Lubbock ABC Project – Rural Site

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Texas Department of Transportation

April 17, 2025

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What is ABC?

ABC = Accelerated Bridge Construction

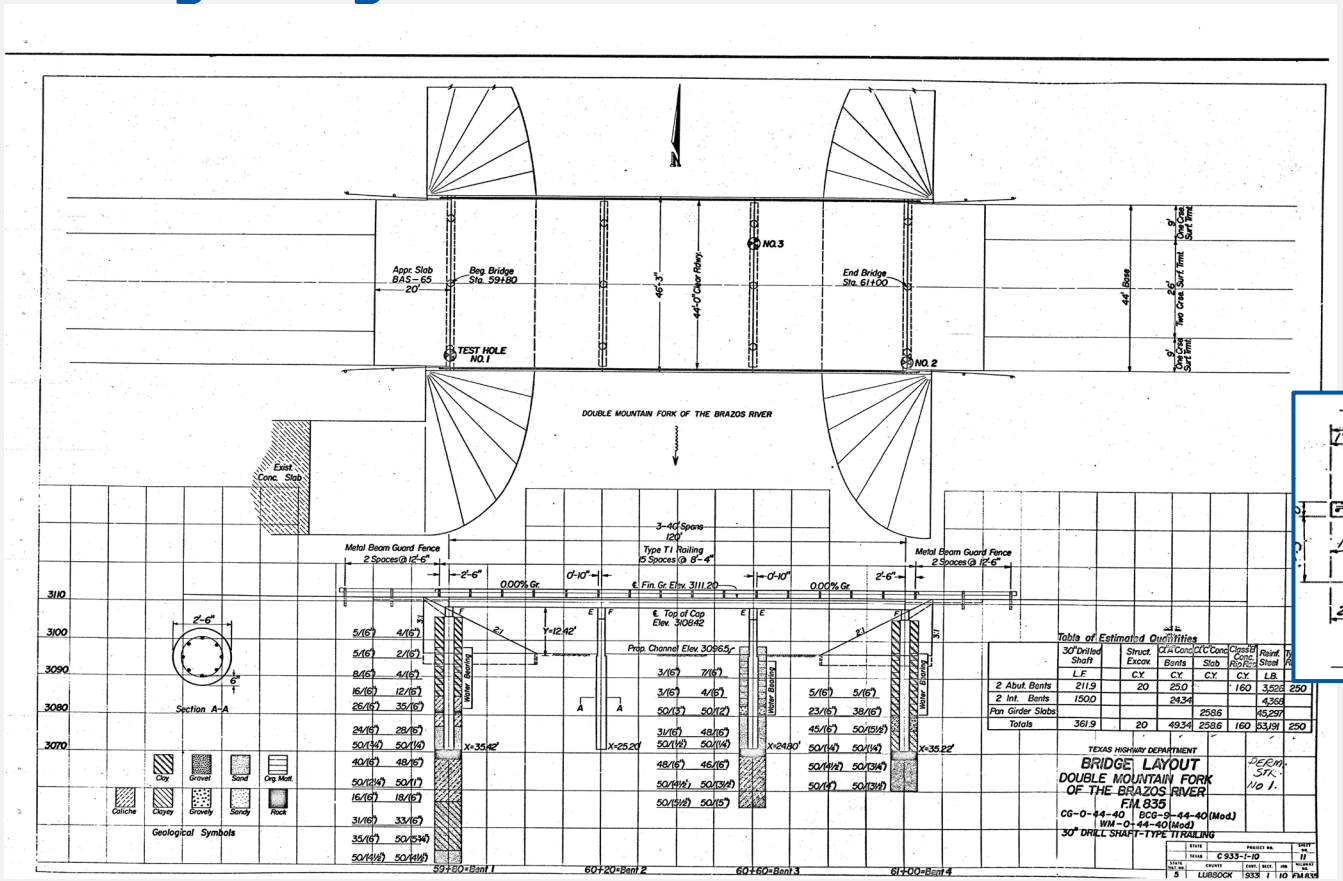
ABC is bridge construction that uses innovative planning, design, materials, and construction methods in a safe and cost-effective manner to reduce the onsite construction time that occurs when building new bridges or replacing and rehabilitating existing bridges. (per FHWA)

Location: East FM 835 in Lubbock, TX

Questions to Consider for a Rural Site

- Do I have good reasons to use ABC like long detours, major traffic generators?
- Do I have a location in close proximity to stage bridge components?
- Can you reuse the substructure?
- How much money do I have?
- Am I close to retirement if we go with traditional cast-in-place construction?

