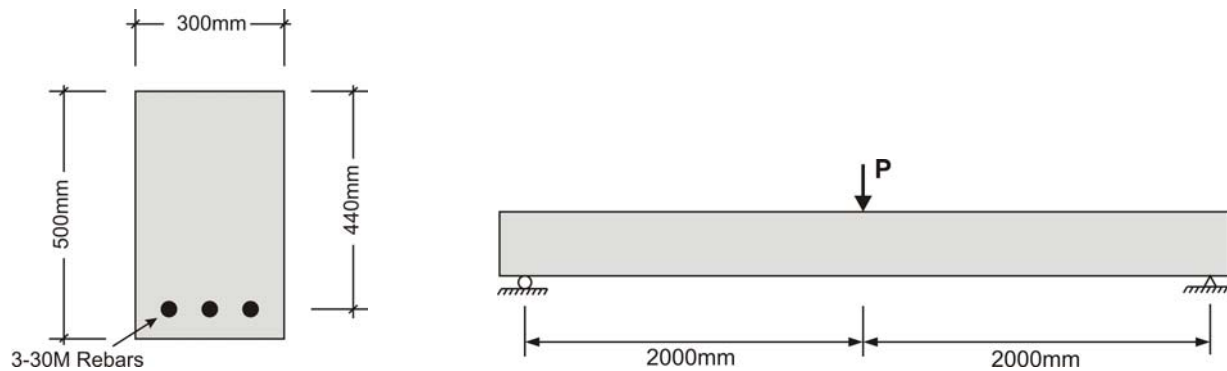


CIVE 3206 –Design of Reinforced Concrete Components Assignment #3 –Behaviour of Beams in Flexure

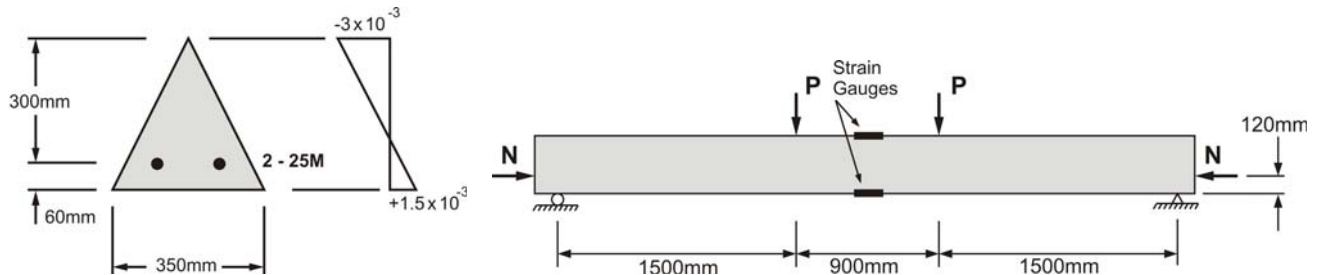
- Consider Beam "A," drawn below.
 - Determine the magnitude of the applied load, P , required to crack the beam section at midspan using both transformed and gross properties.
 - What is the curvature at midspan, ϕ_{cr} , when the section cracks?
 - What is the stress in the steel at midspan when the concrete cracks?
 - What is the stress in the steel at midspan when the applied load, P , is half of that calculated in a)?
Use $E_c = 5500(f'_c)^{0.5}$
- For beam "A", use a linear-elastic approximation of the stress-strain response of concrete and an analysis of the cracked section to determine the maximum value of the load P if we wish to limit the concrete stress at the top of the beam, $f_{c,top}$ to no greater than 15MPa and the steel stress to no greater than 200MPa. Use $E_c = 4500(f'_c)^{0.5}$.



Beam "A"

- For Beam "B", strain gauges attached to the top and bottom surfaces at midspan indicate that the concrete strain at the top is -3×10^{-3} and at the bottom is $+1.5 \times 10^{-3}$. Calculate the value of the load P and the axial force N . Use the Hognestad parabola to model the compressive stress-strain response of concrete. Use two methods to determine the axial load and moment:
 - Integrate the concrete stress block to both calculate the compressive force in the concrete C_c and to determine its location.
 - Use rectangular stress block factors α_1 and β_1 . Your answers to a) and b) should be the same.

For simplicity, do not consider self-weight in any of your answers. This assignment is due at the start of the lecture on Tuesday, January 29 (at 1:05:00pm, EST). (see: <http://tycho.usno.navy.mil/simpletime.html> for the official CIVE3206 time)



Beam "B"