

# Ohio Department of Transportation



## Fracture Critical Member and Fatigue Prone Connection Identification Plan

Reference: ODOT Manual of Bridge Inspection Chapter 4 and Appendix E

District: 12  
County-Route-SLM: CUY-002-1441  
Structural File Number: 1800035

Fatigue Life Study: Year of Study N/A Remaining Fatigue Life N/A

Load Path Redundant: No, structure is fracture critical, inspect FCM's every 24 months

Structurally Redundant: No, acts as simple spans

Internally Redundant: Yes/No, some built up riveted members present

System Redundant: Analysis has not been performed to determine

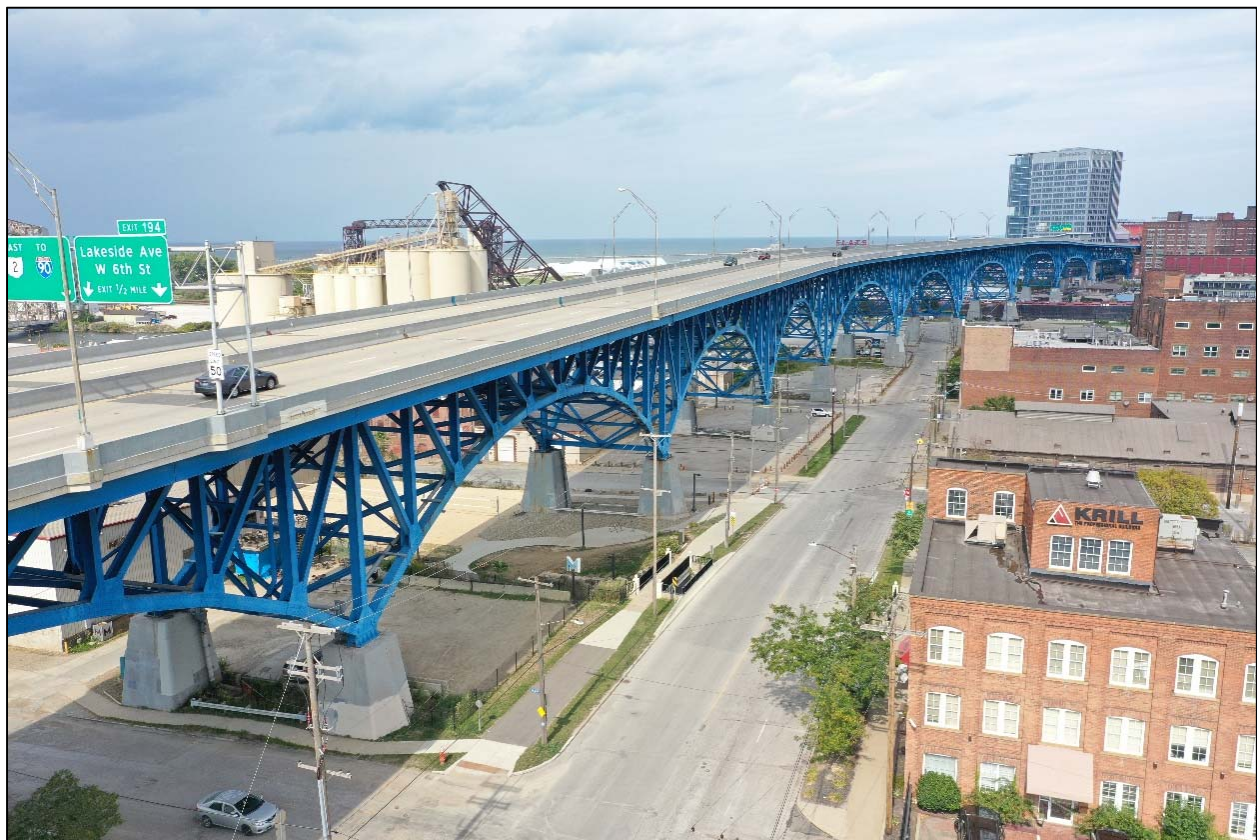
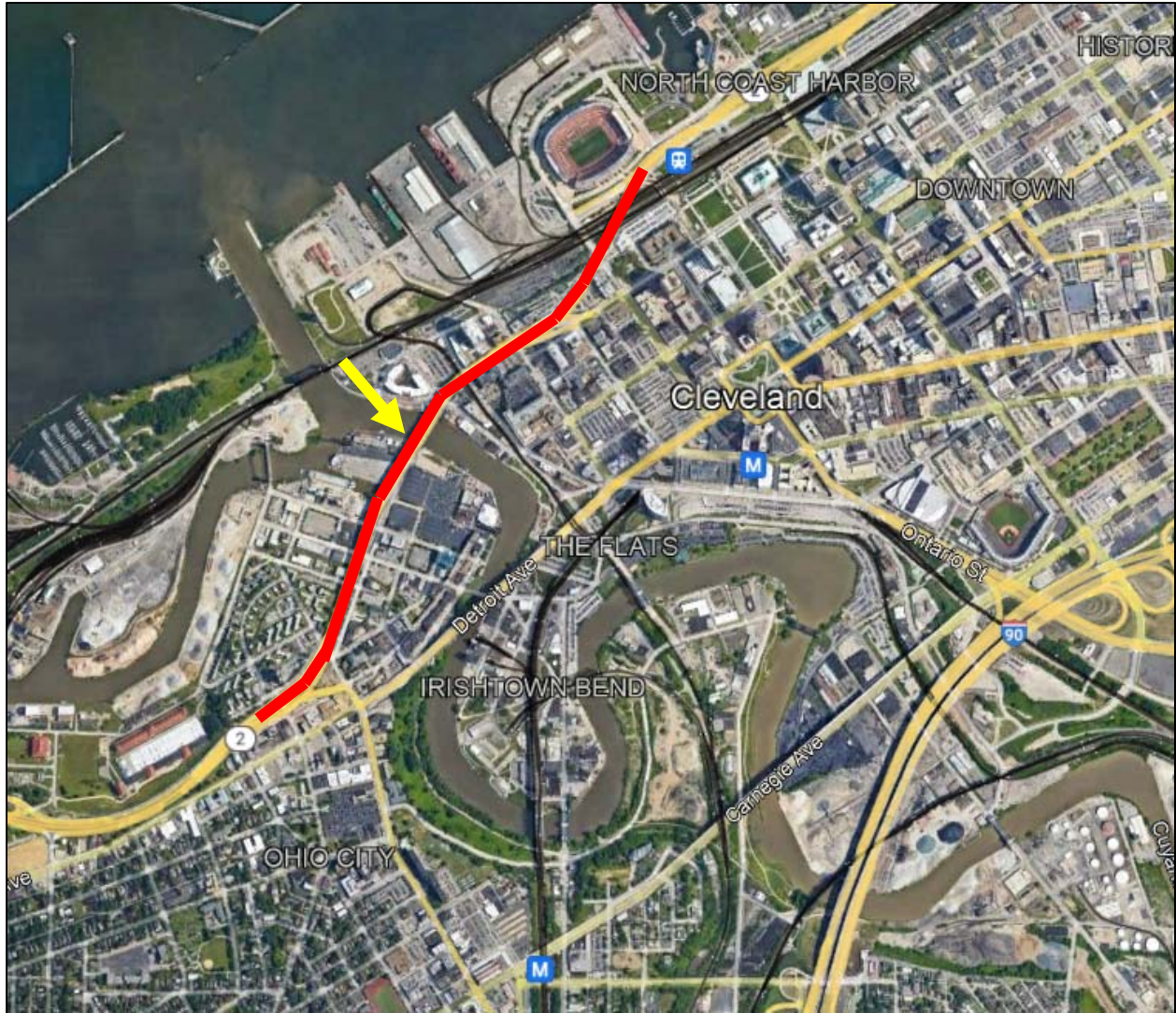


Figure 1: CUY-10-1613 over the Cuyahoga River

**Location:** CUY-2-1441 (SFN 1800035), commonly known as the Main Avenue Bridge, carries four to six lanes of vehicular traffic over the Cuyahoga River Valley, local streets, parking lots, GCRTA Waterfront Line tracks and Norfolk Southern Railroad Tracks.



