Research Updates

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Texas Department of Transportation

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Develop and Validate Precast Column Solutions for Texas Bridges

(Project 0-7089)

September 2020 – July 2024

Precast Column History

a) Limited by lifting due to heavy self-weight. Grouted connection in the top and bottom of the column.

b) Efficient for tall bridges. Column segments are spliced together by vertical reinforcement.

c) Shell is lighter and serves as permanent formwork for inside pour. Grouted connection in the top and bottom of the column.

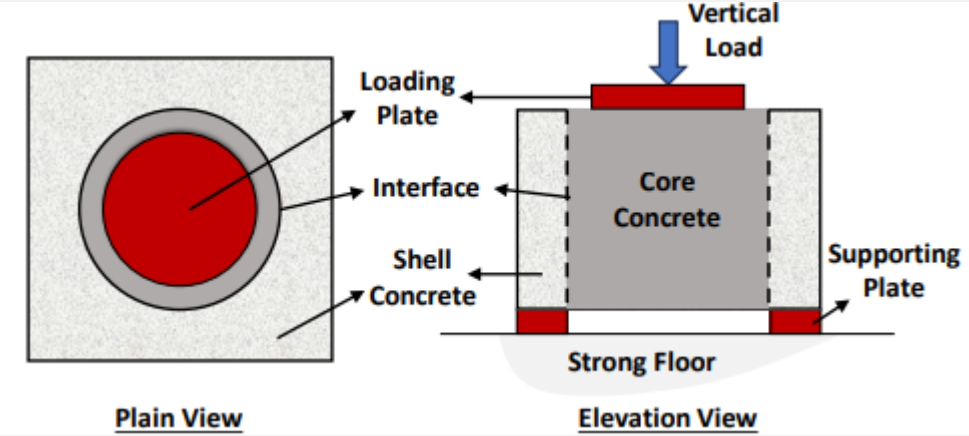
(a) Full-height precast column

(b) Precast segmental column

(c) Precast column shell

Shear Interface Behavior

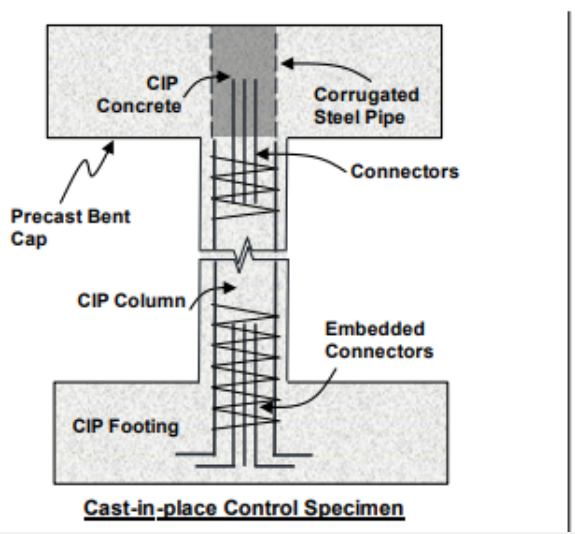
What are the factors affecting interface shear strength between precast and cast-in-place concrete?

