CE 890 Graduate Seminar

SPEAKER: Ahmed Abd El Fattah, Ph.D. student
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TOPIC: "Confinement Model for Eccentric Circular Concrete Columns Wrapped with FRP and Steel"

DATE: October 27, 2010

TIME: 4:00 p.m. (refreshments at 3:45 p.m.)

PLACE: 1052 Rathbone Hall

ABSTRACT

Fiber reinforced polymers (FRP) is an attractive material to the field of strengthening and confining new and existing structures. Many researchers have proven that FRP is an efficient material as it applies easily to the targeted structures with many suitable attributes like corrosion resistance and high strength to weight ratio. FRP is usually used to wrap columns to increase the ultimate strength and strain of the concrete through confinement. Experimental works have proven that the minimum effective ratio of the lateral confining pressure provided by FRP to the peak unconfined concrete strength *f'c* has to be at least equal to 0.08 in order to have ascending branch on the stress strain curve that has a peak beyond the *f'c*. However, existing columns typically have spiral steel reinforcement (SS) in the section when wrapped with FRP. The nature of the problem becomes totally different since there are two systems with different behavior engaged in confinement at different position of action. Many models were proposed to depict the behavior of the FRP alone in confining concrete. On the other hand, the literature has limited studies assessing the behavior of FRP and SS working on confining concrete simultaneously. This paper proposes a model addressing the two materials engagement in circular columns. The development of the effective lateral confinement pressure is based on Lam and Teng model for FRP action and Mander Model for SS action. It also introduces the force eccentricity as a new parameter that plays an important role in estimating the amount of confinement involved. Hence, the level of strength and ductility vary based on the eccentricity. The proposed model respects the fully confined curve (zero eccentricity) as an upper bound curve and the unconfined curve (infinite eccentricity) as a lower bound curve. In between, infinite numbers of stress-strain curves can be generated based on the eccentricity. The higher the eccentricity the smaller the confined concrete compression zone. Accordingly, the ultimate confined strength is gradually reduced from the fully confined value *fcc* to the unconfined value *f'c*. Finally the model is validated by showing good correlation to experimental data.