**Figure 2:** CUY-2-1441 in Cleveland over the Cuyahoga River

**Description:** The bridge is approximately 6,580 feet long. The bridge is comprised of five sections referred to as the West Approach, Main Truss Spans, East Approach – Forward Section, East Approach - Lakefront Trestle Section, and East Approach - Lakefront Ramp Section:

Unit I - West Approach: The West Approach section consists of east and west bound structures separated by the ramps at W. 28th Street. Each portion of the structure carries three lanes of traffic from near West 29th Street to 250 feet east of West 25th Street. These separate structures then merge into one structure near West 25th Street. There are eight individual units, with varying structure types. The four main structure types are: Transverse rigid concrete frames supporting a concrete deck slab (Sections B', D, J' and M), concrete stringers and diaphragms (Section P), longitudinal rigid steel frames supporting floorbeams and stringers (Sections C, K and L'), and a steel floorbeam/stringer system (Section N).

*Fracture critical members:* Steel floorbeams and longitudinal frames in Sections C, K and N.

Unit II - Main Truss Spans: Ten (10) spans of two (2) lines of cantilever Pratt deck style trusses. Truss spans vary from 200' to 400'.

*Fracture critical members:* All floorbeams and select truss chords, diagonals, pins and gusset plates. See *Figure 3* for locations of fracture critical truss chords and diagonals.

Unit III - East Approach – Forward Section: The unit consists of a single span Pratt deck style truss (Span 11), and fourteen (14) spans of steel truss bents that support rolled steel floorbeams with rolled steel stringers bearing on top. Below the eastbound lanes there is lower set of floorbeams which used to support a utility deck.

*Fracture critical members:* All upper deck floorbeams; Select truss chords, diagonals and gusset plates in Span 11. See *Figure 4* for locations of fracture critical truss chords and diagonals in Span 11.

Unit IV - East Approach – East Approach – Lakefront Trestle Section: The units consists of two lines of steel longitudinal rigid frames comprised of riveted built-up beams and columns. Transverse floorbeams frame into the steel longitudinal rigid frames and support rolled stringers.

*Fracture critical members:* All longitudinal frames and floorbeams.

Unit V - East Approach – Lakefront Trestle Section: The unit consists of three riveted, built-up plate girders with rolled floorbeams and stringers. The floorbeams are spaced at

*Fracture critical members:* All girders.

**FCM Access:** A combination of climbing techniques, underbridge inspection vehicles, aerial work platforms, bucket trucks, and ladders were used in previous inspections to achieve arms' length inspection. Alternate techniques to those described below may be employed at the discretion of the inspection team.