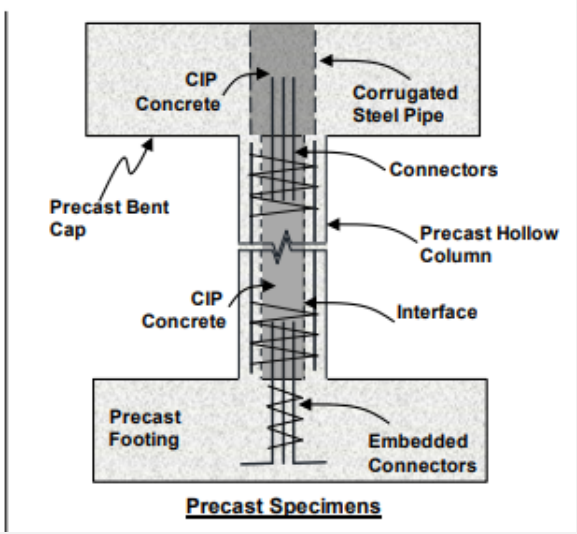


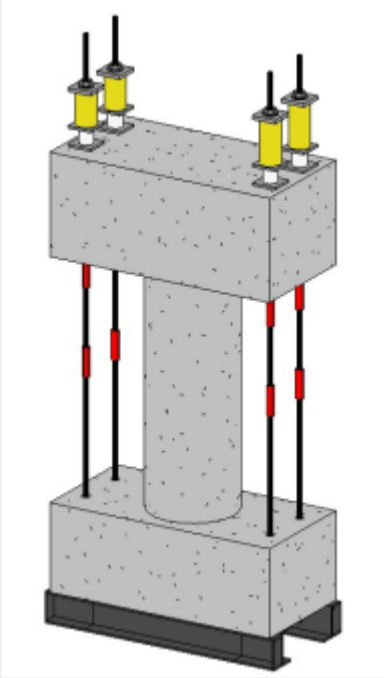
Shear Interface Behavior

- Circular interfaces exhibit a higher strength over square interface
- Different strengths between the precast shell and core has no detrimental impact
- Modest roughening through sandblasting increased interface strength by 19.4% on average for circular interfaces

Full Scale Tests







Full Scale Tests

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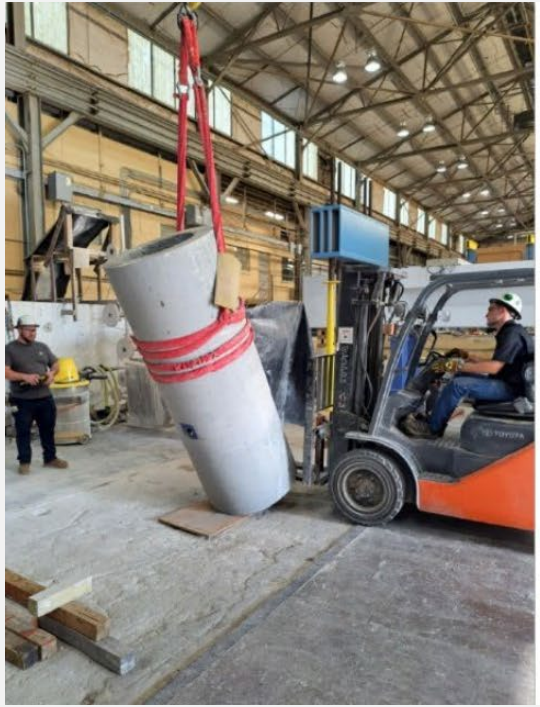

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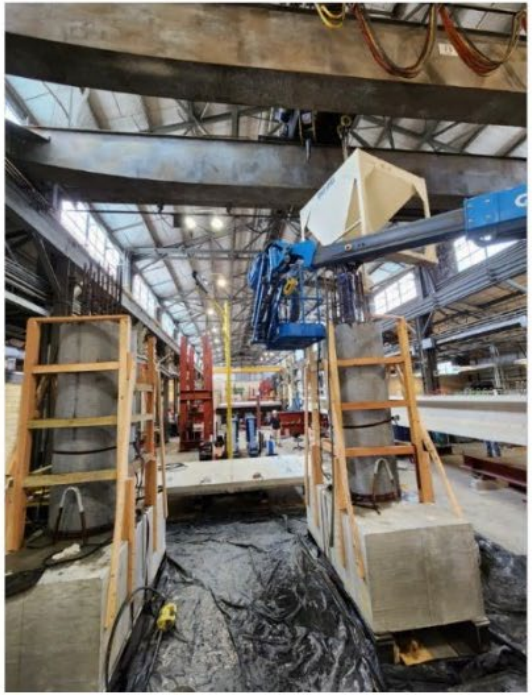
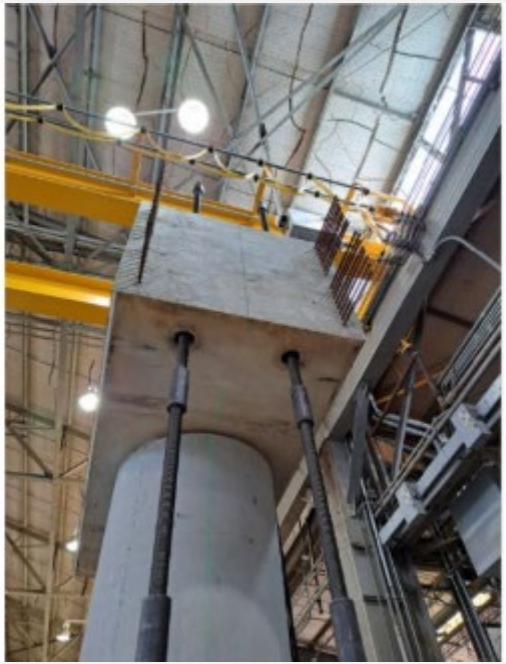


