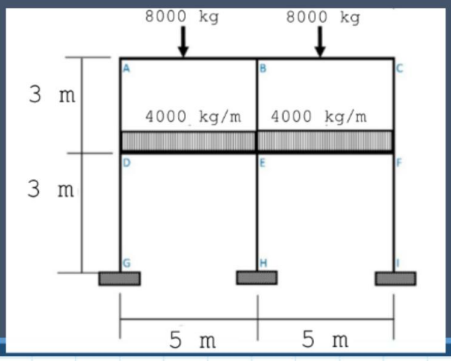
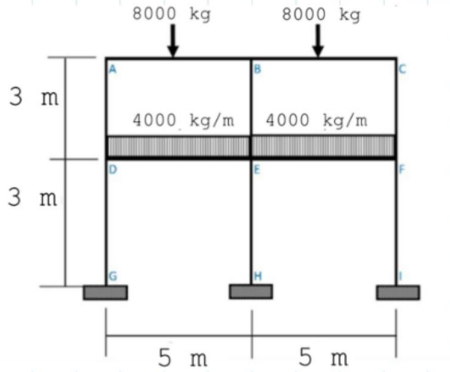
Ejemplo 1:

Determine grado de indeterminación estática, puntos de inflexión, diagrama de momentos, corte y fuerza axial del siguiente marco.



1. Grado de indeterminación estático



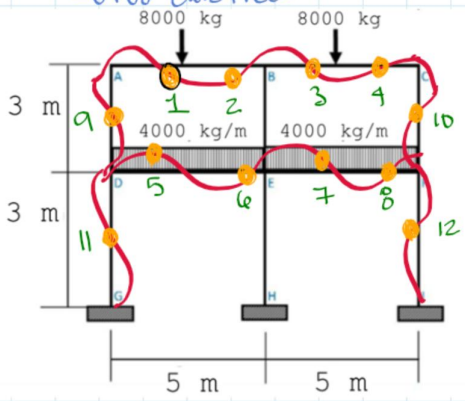
r = 9
n = 9
m = 10
c = 0

$G = 9 + 3*10 - 3*9 - 0 = 12$

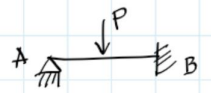
hiperestatico Grado 12

2. Puntos de inflexión

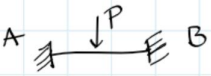
Curva elastica



Estimación de los puntos



PI ① 0 L



0.25L

Promedio 1 0.125L

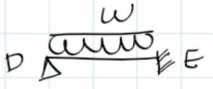
L = 5m 0.625 m ①

PI ② 0.27L

0.25L

0.26L

1.30m ②



PI ⑤ 0 L

0.21L

Promedio 1 0.105L

0.21L

Promedio 2 0.158L

L = 5m 0.79m ⑤

PI ⑥ 0.25L

0.21L

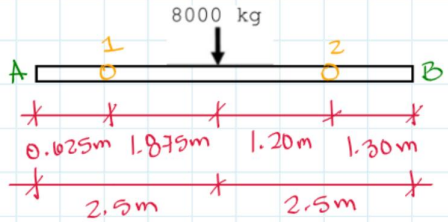
0.23L

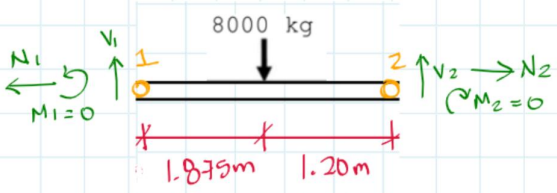
0.21L

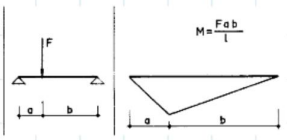
0.22 L

1.10 m ⑥

3. Diagrama de momentos y corte en vigas





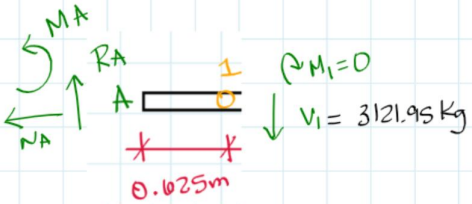


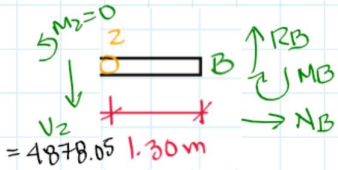
$\sum F_y = 0 \uparrow +$ $\quad V_1 + V_2 - 8000 = 0$

