Tennessee DOT’s Fast Fix 8 Project in Downtown Nashville
Module 3 – Jo Johnston Avenue Bridges

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Terry Mackie – Jones Bros., Inc. (Retired - TDOT)
Presentation Agenda

- Project Introduction
- Matrix of Options Considered & Selected
- Design Elements & Details
- Project Execution
- Questions
Fast Fix 8 Project Project Goals

- Minimize inconvenience to the traveling public and maximize safety of workers and the traveling public.
- Facilitate a collaborative partnership with all of the members of the project team and the stakeholders.
- Provide high quality design and construction products.
- Shorten the delivery time and delays at least two years.
Fast Fix 8 Project Objectives

• Rehabilitate with Accelerated Construction Methods with Only Weekend Interstate Closures
• All Interstate lanes must be operational during work week
• Maximize Value of Lane Closures (Working multiple tasks together)
• Reduce the number of weekend closures (13 Max. Allowed)
Jo Johnston Bridges

- Twin Three Span Continuous Bridges
- Length – 176’ – 10”
- Total Deck Area – ~25,500 SF
- AASHTO Type III – I Beams
- Previously Widened with 36” Box Beams
Pre-Construction Activities

• Working Group Meeting with:
  • TDOT Design Management Team
  • Gresham, Smith & Partners Design Team
  • Kiewit Infrastructure CM Group
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  - Identify Design / Construction Options
  - ROM Budget Impacts
  - Schedule Impacts
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• **Project Types Initially Considered**
  - Structural Steel Superstructure Units
  - Full Depth Deck Panels on Existing AASHTO Beams
  - New Box Beams and Full Depth Deck Panels
  - Lateral Bridge Slide
  - SPMT Bridge Move
  - Bridge Reconfiguration
Pre-Construction Activities

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  - Bridge Reconfiguration / Span Elimination
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- **Evaluation Criteria**
  - Primary Construction Costs
  - Temporary Construction Costs
  - Procurement Schedule
  - Construction Schedule
  - Impact on Existing Alignment / Profile
## Pre-Construction Activities

**Jo Johnston - Existing 3 Span Bridge - PC AASHTO I-Girder**

<table>
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<th>Type</th>
<th>Constr</th>
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<tr>
<td>3</td>
<td>PC</td>
<td>Single Span Conc Beams &amp; Deck Panels with MSE end spans</td>
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### Legend

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<td>(✓)</td>
<td>Acceptable</td>
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<tr>
<td>(-)</td>
<td>Least desirable</td>
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Lowest value for "Total Ranking" score is the preferred alternative.
Jo Johnston Specific Details

- Selected Option –
  - Eliminate End Spans – Use MSE Walls with Engineered Fill
  - Replace Center Span Superstructure with Box Beams & Deck Panels – “Stick Built”
  - Reuse Existing Bents - Modify Bearing Seats
  - Detail Precast Endwalls
  - Detail Precast Approach Slabs – GRS Supported
  - Full Depth Asphalt Approaches
  - Cast-in-Place Cantilevers and Median – Curved Alignment
Jo Johnston Highlights

Bridge Demolition (9 PM to 9AM)

3 Cranes to be positioned in 3 different Locations.
- Abutment A – 300 ton – LTM 1300 All-Terrain Crane
- Abutment B – 200 Ton – LTM 1200 All-Terrain Crane
- Jo Johnson Roadway – 400 ton – LTM 1400 All-Terrain Crane

Girder Removal for Each Span – 4 hours
- 2.5 Girder per Hour (24 Minutes per Pick)
- SBL – 9 Girder Picks
- NBL – 10 Girder Picks
- Each Crane to utilize a 40 ton Capacity Spreader bar
- Average Pick Weight – 65,000 lbs. (32.5 Tons)
Jo Johnston Highlights
Crane Positions for Demo
Jo Johnston Highlights

- **Bridge Erection Plan**
  - One crane location for all picks
  - Increased efficiencies between weekends
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- Piece Pick Count / Weight Analysis – (Per Weekend)

