1. Background/Overview to NEXT Beams
2. Considerations for Bridge Applications
3. Accelerated Bridge Construction (ABC)
4. NEXT Beam Projects

**Background/Overview to NEXT Beams**

- Precast/Prestressed Concrete Institute (PCI) Northeast Region
  - Created bridge technical committee consisting of various PCI Producer Members, Owners/State DOTs, local Consultants, and PCI Northeast Region
  - The Northeast Extreme Tee (NEXT) beam is a variation to the traditional double-tee stemmed beams and is a precast/prestressed concrete section.
  - 2010 PCI Journal article "Development of the Northeast Extreme Tee (NEXT) beam for Accelerated Bridge Construction by Michael Culmo and Rita Seraderian

**Highlights**

- Short to medium span ranges
- Section depths vary from 24 to 36 inches
- Top flange width varies from 8 to 12 ft.
- Single form allows for variation in beam depths and widths by using fillers and/or adjustable side rails
- Distance between stems can accommodate utilities
- 4” top flange thickness acts as a stay-in-place form (eliminating deck forming)
- Variable top flange width allows for variable bridge widths to match/fit any combination of roadway number of lanes and shoulder widths
- Speed of construction (by eliminating field work)
- Top flange can be thickened to 8” and can act as the structural slab for the bridge
- Ease of fabrication by using straight prestressing strands

**NEXT F Beam Section**

Refer to PCI Bridge Design Manual for beam section properties

**NEXT D Beam Section**

Refer to PCI Bridge Design Manual for beam section properties
Design Criteria used to satisfy AASHTO LRFD Specs:
- $f'c_i$ up to 6.8 ksi
- $f'c$ up to 8.0 ksi
- Allowable tension at release = $0.24\sqrt{f'c}$(f'c)
- 0.6" diameter 270 ksi low-relaxation strands
- Refer to section 6.5.2 in PCI’s BDM for complete listing of design criteria

Considerations for Bridge Applications
- Design criteria
  - Functional requirements
  - Geometrics
    - Roadway typical section, alignment, & profile
    - clearances
    - Access
    - Right-of-Way
    - Utilities
    - Environmental
- Cost
  - Initial
  - Life-cycle
  - Road-user
- Time
  - Safety for both construction workers and public
- Durability
- Bridge Characteristics
  - Length
  - Typical section/width
  - Depth
  - Number of spans/substructure units
  - Material(s) type (superstructure & substructure)
- Geotechnical/foundations
- Aesthetics
- Seismic

Cost-Plus-Time (A+B) Innovative Contracting Method
A+B Bidding
The nature of Accelerated Bridge Construction projects is that a reduction in project time is desirable. The selection of the low bid can take into account the time component of the project. There are two common methods of addressing this in the bidding phase of the project.
A+B bidding is a method that assigns a value to the base bid price (the "A" component) and a value to a time component (The "B" component). The low bid is determined the sum of these two components.
- The "A" component is the dollar bid for the contract work items.
- The "B" component is the time to complete the project or a portion of the project converted to dollars, usually by using road user cost models that compute the “cost” of road user delays.

Accelerated Bridge Construction (ABC)
Goals & Initiatives
- Minimize traffic disruptions and/or road closures during bridge construction
  - Reduce user delay-related costs
- Improve work-zone safety
- Improve bridge construction quality and/or durability
- Minimize disruption to environmentally sensitive areas
- Promote standardization
- Take advantage of site accessibility and/or existing right-of-ways
- Reduce construction time
  - Accelerate the overall project
  - Utilize accelerated bridge construction techniques
Accelerated Bridge Construction (ABC) Considerations

- High traffic volumes
- Right-of-way
- Environmental
- Time
- Cost
- Construction quality
- Safety
- Mobility impacts
- Availability of Prefabrication Bridge Elements
- ABC Technologies
- Planning, Design, & Construction
- Site Selection
- Contracting/Procurement/ Delivery Methods
- Construction equipment and/or means-and-methods
- Standardization
- Construction Specifications and Materials

