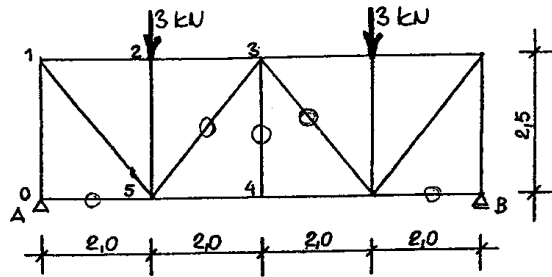


III./1.

Rácsostartó

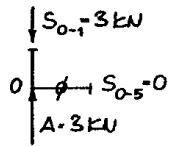
①



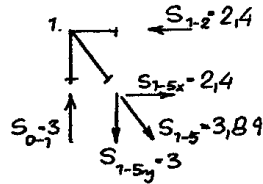
A Geometriai és terhelési szimmetria miatt a rútcsové és a rúdelemek is szimmetrikusak lesznek - elegendő a fél szerkezetet vizsgálni

Utaknak: S_{0-5} /0 CSP egyensúlya miatt /
 S_{3-5} és S_{3-4} /3 CSP egyensúlya miatt /

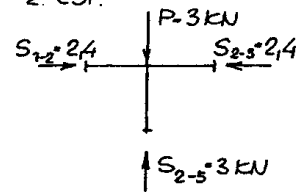
0. CSP.



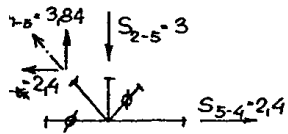
1. CSP.



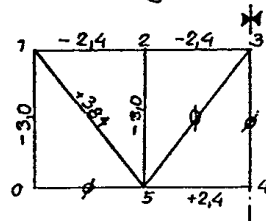
2. CSP.



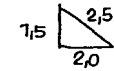
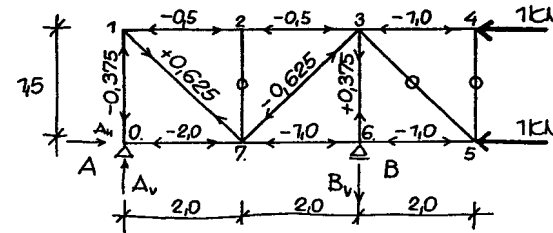
5. CSP.



eredményvárlat:



III./2. Rácsostartó



1. Támascsörök
 $A_H = 2 \text{ kN} \rightarrow$

$\sum M_A = 0$

$-1 \cdot 1.5 + B_V \cdot 4 = 0$

$B_V = 0.375 \text{ Mp} \downarrow$

$A_V = 0.375 \text{ Mp} \uparrow$

$l_{1-7} = l_{3-7} = l_{3-5} = 2.5 \text{ m}$

2. Rúdelemek

0. csomópont

$S_{0-1} = -0.375 \text{ kN}$

$S_{0-7} = -2.00 \text{ kN}$

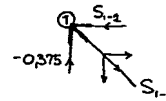
1. csomópont

$S_{1-7} = +0.375 \text{ kN} \downarrow$

$S_{1-7}^* = 0.375 \cdot \frac{2.0}{1.5} = 0.5 \text{ kN}$

$S_{1-7} = 0.5 \cdot \frac{2.5}{2.0} = +0.625 \text{ kN}$

$S_{1-2} = -0.5 \text{ kN}$



2. csomópont

$S_{2-3} = -0.5 \text{ kN} \sim$ Mondja el a kár-

vas átmetszés

módsterét és ha

marad idő elle-

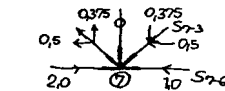
nőzhető pl. a

körépső 3. rd.

