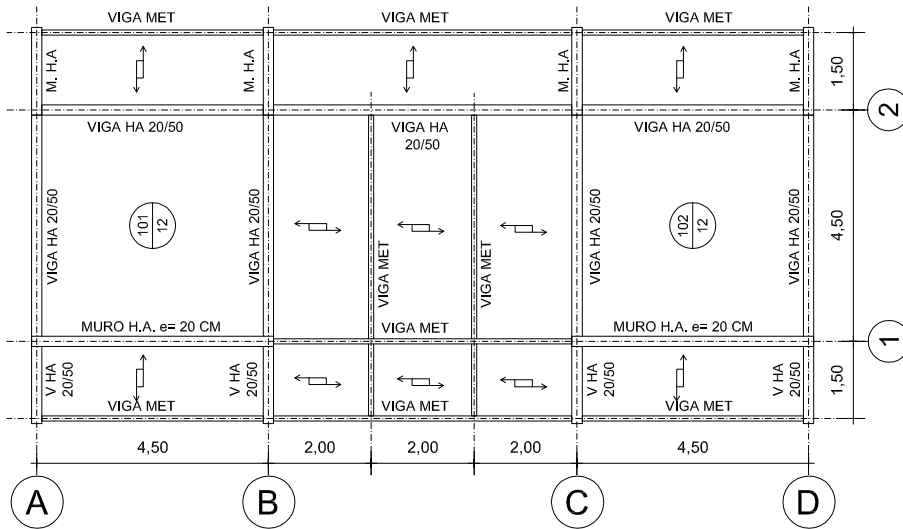


GUÍA N°4 - RESULTADOS

Profesores: Verónica Veas B. - Jing Chang Lou

Ayudante: Elisabeth Avalos - Preeti Bellani



DATOS:

Pesos:

Envigado + S. Uso = 250 kg/m²Hormigón = 2500 kg/m³LOsa HA + S. Uso = 550 kg/m²

Se desprecia el peso propio de las vigas metálicas

Acero A37-24ES

Fds = 1.440 kg/cm²Es = 2.100.000 kg/cm²

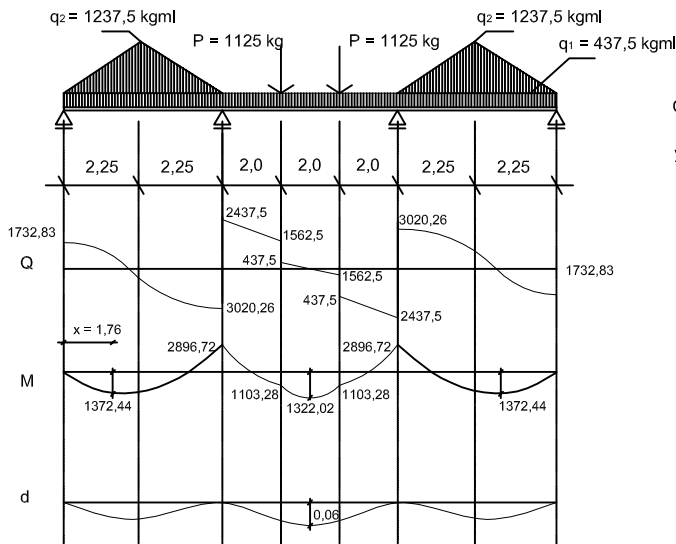
Hormigón H-20

Fdc = 67 kg/cm²Ec = 200.000 kg/cm²

Flecha admisible según norma

Ymax = L/300

VIGA EJE 2



Comprobación por deformación

$$y_{adm} = \frac{600}{300} = 2 \text{ cm}$$

y max en tramo central de la viga

$$y_{max} = -\frac{23PL^3}{648EI} - \frac{5qL^4}{384EI} + \frac{ML^2}{16EI} + \frac{ML^2}{16EI}$$

