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

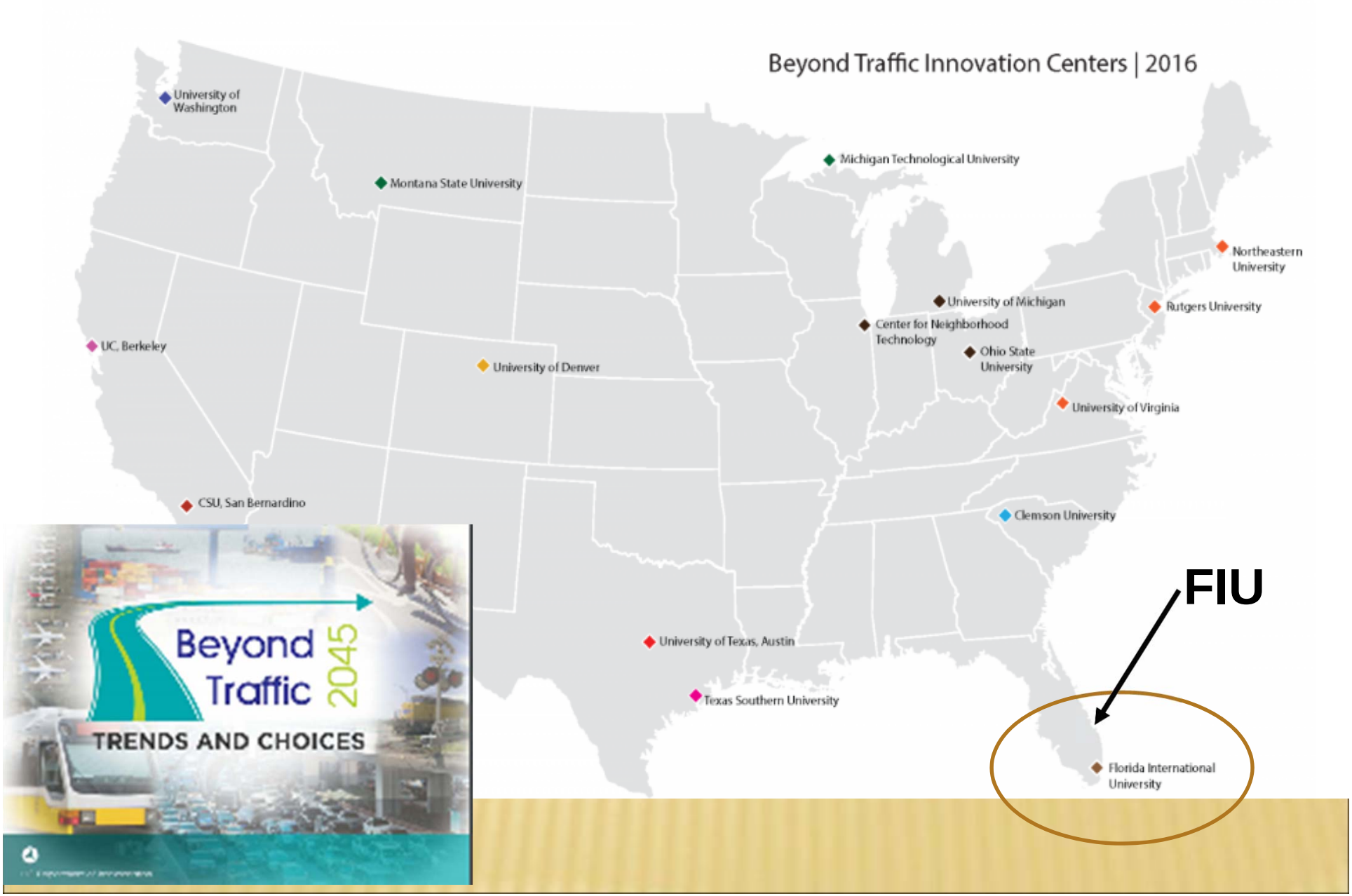
University of Nevada-Reno

Iowa State University

University of Washington

University of Oklahoma

DOT announces Beyond Traffic Innovation Centers



Presentation Outline

This presentation provides highlights of ongoing research projects that are being conducted at ABC-UTC at Florida International University (FIU).

Development of Accelerated Repair Methodologies

One of the major research focus area is the development of accelerated repair methods for damaged bridge elements.

Corrosion Damage

Fact is that:
Lack of funding and number of substandard bridges demand development of accelerated repair methods

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

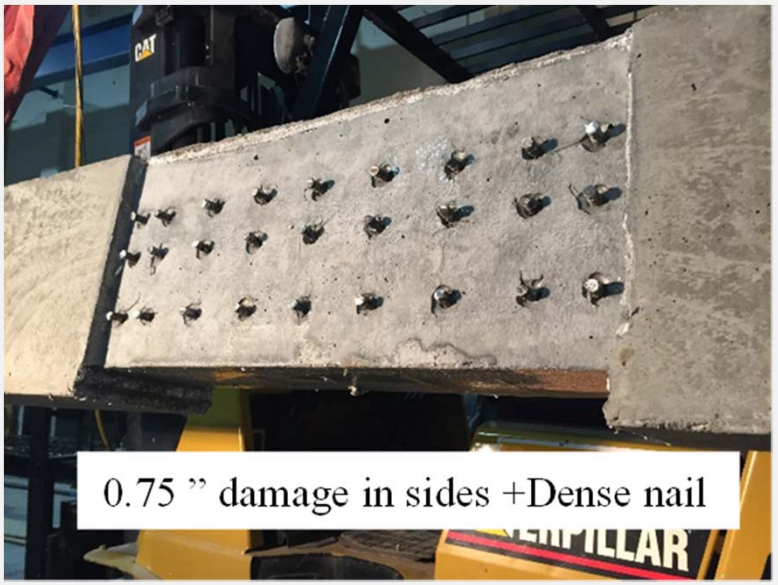
Repair of Bridge Elements Subjected to Predominantly Moment

