Accelerated Bridge Construction University Transportation Center

Atorod Azizinamini, Ph.D., P.E.
Director, ABC-UTC
Florida International University

2016-2022

Florida International University- Lead

Partner Universities

University of Nevada-Reno

Iowa State University

University of Washington

University of Oklahoma

Closing down of some of these bridges can cost society in **millions,** even for a day and *result in economic losses even in neighboring states*

Bridge construction zones contribute to **traffic delays, reduced mobility** and **impacts the environment and public health**

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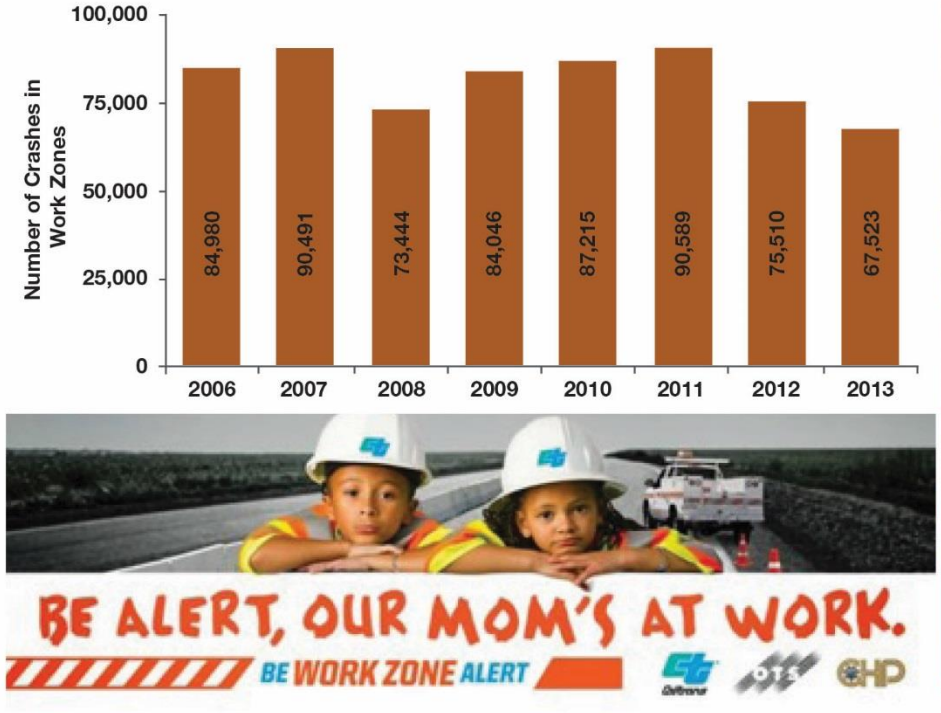
Safety: Construction Zones are be prone to accident



Widow of highway worker pleads for safety

Alison Dirr,
USA TODAY NETWORK
Wisconsin – 6:12 p.m. CDT
April 12, 2015

Delivering a Transportation Program, such as building a bridge is a service that is provided to public. We need solutions that effectively address following issues

A. Keeping traffic flowing while upgrading substandard bridges

B. Safety

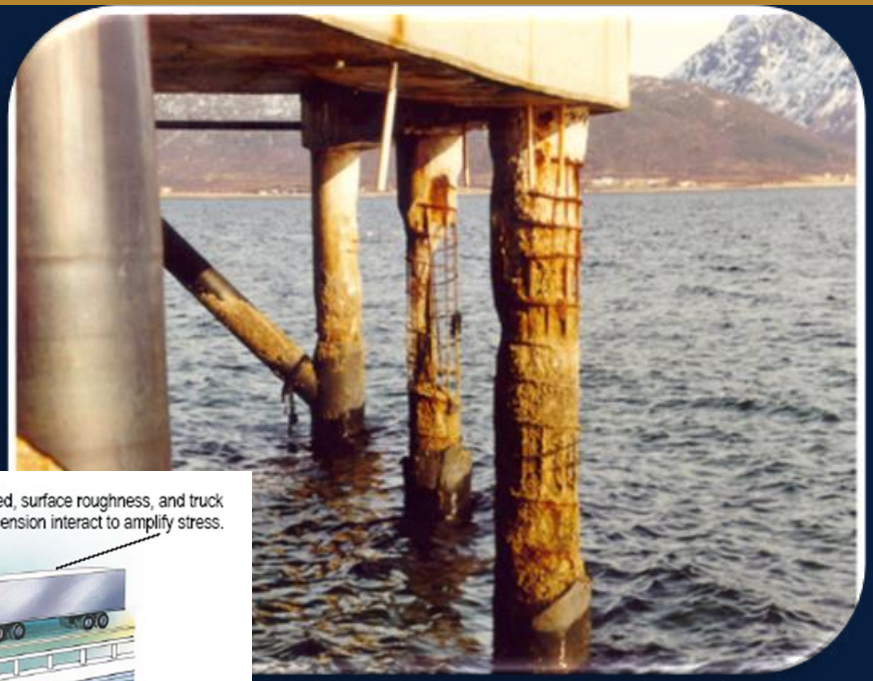
C. Onsite construction duration limitation

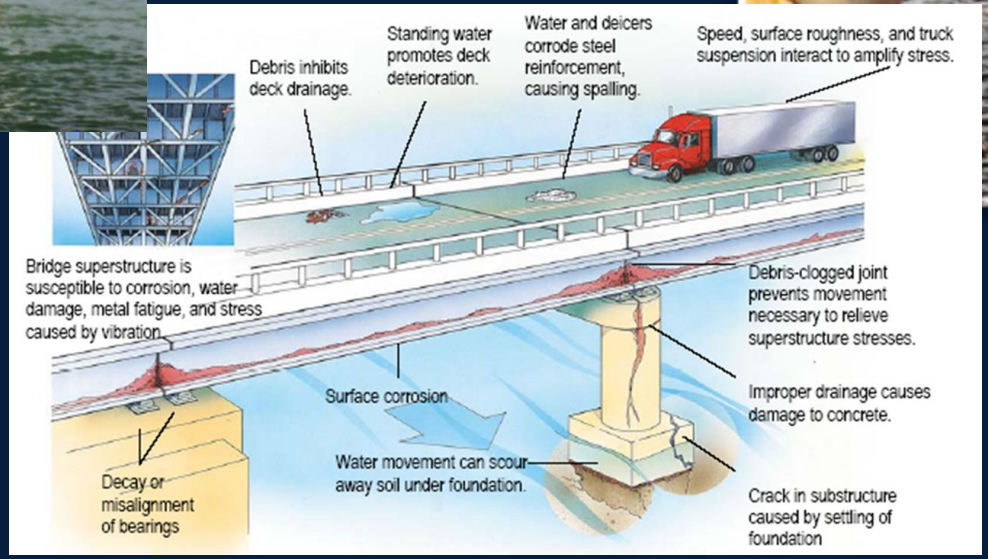
We can build them off site and move them in final location

Photo: ©UDOT

We can build large segments and attach them together onsite

Rehabilitating and Restoring the Current System. Why to do it?





Few lessons that we can learn from past 100 years

Question: Why some of our most notable bridges, such as Brooklyn Bridge and the Williamsburg Bridge have lasted more than 100 years? Three main reasons:

- Maintainable and well maintained over their 100-year lives as a result of their extreme importance or high capital replacement cost;

- Adaptable to changes in functional use, as well as service limit state demands; and/ or

- Originally overdesigned.

Few lessons that we can learn from past 100 years

Could we have predicted 150 years ago what would be the mode of transportation and level of traffic we have today?

New and disruptive technologies are being introduced at a much faster rate than 100 years ago.

Can we predict what will be mode of transportation 100 years from now?

