AASHTO Innovations Initiative

Press-Brake Steel Tub Girders

October 25, 2021
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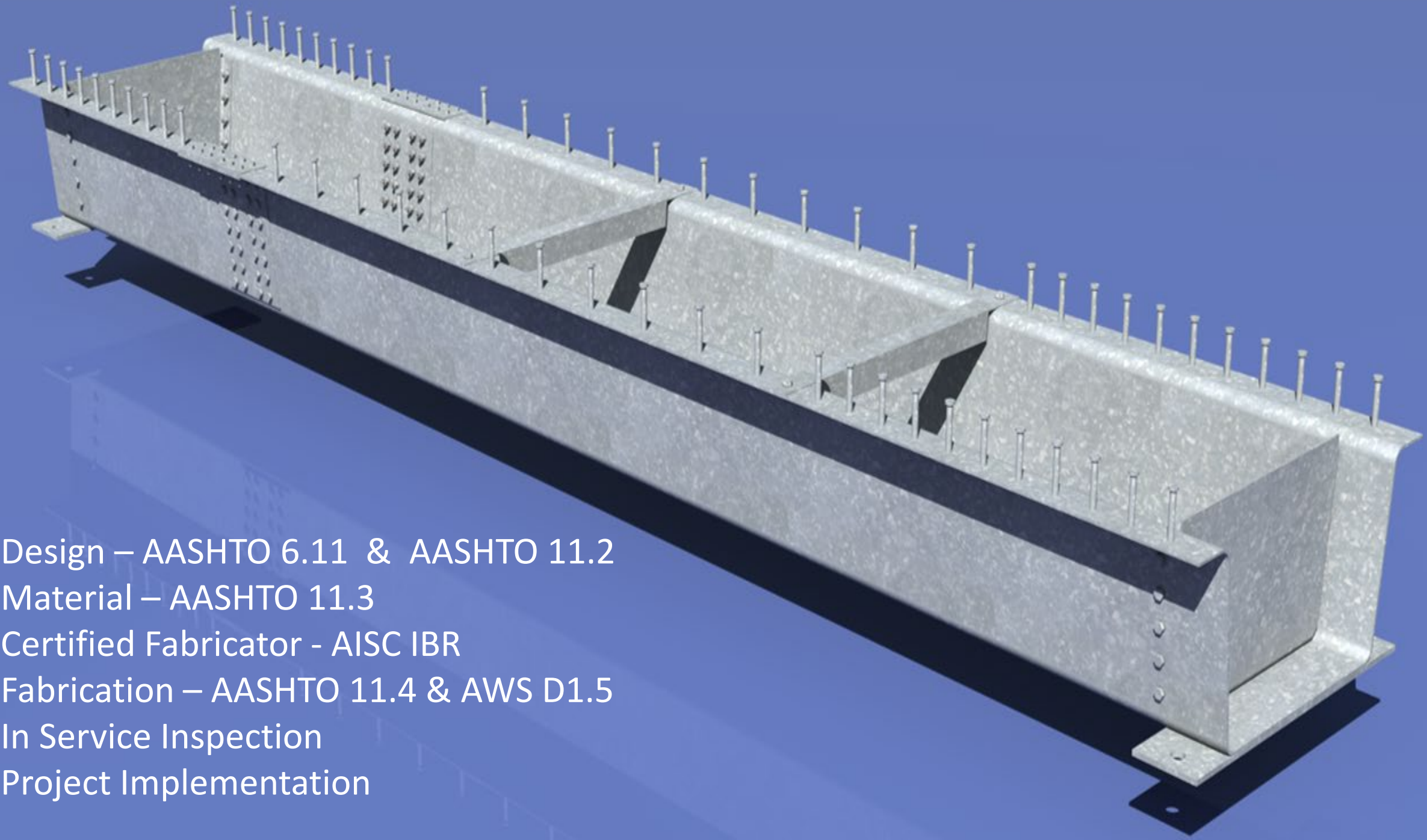
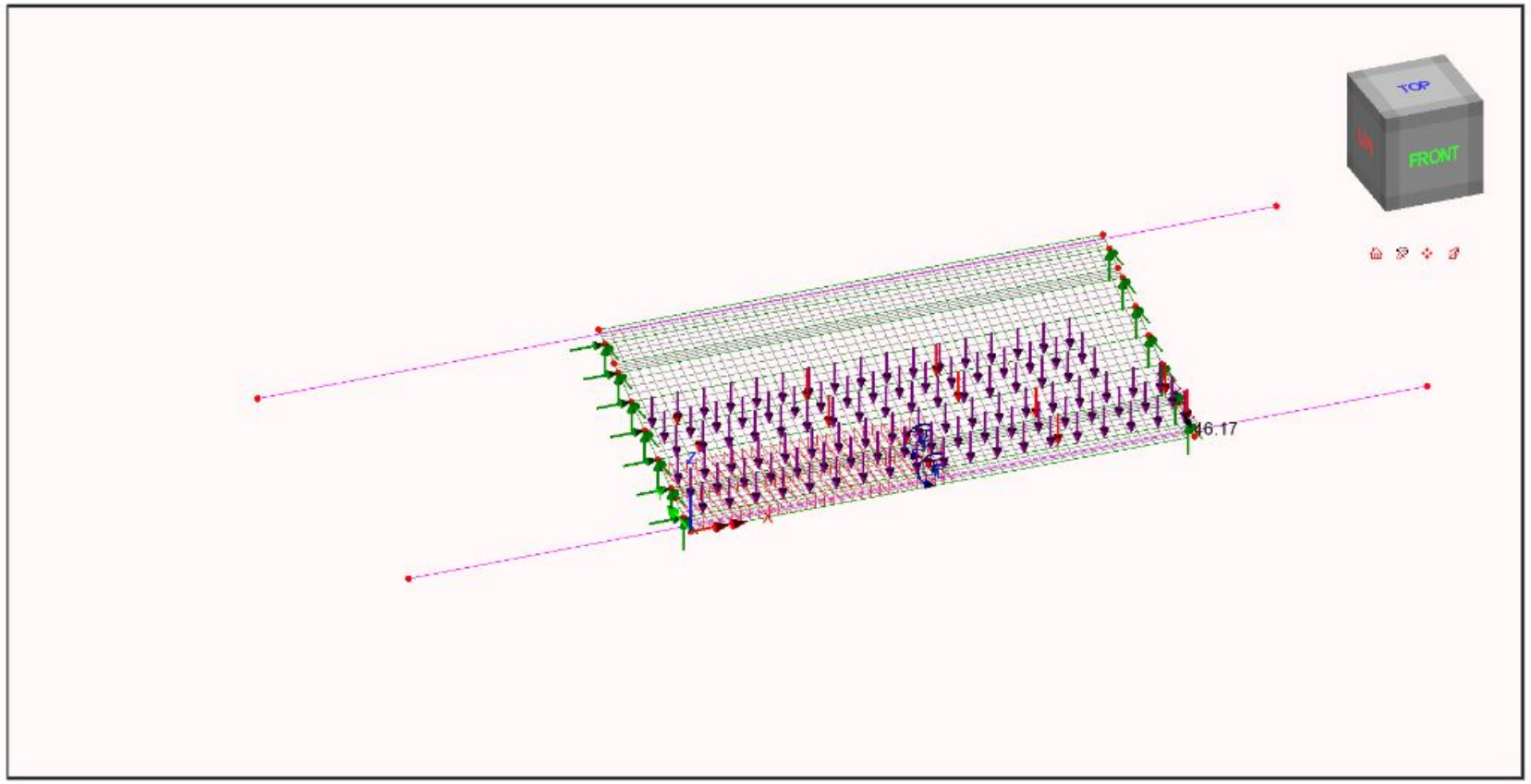