Accelerated Bridge Construction (ABC) Technologies

- source: FHWA Every Day Counts Initiative from USDOT/FHA Accelerated Bridge Construction Manual (Publication No. HIF-12-013)
- ALDOT Ross Clark Circle (Dothan) Bridge Slide Project utilized the following ABC technologies:
  - Prefabricated bridge elements (PBEs)
  - Fast Track Contracting (i.e., design-build and incentive/disincentive clause)
  - Structure Placement Methods (i.e., horizontal slide)

NEXT Beam Projects

- 20 Projects are listed on PCI's Northeast Regions website
  http://www.pcine.org/index.cfm/projects/next-beam
- MassDOT, NYSDOT, and PENNDOT have standards for NEXT beams
- Rita L. Seraderian, P.E., FPCI, LEED AP
  Executive Director
  Precast/Prestressed Concrete Institute Northeast
  116 Radcliffe Road
  Belmont, MA 02478
  617-484-0506 or 888-700-5670

The first NEXT Beam bridge
Route 103 over the York River (York, Maine)

- PCI Journal Winter 2013 article by Lauren S. Gardner and Steven M. Hodgdon
  - “The first NEXT beam bridge”
- 7-span bridge
  - 510 ft. length, max. span = 80 ft.
- 36” NEXT F beams
- Shallow superstructure to maintain existing navigational clearances
- Increased roadway width
- Historic and environmentally sensitive site; accelerated bridge construction critical

- Six alternatives considered during preliminary design
  - Right-of-way limits
  - Profile requirements
  - Environmental impacts
  - Span configurations
  - Cost
  - Ease and duration of construction
- Dual-design superstructures carried into bids
  - NEBT
  - NEXT beams
- 4 of the 5 contractors bid the project using NEXT beams
- Project cost savings by reducing erection and construction time

Northeast PCI Region

- NEXT Beam Case Study webinar by Rita L. Seraderian
  Florida International University
  Accelerated Bridge Construction University Transportation Center
  (ABC-UTC)
  February 15, 2018

Georgia Department of Transportation (GDOT)

3.8 Other Precast Concrete Beams

3.8.1 General

Several new precast beam types are being utilized by the Bridge Office to provide options for rapid delivery and rapid construction for select bridges in the state. These beam types are the cored slab beam, box beam and Next-F beam. Table 3.8.1-1 shows general guidance for appropriate use of these beam types.

If any of these beam type are selected, contact the Bridge Office for current standard details and drawings.

Table 3.8.1-1 Guidance For Use of New Precast Beam Types

<table>
<thead>
<tr>
<th>Bridge Type</th>
<th>Cored Slab</th>
<th>Box Beam</th>
<th>Next Beam</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Span Lengths</td>
<td>20 ft. to 70 ft.</td>
<td>40 ft. to 70 ft.</td>
<td>40 ft. to 70 ft.</td>
</tr>
<tr>
<td>PDT</td>
<td>&lt;= 2000 yds.</td>
<td>&lt;= 2000 yds.</td>
<td>Not limited</td>
</tr>
<tr>
<td>Truck Volume</td>
<td>&lt;= 100 yd.</td>
<td>&lt;= 100 yd.</td>
<td>Not limited</td>
</tr>
<tr>
<td>Minimum Width</td>
<td>24&quot; gutter to gutter</td>
<td>26&quot; gutter to gutter</td>
<td>30&quot; gutter to gutter</td>
</tr>
</tbody>
</table>
GDOT NEXT beam projects

<table>
<thead>
<tr>
<th>Project Name</th>
<th>NEXT Beam</th>
<th>Span</th>
<th>Project Type</th>
<th>Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>0007171, SR 97 over Big Slough, Decatur County</td>
<td>NEXT F, 36&quot;, 10'-9¼&quot;</td>
<td>57'-0&quot;</td>
<td>Bridge Replacement</td>
<td>2016</td>
</tr>
<tr>
<td>0007181, SR 64 over Ten Mile Creek, Lanier County</td>
<td>NEXT F, 32&quot;, 9'-3¼&quot;</td>
<td>67'-0&quot;</td>
<td>Bridge Replacement</td>
<td>2017</td>
</tr>
<tr>
<td>0007180, SR 171 over Little Ockeepee River, Johnson County</td>
<td>NEXT F, 36&quot;, 9'-9¼&quot;</td>
<td>87'-0&quot;</td>
<td>Bridge Replacement</td>
<td>2017</td>
</tr>
<tr>
<td>0007161, SR 32 over Little Satilla River O/F, Brantley County</td>
<td>NEXT F, 32&quot;, 10'-9¼&quot;</td>
<td>53'-0&quot;</td>
<td>Bridge Replacement</td>
<td>2017</td>
</tr>
</tbody>
</table>

