

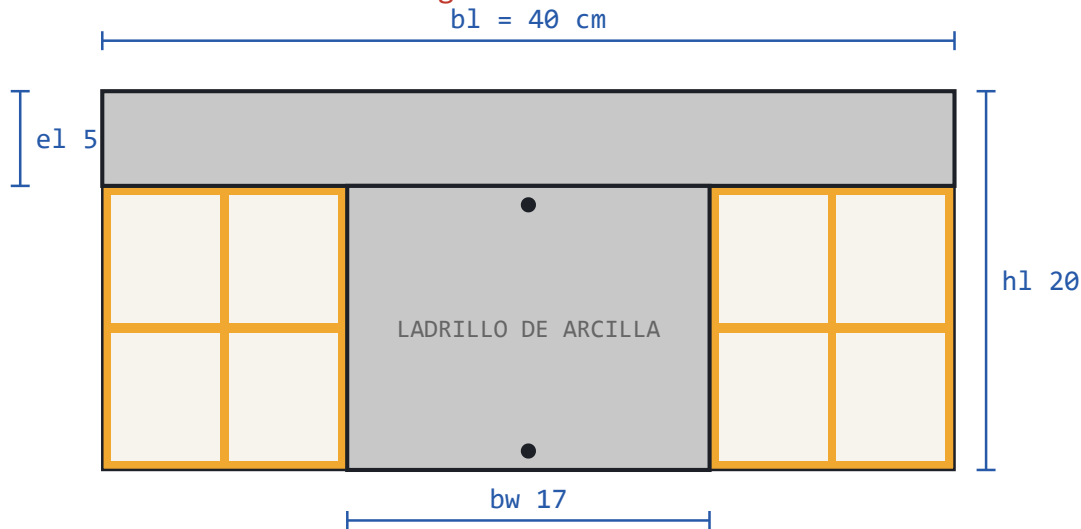
DISEÑO DE LOSA ALIGERADA EN 1 SENTIDO

Robert Jiménez Marín · 9/8/2026
6 tramos · vigueta T (40/5/20/17 cm) · $f'_c=210$ · $f_y=4200$

1.0 DATOS DE LA VIGUETA

SECCIÓN DE LA VIGUETA

Ladrillo a usar: $15 \times 30 \times 30$ · 8.2 kg



f'_c	210 kg/cm ²	f_y	4200 kg/cm ²
Ø Acero (peralte)	3/8"	Peralte d	17.52 cm
φ Cortante	0.85	φ Flexión	0.9

2.0 METRADO DE CARGAS

2.1 Carga muerta — peso propio

Losa: $0.75 \times 0.05 \times 1.00 \times 2400$	90.00 kg/m ²
Vigueta: $2.5 \times (0.17 \times 0.20) \times 1.00 \times 2400$	204.00 kg/m ²
Ladrillo: $8.33 \text{ lad/m}^2 \times 8.20 \text{ kg/lad}$	68.31 kg/m ²
Tabiquería + Cielo Raso + Piso (s/c)	200.00 kg/m ²
D (Carga muerta)	562.31 kg/m ²

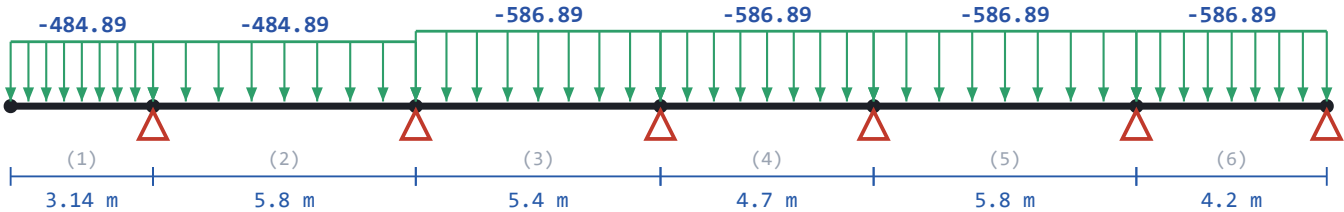
Sobrecarga de diseño: $W_{du} = 1.4 \times 562.31 = 787.228 \text{ kg/m}^2 \cdot W_{duv} = 787.228/2.5 = 314.89 \text{ kg/ml}$

2.2 Carga viva — $W_{luv} = 1.7 \times CV / 2.5$

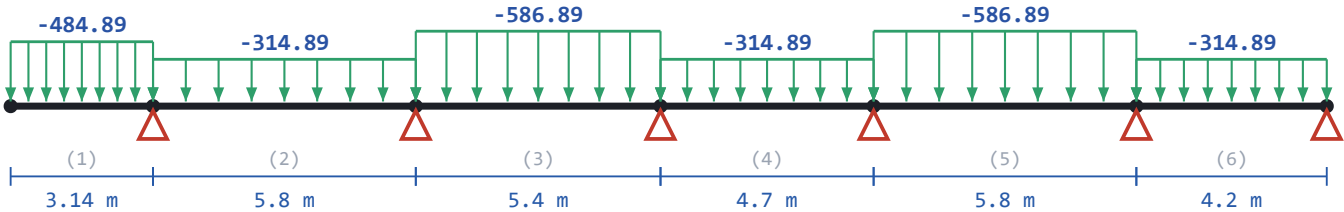
Tramo	CV (kg/m²)	W_{luv} (kg/ml)
1	250	$1.7 \times 250 / 2.5 = 170.00$
2	250	$1.7 \times 250 / 2.5 = 170.00$
3	400	$1.7 \times 400 / 2.5 = 272.00$
4	400	$1.7 \times 400 / 2.5 = 272.00$
5	400	$1.7 \times 400 / 2.5 = 272.00$
6	400	$1.7 \times 400 / 2.5 = 272.00$