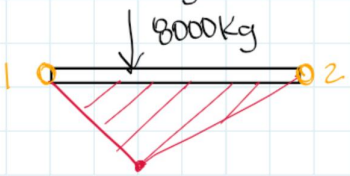
$\sum M_2 = 0 \circlearrowleft +$

$3.075 V_1 - 1.2 * 8000 = 0$ $\quad V_1 = 3{,}121.95$ Kg

$V_2 = 4{,}878.05$ Kg







$\sum F_y = 0 \uparrow +$ $\quad R_A - 3121.95 Kg = 0$

$R_A = 3121.95$ kg

$\sum F_y = 0 \uparrow +$ $\quad R_B - 4878.05 = 0$

$R_B = 4878.05$ Kg

$M_c = \dfrac{8000 * 1.875 * 1.20}{3.075}$

$\sum M_A = 0 \circlearrowleft +$

$3121.95 * 0.625 - M_A = 0$

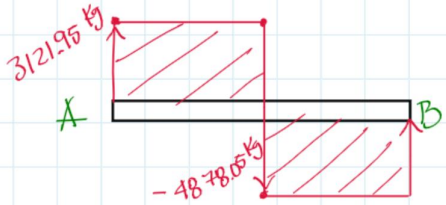
$M_A = 1951.219$ Kg-m

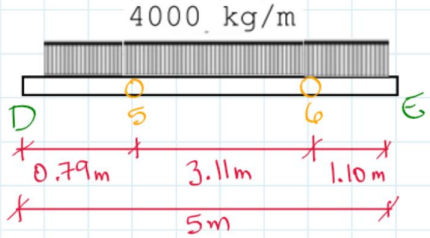
$\sum M_B = 0 \circlearrowleft +$

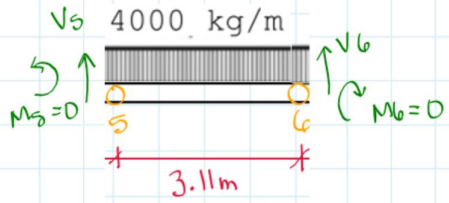
$M_B - 4878.05 * 1.30 = 0$

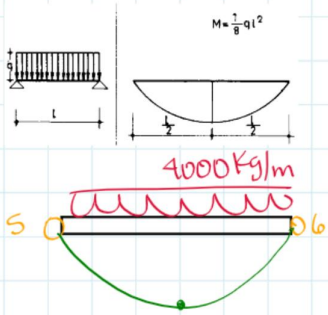
$M_B = 6341.465$ Kg-m

$M_c = 5{,}853.659$ Kg-m









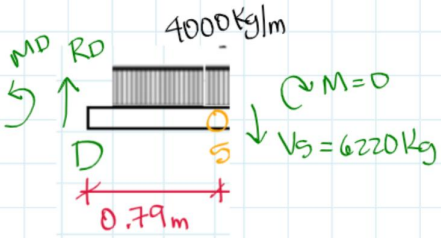
$\sum F_y = 0 \uparrow +$ $\quad V_5 + V_6 - 4000 * 3.11 = 0$

