ABC Technologies & Resources

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Illinois Tollway ABC Workshop
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ABC Technologies & Resources

- Categories of ABC Technologies
- Types of Prefabricated Bridge Elements and Systems (PBES) for ABC
- Examples of PBES for ABC
- ABC Resources
Categories of ABC Technologies

- Project Planning
- Geotechnical Solutions
- Structural Solutions
PROJECT PLANNING

Decision-Making Tools

- FHWA Process  [FHWA Decision-Making Framework] [Final Report]
- State Process
- TPF-5(221)  [AHP Decision-Making Tool]; [Final Report]; [Public Roads, November/December 2011]
- Benefit/Cost Method
- Other Decision-Making Tool

Site Procurement

- Programmatic Agreement
- Right-of-Way Acquisition
- Relocation Incentive
- Flexibility in Utilities
- Early Environmental Clearance & Permitting
- Electronic Shop Drawing Submittal & Approval Process
- Fabrication Drawings Prior to Bid
- Material Procurement Prior to Contract Award
- Other Site Procurement

Project Delivery

- Design-Bid-Build
- Design-Build
- In-House Force
- CMGC  [Construction Manager / General Contractor]
- Alternative Technical Concept
- Alternative Ton (Foundation)
- Other Project Delivery

Contracting

- A+B Bidding
- A+B+C Bidding
- Contractor Revision
- Value Engineering
Contracting

- A+B Bidding
- A+B+C Bidding
- Full Lane Closure
- Warranty
- Lane Rental
- Incentive / Disincentive Clause
- No Excuse Bonus
- Lump Sum Bonus
- Contractor Option

- Contractor Revision
- Value Engineering
- VE with Partnering
- Formalized Partnering
- Best Value Award
- Performance Contracting
- Emergency Contract
- Accelerated Bid Process
- Other Contracting

GEOTECHNICAL SOLUTIONS

Foundations and Walls

- Continuous Flight Auger Pile
- Micropile
- High-Capacity Pile
- GRS IBS [Geosynthetic Reinforced Soil Integrated Bridge System]
- CIP Substructure Under Traffic
- Reused Substructure/Foundation Unit
- Pre-Grouted Void
- Other Foundation/Wall

Rapid Embankment

- EPS Geofoam [Expanded Polystyrene Geofoam]
- Self-Compacting Backfill
- Intelligent Compaction
- Fully-Contained Flooded Backfill
- Embankment Surcharge
- Lightweight Fill
- Other Rapid Embankment
STRUCTURAL SOLUTIONS

Prefabricated Bridge Elements and Systems (PBES)

PBES are the structural components of a bridge that are built off-site or near the site of a bridge, and include features that reduce the on-site construction time and mobility impact time that would occur if conventional construction methods were used.

Prefabricated Elements

Prefabricated elements are a category of PBES which comprise a single structural component of a bridge.

Deck Elements

- Full-Depth Precast Deck Panel w/PT
- Full-Depth Precast Deck Panel w/o PT
- Partial-Depth Precast Deck Panel
- FRP Deck Panel {fiber-reinforced polymer deck panel}
- Steel Grid (open) Deck
- Steel Grid (concrete filled) Deck
- Aluminum Deck
- Exodermic Deck
- Orthotropic Deck/SPS {Sandwich Plate System}
- Orthotropic Deck/Other
- UHPF Waffle Deck
- Other Deck Element

Deck beam elements eliminate conventional on-site deck forming activities. To reduce on-site deck forming operations, deck beam elements are typically placed in an abutting manner. Full-width beam elements eliminate conventional on-site beam placement activities. They are typically rolled, slid, or lifted into place to allow deck placement operations to begin immediately.
Deck beam elements eliminate conventional on-site deck forming activities. To reduce on-site deck forming operations, deck beam elements are typically placed in an abutting manner. Full-width beam elements eliminate conventional on-site beam placement activities. They are typically rolled, slid, or lifted into place to allow deck placement operations to begin immediately after placement. Given their size and weight, the entire deck is not included.

### Deck Beam Elements
- Adjacent Deck Bulb T Beam
- Adjacent T Beam
- Adjacent Inverted T Beam
- Adjacent Box Beam
- Adjacent Slab Beam
- Adjacent Slab Beam w/Backwall
- MDcBc {Modular concrete-Decked concrete Beam}
- MDcBs {Modular concrete-Decked steel Beam}
- MDcBs/FSPGS {Folded Steel Plate Girder System}
- PT Concrete Through-Girder
- Other Deck Beam Element

### Full-Width Beam Elements
- Truss Span w/o Deck
- Arch Span w/o Deck
- Precast Segmental
- Steel Segmental
- Other Full-Width Beam Element

### Pier Elements
- Precast Pile Cap
- Precast Cap Shell
- Precast Cap & Column(s)
- Precast Column Cap
- Precast Column(s)
- Precast Footing Shell
- Steel Pile Cap
- Steel Column Cap
- Steel Column(s)
- Steel Cap & Column(s)
- Other Pier Element
Pier Elements
- Precast Pile Cap
- Precast Cap Shell
- Precast Cap & Column(s)
- Precast Column Cap
- Precast Column(s)
- Precast Footing Shell
- Precast Footing(s)
- Precast Caisson Cap
- Steel Pile Cap
- Steel Column Cap
- Steel Column(s)
- Steel Cap & Column(s)
- Other Pier Element

Abutment and Wall Elements
- Precast Abutment Cap
- Precast Backwall
- Precast Abutment Cap w/Backwall
- Precast Abutment Stem
- Precast Wingwall
- Precast Cheek Wall
- Precast Abutment Footing
- Steel Sheet Piling
- Precast Sheet Piling
- Precast Lagging Panel
- Precast Full-Height Wall Panel
- Precast Retaining Wall
- MSE Wall (mechanically-stabilized earth wall)
- Modular Block Wall
- GRS Abutment (geosynthetic reinforced soil abutment)
- Proprietary Wall
- Precast 3-Sided Culvert
- Other Abutment Element

Prefabricated Systems
Prefabricated systems are a category of PRFS that consists of an entire superstructure, an entire superstructure and substructure, or a substructure.
Prefabricated Systems

Prefabricated systems are a category of PBES that consists of an entire superstructure, an entire superstructure and substructure, or a total bridge that is procured in a modular manner such that traffic operations can be allowed to resume after placement. Prefabricated systems are rolled, launched, slid, lifted, or otherwise transported into place, having the deck and preferably the parapets in place such that no separate construction phase is required after placement.

Superstructure Systems

Superstructure systems include both the deck and primary supporting members integrated in a modular manner such that mobility disruptions occur only as a result of the system being placed. These systems can be rolled, launched, slid, lifted, or transported in place, onto existing or new substructures (abutments and/or piers).

- FDCBc {Full-Width concrete-Decked concrete Beam Unit}
- FDCBs {Full-Width concrete-Decked steel Beam Unit}
- Through-Girder Span w/Deck
- Truss Span w/Deck
- Arch Span w/Deck
- Steel Orthotropic Box Girder Span
- Prestressed Multi-Cell Box Girder Span
- Metal Panel Deck Span
- RDcBc {Reused concrete-Decked concrete Beam span}
- RDcBs {Reused concrete-Decked steel Beam span}
- Other Superstructure System

Superstructure / Substructure Systems

Prefabricated superstructure/substructure systems include either the interior piers or the abutments, which are integrated in a modular manner with the superstructure as described above. Superstructure/substructure systems can be slid, lifted, or transported into place onto new or existing substructures.

- Rigid Frame w/Deck and Bailing
Superstructure / Substructure Systems

Prefabricated superstructure/substructure systems include either the interior piers or the abutments, which are integrated in a modular manner with the superstructure as described above. Superstructure/substructure systems can be slid, lifted, or transported into place onto new or existing substructures.

- Rigid Frame w/Deck and Railing
- Other Super/Substructure System

Total Bridge Systems

Total bridge systems include the entire superstructure and substructures (both abutments and piers) that are integral with the superstructure that are built off-line and installed in a manner to allow traffic operations to resume after placement. This excludes projects that are built off-line and, once complete, traffic “shifted” to the new alignment.

- Rolled/Launched/Slid/Lifted
- Other Total Bridge System

Miscellaneous Elements

Prefabricated miscellaneous elements either eliminate various activities that are associated with conventional bridge construction or compliment the use of PBES.

- Precast Approach Slab
- Precast Curb
- Precast Fencing
- LWC Beam {lightweight concrete beam}
- LWC Deck {lightweight concrete deck}
- LWC Substructure {lightweight concrete substructure}
Miscellaneous Elements

Prefabricated miscellaneous elements either eliminate various activities that are associated with conventional bridge construction or compliment the use of PBES.

