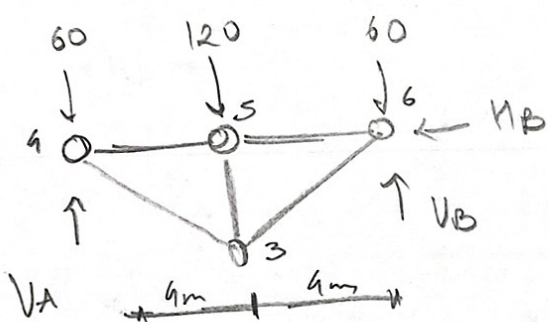
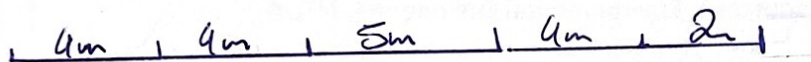
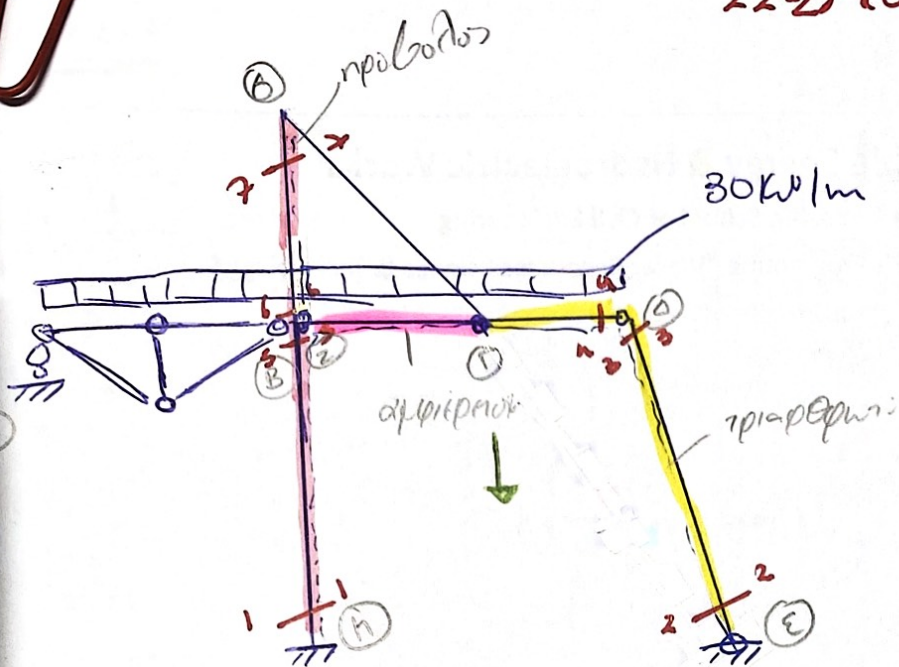


22-B Kavaliki



$$\frac{ql}{2} = \frac{30 \times 4}{2} = 60$$

$$\sum F_x = 0 \Rightarrow V_A + V_B = 240 \text{ kN}$$

$$\sum F_y = 0 \Rightarrow H_B = 0$$

$$\sum M_B = 0 \Rightarrow 3V_A = (3 \times 60) + (120 \times 4)$$

$$\Rightarrow 3V_A = 480 + 480 \Rightarrow V_A = 120 \text{ kN}$$

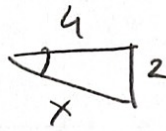
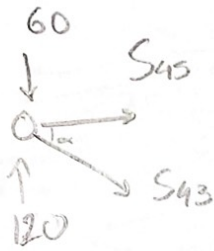
$$\text{Αρα } V_B = 240 - 120 = 120 \text{ kN}$$

Αντίστροφο

1) Ναυ λαβή την αλυσίδα
του αλυσίδα

$$2) \int_{\text{EA}} \frac{M \bar{N} dx}{EA} \text{ πολλαπλασιασ } l? \text{ (2)}$$

