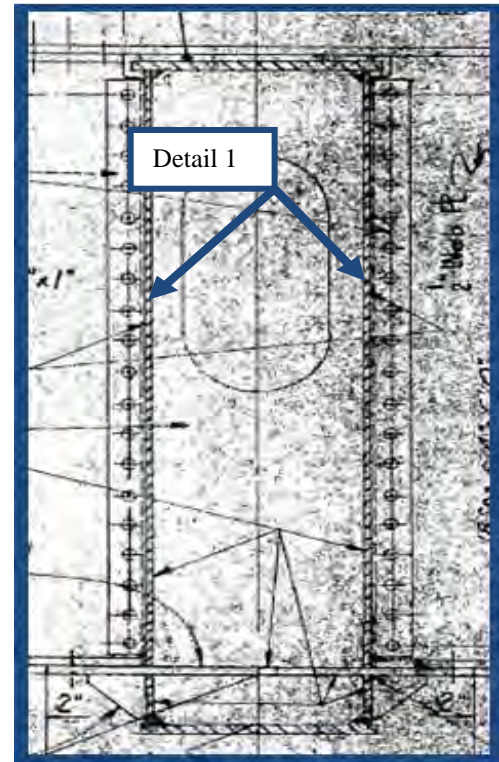


Figure 18: Section of Pier Cap 9

#### *Fatigue Prone Detail 9*

Drilled hole and sawcut stress relief retrofit in web plates.

Category B

Location: Girders 5 through 7 bottom flange tie plate connections to both web plates, and Girder 8 bottom flange tie plate connection to the west web plate.

#### *Fatigue Prone Detail 12*

Drilled hole stress relief retrofit in web plates. Category: D

Location: Both web plates above and below the bottom flange tie plate and on each side of the pier cap connections of Girders 1, 2, 3, 4, 8, 9, and 10.

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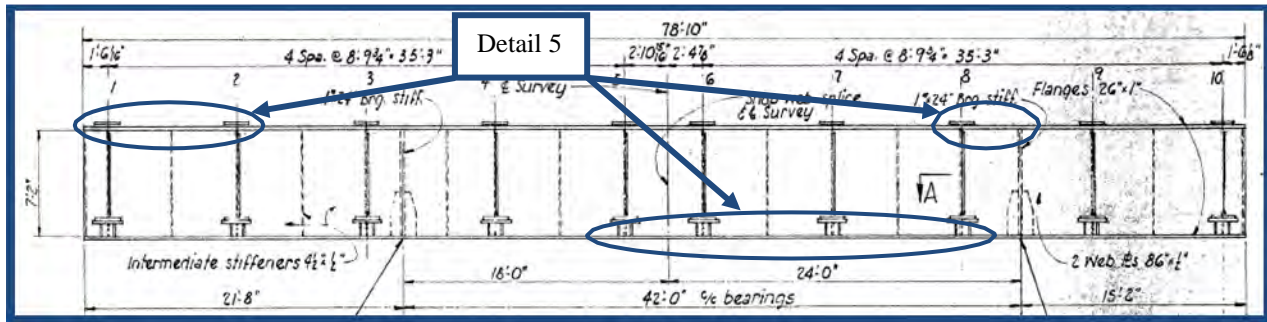


Figure 19: Elevation of Pier Cap 9

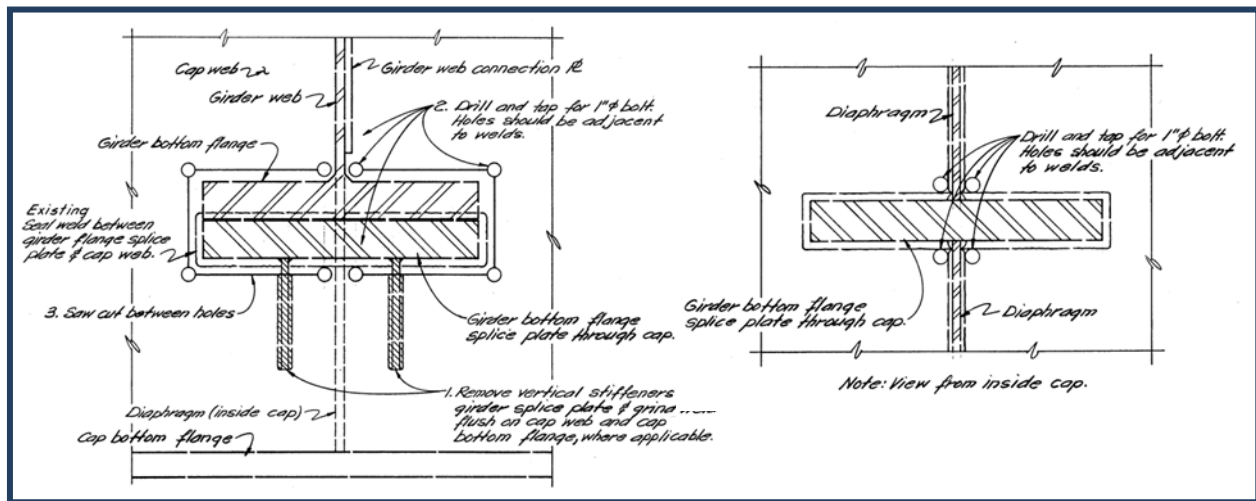


Figure 20: Web plate retrofit details from rehabilitation plans

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### 3.0 EVALUATION AND RECOMMENDATIONS

Based on the fracture critical inspection, the pier caps of Bridge No. HAM-562-0147, and its associated fatigue prone details, the rating of the fracture critical members has been lowered to POOR Condition [4] overall. This is due to the new crack observed near Girder 6 inside Pier Cap 6.

Collins appreciates the opportunity to work with the Ohio Department of Transportation on this project and looks forward to working together in the future. We would be happy to discuss any aspect of the report with you in person or via phone or email.

Respectfully Submitted,  
COLLINS ENGINEERS, INC.

A handwritten signature in blue ink that reads "Michael Seal".

Michael Seal, P.E.  
Project Manager

A handwritten signature in black ink that reads "Kevin Mitchell".

Originated by:  
Kevin Mitchell, E.I.T.

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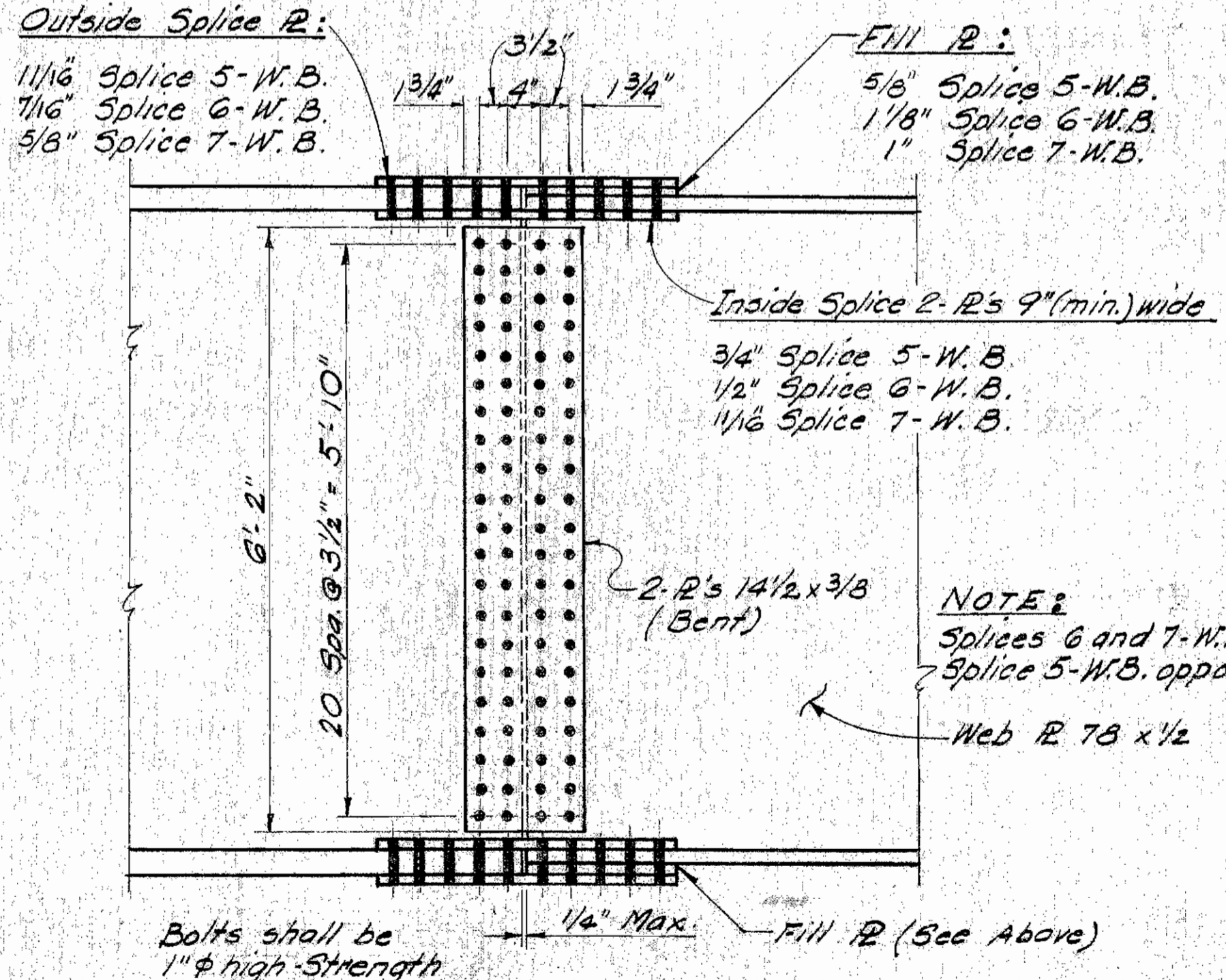
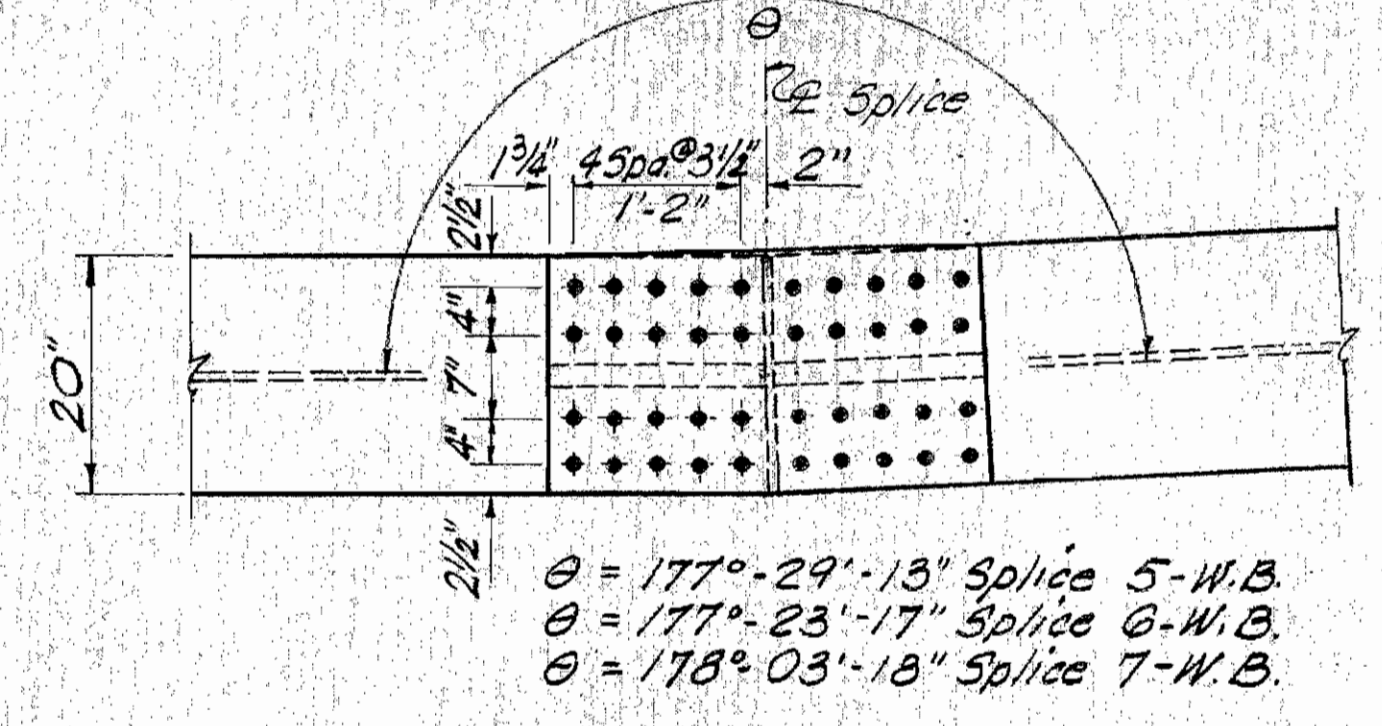
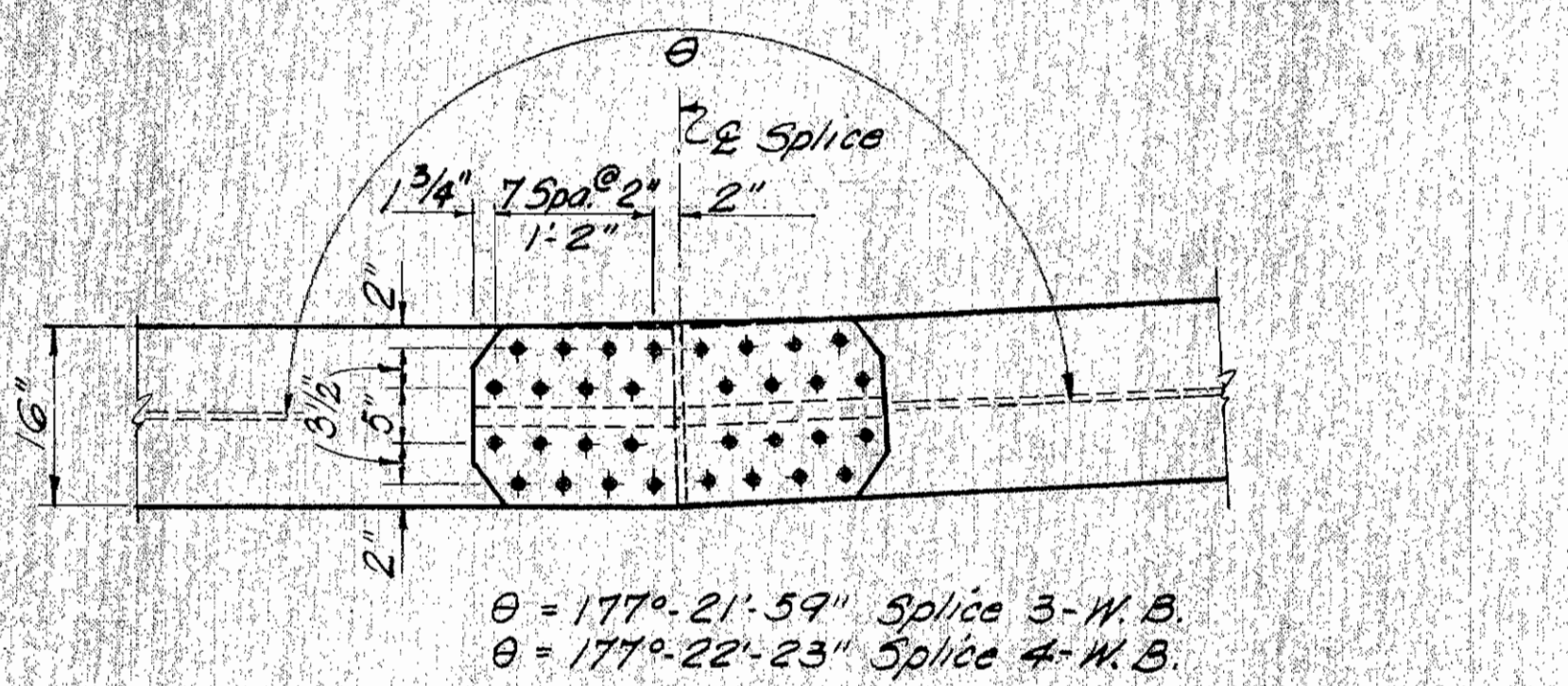
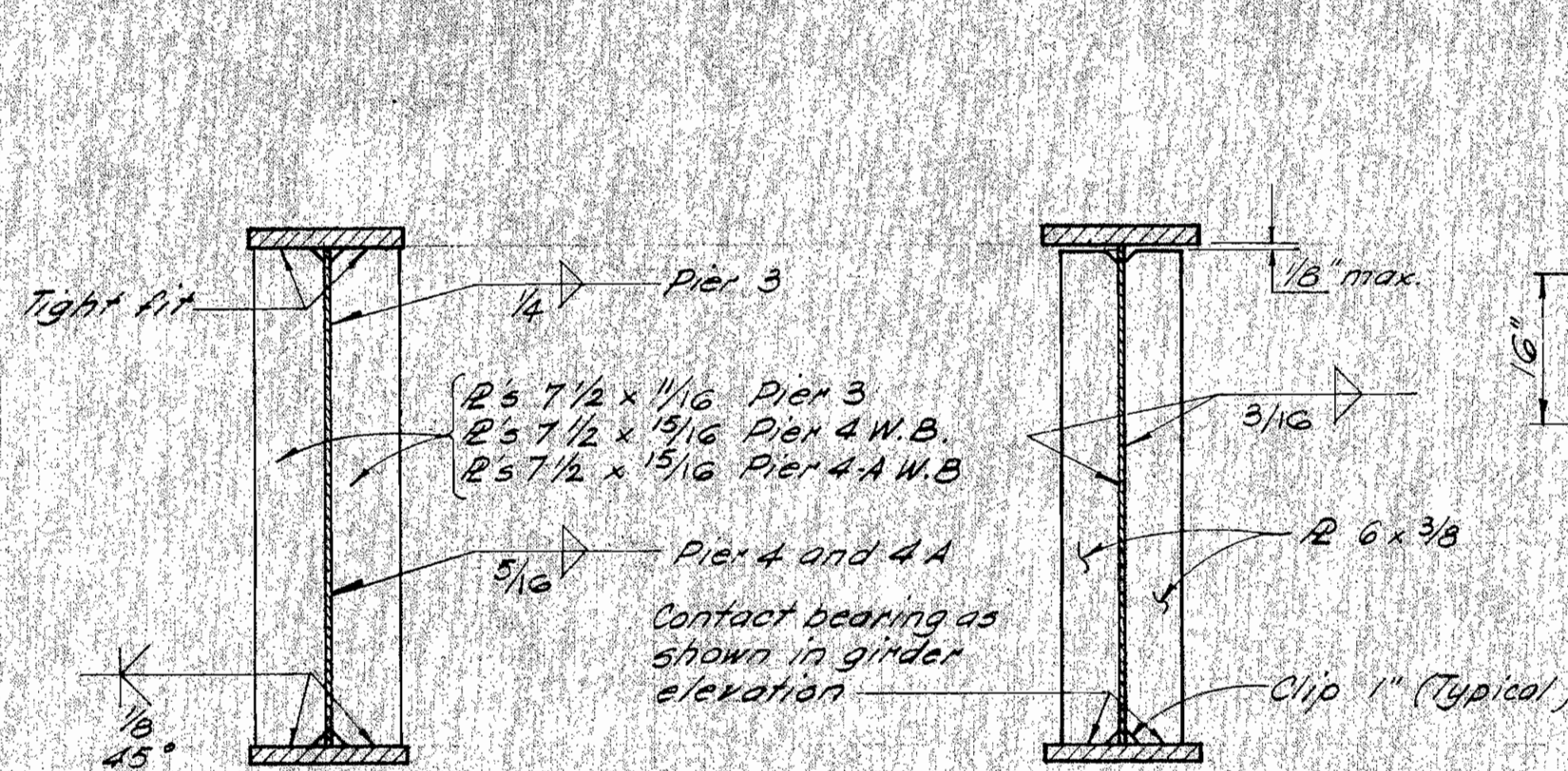
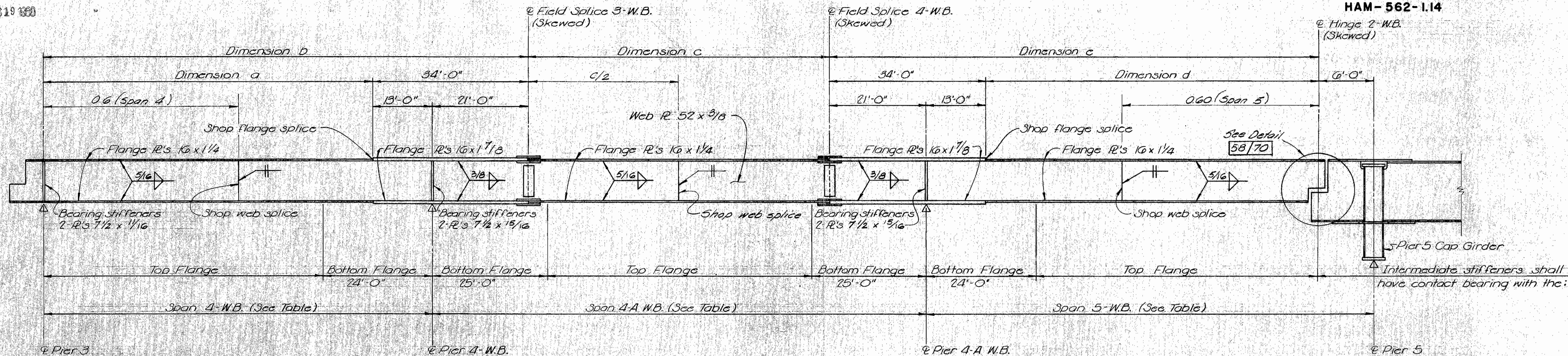
**EXHIBIT 1 – EXISTING PIER CAP PLANS**

MICROFILMED  
DEC 19 1980

FED. RD. DIVISION	STATE	PROJECT	TYPE FUNDS
2	OHIO		

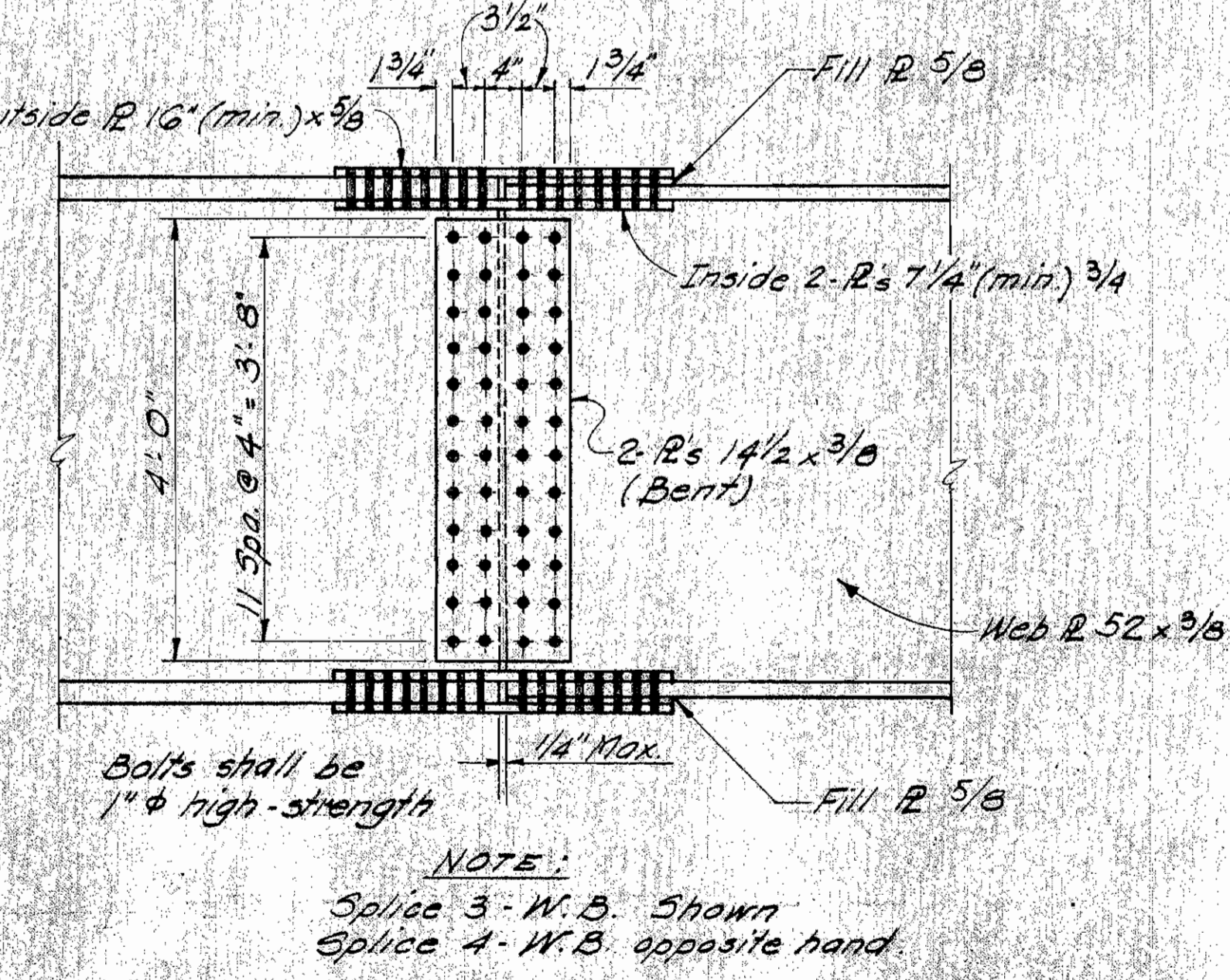
HAM-562-1.14

269  
353



BEARINGS STIFFENERS INTERMEDIATE STIFFENERS

Girder Line	DIMENSIONS								
	Span 4-W.B.	Span 4-A	Span 5	a	b	c	d	e	
1	83'-3 5/16"	105'-10 1/8"	87'-5 1/8"	70'-3 5/16"	104'-3 5/16"	63'-10 1/8"	68'-5 1/8"	102'-5 1/8"	
2	83'-8 5/8"	106'-4 1/8"	88'-6"	70'-8 5/8"	104'-8 5/8"	64'-4 1/8"	69'-6"	103'-6"	
3	84'-1 5/16"	106'-10 3/4"	89'-6 5/16"	71'-1 5/16"	105'-1 5/16"	64'-10 3/4"	70'-6 5/16"	104'-6 5/16"	
4	84'-6"	107'-4 1/8"	90'-7 3/8"	71'-6"	105'-6"	65'-4 1/8"	71'-7 3/8"	105'-7 3/8"	
5	84'-10 5/8"	107'-10 3/8"	91'-8 1/4"	71'-10 5/8"	105'-10 3/8"	65'-10 5/8"	71'-8 1/4"	106'-8 1/4"	



FIELD SPLICES 3 AND 4 W.B. LANES

FIELD SPLICES 5, 6 AND 7 W.B. LANES

For joint preparations see 37/70

NOTE:  
Splices 6 and 7-W.B. Shown  
Splice 5-W.B. opposite hand.

