



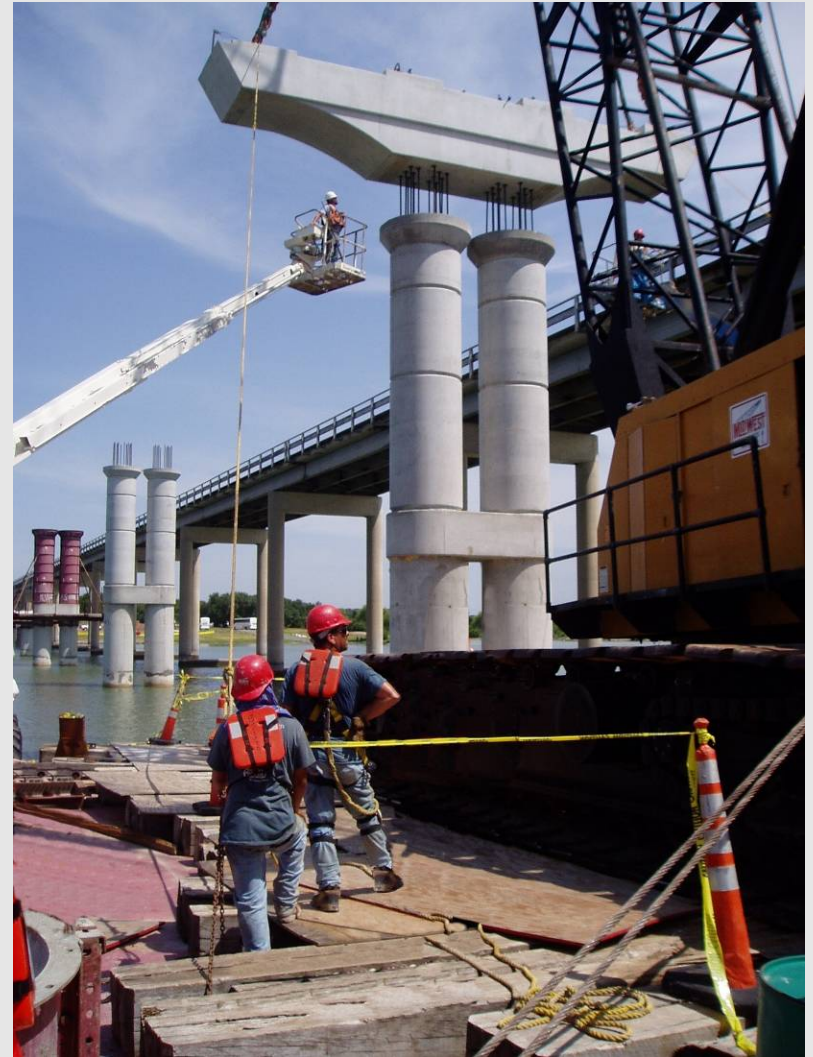
PRECAST BRIDGE ELEMENTS IN TEXAS

Steven Austin, P.E. - TxDOT Bridge Division
2019 National Concrete Consortium



Precast Bridge Elements

- TxDOT's primary technique for accelerated bridge construction.
- In addition to increased speed, also typically comes with increased quality.
- Can encompass practically every element from the ground up.
- Accurate surveying critical.



TxDOT's Bread & Butter: Precast Bms/Girders and Deck Panels

Over 1 million linear feet of precast beams let in each of 2017 and 2018.



