ASCE Montgomery, Alabama Branch

Innovations in the Prestressed Concrete Industry

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Forterra Pipe & Precast, Pelham Prestress Division
November 10, 2015

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Concrete Technology

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Concrete Technology

Innovations in Concrete Technology in the Prestressed Concrete Industry:

- **Advancements in Concrete Mixer Technology**
- **Improvements to Chemical Admixtures**
- **Batch Control Systems (Moisture Probes)**
- **These Technologies Allow Self-Consolidating Concrete Production**

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Concrete Technology

- Twin Shaft Mixer
- Fast, Thorough Mixing Action

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Pelham, AL Bridge Plant

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Twin Shaft Mixer

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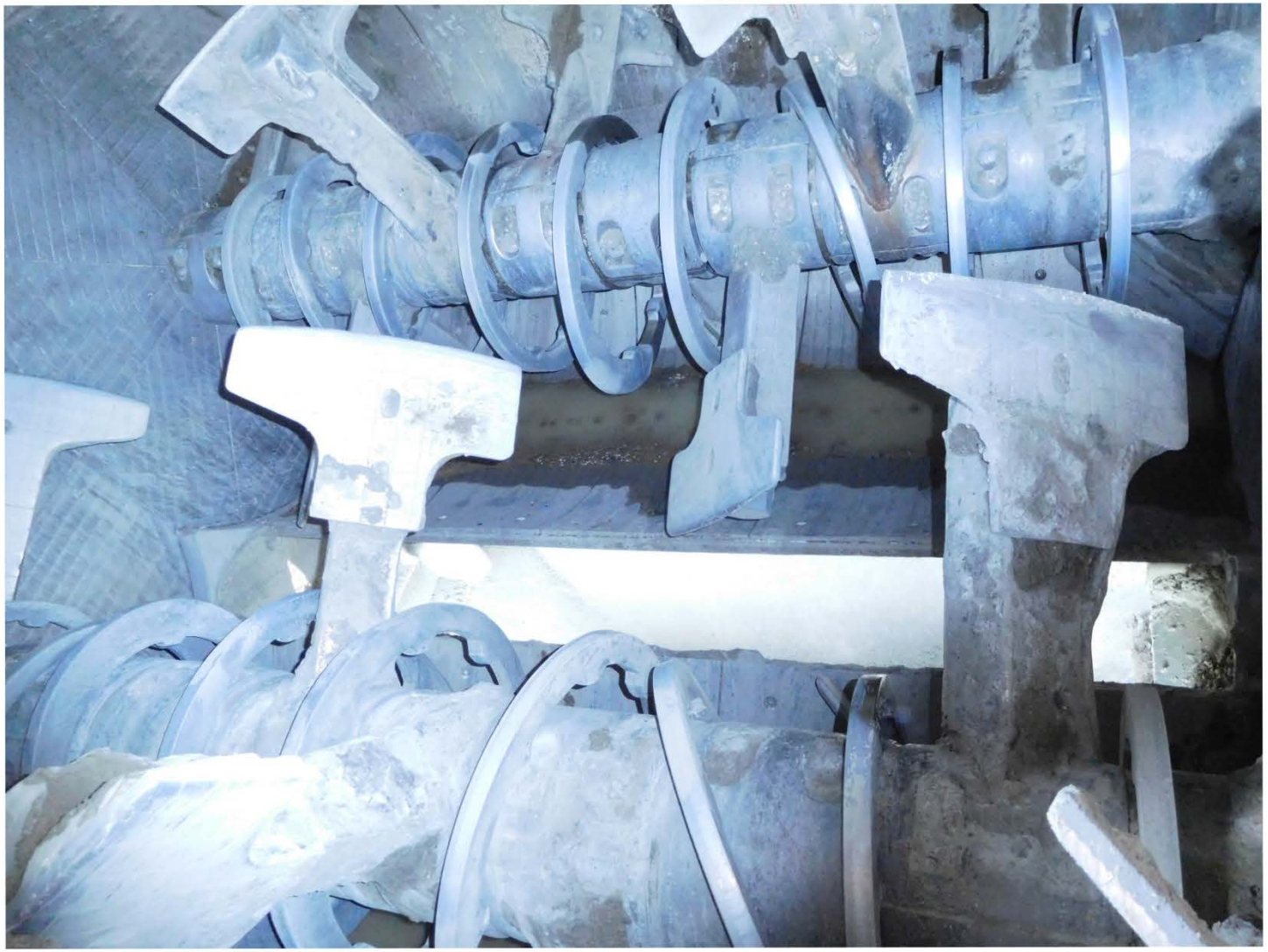
Twin Shaft Mixer



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Self-Consolidating Concrete

- Flowing Concrete
- Allows Placement Without Vibration
- Safer Working Environment
- Enhanced Surface Finish on Products

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Self-Consolidating Concrete

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Self-Consolidating Concrete

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Self-Consolidating Concrete

- Product has been Thoroughly Researched by ALDOT
- Full Scale Prestressed Concrete Girders have been Produced and are in Service
- Definite Benefits for the Precast Concrete Industry
- ALDOT has Special Provision Implemented
- Pelham, AL Bridge Plant is Producing Bridge Beams w/SCC

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Products

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Precast Substructure Components

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Scope Of Precast Substructure Components

Precast Columns- (42” x 42”); Avg. Length Approx. 26 ft.

Precast Caps- (48” Wide x 48” min., Depth); Max Length 35’-6”

Column Sleeves- NMB #14 Sleeves for #11 Footing Dowels. Total of 12 Sleeves per Column. Footing Dowels Positive Projection from Cast-In-Place Footing, Set with a Template.

Cap Sleeves- NMB #14 Sleeves for #11 Column Bars. Total of 24 Sleeves Installed in Bottom of Caps (12 per Column).

These Products have been Produced at our Pelham, AL Yard.

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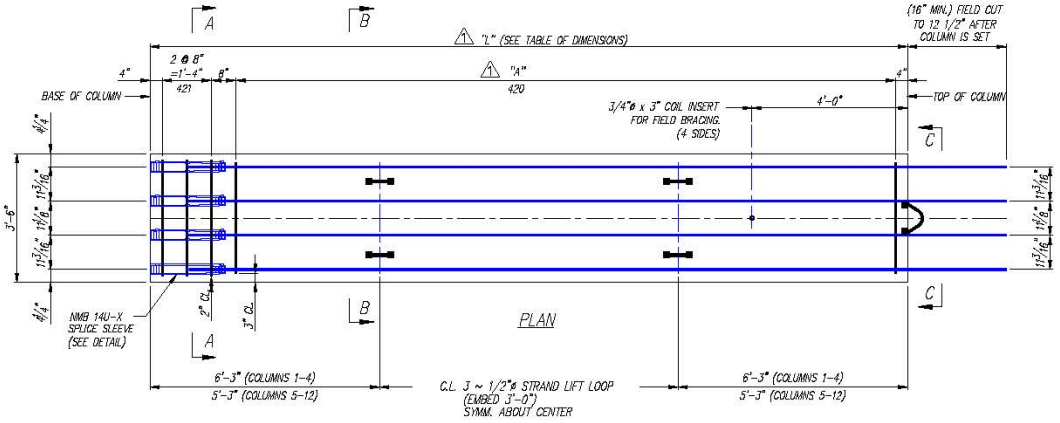
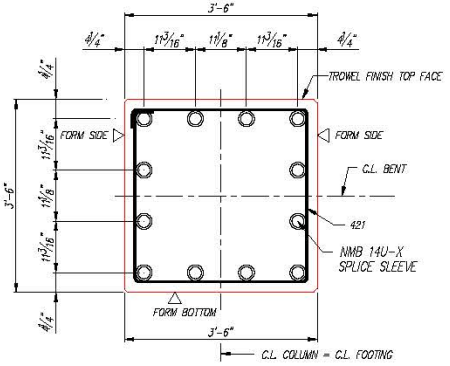
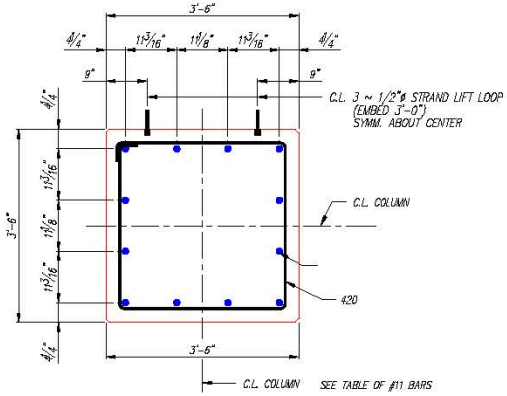