39/70

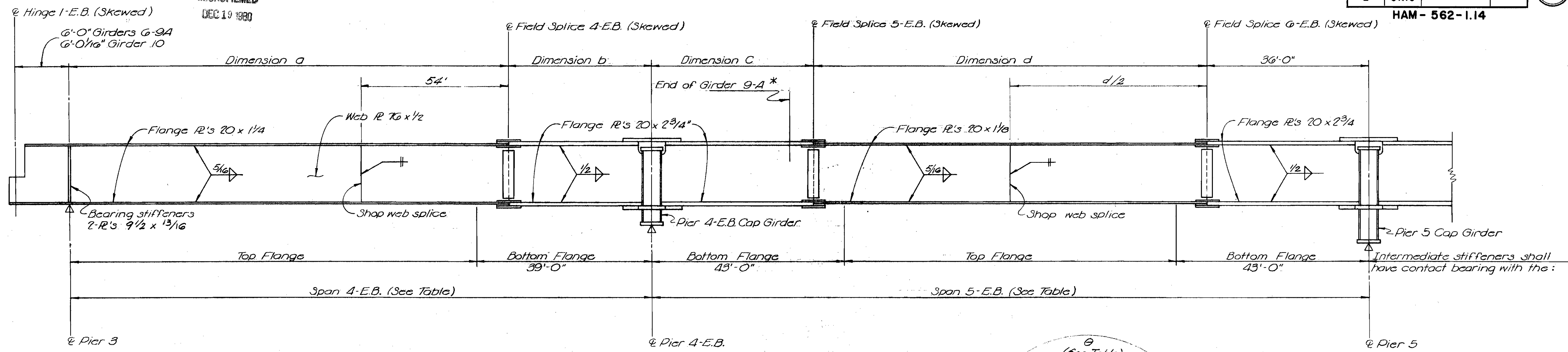
VOGT, IVERS, & ASSOCIATES  
ENGINEERS ARCHITECTS  
CINCINNATI CHICAGO

**GIRDERS - UNIT 2 W.B.**  
BRIDGE NO. HAM-562-0150  
NORWOOD LATERAL OVER  
ROSS AVE. AND B.&O.R.R.

HAMILTON COUNTY STA. 79+47.35  
STA. 93+52.25

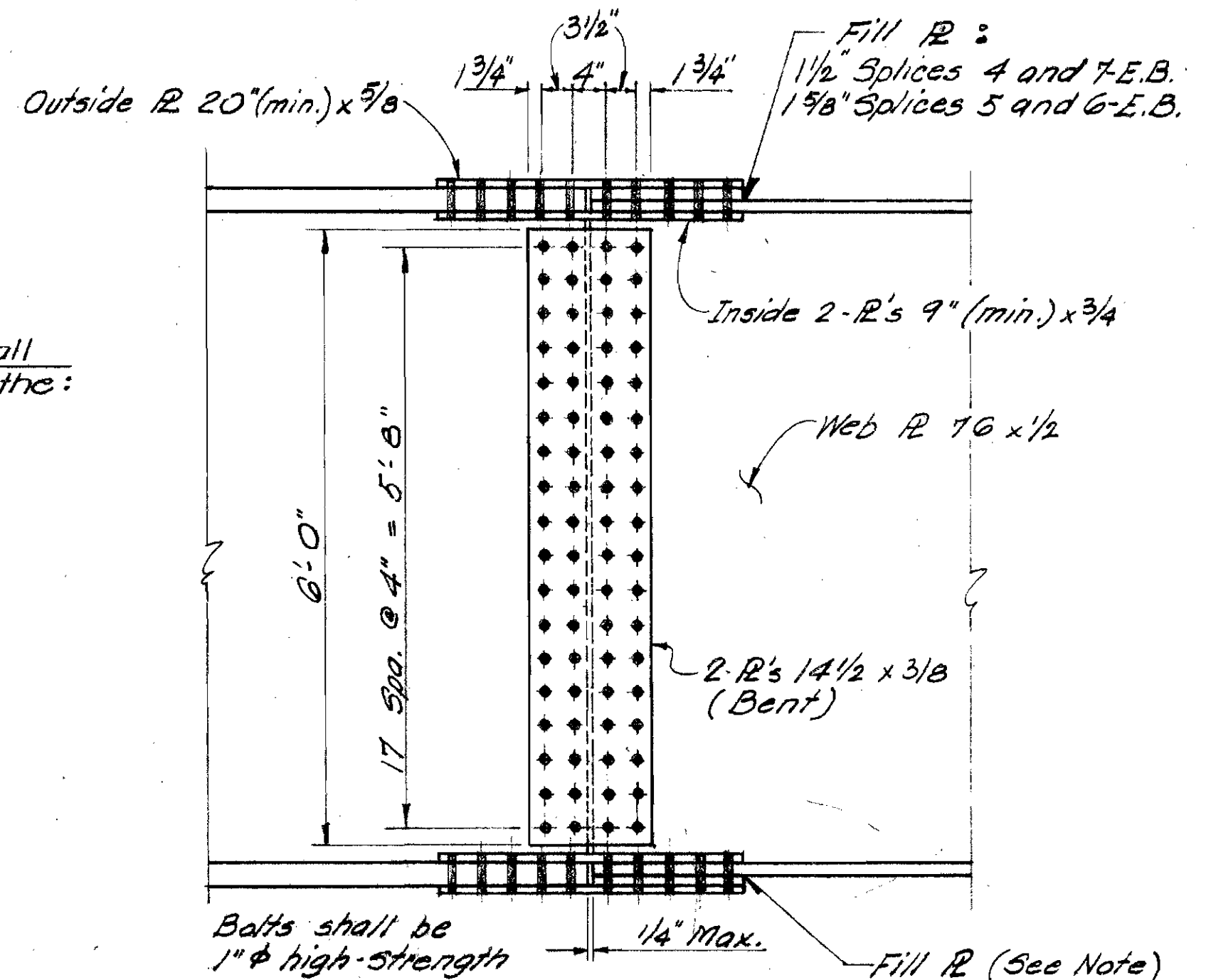
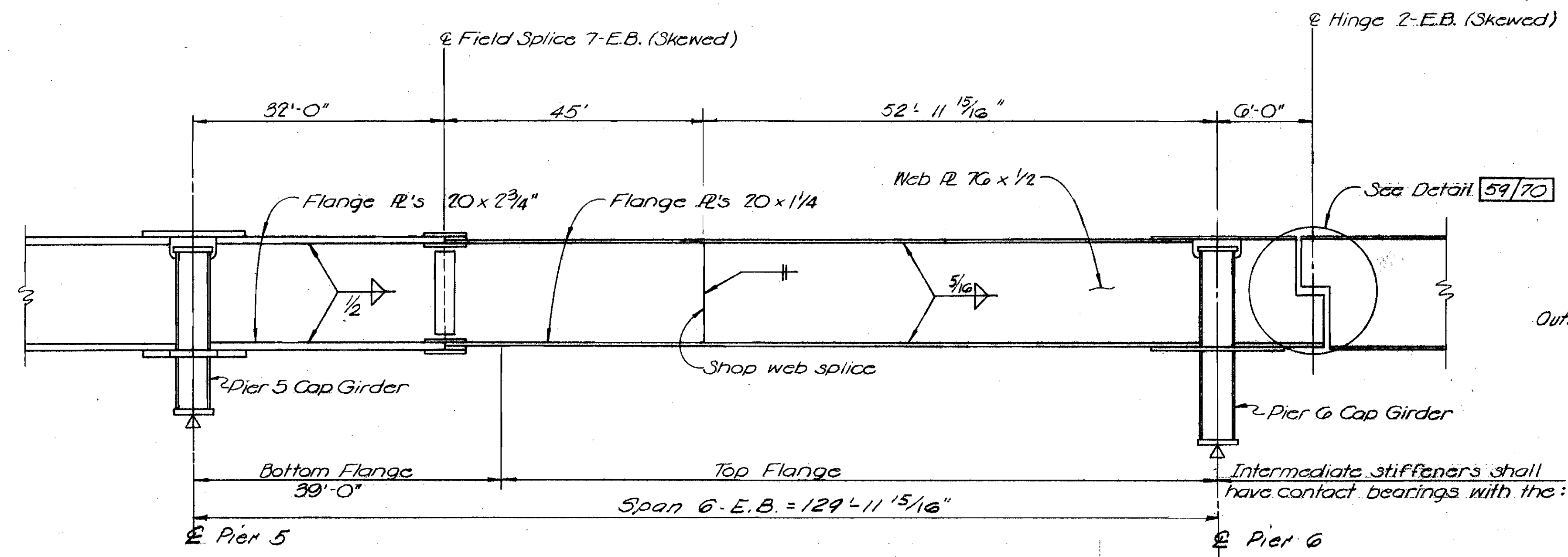
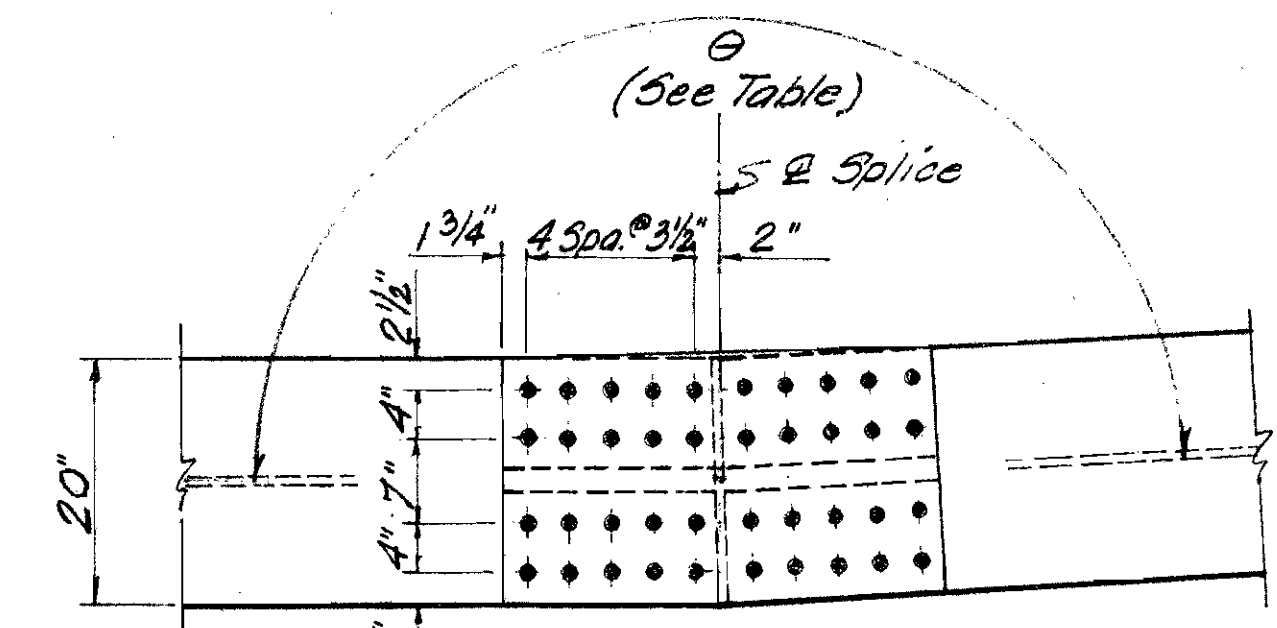
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M.M.	M.M.	L.B.F.	L.F.L.	W	2/20/68	

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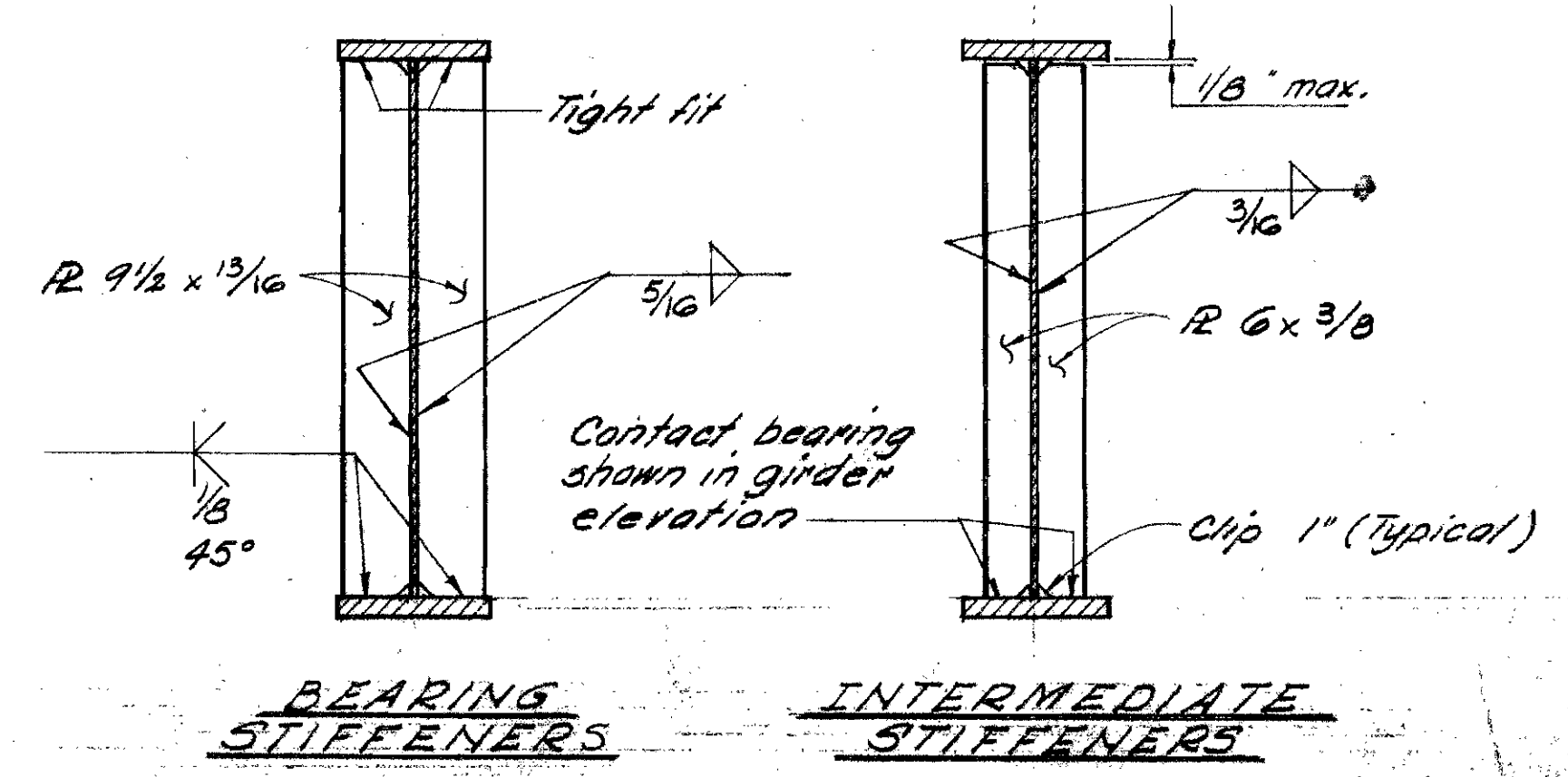
SPLICE ANGLES  $\theta$  - E.B. LANES

GIRDER	SPLICE 4	SPLICE 5	SPLICE 6	SPLICE 7
6	177°35'42"	178°06'10"	177°10'53"	177°32'58"
7	177°35'42"	178°06'10"	177°10'53"	177°32'58"
8	177°35'42"	178°06'10"	177°10'53"	177°32'58"
9	177°35'42"	178°06'10"	177°10'53"	177°32'58"
9-A	177°49'55"	—	—	—
10	178°23'16"	177°31'13"	178°05'44"	177°32'58"



For joint preparations see 37/70

Girder Line	DIMENSIONS					
	Span 4	Span 5	a	b	c	d
6	125'-6 3/8"	160'-0 9/16"	93'-6 3/16"	32'-0"	36'-0"	88'-0 9/16"
7	127'-5 3/4"	160'-0 9/16"	95'-5 3/4"	32'-0"	36'-0"	88'-0 9/16"
8	129'-5 3/16"	160'-0 9/16"	97'-5 3/16"	32'-0"	36'-0"	88'-0 9/16"
9	131'-4 1/16"	160'-0 9/16"	99'-4 1/16"	32'-0"	36'-0"	88'-0 9/16"
9-A	132'-6 3/4"	28'-3 1/8"	100'-7 1/16"	31'-11 1/16"	28'-3 1/8"	—
10	133'-9 1/8"	159'-10 7/16"	101'-9 1/16"	31'-11 1/16"	35'-11 7/8"	87'-10 1/16"



NOTE:  
 Splices 5 and 7 - E.B. Shown.  
 Splices 4 and 6 - E.B. opposite hand.  
 FIELD SPLICES 4, 5, 6 AND 7 - E.B. LANES

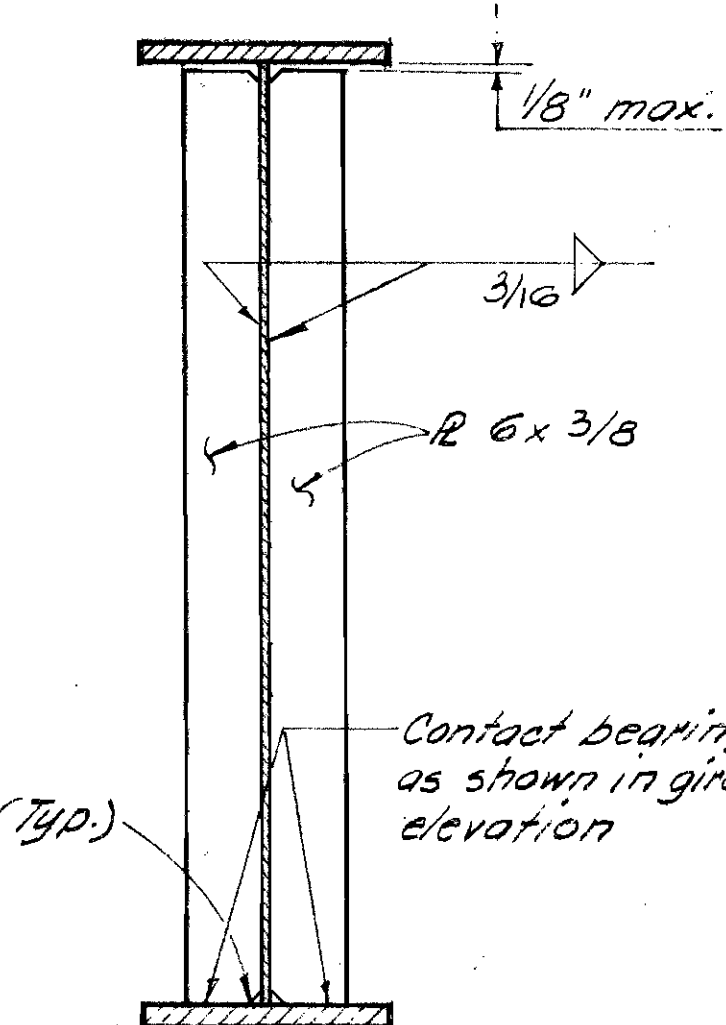
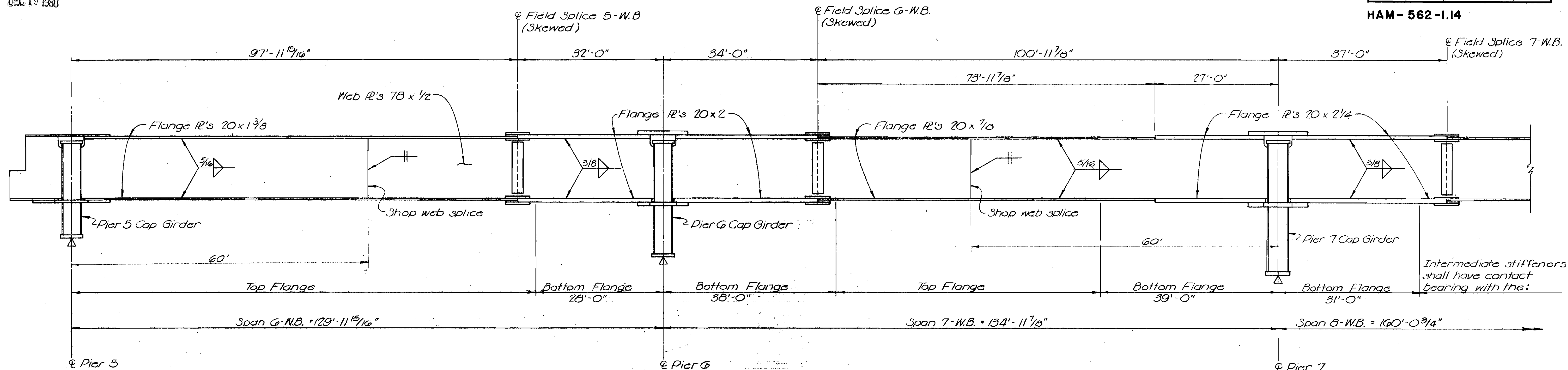
40/70  
**VOGT, IVERS, & ASSOCIATES**  
 ENGINEERS ARCHITECTS  
 CINCINNATI CHICAGO  
**GIRDERS - UNIT 2 E.B.**  
 BRIDGE NO. HAM-562-0150  
 NORWOOD LATERAL OVER  
 ROSS AVE. AND B.&O.R.R.  
 HAMILTON COUNTY STA. 79+47.35  
 STA. 93+52.25  
 DESIGNED DRAWN TRACED CHECKED REVIEWED DATE REVISED  
 M.M. M.M. L.B.F. G.M. L.F.L. *llh* 2-20-68

MICROFILMED  
DEC 19 1980

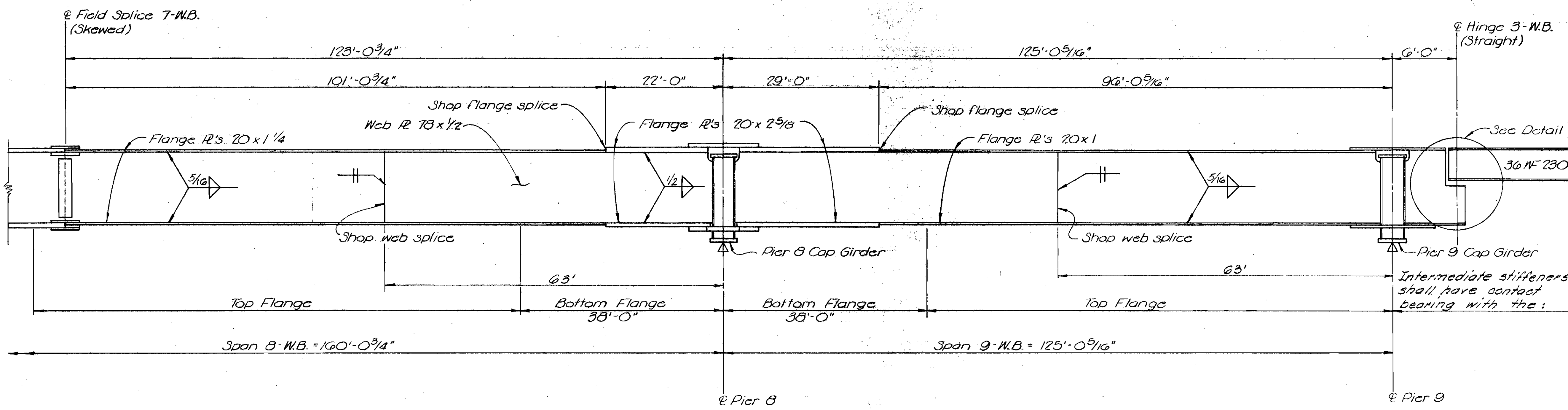
FED. RD. DIVISION	STATE	PROJECT	TYPE FUNDS
2	OHIO		

271  
353

HAM-562-1.14



INTERMEDIATE STIFFENERS



For joint preparations see 37/70  
For field splice see 39/70

VOGT, IVERS, & ASSOCIATES ENGINEERS ARCHITECTS CINCINNATI CHICAGO					
<b>GIRDERS - UNIT 3 W.B.</b> BRIDGE NO. HAM-562-0150 NORWOOD LATERAL OVER ROSS AVE. AND B.&O. R.R. HAMILTON COUNTY STA. 79+47.35 STA. 93+52.25					
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE
M.M.	M.M.	L.B.F.	L.F.L.	688	2-20-68

