Seismic Design: How ABC Bridge Connections can help improve infrastructure resilience in CEUS

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Outline

- Bridges in CEUS using ABC
- Overview of ABC bridge connections
- Benefits of ABC connections
- Some alternatives of ABC connections
- Challenges of ABC connections in CEUS
- Conclusions

Successful ABC bridge Projects in CEUS

Route 202NB over B&M Railroad
Holyoke, MA

Route 1 Bridge over Route 236
Kittery, Maine

Mountain Road over Hartwell Brook
Charlemont, MA

Successful ABC bridge Projects in CEUS

The New Tappan Zee Bridge, NY

The I-95 Corridor Improvement Project

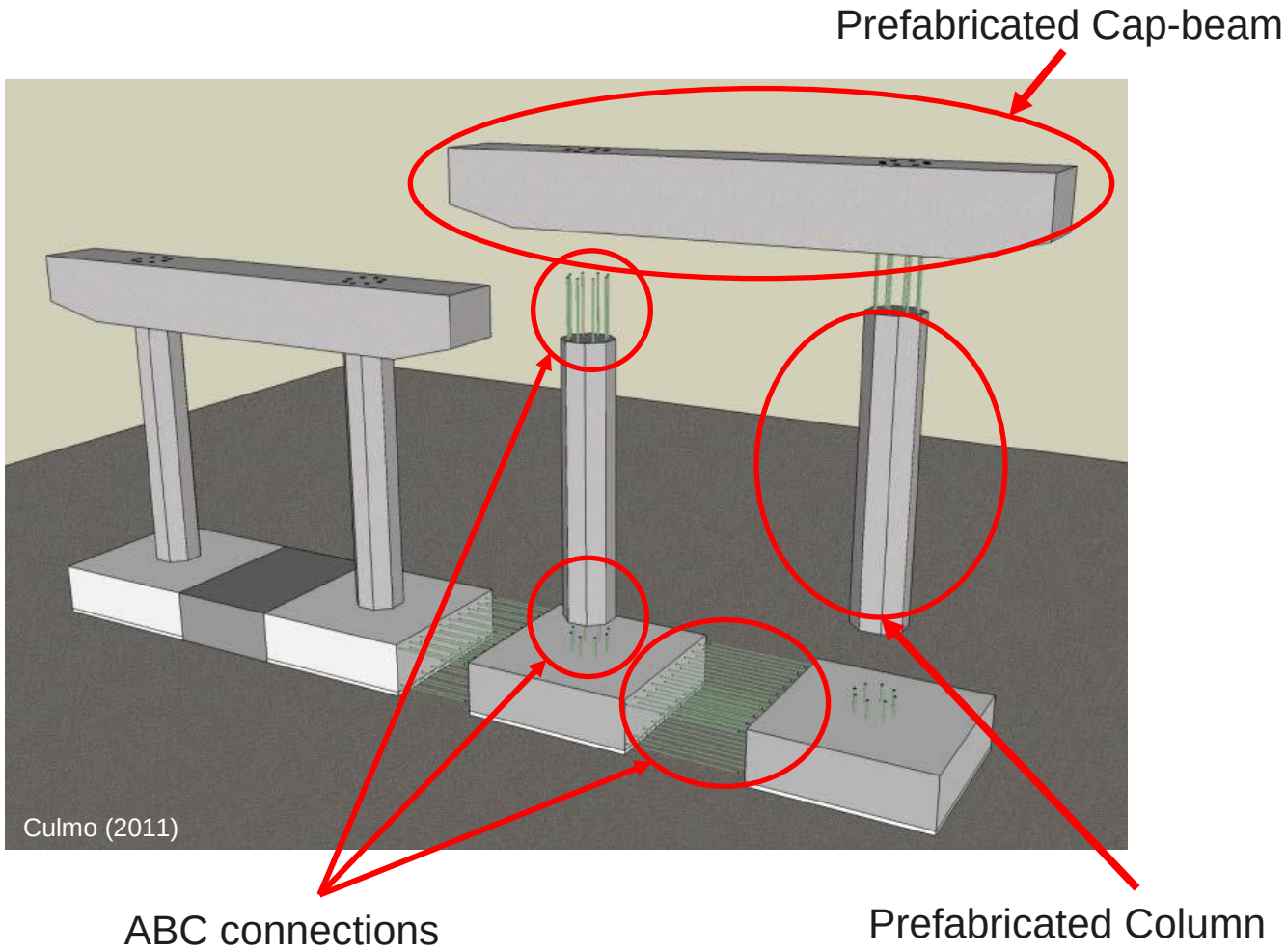
ABC Bridge Connections: An Overview

Source: Mohebbi et al. (2018)

