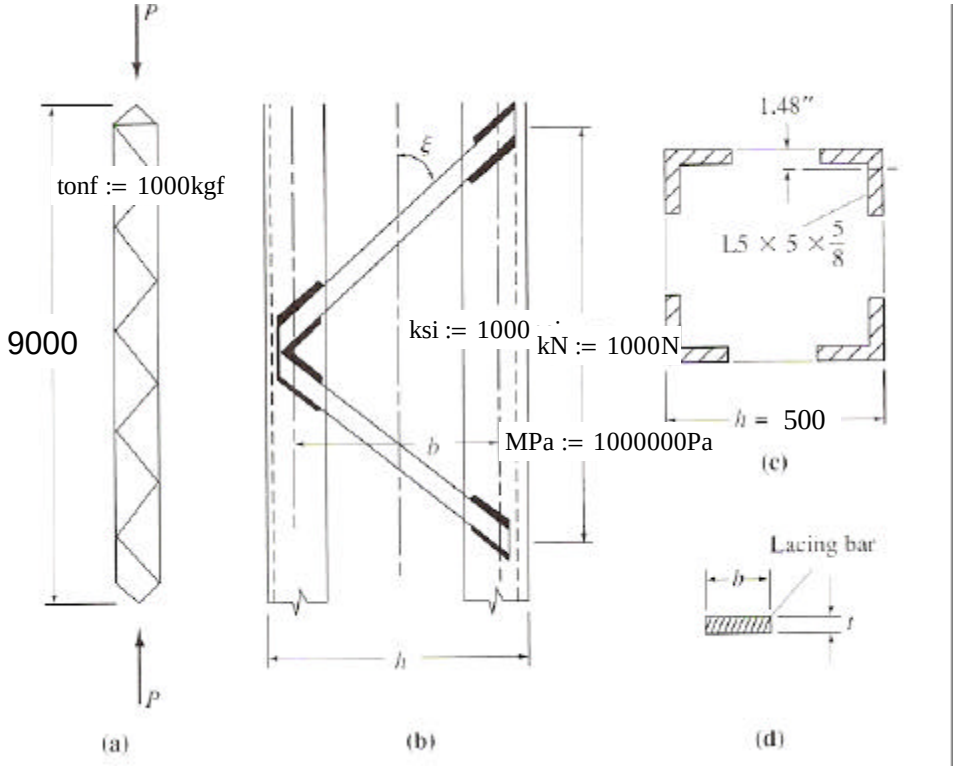
Ejemplo miembros armados:



$KL := 9m$

$D := 450kN$ $L := 2200kN$

Acero A572 Gr. 50 $F_y := 50ksi$ $E := 29000ksi$

L 5x5x5/8: $I_x := 13.6in^4$ $I_y := I_x$ $I_x = 566.075\,cm^4$ $r_x := 1.52in$ $r_y := r_x$ $r_x = 3.861\,cm$

$A := 5.86in^2$ $A = 37.806\,cm^2$ $r_{min} := 0.978in$ $r_{min} = 2.484\,cm$

$x_g := 1.48in$ $y_g := x_g$ $x_g = 3.759\,cm$

(i) Propiedades seccion armada (c):

$$I_{xc} := 4\left[I_x + A\cdot\left(\frac{500mm}{2} - x_g\right)^2\right] \qquad I_{yc} := I_{xc} \qquad I_{xc} = 7.049\times 10^4\,cm^4$$

$A_g := 4A$ $A_g = 151.226\,cm^2$

$$r_{xc} := \sqrt{\frac{I_{xc}}{A_g}} \qquad r_{yc} := r_{xc} \qquad r_{xc} = 21.59\,cm$$

(ii) Carga ultima: $P_u := 1.2 \cdot D + 1.6 \cdot L \qquad P_u = 4060\,kN$

(iii) Relacion de esbeltez modificada para elementos conectores soldados:

$$\lambda_0 := \frac{KL}{r_{xc}} \qquad \lambda_0 = 41.685$$

$h := 500mm - 2x_g \qquad h = 42.482\,cm$

$r_{ib} := r_x \qquad r_{ib} = 3.861\,cm$

$$\alpha := \frac{h}{2r_{ib}} \qquad \alpha = 5.502$$

Considerando que el centro de gravedad de las soldaduras esta a 7.5 cm del borde del angulo

$b_c := 500mm - 2 \cdot 7.5cm \qquad b_c = 35\,cm$

Considerando una inclinacion de 60 grados de los elementos conectores

$$a := 2 \cdot \frac{b_c}{\tan(60deg)} \qquad a = 40.4\,cm$$

que es mayor que el limite recomendado por la AISC para reticulado simple (38 cm). Por esta vez no haremos caso de la recomendacion. Entonces

$$\lambda_m := \sqrt{\lambda_0^{\,2} + 0.82 \cdot \frac{\alpha^2}{1 + \alpha^2} \cdot \left(\frac{a}{r_{ib}}\right)^2} \qquad \lambda_m = 42.716$$

Revisando esbeltez intermedia

$$\frac{a}{r_{min}} = 16.269 < \frac{3}{4}\lambda_m = 32.037 \qquad \text{OK}$$

(iv) Resistencia nominal

Esbeltez local

$b := 5in \qquad t := \frac{5}{8}in \qquad \frac{b}{t} = 8 < 0.45\sqrt{\frac{E}{F_y}} = 10.837$ elementos no esbeltos

entonces

$Q := 1$

$$F_e := \frac{\pi^2 E}{\lambda_m^{\,2}} \qquad F_e = 1082\,MPa$$

$\lambda_m = 42.716 < 4.71\sqrt{\frac{E}{F_y}} = 113.432 \Rightarrow F_{cr} := \left(0.658^{\frac{F_y}{F_e}}\right)\cdot F_y \quad F_{cr} = 302\,MPa$

$P_n := F_{cr}\cdot A_g \quad P_n = 4562\,kN$

$\phi := 0.9 \quad \phi\cdot P_n = 4106\,kN > P_u = 4060\,kN \quad OK$

(v) Elementos conectores (placas):

$V_u := 0.02P_n \quad V_u = 91\,kN$

$P_u := \frac{V_u}{2\cos(60deg)} \quad P_u = 91\,kN$ (hay un elemento conector por cada lado)

Usando la limitacion de L/r < 140

$L := \frac{b_c}{\sin(60deg)} \quad L = 40.4\,cm$

$t_{min} := \frac{L\sqrt{12}}{140} \quad t_{min} = 10\,mm$

Usar t_{min} $\lambda := 140$

$F_e := \frac{\pi^2 E}{\lambda^2} \quad F_e = 101\,MPa$

$\frac{L\cdot\sqrt{12}}{t_{min}} = 140 > 4.71\sqrt{\frac{E}{F_y}} = 113.432 \Rightarrow F_{cr} := 0.877\cdot F_e \quad F_{cr} = 88.3\,MPa$

$A_{req} := \frac{P_u}{\phi\cdot F_{cr}} \quad A_{req} = 11.482\,cm^2 \Rightarrow b := 12cm$

Usar PL12x1 como elemento conector.