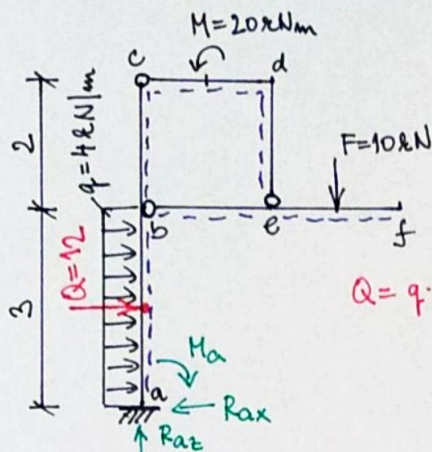
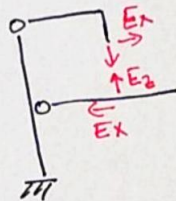
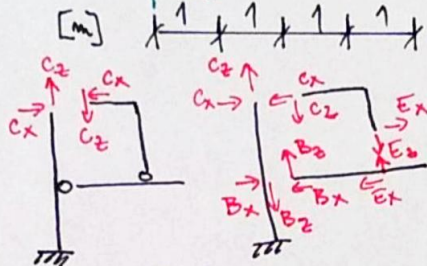




$$Q = q \cdot 3 = 12 \text{ kN}$$



1) reakce - pro vykreslování je nutné nepotřebujeme - použijeme je pro kontrolu

$$\sum F_{ix} = 0 \quad (+) \rightarrow$$

$$Q - R_{ax} = 0 \Rightarrow \underline{R_{ax} = 12 \text{ kN}}$$

$$\sum F_{iz} = 0 \quad (+) \uparrow$$

$$R_{az} - F = 0 \Rightarrow \underline{R_{az} = 10 \text{ kN}}$$

$$\sum M_{ai} = 0 \quad (+) \curvearrowright$$

$$M_a + Q \cdot 1.5 - M + F \cdot 3 = 0$$

$$\underline{M_a = -28 \text{ kNm}}$$

kontrola:

$$\sum M_{if} = 0 \quad (+) \curvearrowright$$

$$M_a + R_{az} \cdot 4 + R_{ax} \cdot 3 - Q \cdot 1.5 - M - F \cdot 1 = 0$$

$$\underline{0 = 0 \text{ v}}$$

2) pro vykreslení je nutné otevřít tu uzavřenou část bode alespoň v jednom místě

- s výhodou provedeme dělení v kloubu (pouze 2 složky interakce)

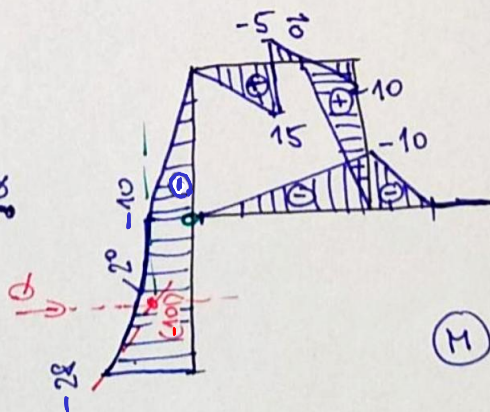
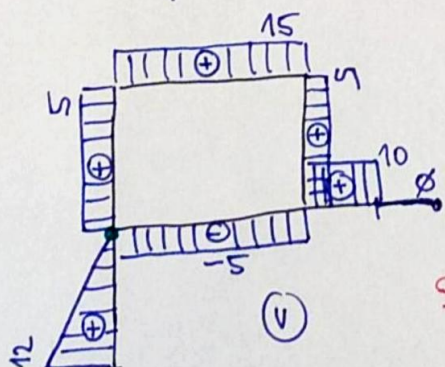
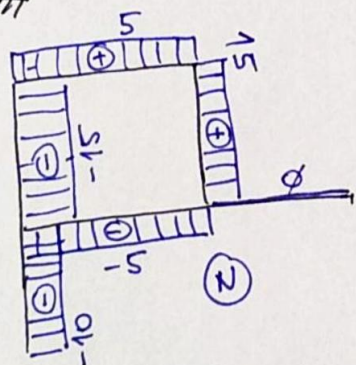
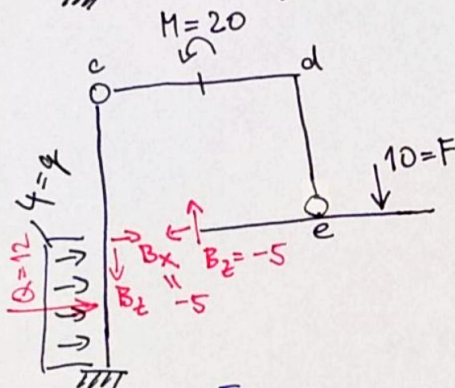
- výpočet interakce

