

## CE 890 Graduate Seminar

**DATE:** September 3, 2008  
**TIME:** 4:00 p.m. (refreshments served at 3:45 p.m.)  
**PLACE:** Rathbone 1052  
**SPEAKER:** Ahmed ABD El Fattah, M.S. Candidate  
**TOPIC:** “Partial Confinement Utilization for Ultimate Analysis of Circular Concrete Columns”

### ABSTRACT

The development of column interaction diagrams for unconfined concrete is a standard analysis procedure. However, the need to develop analysis tools for the actual ultimate capacity of columns is evident. Modern codes and standards are introducing the need to perform extreme event analysis. In previous studies, various models were implemented to assess the ultimate confined capacity of columns under concentric axial loads. On the other hand the effect of confinement in case of the eccentric axial load and the corresponding bending moment are not investigated in such models. So it is demanded to relate the strength and ductility to the degree of confinement utilization in a new model. The more the eccentricity the less the confinement engaged till the effect of the confinement vanishes at pure bending. Accordingly, the ultimate confined strength and the maximum strain range between the fully confined values  $f'_{cc}$  and  $\epsilon_{cu}$  (at zero eccentricity) and the unconfined values  $f'_c$  and 0.003 (at infinite eccentricity) depending on the level of eccentricity.

$$\overline{f_{cc}} = \frac{1}{1 + \frac{e}{H}} f'_{cc} + \frac{1}{1 + \frac{H}{e}} f_{co}$$

$$\overline{\epsilon_{cu}} = \frac{1}{1 + \frac{e}{H}} \epsilon_{cu} + \frac{1}{1 + \frac{H}{e}} (0.003)$$

Where  $\overline{f_{cc}}$  = ultimate confined strength for the eccentric column.

$H$  = diameter of the column.

$\overline{\epsilon_{cu}}$  = ultimate strain for the eccentric column (ductility representative).

Radial loading with constant eccentricity is followed in the nonlinear moment of area concept that considers the finite layer procedure and the secant stiffness approach, to achieve equilibrium points of P- $\epsilon$  and M- $\phi$  up to failure. Three different comparisons are approached to ensure the accuracy of the analysis. The first step is to compare the unconfined analysis results with the well-known software (CSI-Section builder). Secondly, the ultimate capacity of the confined section is compared with experimental data. And finally, the new eccentricity model is compared with the widely used Mander model, which is applicable to concentric column, to examine the accuracy versus safety.