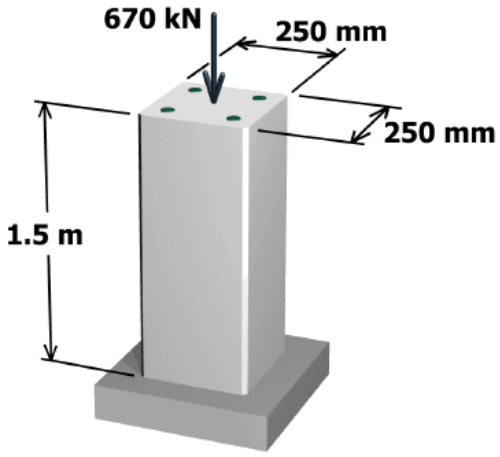
IDE 110 – Summer 2006 Quiz 7 **Name:** _____

The concrete [E_c = 30 GPa] pier is reinforced with four 30mm-diameter steel [E_s = 200 GPa] rods. If the pier is subjected to an axial force of 670 kN, determine the normal force in the concrete N_c.

Show steps clearly. Include units and box the final answer.



① $\Sigma F_y = 0 = N_c + N_s - 670(10^3)$

$N_s = 670(10^3) - N_c$

② $\delta_{steel} = \delta_{concrete}$ $\quad \delta = \frac{NL}{AE}$

$$\frac{N_s(1.5)}{4\left(\frac{\pi}{4}\right)(.03^2)(200\times10^9)} = \frac{N_c(1.5)}{\left(.25^2 - 4\left(\frac{\pi}{4}\right)(.03^2)\right)(30\times10^9)}$$

Solve Simultaneously $\Rightarrow N_s = 160.8$ kN

$$\boxed{N_c = 509.2 \text{ kN}}$$