$\sum M_6 = 0 \circlearrowleft +$ $\quad 3.11 * V_5 - 4000 * 3.11 * 3.11/2 = 0$

$V_5 = 6220$ Kg

$V_6 = 6220$ Kg

$M_c = \dfrac{4000 * 3.11^2}{8} = 4836.05$ Kg-m



$\sum F_y = 0 \uparrow +$

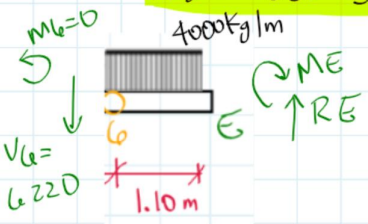
$R_D - 4000 * 0.79 - 6220 = 0$

$R_D = 9380$ Kg

$\sum M_D = 0 \circlearrowleft +$

$4000 * 0.79 * 0.79/2 + 0.79 * 6220 - M_D = 0$

$M_D = 6162$ Kg-m

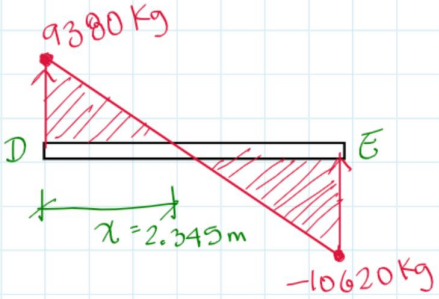


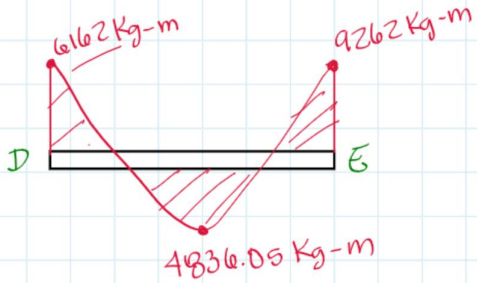
$\sum F_y = 0 \uparrow +$ $\quad R_E - 6220 - 4000 * 1.10 = 0$

$R_E = 10620$ Kg

$\sum M_E = 0 \circlearrowleft +$ $\quad M_E - 6220 * 1.10 - 4000 * 1.10^2/2 = 0$

$M_E = 9262$ Kg-m





4. Diagramas de corte y momento en columnas

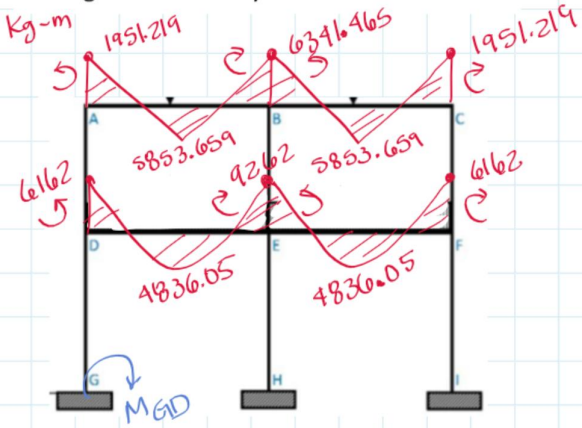
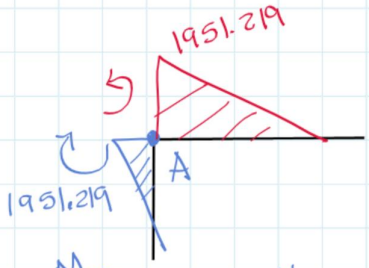
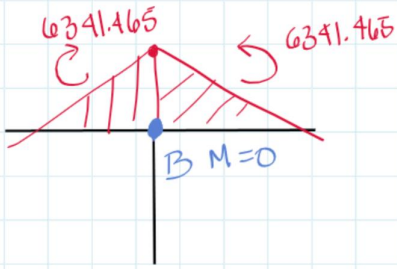
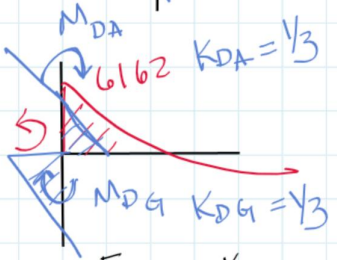