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

Repair of Bridge Elements Subjected to Predominantly Moment

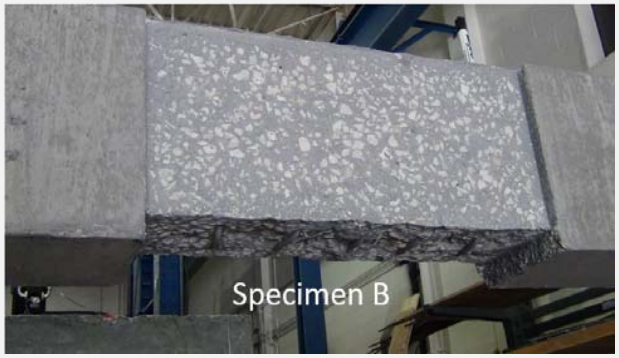
In some specimens “shear studs” in the form
Of short rebars inserted into the concrete is usec
To develop a better bond between UHPC and
Existing concrete

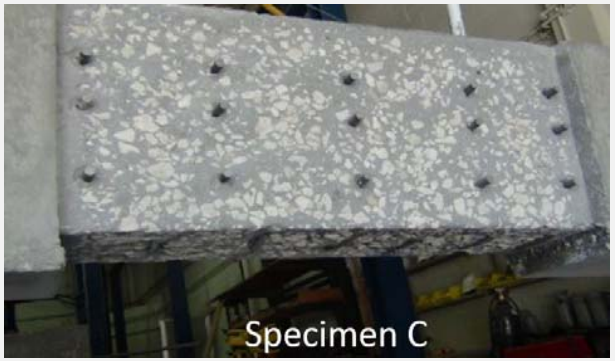


Repair of Bridge Elements Subjected to Predominantly Moment

In other test specimens concrete in damaged Areas were removed to the point where Reinforcement were exposed

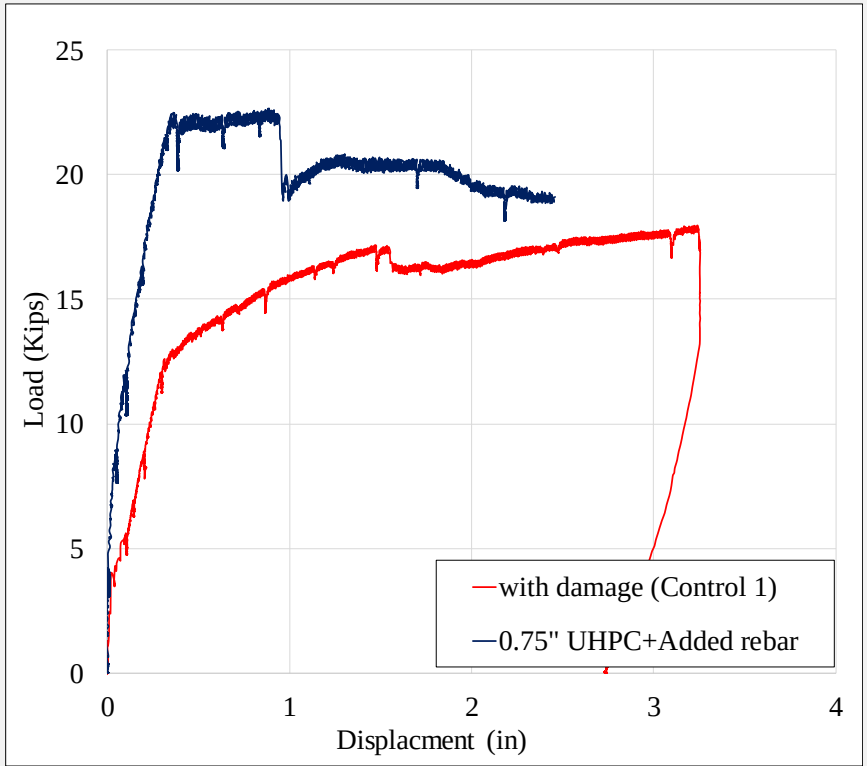
Test Specimens after Sand Blasting





Preliminary Results

Results indicates that suggested repair method Is an viable option



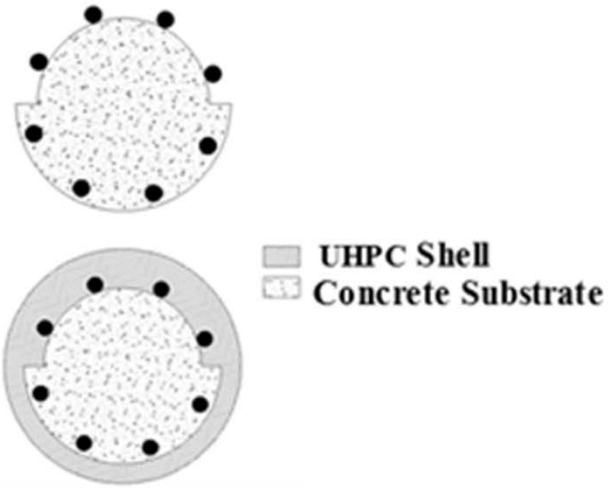
Repair of Bridge Elements Subjected to Predominantly axial loads

Repair of Bridge Elements Subjected to Predominantly axial loads

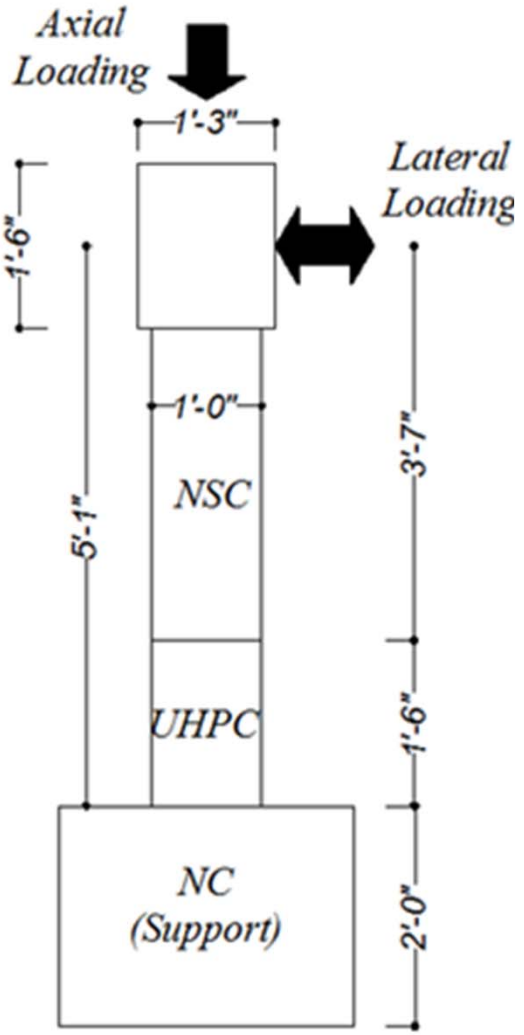
Investigation is in the form of simulating Damages seen in bridge columns and Repairing them using UHPC shell to develop Repair guidelines

