TDOT’s First CM/GC Design and Construction Project
Presented to the 60th Annual Transportation Conference

Project History
• CMGC Alternate Delivery Method – 1st TDOT Project
• Design Consultant
• RFP Process to Evaluate Contractors
  • 4 Teams Submitted Proposals
  • Team Interviews and Innovation Discussions
  • 2 Part Evaluation Based on Technical Proposal & CM/GC Fee
• Kiewit Infrastructure South Company was Selected

Project Location
• Located on the South Loop in Downtown Nashville

Bridge Site 1 – Herman Street
345’ Bridge
4 Continuous Bridge Spans
Rolled Wide Flange Beams
Multi-Post Bents
On-Going Deck Maintenance

Bridge Site 2 – CSKT & Clinton
423’ Bridge
4 Continuous Bridge Spans
Rolled Wide Flange Beams
Multi-Post Bents
On-Going Deck Maintenance

Numerous Ongoing Maintenance Issues
• 140,000+ ADT
• Major Downtown Access Points
Bridge Site 3 – Jo Johnston
- 178’ Bridge
- 3 Span Continuous
- AASHTO I Beams
- Multi-Post Bents
- On-Going Deck Maintenance

Bridge Site 4 – Charlotte Ave.
- 196’ Bridge
- 3 Span Continuous
- Fabricated “K” Frame
- Wide Flange Sleeve Segments
- Frame Supported on Thrust Blocks
- Emergency Deck Repairs in 2013

Options Studied as Part of the Project
- Deck Replacement with Full Depth Panels on Existing Beams
- Superstructure Replacement – various methods
- Full Span Replacements
- Eliminate Spans
- Combination of Options

Option Evaluation Criteria
- Duration of Closures – Number of Weekends
- Rough Order of Magnitude Costs
- Life-Cycle Analysis
- Railroad / Utility / ROW Impacts
- Procurement of Materials
- Constructability
- Risk

Selected Option – Herman Street
- Replace Existing Superstructure with Steel beam Superstructure Units
  - Maintain Existing Beam Spacing
  - Existing Substructures in Good Condition
  - Use “Link-Slab for Live Load Continuity
  - Expansion at Abutments – Fixed Bents
  - Modify Existing Abutment Endwall for New Cross-Slope & Expansion Joint
  - Spray Membrane Deck Seal & Asphalt Overlay

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All cross-frames were installed and block-outs were formed for the closure pours. The deck was cast full width with a screed.

The "Bridge Farm" was a Two Acre Laydown Yard Located in the Median of I-40 within the Weekend Closure Limits of the Project.

Existing bearings were removed and new sector bolting were placed prior to superstructure installation.

Herman Street Highlights
Bolsters were fabricated for each beam line to allow for increasing the deck cross-slope.

Herman Street Highlights

16 Deck units in place awaiting closure pours.

Bolsters were fabricated for each beam to allow for increasing the deck cross-slope.

Link slab with relief cut over bent. No cracking was noted after first week of in-service use.

• Superstructure Replaced with Structural Steel Superstructure Units
• 16 Units set per weekend (more than any previous weekend project)
• Units were longer, wider & heavier than previous projects
• Link Slab used for Live Load Continuity

One of the outcomes of the project was a new concrete mix (TDOT Class X) that meets the required project performance requirements with the bonus of being batched from a plant, delivered by truck and reaching 4000 psi in 4 hours with exceptional shrinkage and bond strength characteristics.
Selected Option – Clinton – CSXT Crossing

- Superstructure Replacement of 2 Spans with 4 Spans Eliminated
- Maintain Span 2 over CSXT and Span 5 over Clinton
- Eliminate End Spans 1 & 6 and Interior Spans 3 & 4
- Use Box Beams and Full Depth Deck Panels
- Use MSE walls except along CSXT Railroad (Cast-in-Place Required)
- Modify Existing Piers to act as Abutments
- Spray Membrane Deck Seal & Asphalt Overlay

Clinton / CSXT Highlights

- Wall facing CSXT ROW were required to be cast-in-place concrete
- Slab had to be cut and removed in pieces as no debris was allowed on CSXT ROW
- MSE Walls were used for all other wall segments
- Contractor was able to get fill placed to bottom of and beneath beams prior to weekend demolition with specialized equipment
Clinton / CSXT Highlights

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

Selected Option – Jo Johnston Avenue

- Superstructure Replacement of 1 Span with 2 Spans Eliminated
  - Maintain Span 2 over Jo Johnston Avenue
  - Eliminate End Spans 1 & 3
  - Use Box Beams and Full Depth Deck Panels
  - Use MSE walls to Contain New Roadway Fill
  - Modify Existing Piers to act as Abutments
  - Spray Membrane Deck Seal & Asphalt Overlay

Jo Johnston Highlights

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

Fine grading was completed on the GRS backfill and then the precast approach slabs were installed.
Selected Option – Jo Johnston Avenue

• Structure Replacement with Single Span Steel Structure
• Construct New Abutments Between “K-Frame” and Existing Abutment
• Eliminate End Spans 1 & 3
• Use Steel Superstructure Units to Replace Existing Bridge
• Use MSE walls to Contain New Roadway Fill
• Spray Membrane Deck Seal & Asphalt Overlay

Selected Option – Charlotte Avenue

Charlotte Avenue Highlights

• Temporary Soil Nail Wall
• Excavation Adjacent to Thrust Blocks to Solid Bedrock.
• Leveling Concrete
• Isolated Footings

Charlotte Avenue Highlights

• Wall Constructed Between old and new supports
• Strip Footing for MSE Block Wall
• Gap Easily Constructed from Wall Fill Elevation.
• Gap Between Existing Beams and New Bent Cap as Small as 1”
Selected Option – Charlotte Avenue

Charlotte Avenue Highlights

Since the units were match-cast, the rebar and cross-frames join together without conflict allowing for quick placement of the five units.

Charlotte Avenue Highlights

Closure pour reinforcing includes overlapping bars and longitudinal locking bars to provide a robust mechanical joint. The edges of the unit slabs were chemically roughened to aid in the bond strength.

The screen placed over the cut line in the forms was easily placed from the top of the deck.

Charlotte Avenue Highlights

The original design had the end walls cast into the superstructure units. These were redesigned to separate Precast pieces to lessen the lift and transport weights of the units – saving some 45,000 pounds.

Charlotte Avenue Highlights

The end wall blocks are pinned to the abutment cap and the approach slabs will be pinned to the end walls. A closure pour ties the superstructure unit to the end wall units.

Conclusions

• Early Contractor Involvement with CM/GC Contract
• Team Approach to Project (Owner-Contractor-Designer)
• Personnel Continuity between Design and Construction Phases
• On-Site Bridge Farm or Fabrication Yard
• Adapting Conventional Bridge Construction to fit ABC Needs
• Bridge Type and Material Selection Process
• Ready-Mix Type Closure Pour Material
• Debrief or Lessons Learned Meetings after each closure
• Project Schedule – Incorporated all Phases and Disciplines