Texas Bridge and Structures Research

Texas Department of Transportation

June 18, 2025

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TxDOT Research Overview

Budget ~ $8 million per year new projects

($30 million for all projects)

Number of new projects ~ 30 to 40

Functional Areas:

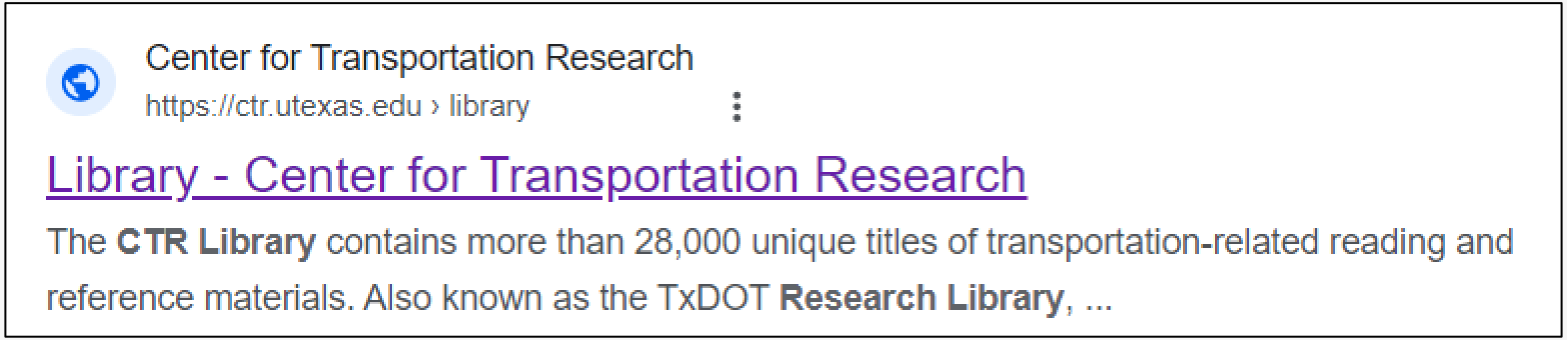
- Construction, Maintenance, and Materials
- Structures and Hydraulics
- Safety and Operations
- Planning and Environmental
- Strategy and Innovation

All reports and projects can be found at

https://library.ctr.utexas.edu/Presto/home/home.aspx

CTR Research Library

- https://ctr.utexas.edu/library/



TxDOT Research Overview

- Recently Completed Research

Functional Area	2019	2020	2021	2022	2023	2024	2025	Total
Construction, Maintenance and Materials	14	7	14	13	13	16	1	**78**
Planning and Environmental	8	5	8	7	6	9	2	**45**
Safety and Operations	11	8	9	18	14	11		**71**
Strategy and Innovation	1	2	2	4	9	5	1	**24**
Structures and Hydraulics	6	8	7	6	11	14	1	**53**
Total:	**40**	**30**	**40**	**48**	**53**	**55**	**5**	**271**

TxDOT Research Overview

- On Going Research

Functional Area	2025	2026	2027	2028	TOTAL
Construction, Maintenance and Materials	8	14	13	2	**37**
Planning and Environmental	8	4	1		**13**
Safety and Operations	6	8	3		**17**
Strategy and Innovation	3	6	1		**10**
Structures and Hydraulics	5	9	6		**20**
Total:	**30**	**41**	**24**	**2**	**97**

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STRUCTURES & HYDRAULICS

Recently Completed 2024 & 2025

Project Number	Project Name
0-6872-01	Use of Geothermal Energy for De-icing Approach Pavement Slabs and Bridge Decks, Phase II
0-6958	Developing Performance Specification for High Performance Concrete
0-7041	**Develop NextGen Texas Bridge Decks**
0-7088	Develop Closure Joint Materials Specification and Evaluate Performance for Side-By-Side Accelerated Bridge Construction (ABC) Superstructure Systems
0-7089	**Develop and Validate Precast Column Solutions for Texas Bridges**
0-7090	Evaluate the Deployment of High Strength Reinforcing Steel in Texas
0-7093	**Develop Refined Design Methods for Lean-On Bracing**

