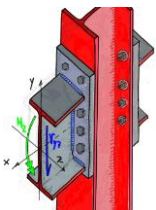


RESOLUCIÓN DE PÓRTICO ISOSTÁTICO MEDIANTE CÁLCULO TRADICIONAL. CONTRASTE DE RESULTADOS CON SOFTWARE DE CÁLCULO STATIK (CUBUS)

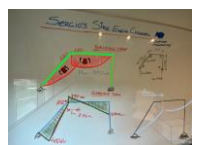
Video explicativo en:

<https://www.youtube.com/watch?v=oyfZt5RrL5M>



Pedro MARTINEZ & Sergio RODRIGUEZ

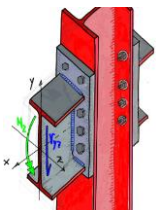
https://youtube.com/@canal_estructuras_sergio



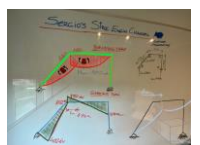
Nota de los autores:

Este documento es únicamente de carácter didáctico. Se ha pretendido en todo momento describir el cálculo "paso a paso" para la total comprensión del mismo.

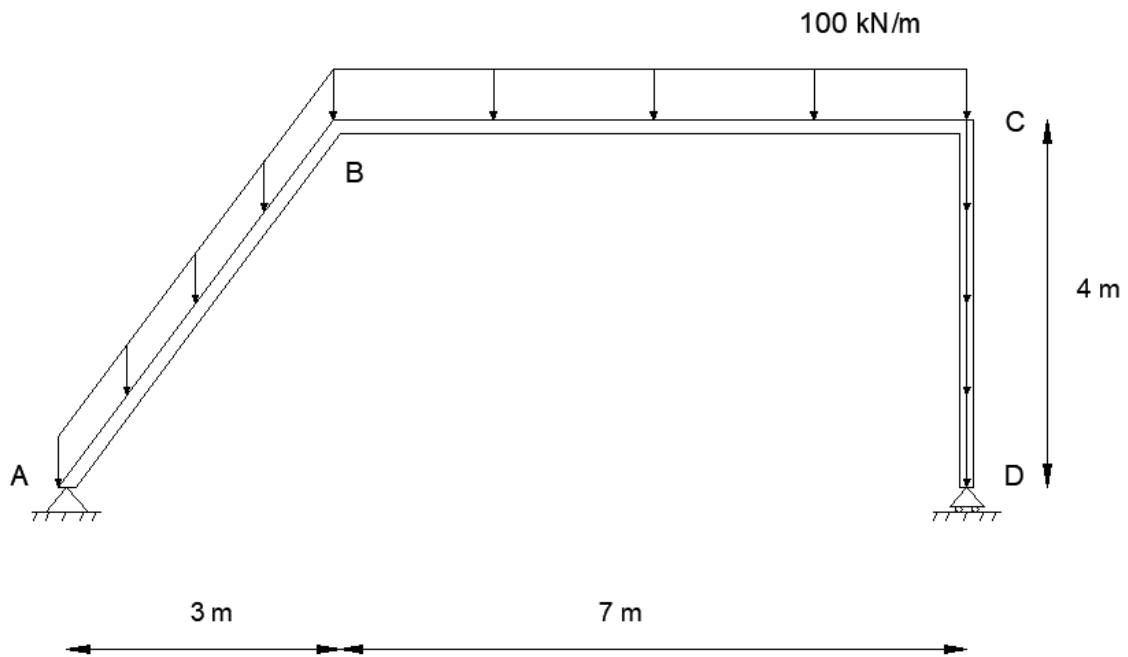
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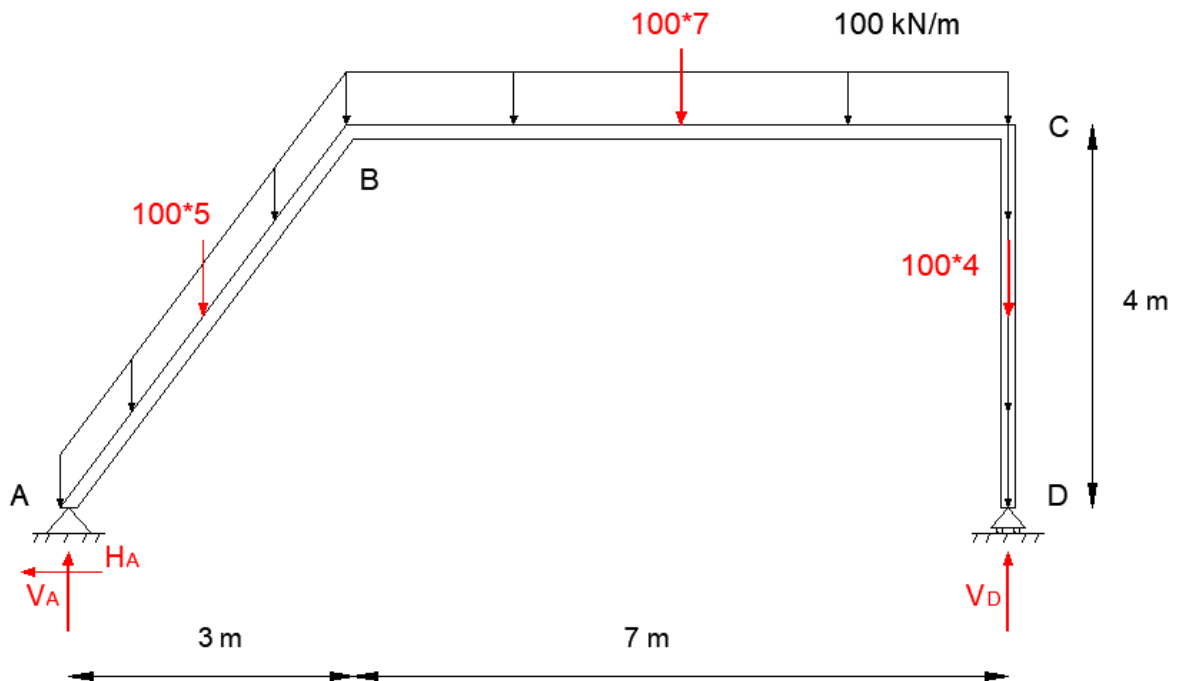
Pedro MARTINEZ & Sergio RODRIGUEZ
https://youtube.com/@canal_estructuras_sergio



