PROB # 8.8

$\lambda = 1.0$ (normal wt.)

$$\phi V_m = \phi V_c + \phi V_s$$

$$\phi V_c = \phi 2 \lambda \sqrt{f'_c}\, b_w d$$

$$= (.75)(2)(1.0)(\sqrt{4000})(12)(25)$$

$$= 28,460 \text{ lbs}$$

$$\phi V_s = \phi A_v f_y \frac{d}{s}$$

$$= (0.75)(2 \times 0.11)(60,000)\left(\frac{25}{10}\right)$$

$$= 24,750 \text{ lbs}$$

$$\phi V_m = 28,460 + 24,750 = \boxed{53,210 \text{ lbs}}$$

vgcm

PROB # 8.9

$$\phi V_m = \phi V_c + \phi V_s$$

$$\phi V_c = \phi 2 \lambda \sqrt{f'_c}\, b_w d$$

$$= (.75)(2)(1.0)(\sqrt{4000})(5)(31)$$

$$= 14,705 \text{ lbs}$$

$$\phi V_s = \phi A_v f_y \frac{d}{s}$$

$$= (0.75)(0.20)(60,000)\left(\frac{31}{8}\right)$$

$$= 34,875 \text{ lbs}$$

$$\phi V_m = 14,705 + 34,875$$

$$= 49,580 \text{ lb}$$

Since $\phi V_s > 4\phi\sqrt{f'_c}\, b_w d = (4)(.75)(\sqrt{4000})(5)(31) = 29,409\ lb$, s must be $\leq d/4$ $= \frac{31}{4} = 7.75''$ instead of d/2 (Code 11.4.5.3). Since s is given, then limit ϕV_s to 29,408 lb. Hence, $\phi V_n =$ 14,705 + 29,408 = 44,113 lb.

PROB # 8.12 (1) $\lambda = 1.0$

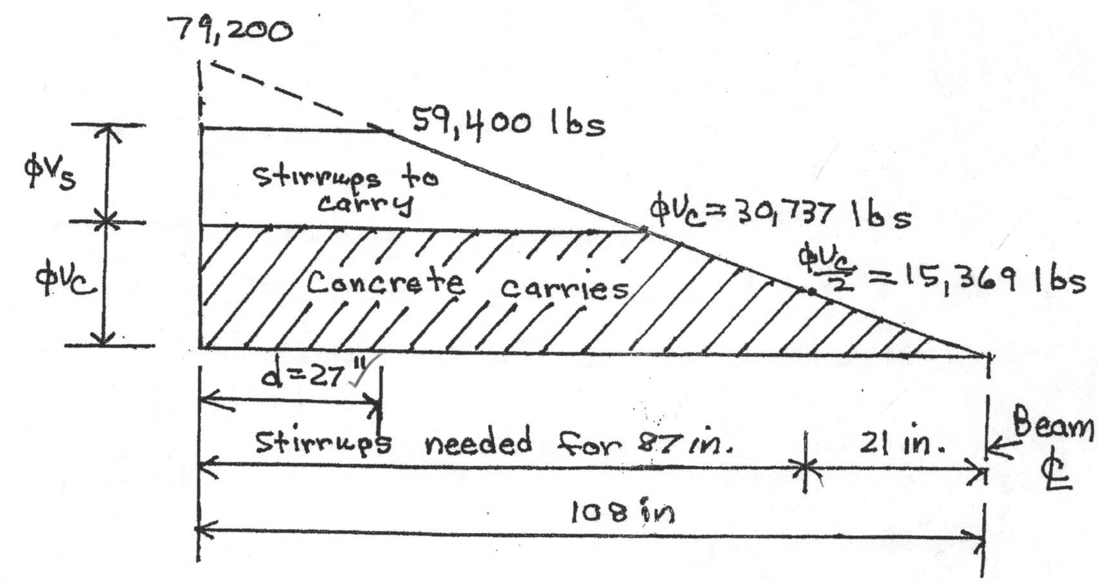
$$\phi V_c = (0.75)(2)(1.0)\sqrt{4000}\,(12)(27) = 30{,}737 \text{ lbs}$$

$$\tfrac{1}{2}\phi V_c = 15{,}369 \text{ lbs}$$

Drawing shear diagram

$$w_u = (1.2)(2) + (1.6)(4) = 8.8\,k/ft$$

$$V_u \text{ @ end} = (9)(8.8) = 79.2\,k$$



For end 27 in.