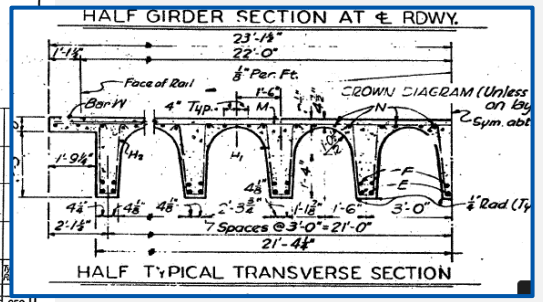
Existing Bridge - 1965



3 Span Concrete Pan Girder

Conc Pan Girders hard to build in half widths

Recommend full road closure



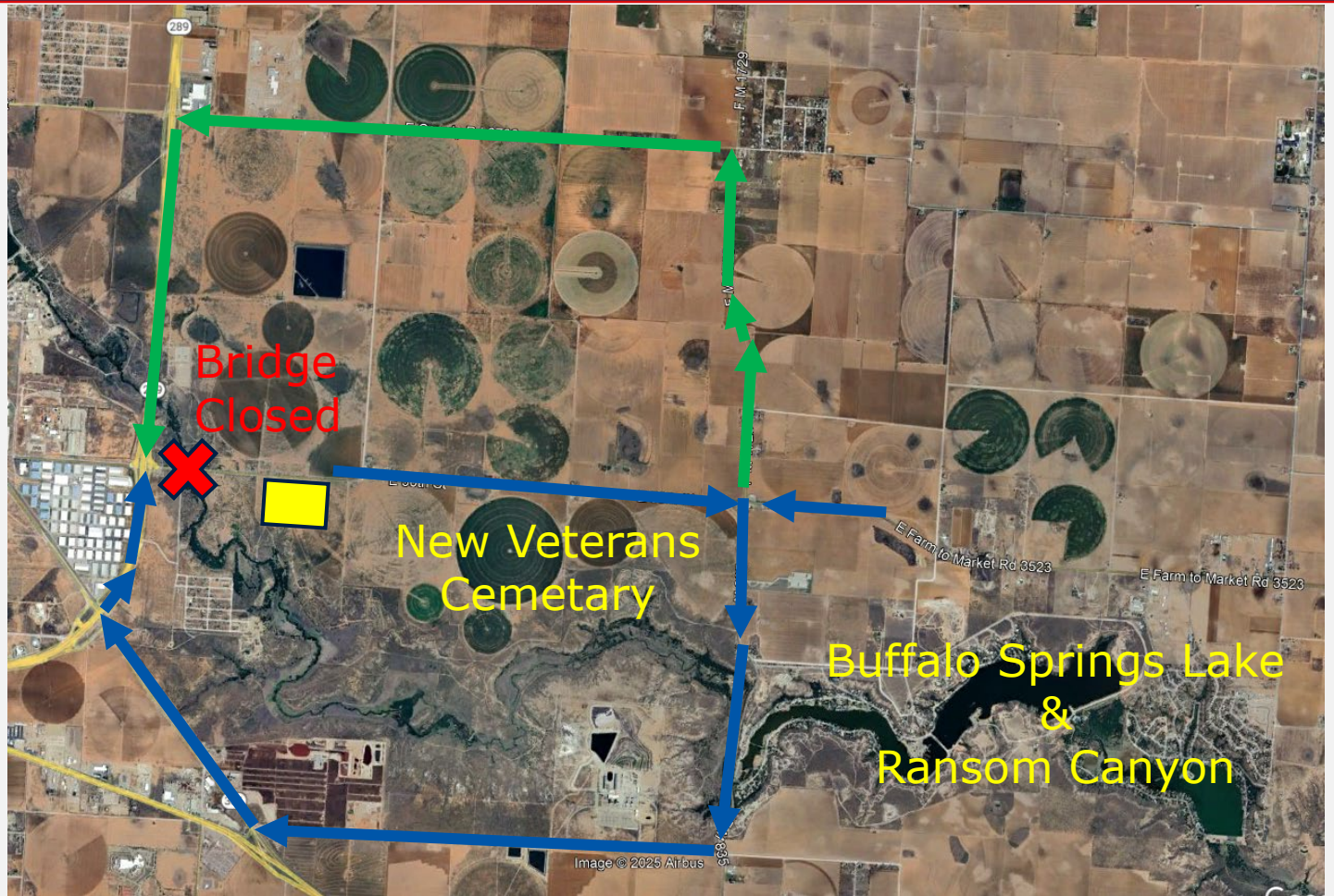
Detours

4000 ADT

3 Month Bridge Closure using ABC

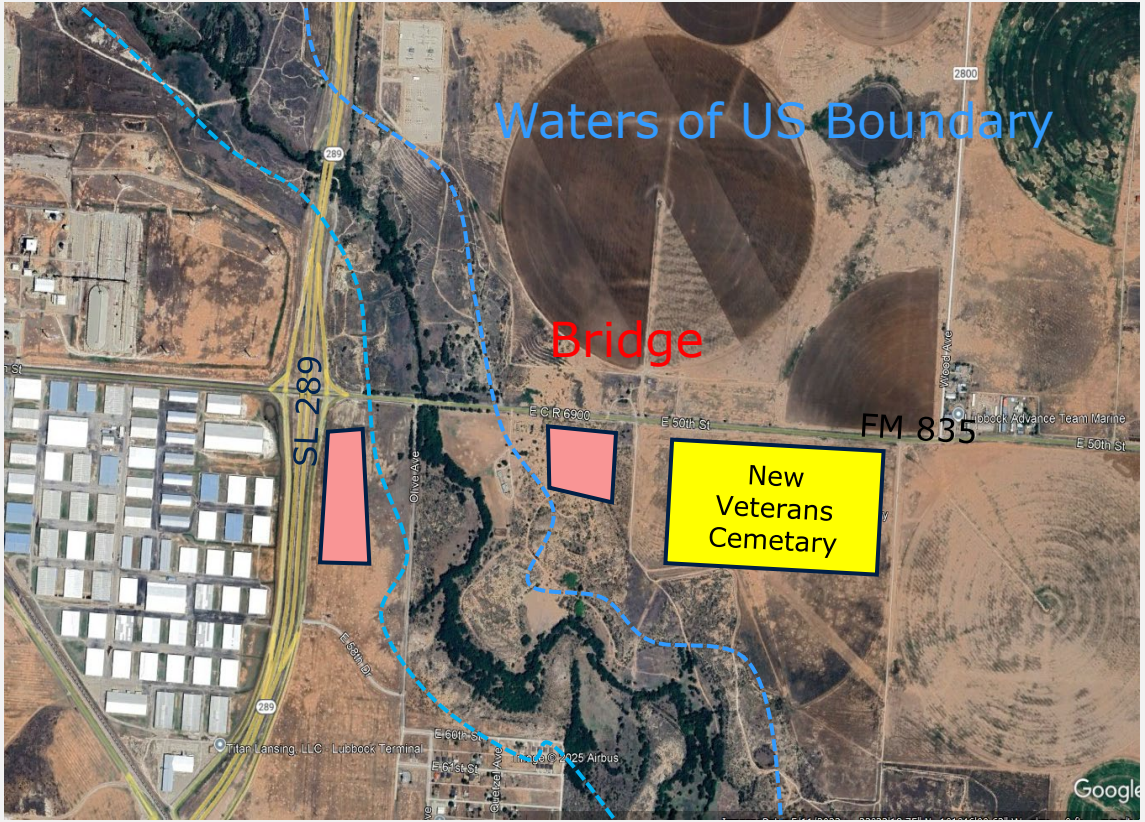
8-10 Month Closure using Traditional

Detour Length
9 miles for Cemetary



Staging Locations

Can’t put stuff in WOTUS!

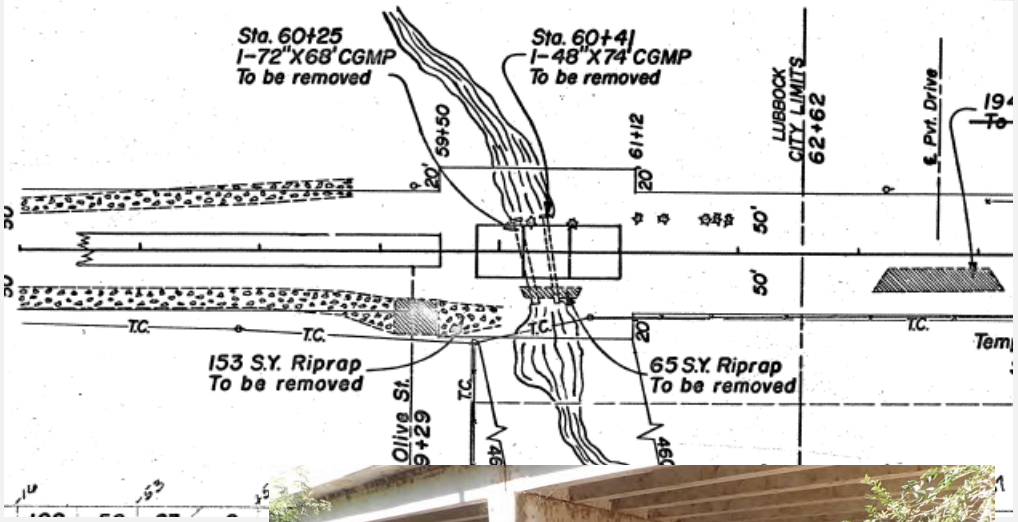


Reuse Substructure?

No.

Existing bridge isn't skewed.

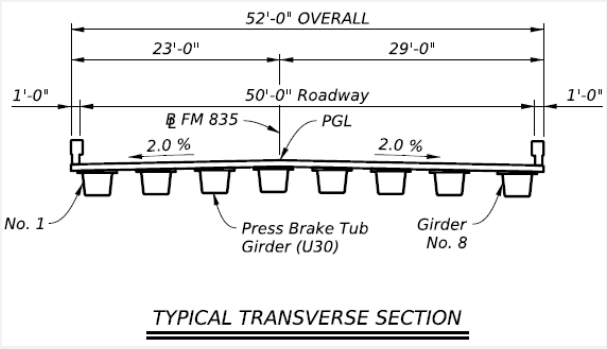
Proposed bridge abutments will be skewed to better align with channel.



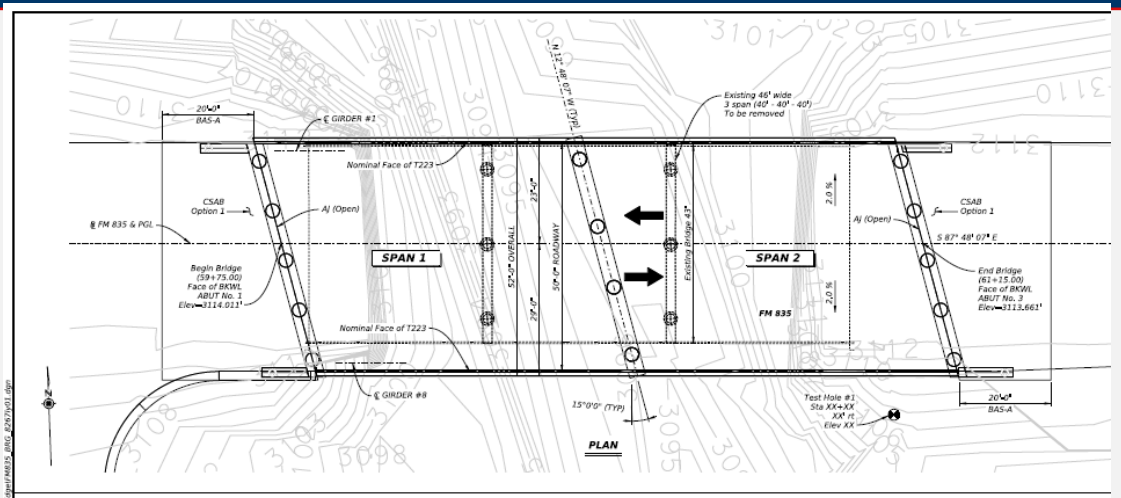
Trying to single span and remove bents in channel. Debris is piling up on bents and causing scour issues.

