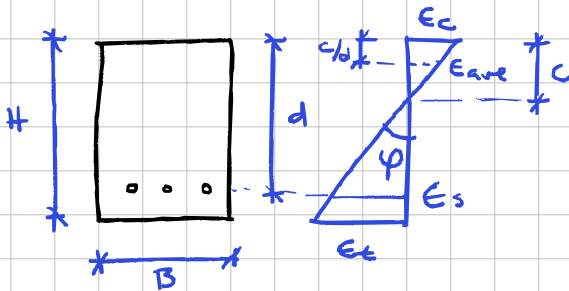


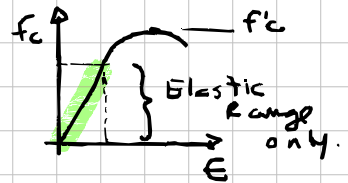
03 - Concrete neutral axis equation

Derivation of a commonly used formula for serviceability checks.



$$\epsilon_{ave} = \phi \cdot c / 2$$

$$\epsilon_s = \phi (d - c)$$



EQUILIBRIUM OF INTERNAL FORCES

$C_c = T_s$ (nominal values, for serviceability)

$$f'_c \cdot B \cdot c = f_y \cdot A_s$$

$$\epsilon_{ave} \cdot E_c \cdot B \cdot c = \epsilon_s \cdot E_s \cdot A_s \rightarrow E_s = E_c \cdot n$$

$$\frac{\phi \cdot c}{2} \cdot E_c \cdot B \cdot c = (d - c) \phi \cdot (n \cdot E_c) \cdot A_s$$

$$\frac{B c^2}{2} = (d - c) A_s \cdot n \quad \leftarrow \text{(usual format)}$$

$$\underbrace{\left(\frac{B}{2}\right) c^2}_A + \underbrace{(A_s \cdot n) c}_B - \underbrace{d A_s n}_C = 0$$