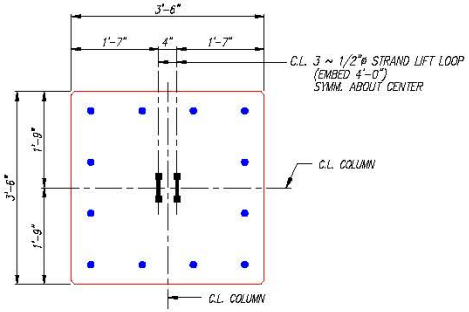
TABLE OF DIMENSIONS			
	QTY.	MARK #	"L"
BENT 3	2	CL-6716-1	28'-5 1/2"
	2	CL-6716-2	29'-3 9/16"
	2	CL-6716-3	29'-1 5/16"
	2	CL-6716-4	28'-4 1/16"
BENT 2	2	CL-6716-5	24'-11 1/2"
	2	CL-6716-6	25'-9 9/16"
	2	CL-6716-7	26'-1 5/16"
	2	CL-6716-8	25'-4 1/16"
BENT 4	2	CL-6716-9	24'-1 3/16"
	2	CL-6716-10	24'-11"
	2	CL-6716-11	24'-8 3/8"
	2	CL-6716-12	23'-10 15/16"



SECTION A-A

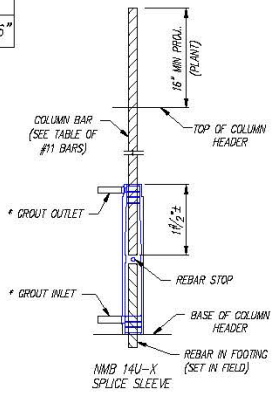


SECTION B-B



SECTION C-C

COLUMN STEEL REINFORCEMENT



* ALL SPLICE SLEEVE INLET AND OUTLET GROUT TUBES TO BE TURNED TO FORM SURFACE OR TOP OF PRODUCT. HOLES MUST BE ACCESSIBLE AND CLEAR OF DEBRIS WHEN FORMS ARE STRIPPED.

SPECIAL NOTES:

1. CONCRETE STRENGTH SHALL BE 4,000 PSI @ STRIPPING.
2. CONCRETE STRENGTH SHALL BE 4,500 PSI @ 28 DAYS.
3. SEE SHEET 10 OF 11 FOR PROPER ORIENTATION OF GROUT TUBES.
4. FORM RECESS AROUND ALL LIFTING LOOPS FOR SMOOTH FINISH WHEN LOOPS ARE CUT AFTER ERECTION. SEE SHEET 10 OF 11 FOR DETAILS.
5. FOR STEEL REINFORCEMENT DETAILS, SEE SHEET 11 OF 11.

REVISIONS	QUALITY CONTROL		
3-31-08 REVISED COLUMN LENGTHS	POUR #	Hanson HEIDELBERG CEMENT Group	Hanson Pipe & Precast Pelham Prestress Division
	MARK #		400 INDUSTRIAL PARK DR. PH: 205 663-4881 PELHAM, ALABAMA 35124 FAX: 205 663-4456
	GIRDER #	PROJECT: CSNHS-0008-00 (232) TROUP CO., GA	
	DATE: INITIAL:	CONTRACTOR: SUNBELT STRUCTURES INC.	
		SCALE: NONE / DATE: 3/31/08 / APPROVED BY: / DRAWN BY: TONY	
		COLUMN DETAILS (BENTS 2 - 4)	HANSON JOB NO. 6716
		HANSON DWG. FILE 6716-CL.DWG / CHECKED BY: D.R.H.	SHEET 3 OF 11

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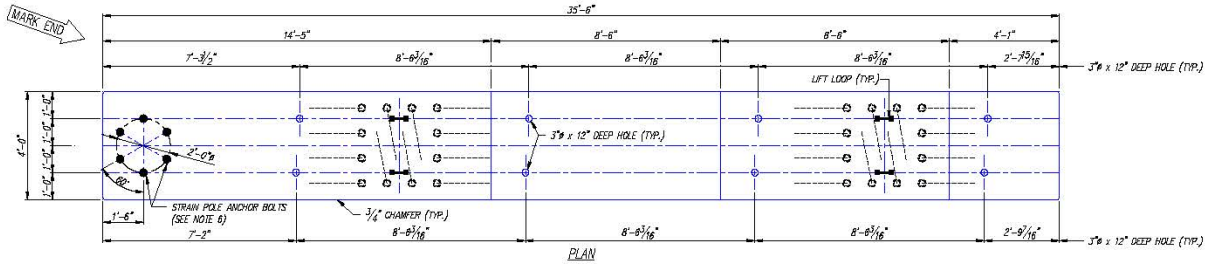
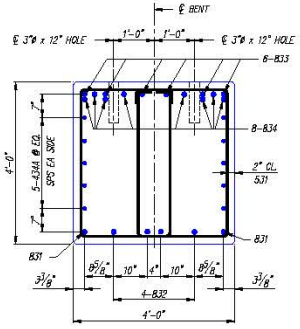


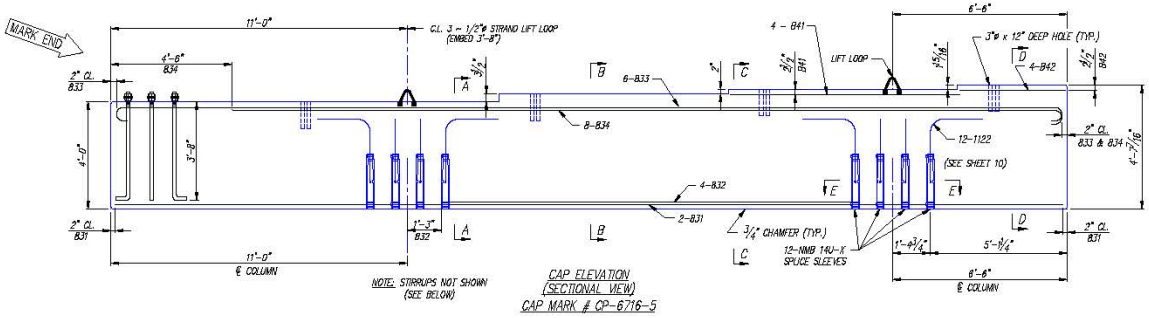
PLAN



SECTION A-A

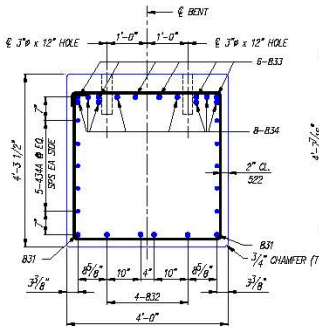
CAPS REQUIRED	
QTY.	MARK #
2	CP-6716-5

REBAR EACH CAP		
QTY.	MARK #	"L"
10	#34A	35'-2"
4	B41	8'-6"
4	B42	3'-9"
13	C41	6'-11"
17	S22	15'-8"
56	S31	12'-10"
2	B31	35'-2"
4	B32	15'-6"
6	B33	37'-0"
8	B34	31'-9"
24	T122	4'-3"

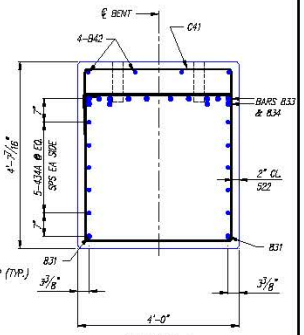


NOTE: STIRRUPS NOT SHOWN (SEE BELOW)

