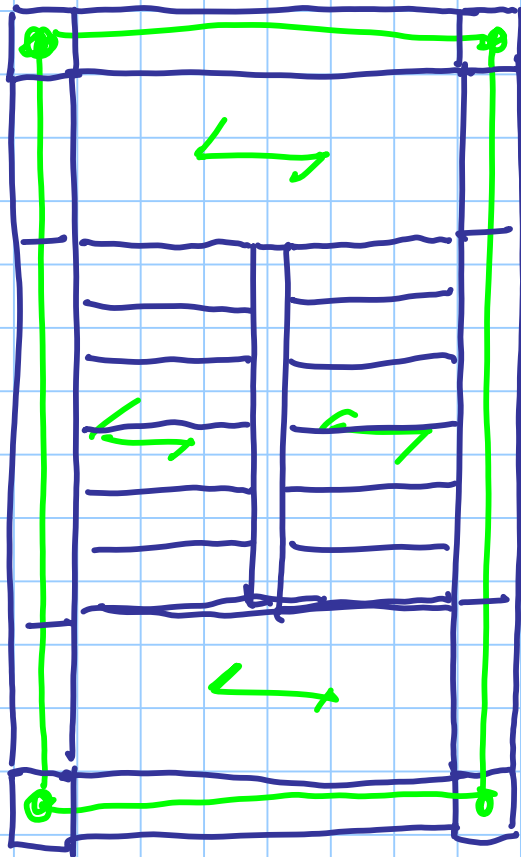


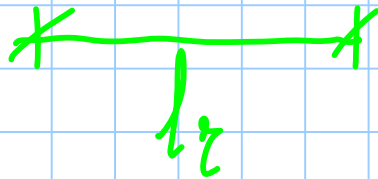
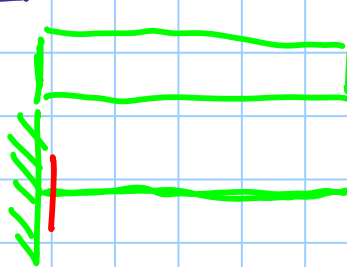
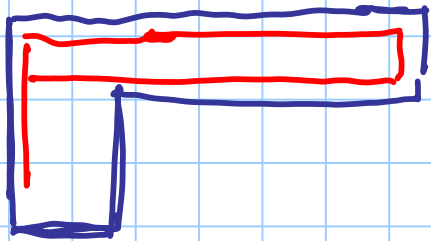
SCALA CON TRAVE A GINOCCHIO

Titolo nota

22/05/2014



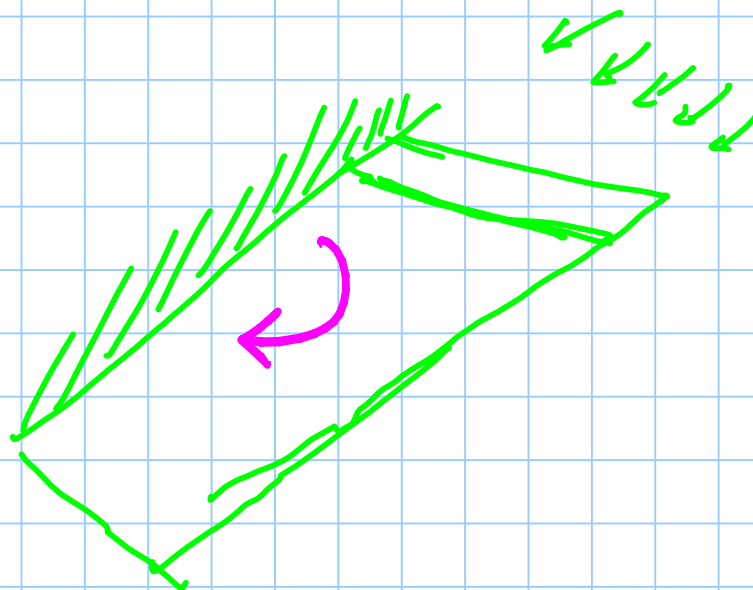
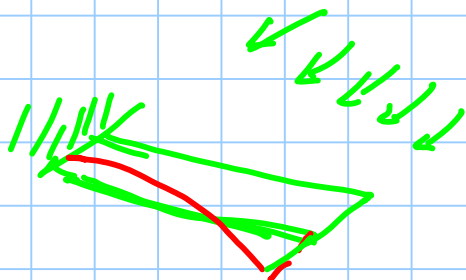
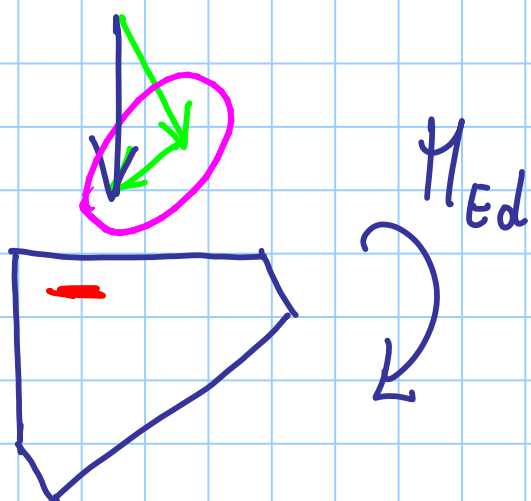
GRADINI

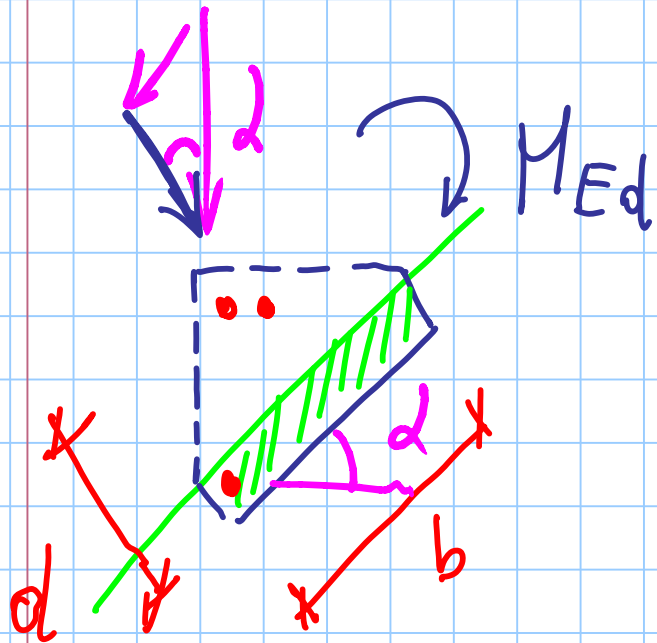


$$(g_d + q_d) \times 0,3 = Q$$

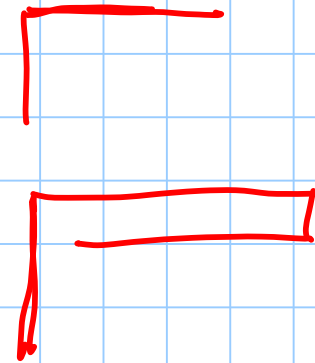
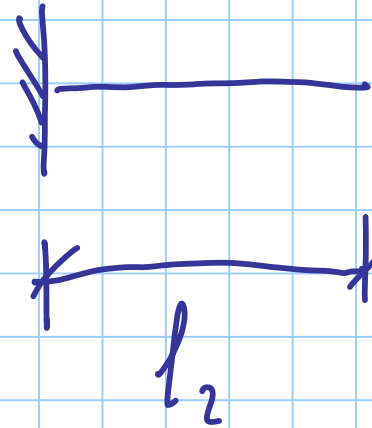
$$M_{Ed} = \frac{Q l_2^2}{2}$$