Repair of Bridge Elements Subjected to Predominantly axial loads

Foam is placed before casting to create cavity, Simulating damage



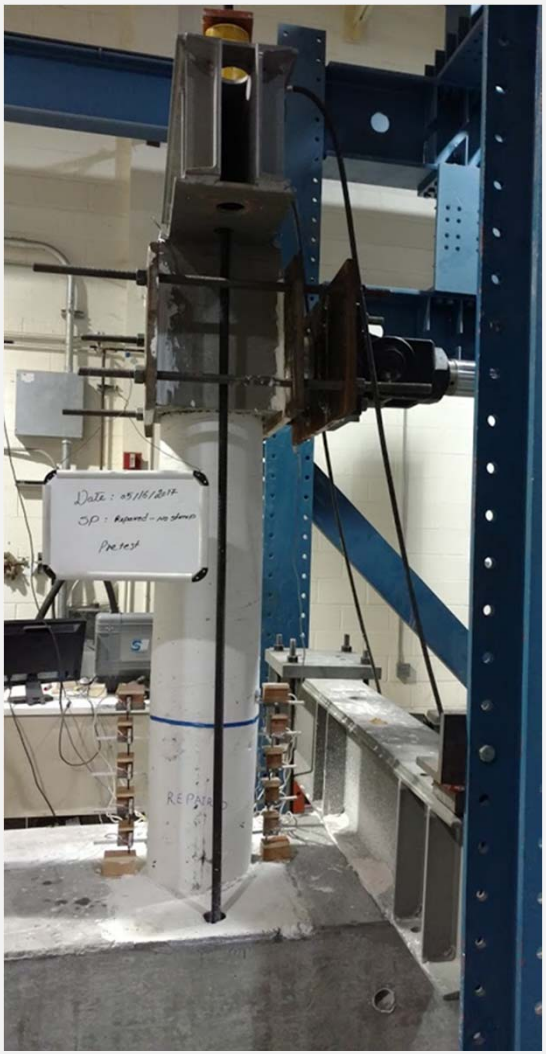
Damaged zone before and after repair