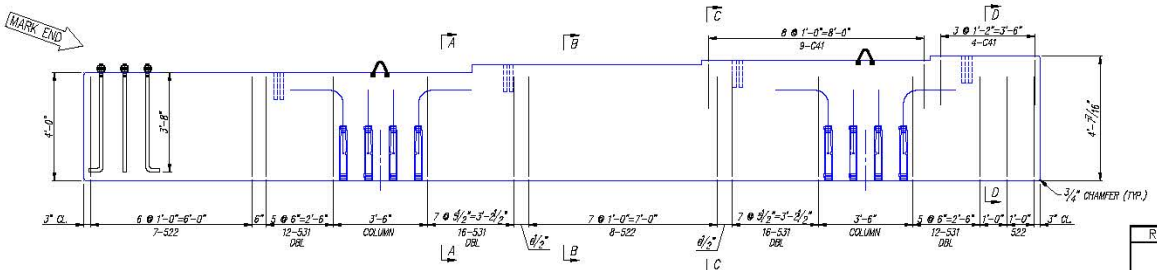
CAP ELEVATION (SECTIONAL VIEW)
CAP MARK # CP-6716-5



SECTION B-B



SECTION D-D
SECTON C-C SIMILIAR TO SECTION D-D



(STIRRUP SPACING)
CAP ELEVATION

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5. FOR STEEL REINFORCEMENT DETAILS, SEE SHEET 11 OF 11.
6. CONTRACTOR TO FURNISH TEMPLATE TO FACILITATE ACCURATE PLACEMENT OF STRAIN POLE ANCHOR BOLTS. SEE SHEET 10 OF 11 FOR ANCHOR BOLT DETAIL.

REVISIONS	QUALITY CONTROL:	Hanson HEIDELBERG CEMENT Group	Hanson Pipe & Precast Pelham Prestress Division 400 INDUSTRIAL PARK DR. PH. 205 663-4681 PELHAM, ALABAMA 35124 FAX 205 663-4456
	POUR #	PROJECT: CSNHS-0008-00 (232) TROUP CO., GA	
	MARK #	CONTRACTOR: SUNBELT STRUCTURES INC.	
		SCALE: NONE / DATE: 3/31/08 / APPROVED BY: / DRAWN BY: TONY	
	GIRDER #	CAP 5 DETAILS	HANSON JOB NO. 6716
	DATE: / INITIAL:	HANSON DWG. FILE 6716-CP5.DWG / CHECKED BY: D.R.H.	SHEET 8 OF 11

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Column Fabrication

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Fabrication-Columns

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Fabrication-Columns

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Fabrication-Columns

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Fabrication-Columns

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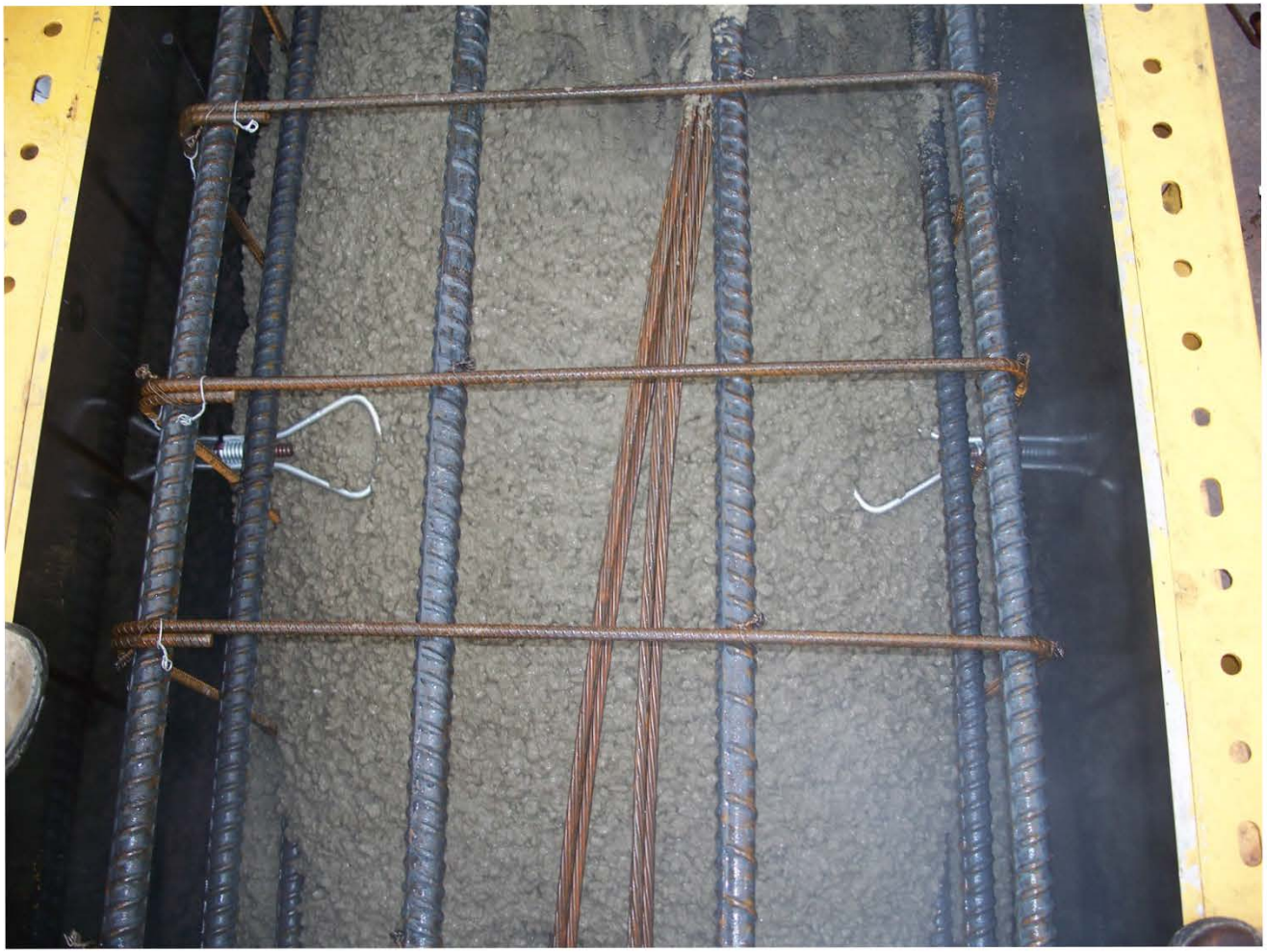
Fabrication-Columns



