University at Buffalo
Department of Civil, Structural and Environmental Engineering
School of Engineering and Applied Sciences

ENGINEERING SEMINAR

# Service and Seismic Performance of Rapidly Constructed Prestressed Bridge Systems

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Dr. Pinar Okumus's research group focuses on understanding the fundamental nonlinear structural behavior of prestressed concrete bridges. The nonlinear response of interest ranges from unexpected inelastic response due to performance problems, to response due to extreme events. Using this understanding, the group aims to create durable and resilient bridge systems which can be analyzed and designed efficiently, and built using accelerated bridge construction methods. This seminar will provide two excerpts from the ongoing work.

## Review of Skew Effects on Prestressed Concrete Girder Bridges: Problems and Current Practices

Atypical load paths in skewed bridges result in stresses larger than the ones experienced by equivalent bridges with no skew. These additional stresses are addressed by the current design codes but only at the strength level, leading to deck cracking, substructure distressing and bearing deterioration under service loads. Given the significant number of skewed bridges particularly in regions with adverse climates, such serviceability problems are of primary importance and require immediate consideration. This paper provides a thorough review of the current AASHTO LRFD provisions and State DOT practices related to bridges with large skew. Practices that mitigate adverse impacts of skew angle at the service level on super-structure and sub-structure components of prestressed concrete girder-deck type bridges were documented. Numerous bridge inspection reports were scanned to identify problems common to prestressed concrete bridges with large skew and characteristics of these bridges. In addition, two prestressed concrete girder-deck type bridges in service with high and low skew angles were inspected to understand the impact of girder type on skew.

## The Influence of Segment Interface Characteristics on Seismic Performance of Post-tensioned Precast Segmental Bridge Piers About the Speakers

This presentation investigates seismic performance of precast concrete segmental piers post-tensioned with unbonded strands through analytical modeling. Low-damage precast concrete segmental bridge columns have been proposed for seismic regions for their accelerated bridge construction benefits. Piers presented in this paper allow shear-slip to dissipate energy through friction. Segments were prefabricated without shear keys to allow shear-slip. Unbonded post-tensioning provided self-centering capabilities. Quasi-static cyclic testing showed that segment interface friction properties determine the amount of energy dissipation. The impact of surface characteristics on the seismic performance was investigated by developing a simple analytical model. The analytical model predicts the overall load-displacement behavior of piers under lateral loading by superposing self-centering and shear-slip responses. A parametric analysis was performed using the analytical model to investigate the influence of friction properties of commonly used interface materials on seismic performance. The results show that energy dissipation is strongly associated with friction and shear-slip. Reduction in friction coefficient increases energy dissipation, decreases stiffness, and increases residual displacements.

**Date: Friday, February 24th, 2017 Time: 11.00 am**
**Location: 140 Ketter Hall, North Campus, University at Buffalo**