$$V_{Ed} = Q l_2$$



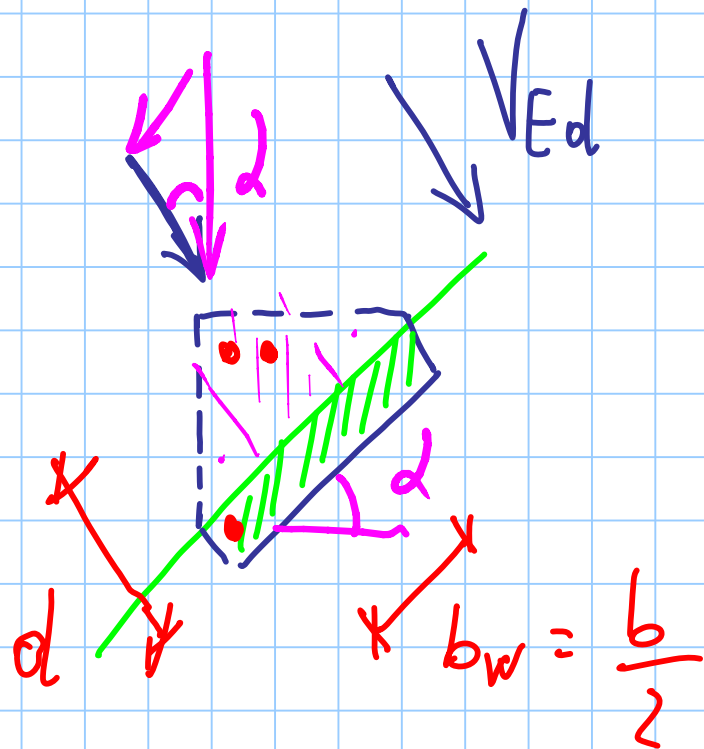


$$(q_d + q_{d'}) \times 0,3 \times l_0 \sin \alpha$$

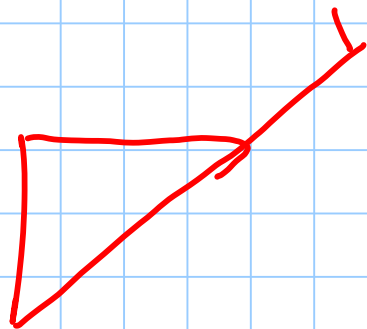
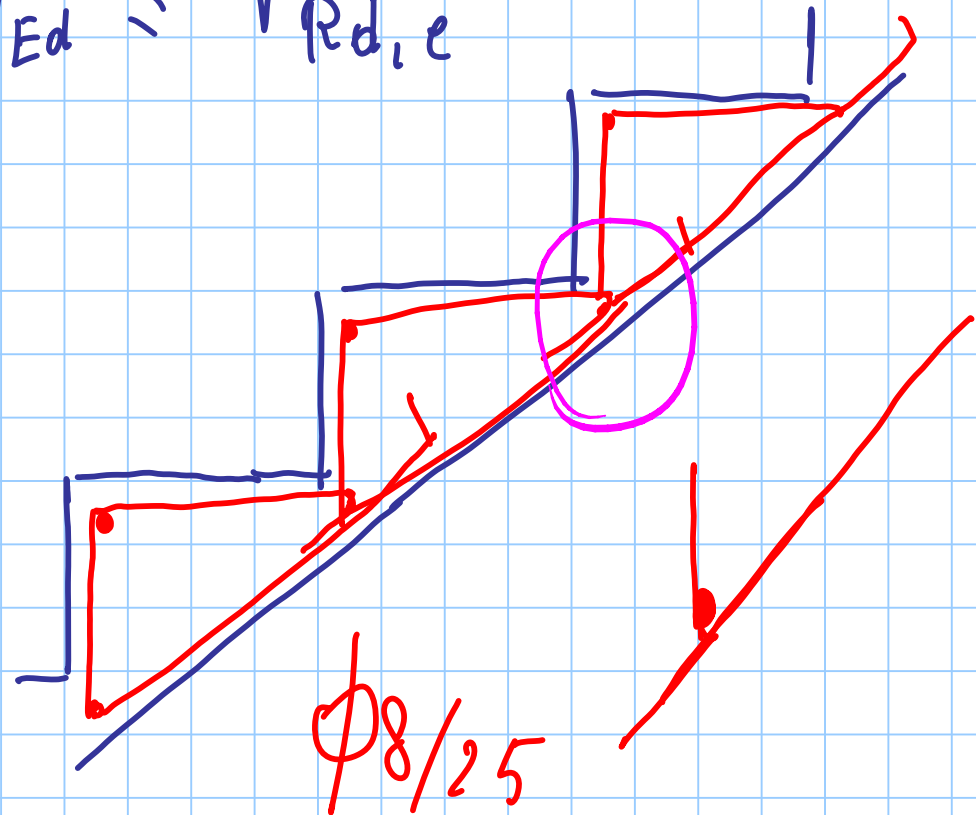


$$M_{Ed} \leq M_{Rd,e} = \frac{b d^2}{\gamma'_{f2}}$$

$$A_s = \frac{M_{Ed}}{0,9 d f_{yd}}$$



$$V_{Ed} \leq V_{Rd,e}$$



$\phi 8/25$

SOLETTA DI COLLEGAMENTO



TRAVE A GINOCCHIO

$$R \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \downarrow \quad \cancel{V_{Ed}} / 0,3 (q_d + q_{ol}) \times l_2$$

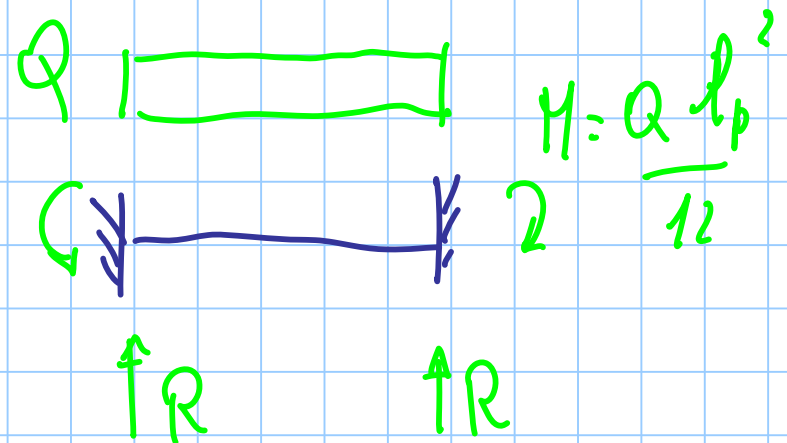
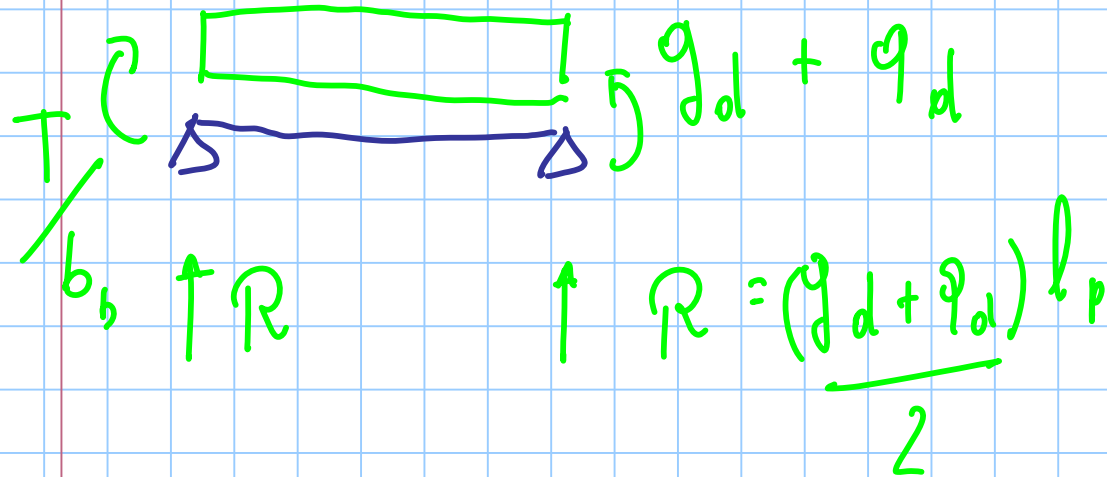
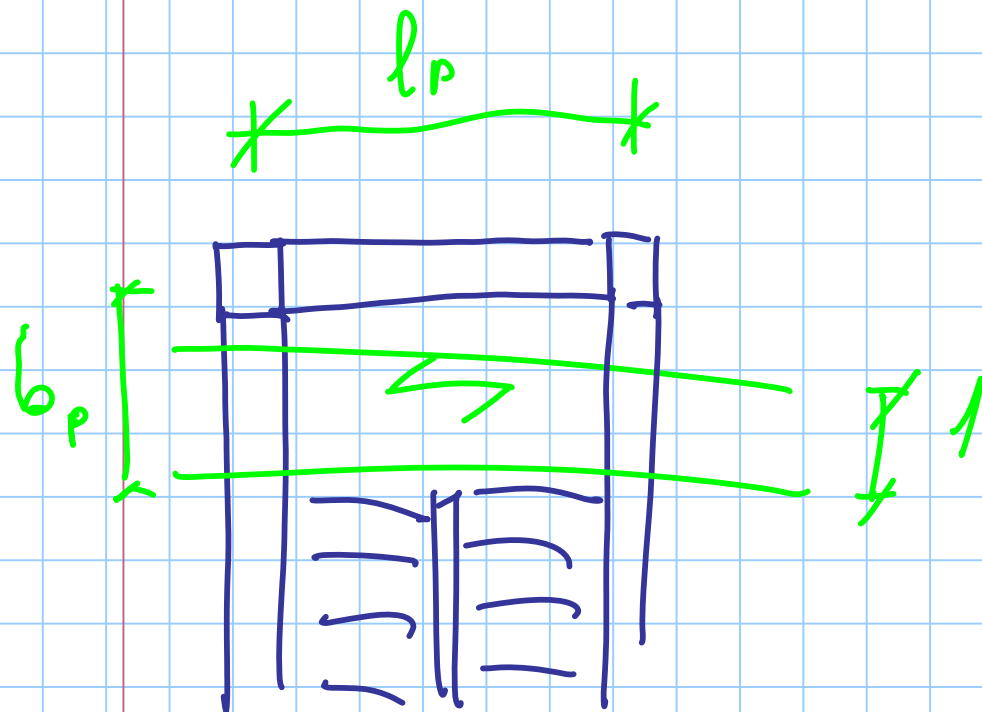
$$T_1 \quad \curvearrowright \quad \cancel{M_{Ed}} / 0,3 = m_t$$