3.0 ALTERNANCIA DE CARGAS (15)

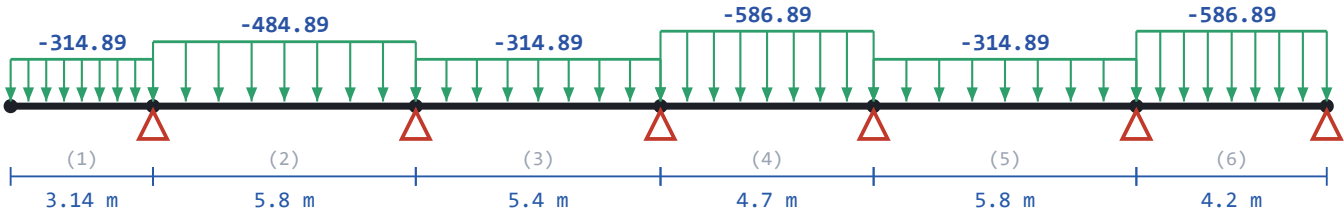
ALTERNANCIA #1



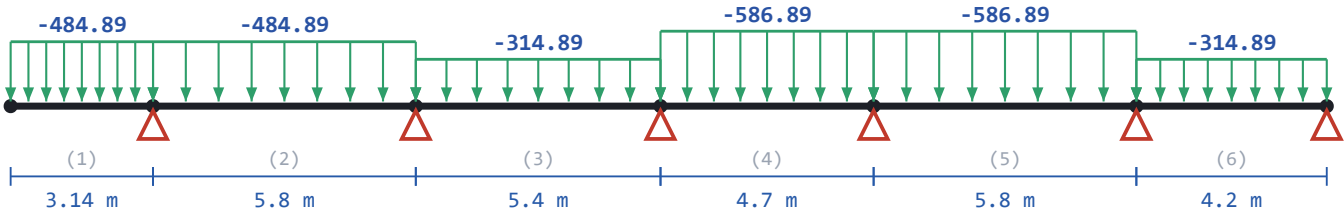
ALTERNANCIA #2



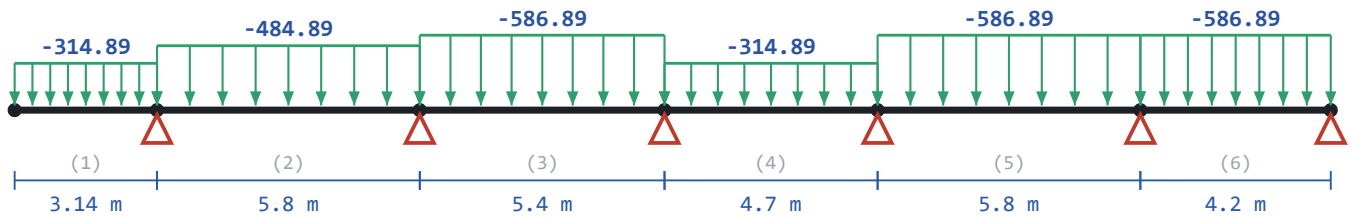
ALTERNANCIA #3



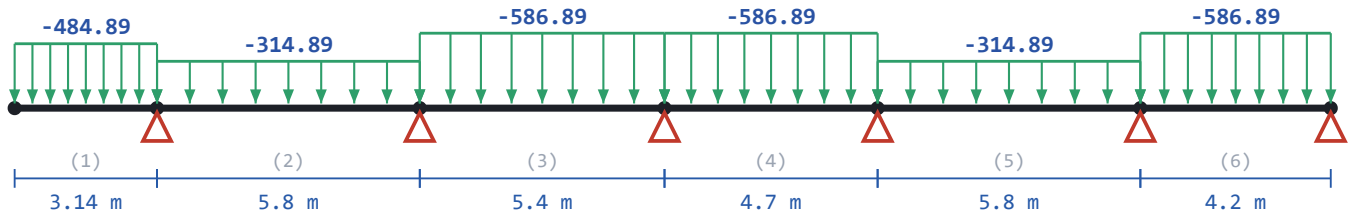
ALTERNANCIA #4



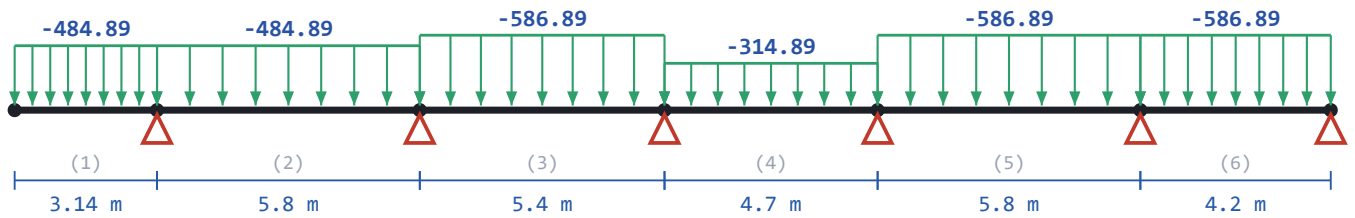
ALTERNANCIA #5



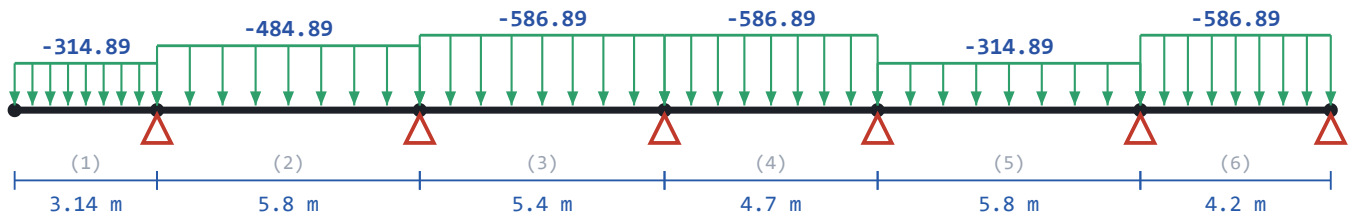
ALTERNANCIA #6



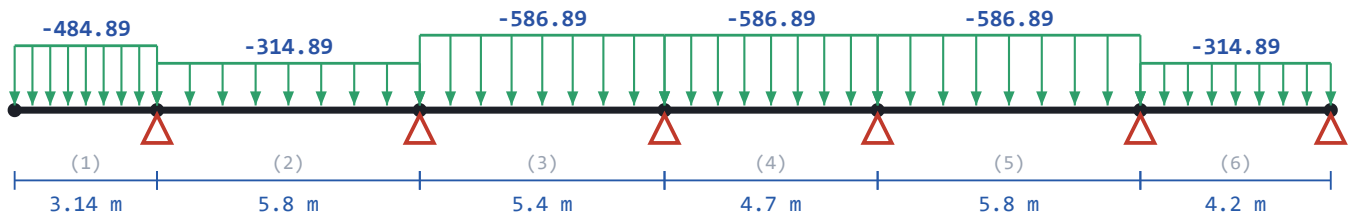
ALTERNANCIA #7



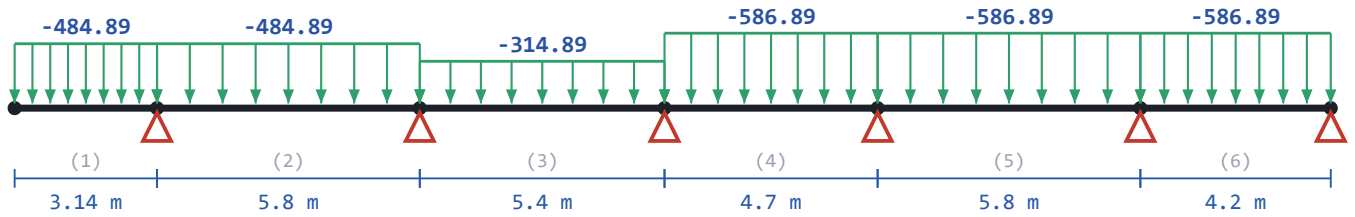
ALTERNANCIA #8



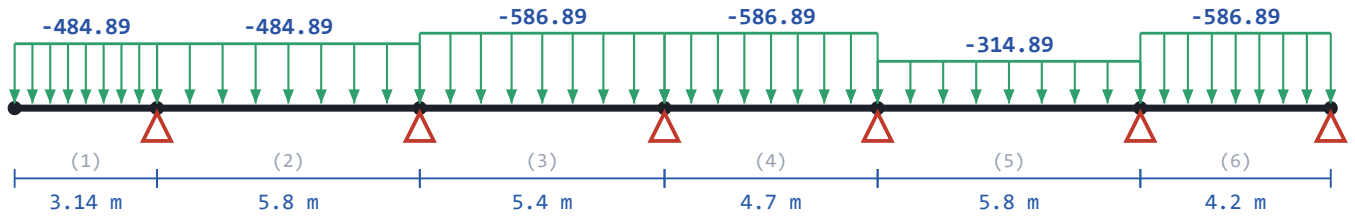
ALTERNANCIA #9



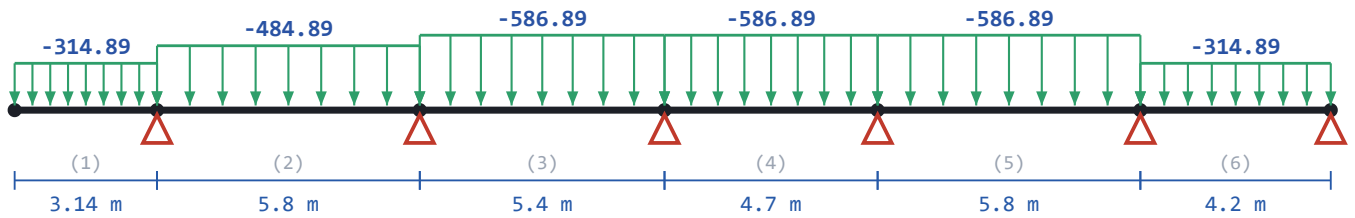
ALTERNANCIA #10



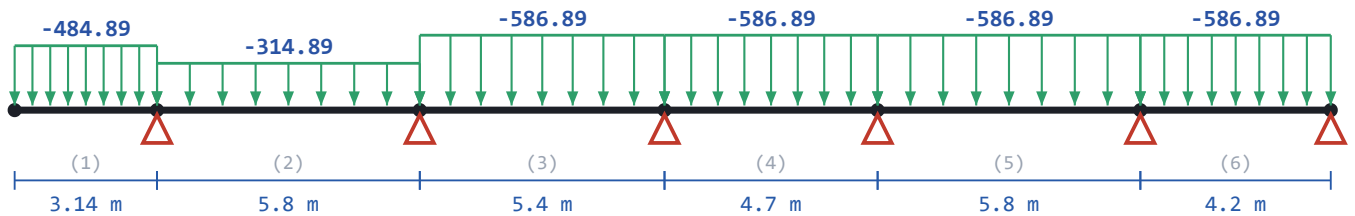
ALTERNANCIA #11



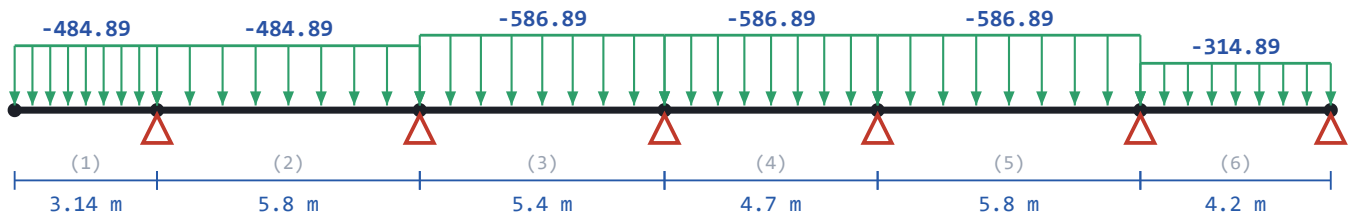
ALTERNANCIA #12



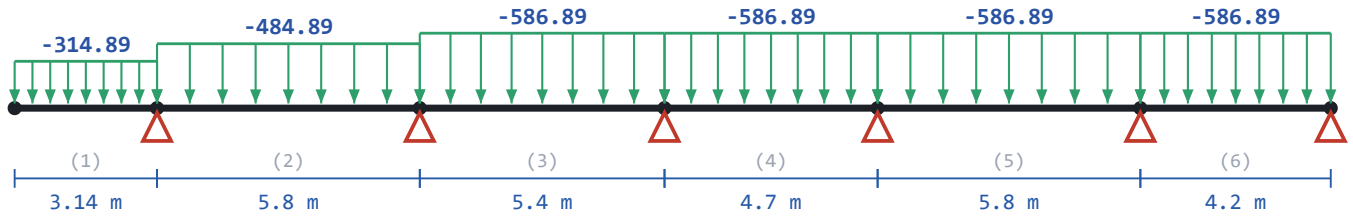
ALTERNANCIA #13



ALTERNANCIA #14



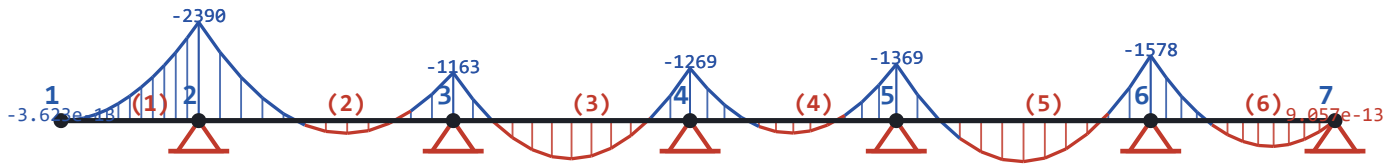
ALTERNANCIA #15



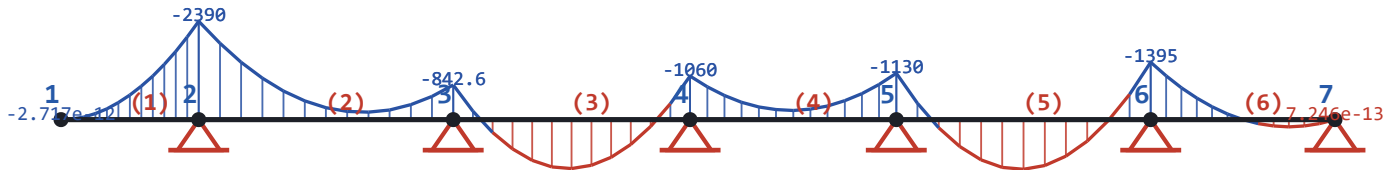
4.0 DIAGRAMAS POR ALTERNANCIA

4.1 Diagramas de momento flector (kg-m)

