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# I-70 over SR 121

## Accelerated Bridge Construction – Design Challenges

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# I-70 over SR 121

## Project Overview

- Located east of Richmond, IN
- Replace Existing Deteriorated Structure

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# I-70 over SR 121

## Project Overview

- At a Project Scoping Meeting – Items Noted
  - *IHCP will only Allow Nightly Lane Closures*
  - *Two Additional Bridges within I-70 MOT Footprint*

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# I-70 over SR 121

## Project Overview

- At a Project Scoping Meeting – Items Noted
  - *Landfill and Quarry East of Bridge*
  - *Open Field Immediately East of Bridge*

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## Engineering Assessment

- Looked at Five Options
- Construction Cost
- Maintenance of Traffic
- Construction Timeframe
- Traffic Impacts
- Engineering Cost

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## Engineering Assessment

- Do Nothing – $0.00
- Conventional – $7,723,000
- SPMT – $8,061,000
- Slide-In – $7,636,000
- Hybrid Slide-In – $8,448,000
- Moved Ahead with a Dual Design - SPMT Option and Slide Option

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## Engineering Assessment

- Self Propelled Modular Transporters (SPMT)

UDOT 4500 South over I-215



# I-70 over SR 121

## Engineering Assessment

- Self Propelled Modular Transporters (SPMT)
  - *Total Estimated Cost = $8,061,000*
  - *Less than One Construction Season*
  - *Two – Two week Single Lane Closures*

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## Engineering Assessment

- Slide-In Superstructure Installation

**ODOT OR 213 over Washington St.**

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# I-70 over SR 121

## Engineering Assessment

- Slide-In Superstructure Installation
  - *Total Estimated Cost = $7,636,000*
  - *One Construction Season*
  - *Two – Two week Single Lane Closures*

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## Final Design - Challenges

- "Design-Build"
- Foundation
- Substructure
- Superstructure
- Interstate Lane Closure Policy
- Expedited Construction
- Provisions

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## Final Design - Challenges

- "Design-Build"
- Foundation
- **Substructure**
- Superstructure
- Interstate Lane Closure Policy
- Expedited Construction
- Provisions

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## Foundation – Spread Footing

- Rock Fairly Shallow at Project Site
- Existing Bridge Piers on Spread Footings
- Low Quality Rock
- Limited Space

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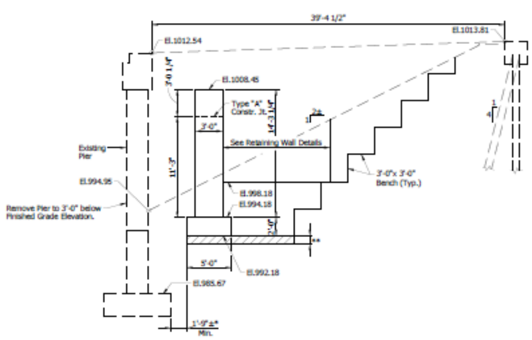
Foundation – Spread Footing

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## Foundation – Micropiles

- Good Fit for Site
- Able to work in Low Head Room
- But…..

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## Foundation – Micropiles

- Buy America Requirement – 106.01(c)
- Geo-strata Magazine Article “Buy America’ Act Threatens U.S. Micropile Business” (September/October 2012)
- Back to the Drawing Board – Drilled Shafts

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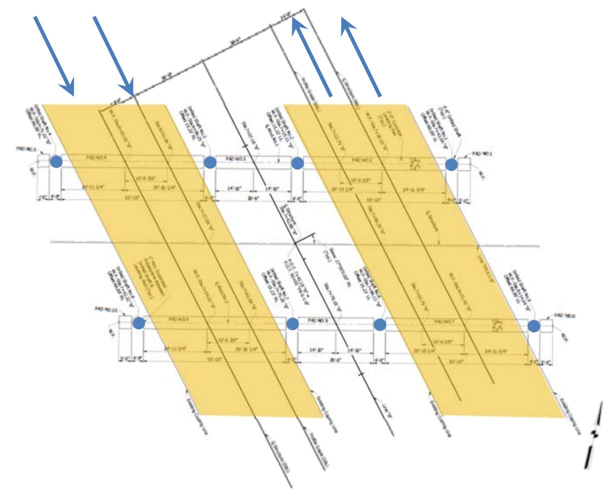
## Foundation – Drilled Shafts



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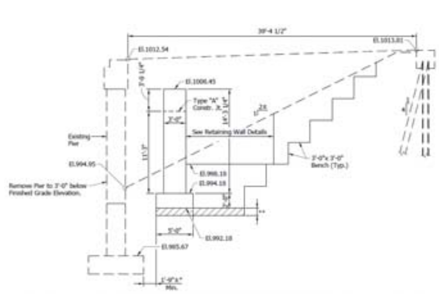
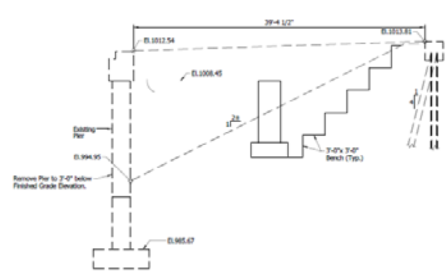
## Substructure - Design

- Full Face Abutment or Conventional Bent





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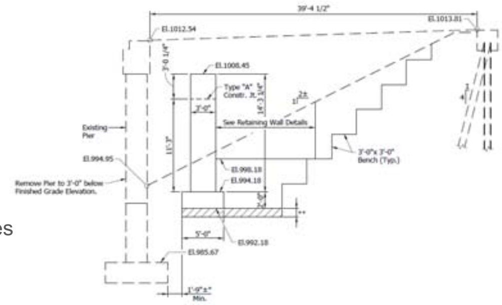
## Substructure - Design

