ASSESSMENT AND RETROFITTING OF CORRODED STEEL H-PILES

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Introduction

Background

- In 2016, the total cost of repairing deficient bridges in the US was almost $32 billion.
- Missouri Department of Transportation (MoDOT) is responsible for maintaining 10,400 bridges, Missouri has the 4th highest number of deficient bridges in the US with more than 3,222 deficient bridges.
- Many of these bridges constructed using steel H-piles which by inspection revealed different degrees of localized corrosion.

Objectives

Develop repair methods that satisfy these criteria:

- Efficient and durable to restore the original axial capacity
- Easy and accelerated technique

Work Process

Corrosion Assessment

- Determine the compressive strength and failure modes.
- Classifying the corroded piles using LS-Dyna.

Repair Optimization

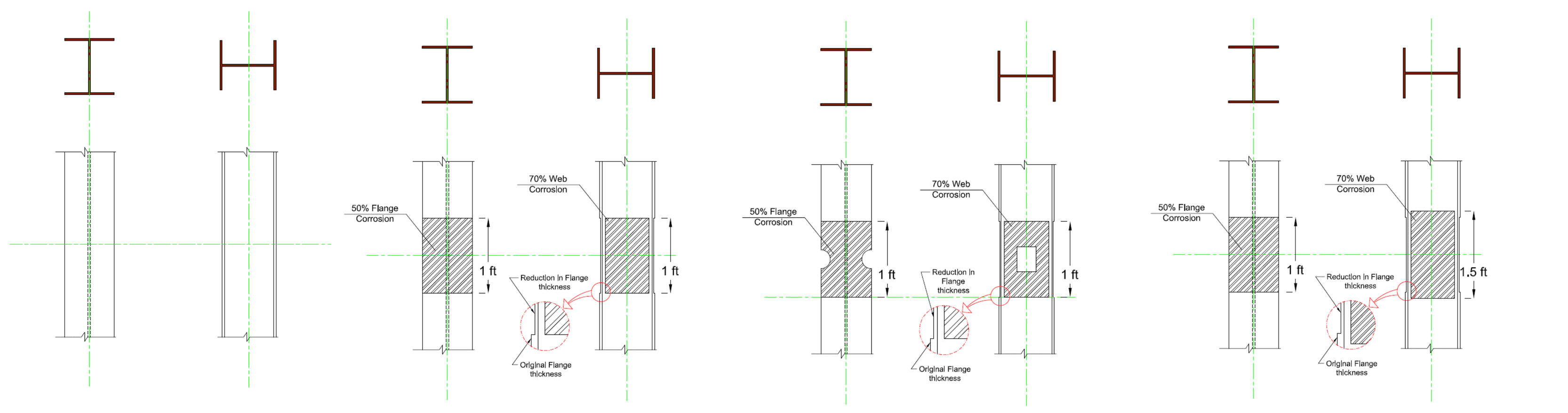
- FRP wrapping
- FRP box filled with concrete
- Ultra-High Performance Concrete (UHPC)
- FRP plates and channels

Bridge Analysis

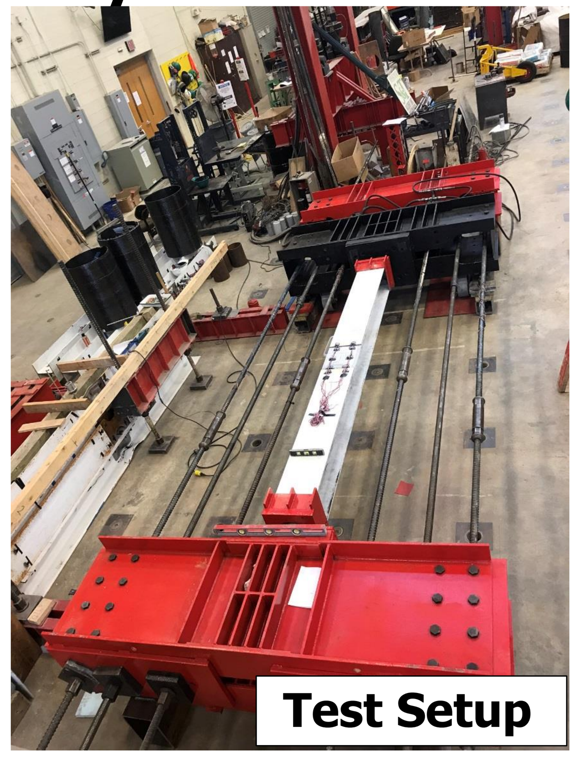
- Testing large-scale corroded piles after different repair methods
- Analyze full bridge before and after repairing the H-piles