7. csomópont

$S_{3-7} = -0.625 \text{ kN}$

$S_{6-7} = -1.0 \text{ kN}$

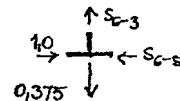


8. csomópont

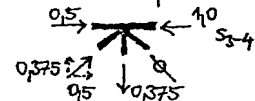
$S_{3-6} = +0.375 \text{ kN}$

$S_{5-6} = -1.0 \text{ kN}$

$S_{3-4} = -1.0 \text{ kN}$

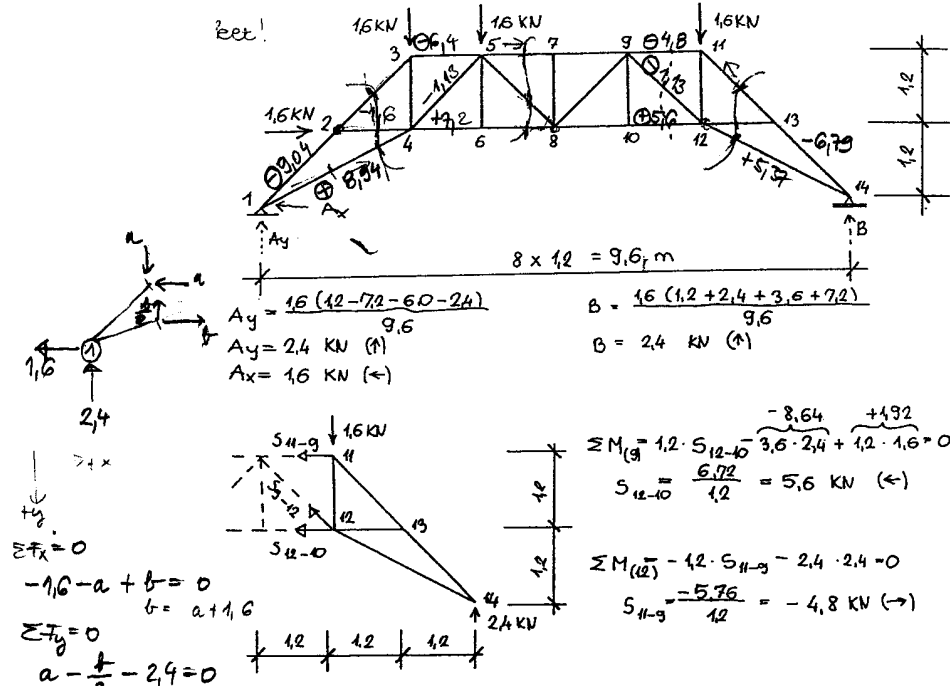


3. csomópont



III./3. Rácsostartó

Határozza meg kármvas átmetszéssel az S_{9-11} ; S_{9-12} ; S_{10-12} rúdererőket
Csomóponti vektoronál az S_{12-14} és a S_{12-14} rúdererőket!

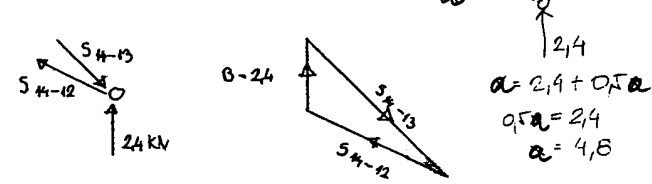


VETÜLETI EGYENLETBŐL

$2a - a - 1.6 - 4.8 = 0 \Rightarrow a = 6.4$
 $b = 6.4 + 1.6 = 8$
 \Rightarrow jobbra felé.