1. Design – AASHTO 6.11 & AASHTO 11.2
2. Material – AASHTO 11.3
3. Certified Fabricator - AISC IBR
4. Fabrication – AASHTO 11.4 & AWS D1.5
5. In Service Inspection
6. Project Implementation

AASHTO LRFD Design

- Section 6.11 - Box Section Flexural Members
- Not considered Fracture Critical Members (FCMs)



Fascia Beam_2 Lanes_ Reaction k-ft

AASHTO LRFD Design

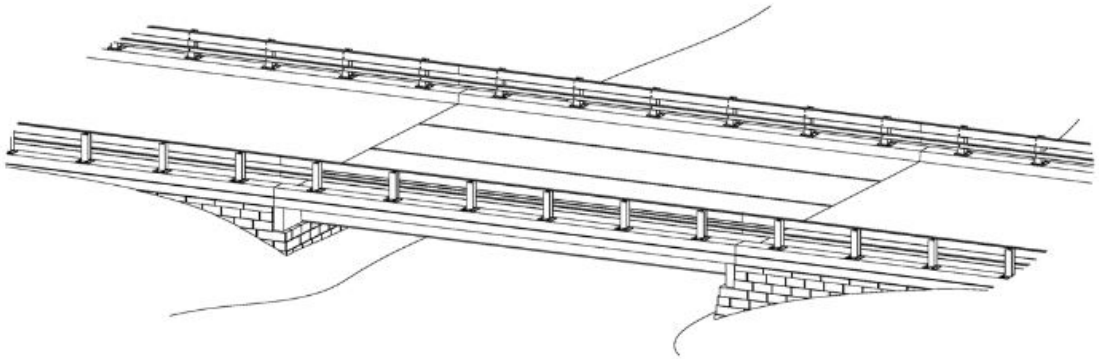
AASHTO PRESS-BRAKE-FORMED TUB GIRDER (PBFTG) Design

Section Identification: Sec := "U18x104"

Governing Specification: -AASHTO LRFD Bridge Design Specifications, 8th Edition, 2017

References to the AASHTO LRFD Bridge Design Specifications are included throughout the design. AASHTO LRFD references are presented in a dedicated column in the right margin of each page, immediately adjacent to the corresponding design procedure. The following abbreviations are used in the AASHTO references:

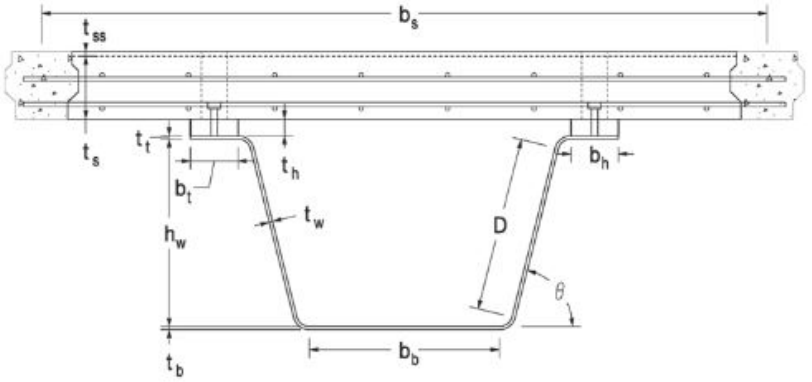
S designates specifications
STable designates a table within the specifications
SFig. designates a figure within the specifications
SEq. designates an equation within the specifications



2. Girder Section Geometry

Sec = "U18x104"

NOTE: Section designation is based on the standard Con-Struct Sections..