1. Determinación de las reacciones del pórtico adjunto

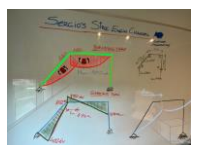
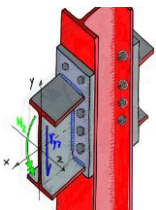


Lo primero que vamos a hacer es determinar si la estructura es isostática o hiperestática.



$$GH = 3 - 3 = 0$$

Como se puede ver, estamos frente a una estructura isostática, lo que quiere decir que se podrá resolver con las ecuaciones de la estática.



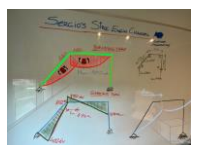
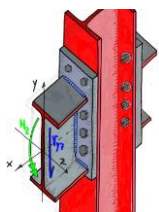
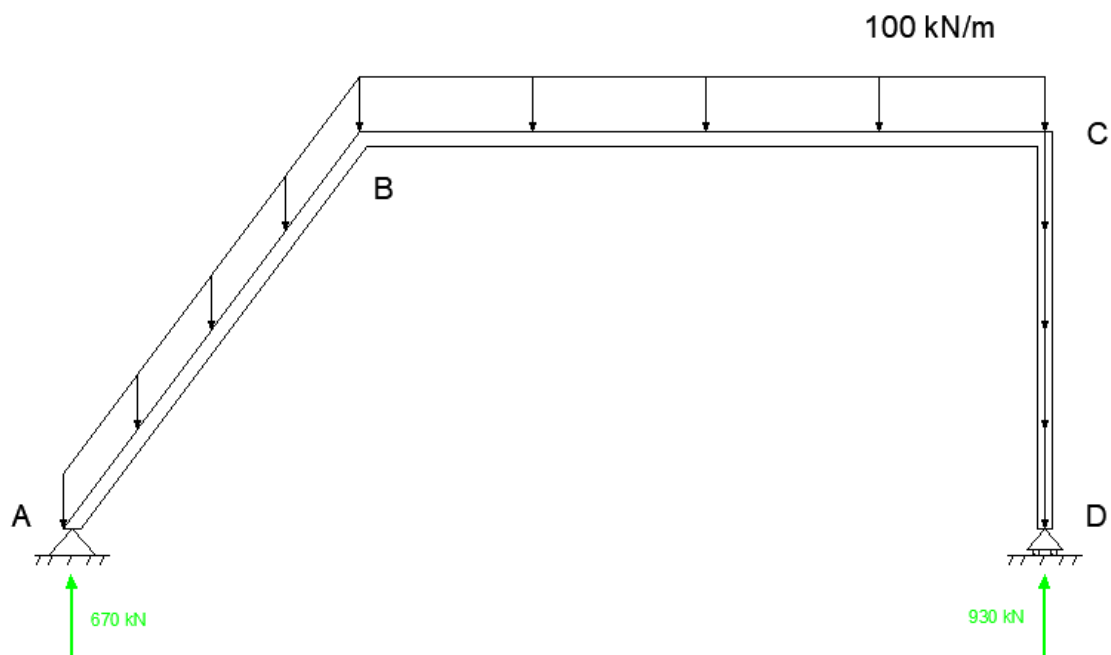
Calculamos las reacciones:

$$\sum FH = 0 \rightarrow H_A = 0 \text{ kN}$$

$$\sum M_A = 0 \rightarrow V_D * 10 = 500 * (1,5) + 700 * (6,5) + 400 * (10) \rightarrow V_D = 930 \text{ kN}$$