- Full Face Abutment
  - *Advantages:*
    - Deeper Section
    - More Working Room
    - Shorter Span
  - *Disadvantages:*
    - More Overturning Forces
    - More Excavation under End Span
    - Soil Mitigation for Backfill

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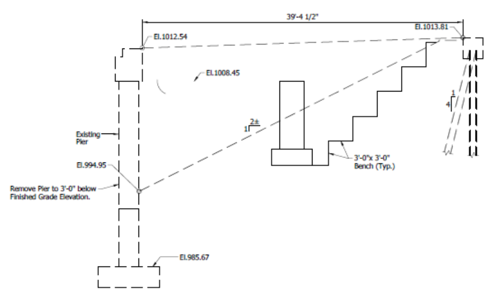
## Substructure - Design

- Conventional Bent
  - *Advantages:*
    - Less Excavation
    - Less Overturning Forces
    - Less Soil Mitigation
  - *Disadvantages:*
    - Tighter Construction Area
    - Longer Span
    - Less Structural Depth

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## Substructure - Geometry

- Full Faced Abutment

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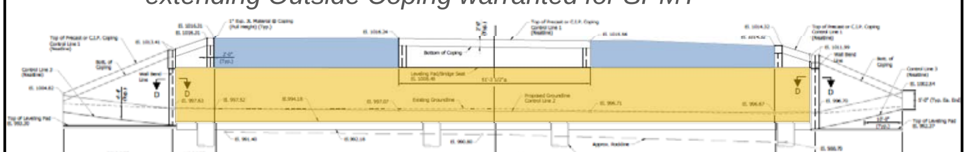
## Substructure - Geometry

- Needed to Accommodate Individual Bridge Installation Systems
  - *Slide System – Needs to be Continuous from Coping to Coping plus Outside*
  - *Due to Drilled Shaft Locations and Construction Speed, extending Outside Coping warranted for SPMT*



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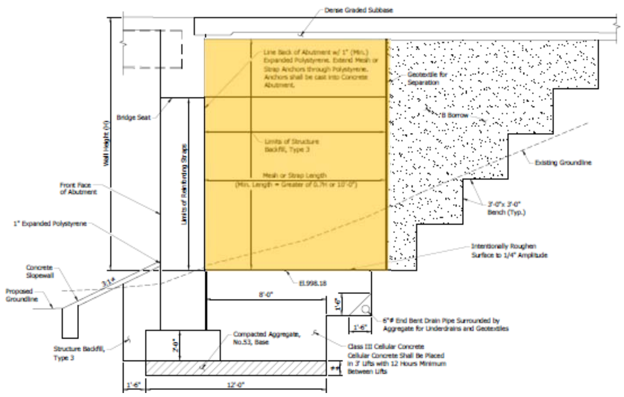
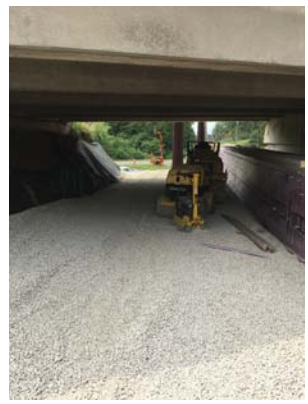
## Substructure - Design

- Full Face Abutment – Use MSE Fill Behind



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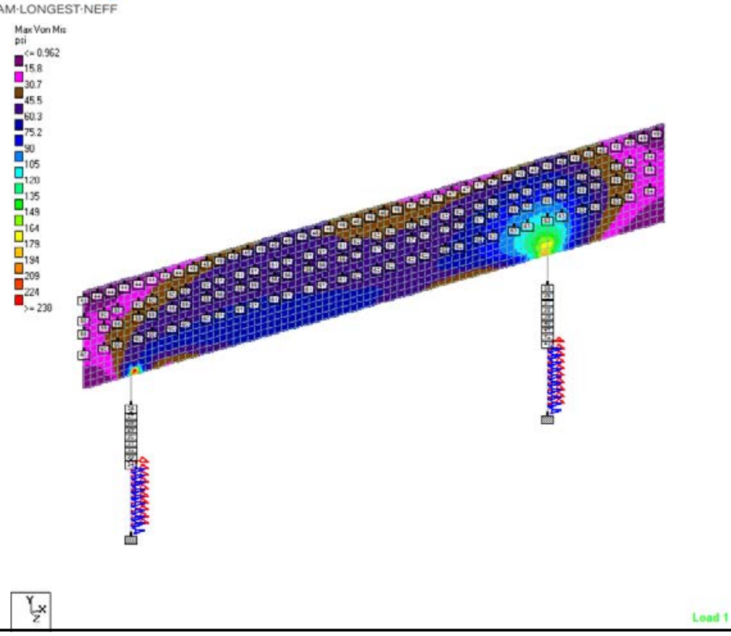

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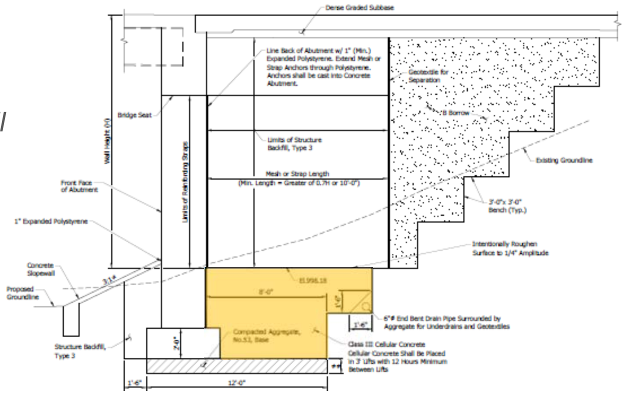
## Substructure - Design

