Design of the Birmingham CBD Segmental Bridges
Birmingham, AL

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Owners Perspective

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Project Needs – Functionally Obsolete
• Opened to traffic in 1973
• Designed for 80,000 vehicles per day
• Current traffic is 160,000 vehicles per day
• Projected 2035 traffic is 225,000 vehicles per day

Project Needs - Lifespan
• Original Construction – Early 1970’s
• Nearing end of 50-year lifespan
• Deteriorating bridge deck
Project Needs - Safety
• Eliminate 3 left lane entrance and exit ramps that are unsafe
• Add lanes and shoulders so disabled vehicles can be removed without stopping traffic

Project Decision
• This infrastructure is functionally obsolete and immediate action was required.
• Multiple options were considered; burying the interstate, rerouting the corridor, and simply re-decking the existing bridges.
• Most options included 20-year time spans and billion-dollar costs.
• ALDOT determined the best course of action would be new construction with a complete shut-down of the interstates.
• This would result in the shortest turnaround time and least disruption.

Why Segmental?
• Minimize duration of interstate closure by offsite prefabrication and rapid construction methods
• Increase span lengths
• Reduce noise
• Improve aesthetics

Placing the Last Segment
October 14, 2019
• 2,316 Segments
• 172 Spans
• Erected in only 217-days
Foundations

Challenges
• I-59/20 full closure for up to 14 months
• Limited right-of-way
• Utility conflicts
• Varying geotechnical conditions along project corridor
• Limited vertical clearance under existing bridges

Solutions
• Build as many foundations as possible, prior to closure of I-59/20
• Compact, low-overhead equipment
• Multiple foundation types (drilled shafts, micropiles & steel h-piles)

Foundation Types
Piers

- Single column piers under each girder line
- Piers are accented with vertical fluted lines
- Flared cap to compliment the sloped webs of the segmental girders
- Contractor elected to precast the piers
- Piers are cast as two (2) separate pieces – columns and caps
- Reinforcing is made continuous with grouted couplers
Superstructure Facts

- Over 1-million square feet
- Total Number of Spans = 172
- Typical Span Lengths = 165-ft
- Number of Segments = 2,316
- Typical Segment Depth = 9-ft
- Typical Segment Length = 12-ft

Bridge Superstructure Layout

5 Lanes 6 Lanes 4 Lanes

Design of the Birmingham Central Business District Segmental Bridge
Design of the Birmingham Central Business District Segmental Bridge
Longitudinal Post-Tensioning

• All external tendons
• Four (4) permanent tendons, with contingency for one (1) future tendon, per web, anchored at end diaphragms.
• Permanent Tendon Anchor Size = 22-strand
• Longer / Wider spans feature one (1) additional 12-strand anchorage at each deviation diaphragm
• Future Tendon Anchor Size = 12-strand

Accommodating Innovative Erection Method

• Design assumed traditional span-by-span erection – all segments supported by erection girders
• Contractor proposed system where each segment is supported individually
• Allows multiple headings
• Allows non-linear construction
• Structure verified post-design for the method used