Welcome

Joshua Laipply, PE (Bridge Branch Manager)

- ABC and CDOT
- Politics of ABC
  
  Tim Harris, PE (Chief Engineer)
  
- Overview
  - Forms and Decision assistance
  - Region 4
  - Region 2
  - Region 6
  - FHWA
Implementing ABC at CDOT

Behrooz Far, PE
Preeda Chomsrimake, PE

R3 Design and Construction
&
Fabrication Inspection
Staff Bridge
CDOT’s ABC Method

• Goal
  – CDOT specific ABC decision –making tool to aid transportation professionals in making educated decisions on using ABC techniques on Colorado transportation projects and other off system projects.
  – The Right ABC method for the Right Project

• Tools
  – Workflow
  – Pre-Scoping Rating
  – AHP Software
DESIGN BULLETIN

Colorado Department of Transportation
Project Development Branch

Accelerated Bridge Construction (ABC)
2012 Number 3, Page 1 of 1
Date: December 13, 2012

Accelerated Bridge Construction (ABC)

In order to further strengthen CDOT’s role as stewards of the taxpayers’ dollars, and to minimize the impact to the traveling public, CDOT has developed a tool for evaluating accelerated bridge techniques, to determine whether or not they are appropriate for a given project.

This design bulletin provides general guidance as to the use of accelerated bridge construction techniques on a project that contains one or more bridges.

Applicable Materials:

All applicable materials for ABC evaluation can be downloaded at the internet link given below. The materials are compressed in a Zip file. Download the materials, unzip the files, and save the files to your local machine.

http://intranet/engineering/staff-bridge/accelerated-bridge-construction/view

Guidance:

The accelerated bridge construction methodology is to be evaluated for all projects that will contain one or more bridges and a justification letter written to the project file as to why or why not an ABC technique will be used on a project. The justification letter should include materials completed during the ABC evaluation. The design team may choose to work with the designated Staff Bridge Engineer for guidance and information regarding the use of the ABC materials.

The document “CDOT_ABC_Selection_Overview” contains an overview of the ABC process. The process is a two-phase approach. One phase is a cursory evaluation as to whether or not ABC is appropriate for a given project. The second phase is an in-depth evaluation as to what type of ABC technique will be employed. This cursory evaluation is to be done during the scoping phase using the spreadsheet “CDOT_Prescoping_ABC_Rating_Attachment_B”. If the results of the cursory evaluation show that an ABC technique is appropriate for the project, the design team may move on to a more in-depth evaluation using the “ABC Decision Making Software” to determine which ABC method best meets the project’s goals and constraints. If the in-depth evaluation is required, the design team shall schedule a meeting with all specialty groups including but not limited to: Staff Bridge, Utilities, Environmental, Traffic, Hydraulics, etc. to execute the ABC Decision Making Software. The results of the software are to become part of the project files.

The above information is represented graphically in the document titled, “ABC_Workflow_Attachment_A”
External CDOT Website Location

ABC documents on the Design & Construction Project Support

http://www.coloradodot.info/business/designsupport

http://www.coloradodot.info/business/designsupport/abc-documents
Design and Construction Project Support

The Design & Construction Support Site has changed. It still contains the same information. Please use our search function if you cannot locate the document you are looking for.

The Design and Construction Project Support Section contains information about Standards and Specifications used during the design and construction of CDOT projects. There are also design aids, Construction Bulletins, Special Provisions, and Support Software.

Please reference the Quick Links located to the left to navigate. Below is a brief outline indicating what information can be found within those links listed in alphabetical order.

- Accelerated Bridge Construction Documents
- Construction Specifications: This area contains standard specifications appropriate for use on CDOT construction Projects and revisions thereto. The 2005 Standard Specifications are now available and should be used on all projects advertised on or after October 13, 2005.
- Bulletins and Manuals: Links to various Design Manuals & Guides, Construction Bulletins.
- Policy Memos: Various Policy Memos as well as Americans with Disabilities Act (ADA) Accessibility Requirements in CDOT Transportation Projects.
- Innovative Contracting and Design - Build: A process of systematic decision-making, risk identification and allocation, identification of goals and objectives, identification and development of strategies, and creation of a competitive procurement environment.
Accelerated Bridge Construction Documents

[ Accelerated Bridge Construction Documents.zip ]
Accelerated Bridge Construction

In the past, the Department used an Accelerated Bridge Construction (ABC) Decision Chart during project scoping to determine if ABC was appropriate for the site. This chart was based on the Federal Highway Administration Manual entitled “Decision-Making Framework for Prefabricated Bridge Elements and Systems (PBES), May 2006”. This process was based on a set of questions regarding specific constraints of each project. If certain thresholds were met, ABC was recommended.

ABC Complete Package.zip — Zip archive, 1357 kB (1390231 bytes)
Material for ABC Evaluation
ABC Evaluation and Decision Matrix Workflow

Project Phase
- Responsible Party
- Pre-Project Scoping
  - CDOT Regional Management
- Project Delivery
  - Decision Matrix
- Conceptual Design
  - CDOT Project Team
- FIR Design
  - CDOT Project Team

New Project → Pre-Scoping ABC Rating

- Project does not utilize ABC
- Project utilizes ABC

AHP Process
To identify ABC Methods
(See ABC Matrix)
## Pre-Scoping Rating

**ABC Ratings Score Factors and Weights**

<table>
<thead>
<tr>
<th>Rating</th>
<th>Score</th>
<th>Factor</th>
<th>Weight</th>
<th>Adjusted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Impact</td>
<td>5</td>
<td>Less than 5000</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Traffic Volume</td>
<td>5</td>
<td>5000 to 9999</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Bridge Importance</td>
<td>5</td>
<td>Higher Importance</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>User Impact</td>
<td>5</td>
<td>Low</td>
<td>7</td>
<td>35</td>
</tr>
<tr>
<td>Economy of Scale</td>
<td>5</td>
<td>Better</td>
<td>8</td>
<td>40</td>
</tr>
<tr>
<td>Safety</td>
<td>5</td>
<td>Low</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>Railroad Impact</td>
<td>5</td>
<td>None</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

Total Score: 40

**DOT Rating Score:** 40 - Minimum Score

**Cost Considerations**

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Additional Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractual Cost</td>
<td>$0</td>
</tr>
<tr>
<td>Additional Cost</td>
<td>$0</td>
</tr>
</tbody>
</table>

