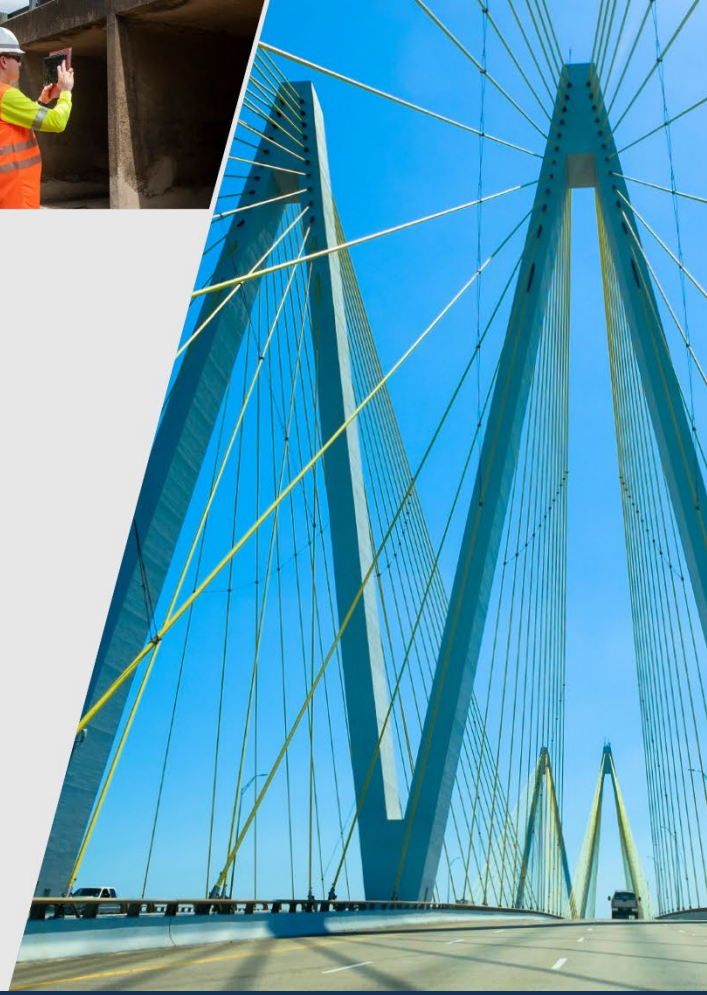
Bridge Widenings

2023 Bridge Webinar – Al Shawn, M.S.,P.E.



January 23, 2023

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What not to do

Do not used standard detail sheets for:

- Abutments
- Bents
- Spans

Things to Consider

- Condition Survey must be done before a bridge can be considered for a widening
- Traffic Lane (Temporary Barrier Location)
- Existing Approach Slab (Shoring?)
- Existing PGL (From survey? New or Old Info? Elevation based on overlay?)
- Repair work needed? (Condition survey)
- Overlay on existing bridge deck?
- Good idea to get survey at each bent cap
- Is Bridge worth widening or better or just replace?
- Utilities
- Previous Widenings
- Beam end conditions of existing bridge
- Existing expansion joint type

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A lot of case specific things to consider.....

Things to Consider

Clearances (Geometric Considerations)

- Leave room for Horizontal Clearance
  - Deck/abutment/bent reinforcing extensions
  - Formwork
  - Beam/Proposed Beam locations

Things to Consider

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Clearances (Geometric Considerations)

- Leave room for Vertical Clearance
  - Lower roadways
  - Railroad Existing and Future Track Lines
  - Additional bridge width with cross slope can reduce vertical clearance or low chord elevations (in some cases this can limit superstructure options)
  - Railroad overpass, vertical clearance should be confirmed with the railroad company during the early stage of design.

