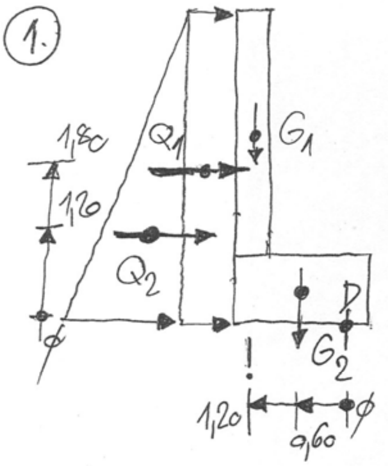
BEVEZETÉS 2006/07. ŐSZ 1. HF MEGOLDÁS

1.



$$G_{1,k} = 25 \cdot 0{,}3 \cdot 2{,}80 = 21{,}0 \text{ kN}$$

$$G_{2,k} = 25 \cdot 0{,}8 \cdot 1{,}50 = 30 \text{ kN}$$

$$Q_{1,k} = 3{,}0 \frac{\text{kN}}{\text{m}} \cdot 3{,}60 = 10{,}8 \text{ kN}$$

$$Q_{2,k} = 9{,}0 \cdot \frac{3{,}60}{2} = 16{,}2 \text{ kN}$$

Elcsúszás:

$$E_{d,stabil} = \Sigma \gamma \mu G_k = 0{,}9 \cdot 0{,}8 (21 + 30) = 36{,}7 \text{ kN}$$

$$E_{d,destabil} = \Sigma \gamma Q_k = 1{,}3 (10{,}8 + 16{,}2) = 35{,}1 \leq E_{d,stabil}$$

$\boxed{\text{elcsúszásra megfelel}}$

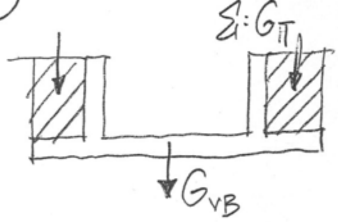
Felborulás:

$$M_{d,stabil} = \Sigma \gamma G_k z = 0{,}9 (21 \cdot 1{,}2 + 30 \cdot 0{,}6) = 38{,}9 \text{ kNm}$$

$$M_{d,destabil} = \Sigma \gamma Q_k z = 1{,}3 (10{,}8 \cdot 1{,}8 + 16{,}2 \cdot 1{,}2) = 50{,}5 \text{ kNm} > M_{d,stabil}$$

$\boxed{\text{felborulásra nem felel meg}}$

2.



$$G_{vB,k} = \Sigma \gamma_{vB} V = 25 \frac{\text{kN}}{\text{m}^3} \left[(4^2 - 3{,}5^2) \cdot 1{,}50 + 0{,}25 a^2 \right]$$

$$G_{T,k} = \Sigma \gamma_t \cdot V_T = 18 \frac{\text{kN}}{\text{m}^3} (a^2 - 4^2) \cdot 1{,}50$$

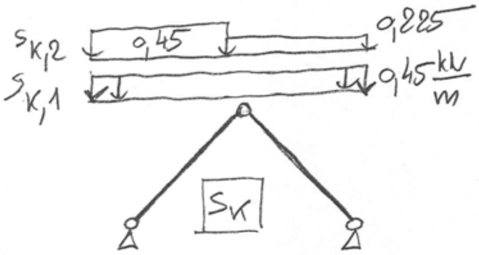
$$E_{d,stb} = 0{,}9 \left[25 (5{,}63 + 0{,}25 a^2) + 27 (a^2 - 16) \right] = 29{,}9 a^2 - 262{,}1$$

$$E_{d,dst} = 1{,}0 \cdot a^2 \cdot 1{,}75 \cdot 10 \frac{\text{kN}}{\text{m}^3} = 17{,}5 a^2 \quad (\text{víz!})$$

$$E_{d,stb} \geq E_{d,dst} \rightarrow 29{,}9 a^2 - 262{,}1 \geq 17{,}5 a^2 \rightarrow a \geq \sqrt{\frac{262{,}1}{12{,}4}} = 4{,}59 \text{ m} \rightarrow 4{,}60 \text{ m}$$

3.)