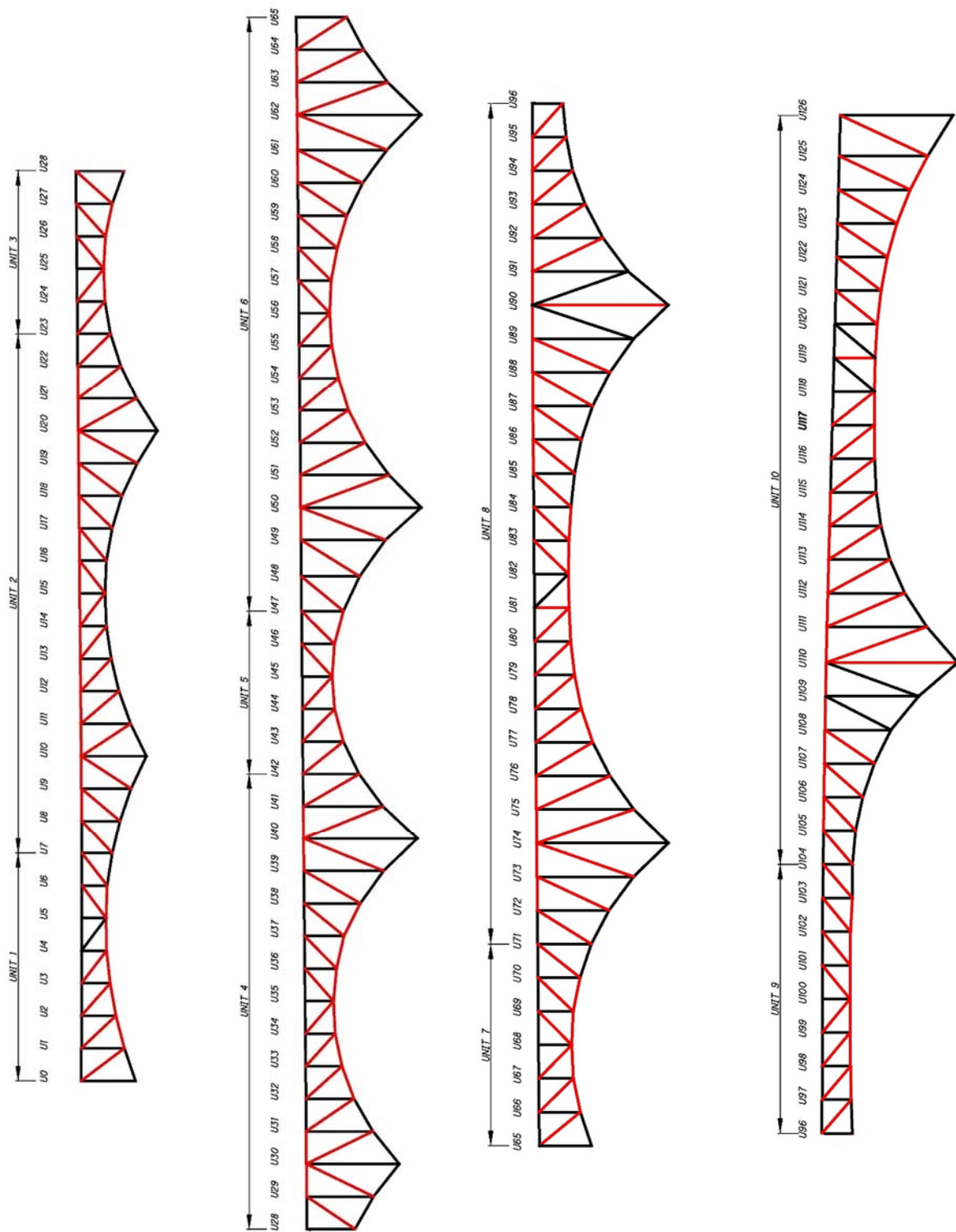
Unit I: The fracture critical girders in this unit are mainly accessed using aerial work platforms or bucket trucks, assisted by ladders.

Unit II: The fracture critical truss members and floorbeams in this unit are mainly accessed using underbridge inspection units and aerial work platforms or bucket trucks.

Unit III: The fracture critical truss members and floorbeams in this unit are mainly accessed using underbridge inspection units, aerial work platforms or bucket trucks, and ladders.

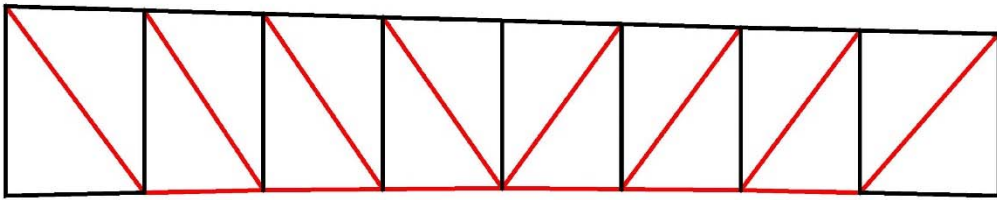
Unit IV: The Fracture Critical girders in this unit are mainly accessed using aerial work platforms or bucket trucks, assisted by ladders.

Unit III: The Fracture Critical truss members and floorbeams in this unit are mainly accessed using underbridge inspection units and climbing techniques.