Few lessons that we can learn from past 100 years

Considering the state of technology and state of transportation infrastructure:

Let’s get most out of existing infrastructure through adaptation of technologies that are capable of upgrading the existing infrastructure at fraction of a cost or rebuilding, without compromising any safety issue

Development of Accelerated Repair Methodologies

One of the major research focus area at ABC-UTC is the development of accelerated repair methods for damaged bridge elements. These methods are in reality strategies to upgrade the existing infrastructure

Corrosion Damage

Fact is that:
Lack of funding and number of substandard bridges demand development of accelerated repair methods, capable of fixing the problem, without adversely affecting mobility and economically

Example damages due to corrosion

Development of Accelerated Repair Methodologies

Ongoing work is divided into two major categories

Development of Accelerated Repair Methodologies

Development of accelerated repair methods for bridge elements

a) subjected to predominantly moment and
b) those to mainly axial loads

Development of Accelerated Repair Methodologies

For Repair we are using UHPC Shell

Repair of Bridge Elements Subjected to Predominantly Moment

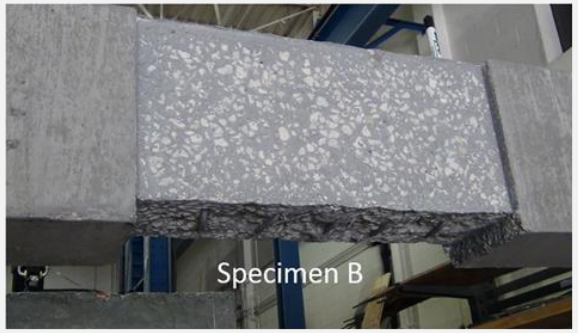
The repair method consists of wrapping the damaged areas of flexural members with a thin UHPC shell

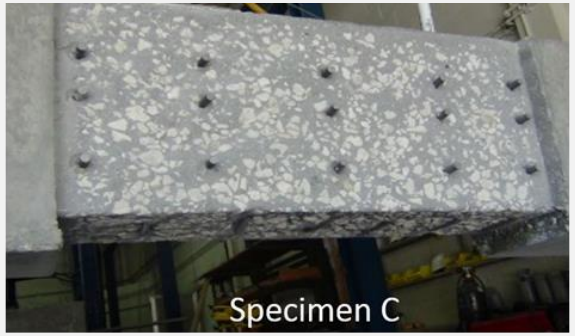
Repair of Bridge Elements Subjected to Predominantly Moment

The repair techniques consists of sand blasting the simulated damaged area and filling the area with UHPC

Repair of Bridge Elements Subjected to Predominantly Moment

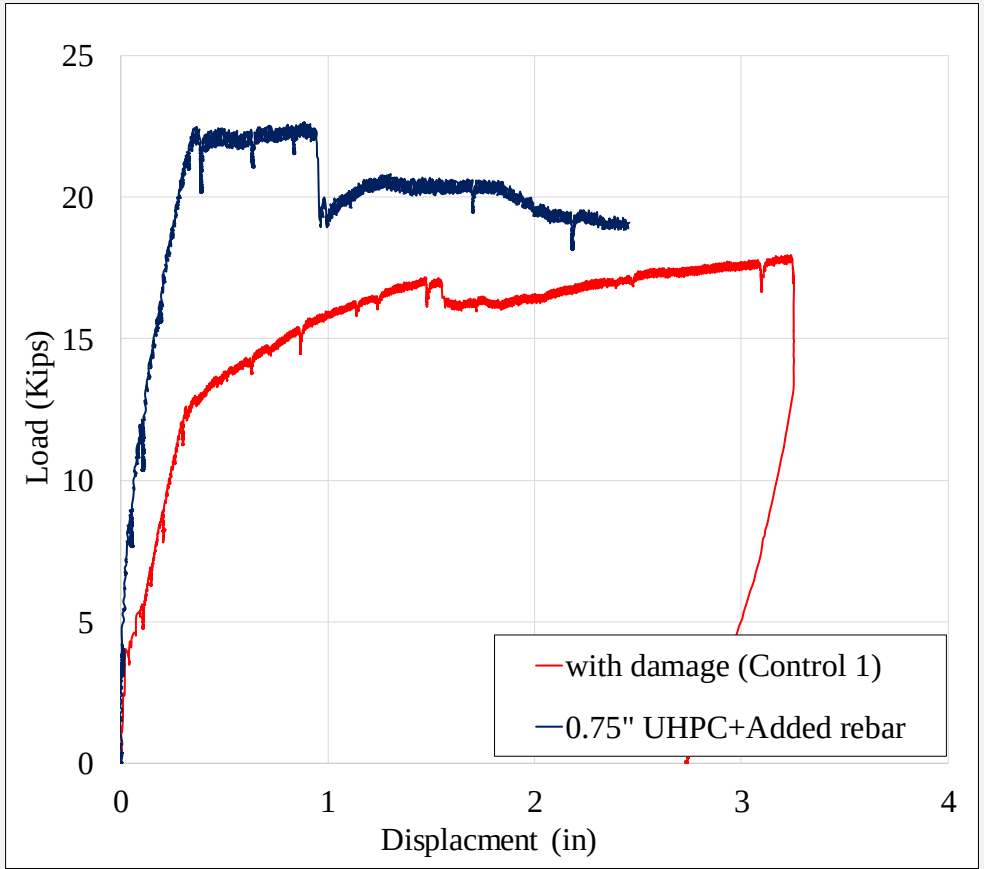
Different ways of attaching UHPC shell to existing concrete is being investigated





Preliminary Results

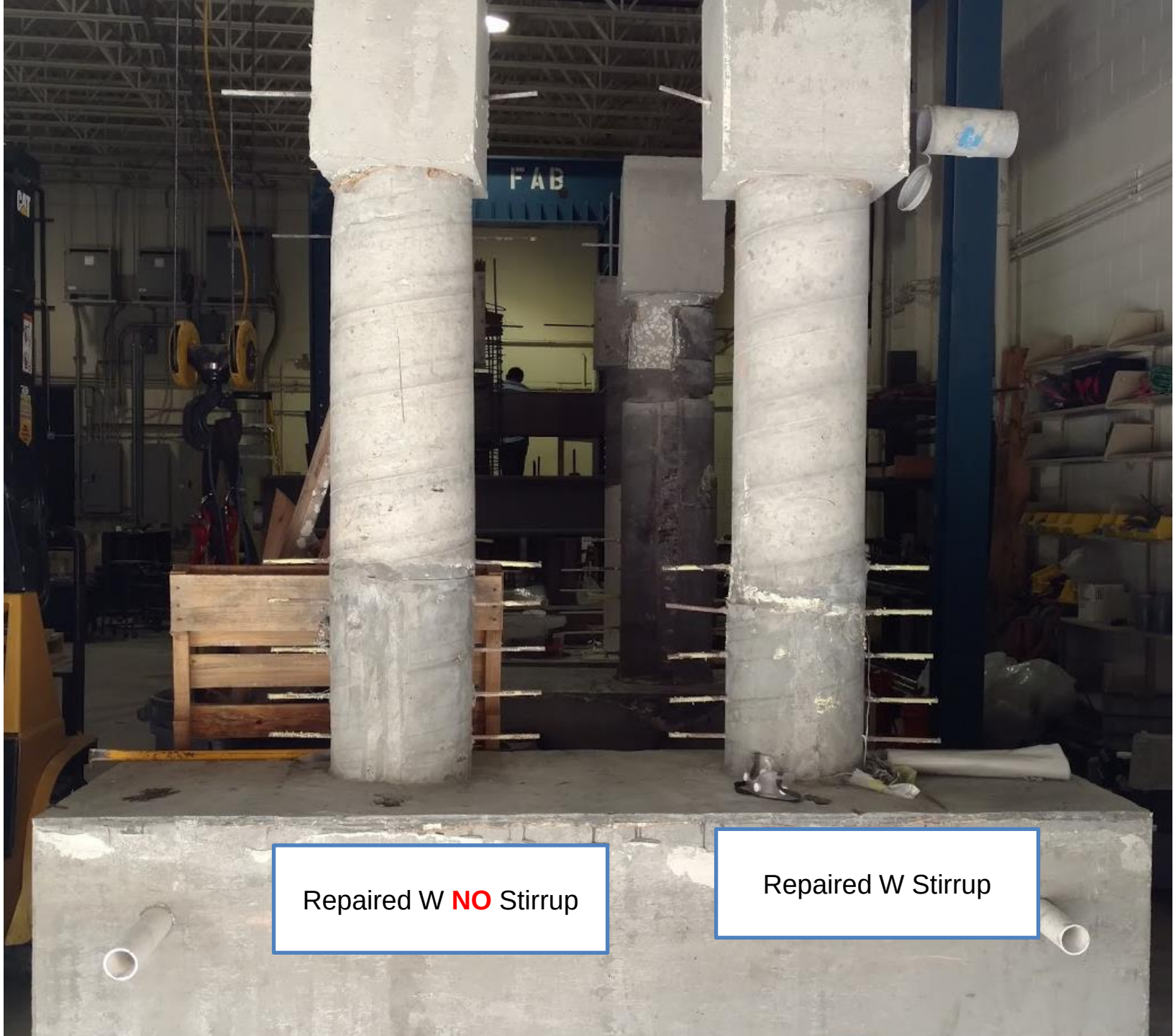
Results indicates that suggested repair method is an viable option