Full Scale Tests


Full Scale Tests

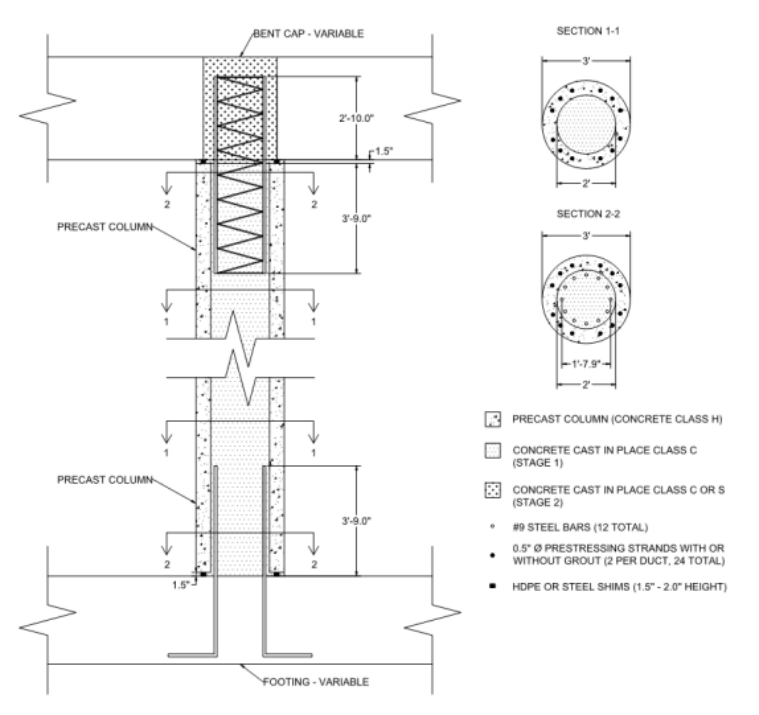
- Under low eccentricity loading (6 in & 12 in), the precast columns exhibited elastic behavior, indicating good performance.
- Internal roughness of the precast columns had minimal impact on final resistance.
- Precast columns showed less cracking than the control specimen.
- Embedment length of connecting bars significantly influenced the capacity of the precast columns

Precast Column Summary

Researchers provided:

- Design assumptions
- Suggested specifications
- Example details

Next steps are project implementation and performance tracking



April 17, 2025

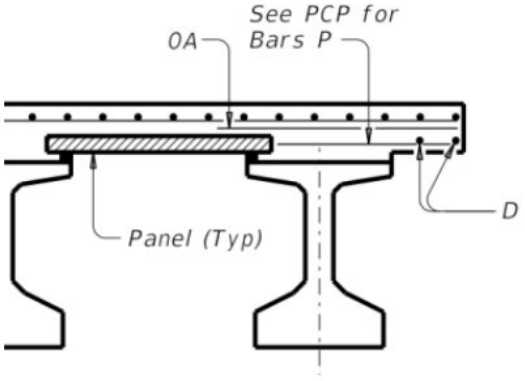
Development of NextGen Texas Bridge Decks