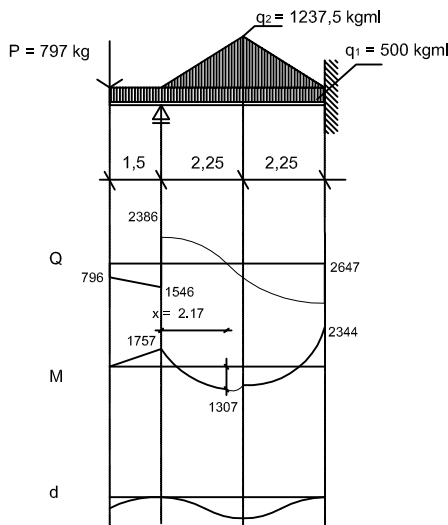
$$I = \frac{bh^3}{12}$$

$$I = 208.333,33 \text{ cm}^4$$

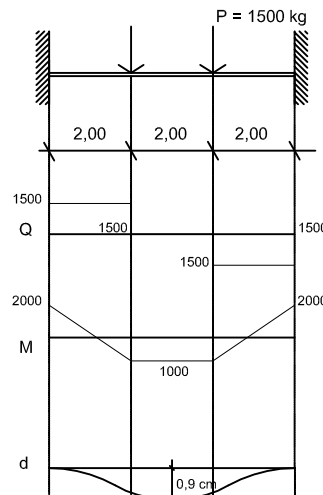
$$y_{max} = 0,06 \text{ cm}$$

$$0,06 \text{ cm} \leq 2 \text{ cm}$$

VIGA EJE B



VIGA EJE 1



Diseño por deformación

$$y_{adm} = \frac{600}{300} = 2 \text{ cm}$$

$$y = 2 \text{ cm} = \frac{5 \times 1500 \times 600^3}{648 \times 21000000 \times I}$$

$$I = 595,23 \text{ cm}^4 \rightarrow \text{Aplicando tabla nos da Perfil IPE 180 con } I=1320 \text{ cm}^4$$

Con el perfil IPE 180 la viga desciende 0,9 cm.

Deformación en vigas

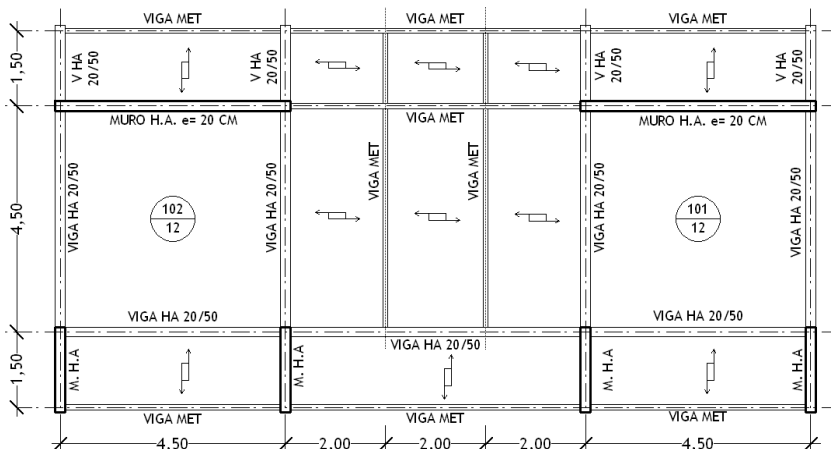
ESTRUCTURAS 2

1

profesores: Verónica Veas - Jing Chang Lou ayudantes: Preeti Bellani - Elisabeth Avalos