Diagrama de Momentos Kg-m







$\Sigma M_D = 0 \curvearrowleft +$

$M_{DA} + M_{DG} - 6162 = 0$

$F_{DA} = \frac{K_{DA}}{K_{DA}+K_{DG}} = \frac{1/3}{1/3+1/3} = 1/2 \qquad F_{DG} = \frac{K_{DG}}{K_{DA}+K_{DG}} = \frac{1/3}{1/3+1/3} = 1/2$

$M_{DA} = M * F_{DA} = 1/2 * 6162 = 3081 \text{ Kg-m}$

$M_{DG} = M * F_{DG} = 1/2 * 6162 = 3081 \text{ Kg-m}$

$M_{GD} = 1/2 * M_{DG} = 1/2 * 3081 = 1540.5 \text{ Kg-m}$

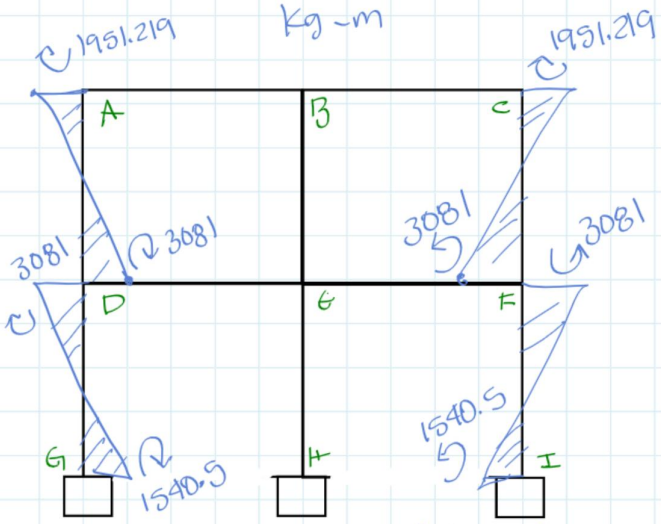
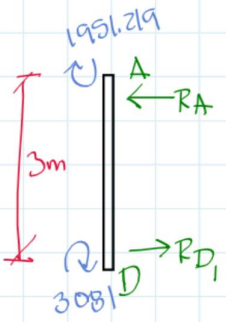


Diagrama de momentos en Kg-m



$\Sigma F_x = 0 \rightarrow +$

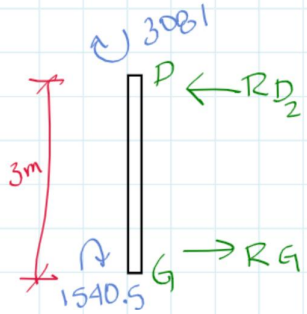
$R_{D_1} - R_A = 0 \qquad R_A = R_{D_1}$

$\Sigma M_A = 0 \curvearrowleft +$

$1951.219 + 3081 - 3 R_{D_1} = 0$

$R_{D_1} = 1677.406 \text{ Kg} \rightarrow$

$R_A = 1677.406 \text{ Kg} \leftarrow$



$\Sigma F_x = 0 \rightarrow +$

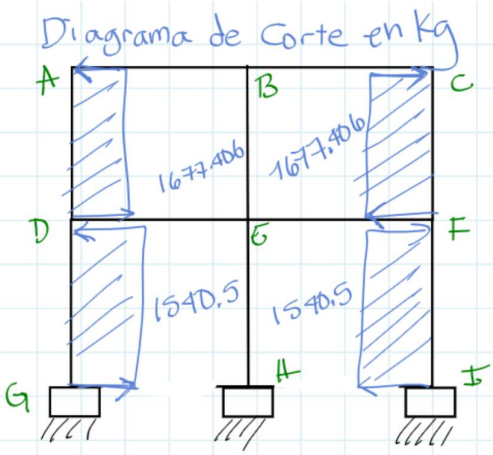
$R_G - R_{D_2} = 0 \qquad R_G = R_{D_2}$

