AUXILIAR 3 – Pernos con carga excéntrica y Tracción

Diseño de Estructuras de Acero

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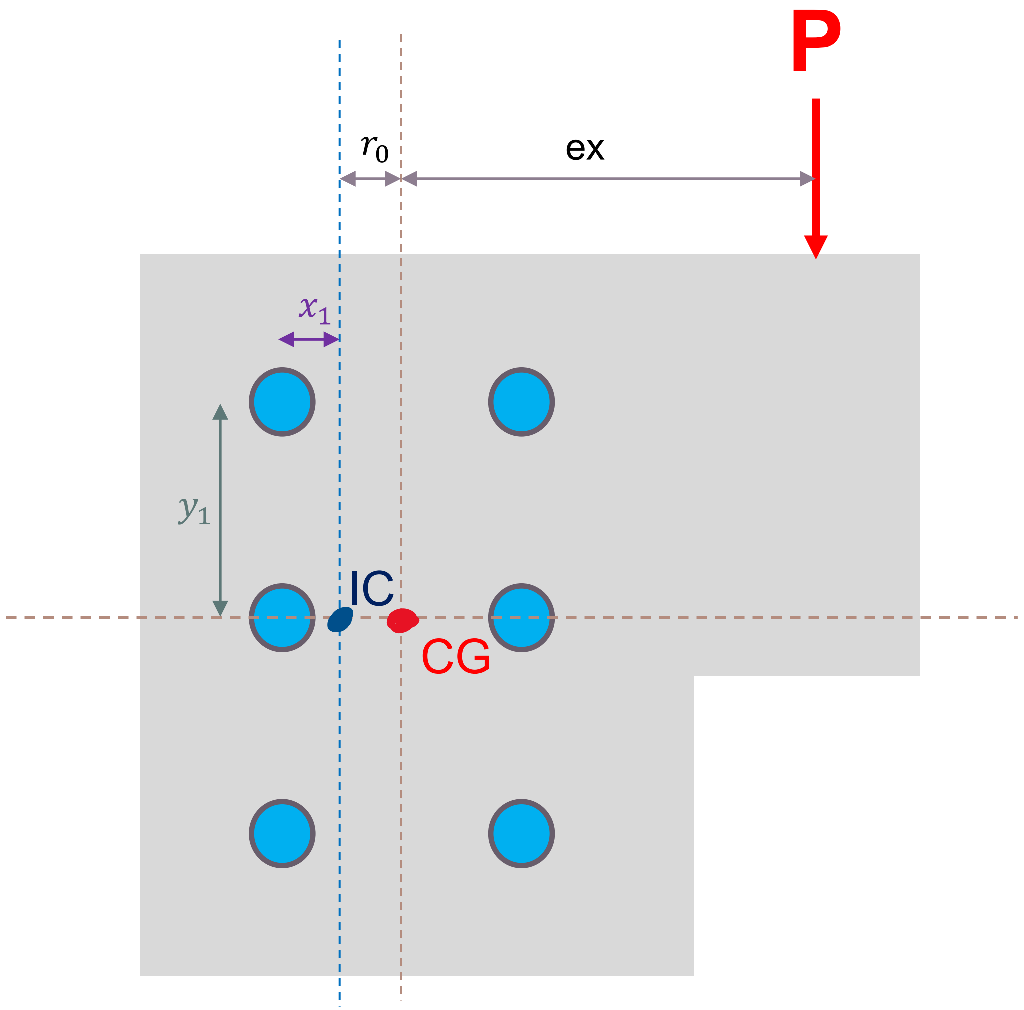
Resistencia Pernos con carga excéntrica