Deformación en vigas

GUIA 4



Deformación en vigas

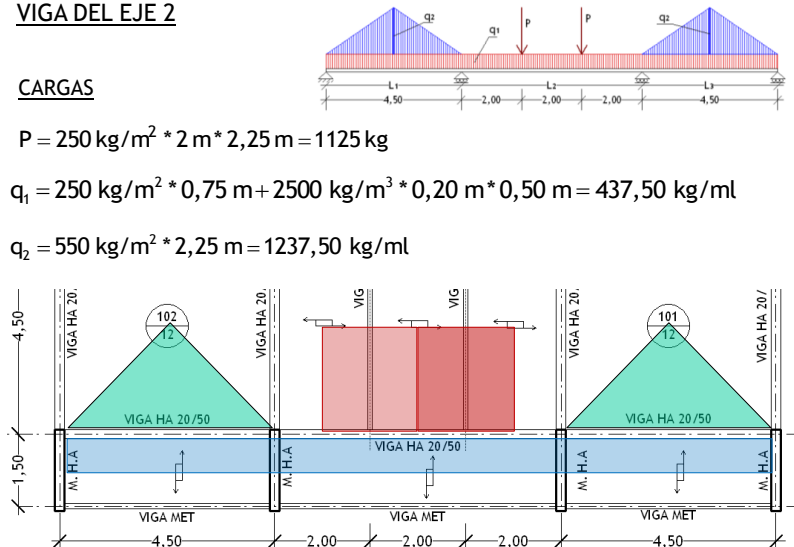
VIGA DEL EJE 2

CARGAS

$$P = 250 \text{ kg/m}^2 * 2 \text{ m} * 2,25 \text{ m} = 1125 \text{ kg}$$

$$q_1 = 250 \text{ kg/m}^2 * 0,75 \text{ m} + 2500 \text{ kg/m}^3 * 0,20 \text{ m} * 0,50 \text{ m} = 437,50 \text{ kg/ml}$$

$$q_2 = 550 \text{ kg/m}^2 * 2,25 \text{ m} = 1237,50 \text{ kg/ml}$$

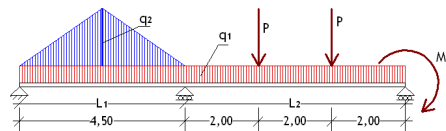
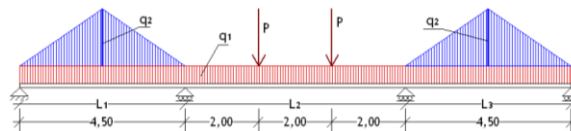


Deformación en vigas

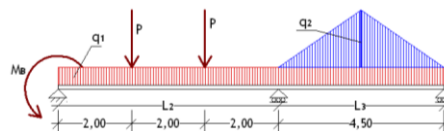
VIGA DEL EJE 2

TEOREMA DE LOS TRES MOMENTOS O CLAPEYRON

$$M_A * L_1 + 2M_B * (L_1 + L_2) + M_C * L_2 = 6 * (T_{C1} + T_{C2})$$



$$2M_B * (L_1 + L_2) + M_C * L_2 = 6 * (T_{C1} + T_{C2})$$



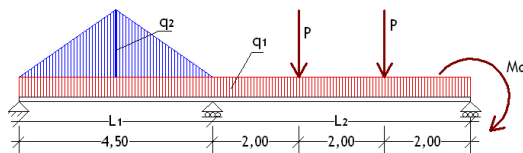
$$M_B * L_2 + 2M_C * (L_2 + L_3) = 6 * (T_{C2} + T_{C3})$$

Deformación en vigas

VIGA DEL EJE 2

TEOREMA DE LOS TRES MOMENTOS O CLAPEYRON

$$M_A * L_1 + 2M_B * (L_1 + L_2) + M_C * L_2 = 6 * (T_{C1} + T_{C2})$$



$$0 * L_1 + 2M_B * (L_1 + L_2) + M_C * L_2 = 6 * \left(\frac{q_1 L_1^3}{24} + \frac{5q_2 L_1^3}{192} + \frac{q_1 L_2^3}{24} + \frac{P L_2^2}{9} \right)$$

$$2M_B * (4,5 + 6) + M_C * 6 = 6 * \left(\frac{437,5 * 4,5^3}{24} + \frac{5 * 1237,5 * 4,5^3}{192} + \frac{437,5 * 6^3}{24} + \frac{1125 * 6^2}{9} \right)$$

$$2M_B * 10,5 + 6M_C = 6 * 13035,27$$

$$21M_B + 6M_C = 78211,62$$

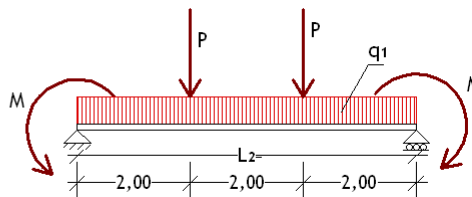
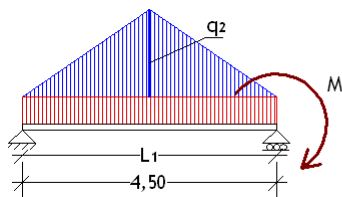
$$M_B = M_C = M$$