Πρόβλημα 4



Να βρούμε
3 άγνωστα εύκολα

$$x^2 = 4^2 + 2^2$$

$$\Rightarrow x = 4,47$$

$$\cos \alpha = \frac{4}{4,47} = 0,895$$

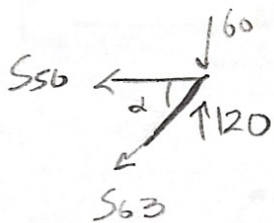
$$\sin \alpha = \frac{2}{4,47} = 0,447$$

$$\sum F_x = 0 \Rightarrow S_{45} - S_{43} \cos \alpha = 0 \Rightarrow S_{45} = S_{43} \cos \alpha \quad (1)$$

$$\sum F_y = 0 \Rightarrow 60 + S_{43} \sin \alpha - 120 = 0 \Rightarrow S_{43} \sin \alpha = 60 \Rightarrow S_{43} = 134 \text{ kN}$$

$$(1) \Rightarrow S_{45} = 134 \times 0,895 \Rightarrow S_{45} = 120 \text{ kN}$$

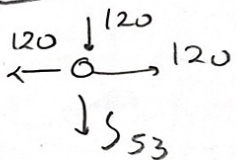
Πρόβλημα 6



Συμμετρία $\rightarrow S_{56} = 120 \text{ kN}$

κ' $S_{63} = 134 \text{ kN}$

Πρόβλημα 5



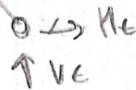
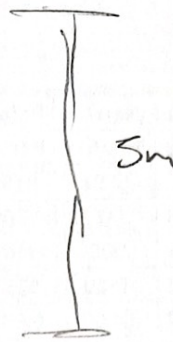
$$\sum F_y = 0 \Rightarrow S_{53} \sin \alpha - 120 = 0 \Rightarrow S_{53} = 120 \text{ kN}$$

Μέλος	Θέση	Απόσταση (kN)
4-5		120 ✓
4-3		134 ✓
5-6		120 ✓
5-3	120 ✓	
6-3		134 ✓

← πρώτα εφελκυσμός
και μετά θλίψη?



$$120W = 4 \times 1$$

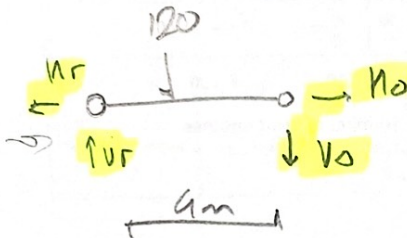


$$\sum F_x = 0 \Rightarrow H_r = H_e$$

$$\sum F_y = 0 \Rightarrow V_r + V_e = 120W$$

$$\sum M_r = 0 \Rightarrow 120 \times (2+2) + 5H_r - 6V_e = 0 \quad (1)$$

H_e and V_e are the reaction forces at the right support.



$$\sum F_x = 0 \Rightarrow H_r = H_o$$

$$\sum F_y = 0 \Rightarrow V_o + 120 = V_r$$

$$\sum M_r = 0 \Rightarrow 4V_o = 2 \times 120 \Rightarrow V_o = -60W$$

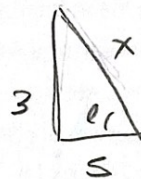
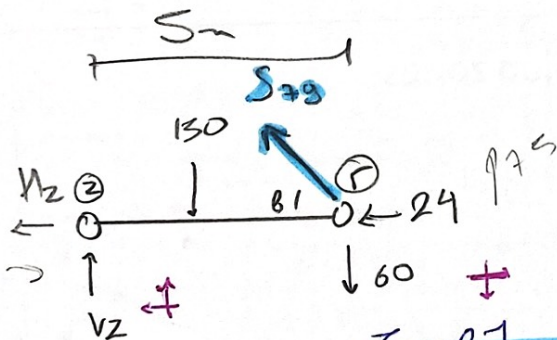
$$\text{Ans } V_r = 60W \text{ and } V_e = 60W \checkmark$$