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Cap Fabrication

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Fabrication-Caps

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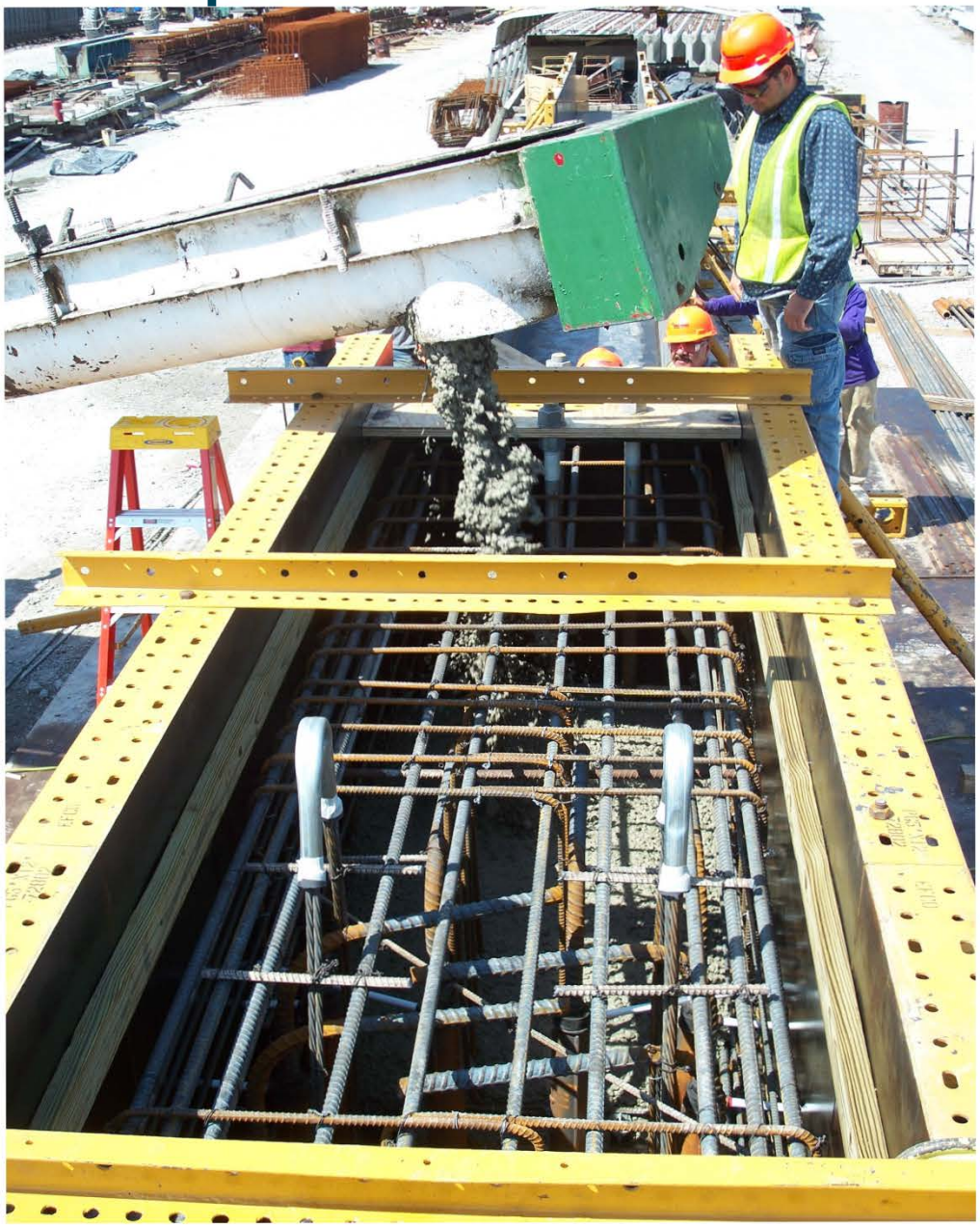
Fabrication-Caps

FORTERRA™

Fabrication-Caps



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Yard Storage Columns & Caps

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Yard Storage-Columns

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Yard Storage-Caps

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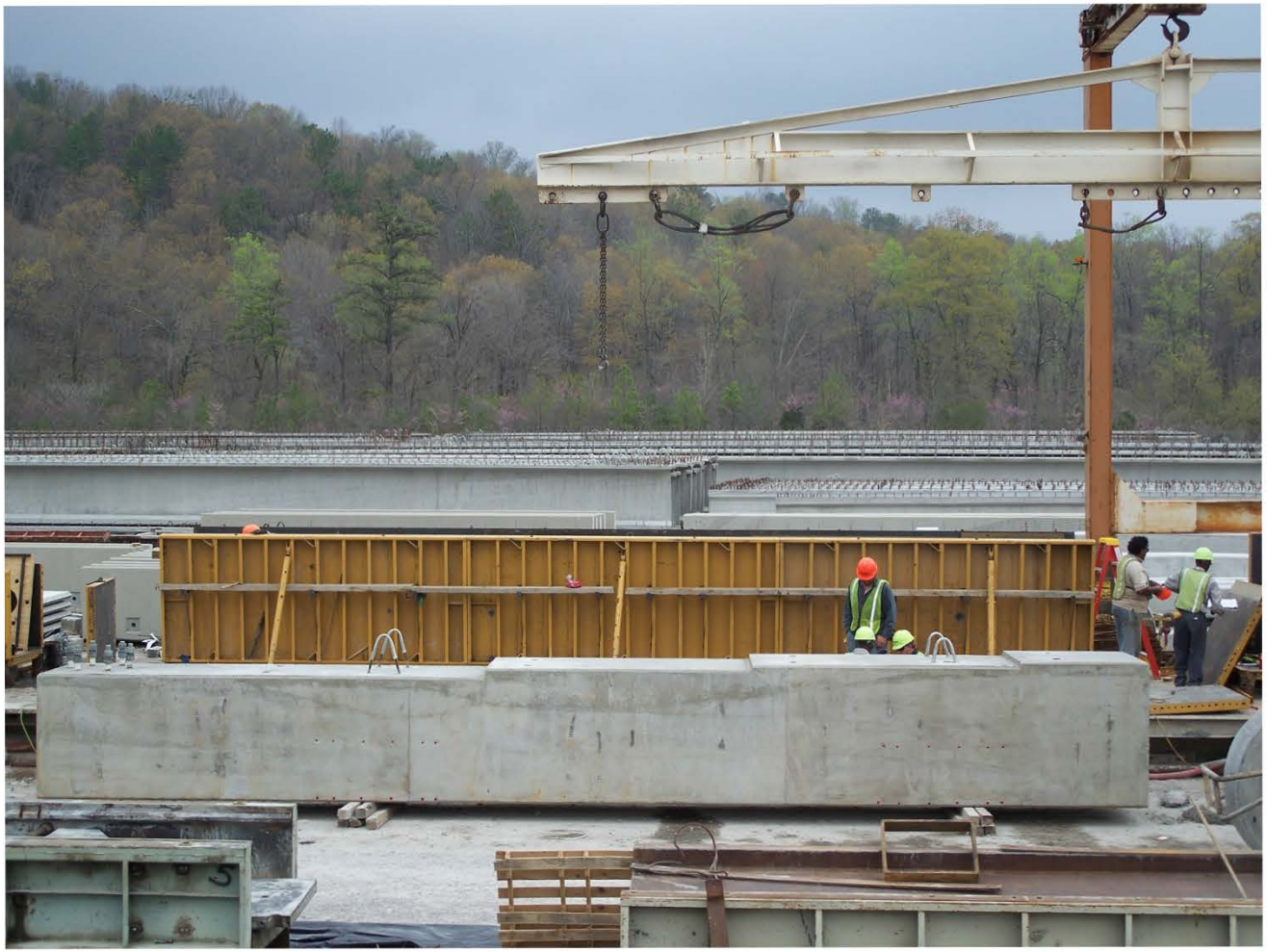
Yard Storage-Caps



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Precast Substructure Erection

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Field Erection-Columns

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Field Erection-Columns

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Field Erection-Columns

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Field Erection-Columns

FORTERRA™

Field Erection-Columns

FORTERRA™

Field Erection-Columns

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Field Erection-Caps

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Field Erection-Caps

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Field Erection-Caps

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Completed Substructure

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ALDOT Testing

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ALDOT Testing

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ALDOT Testing

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Test Results

Grout Cube Breaks @ 21 Days:

- 11,080 psi
- 11,370 psi
- 12,050 psi
- 12,830 psi

Splice Testing Results:

Required Load @ 125 % fy for #11 Bar = 117,000 lbs.

Test Specimen #1 Max Load = 152,200 lbs. Failure Mode Broke Bar.
Test Specimen #2 Max Load = 145,200 lbs. Failure Mode Broke Bar.
Test Specimen #3 Max Load = 145,700 lbs. Failure Mode Bar Slipped.

Test Result = Pass.