(Project 0-7041)

September 2020 – May 2024

Traditional Bridge Deck Construction

- Precast panels have become the go-to when building decks due to quick and effective construction
- One weakness of the current system is overhangs, which relies on formwork



(a) Typical detailing (TxDOT standard)

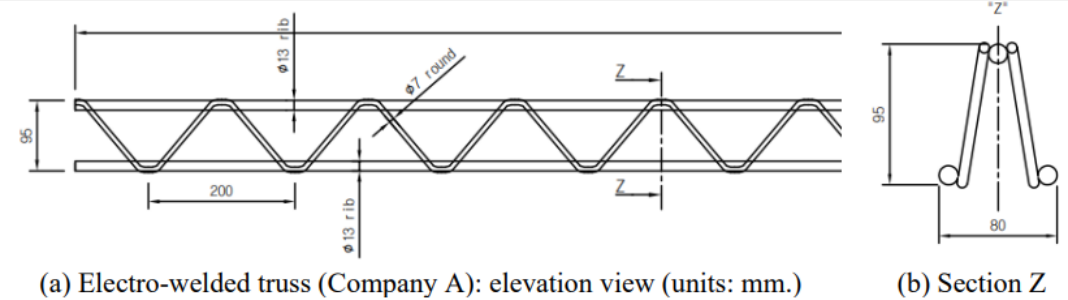
(b) Brackets and supporting formwork (Clifton and Bayrak, 2008)

No Need to Reinvent the Wheel

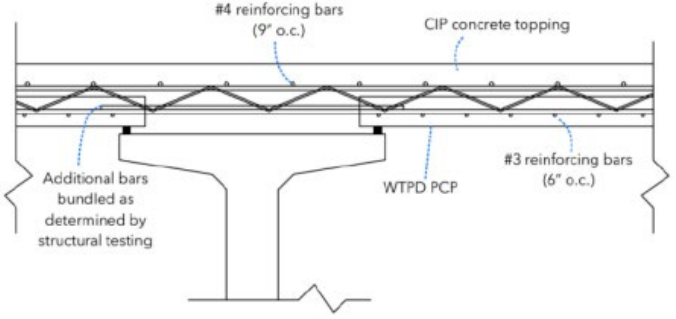
- Spain uses a full-width precast partial-depth panels connected by lattice girders
- These full-width panels eliminate the need for forming overhangs and reduces the amount of reinforcement placed by hand

NextGen Precast Panels

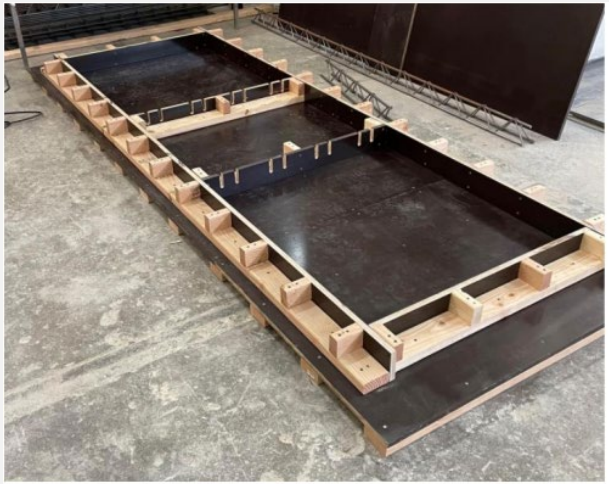
Wire trussed partial depth precast concrete panels (WTPD PCPs) are fabricated to have two panels, with one panel as a deck overhang and one as interior deck support



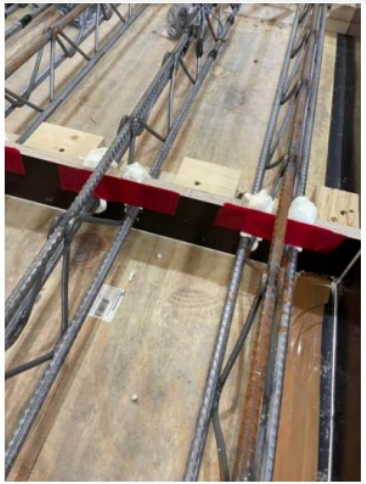
(a) Electro-welded truss (Company A): elevation view (units: mm.) (b) Section Z



