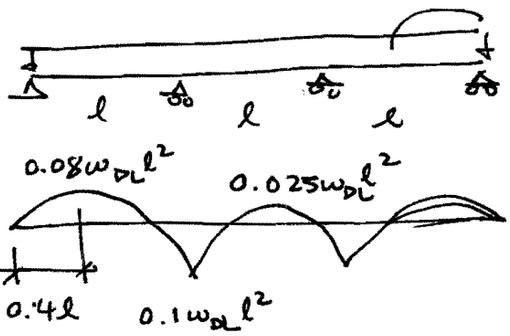
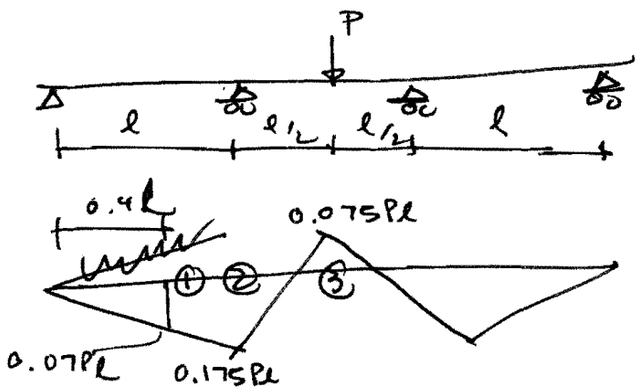
Julien

I am not sure if I understood your question. But I just guessed that you have a beam as shown



Then you place a concentrate force of P as shown



$M_① = 0.08 w_{DL} l^2 + 0.07Pl$

$M_② = 0.025 w_{DL} l^2 + 0.075Pl$

$M_③ = 0.1 w_{DL} l^2 + 0.175Pl$

The section modulus of the beam $S = \frac{I}{c} = \frac{124 \text{ in}^4}{5 \text{ in}} = 24.8 \text{ in}^3$

Given $F_y = 36$ ksi considering max capacity

Max resisting moment $M_{Rmax} = F_y S = 36 \times 10^3 \times 24.8$ [redacted] lb.in

Solving $M_① = M_{Rmax}$, $M_② = M_{Rmax}$, $M_③ = M_{Rmax}$ I do not get P = 60 kips [redacted].

I probably misunderstood the question but 80" = 6.7 m (Very long beam). NIPON