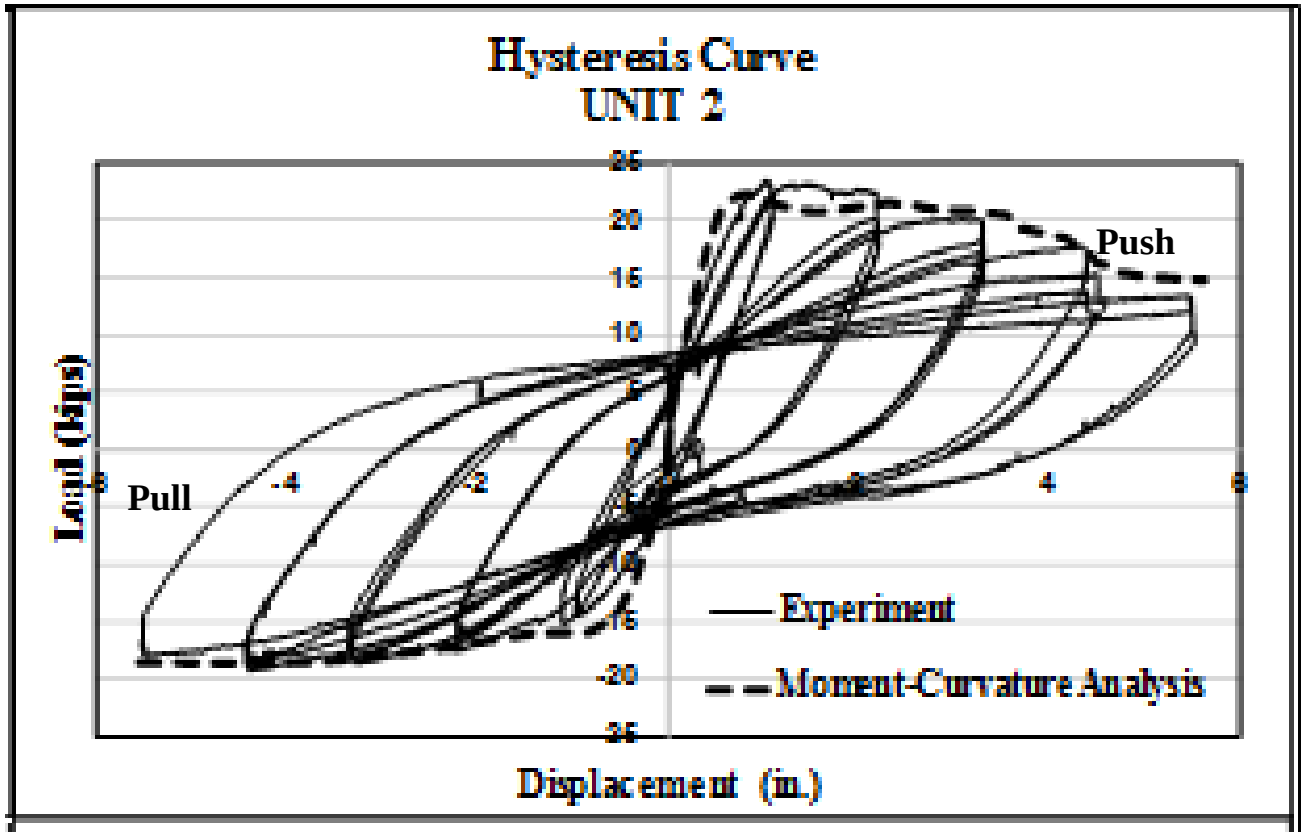
Repair of Bridge Elements Subjected to Predominantly axial loads

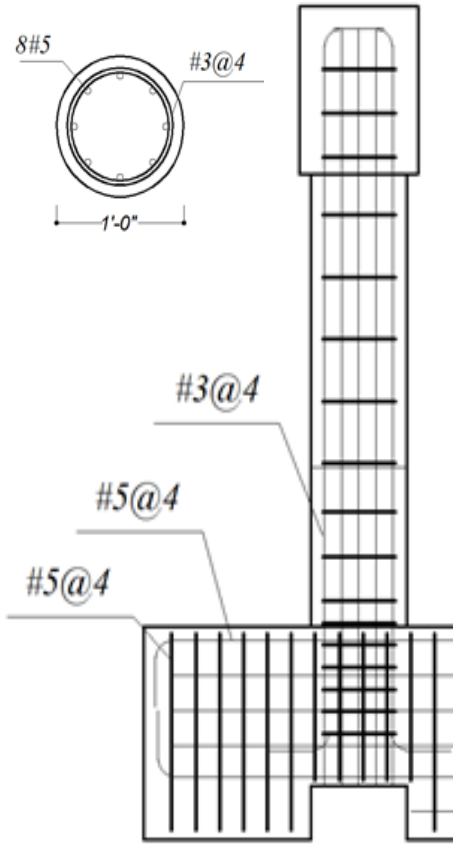
Repair of Bridge Elements Subjected to Predominantly axial loads

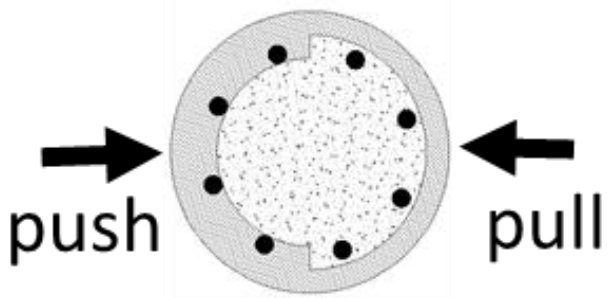
Investigation is in the form of simulating damages seen in bridge columns and repairing them using UHPC shell to develop repair guidelines