Fabrication of Panels



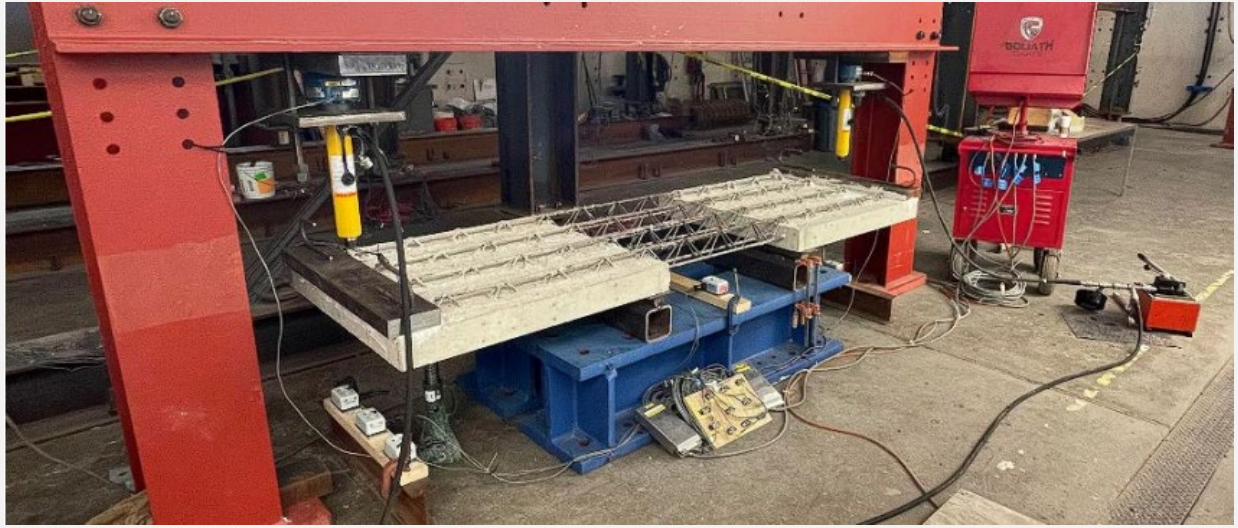
(a) lateral walls and partitions

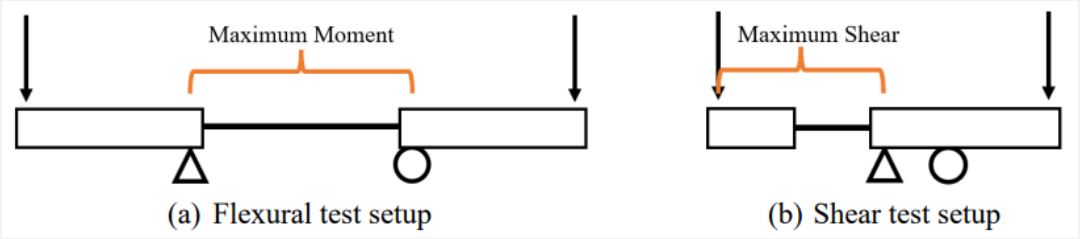


(b) Expanding foam and tape

