



INVERTED TEES

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Inverted Tees



Conventional



Inverted Tee

When to Use Inverted Tees

Vertical Clearance



When to Use Inverted Tees

Vertical Clearance



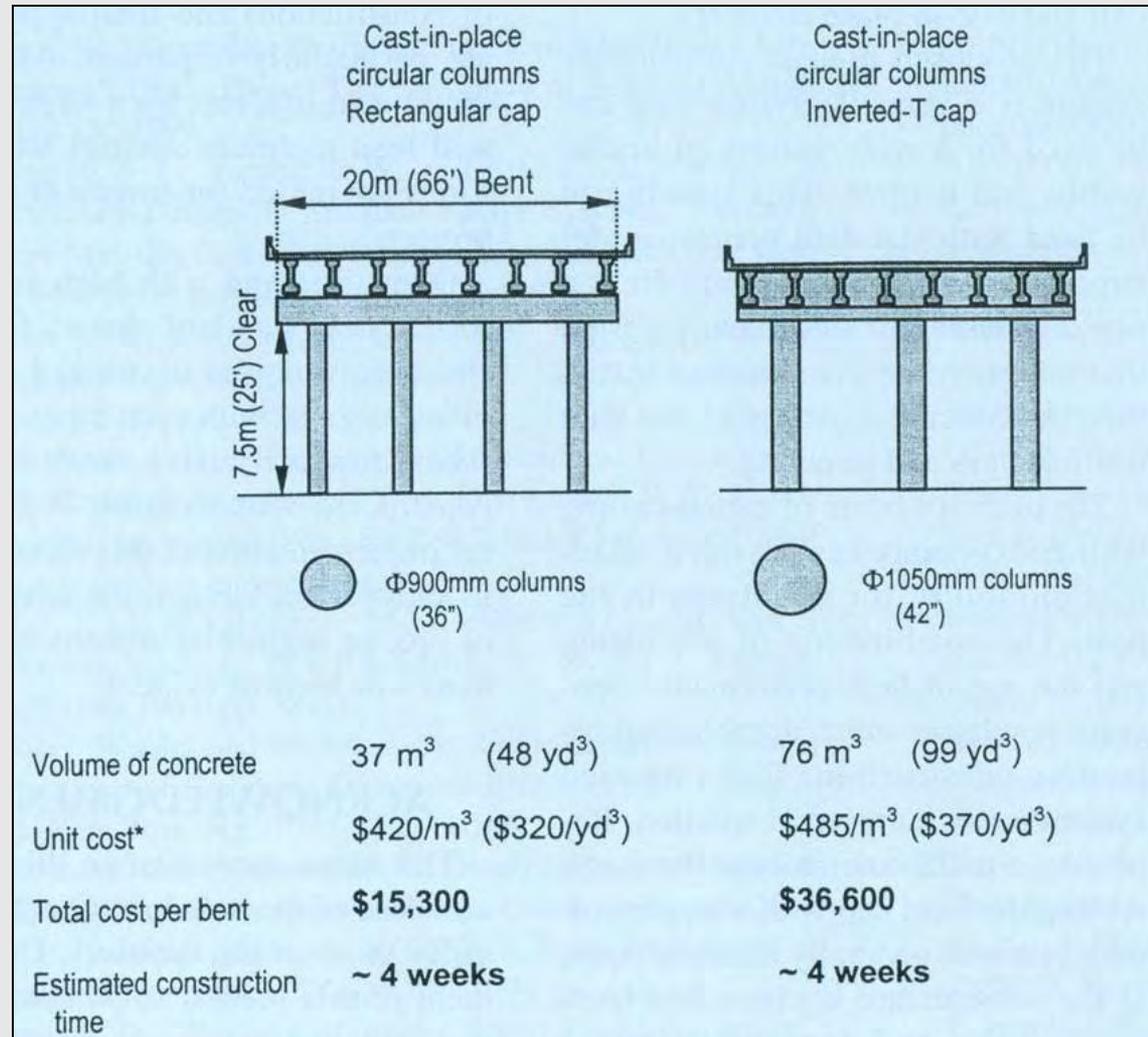
When to Use Inverted Tees

Aesthetics



Cost Comparison

Research Report
1410-2F
Sept. 1998



- <https://fsel.engr.utexas.edu/pdfs/1410-2f.pdf>

Construction Issues

