

Retrofitting of Bridge Columns Using UHPC

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Extended Abstract

The National Bridge Inventory reports indicate that a noticeable portion of the United States bridge infrastructure is drastically approaching the end of its intended design life, mainly due to environmental effects such as corrosion. This mandates developing new techniques and materials for rehabilitation of these deficient structures with an accelerated construction method. To address this issue, a repair method has been developed at Florida International University (FIU), using Ultra High-Performance Concrete (UHPC).

The properties of UHPC make it a suitable choice as the repair material for retrofitting the damaged body of the marine axially loaded elements, and application of UHPC could provide an efficient solution to address the pressing issue of bridge rehabilitation. However, there have been very limited studies investigating the feasibility of using this material to repair concrete columns.

This research aims to investigate the performance of UHPC as retrofit material for damaged bridge columns. To achieve this goal, eleven column prototypes were designed and built to represent a bridge pier or a building column. The columns were then artificially damaged and repaired with UHPC. The specimens were scaled as 1/4 of a bridge column with a height to diameter ratio of 5, and their stubs represented a discontinuity, such as a beam column joint or a footing. The dimensions of the test columns are presented in Figure 1. To evaluate the mechanical performance of the repaired columns they were tested under a combination of static axial and cyclic lateral loads (to simulate operational conditions).

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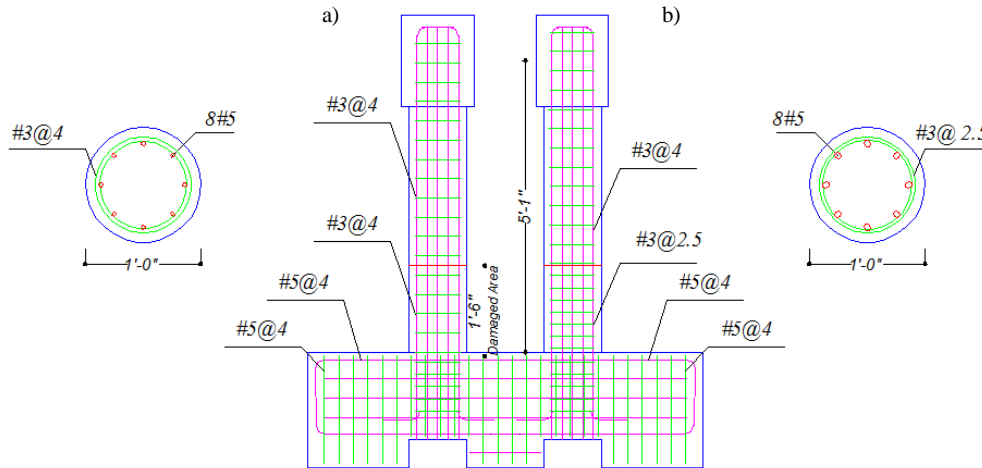


Figure 1. Dimension of the Test Specimens

The first phase of the repair procedure is the mechanical removal of the damaged concrete cover and cleaning the substrate from residue particles and creation of exposed aggregate which is essential to have a good bond between UHPC and existing concrete in repaired areas. Then the lost, corroded, or extremely deformed reinforcement is cut and replaced. Before casting UHPC, the substrate concrete surface is sprayed with water. At the end, all the cavities are filled with UHPC using proper forming. The repair process is depicted in Figure 2.

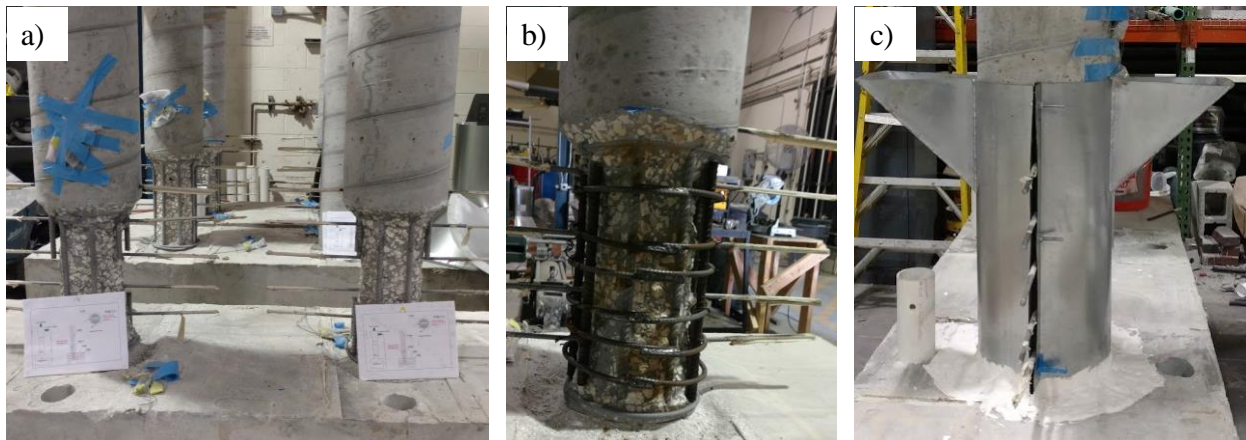


Figure 2. Repair Process: a) Sandblasting the Damaged Surface, b) Replacing Transverse Reinforcements, c) Forming the Column and Casting UHPC.