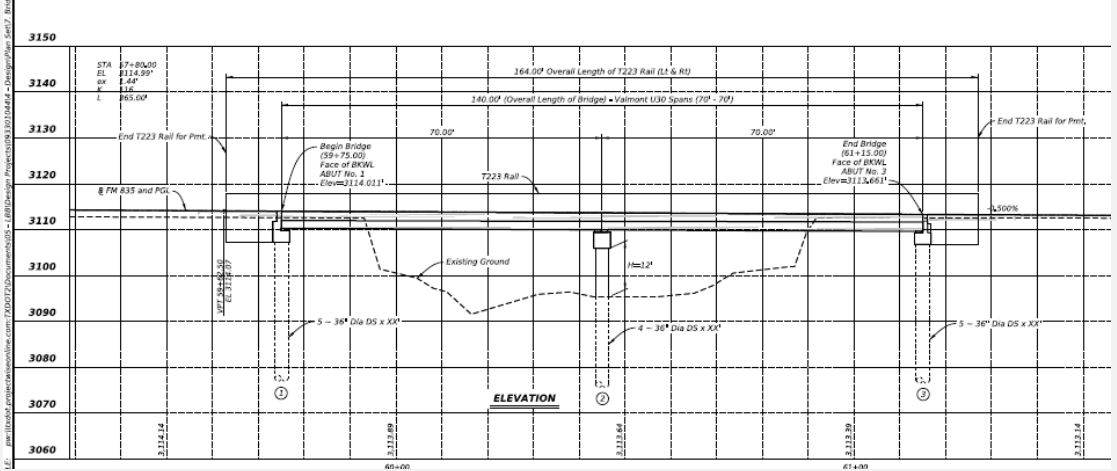
Proposed Bridge

2 Span Press
Brake Tub Girders

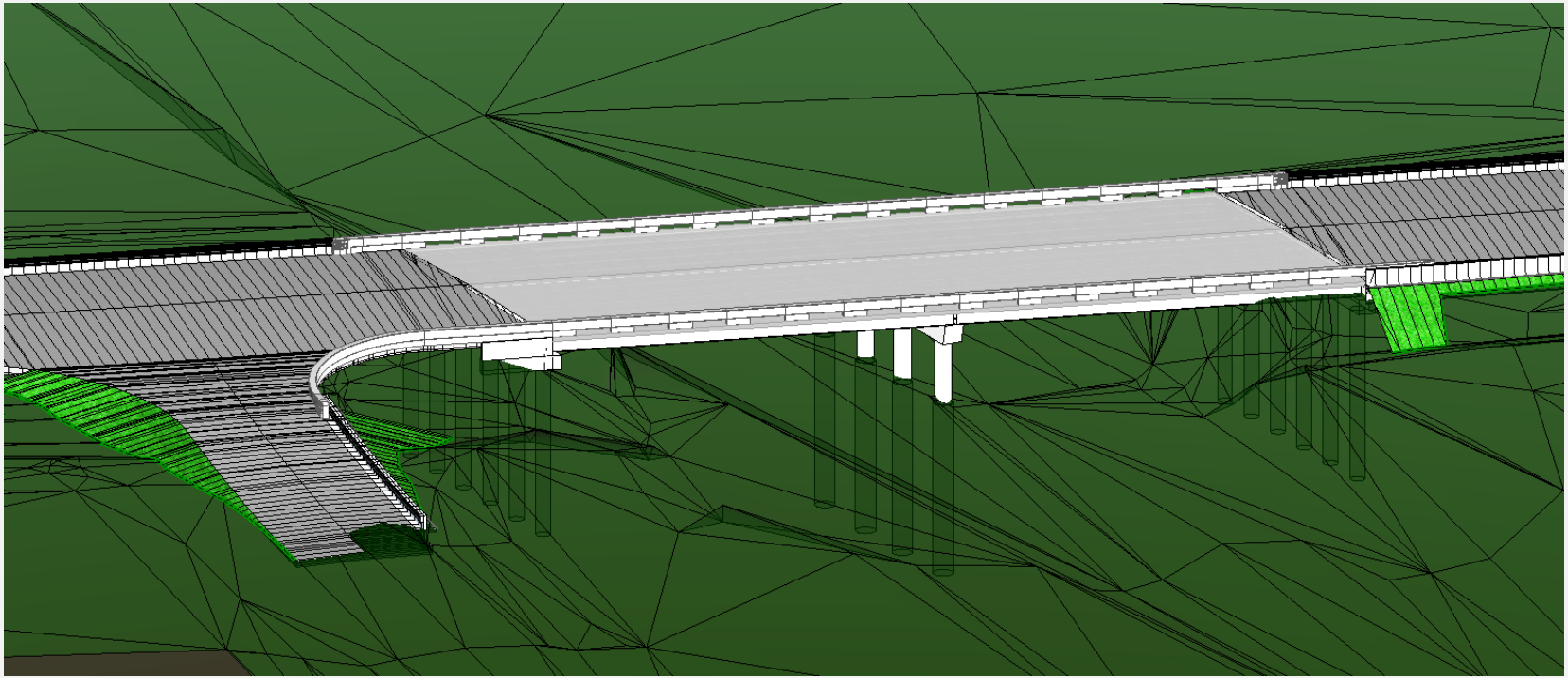


TYPICAL TRANSVERSE SECTION





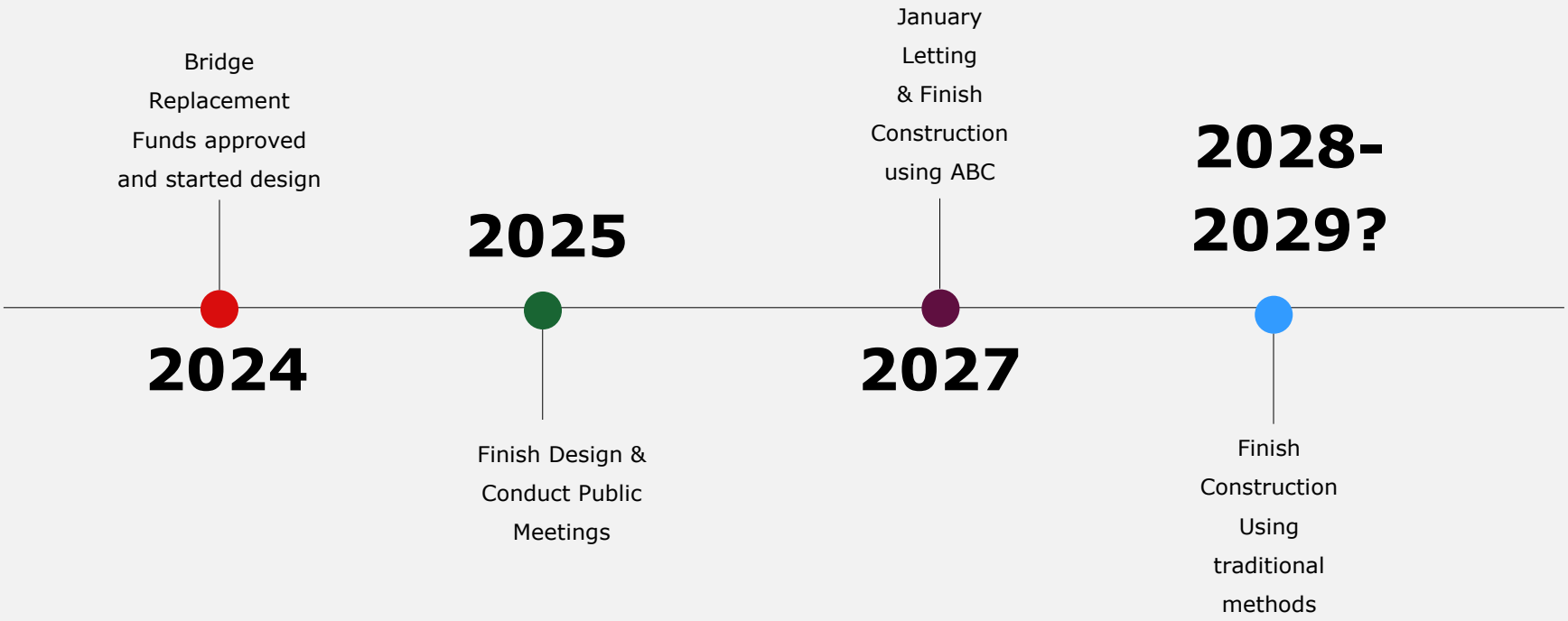
Cool 3D Rendering

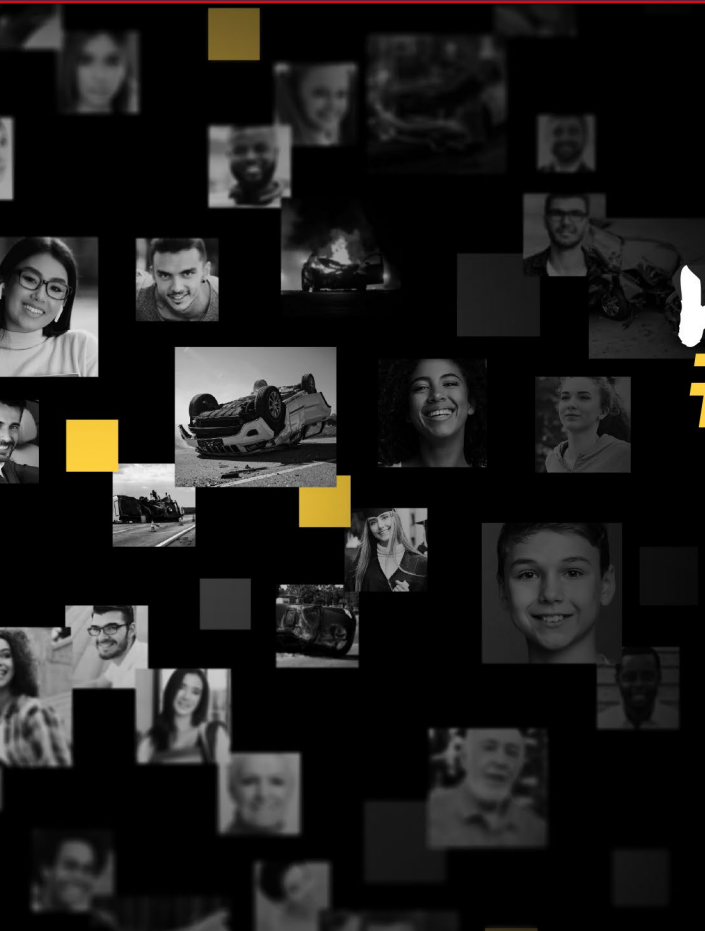


Cost

- Plan for twice as much
- Normal long duration bridge construction = $2 million total
- ABC = $4 million total
- Make sure bridge division has this much to give you.

Project Timeline





HELP #EndTheStreakTX

End the streak of daily deaths on Texas roadways.

TxDOT.gov
#EndTheStreakTX Toolkit

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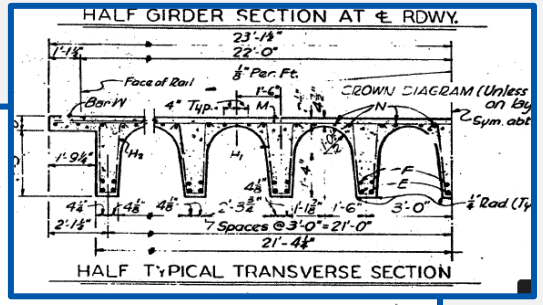
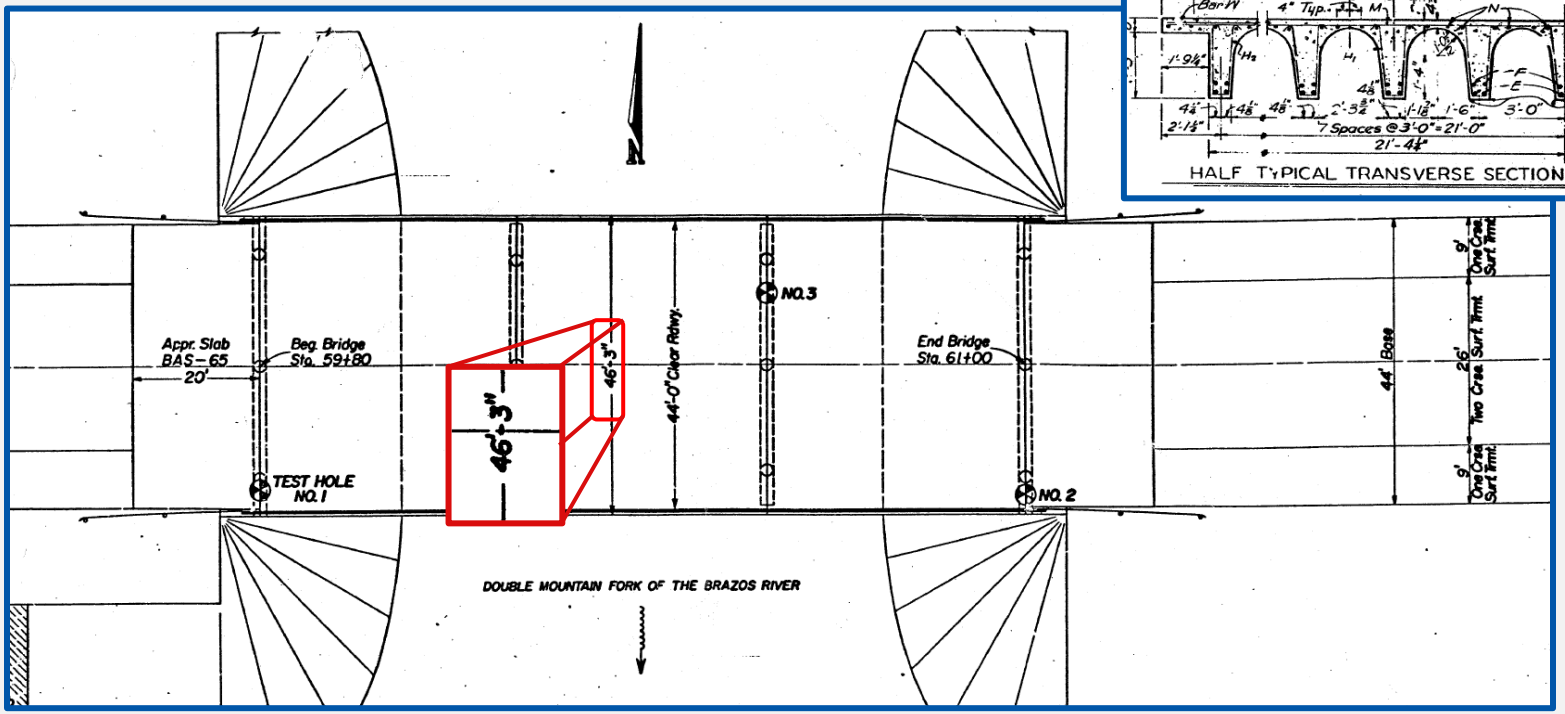
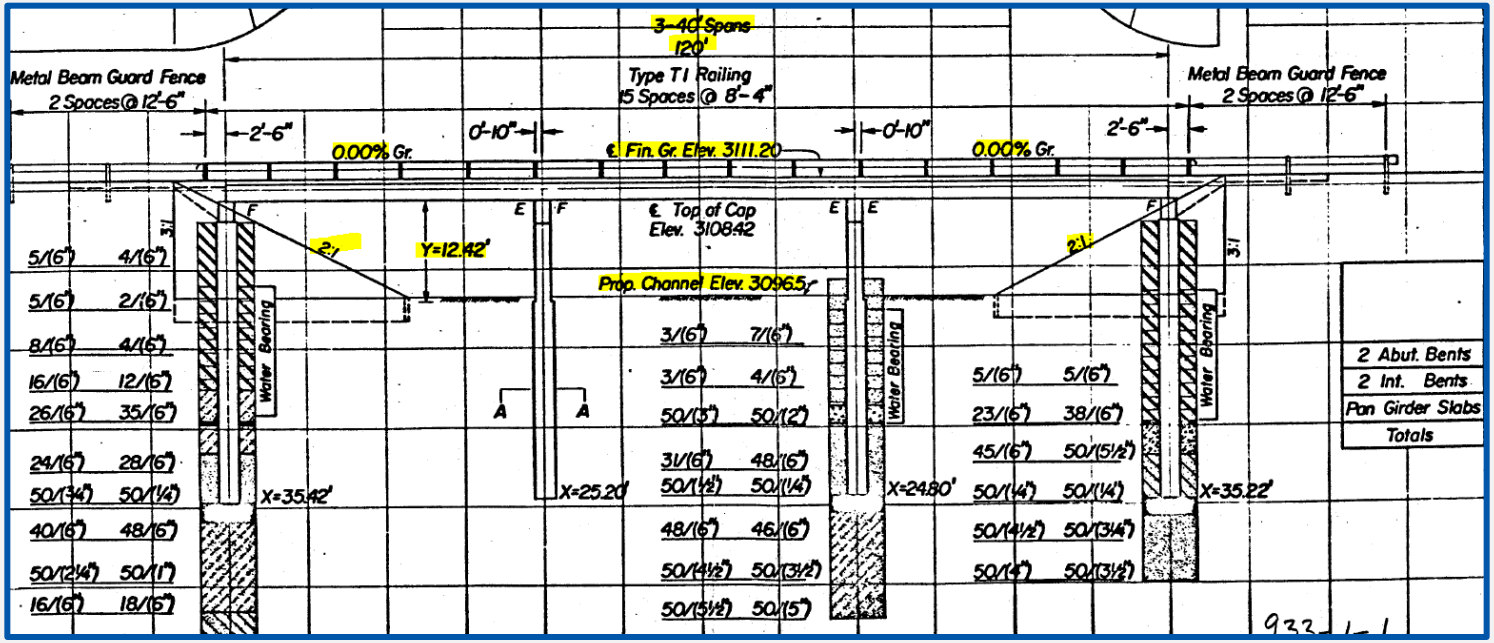
Existing Bridge Layout (Plan)