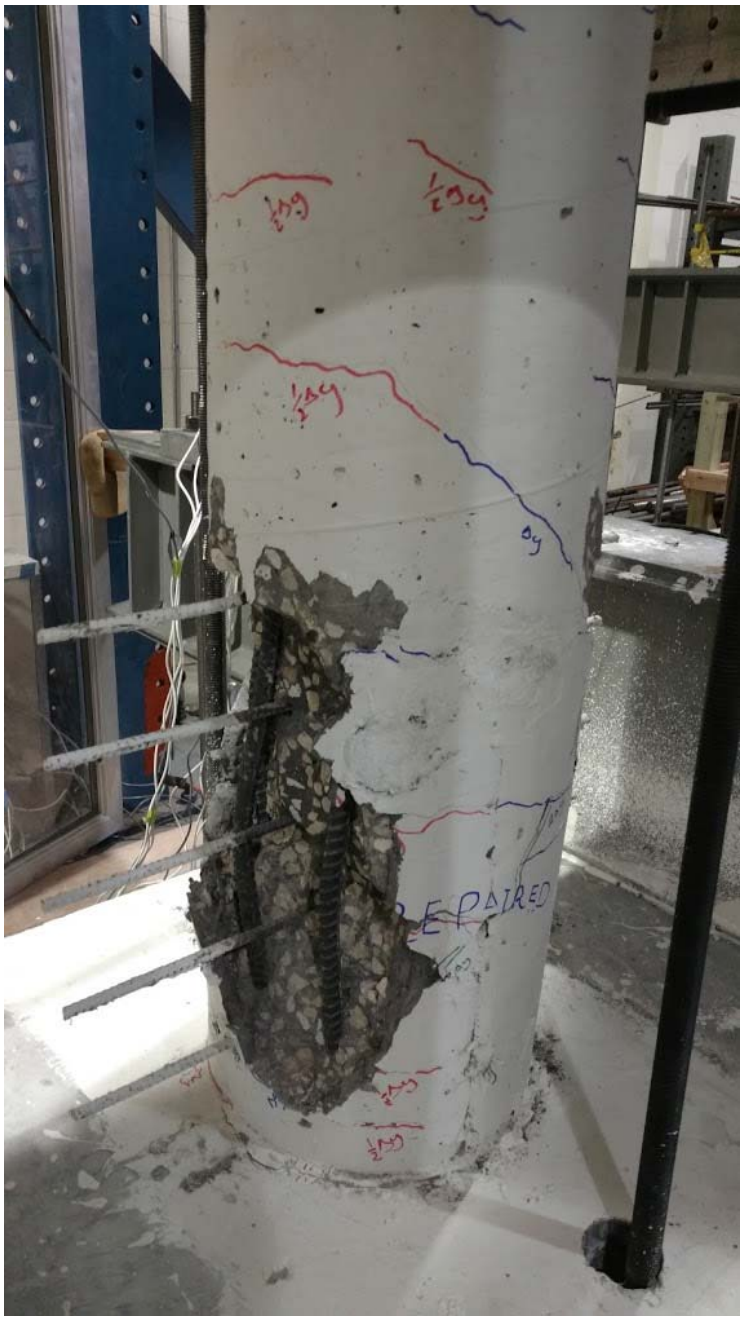

FAB
Repaired W NO Stirrup
Repaired W Stirrup

Repair of Bridge Elements Subjected to Predominantly axial loads

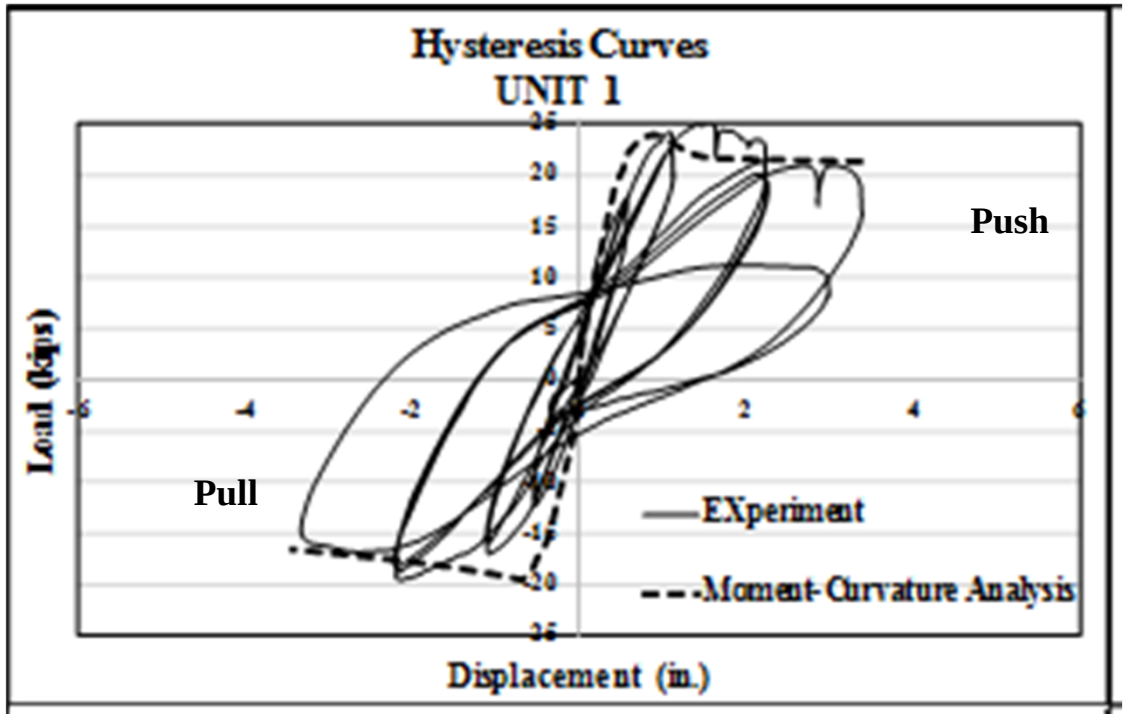
Typical test set up

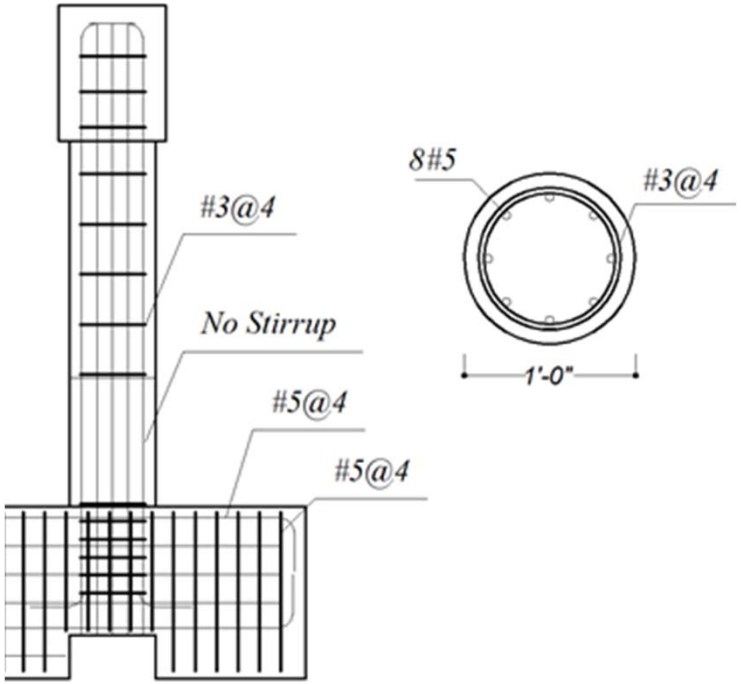