Superstructure Considerations

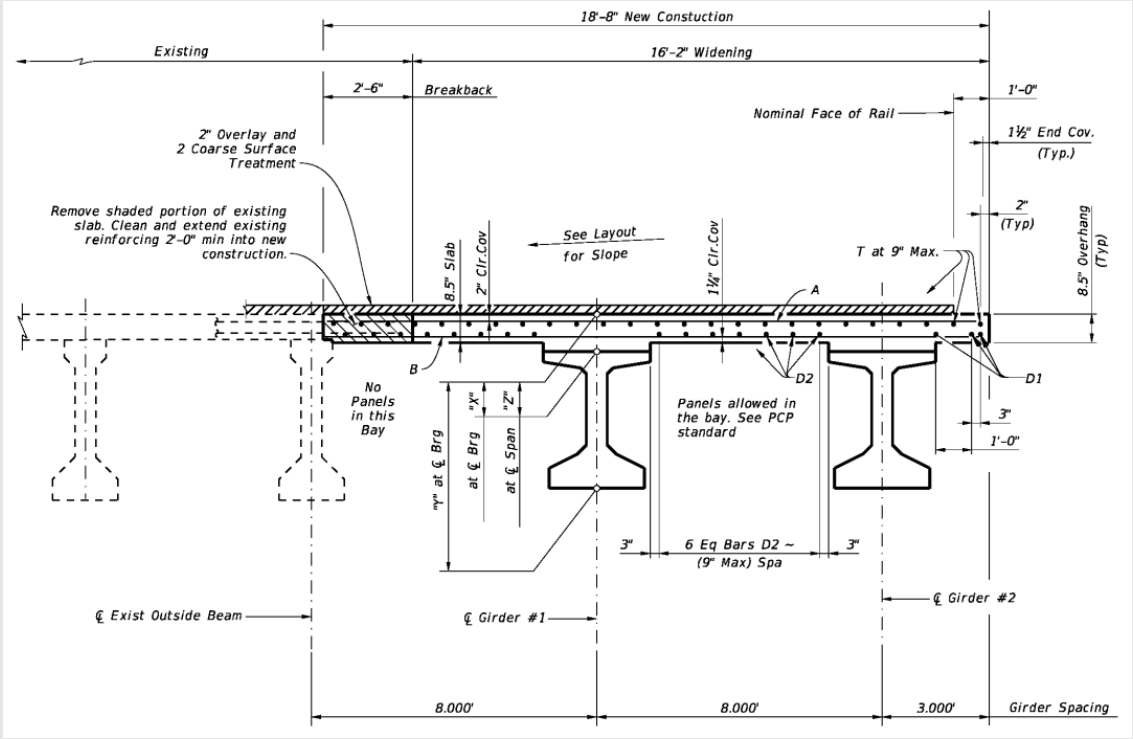
- What is the existing Superstructure type?
- What Superstructure type should you widen with?
  - Steel/Concrete
  - Match existing for proposed widening?
  - Consider Substructure needs (skew…)
- For other superstructure types see Bridge Design Guide, Ch 5, Section 1 – Bridge Widening Guidance

Superstructure Considerations

- Pretensioned Concrete I Beams (AASHTO Beams)
  - Widen with “similar” I Girders → TxGirders
  - Place breakback line at the centerline or towards the outside of the centerline of existing beam to ensure an appropriate level of composite action is retained in the broken back condition.
  - Evaluate bedding and strand extension for prestressed panels used in the first beam bay adjacent to the existing. If insufficient room exists, restrict used of panels. PCP standard provides guidance on stage construction limitations for panels.