Total Project Cost: $0

*Account for the following Construction Costs that can be dramatically increased with ABC construction:*

- Traffic Control
- Railroad Harmonization
- Increased Contractor and/or DOT labor

Develop ABC specific methods and perform AHP analysis with the guidance at PHM.
Example for
US 6 over Garrison

Sufficiency Rating = 31.6 SD
US 6 over Garrison
Pre-Scoping Meeting

- Information Needed
  - Average Daily Traffic
  - Delay/Detour Time
  - Bridge Importance
  - User Costs
  - Economy of Scale
  - Safety
  - Railroad Impacts
  - Site Conditions
## Pre-Scoping Meeting

### Average Daily Traffic (ADT)

- **Average Daily Traffic (ADT)**: 102,000

### Pre-Scoping ABC Rating

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Rating</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Daily Traffic</strong></td>
<td>5</td>
<td>No traffic impacts</td>
</tr>
<tr>
<td><strong>Delay/Detour Time</strong></td>
<td>1</td>
<td>No delays</td>
</tr>
<tr>
<td><strong>Bridge Importance</strong></td>
<td>3</td>
<td>Normal Bridge - minimal access</td>
</tr>
<tr>
<td><strong>User Costs (per day)</strong></td>
<td>1</td>
<td>No user costs</td>
</tr>
</tbody>
</table>

---

- **ADT = 102,000**
### Pre-Scoping Meeting

**Economy of Scale**
- 0: 1 span
- 1: 2 to 3 spans
- 2: 4 to 6 spans
- 3: > 6 spans or multiple structures

**Safety**
- 0: Short duration impact with simple MOT scheme
- 1: Short duration impact with multiple traffic shifts
- 2: Normal duration impact with multiple traffic shifts
- 3: Extended duration impact with multiple traffic shifts
- 4: Extended duration impact with complex MOT scheme

**Railroad Impacts**
- 0: No railroad or minor railroad spur
- 1: One mainline railroad track
- 2: Multiple mainline railroad tracks

**Site Conditions**
- 0: Inhibiting site constraint (e.g., > 1 ft. profile shift)
- 1: Time sensitive constraint (e.g., utility schedules)
- 2: Favorable site conditions
Pre-Scoping Worksheet
Page 2

Pre-Scoping ABC Rating

Project: F-18-ER US 6 over Garrison
By: LEB Checked: BMF
Date: 2/22/2013 Sheet No. 2 of 3

Cost Considerations:
Calculate the following costs for use in determining the lowest total project cost. (Completed at FIR level)

<table>
<thead>
<tr>
<th>Cost Consideration</th>
<th>Traditional Const.</th>
<th>ABC Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Costs</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>User Costs</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Total Project Cost</td>
<td>$0</td>
<td>$0</td>
</tr>
</tbody>
</table>

Note: Do not adjust weight factors without prior consultation with CDOT Project Development Manager

ABC RATING SCORE FACTORS AND WEIGHTS

<table>
<thead>
<tr>
<th>Factor</th>
<th>Score</th>
<th>Weight Factor</th>
<th>Adjusted Score</th>
<th>Maximum Score</th>
<th>Adjusted Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Daily Traffic</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Delay/Detour Time</td>
<td>1</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Bridge Importance</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>User Costs</td>
<td>1</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Economy of Scale</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>Safety</td>
<td>1</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Railroad Impacts</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Site Conditions</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

Total Score: 118 Max. Score: 284

ABC Rating Score: 42% of Maximum Score

The ABC Rating Score is driven by the four most heavily weighted factors: Average Daily Traffic, Delay/Detour Time, User Costs and Safety. For a detailed explanation, review the narrative on page 4 of the ABC Decision Making Process.
Region Director or Chief Engineer to evaluate possible indirect benefits

ABC Rating 0 to 20
- Can project delivery be accelerated with ABC?
  - Yes
  - No
  - Does ABC mitigate a critical environmental issue?
    - Yes
    - No
    - Is the bridge construction on the critical path?
      - Yes
      - No
      - Use Traditional Construction
  - No
  - ABC Rating 20 to 50
  - Use Traditional Construction
  - ABC Rating 50+

Director Decision*
- No
  - Do the existing site conditions support an ABC approach?
    - Yes
    - No
    - Does ABC provide the lowest total project cost?
      - Yes
      - No
      - No
      - Use Traditional Construction
    - No
      - Develop ABC potential methods and perform AHP analysis with the project team before FIR.
- Yes
  - Use Traditional Construction
ABC Matrix

### Accelerated Bridge Construction Matrix

This matrix is to provide suggestions and previously utilized methods for accelerated bridge construction, it is not all inclusive nor intended to dictate any particular method.

<table>
<thead>
<tr>
<th>Substructure</th>
<th>Approach, Embankment &amp; Backfill</th>
<th>Superstructure</th>
<th>Super Structure placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-fabricated approach slabs</td>
<td>Adjacent Girders</td>
<td>Pre-fabricated box culvert</td>
<td></td>
</tr>
<tr>
<td>Flowfill</td>
<td>Precast Deck Panels (partial depth)</td>
<td>Pre-fabricated pedestrian bridge</td>
<td></td>
</tr>
<tr>
<td>Pre-fabricated Pier Caps</td>
<td>Expanded Polystyrene (EPS) Geofoam</td>
<td>Pre-fabricated truss or arch span</td>
<td></td>
</tr>
<tr>
<td>Pre-fabricated columns</td>
<td>Pre-fabricated box culvert</td>
<td>Post-tensioned concrete through beams</td>
<td>Heavy Lift Cranes</td>
</tr>
<tr>
<td>Pre-fabricated foundations</td>
<td>Precast Deck Panels (full depth)</td>
<td>Modular Girder and Deck elements</td>
<td>Longitudinal Bridge Launch</td>
</tr>
<tr>
<td>Geosynthetic Reinforced Soil (GRS) abutment</td>
<td></td>
<td></td>
<td>Self Propelled Modular Transport (SPMT)</td>
</tr>
<tr>
<td>Continuous Flight Auger Piles (CFA)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ABC Costs**

ABC method construction costs generally increase with project complexity. However, many methods of ABC may reduce the overall project cost. Specifically where ABC methods can eliminate or reduce detours, or traffic control.

