



Fracture Critical Member (FCM) Inspection Procedure

Reference: ODOT Manual of Bridge Inspection, Chapter 4

Inspection Responsibility:	ODOT District 12
County-Route-SLM:	CUY-480-0647
Structural File Number:	1812831
Inspection Frequency:	24 Months
Fatigue Life Study:	Year of Study: <u>Not Calculated</u> Remaining Fatigue Life: <u>Not Calculated</u>
Load Path Redundant:	Main Spans: <u>No, Each structure is a three-girder system at 25'-6" spacing, and floorbeam spacing exceeds 14'.</u> Approach Spans: <u>None.</u>
Structurally Redundant:	<u>No, Girders are continuous spans.</u>
Internally Redundant:	<u>No, Tension members consist of welded built-up plate girders and built-up/rolled I-section members.</u>
System Redundant:	<u>No rigorous analysis performed (i.e. finite element, 3-D modeling)</u>



Figure 1 – CUY-480-0647 south elevation, looking northwest.

Location: The CUY-480-0647 Bridge (see Figure 1) spans the Rocky River Valley north of Cleveland Hopkins International Airport (see Figure 2). The bridge carries traffic on Interstate 480 between the cities of Fairview Park and Cleveland, Ohio.

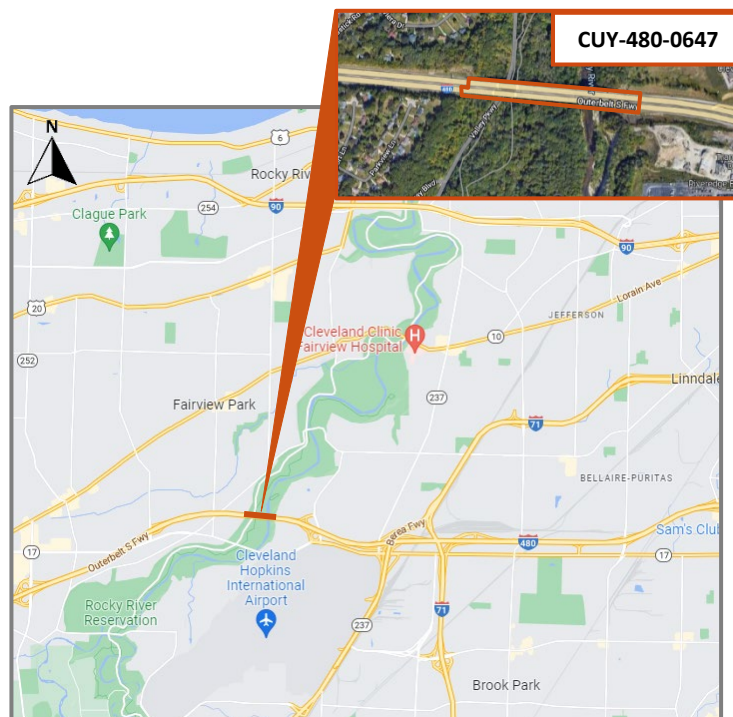


Figure 2 – CUY-480-0647 location map.

Structure Description: Each structure consists of a nine-span superstructure divided into three continuous units by seated hinges present in Spans 4 and 6. Originally constructed in 1970, the existing eastbound structure is approximately 1,571' long, and the existing westbound structure is approximately 1,535' long. Each structure carries four lanes of traffic with wide shoulders along each railing with approximate roadway widths of 69'-0". Span 1 for the eastbound and westbound structures are 139'-8" long and 103'-8" long, respectively, while the remaining spans are the same across both bridges: Spans 2 and 3 are each 177'-4" long, Spans 4, 5, and 6 are each 199'-6" long, Span 7 is 177'-4" long, Span 8 is 155'-2" long, and Span 9 is 82'-8" long.

The deck for each structure is supported by six steel stringers: the interior stringers consist of rolled 21WF55 or 21WF62 sections, stringers along the median (Stringers 6 and 7) consist of rolled 12WF45 sections, and exterior stringers (Stringers 1 and 12) consist of small welded haunched I-sections. The steel floorbeams, which have spacing that varies from 11'-6" to 22'-2" on-center, consist of built-up I-sections of varying height comprised of both rolled wide flange beams and built-up plate sections with transverse stiffeners. The main girders, spaced at 25'-6" on-center, are comprised of haunched, welded plate girders that vary from 12'-0" to 15'-0" in height.

The westbound bridge was closed in 2000 due to a crack being found on the support side of the seated hinge in Span 4 at Girder D. Shortly thereafter, the bridge was repaired by jacking each seated hinge and installing carrier beam retrofits at all twelve hinge locations to provide redundancy. The structure has undergone several additional minor modifications and rehabilitations since its original construction.

The fracture critical members on this structure include all main girders (Girders A through F) and all floorbeams (Floorbeams 1 through 72).