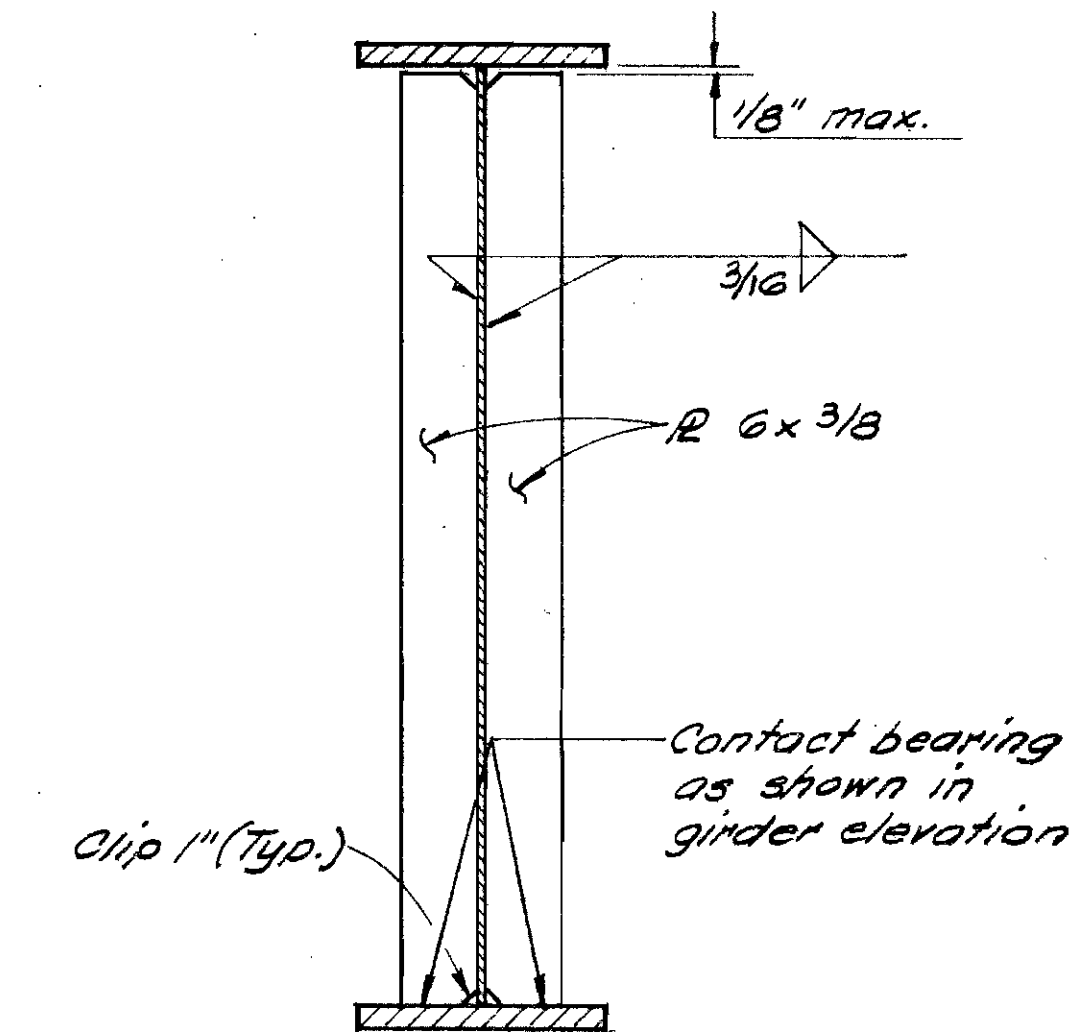
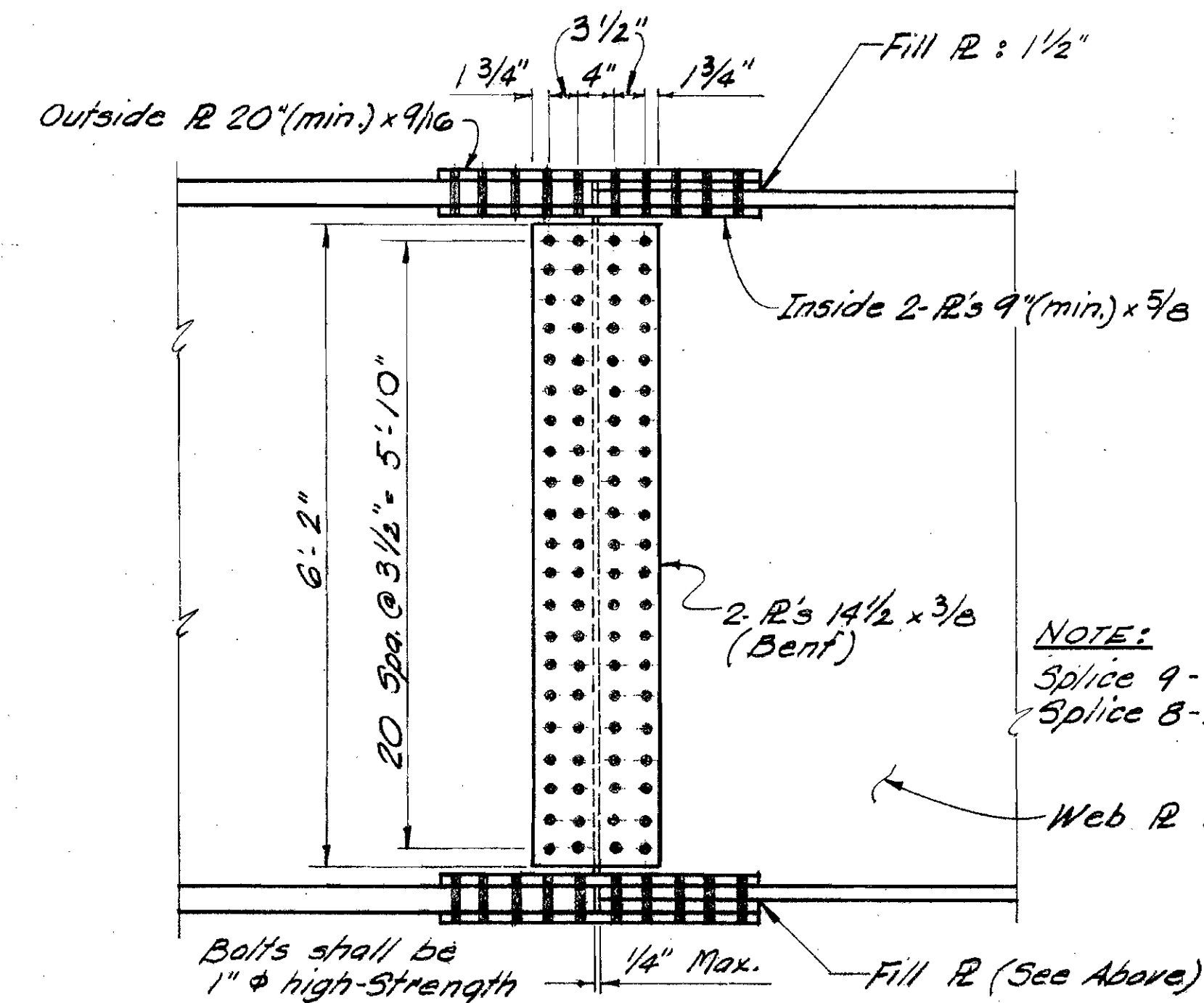
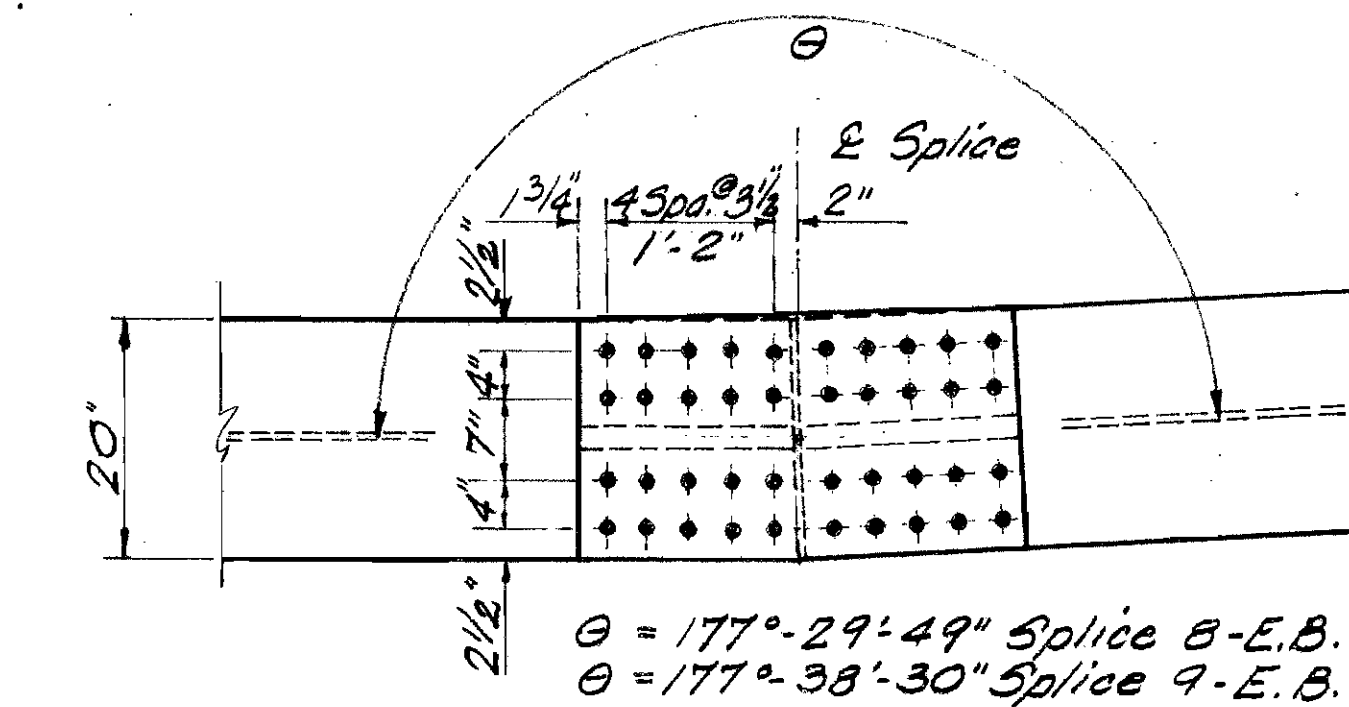
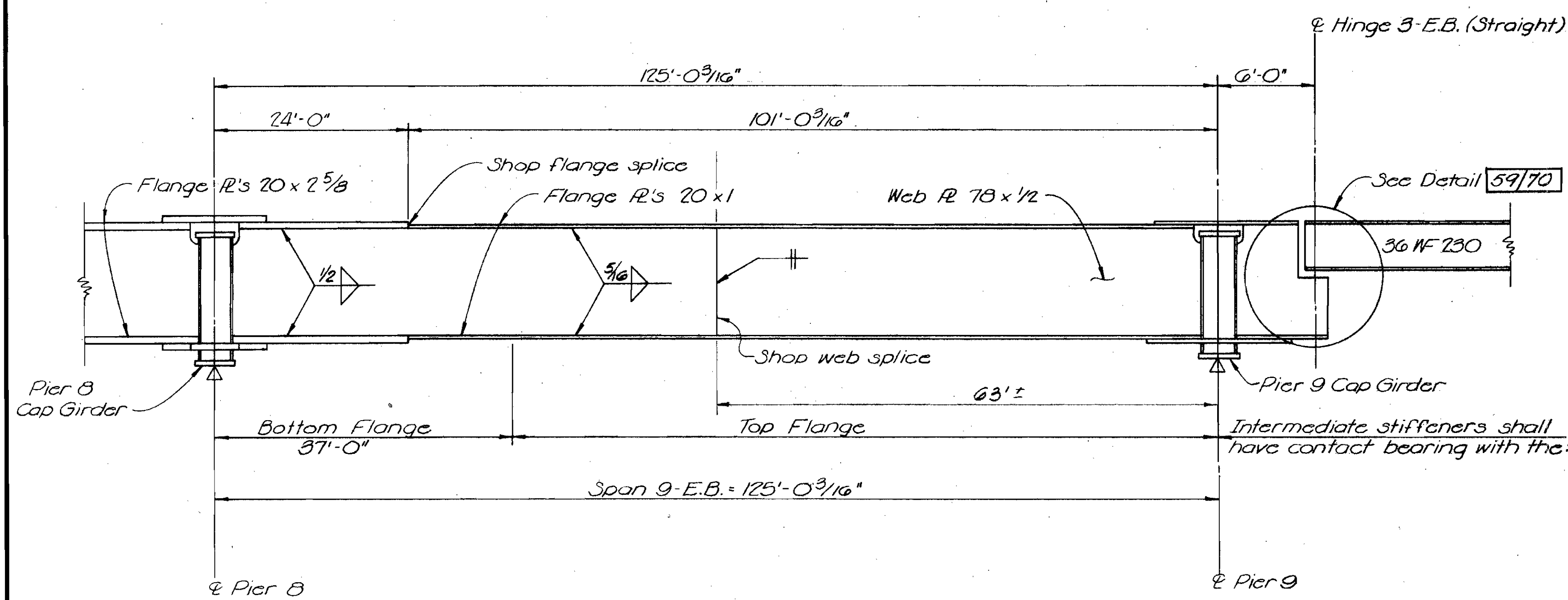
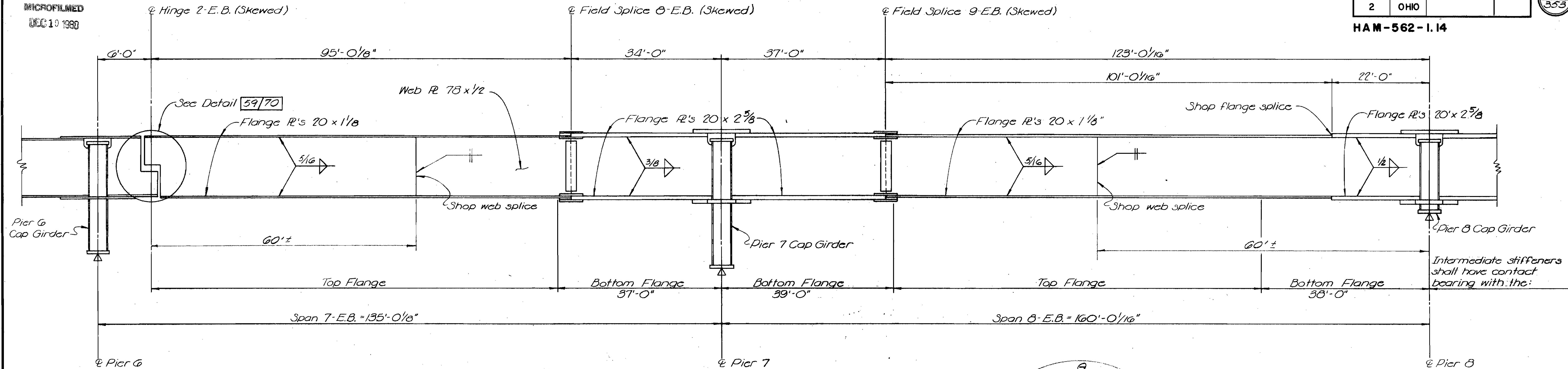


MICROFILMED  
DEC 10 1980

FED. RD. DIVISION	STATE	PROJECT	TYPE FUNDS
2	OHIO		

272  
353

HAM-562-1.14



**INTERMEDIATE STIFFENERS**

For joint preparations see 37/70

NOTE:  
Splice 9-E.B. Shown.  
Splice 8-E.B. opposite hand.

**FIELD SPLICES 8 AND 9-E.B LANES**

VOGT, IVERS, & ASSOCIATES  
ENGINEERS ARCHITECTS  
CINCINNATI CHICAGO

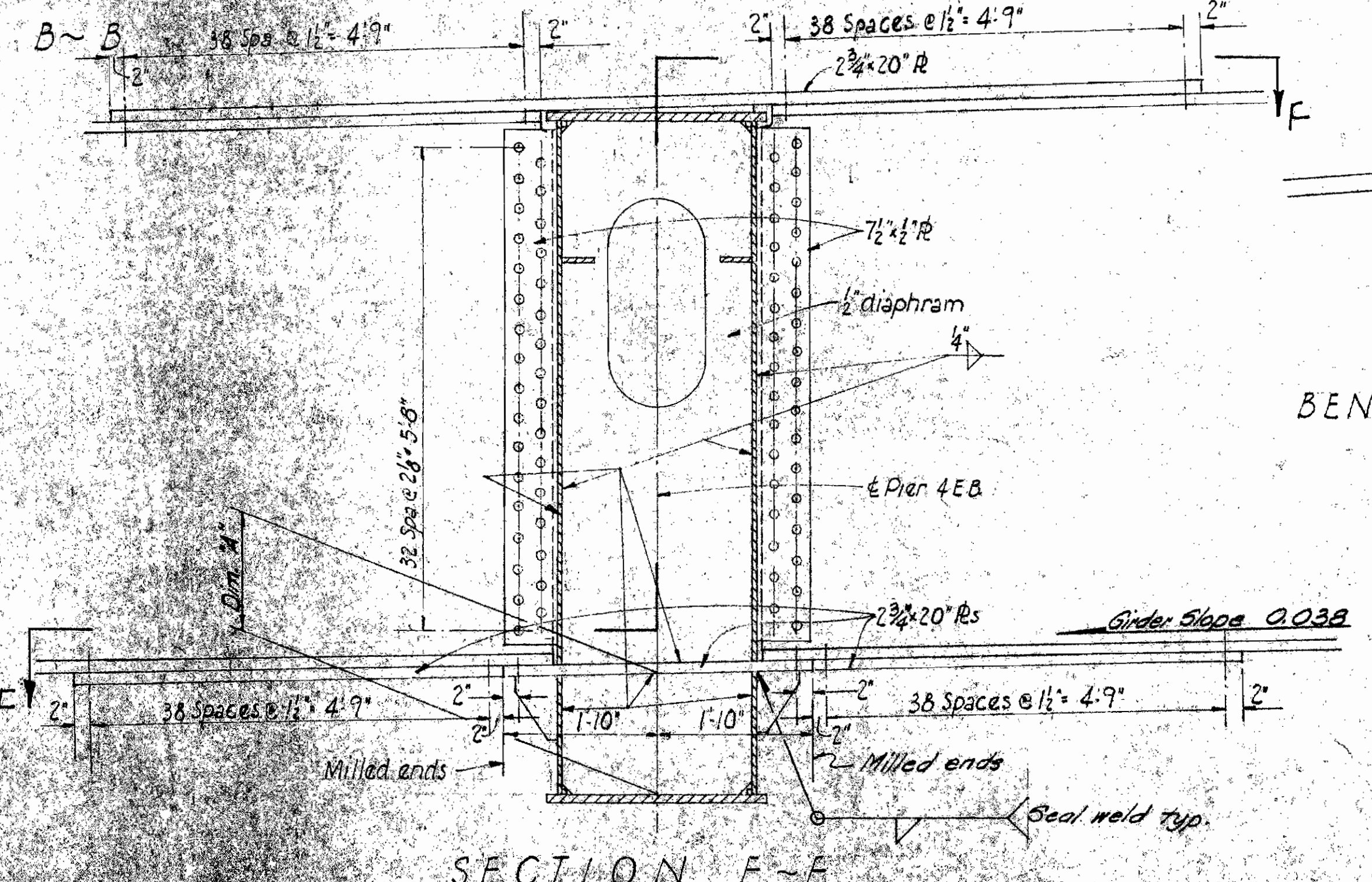
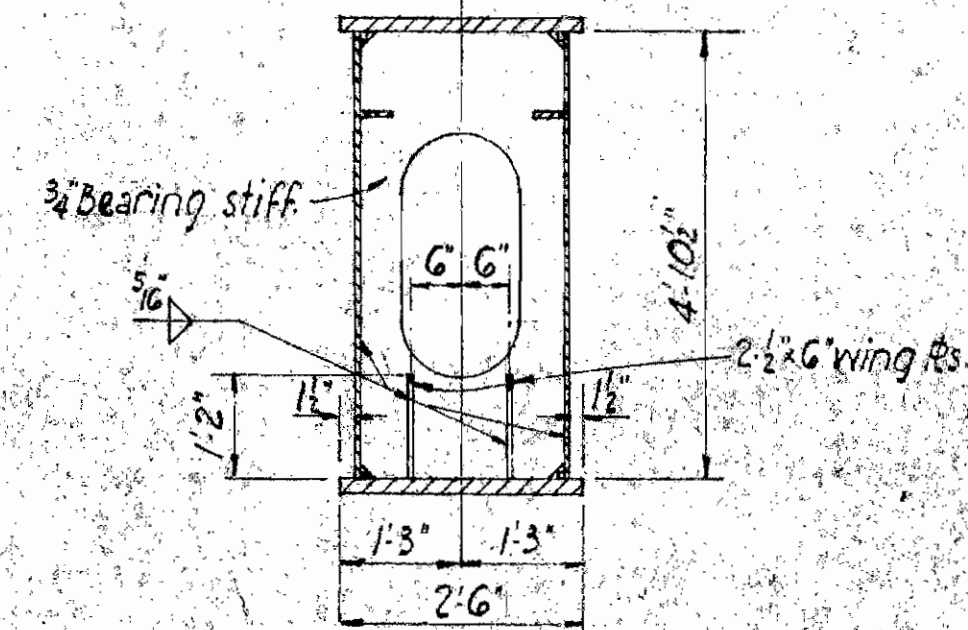
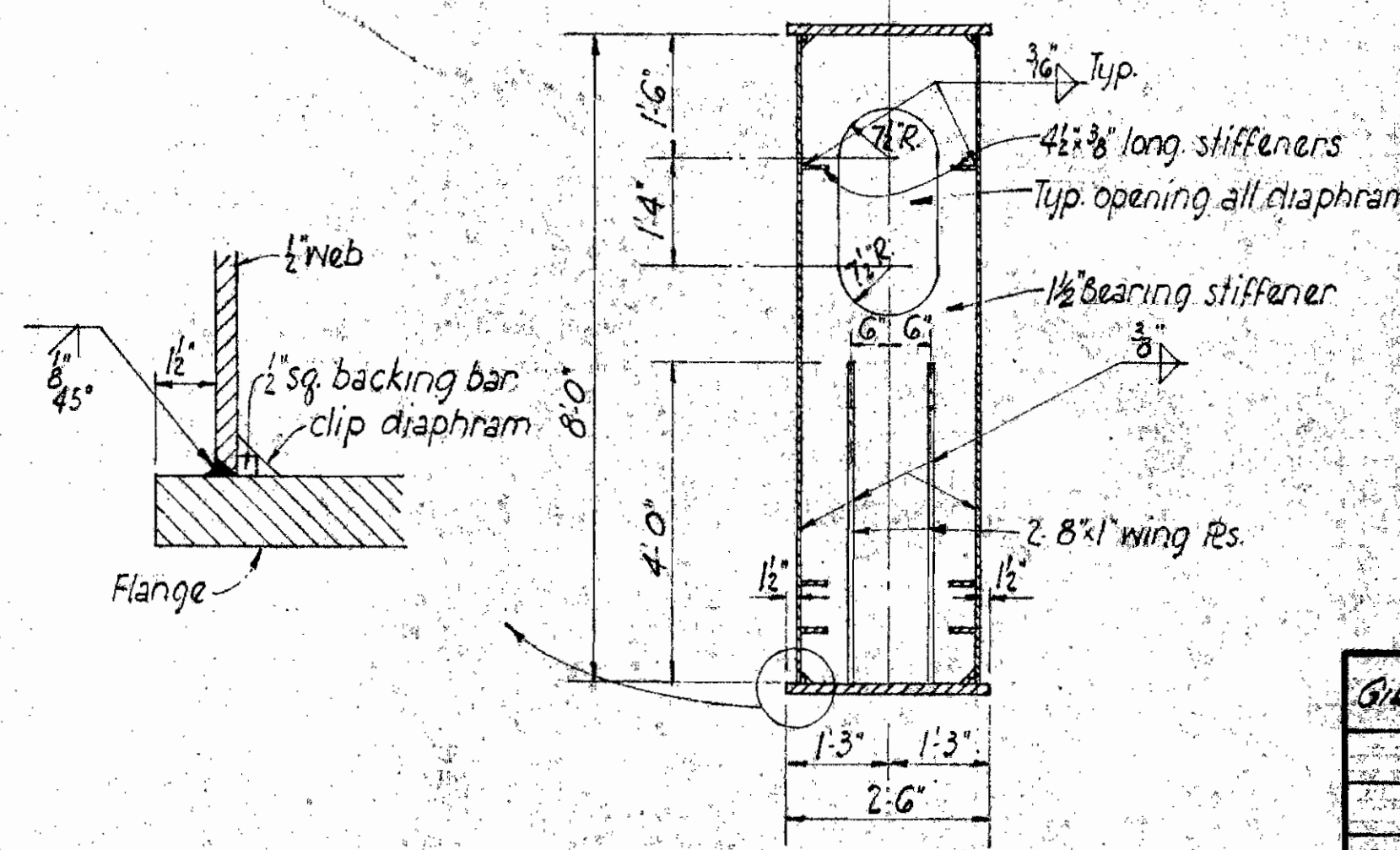
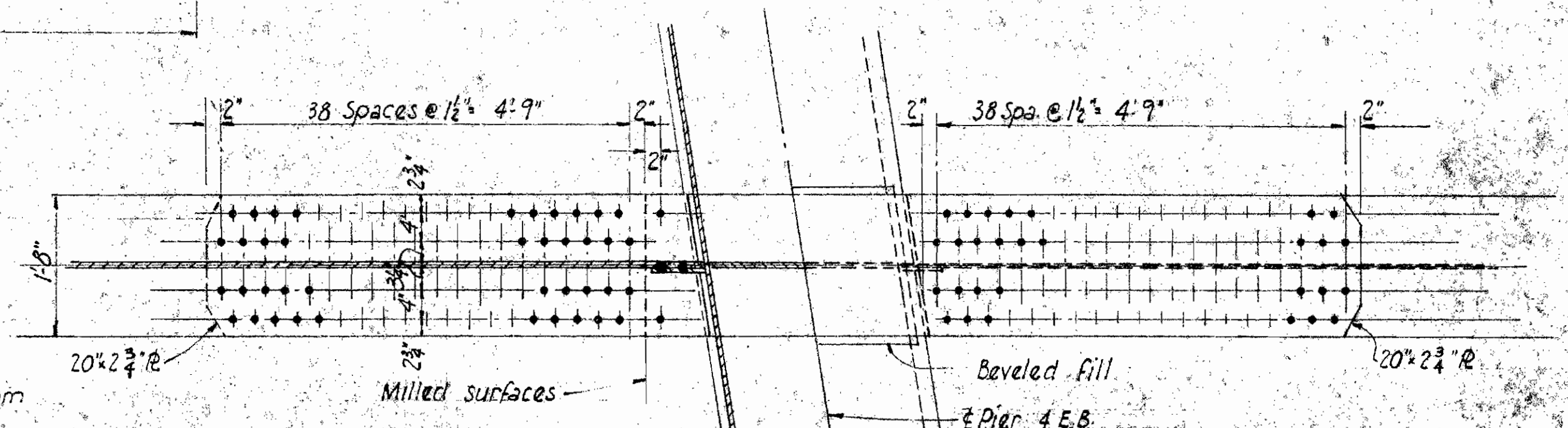
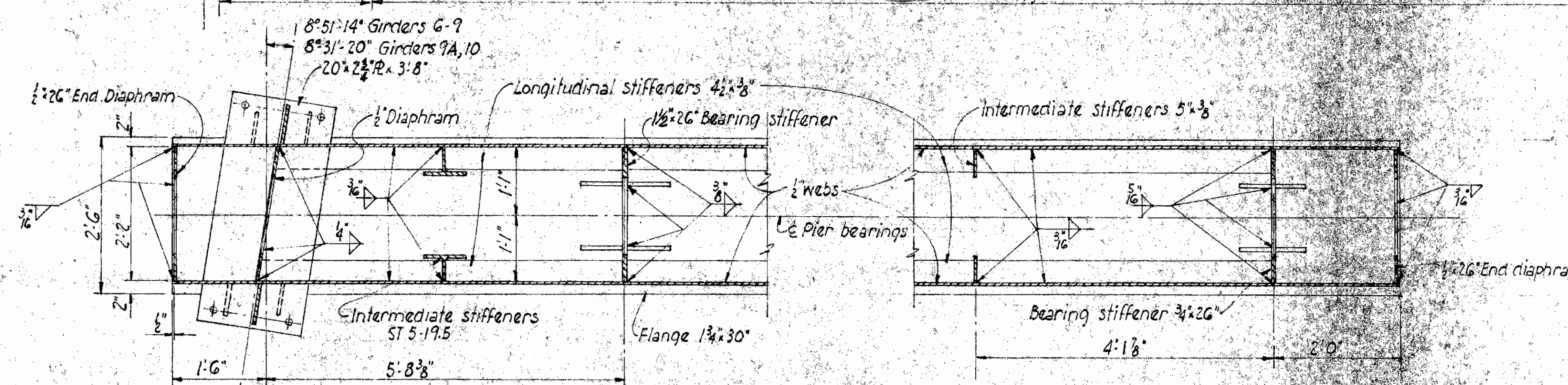
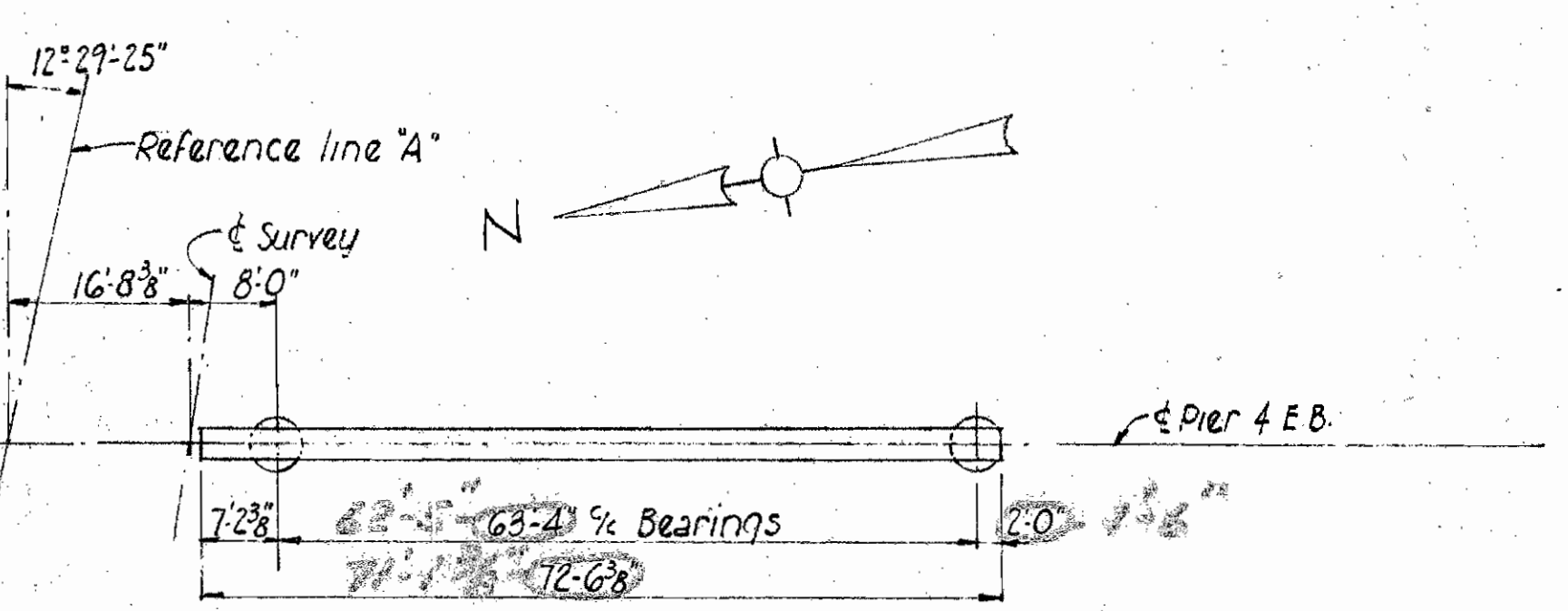
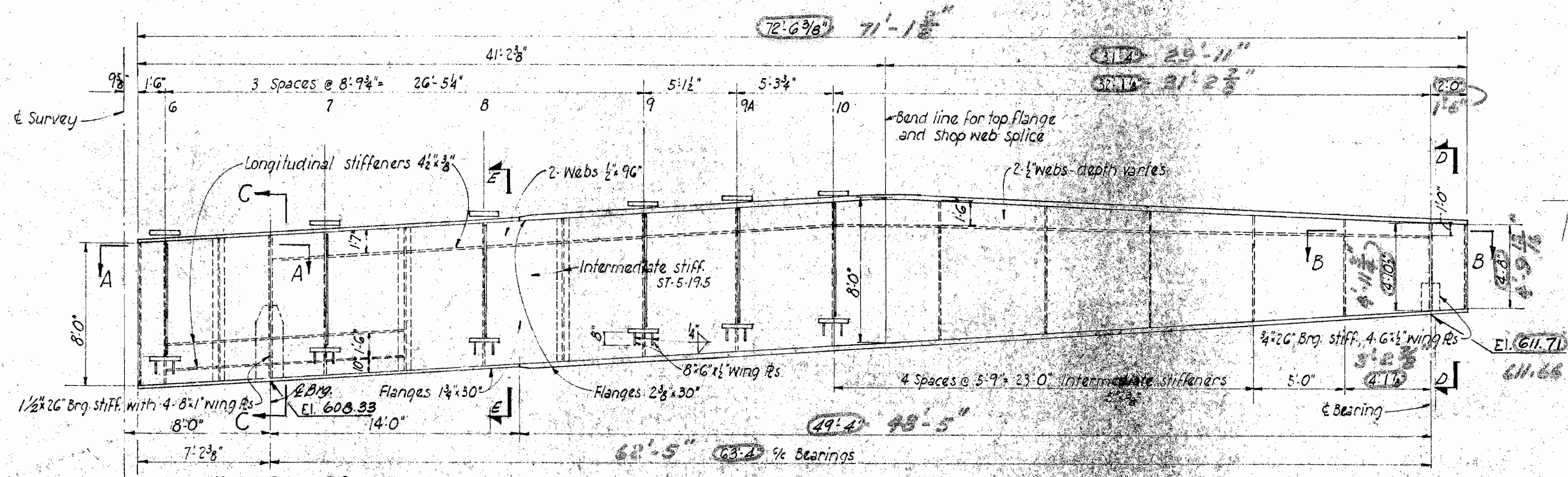
**GIRDERS - UNIT 3 E.B.**