Height of girder: $h_w := 17.25 = 17.25$ (in)

Width of girder: $b_b := 24 + 7.375 = 31.38$ (in)

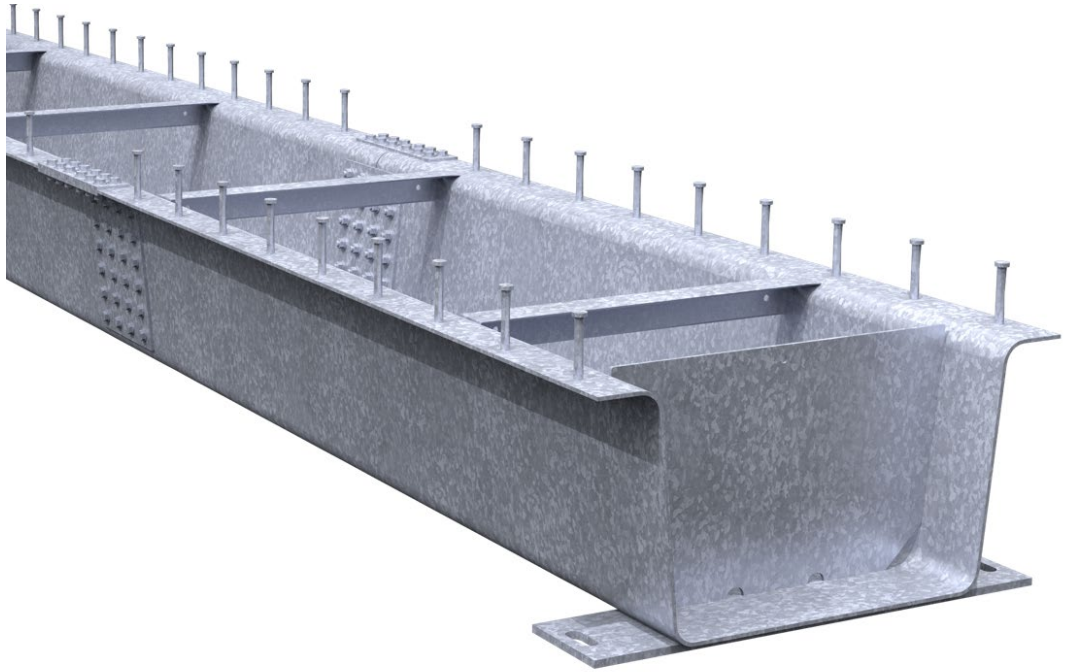
Structural thickness of slab: $t_s := 9$ (in)

Width of interior slab: $b_s := 6 \cdot 12 + 2 = 74$ (in)

Thickness of steel plate: $t := \frac{3}{8}$ (in)

Depth of haunch: $t_h := 2$ (in)

AASHTO LRFD Design



Surface Condition	Definition	Ks (Slip Coefficient)
Class A	Unpainted clean mill scale Blast-cleaned surfaces with Class A coatings	0.30
Class B	Unpainted blast-cleaned surfaces to SSPC-SP 6 or better Blast-cleaned surfaces with Class B coatings Unsealed (pure Zn or 85/15 Zn/Al) thermal-sprayed coatings with a thickness ? 16 mils	0.50
Class C	Hot-dip galvanized surfaces (roughening by wire brushing no longer required)	0.30
Class D	Blast-cleaned surfaces (including HDG) painted with organic zinc-rich coatings	0.45