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Spliced Precast U-Girders

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Spliced Precast U-Girder Bridges

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Spliced Precast Concrete U-Girder Bridges

- New Design Option for Urban Interchanges
- Aesthetically Pleasing Structures
- Combines Spliced Const. with U Beam Cross Sect.
- Locally Manufactured Precast Using Conventional Means and Methods

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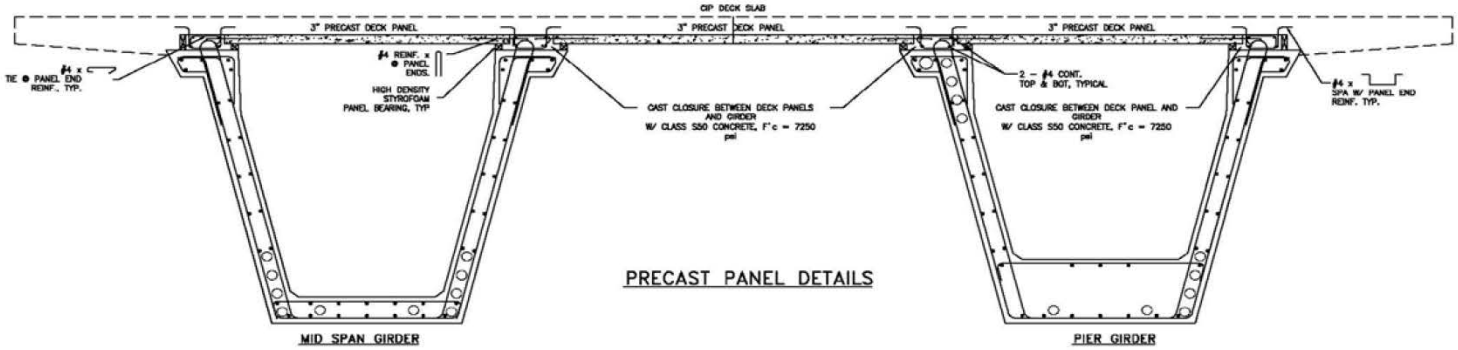
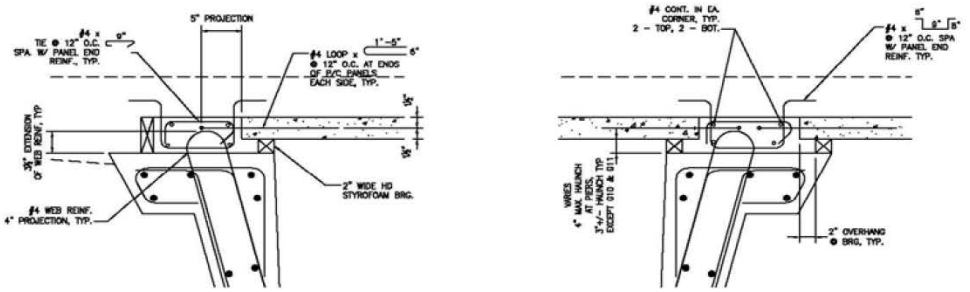
Precast Concrete U-Girders-Typical Section





CONNECTION OF PRECAST PANELS AT GIRDER FLANGES

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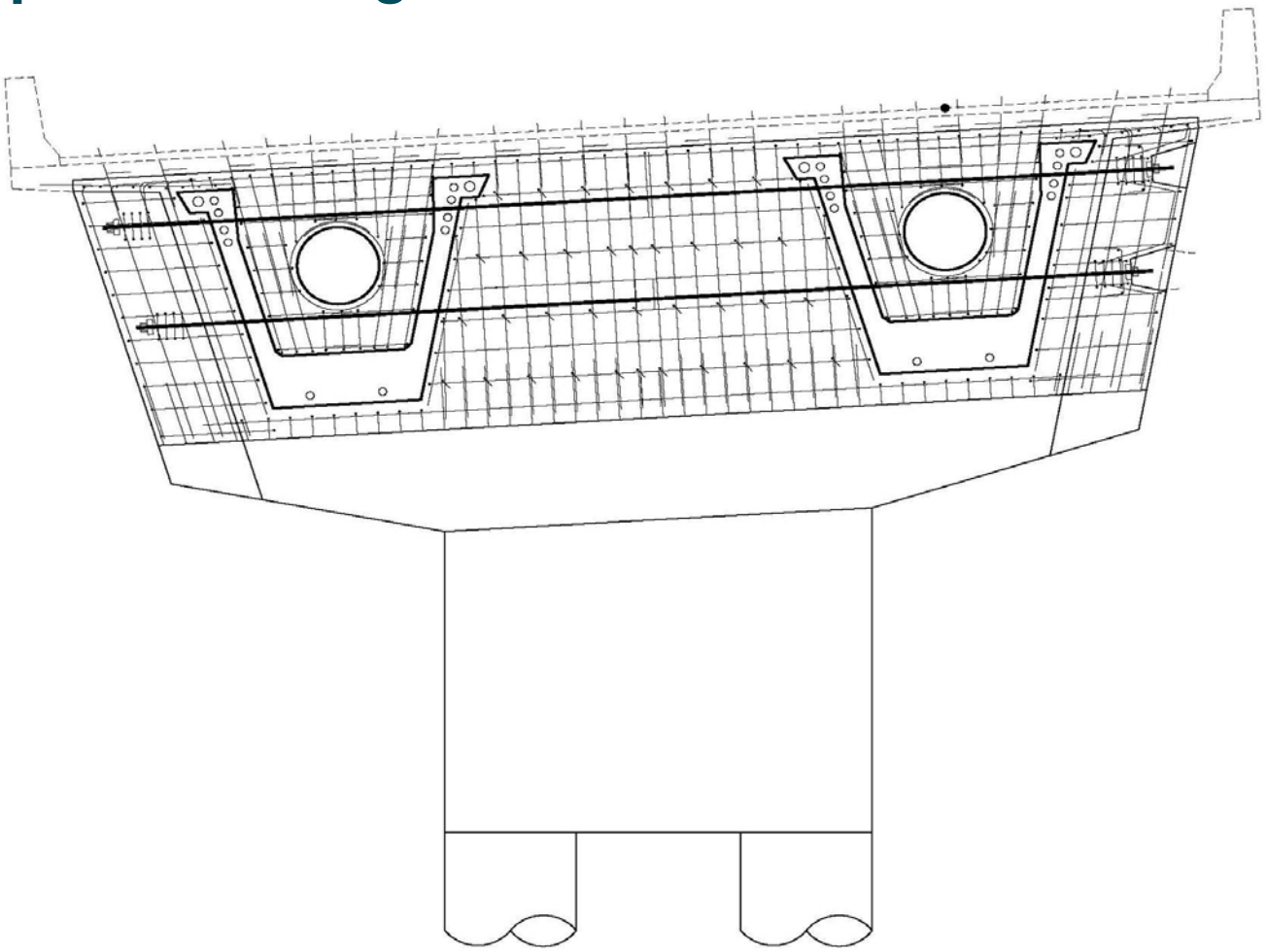
Interior Cap Reinforcing



ELEVATION – INTERIOR PIER DIAPHRAGM

- Composite Cap with 2 Rows of 4 @ 1 3/8” PT Bars
- Lower Section of Cap Supports Diaphragm Casting