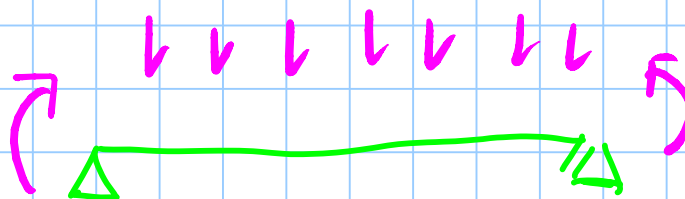
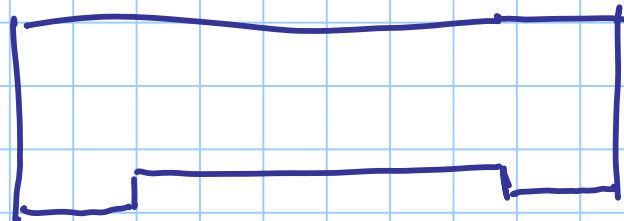
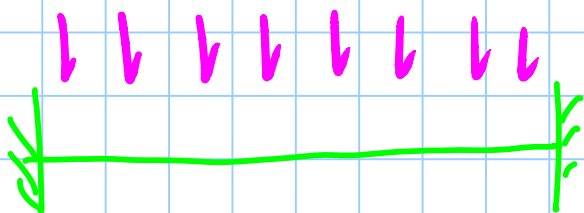
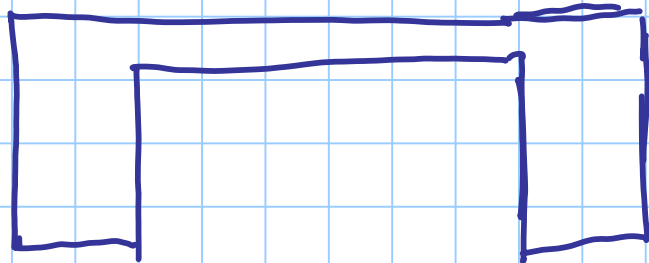
$$l_1 \quad l_2$$

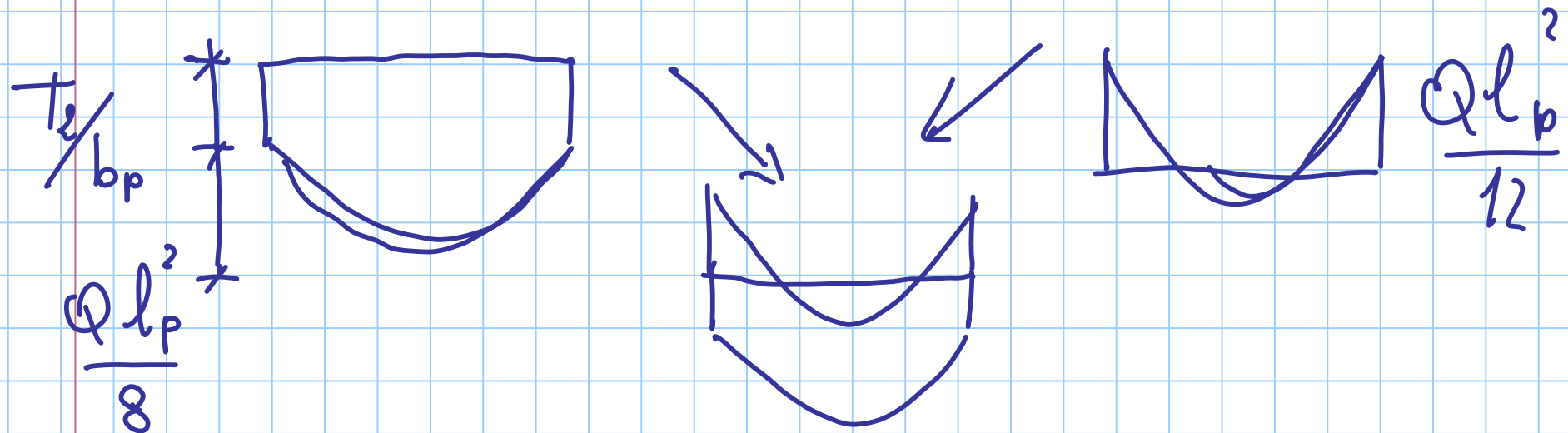
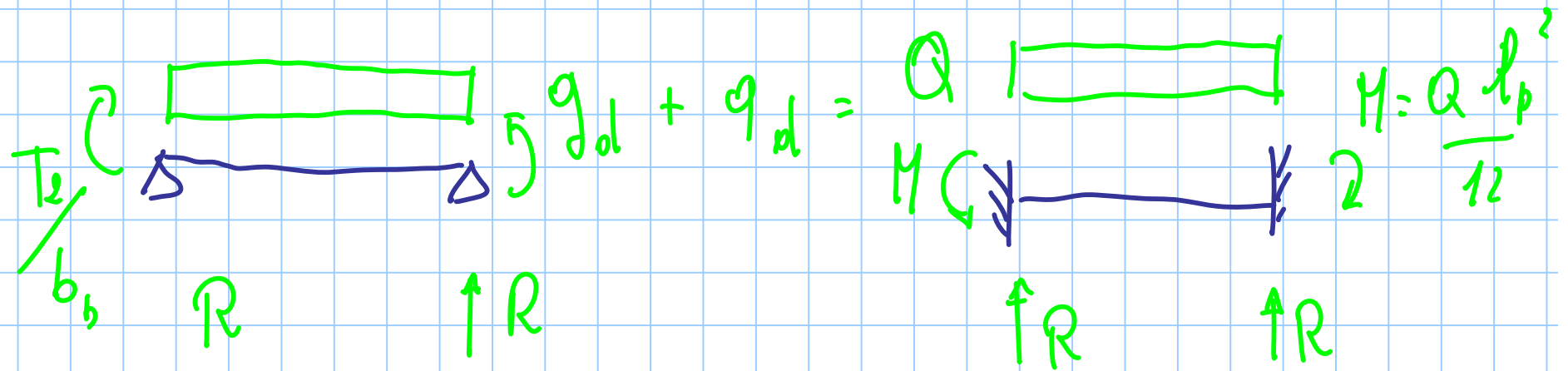
$$l_1$$

$$m_t \frac{L_2}{2} = T_2$$

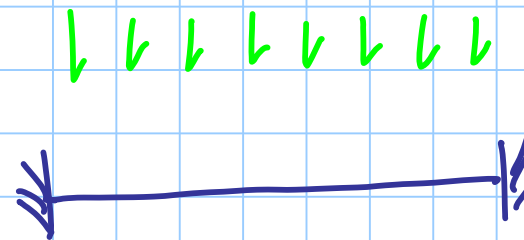
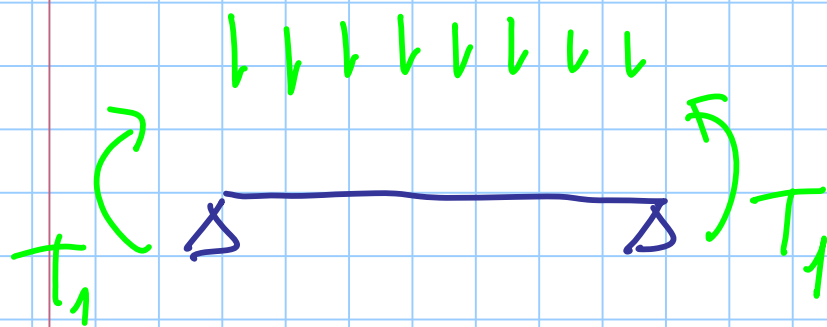
PIA NEROTTOLO