Precast, prefabricated, and modular construction

- Reduces construction time
- Minimizes traffic disruption

ABC Bridge Connections: An Overview



- Precise
- Durable
- Provide continuity of strength across the joint (low to high seismic regions)

ABC Bridge Connections: An Overview

Source: Shoushtari *et al. (2019)*

These techniques have been a **research focus** in recent years, especially in critical structural components, such as connections between columns and foundations or cap beams, in moderate and high seismic zones.

Benefits of ABC Connections

Improved safety

- Reduce hazardous work processes
- Eliminates the risk of accidents
- Improves worker safety

Material quality and product durability

- Durability and longevity in mind

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Reduced time for construction

- Traffic impact

Cost-effective

- Less specialized construction equipment and
- Less on-site fabrication
- Minimizes the impact on the surrounding environment.

Benefits of ABC Connections

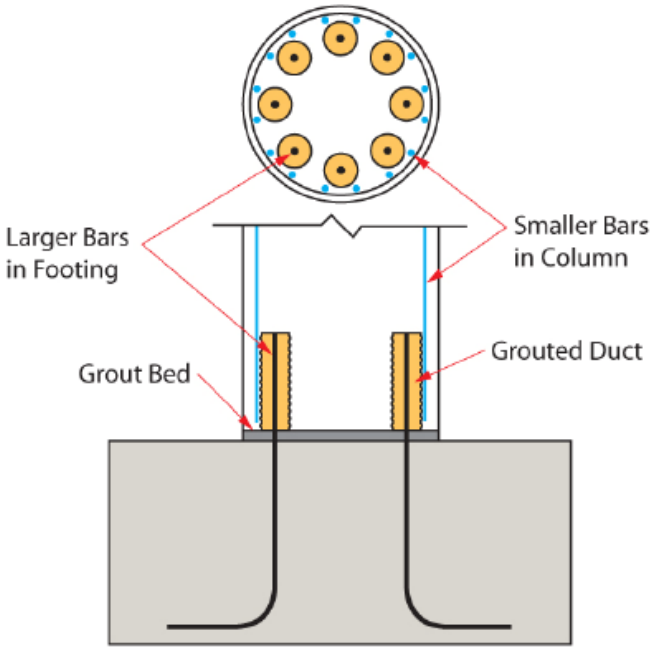
The site constructability

Reduce traffic impact

Material quality and product durability

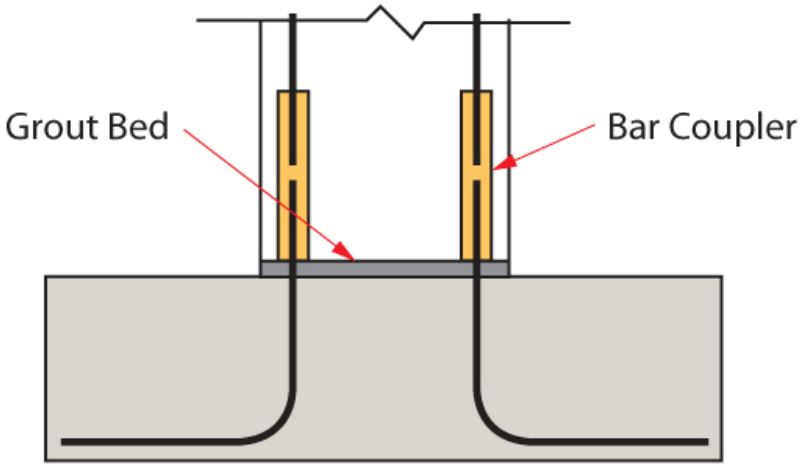
Some alternatives for ABC connections

Grouted connection



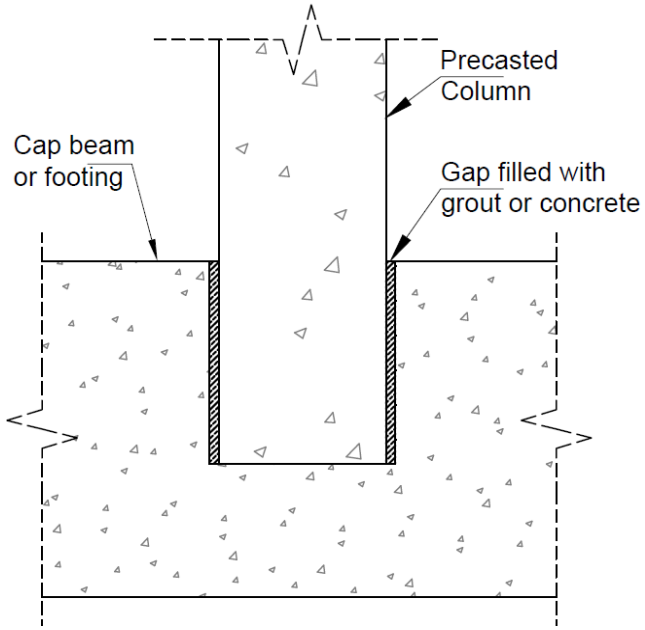
National Academies of Sciences, Engineering, and Medicine 2011

Bar coupler connection



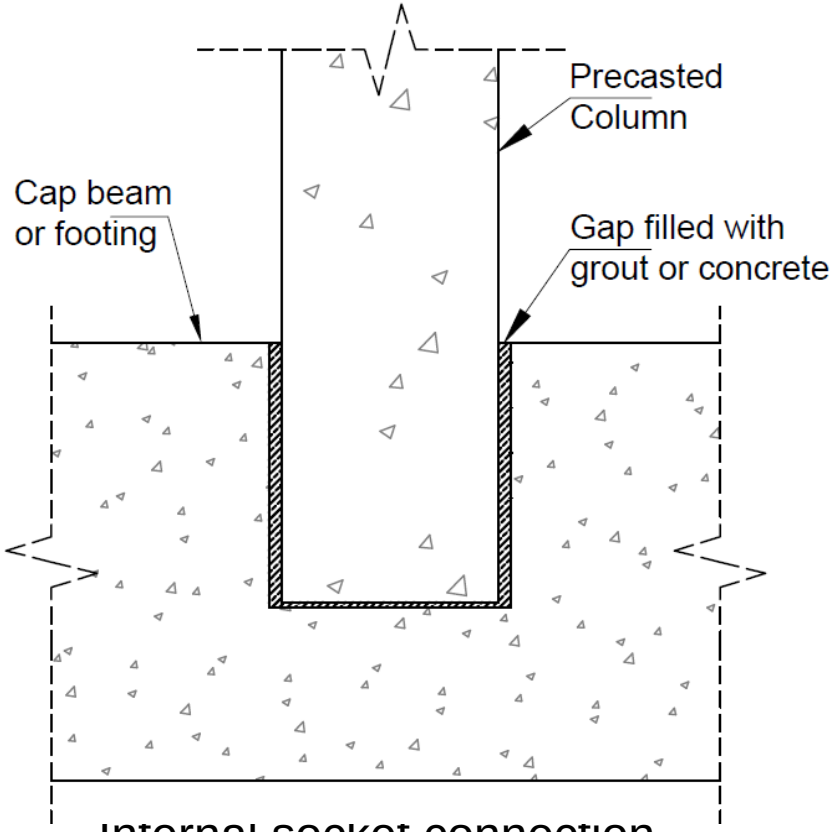
National Academies of Sciences, Engineering, and Medicine 2011