$$(1) \Rightarrow 4 \times 120 + 5H_r - 6 \times 60 = 0$$

$$\Rightarrow 480 + 5H_r - 360 = 0$$

$$\Rightarrow H_r = -24W$$

$$H_o = H_e = -24W \checkmark$$



$$x^2 = 3^2 + 5^2$$

$$\Rightarrow x = 5.831$$

$$\cos \theta = \frac{5}{5.831} = 0.857$$

$$\sin \theta = \frac{3}{5.831} = 0.514$$

The reaction forces at the right support are H_e and V_e .

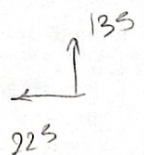
$$\sum M_r = 0 \Rightarrow 5V_2 = 25 \times 150 \Rightarrow V_2 = 75W$$

$$\sum F_x = 0 \Rightarrow 24 + S_{79} \cos \theta + H_2 = 0$$

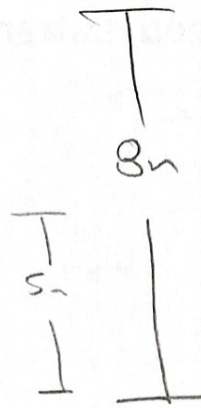
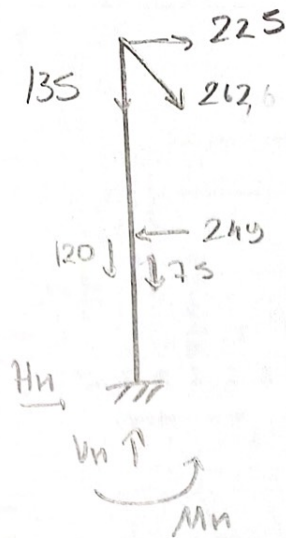
$$\sum F_y = 0 \Rightarrow 150 - 75 + 60 - S_{79} \sin \theta = 0 \Rightarrow 135 = S_{79} \times \sin \theta \Rightarrow S_{79} = 262.6W \checkmark$$

$$\text{Ans } 24 + (262.6 \times 0.857) + H_2 = 0 \Rightarrow H_2 = -249W$$

$$S_{79} \cos \theta = 224W$$



(3)



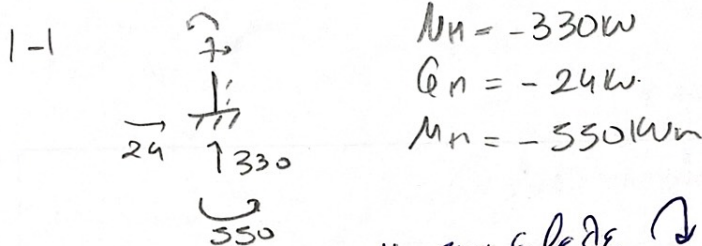
$$\sum F_x = 0 \Rightarrow H_n + 225 = 249 \Rightarrow H_n = 24 \text{ kN} \checkmark$$

$$\sum F_y = 0 \Rightarrow V_n = 120 + 75 + 135 = 330 \text{ kN} \checkmark$$

$$\sum M_n = 0 \Rightarrow M_n + (249 \times 5) - (225 \times 8) \Rightarrow M_n = 555 \text{ kNm} \checkmark$$

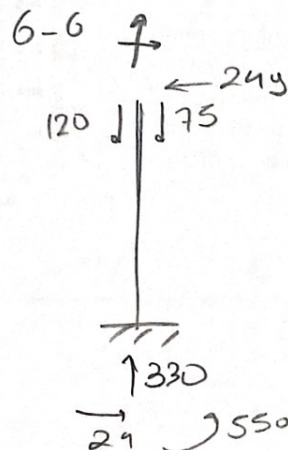
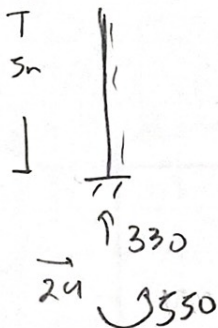
≈ 550
 Consider the
 opposite direction.

