DTY TUTORING, inc.

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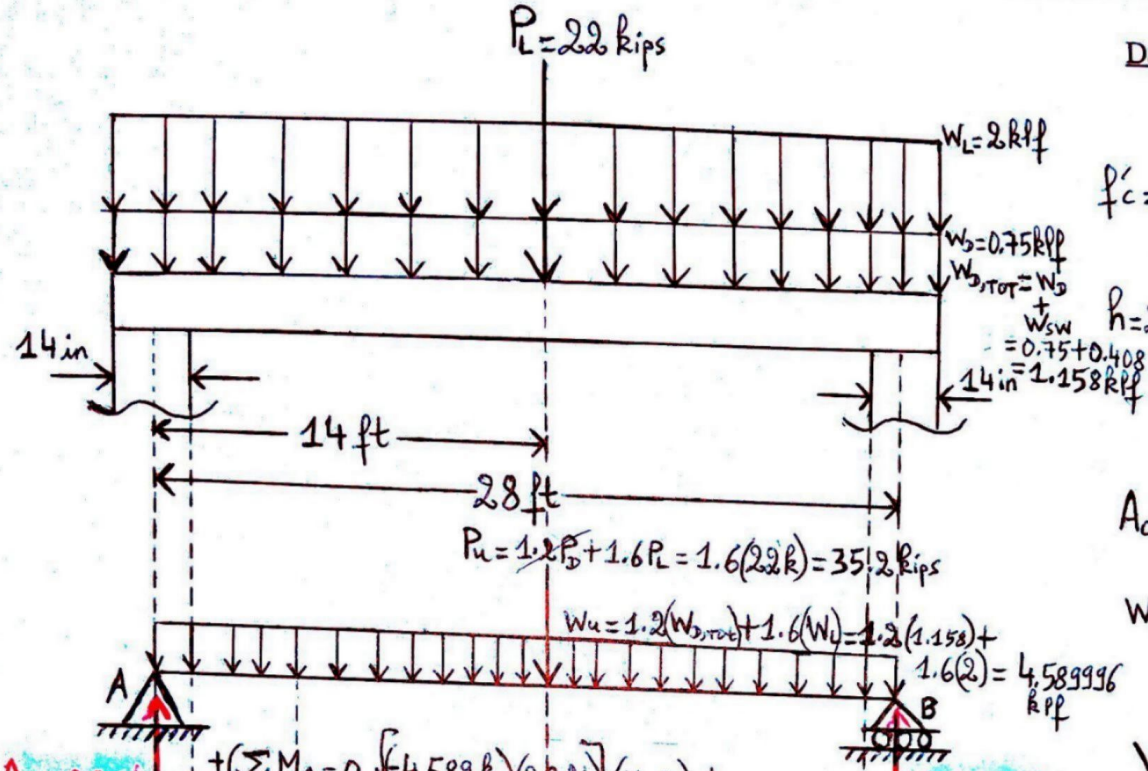
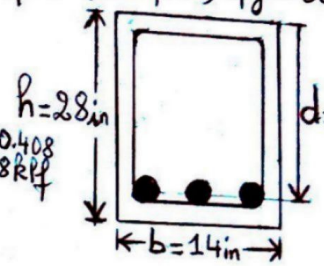
Date: 27th February 2020



Cross-section

$f'_c = 4{,}000$ psi ; $f_y = 60{,}000$ psi



$A_c = bh = \frac{(14in)(28in)}{(144 in^2/ft^2)} = 2.72 ft^2$

$w_{sw} = \gamma_c A_c = \left(0.150\frac{kips}{ft^3}\right)(2.72 ft^2) = 0.40833$ klf

$V_c = 2b_w d\sqrt{f'_c} = \frac{2(14in)(25in)\sqrt{4{,}000psi}}{1{,}000}$

$V_c = 44.3$ kips

$\phi V_c = (0.75)(44.3 kips) = 33.2$ kip.

$\frac{\phi V_c}{2} = \frac{33.2}{2} = 16.6$ kips

$V_{u@d} = 79.2$ kips $> \frac{\phi V_c}{2} = 16.61$

Therefore, stirrups are required.

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$$V_s = \frac{V_u @ d}{\phi} - V_c = \frac{69.6}{0.75} - 44.3 = 48.55471899 \text{ kips}$$

$$\phi V_s = (0.75)(48.55471899) = 36.4 \text{ kips}$$

$$A_b (\#3) = 0.11 \text{ in}^2$$

$$A_v (\text{2 legged stirrup}) = 2A_b = 2(0.11) = 0.22 \text{ in}^2$$

$$S_{req'd} = \frac{A_v f_y d}{V_s} = \frac{(0.22 \text{ in}^2)\left(60 \frac{\text{kips}}{\text{in}^2}\right)(25 \text{ in})}{48.55471899 \text{ kips}} = 6.796455765 \Rightarrow \text{use } 6 \text{ in}$$

$$4 b_w d \sqrt{f'c} = 4(14 \text{ in})(25 \text{ in})\sqrt{4{,}000 \text{ psi}} = 88{,}543.77 \text{ lbs} = 88.5 \text{ kips} > V_s$$

$$S_{MAX} = \text{MIN OF} \begin{cases} \frac{d}{2} = \frac{25}{2} = 12.5 \Rightarrow \text{use } 12 \text{ in} \\ 24 \text{ in} \end{cases}$$

$x_{req'd}$ for S_{MAX}

$$S_{MAX} = \frac{\phi A_v f_y d}{\phi V_{s\,req'd}}$$

$$12 \text{ in} = \frac{(0.75)(0.22 \text{ in}^2)\left(60 \frac{\text{kips}}{\text{in}^2}\right)(25 \text{ in})}{[(-4.589996x) + 45.97853085] \text{ kips}}$$

$$x_{req'd} = 5.523649879 \text{ ft} = 66.28379855 \text{ in from Face of support}$$

For $x < x_{req'd} \Rightarrow$ use $S_{req'd} = 6 \text{ in}$

For $x > x_{req'd} \Rightarrow$ use $S_{MAX} = 12 \text{ in}$

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Stirrup pattern sketch