Existing Bridge Layout (Elevation)

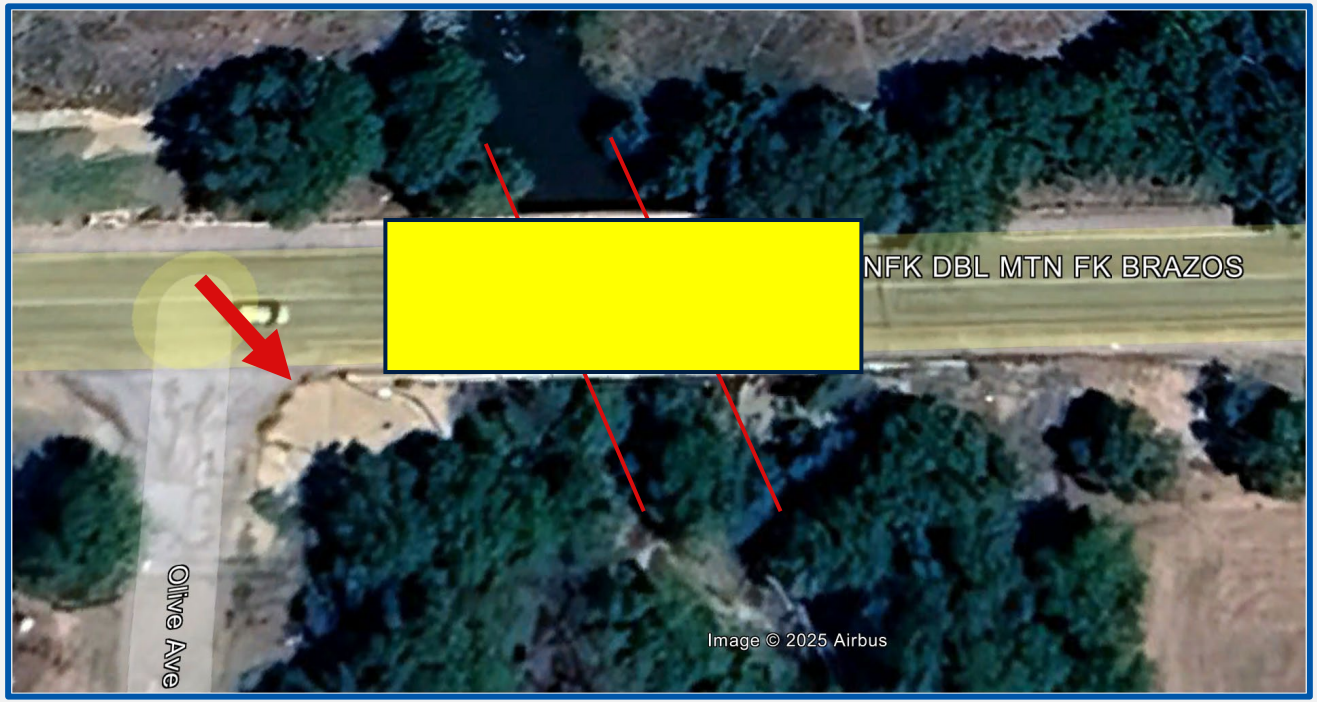


Initially built: 1965

Ariel View of existing road

Source: Google Earth

Ariel View of existing road



Source: Google Earth

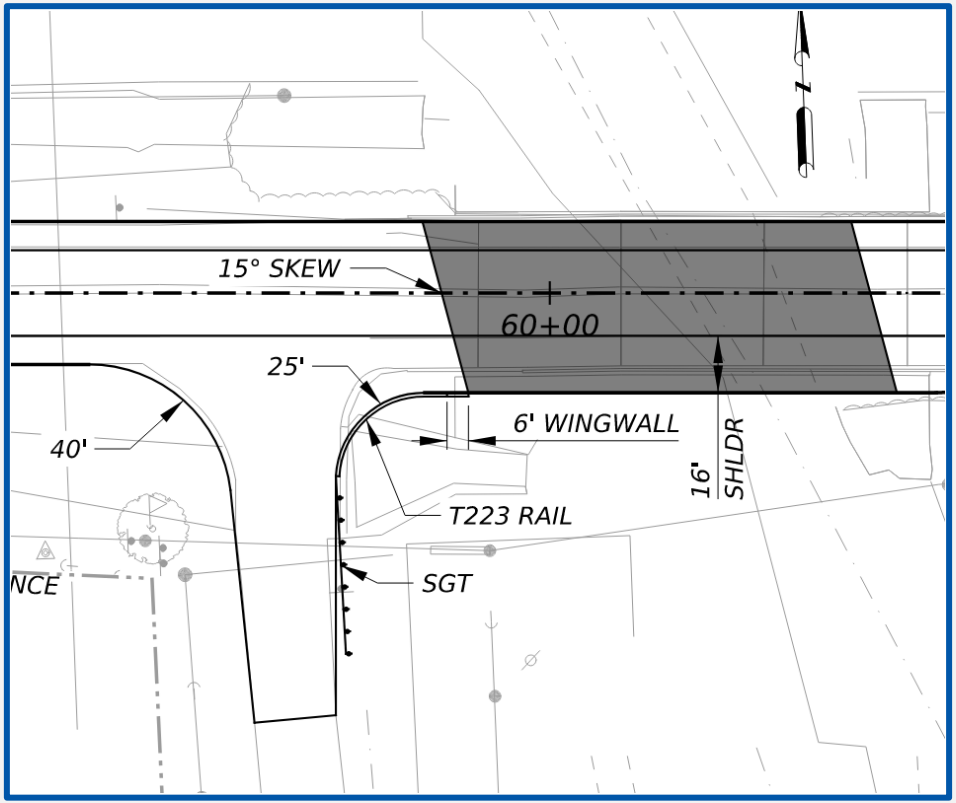
Existing adjacent road

Source: 2021 Inspection Photo

Source: Google Earth (07/2024)

Project Parameters

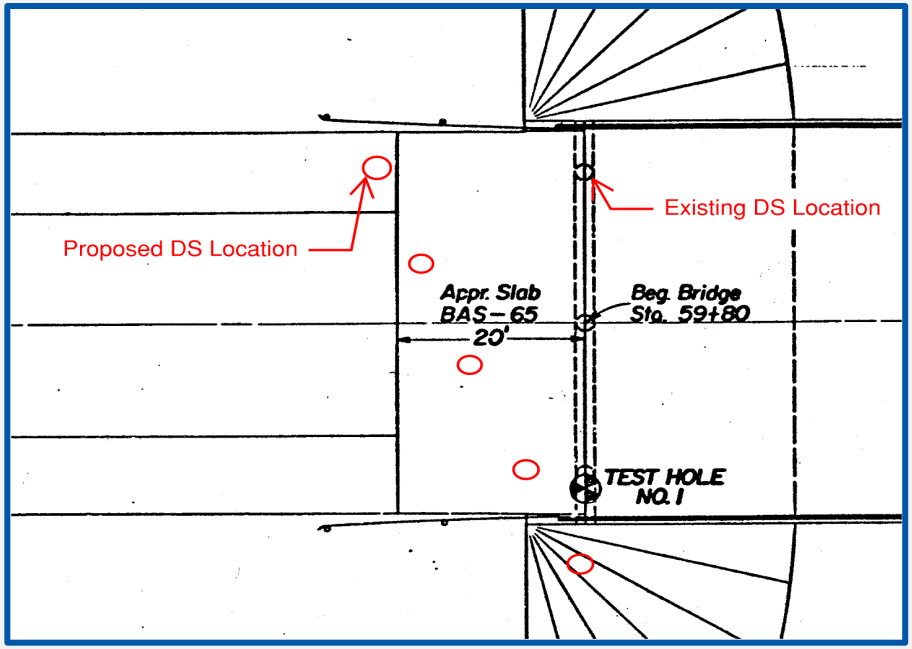
- Full Bridge closure of 2-3 months (ABC)
  - Per Chapter 3 Section 1 Bridge Project Development Manual, "…full closure with ABC should generally be considered the first option."
- 140’ overall Bridge length (2 ~ 70’ spans)
- 15 Degree Skew ~ Important for Design
- 52’ Overall Deck Width
  - Reduce the direct impact at SW corner
- T223 Bridge Rails