TOMEI



S-S $\leftarrow$ $\sum M_z = 0$ $\rightarrow$ $\sum F_x = 0$ $\rightarrow$ $\sum F_y = 0$

$$\begin{aligned} N_z^L &= -330 \text{ kN} \\ Q_z^L &= -24 \text{ kN} \\ \sum M_z^L + 550 + 24 \times 5 &= 0 \Rightarrow M_z^L = -670 \text{ kNm} \end{aligned}$$



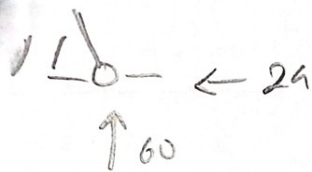
$$M_z^n = -670 \text{ kNm}$$

$$N_n^n = -330 + 120 + 75 = -135 \text{ kN}$$

$$Q_n^n = -24 + 249 = 225 \text{ kN}$$

$$\begin{aligned} 7-7 \quad \begin{aligned} & \xrightarrow{225} M^0 = 0 \\ & \downarrow 135 Q^0 = 225 \text{ kN} \\ & \downarrow 135 N^0 = -135 \text{ kN} \end{aligned} \end{aligned}$$

(u)

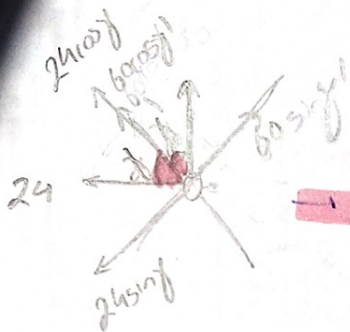


$$s \triangle \begin{matrix} x \\ 2 \end{matrix} \quad x^2 = 5^2 + 2^2$$