Corrosion Assessment

- **Testing different corroded H-piles to determine axial capacity and failure modes.**

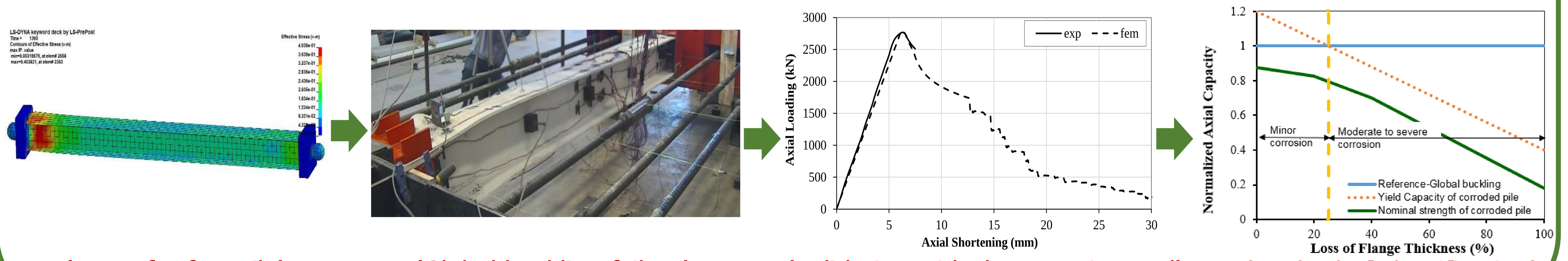


(Ref. pile) (Red. in flange and web) (Cut in flange & web) (diff. length of corrosion)



Test Setup

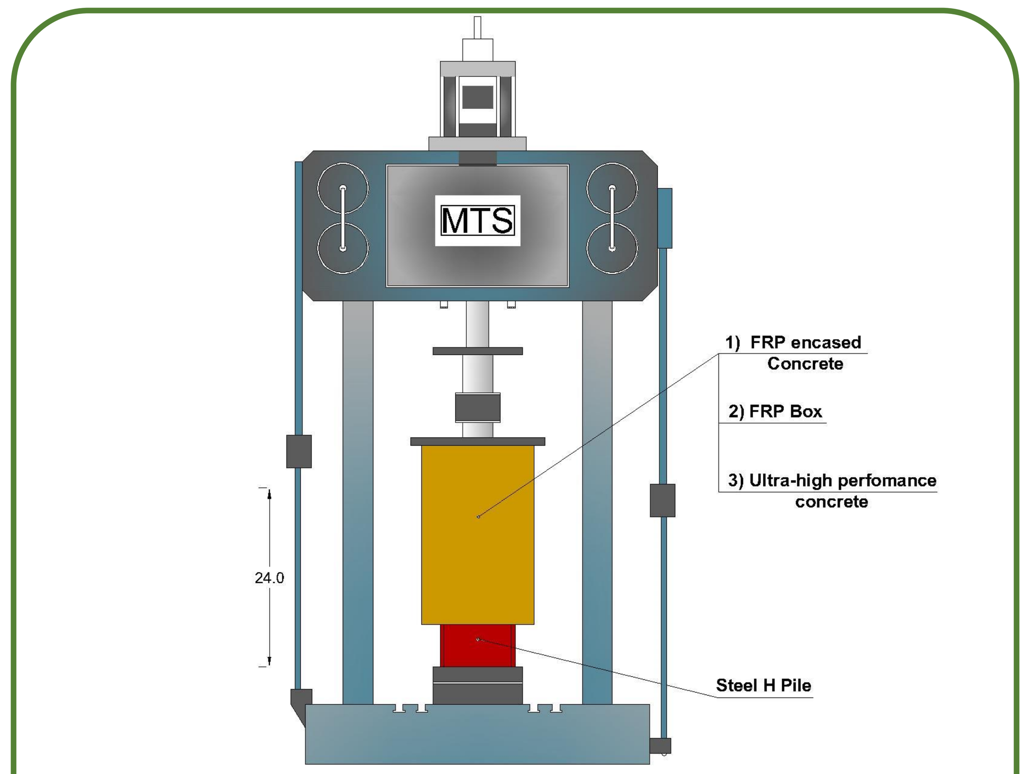
- **Finite Element Model (FEM) development and validation with experimental.**