$$V_u = \phi V_c + \phi V_s$$

$$\phi V_s = V_u - \phi V_c = 59{,}400 - 30{,}737 = 28{,}663 \text{ lbs}$$

$$V_s = \frac{28{,}663}{0.75} = 38{,}217 \text{ lbs}$$

Maximum spacing of stirrups $= \frac{27}{2} = 13.5$ in.

since $V_s < 4\sqrt{f'_c}\,b_w d = (4\sqrt{4000})(12)(27)$

$$= 81{,}966 \text{ lbs}$$

$$s = \frac{A_v f_y d}{V_s} = \frac{(2 \times 0.11)(60{,}000)(27)}{38{,}217} = 9.33 \text{ in.}$$

PROB# 8.12 (2)

Maximum s to provide min A_v of stirrups

$$s = \frac{A_v f_y}{50\, b_w} = \frac{(2)(0.11)(60{,}000)}{(50)(12)} = 22 \text{ in.} > 13.5 \text{ in.}$$

$$s = \frac{A_v f_y}{0.75\sqrt{f'_c}\, b_w} = \frac{(2)(0.11)(60000)}{0.75\sqrt{4000}(12)} = 23.19 \text{ in.} > 13.5 \text{ in.}$$

THEOR. SPACINGS

Distance from face of support	$V_s = \frac{V_u - \phi V_c}{\phi}$	Theoretical spacing $s = \frac{A_v f_y d}{V_s}$
0 to d = 2.25 ft	38,217#	9.33 in.
@ 3 ft	29,417#	12.12 in.
@ 4 ft	17,684#	~~20.15~~ max = 13.5 in.

Spacings selected

1 @ 4 in. = 4 in.
4 @ 9 in. = 36 in.
4 @ 12 in. = 48 in.

88 in. symmetric about ℄

✓ JCMc

PROB #8.14 (1)