- Ben White
IH 35 Interchange



Construction Issues



Construction Issues

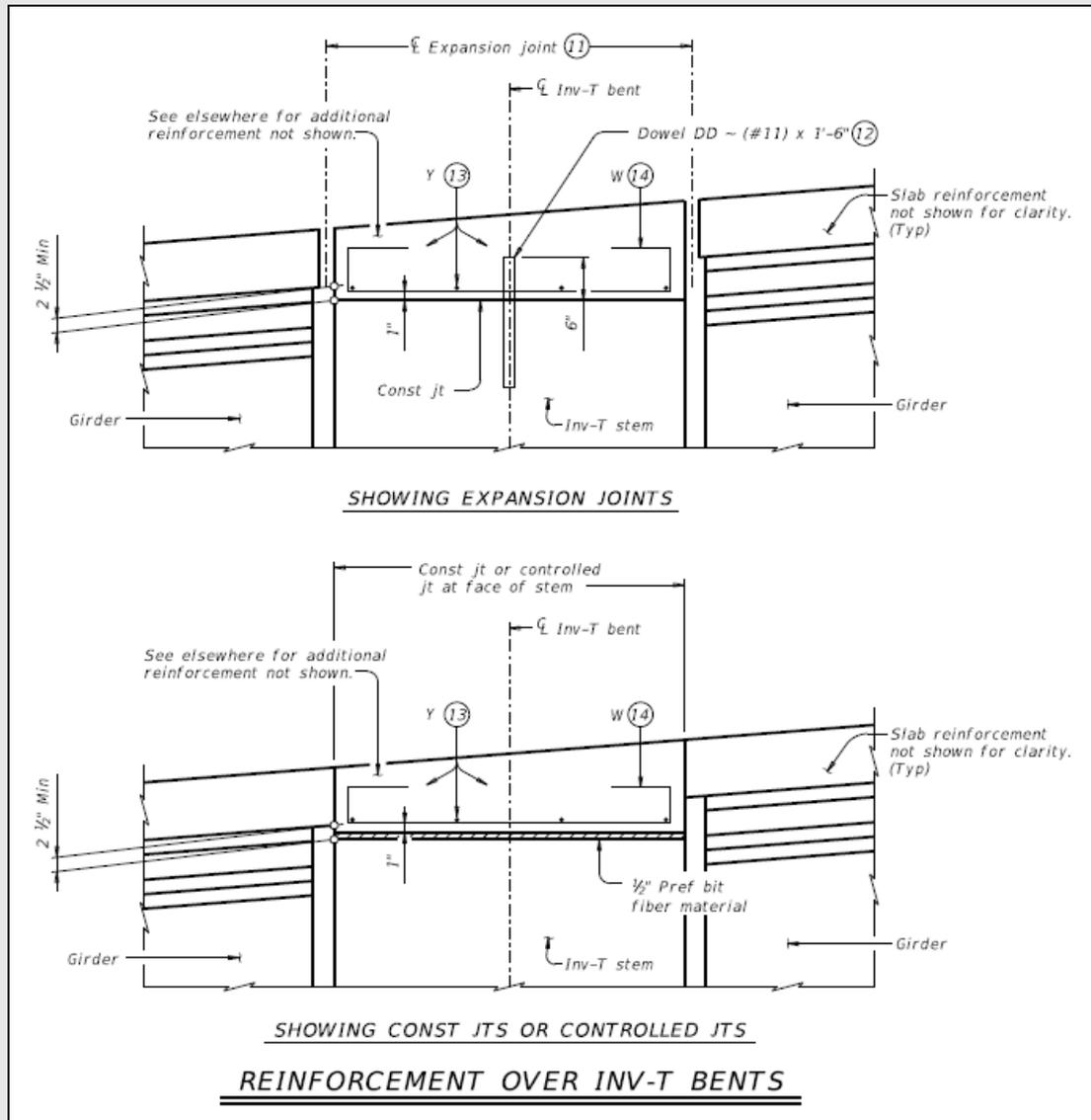


Construction Issues

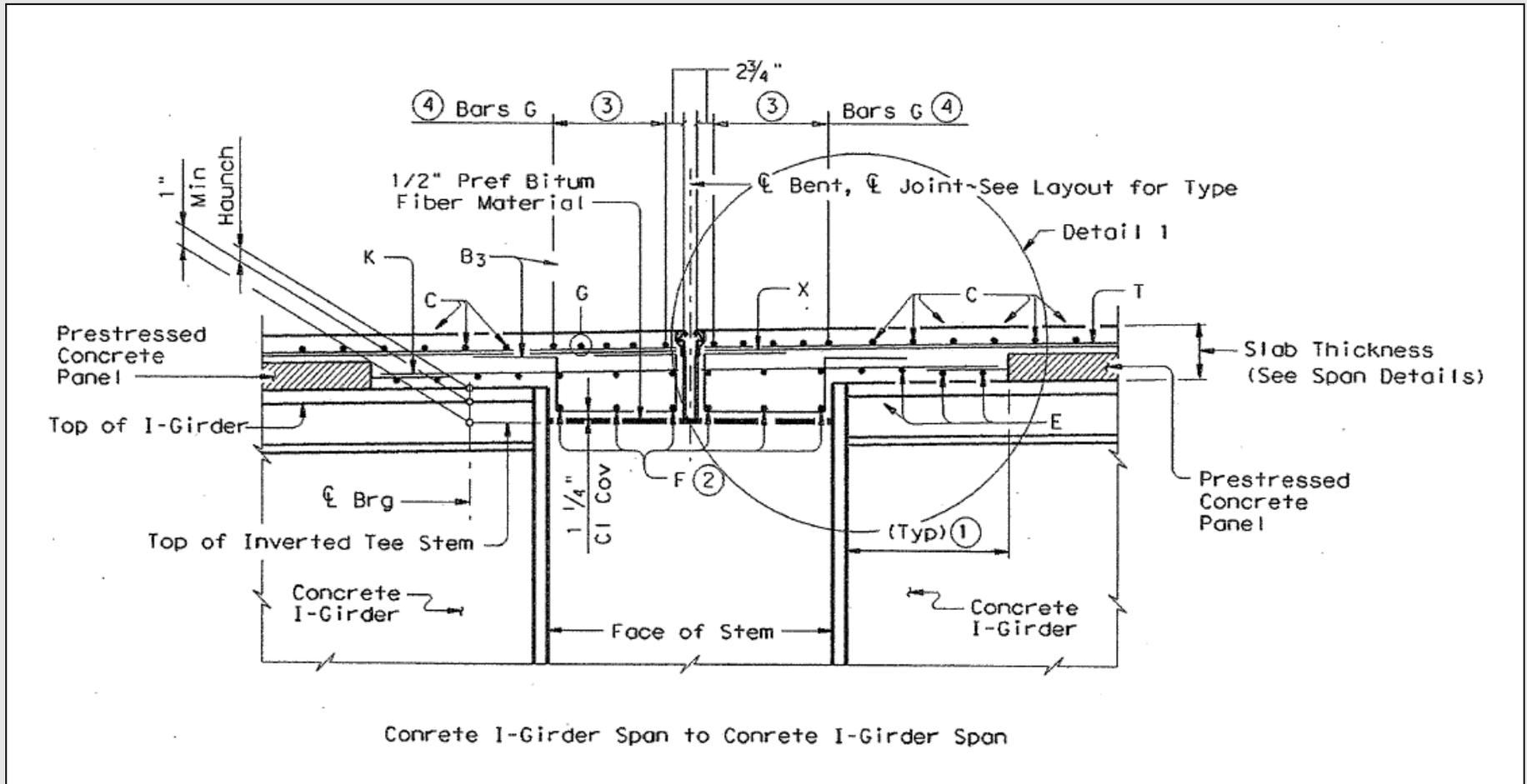


Construction Issues





Joints