Superstructure Considerations

- Pretensioned Concrete I Beams

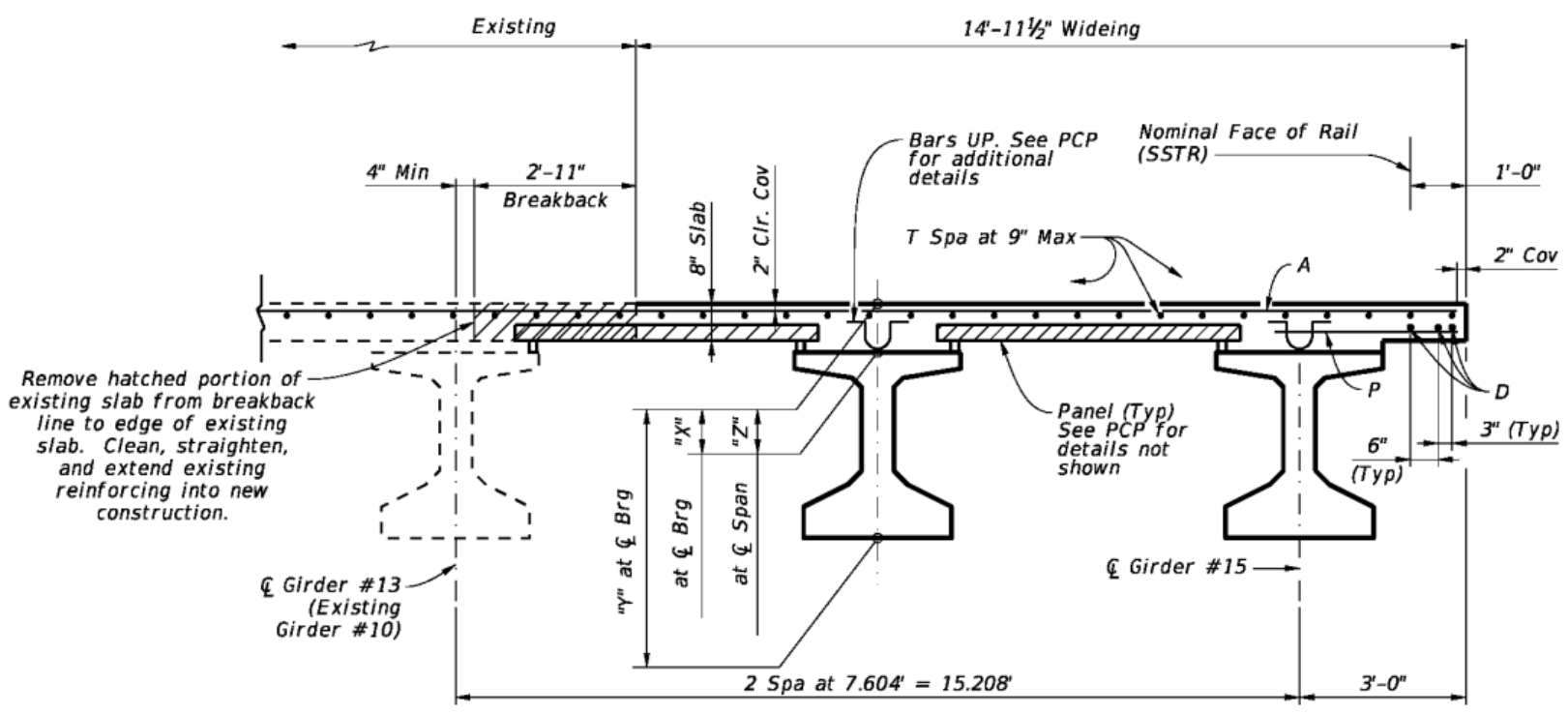


Superstructure Considerations

- Pretensioned Concrete I Girders (TxGirders)
  - Widen with “similar” I Girders → TxGirders
  - Place breakback line a minimum of 4” from CL of girder, so that horizontal interface reinforcement (R Bars) is undisturbed in existing slab
  - PCP considerations similar to Pretensioned Concrete I Beams (AASHTO Beams)

Superstructure Considerations

- Pretensioned Concrete I Girders (TxGirders)



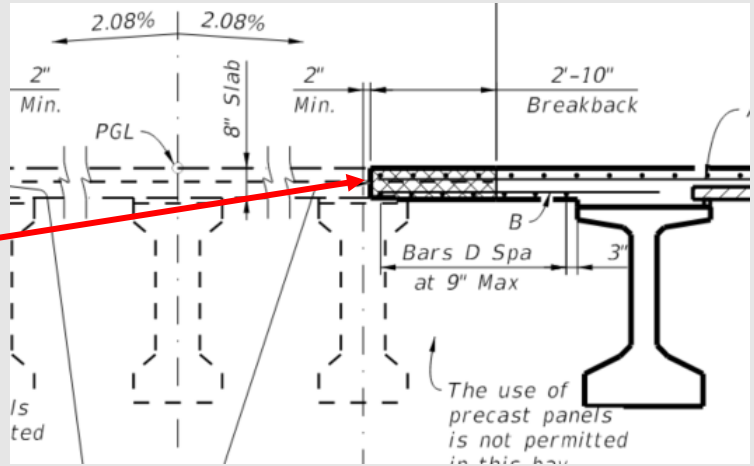
Superstructure Considerations

- Consider lowering the bearing seat elevations to account for the potential of higher than predicted cambers. There is no way to adjust the roadway grade to accommodate high cambers.
  - If beams are lowered, ensure plans are consistent, i.e. bearing seat elevations and “X”, “Y”, “Z” values are consistent.

