

PROJECT: Esco. Pipe x-ing
Pedestrian Bridge

DESIGN
BY: T.N.

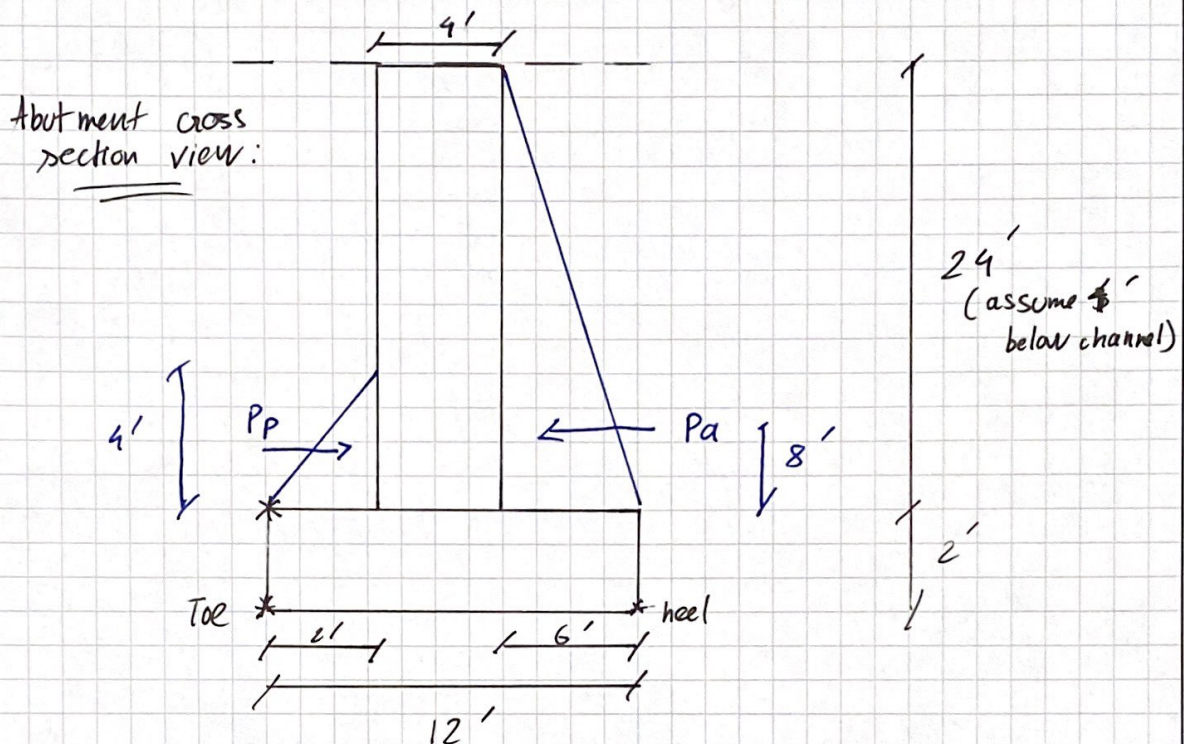
REVIEW
BY:

SHEET NO.

NOTE:
Abutment/Retaining Wall Design

DATE:
04/15/2020

1



$$\gamma_{\text{at rest}} = 60 \text{ pcf}$$

$$\gamma_p = 300 \text{ pcf}$$

$$P_a = \frac{1}{2} (60) (24)^2 = 17,280 \text{ lb/foot of wall}$$

$$P_p = \frac{1}{2} (300) (4)^2 = 2400 \text{ lb}$$

Overturning Moment:

$$\text{O.T.M.} = 17,280 (8') = 138,240 \text{ ft} \cdot \text{lb} \approx 138 \text{ k} \cdot \text{ft}$$



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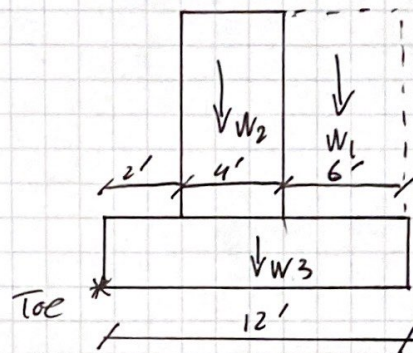
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Righting Moment (Taken about Toe) :

