Given:

SDL = 11psf
LL = 47 psf
Column $\emptyset$ = 12.75" = C
Column weight = 65.48 lb/ft
Column height = 53'

wind positive = 1.9 psf
wind negative = -2.12 psf → governs ⇒ wind = 2.12 psf
Tw = 9'
TL = 16'
f_y = 36ksi
f'c = 4ksi

$$P_u = P_D + P_L = 1.2(65.48\,lb/ft \times 53' + 11psf \times 9' \times 16') + 1.6(47psf \times 9' \times 16')$$

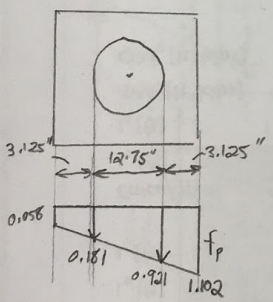
$$P_u = 16,894.13\,lb = 16,894\,kips$$

$$M_u = \frac{w_{wind} L^2}{8} = \frac{[2.12psf(12.75''/12in/ft)] \times 53'^2}{8} = 790.91\,lb\text{-}ft = 0.791\,ft\text{-}kip$$

$$e = \frac{M_u}{P_u} = \frac{(0.791\,ft\text{-}kip)(12\,in/ft)}{16.894\,kip} = 0.562\,inches$$

TRY 19" X 19" plate

$$f = -\frac{P_u}{A} \pm \frac{P_u e c}{I} = -\frac{16,894K}{(19")(19")} \pm \frac{(16.894K)(0.562")(12.75")}{\frac{1}{12}(19")(19")^3} = -0.047 \pm 0.011 \begin{cases} -0.058ksi \leftarrow \\ -0.036ksi \end{cases}$$



$$M_u = (0.921ksi)(3.125")\left(\frac{3.125"}{2}\right) + (1.102ksi - 0.921ksi)(3.125")\left(\frac{2}{3} \times 3.125"\right)$$

$$M_u = 5.675\,in\text{-}kip$$

$$m = \frac{19 - 0.8(12.75)}{2} = 4.4", \quad \text{avg. } f_p = \frac{1.102 + 0.058}{2} = 0.58ksi$$

$$M_{u,trans} = 0.58(4.4)\left(\frac{4.4}{2}\right) = 5.614\,in\text{-}kip < 5.675\,in\text{-}kip \checkmark$$

$$t = \sqrt{\frac{6M_u}{\emptyset_b F_y}} = \sqrt{\frac{6(5.38\,in\text{-}kip)}{0.9(36ksi)}} = 0.998in$$

Baseplate Design for Columns A6 & D6 Appendix E

Given:

SDL = 11psf

LL = 47psf

column ϕ = c = 12.75"

column weight = 65.48 lb/ft

column height = 53'

wind positive = 1.9psf

wind negative = -2.12psf → governs ⇒ wind = 2.12psf

TW = 21'

TL = 16'

Fy = 36ksi

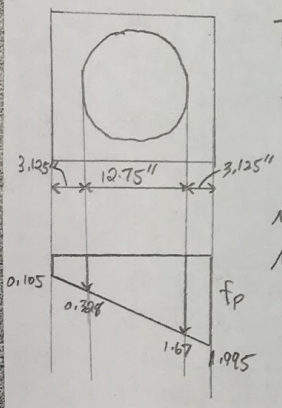
f'c = 4ksi

$P_U = P_D + P_L = 1.2(65.48\,lb/ft \times 53' + 11psf \times 21' \times 16') + 1.6(47psf \times 21' \times 16')$

$P_U = 33,886.928\,lb = 33.87\,kips$

$M_U = \frac{W_{wind} L^2}{8} = \frac{[2.12psf \times (12.75"/12in/ft)] \times 53'^2}{8} = 790.911\,lb\text{-}ft = 0.791\,ft\text{-}kip$

$e = \frac{M_U}{P_U} = \frac{(0.791\,ft\text{-}kip)(12\,in/ft)}{33.87\,kips} = 0.28\,inches$



TRY 19" X 19" PLATE

$f = -\frac{P_U}{A} \pm \frac{P_U e c}{I} = \frac{-33.87k}{(19")(19")} \pm \frac{(33.87k)(0.28")(12.75")}{\frac{1}{12}(19")(19")^3} = -0.094 \pm 0.011 \begin{cases} -0.105ksi \leftarrow \\ -0.083ksi \end{cases}$

$M_U = (1.67ksi)(3.125")\left(\frac{3.125"}{2}\right) + (1.995ksi - 1.67ksi)(3.125")\left(\frac{2}{3} \times 3.125"\right)$

$M_U = 10.27\,in\text{-}kip$

$n = \frac{19 - 0.8(12.75)}{2} = 4.4in$ avg $f_p = \frac{0.105 + 1.995}{2} = 1.05ksi$

$M_U = 1.05(4.4)\left(\frac{4.4}{2}\right) = 10.164\,in\text{-}kip < 10.27\,in\text{-}kip$ ✓

$t = \sqrt{\frac{6M_U}{\phi_b f_y}} = \sqrt{\frac{6(10.27in\text{-}kip)}{0.9(36ksi)}} = 1.37inches$

Baseplate Design for Columns B6 & C6 Appendix E