- Precast Approach Slab
- Precast Curb
- Prefabricated Railing
- Precast Diaphragm
- Steel Diaphragm
- LWC Beam {lightweight concrete beam}
- LWC Deck {lightweight concrete deck}
- LWC Substructure {lightweight concrete substructure}
- Other Miscellaneous Element

Closure Joints / Connections

- CIP Reinforced Closure Joint {cast-in-place reinforced concrete closure joint}
- HEST-LSh Concrete Joint {high-early-strength low-shrinkage concrete joint}
- UHPC Closure Joint {ultra-high-performance concrete closure joint}
- Epoxy Joint
- Grouted Key Closure Joint
- Grouted Blockout w/Shear Connector
- Grouted Duct Connection
- Pocket Connection
- Socket Connection
- Link Slab
- Match Cast Closure Joint
- Bars in Splice Coupler
- PT Ducts/Bonded
- PT Ducts/Un-bonded
- Other Closure Joint/Connection

Overlays

- Standard Concrete Overlay
- High-Density Concrete Overlay
- Micro-Silica Overlay
- Polymer Concrete Overlay
Standard Concrete Overlay  
High-Density Concrete Overlay  
HPC Overlay  
Asphalt Overlay w/Membrane  
Asphalt Overlay w/o Membrane  
Latex-Modified Overlay  
Micro-Silica Overlay  
Polymer Concrete Overlay  
Rapid Set Overlay  
Thin-Bonded Epoxy Overlay  
Asphalt Chip Seal w/o Membrane  
Other Overlay

Construction Equipment and Methods

**SPMT  [Self-Propelled Modular Transporter]**
- SPMT(s)
- SPMT with Gantry System
- SPMT on Barge
- Other SPMT Combination

**Lateral Slide  [aka, Slide-in Bridge Construction]**
- Lateral Slide w/pad
- Lateral Slide w/roller

**Other Equipment**
- High-Capacity Crane(s)
- High-Capacity Crane on Barge
- Strand Jack
- Towed Modular Transporter
- Float In
- Gantry System
- Multi-Axle Flatbed Trailer

**Longitudinal Launch**
- Longitudinal Launch w/pad
- Longitudinal Launch w/roller
ABC Technologies & Resources

- Categories of ABC Technologies
- Types of Prefabricated Bridge Elements and Systems (PBES) for ABC
- Examples of PBES for ABC
- ABC Resources
Prefabricated Bridge Elements & Systems (PBES)

- One type of ABC
- Built:
  - Offsite, or
  - Adjacent to alignment
- Include features that reduce:
  - Onsite construction time
  - Mobility impact time
Prefabricated Deck Elements

Examples:
- Full-depth precast deck panel
- FRP deck panel
- Steel grid deck (open or filled)
Prefabricated Deck Elements

Most Common: Full-depth Precast Deck Panels

Example: 24th Street Bridge over I-29/I-80, Council Bluffs, Iowa
Prefabricated Deck Elements

Most Common: Full-depth Precast Deck Panels

Example: I-70 Bridge over Eagle Canyon (Eastbound), southern Utah
Prefabricated Beam Elements

Examples of Deck Beam Elements:
- Modular decked beam
- Adjacent deck bulb T beam
- Adjacent T beam
- Adjacent box beam
- Adjacent slab beam
Prefabricated Beam Elements

Examples of Full-Width Beam Elements:

- Truss span w/o deck
- Arch span w/o deck
- Precast segmental
- Steel segmental
Prefabricated Pier Elements

Examples:
- Precast caisson cap
- Prefab pile cap – steel or precast
- Prefab column(s) and/or cap – steel or precast
- Precast footing
Prefabricated Abutment & Wall Elements

Examples:
- Precast cap, backwall, wingwall, footing
- Sheet piling – steel or precast
- Precast full-height wall panel
- MSE wall
- GRS abutment
Prefabricated Miscellaneous Elements

Examples:
- Precast approach slab
- Prefabricated railing
- Closure joint
- Overlay
Prefabricated Bridge Systems

Systems: rolled, launched, slid, etc.
- Superstructure
- Superstructure/pier
- Total bridge
Prefabricated Bridge Elements Currently of Most Interest Nationally

Modular Decked Beams

Steel
Concrete
Modular Decked Beams – MDcBs (steel beam with concrete deck)

Example: 2011 MA Salem St Bridge EB (93FAST14)

Example: 2011 MA River Road Bridge in town of Uxbridge
Modular Decked Beams – MDcBc
(concrete beam with concrete deck)

Northeast Extreme Tee (NEXT) Beam

Example: 2011 VT Chester VT 103 Bridge 8

* http://www.pcine.org/index.cfm/resources/bridge/Northeast_Extreme_Tee_Beam
Prefabricated Bridge Elements Currently of Most Interest Nationally

Modular Decked Beams (MDcBc & MDcBs)

Deck Closure Joint Options:
• Width – narrow, or wider to reduce self-weight
• Material – early-strength concrete or grout, or UHPC
• Reinforcement – rebar arrangement
• Longitudinal post-tensioning?
• Overlay?

Goal: Long-term durability of joints
Prefabricated Bridge Systems
Currently of Most Interest Nationally

- Superstructure span moves using self-propelled modular transporters
- Superstructure span lateral slides using hydraulic jacks or winches

- e.g., concrete beams; single-span move
- e.g., steel beams; 2-span move
- e.g., steel beams; 3-span slide
- e.g., concrete beams; 5-span slide
ABC Technologies & Resources

- Categories of ABC Technologies
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- ABC Resources
ELEMENTS Example 1 (MDcBc): 2011 VT Chester VT 103 Bridge 8

- 1 of 2 single-span bridges in project
- Rural location
- Design-bid-build
- 3-week closure
Primary reasons for use of ABC:

- Reduced traffic impacts – 7,200 ADT
- Reduced onsite construction time
- Improved work-zone safety
- Minimized environmental impacts
Elements Example 1 (MDcBc): 2011 VT Chester VT 103 Bridge 8

Precast:
- Abutments
- Beams
- Approach slabs
Elements Example 1 (MDcBc): 2011 VT Chester VT 103 Bridge 8

- PCINE NEXT 28D beam (decked double tee)
- 8-inch-wide longitudinal closure joints of non-shrink grout
Elements Example 1 (MDcBc): 2011 VT Chester VT 103 Bridge 8

Other ABC included:
- Full lane closure
- Incentives/disincentives
- Lump sum bonus
- Value engineering
- Asphalt overlay w/membrane

3-week closure
Elements Ex. 2 (MDcBs): 2011 MA Salem St Bridge EB (93FAST14)

- 3-span bridge on I-93 through City of Medford
- Modular decked beams
- 1 weekend closure
- Design-build project
- 10 weeks for 14 bridges
- Total 41 spans
Primary reasons for use of ABC:

- Reduced traffic impacts – 181k ADT
- Reduced onsite construction time
- Improved site constructability
Elements Ex. 2 (MDcBs): 2011 MA Salem Street Bridge EB (93FAST14)

- Abutments & interior supports repaired prior to closure
Elements Ex. 2 (MDcBs): 2011 MA Salem Street Bridge EB (93FAST14)

- 6 modular decked steel beams per span
- 32-inch-wide longitudinal closure joints of high-early-strength concrete
- Link slabs over interior supports
Elements Ex. 2 (MDcBs): 2011 MA Salem Street Bridge EB (93FAST14)

Other ABC included:
- State decision-making process
- Early environmental clearance
- Electronic submittal/approval
- Full lane closure
- Warranties
- Incentives/disincentives
- No excuse bonus
- Value engineering
- Asphalt overlay w/membrane

I-93 SB detoured Friday at 8 pm
Fully re-opened Monday at 5 am
Elements Ex. 3 (MDcBs): 2015 PA 581 10th Street Bridge

- Borough of Lemoyne in Cumberland County
- 86,000 ADT
- 121-ft-long x 85-ft wide
- 3 continuous spans (37 ft – 47 ft – 37 ft)
- 2-weekend closure vs. 1.5-yr. conv. (9 pm Fri. – 6 am Mon.)

Ref: ABC-UTC August 2015 Webinar
Primary reasons for use of ABC:
- Reduced traffic impact – 86,000 ADT
- Improved work-zone safety
- Improved site constructability

Ref. ABC-UTC August 2015 Webinar
Elements Ex. 3 (MDcBs): 2015 PA 581 10th Street Bridge

Modular decked beams
- Two I-shaped steel girders per modular decked beam
- 7 modular decked beams/span
- 9.25-inch-thick precast deck incl. 1.25-inch LMC overlay
- 2-ft-wide longitudinal closure joints w/high-early-strength concrete

Near-site superstructure construction

Ref: ABC-UTC August 2015 Webinar
Elements Ex. 3 (MDcBs): 2015 PA 581 10th Street Bridge

Ref: ABC-UTC August 2015 Webinar
Elements Ex. 3 (MDcBs): 2015 PA
581 10th Street Bridge

2-weekend closure to replace (9 pm Fri. – 6 am Mon.)