BRIDGE NO. HAM-562-0150  
NORWOOD LATERAL OVER  
ROSS AVE. AND B.&O.R.R.

HAMILTON COUNTY STA. 79+47.35  
STA. 93+52.25

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
M.M.	M.M.	L.B.F. G.M.	L.F.L.	lll	220-68	

42/70



BEND DETAIL FOR TOP FLANGE

1. For end diaphragm cover see 54/70
2. For joint preparations see 37/70
3. For additional notes see 54/70

GIRDER NO.	Dim. "A"
6	1'-3 3/16"
7	1'-3 3/16"
8	1'-3 3/16"
9	1'-3 3/16"
9A	1'-3 3/16"
10	1'-3 3/16"

VOGT, IVERS, & ASSOCIATES  
ENGINEERS ARCHITECTS  
CINCINNATI CHICAGO

**PIER 4 E.B. CAP GIRDER**

BRIDGE NO. HAM-562-0150  
NORWOOD LATERAL OVER  
ROSS AVE. AND B. & O. RR.

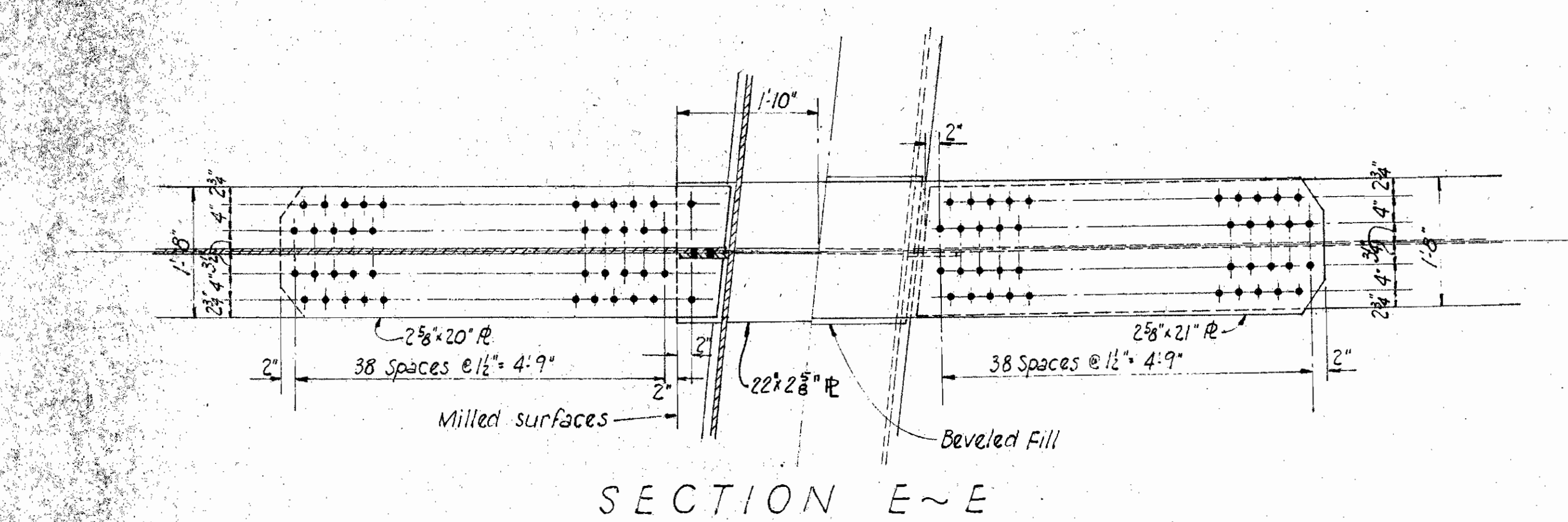
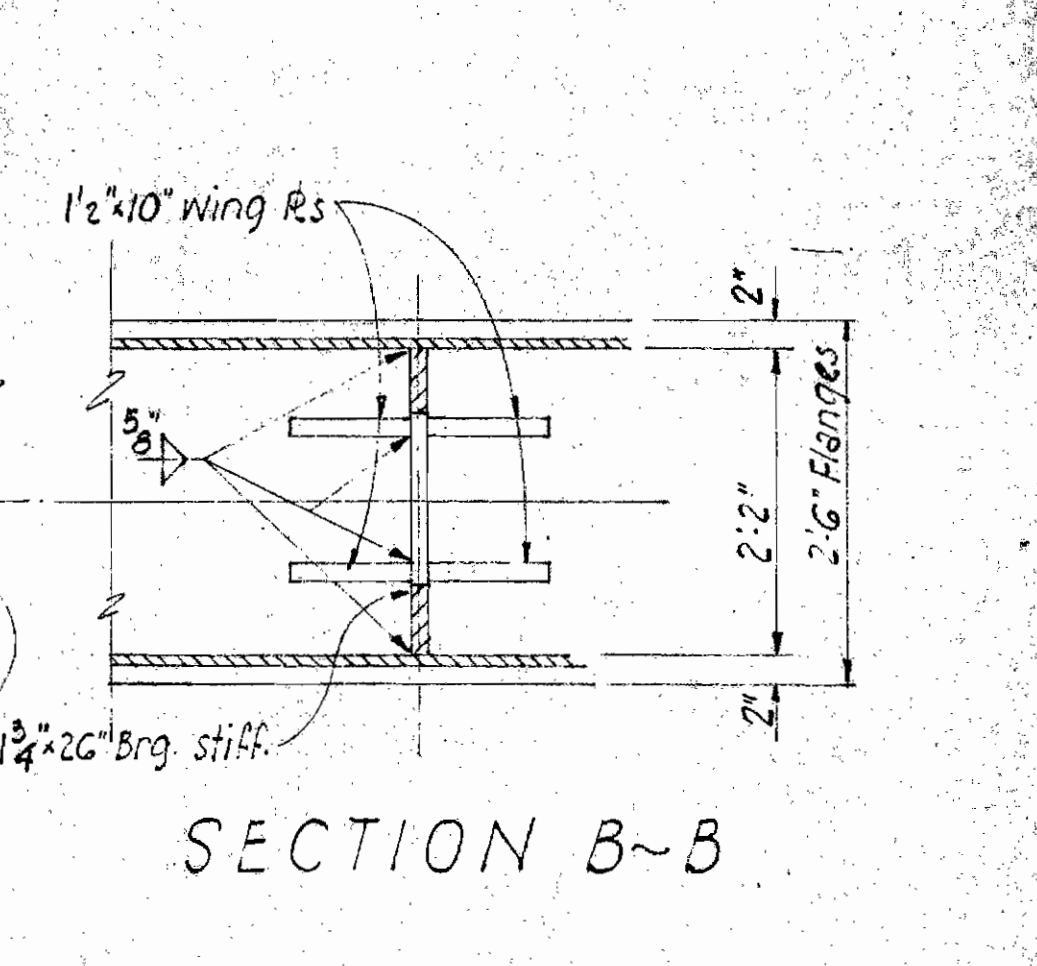
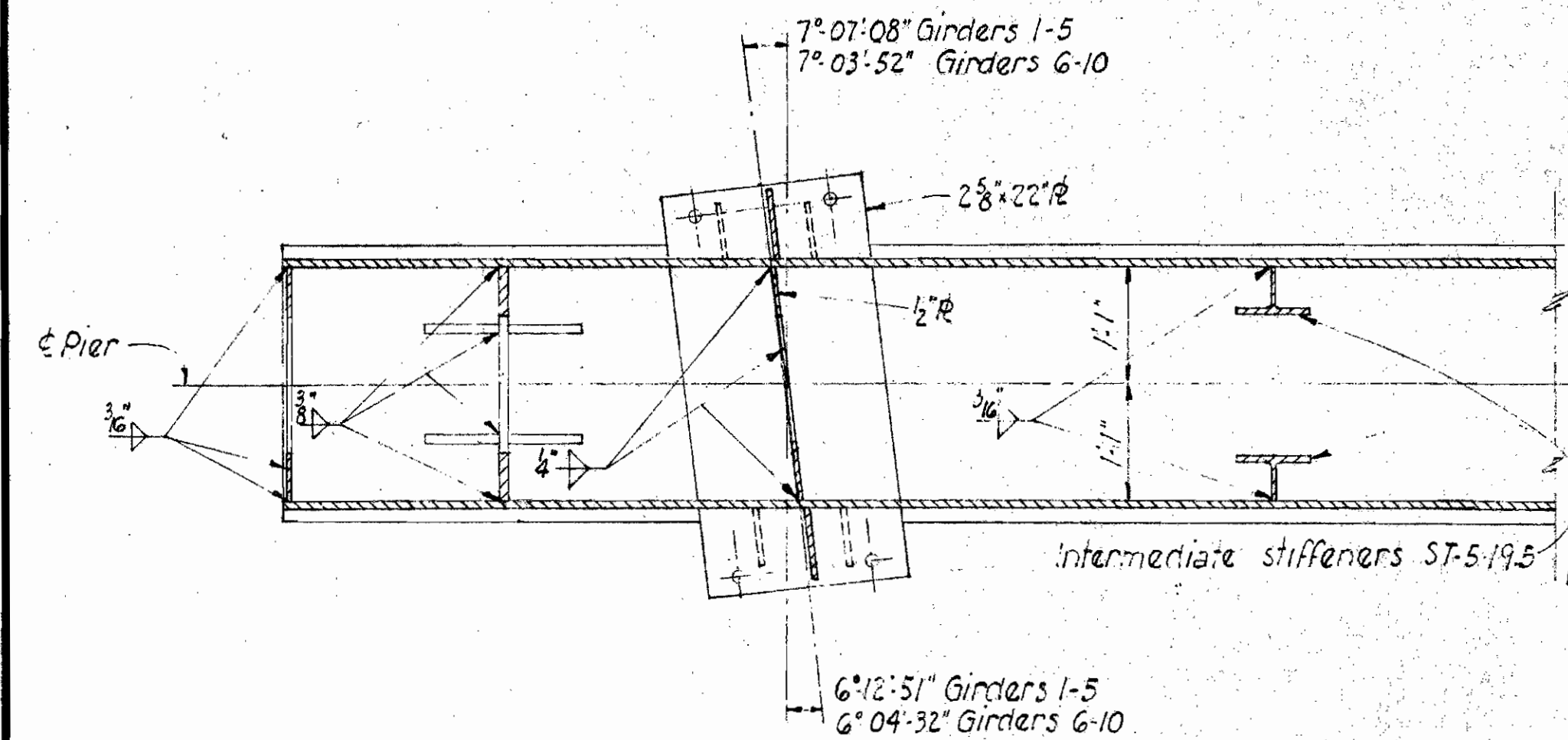
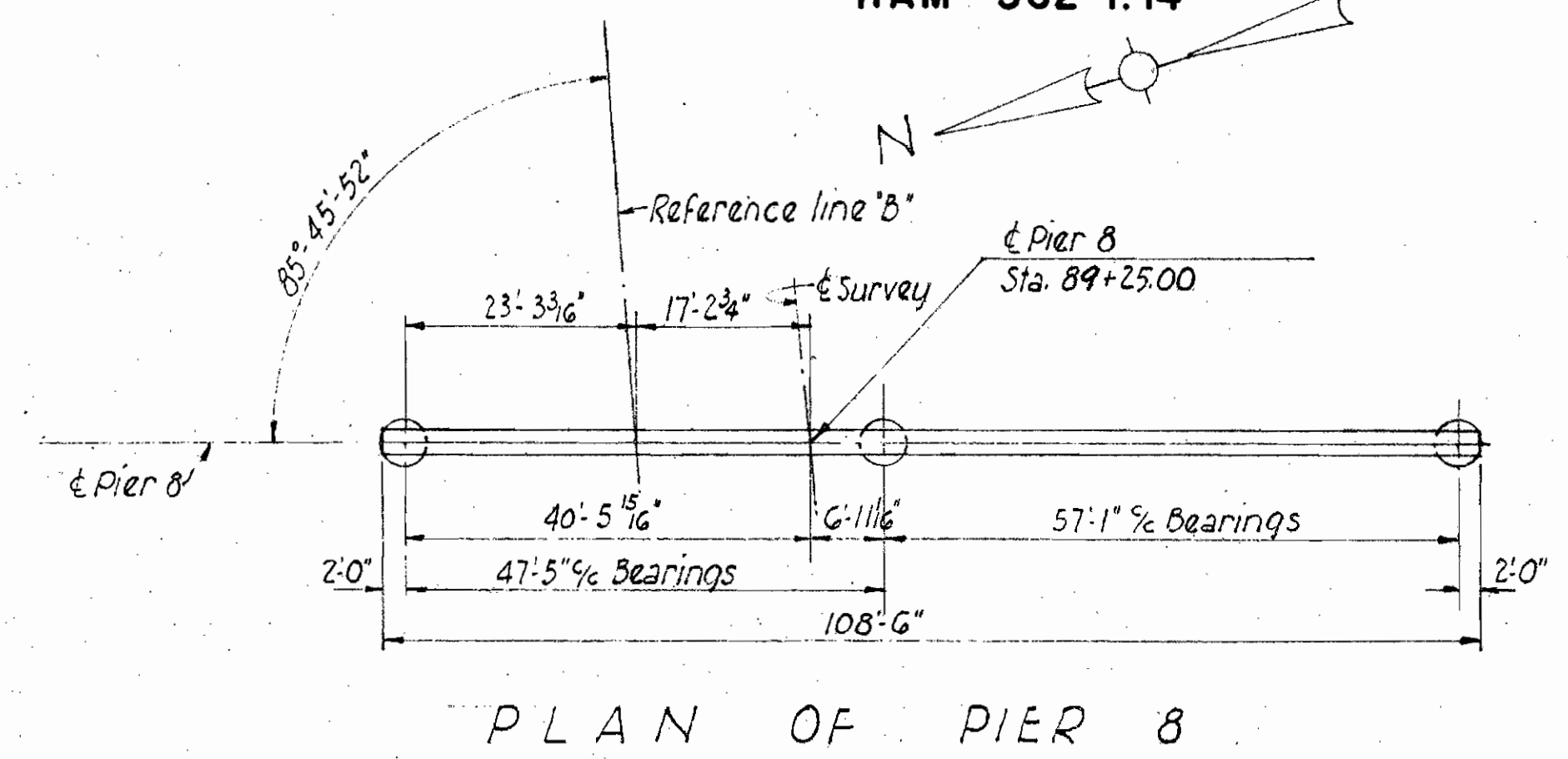
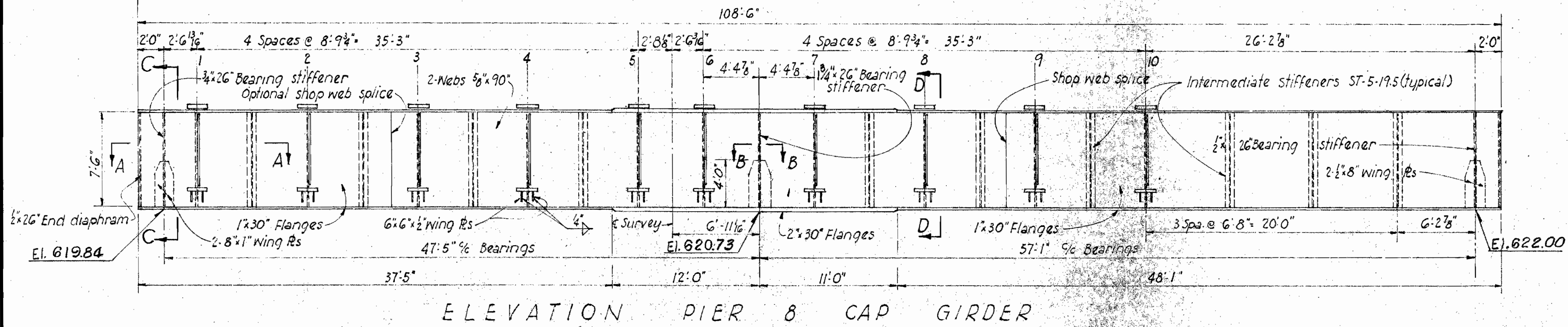
HAMILTON COUNTY STA. 79+47.35  
STA. 93+52.25

APPROVED: J.R. J.R. J.C.P. 220-68

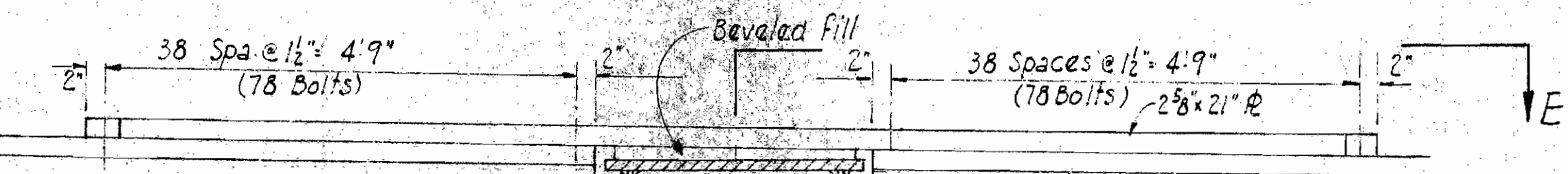






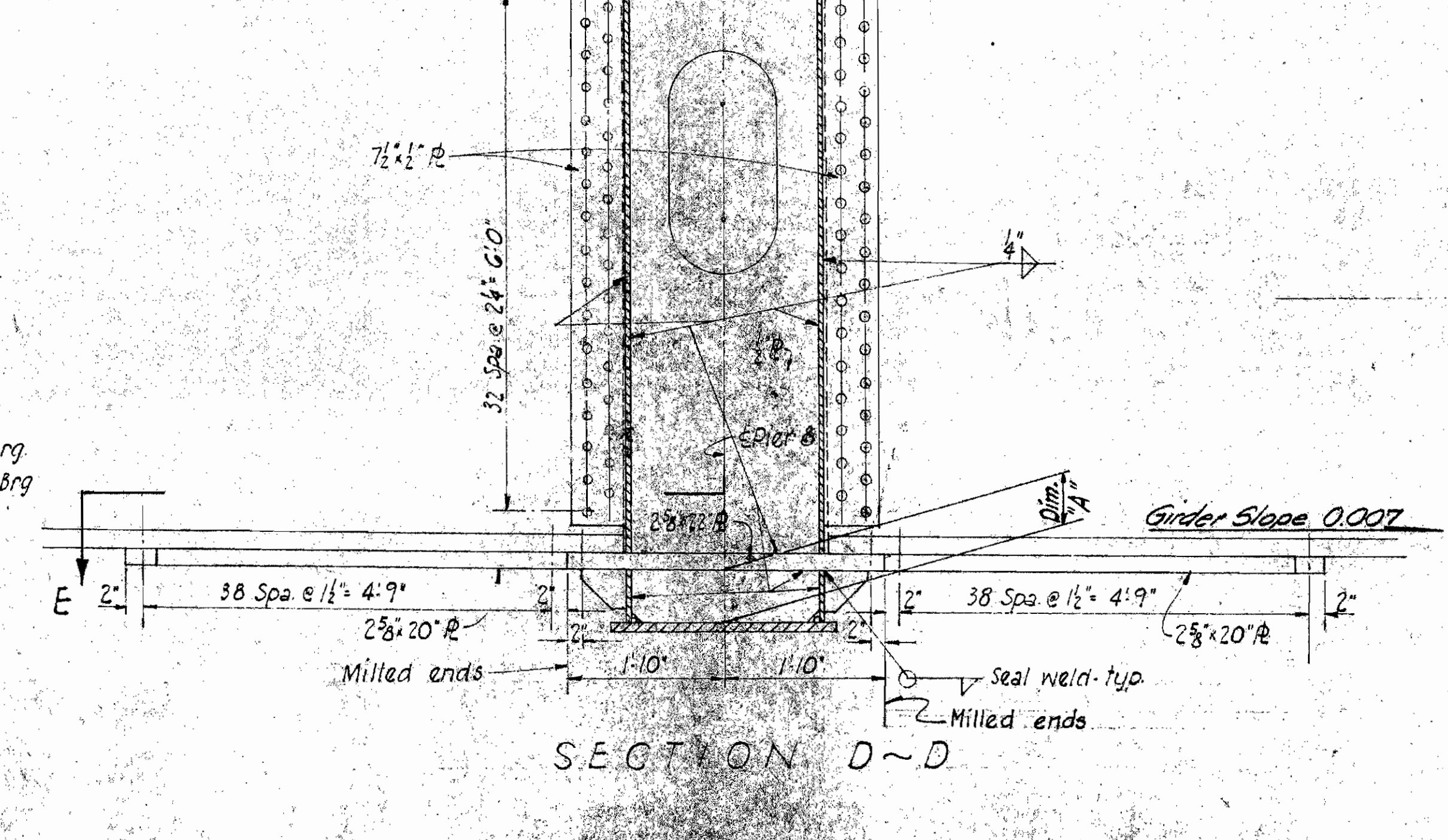
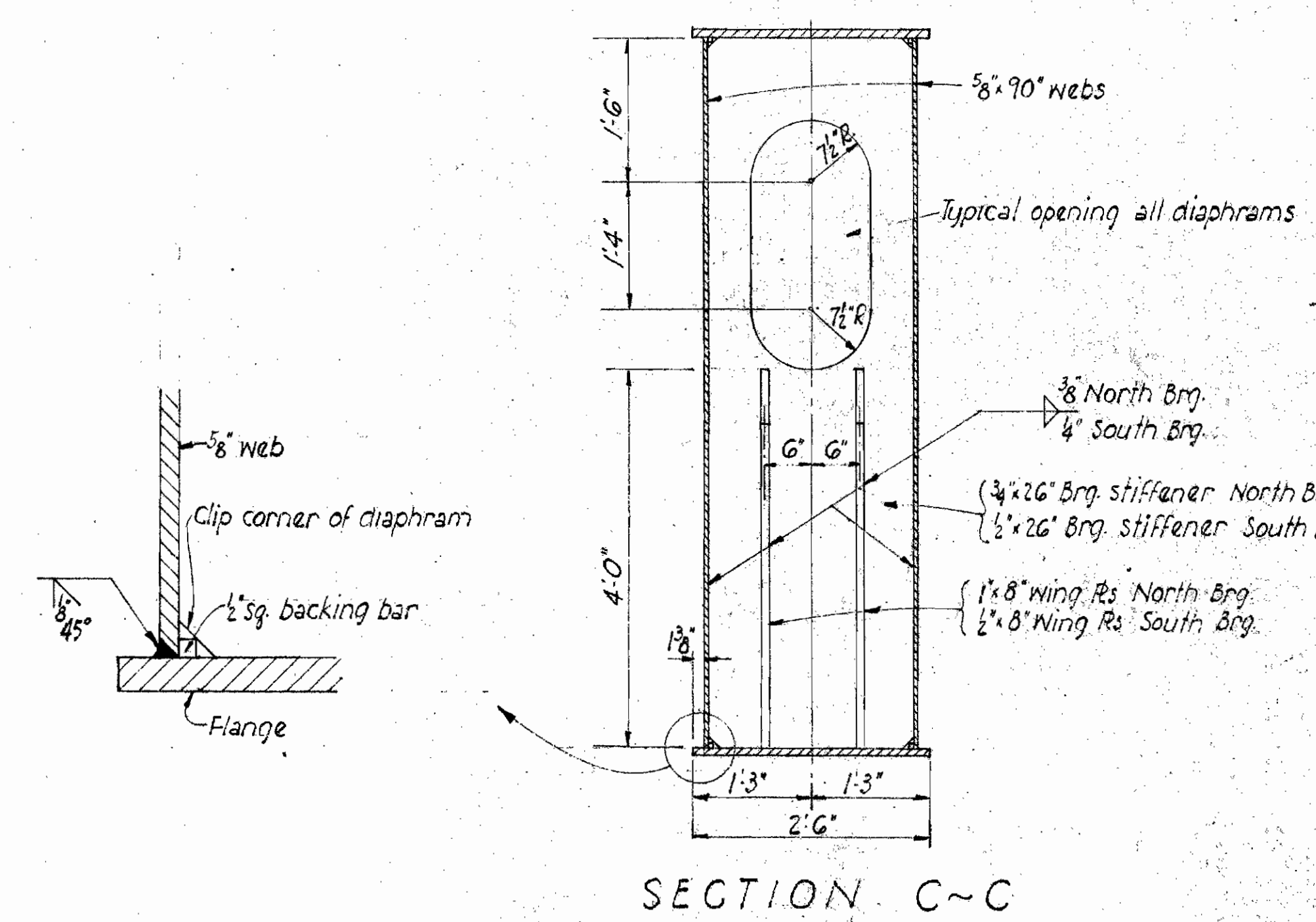