- Used Cellular Concrete in lower portion of MSE section
  - *Lightweight – Concerns with Stability of Soil*
  - *Stable – Will not induce Horizontal Loading on Abutment*

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## Substructure – Strut and Tie

- Strut and Tie Analysis
- Based on AASHTO LRFD 5.6.3 says SHOULD use Strut and Tie
- Based on AASHTO LRFD 5.8.1.1 & 5.8.1.2 says SHALL use Strut and Tie in Deep Beams

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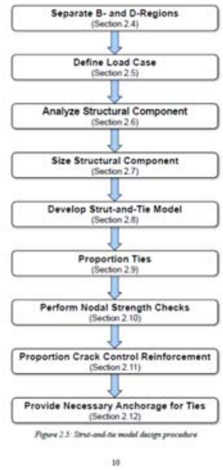
## Substructure – Strut and Tie

- FHWA/TX-12/5-5253-01-1 – Very Good Example

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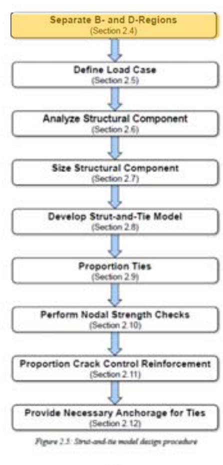
## Substructure – Strut and Tie

- Separate B & D Regions
  - *[AASHTO 5.5.1.2] - 1d from Load Application*
  - *[AASHTO C.5.6.3.2] – Discusses 2d to 2.5d*
  - *Designed Abutment both as B and D Region*

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## Substructure – Strut and Tie

- Define Load Case
  - *Dead Loads from Beam Design*
  - *Live Load – Taking into account the Construction in the Median, Proposed Condition and Future Condition*
  - *Three Live Loading Conditions – Ten Load Combinations (Min and Max LF)*

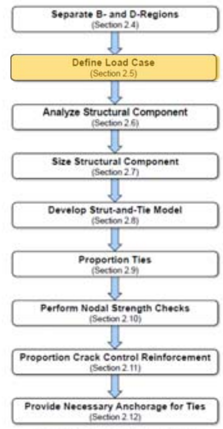


*Figure 2.5: Strut-and-tie model design procedure*

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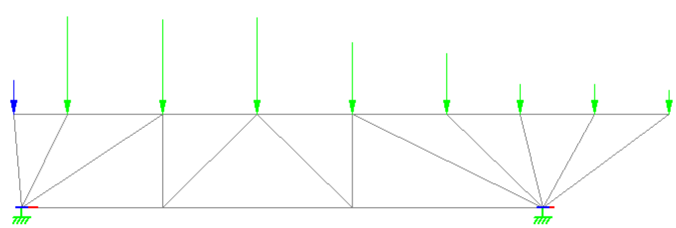
## Substructure – Strut and Tie

- Loading Condition 1 - Proposed



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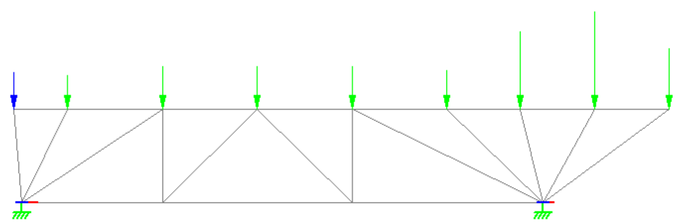
## Substructure – Strut and Tie

- Loading Condition 2 – During Construction/Future MOT



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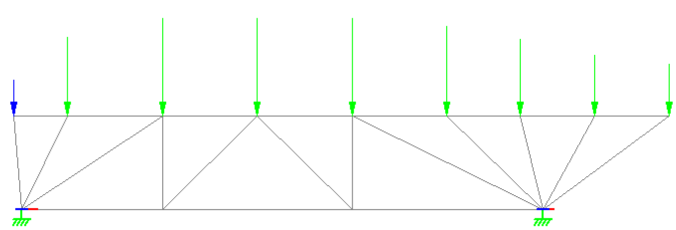
## Substructure – Strut and Tie

- Loading Condition 3 – Three Lane Section



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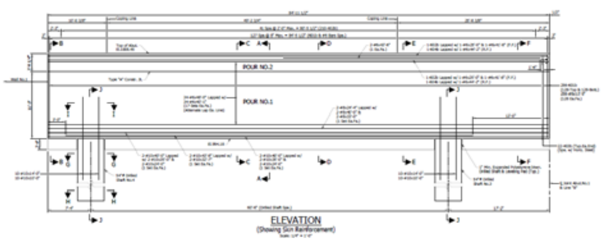
## Substructure – Strut and Tie

- Analyze Structural Component
  - *Perform Conventional Analysis to determine Reactions from Drilled Shafts*



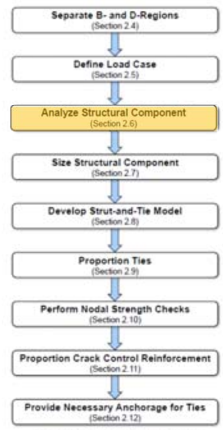




*Figure 2.5: Strut-and-tie model design procedure*

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## Substructure – Strut and Tie

- Size Structural Component
  - *Not required by AASHTO, but a quick and easy check*

$$V_{cr} = \left[6.5 - 3\left(\frac{a}{d}\right)\right]\sqrt{f'_c}\,b_w d \qquad (2.1)$$

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.)