Pocket // socket connection

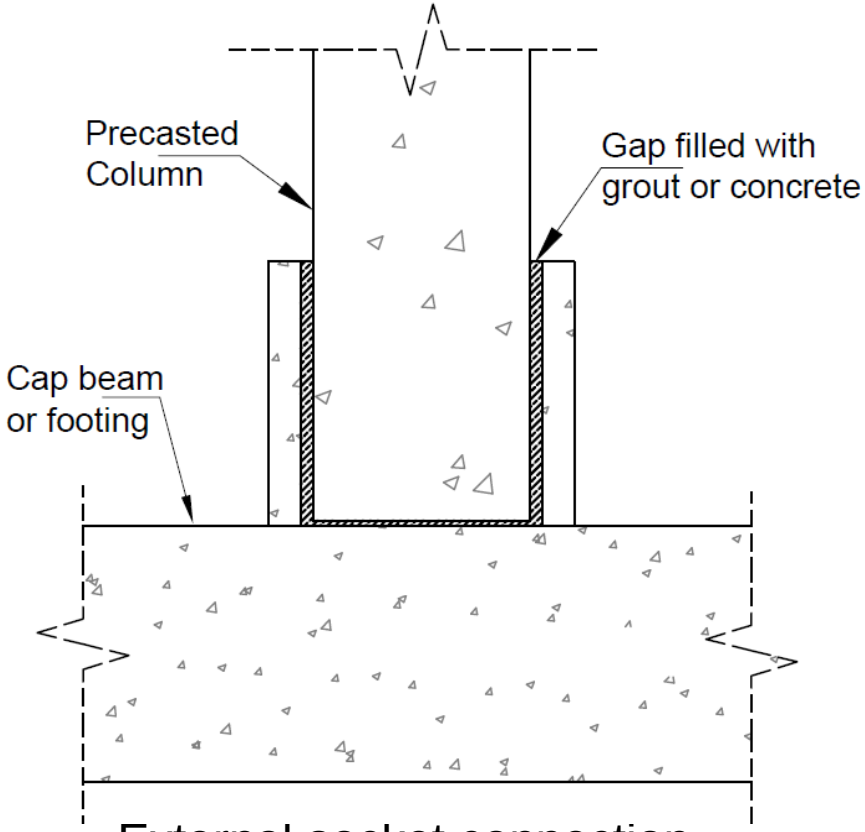


What is a Socket Connection?

The precast column is embedded inside the preformed socket.