$w_u = (1.2)(4) = 4.8 \text{ k/ft}$

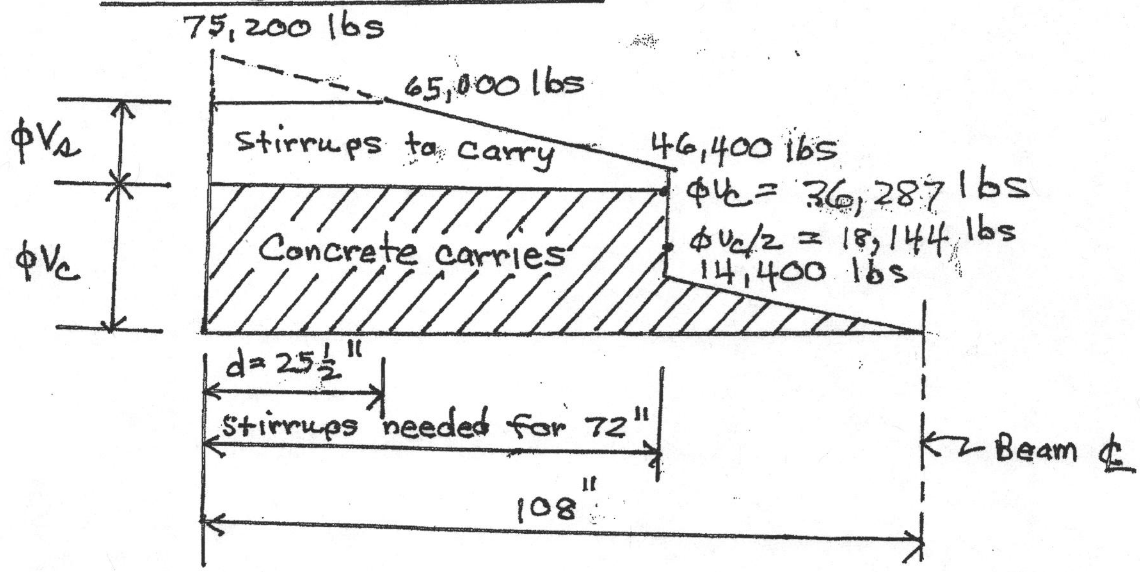
$P_u = (1.6)(20) = 32 \text{ k}$

V_u @ beam end $= (9)(4.8) + 32 = 75.2 \text{ k}$

$\phi V_c = (0.75)(2\sqrt{4000})(15)(25.5) = 36{,}287$ lbs

$\frac{\phi V_c}{2} = 18{,}144$ lbs

Drawing shear diagram



Assuming #3 ⊔ stirrups

$V_u = \phi V_c + \phi V_s$

$V_s = \frac{V_u - \phi V_c}{\phi} = \frac{65{,}000 - 36{,}287}{0.75} = 38{,}284$ lbs

(a) Theoretical s for left 25.5 in

$s = \frac{A_v f_y d}{V_s} = \frac{(2)(0.11)(60{,}000)(25.5)}{38{,}284} = 8.79$ in.

PROB # 8.14 (2)

(b) Max s to provide min A_v of stirrups

$$s = \frac{(2)(0.11)(60{,}000)}{(50)(15)} = 17.6 \text{ in. or } \frac{(0.22)(60{,}000)}{(0.75\sqrt{4000})(15)} = 18.6 \text{ in.}$$

(c) max $s = \frac{d}{2} = \frac{25.5}{2} = 12.75$ in. since V_s which equals 38,284 lbs is less than $(4\sqrt{4000})(15)(25.5) = 96{,}766$ lbs

Theoretical spacings

Distance from face of support	$V_s = \frac{V_u - \phi V_c}{\phi}$	Theoretical spacing $s = \frac{A_v f_y d}{V_s}$
0 to d = 2.125 ft	38,284 lbs	8.79 in
@ 3.00 ft	32,684	10.30
@ 4.00 ft	26,284	~~12.81~~ max = 12.75

USE #3 ⊔ stirrups as follows

1 @ 3 in. = 3 in.
5 @ 9 in. = 45 in.
2 @ 12 in. = 24 in.
72 in.

Symmetric about beam ℄

√ J C Mc

PROB# 8.16 (1)