Recently Completed 2024 & 2025

Project Number	Project Name
0-7112	Development of a Continuous for Live Load Prefabricated Steel Accelerated Bridge Construction (ABC) Unit for Texas Bridges
0-7114	Re-Examine Minimum Reinforcement Requirements for Shear Design
0-7116	Develop Deck and Overhang Design Guidelines for Sound Walls and Other Heavy Loads
0-7158	Calibration of Bridge Performance Models Using Element Data
0-7161	Settlement Criteria and Design Approach for Embankments and Retaining Walls Built on Compressible Soils
0-7167	Evaluate Performance of Sealers and Coatings Applied to TxDOT Bridge Substructures
0-7201	Synthesis of Hydrologic Approaches to Playa Lakes, Areas of Significant Karst Geology, and Arid Regions

Ongoing - 2025

Project Number	Project Name
0-7113	Determine Service and Ultimate Behavior for Bent to Column Joints in TxDOT Substructures
0-7115	Investigate Live Load Distribution and Stability of Prestressed Concrete Girders During Construction
0-7117	Investigate the Strength of Struts Crossing Cold Joints
0-7154	Evaluate Use of 300ksi Strands for TxDOT Prestressed Girders
0-7237	Synthesis: Develop Design Guidelines for Applications of Light Weight Aggregate in Embankments and Mechanically Stabilized Earth (MSE) Walls -- Evaluate Cost Benefit & Performance

Ongoing -2026

Project Number	Project Name
0-7155	Develop/Refine Design Provisions for Headed and Hooked Reinforcement
0-7170	Evaluate Bridge Deck Condition and Replacement Methods
0-7172	Developing a Performance-Based Concrete Overlay Mix Design for Improved Resistance to Early-Age Cracking and Increased Durability
0-7179	Evaluate Safety End Treatments for Roadside Drainage Structures
0-7192	Develop Performance of Baseplate Connections in COSS and Traffic Signal Structures
0-7193	Develop Assessment and Mitigation Guidance for Ancillary Highway Structures with Existing Cracks
0-7203	Evaluate the Effectiveness of Dowels for Lateral Restraint of Prestressed Concrete Beams
0-7234	Address Knowledge Gaps in Scour Analyses for Cohesive and Other Challenging Channel Materials
0-7236	Develop Standardized LRFD Design Methods for Ancillary Highway Structures

Ongoing -2027

Project Number	Project Name
0-7095-01	Flood Assessment System for TxDOT (FAST)
0-7207	Determine Feasibility and Efficacy of Hollow Precast Straddle Bents (2027)
0-7213	Develop Design Methodologies and Efficient Details for Triple I-Girder Steel Straddle Caps (2027)
0-7214	Develop Concrete Girder Splice Details with Application of Ultra-High-Performance Fiber-Reinforced Concrete (UHP-FRC) (2027)
5-7041-01	Implementation of the NextGen Bridge Deck System in Texas
5-6936-01	Implementation of Semi-integral Bridges in Texas

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Develop Refined Design Methods for Lean-On Bracing

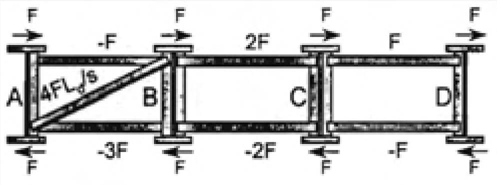
(Project 0-7093)

TxDOT's History with Lean-on Bracing

0-1772 (2003)

5-1772 (2008)

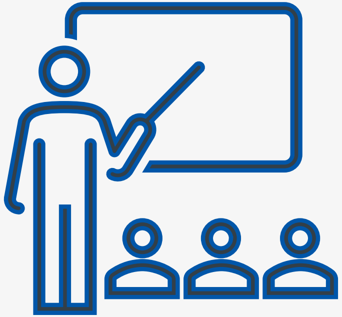
Brazos River (2013)