(a) Specimen I-E-U30

Single Panel Tests





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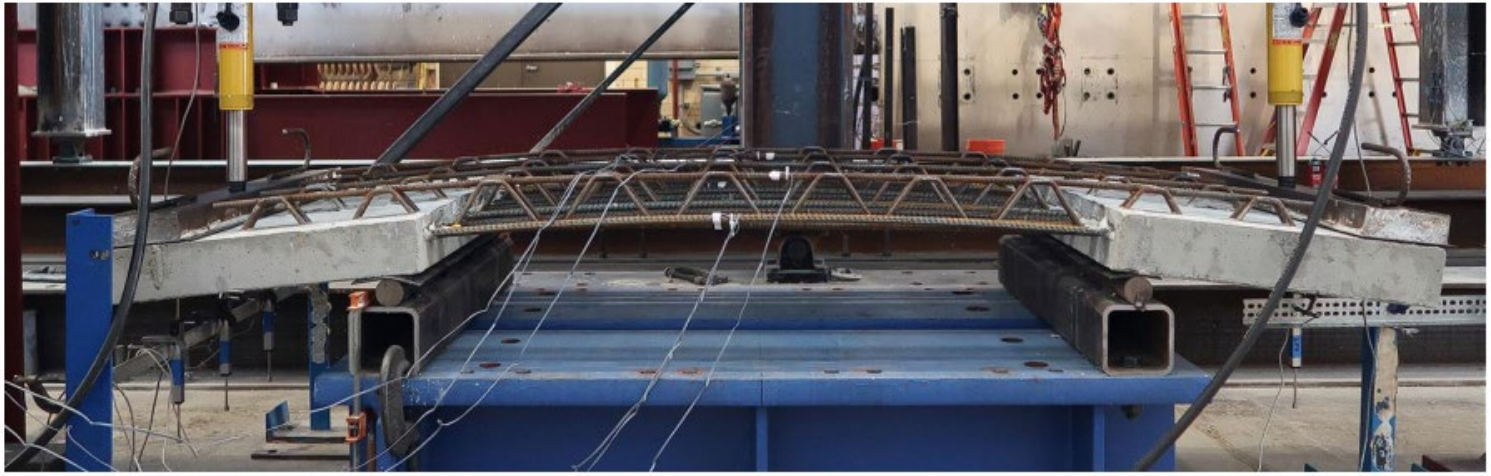
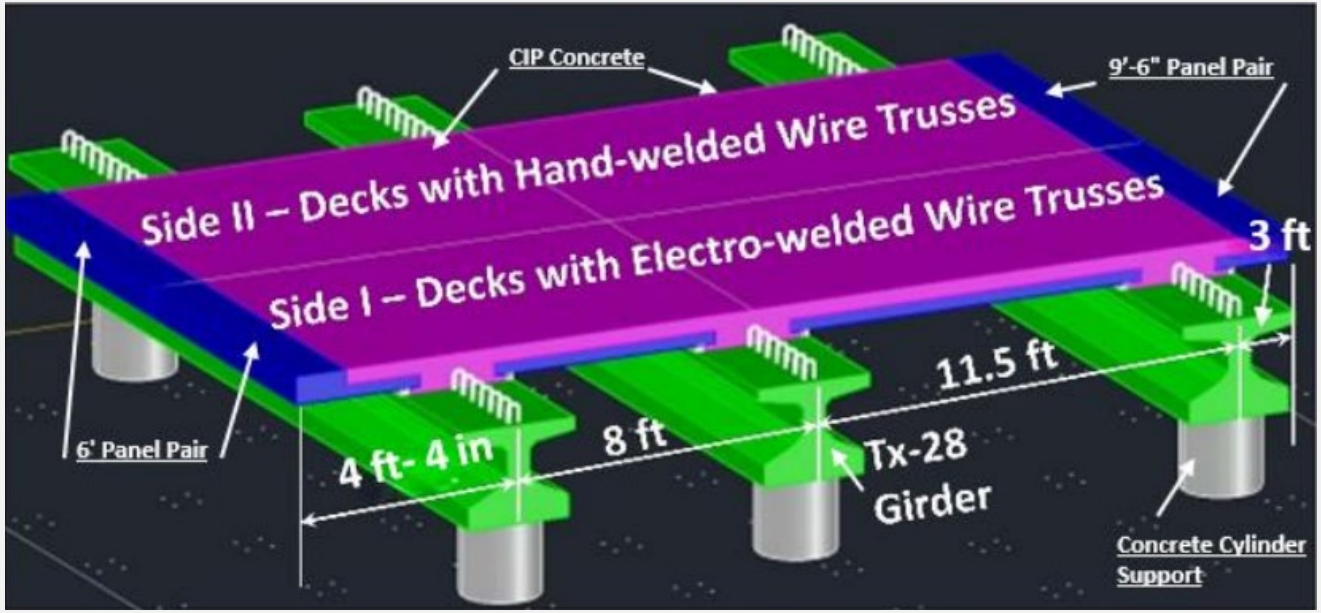