$$x = 5.385$$

$$\cos \gamma = \frac{2}{5.385} = 0.371$$

$$\sin \gamma = \frac{5}{5.385} = 0.929$$



1. Superintendence

2-2

$$24 \times \cos \gamma + 60 \times \sin \gamma$$

$$(24 \times 0.371) + (60 \times 0.929) = 64.6 \text{ W}$$

$$60 \times \cos \gamma - 24 \times \sin \gamma$$

$$(60 \times 0.371) - (24 \times 0.929) = 22.26 - 22.29 \approx 0$$

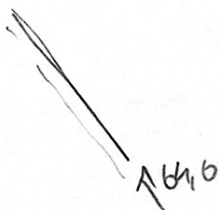
$$Q_c = 0, N_c = -64.6 \text{ W}$$

$$M_c = 0$$

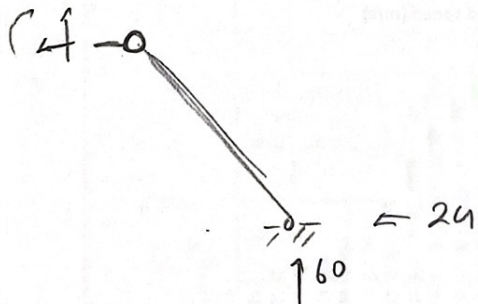
3-3

$$Q_o^s = 0, M_o^s = 0$$

$$N_o^s = -64.6 \text{ W}$$



4-4



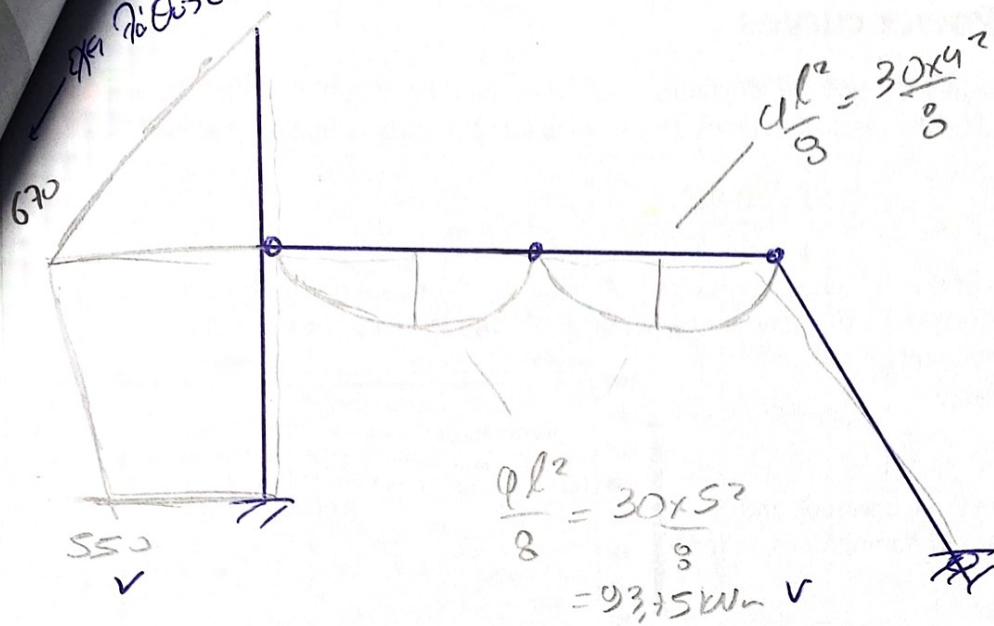
$$Q_o^s = -60 \text{ W}$$

$$N_o^s = -24 \text{ W}$$

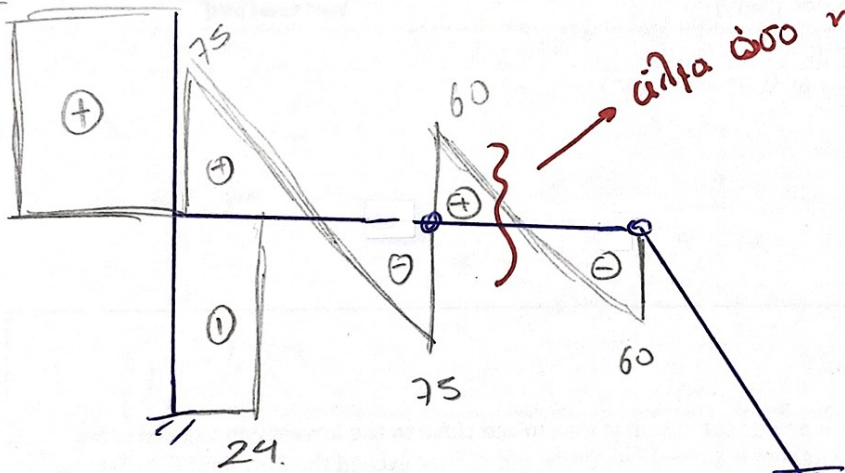
$$M_o^s = (24 \times 5) - (60 \times 2) = 0$$