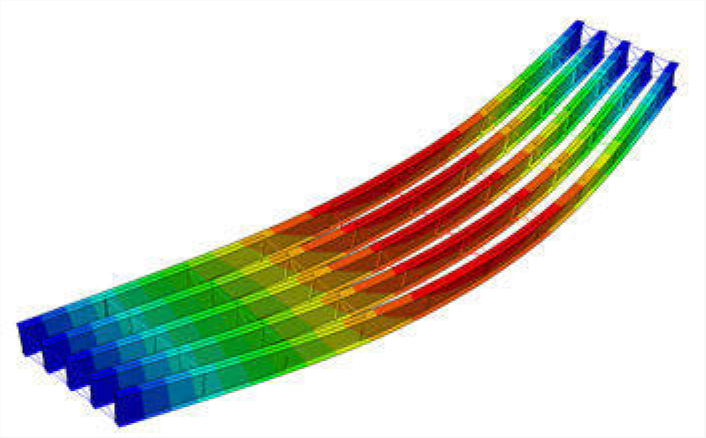


TxDOT’s History with Lean-on Bracing

Burgeoning Interest & New Questions

0-7093 (2024)





0-7093: Develop Refined Design Methods for Lean-On Bracing

University of Texas at Austin & Texas A&M University

The idea was to build upon TxDOT Research Project 0-1772 by clarifying and refining where necessary

- Determine preferred/ideal cross-frame layouts
- Investigate the efficacy of the in-plane girder stiffness expression
- Clarify the use of the brace stiffness expressions

Implementation

- Incorporate the recommendations into the TxDOT Bridge Design Manual and Bridge Design Guide
- Include design examples to be added to the Bridge Design Guide
- Use to inform updates to the TxDOT Preferred Practices for Steel Bridge Design, Fabrication, and Erection document
  - The use of a lean-on bracing system is allowed for straight girder bridges according to the TxDOT Bridge Design Manual
  - TxDOT encourages its use for good candidate bridge projects

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Develop and Validate Precast Column Solutions for Texas Bridges

(Project 0-7089)

Precast Column History

a) Limited by lifting due to heavy self-weight.

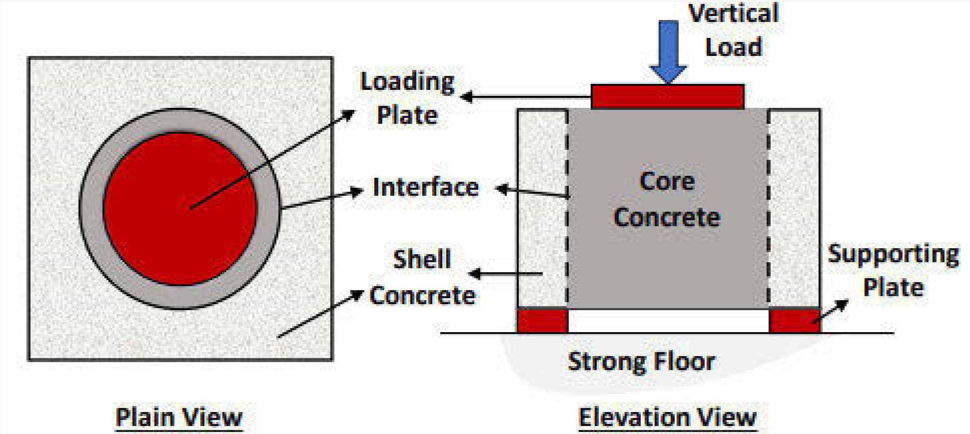
b) Efficient for tall bridges. Column segments are spliced together by vertical reinforcement.

c) Shell is lighter and serves as permanent formwork for inside pour.

(a) Full-height precast column (b) Precast segmental column (c) Precast column shell

Shear Interface Behavior

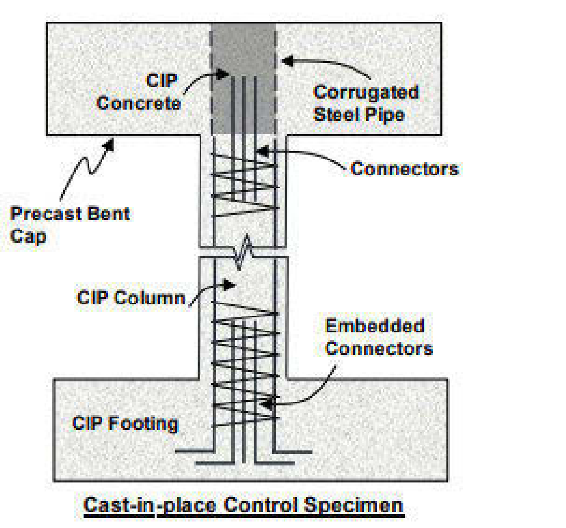
What are the factors affecting interface shear strength between precast and cast-in-place concrete?