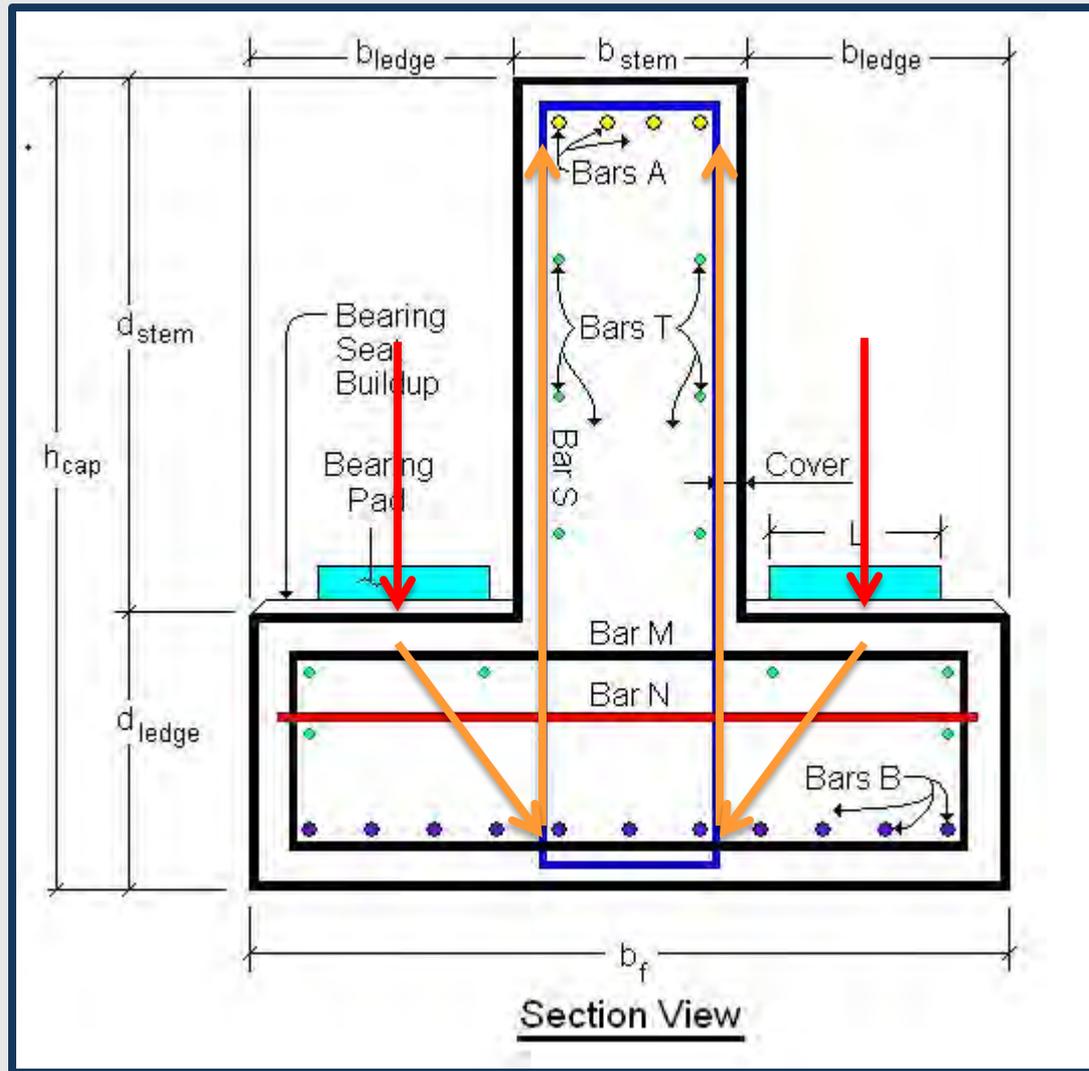


Joints



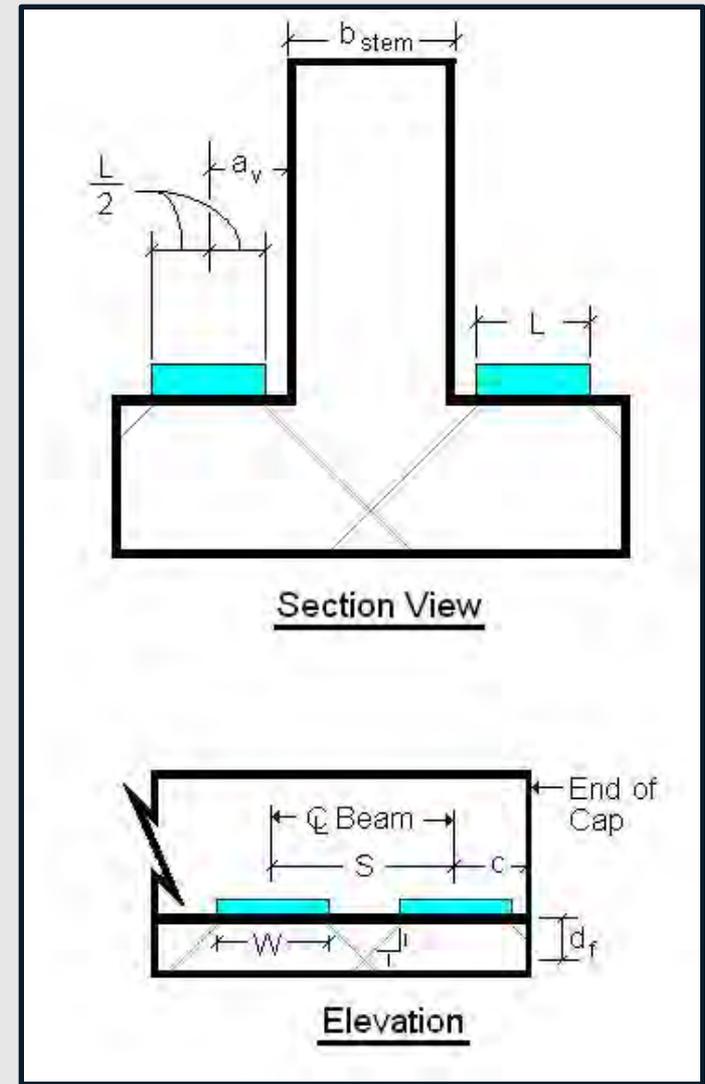
Design Provisions

→
Load Path



Design Provisions

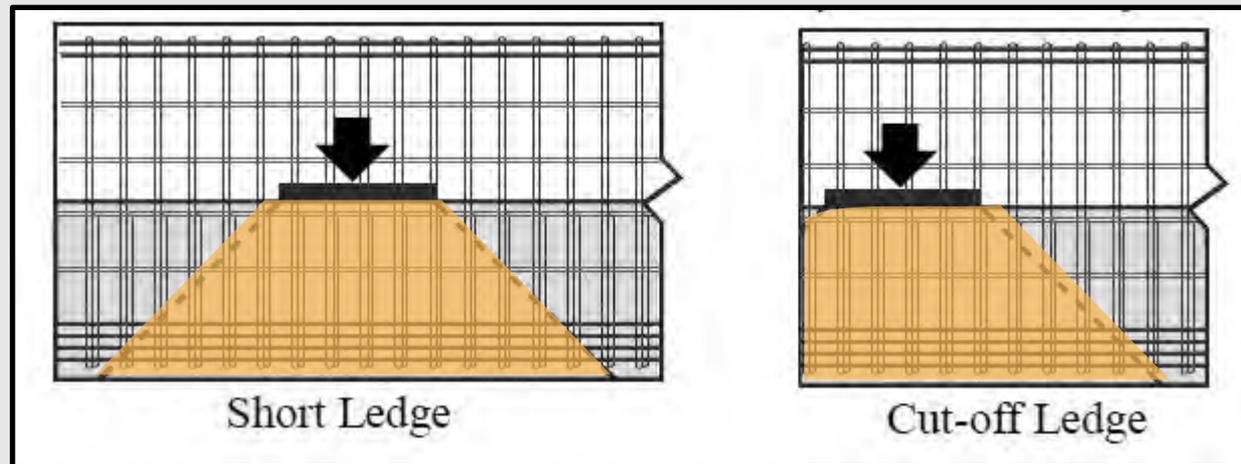
- Punching Shear
 - Resistance at exterior girder must equal or exceed the factored load at adjacent interior girder
 - Not doing so limits our ability to widen bridges
 - No proven way to add punching shear strength to existing ledges