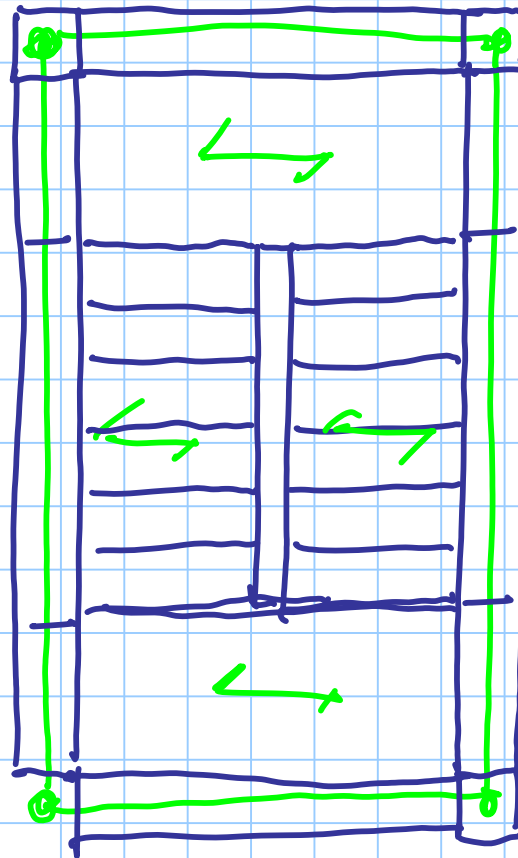




TRAVE DI TESTATA



3.1



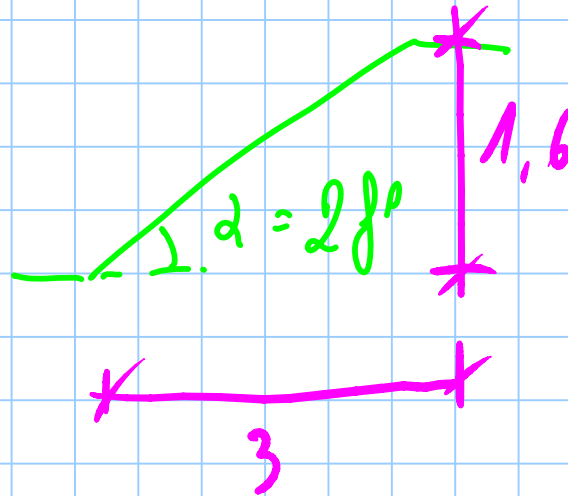
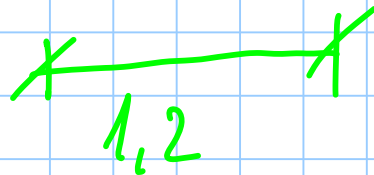
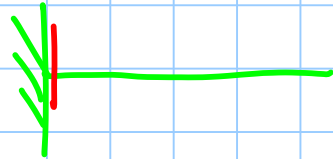
1.2

Scale

q_d
 5 kN/m^2

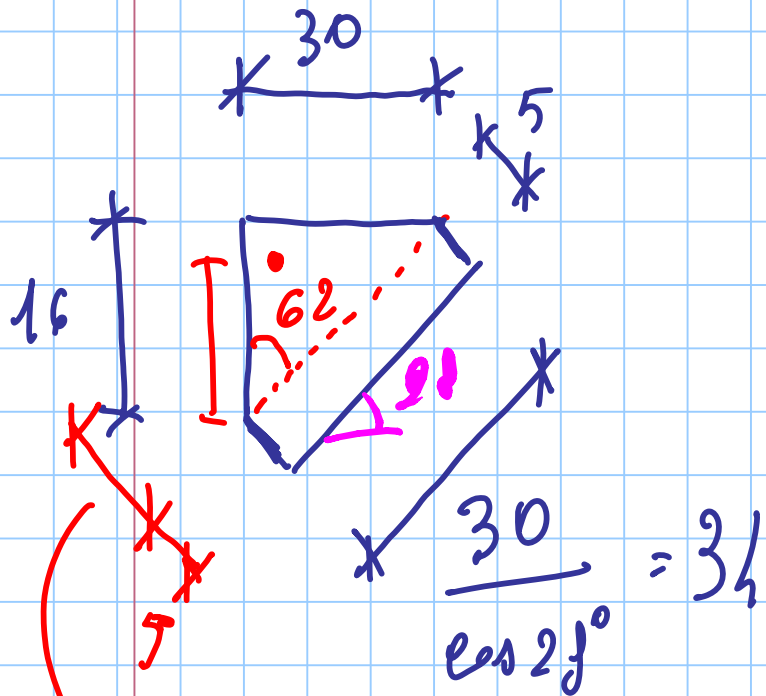
q_d
 6 kN/m^2

$$\boxed{\quad} \Rightarrow (5+6) \times 0,3 \times \cos 28 = 2,91 \text{ kN/m}$$



$$V_{Ed} = 2,91 \times 1,2 = 3,5 \text{ kN}$$

$$M_{Ed} = 2,91 \times \frac{1,2^2}{2} = 2,1 \text{ kNm}$$



$$M_{Rd,c} = \frac{0,34 \times 0,156^2}{0,049^2} = 22,9 \text{ kNm}$$

$$A_s = \frac{2,1 \times 10}{0,9 \times 0,156 \times 391,3} = 0,38 \text{ cm}^2$$

use $\phi 10$

$$(16 - 4) \sin 62^\circ = 10,6 \text{ cm}$$

$$d = 15,6 \text{ cm}$$

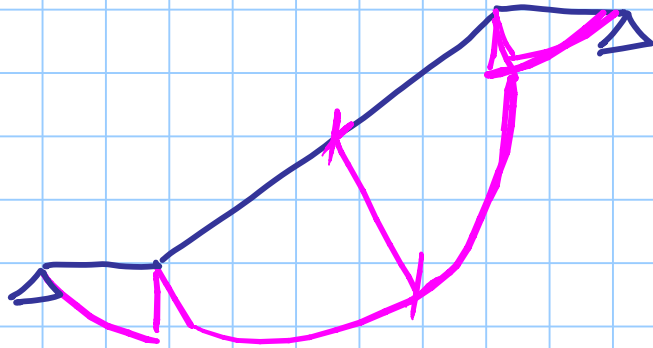
$$V_{Rd,e} = 0,035 \sqrt{K^3 f_{ctk} b_w d}$$

$$K = 1 + \sqrt{\frac{200}{d}} = 2$$

$$V_{Rd,e} = 0,035 \sqrt{2^3 \times 25} \times \frac{17 \times 15,6}{10} = 13,1 \text{ kN}$$