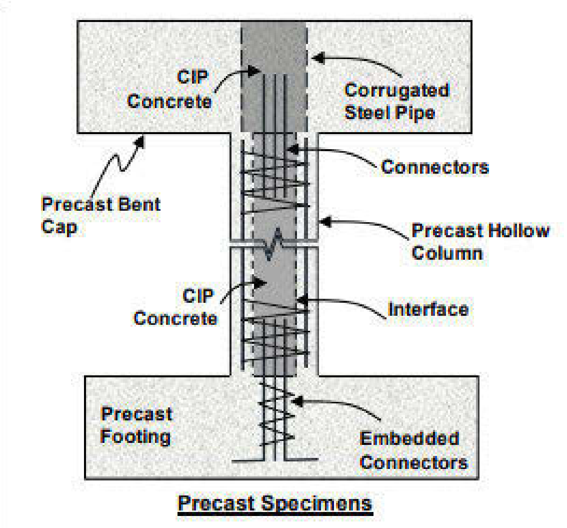


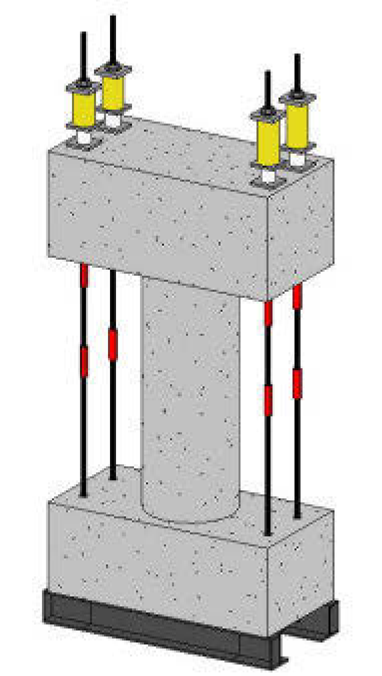
Shear Interface Behavior

- 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

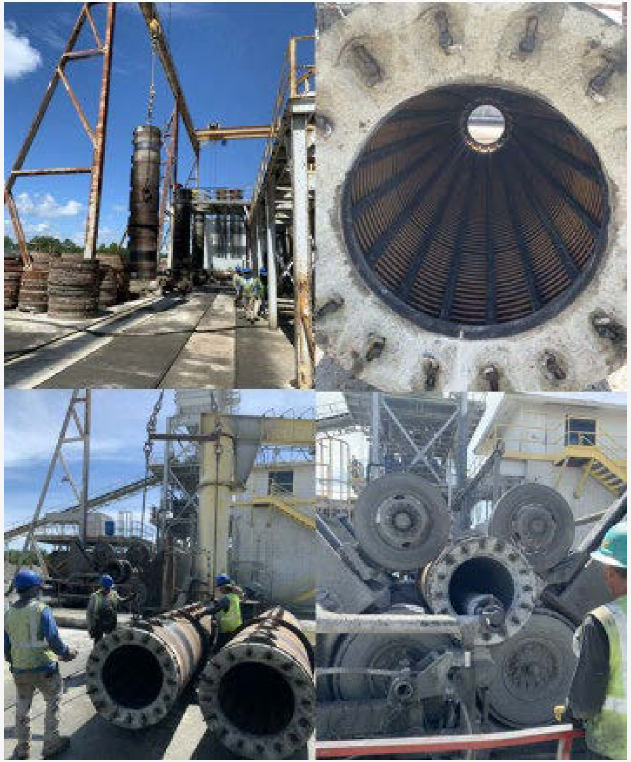
Full Scale Tests







Full Scale Tests



Full Scale Tests

Full Scale Tests

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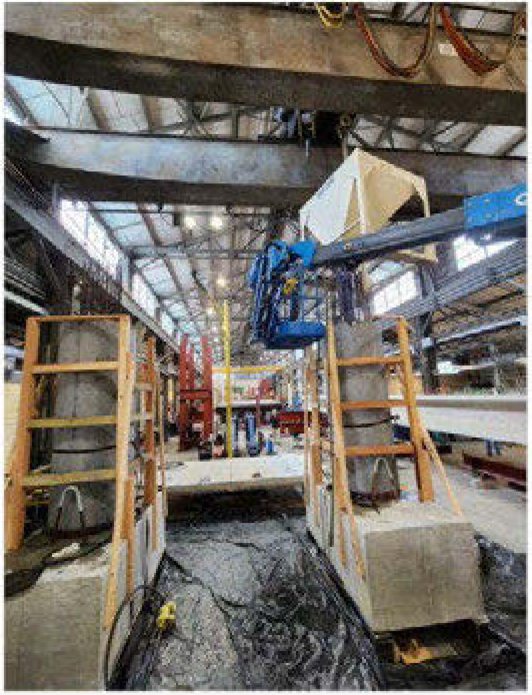


