What are some of the trends in ABC specific to Geotech/Substructures?
Paradigm Shift
old practices

PBES:
Pile Lagging

PBES:
Grouted Couplers

PBES:
Pile Pockets

Every Day Counts

Innovation | Infrastructure | Integrity
Foundation/Substructure work under a separate phase
**Sacramento Wash Crossing at Oatman Highway**

<table>
<thead>
<tr>
<th>Bid Amount</th>
<th>Contractor Name</th>
<th>Contractor Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,957,740.00</td>
<td>DEPARTMENT</td>
<td>PHOENIX, AZ</td>
</tr>
<tr>
<td>$1,870,822.10</td>
<td>PULICE CONSTRUCTION, INC.</td>
<td>PHOENIX, AZ</td>
</tr>
<tr>
<td>$2,370,741.00</td>
<td>FNF CONSTRUCTION, INC.</td>
<td>TEMPE, AZ</td>
</tr>
<tr>
<td>$2,960,604.90</td>
<td>VASTCO, INC.</td>
<td>CHINO VALLEY, AZ</td>
</tr>
</tbody>
</table>

**Workshop begins at 12:30pm**

**What:** The Arizona Department of Transportation (ADOT) in partnership with Mohave County will construct a new bridge using Prefabricated Bridge Elements in 96-hours or less. See how this demonstration project is helping ADOT to implement accelerated bridge construction in a more routine programmatic manner.

**New Structure Features:**
- 113’ 10” long x 38’ 10” wide
- Full-width straddle cap abutments
- Modular Decked Beam (MDB) elements
- Prefabricated approach spans
- Nine-foot vertical raise in profile | 8,700 cubic yards of roadway fill | 1,100 cubic yards of paving

[Video Link]
Walls
Walls
Straddle Cap
Abutments: New or Existing?
Geosynthetic Reinforced Soil
Integrated Bridge System
Interim Implementation Guide

Publication No. FHWA-HRT-11-028  June 2012

US Department of Transportation
Federal Highway Administration
Research, Development, and Technology
Tulane Railbnd Highway Research Center
6300 Georgetown Pike
McLean, VA  22101-2296

GRS-IBS

Beam Seat
(Supported Directly on Bearing Bed)

Jointless
(Continuous Pavement)

Integrated Approach
(Geotextile Wrapped Layers at Beams to Form Smooth Transition)

Facing Elements
(Frictionally Connected - Top Three Courses Pinned and Grouted)

Scour Protection (Rip Rap)
(if Crossing a Water Way)

Bearing Bed
Reinforcement
(LOAD SHEDDING LAYERS SPACED AT ≤ 6 IN.)

Reinforced Soil Foundation
(Encapsulated with Geotextile)
GRS-IBS
CIP w/ T-wall
T-Wall
Ontario: Hwy 401 Cornwall Center Rd. Overpass (4/2015)
SPMT Example
GRS – good!

- Top of RSS Wall
- 4 Layers of Geotextile @ 110 (4.4"")
- 1,500 to 2,000 psi
- Bottom of RSS Wall
- Limit of Excavation
- 4 Layers of Geotextile @ 450 (18"")
- 2340 (7' 6")
- 1800 Granular 'B'
- 540 Granular 'A'
- (21.5")
Sleeper Slabs – no?
SPMT Example
(surcharge)

I-80 State Street to 1300 East
Lateral Loads occur:

- Bid-Well
- Demolition
- Landing
- Wind

“Devils are in the details”
Fixity and lateral stability is provided

Much Better!
WVDOH: Basnettville
2016

Layout!
PBES/ABC
Value Engineering Change Proposal modifications

- Bridge shortened from 110’ to 75’.
- Four-HP14X102 bearing piles replaced 6-HP14X73 piles
- Abutment - cast in place
- Approach/Sleeper slabs – cast in place, high early concrete
  - WVDOH Class B modified concrete, 3000 psi in 4 hr.
- Plate girders to rolled beams
- Existing abutments eliminated need for reinforced fill at approaches
- Shortened bridge eliminated need for waterline relocation
- Shared savings of $170,547.42
## Basnettville Bridge