$$27M = 78211,62$$

$$M = 2896,72 \text{ kgm}$$

Deformación en vigas

VIGA DEL EJE 2



Deformación en vigas

VIGA DEL EJE 2

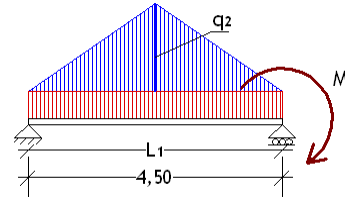
REACCIONES - TRAMO 1

$$R_A = \frac{q_1 L_1}{2} + \frac{q_2 L_1}{4} - \frac{M}{L}$$

$$R_A = \frac{437,5 * 4,5}{2} + \frac{1237,5 * 4,5}{4} - \frac{2896,72}{4,5} = 1732,83 \text{ kg}$$

$$R_B = \frac{q_1 L_1}{2} + \frac{q_2 L_1}{4} + \frac{M}{L}$$

$$R_{B_{izq}} = \frac{437,5 * 4,5}{2} + \frac{1237,5 * 4,5}{4} + \frac{2896,72}{4,5} = 3020,26 \text{ kg}$$



Deformación en vigas

VIGA DEL EJE 2

EC. GENERAL DE CORTE - TRAMO 1

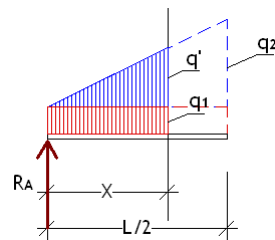
$$R_A - q_1 * x - \frac{2q_2 x}{L} \frac{x}{2} = 0$$

$$1732,83 - 437,5 * x - 275 * x^2 = 0$$

$$x = \frac{-(-437,5) \pm \sqrt{(-437,5)^2 - 4 * -275 * 1732,83}}{2 * -275}$$

$$x_1 = 1,76 \text{ m}$$

$$x_2 = -3,35 \text{ m}$$



Deformación en vigas

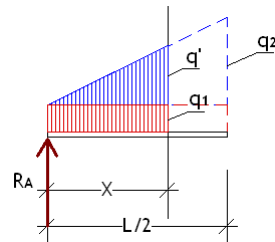
VIGA DEL EJE 2

MOMENTO MAXIMO - TRAMO 1 $x_1 = 1,76 \text{ m}$

$$M_{MAX} = R_A * x - q_1 * \frac{x^2}{2} - \frac{2q_2 x}{L} \frac{x}{2} \frac{x}{3}$$

$$M_{MAX} = 1732,83 * 1,76 - 437,5 * \frac{1,76^2}{2} - \frac{2 * 1237,5}{4,5} * \frac{1,76^3}{6}$$

$$M_{MAX} = 1872,44 \text{ kgm}$$



Deformación en vigas

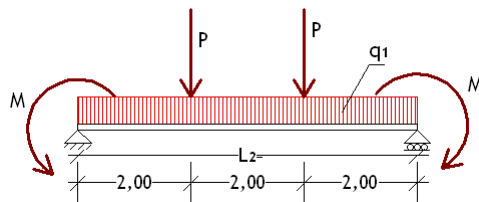
VIGA DEL EJE 2

REACCIONES - TRAMO 2

$$R_{B_{der}} = \frac{q_1 L_2}{2} + P - \frac{M}{L} + \frac{M}{L}$$

$$R_{B_{der}} = \frac{437,5 * 6}{2} + 1125 = 2437,50 \text{ kg}$$

$$R_{B_{der}} = R_{C_{izq}} = 2437,50 \text{ kg}$$



Deformación en vigas

VIGA DEL EJE 2

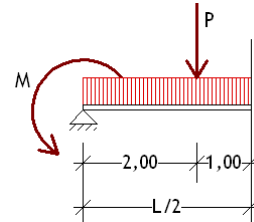
MOMENTO MAXIMO - TRAMO 2

$x = 3\text{ m}$

$$M_{MAX} = R_{B_{der}} * x - q_1 * \frac{x^2}{2} - P * \left(x - \frac{L}{3} \right) - M$$