Prefabricated Elements

Railing

Traffic Barrier

Decked Slab Beams

Prestressed Piling

Retaining walls

Culverts

Bent Cap for Steel Piling

Bent Cap for Round Columns

Spread Boxes – X-Beams

Prestressed Deck Panels

End Treatments

Manholes & Inlets

Sheet Piling

Tx Girders (Bulb Tees)

Column (segments or full height)

U-Beams

Reinforced Concrete Pipes

Slab Beams

Box Beams

I-Beams

Spliced girders

Segmental segments

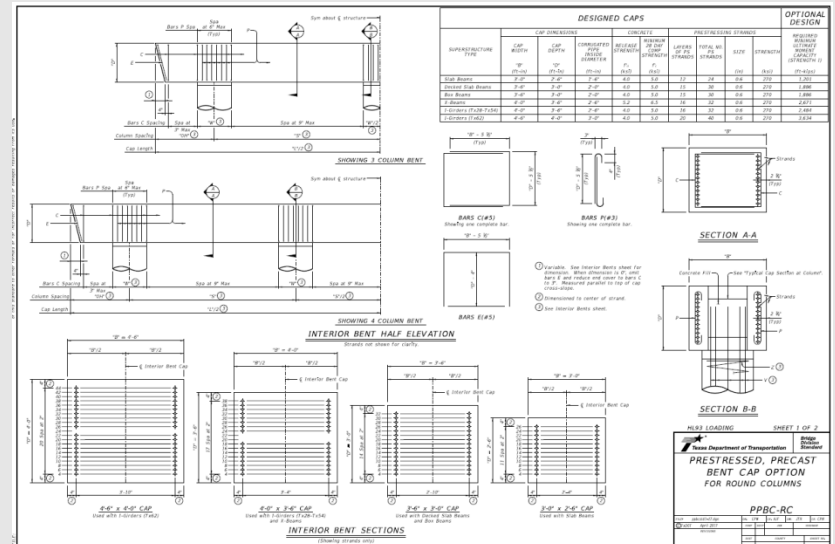
Precast Bent Caps



Precast Bent Caps – Long Water Crossings

SH 66 at Lake Ray Hubbard

- 43 identical precast bent caps
- Estimated time savings of 215 days



Precast Abutments



Precast Columns



Moving Forward

- Prefabricated elements are largely what make TxDOT bridges the least expensive and most durable in the country.
- Prefabricated elements typically speed up construction considerably



Decked Slab Beams



Decked Slab Beams: 6 – 10 Day Construction Projects

FM 1660
Cottonwood Creek
(AUS)

Precast Abutment

Decked Slab Beams

Precast Bent Cap

Steel Piling



Full Width, Full Depth Panels

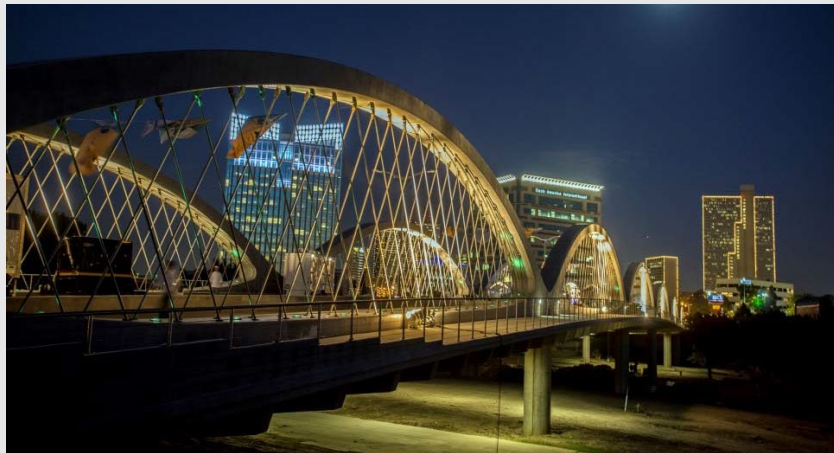
SH 290
Live Oak Creek
(SJT)



Diagram illustrating the cross-section of a bridge deck. The overall width is 29'-0". The roadway width is 27'-0". The deck is supported by existing steel beams or girders. The deck thickness is 8 1/2" (Prop Deck). The nominal face of the rail is 13'-6" from the centerline of the bridge. The top of the proposed deck is 1/8" per foot above the nominal face of the rail. The bottom of the deck is 1/8" per foot below the nominal face of the rail. The deck is supported by existing steel beams or girders. The spacing between the beams is 3'-6" and 7'-4".