Full Scale Tests



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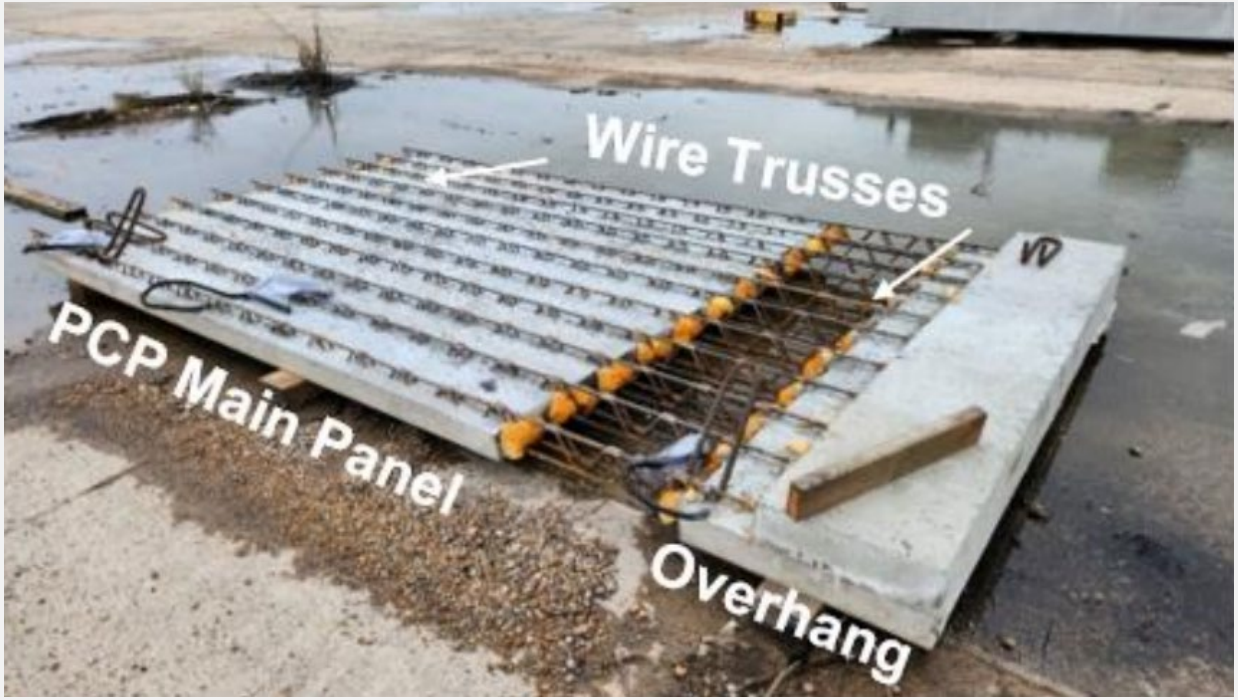