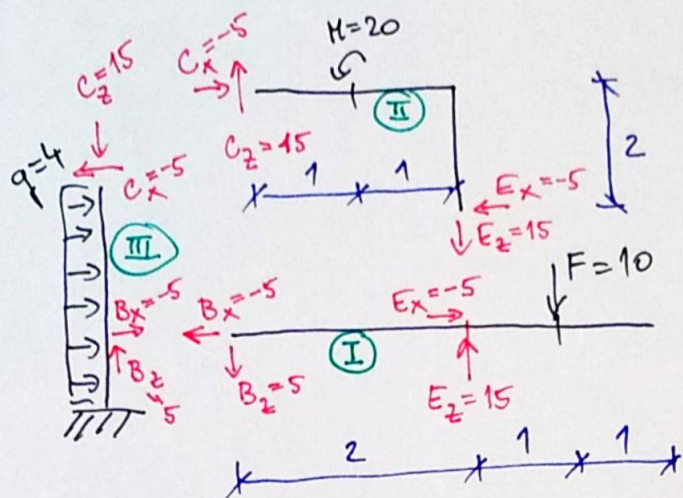
$$\sum M_{ei}^P = 0 \quad (+) \curvearrowright$$

$$B_z \cdot 2 + F \cdot 1 = 0 \Rightarrow \underline{B_z = -5 \text{ kN}}$$

$$\sum M_{ci}^P = 0 \quad (+) \curvearrowright$$

$$-M + B_x \cdot 2 + F \cdot 3 = 0 \Rightarrow \underline{B_x = -5 \text{ kN}}$$





①  $\sum M_{bi} = 0 \quad (+) \downarrow$   
 $F \cdot 3 - E_z \cdot 2 = 0 \Rightarrow \underline{E_z = 15 \text{ N}}$

$\sum M_{ei} = 0 \quad (+) \downarrow$   
 $F \cdot 1 - B_z \cdot 2 = 0 \Rightarrow \underline{B_z = 5 \text{ N}}$

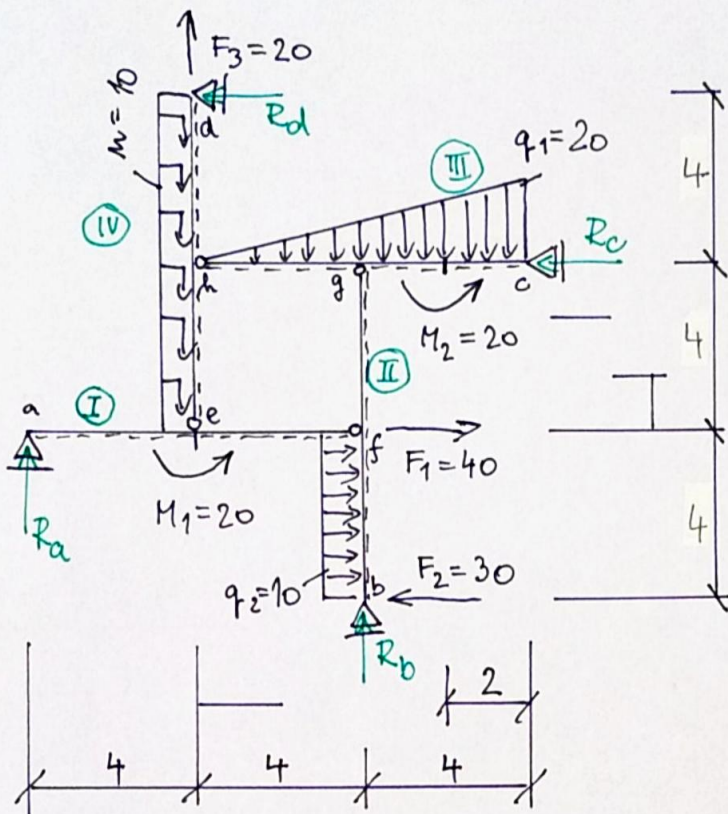
kontrola  
 $\sum F_{zi} = 0 \quad (+) \uparrow$   
 $-B_z + E_z - F = 0$   
 $0 = 0 \checkmark$