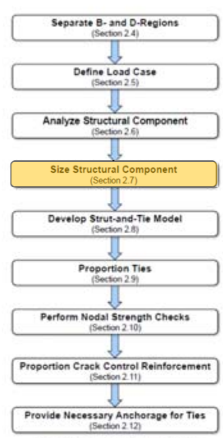


*Figure 2.5: Strut-and-tie model design procedure*

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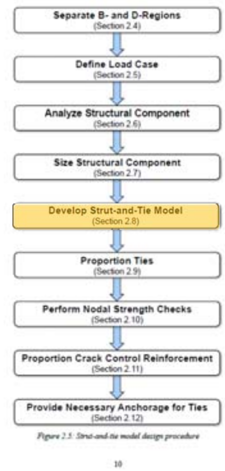
## Substructure – Strut and Tie

- Develop Strut and Tie – [AASHTO 5.6.3.2]
  - *Struts should be oriented in Compressive Direction – 25 Deg. Max Angle*
  - *Top Strut and Bottom Tie Defined by Reinforcement – this became iterative.*
  - *Dead Load of Abutment applied at Discrete Nodes*

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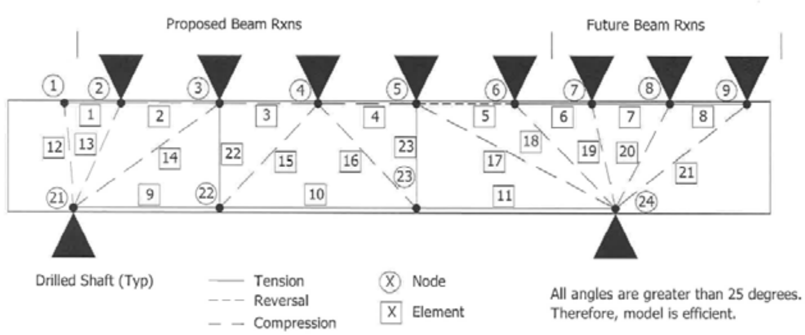
## Substructure – Strut and Tie

- Develop Strut and Tie

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## Substructure – Strut and Tie

- Proportion Tension Ties – [AASHTO 5.6.3.4]
  - *Top and Bottom Chords*

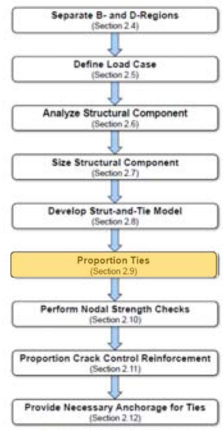


*Figure 2.3: Strut-and-tie model design procedure*

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## Substructure – Strut and Tie

- Proportion Tension Ties – [AASHTO 5.6.3.4]

**Bottom Chords**

Tier 1 Steel (Maximum) = 22.86 $in^2$ ✓

Tier 2 Steel (1 row of 6-#10 eliminated) = 15.24 $in^2$ ✓

Tier 3 Steel (1 row of 6-#10 eliminated and another row of 6-#10 reduced to 2-#10) = 10.16 $in^2$ ✓

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Member 9 | | | | $A_{st\text{-}req}$ = | 18.00 | $in^2$ | < | 22.86 | $in^2$ | Tier | 1 |
| | LC | Force | | | | | ok | | | | |
| | 1 | -835.33 | --> | $A_{st\text{-}req}$ = | 15.47 | $in^2$ | | | | | |
| | 2 | -269.04 | --> | $A_{st\text{-}req}$ = | 4.98 | $in^2$ | | | | | |
| | 3 | -924.36 | --> | $A_{st\text{-}req}$ = | 17.12 | $in^2$ | | | | | |
| | 4 | -939.56 | --> | $A_{st\text{-}req}$ = | 17.40 | $in^2$ | | | | | |
| | 5 | -876.94 | --> | $A_{st\text{-}req}$ = | 16.24 | $in^2$ | | | | | |
| | 6 | -677.53 | --> | $A_{st\text{-}req}$ = | 12.55 | $in^2$ | | | | | |
| | 7 | -823.83 | --> | $A_{st\text{-}req}$ = | 15.26 | $in^2$ | | | | | |
| | 8 | -971.73 | --> | $A_{st\text{-}req}$ = | 18.00 | $in^2$ | | | | | |
| | 9 | -599.86 | --> | $A_{st\text{-}req}$ = | 11.11 | $in^2$ | | | | | |
| | 10 | -948.72 | --> | $A_{st\text{-}req}$ = | 17.57 | $in^2$ | | | | | |
| Member 10 | | | | $A_{st\text{-}req}$ = | 22.51 | $in^2$ | < | 22.86 | $in^2$ | Tier | 1 |
| | LC | Force | | | | | ok | | | | |
| | 1 | -1050.4 | --> | $A_{st\text{-}req}$ = | 19.45 | $in^2$ | | | | | |
| | 2 | -297.48 | --> | $A_{st\text{-}req}$ = | 5.51 | $in^2$ | | | | | |
| | 3 | -1130.87 | --> | $A_{st\text{-}req}$ = | 20.94 | $in^2$ | | | | | |
| | 4 | -1109.59 | --> | $A_{st\text{-}req}$ = | 20.55 | $in^2$ | | | | | |
| | 5 | -1089.43 | --> | $A_{st\text{-}req}$ = | 20.17 | $in^2$ | | | | | |
| | 6 | -866.86 | --> | $A_{st\text{-}req}$ = | 16.05 | $in^2$ | | | | | |
| | 7 | -1089.42 | --> | $A_{st\text{-}req}$ = | 20.17 | $in^2$ | | | | | |
| | 8 | -1213.92 | --> | $A_{st\text{-}req}$ = | 22.48 | $in^2$ | | | | | |
| | 9 | -736.87 | --> | $A_{st\text{-}req}$ = | 13.65 | $in^2$ | | | | | |
| | 10 | -1215.38 | --> | $A_{st\text{-}req}$ = | 22.51 | $in^2$ | | | | | |