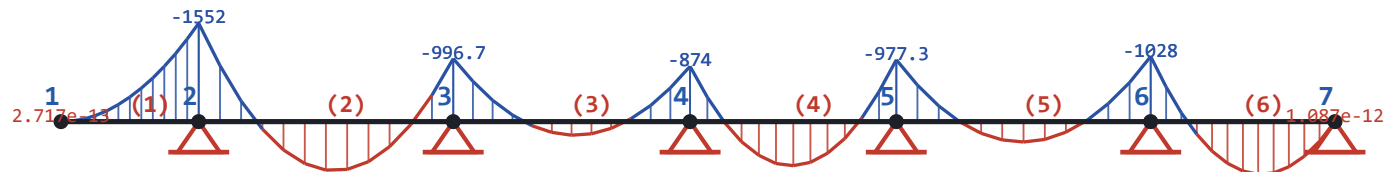
ALTERNANCIA #1 - MOMENTO



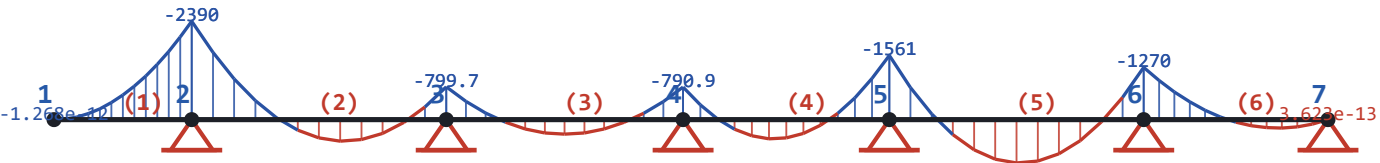
ALTERNANCIA #2 - MOMENTO



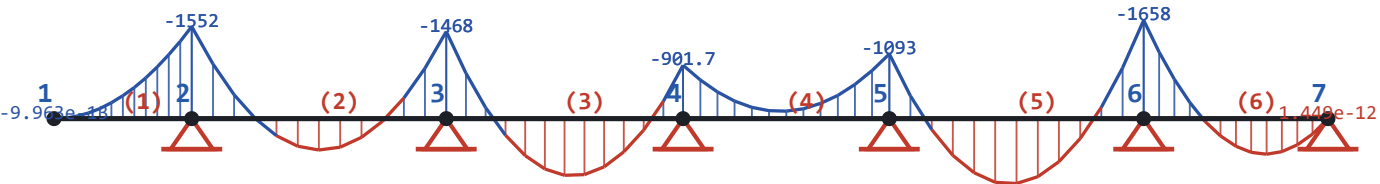
ALTERNANCIA #3 - MOMENTO



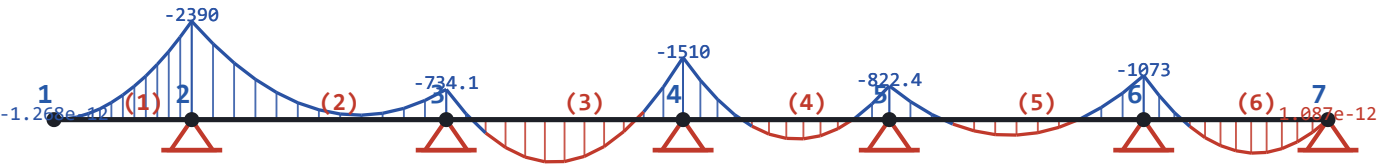
ALTERNANCIA #4 - MOMENTO



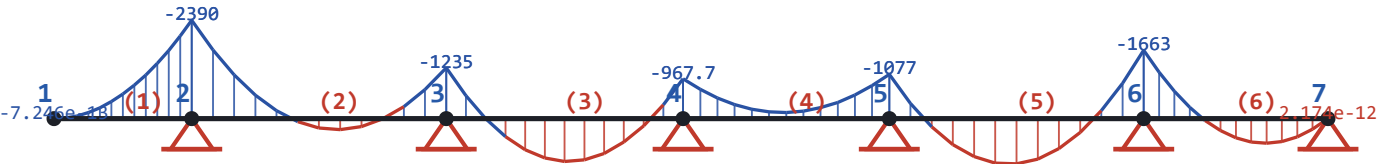
ALTERNANCIA #5 - MOMENTO



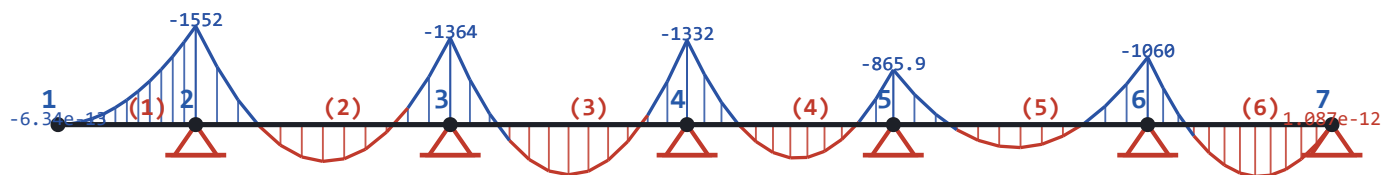
ALTERNANCIA #6 - MOMENTO



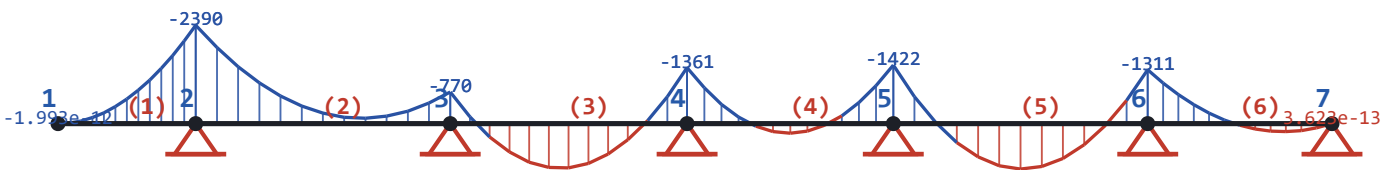
ALTERNANCIA #7 - MOMENTO



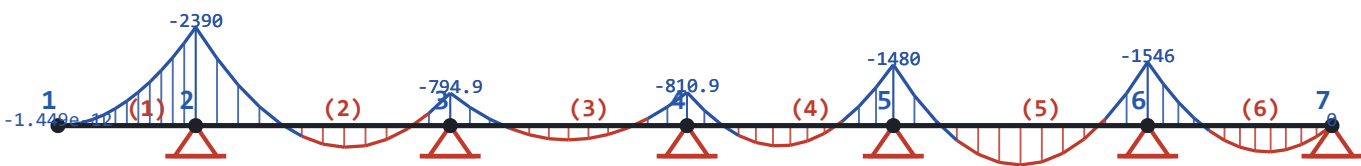
ALTERNANCIA #8 - MOMENTO



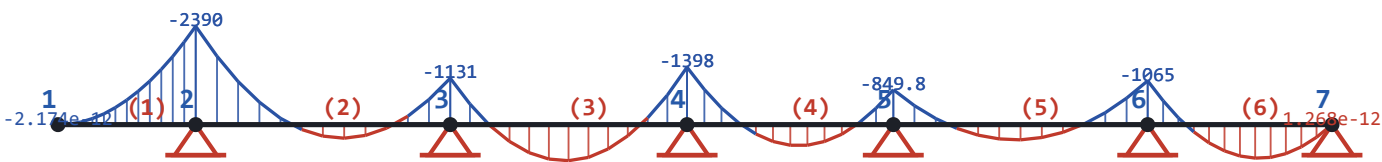
ALTERNANCIA #9 - MOMENTO



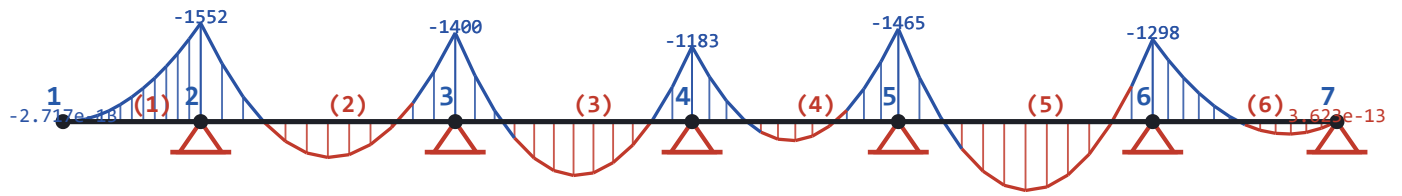
ALTERNANCIA #10 - MOMENTO



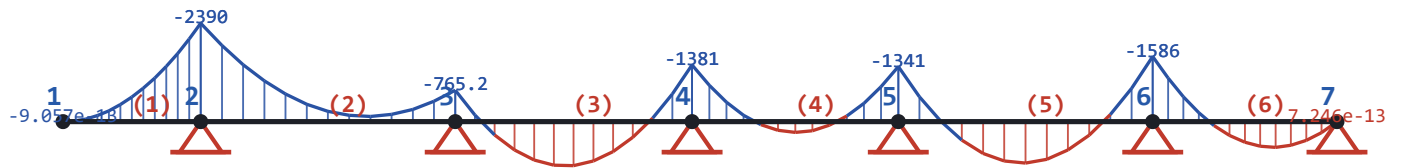
ALTERNANCIA #11 - MOMENTO



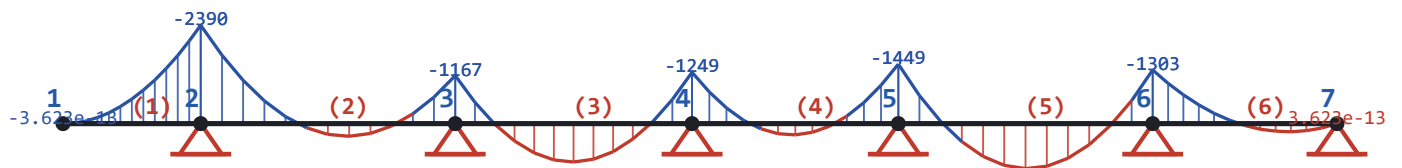
ALTERNANCIA #12 - MOMENTO



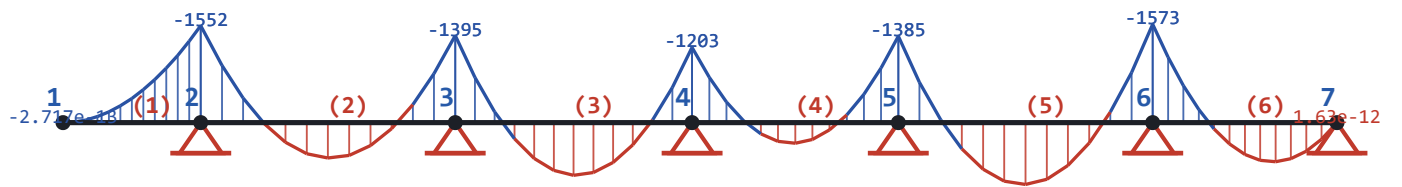
ALTERNANCIA #13 - MOMENTO



ALTERNANCIA #14 - MOMENTO

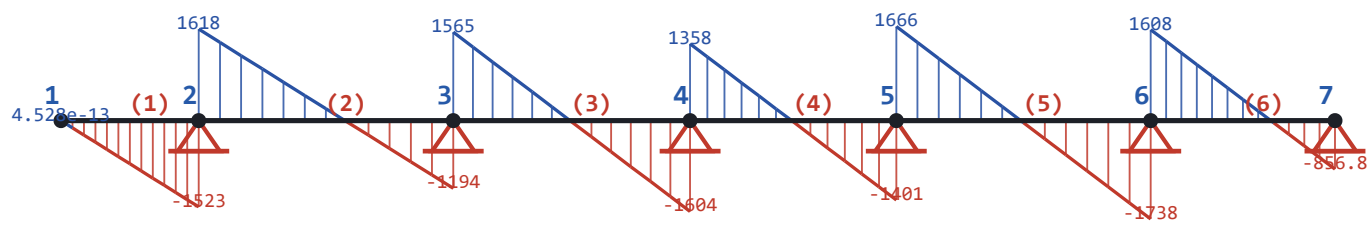


