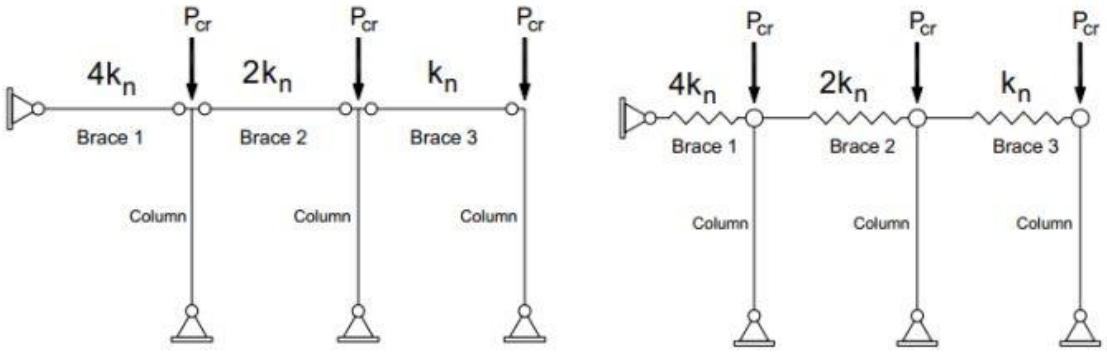


$$Column\ Properties: \begin{cases} L = 264\ in \\ E = 29500\ Ksi \\ I = 307\ in^4 \\ A = 11.7\ in^2 \end{cases} \qquad Section: W12 \times 40$$

$$P_{cr} = \frac{\pi^2 EI}{L^2} = \frac{\pi^2 \times 29500 \times 307}{264^2} = 1282.48\ Kips$$

$$k_s = \frac{P_{cr}}{L_c} = \frac{1282.48}{264} = 4.858 \frac{Kips}{in}$$

Rm

$$\xrightarrow{number\ of\ column=3} k_n = 2.21 k_s = 2.21 \times 4.858 = 10.736 \frac{Kips}{in}$$

$$\beta_{br} = \frac{EA_{br}}{L_{br}} \geq k_n \longrightarrow \frac{29500 \times A_{br}}{100} \geq 10.736 \longrightarrow A_{br} \geq \frac{10.736 \times 100}{29500} = 0.0364\ in^2$$

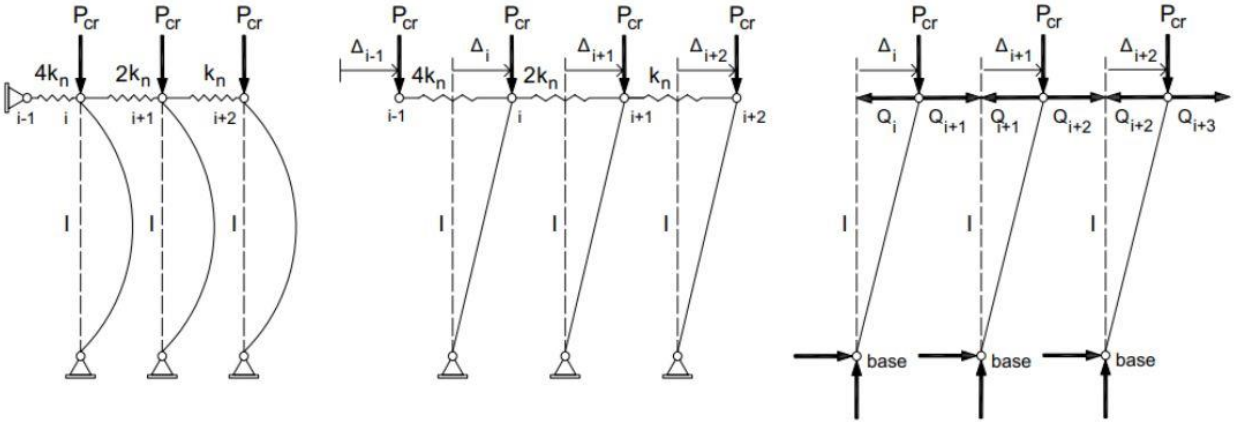
$$Brace\ 1\ Properties(\beta = \beta_i): \begin{cases} L = 100\ in \\ E = 29500\ Ksi \\ I = 10\ in^4 \\ A = 0.1456\ in^2 \end{cases}$$

$$Brace\ 2\ Properties(\beta = \beta_i): \begin{cases} L = 100\ in \\ E = 29500\ Ksi \\ I = 10\ in^4 \\ A = 0.0728\ in^2 \end{cases}$$

$$Brace\ 3\ Properties(\beta = \beta_i): \begin{cases} L = 100\ in \\ E = 29500\ Ksi \\ I = 10\ in^4 \\ A = 0.0364\ in^2 \end{cases}$$