Salmon and Johnson – Steel Structure Design



Análisis Plástico

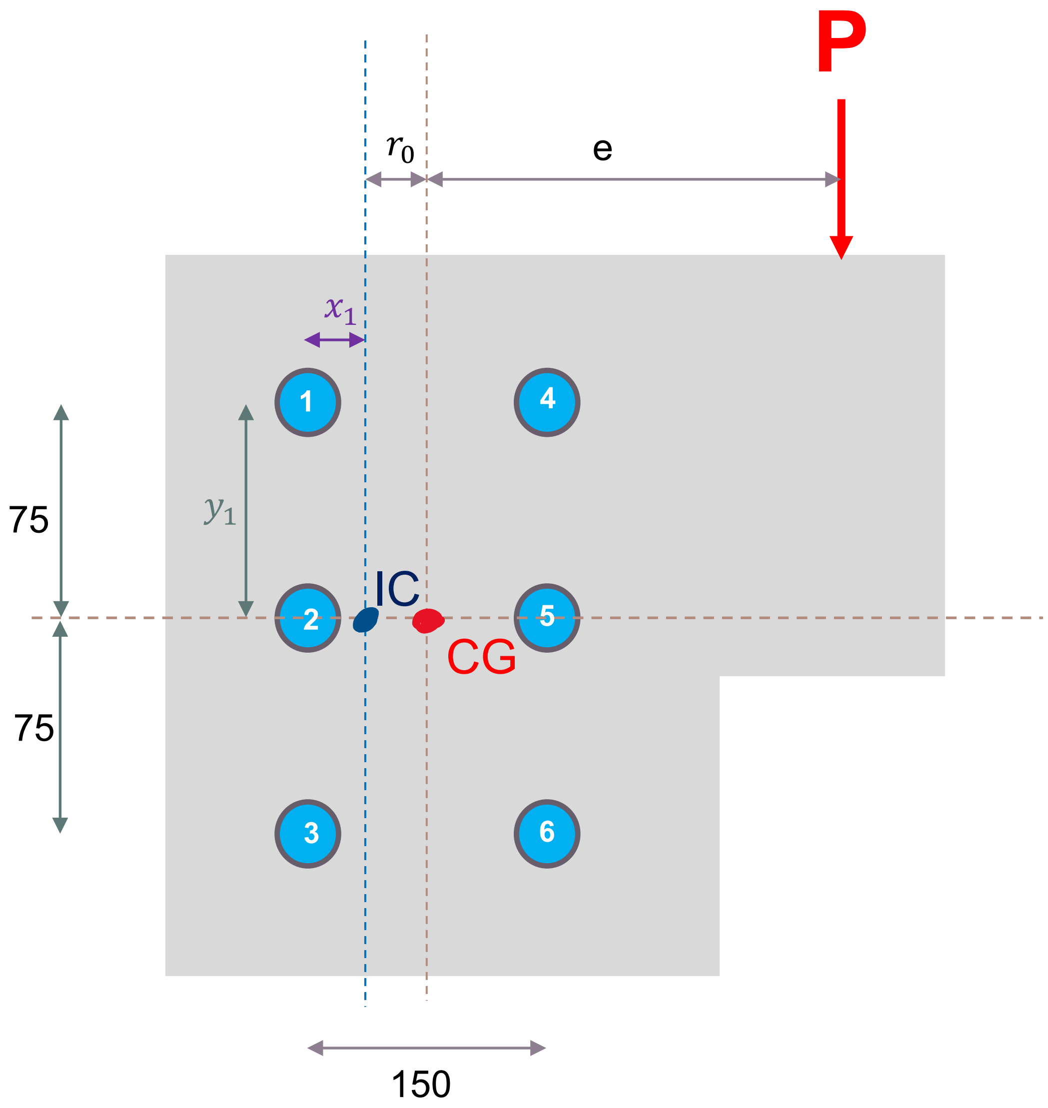
- Una carga excéntrica se puede transformar en un giro con respecto a un centro IC (centro instantáneo de rotación).
- Se relaciona la deformación de cada perno
- $\Delta_{max} = 0.34\ in$

$$R_i = R_{ult}\left(1 - e^{-10\Delta}\right)^{0,55}$$

$$R_{ult} = Fnv * Ab$$

Importante! Usar Δ en pulgadas

Ejercicio 1



Determinar la resistencia del grupo de perno A325 (Fnv=330MPa) y diámetro 1” (2.54cm)

$$\Delta i = \frac{di}{dmax}\Delta max$$

Revisar Excel adjunto para el resultado

Diseño a Tracción (Cap. D)

D2. TENSILE STRENGTH

The design tensile strength, $\phi_t P_n$, and the allowable tensile strength, P_n/Ω_t, of tension members shall be the lower value obtained according to the limit states of tensile yielding in the gross section and tensile rupture in the net section.