SECTION A~A  
Note: A band line exists at the Pier for Girders 1-10



GIRDER NO.	DIM. \"A\"
1	7 3/16\"
2	7 1/16\"
3	7\"
4	6 15/16\"
5	6 7/8\"

GIRDER NO.	DIM. \"A\"
6	6 1/16\"
7	6 3/4\"
8	6 13/16\"
9	6 15/16\"
10	7 1/16\"



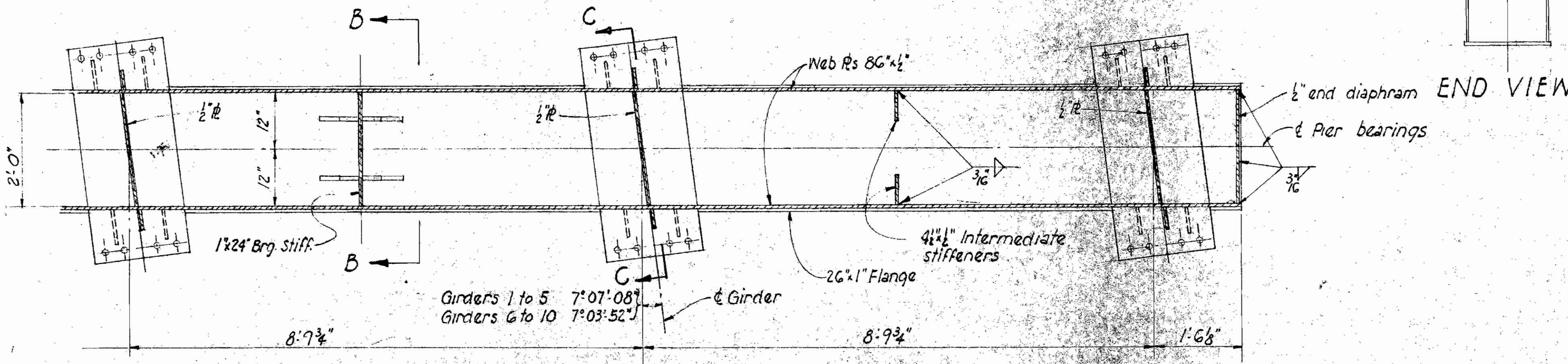
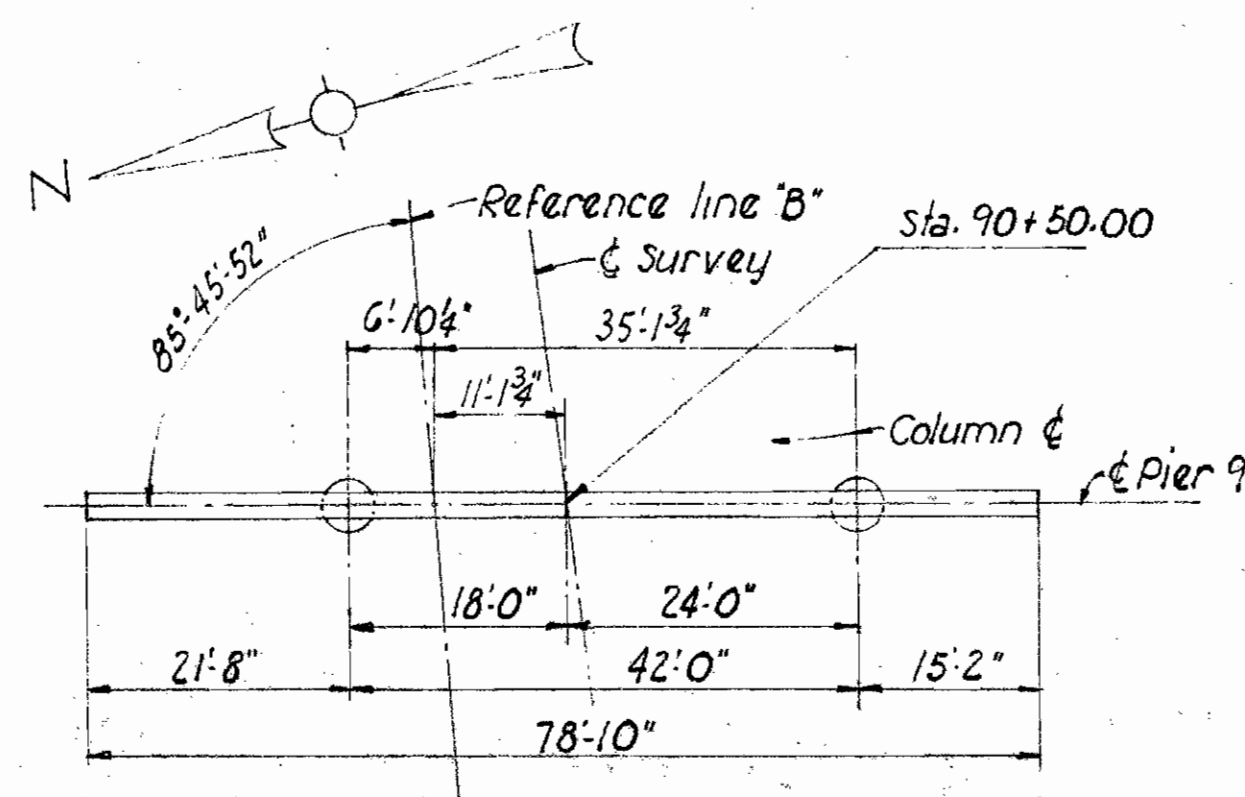
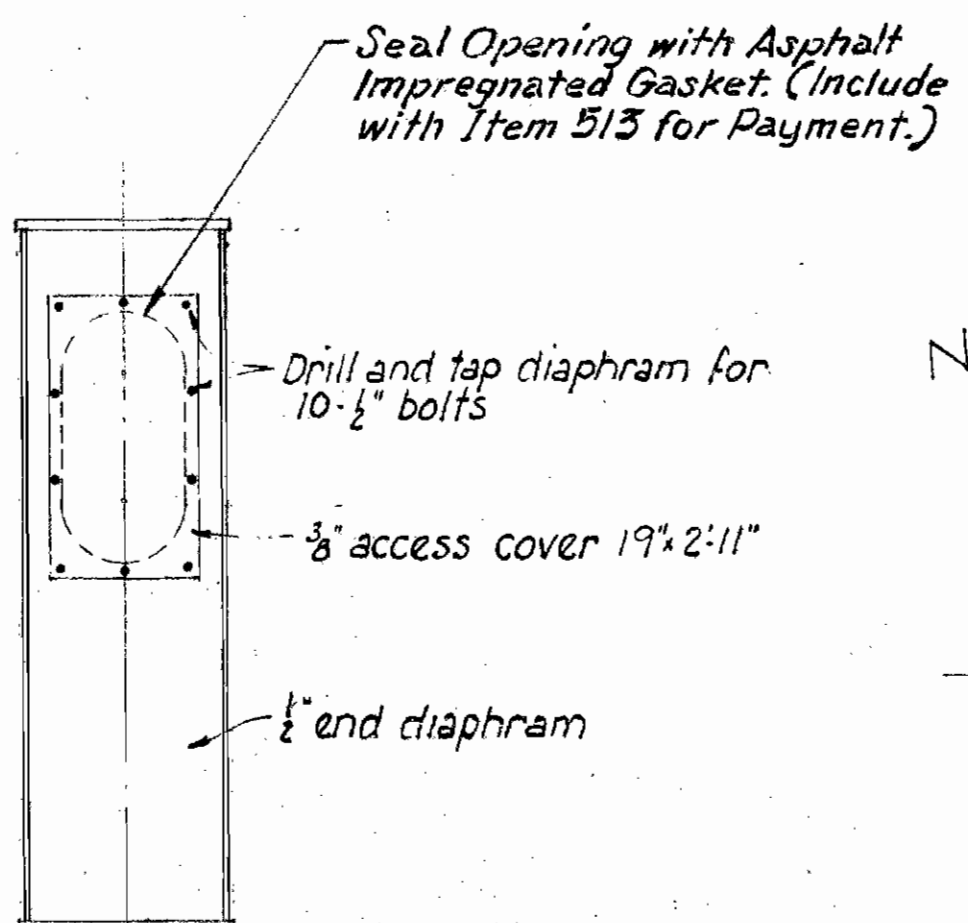
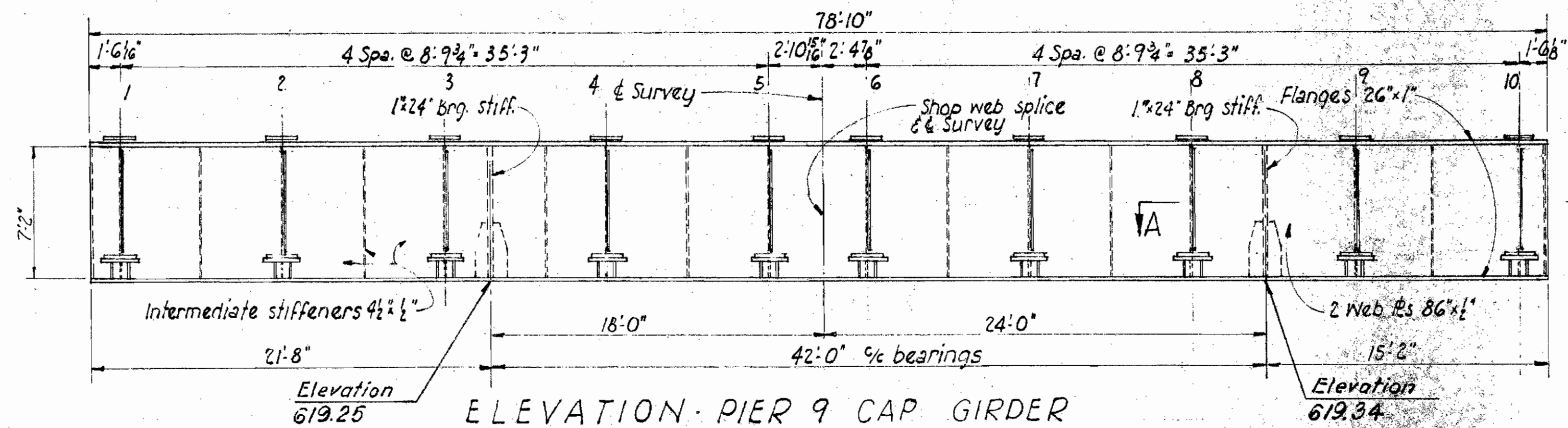
For additional notes and end diaphragm cover see 54/70  
For joint preparation see 37/70

VOGT, IVERS, & ASSOCIATES  
ENGINEERS ARCHITECTS  
CINCINNATI CHICAGO

**PIER 8 CAP GIRDER**  
BRIDGE NO. HAM-562-0150  
NORWOOD LATERAL OVER  
ROSS AVE. AND B.&O.R.R.  
HAMILTON COUNTY STA. 79 + 47.35  
STA. 93 + 52.25

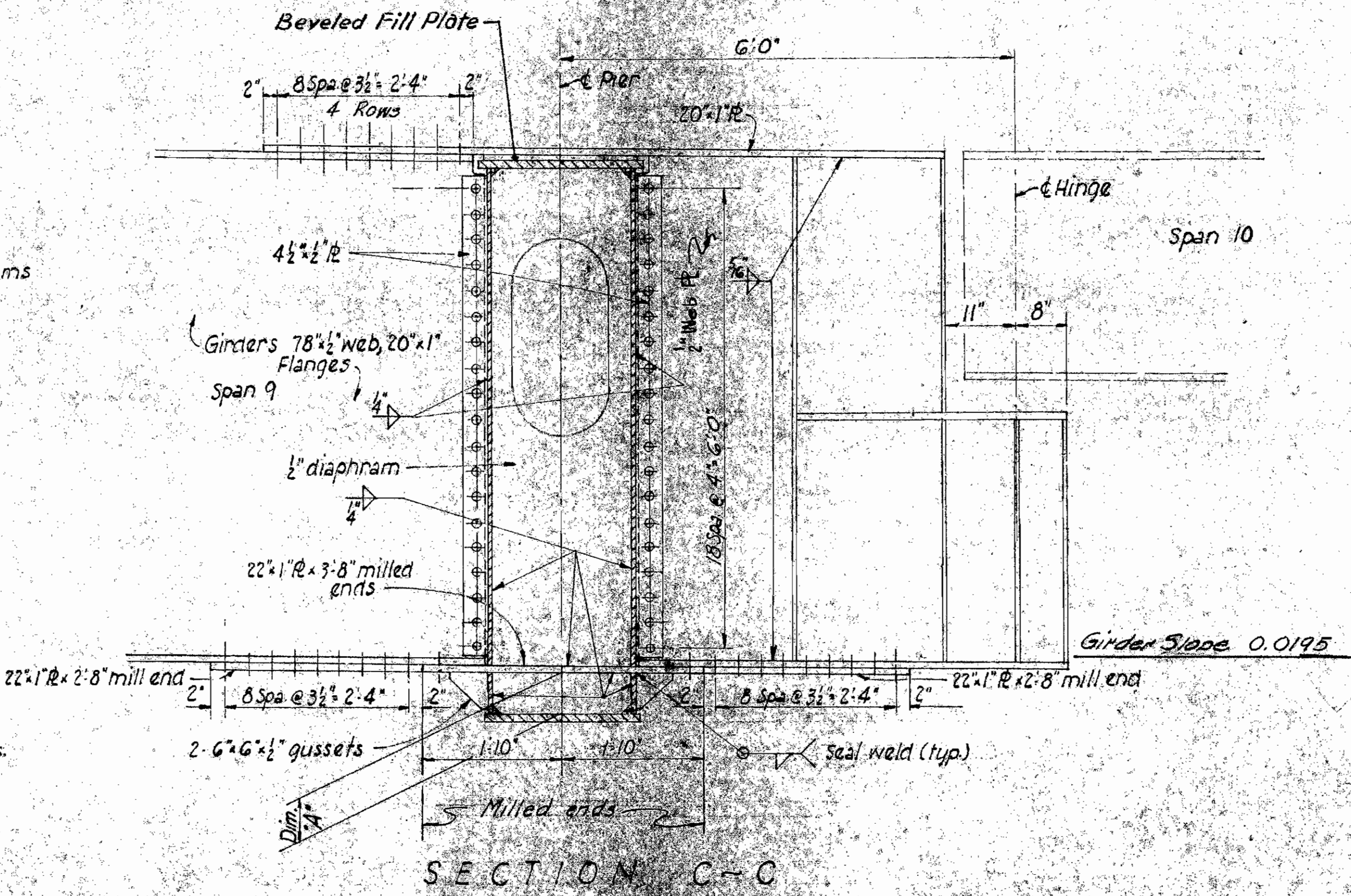
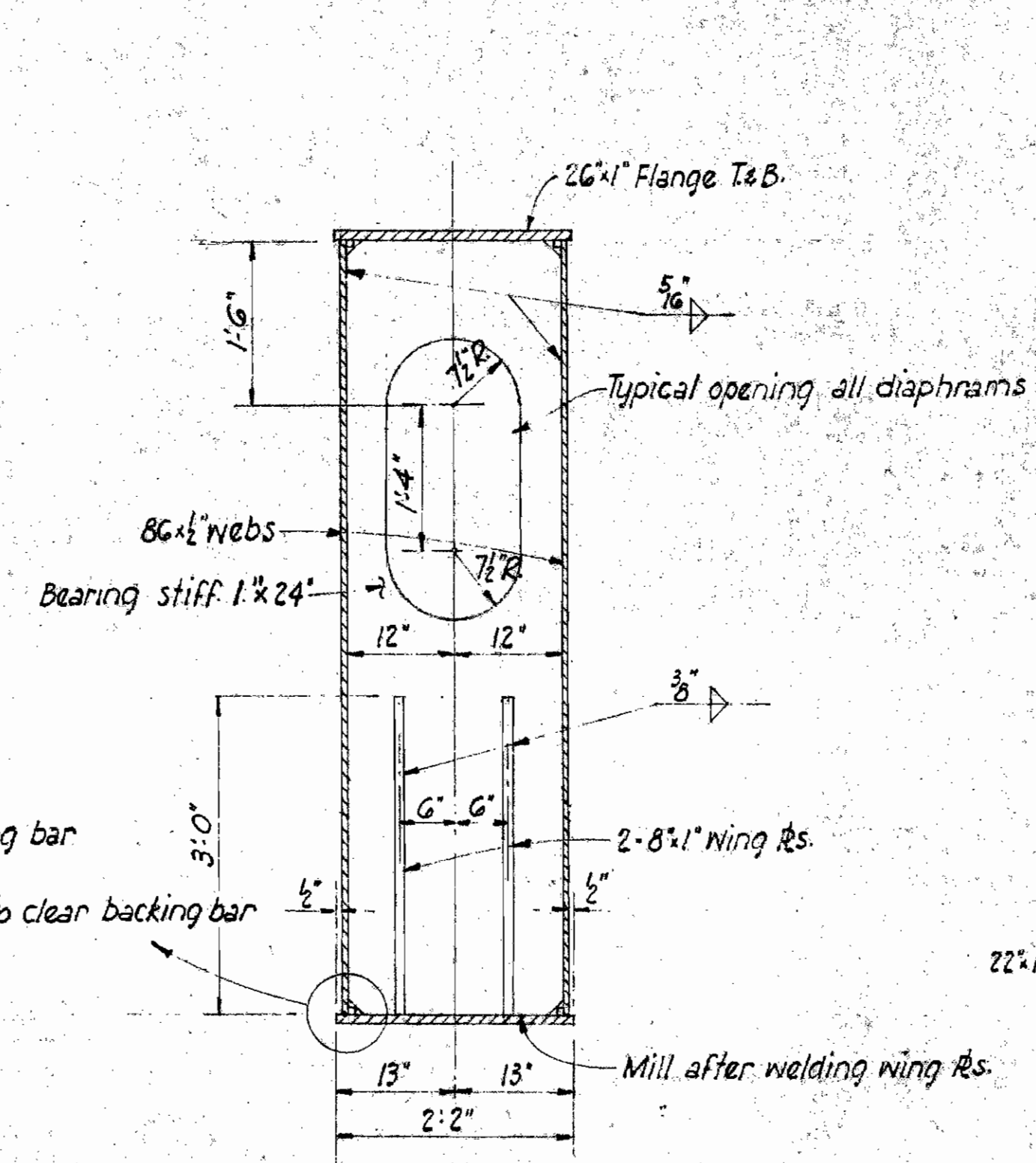
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
J.R.	J.R.		J.C.P.	llt	2-20-68	

HAM - 562-1.14



**NOTES FOR PIER CAP GIRDERS (Sheet 49 through 54/70)**

1. Field paint shall be omitted from the inside of the box girder section.
2. In order to secure full bearing on the milled ends of the compression flanges of the longitudinal girders the compression plates and the girder flanges shall be sub-punched or sub-drilled in the shop and thereafter drilled full size in the field.



GIRDER No.	DIM. "A"
1	7 15/16"
2	7 - 1/8"
3	7"
4	6 15/16"
5	6 7/8"

GIRDER No.	DIM. "A"
6	6 1/16"
7	6 1/16"
8	6 3/4"
9	6 13/16"
10	6 15/16"

For joint preparations see 37/70

54/70

**VOGT, IVERS, & ASSOCIATES**  
ENGINEERS ARCHITECTS  
CINCINNATI CHICAGO

**PIER 9 CAP GIRDER**  
BRIDGE NO. HAM-562-0150  
NORWOOD LATERAL OVER  
ROSS AVE. AND B.O.R.R.

HAMILTON COUNTY STA. 79+47.35  
STA. 93+52.25

DATE	BY	REVIEWED	DATE
J.R.	J.R.	J.C.P.	6/6 22068

**FRACTURE CRITICAL INSPECTION**

SR-562 Over Ross Ave and Indiana & Ohio Railway • SFN3112914 (HAM-562-0147)

