

Find max axial force: $M=0$ stand. Spec. 8.16.4.2.1

$\Phi P_o = \Phi[0.85f'_c(A_g - A_{st}) + A_{st}f_y]$

$A_g = 1017.9 \text{ in}^2$
 $A_{st} = 8.8 \text{ in}^2$

$\Phi P_o = 3101.1 \text{ kip}$ $M_n = 0$

Find axial and moment capacity at balanced strain condition: Stand. Spec 8.16.4.2.3

$\Phi P_b = \Phi[0.85f'_c b a_b + A_s' f_s + A_s f_y]$

$\Phi M_b = \Phi[0.85f'_c b a_b (d - d'/2) + A_s' f_s (d - d') + A_s f_y d']$

$d = 26.40 \text{ (in)}$ dist from extreme compression fiber to centroid of tension steel
 $d' = 9.60 \text{ (in)}$ dist from extreme compression fiber to centroid of comp. steel
 $d'' = 8.40 \text{ (in)}$ dist from centroid of gross section to centroid of tension steel

$a_b = 14.06 \text{ in}$
 $\beta_1 = 0.9$
 $f_s = 33.57 \text{ ksi}$
 $b = 35.13 \text{ in}$
 $A_s' = 3.96 \text{ in}^2$ $A_s = 3.96 \text{ in}^2$

$\Phi P_b = 1155.10 \text{ kip}$
 $\Phi M_b = 16931.00 \text{ in-kip} = 1410.92 \text{ ft-kip}$

Find Moment Capacity of Section: $P=0$ Note: neglect compression steel

$c = 5.89 \text{ (in)}$ with a % error of 0.05% OK
 $b = 25.51$
 $\theta = 50.24$

Reinforcement Ratio: Used to check if $f_s = f_y$
 $\rho = 0.00588$
 $\rho_b = 0.022638$

$\Phi M_n = A_s f_y (d - a/2) = 5643.78 \text{ in-kip} = 470.31 \text{ ft-kip}$ $P_n = 0$ is $\rho < 0.75\rho_b$? OK

Determine if section is adequate for loads applied

$M_u = 167.26495 \text{ ft-kips}$
 $P_u = 4.3608873 \text{ kips}$

Points for interaction diagram: Note: points are connected with straight lines

Article 8.15.4 Stand. Spec: The combined flexural and axial load capacity of compression members shall be taken as 35% of that from 8.16.4

	P	M
1	1085.4	0
2	404.29	493.82
3	0	164.61
4	4.3608873	167.265

Point 4 is from actual loads

Linear Interpolation Program #1 (upper line)
 Are you in upper region? No

	P_u	M_u
Value Below	1085.40	0.00
Value at desired Loc.	4.36	$x = 793.774$ Max
Value Above	404.29	493.82

Linear Interpolation Program #2 (lower line)
 Are you in lower region? Yes

	P_u	M_u
Value Below	404.29	493.82
Value at desired Loc.	4.36	$x = 168.161$ Max
Value Above	0.00	164.61