Full Scale Tests

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Full Scale Tests

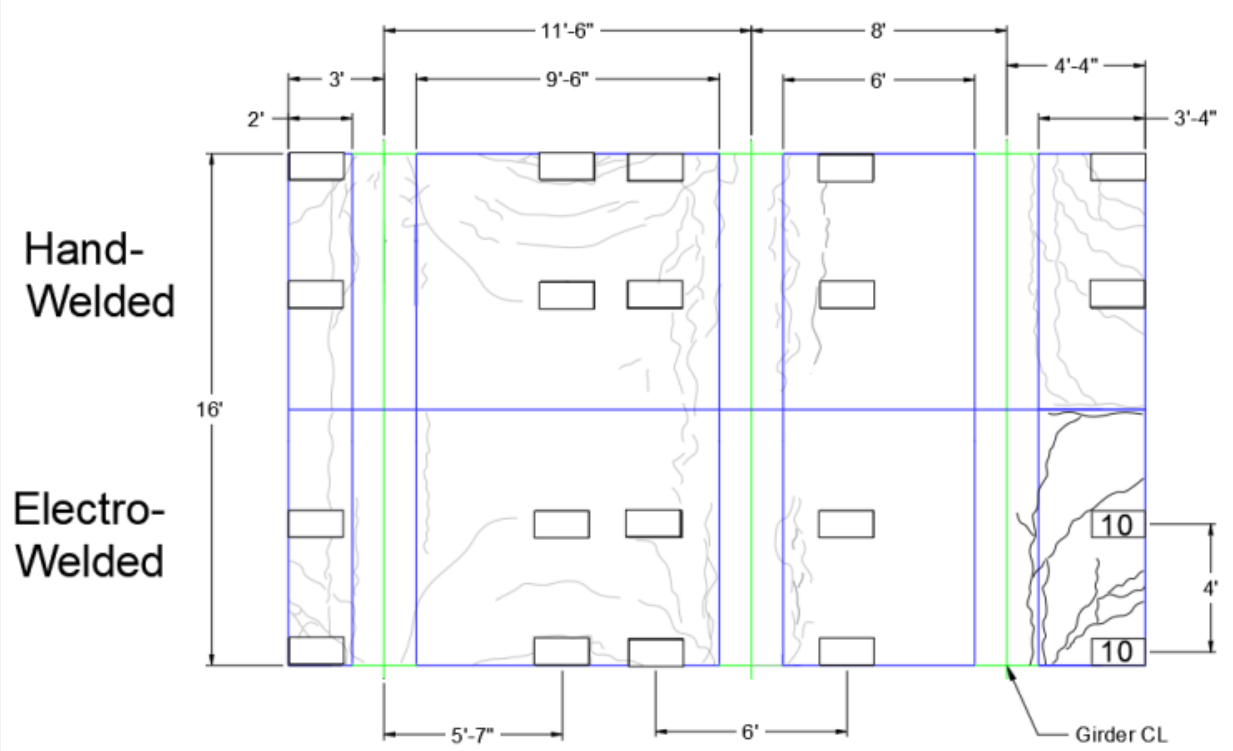
(a) Punching shear failure from side

(b) Punching shear failure from bottom

(c) Punching shear failure from top

(d) Bottom close up

Crack Map of Full Scale Test



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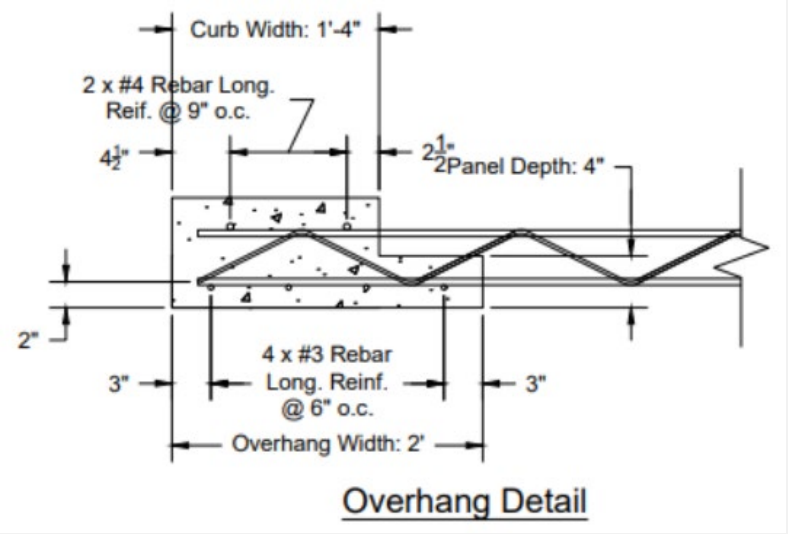

Thank You

For further questions, please reach out to Sara Watts:

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