ALTERNANCIA #15 - MOMENTO

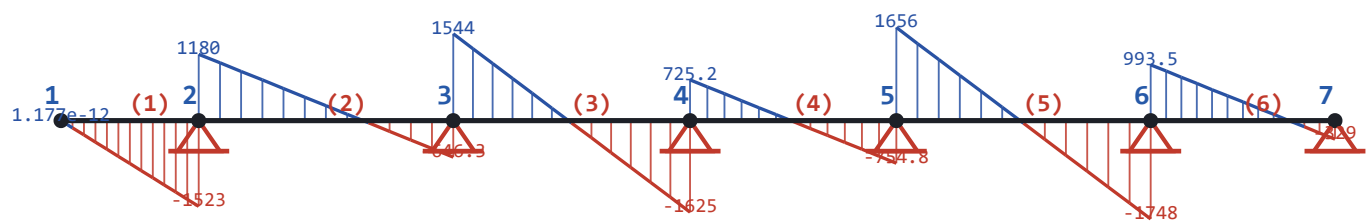


4.2 Diagramas de fuerza cortante (kg)

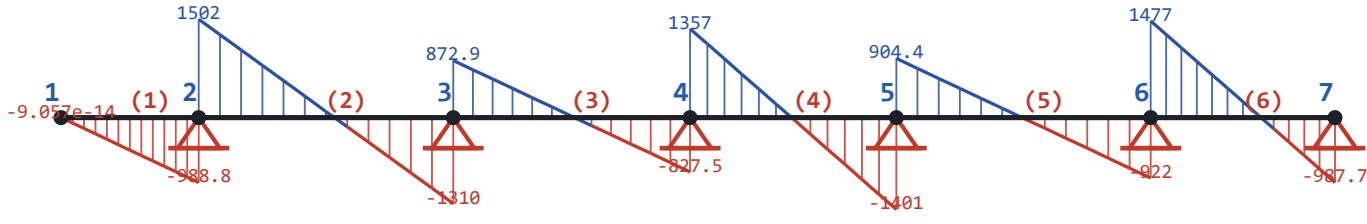
ALTERNANCIA #1 - CORTANTE



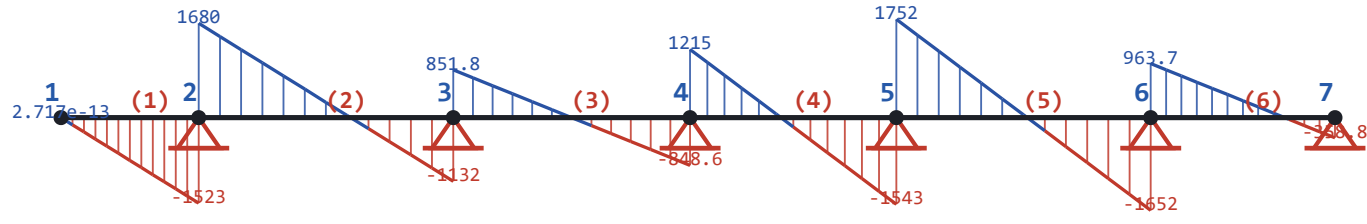
ALTERNANCIA #2 - CORTANTE



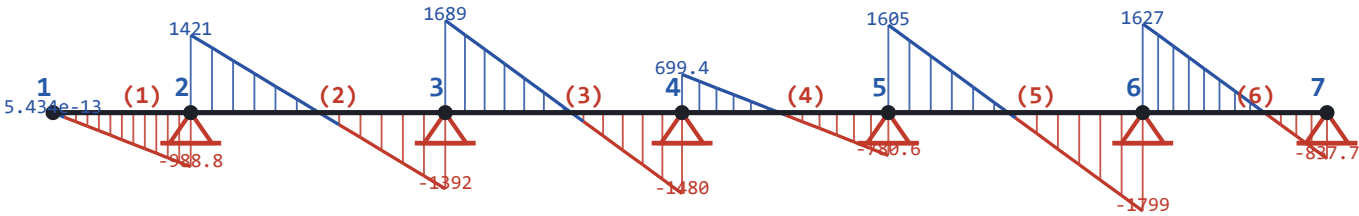
ALTERNANCIA #3 - CORTANTE



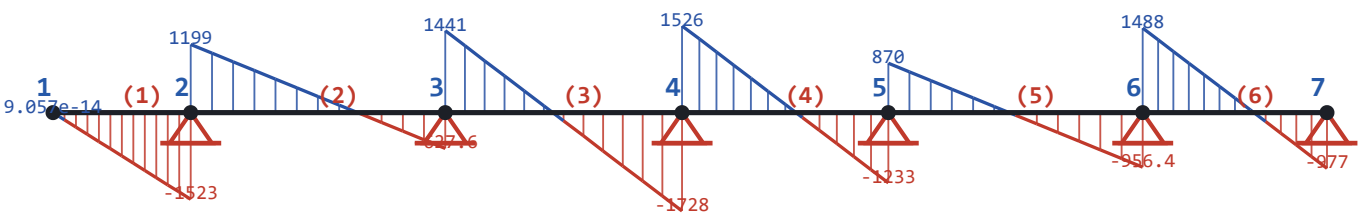
ALTERNANCIA #4 - CORTANTE



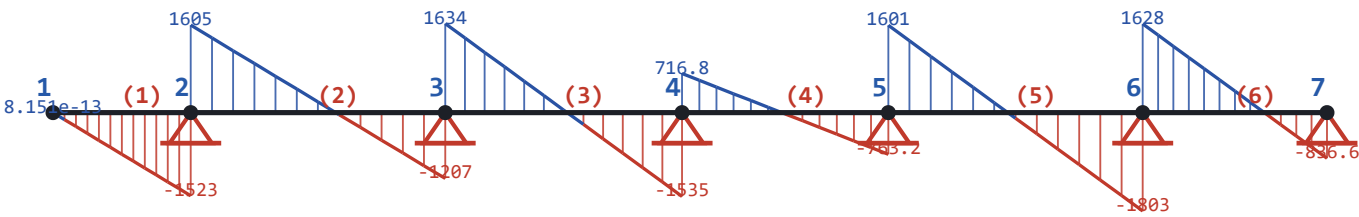
ALTERNANCIA #5 - CORTANTE



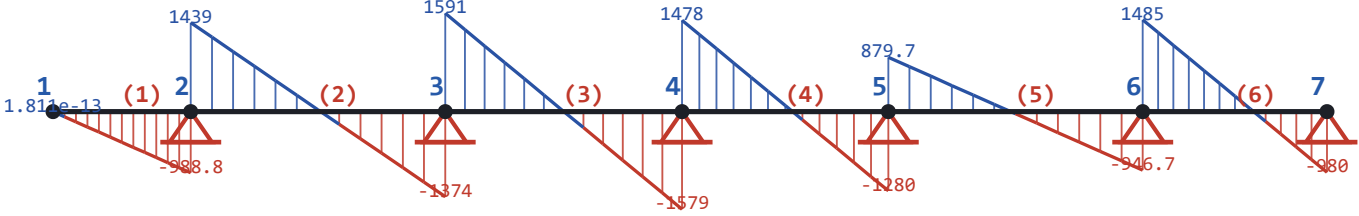
ALTERNANCIA #6 - CORTANTE



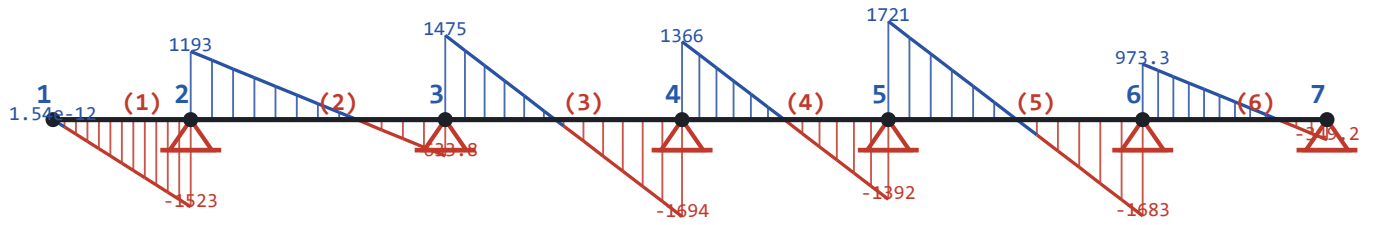
ALTERNANCIA #7 - CORTANTE



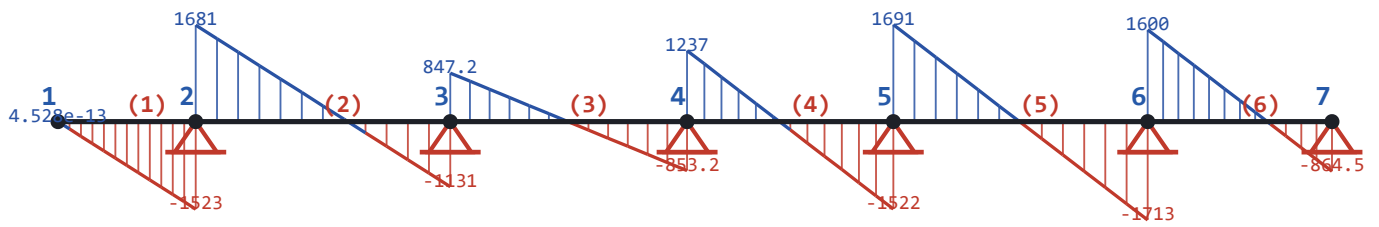
ALTERNANCIA #8 - CORTANTE



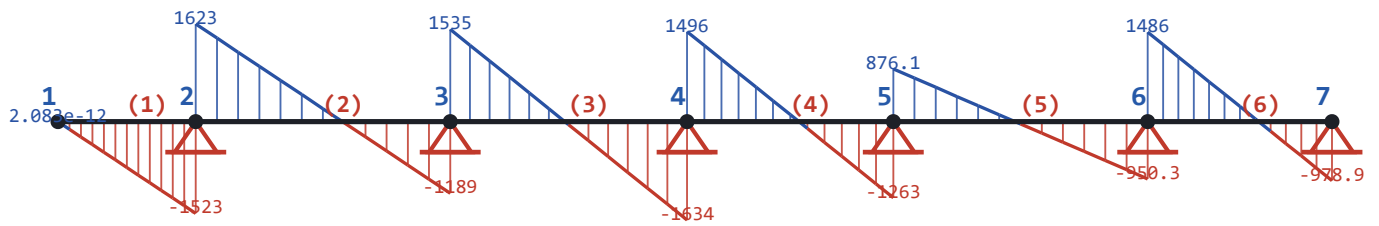
ALTERNANCIA #9 - CORTANTE



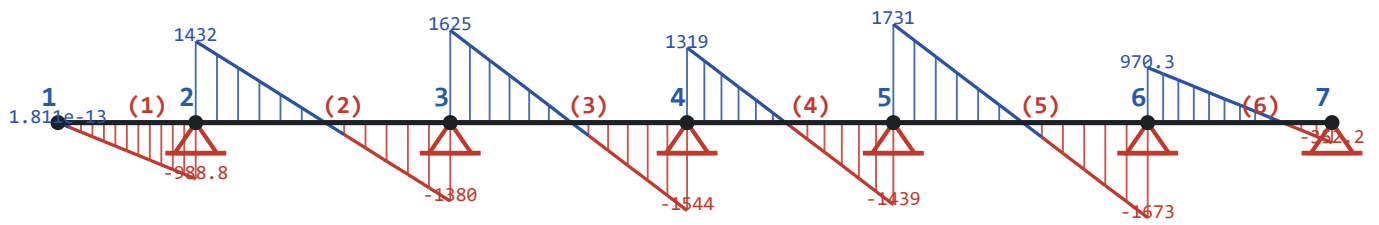
ALTERNANCIA #10 - CORTANTE



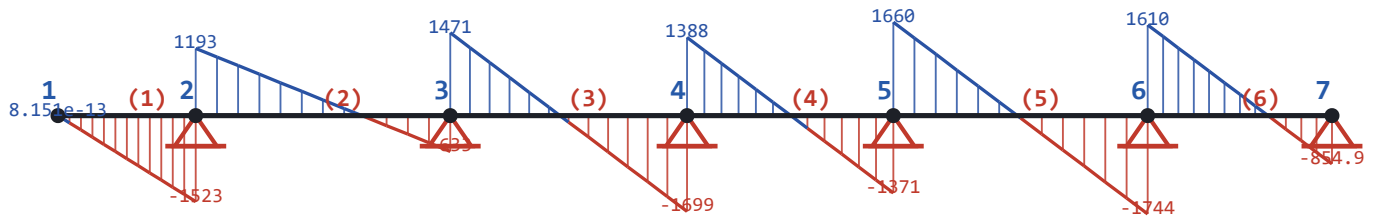
ALTERNANCIA #11 - CORTANTE



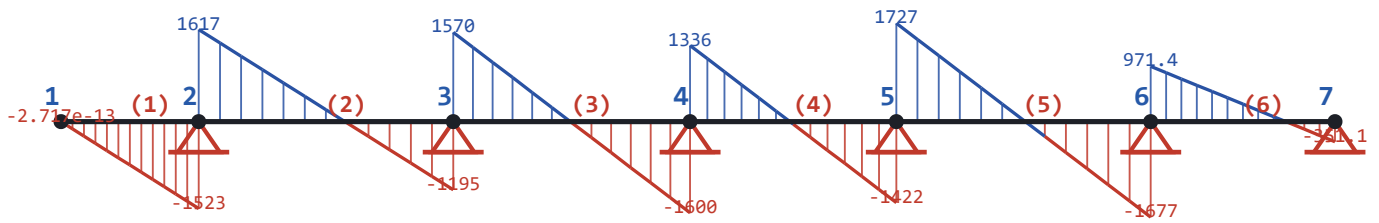
ALTERNANCIA #12 - CORTANTE



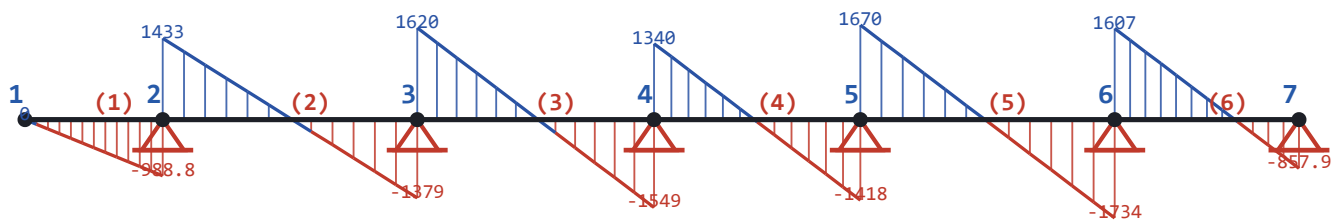