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## Substructure – Strut and Tie

- Check Drilled Shaft Bearing – [AASHTO 5.6.3.5.3]

**Check Column Bearing**

f'c = 3.5 ksi

Node 21 & 24

-Shaft is wider than abutment, therefore:

m = 1.0

v = 0.7 TX-T.2.1 (AASHTO T5.6.3.5.3a-1)

$f_{cu}$ = m*v*f'c = 1.0*0.70*3.5 = 2.45 (AASHTO 5.6.3.5.3a-1)

$\varphi$Fn = $\varphi$*$f_{cu}A_{cn}$

$A_{cn}$ = 36"*47.9" = 1724.4 $in^2$

$\varphi$ = 0.7 [AASHTO 5.5.4.2.1]

$\varphi$Fn = 0.70*2.45*1,724.4 = 2957.3 k

Analysis Rxn's

| Node 21 | | | Node 24 | | |
|---|---|---|---|---|---|
| LC | Rxn | | LC | Rxn | |
| 1 | 809.9 | ok | 1 | **1509.2** | ok |
| 2 | 368.7 | ok | 2 | 1115.1 | ok |
| 3 | 927.8 | ok | 3 | 1391.3 | ok |
| 4 | **1011.6** | ok | 4 | 911.6 | ok |
| 5 | 850.7 | ok | 5 | 1468.3 | ok |
| 6 | 702.3 | ok | 6 | 1373.5 | ok |
| 7 | 801.9 | ok | 7 | 1380.8 | ok |
| 8 | 919.1 | ok | 8 | 1004.1 | ok |
| 9 | 649.4 | ok | 9 | 1270.7 | ok |
| 10 | 887.2 | ok | 10 | 1036.1 | ok |

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## Substructure – Strut and Tie

- Check Beam Bearings – [AASHTO 5.6.3.5.3]

**Check Beam Bearing**

f'c = 3.5 ksi

Brg. Width = 48 in.

Brg. Depth = 36 in.

Node 2, 3, 4, 5, 6, 7, 8 &9

- Assume all are at CTT Nodes
- Applied Loads conservatively contain self weight

m = 1.0

v = 0.85-f'c/20 = 0.68 Use 0.65 TX-T.2.1 (AASHTO T5.6.3.5.3a-1)

$f_{cu}$ = m*v*f'c = 1.0*0.65*3.5 = 2.275 (AASHTO 5.6.3.5.3a-1)

$\varphi$Fn = $\varphi$*$f_{cu}A_{cn}$

$A_{cn}$ = 48.0 x 36.0 = 1728 $in^2$

$\varphi$ = 0.7 [AASHTO 5.5.4.2.1]

$\varphi$Fn = 0.70*2.28*1,728.0 = 2751.8 k

Load Combinations

| Node 2 | | | Node 3 | | | Node 4 | | | Node 5 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| LC | Rxn | | LC | Rxn | | LC | Rxn | | LC | Rxn | |
| 1 | 183.8 | ok | 1 | 298.0 | ok | 1 | 340.0 | ok | 1 | 340.0 | ok |
| 2 | 101.0 | ok | 2 | 128.2 | ok | 2 | 128.2 | ok | 2 | 128.2 | ok |
| 3 | 268.8 | ok | 3 | 339.5 | ok | 3 | 340.0 | ok | 3 | 340.0 | ok |
| 4 | **377.9** | ok | 4 | 351.1 | ok | 4 | 357.4 | ok | 4 | 243.3 | ok |
| 5 | 202.3 | ok | 5 | 322.9 | ok | 5 | 340.0 | ok | 5 | 340.0 | ok |
| 6 | 183.5 | ok | 6 | 216.7 | ok | 6 | 216.9 | ok | 6 | 332.2 | ok |
| 7 | 183.5 | ok | 7 | 239.2 | ok | 7 | 353.4 | ok | 7 | **377.9** | ok |
| 8 | 208.1 | ok | 8 | **355.5** | ok | 8 | **377.9** | ok | 8 | 359.5 | ok |
| 9 | 183.5 | ok | 9 | 216.7 | ok | 9 | 216.7 | ok | 9 | 216.9 | ok |
| 10 | 183.9 | ok | 10 | 323.0 | ok | 10 | **377.9** | ok | 10 | 377.8 | ok |

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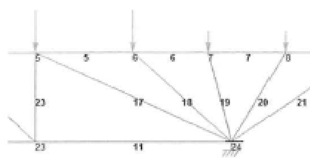
## Substructure – Strut and Tie

- Perform Nodal Strength Checks– [AASHTO 5.6.3.5.3]
  - *Most Complicated and Time Consuming Portion of Design*
  - *Vector Elements*
  - *Partition Nodes*



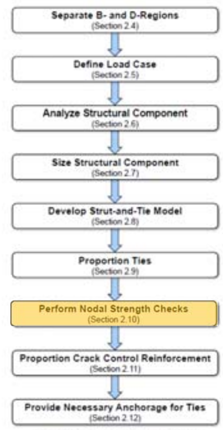




Figure 2.5: Strut-and-tie model design procedure

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A **TRADITION** OF EXCELLENCE **SINCE 1945**

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# I-70 over SR 121

## Substructure – Strut and Tie

- Perform Nodal Strength Checks– [AASHTO 5.6.3.5.3]
  - *Recalculate Node Geometry*

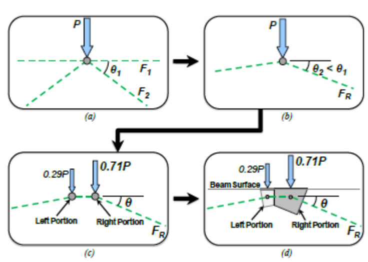


*Figure 2.16: CCC node – (a) original geometry of the STM; (b) adjacent struts resolved together; (c) node divided into two parts; (d) final nodal geometry*

Geometry of Node Partitions

- Proportion out shaft width by vertical force from Left Struts and Right Struts

Rxn = 1509.2 k

Left Shaft Width = 1,064.0/1,509.2*47.9 = 33.77 in.
Right Shaft Width = 444.8/1,509.2*47.9 = 14.12 in.