ACCELERATION BRIDGE CONSTRUCTION

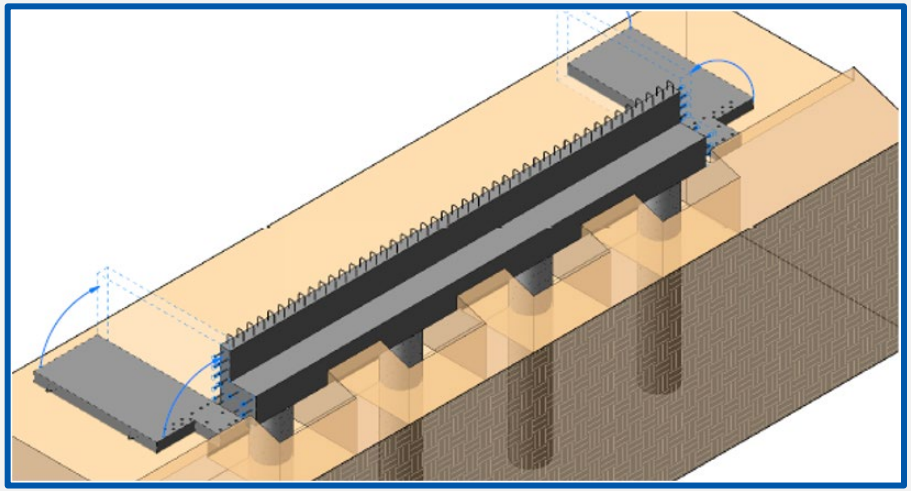
ABC METHODS

- Cap the Drilled Shafts to remove them from the critical path.



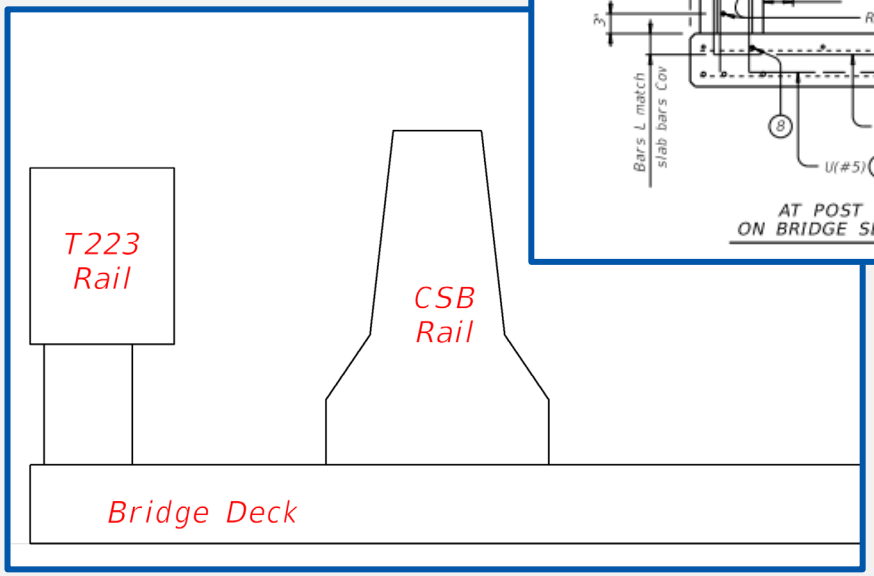
ABC METHODS

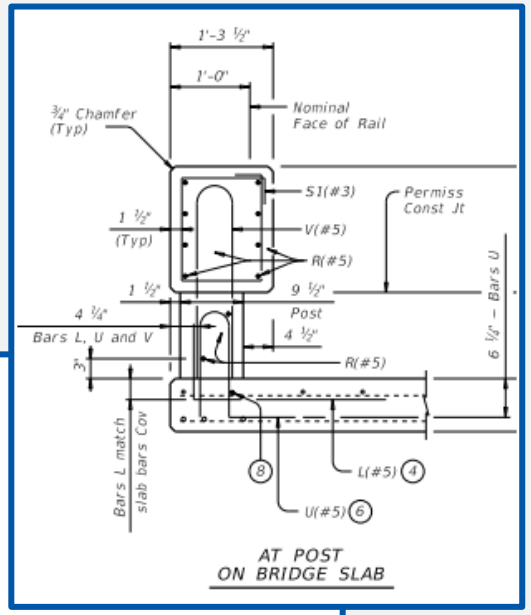
- Cap the Drilled Shafts to remove them from the critical path.
- Use precast substructure elements
  - PBC-RC standard
  - Precast Abutments



ABC METHODS

- Cap the Drilled Shafts to remove them from the critical path.
- Use precast substructure elements
  - PBC-RC standard
  - Precast Abutments
- Cast bridge rail with a temporary rail in front.





Precast Superstructure/Substructure Alternatives

- Found on Bridge Standard webpage
- PCA-SUP ~ Precast alternate for Superstructure
- PCA-SUB ~ Precast alternate for Substructure
- Provide guidance for contractor on how to propose precast alternatives

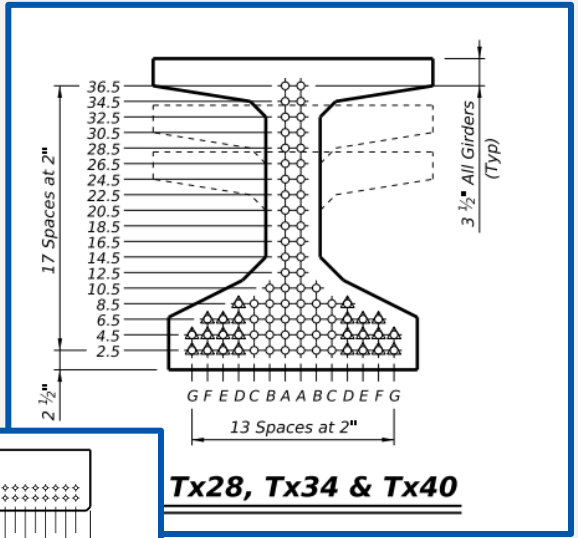
NOTE TO DESIGNER:

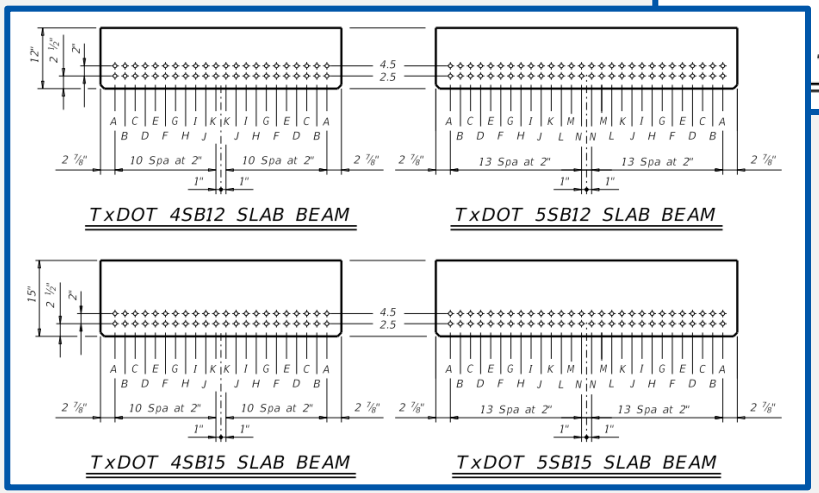
These sheets are to be used as a guide for preparing plans for precast superstructure alternates. Included on these sheets are design and construction requirements for various superstructure precast options. Include appropriate notes from this guide for the specific application. These sheets cannot be used without modification and in all cases notes not required must be removed. This note and the phrase "Not to be used as a standard" must be removed and the sheet must be signed and sealed by a Professional Engineer.

PCA-SUP	Precast Superstructure Alternates	PDF MS-PCA-SUP-24.dgn
PCA-SUB	Precast Substructure Alternates	PDF MS-PCA-SUB-24.dgn

Superstructure Parameters

- Span 70’
- Small Superstructure Depth
  - Assist with the hydraulic opening
- Protected against environment
- Quick to install
- Modular

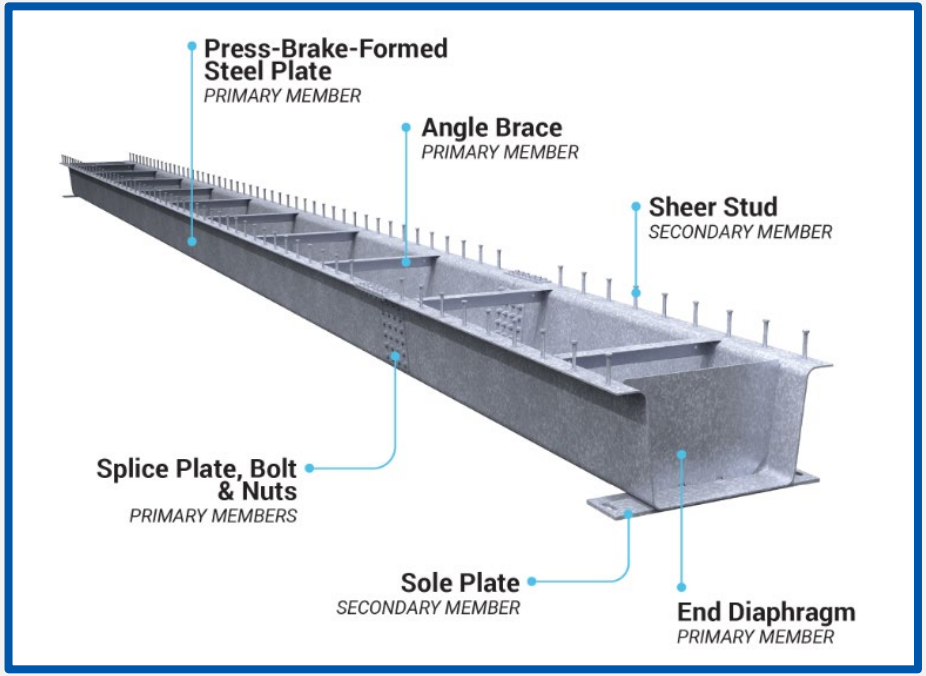




Press Brake Tub Girders (PBTG)

- *PBTGs are shallow trapezoidal boxes fabricated from cold-bent structural steel plate.*
  - Originally proposed by the Short Span Steel Bridge Alliance (SSSBA)
  - A 2009 FHWA call to the North American steel industry to:

"..develop a cost-effective short span steel bridge with modular components which could be placed into the mainstream and meet the needs of today's bridge owners, including Accelerated Bridge Construction (ABC)."