Design Provisions

■ Cap Extension

- Guideline: Extend caps at least 2 ft past the centerline of the exterior beam
- Prevents excessive hanger and ledge reinforcing requirements
- Note: A 2 ft cap extension may not be adequate for punching shear



Design Provisions



- Early practice, no longer recommended
 - Example of no cap extension past end of beam

▪ Typical Practice

- Example of cap extension of 2 ft past \mathcal{C} of exterior beam



Design Provisions

- In-service cracked inverted tee straddle bent caps
 - TxDOT Project 0-6416
 - Size Inverted-Tee Cap by limiting Service I Shear to V_{cr}
 - Possibly post-tension inverted tee straddle bent caps



Design Provisions

- Recent research recommendation (TxDOT Project 0-5253)
- Size Inverted-Tee Cap by limiting Service I Shear to V_{cr}

$$V_{cr} = \left[6.5 - 3 \left(\frac{a}{d} \right) \right] \sqrt{f'_c} b_w d$$

but not greater than $5\sqrt{f'_c} b_w d$ nor less than $2\sqrt{f'_c} b_w d$

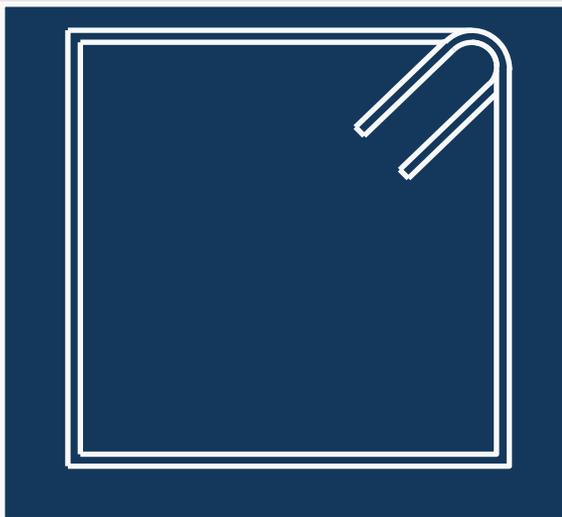
where:

- a = shear span (in.)
- d = effective depth of the member (in.)
- f'_c = specified compressive strength of concrete (psi)
- b_w = width of member's web (in.)

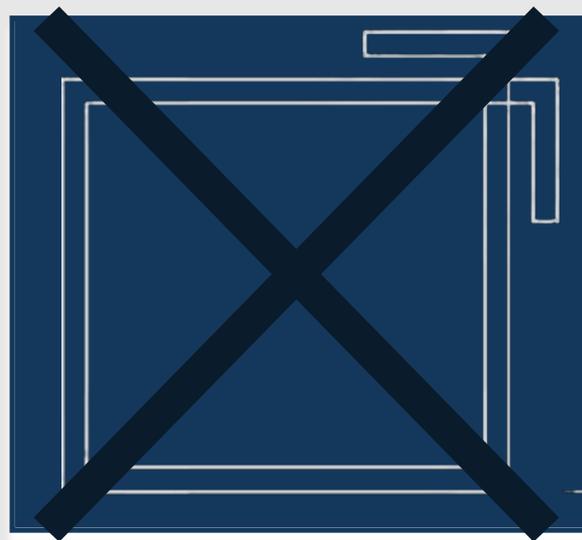
Design Provisions

- Add hanger loads to shear and torsion
 - Hanger + Shear + Torsion

- Stirrups for torsional restraint must be anchored with 135 degree standard hooks (AASHTO LRFD Article 5.11.2.6.4)