**Notes:**

1. FHWA Every Day Counts Initiatives
2. Prefabricated Bridge Elements and Systems (PBES)
Analytic Hierarchy Process

• Decision making process
  – Simplifies numerous factors into pair-wise comparisons
• Project specific weight factors
• Compares ABC alternatives
Step 1: Develop Hierarchy and Set Alternatives

- Select those that apply to your project
- Set Alternatives
### Step 2: Complete Pairwise Comparisons

#### Intensity | Definition | Explanation
--- | --- | ---
1 | Equal importance | Two activities contribute equally to the objective
3 | Weak importance of one over another | Experience and judgment slightly favor one activity over another
5 | Essential or strong importance | Experience and judgment strongly favor one activity over another
7 | Demonstrated importance | An activity is strongly favored, and its dominance demonstrated in practice
9 | Absolute importance | The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8 | Intermediate values between the two adjacent judgments | When compromise is needed
Step 3: Apply to Alternatives

<table>
<thead>
<tr>
<th>Intensity</th>
<th>Definition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Equal importance</td>
<td>Two activities contribute equally to the objective</td>
</tr>
<tr>
<td>3</td>
<td>Weak importance of one over another</td>
<td>Experience and judgment slightly favor one activity over another</td>
</tr>
<tr>
<td>5</td>
<td>Essential or strong importance</td>
<td>Experience and judgment strongly favor one activity over another</td>
</tr>
<tr>
<td>7</td>
<td>Demonstrated importance</td>
<td>An activity is strongly favored, and its dominance demonstrated in practice</td>
</tr>
<tr>
<td>9</td>
<td>Absolute importance</td>
<td>The evidence favoring one activity over another is of the highest possible order of affirmation</td>
</tr>
<tr>
<td>2, 4, 6, 8</td>
<td>Intermediate values between the two adjacent judgments</td>
<td>When compromise is needed</td>
</tr>
</tbody>
</table>
Step 4: Analyze Results

![Image of AHP Decision Making Software interface showing results and charts]
AHP Software

- Project specific
- Documentation of thought process
- Tool to facilitate discussion and come to conclusion for best fit ABC alternative
Subject Matter Expert
Contact Information

Behrooz Far
303-757-9193
BEHROOZ.FAR@STATE.CO.US

Or

Preeda Chomsrimake
303-757-9194
PREEDAA.CHOMSRIMAKE@STATE.CO.US
Thank you

Questions
Region 4 Bridge Slides
US 34 BRIDGE REPLACEMENT EAST OF WRAY

Before

During

72 Hours Later
CDOT Management Team

- Keith Sheaffer, R4 South Program Engineer
- Brett Locke, Sterling Resident Engineer
- Craig Schumacher, Sterling Project Engineer
CDOT/TSH Blended Design Team

- Tsiouvaras Simmons Holderness Engineering: Structure Design
  - Jeff Simmons
  - Treena Fulton
  - Andy Pelster
- Project Engineer (Roadway Design): Craig Schumacher CDOT
- Hydraulic Engineer: Steve Griffin CDOT
- Staff Bridge: Richard Osmun CDOT
- Environmental: Patrick Hickey, Jennifer Gorek, Jennifer Klaetsch CDOT
- Traffic: Daniel Thomas CDOT
- Utilities: Rudy Sipnefski CDOT
- Survey: Lee Groves CDOT
- Right of Way: Dan Michna CDOT
- Materials: Rick Chapman CDOT
Project Construction Team

- CDOT Resident Engineer: Brett Locke
- CDOT Project Engineer: Craig Schumacher
- CDOT Inspector: Carlos Gomez
- CDOT Tester: Andrew Muller
- Tsiouvaras Simmons Holderness: Engineering Review
- Consultant Inspector: Richard McKay
- Construction Contractor: Lawrence Construction
- Project Manager: Anne Lawrence
- Superintendent: Lee Adams
- Foreman: Jose Diaz
Site Challenges

Limited right of way between the BNSF Railroad located to the north of the highway and the structure

Haigler Canal head gate structure located under and to the south of the structure
On Site Detour

ABC Workshop 3/6/2013

STAFF BRIDGE BRANCH
Off Site Detour

• Shortest paved detour route was 69 miles long with a calculated user cost at $48,000 per day.
Bridge Section and Layout
## Alternatives Considered

<table>
<thead>
<tr>
<th>Construction Method</th>
<th>Engineer Estimate</th>
<th>User Costs</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Closure - Off Site Detour</td>
<td>$2,111,031</td>
<td>$4,320,000</td>
<td>$6,431,031</td>
</tr>
<tr>
<td>Complete Closure - On Site Detour to South</td>
<td>$2,629,011</td>
<td>$ -</td>
<td>$2,629,011</td>
</tr>
<tr>
<td>2 Phase construction - One Lane Traffic Open During Construction</td>
<td>$2,382,539</td>
<td>$ -</td>
<td>$2,382,539</td>
</tr>
<tr>
<td>Complete Closure - Lateral Roll-In</td>
<td>$2,323,735</td>
<td>$96,000</td>
<td>$2,419,735</td>
</tr>
<tr>
<td>Complete Closure - In Place Accelerated Bridge Construction</td>
<td>$2,335,517</td>
<td>$672,000</td>
<td>$3,007,517</td>
</tr>
</tbody>
</table>
Design Decisions

• Design two alternatives for contractors to bid.
• Alt 1 = Build in Place Utilizing Accelerated Bridge Construction
• Alt 2 = Slide-In
• Utilize A+B Cost Plus Time Bidding. The B portion being the number of days needed to close US 34 to traffic with a maximum number of days set at 16.
• The Slide-In would involve building the foundations under live traffic, building the bridge superstructure to the south of the existing bridge, and sliding it in to its final position.
Bid Results

- 7 Bidders
  - 4 Bids for the Roll in Option
  - 3 Bids for Rapid In Place Construction

<table>
<thead>
<tr>
<th>Contractor Name</th>
<th>(Section A)</th>
<th>(Section A + B)</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawrence Construction Co.</td>
<td>$2,316,105</td>
<td>$2,508,105</td>
<td>4</td>
</tr>
<tr>
<td>SEMA Construction, Inc.</td>
<td>$2,359,949</td>
<td>$2,791,949</td>
<td>9</td>
</tr>
<tr>
<td>Concrete Express, Inc.</td>
<td>$2,486,341</td>
<td>$2,870,341</td>
<td>8</td>
</tr>
<tr>
<td>Edward Kraemer &amp; Sons, Inc.</td>
<td>$2,800,440</td>
<td>$3,040,440</td>
<td>5</td>
</tr>
<tr>
<td>TLM Constructors, Inc.</td>
<td>$2,448,000</td>
<td>$3,216,000</td>
<td>16</td>
</tr>
<tr>
<td>American Civil Constructors, Inc.</td>
<td>$3,039,318</td>
<td>$3,327,318</td>
<td>6</td>
</tr>
<tr>
<td>Dondlinger &amp; Sons Construction</td>
<td>$3,540,127</td>
<td>$3,924,127</td>
<td>8</td>
</tr>
</tbody>
</table>
## Bid Results