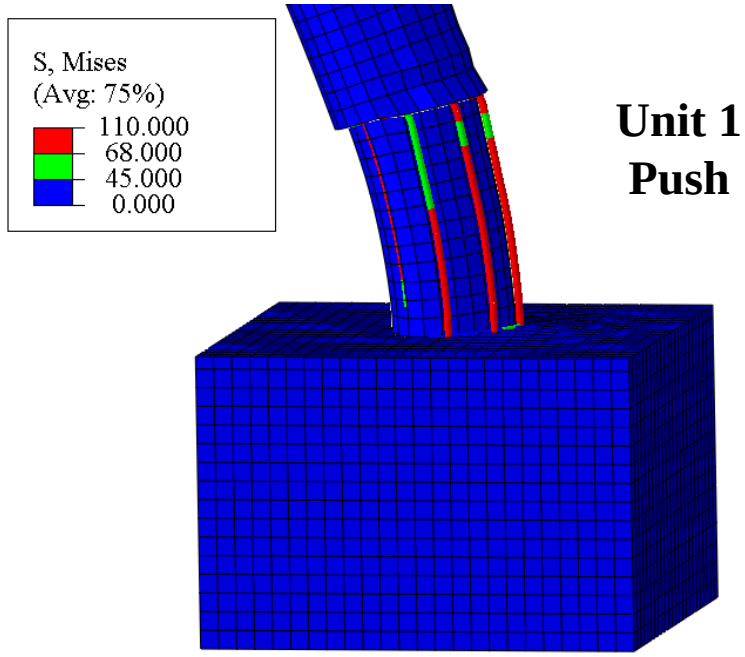

FAB
Repaired W NO Stirrup
Repaired W Stirrup

Test Results- With Stirrups

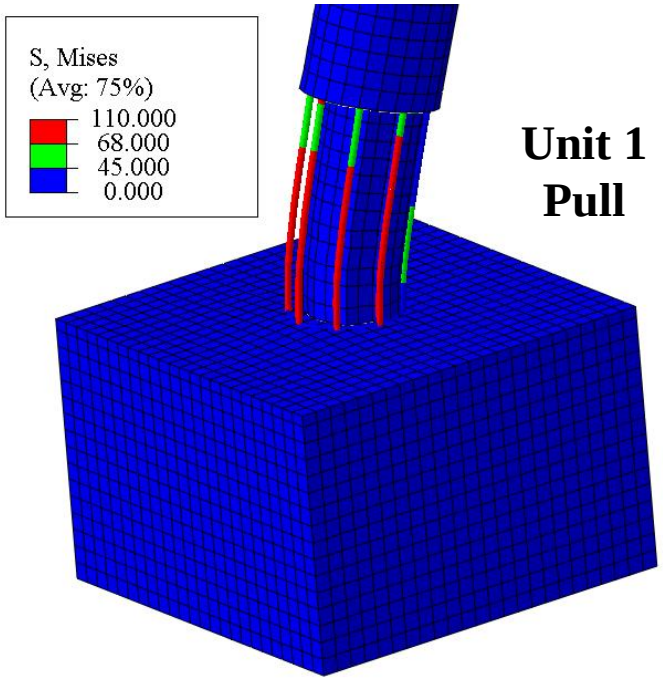




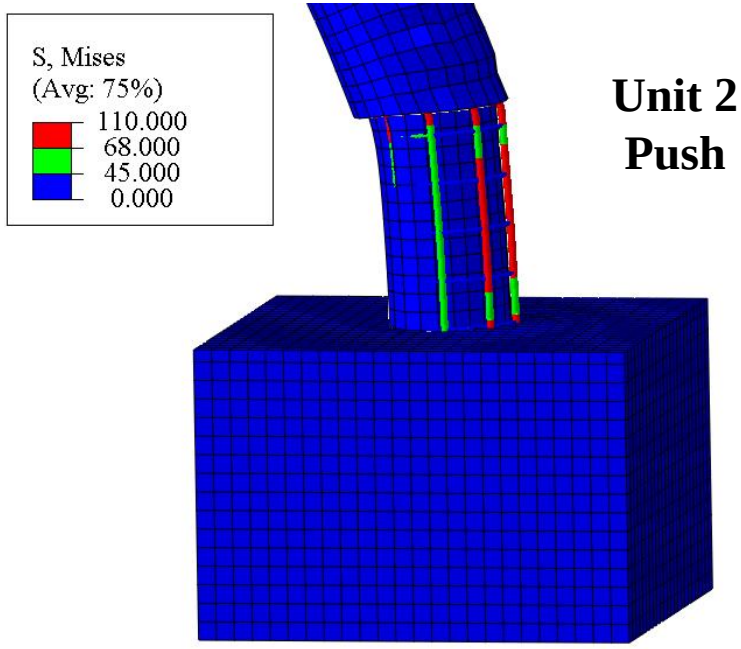




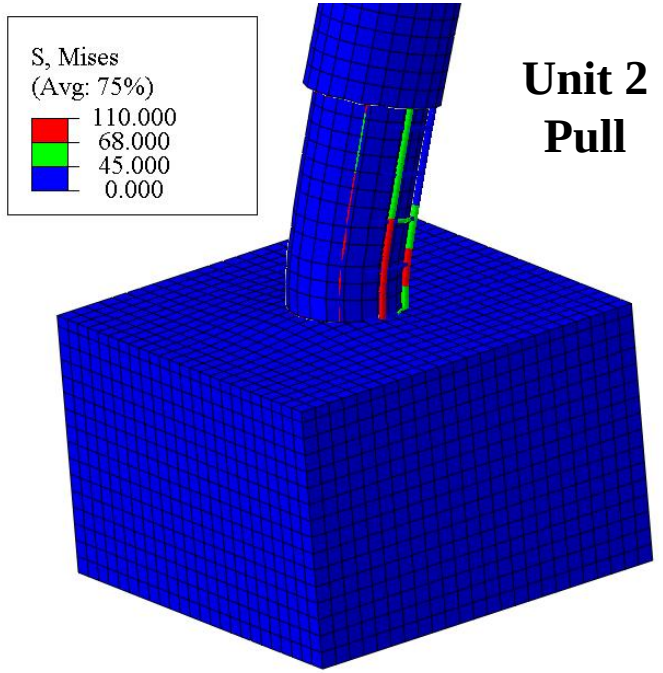
Unit 1 Push



Unit 1 Pull



Unit 2 Push

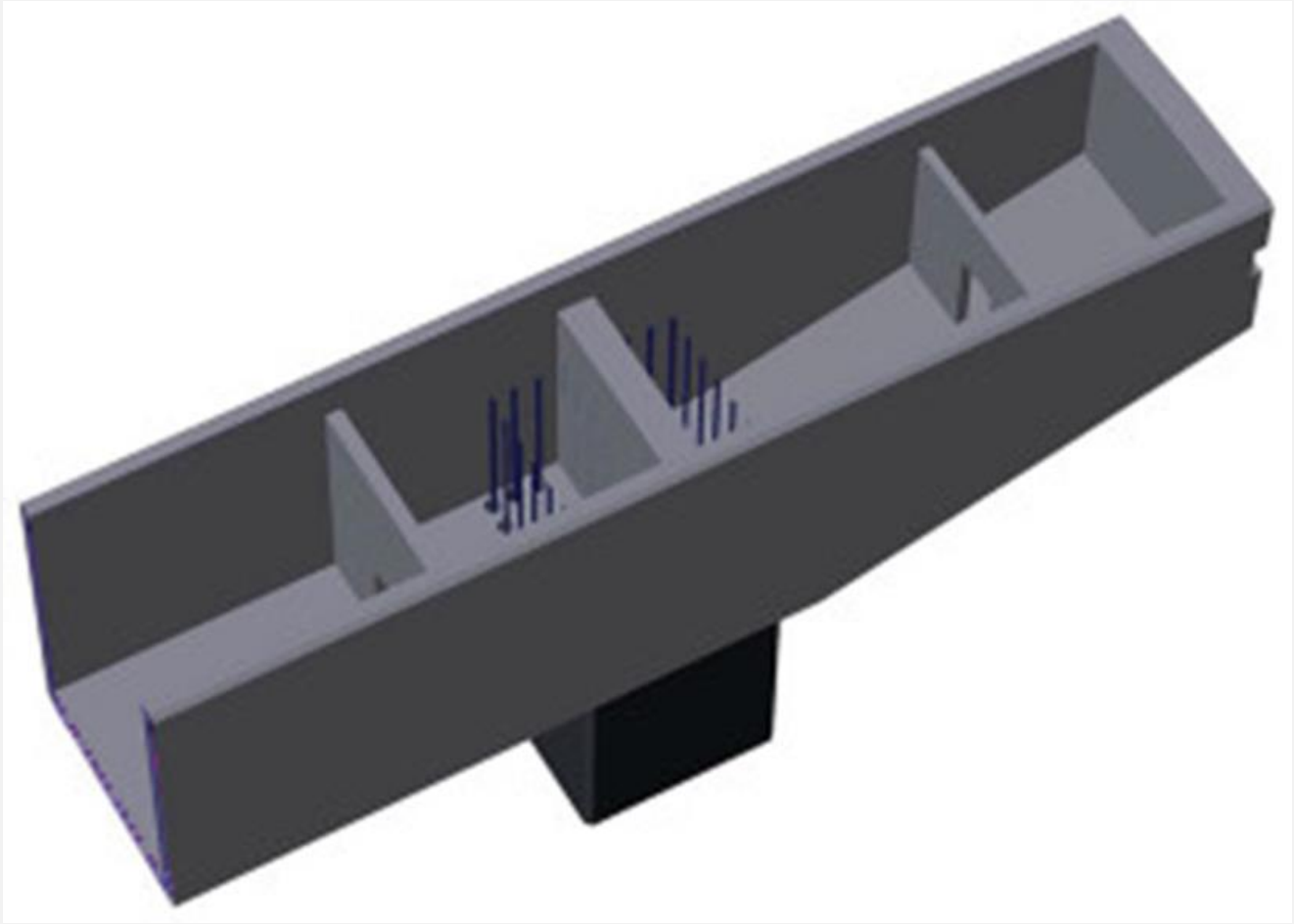


Unit 2 Pull

We are not there yet. Much more work needs to be carried out before we can use UHPC as method for retrofitting