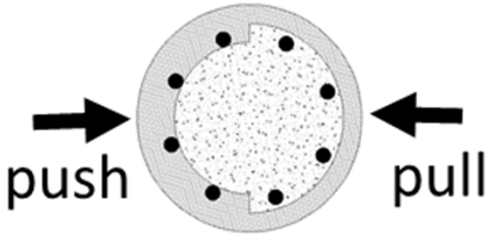
Stirrups are Needed



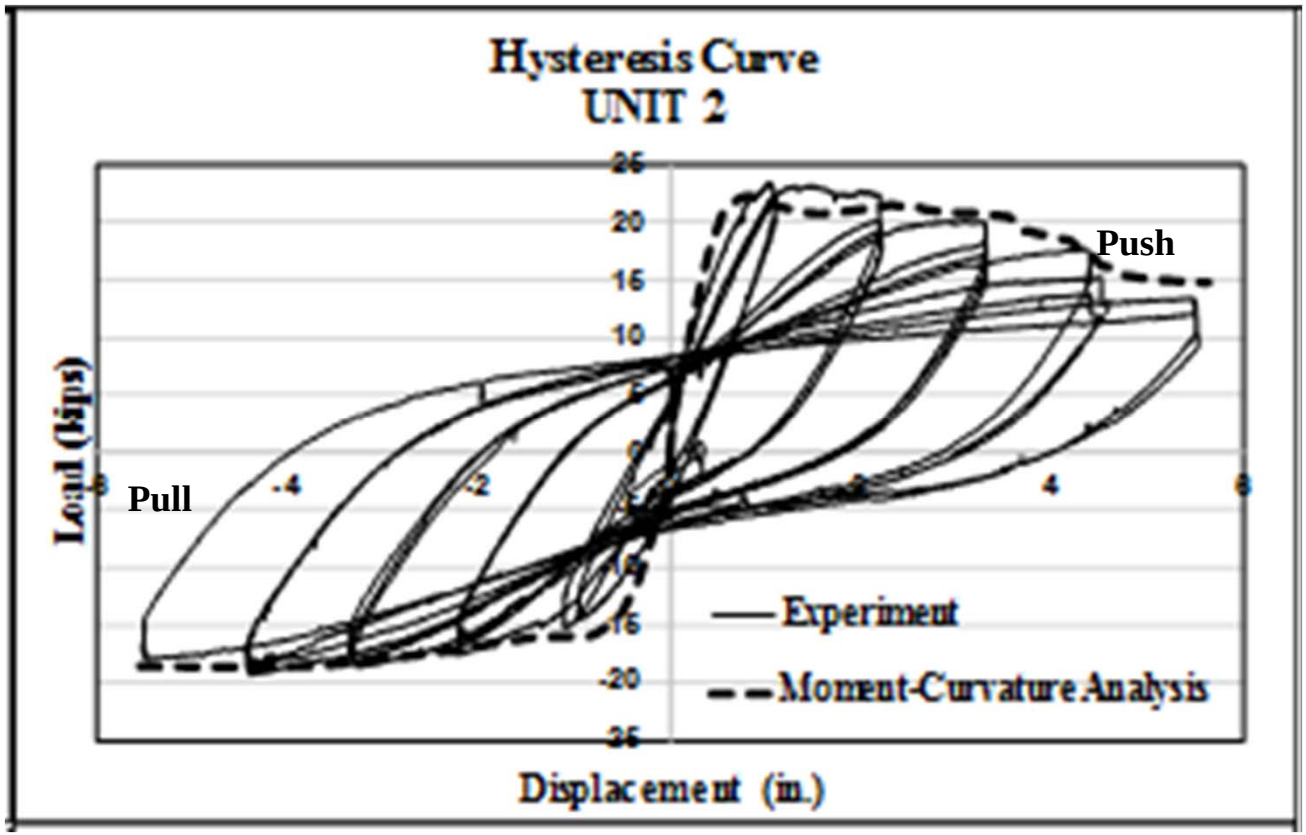
Test Results

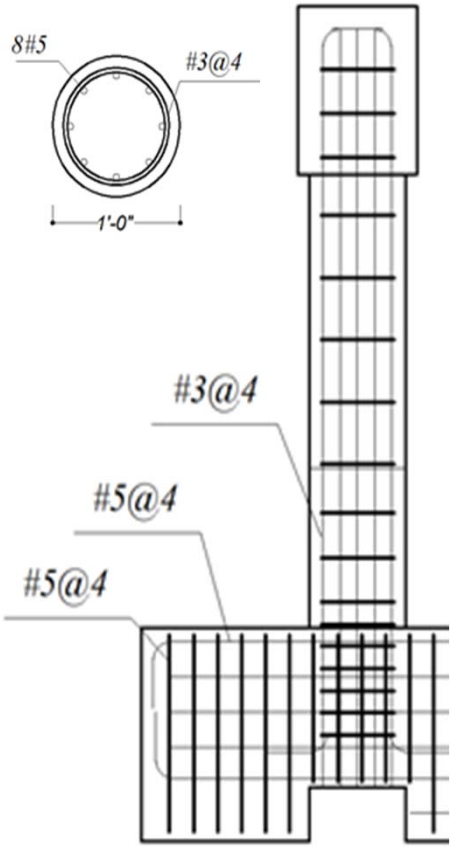


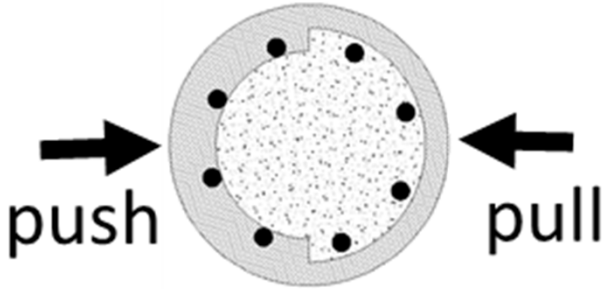