SPMT – Fort Worth West 7th Street Arches



Taking Precast to the Extreme – West 7th Street



12 Precast
Arch Members
102 Precast
Floorbeams

3744 Precast
Sub-Deck Panels

Allowed 5 Months
of Total Closure

Finished 26 Days
Early

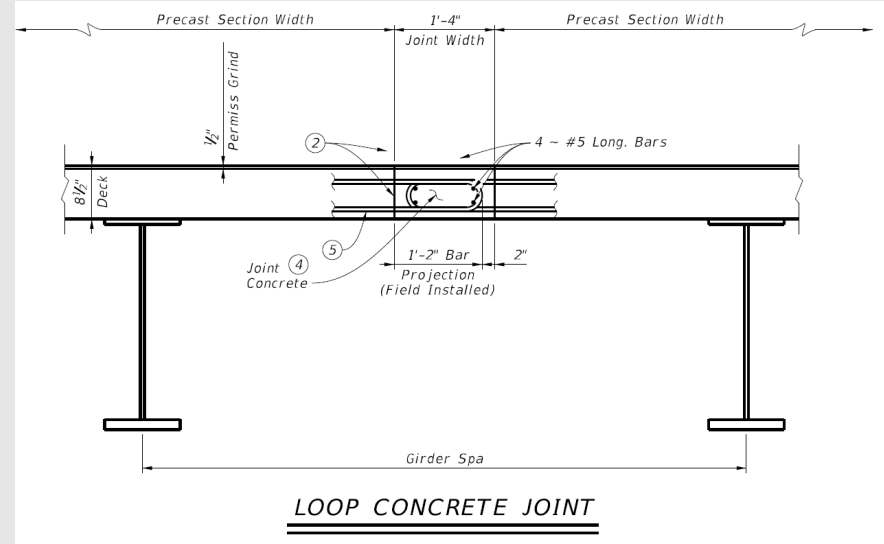
Modular Units



Longitudinal Closure Pours Options (Different Concretes)