- Fabrication of thin shell
- Curing methods
- Handling method
- Transportation issue
- Methods for attaching to damaged area

We also need to find outside the box solutions- One example is use of UHPC formwork



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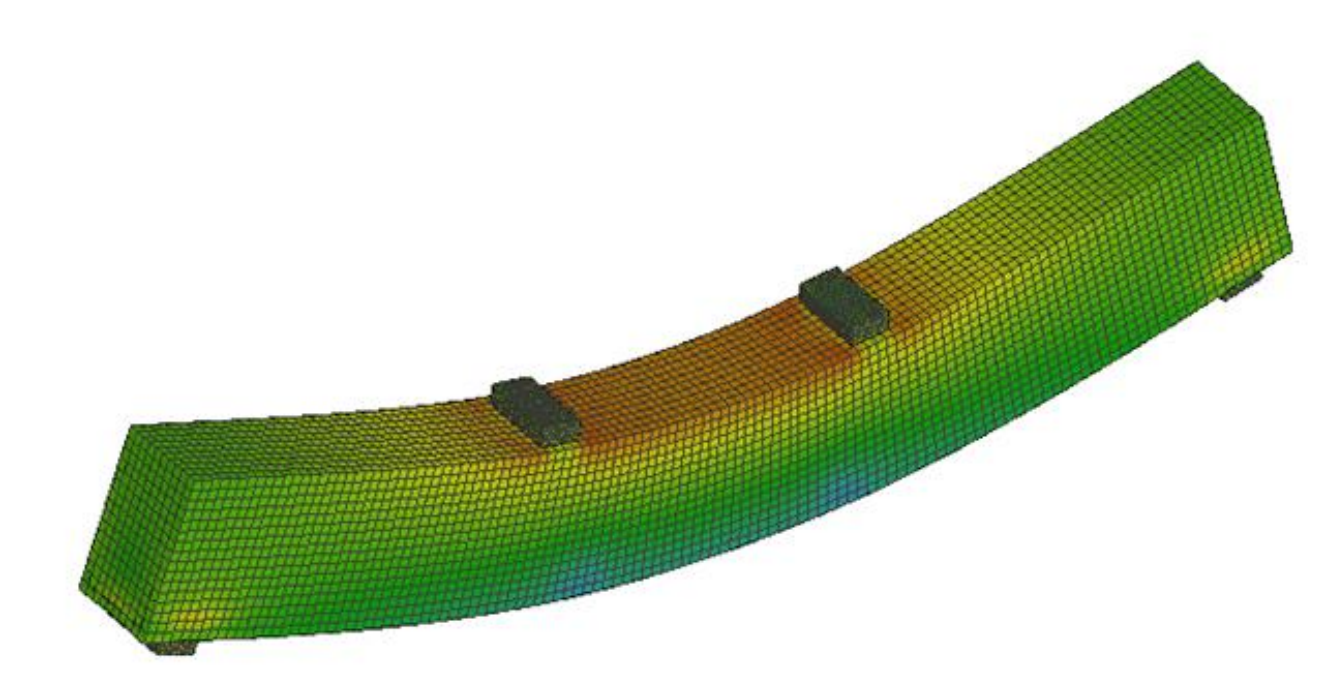
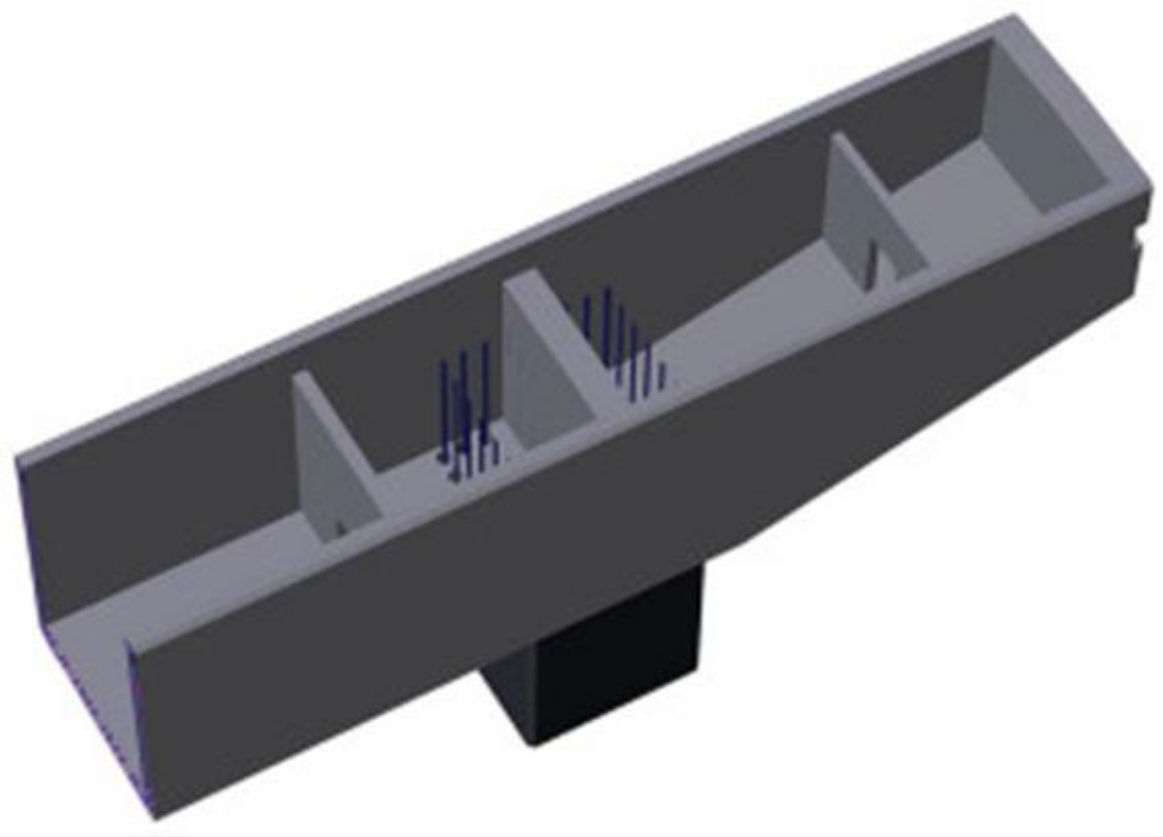
UHPC Shell as Protective Formwork


Photo courtesy of Coastal Precast Systems

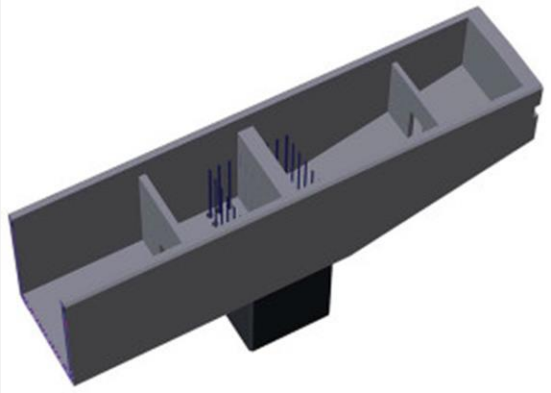
Ongoing work: UHPC Shell as Protective Formwork





