



PROJECT: Esco. Pipe X-ing
Pedestrian Bridge

DESIGN
BY: T. N.

REVIEW
BY:

SHEET NO.

NOTE:
Footing Design

DATE: 04/21/2020

1

Design of heel

$$V_u = 1.2(24')(6')(110) + 1.2(6')(2')(150)$$

$$V_u = 22,752 \text{ lb}$$

$$\phi V_c = 0.75(2\sqrt{4000})(12'')(24'') = 27,322 \text{ lb}$$

$$\phi V_c > V_u$$

OK to use 24" $\approx$ 2' depth footing

M_u @ face of stem:

$$22,752\left(\frac{6'}{2}\right) = 68,256 \text{ lb} \cdot \text{ft} \approx 68 \text{ k} \cdot \text{ft}$$

Assume #8 @ 9" O.C. ($A_s = 1.05 \text{ in}^2/\text{ft}$ of footing)

$$d = 24'' - 3'' \text{ cover} - 0.5'' = 20.5''$$

$$a = \frac{1.05(60)}{0.85(4)(12'')} = 1.54''$$

$$\phi M_n = 0.9 \left[1.05(60) \left(20.5'' - \frac{1.54''}{2} \right) \right] = 1090 \text{ k} \cdot \text{in}$$

$$\phi M_n = 91 \text{ k} \cdot \text{ft}$$

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

* Use #8 @ 9" O.C. for top bar in heel and main reinforcement.

$$A_{s \text{ min}} = 0.0018(12'')(20.5'') \approx 0.432 \text{ in}^2$$

* Use #16 @ 12" O.C. for temp. steel reinf.



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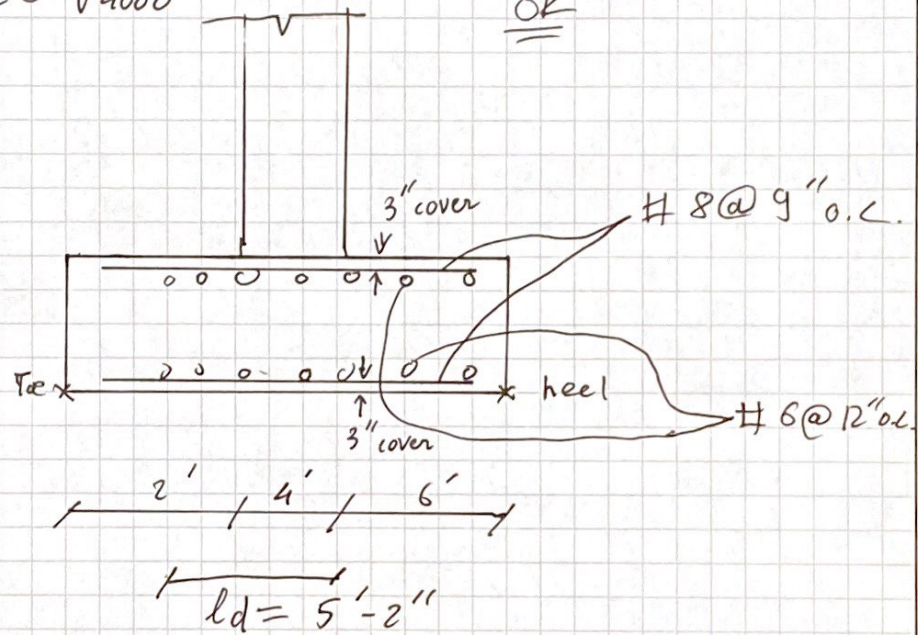
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Design of heel:

$$l_d = \frac{60,000 (1.3)}{20 \sqrt{4000}} (1) = 62'' < 72'' \text{ available}$$

OK





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Soil Pressure under Heel and Toe:

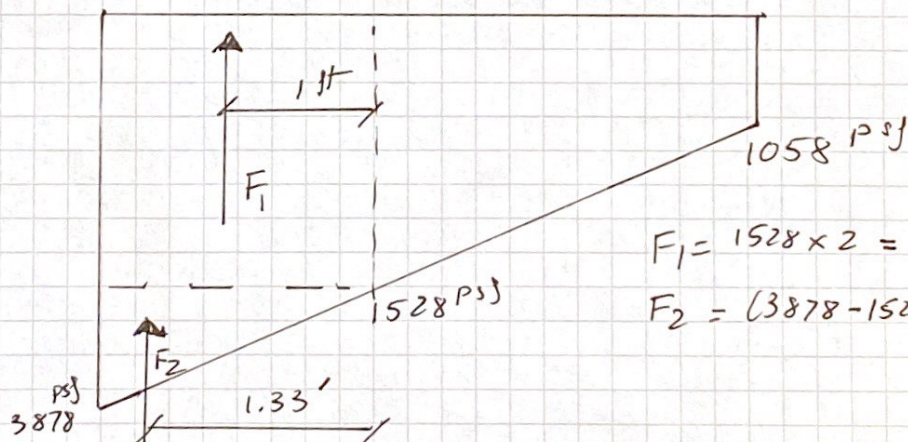
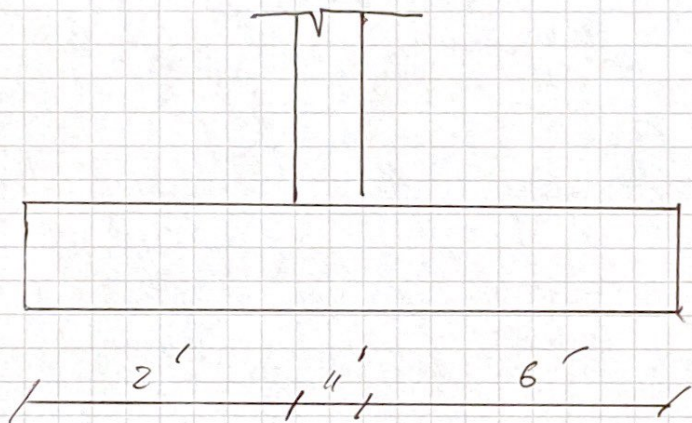
$$A = 2 \times 12 = 24 \text{ ft}^2$$

$$I = \frac{12^3(2)}{12} = 288 \text{ ft}^4$$

$$\left\{ \begin{array}{l} \text{Distance} = \frac{222 \text{ K} \cdot \text{ft} - 138 \text{ K} \cdot \text{ft}}{34 \text{ K}} \\ = 2.5 \text{ ft} \end{array} \right.$$

$$f_{\text{toe}} = -\frac{33840}{24} - \frac{33840(6' - 2.5')(6')}{288} = -3878 \text{ psf}$$

$$f_{\text{heel}} = -\frac{33840}{24} + \frac{33840(6' - 2.5')(6')}{288} = -1058 \text{ psf}$$



$$F_1 = 1528 \times 2 = 3056 \text{ lb}$$

$$F_2 = (3878 - 1528) \times 2 = 4699 \text{ lb}$$



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Design of Toe :

$$M_u @ \text{face of stem} = 3056(1) + 4694(1.33) \\ = 9299 \text{ lb}\cdot\text{ft} \approx 9.3 \text{ K}\cdot\text{ft}$$

$\Rightarrow$ Use same reinforcement as heel.

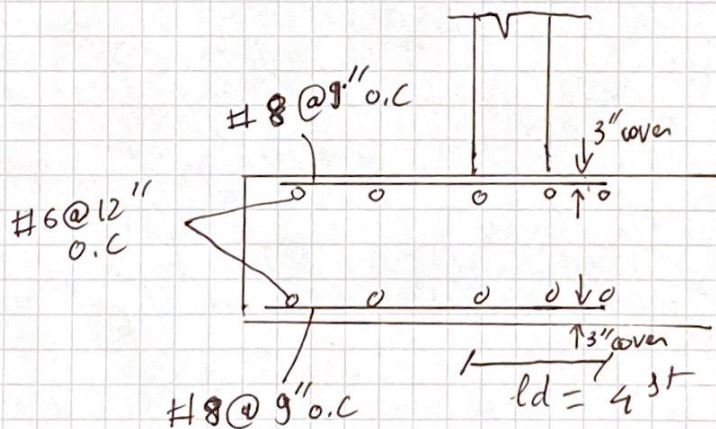
Main reinf : $\#8 @ 9'' \text{ o.c}$

Temp reinf : $\#6 @ 12'' \text{ o.c}$

$$l_d = \frac{60,000(1)}{20\sqrt{4000}}(1) = 47'' < 120'' \text{ available} \\ \underline{\underline{\text{OK}}}$$

l_d for vertical bar in stem: 90° hook

$$l_{dn} = \frac{0.02(60,000)(1'')}{\sqrt{4000}} = 19'' < 24'' \text{ available} \\ \underline{\underline{\text{OK}}}$$



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Reinforcement Detail