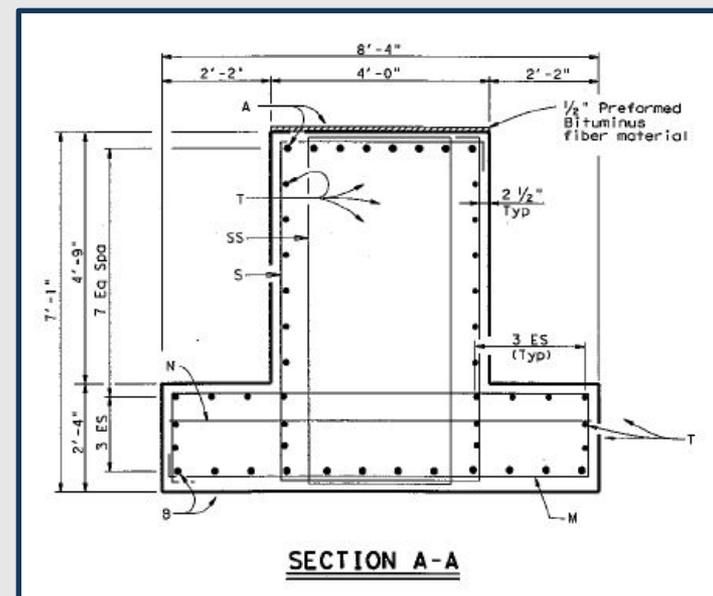
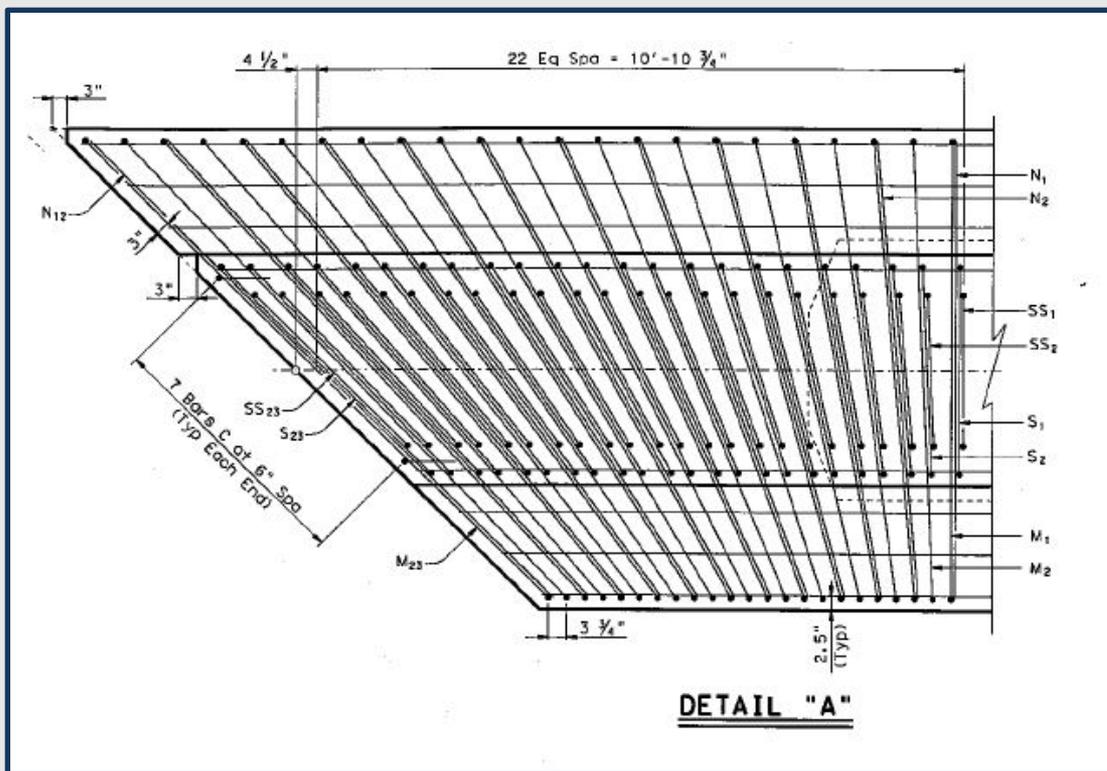
135 Degree Hook



90 Degree Hook

Design Provisions

- Geometry of Inverted tee caps
 - Skewed vs. flat
 - Extending beyond slab for heavy loads



Questions?

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