Source: Valmont Structures

Press Brake Tub Girders (PBTG) - Benefits

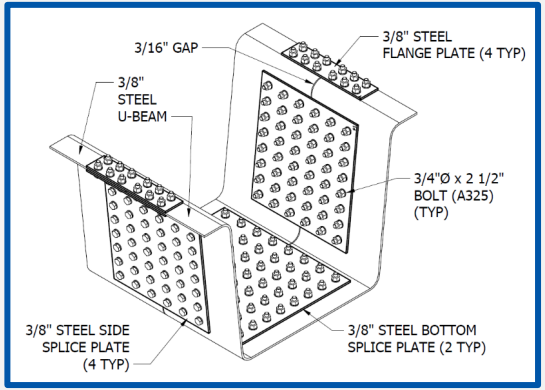
Press Brake Tub Girders (PBTG) - Benefits

- Hot dip galvanized Tubs (Reduced Maintenance)
  - Est. 60 years to first maintenance (in marine/costal environment)
  - Kettles are limited to approx. 55’
- Uncoated Weathering Steel
- Painting Systems

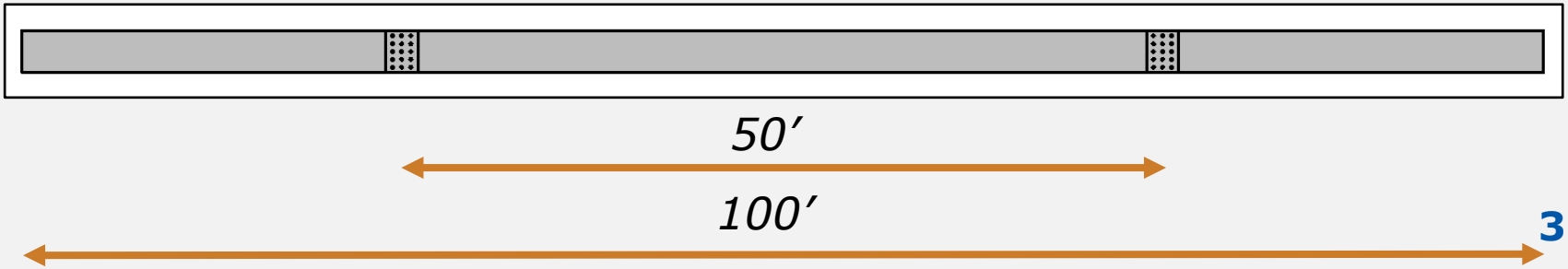
Source: Valmont Structures

Press Brake Tub Girders (PBTG) - Benefits

- Bolt splice for longer beam lengths
  - Press-brake process inherently limits section lengths
    - 55 feet is a reasonable upper limit
  - To achieve longer spans, bolt splices are used



Source: Valmont Structures



Press Brake Tub Girders (PBTG) - Benefits

- Light weight (Fast Installation)
  - Typically can be transported on standard trailers
  - Multiple girders on a single trailer (up to 6)
  - Can be unloaded with a forklift
  - Well suited for limited access sites

Source: NSBA

Press Brake Tub Girders (PBTG) - Benefits

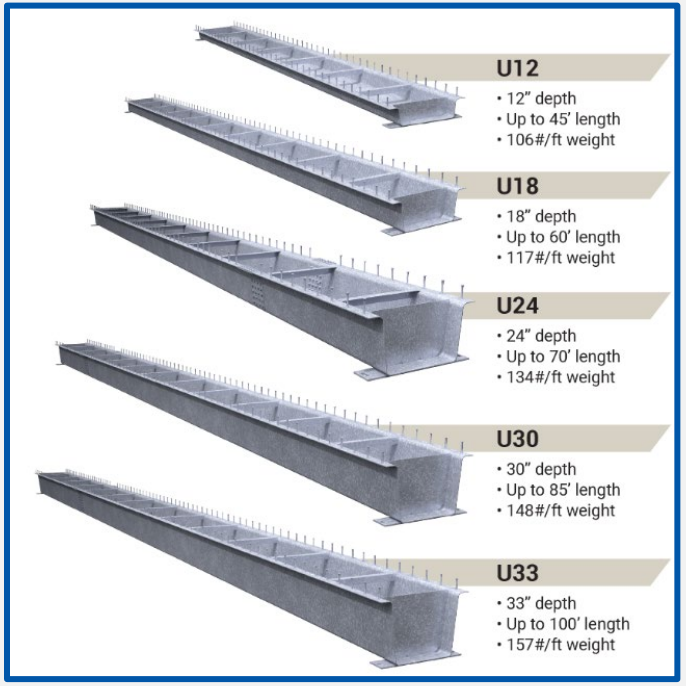
- Utilize Prefabricated Bridge Units
  - Pre-decked units
  - Ultra High Performance Concrete (UHPC) closure joints
  - Accelerated Bridge Construction
    - Units can be set within a day
    - Joint closures can be traffic ready within hours

Source: Pavlo Kozhokin, WVU (West Virginia University)

Press Brake Tub Girders (PBTG) - Design

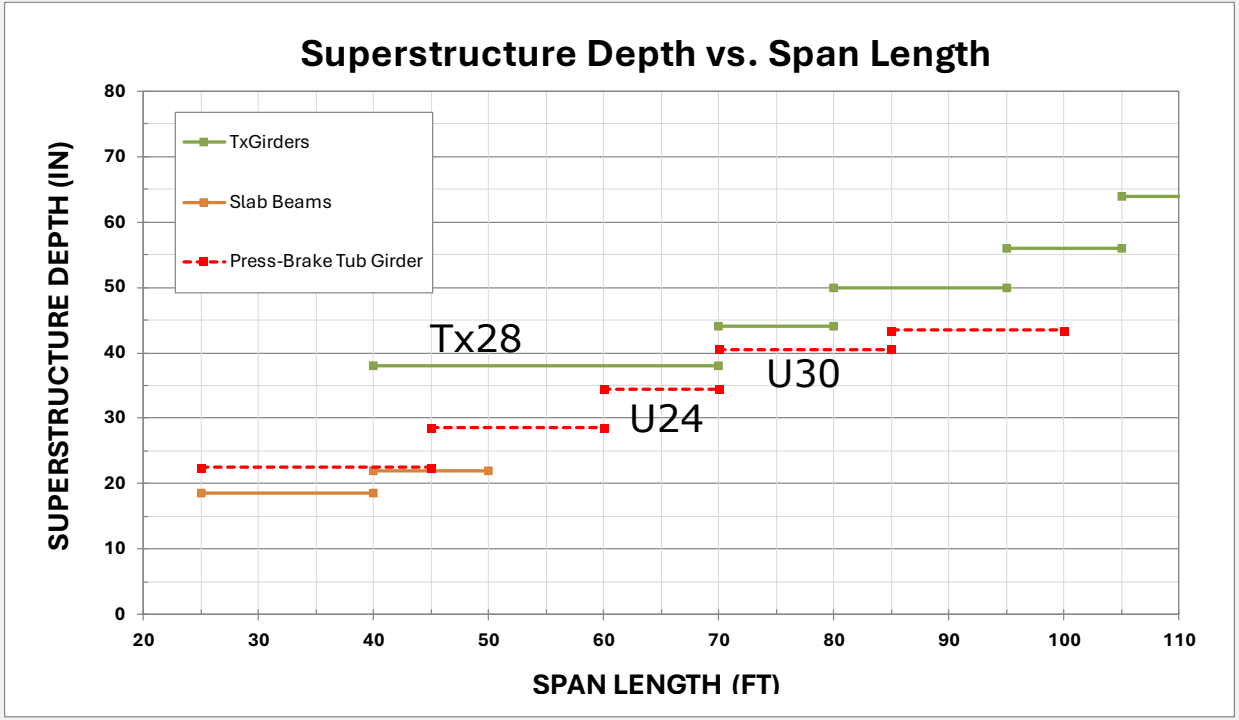
Press Brake Tub Girders (PBTG) - Design

- 5 standard shapes
- U24 Perfect Fit
  - Bearing Deduct = 34”
    (Assume 8.5” deck and 2” haunch)
  - Spans 70’ assuming the girders qualify as compact sections
- Tx28 ~ 630 plf vs U33 ~ 157 plf
- 5SB15 ~ 50’ vs U18 ~ 60’



