Concrete Beam Neutral Axis

Determine the neutral axis depth in a singly reinforced concrete beam.

1. Inputs

Area of reinforcing steel;	$A_s = 3\ \text{in}^2$
Yield strength of reinforcing steel;	$f_y = 50\ \text{ksi}$
Concrete compressive strength;	$f'_c = 4\ \text{ksi}$
Beam width;	$b = 12\ \text{in}$
Compressive stress block ratio;	$\beta_1 = 0.85$

2. Calculations

$$a = \frac{A_s \cdot f_y}{0.85 \cdot f'_c \cdot b} = \frac{3\ \text{in}^2 \cdot 50\ \text{ksi}}{0.85\ \cdot 4\ \text{ksi} \cdot 12\ \text{in}}$$

$$\therefore a = 3.676\ \text{in}$$

Neutral axis depth

$$c = \frac{a}{\beta_1} = \frac{3.676\ \text{in}}{0.85}$$

$$\therefore c = 4.325\ \text{in}$$

[ACI 318-14 22.2.2.4.1]

$$\begin{aligned} Check\ c\ &>\ 3.5 \\ 4.325\ \text{in}\ &>\ 3.5 \\ &\therefore OK \end{aligned}$$