<table>
<thead>
<tr>
<th>Contractor Name</th>
<th>(Section A)</th>
<th>(Section A + B)</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer's Estimate</td>
<td>$ 2,394,382</td>
<td>$ 3,162,382</td>
<td>16</td>
</tr>
<tr>
<td>Lawrence Construction Co.</td>
<td>$ 2,316,105</td>
<td>$ 2,508,105</td>
<td>4</td>
</tr>
<tr>
<td>SEMA Construction, Inc.</td>
<td>$ 2,359,949</td>
<td>$ 2,791,949</td>
<td>9</td>
</tr>
<tr>
<td>Diffrence between #1 and #2</td>
<td>$ 43,844</td>
<td>$ 283,844</td>
<td>5</td>
</tr>
<tr>
<td>% of Low Bid</td>
<td>2%</td>
<td>11%</td>
<td></td>
</tr>
</tbody>
</table>

Bridge Cost = $795,258 / $143 per sq foot  
Bridge Move Pay Item = $73,908 / 9% of Bridge Cost
Key ABC Components

- Offline prefabrication of the complete bridge superstructure
- Construction of substructure in precast shoring vaults
- Demolition of existing bridge, channel improvements, and slide-in of new superstructure completed during 3 day full closure
Offline Superstructure Construction

- Temporary foundation, girder support beam, and track system

- Precast side-by-side box girders erected on temporary beam
Offline Superstructure Construction

- Deck, diaphragm, and bridge rail

- Superstructure complete except wearing surface
Precast Shoring Vaults

Limits of existing bridge
Shoring vaults
Shoring vaults
Temporary location of new superstructure
Precast Shoring Vaults

- Shoring vaults precast off site
- Assembled vaults installed under traffic
- Lids removable for access
- Adaptable to multiple site configurations
- Caisson construction completed under traffic
Precaast Shoring Vaults

- Abutment cap construction completed under live traffic

- Large enough to accommodate full construction of abutment cap and slide-in system track
Slide-in Operation

50 feet in 90 minutes

- Lift bridge off falsework
- Lower bridge onto rollers
- Incremental move along continuous track to final position
- Lift bridge off rollers
- Adjust bearing shims and lower bridge onto bearings

ABC Workshop 3/6/2013

STAFF BRIDGE BRANCH
Track on Temporary Foundation

- Reinforced cast-in-place concrete footing on reinforced fill
- HP 14x89 support beam bolted to temporary footing
- C 10x20 continuous guide channel welded to support beam
Track on Abutment

• 2 ~ 140 kip brackets bolted through abutment cap at each caisson (12 per abutment)
• Support beam with guide channel bolted to brackets
• Support beam and guide channel field spliced
Jacks and Rollers

- 7 ~ 100 ton jacks at each diaphragm
- 7 ~ 100 ton rollers at each diaphragm
- 2 guided rollers
- 5 unguided rollers
Ram System

• Bracket bolted to diaphragm

• Pair of hydraulic cylinders at each diaphragm
  • 30 inch stroke

• Bracket attached to track with removable pins
Design Considerations

• In-place vs. Slide-in
  – In-place
    • Precast, pre-stressed superstructure
    • Integral abutments
    • Caisson foundation
  – Slide-in
    • Precast, pre-stressed superstructure
    • Elastomeric bearing pads
    • Caisson foundation

• Two bridge designs
  – Two sets of plans
Superstructure

- One design – two bridges
- Designed as conventional bridge
- Constructed as conventional bridge
Abutment Cap and Caissons

- Abutment cap design
- Support at each caisson
  - Load path to caissons
- Caisson design cases
  - Final configuration
  - Eccentric load from slide
  - Horizontal force from slide
End Diaphragms

- Added length for slide-in supports
- Slide-in considerations
  - Jacking locations
Diaphragms Cont.

- Roller locations
- Loss of roller(s) during slide

Additional Reinforcing
Bearing Design

• Design forces
  – Vertical
  – Horizontal
  – Rotation

• Slide-in considerations
  – Uneven loading
  – Additional load
Bearings Cont.

- Cover plate
- Loading process
  - Position superstructure
  - Evaluate gap
  - Place shims
  - Place cover plate
  - Lower superstructure
Questions?
Region 2 Bridge Slides

Jeffrey Dobmeier, PE, SE
Jacobs Engineering
Presentation Outline

• Project overview and timeline
• ABC motivation
• Slide and roll concepts
• What went well
• Details to improve upon
Two Acronyms

- ABC = Accelerated Bridge Construction
- CM/GC = Construction Manager / General Contractor
  - Allows contractor input during design phase
  - Real world advice on means and methods
  - More owner control over product than DB

CM/GC Project Team = CDOT + Kiewit + Jacobs
Project Overview
Project Overview
# Project Timeline

<table>
<thead>
<tr>
<th>Date Range</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov 2010</td>
<td>Contracted for Preliminary Design</td>
</tr>
<tr>
<td>April 2011</td>
<td>ABC and CM/GC first discussed</td>
</tr>
<tr>
<td>June 2011</td>
<td>ABC and CM/GC selected</td>
</tr>
<tr>
<td>Sept– Nov 2011</td>
<td>Solicitation of contractor for pre-construction services</td>
</tr>
<tr>
<td>Jan – May 2012</td>
<td>Final design</td>
</tr>
<tr>
<td>June – July 2012</td>
<td>GMP Negotiation and FHWA approval</td>
</tr>
<tr>
<td>August 2012</td>
<td>NTP</td>
</tr>
<tr>
<td>February 2013</td>
<td>Substantial Completion</td>
</tr>
</tbody>
</table>
ABC Motivation

- Detour challenges
  - Lengthy detours on existing roadways
  - Expensive on-site detours
- Less impacts to public
- Proving ground for future work
Slide / Roll - Concept
Slide / Roll – As Implemented
Slide / Roll – As Implemented