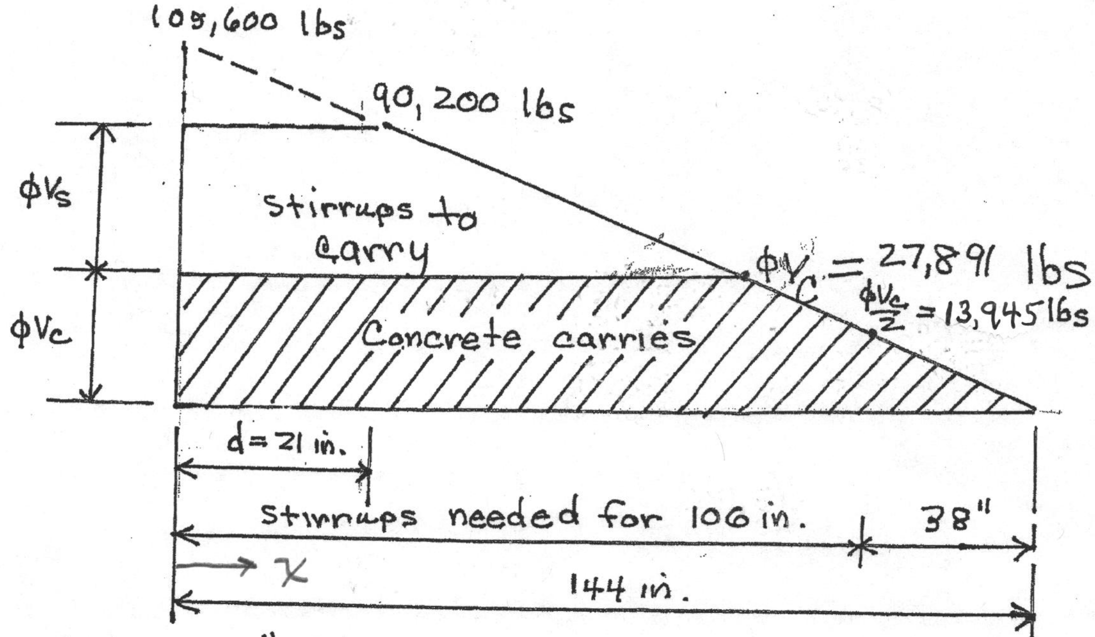
$w_u = (1.2)(2) + (1.6)(4) = 8.8\ k/ft$

V_u @ left end $= (12)(8.8) = 105.6\ k$

$\phi V_c = (0.75)(2\sqrt{4000})(14)(21) = 27{,}891\ lbs$

$\frac{\phi V_c}{2} = 13{,}946\ lbs$

Drawing shear diagram



Assume #4 ⊓ stirrups

$V_u = \phi V_c + \phi V_s$

$V_s = \frac{V_u - \phi V_c}{\phi} = \frac{90{,}200 - 27{,}891}{0.75} = 83{,}079\ lbs$

(a) Theoretical s for left 21 in.

$s = \frac{A_v f_y d}{V_s} = \frac{(2)(0.2)(60{,}000)(21)}{83{,}079} = 6.07\ in.$

PROB# 8.16 (2)

(b) Max s to provide min A_v of stirrups

$$s = \frac{(2)(0.2)(60{,}000)}{(0.75)(\sqrt{4000})(14)} = 36.1 \text{ in}, > \frac{(2)(0.2)(60{,}000)}{(50)(14)} = \quad \text{in}$$

(c) $\max s = \frac{d}{4} = \frac{21}{4} = 5.25$ in. since

$V_s = 83{,}079$ lbs $> (4\sqrt{4000})(14)(21) = 74{,}377$ lbs

and $< (8\sqrt{4000})(14)(21) = 148{,}754$ lbs

Solve for the value of x when $V_s = 74{,}377$

$$V_u = \phi V_c + \phi V_s = 27{,}891 + .75(74{,}377)$$
$$= 83673.75 \text{ lb}$$

$$x = \frac{105.6 - 83.67375}{8.8} = 2.49 \text{ ft} = 29.9 \text{ in}$$

for $x > 29.9$ in, S_{max} changes from $\frac{d}{4}$ to $\frac{d}{2}$

At what value of x can $S = 8$ in. be used?

$$V_s = \frac{A_v f_y d}{s} = \frac{(.4)(60{,}000)(21)}{8} = 63{,}000 \text{ lb}$$

$$V_u = \phi V_s + \phi V_c = .75(63{,}000) + .75(37{,}188) =$$
$$= 75{,}141 \text{ lb}$$

$$x = \frac{105.6 - 75.141}{8.8} = 3.46 \text{ ft} = 41.5 \text{ in.}$$

At what value of x can $S_{max} = d/2 = \cancel{10}.5$" be used? (10")

Using analysis as for $s = 8$", $V_u = 65{,}691$ lb.

$x = 54.4$ in.

#4 ⊓ stirrups		cumulative
1 @ 3"	= 3"	3"
8 @ 5"	= 40	43 > 41.5"
2 @ 8"	= 16	59 > 54.4"
5 @ 10"	= 50	109 > 106"

From support