### Comparison Between Conventional Construction vs. ABC Construction

<table>
<thead>
<tr>
<th>Alternative No. 1 From Design Study Dated Sept. 2010</th>
<th>ABC Construction</th>
<th>Constructed Bridge Downstream on Temporary Support &amp; Slide Onto New Permanent Supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructed Detour/Temporary Bridge Downstream</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100 - Foot Bridge (Single Span)</td>
<td>$674,800</td>
<td>100 - Foot Bridge (Single Span)</td>
</tr>
<tr>
<td>250 Feet of Roadway</td>
<td>$308,500</td>
<td>250 Feet of Roadway</td>
</tr>
<tr>
<td>Detour</td>
<td>$295,400</td>
<td><strong>ABC Additional Items</strong></td>
</tr>
<tr>
<td>E &amp; C (19%)</td>
<td>$243,000</td>
<td>E &amp; C (19%)</td>
</tr>
<tr>
<td><strong>Total Construction</strong></td>
<td>$1,521,700</td>
<td><strong>Total Construction</strong></td>
</tr>
<tr>
<td><strong>Future Value</strong></td>
<td>$1,724,000</td>
<td><strong>Future Value</strong></td>
</tr>
<tr>
<td><strong>Preliminary Engineering</strong></td>
<td>$300,000</td>
<td><strong>Preliminary Engineering</strong></td>
</tr>
<tr>
<td><strong>Right-of-Way</strong></td>
<td>$55,000</td>
<td><strong>Right-of-Way</strong></td>
</tr>
<tr>
<td><strong>Railroad / Utility</strong></td>
<td><strong>$345,000</strong></td>
<td>*Railroad / Utility</td>
</tr>
<tr>
<td><strong>Total Project Cost</strong></td>
<td><strong>$2,424,000</strong></td>
<td><strong>Total Project Cost</strong></td>
</tr>
<tr>
<td></td>
<td><strong>$2,153,500</strong></td>
<td></td>
</tr>
</tbody>
</table>
- Bid Amount: $1,496,839.80
- Three bidders
- Span of bids < $200,000
### Basnettville Bridge

#### Comparison Between Conventional Construction vs. ABC Construction

<table>
<thead>
<tr>
<th>Alternative No. 1 From Design Study Dated Sept. 2010</th>
<th>ABC Construction - Constructed Bridge Downstream on Temporary Superstructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$674,800</td>
<td>$674,800</td>
</tr>
<tr>
<td>$308,500</td>
<td>$308,500</td>
</tr>
<tr>
<td>$295,400</td>
<td>$269,900</td>
</tr>
<tr>
<td>$243,000</td>
<td>$243,000</td>
</tr>
<tr>
<td>$1,521,700</td>
<td>$1,496,200</td>
</tr>
</tbody>
</table>

| Future Value | $1,724,000 | $1,698,500 |
| Preliminary Engineering | $300,000 | $300,000 |
| Right-of-Way  | $55,000    | $55,000    |
| Railroad / Utility* | $345,000 | $100,000 |
| Total Project Cost | $2,424,000 | $2,153,500 |

*Railroad / Utility
Cassion Shells

Tappan Zee: $4Billion
Other Example
Boeing Bridge

Additional Top Lateral Confinement

Cover

1'-0"

Oversized Pile Shaft

Vertical Shaft Reinforcement

Spirals or Hoops

Column

Upper Half Confinement Reinforcement

Lower Half Confinement Reinforcement
Boeing Bridge
Lake Bridges (KYDOT)

30” dia x 1” x 210 ft
72” dia x 2” x 180 ft

~500,000 ft-lb, 80 Ton
CFST

~60% less material
no rebar cage
no rebar fabrication
no on-site crew
no rebar lift
Re-Use Foundations

Milton Madison
~$30-50M

SR30 over Bessemer Avenue
District 11, 57 hours
Re-Use Foundations

Re-Use & ABC compliment one another!!!