ALTERNANCIA #13 - CORTANTE



ALTERNANCIA #14 - CORTANTE

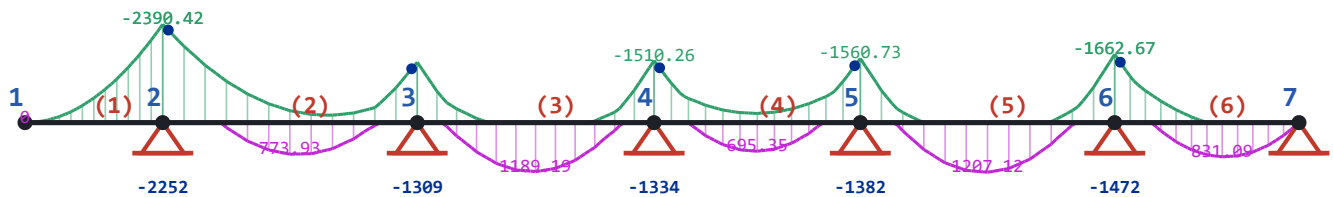


ALTERNANCIA #15 - CORTANTE

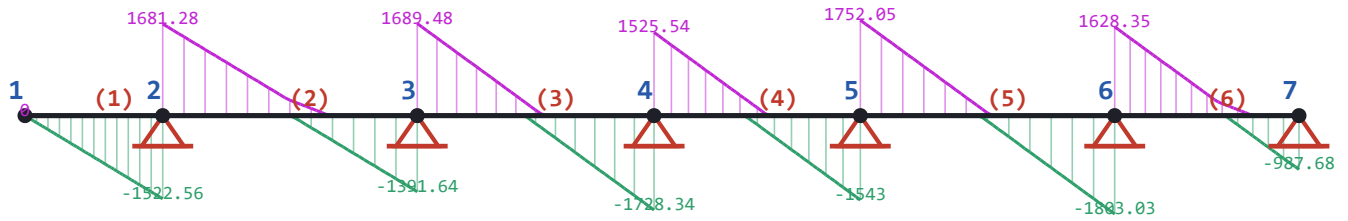


5.0 DIAGRAMAS DE ENVOLVENTE

5.1 ENVOLVENTE DE MOMENTO FLECTOR (KG-M)



5.2 ENVOLVENTE DE FUERZA CORTANTE (KG)



6.0 DISEÑO POR FLEXIÓN

6.1 ENVOLVENTE DE MOMENTOS CORREGIDOS (KG·M)



El momento negativo en cada nudo se toma **a la cara del apoyo** (a $\pm b_{\text{viga}}/2$ del eje, la cara más negativa de las dos barras vecinas), más realista que el pico en el eje. En extremos con la envolvente ≈ 0 se usa $|w \cdot L^2/24|$. En el diagrama de envolvente 5.1 se marca en azul.

6.2 Momento resistente negativo

$$M_u = \phi \cdot \rho_{\text{máx}} \cdot b_w \cdot d^2 \cdot f_y \cdot \left(1 - 0.59 \cdot \rho_{\text{máx}} \cdot \frac{f_y}{f'_c}\right)$$

$$\rightarrow \rho_b = \frac{0.85 \cdot f'_c \cdot 6000 \cdot \beta}{f_y \cdot (6000 + f_y)} = 0.02125 \quad \rho_{\text{máx}} = 0.75 \cdot \rho_b = 0.01594$$