2-weekend closure to apply latex-modified concrete overlay

Ref. ABC-UTC August 2015 Webinar
Elements Ex. 4 (MDcBs): 2015 TN
Fast Fix 8 – Charlotte Avenue Bridges

Ref: ABC-UTC October 2016 In-Depth Web Training

Replacement bridge

Original bridge
Elements Ex. 4 (MDcBs): 2015 TN
Fast Fix 8 – Charlotte Avenue Bridges

- I-40 through downtown Nashville
- 140,000+ ADT
- 130-ft-long x 150-ft wide single span replacement
- In a curve, super-elevated, tapers on both sides for on/off ramps
- 1 weekend closure per bridge

Ref: ABC-UTC October 2016 In-Depth Web Training
In a curve, super-elevated, tapers on both sides for on/off ramps:

Framing for the bridge was simplified to aid in fabrication and to control deflections.

Building the units with uniform dimensions helped with setting the beam camber.

The contractor was able to place the reinforcing for the barrier and median rails in the units which eliminated the need for post weekend median and cantilever pours.
Elements Ex. 4 (MDcBs): 2015 TN
Fast Fix 8 – Charlotte Avenue Bridges

- Primary reasons for use of ABC:
  - Reduced traffic impact – 140,000+ ADT
  - Reduced onsite construction time
  - Improved work-zone safety
  - Improved material quality & product durability

“Bridge Farm” on two acres in median of I-40 within weekend closure limits of project

Ref. ABC-UTC October 2016 In-Depth Web Training
Elements Ex. 4 (MDcBs): 2015 TN
Fast Fix 8 – Charlotte Avenue Bridges

- Metal decking in-place for closure pour form
- Diaphragms attached to bridge to speed up installation.
- Bearings vulcanized to steel sole plates sized for needed cross slope adjustment.

Ref: ABC-UTC October 2016 In-Depth Web Training
Elements Ex. 4 (MDcBs): 2015 TN Fast Fix 8 – Charlotte Avenue Bridges

Ref: ABC-UTC October 2016 In-Depth Web Training
Elements Ex. 4 (MDcBs): 2015 TN Fast Fix 8 – Charlotte Avenue Bridges

End wall blocks pinned to abutment cap:

Closure pours tie all together

Approach slabs pinned to end walls:

Ref: ABC-UTC October 2016 In-Depth Web Training
TDOT Class X mix reaches 4000 psi in 4 hours with exception shrinkage & bond strength characteristics

<table>
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<th>PERFORMANCE CHARACTERISTIC</th>
<th>TEST METHOD</th>
<th>PERFORMANCE CRITERIA</th>
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<td>ASTM C39 (MODIFIED)</td>
<td>@ 8 HOURS (OVERNIGHT CURE) @ 7 DAYS (7 DAY CURE)</td>
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<tr>
<td>SHRINKAGE (S) (CRACK AGE, DAYS)</td>
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<td>FREEZING AND THAWING DURABILITY (F/T). (RELATIVE MODULUS AFTER 300 CYCLES)</td>
<td>ASTM C666 PROCEDURE A (MODIFIED)</td>
<td>GRADE 1 70% ≤ F/T GRADE 2 80% ≤ F/T GRADE 3 90% ≤ F/T</td>
</tr>
</tbody>
</table>

Ref: ABC-UTC October 2016 In-Depth Web Training
SYSTEMS Ex. 1 (SPMT Move): 2011
MA Cedar Street Bridge – Wellesley

- 2-span superstructure roll-in with SPMTs*
- 530-ton self weight
- Urban location
- Weekend closure

* SPMTs = self-propelled modular transporters
Primary reasons for use of ABC:

- Reduced traffic impacts – 39K ADT
- Reduced onsite construction time
- Improved work-zone safety
- Improved site constructability
- Improved material quality & product durability
Systems Ex. 1 (SPMT Move): 2011
MA Cedar Street Bridge – Wellesley

Precast Elements:
- Abutment caps
- Pier cap
- Approach slabs

System:
- 2-Span Superstructure
Systems Ex. 1 (SPMT Move): 2011
MA Cedar Street Bridge – Wellesley

Conventional construction adjacent to bridge site

- W14x159 steel girders @ 6.75-ft spacing
- 8-inch-thick composite cast-in-place concrete deck w/ 3-inch-thick hot-mix asphalt (HMA) wearing surface
Demolish bridge; repair existing substructure; install precast caps
Systems Ex. 1 (SPMT Move): 2011
MA Cedar Street Bridge – Wellesley

Move 2-span superstructure on SPMTs
Systems Ex. 1 (SPMT Move): 2011
MA Cedar Street Bridge – Wellesley

Bridge in final location
Other ABC included:

- State decision-making process
- Electronic shop dwg. submittal & approval
- Full lane closure
- Incentive/disincentive
- Lump sum bonus
- Asphalt overlay w/membrane
- High capacity cranes

Closed Friday at 10 pm
Re-opened Monday at 12 noon
Systems Ex. 2 (SPMT Move): 2011
UT Sam White Lane Bridge over I-15

- 2-span superstructure roll-in with SPMTs*
- 1,910-ton self weight
- Urban location
- Overnight I-15 closure

* SPMTs = self-propelled modular transporters
Primary reasons for use of ABC:
- Reduced traffic impacts – 66K ADT
- Reduced onsite construction time
- Improved work-zone safety
- Improved site constructability
- Improved material quality & product durability

UT Sam White Lane Bridge over I-15

Completed bridge:
354 ft long & 77 ft wide
(177 ft – 177 ft)
Systems Ex. 2 (SPMT Move): 2011
UT Sam White Lane Bridge over I-15

Conventional construction adjacent to bridge site
Systems Ex. 2 (SPMT Move): 2011
UT Sam White Lane Bridge over I-15

Construct substructure onsite
Systems Ex. 2 (SPMT Move): 2011
UT Sam White Lane Bridge over I-15

Move 2-span superstructure on SPMTs
Other ABC included:

- State decision-making process
- Full lane closure
- Thin-bonded epoxy overlay
- Lightweight concrete deck

I-15 closed Saturday at 11 pm
I-15 re-opened Sunday at 7 am
Systems Ex. 3 (Lateral Slide): 2008
OR Elk Creek Bridge (Crossing No. 4)

- 2-span superstructure lateral slide
- Rural location
- 50-mile detour
- Weekend closure of Oregon Route 38
Primary reasons for use of ABC:

- Reduced traffic impacts – 3,900 ADT
- Reduced onsite construction time
- Improved work-zone safety
- Improved site constructability
- Improved material quality & product durability
- Minimized environmental impacts
Systems Ex. 3 (Lateral Slide): 2008 OR Elk Creek Bridge (Crossing No. 4)

222-ft long & 38-ft wide (160 ft – 62 ft)

Conventional superstructure constructed adjacent to bridge site; Cast-in-place substructure constructed under traffic
Systems Ex. 3 (Lateral Slide): 2008
OR Elk Creek Bridge (Crossing No. 4)

Precast:
- Bulb T beams
- Wingwalls – 1 side
- Approach Slabs
- Sleeper Slabs
Other ABC included:

- State decision-making process
- Early environmental clearance/permitting
- Full lane closure
- Incentive / disincentive clauses
Systems Ex. 4 (Lateral Slide): 2005 WA
Hood Canal Bridge (East Approach)

- 5-span superstructure lateral slide
- Rural location
- 200-mile detour or passenger-only ferry
- 49-hour closure of State Route 104
Primary reasons for use of ABC:

- Reduced onsite construction time
- Improved work-zone safety
- Improved site constructability
- Improved material quality & product durability
Systems Ex. 4 (Lateral Slide): 2005 WA Hood Canal Bridge (East Approach)

- 605-ft long & 40-ft wide
- 5 spans (125’-125’-122’-122’-111’)
- 3,800-ton self-weight
- Conventional superstructure constructed adjacent to bridge
- Cast-in-place substructure constructed under traffic
- Precast:
  - Bulb T beams
  - Backwalls
  - Approach slabs
Systems Ex. 4 (Lateral Slide): 2005 WA Hood Canal Bridge (East Approach)

Bridge closed Sunday at 8 pm
Bridge re-opened Tuesday at 9 pm
ABC Technologies & Resources

- Categories of ABC Technologies
- Types of Prefabricated Bridge Elements and Systems (PBES) for ABC
- Examples of PBES for ABC

➤ ABC Resources
ABC Resources

- Federal Highway Administration (FHWA)
- Transportation Research Board (TRB) National Cooperative Highway Research Program (NCHRP)
- TRB Strategic Highway Research Program 2 (SHRP2)
- TRB ABC Joint Subcommittee
- Industry
- Accelerated Bridge Construction University Transportation Center (ABC-UTC)
Accelerated Bridge Construction

- Project Planning
- Geotechnical Solutions
  - Rapid Embankment Construction
- Structural Solutions
  - Prefabricated Elements & Systems
  - Structural Placement Methods

What is ABC?