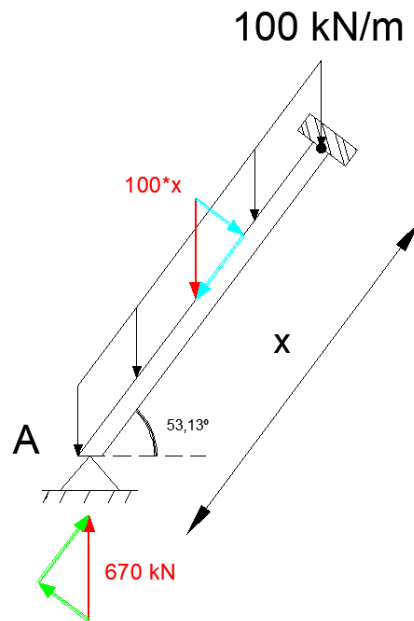
$$\sum FV = 0 \rightarrow V_A + V_D = 500 + 700 + 400 \rightarrow V_A = 1600 - V_D \rightarrow V_A = 670 \text{ kN}$$

Las reacciones quedarían:

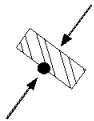


2. Determinación de las leyes de esfuerzos axiles, cortantes y flectores

➤ TRAMO AB: $0 \leq x < 5 \text{ m}$



Ley de axiles



$$N_A^B = 670 * \text{sen}(53,13^\circ) - 100 * x * \text{sen}(53,13^\circ)$$

$$N^A = 536 \text{ kN}$$

$$N^B = 136 \text{ kN}$$

Ley de cortantes

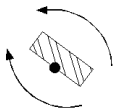


$$V_A^B = 670 * \text{cos}(53,13^\circ) - 100 * x * \text{cos}(53,13^\circ)$$

$$V^A = 402 \text{ kN}$$

$$V^B = 102 \text{ kN}$$

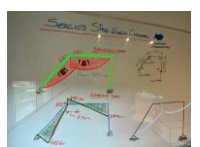
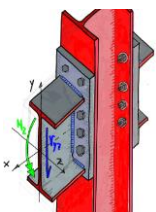
Ley de flectores



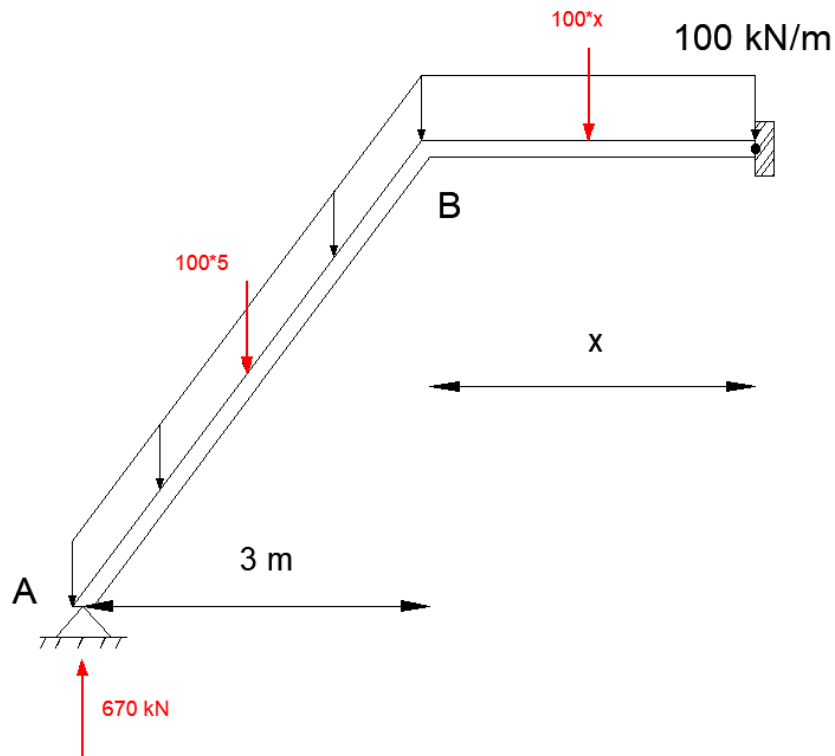
$$M_{z_A}^B = 670 * \text{cos}(53,13^\circ) * x - 100 * x * \text{cos}(53,13^\circ) * \frac{x}{2}$$