Superstructure Considerations

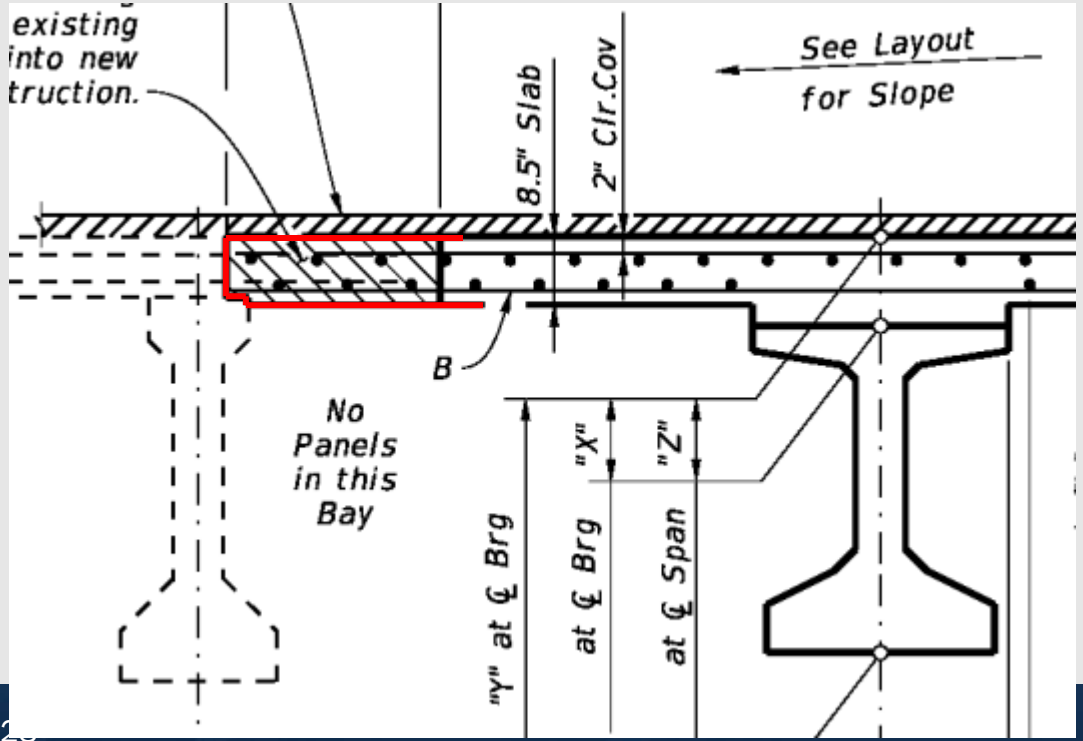
- Clean and extend existing transverse steel full length and lap with transverse steel in the widening.
  - Use grade 60 reinforcing.
- Do not widen a traditionally designed deck with an empirically designed deck.

Remove hatched portion of existing slab from breakback line to edge of existing slab. Clean, straighten, and extend existing reinforcing into new construction. Replace corroded or damaged reinforcement as directed by engineer.



Superstructure Considerations

- Utilize the modern standard deck thickness in the new construction regardless of the thickness of the existing bridge deck.



Superstructure Design

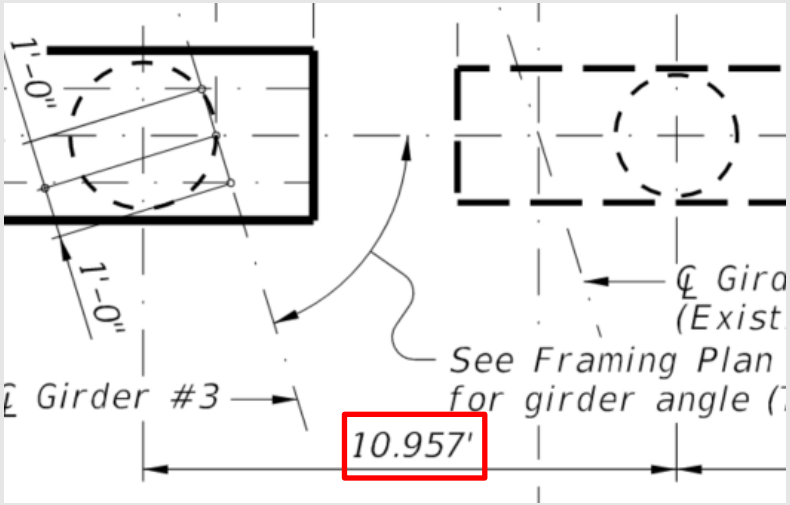
- Load rating of the existing structure is required. Acceptable load rating limits should be discussed with the district where the work is performed.
  - Examine how structure rates for the new legal load. If we cannot strengthen in a viable manner, it might be best to replace.
- When designing beams, consider all temporary loading such as temporary rails as permanent loads for the structure.