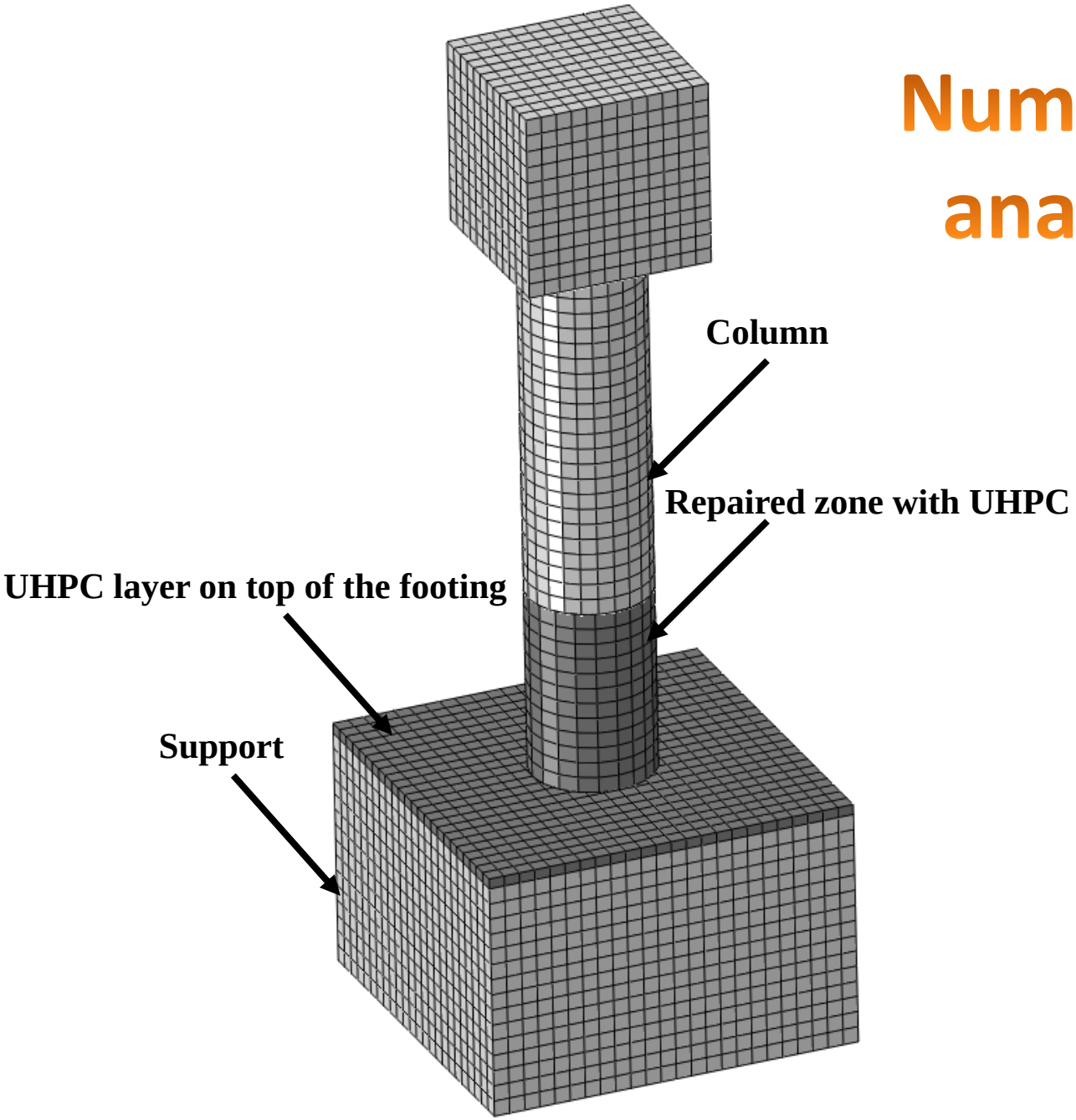
Test Results- With Stirrups

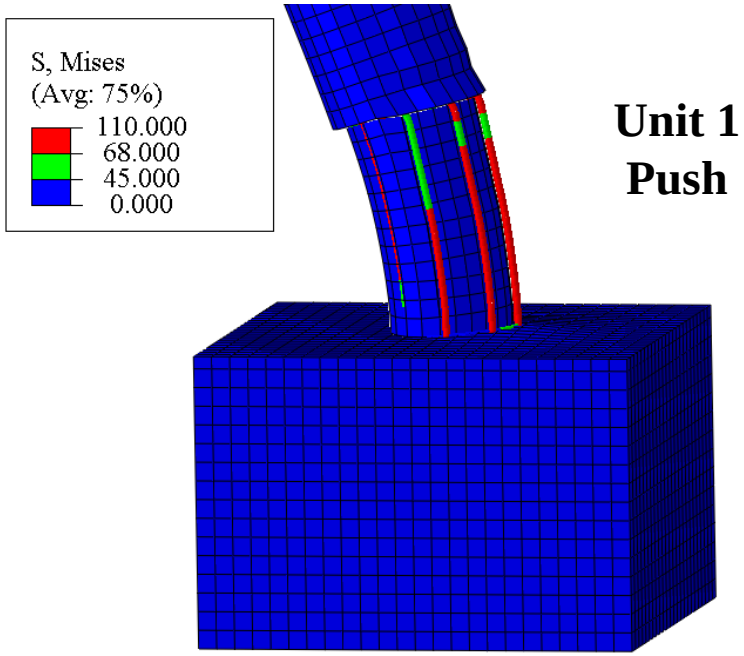




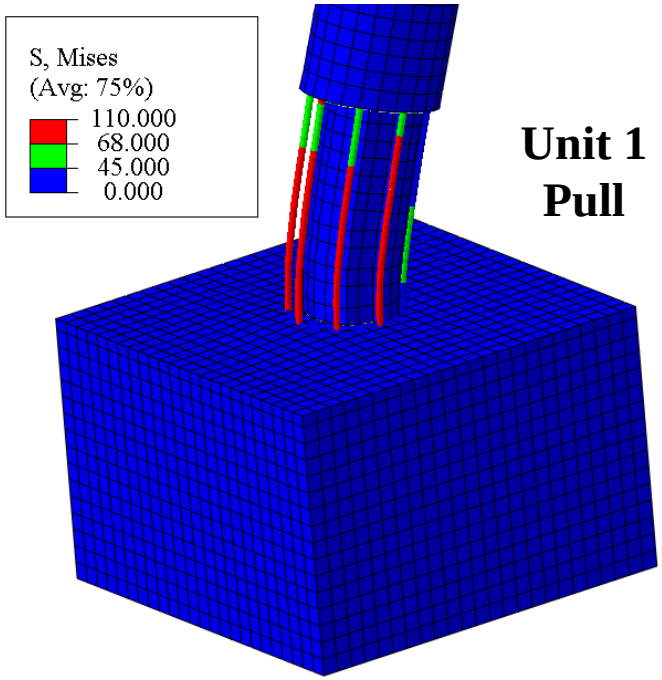


Numerical analysis

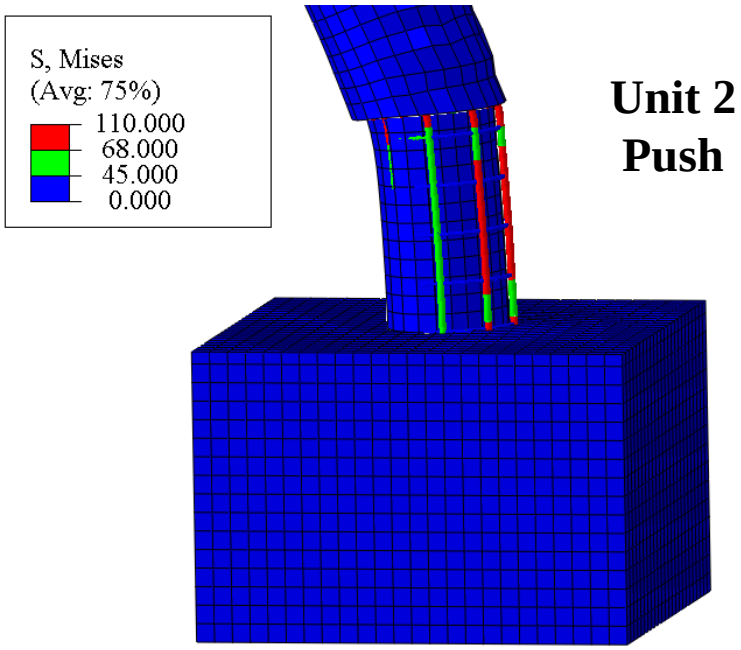