$$g_k = 6\frac{kN}{m^3}\cdot 0{,}1\cdot 0{,}15 + 0{,}90\,m\cdot 0{,}6\frac{kN}{\text{ferde } m^2} = 0{,}63\frac{kN}{\text{ferde } m}$$



$$s_k = t\,\mu_1\cdot s_0 = 0{,}90\,m\cdot 0{,}4\cdot 1{,}25\frac{kN}{m^2} = 0{,}45\frac{kN}{\text{vet. } m}$$

$$\left.\begin{array}{l} d = 6{,}0\,m > h = 5{,}9\,m \\ d = 6{,}0 > b/2 = 10/2 = 5{,}0\,m \end{array}\right\} \rightarrow [1]$$

$$h = 5{,}9\,m\ (6{,}0\,m) \rightarrow \overset{III}{q_p}(z) = 0{,}484\ kN/m^2$$

$$w_{1,k} = c_{pe}^{1}\cdot q_p(z)\cdot t = 0{,}62\cdot 0{,}484\cdot 0{,}90 = 0{,}27\frac{kN}{fer.m}$$

$$w_{2,k} = c_{pe}^{2}\cdot q_p(z)\cdot t = \underset{\text{nyereg}t.}{\underline{-0{,}22}}\cdot 0{,}484\cdot 0{,}90 = 0{,}096\frac{kN}{f.m}$$

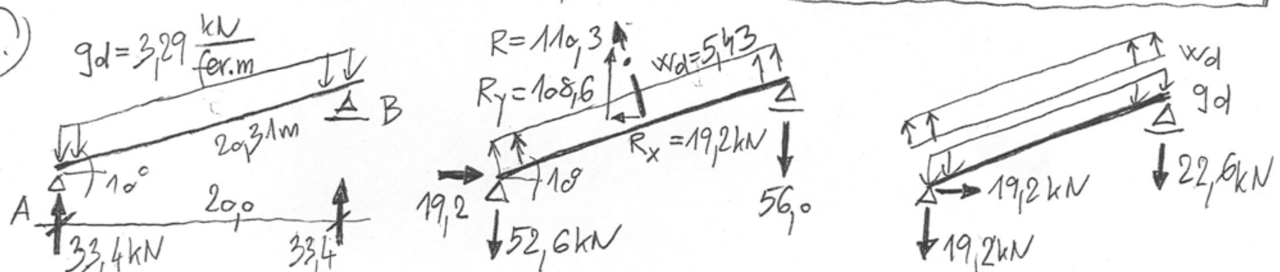
Teherkombinációk:

1. $\gamma_{G,sup}\cdot g_k + \gamma_{Q,sup}[s_{k,1} + \psi_0^w\cdot w_k] = 1{,}35\,g_k + 1{,}5\cdot s_{k,1} + 0{,}6\cdot 1{,}5\cdot w_k$
2. $\gamma_{G,sup}\cdot g_k + \gamma_{Q,sup}[\psi_0^s\cdot s_{k,1} + w_k] = 1{,}35\,g_k + 0{,}5\cdot 1{,}5\,s_{k,1} + 1{,}5\cdot w_k$
3. $\gamma_{G,sup}\cdot g_k + \gamma_{Q,sup}[s_{k,2} + \psi_0^w\cdot w_k] = 1{,}35\,g_k + 1{,}5\,s_{k,2} + 0{,}6\cdot 1{,}5\,w_k$
4. $\gamma_{G,sup}\cdot g_k + \gamma_{Q,sup}[\psi_0^s\cdot s_{k,2} + w_k] = 1{,}35\,g_k + 0{,}5\cdot 1{,}5\,s_{k,1} + 1{,}5\,w_k$

[+ $\gamma_{G,sup}\cdot g_k + \gamma_{Q,sup}\cdot s_{k,1} =$ $1{,}35\,g_k + 1{,}5\,s_{k,1}$]

Stabilitás: ! 5. $\gamma_{G,inf}\cdot g_k + \gamma_{Q,sup}\cdot w_k$ $= 0{,}9\cdot g_k + 1{,}5\cdot w_k$

4.)