$$M_{MAX} = 2437,50 * 3 - 437,5 * \frac{3^2}{2} - 1125 * 1 - 2896,72$$

$$M_{MAX} = 1322,02 \text{ kgm}$$



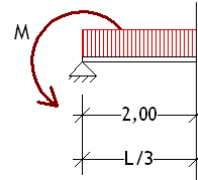
MOMENTO FLECTOR

$x = 2\text{ m}$

$$M_{MAX} = R_{B_{der}} * x - q_1 * \frac{x^2}{2} - M$$

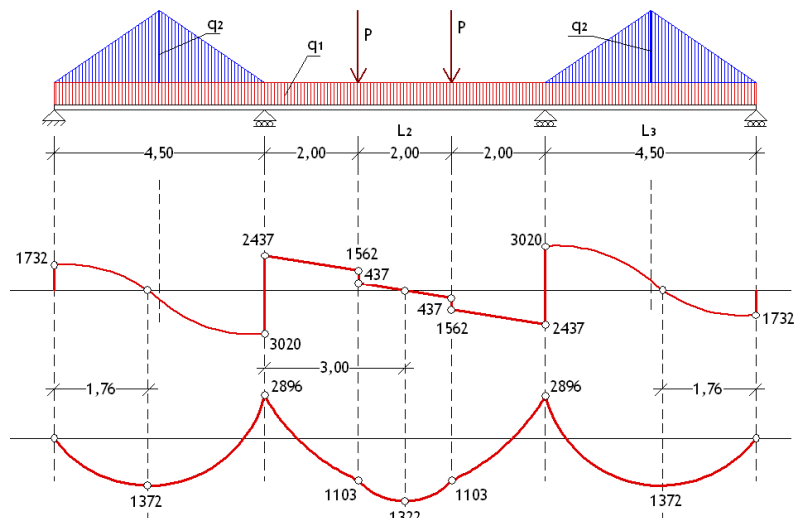
$$M_{MAX} = 2437,50 * 2 - 437,5 * \frac{2^2}{2} - 2896,72$$

$$M_{MAX} = 1103,28 \text{ kgm}$$



Deformación en vigas

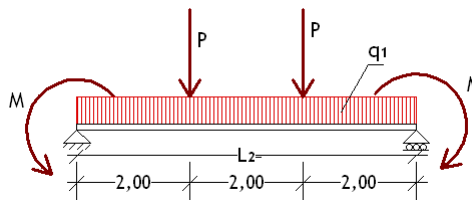
VIGA DEL EJE 2



Deformación en vigas

VIGA DEL EJE 2

FLECHA MAXIMA- TRAMO 2



$$y_{\max} = \frac{5q_1L_2^4}{384EI} + \frac{23PL_2^3}{648EI} - \frac{ML_2^2}{16EI} - \frac{ML_2^2}{16EI}$$

$$y_{\max} = \frac{5 \cdot 4,37 \cdot 600^4}{384EI} + \frac{23 \cdot 1125 \cdot 600^3}{648EI} - \frac{289672 \cdot 600^2}{16EI} - \frac{289672 \cdot 600^2}{16EI}$$

$$y_{\max} = 20,15 \text{ cm}$$

Deformación en vigas

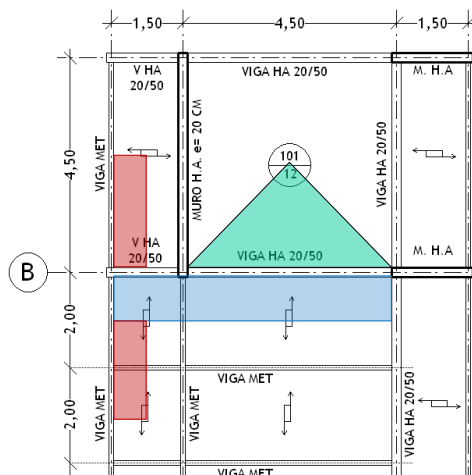
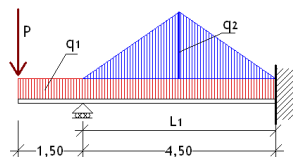
VIGA DEL EJE B

