THE UNIVERSITY OF CONNECTICUT
CIVIL & ENVIRONMENTAL ENGINEERING

SAMUEL TUREK

MASTERS THESIS DEFENSE
DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING
UNIVERSITY OF CONNECTICUT

1:00 PM – TUESDAY, MAY 29TH, 2018
CAST 306

Advisory Committee:
Dr. Sarira Motaref (Major Advisor)
Dr. Arash E. Zaghi (Associate Advisor)
Dr. Richard Christenson (Associate Advisor)

Mechanical Behavior of Hybrid Concrete-Filled Fiber Reinforced Polymer Tube Columns

The current state of America's infrastructure is rapidly declining. Many bridges are approaching or have passed their designed service life. Engineers and bridge owners have an opportunity and obligation to rebuild back better. This can be achieved, in part, through the utilization of novel high performance structural systems. One such technology, the concrete-filled fiber reinforced polymer (FRP) tube (CFFT) system has been studied the past few decades as an alternative design for bridge columns. This column system greatly simplifies construction by eliminating the need for column formwork and associated scaffolding. It has also been shown to outperform traditional reinforced concrete columns under hazardous loading such as earthquake or blast. A CFFT system not requiring any traditional rebar would even further simplify construction. This novel system is achieved by embedding longitudinal steel fibers into the FRP tube of a CFFT. The goal of these steel fibers is to give the system the energy dissipation and ductility capabilities that CFFT's gain from rebar without the additional associated construction costs.

Hybrid metal/non-metal fiber CFFTs (HCFFTs) and traditional all glass CFFTs were manufactured with varying glass fiber angles and number of layers. Specimens were tested under half-cyclic concentric and eccentric compressive loading. The addition of longitudinal steel fibers into a traditional CFFT system may offer an improvement in energy dissipation capability before failure and slow damage progression. These steel fibers may also lead to a reduction in ultimate strain capacity of the CFFT. Mechanical properties of the tested specimens are presented as well as data on energy dissipation, damage progression, and recentering capability.