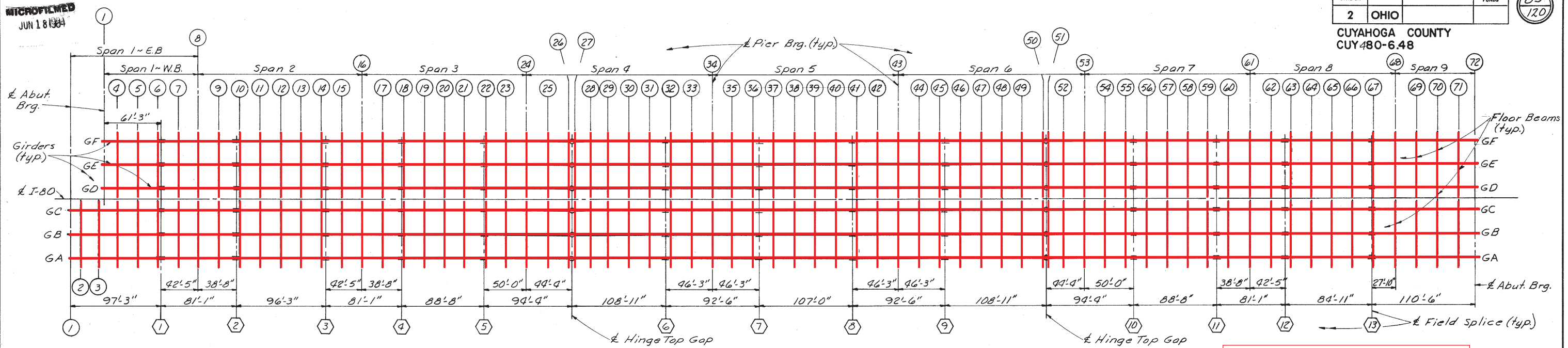
Figure 3 – CUY-480-0647 superstructure underside, looking west in Span 7.