**Figure 3:** Main Truss Spans Fracture Critical Member Locations (Highlighted Red)

*U127*    *U128*    *U129*    *U130*    *U131*    *U132*    *U133*    *U134*    *U135*



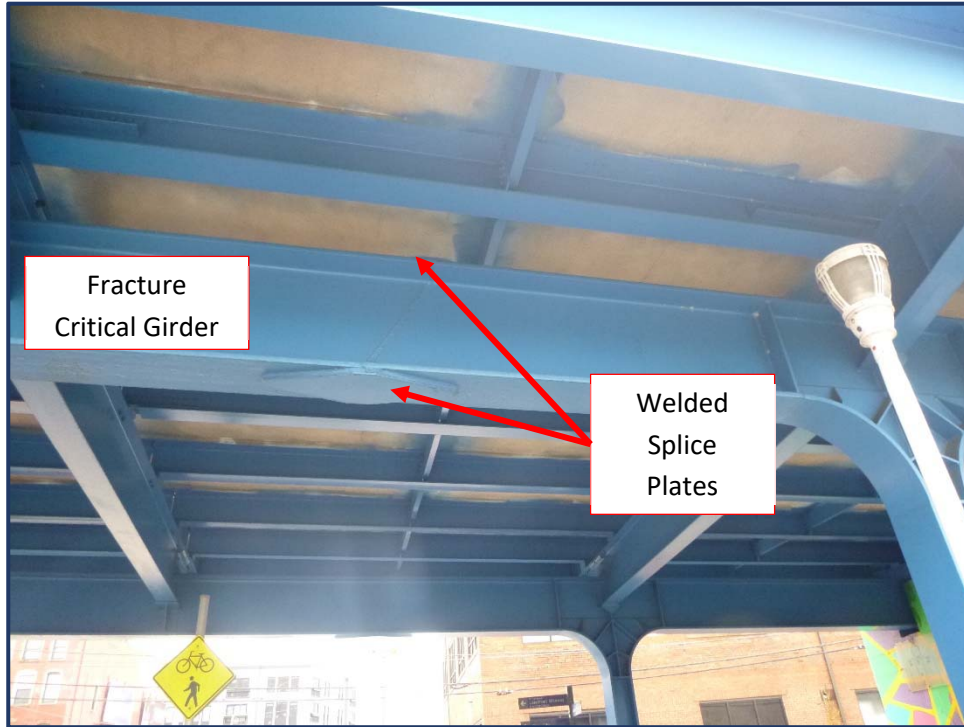
**Figure 4:** Span 11 Fracture Critical Member Locations (Highlighted Red)

## Known Structural Risk Factors & Fatigue Prone Details

*Category reference: AASHTO LRFD Bridge Design Specs, 9<sup>th</sup> Ed. Table 6.6.1.2.3-1*

Photo Reference	Label / Fatigue Category	Where?	Description
1	Welded Flange Plates, <b>Fatigue Category E'</b>	Unit I Sections C & K Girders	Ends of field splice plates welded to top and bottom flanges (four girders total with two splice locations on each girder)
2	Abandoned Utility Brackets, <b>Fatigue Category E'</b>	Unit IV Section A Girder Webs	Abandoned utility brackets welded to webs of girders. Some are E/E' depending on length and location.
3	Cracks in Floorbeam Webs	Unit II Floorbeams at truss upper chords	Cracks in coped corners of floorbeam webs adjacent to truss lines in Unit II (Span 1 FBs 0, 6 & 7; Span 2 FB 0; Span
4	Crack in Diagonal Bracing Gusset Plate	Unit III Frame and Braced Column Floorbeam 9	3/4" crack in south diagonal brace gusset plate at the coping for the bottom flange of the upper floorbeam.

\*Blank cells are for inspectors to add FPD's, retrofits or fatigue crack locations in future inspections