S_{12-9}
 $\sum P_x = -5.6 + 4.8 + S_{12-9x} = 0 \Rightarrow S_{12-9x} = 0.8 \text{ kN} (\rightarrow)$
 $\sum P_y = +1.6 - 2.4 + S_{12-9y} = 0 \Rightarrow S_{12-9y} = 0.8 \text{ kN} (\uparrow)$
 $S_{12-9} = \sqrt{0.8^2 + 0.8^2} = 1.13 \text{ kN} (\nearrow)$

14. CSOMÓPONT

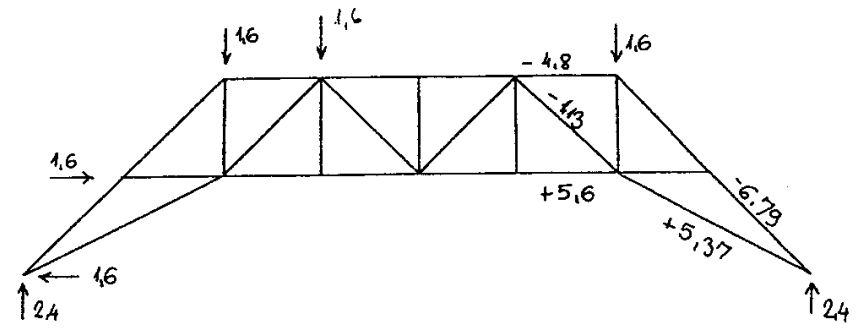


III./3. folyt.

HASONLÓSÁGBÓL

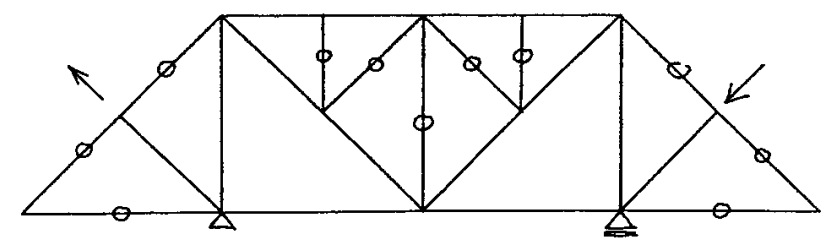
$S_{4-12} = \sqrt{2.4^2 + 4.8^2} = \sqrt{28.80} = 5.37 \text{ kN}$
 $S_{4-13} = \sqrt{2 \cdot 4.8^2} = \sqrt{46.08} = 6.79 \text{ kN}$

EREDMÉNYVÁZLAT



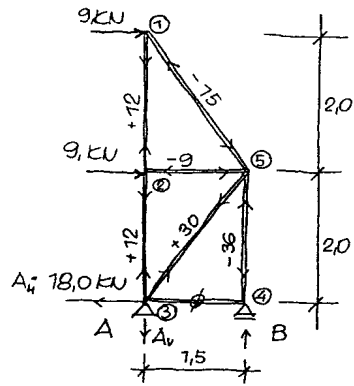
III./4.

HATÁROZZA MEG A VAKRUDAKAT, JELÖLJÉ BE AZ ÁBRÁN!



III./5.

Rácsostartó

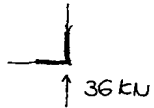


2.1. Támaszerők

$$\begin{aligned} \sum M_A &= 0 \\ 2 \cdot 9,0 + 4 \cdot 9,0 &= 1,5 B \\ B_V &= \frac{54}{1,5} = \underline{\underline{36 \text{ kN}}} \uparrow \\ A_V &= \underline{\underline{36 \text{ kN}}} \downarrow \\ A_H &= \underline{\underline{18 \text{ kN}}} \leftarrow \\ l_{3-5} &= l_{1-3} = 2,5 \text{ m} \end{aligned}$$