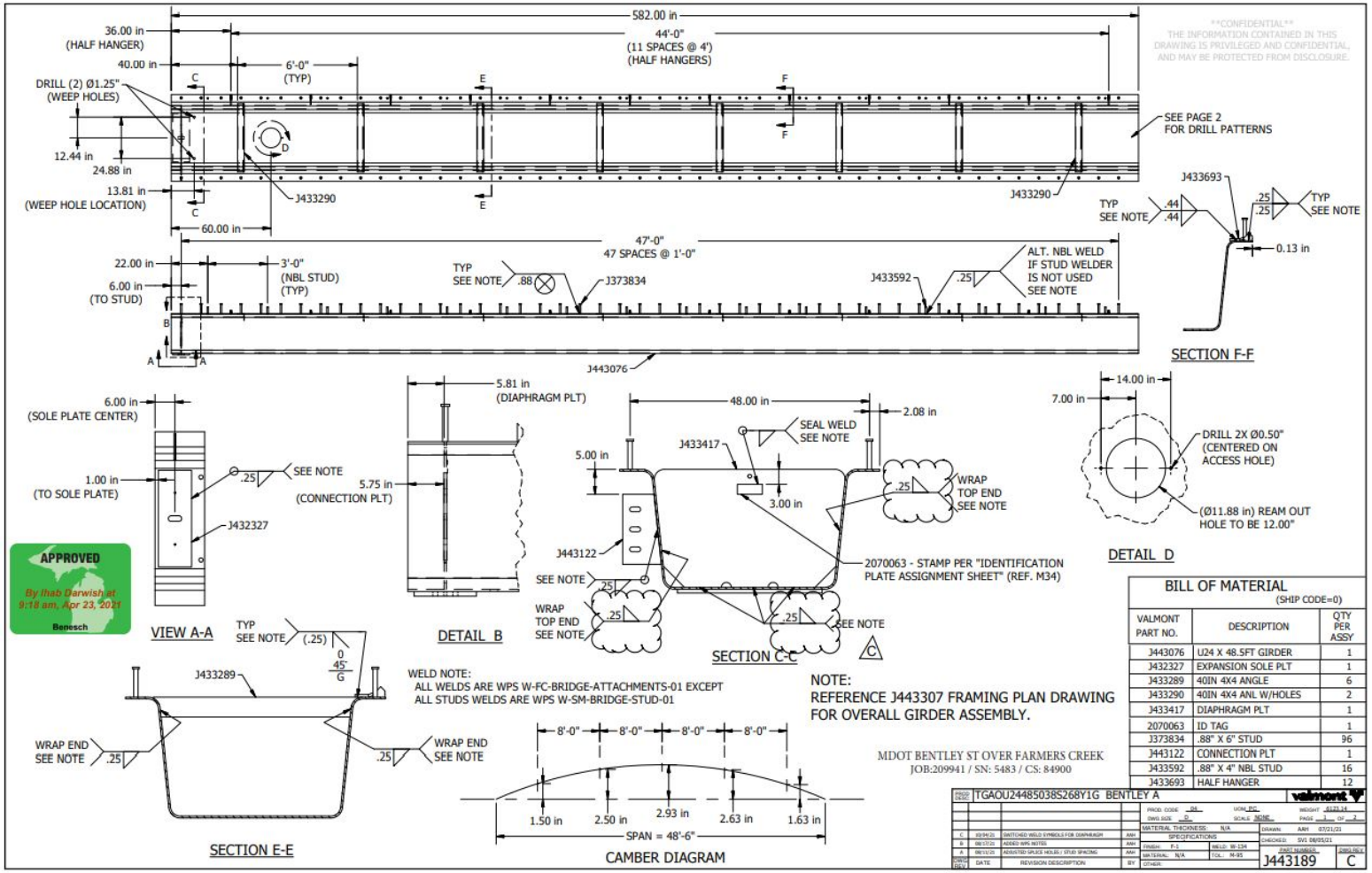
- AASHTO LRFD Bridge Construction Specifications Section 11.5.5.3 Surface Conditions. Faying surfaces specified to be galvanized shall be hot-dip galvanized in accordance with AASHTO M111 (ASTM A123).

- Section 6.13.2.8 Slip Resistance. Class C Surface: hot-dip galvanized surfaces (K_s=0.24)

AASHTO LRFD Design

- AASHTO LRFD Bridge Construction Specifications Section 11.3.3 Welded Stud Shear Connectors shall satisfy all requirements of the AASHTO/AWS D1.5M/D1.5 Bridge Welding Code related to material, manufacturing, physical properties, certification, and welding. Studs welded prior to galvanizing.

