



Project Number
BDV29-977-39

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Shear Friction Capacity of Corrugated Pipe Connection in Precast Footings

October 2023

Current Situation

Although new construction or replacement of bridges is many times in the best interest of the traveling public, high construction costs and potentially lengthy project delivery dates are hard to avoid. Using prefabricated bridge elements and systems (PBES) allows for reduced construction times and quicker turnaround times using Accelerated Bridge Construction (ABC). This project aimed to look at a connection type that would potentially streamline this process even further.

The Florida Department of Transportation (FDOT)—in accordance with the American Association of State Highway and Transportation Officials (AASHTO) Load and Resistance Factor Design (LRFD) Guide—currently recommends a “pocket connection” be installed between precast pile caps and precast piles. A pocket connection is a void made in the precast pile cap and precast pile elements. Reinforcement, typically rebar, is then placed between the elements in the void and the connection is filled with concrete.

This connects and reinforces the bridge elements.

The hypothesis at the time of this project was that connections like these made the precast piles and pile caps fit together perfectly – even if steel reinforcement was not used. Not only would this be more cost-effective, but it could also present a more durable connection.

Research Objectives

The goal of this project was to evaluate the durability of the precast pocket connection without steel crossing the interface. The results of these findings would validate or disprove the research team's hypothesis that the connection does not require steel crossing the interface.

Project Activities

Following a literature review, researchers from Florida International University investigated the behavior of precast pile and pile cap interfaces on specimens that had no steel reinforcement crossing the pile-to-pile cap. The team tested 33 small-scale and eight large-scale specimens to evaluate the connection. Recommendations were developed based on the results of the testing that could inform future PBES bridge construction methods in Florida.

Project Conclusions and Benefits

The evaluation determined that current FDOT recommendations underestimate the shear friction capacity of pocket connections. The research showed that the pocket connection can remain structurally sound when connected without steel. Although both small and large specimens had cracks and failures at the interfaces during testing, researchers also found when the steel is removed and the interface is roughened using concrete paste retardant, the shear friction strength is equal or greater than those where the steel was left in place - validating the research team's hypothesis.

Also, these conclusions further validate FDOT's recommendations for pocket connection installations between precast pile caps and precast pile elements.



Florida International University researchers used these specimens to test shear friction capacity for precast pile caps and precast piles that do not have steel crossing the interface.

For more information, please see fdot.gov/research.