Benefits:
Alignment Studies
NEPA / Environmental
Right-of-Way
Utility
MOT
Chapter 1- Introduction

Chapter 2- Reuse Decision Model

Chapter 3- Evaluation of Existing Foundations / Substructure

Chapter 4- Foundations / Substructure Strengthening

Chapter 5- Case Histories

Contact: Frank Jalinoos, FHWA R&D
(202) 493-3082; frank.Jalinoos@dot.gov

For more information, visit www.fhwa.dot.gov/research/tfhrc/programs/infrastructure/structures/fcp
Summary

Increased use of “separate” stage construction
-- under/adjacent/around, different strategies

Changes in structural elements
-- GeoGrid (SPMTs/Approach Slabs)
-- Straddle cap ~40’
-- CFST

Changes in construction equipment
-- larger/different hammers

Changes in practices
-- Foundation/Substructure re-use
State of the Industry Updates
2014 AASHTO HSCOBS Strategic Plan

Program Objective No. 5 of 8:

Accelerated Bridge Delivery and Construction
• 12-98: Guidelines for PBES Tolerances and Dynamic Effects of Bridge Moves

• 12-102: Development of an ABC Design and Construction Specification

• 12-105: System Performance of ABC Connection in Moderate-to-High Seismic Regions
ABC Subcommittee Reorganization

**AFF10 General Structures** — parent committee

**AFF10(3)** — Subcommittee for ABC

**AFF00** — Design Section (parent)

**AFH00** — Construction Section

**AFF00(2)** Joint Subcommittee for ABC

[www.trbaff103.com](http://www.trbaff103.com)
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

University Transportation Center for ABC update
- ABC-U TC Link
- Dr. Atorod Azizinamini

Workshop No. 123:

Latest Accelerated Bridge Construction Innovations from Research

The half-day ABC workshop provides a forum for the research teams that are supported through the U.S. Department of Transportation’s Accelerated Bridge Construction University Transportation Center (ABC-U TC) to disseminate their latest findings on innovative research projects to address resources, design, bridge design, and engineering for ABC.

TRB Co-sponsors:
- AFF10 - Committee on General Structures
- AFFG02 - Joint Subcommittee on ABC
- AFF40 - Committee on Construction of Bridges & Structures
- AFF50 - Committee on Seismic Design & Performance of Bridges

Estimating Total Cost of Accelerated Bridge Construction
- Presentation Link
- Mohammed Hadi, Florida International University

ABC Project and Research Databases
- Presentation Link
- David Garber, Florida International University

Closure Joint Alternatives for ABC Projects
- Presentation Link
- Dr. Atorod Azizinamini, P.E., Ph.D., Florida International University
New Publications

TECHNOTE
Design and Construction of Field-Cast UHPC Connections

FHWA Publication No: FHWA-HRT-14-094
FHWA Contact: Ben Graybeal, HRDI-40, 202-493-3122, benjamin.graybeal@dot.gov

Introduction
Advancements in the science of concrete materials have led to the development of a new class of cementitious composites called ultra-high performance concrete (UHPC). UHPC exhibits mechanical and durability properties that make it an ideal candidate for use in developing new solutions to pressing concerns about highway infrastructure deterioration, repair, and replacement.12 Field-cast UHPC details connecting prefabricated structural elements used for bridge construction have proven to be an application that has captured the attention of owners, specifiers, and contractors across the country. These connections can be simpler to construct and can provide more robust long-term performance than connections constructed through conventional methods.13 This document provides guidance on the design and deployment of field-cast UHPC connections.

UHPC
UHPC is a fiber-reinforced, portland cement-based product with advantageous fresh and hardened properties. Through the appropriate combination of advancements in superplasticizers, dry constituent gradation, fiber reinforcements, and suplemental cementitious materials, UHPC is able to deliver performance that far exceeds conventional concrete. Developed in the late 20th century, this class of concrete has emerged as a capable replacement for conventional structural materials in a variety of applications.