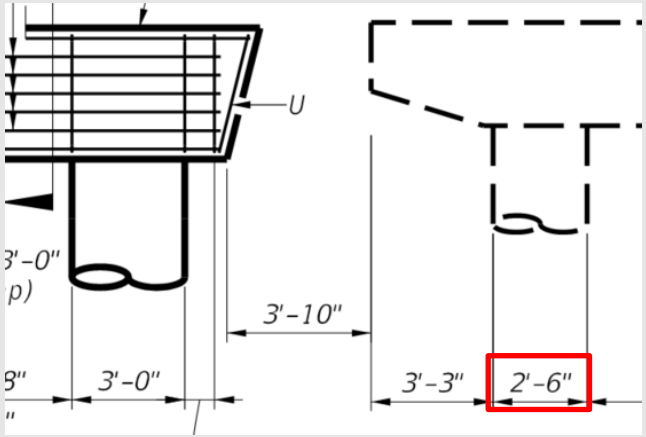
Substructure Guidance

- In most cases the construction joint in an abutment or interior bent will be offset from the breakback line for the slab.
- The construction joint should not be under a beam or within a bearing seat.
  - Preferably the construction joint should be a minimum of 3” away from the bearing seat or edge of beam, whichever is greater.

Substructure Guidance

- Provide a minimum clearance for pile driving for drilled shaft equipment.
  - Minimum clearance between new foundation and existing foundation of 2x the existing/proposed foundation diameter (smaller of the 2 diameters controls)





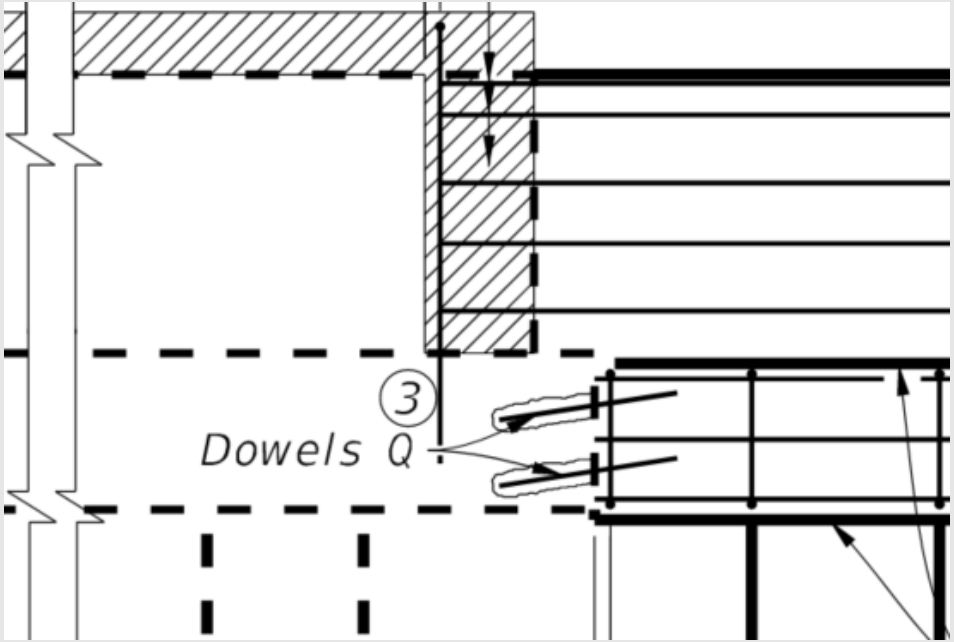
2.5'x2 = 5' Min spa

Substructure Guidance

- Avoid having splices that overlap drilled shaft/pile location
- If unable to provide enough room to splice the reinforcement through traditional overlapping, use welded splices or mechanical couplers. In some cases, a combination of couplers/welded splices and traditional overlapping may be utilized for elements with varying bar sizes. Extend reinforcement that will be mechanically coupled or welded beyond the end of the cap by 1’
  - For bent caps, the full depth open joint between proposed and existing should be at least 1-foot wide to allow for forming of the adjacent phases. The widening bent cap will support the widened portion of the bridge only.