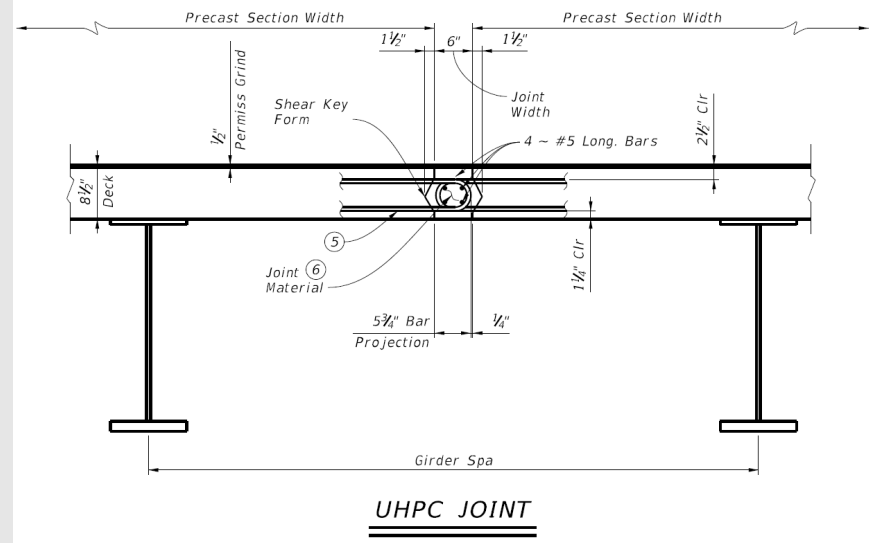
■ Loop Concrete Joint

- Wider closure pour
- Rapid setting concrete with steel fibers



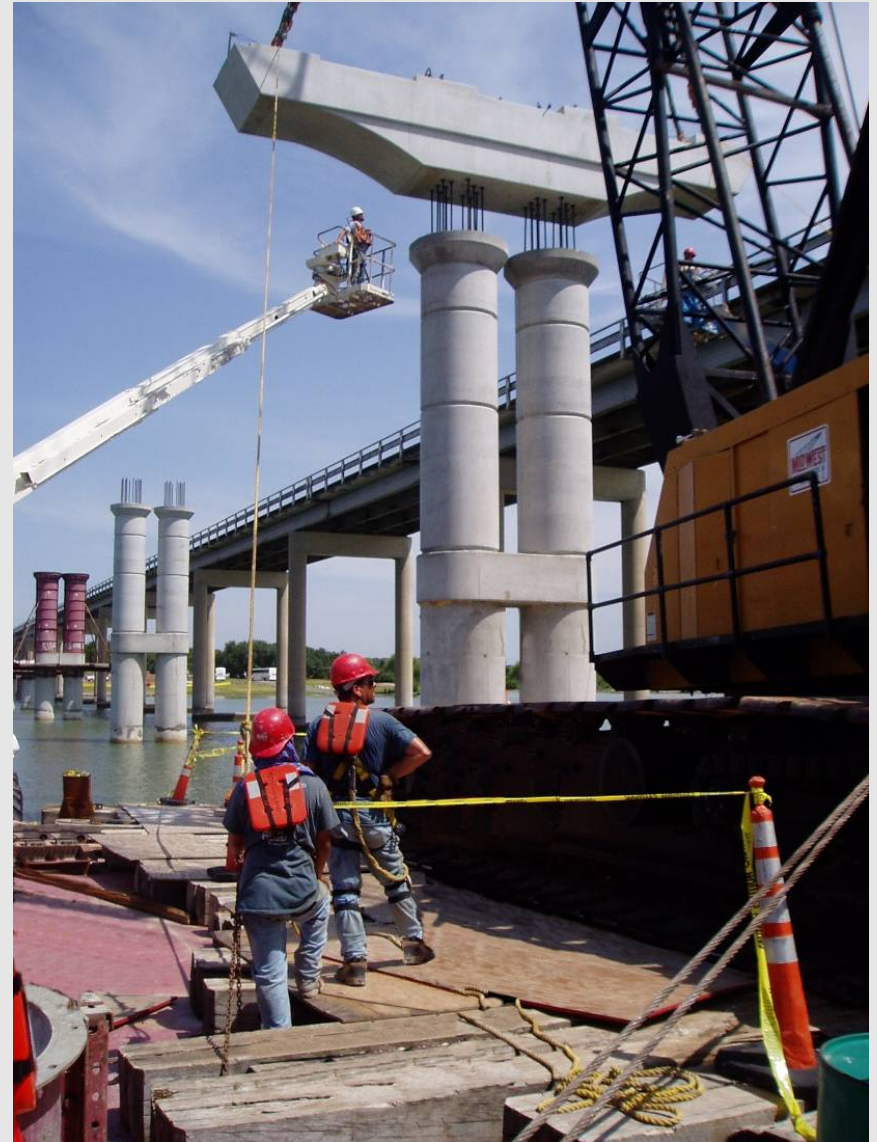
■ UHPC Joint

- Narrow longitudinal closure pour
- Utilize Ultra-high Performance Concrete



Alternate Prestressed Bent or Abutment Designs SOP

- There is increasing interest in utilizing prefabricated elements in all facets of bridge design and construction.
- Precast alternate not always included in plans.
- Developed a Standardized Method to allow Contractors to propose alternate to Cast-in-Place (CIP) Construction
- <http://ftp.dot.state.tx.us/pub/txdot-info/brg/design/alt-prestressed-bent-abutment.pdf>



Alternate Prestressed Bent or Abutment Designs SOP

- Step 1: Contractor submits request to District for alternate design concept, including justification including the benefit to TxDOT.
- Step 2: If request is approved, Contractor develops alternate design package (plans and design calculations).