ABC is a paradigm shift in the project planning and procurement approach where the need to minimize mobility impacts which occur due to onsite construction activities are elevated to a higher priority.

Intrinsic benefits of the ABC approach include improvements in:

- Safety
- Quality
- Durability
- Social costs and
- Environmental impacts.
Prefabricated Bridge Elements and Systems

What is PBES?
PBES are structural components of a bridge that are built offsite, or near-site of a bridge and include features that reduce the onsite construction time and the mobility impact time that occurs when building new bridges or rehabilitating or replacing existing bridges relative to conventional construction methods.

- PBES Definitions

How Does It Work?
1. Components are built outside traffic area(s)
2. Transported to the site
3. Installed rapidly

Events
- EDC-4: Construction Partnering: Innovative and Effective Partnering Practices Conference
  Reno, Nevada
  April 4-6, 2017
- View More Events

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Self Propelled Modular Transporters (SPMTs)

A Self-Propelled Modular Transporter is a combination of multi-axle platforms operated through a state-of-the-art computer-controlled system that is capable of pivoting 360 degrees as needed to lift, carry, and set very large and heavy loads of many types.

SPMTs are motorized vehicles that move at walking speed and are capable of carrying large structures, such as bridges, from offsite locations, positioning them precisely into final position. The SPMT then exits the site, opening the area to traffic possibly within minutes or certainly within a few hours.

What is a Self-Propelled Modular Transporter - or SPMT?

The Federal Highway Administration (FHWA) has identified reducing construction-related impacts to the traveling public as a major priority for the nation’s highway program.

The use of self-propelled modular transporter (SPMT) technology provides agencies and contractors with the ultimate flexibility and speed in removing and installing bridges.

Introduction

- Introduction to SPMT Bridge Moves
- Benefits
Slide-in Bridge Construction

Slide-in bridge construction (SIBC, more commonly known as "lateral slide") is one of several Accelerated Bridge Construction (ABC) technologies being promoted by the FHWA Every Day Counts program.

This webpage links to a variety of key resources from across the country. The focus is on helping owner-agencies, designers, and construction contractors with no experience in SIBC get started in implementing this technology. Read more about SIBC.

Quick Links
Accelerated Bridge Construction Experience in Design, Fabrication and Erection of Prefabricated Bridge Elements and Systems

Published November 2011

Available Online

FHWA ABC Manual
http://www.fhwa.dot.gov/bridge/abc/
3.2.2 Flowcharts for Determination of Appropriate ABC Methods

Fig. 3.2.2-1 Over Roadway or Land
ABC Manual
Chapter 4 – Implementing ABC in a Transp. Agency

Fig. 4.1-1
Prefabricated Bridge Elements and Systems

What is PBES?
PBES are structural components of a bridge that are built offsite, or near-site of a bridge and include features that reduce the onsite construction time and the mobility impact time that occurs when building new bridges or rehabilitating or replacing existing bridges relative to conventional construction methods.

- PBES Definitions

How Does It Work?
1: Components are built outside traffic area(s)
2: Transported to the site
3: Installed rapidly

Events
  Reno, Nevada
  April 4-6, 2017
- View More Events

Contacts
- Benjamin Beerman
  Resource Center
  404-562-3930
  E-mail Benjamin
- Romeo Garcia
  Office of Asset Management, Pavements, and Construction
  202-366-1342
  E-mail Romeo
How Does PBES Impact ABC?

Use of PBES is one strategy that can meet the objectives to Accelerate Bridge Construction while providing additional benefits beyond those with only reducing on-site construction time:

- **ABC improves:**
  - Site Constructability
  - Total project delivery time
  - Material quality and product durability
  - Work-zone safety for the traveling public and contractor personnel
- **ABC reduces:**
  - Traffic Impacts
  - Onsite construction time
  - Weather-related time delays
- **ABC can minimize**
  - Environmental impacts
  - Impacts to existing roadway alignment
  - Utility relocations and right-of-way take

Publications

- [Connection Details for PBES](#)
- [Framework for Decision-Making](#)
- [Manual on Use of Self-Propelled Modular Transporters to Remove and Replace Bridges](#)
- [Prefabricated Bridge Elements and Systems Cost Study: Accelerated Bridge Construction Success Stories](#)
- [Prefabricated Bridge Elements and Systems in Japan and Europe](#)
  - Scan Team Implementation Plan

Projects

- [Graves Avenue Prefabricated Bridge Project](#)

Archive

- Bridge, Rock, Roadway, Rail, Union, Self-Propelled Modular Transporters (SPMTs)
Connection Details for PBES

Forward
Introduction

Chapter 1: General Topics

1.1 Benefits of Prefabrication
1.2 Accelerated Construction Overview
   1.2.1 When to Use Accelerated Construction
   1.2.2 Rehabilitation Projects
   1.2.3 Typical Accelerated Construction Approaches
      1.2.3.1 Short-term Full Closure Projects
      1.2.3.2 Weekend Closures
      1.2.3.3 Overnight Closures
   1.2.4 Examples of Prefabricated Elements
   1.2.5 Opportunities for Architectural Treatments
1.3 Applicability to Typical Bridges
   1.3.1 New Bridges
   1.3.2 Replacement of Existing Bridges
   1.3.3 Rehabilitation of Existing Bridges
   1.3.4 Issues with Curved, Skewed and Flared Bridges

Connection Details for Prefabricated Bridge Elements and Systems

March 03, 2000
Connection Details for Prefabricated Bridge Elements and Systems

Published June 2009

Available Online

FHWA ABC Website
http://www.fhwa.dot.gov/bridge/prefab/if09010/
## Project Summary Archives (FY 2006-2013)

<table>
<thead>
<tr>
<th>State</th>
<th>Project</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL</td>
<td>Improvements to the US 280 Corridor from Hollywood Blvd. to Doug Baker Blvd. in Birmingham, Alabama</td>
<td><strong>Safety</strong>: Adaptive Signal Control</td>
</tr>
<tr>
<td>AR</td>
<td>The Use of Roller Compacted Concrete to Reconstruct a Segment of SH 213 in Fayetteville</td>
<td><strong>Pavement</strong>: Roller Compacted Concrete (RCC)</td>
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<tr>
<td>AZ</td>
<td>Reconstruction of SR 179 in Sedona</td>
<td><strong>Contracting</strong>: Needs-Based Involvement Process</td>
</tr>
<tr>
<td>CA</td>
<td>California Demonstration Project: Safety Improvements on Mountain Ranch Road in Calaveras County</td>
<td><strong>Safety</strong>: Safety EdgeSM, Road Safety Audit</td>
</tr>
<tr>
<td>CA</td>
<td>Pavement Replacement Using a Precast Concrete Pavement System on I-15 in Ontario</td>
<td><strong>Pavement</strong>: Precast Concrete Pavement System (PCPS)</td>
</tr>
<tr>
<td>CO</td>
<td>I-70 Tower Road to Colfax Avenue GRS-IBS Bridge Replacement Project</td>
<td><strong>Bridge</strong>: Geosynthetic Reinforced Soil – Integrated Bridge Systems (GRS-IBS)</td>
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<tr>
<td>CO</td>
<td>Pecos Street over I-70 Bridge Replacement Using SPMT Technology</td>
<td><strong>Contracting</strong>: Self-Propelled Modular Transport (SPMT), Construction Management/General Contractor (CMGC), Roundabouts, HAWK Signal</td>
</tr>
<tr>
<td>CO</td>
<td>Reconstruction of the I-25 Bronco Arch Bridge</td>
<td><strong>Bridge</strong>: Accelerated Bridge Construction (ABC) – Prefabricated Bridge Element System (PBES), Contractor value engineering, A (cost) + B (time to complete), Lane rentals, Incentives and Disincentives, Automatic anti-icing system</td>
</tr>
</tbody>
</table>
Ultra-High Performance Concrete

Design and Construction of Field-Cast UHPC Connections

This document provides guidance on the design and deployment of field-cast UHPC connections. Download the PDF Version (3.97 MB).