Δαγγραφή N-Q-M

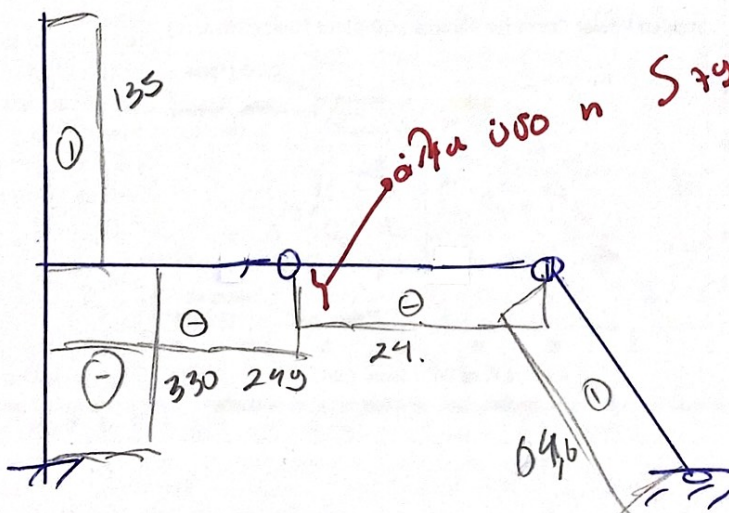
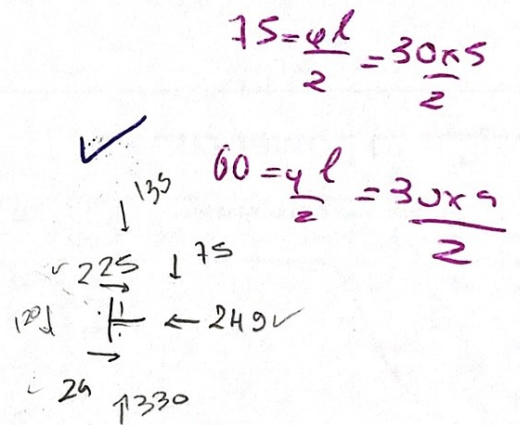
670
550
✓



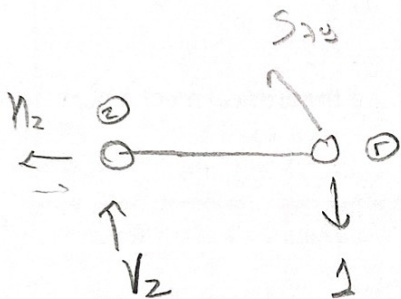
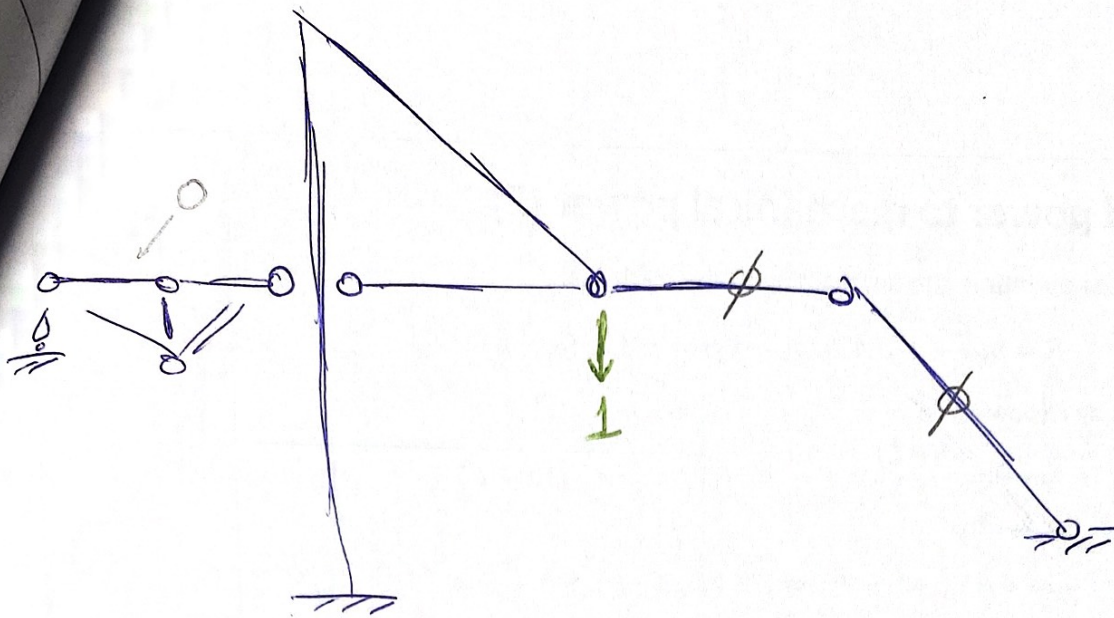
225