$$M_{z^A} = 0 \text{ kN} * \text{m}$$

$$M_{z^B} = 1260 \text{ kN} * \text{m}$$



➤ TRAMO BC: $0 < x < 7$ m



Ley de axiles

$$N_B^C = 0 \text{ kN}$$

Ley de cortantes



$$V_B^C = 670 - 500 - 100 * x$$

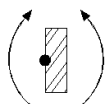
$$V^B = 170 \text{ kN}$$

$$V^C = -530 \text{ kN}$$

Damos el paso por "0" de la función:

$$V_B^C = 0 \rightarrow 670 - 500 - 100 * x = 0 \rightarrow x = 1,7 \text{ m}$$

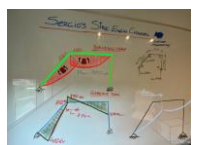
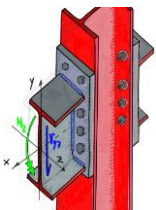
Ley de flectores



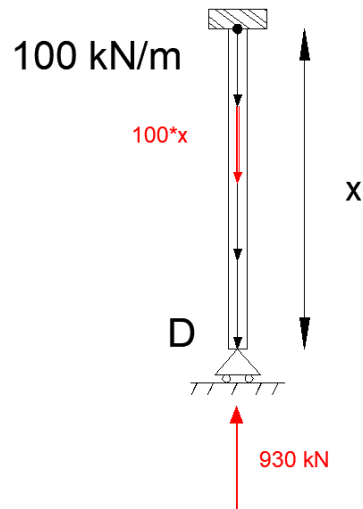
$$Mz_A^B = 670 * (3 + x) - 500 * (1,5 + x) - 100 * x * \frac{x}{2}$$

$$Mz^B = 1260 \text{ kN} * \text{m}$$

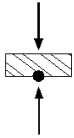
$$Mz^C = 0 \text{ kN} * \text{m}$$



➤ TRAMO DC: $0 \leq x < 4$ m



Ley de axiles



$$N_D^C = 930 - 100 * x$$

$$N^D = 930 \text{ kN}$$

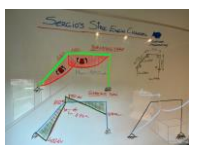
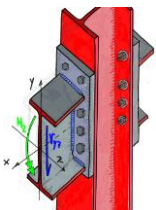
$$N^C = 530 \text{ kN}$$