Advantageous of using UHPC shell as formwork

Minimize formwork/scaffolding costs
Provide a safe work space
Minimize pick weights
Accelerated construction
No need to remove formwork, while it becomes means to protect structure



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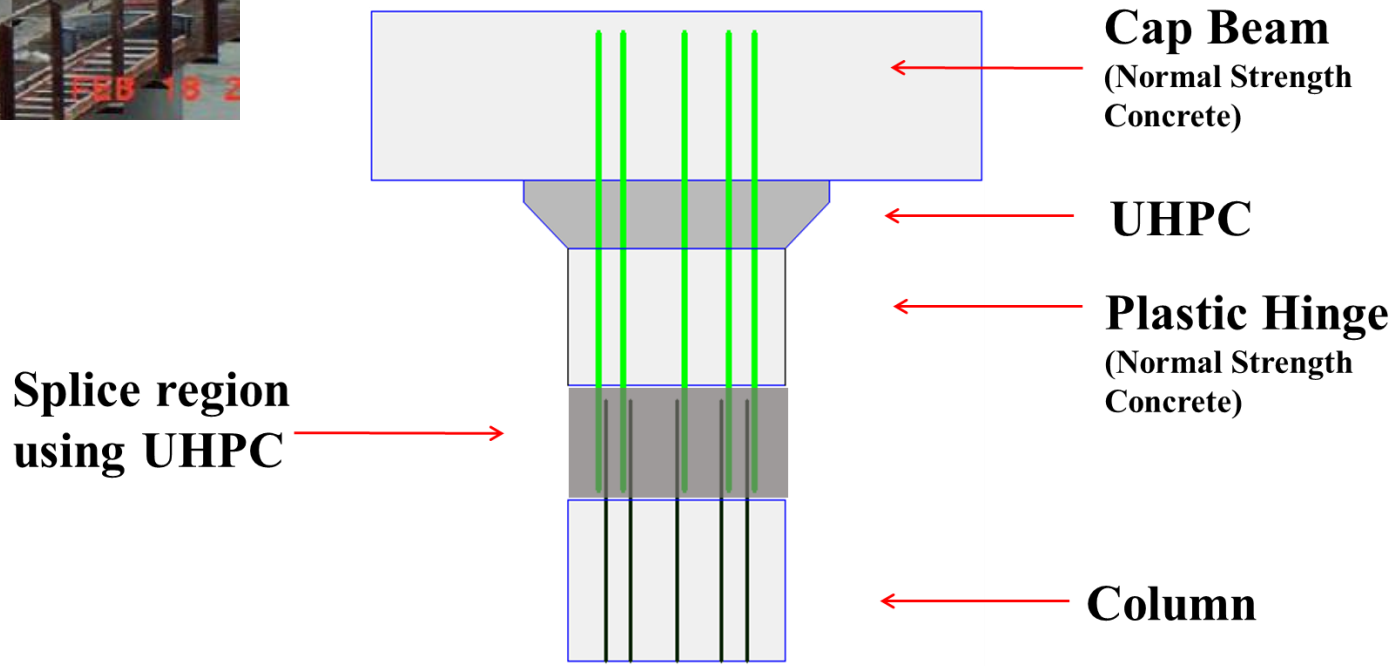
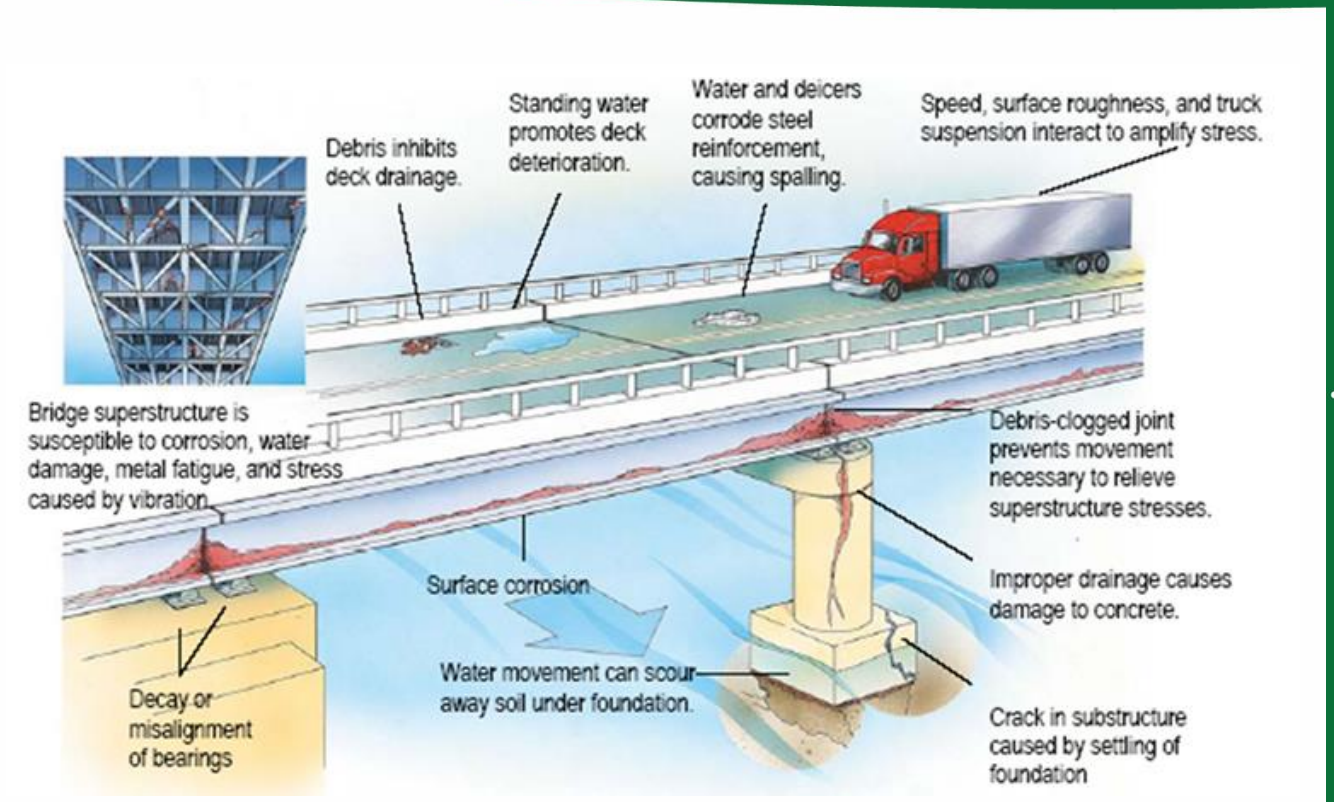
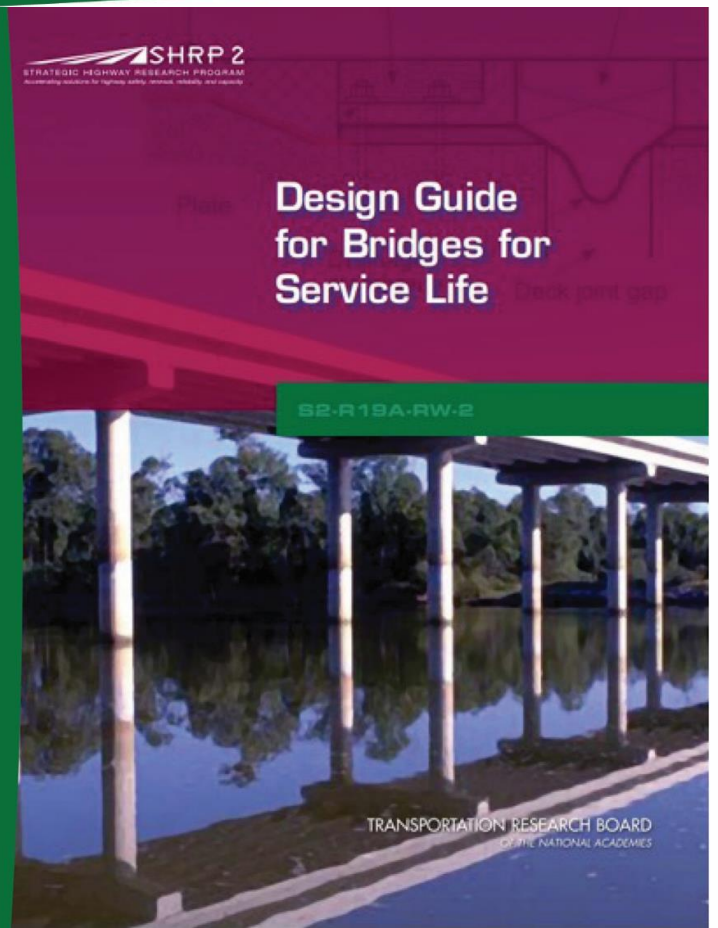
We are taking fresh look at the connections and developing practical and economical solutions