- Regular meetings with contractor and CDOT
  - Brainstorming and vetting concepts
  - Broad ideas down to finer details

Ft. Lyon Canal Bridge
- Prestressed box beams
- Cast-in-place topping
- Integral abutments
- Heavy-duty rollers
- Pull with jacks

Holbrook Canal Bridge
- Steel girders
- Traditional concrete deck
- Integral abutments
- PTFE sliding elements
- Push with jacks
Ft. Lyon Canal Bridge – Roll
Ft. Lyon Canal Bridge – Roll
Ft. Lyon Canal Bridge – Roll
Ft. Lyon Canal Bridge – Roll
Ft. Lyon Canal Bridge – Roll

NOTES:
1. Superstructure not shown for clarity.
2. Bearing pads and
   not shown for clarity.
Ft. Lyon Canal Bridge – Roll
Ft. Lyon Canal Bridge – Roll

\[\text{Diagram of Ft. Lyon Canal Bridge - Roll} \]
Ft. Lyon Canal Bridge – Roll
Holbrook Canal Bridge – Slide

[Diagram of bridge components including abutment, guide stiffener, abutment endwall, lateral push jack, jack track, push block, and elevation notes.]
Holbrook Canal Bridge – Slide
Holbrooke Canal Bridge – Slide
Holbrook Canal Bridge – Slide
Holbrook Canal Bridge – Slide
When/Why to use this technology

- Expensive or lengthy detour routes
- High user costs
- Improve work zone safety
- Waterway crossings
What went well

• Successfully moved two bridges!!!
  – 45 min for slide
  – 100 min for lift & roll
• Geometry adjustments in the field
  – Surveying as-built geometry at staging area
  – Tweaking permanent features to match
What went well

• Double backwall (Roll)
What went well

• Guidance Rollers (Slide)
What went well

• Jacking Track (Slide)
Details to improve upon

- Attachment of lower PTFE plate (Slide)
Details to improve upon

• Closure mechanism (Slide)
Details to improve upon

• Fit-interference at backwalls (Roll)
Positive Experience?

• Absolutely
• Great team of CDOT, Kiewit, and Jacobs
• Sharing knowledge with industry
Questions?
Break – 10 Minutes

or

ABC Workshop  3/6/2013

STAFF BRIDGE BRANCH
Pecos Street over I-70
Replacement of Str. E-16-EW
Using Accelerated Bridge Construction (ABC)
Pecos/I-70 Project Team

- Owner – CDOT
  - CDOT PM: Tamera Hunter-Maurer
- Consultant – Wilson & Company
  - Project Manager: Jim Brady
- CM/GC Contractor – Kiewit Infrastructure
  - Project Manager: Dave Paris
Existing Interchange

The existing signalized intersection of Pecos Street, 48th Avenue, and the I-70 ramps is inefficient, creating undesirable traffic conditions.

Substandard interchange geometry creates driving conditions that are unsafe and operationally inefficient for both passenger vehicles and the many heavy trucks utilizing the interchange.

The existing bridge is structurally deficient and will be replaced.

Average daily traffic on Pecos Street: 19,150 vehicles currently 23,000 vehicles forecasted 2035
Existing Bridge
Proposed Interchange
Proposed Bridges
Project Goals

1. Advance knowledge, experience & cost efficiency of the CDOT construction program and the construction industry in ABC and CM/GC project delivery
2. Provide a well publicized, highly successful ABC project
3. Replace the poor structure, and improve traffic operations and safety within the project budget
4. Accelerate delivery of construction schedule & complete by October 1, 2013
Project Goals (cont.)

5. Minimize inconvenience to traveling public, & maximize safety of workers & traveling public

6. Facilitate a collaborative partnership with all of the members of the project team and stakeholders

7. Provide a high quality design and construction
CM/GC Delivery Method

Benefits

• Allows input from Contractor for project elements unique to ABC methods

• Permanent structure can be designed and detailed for specific ABC method selected

• Costs of ABC will be more accurate with Contractor pricing

• Contractor has advantage to pick the best Bridge Staging location early in process
Why ABC for this Project?

- Reduced construction schedule (preferred by local businesses)
- Reduced road user costs and delays
- Improved safety (work zone & road user)
- Strong public support for ABC approach
- Meets project goal to expand ABC construction knowledge in Colorado for Contractor and Owner
ABC Decision Making Process

• Used UDOT’s ABC Rating Procedure for Pecos
• Based on FHWA “Decision-Matrix Framework for PBES”, May 2006
• Rating procedure is easy to use
• 8 evaluation measures for decision making
• Road User Delays/Costs - major consideration
• CDOT Report CDOT-2010-2 confirms road user delay/costs can be significant
• Favorable site conditions must be satisfied
**Evaluation Measures**

<table>
<thead>
<tr>
<th>ABC Rating Procedure</th>
<th>August 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Daily Traffic</strong></td>
<td></td>
</tr>
<tr>
<td>Combined on and under</td>
<td>0</td>
</tr>
<tr>
<td>Enter 5 for Interstate Highways</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>5000 to 10000</td>
</tr>
<tr>
<td>3</td>
<td>10000 to 15000</td>
</tr>
<tr>
<td>4</td>
<td>15000 to 20000</td>
</tr>
<tr>
<td>5</td>
<td>More than 20000</td>
</tr>
<tr>
<td><strong>Delay/Detour Time</strong></td>
<td>2</td>
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<tr>
<td>1</td>
<td>Less than 5 minutes</td>
</tr>
<tr>
<td>2</td>
<td>5-10 minutes</td>
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<tr>
<td>3</td>
<td>10-15 minutes</td>
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<tr>
<td>4</td>
<td>15-20 minutes</td>
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<tr>
<td>5</td>
<td>More than 20 minutes</td>
</tr>
<tr>
<td><strong>Bridge Classification</strong></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Essential Bridge</td>
</tr>
<tr>
<td>3</td>
<td>Critical Bridge</td>
</tr>
<tr>
<td><strong>User Costs</strong></td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>Less than $10,000</td>
</tr>
<tr>
<td>2</td>
<td>$10,000 to $50,000</td>
</tr>
<tr>
<td>3</td>
<td>$50,000 to $75,000</td>
</tr>
<tr>
<td>4</td>
<td>$75,000 to $100,000</td>
</tr>
<tr>
<td>5</td>
<td>More than $100,000</td>
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<tr>
<td><strong>Economy of Scale</strong></td>
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<tr>
<td>1</td>
<td>2 to 3 spans</td>
</tr>
<tr>
<td>2</td>
<td>4 to 6 spans</td>
</tr>
<tr>
<td>3</td>
<td>More than 5 spans</td>
</tr>
<tr>
<td><strong>Use of Typical Details</strong></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Some complexity, but favorable site conditions</td>
</tr>
<tr>
<td>3</td>
<td>Simple geometry and favorable site conditions</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Short duration impact with multiple traffic shifts</td>
</tr>
<tr>
<td>3</td>
<td>Normal duration impact with multiple traffic shifts</td>
</tr>
<tr>
<td>4</td>
<td>Extended duration impact with multiple traffic shifts</td>
</tr>
<tr>
<td>5</td>
<td>Extended duration impact with complex MOT scheme</td>
</tr>
<tr>
<td><strong>Railroad Impacts</strong></td>
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</tr>
<tr>
<td>1</td>
<td>One mainline railroad track</td>
</tr>
<tr>
<td>2</td>
<td>Multiple mainline railroad tracks</td>
</tr>
</tbody>
</table>

