Development and Seismic Evaluation of Pier Systems with Pocket Connections and Hollow PT/UHPC Columns

Principal Investigators: M. Saiid Saiidi, PhD, PE. and Ahmad Itani, PhD, PE.
Research Assistant: Alireza Mohebbi, PhD Candidate.

BACKGROUND
Research over the past half a decade has focused on various earthquake-resistant accelerated bridge construction (ABC) connections. The focus of this study is on pocket connections because they have shown promising results while not violating the current seismic codes. Seismic performance of precast columns that are prestressed with unbonded carbon fiber reinforced polymer (CFRP) tendons and connected to the footings and the cap beams using pocket connections is experimentally investigated. Two single columns and one two-column bent will be designed and tested on one of the UNR shake tables. Advanced materials, engineered cementitious composite (ECC) and ultra-high performance concrete (UHPC), will be incorporated in plastic hinge of columns to improve seismic performance.

OBJECTIVE
The overall objective of the proposed study is to develop and evaluate resilient bridge piers consisting of prefabricated columns and cap beams subjected to simulated earthquake loading on shake tables. The post-earthquake damage is minimized by using prestressing CFRP tendons to control residual displacements and plastic hinge damage by using ECC and UHPC.

SCOPE
Six tasks will be completed: (1) conducting literature search, (2) developing preliminary design of test models, (3) conducting nonlinear finite element analysis of models, (4) building the test models, conducting shake table tests, and process test data, (5) conducting analytical studies of models, and (6) developing design method and numerical examples.

The experimental component of the study consists of shake table testing of two single columns and one, two-column bent as shown in Fig. 1.