Assignment #11

A. Replace the SCBF LFRS with a BRBF LFRS in Assignment #7. Using the Forces/BRBF that are given, Find

1. Brace Core Area A_{sc} at each story.
2. Required sizes of columns using W14.
3. Forces between columns & foundations

B. Assuming that the SCBF forces at the foundation are:

$$P_u = 3192^K$$

$$T_u = 3090^K$$

and the column is a W14 x 311, design the base connection with 6 anchor rods, and $f'_c = 4000$ psi. Footing is large enough that $A_2/A_1 > 4$

Assignment #11 Buckling Restained Braced Frame

Story	hx	L brace (1)		Fx	Vx	Pu/brace	Req'd Asc	Asc	T	C	PE(C)/story	PE(T)/story
Roof	15.0	18.0		231.6	231.6	144.8	4.23245614	4.5	254.6	331.0	0.0	0.0
5th	15.0	18.0		174.2	405.7	253.6	7.41410819	7.5	424.4	551.7	453.2	594.1
4th	15.0	18.0		125.7	531.5	332.2	9.7130848	10.0	565.8	735.5	0.0	0.0
3rd	15.0	18.0		79.4	610.9	381.8	11.1641082	11.5	650.7	845.9	831.7	847.0
2nd	15.0	18.0		36.2	647.2	404.5	11.8274854	12.0	679.0	882.6	0.0	0.0
											529.6	407.4

Ry =	1	ϕ =	0.9
Fymin =	38		
Fymax =	46		
β =	1.3		
ω =	1.23		

Asc = Pu/2/ϕ/Fymin
T= ω RyFymax Asc
C = βω RyFymax Asc

Story	PE (Comp)	PE (Tension)	P(D)	R*P(L)	PU (Comp)	PU (Tens)	Column	ϕPn
Roof	0.0	0.0	98.4	14.4	159.7	54.1	W14x43	292.0
5th	453.2	594.1	207.6	39.5	794.7	-479.9	W14x90	1000.0
4th	453.2	594.1	316.8	57.6	973.0	-419.9	W14x90	1000.0
3rd	1284.9	1441.1	426.0	81.6	1986.0	-1206.8	W14x176	2010.0
2nd	1284.9	1441.1	535.2	105.6	2167.3	-1146.7	W14x193	2210.0
Foundation	1814.5	1848.5	535.2	105.6	2696.9	-1554.1		

PU (Comp) = 1.55 P(D) + 0.5 P(L) +PE (Comp)
PU (Tens) = 0.55 P(D) - PE(Tens)

P (foundations) = P(D) + P(L) + PE 2455.3 Down
P (foundations) =).55 * P(D) - PE -1554.1

Assignment #11

B. $T_u = 3090^{k}$

$$\Sigma A_{rods} = \frac{T_u}{\phi F_y} = \frac{3090}{0.9 \times 58} = 59.2^{\square''}$$

$$A_s/rod = 59.2/6 = 9.87^{\square''} = \pi r^2 \Rightarrow r = 1.77^{''}$$

use $\underline{6 - 4'' \phi \text{ A449 rods}}$

$$P_u = 3192^{k} = \phi (0.85 f'_c A_1) \sqrt{\frac{A_2}{A_1}}$$

$$= 0.7 (0.85 \times 4 A_1) 2$$

$A_1 = 670^{\square''}$ (Net Area)

$A_1 (gross) = 670 + 6 \times \pi (2.125)^2 = 755^{\square''}$

$\underline{28 \times 28 \text{ Plate}}$

Column W14 x 311 $d = 17.12''$ $b_f = 16.23''$

$$m = \frac{28 - 0.95 \times 17.12}{2} = 5.868$$

$$n = \frac{28 - 0.8 \times 16.23}{2} = 7.508$$

$$n' = \frac{\sqrt{17.12 \times 16.23}}{4} = 4.167$$

$\phi f_b = 0.7 (0.85 \times 4) 2 = 4.76 ksi$

$\phi P_p = 4.76 \times 28 \times 28 = 3731.8^{k}$

$$X = \left[\frac{4 \times 17.12 \times 16.23}{(17.12 + 16.23)^2} \right] \frac{3192}{3731.8} = 0.855$$

$$\lambda = \frac{2\sqrt{0.855}}{1 + \sqrt{1 - 0.855}} = 1.34$$

$\lambda n' = 1.34 \times 4.167 = 5.58 \Rightarrow \ell = 5.58$

$$t_{min} = 5.58 \sqrt{\frac{2 \times 3192}{0.9 \times 50 \times 28 \times 28}} = 2.37''$$

Use $28 \times 28 \times 2\frac{1}{2}''$ plate