1. **Average Daily Traffic**
2. **Delay/Detour Time**
3. **Bridge Classification**
4. **User Costs**
5. **Economy of Scale**
6. **Use of typical details**
7. **Safety**
8. **Railroad impact**
# Scoring and Costs

**ABC Rating Procedure**

August 2011

Note: Do not adjust weight factors without prior consultation with Project Team.

<table>
<thead>
<tr>
<th>ABC RATING SCORE FACTORS AND WEIGHTS</th>
<th>Score</th>
<th>Weight Factor</th>
<th>Adjusted Score</th>
<th>Maximum Score</th>
<th>Adjusted Score</th>
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<tbody>
<tr>
<td>Average Daily Traffic</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td>5</td>
<td>50</td>
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<td>5</td>
<td>50</td>
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<tr>
<td>Bridge Classification</td>
<td>1</td>
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<td>5</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>User Costs</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Economy of Scale</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>9</td>
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<tr>
<td>Use of Typical Details</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Safety</td>
<td>3</td>
<td>10</td>
<td>30</td>
<td>5</td>
<td>50</td>
</tr>
<tr>
<td>Railroad Impacts</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

Total Score: 158  Max. Score: 274

**ABC Rating Score:** 58

The ABC Rating Score is driven by the four most heavily weighted factors: Average Daily Traffic, Delay/Detour Time, User Costs and Safety. For a detailed explanation, review the narrative of the ABC Decision Making Process.

**Cost Considerations:**

Calculate the following costs for use in determining the lowest total project cost.

<table>
<thead>
<tr>
<th>TOTAL PROJECT COST EVALUATION</th>
<th>Alt. 1: 3-phase Conv.</th>
<th>Alt. #2: ABC with SPMT</th>
<th>Alt. #3: ABC with slide-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Cost Costs</td>
<td>$3,552,000</td>
<td>$3,552,000</td>
<td>$3,552,000</td>
</tr>
<tr>
<td>ABC costs or overbuild</td>
<td>$450,000</td>
<td>$800,000</td>
<td>$250,000</td>
</tr>
<tr>
<td>User Delay Costs</td>
<td>$3,543,000</td>
<td>$1,305,000</td>
<td>$1,452,000</td>
</tr>
<tr>
<td>Bridge Project Cost</td>
<td>$7,545,000</td>
<td>$5,657,000</td>
<td>$5,254,500</td>
</tr>
<tr>
<td>User costs/bridge costs</td>
<td>1.00</td>
<td>0.37</td>
<td>0.41</td>
</tr>
</tbody>
</table>
Final tests for using ABC

1. Can project be accelerated using ABC?
2. Does ABC mitigate a critical environmental issue?
3. Does ABC provide lowest total project cost?
4. Do existing site conditions support an ABC approach?
Do Site Conditions favor ABC?

Considerations
- Existing and proposed grades
- Room for substructure construction
- Room for maintaining traffic
- Size of Bridge Staging Area
- Suitability of Travel path
Do Site Conditions favor ABC?

CM/GC delivery method allowed Contractor to select best site for BSA

Actual Bridge Staging Area
Decisions made prior to CM/GC Contractor selection

- Interchange type and geometrics
- Project Goals
- ABC approach (using ABC Decision Process)
- Structure layout
- Structure type options
Decisions made with CM/GC Contractor

- Structure type
- Abutment foundation
- ABC method
- Bridge Staging Area (BSA) location
- Temporary supports at BSA
- Construction schedule
ABC: Roll-in Approach (selected)

- Construct superstructure in Bridge Staging Area
- Construct abutments behind existing piers
- No I-70 closures until bridge move
- Replace superstructure in 50-hour weekend closure of I-70
ABC: Slide-in Approach

- Construct superstructure adjacent to existing bridge over I-70
- Construct abutments behind existing piers
- **Requires several I-70 closures (more user costs)**
- Replace superstructure in 24-48 hour weekend closure
- Technique is not new to CDOT
- Reduced safety by constructing over I-70
Costs associated with ABC

• Estimated about $1.5M for ABC approach using roll-in. Actual costs less than $2M
• Other elements not included in ABC costs:
  – Lifting Diaphragms
  – Wingwall tops placed after roll-in
  – Low overhead caisson rig for working under existing bridge
3D analysis required to determine permanent and temporary loads
- Selected plate element model
- Used to determine reactions in lifting diaphragms
- Used to develop acceptable distortion limits for bridge move
Lessons Learned

• Simplify geometry when possible
• Selection of bridge modeling is critical for handling all loading conditions
• More balanced loads at temporary supports helps simplify SPMT design
• Bearings – need better method for setting bearings to evenly distribute loads
• Deck PT – Type 7 barrier would be better than Type 10 for avoiding rebar conflicts with PT anchorages
• Lighter weight bridge reduces cost of SPMT (about $10,000 per axle for Pecos)
Pecos/I-70 - Fun Facts

• 96 Self-Propelled Modular Transporters (SPMT) Axles
• Bridge weighs a total of 2,400 tons
  – 1,060 CY of concrete
  – 300,000 LBS Reinforcing Steel
• 7,200 feet, or 1.3 miles of Post Tensioning
• Traffic Counts per Day:
  – I-70 – 130,000
  – Pecos Street – 19,000
Construction - Bridge Staging Area
Construction – North Abutment
ABC Roll-in