Fluencia (a) For tensile yielding in the gross section

$$P_n = F_y A_g \tag{D2-1}$$

$$\phi_t = 0.90 \text{ (LRFD)} \qquad \Omega_t = 1.67 \text{ (ASD)}$$

Rotura (b) For tensile rupture in the net section

$$P_n = F_u A_e \tag{D2-2}$$

$$\phi_t = 0.75 \text{ (LRFD)} \qquad \Omega_t = 2.00 \text{ (ASD)}$$

AREA EFECTIVA NETA (Cap. D3)

D3. EFFECTIVE NET AREA

The gross area, A_g, and net area, A_n, of tension members shall be determined in accordance with the provisions of Section B4.3.

The effective net area of tension members shall be determined as

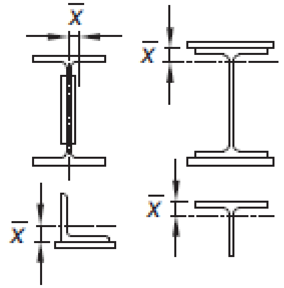
$$A_e = A_n U \tag{D3-1}$$

where U, the shear lag factor, is determined as shown in Table D3.1.

For open cross sections such as W, M, S, C, or HP shapes, WTs, STs, and single and double angles, the shear lag factor, U, need not be less than the ratio of the gross area of the connected element(s) to the member gross area. This provision does not apply to closed sections, such as HSS sections, nor to plates.

FACTOR U (Tabla D3.1)

TABLE D3.1
Shear Lag Factors for Connections to Tension Members

Case	Description of Element	Shear Lag Factor, *U*	Example
1	All tension members where the tension load is transmitted directly to each of the cross-sectional elements by fasteners or welds (except as in Cases 4, 5 and 6).	$U = 1.0$	–
2	All tension members, except HSS, where the tension load is transmitted to some but not all of the cross-sectional elements by fasteners or by longitudinal welds in combination with transverse welds. Alternatively, Case 7 is permitted for W, M, S and HP shapes. (For angles, Case 8 is permitted to be used.)	$U = 1 - \dfrac{\bar{x}}{l}$	
3	All tension members where the tension load is transmitted only by transverse welds to some but not all of the cross-sectional elements.	$U = 1.0$ and A_n = area of the directly connected elements	–
4[a]	Plates, angles, channels with welds at heels, tees		

7	W-, M-, S- or HP-shapes, or tees cut from these shapes. (If *U* is calculated per Case 2, the larger value is permitted to be used.)	with flange connected with three or more fasteners per line in the direction of loading	$b_f \geq \frac{2}{3}d,\ U = 0.90$ $b_f < \frac{2}{3}d,\ U = 0.85$
		with web connected with four or more fasteners per line in the direction of loading	$U = 0.70$
8	Single and double angles. (If *U* is calculated per Case 2, the larger value is permitted to be used.)	with four or more fasteners per line in the direction of loading	$U = 0.80$
		with three fasteners per line in the direction of loading (with fewer than three fasteners per line in the direction of loading, use Case 2)	$U = 0.60$

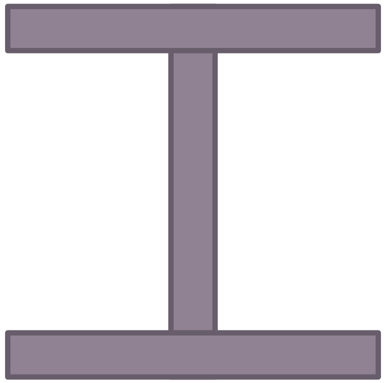
B = overall width of rectangular HSS member, measured 90° to the plane of the connection, in. (

