I Shape Beam-Column Per AISC 360-10

Ref: AISC 14th Edition

Ver A.1
Build 15.11.09

INPUT

$I_memb := \text{"W10X22"}$ I Member Shape

$L_{bx} := 10 \cdot ft$ Unbraced Compressive Length x axis

$P_{axial} := \begin{pmatrix} -10.0 \\ 0.0 \end{pmatrix} \cdot kip$ Envelope of Axial Loads (Negative for Compression) (Positive for Tension)

$L_{by} := 10 \cdot ft$ Unbraced Compressive Length y Axis (Minor Axis)

$L_{bz} := L_{by}$ Unbraced Torsional Length

$M_x := 35 \cdot kip \cdot ft$ Bending About X (Major) Axis

$M_y := 1.0 \cdot kip \cdot ft$ Bending About Y (Minor) Axis

$K_x := 1.0$ $K_y := 1.0$ $K_z := 1.0$

$L_b := L_{by}$ Lateral Unbraced Length of Beam

$C_b := 1.0$ $F_y := 50 \cdot ksi$

I Shape Properties

(From AISC Database v14.1)

$Imemb = \text{"W10X22"}$ I Size ("0.000" if section does not exist)

$d = 10.200 \cdot in$	$S_x = 23.200 \cdot in^3$	$I_x = 118.00 \cdot in^4$	$r_x = 4.270 \cdot in$	$k_{des} = 0.660 \cdot in$
$t_w = 0.240 \cdot in$	$S_y = 3.970 \cdot in^3$	$I_y = 11.40 \cdot in^4$	$r_y = 1.330 \cdot in$	$C_w = 275 \cdot in^6$
$b_f = 5.750 \cdot in$	$Z_x = 26.000 \cdot in^3$	$h_o = 9.840 \cdot in$	$r_{ts} = 1.550 \cdot in$	
$t_f = 0.360 \cdot in$	$Z_y = 6.100 \cdot in^3$	$A_g = 6.490 \cdot in^2$	$J = 0.239 \cdot in^4$	

Perform Unity Check

Per AISC H1-1a or H1-1b as appropriate

$$P_{c_i} := \begin{cases} \dfrac{P_{n.ten}}{\Omega_{1.67}} & \text{if } P_{axial_i} \ge 0 \\ \dfrac{-P_{n.comp}}{\Omega_{1.67}} & \text{if } P_{axial_i} < 0 \end{cases}$$

$$P_c = \begin{pmatrix} -106.8 \\ 194.3 \end{pmatrix} \cdot kip$$

Design (Available) Strengths
(positive for tensile)
(negative for compressive)

$$\frac{P_r}{P_c} = \begin{pmatrix} 0.094 \\ 0.000 \end{pmatrix}$$

$$M_{cx} := \frac{M_{n.x}}{\Omega_{1.67}} = 50.6 \cdot kip \cdot ft$$

$$M_{cy} := \frac{M_{n.y}}{\Omega_{1.67}} = 15.2 \cdot kip \cdot ft$$

Design (Available) Bending Strengths

$$U_i := \begin{cases} \dfrac{P_{r_i}}{P_{c_i}} + \dfrac{8}{9} \cdot \left(\dfrac{M_{rx}}{M_{cx}} + \dfrac{M_{ry}}{M_{cy}} \right) & \text{if } \dfrac{P_{r_i}}{P_{c_i}} \ge 0.2 \quad \text{H1-1a} \\ \dfrac{P_{r_i}}{2 \cdot P_{c_i}} + \left(\dfrac{M_{rx}}{M_{cx}} + \dfrac{M_{ry}}{M_{cy}} \right) & \text{if } \dfrac{P_{r_i}}{P_{c_i}} < 0.2 \quad \text{H1-1b} \end{cases}$$

$$P_r = \begin{pmatrix} -10.000 \\ 0.000 \end{pmatrix} \cdot kip$$

$$M_{rx} = 35.000 \cdot kip \cdot ft$$

$$M_{ry} = 1.000 \cdot kip \cdot ft$$

Required Strengths are Equal to the Applied Loads

$$IShape := \begin{cases} \text{"Fails Unity Check"} & \text{if } \max(U) > 1 \\ \text{"Passes Unity Check"} & \text{if } \max(U) \le 1 \end{cases}$$

$$U = \begin{pmatrix} 0.804 \\ 0.757 \end{pmatrix}$$

$\max(U) = 0.804$

$IShape = \text{"Passes Unity Check"}$