$$g_d = 0{,}90\left[0{,}16\cdot 1{,}20\cdot 6\frac{kN}{m^3} + 5{,}0\cdot 0{,}5\frac{kN}{m^2}\right] = 3{,}29\frac{kN}{f.m}$$

$$A = B = 3{,}29\cdot 20{,}31/2 = 33{,}4\ kN\ (\uparrow)$$

$$w_d = 1{,}5\cdot\left[\underset{d>h\rightarrow[1]}{-0{,}94}\cdot \underset{\overset{II}{q}(8\,m)}{0{,}77}\frac{kN}{m^2}\cdot 5{,}0\,m\right] = -5{,}43\frac{kN}{fm}$$

$$\Sigma M_A = \emptyset \rightarrow \underline{B} = \frac{5{,}43\cdot 20{,}31^2}{2\cdot 20{,}0} = \underline{56{,}0\ kN}(\downarrow)$$

$$\Sigma V = \emptyset \rightarrow \underline{A_y} = 108{,}6 - 56 = \underline{52{,}6\ kN}(\downarrow)$$

5. **Vb. födém**

1,5 cm kerámia	$0{,}015\,m \cdot 24\,kN/m^3$	$= 0{,}36$
5 cm beton	$0{,}05 \cdot 24$	$= 1{,}20$
1 rtg PE fólia	—	
2 cm lépésálló üveggyapot	$0{,}02 \cdot 0{,}35$	$= 0{,}01$
12 cm vasbeton lemez	$0{,}12 \cdot 25$	$= 3{,}00$
1,5 cm vakolat	$0{,}015 \cdot 20$	$= 0{,}30$
+ 25/25 cm lelógó vb. ger	$\frac{0{,}25^2}{1{,}50} \cdot 25$	$= 1{,}04$
+ 2 x 1,5/25 cm vakolat/ger.	$\frac{2 \cdot 0{,}015 \cdot 0{,}25}{1{,}50} \cdot 20$	$= 0{,}10$ (elmaradhat)

$g_K = 6{,}01\ kN/m^2$

$g_d = 1{,}35 \cdot 6{,}01 = 8{,}11\ \frac{kN}{m^2}$

Fa lapostető

5 cm kavicsterítés	$0{,}05 \cdot 16{,}0\ \frac{kN}{m^3}$ (18, ez jó)	$= 0{,}80$ (0,90)
2 rtg bitumenes vtg. lemez	$2 \cdot 0{,}05\ kN/m^2$	$= 0{,}10$
5,7 cm Kerto-Q furnérfa	$0{,}057 \cdot 6\ kN/m^3$	$= 0{,}34$
16/30 cm fagerenda / t = 3,0 m	$\frac{0{,}16 \cdot 0{,}30}{3{,}0} \cdot 6\ kN/m^3$	$= 0{,}10$

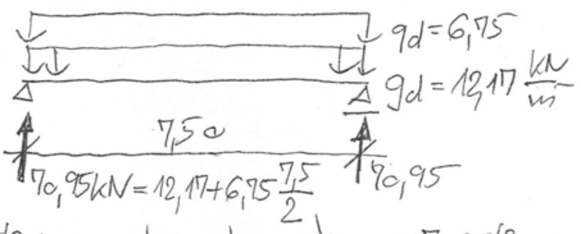
$g_K = 1{,}34\ kN/m^2$ (1,44)

$g_d = 1{,}35 \cdot 1{,}34 = 1{,}81\ \frac{kN}{m^2}$ (1,94)

6. **Fióktartó**: $t = 1{,}5\,m$

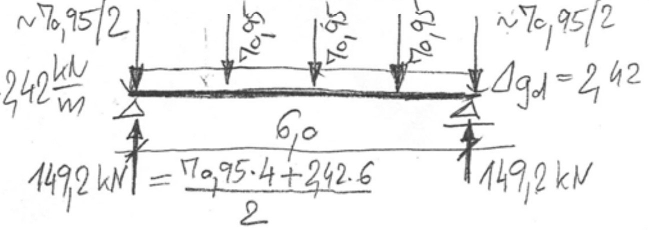
$g_d = 8{,}11\ \frac{kN}{m^2} \cdot 1{,}5\,m = 12{,}17\ \frac{kN}{m}$

