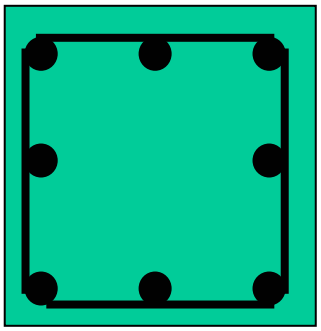
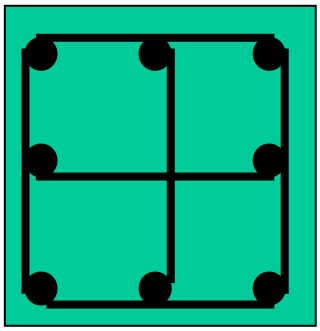
**CE243A- Behavior and Design of RC Elements**

**Assignment #3**
**Stress-strain behavior of concrete & Code provisions for transverse reinforcement**
Due date: 1 November 2004

**3.1** Determine unconfined and confined concrete stress-strain relations for the following columns using the Modified-Kent Park and Saatcioglu and Razvi models. Use $f'_c$ = 4000 psi and $f_y$ = 60 ksi (27.6 and 414 MPa). Plot all relations for each cross section on a single graph and compare (use excel or some other program). Also verify by hand calculations the values for peak stress and the associated strain, and the residual stress capacity and associated strain (note: for unconfined concrete, the residual stress capacity is zero).



20" x 20" w/ 8 - #8 Vertical
#4 @ 3.0" Hoops, 1.5" clear



20" x 20" w/ 8 - #8 Vertical
#4 @ 4.5" Hoops, 1.5" clear

**3.2** For the column cross sections given below, determine required hoop configuration and spacing according to Chapter 21 of ACI 318-02. Assume the sections are located in a "plastic hinge" region of a special moment resisting frame (see Section 21.4). Use $f'_c$ = 4000 psi and $f_y$ = 60 ksi. Assume a clear column height of 12 ft and that no checks are required for shear strength. Clear cover is 1.5" to the hoops.

(a) 30" x 30" column with 12-#10 bars symmetrically placed around the column cross section.
(b) 30" x 30" column with 16-#8 bars symmetrically placed around the column cross section.