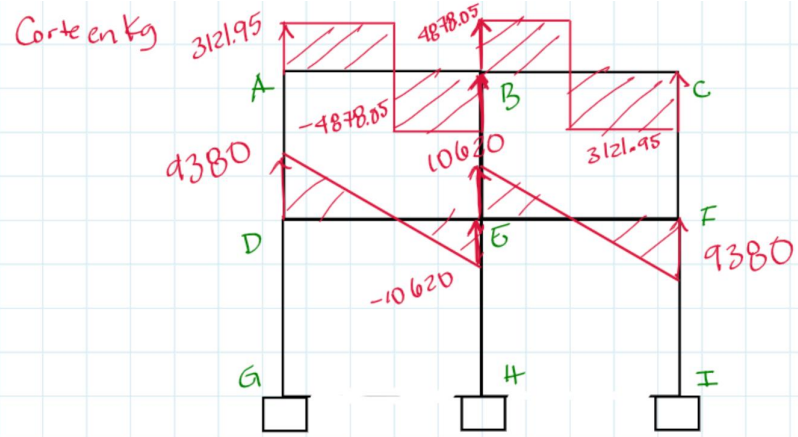
$\Sigma M_D = 0 \curvearrowleft +$

$3081 + 1540.5 - 3 R_G = 0$

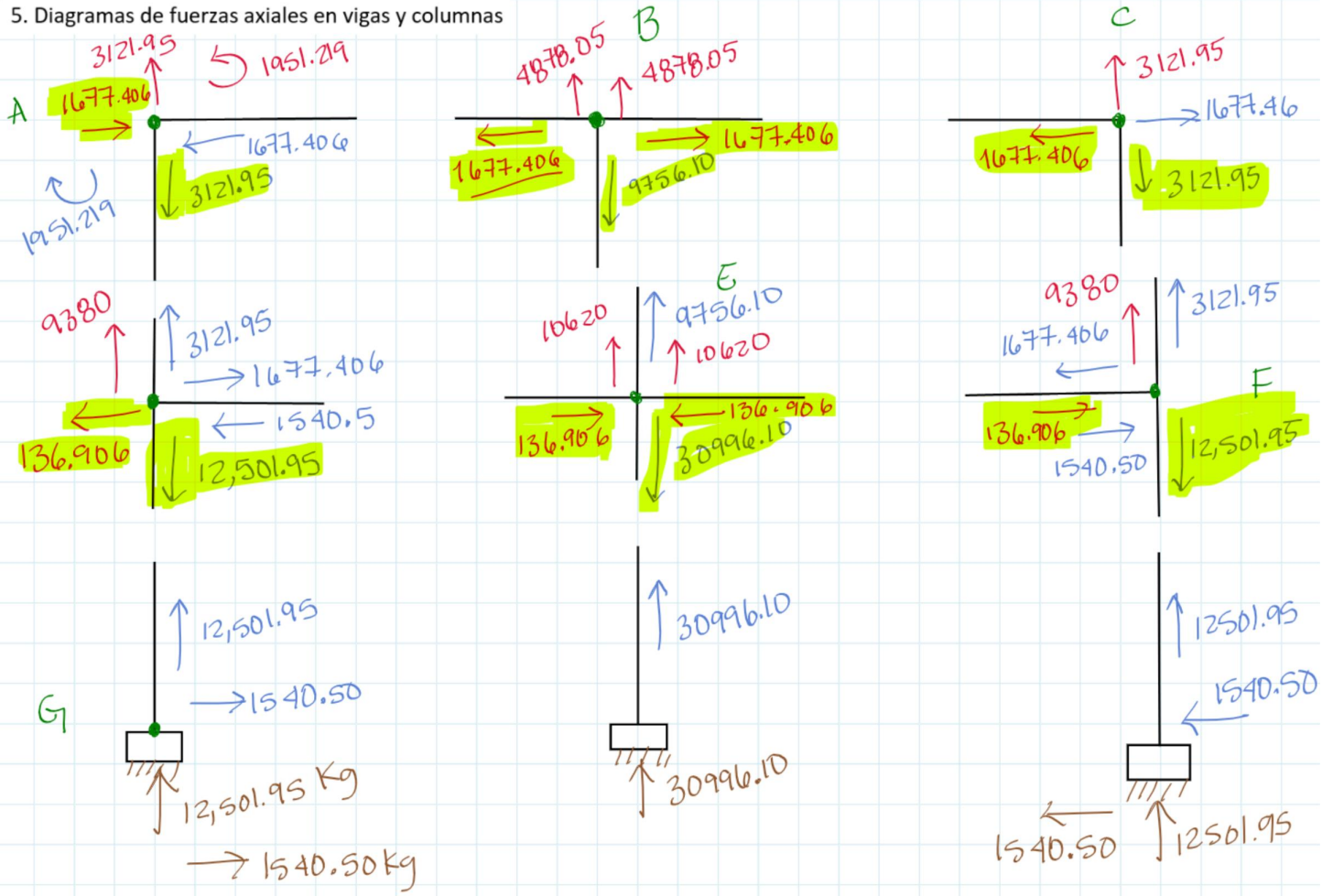
$R_G = 1540.5 \text{ Kg} \rightarrow$

$R_{D_2} = 1540.5 \text{ Kg} \leftarrow$





5. Diagramas de fuerzas axiales en vigas y columnas



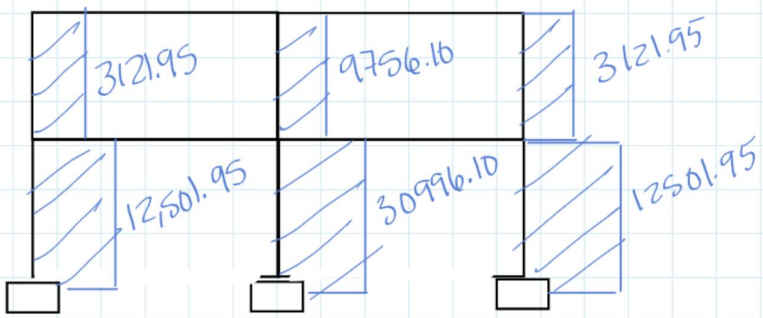