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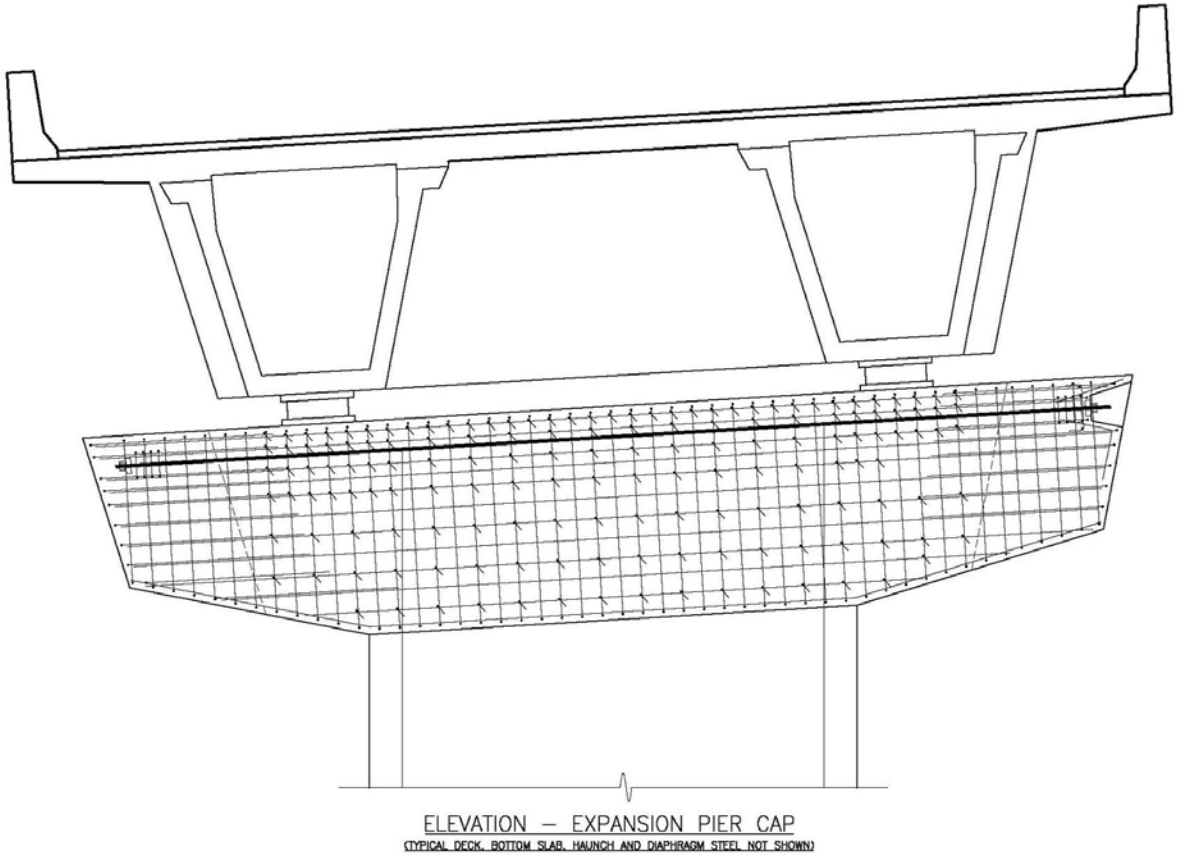
Expansion Pier Cap Reinforcement



- 8’-0” Wide x 7’-0” Deep
- Post-Tensioning 7 @ 1 3/8” Diam. PT Bars

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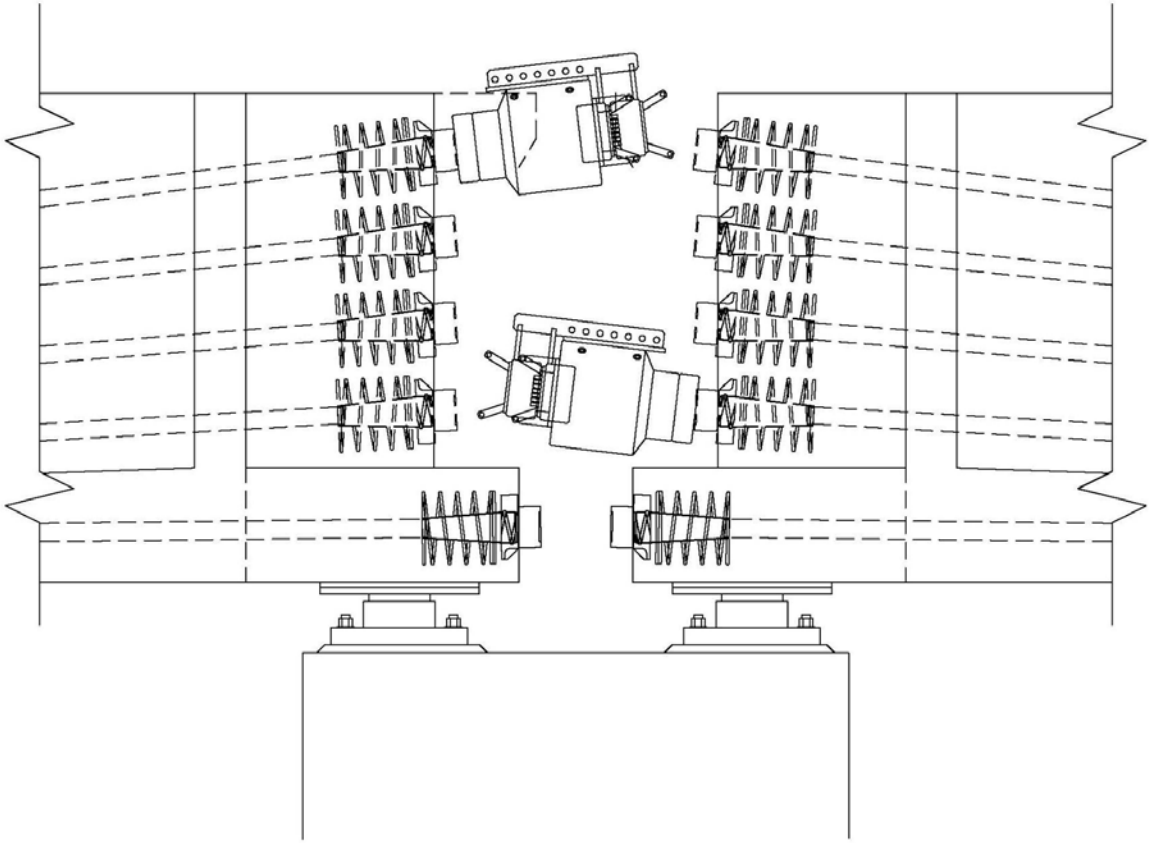
Post Tensioning Details at Expansion Piers



- Diaphragms Designed to Allow Double End Stressing

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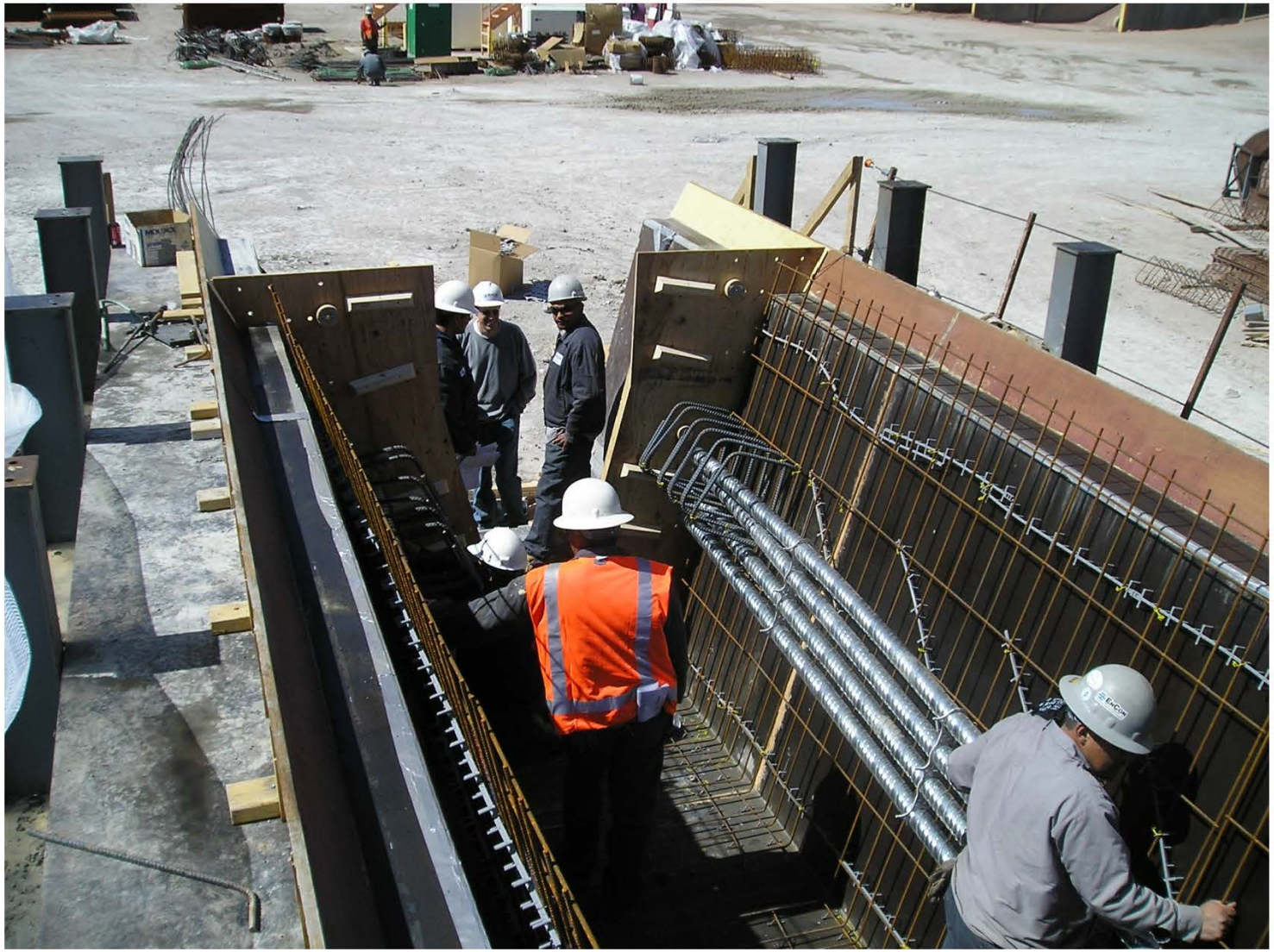
Fabrication



