- for column DE :

$\beta_d = \frac{1.4 \times 50}{93.8} = 0.746$

$\Rightarrow EI = \frac{4 \times 10^9}{1 + 0.746} = 2.29 \times 10^9$ lb-in²

$\Rightarrow P_c = \frac{\pi^2 \times 2.29 \times 10^9}{(0.7 l \times 22 \times 12)^2} = 643295.74$ lb $= 643$ kips

$C_m = 0.6 + 0.4(0.75) = 0.9 > 0.4$ ok

$P_u = 93.8$ kips

$\delta_{ns} = \frac{0.9}{1 - \frac{93.8}{0.75 \times 643}} = 1.12$

$\Rightarrow M_c = 1.12 \times 78.1 = 87.5$ ft-kip (explain)

and design column DE for $P_u = 93.8$ k
$M_u = M_c = 87.5$ ft-kip

check minimum eccentricity
$e = 1.02''$
$\Rightarrow M_{min} = 93.8 \times 1.02/12 \cong 8$ ft-k (M_2 ok

5- Check design :

CD : $P_u = 152.8$ k
$M_u = 107.8$ ft-k

$P_u/A_g = 0.78$
$M_u/A_g l = 0.47$
$\gamma \cong 0.65$

$\gamma = 0.6 \rightarrow \rho = 0.034$
$\gamma = 0.75 \rightarrow \rho = 0.024$

∴ for $\gamma = 0.65$
$\rho \cong 0.032$
$A_s = 6.08$ in²
4#11
or 8#8 ✓

∴ DE : $P_u = 93.8$ k
$M_u = 87.5$ ft-k

$P_u/A_g = 0.48$
$M_u/A_g l = 0.38$

$\gamma = 0.6 \rightarrow \rho = 0.025$
$\gamma = 0.75 \rightarrow \rho = 0.015$

∴ for $\gamma = 0.65$
$\rho = 0.022$
$A_s = 4.3$ in²
4#10
or 8#7 ✓