Advances in the science of concrete materials have led to the development of a new class of cementitious composites called ultra-high performance concrete (UHPC). The links above will direct you to pages detailing UHPC projects, bridges with UHPC components, articles that focus on UHPC research, and the main contact at Turner-Fairbank Highway Research Center (TFHRC) for UHPC.
# National Cooperative Highway Research Program (NCHRP) Example Research Related to ABC

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Status</th>
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<tbody>
<tr>
<td>12-65</td>
<td>Full-Depth, Precast-Concrete Bridge Deck Panel Systems</td>
<td>Report 584</td>
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<tr>
<td>12-74</td>
<td>Development of a Precast Bent Cap System for Seismic Regions</td>
<td>Report 681</td>
</tr>
<tr>
<td>12-88</td>
<td>Application of Accelerated Bridge Construction Connections in Moderate-to-High Seismic Regions</td>
<td>Report 698</td>
</tr>
</tbody>
</table>

Example Connection Detail

NCHRP PROJECT 12-74

EXAMPLE PRECAST BENT CAP CONNECTION DETAILS

SDCs B, C, & D
NON-INTEGRAL
GROUTED DUCT

BY: JWM/CH
CHECK: MS/AW
DATE: 11/24/09
SCALE: 1/4" = 1'-0"
SHEET: 1 of 1
# FY 2014 NCHRP Research Related to ABC

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>12-98</td>
<td>Recommended Guidelines for Prefabricated Bridge Elements and Systems Tolerances and Dynamic Effects of Bridge Moves</td>
<td>ongoing</td>
</tr>
<tr>
<td>12-102</td>
<td>Recommended AASHTO Guide Specification for ABC Design and Construction</td>
<td>ongoing</td>
</tr>
<tr>
<td>12-105</td>
<td>Proposed AASHTO Seismic Specifications for ABC Column Connections</td>
<td>ongoing</td>
</tr>
</tbody>
</table>

Google search: NCHRP xx-xxx
NCHRP Domestic Scan Program

Domestic Scan on Best Practices in Accelerated Construction Techniques

March 2009

NCHRP Domestic Scan Program

Domestic Scan on Best Practices in Performance of ABC Connections in Bridges Subjected to Multi-hazard And Extreme Events

October 2012

Strategic Highway Research Program 2 (SHRP2) – Renewal: Bridges

http://shrp2.transportation.org/Pages/Bridge-Designs-for-Rapid-Renewal.aspx

SHRP2 R04: Innovative Bridge Designs for Rapid Renewal

ABC Standard Concepts: The Lateral Slide Addendum Report
TRB Section - Structures AFF00
TRB Section - Construction AFH00
Joint Subcommittee on Accelerated Bridge Construction AFF00(2)

Approximately one-fourth of the Nation's 600,000 bridges require rehabilitation, repair, or total replacement. The construction-related work used to address these needs can create significant impacts to the surrounding area including mobility, safety, and other social-economic related impacts. Throughout the U.S., owner agencies are realizing that the results of using ABC strategies not only helps to address onsite related constraints, but can also improve how a bridge program is delivered when used in a more routine, programmatic manner.

Scope: The TRB Joint Subcommittee on Accelerated Bridge Construction (ABC) supports research, technology transfer, and implementation to advance ABC technologies related to policy, planning, procurement, design, materials, construction and contracting. The objective of the subcommittee is to expand the knowledge and expertise to foster the implementation of ABC related technologies.

Road Map:
The subcommittee will...

1. Stay informed on the current state of practice/art.
2017 Subcommittee Meeting:

Agenda
Meeting Presentation Guide
2016/2017 Activities Statement
2017 TRB Structures Group Compiled RNS

TRB NCHRP ABC update

2015 NCHRP Annual Report
Waseem Dekelbab/NAS

TRB SHRP2 R04 update

SHRP2 R04 Resources Link
Finn Hubbard/AASHTO

Turner-Fairbanks Highway Research Center update

Presentation Link
Dr. Benjamin Graybeal/TFHRC
Submit Research

If you know of a completed or ongoing project that should be included in the National ABC Research tracking spreadsheet (described below), have a new research idea, or would like to sponsor a project - please send your information to the following email link: ABC Research Topic

Research Tracking Spreadsheet

The National ABC Research project tracker provides an overview of approximately 120 ABC related research projects occurring throughout the U.S.

It includes hyperlinks to completed deliverables, the status of on-going projects, and a list of ABC related Research Needs Statements (RNS) that are pending sponsorship.

Yellow highlighted projects are fairly new, red highlighted projects are pending additional information.

It is highly recommended to select this link and download the file to your computer: Project Tracker link.

The downloaded file will open up as an Excel spreadsheet that is easier to work with.
Industry ABC Resources

Precast/Prestressed Concrete Institute (PCI)
http://www.pci.org
Industry ABC Resources

PCI Northeast
http://www.pcine.org (Bridge Resources)
ABC University Transportation Center (ABC-UTC)

USDOT Tier 1 UTC since September 2013

Consortium of Universities:
• Florida International University (FIU) – lead
• Iowa State University (ISU)
• University of Nevada, Reno (UNR)
• University of Oklahoma, Norman (OU)
• University of Washington, Seattle (UW)
Accelerated Bridge Construction
University Transportation Center (ABC-UTC) – http://abc-utc.fiu.edu/
Events

February 28, 2017 – March 4, 2017
2017 PCI Convention & National Bridge Conference - Cleveland, OH

March 7, 2017
FHWA Every Day Counts Webinar 1: Introduction to UHPC

March 16, 2017
Georgia’s Rapid Replacement Utilizing Full-Depth Precast Deck Panels with UHPC Closure Joints
February 28, 2017 – March 4, 2017

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March 7, 2017

FHWA Every Day Counts Webinar 1: Introduction to UHPC

March 16, 2017

Georgia’s Rapid Replacement Utilizing Full-Depth Precast Deck Panels with UHPC Closure Joints

March 22, 2017 – March 24, 2017

2017 NASCC: The Steel Conference - San Antonio, TX

March 23, 2017

Call for Presentation Abstracts - Submission Deadline - 2017 Western Bridge Engineers’ Seminar - Portland, OR

UPCOMING EVENTS

February 28, 2017 – March 4, 2017

2017 PCI Convention & National Bridge Conference - Cleveland, OH

March 7, 2017

FHWA Every Day Counts Webinar 1: Introduction to UHPC

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Georgia’s Rapid Replacement Utilizing Full-Depth Precast Deck Panels with UHPC Closure Joints

March 22, 2017 – March 24, 2017

2017 NASCC: The Steel Conference - San Antonio, TX

March 23, 2017

Call for Presentation Abstracts - Submission Deadline - 2017 Western Bridge Engineers’ Seminar - Portland, OR
Welcome
The ABC-UTC has assembled an experienced, knowledgeable, and engaged group of bridge academics and engineers who collectively will provide the transportation industry with the tools needed to effectively and economically utilize the principles of ABC to enhance mobility, and safety and produce safe, environmentally friendly, long-lasting bridges.

Read More.

Georgia’s Rapid Replacement Utilizing Full-Depth Precast Deck Panels with UHPC Closure Joints
March 16, 2017 (1:00 pm – 2:00 pm EST)

2015 Highlights Report
The 2015 Highlights Report summarizes the ABC-UTC’s work during 2015.

In-Depth Web Training Archive

Tennessee DOT’s “Fast Fix 8” Project in Downtown Nashville
The 2016 in-depth web training featured the Tennessee DOT’s “Fast Fix 8” project in downtown Nashville, completed in December 2015. The high-profile
Project & Research Databases

Project Database

The ABC-UTC is working in cooperation with FHWA, bridge owners, and other bridge professionals to accumulate available completed construction projects in which ABC technologies are used and research projects in which ABC technologies have been investigated. The Project Database has been expanded from its origin, the FHWA National ABC Project Exchange.

A user guide was developed to familiarize users with the database (Project Database – User Guide). Any additional questions on the database can be directed to David Garber (dgarber@fiu.edu).

ABC Project Database

Project Submission Process:

Individuals with knowledge of completed ABC construction projects and upcoming, ongoing, and planned projects can submit data through the ABC Project Database.

http://abc-utc.fiu.edu/
Project & Research Database

http://abc-utc.fiu.edu/
http://utcdb.fiu.edu/

Training Videos
Project & Research Database

http://abc-utc.fiu.edu/

Updates / Comments / Assistance
3 Search Methods

Method of Search #1: Interactive Map

ABC Project Database

Search for bridges

List all projects

Click on pin icons to view bridge details:

Map  Satellite

United States

2008 - 24th Street Bridge over I-29/I-80
2008 - 24th Street Bridge over I-29/I-80

Year ABC Built: 2008
State: Iowa
Owner: State
Location: Urban
Spans: Two-span
Beam Material: Steel
Max Span Length (ft.): 178.50
Total Bridge Length (ft.): 353.50
Construction Equipment: Conv
State ID #: 7801.70080
NBI #: 044691
Coordinates: Latitude: 41.2321

Bridge Description
Project Summary:
Project Location: on 24th Street of Iowa City
Mobility Impact Time: ABC: < 6 mo
ABC Project Database