[Diagram of a bridge roll-in project]
Pecos/I-70 Project Schedule

• Winter 2013 – Bridge structure construction off-site, improvements to Pecos Street and building eastbound on- and off- ramps

• Spring 2013 – installation of pedestrian bridge and two-month closure of Pecos Street

• Summer 2013 – bridge roll-out

• Project completed summer 2013
Questions?
National Perspective On Accelerated Bridge Construction

Jamal Elkaissi, PE, MS
Federal Highway Administration

ABC Workshop 3/6/2013
Presentation Outline

• Facts about ABC
• How the States Responding to ABC
• Nationwide Case Studies
• Lessons Learned & Best Practices
• Implement Standardization- Practice
Age of U.S. Bridges

![Age of U.S. Bridges chart]

- Age distribution of U.S. bridges:
  - 6% < 5 years old
  - 7% 6-10 years old
  - 7% 11-15 years old
  - 9% 16-20 years old
  - 7% 21-25 years old
  - 11% 26-30 years old
  - 9% 31-35 years old
  - 11% 36-40 years old
  - 20% 41-50 years old
  - 18% > 50 years old

ABC Workshop 3/6/2013

STAFF BRIDGE BRANCH
U.S. Bridge Construction
By Decade

By Decade:
- Pre-1909
- 10s
- 20s
- 30s
- 40s
- 50s
- 60s
- 70s
- 80s
- 90s

Construction numbers range from 0 to 140,000.
Front burner priorities

- By 2020, 90% of Urban Interstate Highways are at or exceeding capacity
- 1/3 bridges – some 200,000 bridges – are structurally deficient or functionally obsolete
- Annual loss of 41,000 lives
Conventional Construction Site
Congestion Impact

Congestion robs our nation of productivity and quality of life

- 4 billion hours/year time delay
- 2.7 billion gallons of wasted gas/year
- $73 billion in 75 urban areas
Cost of Congestion to U.S. Businesses

$500K/year for additional travel time for maintenance crews

Congestion at the Ambassador Bridge, cost users between $150M and $200M.

Intel has moved their shipment departure time up two hours
Work Zone Impacts

- 6,400 work zones (2003)
- 6,157 lane miles closed
- 20% capacity reduction
- Safety Issues
Construction Workers Injuries

- 44% of bridge construction workers injuries involve a vehicle traveling through a work zone (OSHA Type 1622, 1984-2010)
- 2/3 are fatal
- 28% of worker injuries involve construction vehicles
WHY ABC
“Get In, Get Out, Stay Out!

ADVANTAGES:

• Reduced onsite construction time
• Minimized traffic disruption – from months to days-User Costs
• Reduced Environmental impact
• Improved work zone safety –
• Lower First and Life-Cycle Costs
• Improved product quality – controlled environment
What is ABC?

**Paradigm Shift**

- Innovative methods to decrease bridge construction time
- Build elements offsite/outside traffic area
- Transport to site and install rapidly
COMPONENTS OF ABC

- **Project Planning**
  Decision Making Frame work

- **PBES**
  **Superstructure**
  Precast Full Depth Deck Panels
  Precast Straight and Curved Girders
  Steel Girders, Straight and Curved
  Fiber Reinforced Polymer (FRP) Panels
  Precast Approach Slabs

- **Substructure**
  Precast Pier Caps
  Precast Piers

- **Contracting Methods/Innovative**
  Design/Built
  Best Value
  CMGC
  A+B
  A+B+C
  Warranties
  Incentives/Disincentives

ABC Workshop 3/6/2013

STAFF BRIDGE BRANCH
COMPONENTS OF ABC

• Structural Placement Methods
  Self-Propelled Modular Transporter (SPMTs)
  Longitudinal Launching
  Horizontal Sliding or Skidding
  Conventional & Heavy Lifting Equipment & Methods

• Geotechnical Solutions
  Geosynthetic Reinforced Soils (GRS) Integrated Bridge Systems (IBS)
  Expanded Polystyrene (EPS) Geofoam
  Self Compacting material

• Right Of Way
  Flexibilities in Right –of-Way

• Utilities
  Flexibilities in Utility Accommodation and Relocation
How the Nation Responding to ABC

<table>
<thead>
<tr>
<th>Authorized Projects</th>
<th>1(^{st})</th>
<th>2(^{nd})</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBES</td>
<td>143</td>
<td>200</td>
</tr>
<tr>
<td>PBES w/ Fed Aid</td>
<td>132</td>
<td>168</td>
</tr>
</tbody>
</table>

2010 to June 2012: 802 bridges Elements

PBES with Federal Funds Design or Built

Fully Implemented
Varying Degree Devel.
200 Non-Federaly Funded
168 Federal Funded (10%)
What Are They Selecting

SYSTEMS:
- Super .................. 35
- Sub & Super ....... 24
- Total Bridge ........ 6

Abutment, Wingwalls
Pier cap, Column and/or footing
Full-depth deck panels
Partial-depth deck panels
Beams: more efficient shapes

3rd Survey Results

0  10  20  30  40  50  60  70
Utah Case Studies

4500 South Bridge over I-215E, UT - 2007

Prefabricated Superstructure driven into position with SPMTs
- I-215 closed over a weekend
- 4500 South closed only 10 days
4500 South over I-215

Construction Year: 2007
Total Construction Cost: $7,700,000
ABC Construction Cost: $900,000*
Facility User Cost Per Day: $35,500
Estimated Days Saved: 120
User Savings: $4,260,000
Cost Benefit Ratio: 5

* Project cost does not take into account for traffic control cost savings from traditional to ABC

ABC Workshop 3/6/2013

STAFF BRIDGE BRANCH
Utah Case Studies

Full Superstructure I-215 East over 3760 South

- Full superstructure replacement deck precast on steel girders
- Lifted into place by cranes
## Full Superstructure I-215 East over 3760 South

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Year</td>
<td>2004</td>
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<tr>
<td>Total Construction Cost:</td>
<td>$2,690,965</td>
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<tr>
<td>ABC Construction Cost:</td>
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<tr>
<td>Facility User Cost Per Day:</td>
<td>$34,000</td>
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<tr>
<td>Estimated Days Saved:</td>
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<tr>
<td>User Savings:</td>
<td>$1,020,000</td>
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<tr>
<td>Cost Benefit Ratio:</td>
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</tbody>
</table>