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Fabrication-Curved Casting Bed

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Fabrication

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Fabrication-Yard Storage

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Fabrication-Yard Storage

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Construction Sequence

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Substructure

- Flexible Piers and Foundations
- Integral Pier Caps at Interior Piers
- Expansion Joints at 600’-800’
- Bearings Eliminated Where Possible

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Girder Erection

- Erected with Conventional Cranes (240 to 300t)
- Set on Falsework Towers at Splices

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Girder Erection

- SH58 Ramp A
- Temporary Shoring Towers Spaced at 100’ (+/-)

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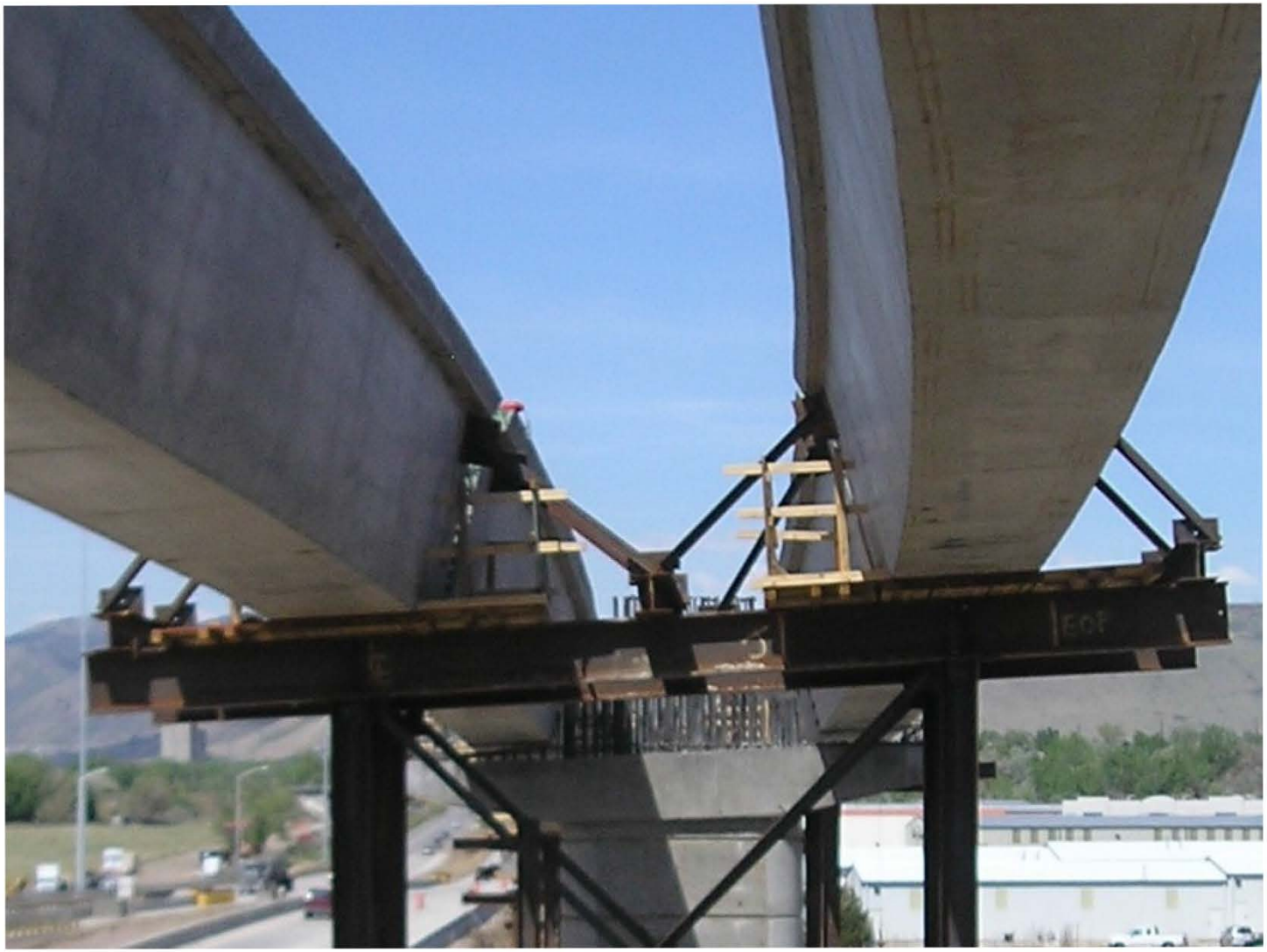
Girder Erection



- At Shoring Towers, Double Angle Braces Installed as Girders are Erected, Prior to Releasing Cranes

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Girder Erection

- Similar Bracing is Used at Abutments

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Girder Erection

- **Girders Supported on Straddle Bents at Skewed Traffic Opening. Special Shoring Condition.**

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Girder Erection

- When Shoring Towers are not an Option, Strong-Back Hanger Systems may be Utilized

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Girder Erection

- Another Example of Strong-Back Hanger System

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Closure Pours

- After Girder are Erected, Closure Pours are Cast

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Post-Tensioning

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Post-Tensioning

- Prior to Post-Tensioning, CIP Lid Slabs Installed to Close the U-Girders.
- This Work is Performed on Curved Sections

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Post-Tensioning

- Expansion Diaphragm at Abut. w/ PT Anchorages

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Post-Tensioning

- Expansion Pier with Access for Post-Tensioning Equipment

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Post-Tensioning

- Longitudinal Post-Tensioning Operation at Exp. Pier

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Deck Pour

- After Post-Tensioning, Shoring is Removed
- Deck is Formed and Poured Using Conventional Methods

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Completed Structures

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Completed Structures

Recap:

- **U-Girder Cross Section Makes Casting Curved Girders Possible**
- **Using Straight and Curved Sections Creates Unified Aesthetics**

Hanson
HEIDELBERGCEMENT Group

Completed Structures

IH 25 over Platte River (Bronco Bridge)