- Place Node 24A and 24B at new locations in center of Left and Right partition

Offset Left = 33.77/2-47.9/2 = -7.06 in. = -0.59 ft
Offset Right = 47.9/2-14.12/2 = 16.89 in. = 1.41 ft

- Determine New Angles based on vectored loads and offsets above

Left
x = (11.67 - 0.56)/tan(39.17) = 13.63 ft
Angle = tan-1 [(11.67 - 0.56)/(13.63-0.59)] = 40.41 deg

Right
x = (11.67 - 0.56)/tan(49.72) = 9.41 ft
Angle = tan-1 [(11.67 - 0.56)/(9.41-1.41)] = 54.22 deg

Struts "+" is compression

| Mem. | Force (k) | Angle |
|---|---|---|
| Lt | 1684.6 | 40.41 |
| Rt | 583.1 | 54.22 |
| 11 | -929.03 | 0.00 |

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# I-70 over SR 121

## Substructure – Strut and Tie

- Perform Nodal Strength Checks– [AASHTO 5.6.3.5.3]
  - *Check Back Face – [AASHTO 5.6.3.5.3a]*

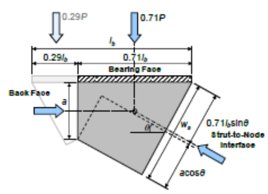


*Figure 2.17: Geometry of a CCC node (adapted from Birrcher et al., 2009)*

**Node 24B - CCC**

**Back Face**

| | | | | |
|---|---|---|---|---|
| $a$ = 13.49 in. | | | | [AASHTO T5.6.3.5.2] |
| $m$ = 1.0 | | | | |
| $v$ = 0.85 | TX-T.2.1 | | | (AASHTO T5.6.3.5.3a-1) |
| $f_{cu} = m*v*f'c$ = | 1.0*0.85*3.5 = | 2.975 | | (AASHTO 5.6.3.5.3a-1) |
| $\varphi Fn = f*f_{cu}A_{cn}$ | | | | |
| $A_{cn}$ = 13.49 in. x 36 in = | | 485.6 $in^2$ | | |
| $\varphi$ = 0.7 | | | | [AASHTO 5.5.4.2.1] |
| $\varphi Fn$ = 0.70*2.98*485.6 = | 1011.3 k | > 377.0 k | **ok** ✓ | |
| | | Horiz Compression force for CCC Side | | |

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# I-70 over SR 121

## Substructure – Strut and Tie

- Perform Nodal Strength Checks– [AASHTO 5.6.3.5.3]
  - *Check Node Face – [AASHTO 5.6.3.5.3a]*

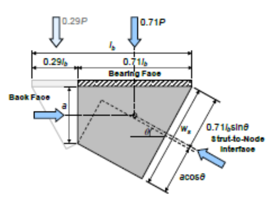


*Figure 2.17: Geometry of a CCC node (adapted from Birrcher et al., 2009)*

**Strut-to-Node Interface**

| | | | | |
|---|---|---|---|---|
| $l_b$ = 14.12 in. | | | | |
| $a$ = 13.49 in. | | | | [AASHTO T5.6.3.5.2] |
| $w_s = l_b\sin\Theta + a\cos\Theta$ = | 14.12*sin(54.22) +13.5*cos(54.22) = | 19.34 | TX-2.3 | |
| $m$ = 1.0 | | | | |
| $v$ = 0.85-f'c/20 = | 0.68 | Use 0.65 | TX-T.2.1 | (AASHTO T5.6.3.5.3a-1) |
| $f_{cu} = m*v*f'c$ = | 1.0*0.65*3.5 = | 2.275 | | (AASHTO 5.6.3.5.3a-1) |
| $\varphi Fn = \varphi*f_{cu}A_{cn}$ | | | | |
| $A_{cn}$ = 19.34 in. x 36 in = | | 696.3 $in^2$ | | |
| $\varphi$ = 0.7 | | | | [AASHTO 5.5.4.2.1] |
| $\varphi Fn$ = 0.70*2.28*696.3 = | 1108.8 k | > 583.1 k | **ok** ✓ | |

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# I-70 over SR 121

## Substructure – Strut and Tie

- Perform Nodal Strength Checks– [AASHTO 5.6.3.5.3]
  - *Check Anchorage – [AASHTO 5.6.3.4.2]*
  - *Each Check Varies Depending on Node Type – CCC, CCT, CTT*

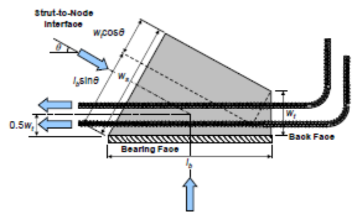


*Figure 2.15: Geometry of a CCT node (adapted from Birrcher et al., 2009)*

Provide Necessary Anchorage for Ties [AASHTO 5.6.3.4.2]

Deterimine length widthin Nodal Zone and Extended Nodal Zone

Length = $l_b + a/2/\tan\Theta_1 + a/2/\tan\Theta_2$

= 47.90+13.49/2/tan(39.17)+13.49/2/tan(49.72)

= 61.9 in.