$\sum F_{ix} = 0 \quad (+) \leftarrow$   
 $B_x - E_x = 0 \Rightarrow \underline{B_x = E_x}$

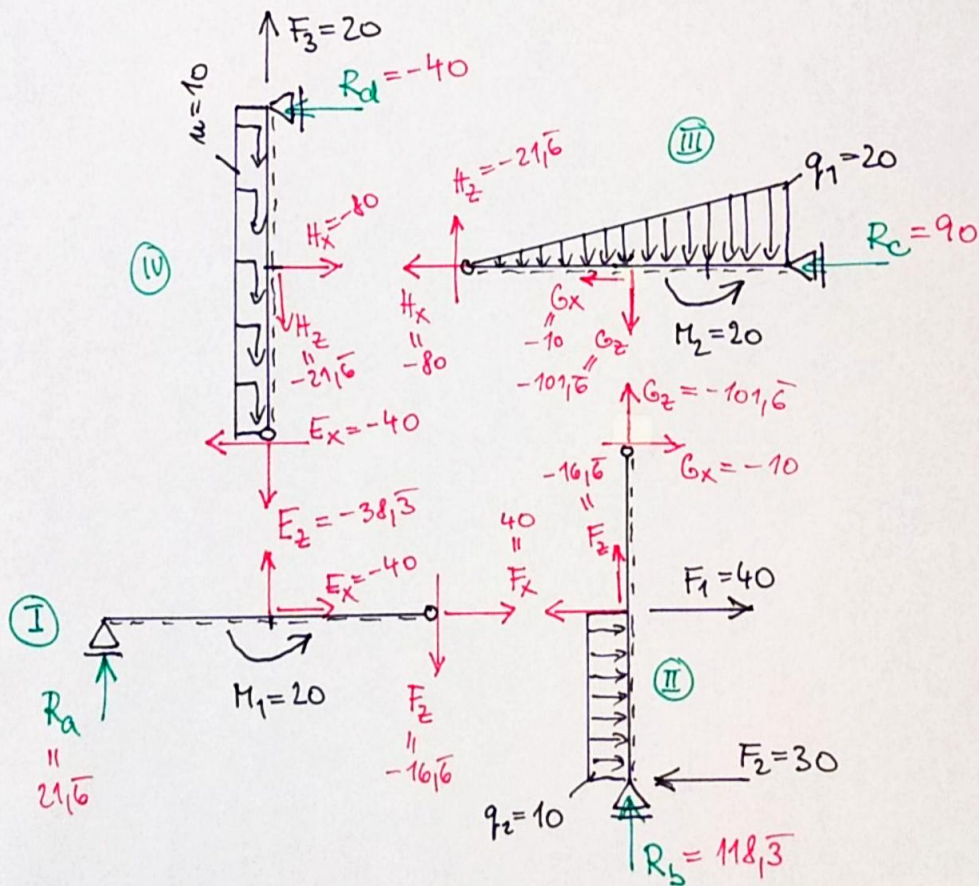
②  $\sum M_{ci} = 0 \quad (+) \uparrow$   
 $H - E_x \cdot 2 - E_z \cdot 2 = 0$   
 $\underline{E_x = -5 \text{ N} = B_x}$

$\sum F_{zi} = 0 \quad (+) \uparrow$   
 $C_z - E_z = 0 \Rightarrow \underline{C_z = E_z = 15 \text{ N}}$

$\sum F_{xi} = 0 \quad (+) \rightarrow$   
 $C_x - E_x = 0 \Rightarrow \underline{C_x = E_x = -5 \text{ N}}$