Alternate Prestressed Bent or Abutment Designs SOP

- Step 3: TxDOT Project Manager sends request for approval to the original Engineer of Record.
 - If a consultant, review is paid for under the Construction Phase Services.
 - If contract does not include Construction Phase Services, TxDOT Bridge Division will review.
- Step 4: Reviewer stamps the plans. If marked “Return for Corrections” then the submittal process starts again.



Alternate Prestressed Bent or Abutment Designs SOP

- Step 5: If approved, TxDOT notifies Contractor. Alternate plans are filed with contract plans so the as-builts are accurate.
- Step 6: Contractor submits shop plans. TxDOT District PM forwards to the appropriate party for review.
- Step 7: Prestressed bents are fabricated and erected.



Lateral Slide-in – LP 345 / Fredericksburg Rd (San Antonio)



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Pre-Letting Activities

- Decide What is Tolerable Related to Traffic Control and Length of Closures (Every hour of a closure is very valuable for construction)
- Community involvement
- Consider possible staging locations and what is feasible
- Advertise early the plans for AGC/Contractor Review and Comment
- Include options within contract to allow contractor innovations/alterations?
- Consider having Pre-bid Meeting
- Start/continue the education of project personnel. Staff with considerable understanding of project essential to successful ABC project.

Section Weights and Widths – Modular Units (DAL Project)

- Guidance from AGC:
 - Maximum desirable transportable load over long distance ~ 100 Tons
 - Maximum desirable lift load (assuming two crane lift) ~ 150 Tons
- Widths over 10 – 12 ft become problem for long distance transportation