Full Scale Tests



Full Scale Tests

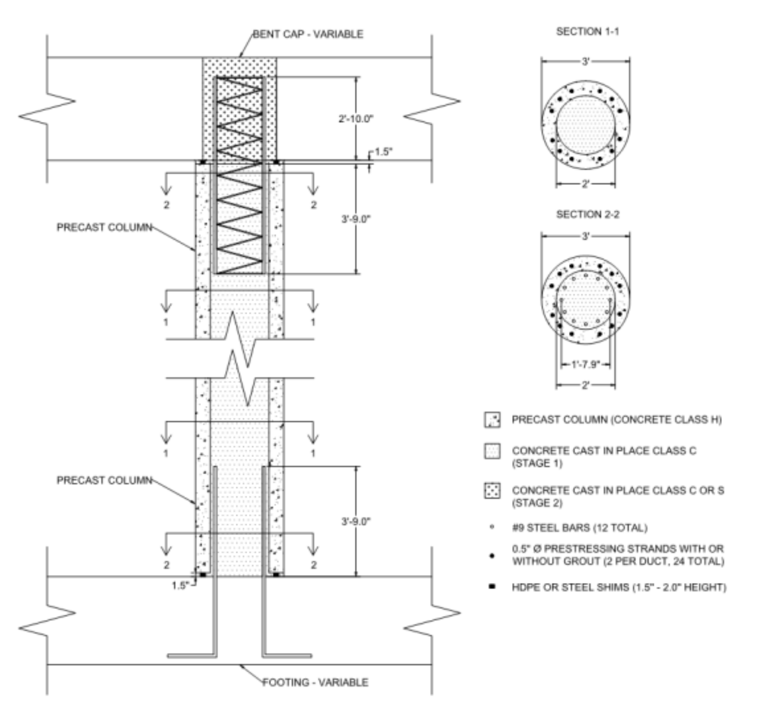
- Under low eccentricity loading (6 in & 12 in), the precast columns exhibited elastic behavior, indicating good performance.
- Internal roughness of the precast columns had minimal impact on final resistance.
- Precast columns showed less cracking than the control specimen.
- Embedment length of connecting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

Precast Column Summary

Researchers provided:

- Design assumptions
- Design methodology
- Suggested specifications
- Example details

Next steps are project implementation and standards development.



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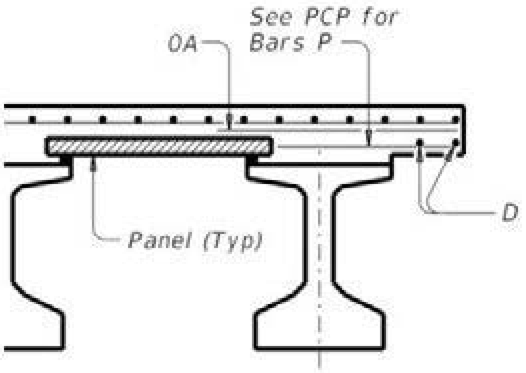
Development of NextGen Texas Bridge Decks

(Project 0-7041)