*Photo 1 – Welded Cover Plates at Girders in Unit I*



*Photo 2 – Abandoned Utility Brackets on Unit IV Girder Webs*

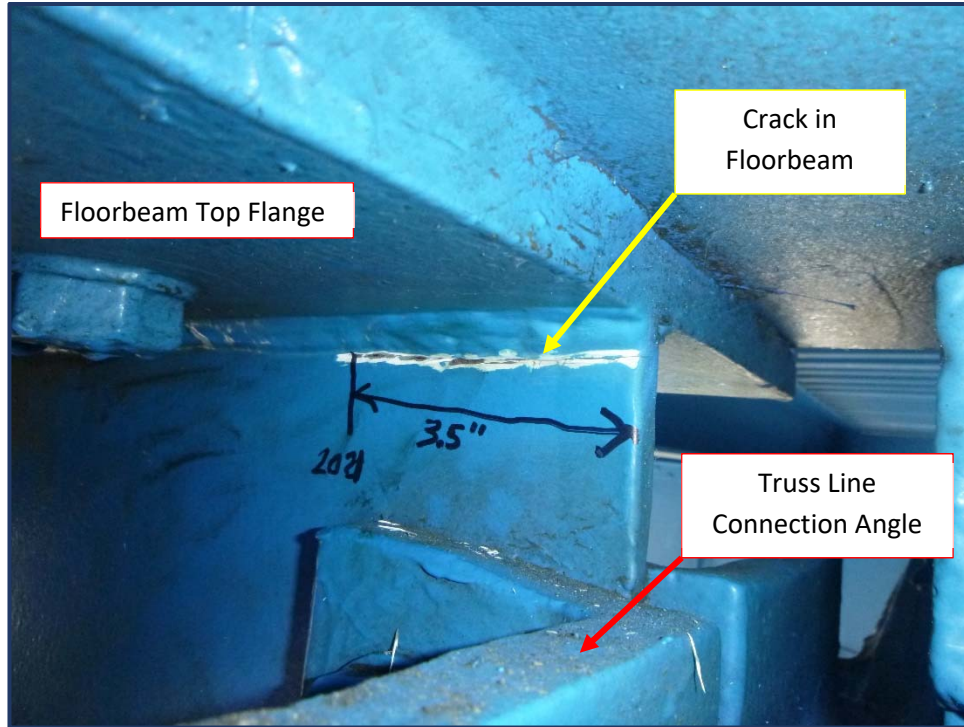


Photo 3 – Cracks in Unit II Floorbeam Web at Top Flange, at Truss Lines

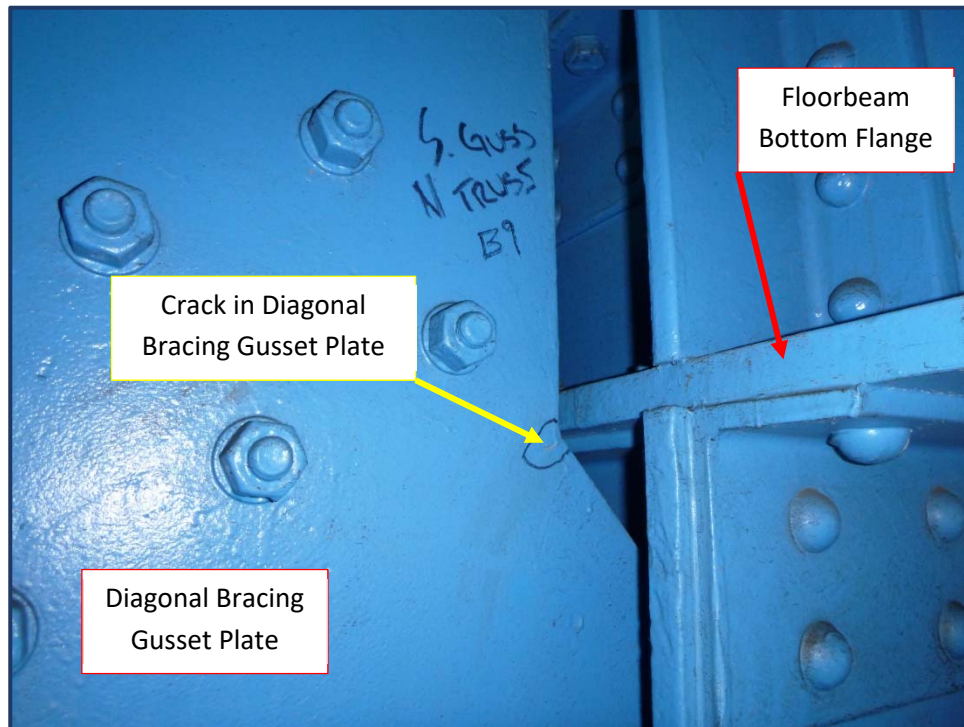


Photo 4 – Crack in Diagonal Bracing Gusset Plate, Unit III, Floorbeam 9, North Column