$[m, kN, EN/m, ENm]$



$$\textcircled{\text{III}} \quad \Sigma M_{hi} = 0 \quad \textcircled{+} \curvearrowright$$

$$G_2 \cdot 4 - M_2 + (q_1 \cdot 8 \cdot \frac{1}{2}) \cdot (\frac{2}{3} \cdot 8) = 0$$

$$\underline{G_2 = -101,6 \text{ kN}}$$

$$\Sigma M_{gi} = 0 \quad \textcircled{+} \curvearrowright$$

$$H_2 \cdot 4 - M_2 + (\frac{1}{2} q_1 \cdot 8) \cdot (\frac{2}{3} \cdot 8 - 4) = 0$$

$$\underline{H_2 = -21,6 \text{ kN}}$$

kontrola:

$$\Sigma F_{iz} = 0 \quad \textcircled{+} \uparrow$$

$$H_2 - G_2 - q_1 \cdot 8 \cdot \frac{1}{2} = 0 \quad \underline{0 = 0 \checkmark}$$

$$\textcircled{\text{II}} \quad \Sigma M_{gi} = 0 \quad \textcircled{+} \curvearrowright$$

$$F_1 \cdot 4 - F_x \cdot 4 - F_2 \cdot 8 + (q_2 \cdot 4) \cdot (4 + 2) = 0$$

$$\underline{F_x = 40 \text{ kN}}$$

$$\Sigma M_{fi} = 0 \quad \textcircled{+} \curvearrowright$$

$$G_x \cdot 4 + F_2 \cdot 4 - (q_2 \cdot 4) \cdot 2 = 0$$

$$\underline{G_x = -10 \text{ kN}}$$

kontrola:

$$\Sigma F_{xi} = 0 \quad \textcircled{+} \rightarrow$$

$$G_x - F_x + F_1 - F_2 + q_2 \cdot 4 = 0 \quad \underline{0 = 0 \checkmark}$$

$\textcircled{\text{I}}$

$$\Sigma F_{xi} = 0 \quad \textcircled{+} \rightarrow$$

$$E_x + F_x = 0$$

$$\underline{E_x = -F_x = -40 \text{ kN}}$$

$$\textcircled{\text{IV}} \quad \Sigma M_{hi} = 0 \quad \textcircled{+} \curvearrowright$$

$$E_x \cdot 4 - R_d \cdot 4 = 0$$

$$\underline{R_d = -40 \text{ kN}}$$

$$\Sigma M_{di} = 0 \quad \textcircled{+} \curvearrowright$$

$$E_x \cdot 8 - H_x \cdot 4 = 0$$

$$\underline{H_x = -80 \text{ kN}}$$

kontrola:

$$\Sigma F_{xi} = 0 \quad \textcircled{+} \rightarrow \quad H_x - E_x - R_d = 0 \quad \underline{0 = 0 \checkmark}$$

$$\sum F_{zi} = 0 \quad (+) \uparrow$$

$$F_3 - H_2 - E_2 - m \cdot l = 0$$

$$E_2 = -38,3 \text{ kN}$$

$$\textcircled{\text{I}} \quad \sum M_{ai} = 0 \quad (+) \uparrow$$

$$E_2 \cdot 4 + M_1 - F_2 \cdot 8 = 0$$

$$F_2 = -16,6 \text{ kN}$$

$$\sum M_{fi} = 0 \quad (+) \uparrow$$

$$-R_a \cdot 8 - E_2 \cdot 4 + M_1 = 0$$

$$R_a = 21,6 \text{ kN}$$

kontrola:

$$\sum F_{zi} = 0 \quad (+) \uparrow$$

$$R_a + E_2 - F_2 = 0 \quad 0 = 0 \text{ V}$$

$$\textcircled{\text{II}} \quad \sum F_{zi} = 0 \quad (+) \uparrow$$

$$R_b + F_2 + G_2 = 0 \Rightarrow R_b = 18,3 \text{ kN}$$

$$\textcircled{\text{III}} \quad \sum F_{xi} = 0 \quad (+) \leftarrow$$

$$H_x + G_x + R_c = 0 \Rightarrow R_c = 90 \text{ kN}$$

kontrola na cele! kci

$$\sum F_{xi} = 0 \quad (+) \rightarrow$$

$$-R_d - R_c + q_2 \cdot 4 + F_1 - F_2 = 0 \quad 0 = 0 \text{ V}$$

$$\sum F_{zi} = 0 \quad (+) \uparrow$$

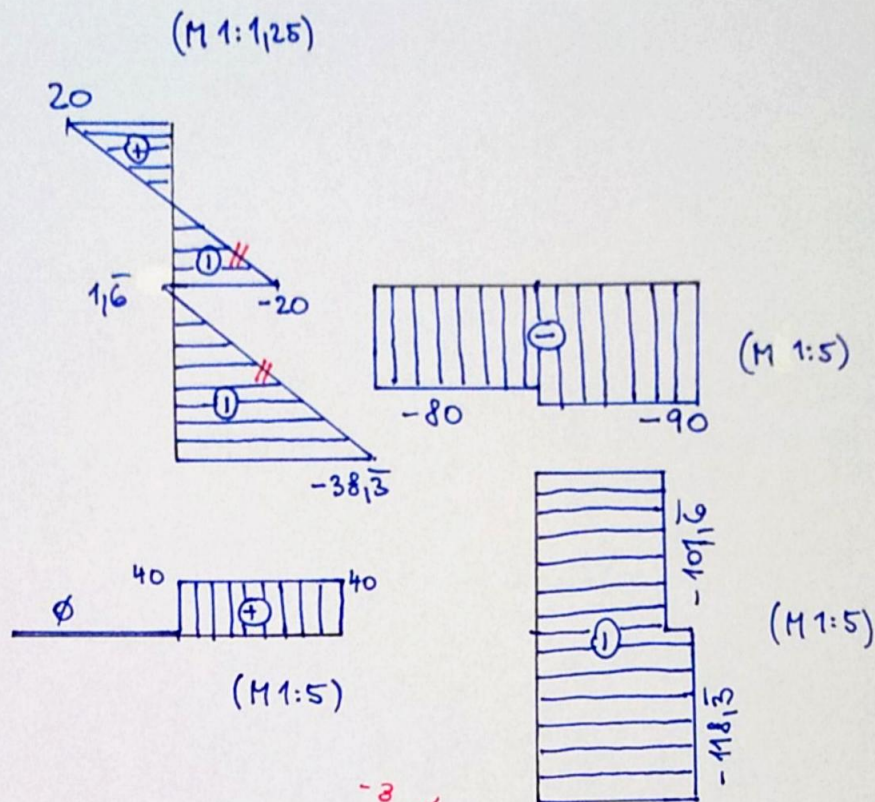
$$F_3 - m \cdot 8 + R_a + R_b - \frac{1}{2} q_1 \cdot 8 = 0 \quad 0 = 0 \text{ V}$$

$$\sum M_{ai} = 0 \quad (+) \uparrow$$

$$M_1 + M_2 + F_3 \cdot 4 + R_d \cdot 8 - (m \cdot 8) \cdot 4 + R_c \cdot 4 + (q_2 \cdot 4) \cdot 2 + R_b \cdot 8 - F_2 \cdot 4 - \left(\frac{1}{2} q_1 \cdot 8\right) \cdot \left(4 + \frac{2}{3} \cdot 8\right) = 0$$