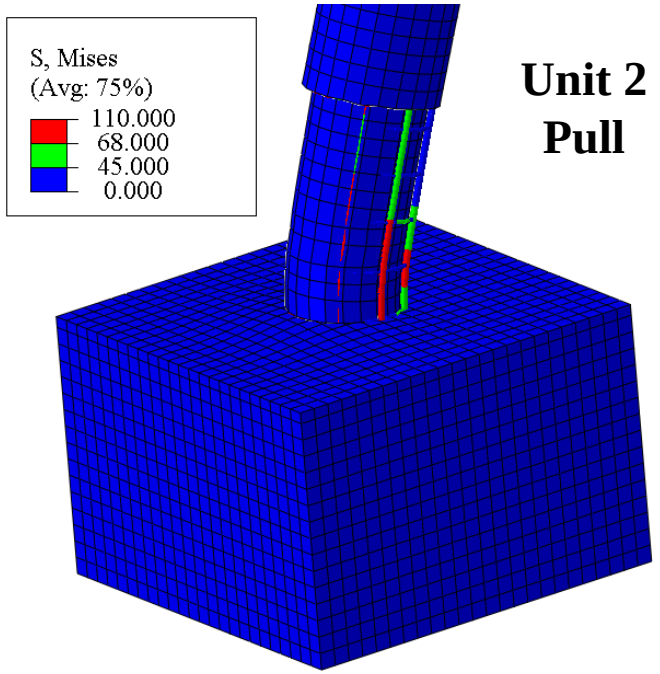
Unit 1 Push



Unit 1 Pull

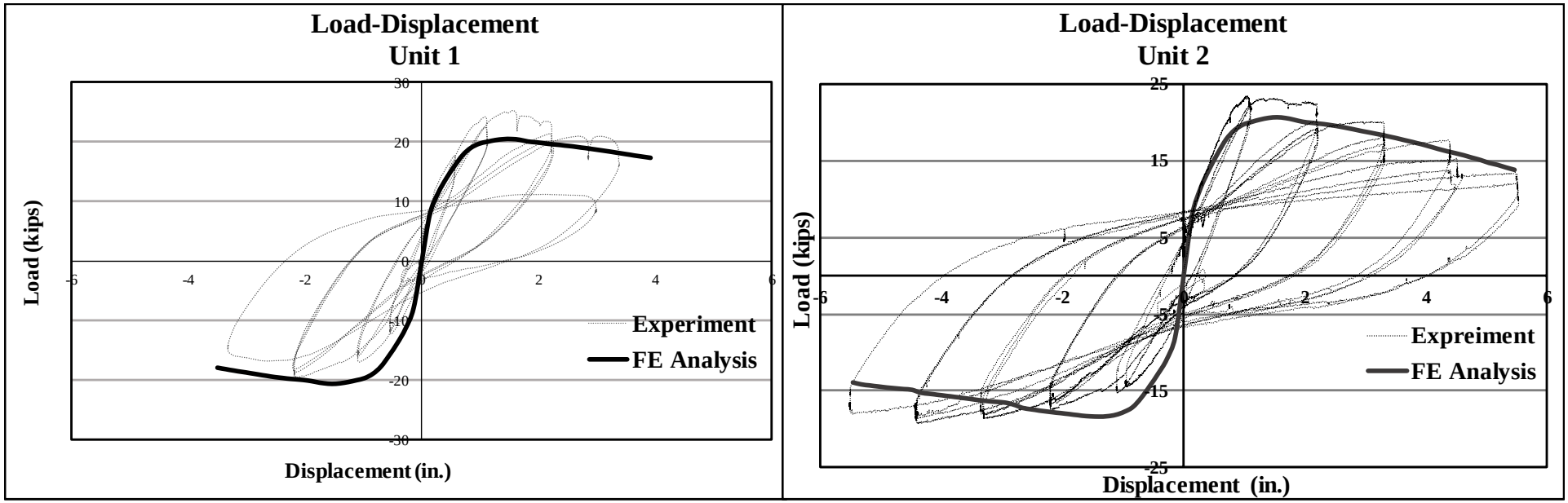


Unit 2 Push



Unit 2 Pull

Numerical analysis



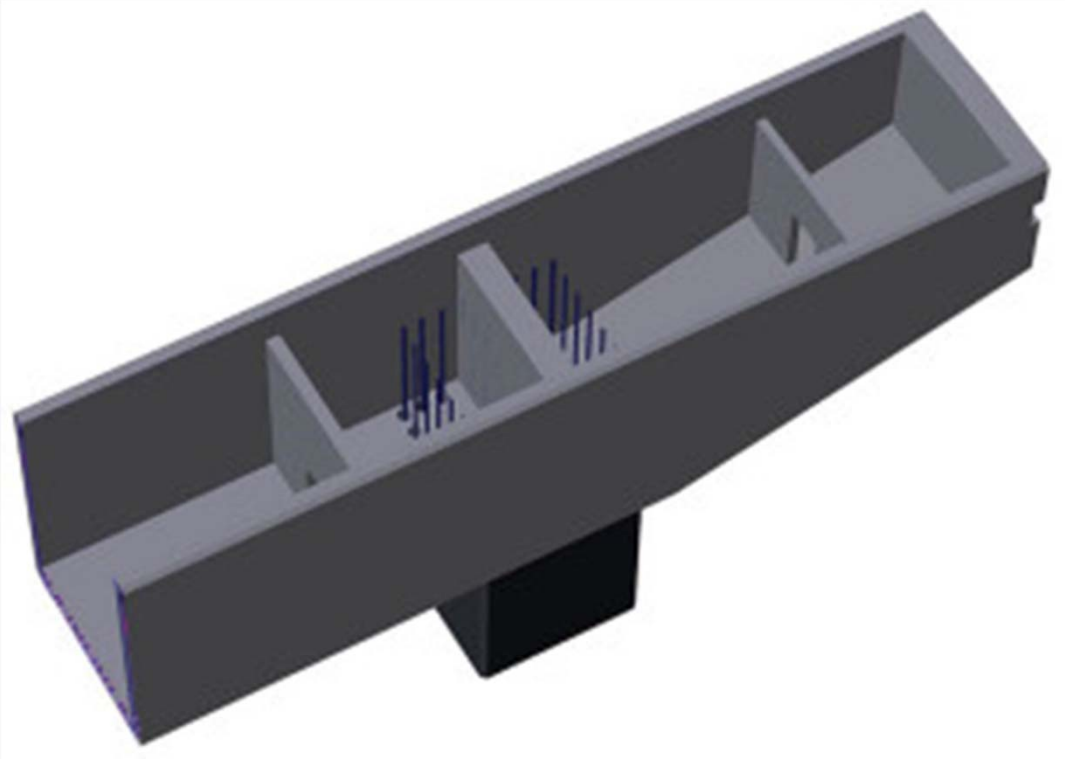
Failure away from interface of UHPC and NSC