Diagrama de Axiales en kg

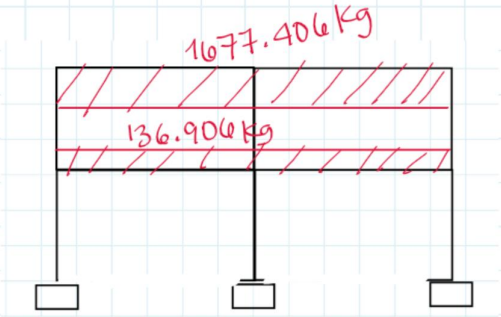


Diagrama de axiales en Vigas

RESUMEN

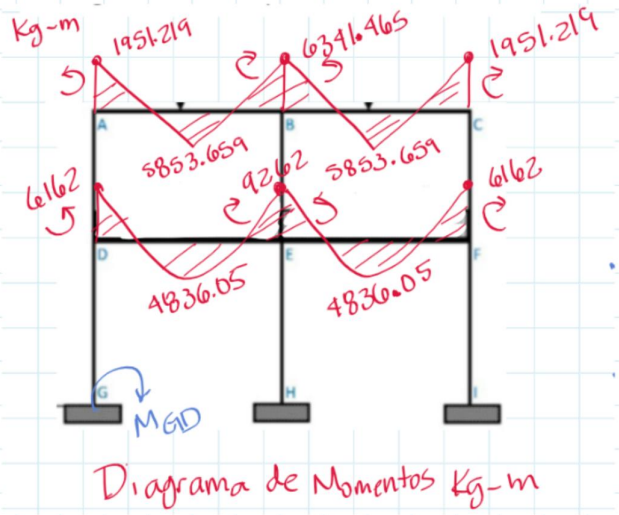


Diagrama de Momentos Kg-m

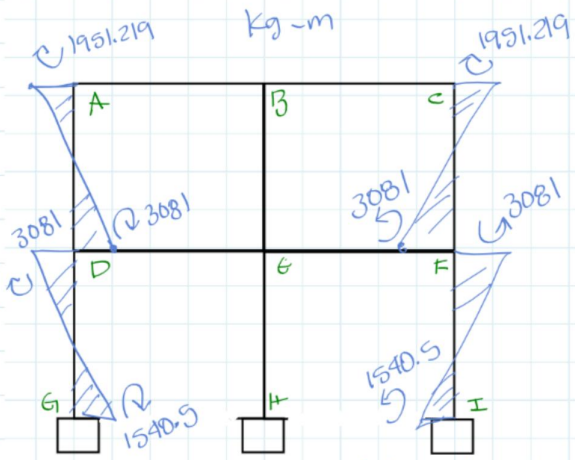
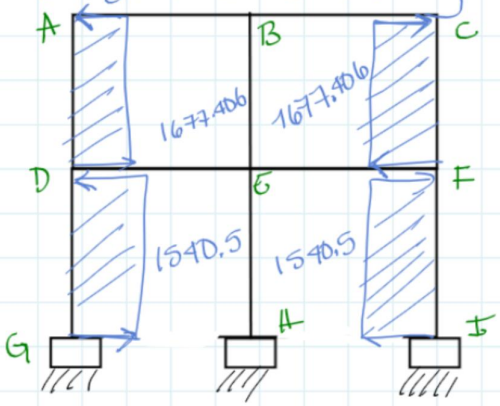
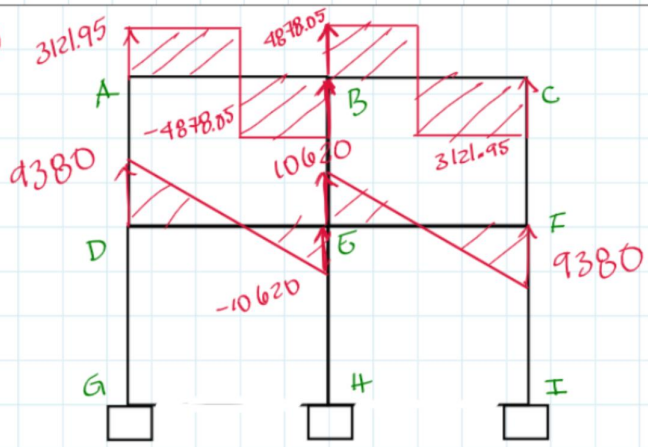