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

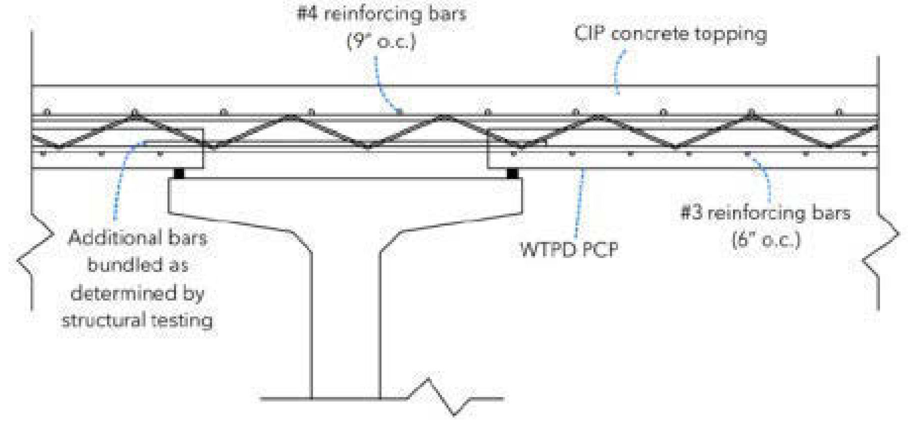


(a) Typical detailing (TxDOT standard)