CARGAS

$$P = 250 \text{ kg/m}^2 \cdot 2,25 \text{ m} \cdot 0,75 \text{ m} \\ + 250 \text{ kg/m}^2 \cdot 2 \text{ m} \cdot 0,75 \text{ m} = 796,87 \text{ kg}$$

$$q_1 = 2500 \text{ kg/m}^3 \cdot 0,20 \text{ m} \cdot 0,50 \text{ m} \\ + 250 \text{ kg/m}^2 \cdot 0,75 \text{ m} = 437,50 \text{ kg/ml}$$

$$q_2 = 550 \text{ kg/m}^2 \cdot 2,25 \text{ m} = 1237,50 \text{ kg/ml}$$

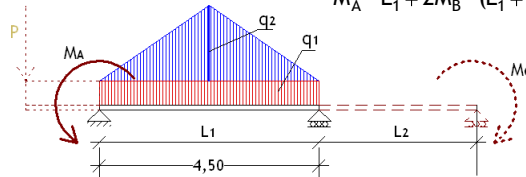


Deformación en vigas

VIGA DEL EJE B

TEOREMA DE LOS TRES MOMENTOS O CLAPEYRON

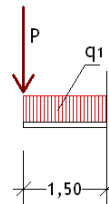
$$M_A * L_1 + 2M_B * (L_1 + L_2) + M_C * L_2 = 6 * (T_{C1} + T_{C2})$$



$$M_A * L_1 + 2M_B * (L_1 + L_2) + 0 * L_2 = 6 * \left(\frac{q_1 L_1^3}{24} + \frac{5q_2 L_1^3}{192} + 0 \right)$$

$$M_A = -796,87 * 1,5 - 500 * 1,5 * 0,75$$

$$M_A = -1757,80 \text{ kgm}$$

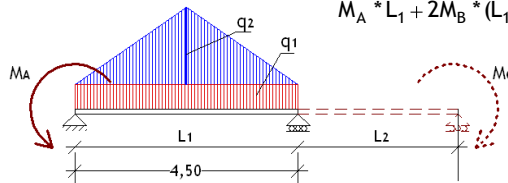


Deformación en vigas

VIGA DEL EJE B

TEOREMA DE LOS TRES MOMENTOS O CLAPEYRON

$$M_A * L_1 + 2M_B * (L_1 + L_2) + M_C * L_2 = 6 * (T_{C1} + T_{C2})$$



$$M_A * L_1 + 2M_B * (L_1 + L_2) + 0 * L_2 = 6 * \left(\frac{q_1 L_1^3}{24} + \frac{5q_2 L_1^3}{192} + 0 \right)$$

$$1757,80 * 4,5 + 2M_B * (4,5 + 0) = 6 * \left(\frac{500 * 4,5^3}{24} + \frac{5 * 1237,5 * 4,5^3}{192} \right)$$

$$7910,10 + 9M_B = 6 * 4835,08$$

$$9M_B = 21100,38$$

$$M_B = 2344,48 \text{ kgm}$$

Deformación en vigas

VIGA DEL EJE B

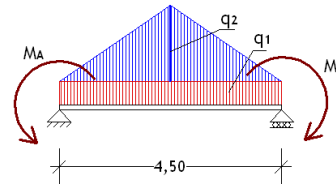
REACCIONES

$$R_A = \frac{q_1 L_1}{2} + \frac{q_2 L_1}{4} + \frac{M_A}{L} - \frac{M_B}{L}$$

$$R_A = \frac{500 \cdot 4,5}{2} + \frac{1237,5 \cdot 4,5}{4} + \frac{1757,80}{4,5} - \frac{2344,48}{4,5} = 2386,82 \text{ kg}$$

$$R_B = \frac{q_1 L_1}{2} + \frac{q_2 L_1}{4} - \frac{M_A}{L} + \frac{M_B}{L}$$

$$R_B = \frac{500 \cdot 4,5}{2} + \frac{1237,5 \cdot 4,5}{4} - \frac{1757,80}{4,5} + \frac{2344,48}{4,5} = 2647,56 \text{ kg}$$