$g_d = 1{,}5 \cdot 3{,}0\ \frac{kN}{m^2} \cdot 1{,}5\,m = 6{,}75\ \frac{kN}{m}$



Mestergerenda (lelógás):

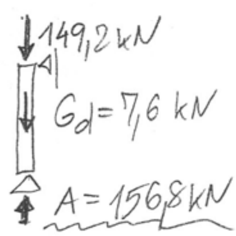
$\Delta g_d = 1{,}35\,(0{,}25^2 \cdot 25 + 3 \cdot 0{,}25 \cdot 0{,}015 \cdot 20) = 2{,}42\ \frac{kN}{m}$



Oszlop (önsúly)

$G_d = 1{,}35\left[0{,}25^2 \cdot 25 + (0{,}28^2 - 0{,}25^2) \cdot 20\right] \cdot 3{,}0 = 7{,}6\ kN$

(vakolat elmaradhat → 6,4 kN)



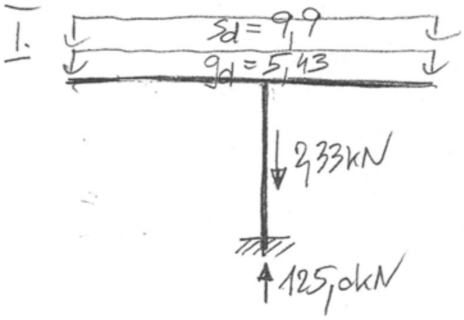
7.)

$G_{d,pillér} = 1{,}35 \cdot 2 \cdot 0{,}10 \cdot 0{,}40 \cdot 3{,}6 \cdot 6\,\frac{kN}{m^3} = 2{,}33\,kN$ $\quad g_d^{tető} \overset{(1{,}94)}{=} 1{,}81 \cdot 3{,}0 \overset{(5{,}82)}{=} 5{,}43\,\frac{kN}{m}$

$s_d = \gamma_Q \cdot \mu \cdot s_0 \cdot t = 1{,}5 \cdot 0{,}8 \cdot \underline{2{,}75\,\frac{kN}{m^2}} \cdot 3{,}0\,m = 9{,}9\,kN/m$ $\quad (h \approx 1000\,m)$

$w_d = \gamma_Q \cdot c_{p,e} \cdot q_p(z) \cdot b = 1{,}5 \cdot 1{,}4 \cdot 0{,}627\,\frac{kN}{m^2} \cdot 2 \cdot 0{,}10\,m = 0{,}26\,kN/m$ $\quad (0{,}185)$

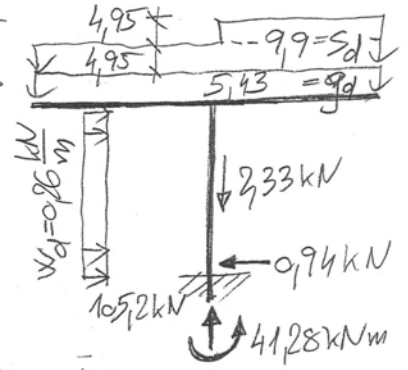
I.



II. zóna

(III.: 0,446 is jó)

II.



$\underline{A_y} = (9{,}9 + 5{,}43) \cdot 8{,}0 + 2{,}33 = \underline{125{,}0\,kN\ (\uparrow)}$

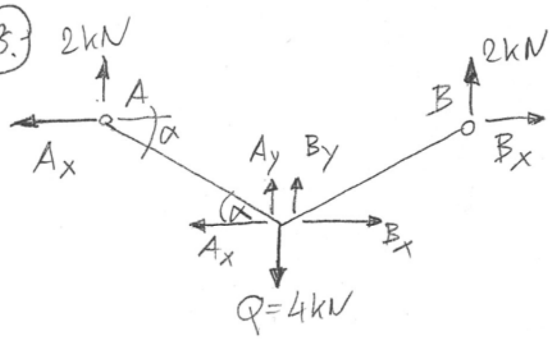
$\underline{A_x} = \emptyset \qquad \underline{M_A = \emptyset}$

$\underline{A_y} = 125{,}0 - 4{,}95 \cdot 4{,}0 = \underline{105{,}2\,kN\ (\uparrow)}$

$\underline{A_x} = 0{,}26\,\frac{kN}{m} \cdot 3{,}6\,m = \underline{0{,}94\,kN\ (\leftarrow)}$

$\underline{M_A} = \frac{0{,}26 \cdot 3{,}6^2}{2} + \frac{4{,}95 \cdot 4^2}{2} = \underline{41{,}28\,kNm\ (\circlearrowright)}$

8.)



