STATE of ABC in STATE of INDIANA

INDIANA BRIDGE DESIGN CONFERENCE
January 21, 2020

ABC in Indiana

Accelerated Bridge Construction
Indiana's Thoughts
Indiana's Experience
Current Project Spotlights
Challenge Moving Forward
Accelerated Bridge Construction

• Definition
• Benefits
• Concepts
• Applications

ABC is rapid construction of bridge elements using planning, design, materials and methods to reduce onsite construction time.

Accelerated Bridge Construction

BENEFITS / IMPROVEMENTS
• Safety
• Quality
• Durability
• Social costs
• Environmental impacts

ABC IMPROVES:
• Site constructability
• Project delivery time
• Workzone safety

ABC REDUCES:
• Traffic impacts
• Onsite construction time
• Weather-related time delays
ABC Elements and Methods

ACCELERATED BRIDGE CONSTRUCTION (ABC)

- Prefabricated Elements & Systems (PBES)
- Structure Placement Methods
- Accelerated Geotech Work
- Rapid Demolition
- Innovative Contracting

Major Arch Rehabilitation

*Minneapolis, MN*

SELF-PERFORMED PRECASTING
Rapid Bridge Replacement
*Keg Creek, Iowa*

Precast Approach Slabs
Prefabricated Decked Beam Elements

Gantry Cranes / Above Deck Driven Carriers
Obstacles to Implementing ABC

- Owners’ Perspective
  - Recognize challenges in getting industry support
  - Seek to balance the increase in construction cost against user cost savings
  - Seek innovation, but with standardization
- Contractor’s Perspective
  - Concerned about risk level and profitability
  - Outsourcing work to precasters or specialty subs
  - Will invest as number of projects grow
Obstacles to Implementing ABC

- Engineer’s Perspective
  - Lack of familiarity with ABC methods
  - Need design manuals, specifications and design aids
  - Understanding erection methods for large prefabricated elements
  - ABC opportunities

Indiana’s Thoughts

I interviewed Stephanie Wagner (INDOT Director of Bridge Design) about ABC:
  - ABC is not just bridge slides, also about limiting interface of traffic and construction.
  - Part of our process now, part of the discussion.
  - Consider it a tool in your toolbox during SST analysis.
  - Indiana’s ABC history is suddenly here. Let’s move forward.
  - You have our support to propose ABC solutions.
Indiana’s Thoughts

• Goals for ABC in Indiana
  – Improve efficiency and safety during construction
  – Encourage implementation across INDOT program
  – Normalize techniques – design and construction
  – Normalize costs – design and construction
  – Balance INDOT’s program
    • Less time on one project means more on the next!

ABC in Indiana

Accelerated Bridge Construction
Indiana’s Thoughts
Indiana’s Experience

CLASSIC VS. CURRENT
Indiana’s Experience - Classics

1. Sedley Road Bridge
2. Milton Madison Bridge
3. I-70 Bridge Slide
4. Additional Experience

Sedley Road Bridge over RR
Sedley Road Bridge over RR

- First use of precast PT concrete through-girders with deck panels
- Open in 1999 after 136 work days

Milton-Madison Bridge

- Contractor-driven ABC
- D-B project, limiting river crossing closure days
- INDOT’s contract proposal
  - Ferry service during a bid amount of closure days
- ABC Solution
  - Construct new truss adjacent to existing (temp. location)
  - Transfer traffic to new and demolish old truss
  - Slide new truss to permanent location on strengthened existing piers
Milton-Madison Bridge

- Truss lift to temporary piers
- Benefits
  - Closure reduced from 365 days to 10 days
  - 20% cost reduction

I-70 Bridges over SR 121

- Agency-driven ABC
- ABC Method: Full bridge slide
- Goals:
  - Accelerate adoption of ABC on Indiana interstates
  - Develop experience (design and construction)
  - Minimize user and MOT cost
I-70 Bridges over SR 121

- BLN designed slide-in and SPMT/offline options
- Alternate bidding allowed contractor to choose

<table>
<thead>
<tr>
<th>A+B Bidding</th>
<th>A</th>
<th>Construction Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>User Cost of I-70/SR 121 Closures</td>
<td></td>
</tr>
</tbody>
</table>

- Walsh/ASI built slide-in option

2. Precast bridge elements (beams, railings, MSE)
3. “Old-school” partial-depth deck panels
4. Gantries on I-69 and I-65
5. Others (audience participation?)
ABC in Indiana

Accelerated Bridge Construction

Indiana's Thoughts

Indiana's Experience

Current Project Spotlights

Indiana’s Experience - Current

1. US 52 over Mud Creek
2. US 33 over Blue River
3. I-69 over Cedar Creek A+B
4. I-65 / I-70 North Split
US 52 over Mud Creek

- **Location:** Greenfield District
- **Status:** Design by HNTB / Letting Sept 2020
- **ABC Method:** PBES + rapid bridge replacement
- **Driver:** District-driven
- **Goals:** Reduce construction duration and traffic/mobility impacts
US 52 ABC Process

- ABC Screening and Feasibility Report
  - Screen to determine ABC viability
  - Score per standard industry processes
  - THEN...evaluate ABC techniques for technical feasibility and economic justification