$$\Rightarrow M_u(-) = 2554 \text{ kg} \cdot \text{m} \quad M_{\text{máx}}(-) = 2252.42 \text{ kg} \cdot \text{m}$$

OK! · CUMPLE $M_u(-) > M_{\text{máx}}(-)$

6.3 Momento resistente positivo

Asumiendo $c = 5 \text{ cm}$ (espesor de losa) $\rightarrow$ viga rectangular $b = 40 \text{ cm}$.

$$a = \beta \cdot c = 4.25 \text{ cm} \quad A_s = \frac{0.85 \cdot f'_c \cdot a \cdot b}{f_y} = 7.22 \text{ cm}^2$$

$$M_u(+) = \phi \cdot A_s \cdot f_y \cdot (d - a/2) = 4206 \text{ kg} \cdot \text{m} \quad M_{\text{máx}}(+) = 1207.12 \text{ kg} \cdot \text{m}$$

OK · CUMPLE $M_u(+) > M_{\text{máx}}(+)$

6.4 Área de acero mínimo y máximo

$$A_{smin} = \frac{0.7 \cdot \sqrt{f'c} \cdot b_w \cdot d}{f_y} = 0.72 \text{ cm}^2$$
$$A_{smax} = \rho_{max} \cdot b_w \cdot d = 4.75 \text{ cm}^2$$

6.5 Área de acero de los momentos en losas (cm²)

$$A_s = \frac{0.85 \cdot f'c \cdot b \cdot d}{f_y} \cdot \left(1 - \sqrt{1 - \frac{2 \cdot M_u}{\phi \cdot 0.85 \cdot f'c \cdot b \cdot d^2}} \right)$$