Diagrama de momentos en kg-m

Diagrama de Corte en kg



Corte en kg



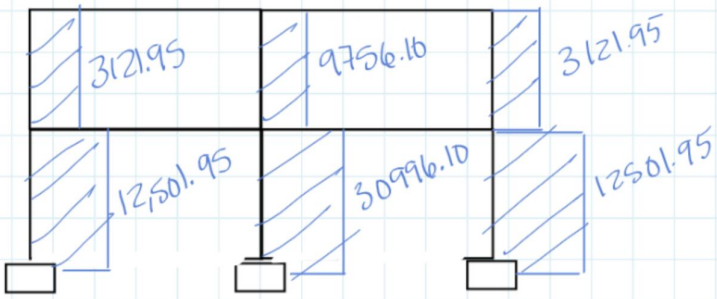


Diagrama de Axiales en kg

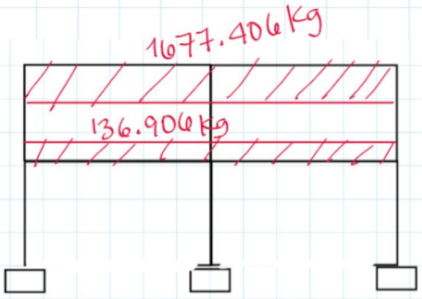


Diagrama de axiales en Vigas

G

12,501.95 kg

1540.50 kg

1540.5 kg-m

H

30996.10 kg

I

1540.50 kg

12501.95 kg

1540.50 kg-m

Reacciones