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Innovations in the Prestressed Concrete Industry

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Concrete Technology
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
Concrete Technology

- Twin Shaft Mixer
- Fast, Thorough Mixing Action
Self-Consolidating Concrete

- Flowing Concrete
- Allows Placement Without Vibration
- Safer Working Environment
- Enhanced Surface Finish on Products
Self-Consolidating Concrete
Self-Consolidating Concrete
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 Draft Specification Developed
- Industry is Looking Forward to Final Implementation
Products
Precast Substructure Components
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.
Plant Production-Formwork
Column Fabrication
Fabrication-Columns
Fabrication - Columns
Fabrication-Columns
Fabrication - Columns
Fabrication-Columns
Cap Fabrication
Fabrication-Caps
Fabrication-Caps
Fabrication-Caps
Yard Storage Columns & Caps
Yard Storage-Caps
Yard Storage-Caps
Precast Substructure Erection
Field Erection-Columns
Field Erection-Columns
Field Erection-Columns
Field Erection-Columns
Field Erection-Columns
Field Erection-Columns
Field Erection-Caps
Field Erection-Caps
Field Erection-Caps
Completed Substructure
ALDOT Testing
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.**
Spliced Precast U-Girders
Spliced Precast U-Girder Bridges
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
Precast Concrete U-Girders-Typical Section

PRECAST PANEL DETAILS

CONNECTION OF PRECAST PANELS AT GIRDER FLANGES
Interior Cap Reinforcing

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

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

- Diaphragms Designed to Allow Double End Stressing
Fabrication
Fabrication-Curved Casting Bed
Fabrication
Fabrication-Yard Storage
Fabrication-Yard Storage
Construction Sequence
Substructure

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

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

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

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

- Similar Bracing is Used at Abutments
Girder Erection

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

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

- Another Example of Strong-Back Hanger System
Closure Pours

- After Girder are Erected, Closure Pours are Cast
Post-Tensioning
- Prior to Post-Tensioning, CIP Lid Slabs Installed to Close the U-Girders.
- This Work is Performed on Curved Sections
Post-Tensioning

- Expansion Diaphragm at Abutment w/ PT Anchorages
Post-Tensioning

- Expansion Pier with Access for Post-Tensioning Equipment
Longitudinal Post-Tensioning Operation at Exp Pier
- After Post-Tensioning, Shoring is Removed
- Deck is Formed and Poured Using Conventional Methods
Completed Structures
Completed Structures

Recap:
- U-Girder Cross Section Makes Casting Curved Girders Possible
- Using Straight and Curved Sections Creates Unified Aesthetics
IH 25 over Platte River (Bronco Bridge)
Completed Structures

Austin Bluffs Overpass
Completed Structures

SH 58 Ramp A
PCI Zone 6 Web Site [http://www.gcpci.org](http://www.gcpci.org)
Standard Drawings for U-Girders
Select:
- Bridge Resources
- Bridge Products
- PCI Zone 6 (SE Region) Curved Spliced U-Girders
Transportation
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.
Transportation

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

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

- Equipment must be able to Maneuver at Job Site
Transportation

- 19 Axle Rig for Hauling U-Girders
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
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