Abutment Widenings

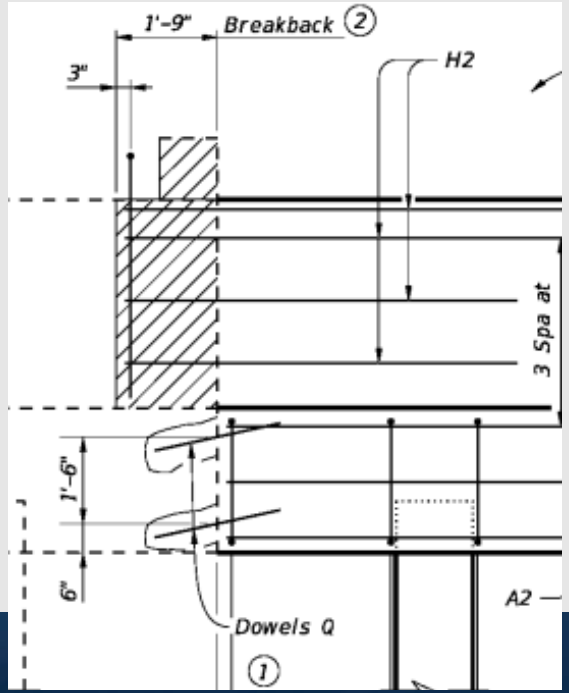
- Connect using a bent cap shear connection consisting of 4 ~ #6 dowels minimum using an epoxy post-installed connection. Or larger reinforcing bar as necessary.



③ Drill and epoxy dowels Q 1'-6" minimum into existing structure.

Abutment Widenings

- If there is an existing backwall and the bearing area is sufficient for the new superstructure, match the face of the existing backwall and connect by breaking back and providing a minimum splice length of horizontal steel.