Development of #10 = 50.9", therefore developed within nodal zone. Extend minimum of 13.49/2/tan(49.72) = 5.72 in. from the outside of the shaft. Use 2'

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## Substructure – Strut and Tie

- Proportion Crack Control Reinforcement – [AASHTO 5.6.3.6]

Satisfy Control Reinforcement *[AASHTO 5.6.3.6]*

- Space horizontal bars no less than

d/4 = (12.41 - 0.56)*12/4 = 35.54 in

12 in = 12 in Use 12.00 in. max

Vertical Bars: $A_v/b_w s_v >= 0.003$ *(AASHTO 5.6.3.6-1)*

Horizontal Bars: $A_h/b_w s_h >= 0.003$ *(AASHTO 5.6.3.6-2)*

Assuming #6 bars (1 each face), determine spacing

As = 0.44 $in^2$ * 2 = 0.88 $in^2$

$s_v$ = 0.88/0.003/36 = 8.15 in < 12.00 in Use 8.15 in. max

$s_h$ = 0.88/0.003/36 = 8.15 in < 12.00 in Use 8.15 in. max

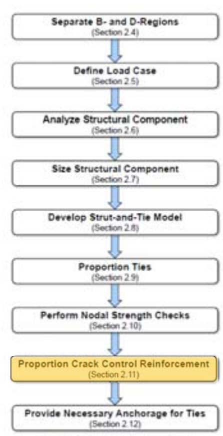


*Figure 2.5: Strut-and-tie model design procedure*

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# I-70 over SR 121

## Substructure – Strut and Tie

- Proportion Stirrups in High Shear Regions – [AASHTO 5.6.3.4.1]

**Proportion Stirrups in High Shear Regions**

All Vertical ties are under beams, therefore, calculated shear stirrups can be distributed over the half of the adjacent panels

Member 22

| LC | Force (k) |
|---|---|
| 1 | 217.4 |
| 2 | 28.8 |
| 3 | 208.8 |
| 4 | 171.9 |
| 5 | 214.8 |
| 6 | 191.4 |
| 7 | 268.5 |
| 8 | 244.8 |
| 9 | 138.5 |
| 10 | 269.6 <-- |

| Node | x | y |
|---|---|---|
| 2 | 12.66 | 11.67 |
| 3 | 23.65 | 11.67 |
| 4 | 34.64 | 11.67 |

Max = 269.6 k

Panel 1 Width = 10.99 ft

Panel 2 Width = 10.99 ft

$P_n = f_y A_{st} + A_{ps}(f_{pe} + f_y)$ (AASHTO 5.6.3.4.1-1)

$F_u = \varphi f_y A_{st}$

$\varphi$ = 0.9

fy = 60

$A_{st\text{-}reqd}$ = 269.6/(0.9*60) = 4.99 in$^2$

Stirrups Req'd = 4.99/10.99 = 0.45 in$^2$/ft

Assuming #6 bars each face: $A_s$ = 0.88 in$^2$ ---> Req'd Spa. = 23.2 in. max

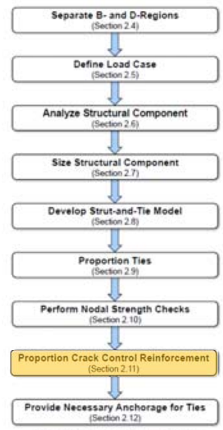


*Figure 2.5: Strut-and-tie model design procedure*

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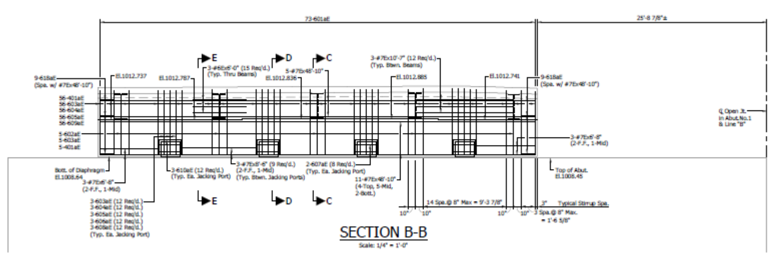
# I-70 over SR 121

## Superstructure

- Mostly followed Typical Design
- End Diaphragms Unique
  - *Slide Diaphragm – Accommodate Jacking Ports*

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## Superstructure

- End Diaphragms Unique
  - *Slide Diaphragm – Accommodate Jacking Ports*

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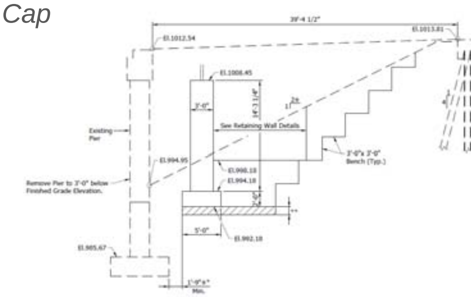
# I-70 over SR 121

## Superstructure

- End Diaphragms Unique
  - *SPMT – Not Enough Room to cast up to Bridge Seats*
  - *Used Precast Bridge Seat Cap*

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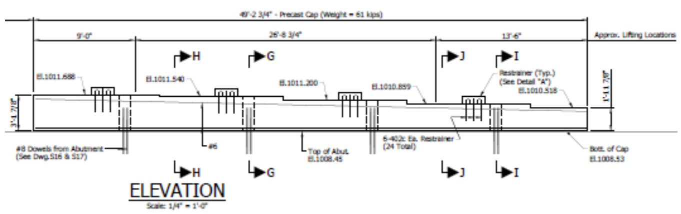
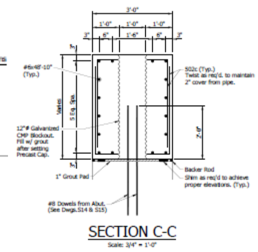
# I-70 over SR 121