US 52 ABC Process

US 52 over Mud Creek ABC Screening Score Summary

<table>
<thead>
<tr>
<th>Category</th>
<th>Score</th>
<th>Weight Factor</th>
<th>Adjusted Score</th>
<th>Maximum Score</th>
<th>Adjusted Max Score</th>
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</thead>
<tbody>
<tr>
<td>1. Average Daily Traffic</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
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<tr>
<td>2. Truck Traffic %</td>
<td>5</td>
<td>5</td>
<td>25</td>
<td>25</td>
<td>25</td>
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<tr>
<td>3. Skid Resistance</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>4. Repeatability</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>5. Roadway and Weather Safety</td>
<td>5</td>
<td>5</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>6. Underpassing Factor</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total: 174 Max: 334 Normalized Score: 52

Results of screening support ABC evaluation
US 52 ABC Process

• Find feasible ABC methods
  – Precast concrete slab spans
  – FSBeam / MnDOT precast slab beams
  – Decked Bulb Tee (one-span)
  – NEXT Beams (one-span)

• Precast concrete slab spans selected
  – Simplest construction
  – Avoids PCI-certified off-site precasting and out-of-state systems
  – Can be field-cast in a staging area

US 52 ABC Process

<table>
<thead>
<tr>
<th>ABC</th>
<th>CONVENTIONAL</th>
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<tbody>
<tr>
<td>30 days</td>
<td>120 days</td>
</tr>
<tr>
<td>Higher Constr. $$$$</td>
<td>Lower Constr. $$$$</td>
</tr>
<tr>
<td>Lower User $$$$</td>
<td>Higher User $$$$</td>
</tr>
<tr>
<td>Lower Lifecycle $$$$</td>
<td>Higher Lifecycle $$$$</td>
</tr>
</tbody>
</table>

Table 5-2: Summary of Comparative Costs

<table>
<thead>
<tr>
<th>Alternate and Description</th>
<th>Comparative Construction Cost</th>
<th>User Cost</th>
<th>Lifecycle Cost</th>
<th>Total Comparative Cost</th>
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</thead>
<tbody>
<tr>
<td>Approach 1 - Three-span Precast Reinforced Concrete Steel Bridge with ABC Techniques</td>
<td>$688,000</td>
<td>$5,553,000</td>
<td>$46,000</td>
<td>$5,593,000</td>
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<tr>
<td>Approach 2 - Three-span Pre Cast Reinforced Concrete Steel Bridge with ABC Techniques</td>
<td>$944,000</td>
<td>$385,000</td>
<td>$50,000</td>
<td>$954,000</td>
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<tr>
<td>Approach 3 - Single Span Precast Prestressed Concrete Bridge with Conventional Construction Techniques</td>
<td>$688,000</td>
<td>$5,553,000</td>
<td>$46,000</td>
<td>$5,593,000</td>
</tr>
</tbody>
</table>

• Compared ABC to Conventional
**Design / Detail Highlights**

- **Bridge Piles**
  - Driven with 3” tolerance, requiring a template
  - Design same/similar pile pattern for piers and end bents (reuse template)

- **Precast Concrete**
  - Everything! Substructure, superstructure, railing, approach slabs….even sleeper slabs
  - Sized to accommodate typical crane lifting (not a monster)
  - UHPC closures
  - VES LMC overlay after closures
US 33 over Blue River

- Location: Fort Wayne District
- Status: Design by USI / Letting Nov 2020
- ABC Method: PBES superstructure replacement
- Driver: Design-driven
- Goals: Reduce construction duration and traffic/mobility impacts (27 mile detour)
Design / Detail Highlights

Decked Bulb Tees [eliminated]

Composite Steel System [selected]

- UHPC closures, grind and groove deck after
I-69 over Cedar Creek

- **Location:** Fort Wayne District
- **Status:** Design by INDOT / Letting this month
  - Cheryl Folz and St. Wagner
- **ABC Method:** Contractor’s choice
  - A+B bidding, temporary bridge @ median
- **Driver:** Contractor-driven
- **Goals:** Provide opportunity for contractor innovation for B (time) component  
  Reward not just low cost, but ability to construct rapidly (final bridge with PBES, or temporary bridge)
I-65/I-70 North Split

- **Location:** Greenfield District
- **DBBV Status:** Active Procurement / 2020-2022
- **ABC Method:** Contractor’s choice
  » Encouraged by 40+ bridges, traffic volume
- **Driver:** Value-driven
- **Goals:** Value and closure reduction
  » Selection places value on closure durations, interstate/local
  » Contractor bids # days of closure for specific movements
- **USP included in technical provisions for guidance**

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Moving Forward

• Classic and current examples show drivers
  – Agency, designer, contractor, value
• ABC adopted across US and abroad
• Tools available
  – SHRP2: guidance, equations, details
  – NCHRP 12-98: PBES tolerances and dynamic effects
  – AASHTO Guide Specification
• “Precast is easy” – Stephanie Wagner

You have INDOT’s support. What are your ABC ideas?

Acknowledgements

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Indiana Bridge Design Conference

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