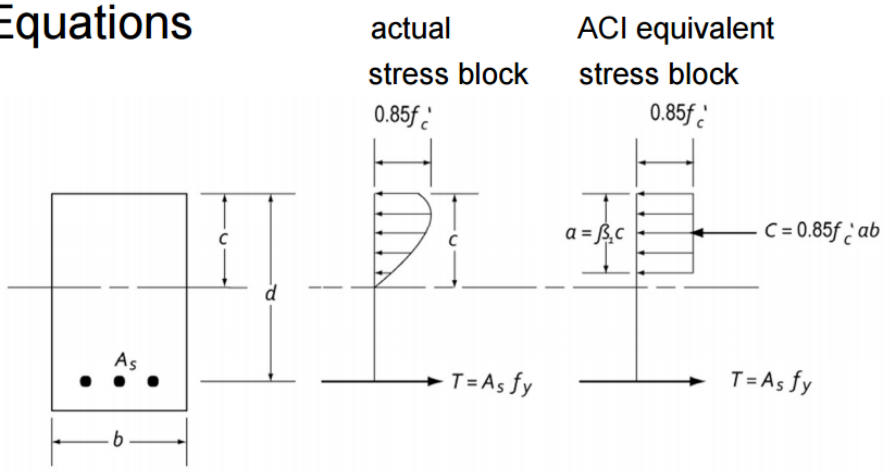
Analysis of rectangular beam

Flexure Equations



$$C = T$$

$$0.85f_c'ab = A_sf_y$$

solving for a,

$$a = \frac{A_sf_y}{0.85f_c'b} = \frac{\rho f_y d}{0.85f_c'}$$

$$\rho = \frac{A_s}{bd}$$

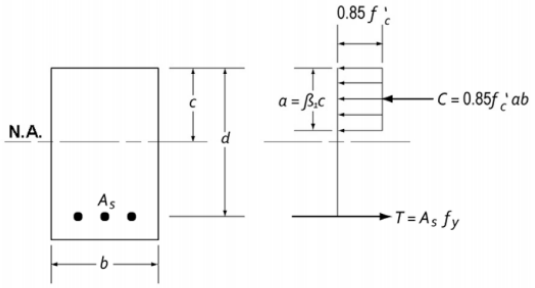
$$M_n = T\left(d - \frac{a}{2}\right) = A_sf_y\left(d - \frac{a}{2}\right)$$

$$M_u = \phi M_n$$

$$M_u = \phi M_n = \phi A_sf_y\left(d - \frac{a}{2}\right)$$

$$M_u = \phi A_sf_yd\left(1 - 0.59\frac{\rho f_y}{f_c'}\right)$$

Rectangular Beam Analysis



2. Find a

3. Find nominal Mn

4. Find required Mu

   Mu = Φ Mn

   (using old pre-2005 Φ value)

$a = \frac{A_s f_y}{.85 f_c' b} = \frac{(2.37)(60000)}{.85(4000)(12)} = 3.49$

$M_n = A_s f_y (d - \frac{a}{2})$

$M_u = \phi A_s f_y (d - \frac{a}{2})$

$M_u = .9(2.37)(60000)(17.5 - \frac{3.49}{2})$

$M_u = 2017000$ in-lb

$M_u = 168$ ft-k

Analysis of rectangular beam example (done by mr. Naim hassan)

A simply supported beam of 20'' total depth & width 12" , here 72.5 grade steel (500w) is used and compreesive strength of concrete is 3 ksi. 3#9 bar is used

Find the moment capacity of the beam.

SOLUTION:

GIVEN f y = 60 Ksi

$f'_c = 3$ Ksi

h = 20"

d=20"-2.5"=17.5"

NOW, T=C

$A_S f_y = 0.85 f'_c a b$

$$a = \frac{A_s f_y}{0.85 f''_c \ b} = \frac{3 \times 1 \times 72.5}{0.85 \times 3 \times 12}$$

a=7.11 inch

$M_n = T (d-a/2)$

$M_n = A_s f_y (d-a/2)$

$M_n = 3 \text{ x1x } 72.5 \text{ x}(17.5 - \frac{7.11}{2})$

$M_n = 253$ K-ft