## Superstructure

- End Diaphragms Unique
  - *SPMT – Not Enough Room to cast up to Bridge Seats*
  - *Used Precast Bridge Seat Cap*

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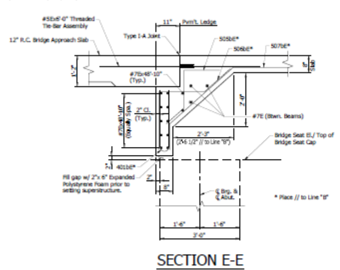
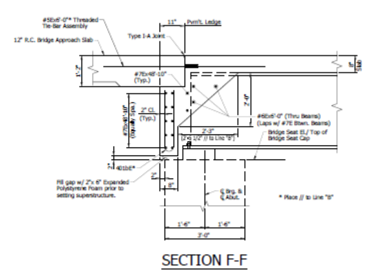
# I-70 over SR 121

## Superstructure

- End Diaphragms Unique
  - *SPMT – End Diaphragm needed to Eliminate Joint but Minimize Dead Load*

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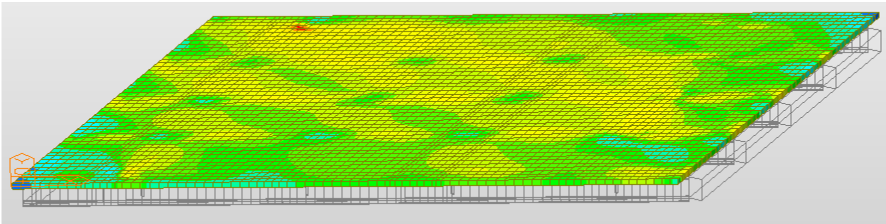
# I-70 over SR 121

## Superstructure

- SPMT – Needed to perform 3D Finite Element of Transportation



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# I-70 over SR 121

## Speed of Construction

- Tried to incorporate Precast wherever possible
- Precast Sleeper Slab w/ Precompressed Foam Joint instead of Terminal Joint
- MSE Wall Wings
- Allowed to Open with Concrete Strength = 500 psi

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# I-70 over SR 121

## A+B Contract Provisions

- As Part of the Bid, Contractor to bid Number of Hours of I-70 Lane Closure and Days of SR 121 Road Closure
- I-70: Bid, Incentive and Disincentive = $2,500/hour on Fridays and $2,000/Hour on other Days
- SR 121: Bid, Incentive and Disincentive = $4,000/day

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# I-70 over SR 121

## Superstructure Installation Contract Provisions

- Regardless of the Installation Method Chosen, Performance Based Provision.
- Requirements of Revisions to Contract Plans, Working Drawings, Contingency Plans, Installation Plans, Tolerances
- Installation Bid at $160,000 and Engineering Bid at $95,000

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# I-70 over SR 121

## Contract Award

- Walsh was the Successful Bidder – Slide Option
- Construction Cost $5,630,000 (Original Estimate $6,921,000)
- B Component = $855,000
- 24 Days of I-70 Lane Closure
- 30 Days of SR 121 Full Closure

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# I-70 over SR 121

## Actual Construction

- Two Eight Day Lane Closures
- Two Three SR 121 Road Closure Days for Bridge Demolition
- 14 Days of SR 121 Closure for Road Work on SR 121
- https://www.youtube.com/watch?v=N4FrVGW0Upg&feature=youtu.be
- https://www.youtube.com/watch?v=6SBjNkCRmUg&feature=youtu.be

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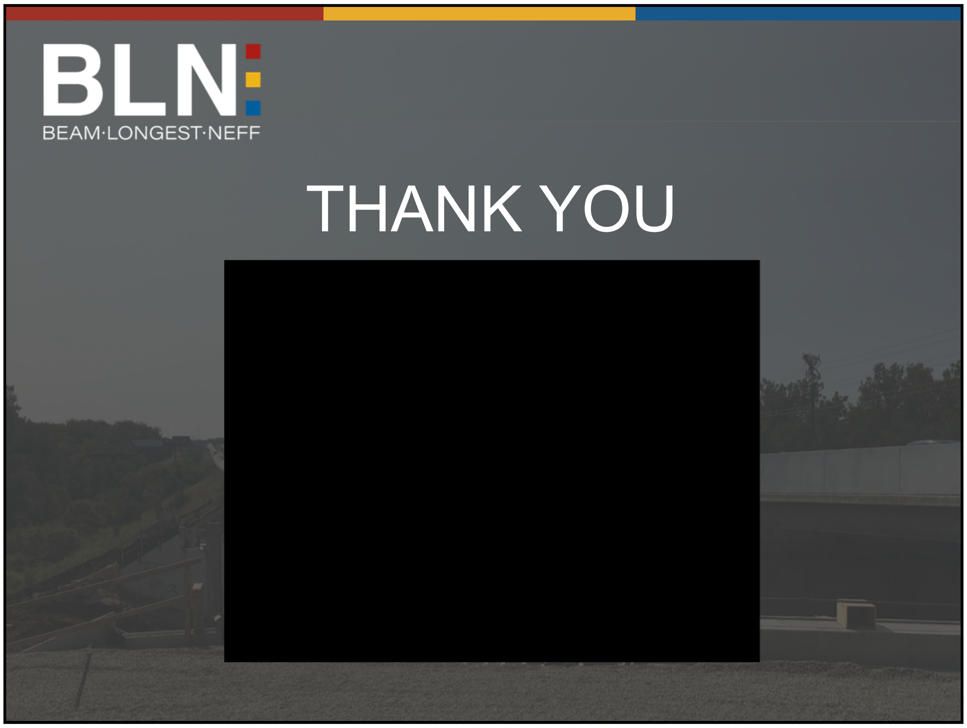
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THANK YOU