  - Beams - Wt = 22 Tons 8 Pieces
  - Deck Panels - Wt = 24 Tons 24 Pieces
  - Abutment End Blocks - Wt = 5 Tons 18 Pieces
  - Approach Slabs - Wt = 11 Tons 16 Pieces

  Total Pieces to Install 66 Pieces
Jo Johnston Highlights

1 - Core Drilling
- 10 Core Drills – 2 holes per hour each (20 holes per hour production rate)
- 32 holes needed for 8 beam bearing plates
- 50 holes needed for the Endwalls
- 48 holes needed for the Approach Panels
- Total of 130 holes per weekend

2 - Profiling Beams
- As the beams are set they will be profiled (Note: After 1st weekend, beams were profiled on truck prior to installation)
- Make any shim adjustments needed.
- Shims will be installed to the correct thickness
- Backer rod installed between the shims.

3 - Closure Pours
- As deck panels are installed the rebar for the closures will be threaded in and forms installed from underneath.
- High Early Concrete will be brought in 4 Yard Batches.
- The same crane used for all the precast setting will be used to fly the concrete bucket for the Closure Pours.
- The Approach Panels will be poured first so the paving can start as soon as possible.
Jo Johnston Highlights

- Bridge components included prestressed box beams, prestressed full depth deck panels and precast end walls.

Precast end walls were installed on the existing bent caps. The units were pinned to the cap with 1” dowel bars. The units were grouted together at joints located behind the box beams.
Jo Johnston Highlights

- Bridge components included prestressed box beams, prestressed full depth deck panels and precast end walls.

Precast end walls were installed on the existing bent caps. The location of the dowels were set to “theoretically” miss the main reinforcing steel. The contractor elected to use a pacometer to help the reinforcing steel prior to coring the caps.
Jo Johnston Highlights

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There were longitudinal joints located over every beam line to establish a composite connection for the superstructure.
Jo Johnston Highlights

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Transverse joints used a shear key and a “lug” type connection for the reinforcing splice bar spanning between the panels. The length of the lap was based on the higher strength material used for the closure pours.
Jo Johnston Highlights

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The prestressed panels were placed transverse to the beams and spanned either 3 or four bays. The amount of prestressing force was set to maintain a compressive force under the design load.
Panel dimensions were set to permit shipping the panels without any special requirements for escorts or flagging.

Each panel segment required four lifting points to control lifting and handling stresses.
Jo Johnston Highlights

- Bridge approach slabs were also precast and supported by geosynthetic reinforced soil backfill.

The GRS backfill was placed in lifts to a total thickness of 24” and then fine grading to final elevations was completed. The reinforced zone was extended 5 feet beyond the approach slab to minimize the potential for differential settlement between the rigid and flexible pavement.
Jo Johnston Highlights

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The joint and connection details on the approach slabs were the same as the deck panels.
Jo Johnston Highlights
NCHRP 10-71 Cast In Place Connections For Precast Deck Systems

A new concrete mix that met the above required performance requirements was approved. It was produced at a nearby ready mix plant (4 yard batches) and achieved 4000 psi in 4 hours. This replaced the labor intensive bag mixes that have been used on previous TDOT accelerated projects.
Closure Pour Concrete for Connections
NCHRP Synthesis 333 suggest membranes have a longer live if applied right after construction.

First use of spray applied membrane by TDOT – applied directly to the deck. Cost roughly $10 per sq. foot.

The product is applied in three layers with a total thickness of 120 mils.
Jo Johnston Summary

- Three span bridge replaced with single span structure
- Retaining walls used to eliminate end spans
- Pre-weekend work did not impact interstate traffic
- Replacement structures used prestressed beams and full depth deck panels
Lessons Learned

- Early Coordination and Community Outreach – This Project embraced by the community and the media.
- Communication between owner, designer, and contractor is imperative through all phases of the project.
- Keep the door of innovation open during the planning and design phases.
- Set the maximum allowable construction and traffic lane closure times at the beginning of the project planning and stick to it.
- Work operations were improved from weekend to weekend by detailed work observations, task time studies and post weekend meeting to discuss what worked and what could be improved.
- Large Demo Cranes could be available for Erection
- Time available for multi-span “stick building” option
Questions