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FED. RD. DIVISION	STATE	PROJECT	TYPE FUNDS
2	OHIO		

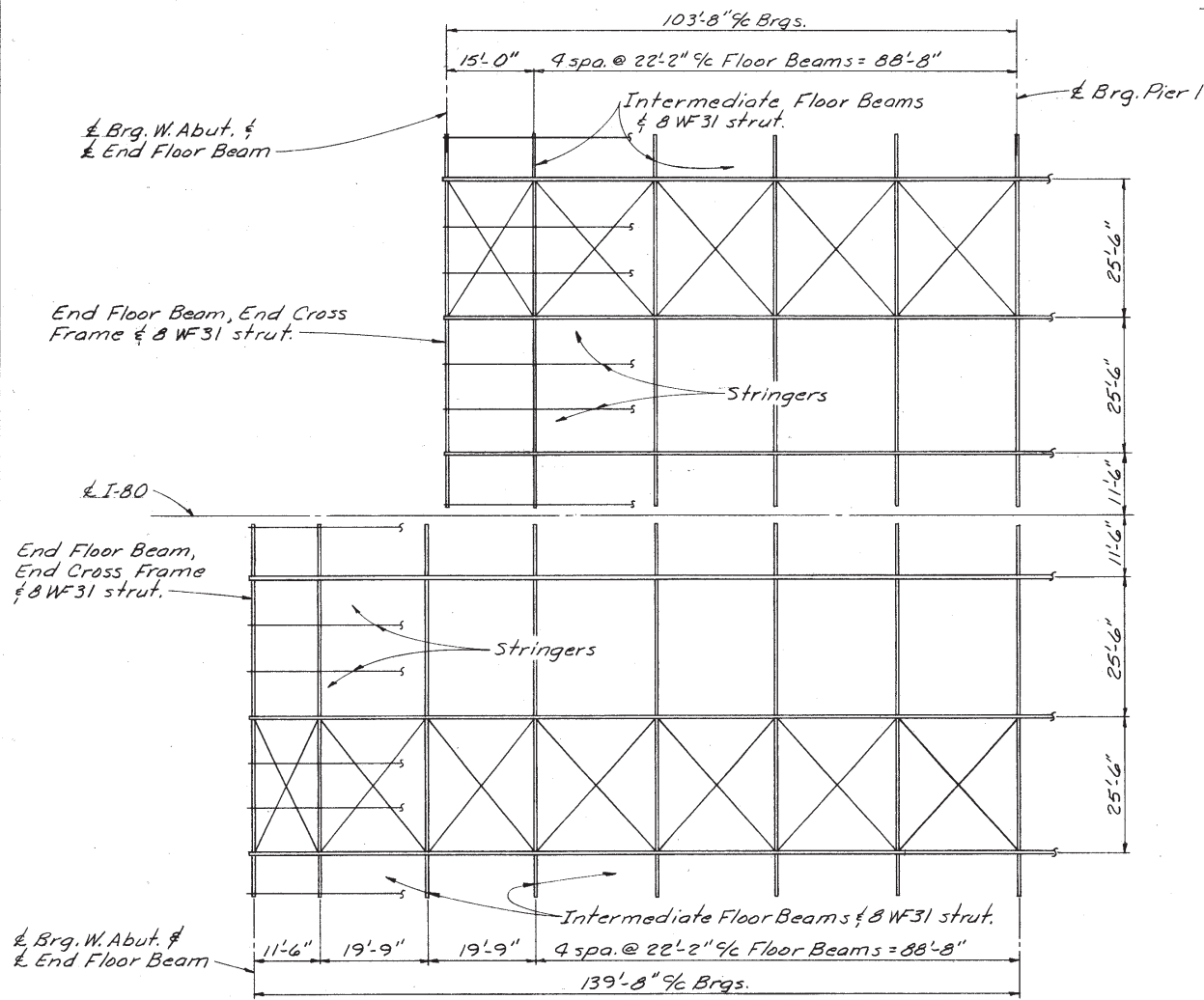
89
120

CUYAHOGA COUNTY
CUY480-6.48

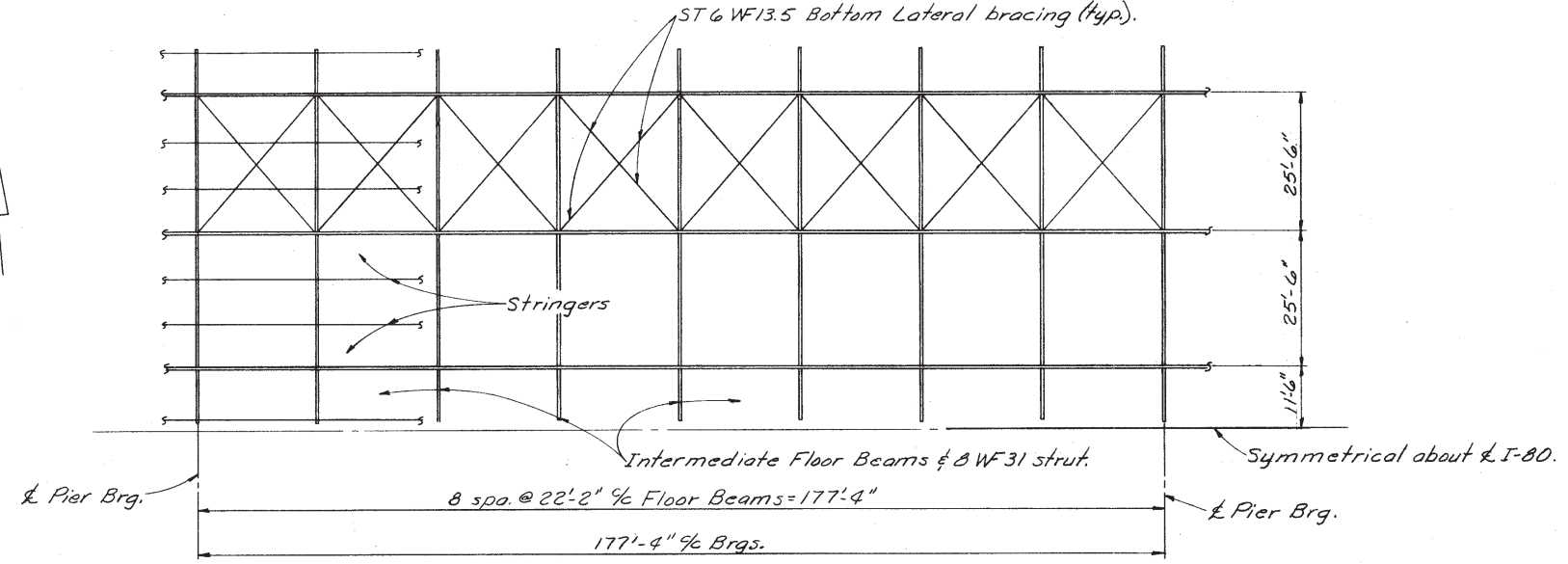


GENERAL FRAMING PLAN
(Stringers & Lateral system not shown.)

Girders and floor beams are fracture critical members



SPAN 1 FRAMING PLAN
(Stringer intermediate crossframes not shown.)



SPANS 2,3 & 7 FRAMING PLAN
(Stringer intermediate crossframes not shown.)

BEARING UNITS	
Location (& Bearing)	Unit
W. Abutment ~ All Girders	R-925
Pier 1 ~ " "	R-1125
Piers 2 & 7 ~ " "	B-1125
Piers 3 thru 6 ~ " "	B-1250
Pier 8 ~ " "	R-850
E. Abutment ~ " "	R-300

For details of Bearing Units, see sheets 40 & 41/53

ALDEN E. STILSON & ASSOCIATES, LIMITED
CONSULTING ENGINEERS
COLUMBUS, OHIO 30/53

FRAMING PLAN
BRIDGE No. CUY480-0648
OUTERBELT SOUTH over ROCKY RIVER
CUYAHOGA COUNTY STA. 441+96.50 E.B.
STA. 457+67.50

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
GEA	JER	DW	RWE	J.E.V.	2/23/68	