Ley de cortantes

$$V_D^C = 0 \text{ kN}$$

Ley de flectores

$$Mz_D^C = 0 \text{ kN} * m$$



3. Determinación de los diagramas de esfuerzos axiales, cortantes y flectores

Diagrama de axiles

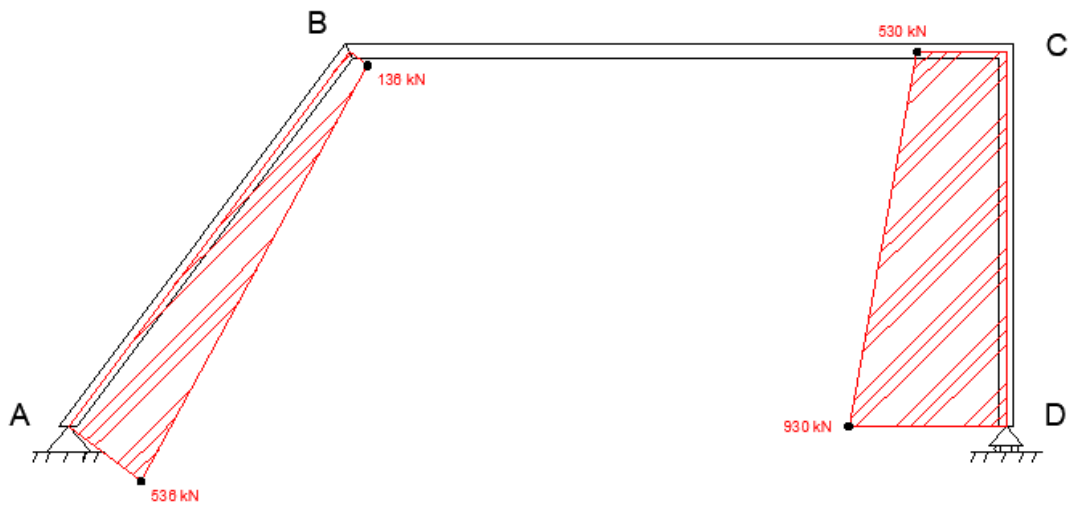


Diagrama de cortantes