$$(5 + 6) \times 1,2 = 13,2 \text{ kN/m} \quad \text{gredlini}$$



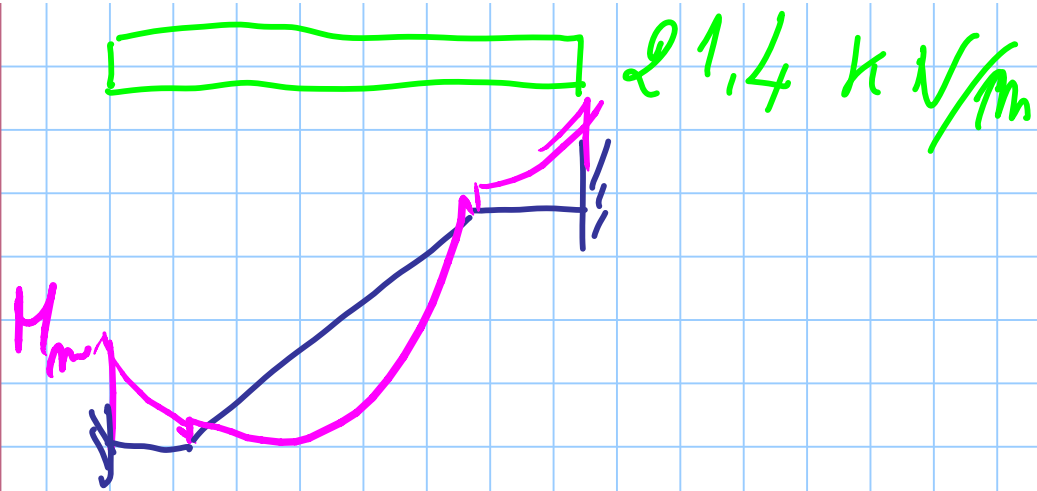
$$4,9 \text{ kN/m} \quad \text{p.p.}$$

$$3,3 \text{ kN/m} \quad \text{comp.}$$

$$M_{\max} = 21,1 \times \frac{5,7^2}{8} = 86,7 \text{ kNm}$$

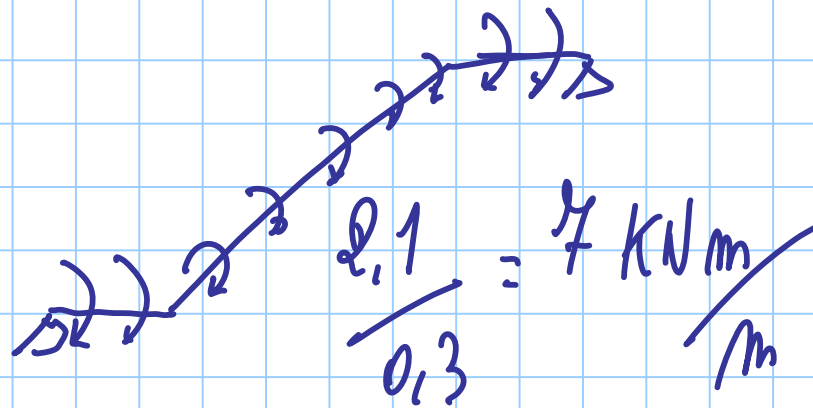
$$21,4 \text{ kN/m}$$

$$V_{\max} = 21,1 \times \frac{5,7}{2} = 61 \text{ kN}$$



$$M_{max} = \frac{q \times l^2}{12} = \frac{1,4 \times 12^2}{12} = 57,9 \text{ kNm}$$

$$V_{max} = 61 \text{ kN}$$

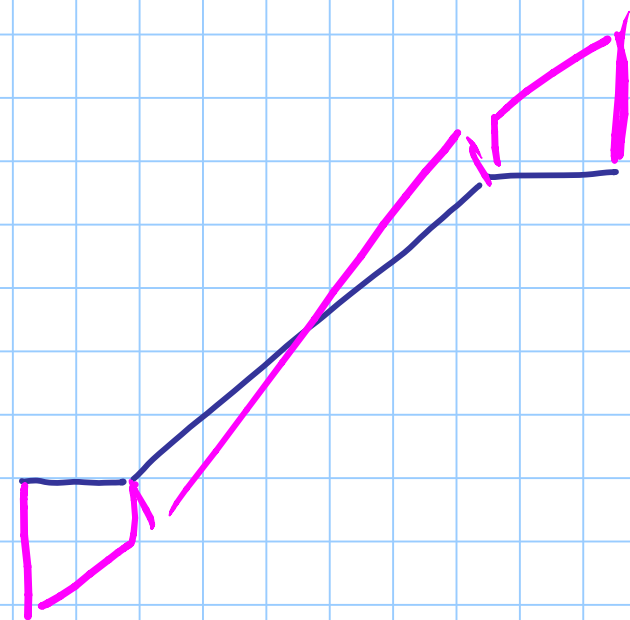
$$\frac{2,1}{0,3} = 7 \text{ kNm/m}$$


A diagram of a curved beam segment, likely a quarter-circle, with a distributed load represented by arrows along its length.

$$\frac{11 \times 3,1^2}{12}$$

11

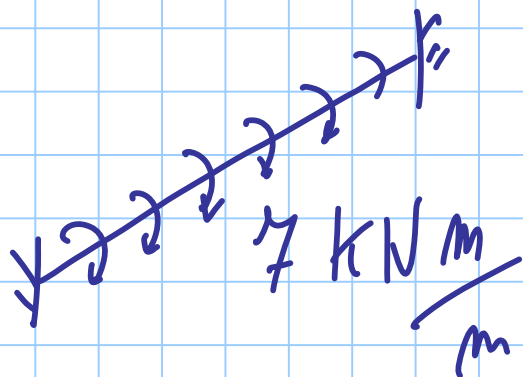
$$8,8 \text{ kNm/m}$$



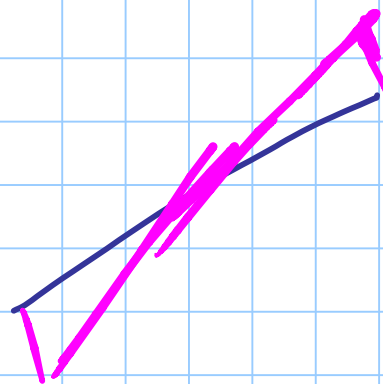
A diagram of a frame structure consisting of a horizontal member, a vertical member, and an inclined member. A pink line is drawn along the frame, possibly representing a load path or a specific structural analysis line.

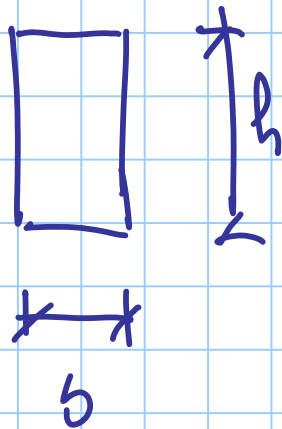
$$T_{\max}^1 = \left(8,8 \times 1,35 \times 2 + 7 \times 3 \right) \frac{1}{2}$$

$$= 22,4 \text{ kNm}$$



$$T_{\max}^2 = \frac{7 \times 3}{2} = 10,5 \text{ kN/m}$$





$$d = \gamma' \sqrt{\frac{M_{max}}{b}} = 0,018 \sqrt{\frac{86,7}{0,3}} = 0,31 \text{ m}$$

30 x 40

$$T_{Rd, max} = 2 A_k t f'_{cd} \frac{\cot \theta}{1 + \cot^2 \theta}$$

$$\cot \theta = 2$$

$$A_k = \frac{T_{Ed}}{2 t f'_{cd}} \frac{1 + \cot^2 \theta}{\cot \theta} = \frac{22.4}{2 \times 0.1 \times 7.1} \frac{5 \times 10}{2}$$

$$t = 2 \times 5 = 10 \text{ cm} \quad = 394 \text{ cm}^2$$

$$A_k = b_k h_k \Rightarrow h_k = \frac{A_k}{b_k} = \frac{394}{20} = 19,7 \text{ cm}$$

$$h = h_k + t = 29,7 \text{ cm}$$

30 X 50

$$V_{Rd, \max} = 0,9 d b_w f_{ct} \frac{e t y_0}{1 + e t y_0} = 0,9 \times 45 \times 30 \times 7,1 \times \frac{2}{5} \times \frac{1}{10}$$

$$= 345 \text{ kN}$$

$$T_{Rd, \max} = 2 A_k t f_{ct} \frac{e t y_0}{1 + e t y_0} = 2 \times 800 \times 0,1 \times 7,1 \times \frac{2}{5} \times \frac{1}{10}$$

$$= 45,4 \text{ kNm}$$

$$t = \frac{A}{u} = \frac{1500}{160} = 9,3 \text{ cm}$$

$$2e = \underline{\underline{10 \text{ cm}}}$$

$$A_k = 20 \times 40 = 800 \text{ cm}^2$$

$$V_{Rd, \max} = 0,9 d b_w f_{ct} \frac{e t y_0}{1 + e t y_0} = 0,9 \times 45 \times 30 \times 7,1 \times \frac{2}{5} \times \frac{1}{10}$$