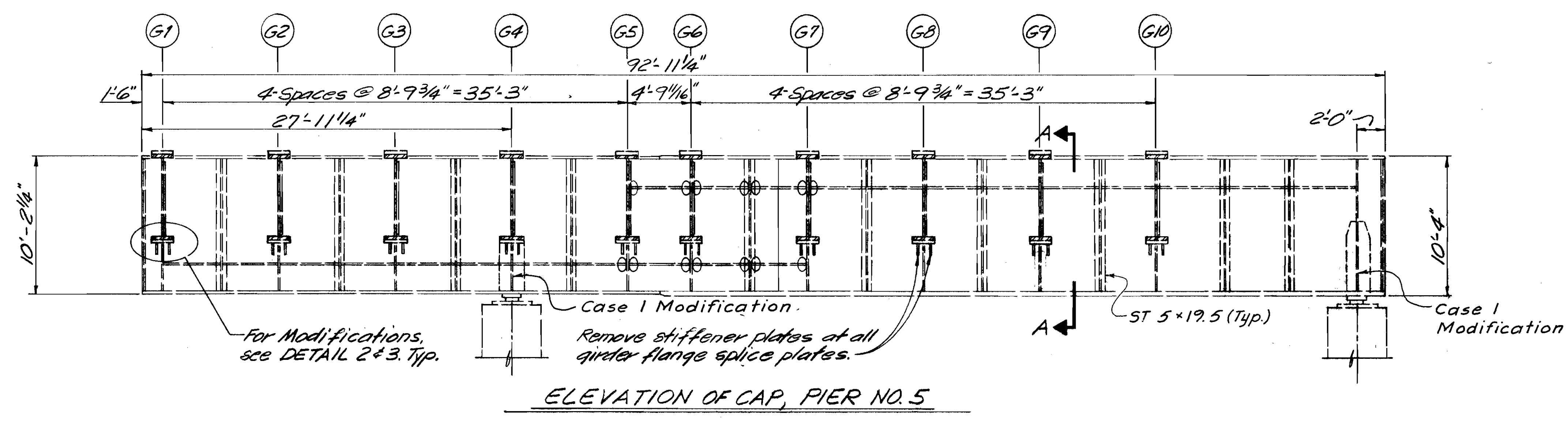
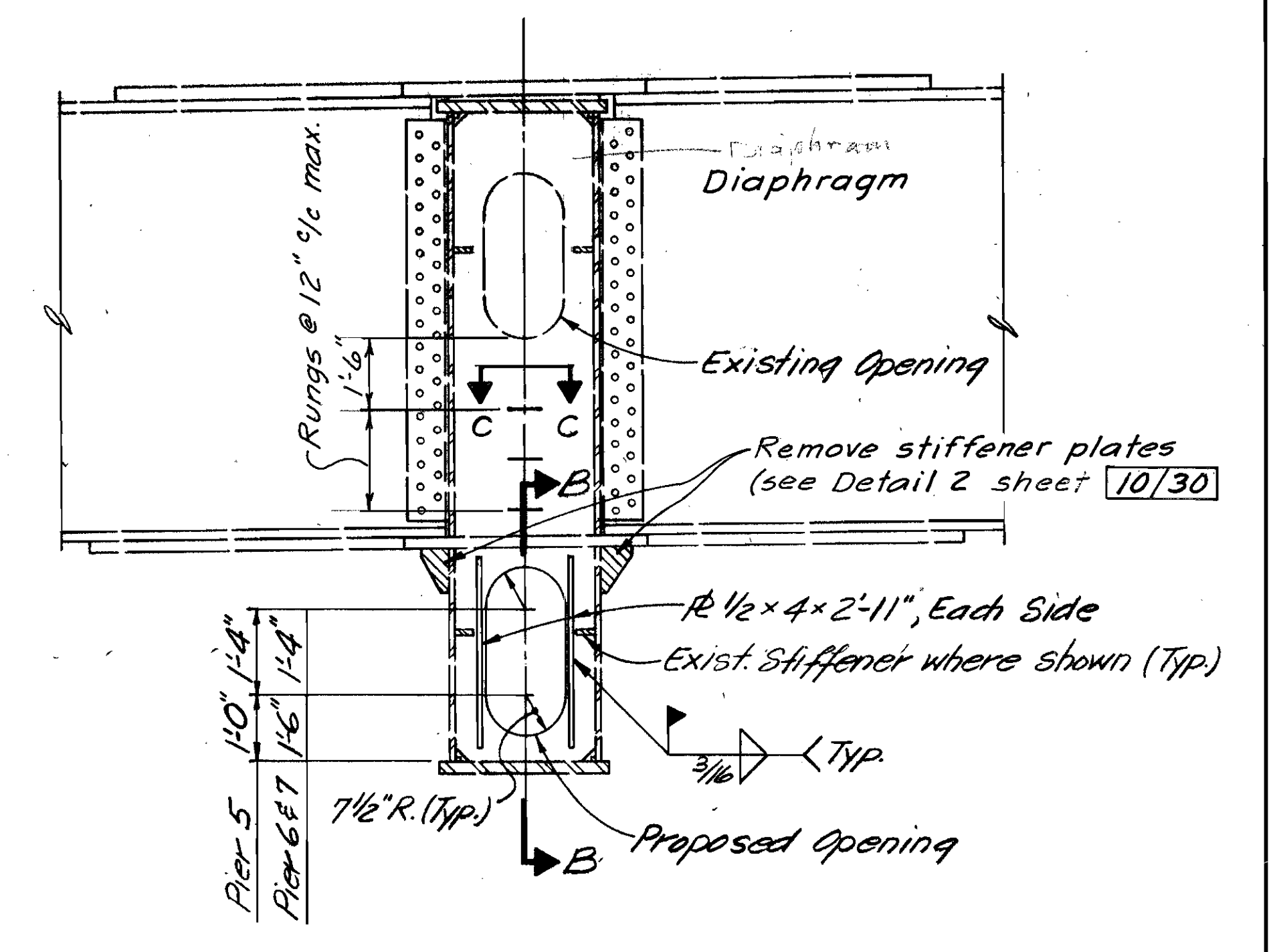
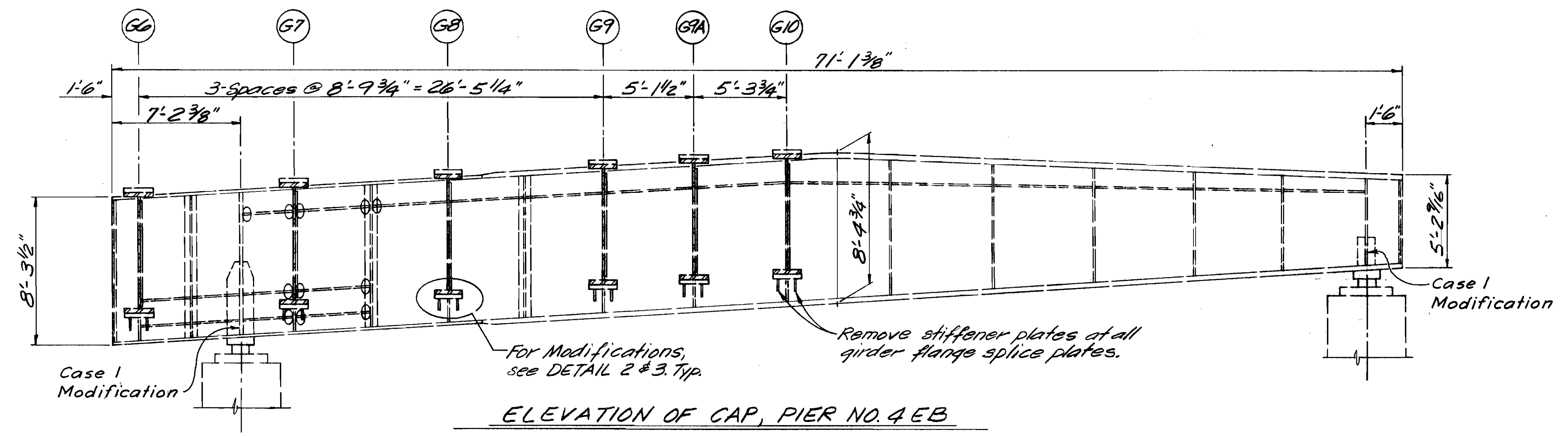
Hamilton County, OH • July 2023

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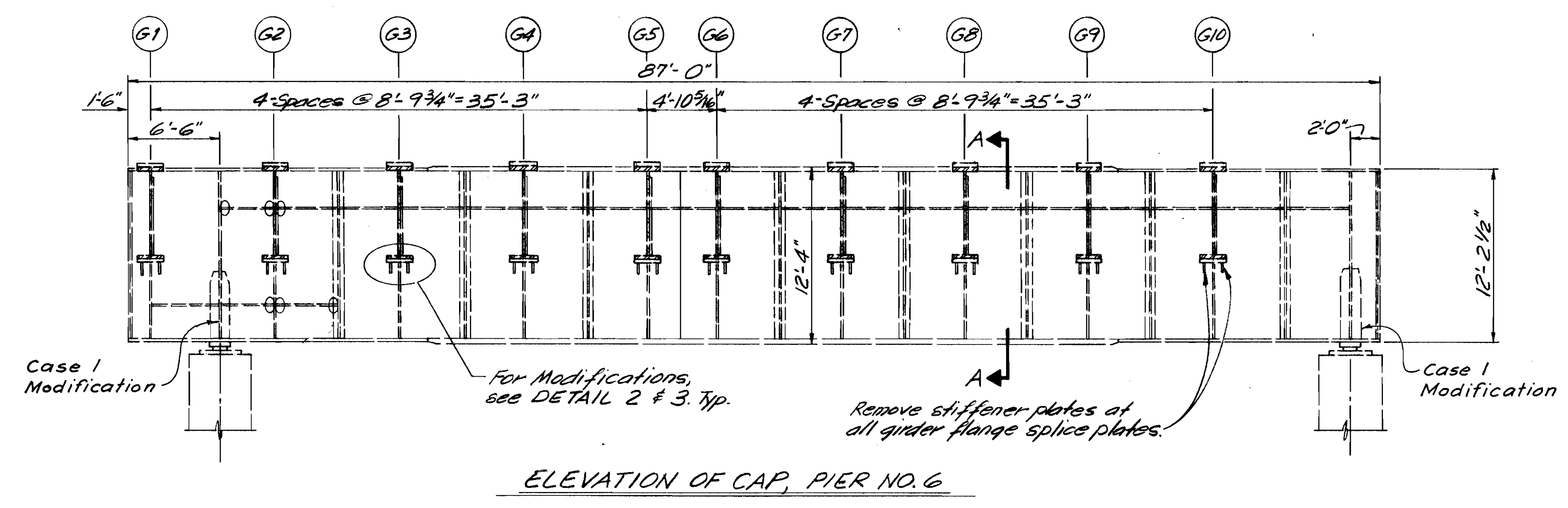
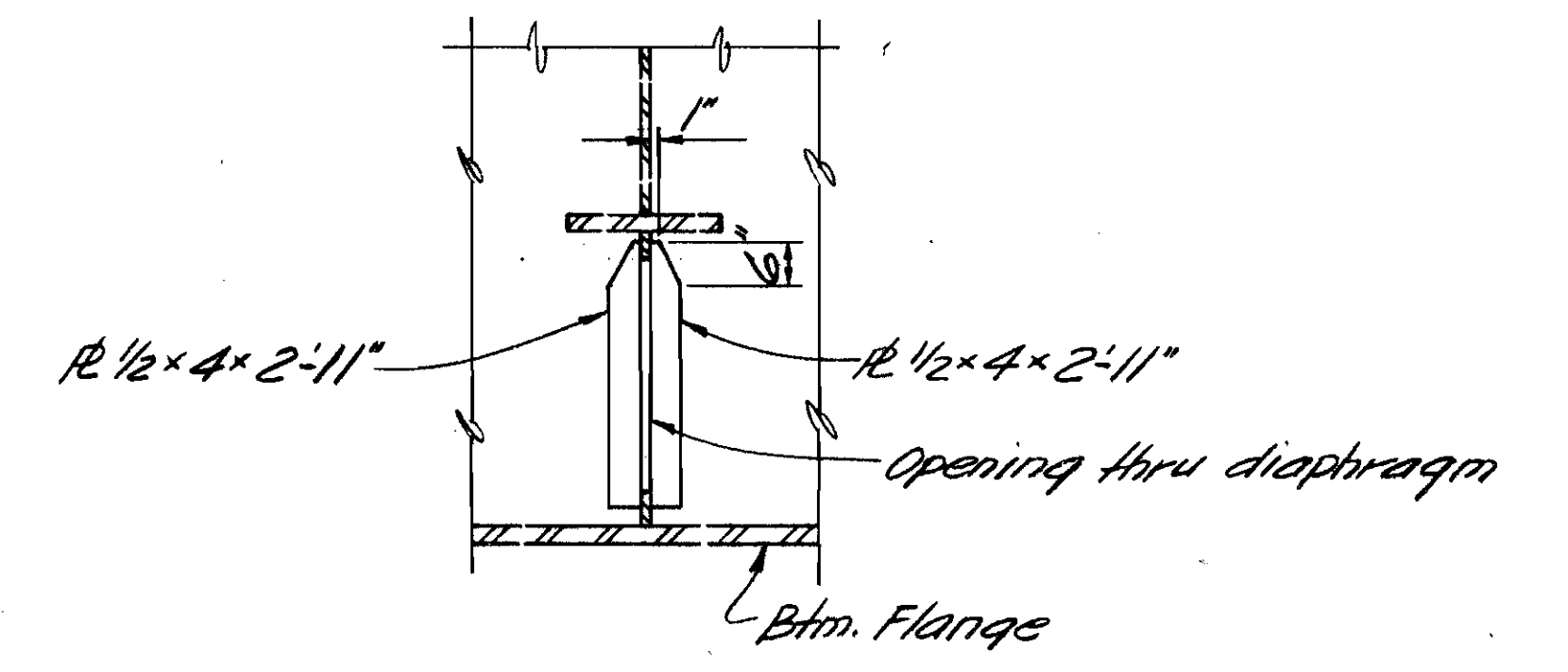


**EXHIBIT 2 – REHABILITATION PLANS**



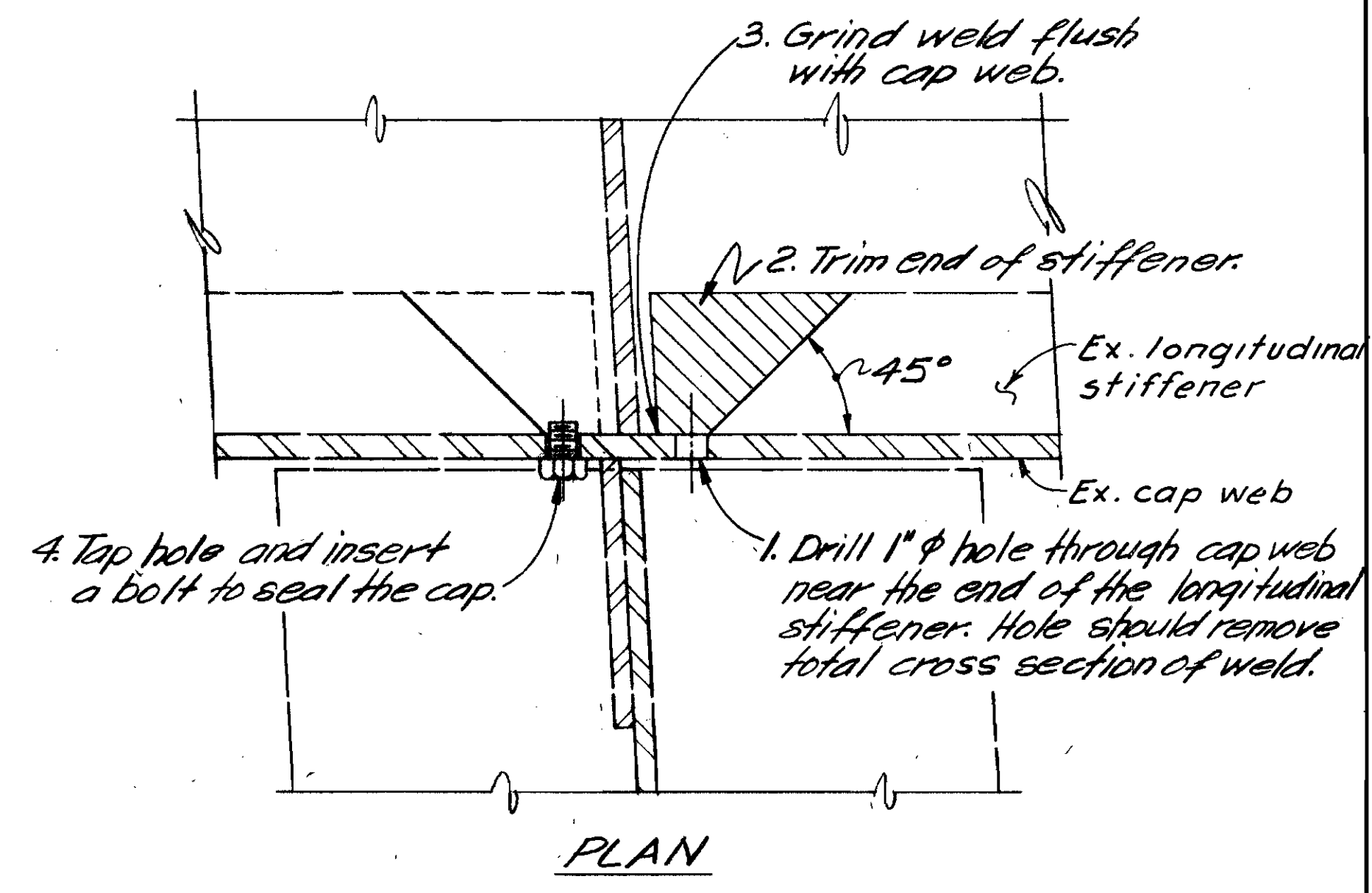
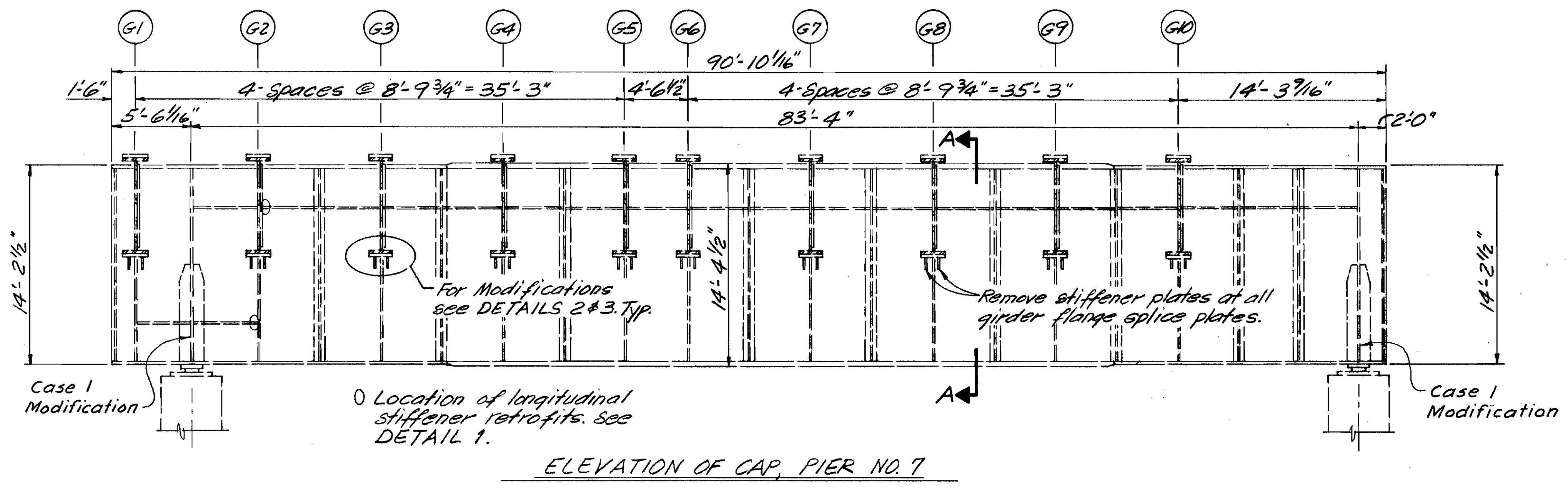


**SECTION A-A**  
TYPICAL AS NOTED  
Pier No. 5: G2, G3, G5 thru G10  
Pier No. 6: G2 thru G10  
Pier No. 7: G2 thru G10

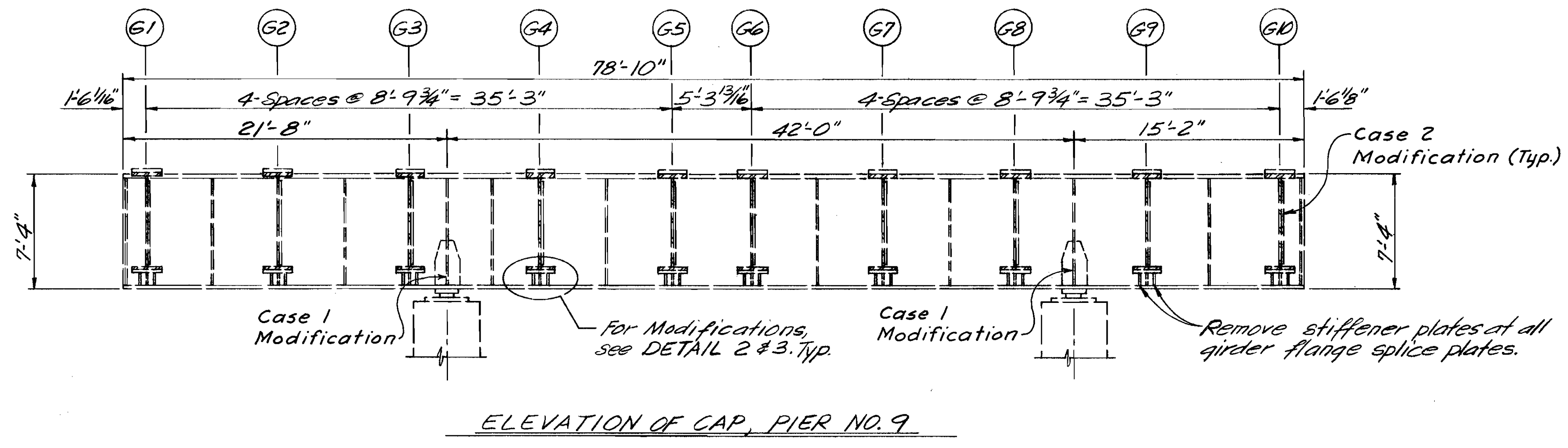
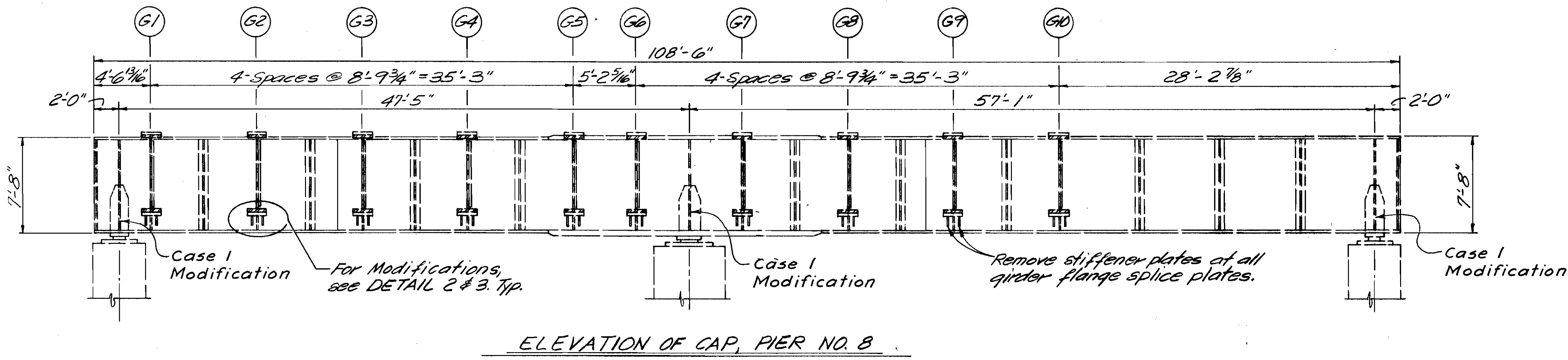


**NOTES:**  
Unless noted otherwise, all diaphragm shall be modified per Case 2 detail as shown on sheet 10/30.  
For Case 1 modification see sht. 10/30.  
O denotes location of longitudinal stiffener retrofits. See DETAIL 1 on Sheet 9/30.  
For DETAIL 2 & 3, see sht. 10/30.  
For SECTION C-C see sht. 10/30.

BALKE ENGINEERS 8/30 1848 SUMMIT RD. CINCINNATI, OHIO 45237					
<b>PIER CAP DETAILS</b> BRIDGE NO. HAM-562-0147 NORWOOD LATERAL OVER ROSS AVE. AND B. & O. R.R.					
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED DATE	REVISED
MRS	WJH	~	VDG	CRS 3/93	

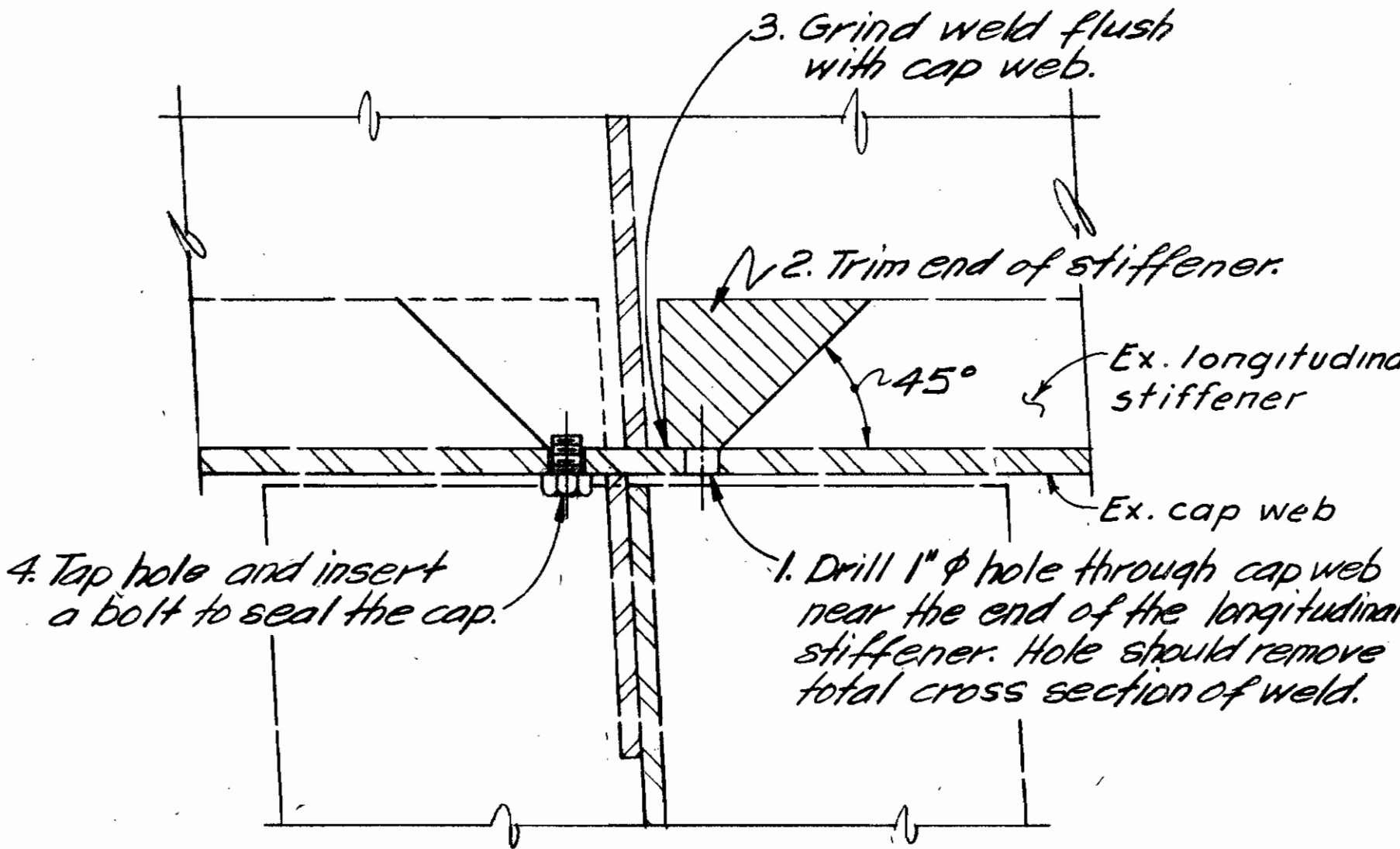


Retrofit detail for termination of longitudinal stiffener in tension zone of cap.