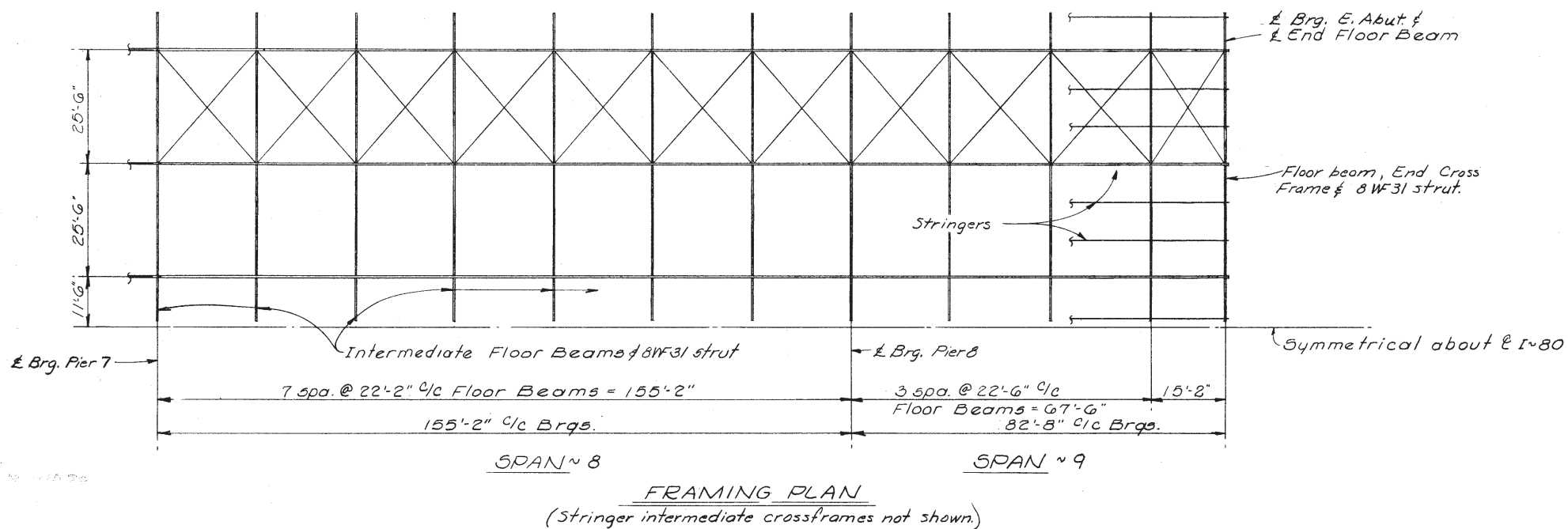
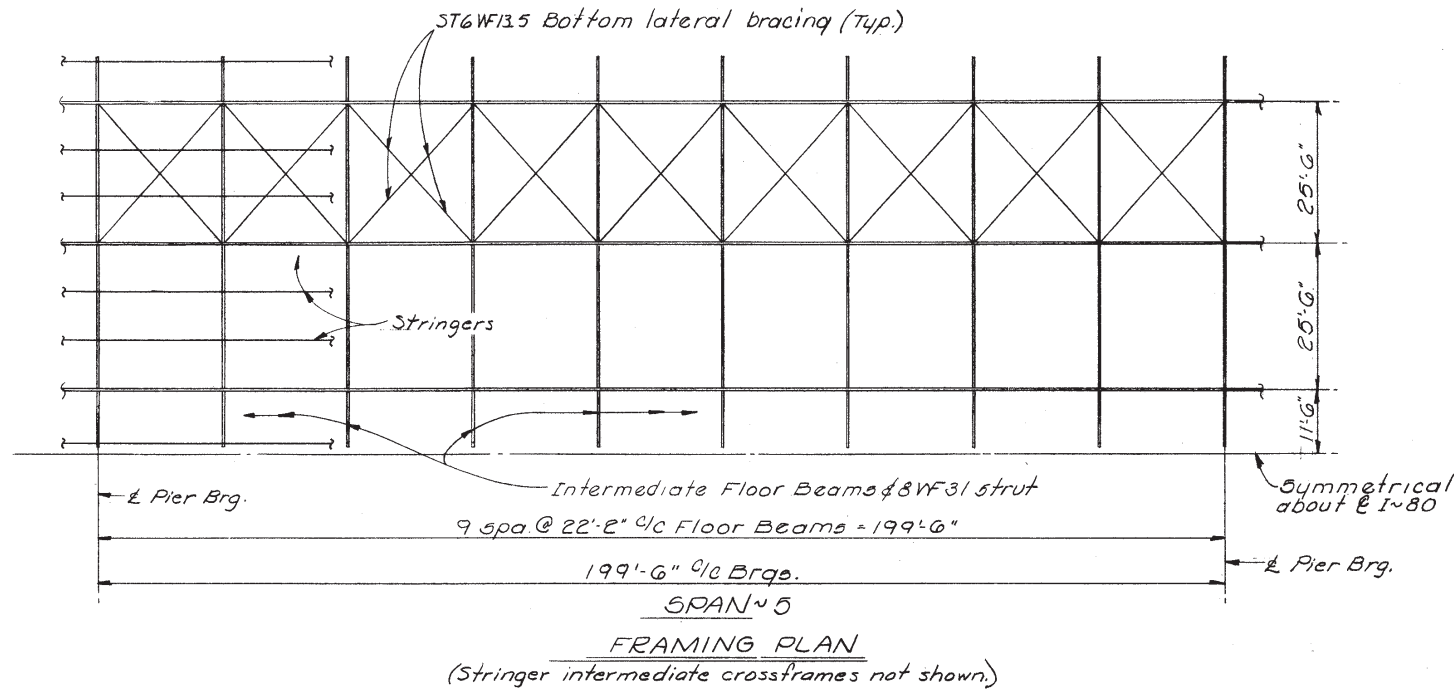