Method of Search #2: Faceted Navigation

Faceted Navigation Pane

List of all projects In Project Database

2013 - Milton-Madison Bridge

State: Indiana; Year: 2013; Location: US Route 421 across the Ohio River between the towns of Milton in Kentucky and Madison in Indiana; Spans: > Three-span; Dimensions: 3,200-ft-long and 40-ft-wide steel through-truss bridge with four river spans (599 ft - 600 ft - 727 ft - 500 ft); prestressed concrete approach spans Kentucky (71 ft - 90 ft - 92 ft - 114 ft); prestressed concrete approach spans Indiana (112 ft - 117 ft - 117 ft); Beam Material: Steel; Structural Solutions: MSE walls; Truss span w/deck; CIP reinforced concrete closure joints; Geotechnical Solutions: High-capacity piles; Other foundation/wall; finite element analysis of existing pier caissons with passive soil resistance / scour mitigation; Project Planning: Design-build; Full lane closure; Construction Equipment: Strand jacks; Float in; High-capacity crane on barge; Lateral Slide w/pad (skids)
Method of Search #3: Keyword Search

ABC Project Database

Search for bridges

103 bridges found

2013 - Milton-Madison Bridge

State: Indiana; Year: 2013; Location: US Route 421 across the Ohio River between the towns of Milton in Kentucky and Madison in Indiana; Spans: Three-span; Dimensions: 3,200-ft-long and 40-ft-wide steel through-truss bridge with four river spans (500 ft - 600 ft - 727 ft - 500 ft); prestressed concrete support columns; Kentucky (KY) & Ohio (OH) state parkways; construction period: March 2013 to March 2015; open to traffic: May 2015; project length: 0.5 mi; project cost: $35 million; project manager: S. R. Monteith, Federal Highway Administration; project contractor: M. Eury Construction; project phase completed: April 2015; key search words: bridge, Milton, Madison, Ohio, Kentucky, steel, through-truss, river, construction, traffic, parkway.
Bridge Summary Sheet:
Salem Street Bridge Eastbound (93Fast14)
The ABC-UTC is working in cooperation with FHWA, bridge owners, and other bridge professionals to accumulate available completed construction projects in which ABC technologies are used and research projects in which ABC technologies have been investigated. The **Project Database** has been expanded from its origin, the FHWA National ABC Project Exchange.

A user guide was developed to familiarize users with the database ([Project Database – User Guide](#)). Any additional questions on the database can be directed to David Garber ([dgarber@fiu.edu](mailto:dgarber@fiu.edu)).

---

**Project Submission Process:**

Individuals with knowledge of completed ABC construction projects and upcoming, ongoing, and completed ABC research projects are encouraged to submit project details into the databases. A two-step submission process allows individuals to submit minimal first-step information for approval by bridge owners and the ABC-UTC Database Steering Subcommittee to ensure the projects are appropriate for the databases. Upon first-step approval, submitters will receive a link to complete uploading of project information. Upon second-step approval by bridge owners and the ABC-UTC Database Steering Subcommittee, the projects will be added to the databases.

---

You may want to develop content offline for the step-two submission, and then copy and paste text online. [Click here for Word template to populate offline for subsequent online submission; example wording is provided but may not be appropriate for your specific project.](#)
Complete the Following Steps: 1

The information that will be required for full submission can be found in the below MS Word Template. The majority of this information will be gathered in the second stage of the submission process, but this Template can be used to aid in the submission process.

**MS Word Template for Submission**

**Submitters Information:**

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name</td>
<td>Last Name</td>
</tr>
<tr>
<td><strong>Title</strong></td>
<td></td>
</tr>
<tr>
<td>Title (e.g. PE, PhD, etc)</td>
<td></td>
</tr>
<tr>
<td><strong>Position</strong></td>
<td><strong>Organization</strong></td>
</tr>
<tr>
<td>Position</td>
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<td><strong>Phone</strong></td>
</tr>
<tr>
<td>Email</td>
<td>Phone</td>
</tr>
</tbody>
</table>

**Your Relationship to ABC Project:**

e.g. Bridge Owner, Bridge Designer, etc.
Owner Information:
- Same as submitter's information.

First Name: [Input]
Last Name: [Input]
Title: [Input]
Position: [Input]
Owner Organization: [Input]
Email: [Input]
Phone: [Input]

Project Information
Project Name: [Input]
Owner Type: [Input]
Year ABC Completed: 2017
County:
State: Alabama
Country: USA
State ID #

NBI #

State ID #

National Bridge Inventory #

Location Description:

e.g. road designation, name of river crossing, near by town or city, etc.

Coordinates

Latitude

Longitude

Brief Project Summary:

In 500 words or less, describe why this project should be added to the database

I agree that the information provided above is accurate to the best of my knowledge. By submitting this information I give the ABC-UTC the rights to publish the data online and in the ABC-UTC database. The ABC-UTC reserves the right to alter information prior to publication.

Agree

Submit
2-Step Project Submission Process

- Anyone can propose a project for submission via streamlined Step 1 process
- After Step 1 approval, detailed project information and documents can be uploaded in Step 2
- Project information is fully vetted before official entry into database
Research Submission Process:

Individuals with knowledge of upcoming, ongoing, and completed ABC research projects are encouraged to submit project details into the database. The research submission process is a one-step process where all required information for the database is gathered during the initial submission. Submitted research projects will be added to the research database after approval by the ABC-UTC Database Steering Subcommittee.

New research projects can be submitted by anyone by clicking the button below.

Submit New ABC Research

Keywords for Database Search

The Project Database and Research Database both utilize lists of ABC-related “Keywords” that have been used to classify and describe each ABC project. These keywords should be used in searching the databases and also for entering new projects into the databases.
Keywords for Database Search

This keywords page contains a comprehensive list of different types of ABC technologies, techniques, processes, and other definitions related to:

- Funding
- Federal Incentive Programs
- Time Metrics
- Primary Drivers
- Project Planning
- Geotechnical Solutions
- Prefabricated Bridge Elements and Systems
- Construction Equipment and Methods

These keywords can be used for searching and should be used to aid in the new project submittal process.

ABC Project Database

Accelerated Bridge Construction (ABC)

ABC is bridge construction that uses innovative planning, design, materials, and construction methods to reduce the on-site construction time that occurs when building new bridges or replacing and rehabilitating existing bridges.
2nd-Cycle Projects – Completed

- **Demolition Requirements for Bridge Construction Projects – Best Practices Guideline (Phase I):** The goal of this project is to determine the current state of practice and state of the art in bridge demolition (both conventional and ABC) and develop a best practices guideline for bridge demolition. Phase I of this project involved a survey of State DOTs on their bridge demolition practices.

1st-Cycle Projects – Continuing

- **Development of Manual for Enhanced Service Life of ABC Projects:** The main objective of this project is to develop a manual devoted to service life performance of ABC projects.

1st-Cycle Projects – Completed

- **Compilation of ABC Solutions:** The objective of the project is to compile information on existing accelerated bridge technologies and present the information in a manner useful to designers.
- **International Database of ABC Research:** This project involves the development of a comprehensive database that is both user friendly and easily navigable.
- **Estimating Total Cost of Bridge Construction using ABC and Conventional Methods of Construction (Phase I):** The objective of this project is to create a framework for evaluating and utilizing public costs as part of the decision-making processes associated with bridge construction and the development of a public cost analysis and estimation tool.
- **Extending Application of SDCL to ABC (Phase I – Conceptual and Analytical):** The objective of the project is to...
Compilation of ABC Solutions

Resources
Final Report: ABC Solutions Final Report
Quarterly Report: October to December 2015
Overview Poster: May 2015

Background
Development of accelerated bridge systems has been occurring across the country, many times in isolation. Although FHWA and others have worked to facilitate communication between these efforts, there as of yet does not exist a comprehensive resource to aid designers in selecting an appropriate system for a particular project.

Objective
The objective of the project is to compile information on existing accelerated bridge technologies and present the information in a manner useful to designers.

Scope
The compilation will include all bridge types constructed of any material, using accelerated bridge construction. The ABC-UTC steering committee has recommended that proprietary systems, composites and ultra-high performance concrete be avoided when possible. This advisement will be considered during the development of any rankings or recommendations that may occur. However, such systems will not necessarily be omitted due to the presence of these features. Rather, an attempt will be made to present all of the alternatives and provide objective information so the end user can make an informed decision regarding the suitability of any particular system.
ABC Project Database

- Starting point was FHWA ABC Projects Database
- Created online database to host the information
- Created website and user interface to:
  - Navigate database
  - Present database entries
  - Allow for user input
2nd-Cycle Projects – Completed

- **Demolition Requirements for Bridge Construction Projects – Best Practices Guideline (Phase I)**: The goal of this project is to determine the current state of practice and state of the art in bridge demolition (both conventional and ABC) and develop a best practices guideline for bridge demolition. Phase I of this project involved a survey of State DOTs on their bridge demolition practices.

1st-Cycle Projects – Continuing

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- **Extending Application of SDCL to ABC (Phase I – Conceptual and Analytical)**: The objective of the
International Database of ABC Research

ABC Research Database

Submit New ABC Research

Link to latest QUARTERLY PROGRESS REPORT Ending March 31

Link to OVERVIEW POSTER

Link to latest ARCHIVED PROGRESS REPORT

Background
In recent years there has been a significant push for more durable bridges that are less expensive and take less time to construct. These desires within the bridge community have led to numerous federal, state, and local agencies encouraging the use of accelerated bridge construction (ABC) practices. As with any new and emerging engineering topic, it is essential that measures be taken to prevent repetition of research and provide a source of information for various stakeholders.