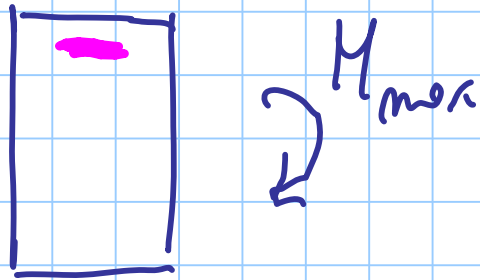
$$= 345 \text{ kN}$$

$$T_{Rd, \max} = 2 A_{st} f_{ct} \frac{e t y_0}{1 + e t y_0} = 2 \times 800 \times 0,1 \times 7,1 \times \frac{2}{5} \times \frac{1}{10}$$

$$= 45,4 \text{ kNm}$$

$$\frac{V_{Ed}}{V_{Rd, \max}} + \frac{T_{Ed}}{T_{Rd, \max}} = \frac{64}{345} + \frac{22,4}{45,4} = 0,67 \quad \text{OK!}$$

$$A_s = \frac{M}{0,9 d f_{yd}} = \frac{57,9 \times 10}{0,9 \times 0,45 \times 391,3} = 3,65 \text{ cm}^2$$



$$\frac{A_{sw}}{s} \approx \frac{V_{Ed}}{0,9 d f_{yd}} \frac{1}{\cot \theta} = \frac{61 \times 10}{0,9 \times 0,45 \times 391,3} \frac{1}{2} =$$

$$\approx 1,92 \text{ cm}^2/\text{m}$$

$$n_{\phi 3} = \frac{1,92}{1} = 1,92$$

$$\frac{A_{sw}}{s} = \frac{T_{Ed}}{2 A_k f_{yd}} \frac{1}{\cot \gamma} = \frac{22.4}{2 \times 800 \times 391.3} \frac{1}{2} \times \frac{10^6}{10^2} \times \frac{10^3}{10^2}$$

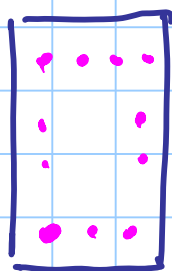
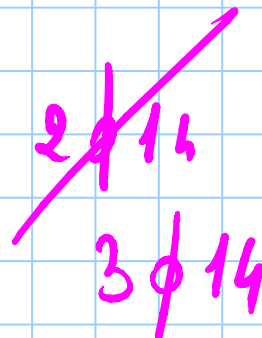
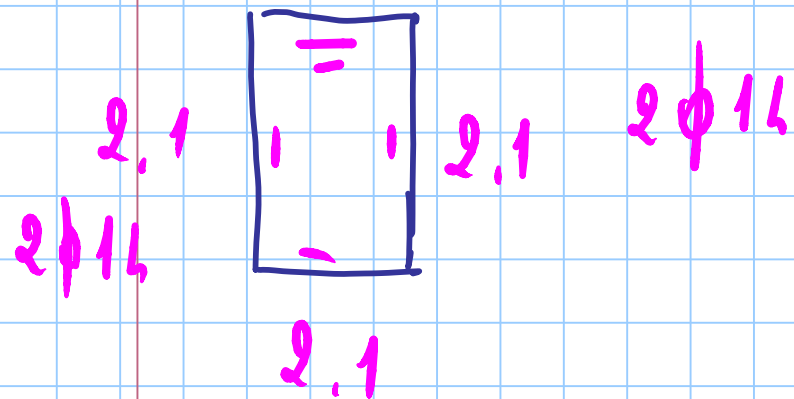
$$= 1.79 \text{ cm}^2/\text{m}$$

$$n_{\phi_s} = \frac{1.79}{0.5} = 3.6$$

$$A_{s, \text{bm}} = \frac{T_k \mu_k e f_{gg}}{2 A_k f_{yd}} = \frac{22,4 \times 120}{2 \times 800 \times 391,3} \times 2 \times \frac{10^3}{10^3}$$

$$= 8,6 \text{ cm}^2$$

$$3.65 + 2.1 = 5.75 \quad 4 \phi 14$$



$$m_{\lambda}^v = 1,92$$

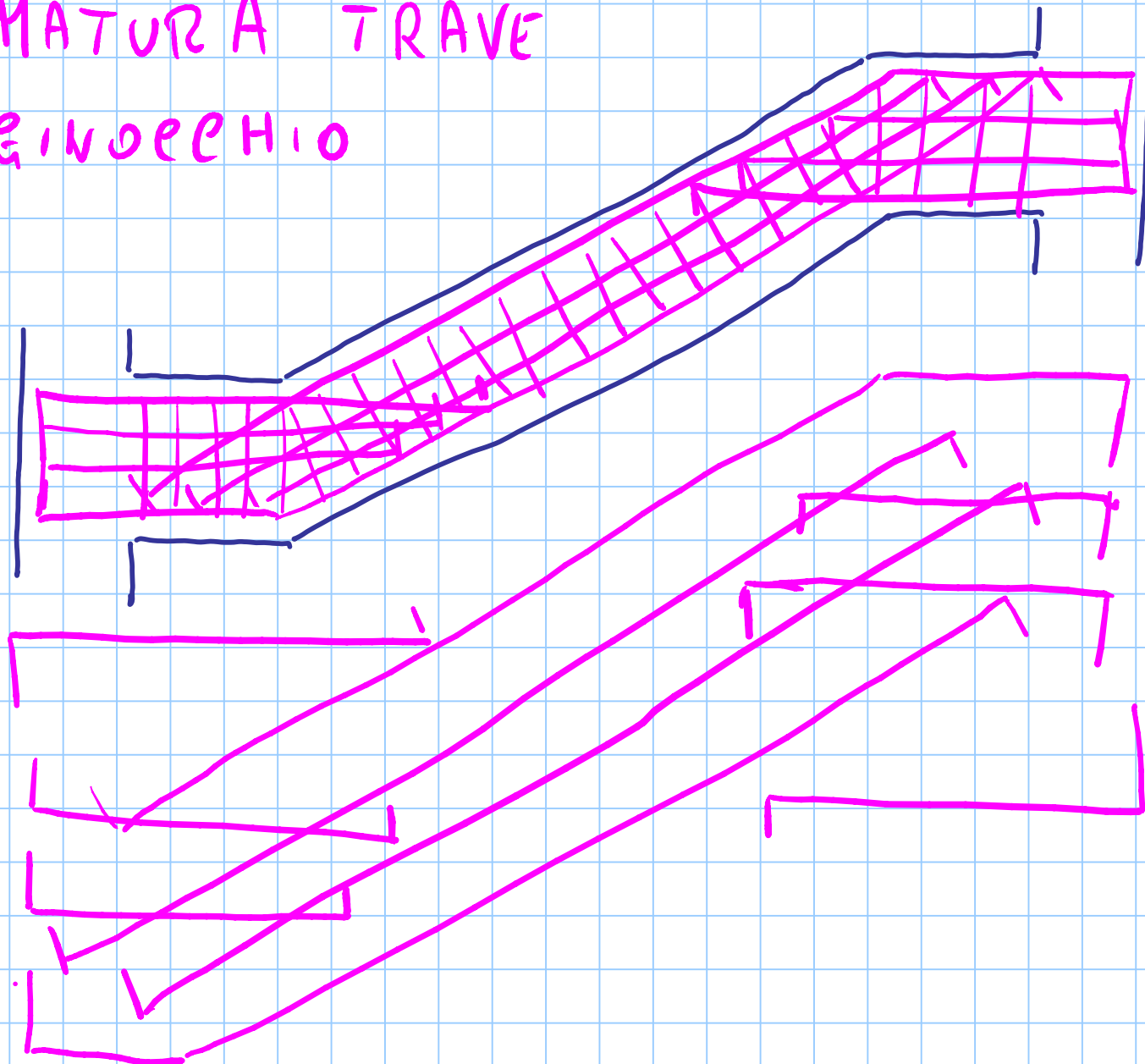
$$\lambda = 5,52$$

$$m_{\lambda}^r = 3,6$$

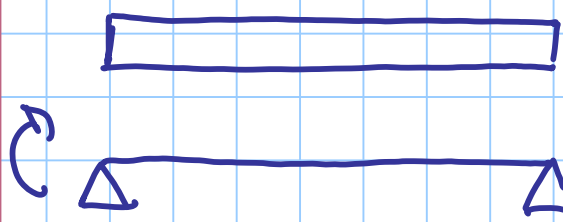
$$S = \frac{100}{5,52} = 18,1 \text{ km}$$