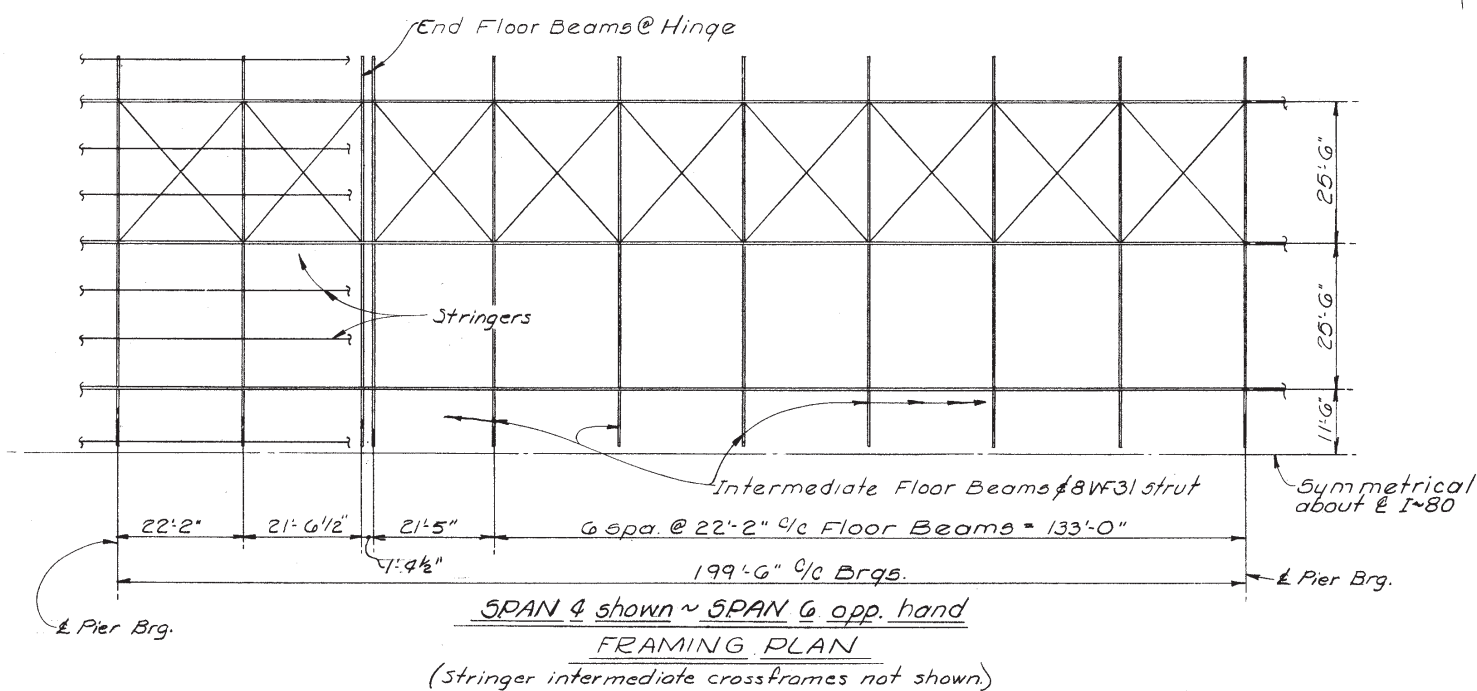
Rev. 10-22-70