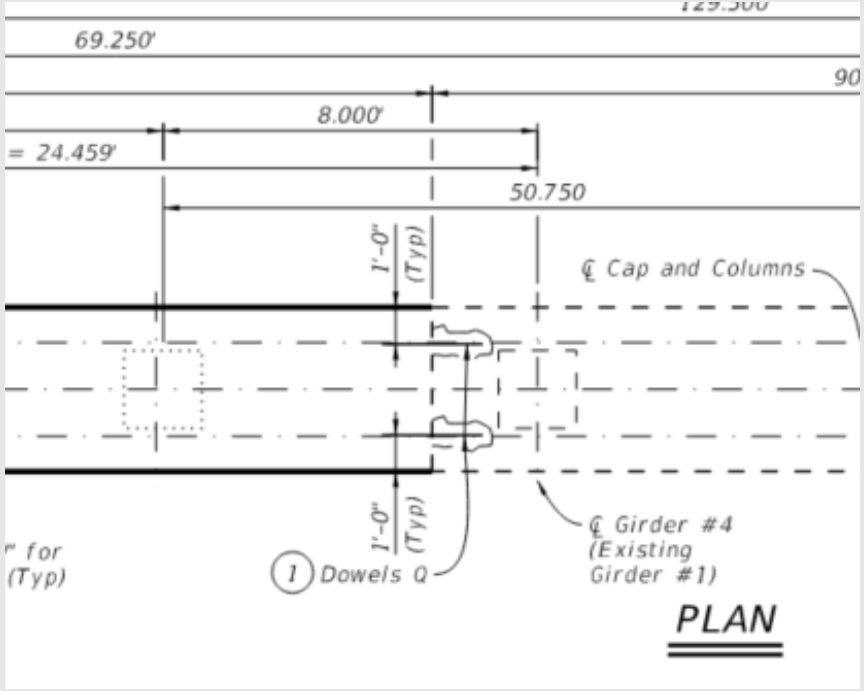


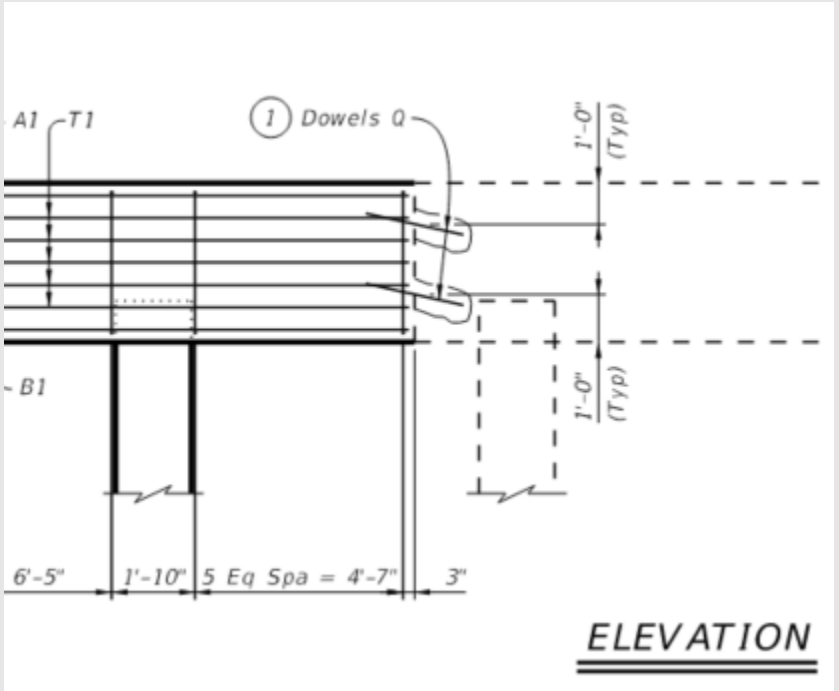
Interior Bent Widenings

- Connected Bents
  - A connected bent with one or more columns using a bent cap shear connection consisting of 4 ~ #6 dowels minimum using an epoxy post-installed connection. Or larger reinforcing bar as necessary.
  - A connected bent with one or more columns using a bent cap shear and moment connection with mechanically coupled longitudinal reinforcing. Verify that localized removal of end concrete in the existing bent cap does not compromise the structural resistance of the existing bent cap relative to existing structural loads.

Interior Bent Widenings

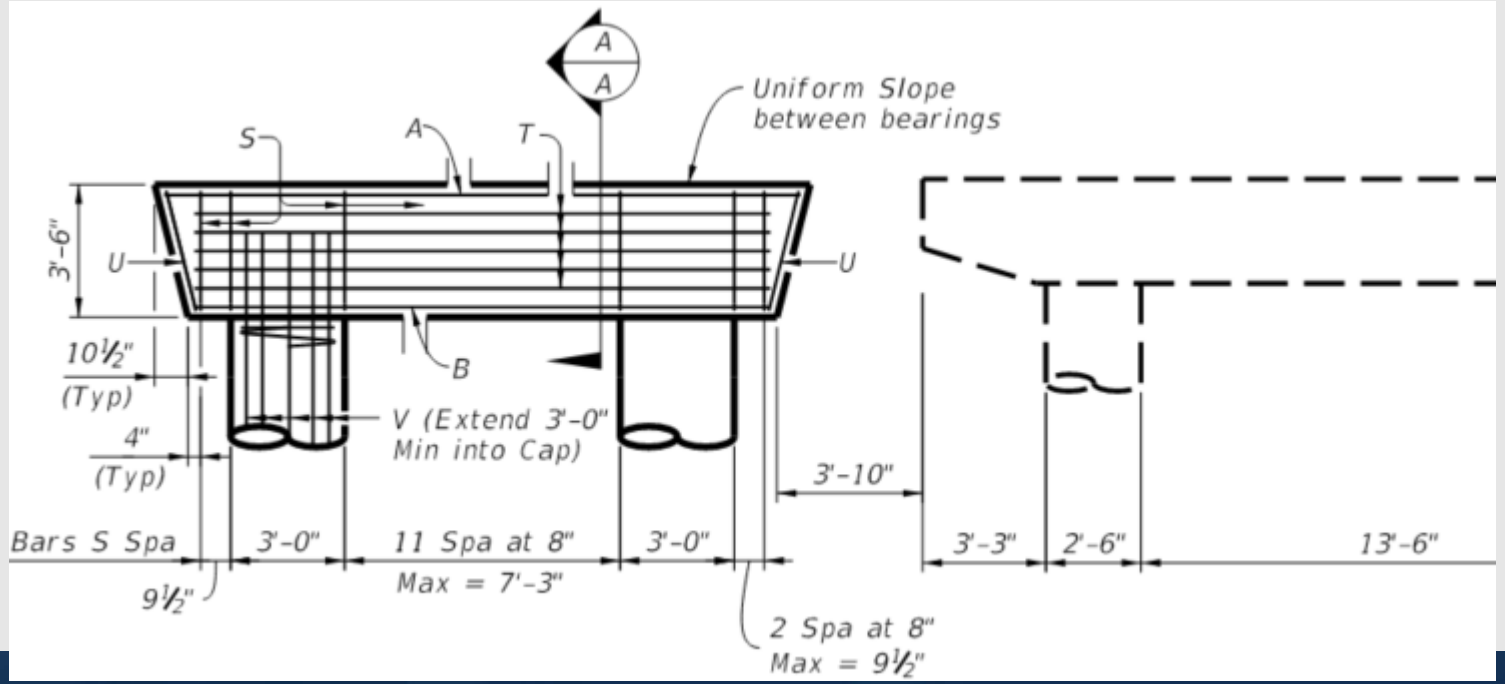
- Connected Bents





Interior Bent Widenings

- Independent Non-Connected Bents
  - Conform to the criteria of Chapter 4 Section 8 or 9 of the Bridge Design Guide depending on single or multi column case.