NOTES  
 Unless noted otherwise, all diaphragms shall be modified per Case 2 detail as shown on sheet 10/30  
 For Case 1 modification see sheet 10/30  
 For SECTION A-A see sheet 8/30  
 For DETAIL 2 & 3 see sheet 10/30

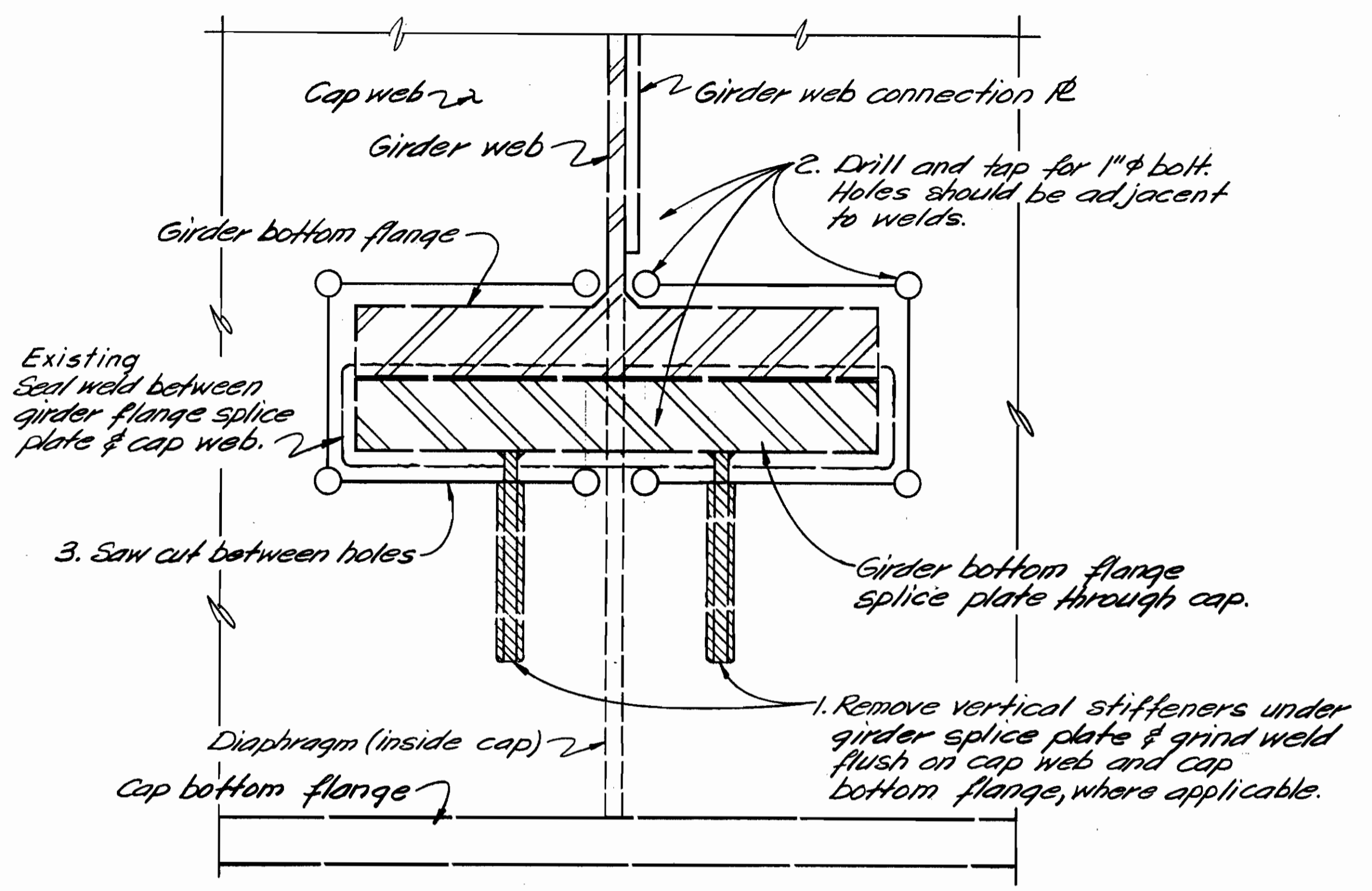
BALKE ENGINEERS					9/30
1848 SUMMIT RD.					
CINCINNATI, OHIO 45237					
PIER CAP DETAILS					
BRIDGE NO. HAM-562-0147					
NORWOOD LATERAL OVER					
ROSS AVE. AND B. & O. R.R.					
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED DATE	REVISED
MRS	WJH	~	VDG	GRS 3/93	



PLAN

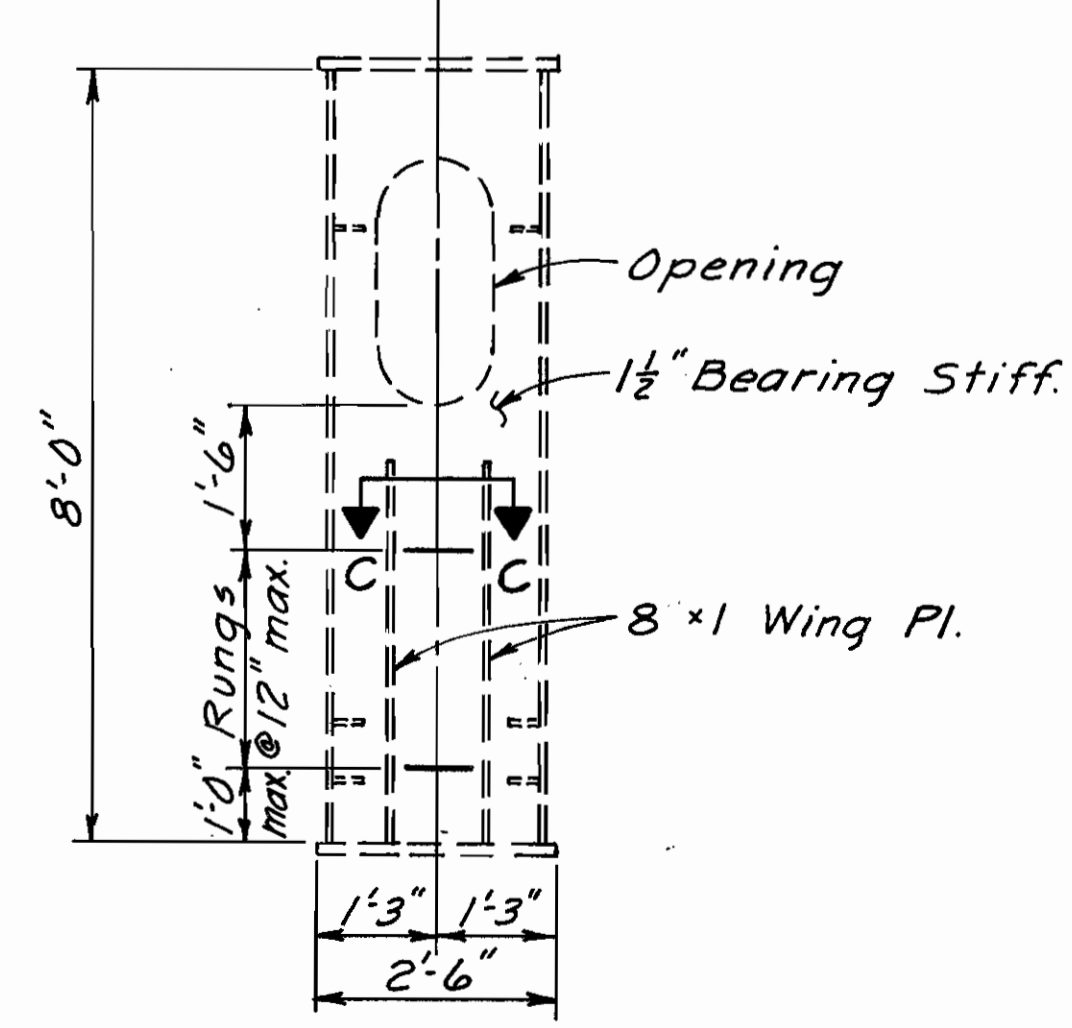
DETAIL 1

Retrofit detail for termination of longitudinal stiffener in tension zone of cap.

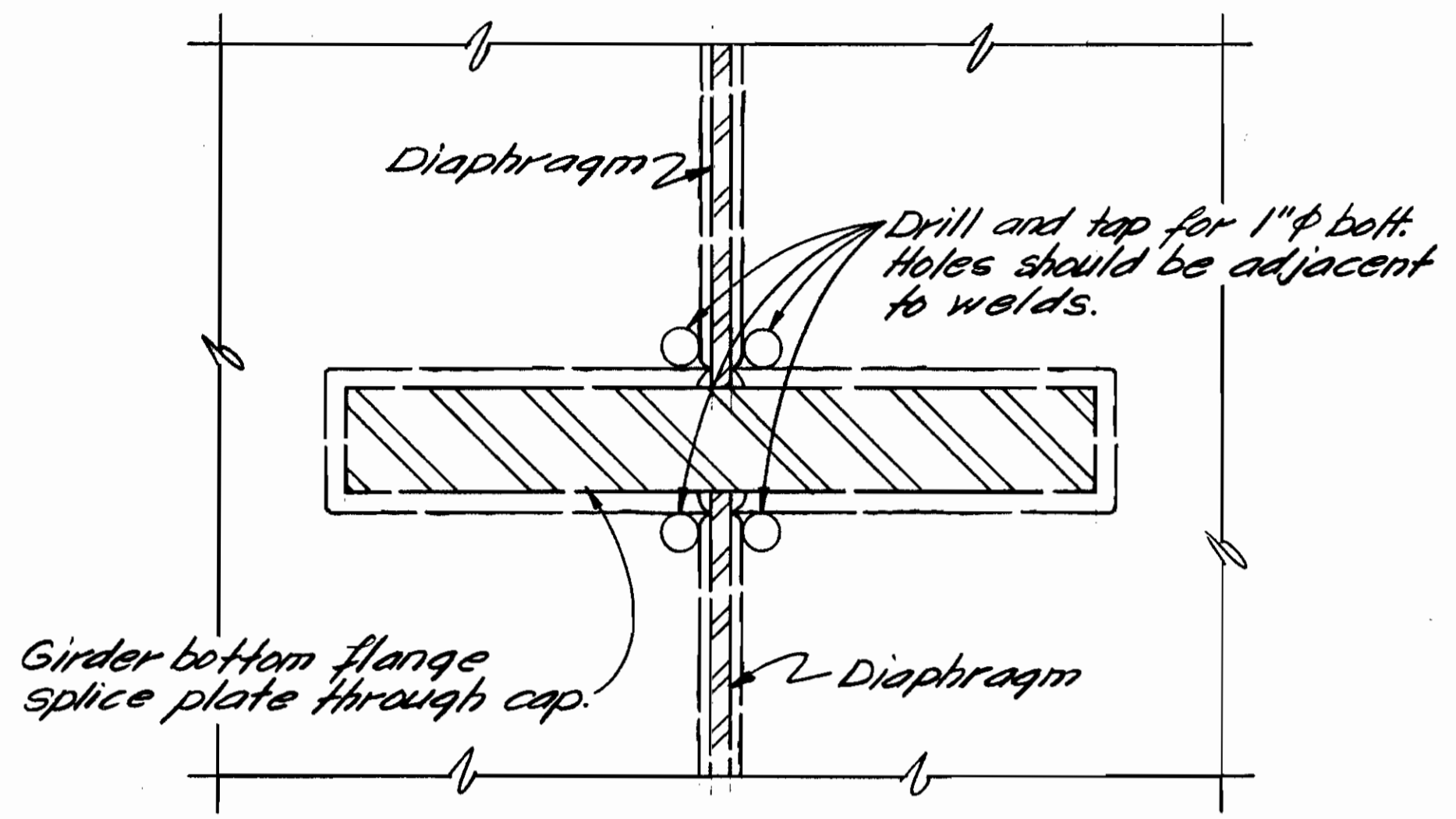


**DETAIL 2**

- TYPICAL AS NOTED
- Pier 4 E.B. : G8 thru G10
  - Pier 5 : G5 thru G10
  - Pier 6 : G3 thru G10
  - Pier 7 : G1 thru G3
  - Pier 8 : G1 thru G4, G8 thru G10
  - Pier 9 : G5 thru G7



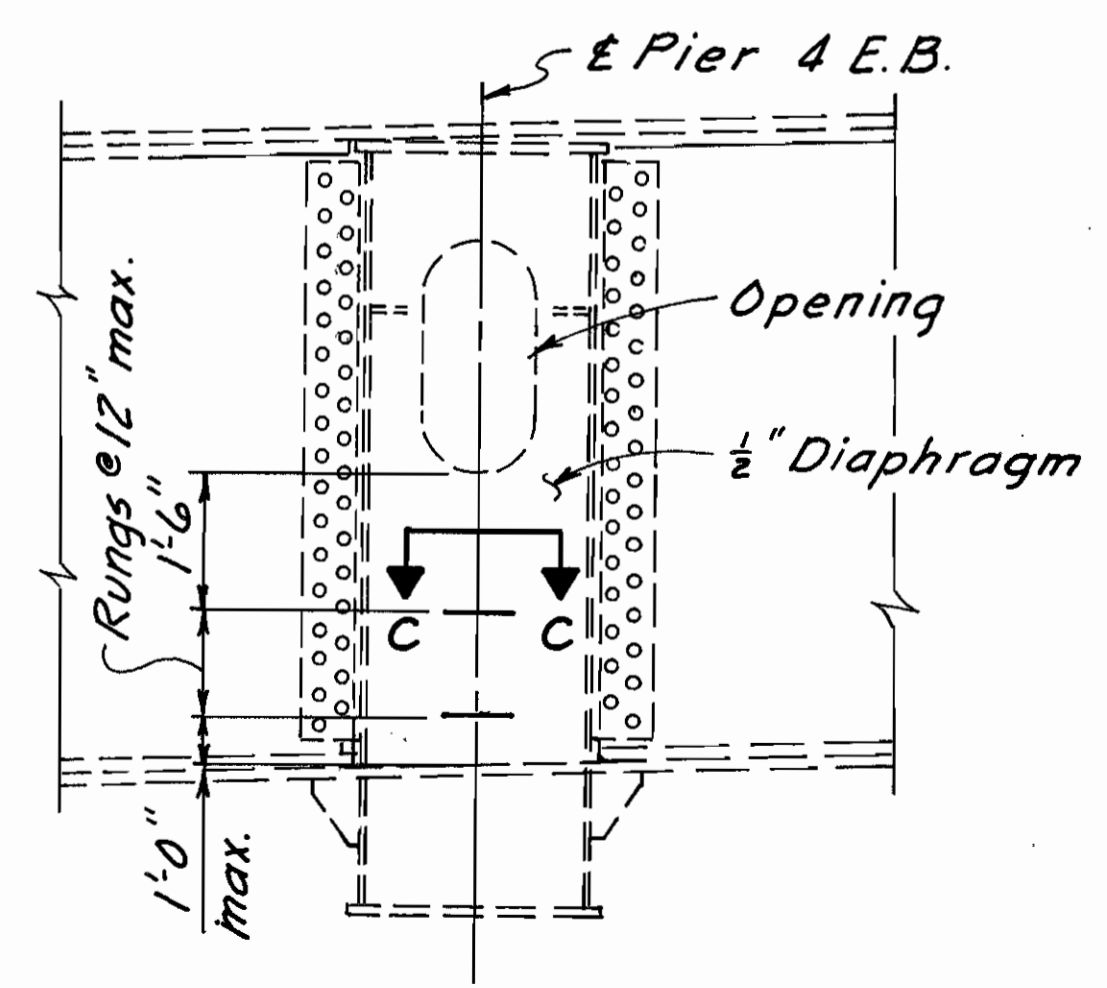
**CASE 1**  
Stiffener Modification



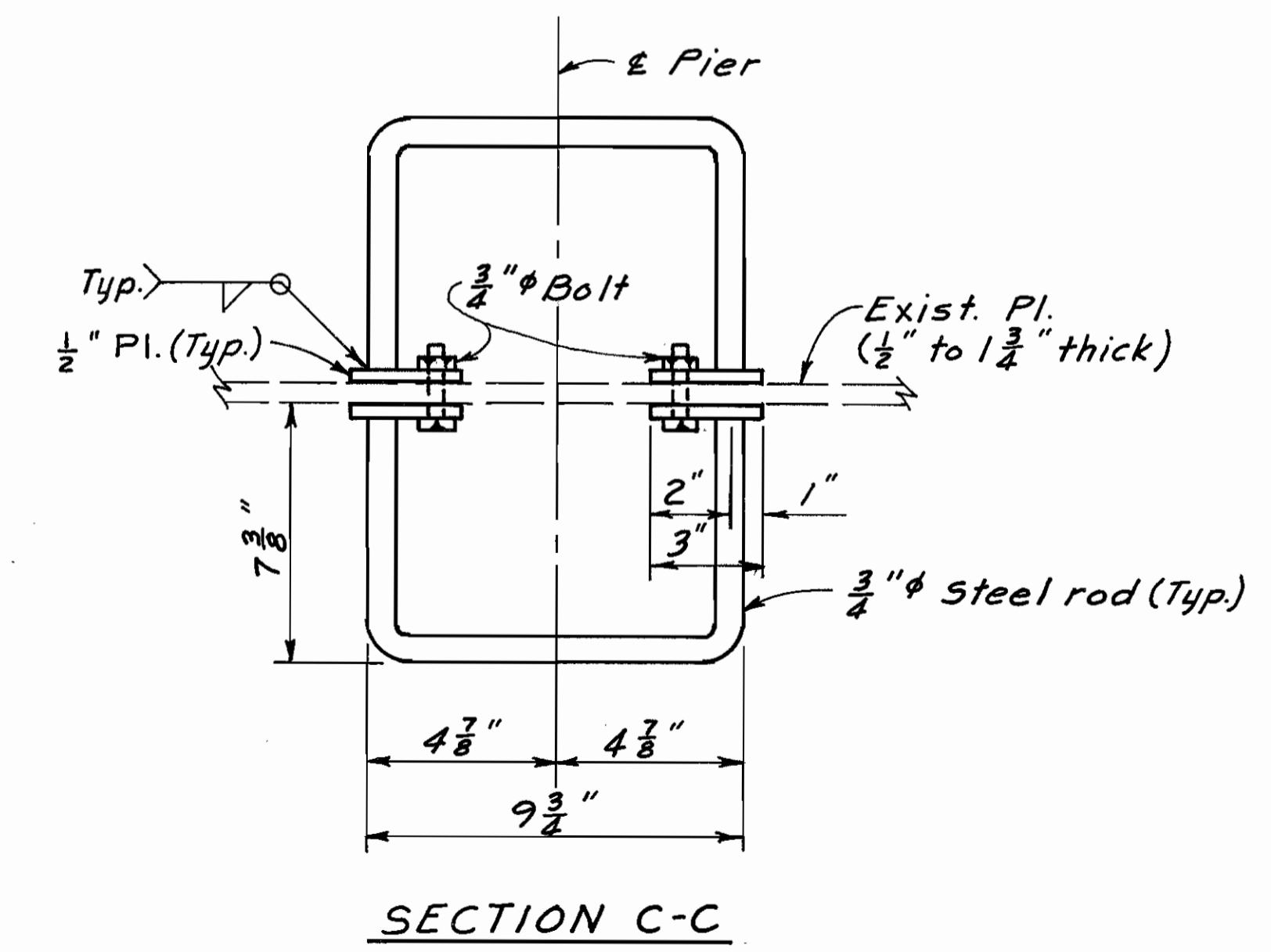
Note: View from inside cap.

**DETAIL 3**

- TYPICAL AS NOTED
- Pier 4 E.B. : G6 & G7
  - Pier 5 : G1 thru G4
  - Pier 6 : G1 & G2
  - Pier 7 : G4 thru G10
  - Pier 8 : G5 thru G7
  - Pier 9 : G1 thru G4, G8 thru G10



**CASE 2**  
Diaphragm Modification



**SECTION C-C**

**Notes**  
In addition to the work detailed on the plans, sheets 8-10, the following work is required on the box girder pier caps at Piers No. 4 E.B., 5, 6, 7, 8, and 9.

Remove pigeon droppings, debris and corrosion from exterior of all pier caps. Remove concrete between girder bottom flanges and cap web plates on all pier caps.

Remove rags and debris from the inside of all pier caps.

On cap of Piers No. 4 E.B., 5, 6, 7, 8 clean corroded and burned areas inside cap. Paint cleaned areas with primer coat of paint and apply final coat of paint, silver or white, to entire inside of cap, per System EEU.

On cap of Pier No. 4 E.B. replace deteriorated seal at north access hatch with elastomeric gasket of 1/8" thick neoprene closed cell sponge. Apply neoprene caulking around access hatch cover. Caulking should be applied to bare steel.

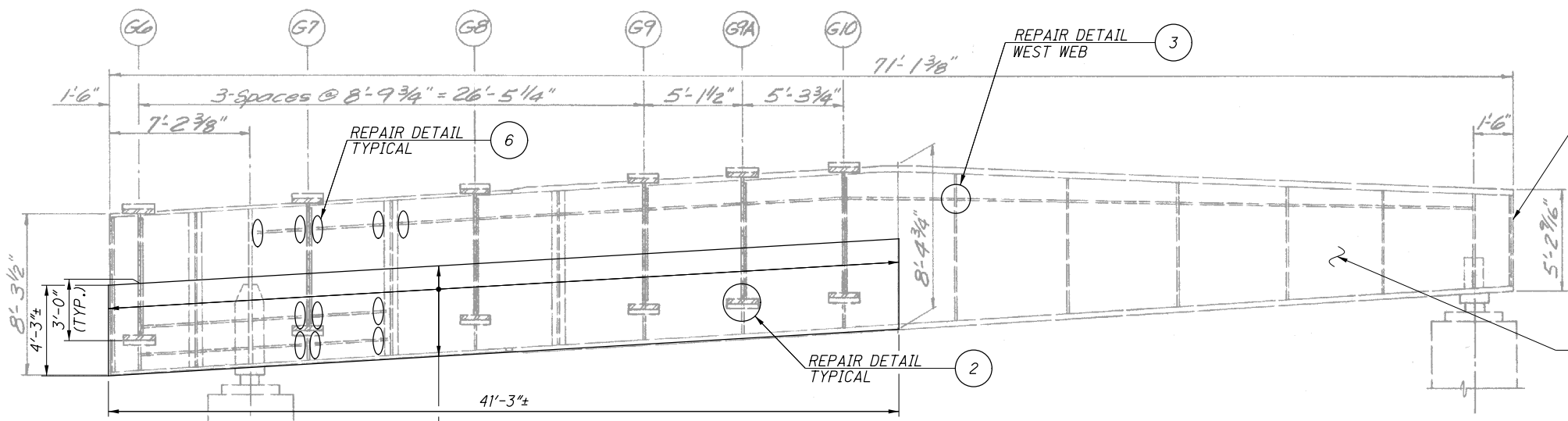
The cap of Piers No. 4 E.B. and 8 is bearing on anchor rod at south bearing device. Remove portion of anchor rod on which cap is bearing.

Clean and paint all bearings per System OZEU.

All labor, material and equipment necessary to execute the above work shall be included for payment in the unit price bid for Item 513 Structural steel misc. Repair of fracture-critical box girder pier cap.

BALKE ENGINEERS 10/30 1848 SUMMIT RD. CINCINNATI, OHIO 45237				
PIER CAP DETAILS BRIDGE NO. HAM-562-0147 NORWOOD LATERAL OVER ROSS AVE. AND B.&O. R.R.				
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED DATE
MRS	WUH	~	VDG	CRS 3/93

G:\CL\0080\Bridg\13\_(HAM-562-0147)\Sheets\93100SD01.dgn 6/12/2013 10:52:14 AM snlengenfelte

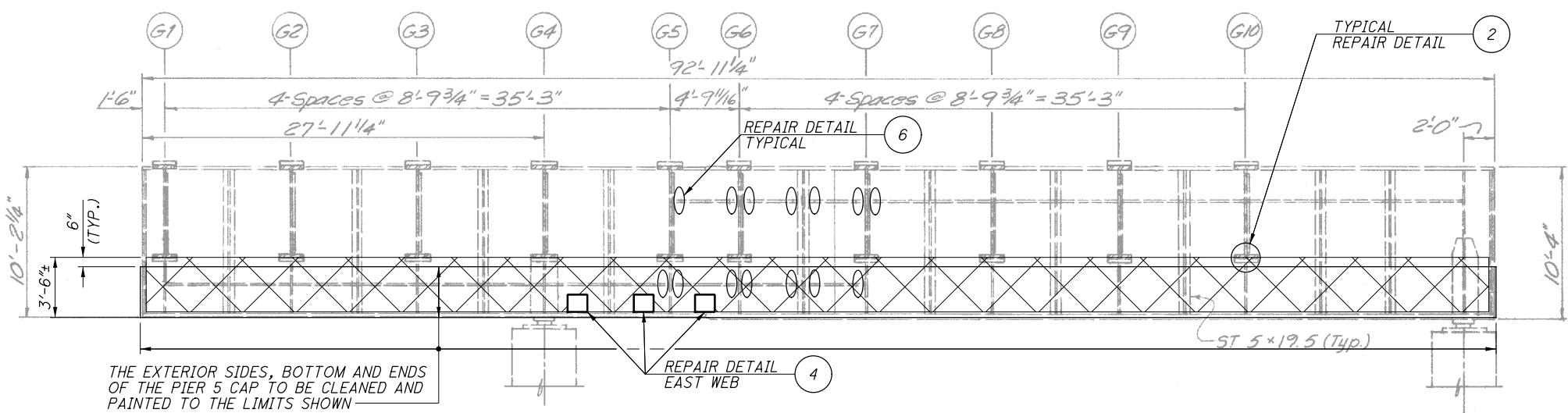


**WEST ELEVATION OF CAP, PIER NO. 4 E.B.**  
(ELEVATION TAKEN FROM 1991 REHAB. DRAWINGS)

THE EXTERIOR SIDES, BOTTOM AND END OF THE PIER 4 E.B. CAP TO BE CLEANED AND PAINTED TO THE LIMITS SHOWN

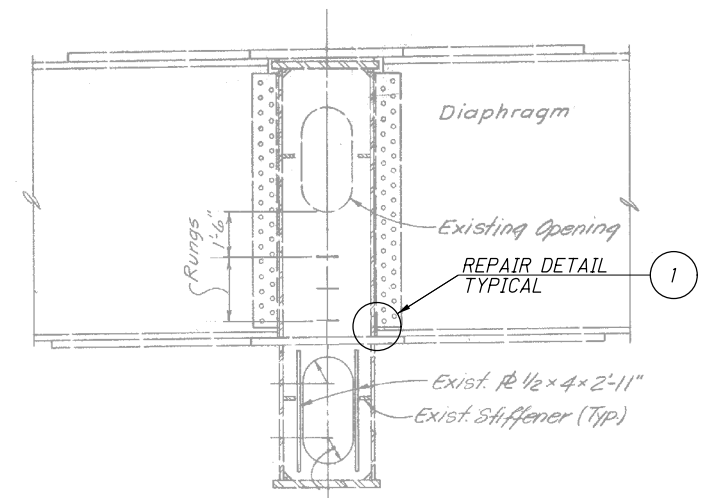
RESEAL SOUTH ACCESS HATCH WITH NEW NEOPRENE GASKET

THE ENTIRE INTERIOR SURFACE AREA OF PIER 4 E.B. CAP TO BE CLEANED AND PAINTED USING THE EEU PAINT SYSTEM.