αίμα όσο n $S_{79x} \rightarrow 135 \text{ KN}$
 $Q [KN]$



αίμα όσο n $S_{79x} \approx 225 \text{ KN}$



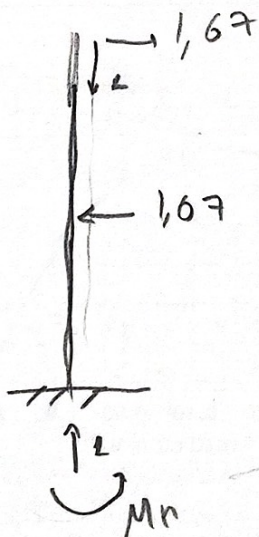
$$\sum F_x = 0 \Rightarrow S_{xyx} = -N_2$$

$$\sum F_y = 0 \Rightarrow S_{xyy} + V_2 = 1 \Rightarrow S_{xyy} = 1$$

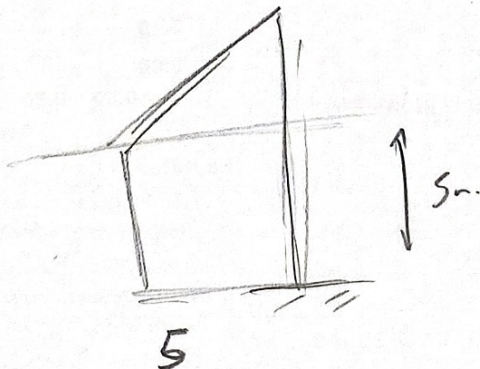
$$\sum M_r = 0 \Rightarrow V_2 = 0$$

$$S_{xy} = \frac{1}{0,514} = 1,95 \text{ kN}$$

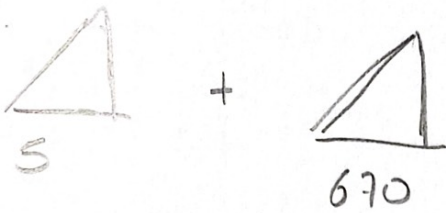
$$N_2 = -1,95 \times 0,514 = 1,00 \text{ kN}$$



$$M_n = (-1,67 \times 5) + (1,67 \times 9) = 5 \text{ kNm}$$

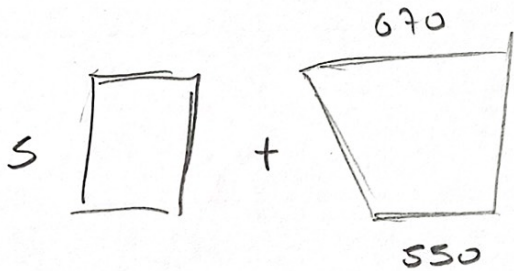


$$\frac{\sum \bar{m} \bar{u}_k^2}{EI} + \sum \frac{N \bar{u}_k}{EA}$$



$$Q \times \frac{1}{3} \times \alpha \times \bar{a} = 3 \times \frac{1}{3} \times 5 \times 670 = 3350 \text{ kN}^2 \text{ m}^3$$

$$\sum \bar{m} \bar{u}_k^2 = 5 \times 1.17 = 5.85 \text{ kN}^2 \text{ m}^2$$



$$Q \times \frac{1}{2} \times \alpha (\bar{a}_1 + \bar{a}_2) =$$

$$3 \times \frac{1}{2} \times 5 \times (670 + 550) = 610 \text{ kN}^2 \text{ m}^2$$

$$\frac{3350 + 610}{65.0000} = 0,006 \text{ m}$$

$$\sum \frac{N \bar{u}_k}{EA} = \frac{1,95 \times 262}{30.000} = \frac{511 \text{ kN}}{30.000 \text{ kN}} = 0,017 \times 10^2$$

$$\delta = 0,023 \text{ m}$$