AS CALCULADO (CM²)



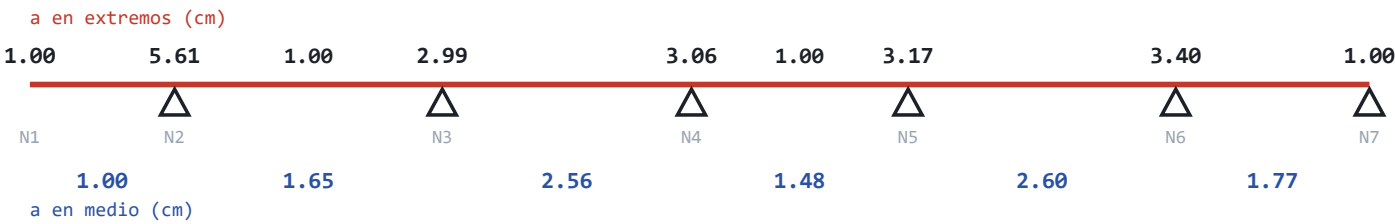
6.6 AS CORREGIDO - AS_{MÍN} < AS < AS_{MÁX} (CM²)



6.6.1 Cálculo del valor de "a"

$$a = \frac{A_s \cdot f_y}{0.85 \cdot f'c \cdot b_w}$$

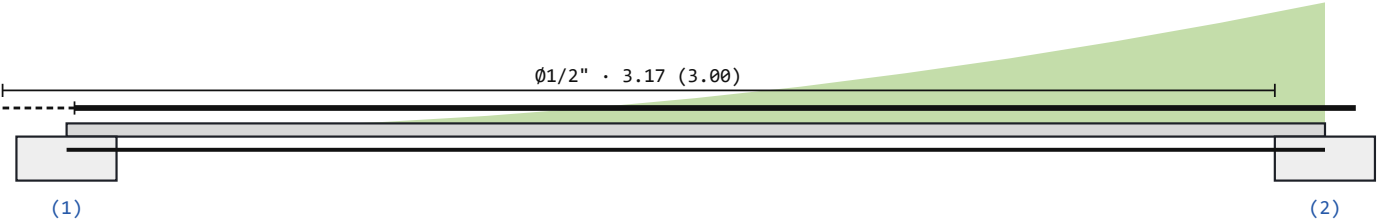
VALOR DE "A" (CM)



