PCINE NEXT Beams

Northeast Extreme Tee Beam
“NEXT Beam”

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Presented by:
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Bridge Department Manager
Beam, Longest and Neff, LLC

PCINE Bridge Technical Committee

- Established in 1990
- State DOT’s Engineers, Consultants & Precasters
- Focus is on Updating and Developing Regional Standards for ABC Bridge Construction since 2004

**Precasters**
- Rita Seraderian - PCI Northeast
- Joe Carrara - J. P. Carrara & Sons
- Ben Cota - J. P. Carrara & Sons
- Chris Fowler - Oldcastle Precast
- Jared Steller - Dailey Precast
- Scott Harrigan – Fort Miller
- Chris Moore – United Precast
- Troy Jenkins - NPP

**Consultants**
- Michael Culmo - CME Associates, Inc.
- Eric Calderwood - Calderwood Engr.
- Vartan Sahakian -Commonwealth Engr.
- Darren Conboy - Jacobs Engr.
- Ed Barwicki - Lin Associates

**State DOT**
- Tim Fields – CTDOT
- Bryan Reed - CTDOT
- Robert Bulger – Maine DOT
- Brian Reeves – Maine DOT
- Alex Bardow - MassDOT
- Maura Sullivan – MassDOT
- Edmund Newton – MassDOT(retired)
- Duane Carpenter – NYSDOT
- Michael Twiss – NYSDOT
- Jason Tremblay –NHDOT
- David Scott - NHDOT
- Mike Savella - Rhode Island DOT
- Rob Young – Vermont AOT
Why Develop a New Bridge Section?

Box Beams have limitations

- Closed cells limit inspection
- Geometric limitations
- Durability concerns
- Multi-step fabrication process
**Development of the NEXT Beam**

- Started in 2006 – Completed in 2008
- Open Double-Tee, Single-Pour Production
- Reduced Fabrication and Installation Cost
- Width varies from 8 ft to 12 ft
- Spans: 20 ft to 80 ft
- Works well for Accelerated Construction (ABC)

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**Development of the NEXT beam**

Depth 24” – 36” in 4” increments  
Typical Span Range 20’ – 80’  
Width will vary 8'-0” – 12'-0”

<p>| | |</p>
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<td>Dimension A (minimum 7'-11½&quot;) for 8'-0&quot; beam spacing</td>
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<tr>
<td>1/4&quot; CHAMFER (TYP)</td>
<td>1/4&quot; DRAFT ON EDGE</td>
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*NEXT F BEAM*
NEXT Beam Shapes

NEXT “F” plus 8” CIP Deck
- No Forming between Flanges
- Easily Accommodates Vertical Curves w/CIP Topping
- Easily Handles Camber Variations between Members

NEXT “D” no CIP Deck
- No CIP Topping/Deck
- Best Section for ABC
- Special Concrete for Flange Connection

NEXT “E” plus 4” CIP Deck
- Uses Less Topping & Reinforcement
- Flange Connection Made with CIP
- Easily Accommodates Vertical Curve
- Easily Handles Camber Variations between Members

Development of the NEXT beam

NEXT “F” BEAM
- Top Flange to act as form only
- Shear Reinforcement kept to #4 bars to maximize cover
- Designer to verify flange reinforcement based on deck thickness
Development of the NEXT beam

NEXT “D” BEAM
- Top Flange is a structural deck
- Shear Reinforcement kept to #4 bars to maximize cover

NEXT “E” BEAM
- Top Flange to act as bottom portion of the deck
- Shear Reinforcement kept to #4 bars to maximize cover
- Design of deck should be based on conventional CIP concrete deck
## NEXT Beam Properties

### NEXT Beam - Section Properties

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### NEXT Beam Details

- **NEXT Beam - Main Deck Reinforcing Details**
- **NEXT Beam - Angle Connection Details**
- **NEXT Beam - Main Connection Details**
- **NEXT Beam - Shear connector details**
- **NEXT Beam - Lintel attachment details**
- **NEXT Beam - Main Ballasting Drawing**

