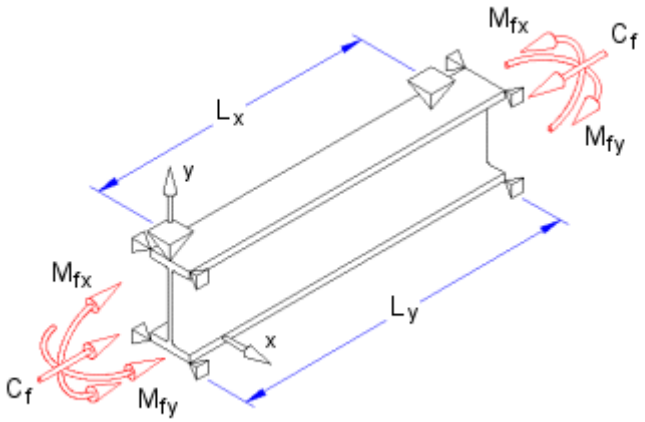
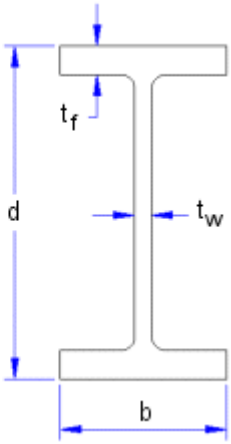
Design of Beam-Columns to CAN/CSA-S16.1-94





Factored Compressive Load	C_f
Factored Moment about X-Axis	M_{fx}
Factored Moment about Y-Axis	M_{fy}

Axial Compression

$C_r = \phi A F_y (1+\lambda^{2n})^{-1/n}$

where

ϕ = 0.9

n = 1.34 for Group 1, 2 and 3 W-shapes of CSA G40.20 Table 1

$(KL/r)_{max}$ = $Max(K_x \cdot L_x/r_x, K_y \cdot L_y/r_y)$

$\lambda = (KL/r)_{max} [F_y/(\pi^2 E)]^{1/2}$

Bending about X-Axis

$M_u = \omega_{2x} \cdot \pi \cdot [E \cdot I_y \cdot G \cdot J + (\pi \cdot E / L)^2 \cdot I_y \cdot C_w]^{1/2} / L$

where

ω_{2x} = $Min(1.75 + 1.05 \cdot K_x + 0.3 \cdot K_x^2, 2.50)$

K_x = $M_{fx,min} / M_{fx,max}$ = 0.00/400 = 0.00

$M_p = Z_x \cdot F_y$

$M_{rx} = Min(1.15 \cdot \phi \cdot M_p \cdot (1 - 0.28 \cdot M_p/M_u), \phi \cdot M_p)$

Bending about Y-Axis

$M_{ry} = \phi \cdot Z_y \cdot F_y$

Biaxial Bending

$M_{fx}/M_{rx} + M_{fy}/M_{ry} <= 1.0$

Cross-Sectional Strength

$C_f/(\phi \cdot A \cdot F_y) + 0.85 \cdot M_{fx}/(\phi \cdot Z_x \cdot F_y) + 0.6 \cdot M_{fy}/(\phi \cdot Z_y \cdot F_y) <= 1.0$

Overall Member Strength

$C_f/C_{ro} + 0.85 \cdot U_{1x} \cdot M_{fx}/(\phi \cdot Z_x \cdot F_y) + 0.6 \cdot U_{1y} \cdot M_{fy}/(\phi \cdot Z_y \cdot F_y) <= 1.0$

where

C_{ro} = $\phi A F_y (1+\lambda_x^{2n})^{-1/n}$

λ_x = $K_x \cdot L_x / r_x \, [F_y / (\pi^2 E)]^{1/2}$

U_{1x} = $\omega_{1x} / (1 - C_f / C_{ex})$

ω_{1x} = $\text{Max}(0.60 - 0.4 \cdot K_x, 0.40)$

K_x = $M_{fx,min} / M_{fx,max} = 0.00/400 = 0.00$

C_{ex} = $\pi^2 \cdot E \cdot I_x / L_x^2$

U_{1x} = $0.60 / (1 - 6000 / 155545) = 0.62$

U_{1y} = $\omega_{1y} / (1 - C_f / C_{ey})$

ω_{1y} = 1.0

C_{ey} = $\pi^2 \cdot E \cdot I_y / L_y^2$

Lateral Torsional Buckling Strength

$C_f/C_{ry} + 0.85 \cdot U_{1x} \cdot M_{fx}/M_{rx} + 0.6 \cdot U_{1y} \cdot M_{fy} / (\phi \cdot Z_y \cdot F_y) <= 1.0$

where

C_{ry} = $\phi A F_y (1+\lambda_y^{2n})^{-1/n}$

λ_y = $K_y \cdot L_y / r_y \, [F_y / (\pi^2 E)]^{1/2}$

U_{1x} = $\text{Max}[\omega_{1x} / (1 - C_f / C_{ex}), 1.0]$