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FED. RD. DIVISION	STATE	PROJECT	TYPE FUNDS
2	OHIO		

90
120

CUYAHOGA COUNTY
CUY 480-6.48



NOTE
For Bearing Units, see sheets 4142/53

ALDEN E. STILSON & ASSOCIATES, LIMITED CONSULTING ENGINEERS COLUMBUS, OHIO						31/53
FRAMING PLAN						
BRIDGE No. CUY480-0648 OUTERBELT SOUTH over ROCKY RIVER CUYAHOGA COUNTY						
						STA. 441+96.50 E.B. STA. 457+67.50
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
GEA	JEK		RUE	J.E.V.	2/23/68	

Rev. 10-22-70

Inspection Risk Factors

Inspection Procedure and Inspector Access Risk Factors: A combination of aerial lift equipment, rope access techniques, protected climbing techniques, ladders, and/or rigging are required to gain hands-on access to all the fracture critical members and their tension regions. In the 2022 inspection, all fracture critical members were accessed with a 62' under-bridge inspection unit (snooper) and using protected climbing and rope access techniques utilizing the installed safety cables along the girders.

- Inspection Methods
 - Main girders: Inspect the bottom flange and bottom half of the web in positive moment regions, the top flange and top half of the web in negative moment regions, and the full height of the web in primary shear regions. Inspect each member for its full length, particularly for distress at fatigue prone details and at prior retrofit locations.
 - Floorbeams: Inspect the bottom flange and bottom half of the web in positive moment regions, the top flange and top half of the web in negative moment regions, and the full height of the web in primary shear regions, especially at the copes for cracks and for distress at fatigue prone details.
- Access
 - Under-bridge inspection unit: Used to gain hands-on access to the main girders and floorbeams which are within reach from the outside lane and shoulder of each structure
 - Protected climbing and rope access: Used to gain hands-on access to the interior faces of girders below the median and floorbeam cantilevers not within reach of the snooper. Girders are accessed from the bridge ends using installed safety cables.
- Maintenance of Traffic
 - Single right lane and shoulder closures in each direction of I-480 are required during snooper work.
- Inspector Risks
 - Work at heights
 - Traffic on the bridge
 - Working over water
 - Cold/hot extreme temperatures
 - Biological/wildlife hazards

Inspection Risk Factors			
Risk Factor	Location	Description	Photo
Fracture Critical Structure	Superstructure	Main girder or floorbeam failure would cause partial or complete collapse of the structure.	-
Fatigue Prone Detail – Category E	Girder web	Base metal at the end termination of longitudinal stiffener to web welds with no transition radius (Category E)	1
Fatigue Prone Detail – Category E	Girder web	Base metal at lateral bracing connection plate to web welds (Category E)	2
Fatigue Prone Detail – Category E	Girder web	Base metal at abandoned channel bracket to web welds (Category E)	3
Fatigue Prone Detail – Category E'	Girders at hinge seats	Base metal at the termination of longitudinal seat plates welds to floorbeam webs (thickness > 0.8") (Category E')	4
Fatigue Prone Detail – Category E	Floorbeam webs	Base metal at all-around access hole reinforcing plate welds to webs of floorbeam cantilevers (Category E)	5
Fatigue Prone Detail – Category E	Stringer bottom flanges	Base metal at the termination of partial length welded cover plates with welds across the ends (flange thickness ≤ 0.8") (Category E)	6
Previous Cracking and Repairs	Girder webs along lateral bracing connections and floorbeam flange	Overcuts, misshapen arrest holes, or areas that were not fully sawcut during installation.	7
Previous Cracking and Repairs	Girders at hinge seats in Spans 4 and 6s	Installed carrier beam retrofits at all 12 hinge locations in response to previous cracking noted in Girder D in Span 4.	8
High ADTT	All primary truss members and floorbeams	Average daily traffic is 120,850 vehicles with average truck traffic of 7,240.	-

Category Reference: AASHTO LRFD Bridge Design Specs Table 6.6.1.2.3-1

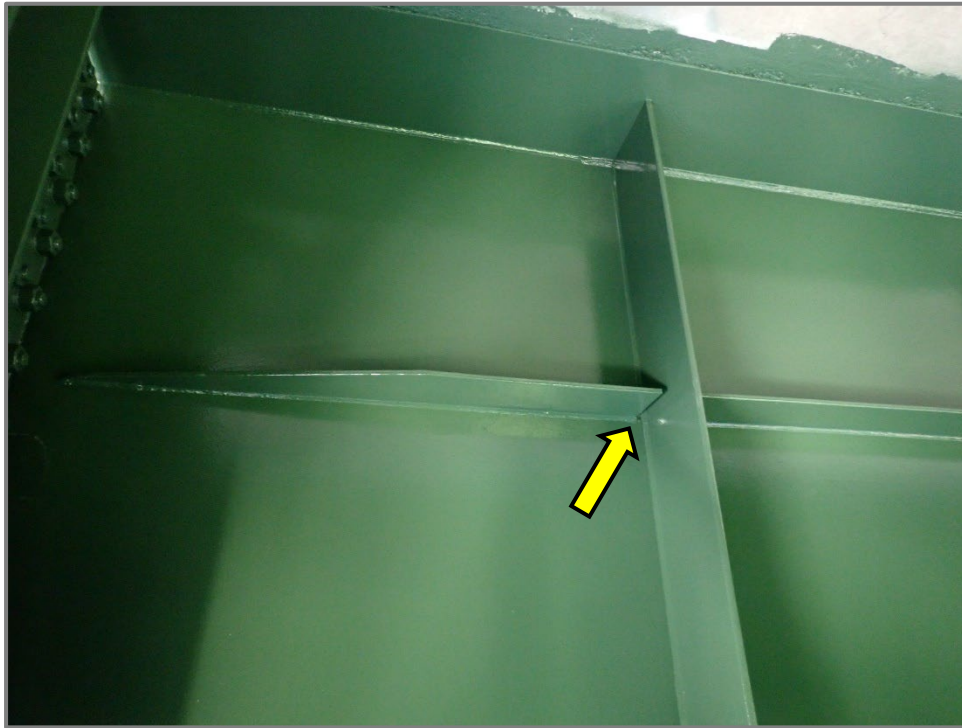


Photo 1 – Base metal at the end termination of longitudinal stiffener to girder web welds with no transition radius (Category E). Girder E at Floorbeam 18 shown, looking northeast.