7.0 DISTANCIA DE CORTE DE ACERO POR FLEXIÓN (M)

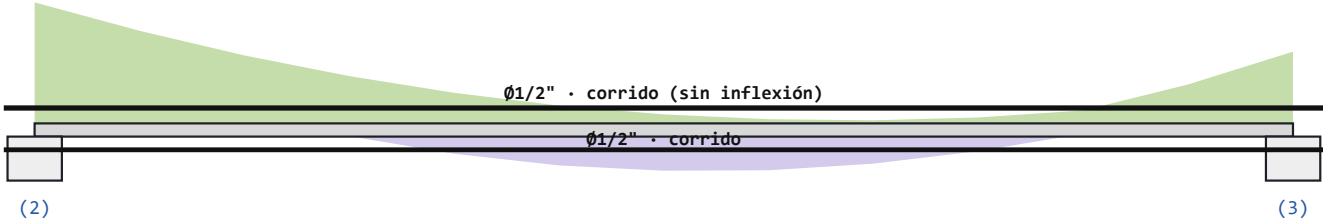
DISTANCIAS DE CORTE - BARRA #1

ARMADO BARRA 1 • L=3.14 m



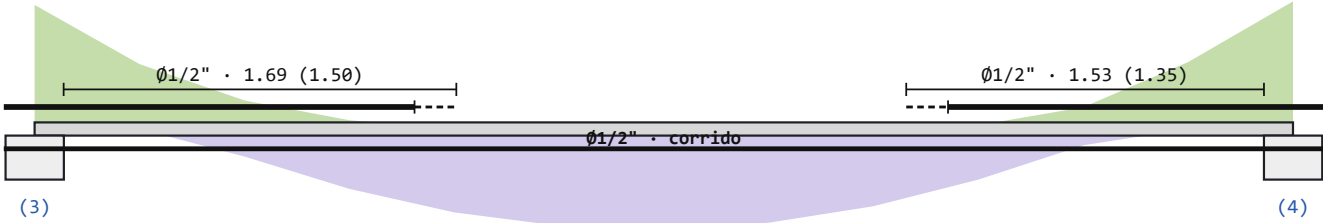
DISTANCIAS DE CORTE - BARRA #2

ARMADO BARRA 2 • L=5.80 m



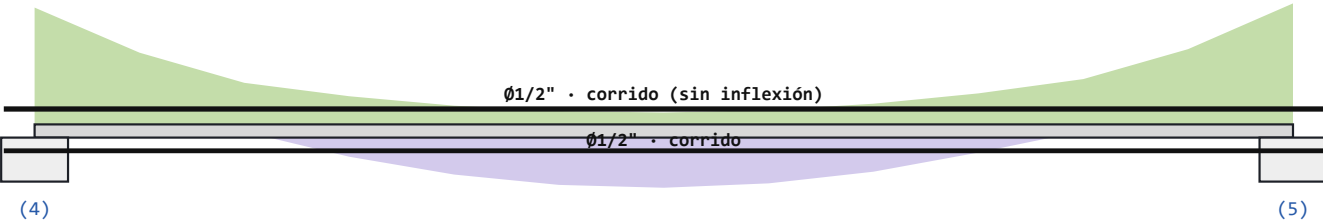
DISTANCIAS DE CORTE - BARRA #3

ARMADO BARRA 3 • L=5.40 m



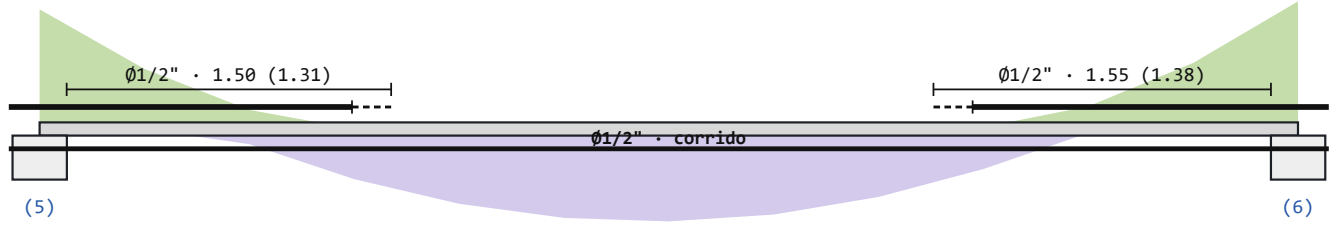
DISTANCIAS DE CORTE - BARRA #4

ARMADO BARRA 4 • L=4.70 m



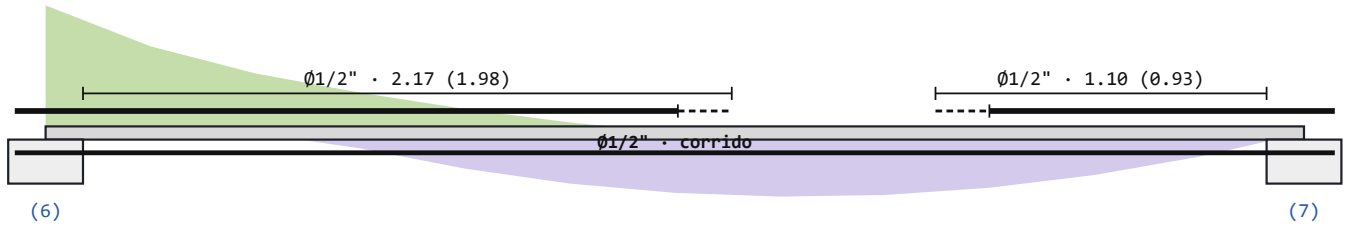
DISTANCIAS DE CORTE - BARRA #5

ARMADO BARRA 5 • L=5.80 m



DISTANCIAS DE CORTE - BARRA #6

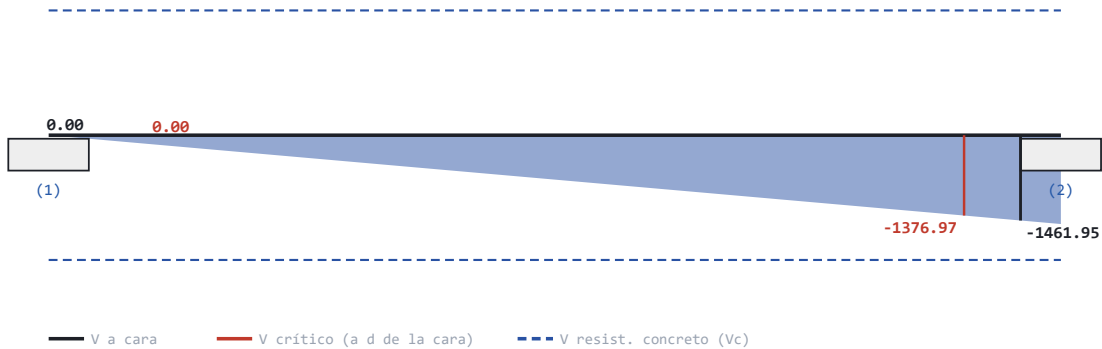
ARMADO BARRA 6 • L=4.20 m



8.0 VERIFICACIÓN POR CORTANTE (ENSANCHAMIENTO DE VIGUETA)

BARRA #1 - VC = 2139.46 KG

BARRA #1 – Cortante resistente $V_c = 2139.46$ kg



LADO IZQUIERDO

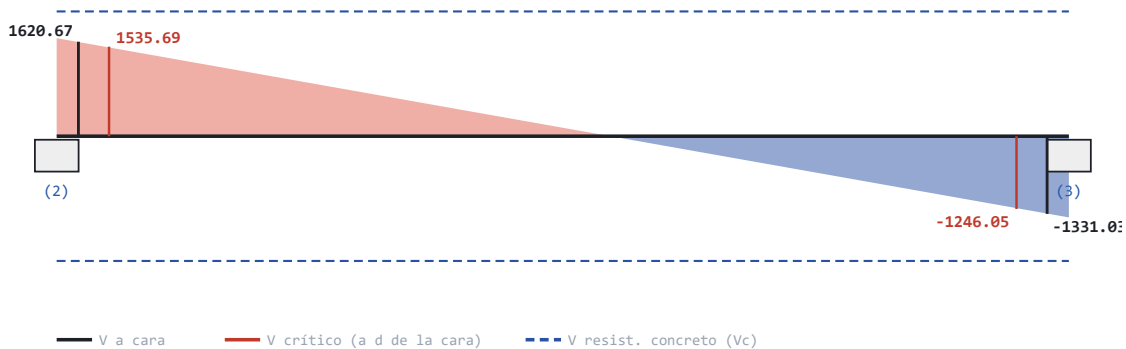


LADO DERECHO



BARRA #2 - VC = 2139.46 KG

BARRA #2 – Cortante resistente $V_c = 2139.46$ kg



LADO IZQUIERDO

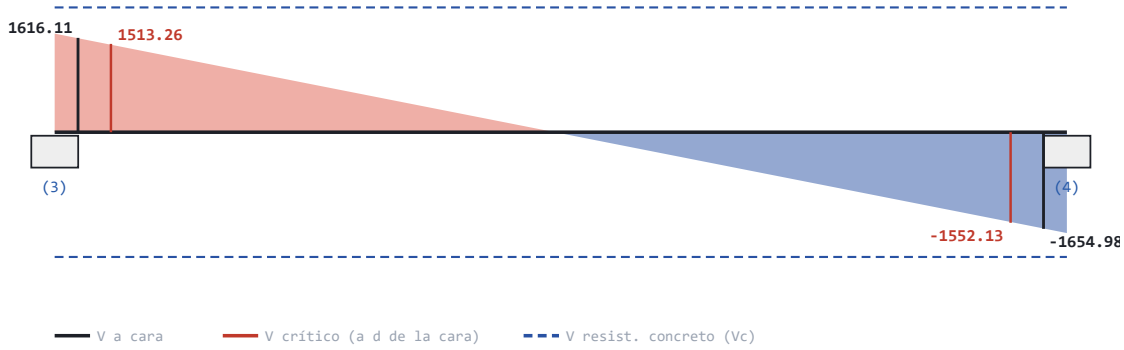


LADO DERECHO



BARRA #3 - VC = 2139.46 KG

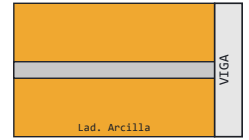
BARRA #3 – Cortante resistente $V_c = 2139.46$ kg



LADO IZQUIERDO

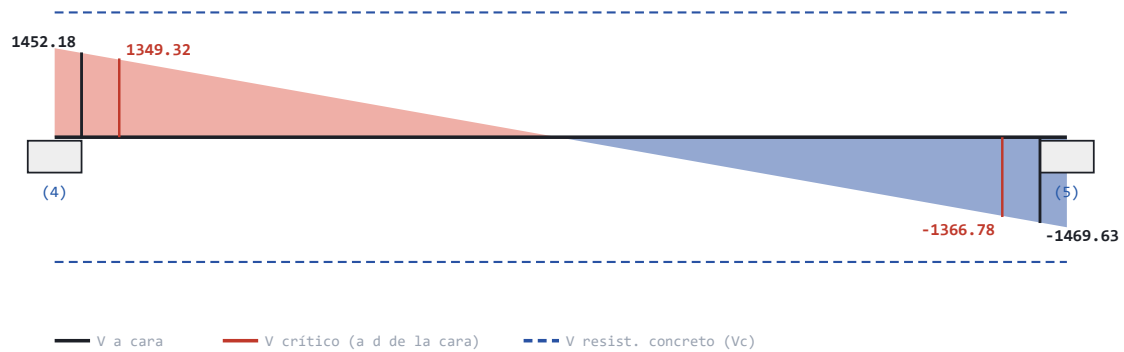


LADO DERECHO



BARRA #4 - VC = 2139.46 KG

BARRA #4 – Cortante resistente $V_c = 2139.46$ kg



LADO IZQUIERDO

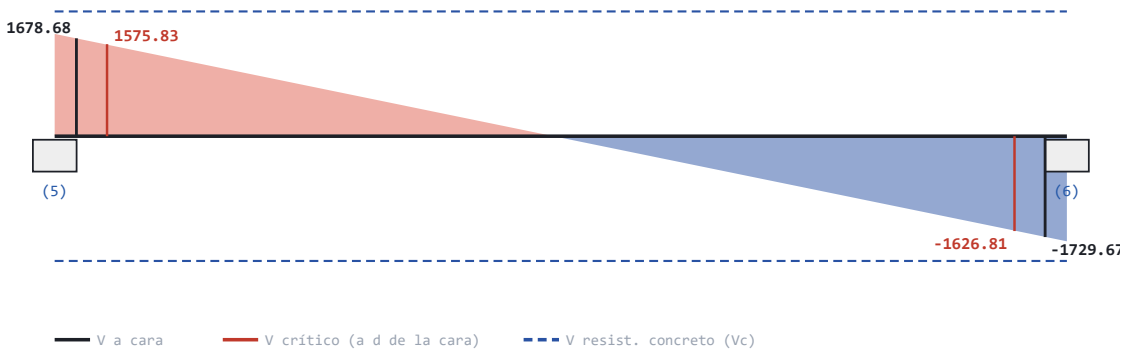


LADO DERECHO



BARRA #5 - VC = 2139.46 KG

BARRA #5 – Cortante resistente $V_c = 2139.46$ kg



LADO IZQUIERDO



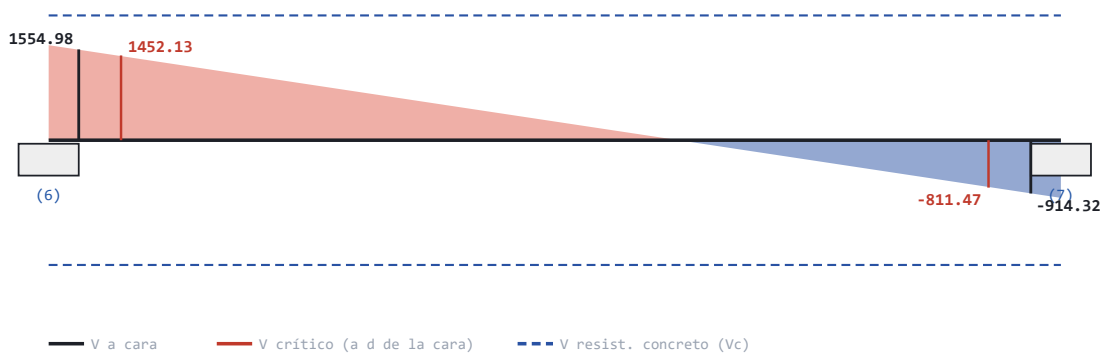
LADO DERECHO



BARRA #6 - VC = 2139.46 KG

BARRA #6 – Cortante resistente $V_c = 2139.46$ kg

LADO IZQUIERDO



LADO DERECHO



9.0 DISTRIBUCIÓN FINAL DE ACERO EN LA LOSA ALIGERADA

ACERO SUPERIOR (NEGATIVO) E INFERIOR (POSITIVO) POR TRAMO