$A_{brace1}(\beta = 2\beta_i) = 0.2912\ in^2$ $A_{brace2}(\beta = 2\beta_i) = 0.1456\ in^2$

$A_{brace3}(\beta = 2\beta_i) = 0.0728\ in^2$



$$Q_i = 4k_n(\Delta_i - \Delta_{i-1}) \rightarrow Q_i + 4k_n\Delta_{i-1} - 4k_n\Delta_i = 0 \quad (1)$$

$$Q_iL - Q_{i+1}L - P_{cr}\Delta_i = 0 \rightarrow Q_i - Q_{i+1} - \frac{P_{cr}}{L}\Delta_i = 0 \quad (2)$$

$$Q_{i+1} = 2k_n(\Delta_{i+1} - \Delta_i) \rightarrow Q_{i+1} + 2k_n\Delta_i - 2k_n\Delta_{i+1} = 0 \quad (3)$$

$$Q_{i+1}L - Q_{i+2}L - P_{cr}\Delta_{i+1} = 0 \rightarrow Q_{i+1} - Q_{i+2} - \frac{P_{cr}}{L}\Delta_{i+1} = 0 \quad (4)$$

$$Q_{i+2} = k_n(\Delta_{i+2} - \Delta_{i+1}) \rightarrow Q_{i+2} + k_n\Delta_{i+1} - k_n\Delta_{i+2} = 0 \quad (5)$$

$$Q_{i+2}L - Q_{i+3}L - P_{cr}\Delta_{i+2} = 0 \rightarrow Q_{i+2} - Q_{i+3} - \frac{P_{cr}}{L}\Delta_{i+2} = 0 \quad (6)$$

$$\begin{bmatrix} 4k_n & 1 & -4k_n & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & -\frac{P_{cr}}{L} & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2k_n & 1 & -2k_n & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & -\frac{P_{cr}}{L} & -1 & 0 & 0 \\ 0 & 0 & 0 & 0 & k_n & 1 & -k_n & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & -\frac{P_{cr}}{L} & -1 \end{bmatrix} \begin{Bmatrix} \Delta_{i-1} \\ Q_i \\ \Delta_i \\ Q_{i+1} \\ \Delta_{i+1} \\ Q_{i+2} \\ \Delta_{i+2} \\ Q_{i+3} \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix}$$

$$\Delta_{i-1} = Q_{i+n} = 0 \qquad k_n = mk_s \qquad k_s = \frac{P_{cr}}{L}$$

$$\begin{bmatrix} 1 & -4mk_s & 0 & 0 & 0 & 0 \\ 1 & -k_s & -1 & 0 & 0 & 0 \\ 0 & 2mk_s & 1 & -2mk_s & 0 & 0 \\ 0 & 0 & 1 & -k_s & -1 & 0 \\ 0 & 0 & 0 & mk_s & 1 & -mk_s \\ 0 & 0 & 0 & 0 & 1 & -k_s \end{bmatrix} \begin{Bmatrix} Q_i \\ \Delta_i \\ Q_{i+1} \\ \Delta_{i+1} \\ Q_{i+2} \\ \Delta_{i+2} \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix} \quad \longrightarrow$$

$$8m^3(k_s)^3 - 22m^2(k_s)^3 + 10m(k_s)^3 - (k_s)^3 = 0 \longrightarrow$$

$$k_s^3[8m^3 - 22m^2 + 10m - 1] = 0$$

$$\begin{cases} f(m).(k_s)^3 = 0 \\ (k_s)^3[8m^3 - 22m^2 + 10m - 1] = 0 \end{cases} \Longrightarrow f(m) = 8m^3 - 22m^2 + 10m - 1$$