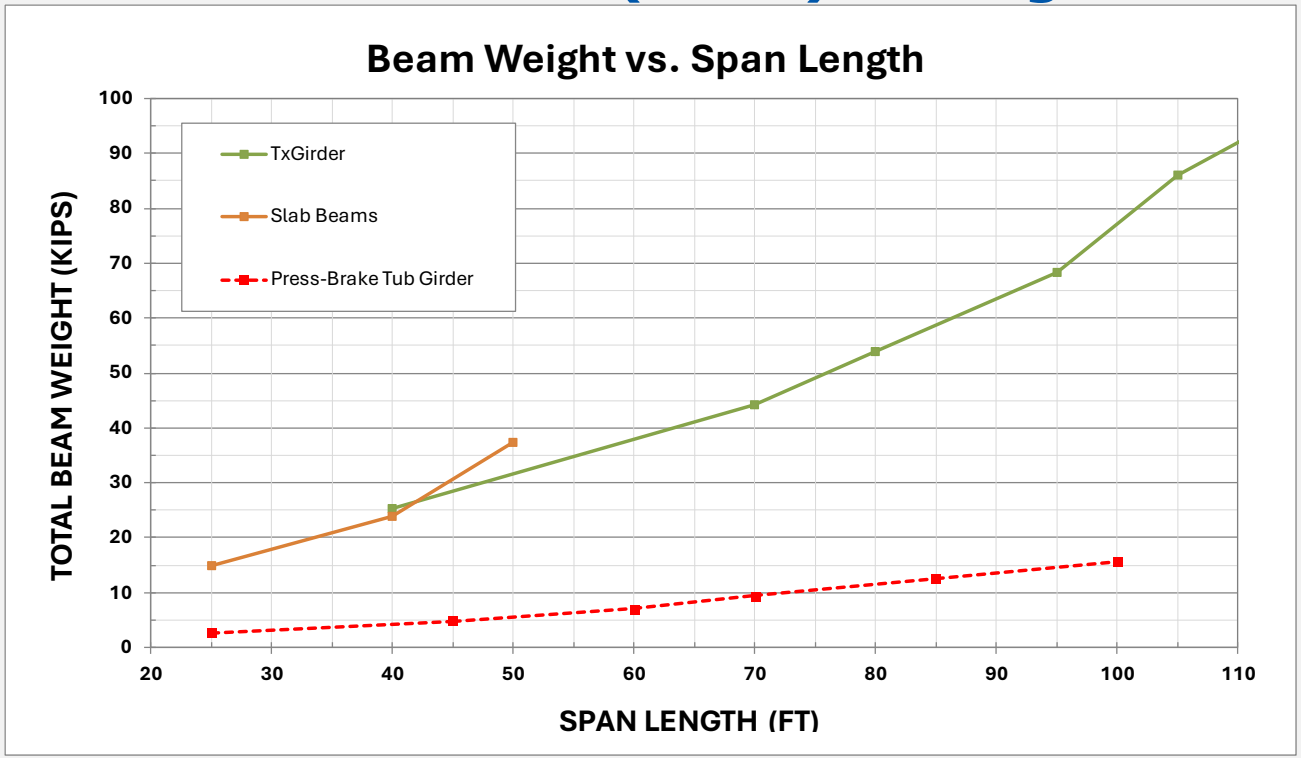
Source: Valmont Structures

Press Brake Tub Girders (PBTG) - Design

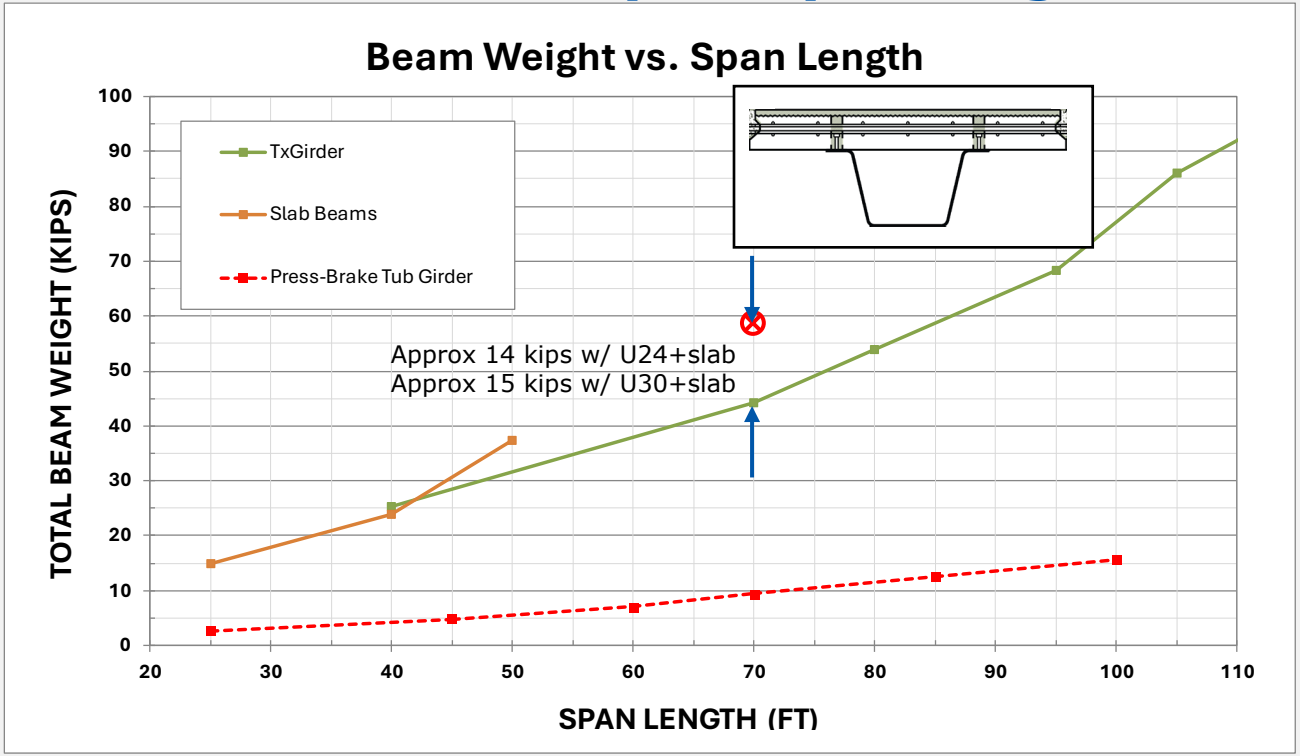


Note: Depth does not account for camber

Press Brake Tub Girders (PBTG) - Design



Press Brake Tub Girders (PBTG) - Design



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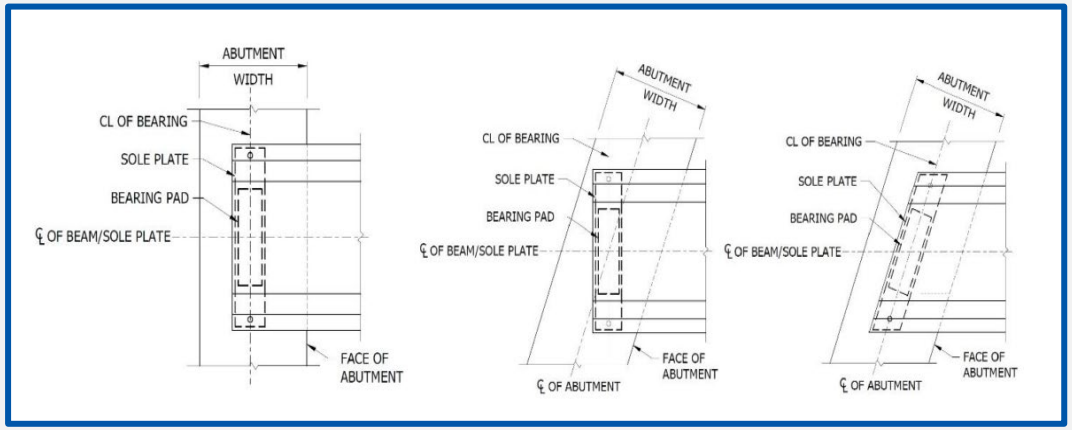
Press Brake Tub Girders (PBTG) - Design

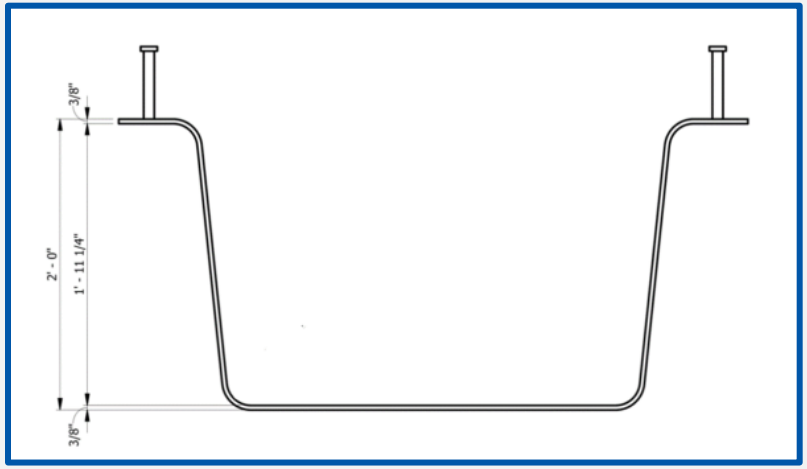
- AASHTO 6.11.6.2 provides requirements for compact sections
  - AASHTO 6.11.2.3 ~ Special Restrictions on Use of LLDF for Multiple Box Sections
    - **Zero skew**
    - C-C flange distance
    - Overhang limits



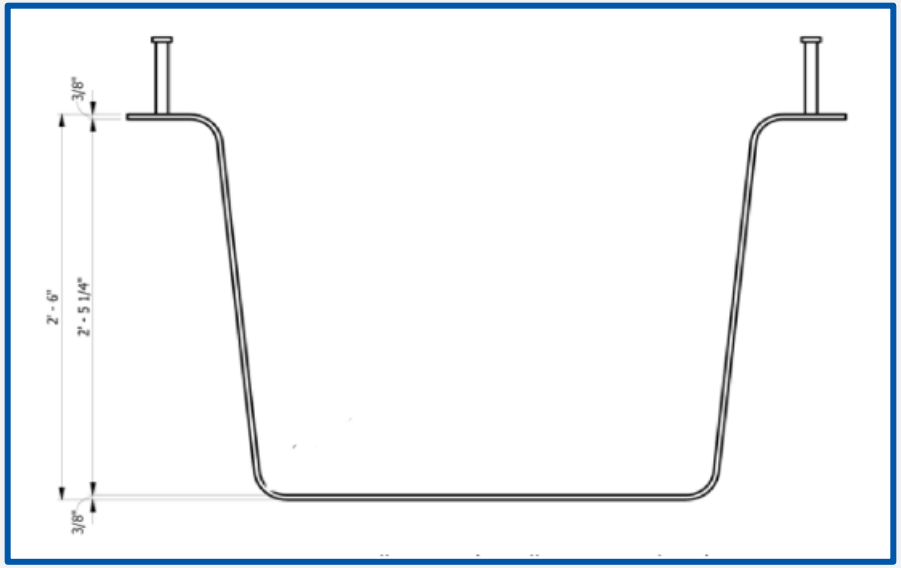
Source: Valmont Structures

Press Brake Tub Girders (PBTG) - Design

Design for Non-Compact sections -> Increase to U30 PBTG



U24 (PBTG)



U30 (PBTG)