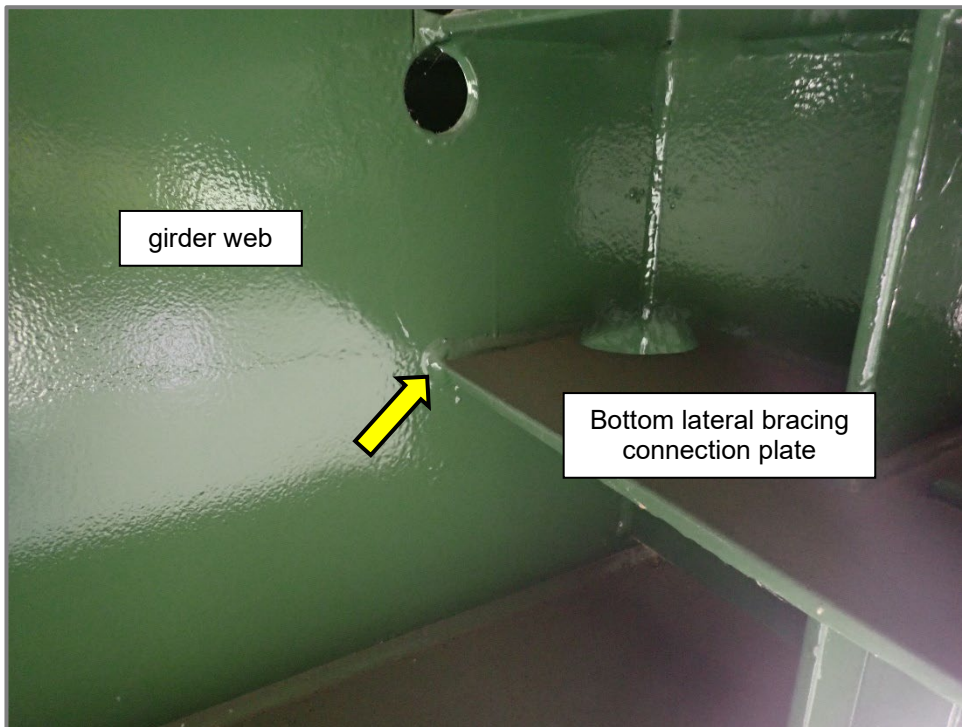


Photo 2 – Base metal at lateral bracing connection plate to girder web welds (Category E). Girder F at Floorbeam 37 shown, looking south.



Photo 3 – Base metal at abandoned channel bracket to girder web welds (Category E). Girder C between Floorbeams 52 and 53 shown, looking northwest.

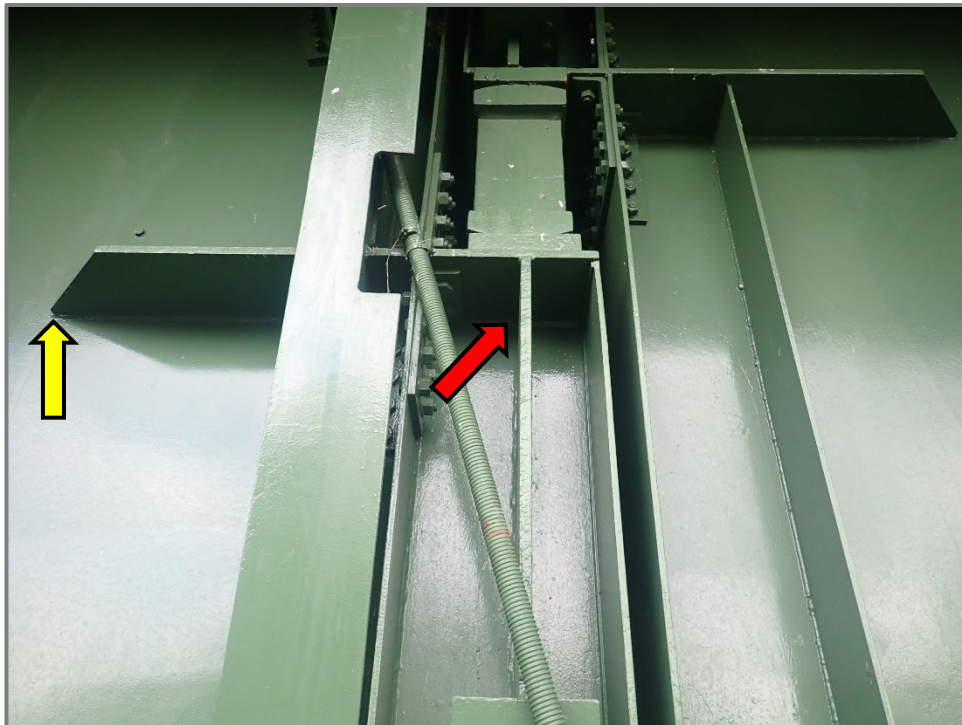


Photo 4 – Base metal at the termination of longitudinal seat plates welds to floorbeam webs (thickness > 0.8") (Category E'). Girder A at the Span 4 hinge shown, looking north. Note triaxial constraint below hinge.



Photo 5 – Base metal at all-around access hole reinforcing plate welds to webs of floorbeam cantilevers (Category E). Floorbeam 26 north cantilever at Girder C shown, looking east.