Objective
Through the course of this project, a comprehensive database will be assembled that is both user friendly and easily navigable.

Scope
Through the course of this project, a comprehensive database will be assembled that is both user friendly and easily navigable. The database will incorporate published studies (gathered through a thorough review of available literature) and unpublished and ongoing studies (gathered through resources available through ABC-UTC and possibly a short survey of state departments of transportation).

Research Team:
Objective
To develop a comprehensive database of published, ongoing and planned research related to ABC; linked to project database
The Research Database is fully functioning. The research is currently being populated to match the TRB ABC Subcommittee’s research tracking spreadsheet, Project Tracker.

Research Submission Process:

Individuals with knowledge of upcoming, ongoing, and completed ABC research projects are encouraged to submit project details into the database. The research submission process is a one-step process where all required information for the database is gathered during the initial submission. Submitted research projects will be added to the research database after approval by the ABC-UTC Database Steering Subcommittee.

New research projects can be submitted by anyone by clicking the button below.

Submit New ABC Research
2nd-Cycle Projects – Completed

- **Demolition Requirements for Bridge Construction Projects – Best Practices Guideline (Phase I)**: The goal of this project is to determine the current state of practice and state of the art in bridge demolition (both conventional and ABC) and develop a best practices guideline for bridge demolition. Phase I of this project involved a survey of State DOTs on their bridge demolition practices.

1st-Cycle Projects – Continuing

- **Development of Manual for Enhanced Service Life of ABC Projects**: The main objective of this project is to develop a manual devoted to service life performance of ABC projects.

1st-Cycle Projects – Completed

- **Compilation of ABC Solutions**: The objective of the project is to compile information on existing accelerated bridge technologies and present the information in a manner useful to designers.
- **International Database of ABC Research**: This project involves the development of a comprehensive database that is both user friendly and easily navigable.
- **Estimating Total Cost of Bridge Construction using ABC and Conventional Methods of Construction (Phase I)**: The objective of this project is to create a framework for evaluating and utilizing public costs as part of the decision-making processes associated with bridge construction and the development of a public cost analysis and estimation tool.
- **Extending Application of SDCL to ABC (Phase I – Conceptual and Analytical)**: The objective of the project is to extend the use of SDCL (Structural Design and Cost Library) to ABC projects.
Estimating Total Cost of ABC Research Project
Accelerate Bridge Construction
University Transportation Center (ABC-UTC)
Florida International University

ABC-UTC Project Team
Mohammed Hadi, Ph.D., P.E.
Ali Mostafavidarani, Ph.D.
Wallied Orabi, Ph.D.
Yan Xiao, Ph.D., P.E.
Mohamed Ibrahim, Ph.D. Candidate
Jianmin Jia, Ph.D. Candidate
Current Decision-Making Tools

None of these tools quantitatively evaluates total cost of ABC projects and objectively compares it to similar conventional bridge projects.
Total Cost Estimation Methods

- Construction Method
- Bridge Characteristics
- Bridge Location
- Transportation Network Data
- Real World Traffic Data

Conceptual and Parametric Cost Estimation

Detailed Cost Analysis

User Cost Estimation Tools
- QDAT
- Realcost2.5
- L03/C11
- L07
- Quickzone
- DTA

Total Cost
Note: Above graphic does not include user costs
1. Construction Cost

<table>
<thead>
<tr>
<th></th>
<th>ABC</th>
<th>Conventional</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>275</td>
<td>228</td>
<td>20%</td>
</tr>
<tr>
<td>Min</td>
<td>33</td>
<td>28</td>
<td>17%</td>
</tr>
<tr>
<td>Max</td>
<td>1061</td>
<td>1257</td>
<td>-16%</td>
</tr>
</tbody>
</table>

Number of case studies where the cost of ABC was less than Conventional = 21%

Hypothesis Testing

Paired Samples Test

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>ABC - Conventional</td>
<td>46.609</td>
<td>110.091</td>
<td>15.122</td>
<td>3.082</td>
<td>52</td>
<td>.003</td>
</tr>
</tbody>
</table>

1- Significant evidence that Means are not equal.
2- ABC > Conventional
2. Preliminary Engineering Cost (PE)

<table>
<thead>
<tr>
<th></th>
<th>ABC</th>
<th>Conventional</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>11.2%</td>
<td>10.8%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Min</td>
<td>2.1%</td>
<td>1.8%</td>
<td>0.4%</td>
</tr>
<tr>
<td>Max</td>
<td>25.1%</td>
<td>23.7%</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

Number of case studies where the cost of ABC was less than Conventional = 50%

Hypothesis Testing

Paired Samples Test

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
</table>

1- NO Significant evidence that Means are not equal.
3. Construction Engineering Cost (CE)

<table>
<thead>
<tr>
<th></th>
<th>ABC</th>
<th>Conventional</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>6.8%</td>
<td>8.3%</td>
<td>-1.5%</td>
</tr>
<tr>
<td>Min</td>
<td>0.9%</td>
<td>4.1%</td>
<td>-3.2%</td>
</tr>
<tr>
<td>Max</td>
<td>12%</td>
<td>13.5%</td>
<td>-1.5%</td>
</tr>
</tbody>
</table>

Number of case studies where the cost of ABC was less than Conventional = 70%

Hypothesis Testing

Paired Samples Test

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC - Conventional</td>
<td>-1.51</td>
<td>5.429</td>
<td>1.717</td>
<td>-5.394 - 2.374</td>
<td>-.880</td>
<td>9</td>
<td>.402</td>
</tr>
</tbody>
</table>

1- NO Significant evidence that Means are not equal.
User Costs/Impacts Estimation

- User can select, unselect, and/or weight any of the following components
  - Travel time
  - Reliability of travel time
  - Emission, fuel consumption, and vehicle operating costs
  - Motorist’s safety
  - Worker’s safety
  - Diversion out of the facility
  - Impacts on businesses
  - Impacts on freight (by commodity types)
Case Study – Importance of Including User Cost (I-4 Orlando)

<table>
<thead>
<tr>
<th>Costs in dollar value ($)</th>
<th>Mobility Impact</th>
<th>Reliability Impact</th>
<th>Safety Impact</th>
<th>Emission Impact</th>
<th>Project Construction Cost</th>
<th>Agency Construction Cost</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>C=1000 veh/hr/lane</td>
<td>ABC 120,347</td>
<td>32,807</td>
<td>40,864</td>
<td>1,615</td>
<td>430,000</td>
<td>53,320</td>
<td>678,953</td>
</tr>
<tr>
<td>(Capacity with Const.)</td>
<td>Conv. 224,591</td>
<td>258,414</td>
<td>77,313</td>
<td>2,274</td>
<td>342,125</td>
<td>46,529</td>
<td>951,246</td>
</tr>
<tr>
<td>C=1136 veh/hr/lane</td>
<td>ABC 120,347</td>
<td>32,489</td>
<td>40,864</td>
<td>1,615</td>
<td>430,000</td>
<td>53,320</td>
<td>678,635</td>
</tr>
<tr>
<td></td>
<td>Conv. 191,339</td>
<td>202,851</td>
<td>77,207</td>
<td>2,425</td>
<td>342,125</td>
<td>46,529</td>
<td>862,476</td>
</tr>
<tr>
<td>C=1264 veh/hr/lane</td>
<td>ABC 120,347</td>
<td>32,311</td>
<td>40,864</td>
<td>1,615</td>
<td>430,000</td>
<td>53,320</td>
<td>678,457</td>
</tr>
<tr>
<td></td>
<td>Conv. 183,026</td>
<td>73,715</td>
<td>77,207</td>
<td>2,499</td>
<td>342,125</td>
<td>46,529</td>
<td>725,101</td>
</tr>
</tbody>
</table>
2nd-Cycle Projects

- **Material Design and Structural Configuration of Link Slabs for ABC Applications**: The objective of this research is to develop details and recommendations to properly implement a link slab in joint-less bridges constructed with ABC techniques. This will be accomplished through a comprehensive set of experimental tests and numerical simulations.

- **Investigation of Macro-Defect Free Concrete for ABC including Robotic Construction**: The goal of this project will be to assess important characteristics and to develop conceptual uses for this new material with a specific focus on accelerated/robotic bridge construction.

- **An Integrated Project to Enterprise-Level Decision Making Framework for Prioritization of Accelerated Bridge Construction**: This project aims to develop a decision-making algorithm that brings together the project-level decision process that involves the choice of optimized construction techniques together with the enterprise-level process that implements regional prioritization schemes considering indirect costs (such as drivers’ delay, economic impact, opportunity losses, economic growth, and social investments) in addition to the direct costs associated with implementation of the ABC techniques.

