2nd Avenue Bridge
ABC of Unbraced Network Arch

Agenda

• Introduction and Site Constraints
• Project Goals
• Bridge Details
• ABC Options Considered/Selected
• Bridge Erection and Move
• Conclusions
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I-94 under Second Avenue
(looking west)

- Existing structure built in 1953
- Length – 213’6”  Width – 81’10”
- HS 20 Loading

Traffic Volume (ADT 2017)
- I-94: 142,650
- Second Ave: 985
I-94 Detailed Engineering Report

- Developed in 2010
- Preliminary alignment and cross sections of I-94
- Structure study concepts
- Accommodate interim and future alignment

Advanced Bridge Goals

- Minimize impact to I-94
- Minimize “throw away” work
Structure – Multi Span Option

STAGE II – NEW BRIDGE CONSTRUCTION

FUTURE STAGE I – PIER CONSTRUCTION

FUTURE STAGE II – PIER REMOVAL
Multi Span Design

- Concrete beams are not an option
- Continuous steel beams necessary due to splicing
- Interim design – 3 spans
- Future design – 2 spans
- Substructure - spread footings or deep foundations
- Interim and future allow for build out of I-94
Structure – Network Arch Option
Network Arch Design

- Clear span does not require proposed pier construction affecting traffic on I-94
- Network arch is more efficient than traditional tied arch structure
- Inclined hangers greatly reduce arch rib moment and shear forces
Bridge Details
Selected ABC Alternative
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SPMT Installation of Arch Span
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Staging Area
Upper Level
Meetings with Fabricators and Suppliers

• First web meeting – designer presentation on project constraints
• Series of confidential, one-on-one meetings with individual heavy-lift contractors
• Identify feasible bridge move methods
• Establish basis of design
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Industry Outreach During Bridge Move Study

- ALE
- Barnhart
- Bigge Crane and Rigging Co.
- EMMERT International
- Fagioli
- Mammoet
- Sarens Group
- HDR
- Tetra Tech
Arch Span Erection Sequence

Elevation View

Plan View

Post-tensioned end floorbeams placed after bridge move
Arch Span Move – Comparison

Span 245’-0”
Width 96’-6” out-out
Skew 18 degrees
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Arch Span Move – Temporary Works

Bridge must be supported symmetrically at all times
Arch Span Move – Temporary End Diaphragm
Arch Span Move – Temporary Arch Lifting Frames
Arch Span Move – Temporary Lateral Bracing Frame
Arch Span Move – Handoff Method
Arch Span Move Sequence – Initial SPMT Placement

44’-4” 44’-4”
Arch Span Move Sequence – Prep for Handoff #1
Arch Span Move Sequence – Handoff #1
Arch Span Move Sequence – Moving to Handoff #2
Arch Span Move Sequence – Handoff #2

SECOND HANDOFF TO SPMT
Arch Span Move Sequence – Move to Final Position
Arch Span Move Sequence – Jacking Down
How did we do it?
Prequalification of Contractor Teams

- Approx. 6 months prior to anticipated letting
- 80% plans provided - information only
- Demonstrated experience:
  - Contractor
  - Structural Engineer
  - Heavy-lift specialty contractor
- Shortlist of five teams – eligible to bid project
Detailed Review and Independent Check

• Contractor submittal of analysis/design during step-by-step erection process
• If move method different from concept, HDR to perform analytical check of each stage
• Check of all temporary members and connections
• Stability of arch ribs is critical
Specialty Services During Construction

• EOR remains fully involved throughout construction phase
• “Third Set of Eyes” is being added under a separate contract
• Independent structural analysis
• Review of critical contractor submittals
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Conclusions

• ABC projects – especially for a complex bridge – can be done using D/B/B

• Industry outreach useful in making informed decisions on structure type and bridge move

• Collaboration between MDOT and design teams key to successful project
Questions?

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