ABC-UTC September 2019 Monthly Webinar – 09/19/19

Agenda:
• Project Challenges – Precast Segmental Solutions
• Simplicity Drives Process
• Lesson Learned – Best Practices
• Questions and Answers
Precast Segmental Bridges for the LaDOTD I-49/I-220 Interchange
PUBLIC DEMAND FOR AESTHETICS
LOW COST, NO COST SOLUTIONS

Precast Segmental Bridges for the LaDOTD I-49/I-220 Interchange

Project Challenges - Precast Solutions
URBAN INTERCHANGE
SPAN LAYOUT AND CROSS SECTIONS

- Spans varies from 140 ft to 260 ft
- Segments depths varies from 9 ft to 13 ft
- Pier heights range from 14 ft to 90 ft
- Cross section widths varies from 31.5 ft to 50.83 ft
- Horizontal curve radius varies from 550 ft to 3,500 ft
- Minimize number of machines and form changes
- Small number of segments with a lot of variation
- Consistency of bulkheads, post-tensioning, and rebar layouts
- Segment depth, width, and weights
• Cast segments on site versus existing facilities away from site
• Site offices and labor – one versus multiple locations
• Variance in pier heights and span lengths
• Erection methods
• Casting yard and storage close to site
• Casting yard on available right of way
• Casting machines capable of segment dimension changes
• Efficient yard layout
• Matchcast from pier segment to center of span
• Minimize forming requirements – constant column and cap
• Variable pier heights handled with constant column details
• Aesthetics enhancements where form follows function
• Simple reinforced concrete footings, pier columns, and caps
• Integration of bridge aesthetics with construction and future maintenance
Drill Shaft Capacity - 970 tons to 1,600 tons required nominal resistance
Length Range from 39 ft to 90 ft
Drill Shaft spacing typically 16.5 ft
Footing size from 24.5 ft x 41 ft x 8.5 ft up to 41.5 ft x 57.5 ft x 9.5 ft
Temporary towers sit on footing
SITE ACCESS FOR CASTING YARDS, SUBSTRUCTURE, & SUPERSTRUCTURE CONSTRUCTION

- Modular towers used for cantilever stability during construction
- Accessibility of erection cranes
- Non-linear construction sequence
- Segments pre-positioned for crane erection
- Faster, Simpler & Competitive
CROSS SECTIONS ADAPTATION TO VARYING ROADWAY WIDTHS AND SEGMENT DEPTHS

- Constant exterior shape
- Varying wing widths
- Accommodated by one casting machine
- Special segments (pier, abutment, and deviator) with modified form panels
CROSS SECTIONS ADAPTATION TO VARYING ROADWAY WIDTHS AND SEGMENT DEPTHS

Precast Segmental Bridges for the LaDOTD I-49/I-220 Interchange
CROSS SECTIONS ADAPTATION TO VARYING ROADWAY WIDTHS AND SEGMENT DEPTHS

Precast Segmental Bridges for the LaDOTD I-49/I-220 Interchange
POST-TENSIONING LAYOUTS
CANTILEVER INTERNAL TENDONS

Precast Segmental Bridges for the
LaDOTD I-49/I-220 Interchange

Simplicity Drives Process
POST-TENSIONING LAYOUTS
BULKHEAD FOR INTERNAL POST-TENSIONING

Precast Segmental Bridges for the LaDOTD I-49/I-220 Interchange
POST-TENSIONING LAYOUTS
EXTERNAL CONTINUITY TENDONS

PreCast Segmental Bridges for the LaDOTD I-49/I-220 Interchange

Simplicity Drives Process
POST-TENSIONING LAYOUTS
ELEVATIONS EXTERNAL TENDONS

Precast Segmental Bridges for the
LaDOTD I-49/I-220 Interchange
Diabolos allow standard inserts for varying tendon geometry
Eliminates schedule 40 pipe
Continuous HDPE ducts
Reduces cross section thickness and weight
Easier to install, inspect, and maintain
USE OF DIABOLOS AND EXTERNAL POST-TENSIONING

Precast Segmental Bridges for the LaDOTD I-49/I-220 Interchange

Simplicity Drives Process
DIABOLO VERSUS STEEL PIPE FOR EXTERNAL TENDONS

Precast Segmental Bridges for the LaDOTD I-49/I-220 Interchange
LIMITED NUMBER OF SEGMENT TYPES

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- Maximize use of common casting machines and details!
• Same temporary support system at each pier location
• One crane size for all segmental erection
• Consistent erection procedures for all segmental cantilevers and ramps
BALANCED CANTILEVER SUPERSTRUCTURE CONSTRUCTION

- Non-linear construction sequence
- Work at multiple locations at the same time
- Precasting and erection accelerate bridge construction
MISCELLANEOUS DETAILS

- **Bearings**
  - Multi-rotational, guided, and fixed disk bearings
  - Up to 3,100 kips service level design axial load in bearings
  - Up to 8 inches of total movement in bearings

- **Expansion Joints**
  - Finger joint expansion device
  - 4 inches to 10 inches of total movement in expansion device
  - Distance between expansion joints range from 700 ft to 1,900 ft

- **Drainage**
  - Drain Scuppers within cantilever wings of concrete box section
  - Drain pipe leads to catch basin at pier locations
Similar interchange flyover ramps
Variable spans and cross sections
First use of diabolos in Florida
Common segment details
Consistent casting and erection requirements
Similar aesthetics required
LESSONS LEARNED

- Experienced contractor with existing resources
- Variable segment depth, diabolos, and external post-tensioning
- Minimize exceptions and maximize commonality
- Consistency of methods and special equipment
- Balanced cantilever advantageous for critical path scheduling
- Construction simplicity drives cost efficiency
Questions and Answers

• LaDOT Panelists
  • Paul Vaught III, P.E. – Asst. Bridge Design Administrator
  • Bernard Sincavage, P.E. – District 04 Eastern Area Engineer

• FINLEY Panelist
  • Craig Finley, P.E. – Managing Principal
  • Ivan Liu, P.E. – Bridge Engineer
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