We already have Developed UHPC based solutions for challenges faced by contractors in the field



We need to pay attention to service life design





Developing customized guide for ABC
A major question: Closure Joint

1- Straight Lap Bars

* Requires Large Width (36 inches)

2- Headed Bars

* Smaller Width – 12 to 14 inch
* Limited Suppliers
* ***Cost***
* ***Tolerance and Clearance Issues***

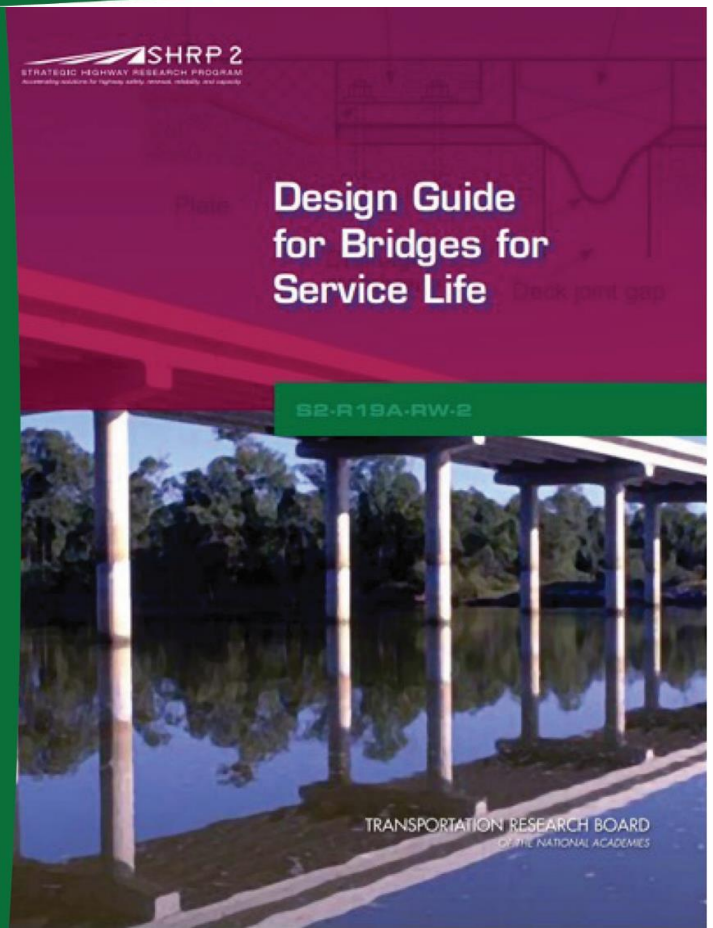
3- UHPC

* Smallest Width – 6 to 8 inches
* Limited Suppliers of UHPC

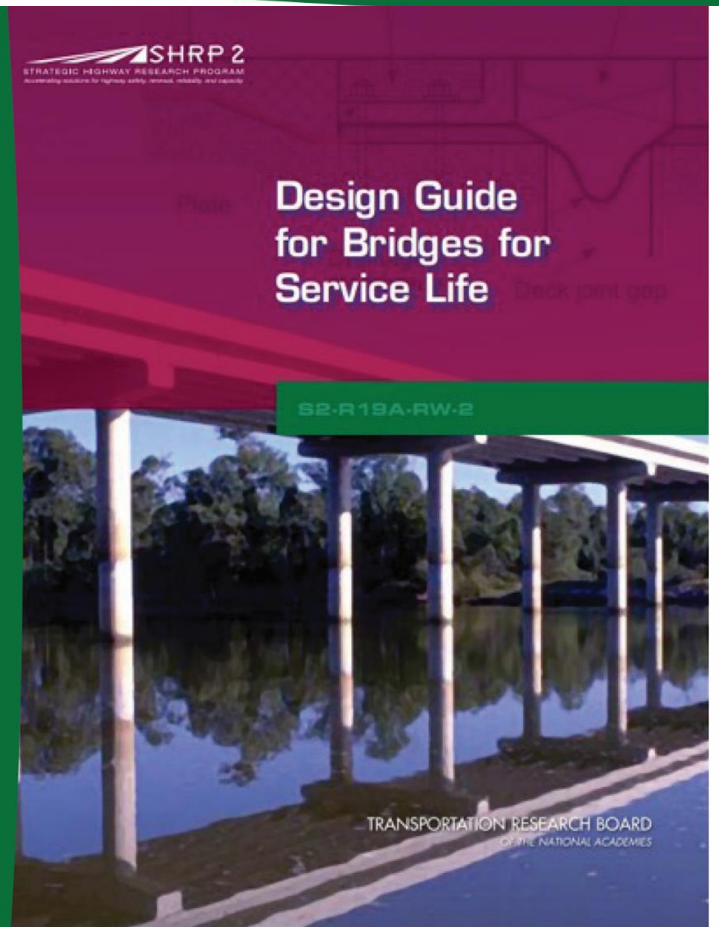
4- Full Hook

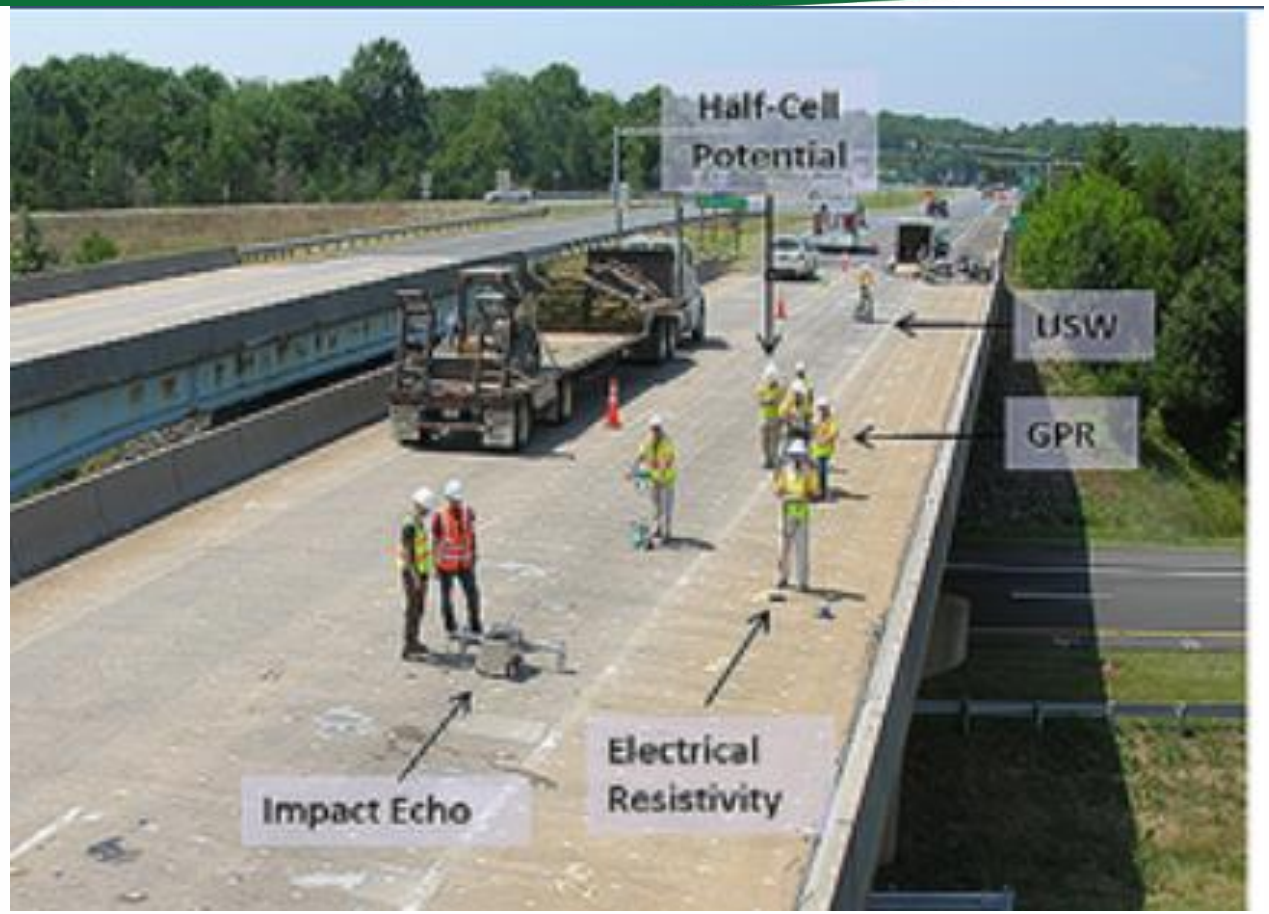
* Bend Radius Limitation on Bars
* Top and bottom bars-same