* Project cost does not take into account for traffic control cost savings from traditional to ABC
Utah Case Studies

I-80 State Street to 1300 East Multiple Structures, UT - 2008

- I-80W over Highland Drive
- I-80W over 900 East Street
- I-80W over 700 East Street
- I-80W over 600 East Street
- I-80W over 500 East Street
- I-80W over 300 East Street
- I-80W 600 East Ramp Bridge
Utah Case Studies

- Replacement of seven structures along I-80
- Moved to location using SPMTs
- Moved over final location using skid shoes
- Lowered to final location using climbing jacks
I-80 State Street to 1300 East
I-80 State Street to 1300 East
I-80 State Street to 1300 East
I-80 State Street to 1300 East
Utah Case Studies

Rapid Deck at Wanship over I-80

- Deck replacements using precast deck panels
Rapid Deck at Wanship over I-80

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Year:</td>
<td>2004</td>
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<tr>
<td>Total Construction Cost:</td>
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<tr>
<td>ABC Construction Cost:</td>
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<tr>
<td>Facility User Cost Per Day:</td>
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<td>Estimated Days Saved:</td>
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<td>User Savings:</td>
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<tr>
<td>Cost Benefit Ratio:</td>
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</table>

* Project cost does not take into account for traffic control cost savings from traditional to ABC
Utah Case Studies

Fort Lane/I-15 South Layton Interchange, UT – 2010

Longitudinal Launching
Utah Case Studies

Fort Lane/I-15 South Layton Interchange
<table>
<thead>
<tr>
<th>ABC Method / Element</th>
<th>Number of Bridges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge Launch</td>
<td>2</td>
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<tr>
<td>Self Propelled Modular Transporters (SPMT)</td>
<td>23</td>
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<tr>
<td>Slide-in</td>
<td>5</td>
</tr>
<tr>
<td>Heavy Lift Cranes</td>
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</tr>
<tr>
<td>Half Depth Precast Deck Panels</td>
<td>63</td>
</tr>
<tr>
<td>Full Depth Precast Deck Panels</td>
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<tr>
<td>Precast Voided Slabs</td>
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<tr>
<td>Approach Slab Panels</td>
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<tr>
<td>Precast Sleeper Slabs</td>
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<tr>
<td>Precast Abutments</td>
<td>6</td>
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<tr>
<td>Precast Bent Caps</td>
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<tr>
<td>Precast Columns</td>
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<tr>
<td>Prefabricated Pedestrian Bridge</td>
<td>5</td>
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<tr>
<td>Precast Box Culvert</td>
<td>44</td>
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</table>
Nevada Case Study

Slide-In Construction

Photos courtesy of Nevada DOT

Accelerated Bridge Construction
Weekend Bridge - Colorado

Mitchell Gulch Bridge

ABC Workshop 3/6/2013

STAFF BRIDGE BRANCH
Bronco Arch Bridge – Colorado
Total Prefabricated elements
A Good Candidate for ABC
FAST 14 Project
Mass Case Study
I93- Bridge Replacement

14 Bridges In 10 Weekends
Superstructure Units

Preparation to set PMSE's

- Install shoring, cope existing stringers
- Drill, install rebar, and place pedestals

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STAFF BRIDGE BRANCH
Massachusetts Case Study
Prefabricated Substructures

- Lake Ray Hubbard Bridge, 2002
- Lake Belton Bridge, 2004
- Newark International Airport Monorail, 2001

PreCast Cap Standard currently under development at TxDOT
I-287 Cross Westchester Expressway, NY

Pier
Mill St. Bridge in Epping, NH

2.5 hours to set all elements, 15-30 mins per piece

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STAFF BRIDGE BRANCH
Superstructure Units
Full Depth Precast Deck Panels
Folded Steel Plate Bridge
Folded Steel Plate Bridge
Embankment

Accelerated Geotechnical; Geofoam Embankment
Lessons Learned And Best Practices
COST

Traditional Business Model

- Successful business model
- Existing interstate was constructed
- Competition determines the lowest construction cost
- Contractors select time and method
societal Costs

- Linear relationship
- Cost depends on volume of traffic
- Longer construction duration increase impacts to users
COST

New Business Model

- New paradigm
- Lowest construction cost  $\rightarrow$ lowest project cost
- Societal costs minimized
- Political capital
- Public praise
SPMT Bridge Move Costs in Utah

Cost per bridge span moved

- I-215; 4500 South
- I-80; State Street to 1300 East
- I-80; Mt. Delle to Lambs Canyon
- 3300 South over I-215
- I-15; Widening, 500 North to I-215
- Pioneer Crossing

COST
Old Adage

You can only have any two

Rapid Construction
High Quality
Low Cost

By elimination of temporary bridges or costly stage construction schemes, you CAN have all three
Lessons Learned and Best Practices

• Engage the industry
Share or Define Risk

• Contractors perceived level of risk translates to dollars on bid day
• May prevent interest in the project
• Limit what's incidental, and what can’t be defined by specification or plans
With DB project delivery, the designer-builder assumes responsibility for the majority of the design work and all construction activities. This provides the designer-builder with increased flexibility to be innovative, along with greater responsibility and risk.

Benefits:
- Considerable time savings over the traditional process of Design-Bid-Build (DBB)
- Allows design to be tailored to contractor’s resources
- Allows quality evaluation factors and best-value selection criteria when selecting contractors
CM/GC occupies the middle ground between the traditional (DBB) and (DB). CM/GC provides for project acceleration by allowing the owner to contract with a construction manager early in the design process and agree to a negotiated price for construction later before the design is complete.

Benefits:
- Reduces Costs
- No compromise on quality
- Enhances potential for creativity
Clean simple details

• Tend to:
  – Drive down costs
  – Be built to higher standards
  – Reduce inventories & speed replacements
  – Reduce overheads & distributed costs
One of a kind designs

- Limits re-use of
  - Technology
  - Equipment, forms, yards
  - Cost history
  - Personnel
Design
Implement Standardization

• ABC Manual and Standard Drawings
Why ABC?

- Minimizes Traffic delays
- The Public expects it!
- The Public demands it!
- It’s’ Good Engineering!

Malcolm T. Kerley, P.E.
Chief Engineer, VDOT
Chair, AASHTO Subcommittee on Bridges and Structures
Thank you

Questions
Thanks for Attending

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