The Federal Highway Administration (FHWA) defines UHPC as follows:
UHPC is a cementitious composite material composed of an optimized gradation of granular constituents, a water-to-cementitious materials ratio less than 0.25, and a high percentage of discontinuous internal fiber reinforcement. The mechanical properties of UHPC include compressive strength greater than 21.7 ksi (150 MPa) and sustained post-cracking tensile strength greater than 0.72 ksi (5 MPa).1 UHPC has a discontinuous pore structure that reduces liquid ingress, significantly enhancing durability compared to conventional concrete.2

TABLE OF CONTENTS:
Common Connections..........................4
Design Guidance................................11
Specifying UHPC...............................17
Construction Engineer Inspection..........26
Case Study......................................27
Deployments....................................32

FHWA - Tech Notes

**TECHNOTE**
Dimensional Stability of Grout-Like Materials Used in Field-Cast Connections


**TECHNOTE**
Bond of Field-Cast Grouts to Precast Concrete Elements

<table>
<thead>
<tr>
<th>Webinar Topic</th>
<th>Tentative Speakers</th>
<th>Date and Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Introduction to UHPC</td>
<td>Characteristics of UHPC – EDC UHPC Team</td>
<td>March 7, 2017</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 pm – 2:30 pm EST</td>
</tr>
<tr>
<td>2. Why UHPC for Prefabricated Bridge Element Connections?</td>
<td>Overview – EDC UHPC Team</td>
<td>April 4, 2017</td>
</tr>
<tr>
<td></td>
<td>Superstructure Connections – Iowa DOT</td>
<td>1 pm – 2:30 pm EST</td>
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<td></td>
<td>Substructure Connections – NYSDOT</td>
<td></td>
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<tr>
<td></td>
<td>Long-Term Performance – EDC UHPC Team</td>
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<tr>
<td>3. Structural Design, Detailing, and Specifying UHPC for Prefabricated Bridge Element Connections (PBEC)</td>
<td>Overview – EDC UHPC Team</td>
<td>May 9, 2017</td>
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<td>Lessons Learned – Iowa State University</td>
<td>1 pm – 2:30 pm EST</td>
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<td>Franklin Ave. Bridge Rehab Project – MNDOT &amp; Hennepin County</td>
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<td></td>
<td>NYSDOT I-81 Case Study</td>
<td>1 pm – 2:30 pm EST</td>
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<td>Contractor Perspectives on UHPC</td>
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<tr>
<td>5. UHPC Implementation Stories</td>
<td>UHPC Implementation – DeLDOT</td>
<td>July 11, 2017</td>
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<td>UHPC Implementation – GDOT</td>
<td>1 pm – 2:30 pm EST</td>
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<tr>
<td>6. Pulaski Skyway – Owner’s Perspective</td>
<td>Project Overview – EDC UHPC Team</td>
<td>August 15, 2017</td>
</tr>
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<td></td>
<td>Owner’s Perspective and Lessons Learned – NJDOT</td>
<td>1 pm – 2:30 pm EST</td>
</tr>
</tbody>
</table>

Monthly ABC Webinars: 78th webinar to date!

Thursday May 18, 2017
1:00 to 2:00 p.m. EST

VADOTs High Performance Concrete
Link Slabs & Overlay
www.abc-utc.fiu.edu

Project Examples use PBES/ABC
- Project Summary
- Contract Plans
- Specifications
- Bid Tabs
- Schedule
- Pictures
www.abc-utc.fiu.edu

Call for Abstract – Extended Deadline: February 24th, 2017
Click HERE to Submit Abstract Online

2017 National Accelerated Bridge Construction Conference
December 7 and 8, 2017
Workshops - December 6, 2017
What is good for our customers is good for all of us, ABC…

- Demonstrates: good government/good stewardship
- Garners and fosters public/political support for transportation programs
- Positive message of our contracting and engineering community
- Better product: safer, less risk, better quality, better use of our time/resources
U.S.A. is the Global Leader

No other country has completed more ABC projects in terms of

Volume
Diversity
Complexity

Effectiveness
Thank You!

FHWA

Benjamin Beerman, P.E.

benjamin.beerman@dot.gov