Source: Valmont Structures

Press Brake Tub Girders (PBTG) - Design

Beam Spacing

- Conform to **Article 6.11.2.3** of AASHTO BDS 9th
- "w" ~ distance from Center to Center of flanges of same tub girders
- "a" ~ distance from Center to Center of flanges of adjacent tub girders.
- 0.8*w ≤ a ≤ 1.2*w
- Overhang ~ min(0.6*a, 6')

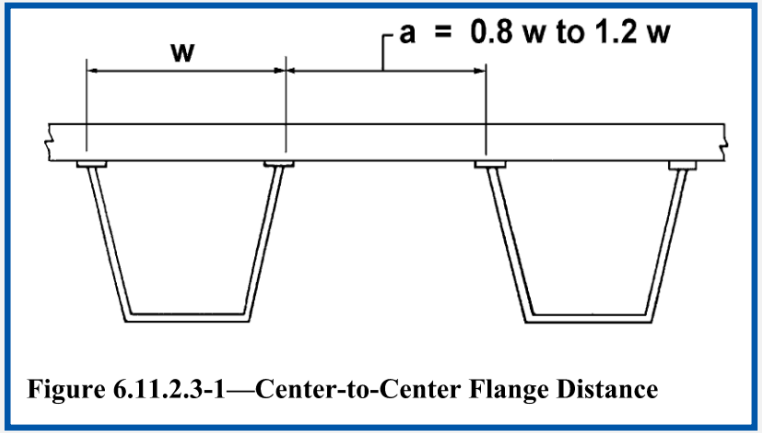
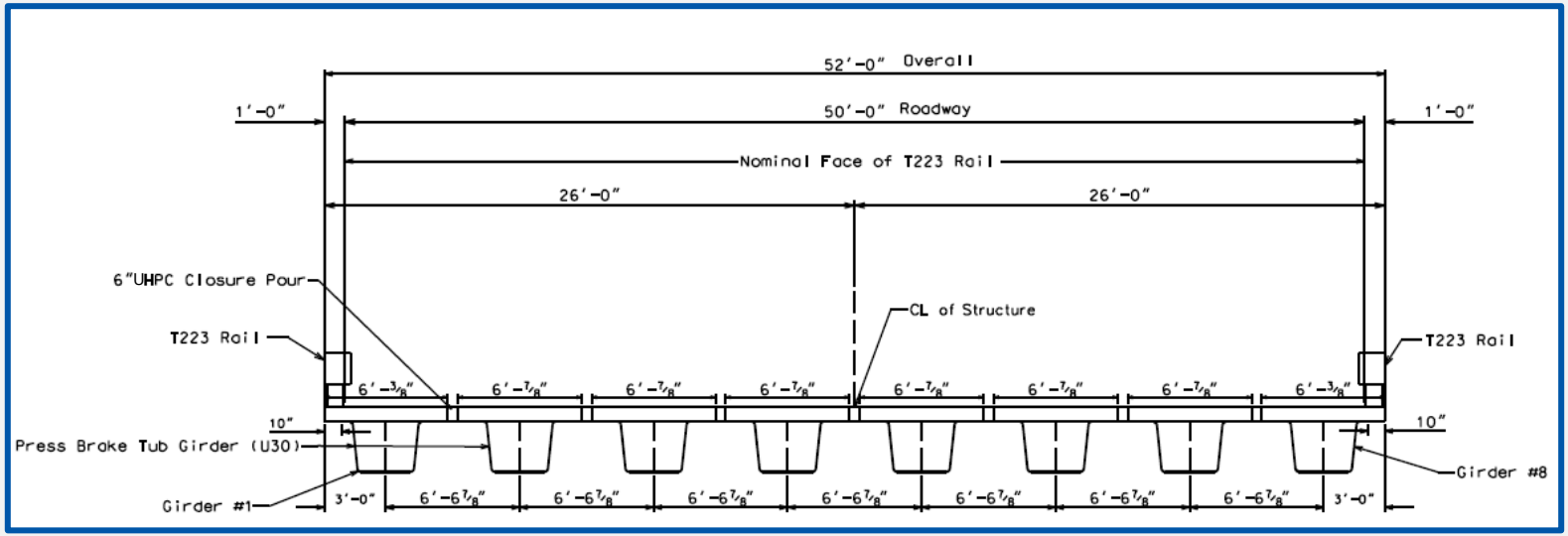


Figure 6.11.2.3-1—Center-to-Center Flange Distance

Source: AASHTO BDS 9th ed.

Press Brake Tub Girders (PBTG) - Design



8 ~ U30 Press Brake Tub Girders with pre-deck top

- 3’ Overhangs
- 6’ – 6 7/8” tub spacing.

Press Brake Tub Girders (PBTG) - Design

$$L_T = 70\ ft$$

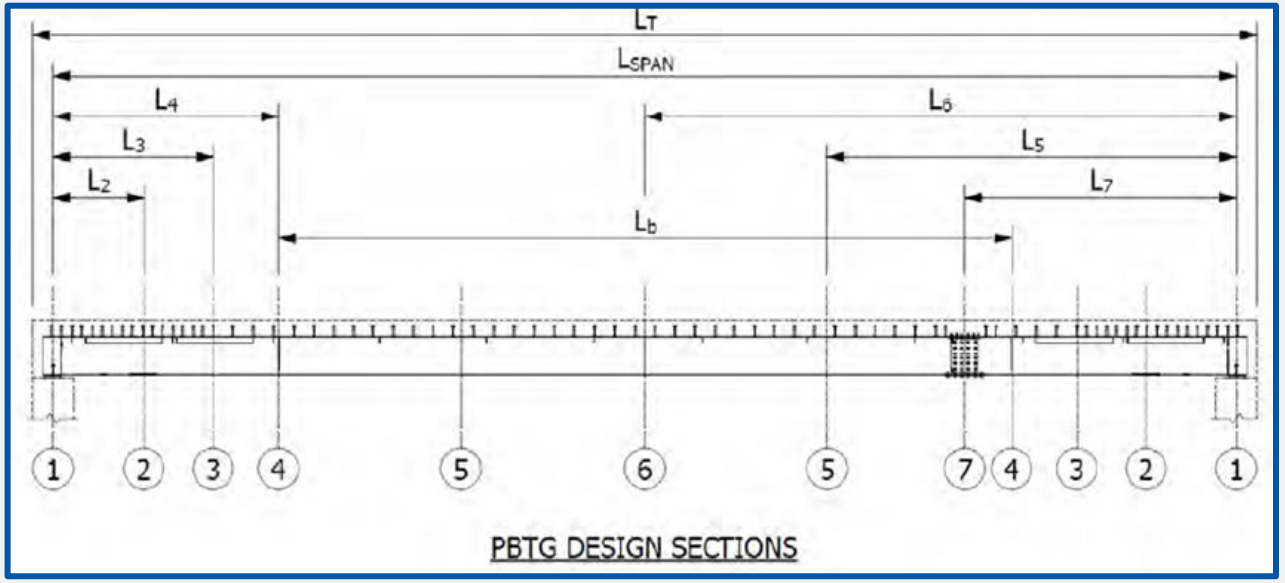
- CL Abut to CL Bent

$$L_{SPAN} = 68\ ft$$

- CL Brg to CL Brg

$$L_7 = 12.5\ ft$$

- Bolt Splice to CL Brg



PBTG DESIGN SECTIONS

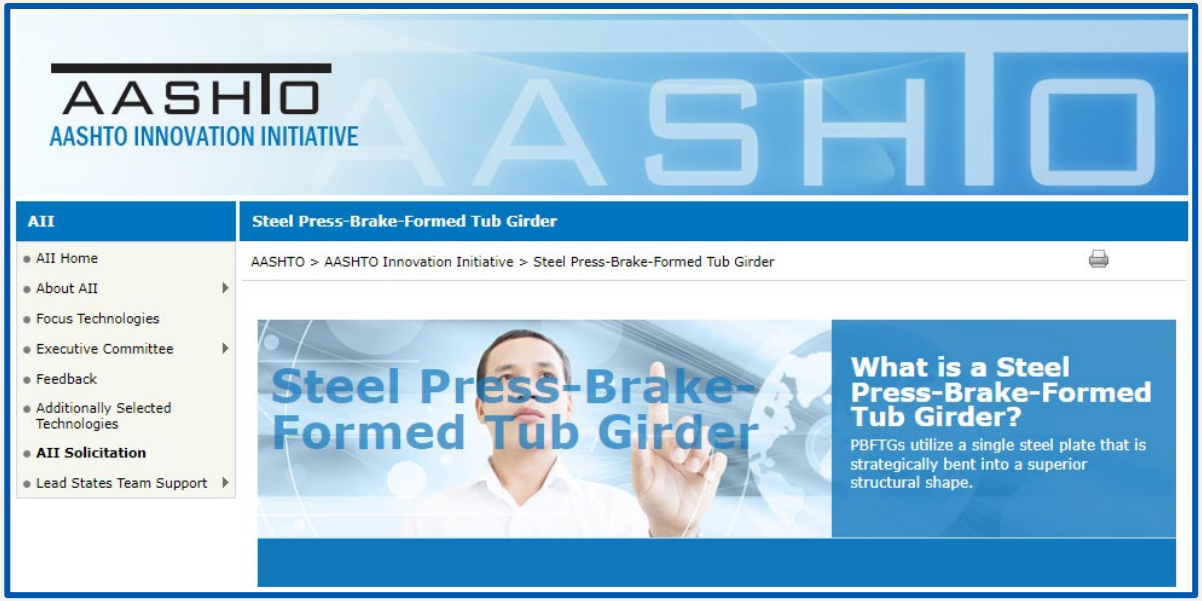
Press Brake Tub Girders (PBTG) - Resources

Press Brake Tub Girders (PBTG) - Resources

- Short Span Steel Bridge Alliance (SSSBA)
- Valmont Structures (https://www.valmontstructures.com/products-solutions/bridge-systems)
- Kelly, 2014 (WVU)
  - https://researchrepository.wvu.edu/etd/5958/
  - Stability and torsional bahavior
- Kozhokin, 2016 (WVU)
  - https://researchrepository.wvu.edu/etd/6010/
  - Performance of UHPC joint connections between adjacent pre-decked girders
- Gibbs, 2017 (WVU)
  - https://researchrepository.wvu.edu/etd/5671/
  - First in-service instrumentation and developed unique LLDFs
- Tennant, 2018 (WVU)
  - https://researchrepository.wvu.edu/etd/6783/
  - Fatigue performance of galvanized composite PBTGs

Press Brake Tub Girders (PBTG) - Resources

AASHTO Innovative Initiative Focus Technology (2021)



https://aii.transportation.org/Pages/Steel_PBFTG.aspx

Questions?