- **Rapid Bridge Demolition Plan Review Guidance**: This research will develop rapid bridge demolition plan review guidance, based on a comprehensive literature review; surveys of DOTs, and demolition contractors and consultants; and a synthesis of the information obtained.

1st-Cycle Projects – Continuing

- **Development of Prefabricated Bridge Railings**: The purpose of this research is to begin the process of developing crash-tested prefabricated bridge railings that have durable anchorage details.
Development of Prefabricated Concrete Bridge Railings

Objective

To begin the process of developing crash-tested prefabricated bridge railings that have durable anchorage details

Note: A separate follow-on project will crash test bridge railings developed in this project
Precast Barrier 1

Connection using U-bar

Rebar Spacer Wheel
Precast Barrier 2

Connection using inclined stainless steel bar with threaded end

**STEPS**
1. Pour concrete deck with bar splicer and wood block to position bar splicer.
2. Place precast concrete barrier on deck with grout pad between deck and barrier.
3. Insert stainless steel bar with threaded end into barrier and bar splicer.
4. Grout from inlet.
5. Seal outlet.

**Diagram Description**
- Precast Barrier
- #8 Stainless Steel Bar with Threaded End
- #5 @ 4 3/4" C-C
- #4 Longit. Bars (Top)
- #5 Longit. Bars (Bottom)
- Wood Block Bar Splicer
- Bridge Deck
- Threaded End
- Bar Splicer
Barrier-to-Barrier Connection

Plan View of Barrier to Barrier Connection

End Segment Elevation

Plan View
Prefabricated Bridge Railing Test Plan

- Test plan included quasi-static testing of two barrier connection concepts
- Hydraulic actuator applied loads cyclically
- Included instrumentation:
  - linear variable differential transformers (LDVTs)
  - strain gauges
  - load cells
3D Model of Lab Set-up with Applied Load Locations
Laboratory test – precast barrier with inclined rod connection
Development of Prefabricated Concrete Bridge Railings

Current Status

- Quasi-static testing completed
  - Inclined reinforcement connection was sufficient for Test Level 4
  - U-bar connection design revised to address insufficient development length of top deck reinforcement

- Ongoing pooled-fund solicitation led by Iowa DOT for 2009 AASHTO MASH crash-testing
A focus of the ABC-UTC is transfer of the latest ABC knowledge to bridge owners and other bridge professionals. Links on the left menu provide extensive information:

- **Monthly Webinar.** The ABC-UTC is continuing the free monthly webinars that the ABC Center at Florida International University first hosted in early 2011.
- **Webinar Archives.** Recordings and pdfs of featured presentations since 2011 are available.
- **In-Depth Web Training.** A program of in-depth web training was initiated in 2014 to provide more detailed coverage of select projects and topics related to ABC.
- **In-Depth Web Training Archives.** Recordings and pdfs of modules are available.
- **Conference Archives.** The ABC-UTC hosted its first National ABC Conference in 2014. Conferences include pre-conference workshops followed by strong programs of technical presentations. Various information is provided in conference archives.
- **Continuing Education Courses.** The ABC-UTC short courses provide the bridge community with the opportunity to learn more about various aspects of ABC.
- **Project & Research Databases.** The ABC-UTC is working in cooperation with FHWA, bridge owners, and other bridge professionals to accumulate available completed construction projects in which ABC technologies are used and research projects in which ABC technologies have been investigated.
Webinar Archives

The ABC Center at FIU has offered free monthly webinars since March 2011. The ABC-UTC is continuing this series and maintaining an archive of the past events. The intended audience of these webinars includes engineers and other bridge professionals with content ranging from design issues to construction and contracting. These webinars attract an average of 4,000 participants each month.

For listing of monthly webinars to date, click here.

February 16, 2017

Programmatic Implementation and Value of ABC – The VTrans Approach

January 19, 2017

ABC Rehabilitation of Historic Franklin Avenue Bridge

December 29, 2016

From HCB to ABC – The Knickerbocker Bridge in Boothbay, Maine
http://abc-utc.fiu.edu/events/webinar-archives/

Programmatic Implementation and Value of ABC – The VTrans Approach

Wayne B. Symonds, P.E., Structures and Hydraulics Program Manager, Vermont Agency of Transportation (VTrans);
Kristin Higgins, P.E., ABP/PIIT Senior Project Manager, VTrans;
Jennifer Fitch, P.E., ABP/PIIT Project Manager, VTrans

Webinar held on 02/16/2017

Webinar Documents
Programmatic Implementation and Value of ABC – The VTrans Approach - pdf of presentation
News - February 16, 2017 - pdf of presentation
In-Depth Web Training Archives

Building upon the series of 35-minute featured presentations in the monthly webinars hosted by the ABC-UTC, a program of annual in-depth web training was initiated in 2014 to provide more detailed coverage of select projects and topics related to ABC. Each training is four hours in length and consists of six modules, each a 30-minute presentation by an expert in the focus area of the module followed by a 10-minute Q&A session. Below are the archives of the in-depth web training presented to date.

October 4, 2016

Tennessee DOT's “Fast Fix 8” Project in Downtown Nashville

November 10, 2015

Milton-Madison Bridge Replacement: the Mega-Lateral Slide

November 4, 2014

MassDOT's 93FAST14 Project
http://abc-utc.fiu.edu/resources/state-dot-websites/

State DOTs

Iowa DOT
[For more information, contact Ahmad Abu-Hawash, Chief Structural Engineer, Ahmad.Abu-Hawash@dot.iowa.gov]
- Accelerated Bridge Construction
- Innovative Bridge Research and Construction/Deployment (IBRC/IBRD) Program

Massachusetts DOT
[For more information, contact Thomas P. Donald, Director of Bridge Project Management, thomas.donald@state.ma.us]
- Accelerated Bridge Program
- LRFD Bridge Manual, Part III – Prefabricated Elements

Michigan DOT
[For more information, contact Dave Juntunen, Bridge Development Engineer, JuntunenD@michigan.gov]
The Transportation Research Board (TRB) ABC Joint Subcommittee functions under the TRB AFF00 Structures Section and AFH00 Construction Section.

Results from 2017 Industry Poll

2017 TRB Annual Meeting and Workshop Materials

The ABC Joint Subcommittee membership includes representation from the following TRB committees:

- AFF10, General Structures
- AFF20, Steel Bridges
- AFF30, Concrete Bridges
- AFF50, Seismic Design and Performance of Bridges
- AFH40, Construction of Bridges and Structures
- AHD30, Structures Maintenance
- AHD35, Bridge Management

All are welcome to attend ABC Subcommittee meetings during the TRB Annual Meeting. Of its many activities, the Subcommittee maintains and posts an ABC Research Tracking Spreadsheet that provides the status and deliverables of approximately 100 related research projects that are either completed, under development, or proposed. The Subcommittee also evaluates Research Topic Ideas for further development.
FHWA ABC Contact: Benjamin Beerman, benjamin.beerman@dot.gov

Links to FHWA ABC Publications:

- Bond of Field-Cast Grouts to Precast Concrete Elements, 2017
- Dimensional Stability of Grout-Like Materials Used in Field-Cast Connections, 2016
- Material Characterization of Field-Cast Connection Grouts, 2013
- Engineering Design, Fabrication, and Erection of PBES, 2013
- Contracting and Construction of ABC Projects with PBES, 2013
- ABC Manual, 2011
- Connections Manual, 2009
- PBES Case Studies, 2006
- Decision-Making Framework, 2005
- Highways for LIFE Summary Reports

Links to FHWA Ultra-High Performance Concrete (UHPC) Publications:
(FHWA UHPC Contact: Benjamin Graybeal, Benjamin.Graybeal@dot.gov)

- FHWA UHPC Website
- UHPC Deployments Across US and Canada
- Design and Construction of Field-Cast UHPC Connections, 2014
2017 National Accelerated Bridge Construction Conference

December 7 and 8, 2017
Workshops - December 6, 2017

Click HERE to Submit Abstract Online

2017 National Accelerated Bridge Construction Conference

The 2017 National Accelerated Bridge Construction Conference, sponsored by the ABC UTC, will be held...
Raimondo Marks One-Year Anniversary Of RhodeWorks Law

Governor Gina Raimondo said the RhodeWorks law passed amid controversy last year is yielding positive dividends for the state. Raimondo said RhodeWorks has ... set more than 100 deficient bridges on the path to improvement, and enabled the state to save millions of dollars through preventive maintenance on 500 other bridges.

BRIDGE REHABILITATION: U.S. DOT awards FIU funds to help build safer bridges
ABC Technologies & Resources

Thank You!

Mary Lou Ralls, P.E.
Director of Technology Transfer, ABC-UTC
Principal, Ralls Newman LLC
ralls-newman@sbcglobal.net