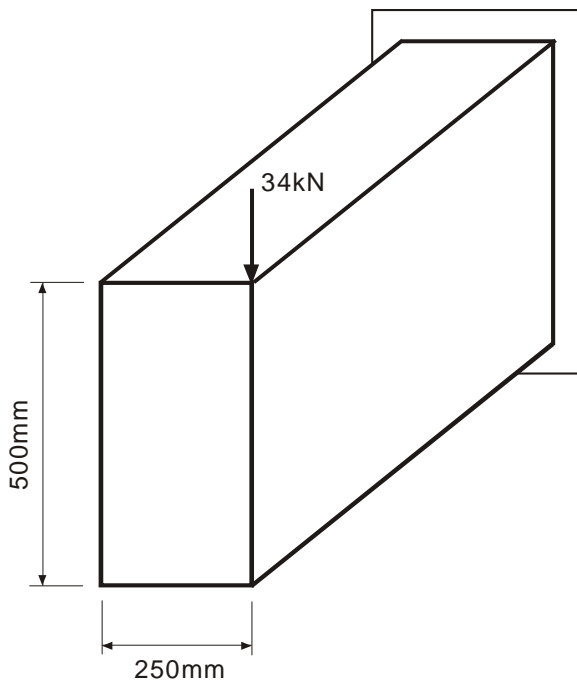


447.328 Theory of Reinforced Concrete and Lab. II
Fall 2007

Midterm Exam #1
(Closed Textbook & Note)

October 17, 2007
Instructor: JAE-YEOL CHO

Problem 1. (20 pts.) Consider a solid rectangular cantilever concrete beam which carries a factored concentrated load of 34kN acting at 125mm away from the center of beam. Determine whether torsional design is required for this beam according to current design code (KCI 2007). $f_{ck} = 28\text{MPa}$.



[Hint] The cracking torque is $T_{cr} = \frac{1}{3} \sqrt{f_{ck}} \frac{A_{cp}^2}{p_{cp}}$

Problem 2. (each 5 pts.) Briefly answer to the following questions.

1. Why is there a plateau at T_{cr} in torque-twist relation curve?
2. What does $\frac{1}{3} \sqrt{f_{ck}}$ mean in the cracking torque $T_{cr} = \frac{1}{3} \sqrt{f_{ck}} \frac{A_{cp}^2}{p_{cp}}$?
3. The limitation on shear stress for hollow section is,

$$\frac{V_u}{b_w d} + \frac{T_u p_h}{1.7 A_{oh}^2} \leq \phi \left(\frac{V_c}{b_w d} + \frac{2}{3} \sqrt{f_{ck}} \right)$$

If the wall thickness varies around the perimeter of a hollow section, how do we have to consider it in calculation?

4. According to KCI Code Provision 7.5.2, for secondary torsion (i.e., compatibility torsion),

the factored torsional moment can be reduced to $\phi \frac{1}{3} \sqrt{f_{ck}} \frac{A_{cp}^2}{p_{cp}}$. What is the reason?

Problem 3. (60 pts.) The short column shown below will be subjected to an eccentric load causing uniaxial bending about Y axis. $f_y=400\text{MPa}$, $f_{ck}=27\text{MPa}$, A_s of D35 = 956.6mm^2

1. Construct the nominal strength interaction curve for this column, calculate at least five points, including those corresponding to pure bending, pure axial thrust, and balanced failure. (40 pts)
2. Show on the same drawing the design strength curve obtained through introduction of the KCI strength reduction factors. (10 pts)
3. Design the lateral reinforcement for columns, giving key dimensions for ties. (10 pts)