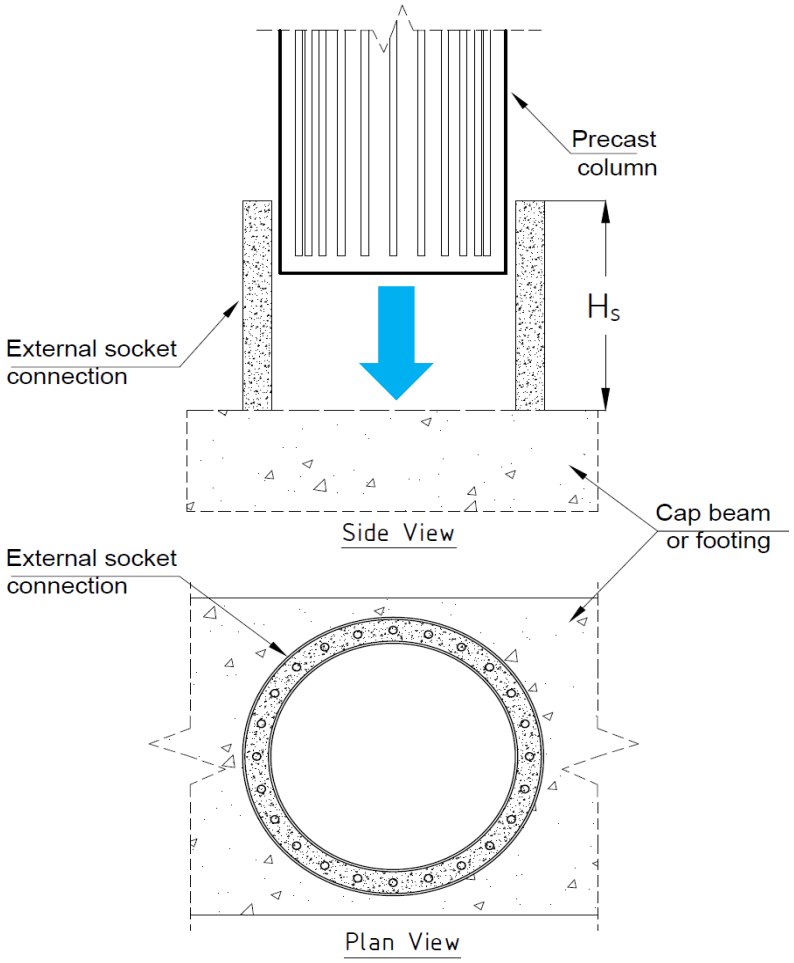


Internal socket connection

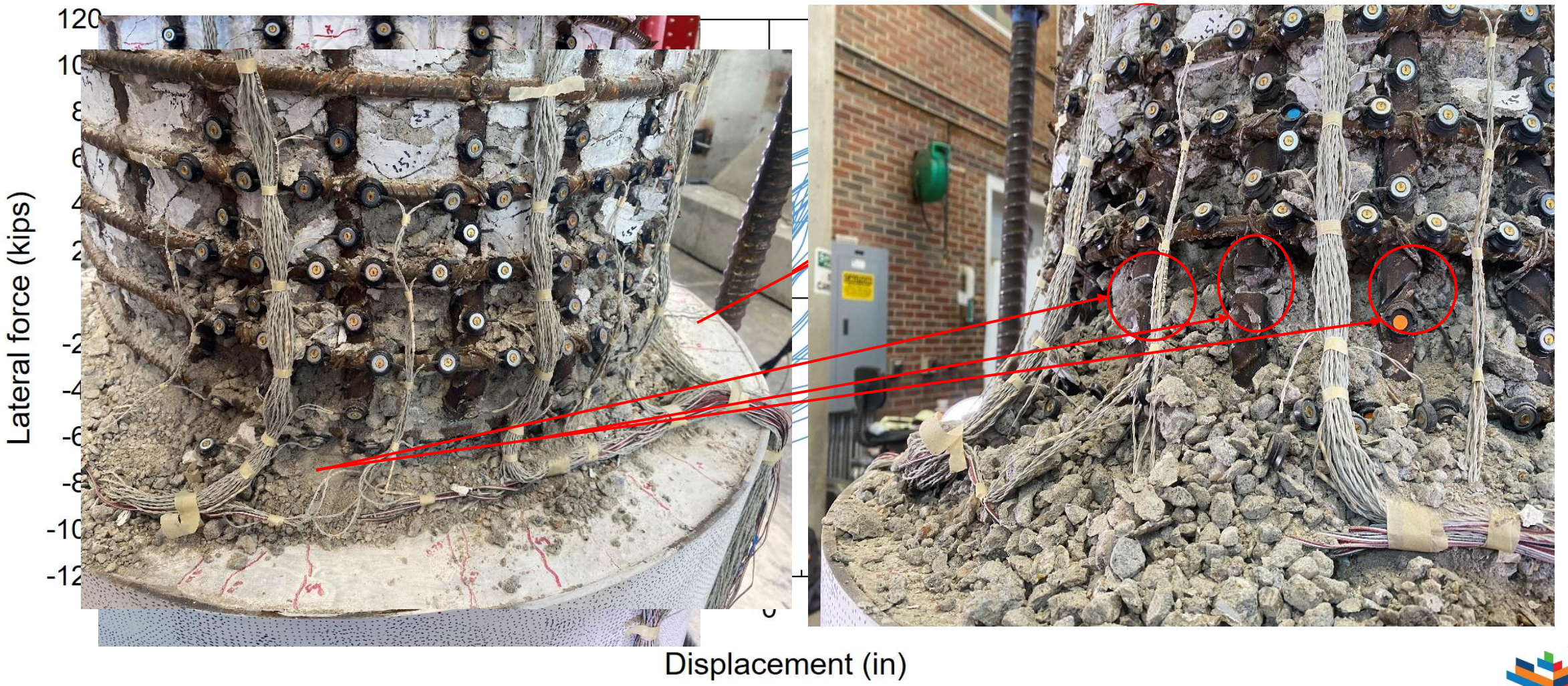


External socket connection

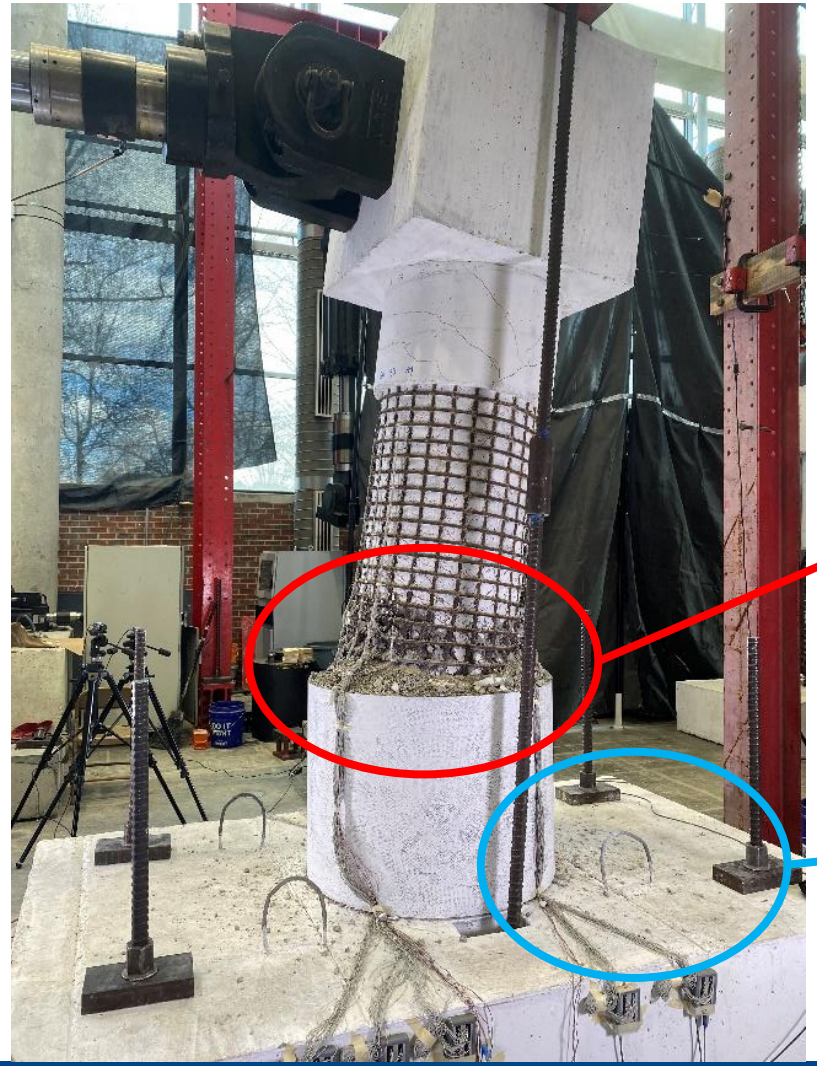
External Socket Connection



Force-displacement

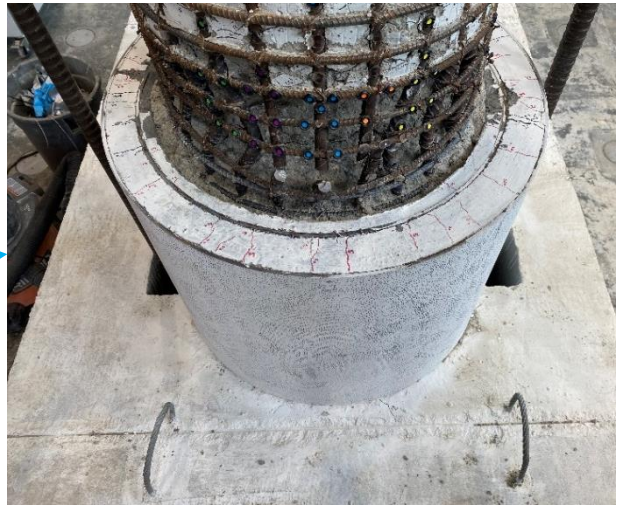


Plastic hinge location

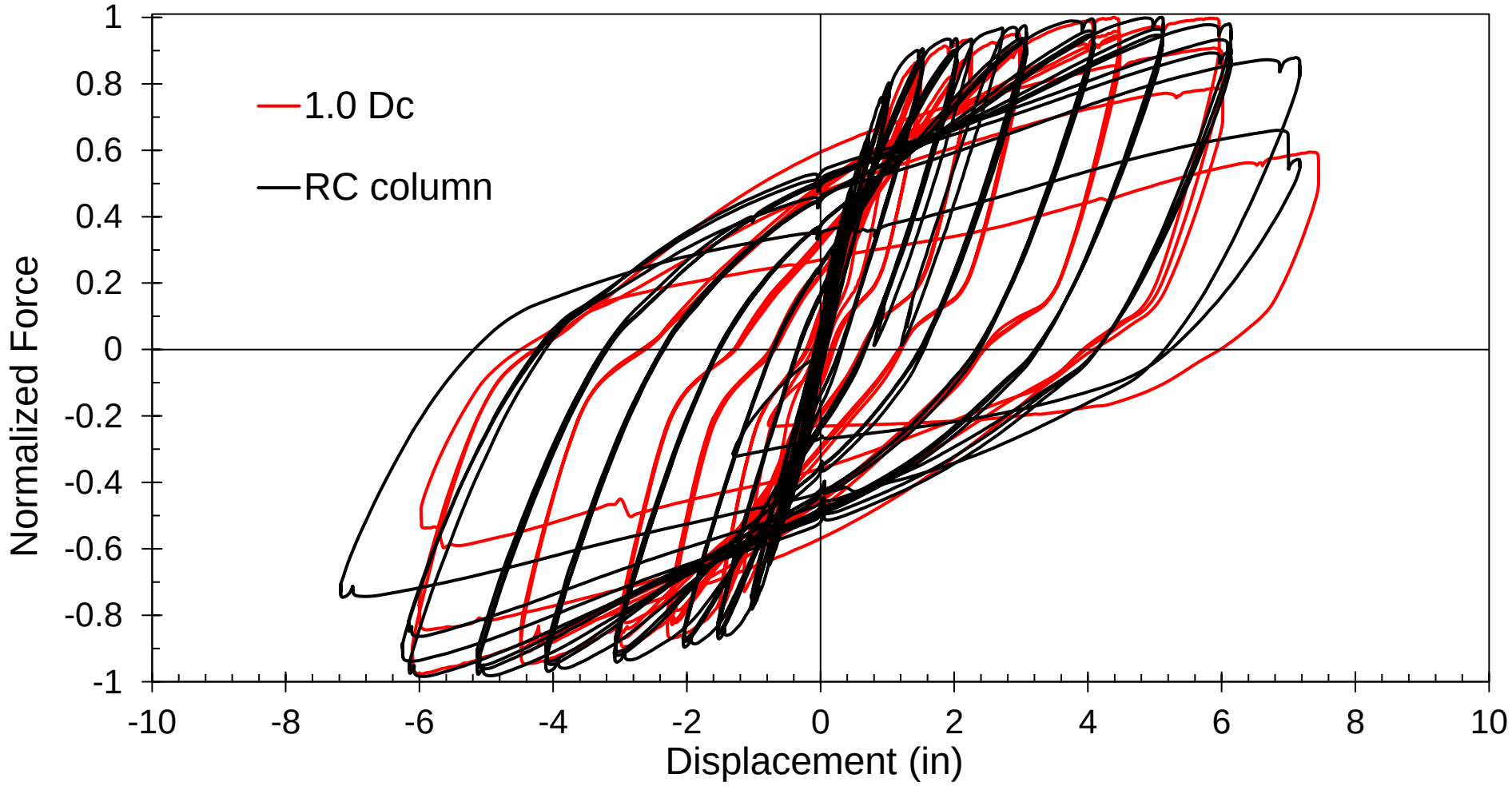


Plastic hinge develops on the columns

Foundation remains elastic



ABC connection compared with CIP column



Challenges and Limitations of ABC Connections in CEUS

Maintaining Quality

- High-quality materials
- Expert fabrication
- Tight tolerances
- Quality control

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Connectivity Issues

- Withstand seismic events (low to high seismic regions)
- Provide adequate stiffness to maintain bridge superstructure continuity.

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Adapting to Environmental Conditions

- i.e., Temperature changes

Conclusions

The Benefits Outweigh the Challenges

The potential benefits of ABC Bridge Connections for infrastructural resilience far outweigh the challenges associated with their implementation.

Training and Education are Key

Investment in **skills training** and **education** for workers and engineers will be a critical component in scaling the use of ABC techniques across CEUS and beyond.

Any questions?