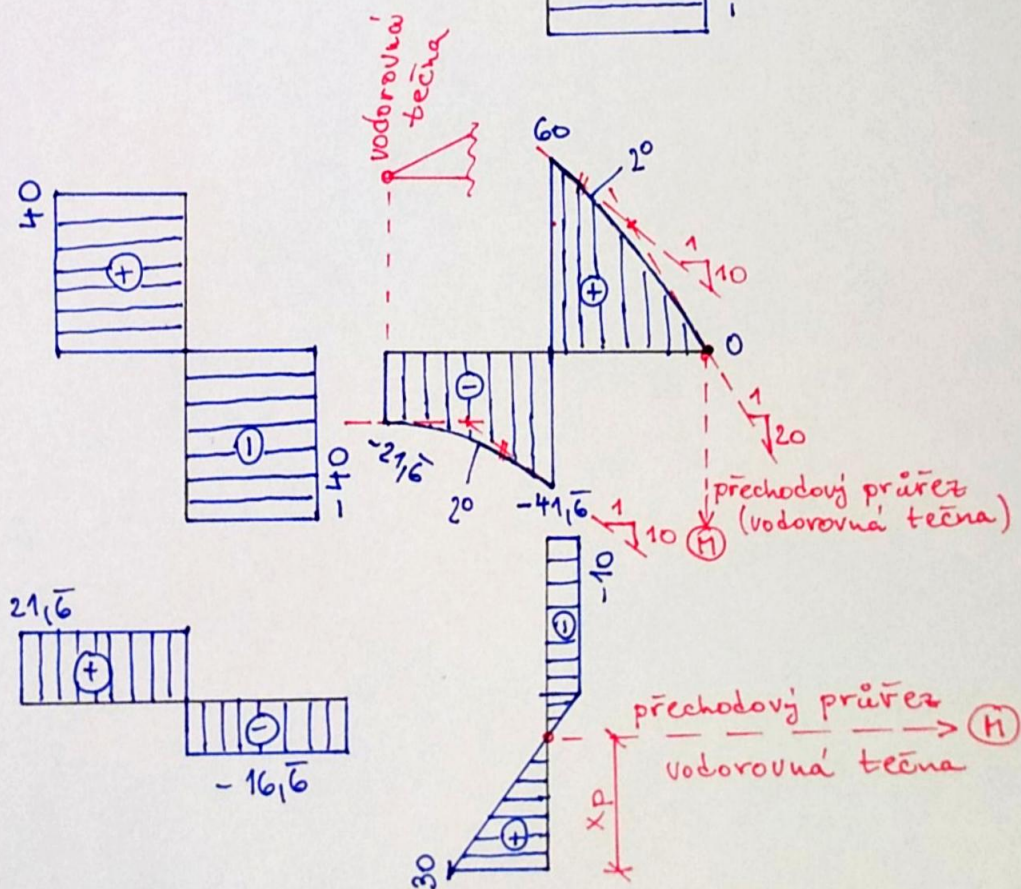
$$0 = 0 \text{ V}$$

(N)



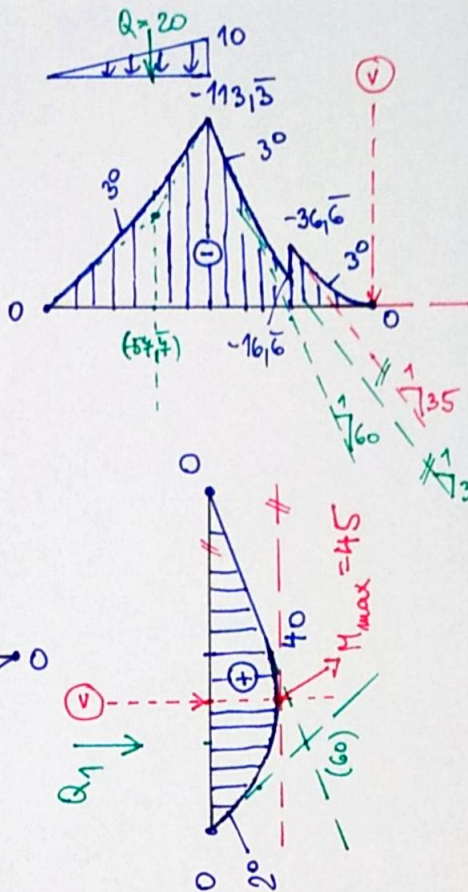
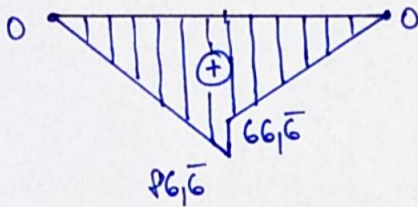
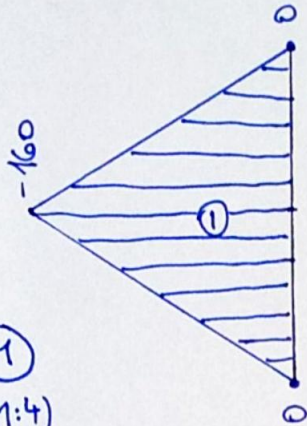
(M 1:2)

(V)



$$X_p = \frac{V_{bf}}{q} = \frac{30}{10} = 3 \text{ m}$$

(M)  
(M1:4)



Sklon tečen  
v bodě  
-160 a 86.6 je  
roven  $V_g$   
||  
 $\frac{15+20}{2} \cdot 2 = 35 \text{ kN}$

$$M_{Q_1}^L = (\text{pod } Q_1 \text{ bez } q_1) =$$

$$= F_2 \cdot 2 = 60 \text{ kNm}$$

$$M_{\max}^L = F_2 x_p - (q \cdot x_p) \cdot \frac{x_p}{2} = \underline{45 \text{ kNm}}$$

$$M_{\max}^L = M_b + \int_0^{x_p} V(x) dx =$$

$$= 0 + \frac{1}{2} 30 \cdot x_p = \underline{45 \text{ kNm}} \checkmark$$