USE OF PRETENSIONED BENT CAPS IN TEXAS
Intro Slide

- Gregg A. Freeby, P.E.
  - Director, Bridge Division
  - Texas Department of Transportation

- Christopher P. Miller, P.E.
  - Transportation Engineer, Bridge Division
  - Texas Department of Transportation
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Conventionally Reinforced, Precast Bent Caps

- Introduced in the 1990’s
- Used to address issues with conventional cast-in-place caps
Cast-in-Place Construction Issues

- Concrete Quality
- Worker Safety
- Construction Time
US 290 Ramp G (1994)

- Precast Inverted-T straddle bents
- Lower Roadway Closure:
  - Conventional Caps: 41 days
  - Precast Alternative: 6 hours
Redfish Bay (1994)

- 0.5 mile bridge over Gulf Coast
- 44 Identical Bent Caps
Prestressed, Precast Bent Caps

- Same advantages as conventionally reinforced, precast caps
- Prestressing provides enhanced crack control
Prestressed, Precast Bent Caps

- Design Philosophy:
  - Symmetric Strand Patterns to eliminate camber
  - Limit cap weights to girder weights (or fabricator lifting limits)
  - Design for zero tension during transportation
  - Design for tension stresses below cracking for service load levels
Prestressed, Precast Bent Caps

- Initial Design Concept
  - Used for each of the projects that have been by TxDOT BRG Division
Prestressed, Precast Bent Caps

- Strands primarily along top and bottom faces
- Grouted-duct connection
  - Dowels extending from top of column into ducts in cap
Prestressed, Precast Bent Cap Standard

- Released April 2017
- Intended as an alternate for bridges using standard drawings
- Include standard in plan sets using standard designed interior bents supported on round columns
- Applies to bridges with following beam types:
  - TxGirders (Bulb Tees)
  - X-Beams (Spread Box)
  - Box Beams
  - Decked Slab Beams
  - Slab Beams
- No adjustments to quantities required
- No Special Specifications
## Prestressed, Precast Bent Cap Standard

### Designed Caps

<table>
<thead>
<tr>
<th>Superstructure Type</th>
<th>Cap Dimensions</th>
<th>Concrete</th>
<th>Prestressing Strands</th>
<th>Required Strands (Calculate Using Strength of Strands)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width (in)</td>
<td>Depth (in)</td>
<td>Diameter (in)</td>
<td>Tensile Strength (ksi)</td>
</tr>
<tr>
<td>Steel Beam</td>
<td>24</td>
<td>24</td>
<td>3.0</td>
<td>40</td>
</tr>
<tr>
<td>Decked Steel Beam</td>
<td>36</td>
<td>36</td>
<td>3.0</td>
<td>40</td>
</tr>
<tr>
<td>Box Beam</td>
<td>36</td>
<td>36</td>
<td>4.5</td>
<td>40</td>
</tr>
<tr>
<td>H-Beam</td>
<td>48</td>
<td>48</td>
<td>6.0</td>
<td>40</td>
</tr>
<tr>
<td>I-Beam (19x19x30)</td>
<td>42</td>
<td>42</td>
<td>4.5</td>
<td>40</td>
</tr>
<tr>
<td>I-Beam (24x24x30)</td>
<td>48</td>
<td>48</td>
<td>4.5</td>
<td>40</td>
</tr>
</tbody>
</table>

### Optional Design

### Section A-A

### Section B-B

### Interior Bent Sections

### Interior Bent Half Elevation

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Prestressed, Precast Bent Cap Standard

- Connection
  - Full-Depth pocket at column locations
  - Extend Column Reinforcing past to of column
  - Use concrete instead of grout
  - Class C or Class S concrete
Prestressed, Precast Bent Cap Standard

- Strands placed along side faces
  - Prevent strands from conflicting with pocket connection
Completed Projects

1. LP 1604, Bexar Co
2. FM 973, Travis Co
3. Pecos River Bridge, Crane Co
4. Fischer Store Road, Hays Co
1. LP 1604, Bexar Co

- 2014

- Prestressed Caps requested by contractor post-letting
- Eastern side of San Antonio
- Just north of IH 10
- Constructed in 2014
- 36 Bents Total (18 NB, 18 SB)
- Identical Length and Column Spacing
LP 1604 Bexar County, San Antonio, TX

- 18 Bents Installed in 3 Days for first bridge
- First Day: 2 Bents, Cross Creek    Second Day: 14 Bents    Third Day: 2 Bents
- Shims to create bedding layer and make-up elevation differences
- Beams can be placed onto cap once grout reaches 2500 psi
2. FM 973, Travis Co

- 2014

- Prestressed Caps requested by contractor post-letting
FM 973 over Colorado River, Travis Co

- 8 Bents Total (4 NB, 4 SB)
- Accelerated Construction Timeline
Approx 15 mins per from pick to release
Shear Keys
- Pre-installed rebar to avoid conflicts with strands
- Dowel to Duct Connection
- Grout
3. Pecos River Bridge, Crane Co

- 2016

- Original Plan Set required use of prestressed caps
Pecos River Bridge

- Remote site location:
  - No concrete batch plants nearby
- Decked Slab Beam Bridge
  - Earwalls, Bearing Seats
Pecos River Bridge

- Prestressed Abutments
Pecos River Bridge

- Precast Wingwalls
4. Fischer Store Road, Hays Co

- 2016

- Prestressed Caps provided as alternate to cast-in-place caps in plan set
Fischer Store Road

- Original Bridge washed out from major flood event
Fischer Store Road

- Emergency Replacement Project w/ Short Construction Timeline
Fischer Store Road

- Demolition/New Construction complete in approximately 80 days
Ongoing Research: 0-6863 2015-2017

- Full scale tests analyzing performance at varying service and strength load levels
Acknowledgements

- **Fabricator:**
  - Bexar Concrete Works

- **Contractor:**
  - Texas Sterling Construction Co. – LP 1604
  - Lane Construction – FM 973
  - Relmco Inc.- Pecos River Bridge
  - Dan Williams Co – Fischer Store Rd

- **Research Team**
  - Texas A&M and TTI
Moving Forward

- Implementation of research project 0-6863 findings

- Update Standards
  - Refinement of reinforcing details
  - Addition of voids to reduce shipping weight
  - Revised connection details for easier constructability

- Create a generalized prestressed standard for use with non-standard bridges

- Increase awareness and use of prestressed, precast standards across the state
Other ABC in Texas

- Bridge Decks
- Beam Systems
- Slides/Launches/Phasing
Bridge Decks - Full Depth Deck Panels

- SH 290 over Live Oak Creek
- 2008
Upcoming Waco Project
Beam Systems – Decked Slab Beams
Beam Systems - Decked TxGirders (Concept Only)
Lateral slide
- One project: Loop 345 San Antonio

SPMT
- None yet

Launching
- Only as an erection technique for concrete girders

Creative phasing
- Houston tied arches
- West 7th precast arches
Questions?

TxDOT Bridge Standards Website:
http://www.dot.state.tx.us/insdtdot/orgchart/cmd/cserve/standard/bridge-e.htm
(Precast Standards found under Miscellaneous Standards)