5- New Detail - ABC-UTC



Ongoing and upcoming FHWA LTBP Program can Provide missing and critical information





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Need to work with contractors
Introduce them to new ideas

Approach by New York Thruway Authority to develop solutions for New Tappan Zee Bridge for service life

How to Influence Contractor, Before project is let
Case of Tappan Zee Bridge $4Billion

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Extended Abstract

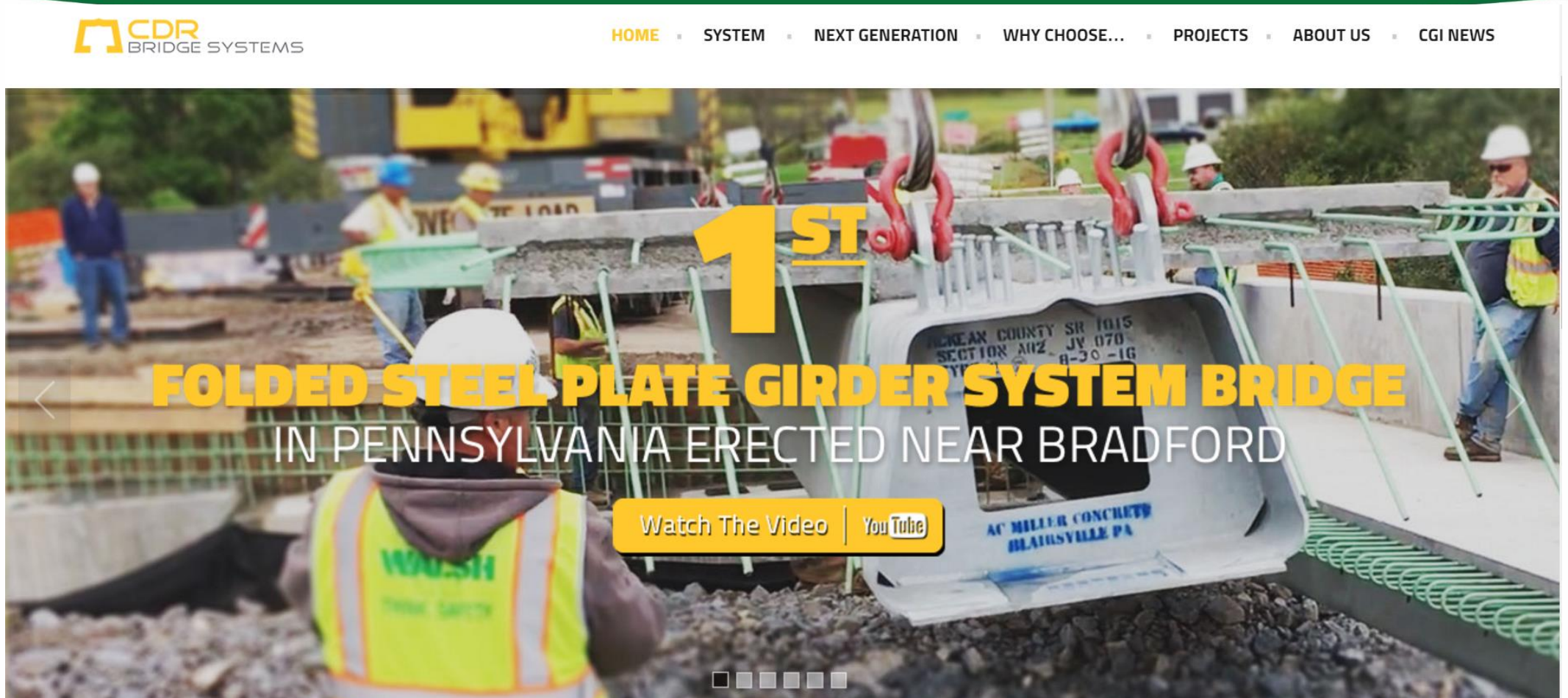
Design for Service Life: General Con

This extended abstract provides an overview of a systematic approach to s
bridges. The approach was developed in a research project entitled "Bridg
beyond 100 Years: Innovative Systems, Subsystems and Components" su
project of the second Strategic Highway Research Program (SHRP 2). Th

We need to have timely input into major initiatives and inform major stakeholders of new technologies that UTCs are developing- Working with California High Speed Rail Authority

We need to minimize time it take to get the solutions into market

Example- Second generation of Folded Plate Technology – Industry is anticipating its introduction and will be used immediately

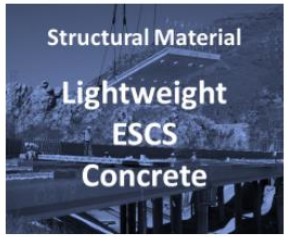


At ABC-UTC we are becoming the clearing House for new technologies

Proven Advanced Technologies

"Proven Advanced Technologies" are innovations that have been tested and used by at least one state and identified as successful ABC solutions that have value and merit for use by other states and counties throughout the nation to help rebuild the infrastructure.

The nomination process for additional technologies is currently under development.



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Getting the word out

MARCH 2017
Georgia's Rapid Replacement Utilizing Full-Depth Precast Deck Panels with UHPC Closure Joints

SPEAKERS:
Bill DuVall, P.E.
State Bridge Engineer,
Georgia Department
of Transportation

Dexter Whaley, P.E.
Bridge Design Group
Manager, GDOT

Map of over **1073 registered sites** by state that attended the March 2017 Webinar.

APRIL 2017
PennDOT's Rapid Bridge Replacement Project Utilizing Folded Steel Plate Girder Bridge

SPEAKERS:
Tom Maciocce, P.E.
Chief Bridge Engineer,
Pennsylvania Department
of Transportation

Charles Zugell, P.E.
Design Build Coordinator
Walsh/Granite JV

Curt Beveridge
Project Manager,
Walsh/Granite JV

Map of over **1100 registered sites** by state that attended the April 2017 Webinar.

At ABC-UTC, Technology Transfer is an integral part of every activity

About 750 attended 2014 and 700 attended 2015 National ABC Conferences

18 four- or eight-hour long workshops during 2014 and 2015 national ABC Conferences

275 technical presentations during 2014 and 2015 National ABC Conferences

95 companies exhibited their services during 2014 and 2015 National ABC Conferences

Visit
www.ABC-UTC.FIU.EDU