AASHTO LRFD Design



Materials

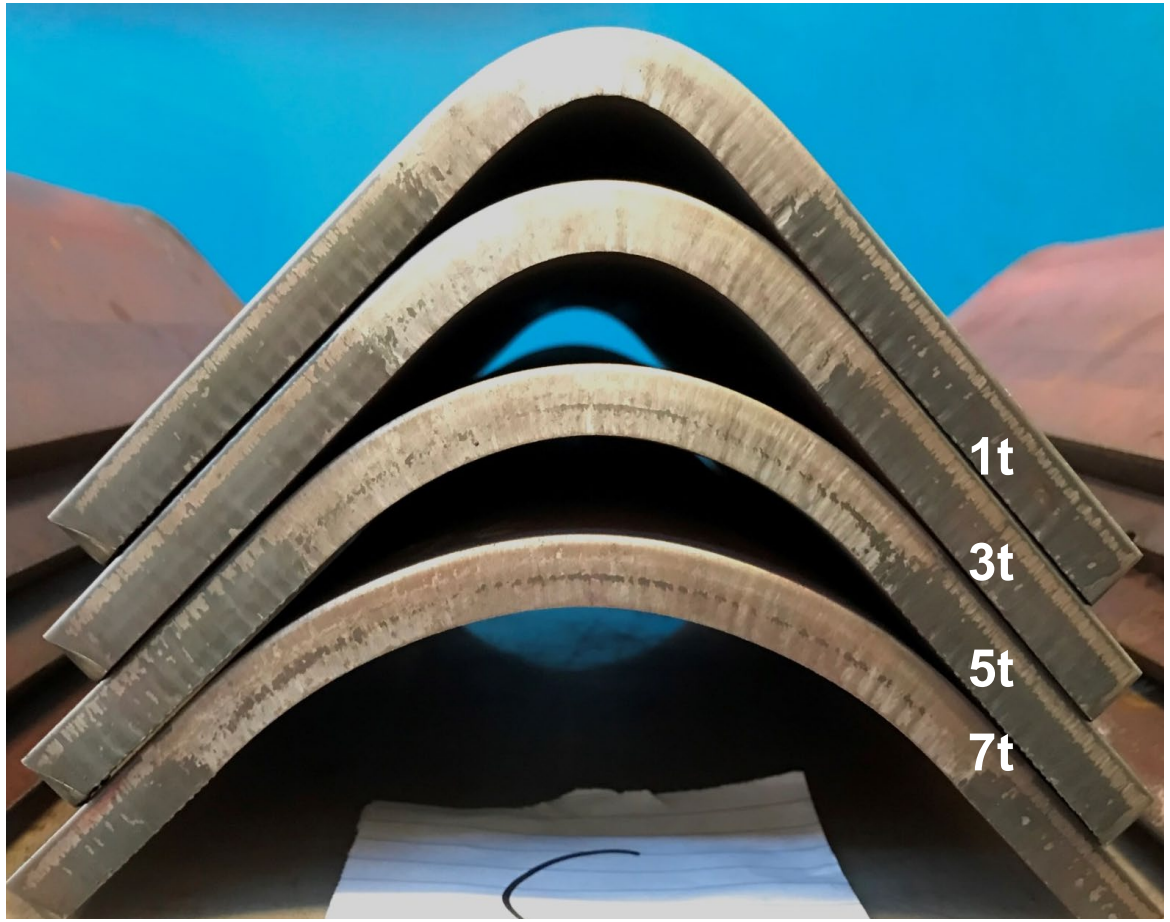
- AASHTO LRFD Bridge Construction Specifications Section 11.3.1.2 AASHTO M270. Steel Plates and Structural Shapes shall conform to ASTM A709/A709M
- Primary components as defined by AASHTO 6.6.2 require Charpy V-notch Impact testing
- Maximum 0.06% silicone content to avoid blast cleaning prior to galvanizing (ASTM A385)