Hanson
HEIDELBERGCEMENT Group

Completed Structures

Bijou Street Bridge

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Completed Structures

Austin Bluffs Overpass

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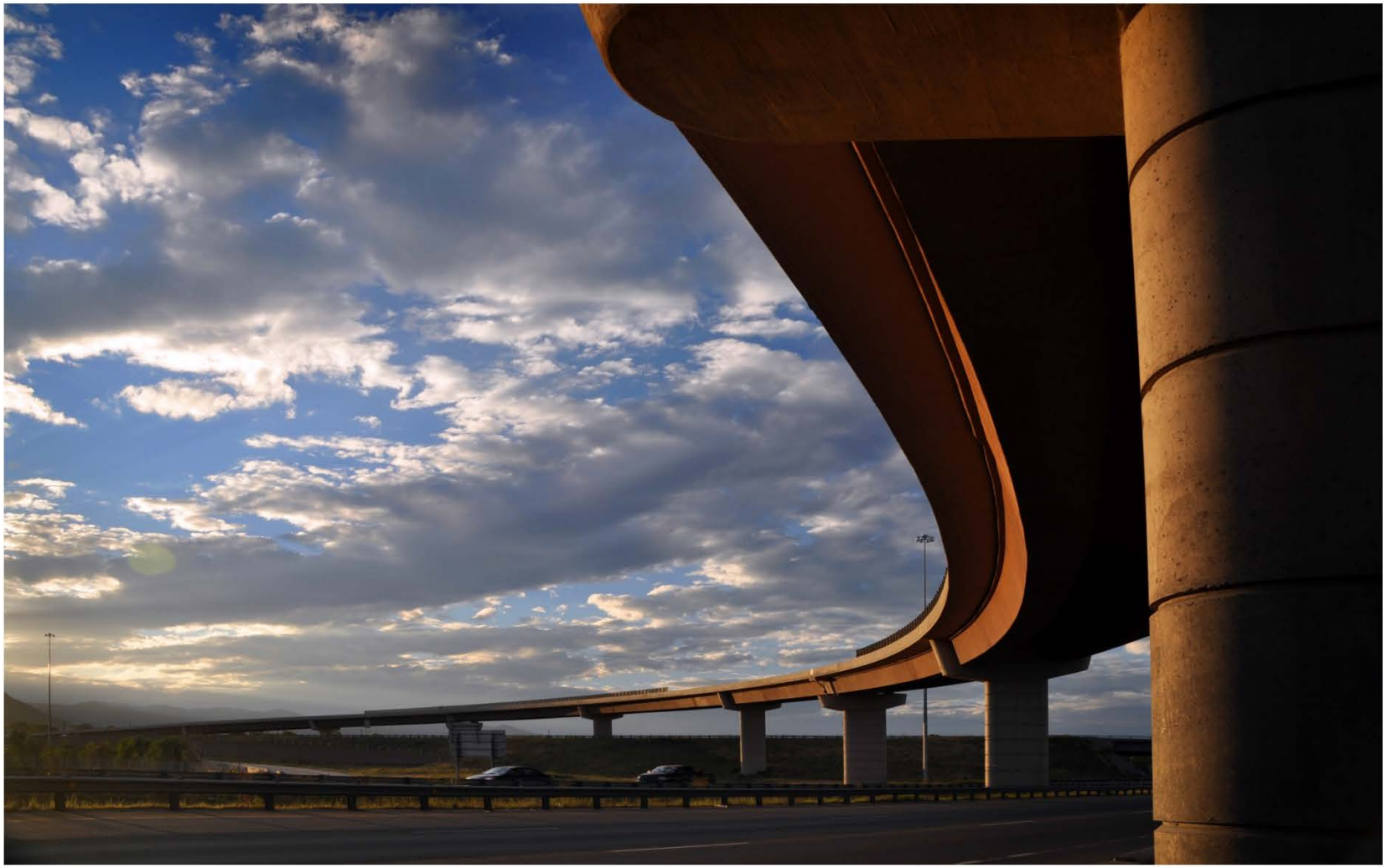
Completed Structures



SH 58 Ramp A

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Additional Information

PCI Zone 6 Web Site http://www.gcpci.org
Standard Drawings for U-Girders
Select:

- **Bridge Resources**
- **Bridge Products**
- **PCI Zone 6 (SE Region) Curved Spliced U-Girders**

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NEXT Beam
(Northeast Extreme Tee)

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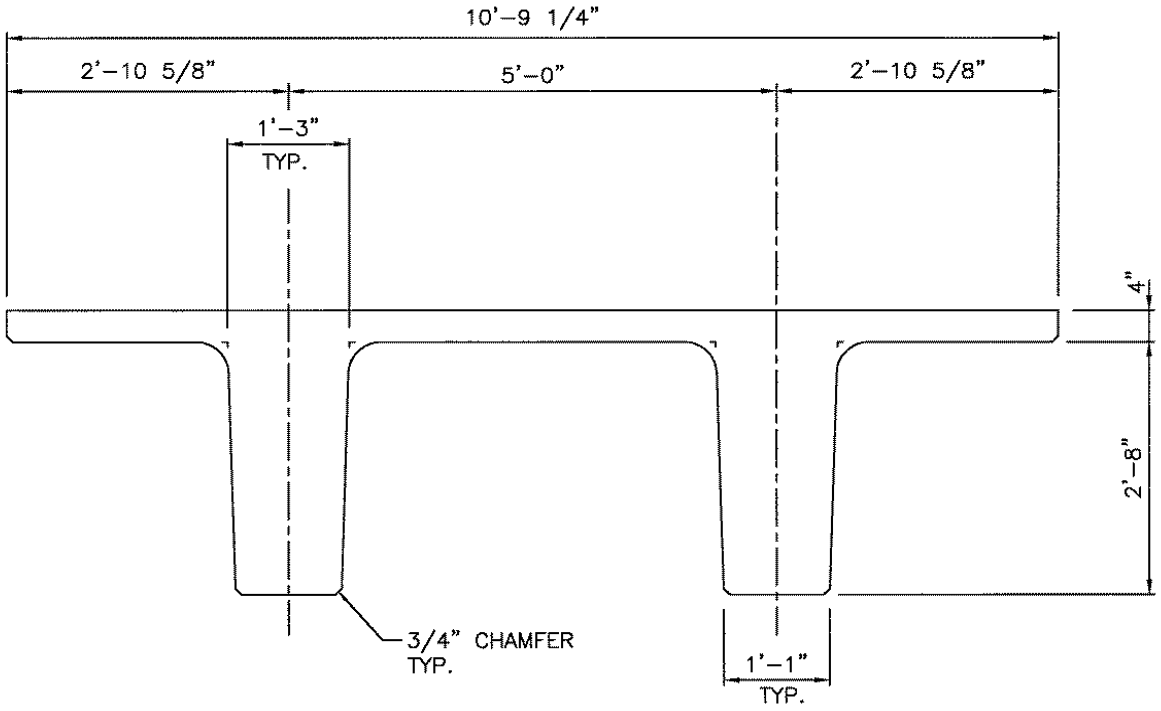
NEXT Beam-Typical Section



36" NEXT F-BEAM
TYPICAL SECTION - 40 ft. CLEAR ROADWAY
AREA = 1,413 in
(1,483 lbs./ft.)

Project: Decatur County, Georgia
SR 97 over Big Slough
4 Spans @ 70 feet

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NEXT Beam Form

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NEXT Beam-Storage

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NEXT Beam-Jobsite

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Transportation

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Transportation

- Product Innovation has Driven the Requirement for Improved Hauling Equipment.
- Products Continue to Increase in Weight as Production Capabilities Improve.
- As Discussed, Product Weights in some States Approaching 250,000 lbs.
- In the Prestressed Concrete Industry, if you can't Ship It, You can't Make It.
- The Trailer Manufacturing Industry has Responded with Increased Weight Capacity Equipment.

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Transportation

- Transporting 200 ft. Long Girder
- Girder Depth 8’-4”
- Approximate Weight 250,000 lbs.

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Transportation

- Steerable Trailer 250,000 lb. Max Haul Weight
- Supported for Stability During Hauling

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Transportation

- Equipment must be able to Maneuver at Job Site

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Transportation

- 19 Axle Rig for Hauling U-Girders

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Conclusion

- Innovation is Alive and Well in the Prestressed Concrete Industry
- Today We've Covered Developments in Concrete Technology, Product Production and Transportation
- We Expect to see Continued Research and Improvement in these Areas
- Acknowledgement: Mr. Gregg Reese, P.E.
Summit Engineering
Denver, Colorado
- Thank You for Your Time!

FORTERRA™