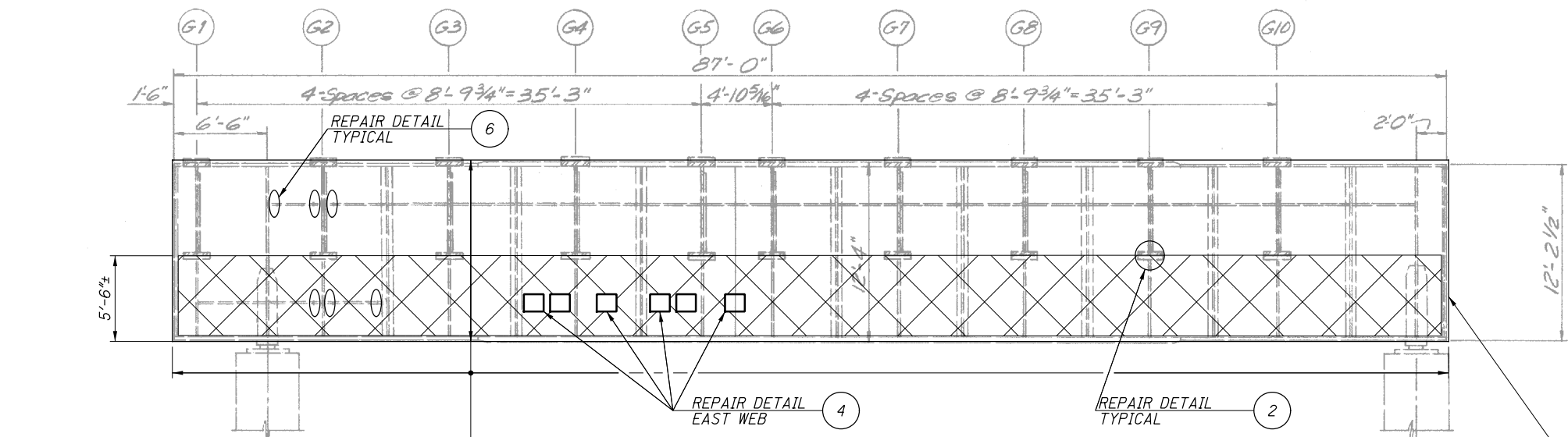


**WEST ELEVATION OF CAP, PIER NO. 5**  
(ELEVATION TAKEN FROM 1991 REHAB. DRAWINGS)

THE EXTERIOR SIDES, BOTTOM AND ENDS OF THE PIER 5 CAP TO BE CLEANED AND PAINTED TO THE LIMITS SHOWN



**TYPICAL SECTION**  
PIERS 5, 6 AND 7 SHOWN  
PIERS 4 E.B., 8 AND 9 SIMILAR  
(SECTION TAKEN FROM 1991 REHAB. DRAWINGS)






**WEST ELEVATION OF CAP, PIER NO. 6**  
(ELEVATION TAKEN FROM 1991 REHAB. DRAWINGS)

THE EXTERIOR EASTERN SIDE AND BOTTOM OF THE PIER 6 CAP TO BE CLEANED AND PAINTED TO THE LIMITS SHOWN

RESEAL SOUTH ACCESS HATCH WITH NEW NEOPRENE GASKET. REPLACE 7 MISSING BOLTS AT SOUTH WHICH SHALL BE INCIDENTAL TO THE STEEL PIER CAP SEAL, AS PER PLAN.

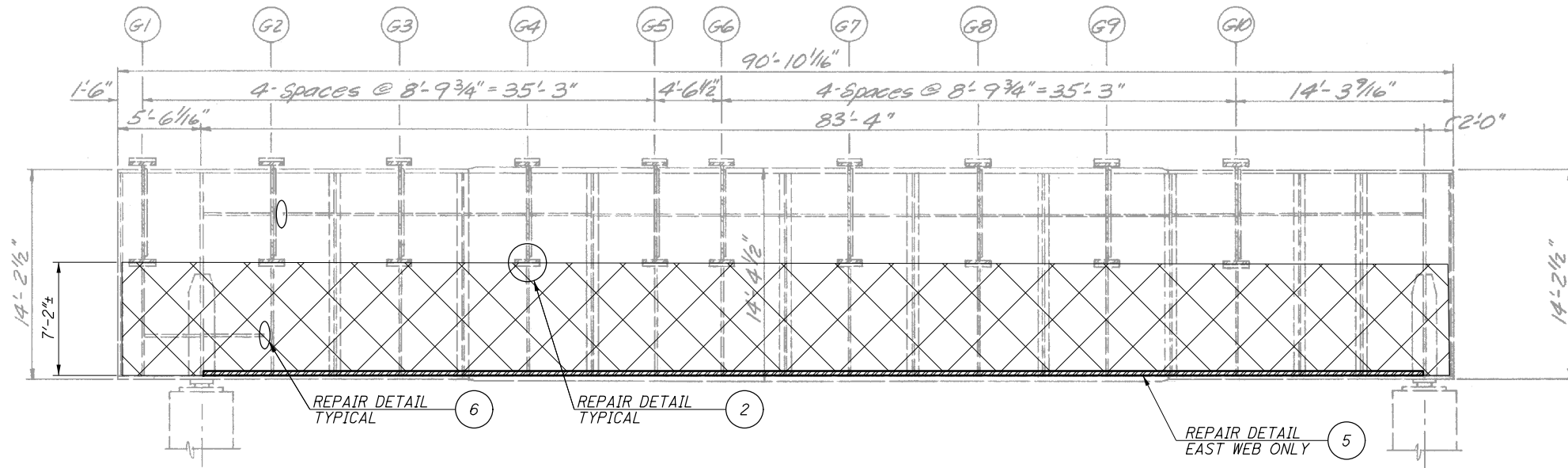
**LEGEND:**

-  - INDICATES THE LIMITS OF INTERIOR ZONE PAINTING USING THE EEU PAINT SYSTEM AT PIERS 5 AND 6 ONLY (FOR LIMITS OF INTERIOR PAINTING AT PIER 4 E.B., SEE WEST ELEVATION OF CAP, PIER NO. 4 E.B.). CLEAN AND PAINT ALL SURFACES (DIAPHRAGMS, WEBS, STIFFENERS, ETC) FROM THE TOP OF THE TIE PLATES TO AND INCLUDING THE BOTTOM FLANGE.
-  - INDICATES REPAIR DETAIL 4
-  - INDICATES REPAIR DETAIL 6

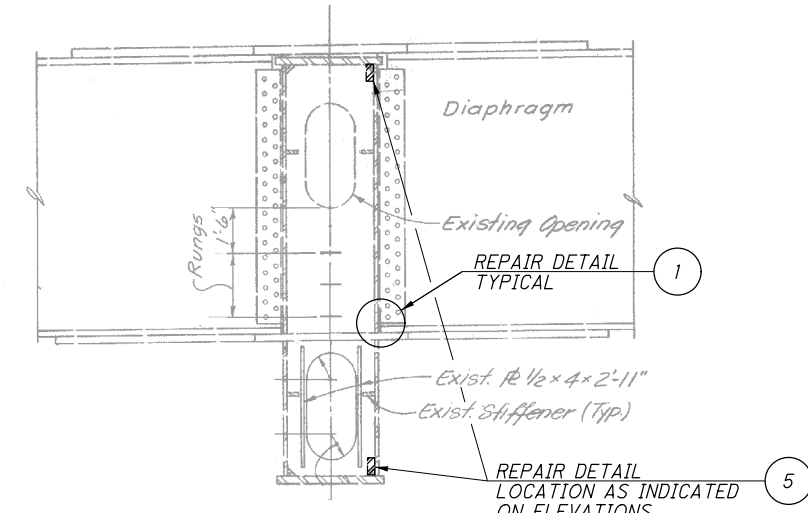
**NOTES:**

1. FOR DETAILS AND PAYMENT FOR REPAIR DETAILS 1 THRU 4 AND 6, SEE SHEET 8/16.
2. SEALING THE ACCESS HATCHES WITH NEW NEOPRENE GASKETS IS INCLUDED FOR PAYMENT UNDER ITEM SPECIAL STRUCTURE MISC.: STEEL PIER CAP SEAL. SEE THE STRUCTURE GENERAL NOTES ON SHEET 2/16.
3. FOR NOTES AND PAYMENT INFORMATION ON THE EEU PAINT SYSTEM, SEE SHEET 2/16. ANY PAINT DISTURBED BY THE INTERIOR REPAIRS PERFORMED OUTSIDE OF THE ZONE PAINTING SHALL BE REPAIRED AND PAID FOR UNDER THE EEU PAINT SYSTEM PAY ITEMS.

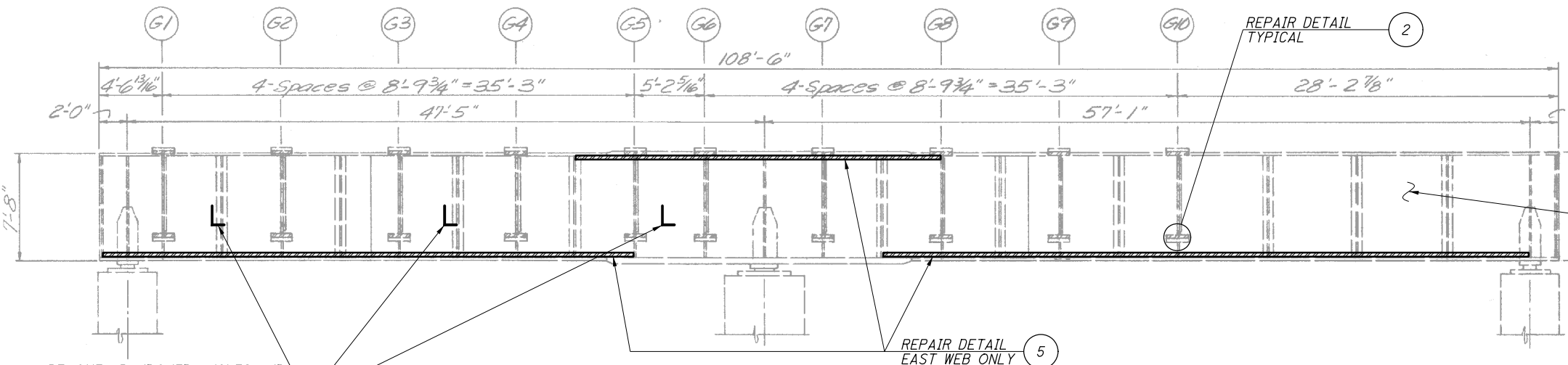
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**WEST ELEVATION OF CAP, PIER NO. 7**  
(ELEVATION TAKEN FROM 1991 REHAB. DRAWINGS)



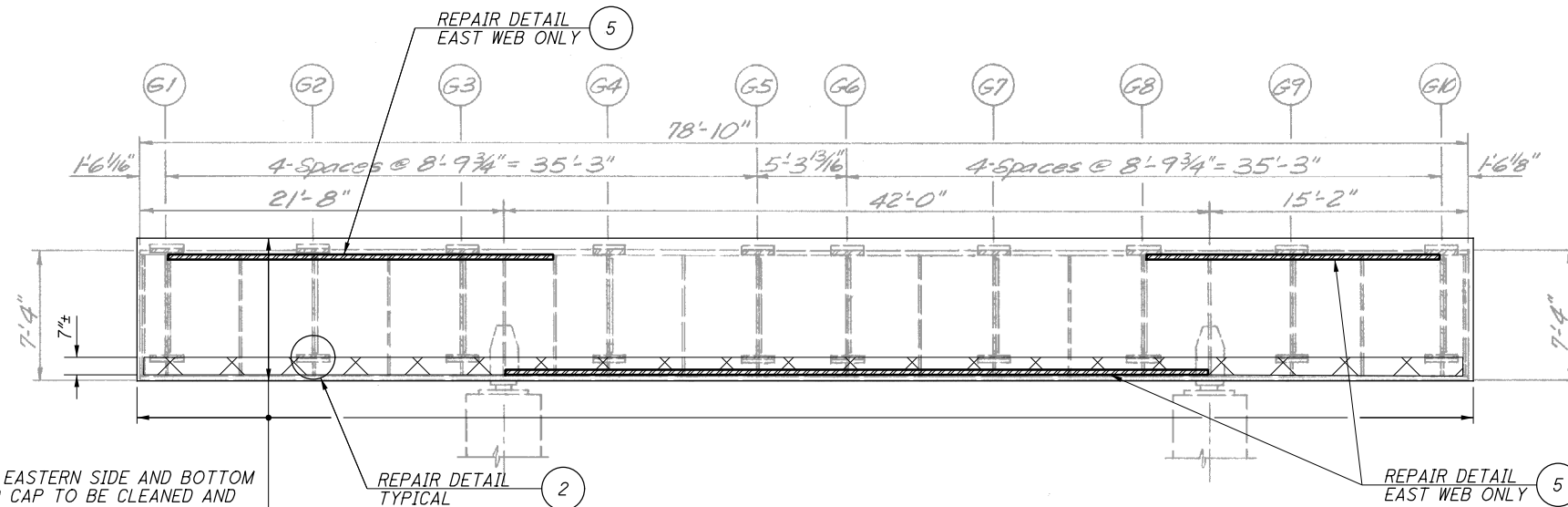
**TYPICAL SECTION**  
PIERS 5, 6 AND 7 SHOWN  
PIERS 4 E.B., 8 AND 9 SIMILAR  
(SECTION TAKEN FROM 1991 REHAB. DRAWINGS)



**WEST ELEVATION OF CAP, PIER NO. 8**  
(ELEVATION TAKEN FROM 1991 REHAB. DRAWINGS)

THE ENTIRE INTERIOR SURFACE AREA OF PIER 8 CAP TO BE CLEANED AND PAINTED USING THE EEU PAINT SYSTEM.



REMOVE ABANDONED ANGLES AND GRIND WELDS FLUSH ON THE EAST AND WEST WEB & EXTERIORS (SIX TOTAL)



**WEST ELEVATION OF CAP, PIER NO. 9**  
(ELEVATION TAKEN FROM 1991 REHAB. DRAWINGS)

THE EXTERIOR EASTERN SIDE AND BOTTOM OF THE PIER 9 CAP TO BE CLEANED AND PAINTED TO THE LIMITS SHOWN

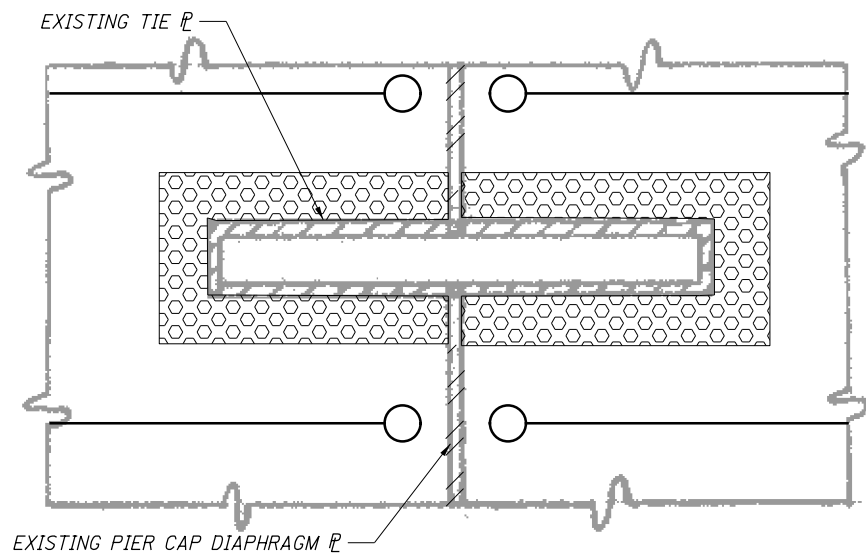
**LEGEND:**

-  - INDICATES THE LIMITS OF INTERIOR ZONE PAINTING USING THE EEU PAINT SYSTEM AT PIERS 7 AND 9 ONLY (FOR LIMITS OF INTERIOR PAINTING AT PIER 8, SEE WEST ELEVATION OF CAP, PIER NO. 8). CLEAN AND PAINT ALL SURFACES (DIAPHRAGMS, WEBS, STIFFENERS, ETC) FROM THE TOP OF THE TIE PLATES TO AND INCLUDING THE BOTTOM FLANGE.
-  - INDICATES REPAIR DETAIL 6

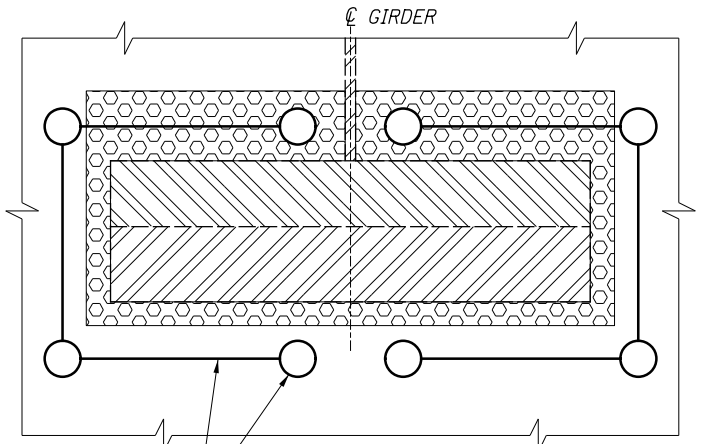
**NOTES:**

1. FOR DETAILS AND PAYMENT FOR REPAIR DETAILS 1, 2, 4, 5 AND 6, SEE SHEET 8/16.
2. GRINDING THE WELDS AT THE ABANDONED ATTACHMENTS IS INCLUDED FOR PAYMENT UNDER ITEM 513-STRUCTURAL STEEL, MISC.: GRINDING PER FOOT. SEE THE STRUCTURE GENERAL NOTES ON SHEET 7/16.
3. FOR NOTES AND PAYMENT INFORMATION ON THE EEU PAINT SYSTEM, SEE SHEET 2/16. ANY PAINT DISTURBED BY THE INTERIOR REPAIRS PERFORMED OUTSIDE OF THE ZONE PAINTING SHALL BE REPAIRED AND PAID FOR UNDER THE EEU PAINT SYSTEM PAY ITEMS.

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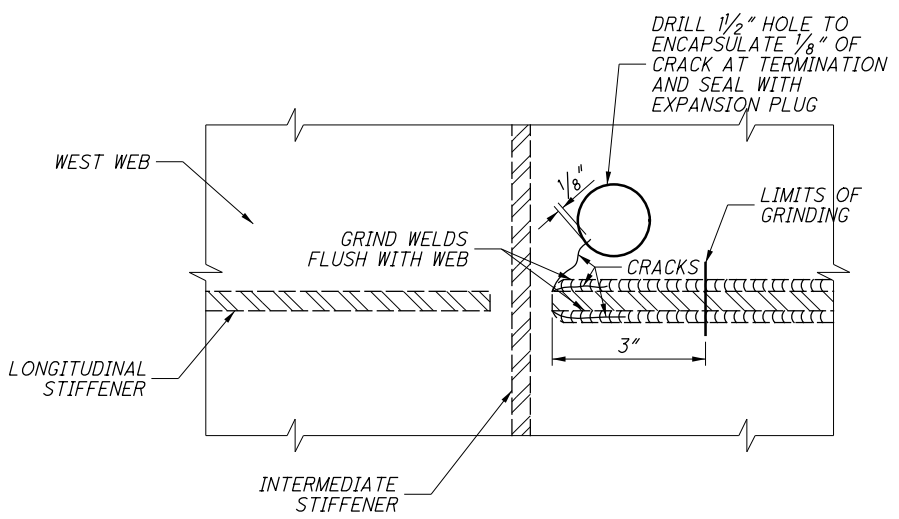


**REPAIR DETAIL**  
**INTERIOR TIE** 1



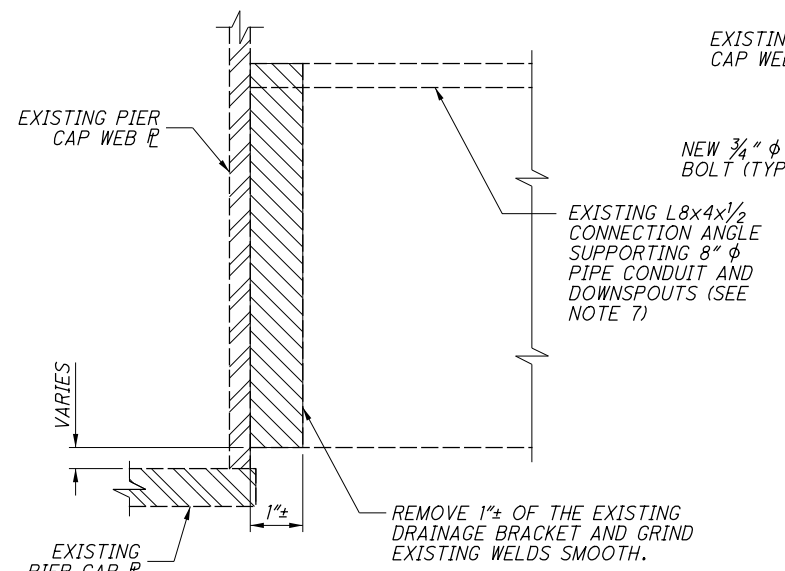
CLEAN AND RECAULK EX. SAW CUTS AND REPLUG THE STRESS HOLES WITH 1" EXPANSION PLUGS (TYP.)

**REPAIR DETAIL**  
**EXTERIOR TIE** 2

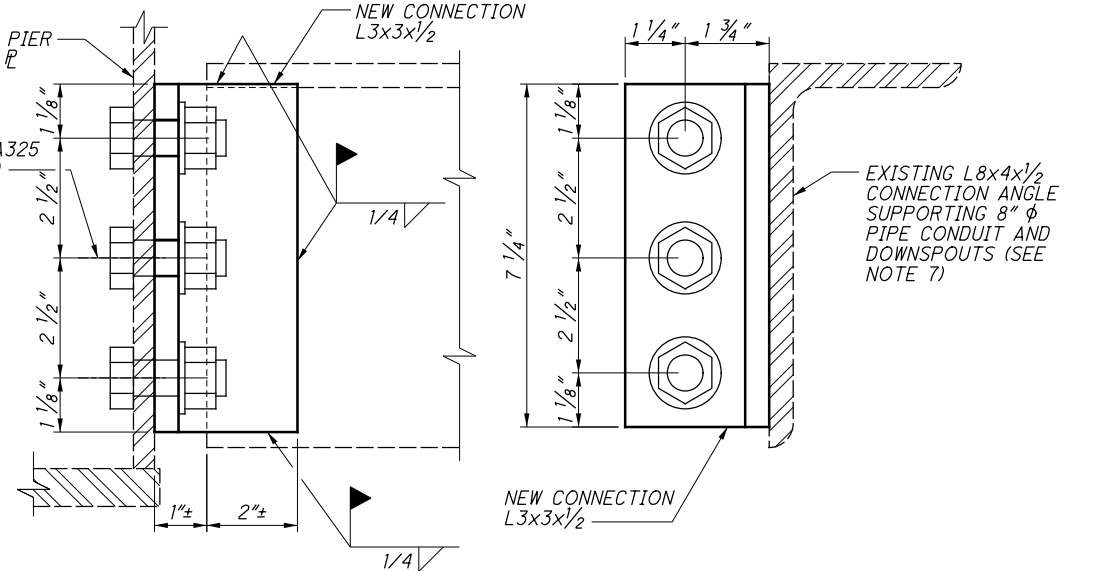


**SECTION A-A**

**REPAIR DETAIL** 3

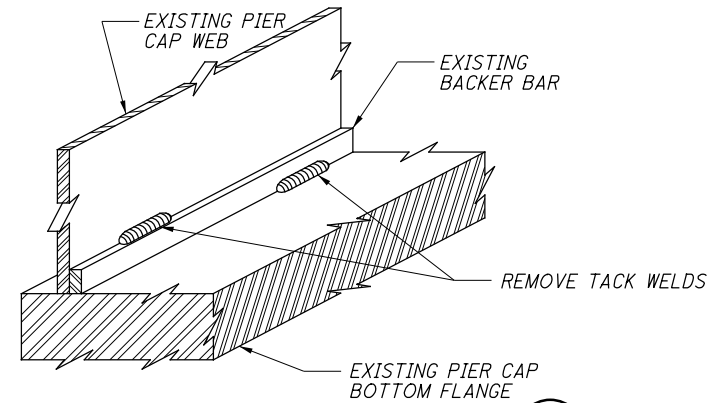


**STEP 1 FOR REPAIR DETAIL 4**

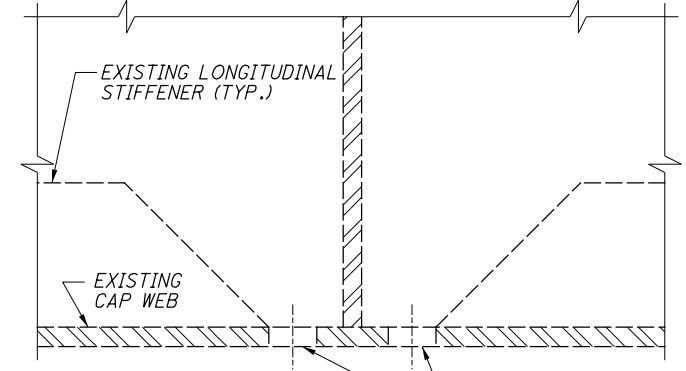


**STEP 2 FOR REPAIR DETAIL 4**

**REPAIR DETAIL**  
**DRAIN BRACKET RETROFIT** 4



**REPAIR DETAIL**  
**BACKING BAR WELD REMOVAL DETAIL** 5  
(BOTTOM FLANGE SHOWN, TOP FLANGE SIMILAR)



**REPAIR DETAIL**  
**LONGITUDINAL STIFFENERS** 6  
REPLUG AND CAULK THE EXISTING STRESS HOLES WITH NEW 1" EXPANSION PLUGS (TYP.)

**LEGEND FOR REPAIR DETAILS 1 AND 2:**

- LIMITS OF 1/2" WIDE ULTRASONIC IMPACT TREATMENT (UIT)

**NOTES:**

- FOR LOCATIONS OF REPAIR DETAILS 1 THRU 6, SEE SHEETS [6/16](#) AND [7/16](#). FOR THE GENERAL NOTES, SEE SHEETS [1/16](#) AND [2/16](#).
- THE ULTRASONIC IMPACT TREATMENT IS INCLUDED FOR PAYMENT UNDER ITEM STRUCTURAL STEEL, MISC.: ULTRASONIC IMPACT TREATMENT.
- THE CLEANING AND RE-CAULKING OF THE SAW CUTS AND PLUGGING THE STRESS RELIEF HOLES IS INCLUDED FOR PAYMENT UNDER ITEM SPECIAL MISC.: 1" RUBBER EXPANSION PLUGS.
- ALL WORK ASSOCIATED WITH THE CRACK REPAIR RETROFIT AT THE LONGITUDINAL STIFFENER AT PIER 4 E.B. IS INCLUDED FOR PAYMENT UNDER ITEM 513 - STRUCTURAL STEEL, MISC.: 1/2" STRESS RELIEF HOLE RETROFIT.
- THE NEW DRAINAGE BRACKET CONNECTIONS, INCLUDING GRINDING THE WELDS, NEW CONNECTION ANGLES AND THEIR BOLTED CONNECTIONS, WELDING THE EXISTING DOWNSPOUTS AND DRAINAGE CONDUITS ARE INCLUDED IN ITEM 513 - STRUCTURAL STEEL MISC.: STRUCTURAL STEEL REHABILITATION.
- THE GRINDING OF THE BACKER BAR TACK WELDS IS INCLUDED IN ITEM 513 - STRUCTURAL STEEL, MISC.: GRINDING PER FOOT.
- THE CONTRACTOR SHALL ADEQUATELY SUPPORT THE EXISTING 8" PIPE CONDUIT AND DOWNSPOUTS DURING THESE REPAIRS TO THE SATISFACTION OF THE ENGINEER.