Deformación en vigas

VIGA DEL EJE B

MOMENTO MAXIMO

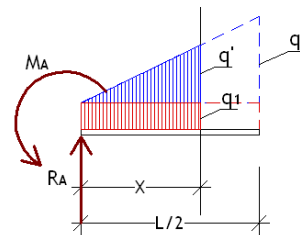
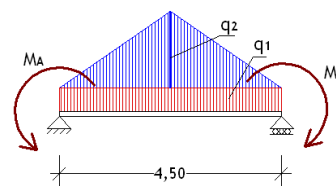
$$R_A - q_1 \cdot x - \frac{2q_2 x}{L} \cdot \frac{x}{2} = 0$$

$$2386,82 - 500 \cdot x - 275 \cdot x^2 = 0$$

$$x = \frac{-(-500) \pm \sqrt{(-500)^2 - 4 \cdot (-275) \cdot 2386,82}}{2 \cdot (-275)}$$

$$x_1 = 2,17 \text{ m}$$

$$x_2 = -3,99 \text{ m}$$



Deformación en vigas

VIGA DEL EJE B

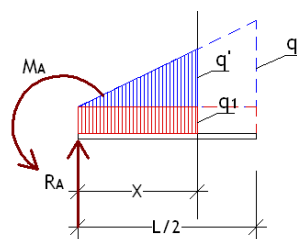
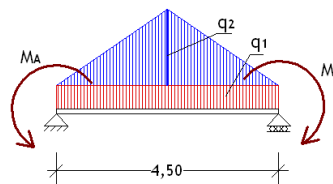
MOMENTO MAXIMO

$$x_1 = 2,17 \text{ m}$$

$$M_{MAX} = -M_A + R_A \cdot x - q_1 \cdot \frac{x^2}{2} - \frac{2q_2 x}{L} \cdot \frac{x}{2} \cdot \frac{x}{3}$$

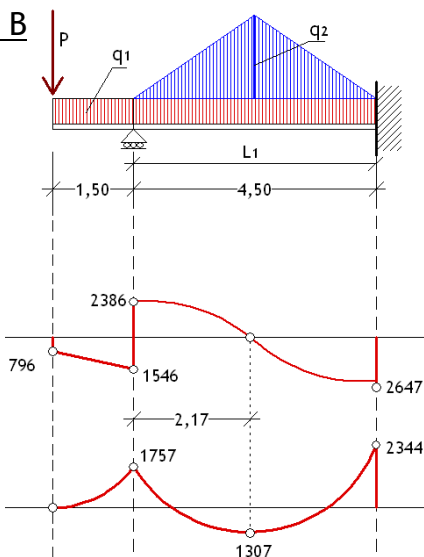
$$M_{MAX} = -1757,80 + 2386,82 \cdot 2,17 - 500 \cdot \frac{2,17^2}{2} - \frac{2 \cdot 1237,5}{4,5} \cdot \frac{2,17^3}{6}$$

$$M_{MAX} = 1307,67 \text{ kgm}$$



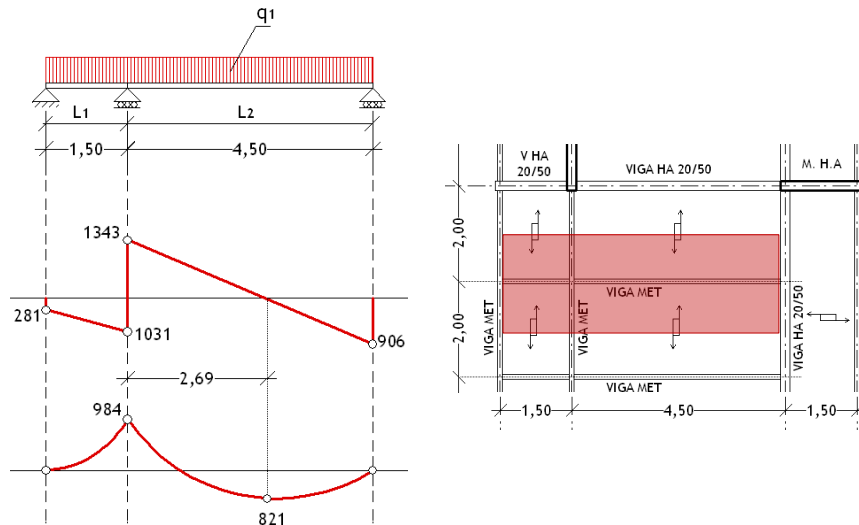
Deformación en vigas

VIGA DEL EJE B



Deformación en vigas

VIGA METALICA



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