$\phi^{8/15}$

ARMATURA TRAVE A GINOCCHIO




PIANEROTTOLO

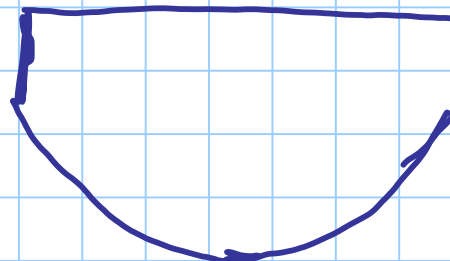


$$q_d + q_{d1} = 11 \text{ kN/m} = q$$

$$M = \frac{T_{\max}^2}{b_b} = \frac{10,5^2}{2} = 8,49 \text{ kNm}$$

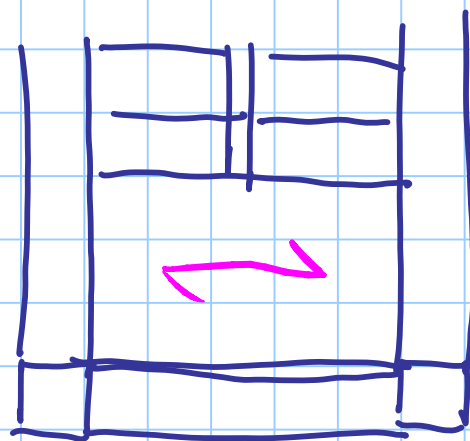


$$l_p = 3,1$$



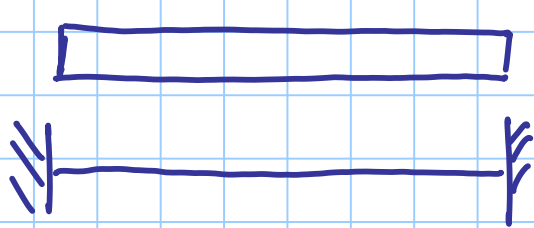
$$8,49 = M$$

$$M + \frac{q l_p^2}{8} = 22,0$$

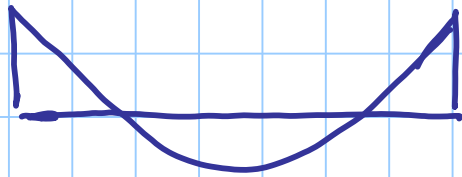
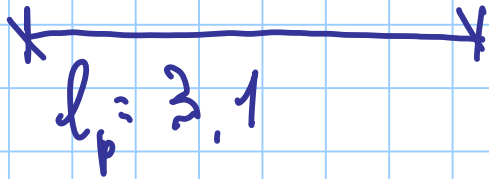


$$l_p = 3,1$$

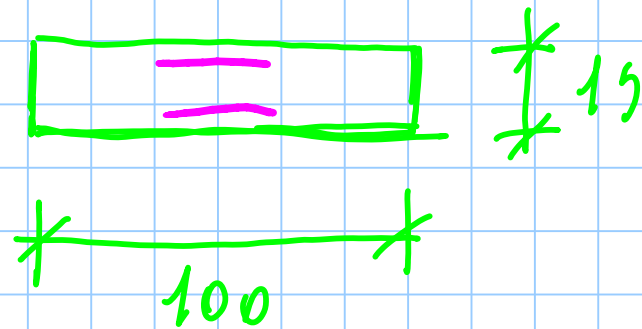
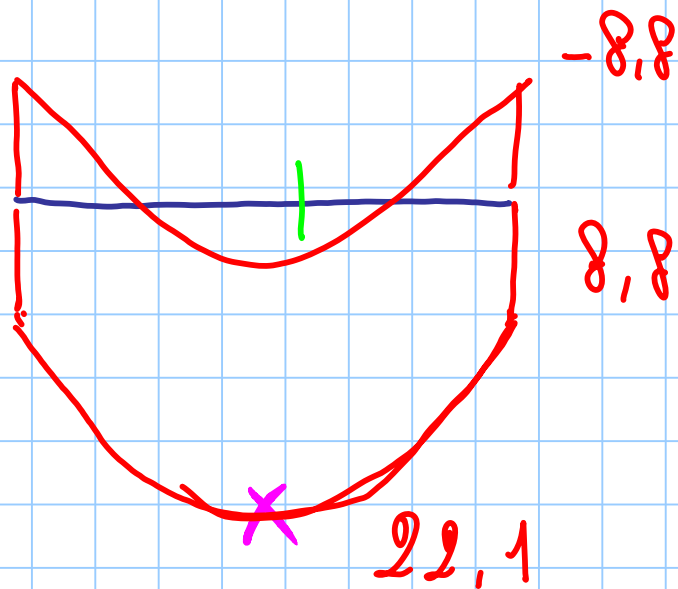
$$b_p = 1,2$$



$$q_d + q_{sd} = 11 \text{ kN/m} = q_1$$



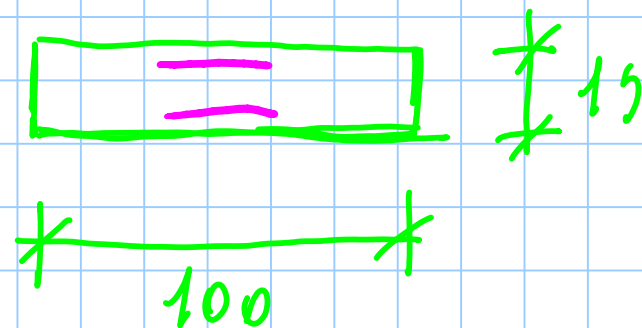
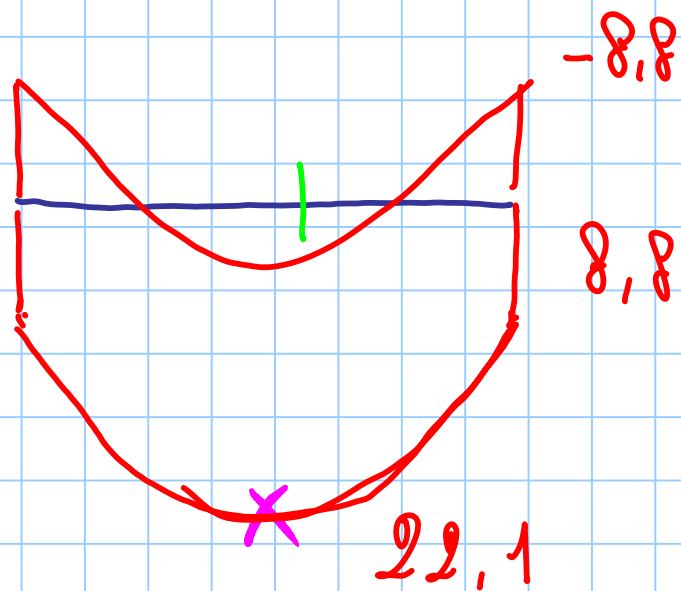
$$\frac{q l_p^2}{12} = 8.81 \text{ kNm}$$



Verifizierung κ Axiom im CLS

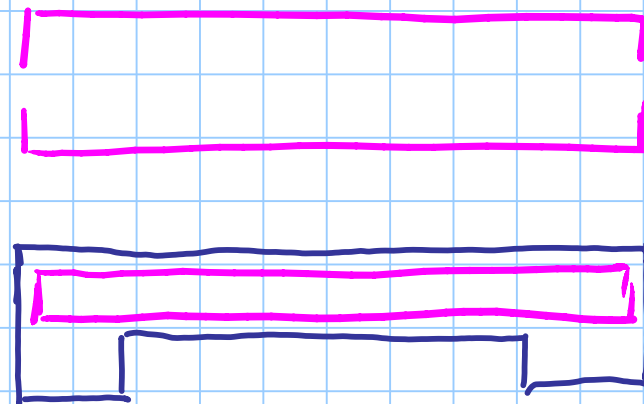
$$M_{\max}(22,1) \leq M_{Rd} = \frac{b d^2}{\gamma' 2}$$