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

Seismic Retrofit Application

UHPC Shell as Protective Formwork



FIU
FLORIDA INTERNATIONAL UNIVERSITY

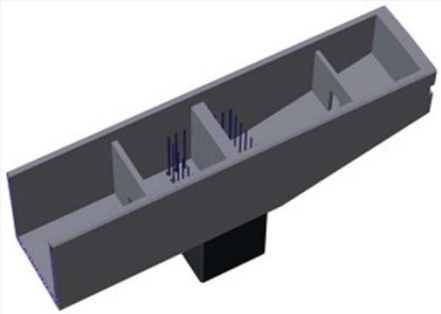
UHPC Shell as Protective Formwork


Photo courtesy of Coastal Precast Systems

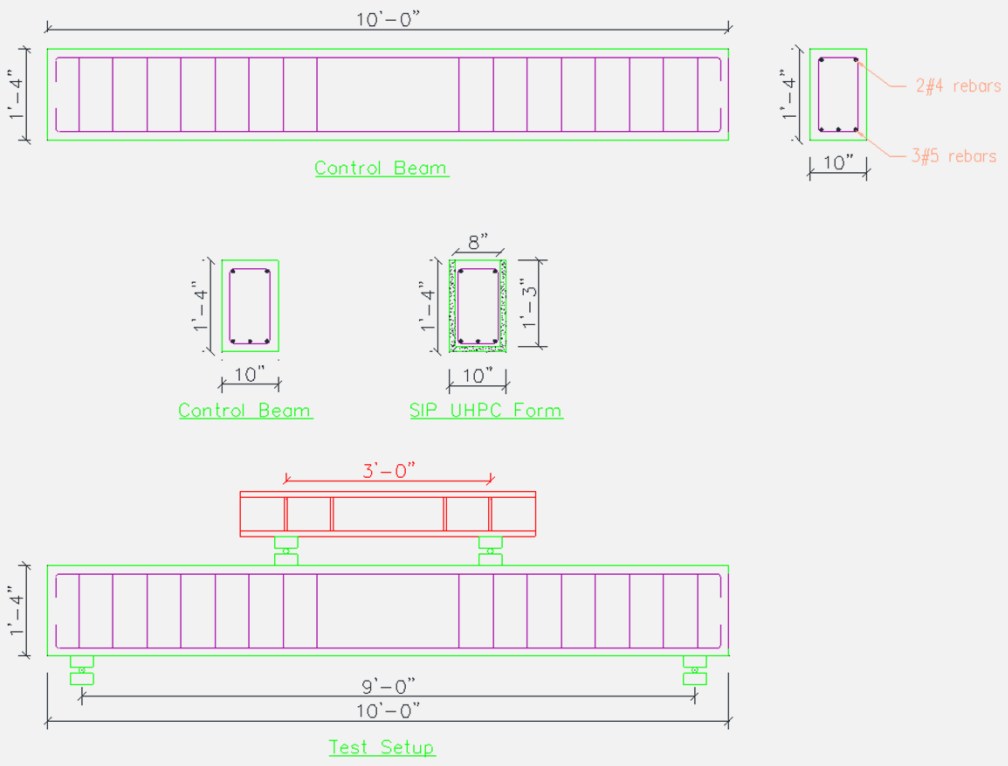
Advantages of UHPC Shell as Protective Formwork

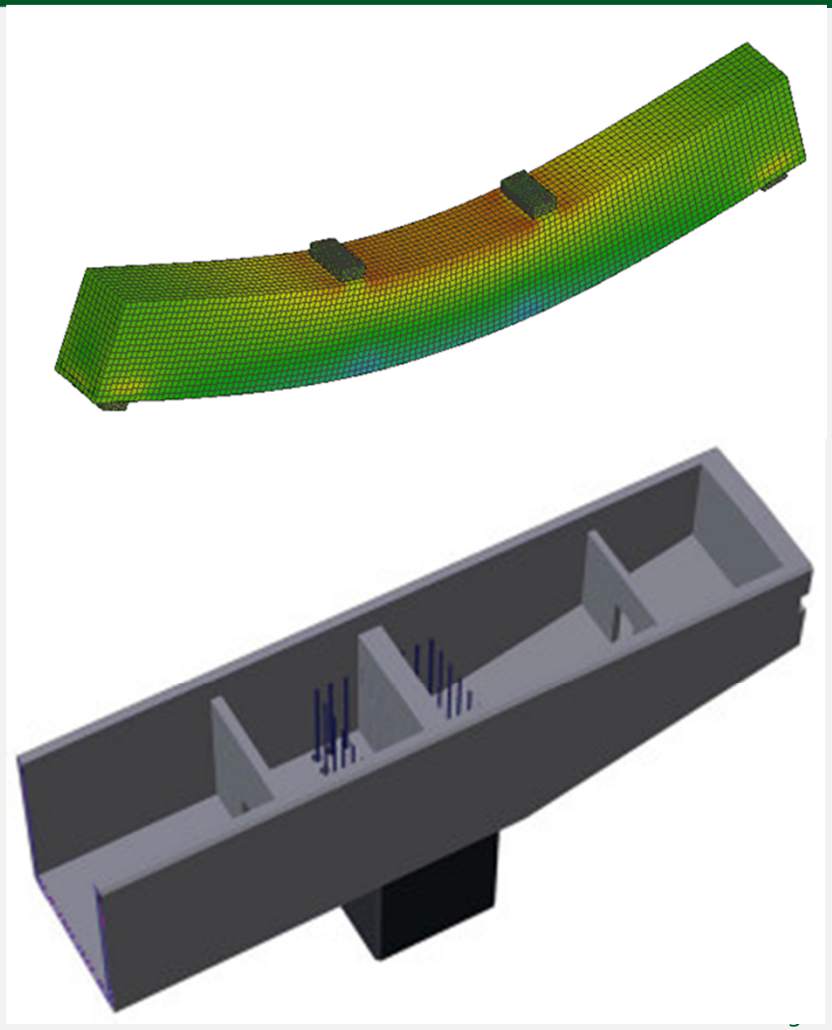
Minimize formwork/scaffolding costs
Provide a safe work space
Minimize pick weights
Accelerated construction
Increased quality of stay-in-place forms because of factory fabrication of shells

FIU
FLORIDA INTERNATIONAL UNIVERSITY



Ongoing work: UHPC Shell as Protective Formwork





We are inviting you to attend the 2017 National Accelerated Bridge Construction Conference as our guest

www.ABC-UTC.FIU.EDU