PhD DEFENSE ANNOUNCEMENT

STUDENT: **Cheng Shi**

Department of Civil & Environmental Engineering

DISSERTATION CHAIRS: **Drs. Abdeldjelil Belarbi Dr. Mina Dawood**

DATE: **November 12, 2015**; TIME: **2:00 PM**
LOCATION: **CEE Conference Room**

Title: *Evaluation of Steel H-piles with Localized Corrosion and Rehabilitation Using Friction-Type Bolted Steel Plates*

Abstract

The work presented in this dissertation has two major research objectives related to steel bridge piles with severe but localized corrosion: (1) development of a numerical framework to predict the axial capacity of the corroded piles, and (2) development and evaluation of a friction-type bolted steel plate-based rehabilitation system to be used for the repair of deteriorated piles.

To accomplish the first research objective, an investigation of the remaining compressive capacity of H-piles with simulated corrosion was carried out. This included an experimental program and numerical simulations. Seven 15-ft-long HP12×53 piles were machined to simulate the section loss due to corrosion and tested under uniaxial compression load. The results obtained from the experimental study were used (1) as a validation for the developed numerical framework, and (2) as a control group of experimental investigation of the proposed repair system. A finite element model was developed and validated using the experimental results of this study. A parametric study was carried out using the model to investigate the effects of parameters including slenderness of the corroded flange and web, slenderness of the pile, location and extent of the corroded region, and the magnitude of residual stresses. The results indicated that flange thickness reduction is a critical factor influencing the remaining capacity of partially corroded H-piles. The results also demonstrated that increasing pile slenderness and residual stresses reduce the capacity of piles that fail by flexural buckling but have negligible effect on piles that fail by flange/web local buckling.

To achieve the second objective of this study, a friction-type bolted plate-based repair system was proposed. In this proposed method the applied axial load is transferred from the original pile to the steel repair plates through friction at the interface between the pile flanges and the steel repair plates.

The evaluation of the retrofitted piles consisted of both experimental and numerical programs. Seven piles with the same configurations as the corroded control group were repaired and tested under axial compression. The experimental results demonstrated the effectiveness of the rehabilitation method by ensuring acceptable axial capacity and stiffness. A finite element analysis was conducted to study the factors that influence the efficiency of the repair system, including the length of the steel plates, the magnitude of bolt pretension and slip resistance. The findings indicated that increase the length of the repair system, magnitude of bolt pretension and slip resistance can enhance the capacity of pile with local failure within the corroded region. These three factors do not have a significant strengthening effect if a pile fails by flexural buckling.