$\Sigma V = \emptyset \quad A_y = B_y = \frac{4\,kN}{2} = 2\,kN\ (\uparrow)$

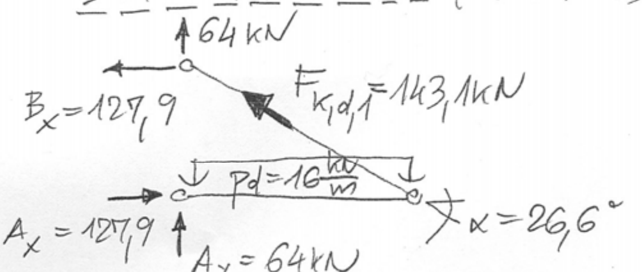
$A_x = B_x = \frac{A_y}{tg\,\alpha} = \frac{2\,kN}{tg\,\alpha}$

$F_{kötél} = A = B = \frac{A_y}{\sin\alpha} = \frac{2\,kN}{\sin\alpha}$

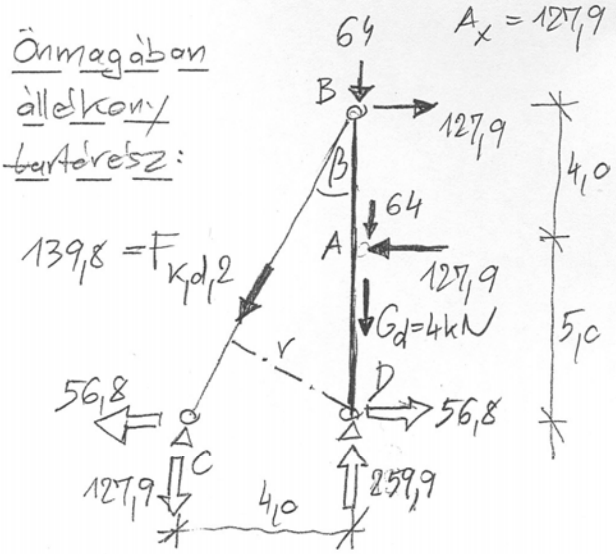
$\alpha°$	$A_y = B_y$ (↑)	$A_x = B_x$ ⇆	$A = B$ ↖ ↗
45°		2 kN	2,83 kN
30°	2 kN	3,46 kN	4,0 kN
15°		7,46 kN	7,73 kN
0°		nem egyensúlyozható	

9.

<u>Beakasztott tartó</u> (előadásból)



<u>Önmagában állékony tartórész:</u>



$$\beta = \mathrm{atg}\,\frac{4{,}0}{9{,}0} = 23{,}96^\circ$$

$$r = 9 \cdot \sin 23{,}96^\circ = 3{,}66\,\mathrm{m}$$

$\Sigma M_D = 0$ $\quad 127{,}9 \cdot 9{,}0 - 127{,}9 \cdot 5{,}0 - F_{k,d,2} \cdot 3{,}66 = 0 \rightarrow F_{k,d,2} = 139{,}8\,\mathrm{kN}$

$C_y = 139{,}8 \cdot \cos 23{,}96^\circ = \underline{127{,}9\,\mathrm{kN}}$ (↓) $\quad C_x = 139{,}8 \cdot \sin 23{,}96^\circ = \underline{56{,}8\,\mathrm{kN}}$ (←)

$\Sigma Y = 0$ $\quad 127{,}9 + 64 + 64 + 4 - D_y = 0 \rightarrow \underline{D_y = 259{,}9\,\mathrm{kN}}$ (↑)

$\Sigma X = 0$ $\quad 127{,}9 - 127{,}9 - 56{,}8 + D_x = 0 \rightarrow \underline{D_x = 56{,}8\,\mathrm{kN}}$ (→)