Diferencia entre Ag, An y Ae

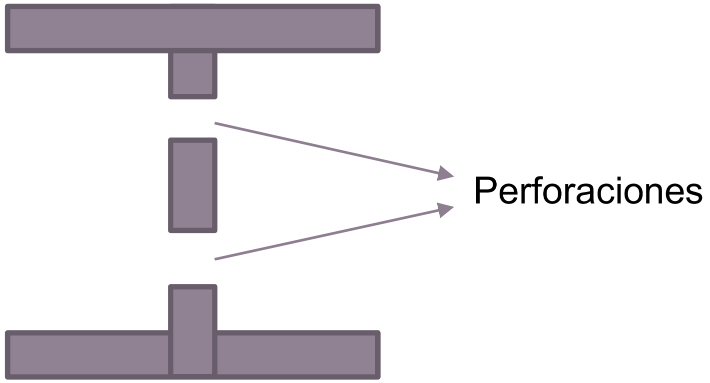
Ag (Área Gruesa): Área geométrica de la sección

An (Área neta): Área geométrica descontando perforaciones

Ae (Área neta efectiva): Area neta reducida por el factor U



Ag



An

Ejercicio 2

La Figura 1 muestra un tipo de conexión de arriostramiento. Determine la resistencia nominal de cada uno de los siguientes casos:

a) Fluencia en el área gruesa del arriostramiento
b) Fractura en el área neta efectiva del arriostramiento
c) Fluencia en el área de los ángulos de conexión
d) Fractura en el área efectiva de los ángulos de conexión.

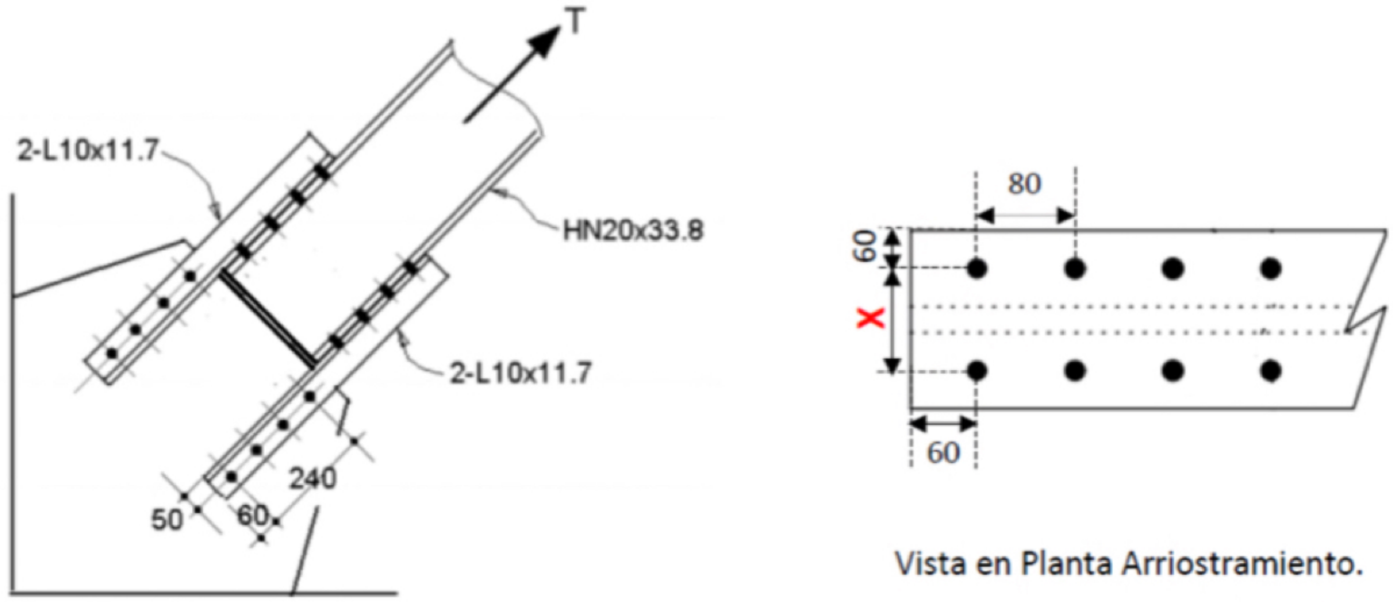


Figura 1: Vista de conexión y en planta .

Considere:

1. Acero ASTM A36
2. Pernos acero ASTM A325 ϕ =3/4"
3. Perfiles según catálogo CINTAC.
4. Dimensiones en [mm]