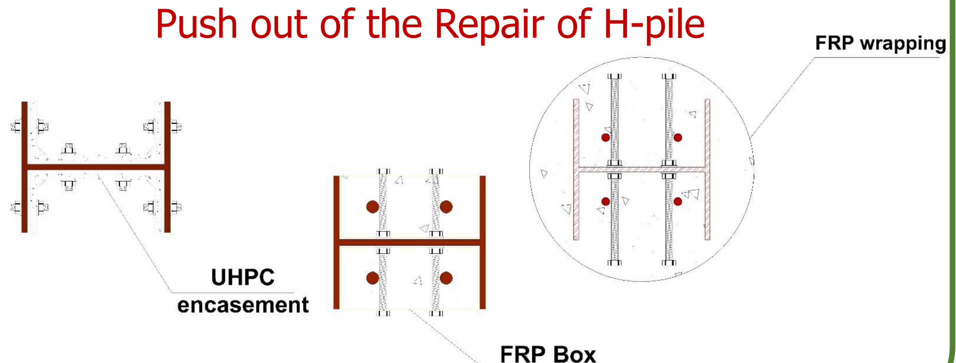
(FEM of ref. H-pile) (Global buckling failure) (Validation with the Experimental) (Method of classification)

Repair Optimization

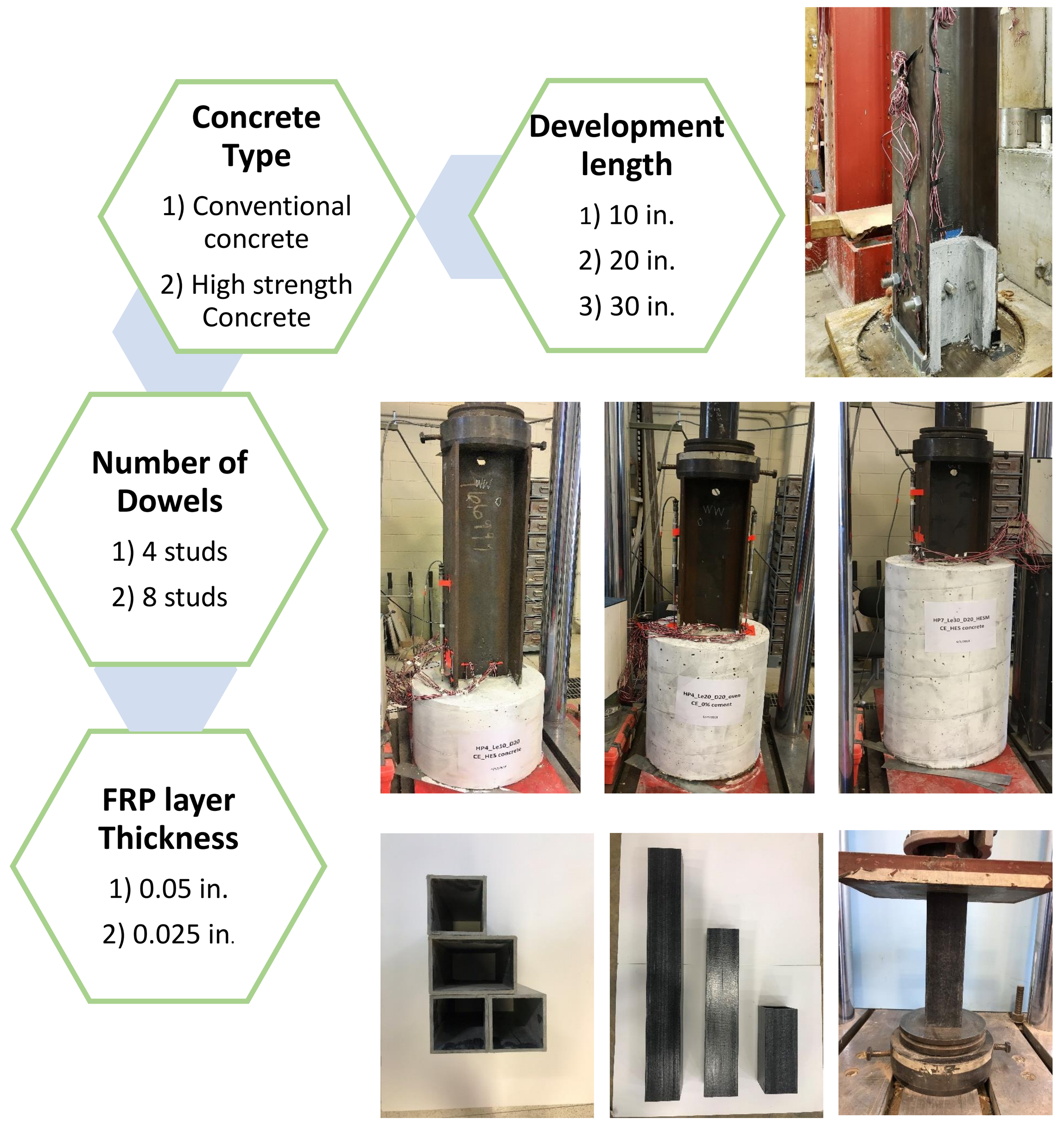
Test Setup



Push out of the Repair of H-pile



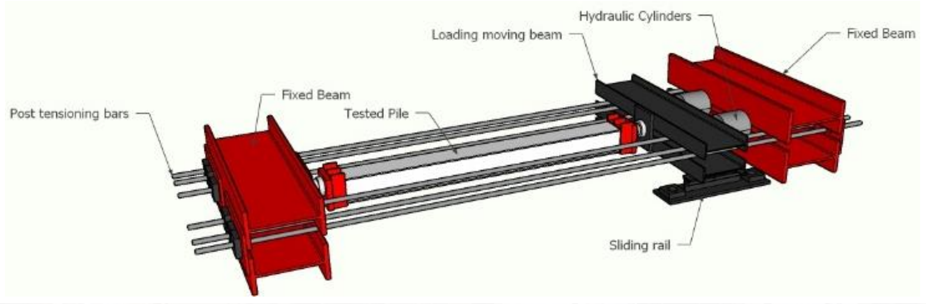
Examples of repaired sections



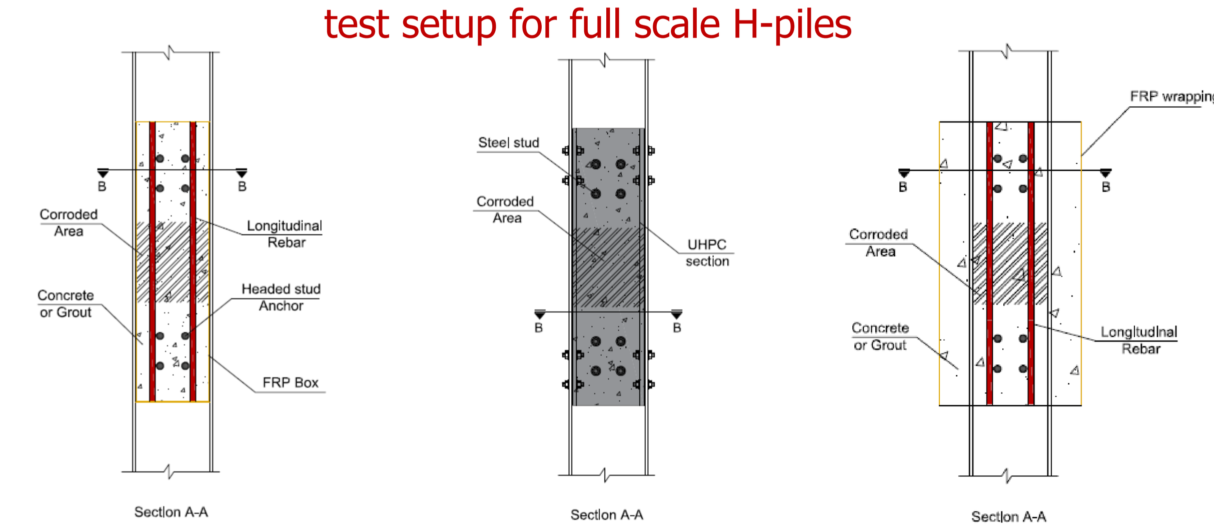
Experimental parameter for the repair methods

Bridge Analysis

- **Testing large-scale retrofitted piles**



test setup for full scale H-piles



Different repair techniques for full scale H-piles

Findings And Conclusion

- There are several research groups that have addressed the residual strength of corroded steel elements; however, the data on corroded and repair of steel H-piles are very limited.
- 10 Full Scale specimens have been tested to assess the corrosion and determine the residual capacity of H-piles.
- FE models have been conducted and validated with the experimental results.
- Parametric Study of FRP Wrapping repair has been conducted with Experimental work resulting in testing 33 specimens.
- Three full scale repaired corroded H-piles with FRP wrapping tested to achieve the original capacity of H-pile.
- Three full scale specimens tested with eccentricity to monitor the effect of moment on the capacity of corroded H-piles.

Acknowledgement

- Missouri Department of Transportation (MoDOT)
- Department of Education (D.O.E)
- Mid-America Transportation Center (MATC)