Is Shear Reinforcement Required? $f_v > f_v'$

Solve for shear strength $f_v' = \phi 2\sqrt{f_c'}$

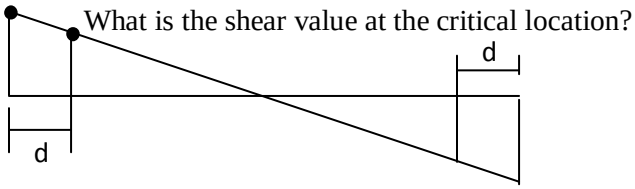
Where $\phi = 0.75$is the strength reduction factor for shear.

$f_v' =$

Critical shear occurs at d from the support

$V_u = 74{,}800lb$

What is the shear value at the critical location?



$$V_u = \frac{wL}{2} = \frac{4{,}400\frac{lb}{ft}34ft}{2} = 74{,}800lb$$

(factored shear force)

$$V_{due\ to\ distance\ d} = \frac{w2d}{2} = wd = \left(4{,}400\frac{lb}{ft}\right)(32in)\frac{1ft}{12in} = 11733.3lb$$

$$V_{critical} = \left(\frac{wL}{2}\right) - \left(\frac{w2d}{2}\right) = V_u - (wd) =$$

(shear force at critical location)

Find the shear strength at the critical depth d

$$f_v = \frac{V_{critical}}{bd} =$$

Shear reinforcement is required when the actual shear stress is greater than the shear strength provided by the concrete

$f_v > f_v'$

Find the overstress value

$\bar{V}=f_v - f_v'$

$\bar{V} =$

Code requires a minimum overstress value of 50psi as a safety provision,
Therefore:

Using Table 31.2 Find the maximum spacing of stirrups

$\bar{V} \leq 4\sqrt{f_v'}$

Therefore, use spacing of :

Find the Area of shear steel

$A_v = \frac{\bar{V}bs}{f_y}$

Where $\bar{V}$ is the overstress value, b is the beam width, s is the maximum spacing of stirrups, and $f_y$is the yield stress of steel.

The required cross-sectional area of the stirrup is:

$A_v =$

Therefore, the required steel bar has an area:

$A_{bar} = \frac{A_v}{2} =$

for a two leg stirrup.

However code requires minimum area of #3bar

Therefore, use:

Find the distance from support where stirrups are required.

Stirrups are required until:

$f_v < 0.5f_v'$
$f_v <$ _____

Find the length at which f_v is less than 47.45psi

$f_{v\ at\ l} = 0.5f_v'$
$\_\_\_\_\_ = 0.5f_v'$

$f_v = \frac{V_{critical}}{bd}$

$V_{critical} = \left(\frac{wL}{2}\right) - \left(\frac{w2d}{2}\right) = V_u - (wl) =$_____

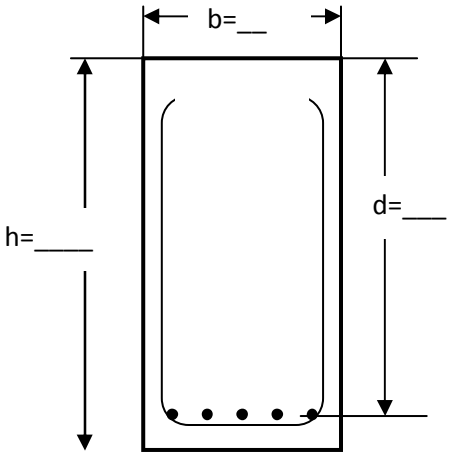
$f_v =$ _____

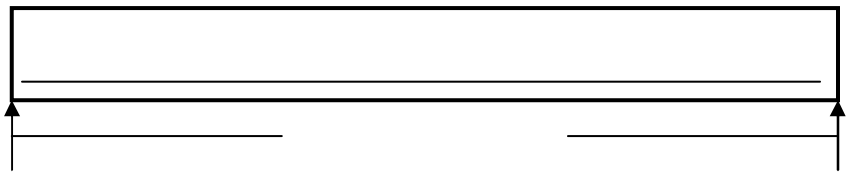
$l =$ _____

Spacing is ____in, therefore

Therefore, _____ stirrups at _____ will be needed from each end.

Cross Section





s =_____
on the ends s/2=____
_____

Total beam length = 34 ft

$34ft\frac{12in}{1ft} = 408in$
$408in - \_\_\_\_ - \_\_\_\_\_ = \_\_\_\_\_$