FBD



- Concrete wt = 150 pcf
- Assume soil wt = 110 pcf
- Design Per foot of wall

$$W_1 = 110 (6' \times 24') = 15840 \text{ lb}$$

$$W_2 = 150 (4' \times 24') = 14400 \text{ lb}$$

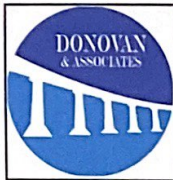
$$W_3 = 150 (2' \times 12') = 3600 \text{ lb}$$

$$\text{Total Righting Moment} = (15840 \times 9') + (14400 \times 4') + (3600 \times 6')$$

$$\text{Total Righting Moment} = 221760 \text{ lb}\cdot\text{ft} \approx 222 \text{ k}\cdot\text{ft}$$

$$\begin{array}{l} \text{Righting Moment} \\ (222 \text{ k}\cdot\text{ft}) \end{array} > \begin{array}{l} \text{Overturning Moment} \\ (138 \text{ k}\cdot\text{ft}) \end{array} \quad \underline{\underline{\text{OK}}}$$

$$\text{F.S.} = \frac{222}{138} \approx 2.0 \quad \underline{\underline{\text{OK}}}$$



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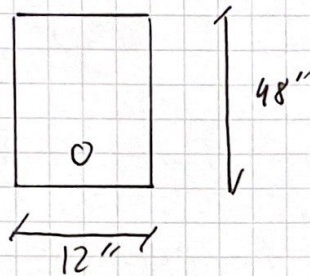
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Wall Vertical Reinforcement (stem reinf)

- Assume #8 @ 6" O.C ($A_s = 1.57 \text{ in}^2$)



$$d = 48 - 3 \text{ cover} - 0.5''$$

$$d = 44.5''$$

$$f_y = 60 \text{ ksi}$$

$$f_c = 4 \text{ ksi}$$

$$a = \frac{1.57(60 \text{ ksi})}{0.85(4 \text{ ksi})(12'')} = 2.31''$$

$$\phi M_n = 0.9 \left[1.57(60) \left(44.5'' - \frac{2.31''}{2} \right) \right]$$

$$\phi M_n = 4084 \text{ K}\cdot\text{in} \approx 340 \text{ K}\cdot\text{ft}$$

$$\phi M_n > M_u \quad \underline{\underline{OK}}$$

(340 K-ft) (222 K-ft)

$$\text{Minimum Reinforcement} = 0.0018(12)(12) = 0.3 \text{ in}^2$$

$\Rightarrow$ - Use #8 @ 6" O.C. for vertical reinforcement

- Use #6 @ 12" O.C. for transverse reinforcement



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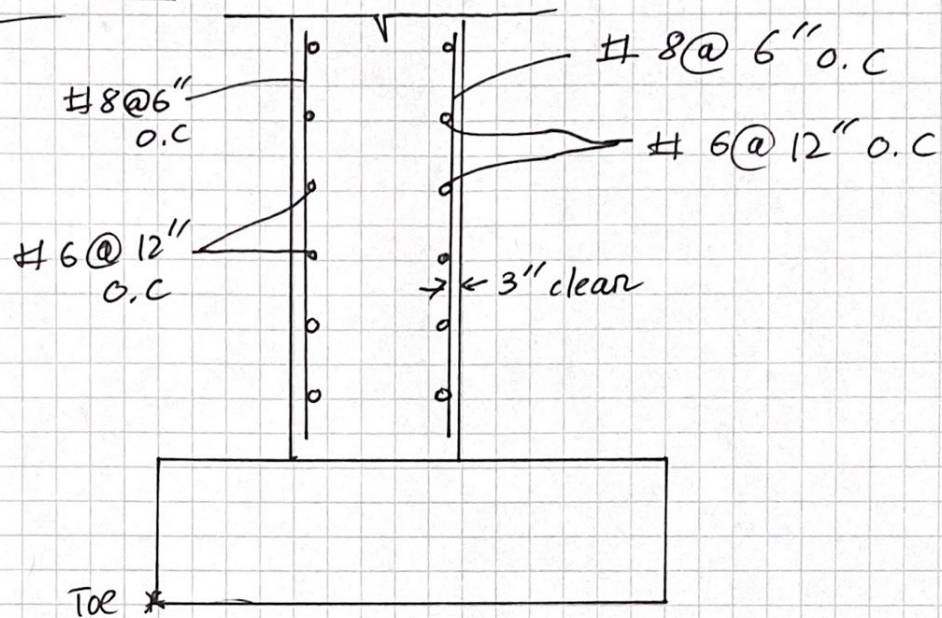
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Reinforcement Detail:



Wall Section