Fabrication

- Intermediate (IBR) certification for typical bridges:
  - Rolled beams with field or shop splices, straight or radius over 500 ft
  - Built-up sections with constant web depth with or without splices, straight or radius over 500 ft
- Meets all requirements of AASHTO LRFD Bridge Construction Manual
  - Inclusive of AISC Quality Certification Program

Fabrication

- AASHTO LRFD Bridge Construction Specifications Section 11.4.3.3.2 - the minimum bend radii for cold bending (at room temperature)….shall be taken as 5.0t for all grades and thicknesses of…AASHTO M270



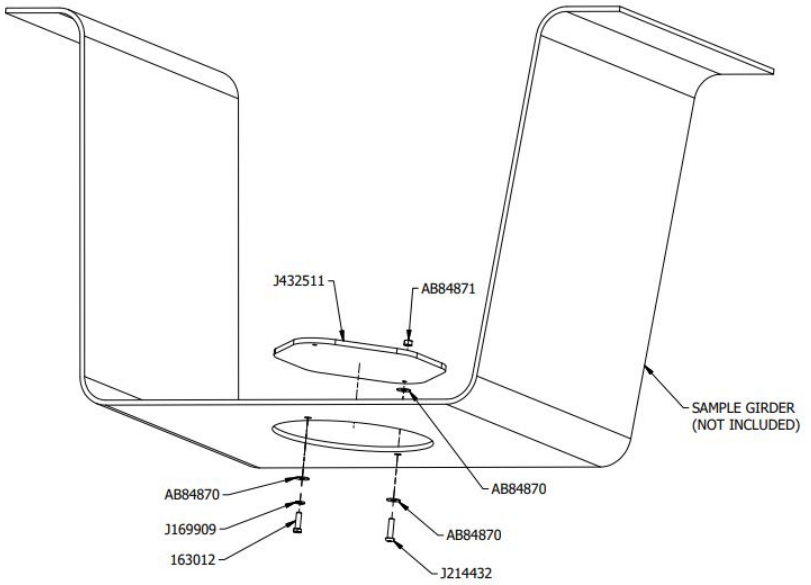
Fabrication

- AASHTO LRFD Bridge Construction Specifications Section 11.1.1 - Fabrication, welding, welder and welding procedure qualification tests shall conform to the provisions of AASHTO/AWS D1.5 Bridge Welding Code.

Fabrication

- AASHTO LRFD Bridge Construction Specifications Section 11.3.7- Galvanizing shall be in accordance with AASHTO M 111M/M 111 (ASTM A123/A123M)

In Service Inspection



- Classified as an AASHTO Steel Box Section Flexural Members, which are internally redundant as they consist of two vertical webs, each being sufficient to carry the load in event of failure of the other
- To facilitate inspection, openings with removable covers are provided at the ends, or bottom of the steel tub girder that allow visual observation of the interior elements
- Visual inspection should look for chalky white staining or zinc oxide build-up on the surface. Areas to concentrate on include areas where water can pool, leaching water from the above concrete bridge deck and around bolted splices.
- Press-brake formed steel tub girder fabrication includes no fatigue sensitive details in high-tension areas

Project Implementation

COMPLETED GOVERNMENT AGENCIES PROJECTS:

- Michigan Local Agencies (12 Bridges)
- Michigan DOT Design-Build Bundling Project (19 Bridges)
- Illinois Local Agencies (with IDOT approval) (2 Bridges)
- West Virginia DOT (2 Bridges)
- Pennsylvania Local Agencies (1 Bridge)
- Texas Local Agencies (2 Bridges)
- Saskatchewan Ministry of Highways (1 Bridge)
- U.S. Forest Service (1 Bridge)
- U.S. Army Corps of Engineers (1 Bridge)

PENDING APPROVALS:

- PennDOT Bulletin 15 Approval
- TxDOT (based on first project)

Thank you!

Questions?