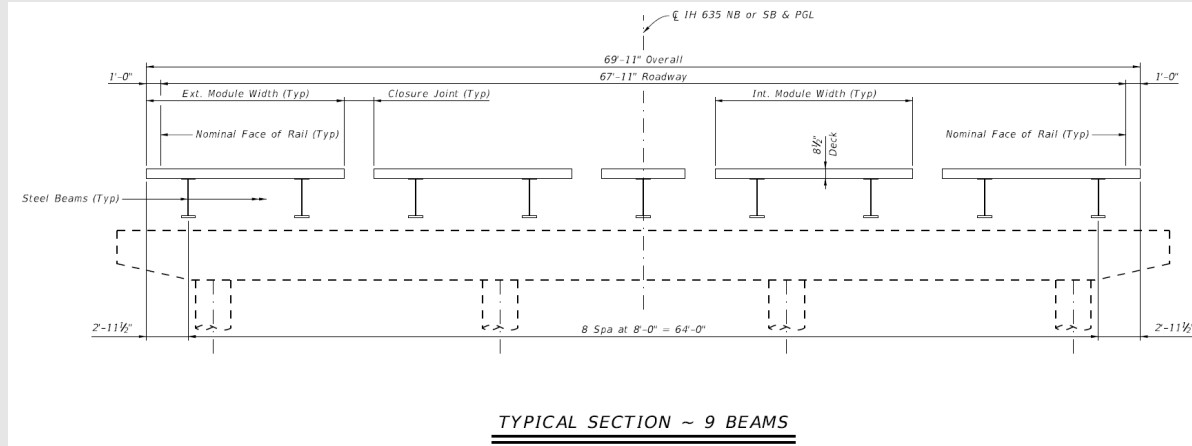


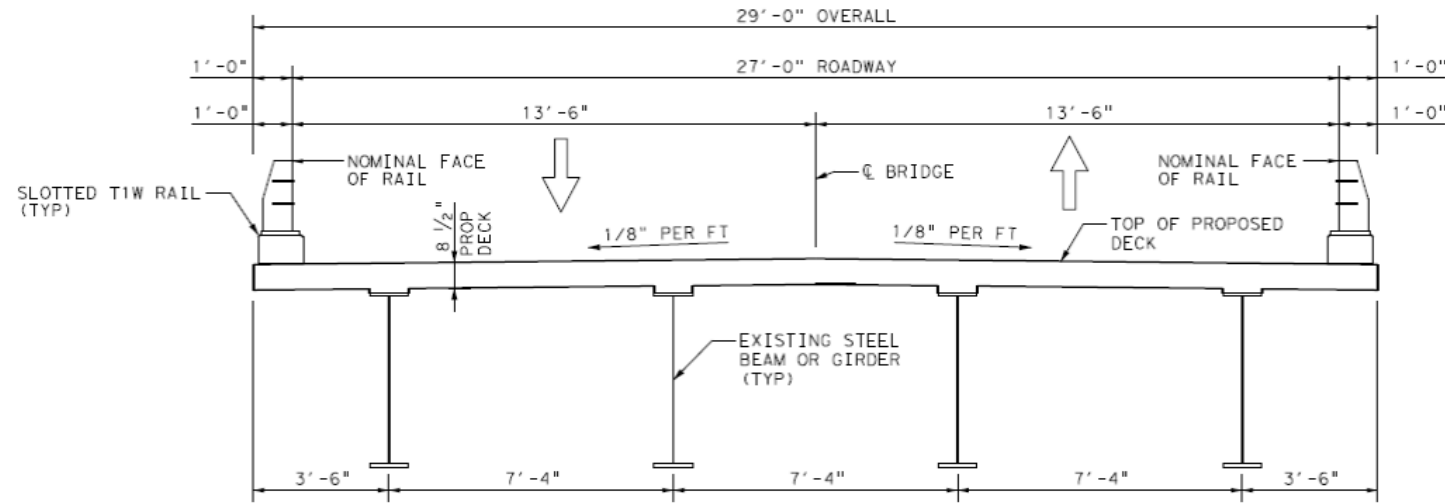
TABLE OF PREFABRICATED SUPERSTRUCTURE OPTIONS

Number Girders	Beam Spa (ft)	Number of Modules	Closure Joint Width (in)	Closure Joint Type	Number of Closure Joints	Asymmetric Interior Overhang on Ext Module	Ext Module Concrete Width (ft)	Ext Module Weight (Tons)	Symmetric Overhang on Int Module (ft)	Int Module Concrete Width (ft)	Int Module Weight (Tons)
8	9.143	4	32	DBA Concrete	3	3.24	15.34	105	3.24	15.62	107
8	9.143	4	16	Loop Concrete	3	3.90	16.01	109	3.90	16.95	114
8	9.143	4	6	Loop UHPC	3	4.32	16.42	111	4.32	17.79	118
9	8.000	5	32	DBA Concrete	4	2.67	13.63	96	2.67	13.33	95
9	8.000	5	16	Loop Concrete	4	3.33	14.29	100	3.33	14.67	102
9	8.000	5	6	Loop UHPC	4	3.75	14.71	102	3.75	15.50	106
10	7.111	5	32	DBA Concrete	4	2.22	12.29	89	2.22	11.56	86
10	7.111	5	16	Loop Concrete	4	2.89	12.96	93	2.89	12.89	93
10	7.111	5	6	Loop UHPC	4	3.31	13.38	95	3.31	13.72	97