$$V_{\max}(17,1) \leq V_{Rd,e}$$

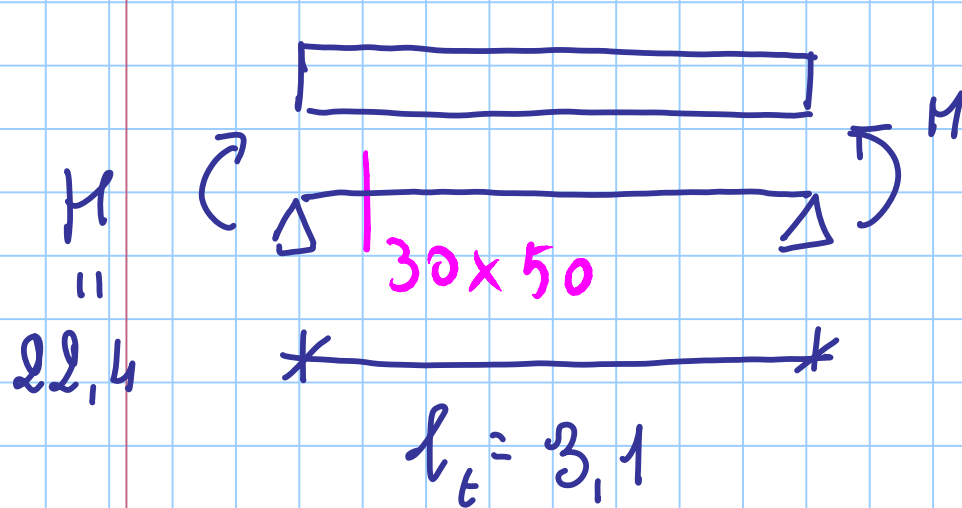


Progetto armatura

$$A_s = \frac{M}{0,9 d f_{yd}}$$



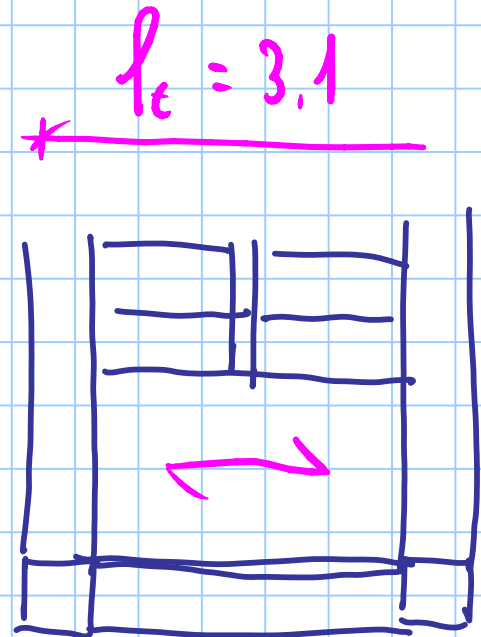
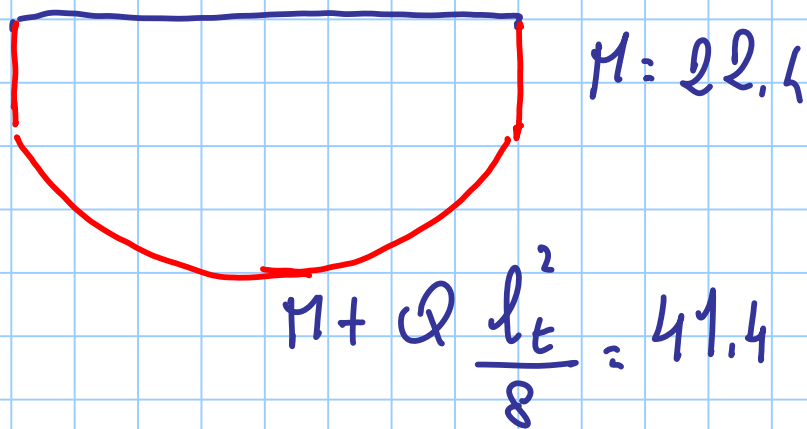
TRAVE DI TESTATA



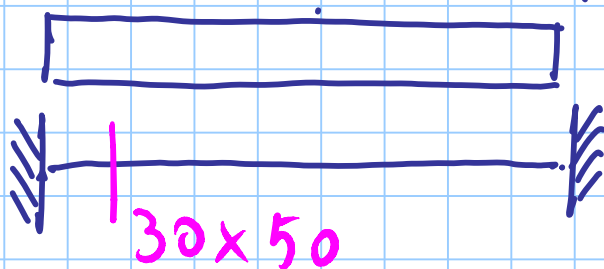
$$0,5 \times 11 = 5,5$$

$$Q = 15,8 \text{ KN m}$$

Temperature
p.p.
pieno



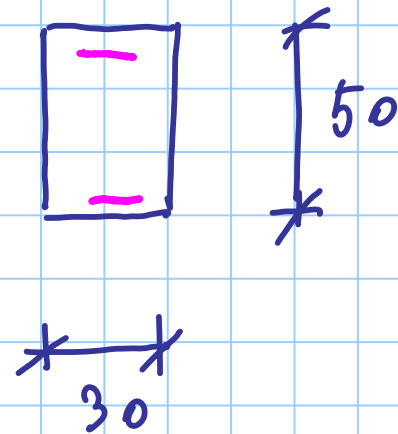
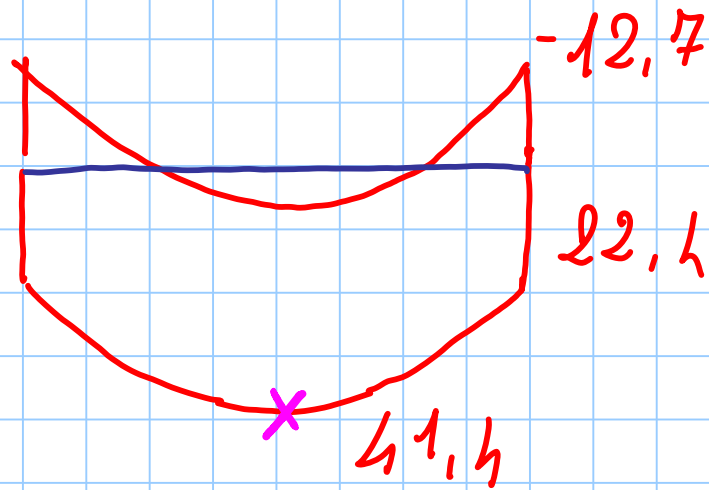
$$Q = 15,8 \text{ KN m}$$



$$l_t = 3,1$$

A diagram of a beam of length l_t with a parabolic load distribution. The load starts at zero at the left end, reaches a minimum at the center, and returns to zero at the right end. The area under the parabola is shaded in red.

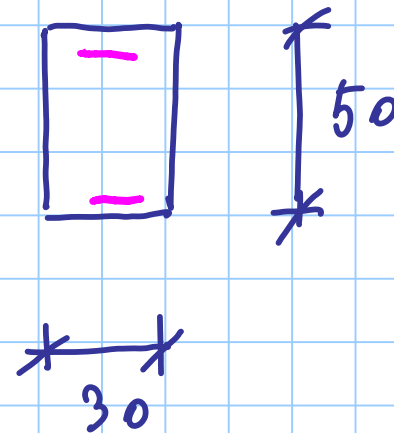
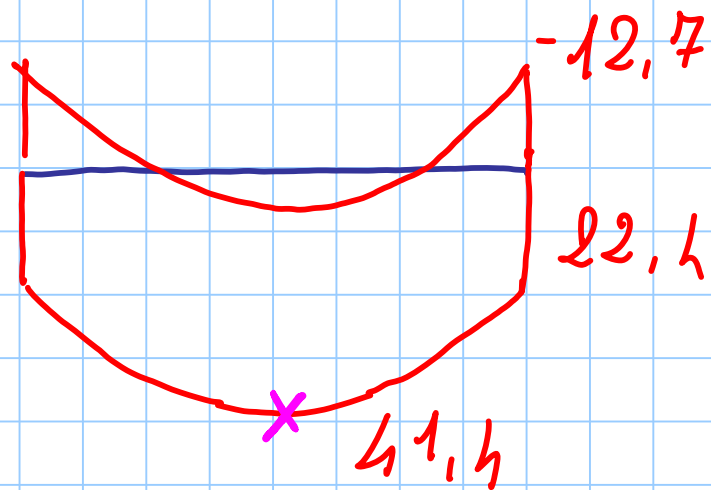
$$\frac{Q l_t^2}{12} = 12,7$$



Verifie section im ELS

$$M_{\max}(41,4) \leq M_{rd} = \frac{b d^2}{\gamma_{11}}$$

$$V_{\max}(24,5) \leq V_{Rd, \max} = 0,9 d b_w f_{cd} \frac{e \tan \theta}{1 + e \tan^2 \theta}$$



Progetto armatura

$$A_s = \frac{M}{0,9 d f_{yd}}$$

$$\frac{A_{sw}}{s} = \frac{\checkmark}{0,9 d f_{yd} \cot \theta}$$