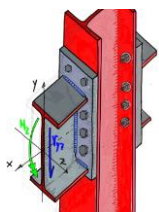
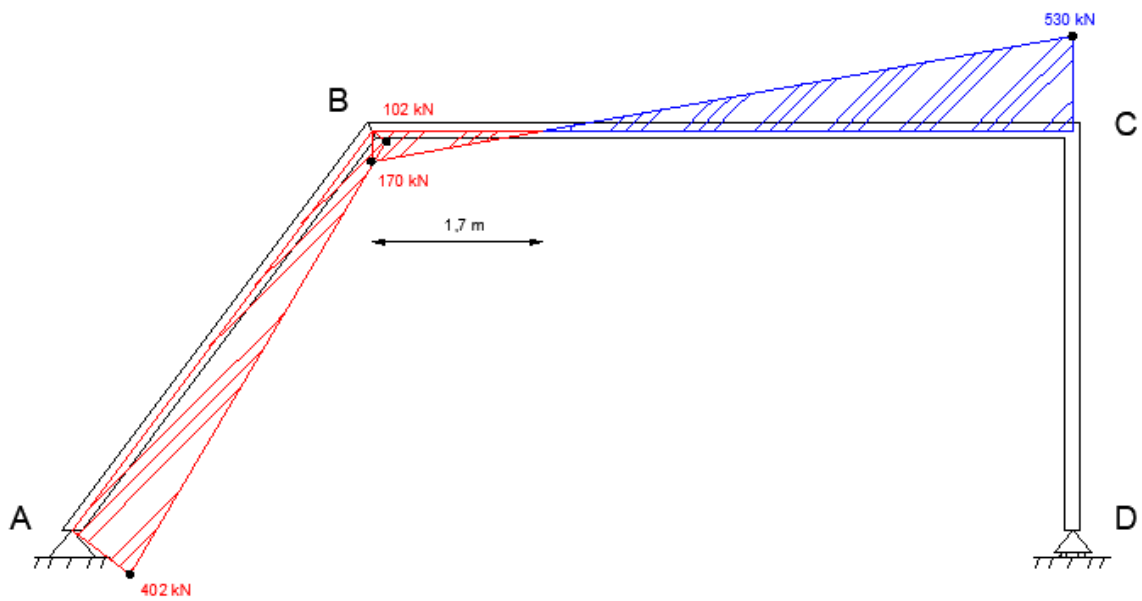
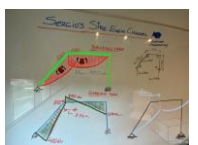
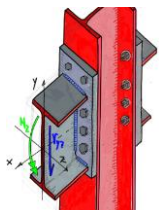
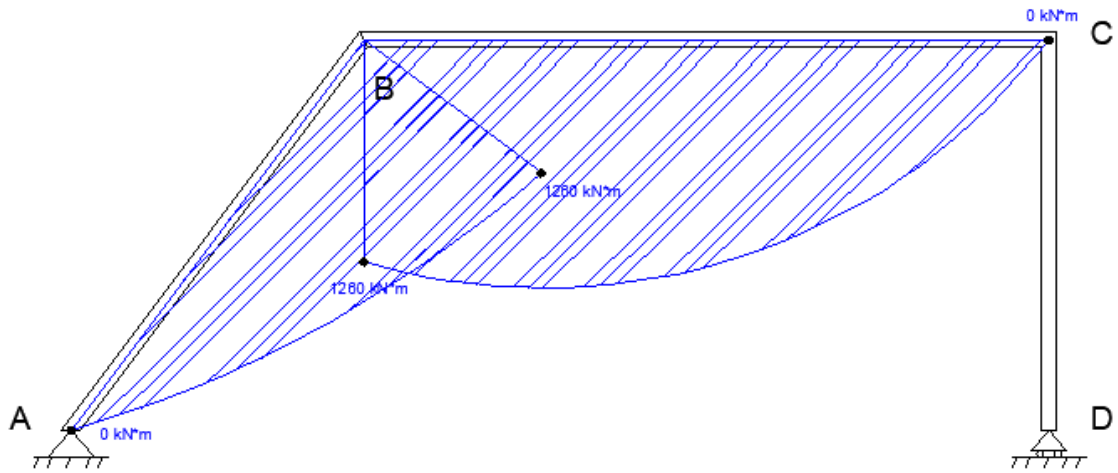
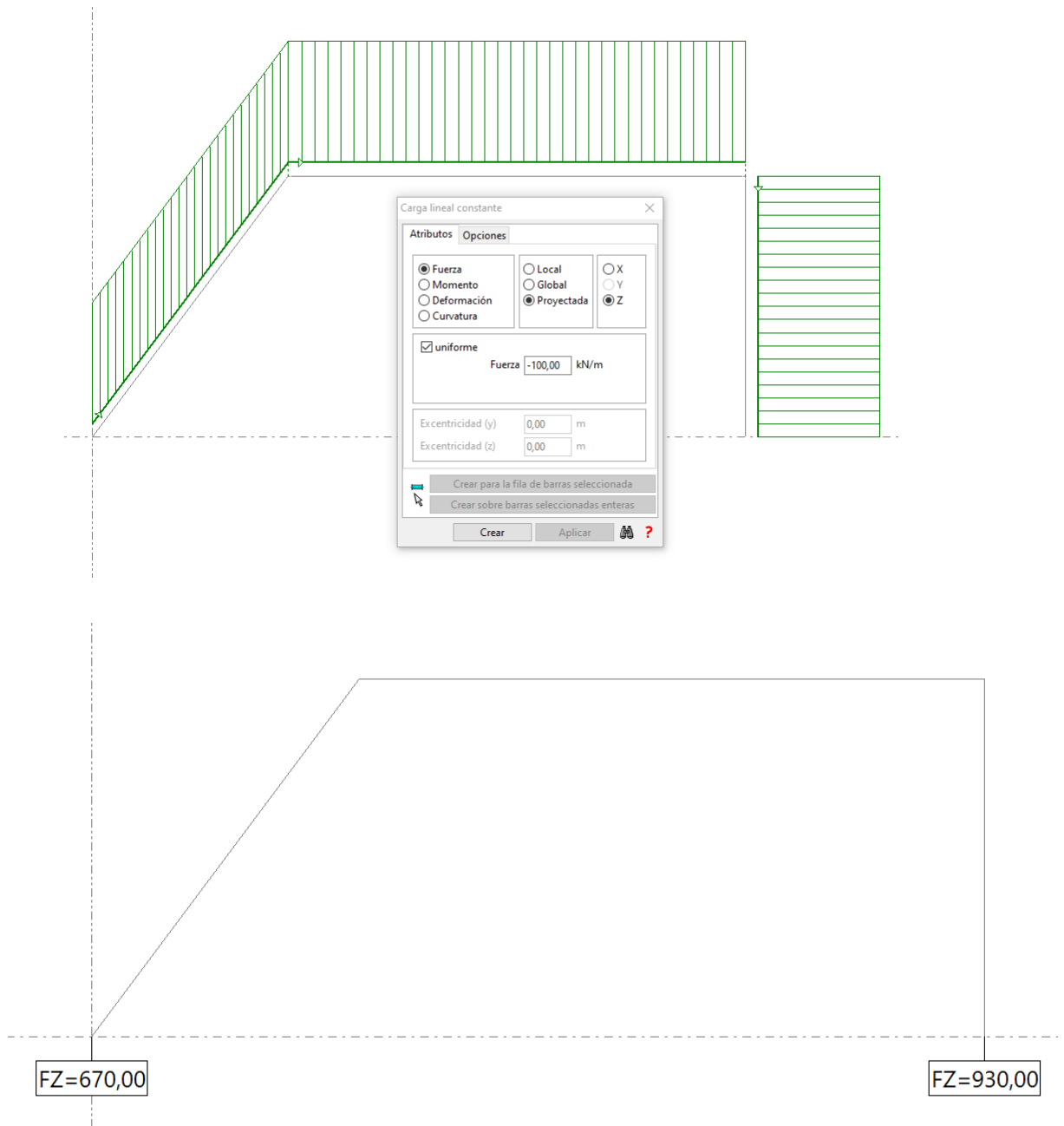