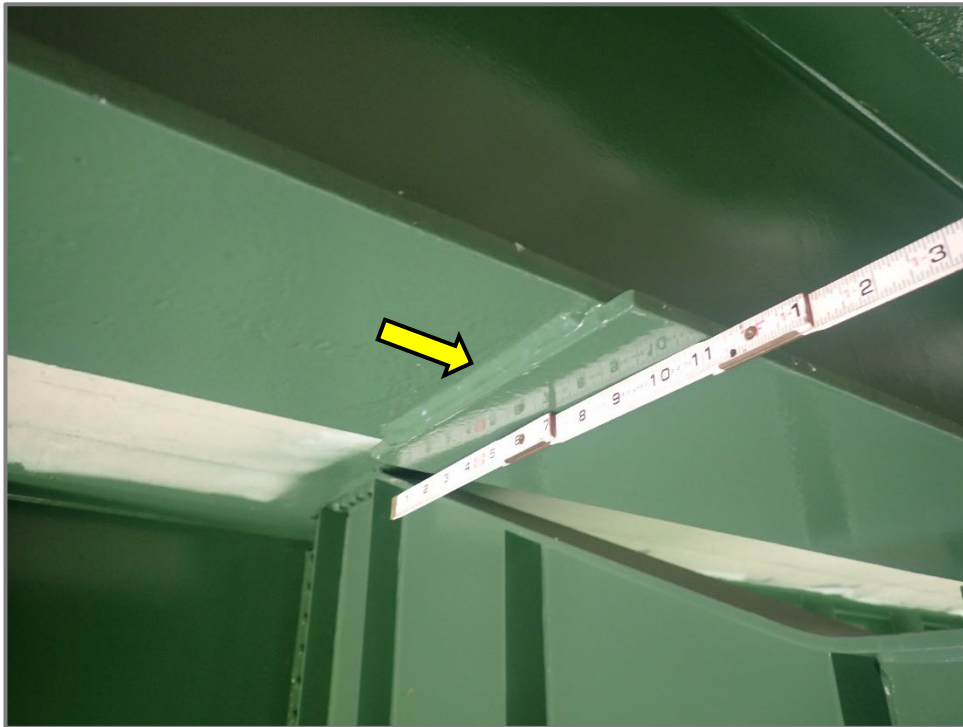


Photo 6 – Base metal at the termination of partial length welded cover plates with welds across the ends (flange thickness ≤ 0.8 ") (Category E). Stringer 3 on the west side of Floorbeam 20 shown, looking northeast.

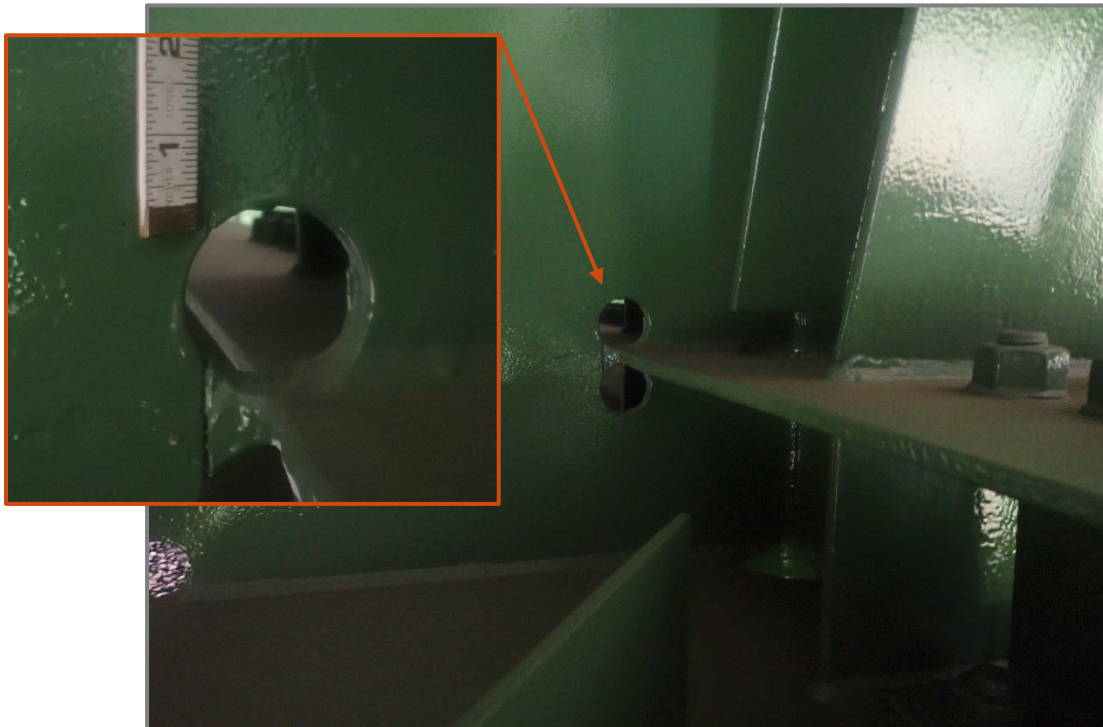


Photo 7 – Typical dogbone retrofit overcut in the girder web, looking north at Girder B at Floorbeam 4. Note that some overcut locations are not visible due to the new paint system.



Photo 8 – Typical carrier beam retrofit installed below the seated hinge joints, looking north at Girder A at the Span 4 expansion joint.