



THEORY

MAX MOMENT

$$M_t = \frac{PY}{3} \left(\frac{Y}{2} + \frac{D}{2} - \frac{3Y}{16} \right)$$

$$= \frac{PY}{3} \left(\frac{5Y}{16} + \frac{D}{2} \right)$$

FORCE

$$\frac{X}{C} = \tan(45 - \frac{\phi}{2}) \therefore C = \frac{X}{\tan(45 - \frac{\phi}{2})}$$

NATIVE SOIL $\phi = 20^\circ$ $C = 100$ PSF
 $\gamma =$ SOIL UNIT WEIGHT = 125 PCF

$$F = \gamma X [\tan^2(45 - \frac{\phi}{2})] - 2c \tan(45 - \frac{\phi}{2})$$

$$F = (\gamma X - 2c) \tan(45 - \frac{\phi}{2})$$

STRESSES

LOADS & SPANS

$$8'-0" = 0'-4" = 7'-8" = 7.67 \text{ FT}$$

$$D = 2'-0" \text{ (DRILL)} \quad Y = 7.67 - 2.00 = 5.67 \text{ FT}$$

$$X = Y/2 = 2.84 \text{ FT}$$

NATIVE SOIL BACKFILL

$$P = [125(2.84) - 2(100)] \tan 45 - \frac{20}{2} = 109 \text{ LBS}$$

BENDING

$$M = \frac{(109)(5.67)}{3} \left[\frac{5(5.67)}{16} + \frac{2.00}{2} \right] = 571 \text{ FT-LB}$$

LAGGING SIZE

$$S_{REQ'D} = \frac{571(12)}{800} = 8.6 \text{ IN}^3$$

3x12 ROUGH ($F_b = 800$ PSI MIN)

$$S = \frac{bd^2}{6} = \frac{12(3)^2}{6} = 18.0 \text{ IN}^3 \quad \text{OK}$$

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SOLDIER BEAM LAGGING