Diagrama de flectores



4. Comparación de resultados usando STATIK



| RESUMEN CÁLCULOS [REACCIONES] | | | | | | | |
|-------------------------------|-------|------|--------|------|---------------------|--------|------|
| TABLE: Joint Reactions | | | | | Cálculo tradicional | | |
| Nudo | Carga | Fx | Fz | My | Fx | Fz | My |
| | | KN | KN | KN-m | KN | KN | KN-m |
| K_1 | SC | 0,00 | 670,00 | 0,00 | 0,00 | 670,00 | 0,00 |
| K_2 | SC | 0,00 | 930,00 | 0,00 | 0,00 | 930,00 | 0,00 |

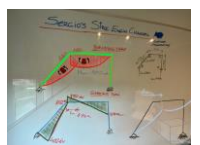
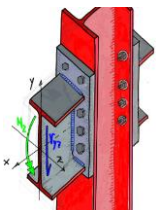
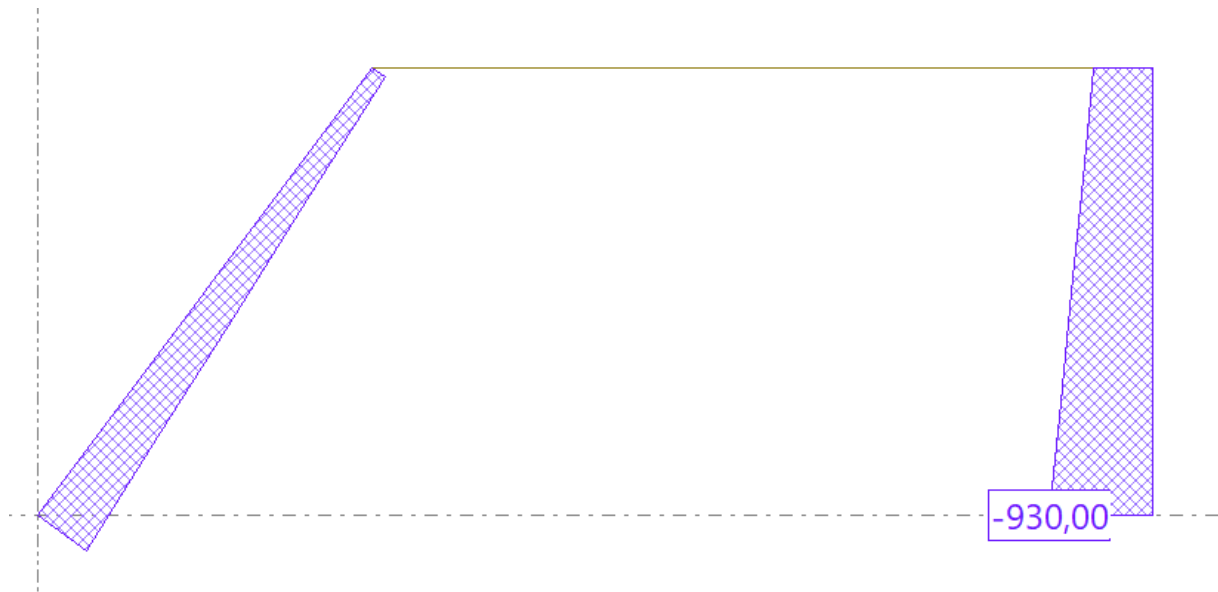


Diagrama de axiles



| RESUMEN CÁLCULOS [AXIL] | | | | |
|-------------------------|---------|---------------------|--------|-----------|
| SOLICITACIONES | | Cálculo tradicional | | Variación |
| Barra | Nx | x | Nx | % |
| | KN | m | KN | |
| S_1 | -536,00 | 0 | 536,00 | N/A |
| S_1 | -136,00 | 5 | 136,00 | N/A |
| S_2 | 0,00 | 0 | 0,00 | N/A |
| S_2 | 0,00 | 7 | 0,00 | N/A |
| S_3 | -930,00 | 0 | 930,00 | N/A |
| S_3 | -530,00 | 4 | 530,00 | N/A |

NOTA: Los signos de las reacciones y esfuerzos dependen del convenio empleado

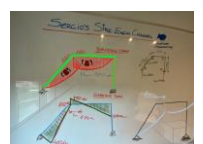
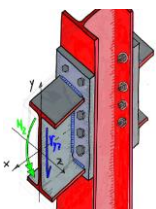
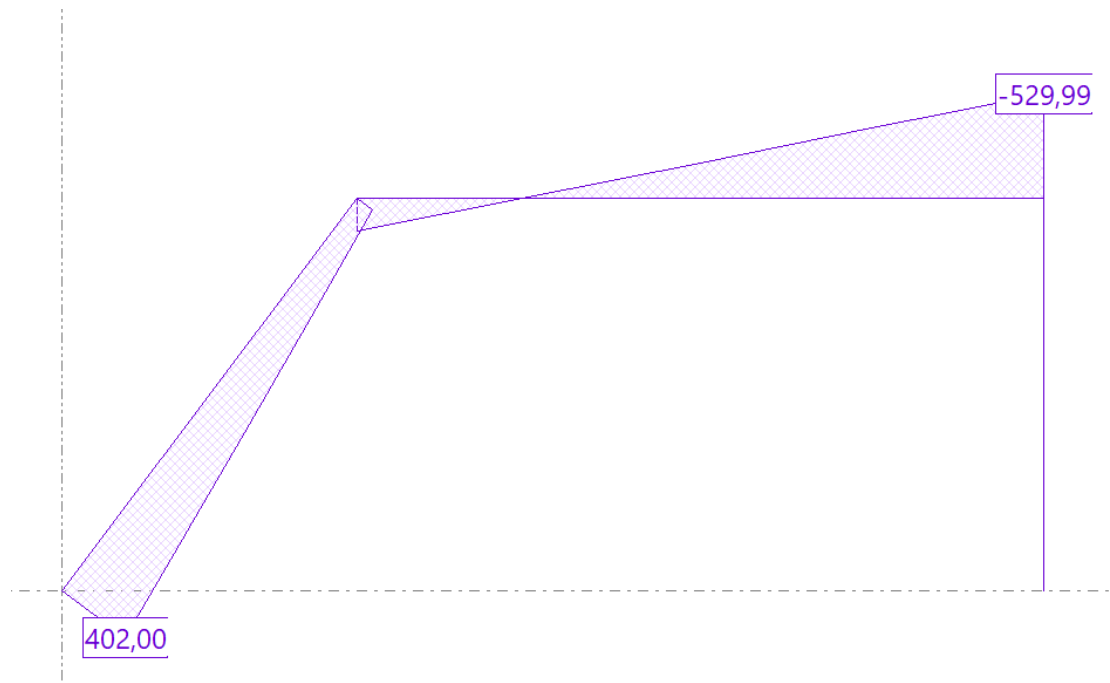