Culvert Widening? (Lengthening)

Determining if a Culvert Can Be Lengthened

Evaluate Structural Condition

- Obtain latest inspection reports from AssetWise
- Conduct condition survey (maybe)
- Load rate culvert (maybe)

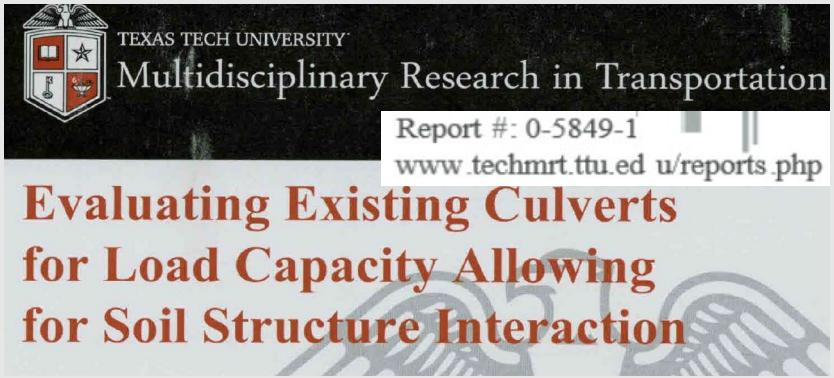
Age or Era Considerations

- Oldest lengthening is about 100 years old.
- Pre-1938, 1938, 1946, 1958, 2003 era standard designs

Consider Proposed Condition

- Removing or adding fill?

[Bridge Workshop - 2019 Culvert Load Rating Presentation]



Culvert Lengthening Considerations

Overall Geometry

- Requisite roadway and shoulder width
- Terrain
- Description for Proposed culvert with appropriate standards
- Hydraulic data (Headwater and tailwater elevations and outlet Velocity)

End Geometry

- ROW Availability
- Construction Access
- Side Slope Rate
- Treatments for Traffic Safety
- Culvert Size

Safety Elements

- Safety End Treatments
- Need for Bridge Rails or MBGF
- Clear Zone (Non-Bridge Class)

Traffic Control During Construction

- Room for Equipment
- Temporary Barriers
- Temporary Shoring

Culvert Lengthening Considerations

Review of Inventory Record

- Inventory Record
- Bridge Inspection Record
- Inspection Photos
- Construction Drawings
- Design Standard
- Hydraulic Considerations

District: 02 County: 213 Cont-Sec: 0259-02 Structure: 008 Route: US 67
Feature Crossed: Woods Branch Inspector's Signature: [signature] Date: 12/19/2012
Company Name: Bontempo Structural Engineering, Inc. (F-7708)
Location: 1.2 MI West of FM 203 Maintenance Section: 05
Latitude: N 32° 11' 24.60" Longitude: W 97° 51' 20.86" Milepoint: 07.124
General Description:
3-barrel (8' x 8') concrete box culvert. No approach guardfence is provided. Culvert is on a high speed paved road with a high ADT (~3,900 vpd).

Bridge Length: 27 ft. Deck Width: 57.3 ft. Lanes On: 02 Lanes Under: 00
Skew Angle: 0 Deg. ☐ Lf. Fwd. ☐ Rt. Fwd. Bridge Rail: None
Clear Width Between: 43 ft. ☐ Curbs, ☐ Rails, ☒ Pvmt Edges Approach Rdway Wid: 43 ft.
Deck Type: Concrete
Surfacing: ~2" asphalt Vertical Over-Clearance: ft. ☒ Unimpaired

Horizontal / Vertical Alignment: Good / Good
Date Built / Design Load: 1925 (Widened in 1953) / Unknown (H 20-44)
Regulatory / Advisory Speeds: 70 mph / None
Posted Load Restriction: ☒ None

Original built in 1925; Widened in 1953

Questions?

- Questions tend to be District and project specific
  - Please email

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Thank You

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