Pre-Construction- Contractor Submittals

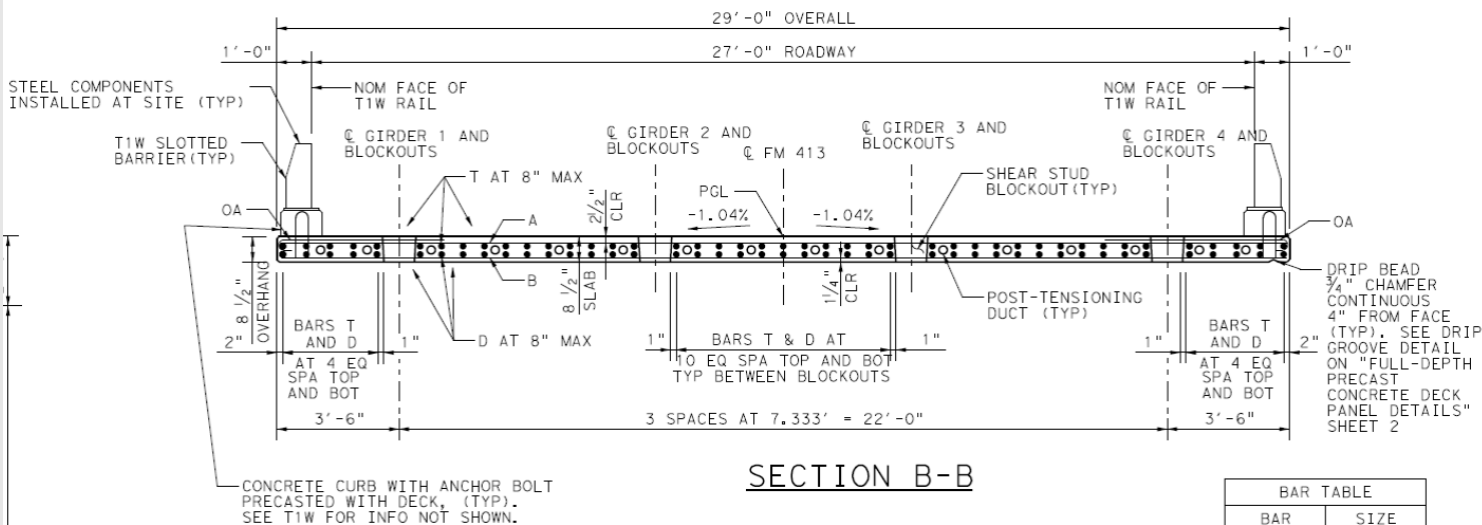
- Fabrication Drawings and Procedures
 - Item 424 (Precast Fabrication)/DMS-7300
 - Multi-project Fabrication Plant
 - Project Specific Fabrication Plant
 - Item 441 (Steel Fabrication)
 - DMS-7370 Considerations

Full Width, Full Depth Panels



Bridge Summary:

- 671' Long
- 9 Spans
- 470' Main Unit
- 63 Precast Panels
- Normal Reinforcing
- Post-tensioned together
- \$16/SF Deck Removal
- \$44/SF Deck
- \$13/SF Rail



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- Erection/Construction Procedures
 - Item 5, Table 1 Requirements
 - Item 7.16 “HAULING AND LOADS ON ROADWAYS AND STRUCTURES”

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 - Item 5, Table 1 Requirements
 - Item 7.16 “HAULING AND LOADS ON ROADWAYS AND STRUCTURES”
- Material Information
 - Concrete Mix Verification (Note Standard Specification is just that – Standard Construction – For ABC explore Special Provisions/Specifications to Reduce Time)
 - “Mock-up” requirements
 - Different materials and everybody needs to be brought up to speed

During Construction

- Pre-plan everything
- Verify survey data
- Utilize concrete maturity method for construction processes
- Account for dimensional tolerance of pieced together members
- Take notes and review work
- Call for support (Establish and maintain key phone numbers for SME's)
- Rapid decision making essential

Summary

- Precast options offer more Accelerated Bridge Construction (ABC) solutions
 - Many options
 - Ask for contractor input
 - Allow for innovations
- Community Involvement
 - Promote ABC as a less disruptive (in time) alternative
 - Get in, Get out, Stay out
- Thorough planning
- Great communication is key to success



QUESTIONS?

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