GDOT NEXT beam project
SR 97 over Big Slough, Decatur County

4-spans (70-70-70-70 ft.)
36" NEXT F-beams
Photos and shop drawings provided by FORterra (Pelham, AL)

Alabama NEXT beam project

- Bridge Replacement on Dunlap Drive over Pinto Pass (Mobile, AL)
- Design by ALDOT Bridge Bureau
- 60 ft. single span
- 28" NEXT D beams

Google maps

Baldwin County Highway Department (BCHD)
Baldwin County, AL

BCHD Bridge Retrofits

Project Goal
1. Replace the superstructure and re-use the Existing Substructures/Bents
2. Consider accelerated construction techniques/solutions
3. Address long-term serviceability and bridge maintenance
4. Maintain existing right-of-way

Retrofit Options to Replace the Existing Superstructure
- Conventional AASHTO Type I girders with a cast-in-place deck and modified roadway profile and regrading at approaches (would require roadway profile to be raised approx. 1.4 ft. including regrading of approaches with possible bank stabilization and possible ROW impacts)
- Double Tee/NEXT beams with 8-inch top flange and UHPC joints (would match roadway profile and eliminate roadway improvements and maintain existing ROW)

UHPC Resources
- Ultra-High Performance Concrete: A State-of-the-Art Report for the Bridge Community
- FHWA-HRT-14-084 (Design and Construction of Field-Cast UHPC Connections) and FHWA-HRT-11-038 (Ultra-High Performance Concrete)
- FHWA-HRT-14-090 (Bond Behavior of Reinforcing Steel in Ultra-High Performance Concrete)
- Suggest attending Benjamin Graybeal’s (FHWA) presentation tomorrow on “Ultra-High Performance Concrete and its Use for Accelerated Bridge Construction”
BCHD Bridge Retrofits

Bridge Typical Sections

- AASHTO Type I girders w/ CIP Deck
- NEXT D beams with UHPC

**Construction Schedule**

<table>
<thead>
<tr>
<th>Construction Activity</th>
<th>Description</th>
<th>Duration, weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>miscellaneous mobilization</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>remove existing channel beams</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>erect AASHTO Type I girders</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>form &amp; pour</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>form &amp; pour NEXT D beams</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>place metal deck forms</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>pour deck</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>pour bridge barrier</td>
<td>2</td>
</tr>
<tr>
<td>9</td>
<td>form &amp; pour end slabs</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>approach roadway reinforcement</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>approach roadway embankment</td>
<td>1</td>
</tr>
</tbody>
</table>

**Subtotal (weeks)** = 18

<table>
<thead>
<tr>
<th>Construction Activity</th>
<th>Description</th>
<th>Duration, weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>miscellaneous mobilization</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>remove existing channel beams</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>erect NEXT D beams</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>form &amp; pour UHPC joints</td>
<td>1.5</td>
</tr>
<tr>
<td>5</td>
<td>form &amp; pour bridge barrier</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>place precast end slabs &amp; pour UHPC joints</td>
<td>3.5</td>
</tr>
</tbody>
</table>

**Subtotal (weeks)** = 10

**Construction Sequence**

**Existing Bridge**

- Step 1: remove existing superstructure
- Step 2: erect NEXT beams
- Step 3: pour UHPC joints

**New Bridge**

- Step 1: remove existing superstructure
- Step 2: erect NEXT beams
- Step 3: pour UHPC joints
BCHD Bridge Retrofits
Construction Sequence

Step 4: pour barriers

Q/A

“Next Beam Bridge Applications

“The road to success is always under construction.”