Diagrama de cortantes



| RESUMEN CÁLCULOS [CORTANTE] | | | | |
|-----------------------------|---------|---------------------|---------|-----------|
| SOLICITACIONES | | Cálculo tradicional | | Variación |
| Barra | Vz | x | Vx | % |
| | KN | m | KN | |
| S_1 | 402,00 | 0 | 402,00 | N/A |
| S_1 | 102,00 | 5 | 102,00 | N/A |
| S_2 | 170,00 | 0 | 170,00 | N/A |
| S_2 | -530,00 | 7 | -530,00 | N/A |
| S_3 | 0,00 | 0 | 0,00 | N/A |
| S_3 | 0,00 | 4 | 0,00 | N/A |

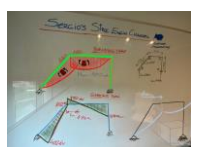
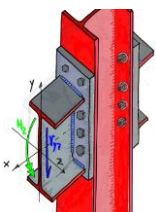
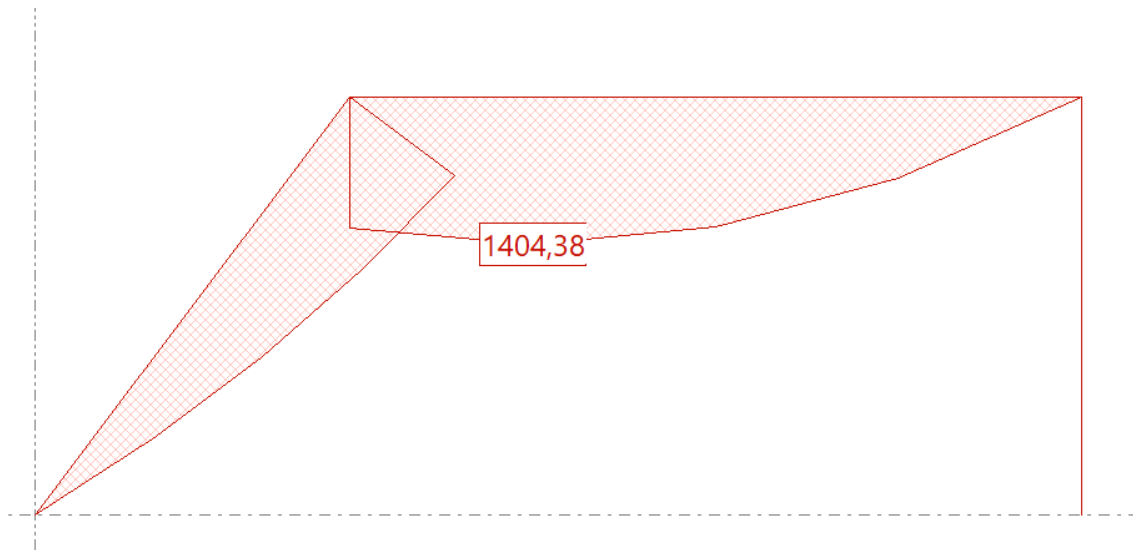


Diagrama de flectores



| RESUMEN CÁLCULOS [FLECTOR] | | | | |
|----------------------------|---------|---------------------|---------|-----------|
| SOLICITACIONES | | Cálculo tradicional | | Variación |
| Barra | Mz | x | Mz | % |
| | KN | m | KN | |
| S_1 | 0,00 | 0 | 0,00 | N/A |
| S_1 | 1260,00 | 5 | 1260,00 | N/A |
| S_2 | 1260,00 | 0 | 1260,00 | N/A |
| S_2 | 0,00 | 7 | 0,00 | N/A |
| S_3 | 0,00 | 0 | 0,00 | N/A |
| S_3 | 0,00 | 4 | 0,00 | N/A |