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PCINE NEXT Beams

2/16/2016
NEXT Beam Details

NEXT F - SAMPLE INTEGRAL ABUTMENT SECTION

NEXT Beam Details

NEXT F - SAMPLE SEMI-INTEGRAL ABUTMENT SECTION
Chapter 6 - Preliminary Design

6.9 Prelim. Design Charts
- NEXT Type D Beams
- NEXT Type F Beams

6.10 Prelim. Design Data
- NEXT Type D Beams
- NEXT Type F Beams

Chapter 9 - Design Examples

Example 9.7
- NEXT Type 36 D
- Single Span
- Non-Composite Deck

Example 9.8
- NEXT Type 36 F
- Single Span
- Composite Deck
CHAPTER 6
PRELIMINARY DESIGN

6.10 Preliminary Design Data

Table NEXT-5
NEXT Beam Type F x 96

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NEXT Beam 28 F x 80-Wide Beam

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PCI BRIDGE DESIGN MANUAL

CHAPTER 9, DESIGN EXAMPLE 9.8
DOUBLE-TEE BEAM (NEXT 36 F), SINGLE SPAN, COMPOSITE DECK

9.8 Transformed Sections, Shear General Procedure, Refined Losses

9.8.1 INTRODUCTION
This design example demonstrates the design of an 80-ft, single span, PCI Northeast Extreme Double-Tee bridge with no skew. This example illustrates in detail the design of a typical interior beam at the critical sections in positive flexure, shear, and deflection due to prestress, dead loads, and live load. The superstructure consists of five beams spaced at 8-ft-10½-in. centers, as shown in Figure 9.8.1.1. Beams are designed to act compositely with the 6-in-thick cast-in-place concrete deck to resist all superimposed dead loads, live loads, and impact. A ½-in-thick wearing surface is considered to be an integral part of the 6-in-thick deck. Design live load is HL-93. The design is accomplished in accordance with AASHTO LRFD Bridge Design Specifications, Fifth Edition, 2010, and the 2011 Interim Revisions. Elastic stresses from external loads are calculated using transformed sections. Shear strength is calculated using the general procedure. Time-dependent prestress losses are calculated using the refined estimates.

Figure 9.8.1.1
Bridge Cross Section
Top Tension Crack Memo

Limit the top tension stresses to 0.2 ksi at release.
Limit Skew to 20 degrees.

Bridge beams where minor controlled transverse cracking is acceptable. AASHTO LRFD Bridge Design Specifications, Article 5.9.4.1.2. AASHTO Table 5.9.4.1.2-1

Management of top tension stresses at beam ends:
- 25% Debonding
- Bonded top tension reinforcement will not prevent cracks.
- Top strand should not be used to fulfill this article.
- Sand spacing of mild reinforcement should be per AASHTO Article 5.7.3.4.

AASHTO LRFD Bridge Design Specifications, Article 5.9.4.1.2.

Additional Guidance on website www.pcine.org

• FAQ
• Design Assumptions
SHRP2 Research Project

Transportation Research Board Project
**SHRP 2 - Innovative Bridge Designs for Rapid Renewal**
ABC Toolkit

www.trb.org/main/blurbs/168046.aspx

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**NEXT Beam Production**

[Image of NEXT Beam Production process]
NEXT Beam Production

NEXT Beam Shipping
Maine DOT Project

Maine DOT Project
South Worthington, MA – Total Precast Built in 60 Days

South Worthington, MA – Total Precast Built in 60 Days
South Worthington, MA – Total Precast Built in 60 Days

South Worthington, MA – Total Precast Built in 60 Days
South Worthington, MA – Total Precast Built in 60 Days
**TIMELINE NEXT Beam Developed in 2008**

- **2009**: First NEXT Beam Cast
- **2010**: 2 Bridges
- **2011**: 7 Bridges
- **2012**: First NEXT D bridges are Built in Maine & Vermont, MA and NY build first Bridges
- **2011-12**: Logan Airport uses NEXT beams for Runway Extension and new Airport Viaduct
- **2013**: NY built First Lateral Slide
- **2014**: First Curved Flange Project
- **2015**: NJ and RI build their first projects
- **2016**: NY built First Lateral Slide

**NEXT Beam Acceptance - States with NEXT Beams**

- Massachusetts DOT
- Vermont AOT
- Maine DOT
- Rhode Island DOT
- New Hampshire DOT
- New York State DOT and New York City DOT
- New Jersey DOT
- Delaware DOT
- Pennsylvania DOT
- Virginia DOT

**States with NEXT Beam in Design/Construction:**

- Connecticut DOT

New Brunswick has also adopted the new shape for Canada
Questions?