(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

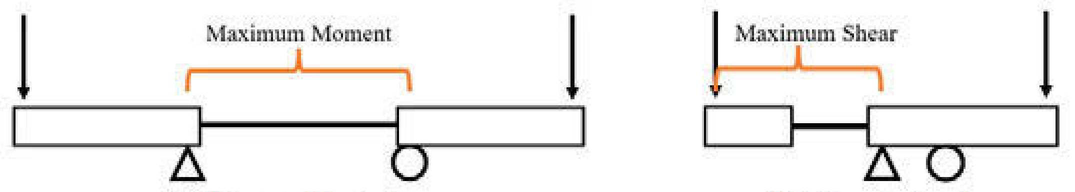
Fabrication of Panels


(a) lateral walls and partitions


(b) Expanding foam and tape


(a) Specimen I-E-U30

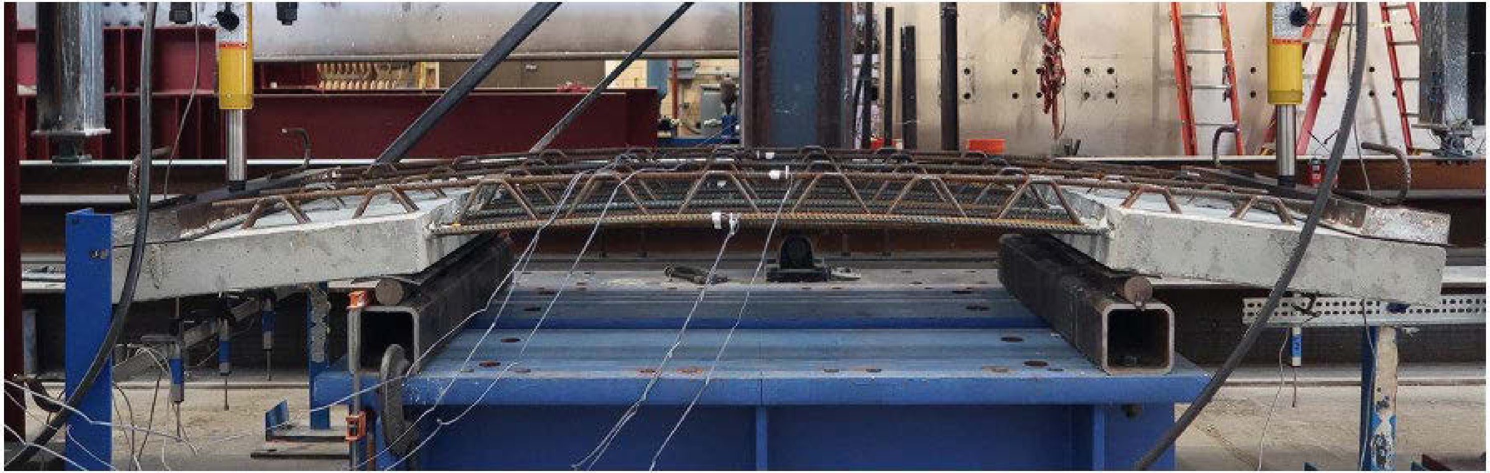
Single Panel Tests



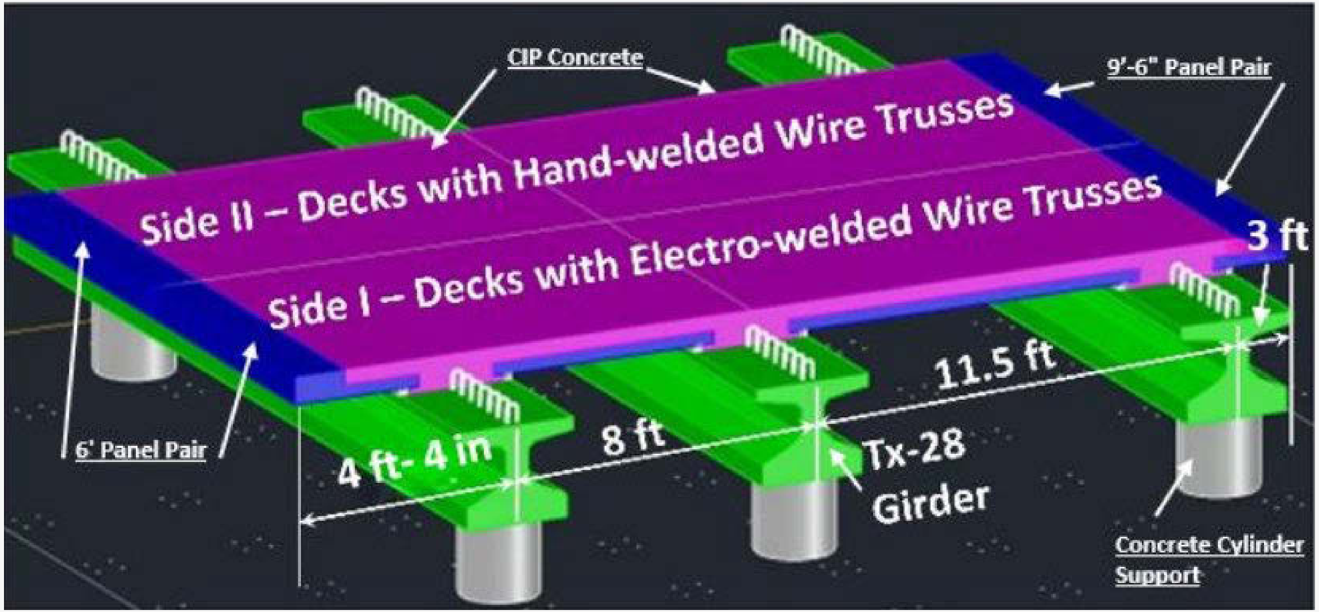
(a) Flexural test setup

(b) Shear test setup

Single Panel Tests



Full Scale Tests



Full Scale Tests

0-7041: Develop NextGen Texas Bridge Decks

Photo Credit: Center for Transportation Research

Full Scale Tests




Full Scale Tests

(a) Punching shear failure from side

(b) Punching shear failure from bottom

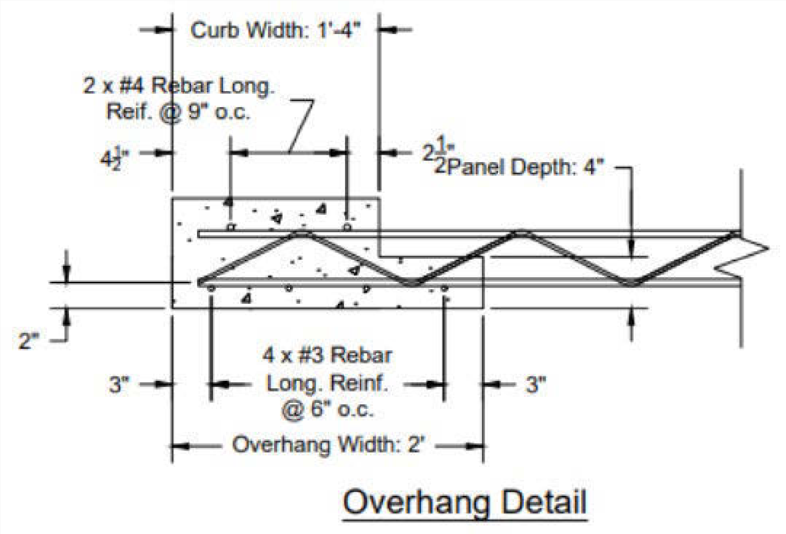
(c) Punching shear failure from top

(d) Bottom close up

NextGen Deck Summary

Researchers provided:

- Design assumptions
- Suggested specifications
- Example details



Next steps are project implementation and performance tracking

Draft standard details are available upon request.