2.2. Ríderők

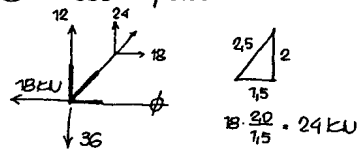
④ csomópont



$$S_{4-5} = -36 \text{ kN}$$

$$S_{3-4} = 0$$

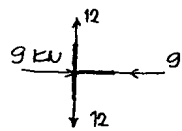
③ csomópont



$$S_{3-5} = 18 \cdot \frac{2,5}{1,5} = \underline{\underline{+30 \text{ kN}}}$$

$$S_{2-3} = \underline{\underline{+12,0 \text{ kN}}}$$

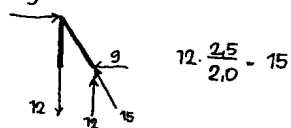
② csomópont



$$S_{2-5} = -9,0 \text{ kN}$$

$$S_{1-2} = \underline{\underline{+12,0 \text{ kN}}}$$

① csomópont

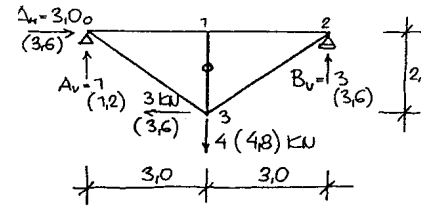


$$S_{1-5} = -15,0 \text{ kN}$$

III./6.

Rácsostartó

Katározdát meg a ríderőket!



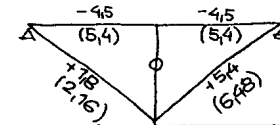
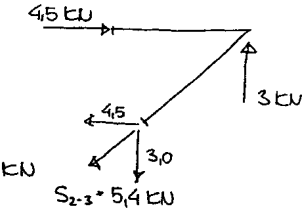
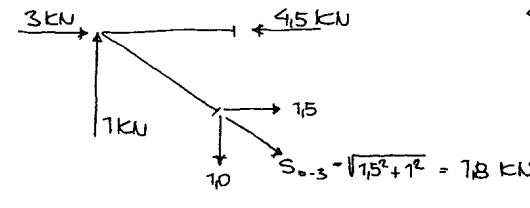
$M_A = 0$

$$-6 \cdot B_V + 3 \cdot 4 + 2 \cdot 3 = 0$$

$$B_V = 3 \text{ (3,6) kN}$$

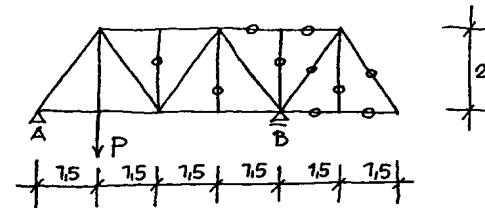
$$A_V = 1 \text{ (1,2) kN}$$

$$A_H = 3 \text{ (3,6) kN}$$



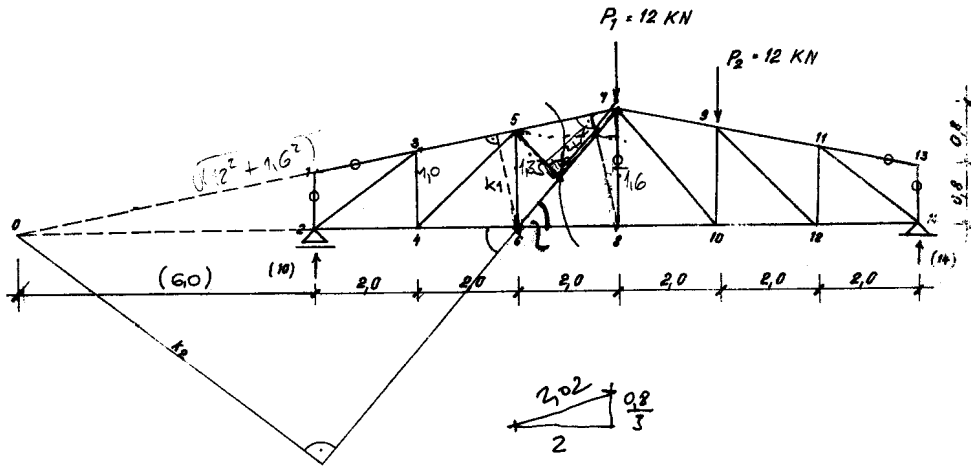
III./7.

A változt rácsostartón jelölje a vakmádat!



Rácsos tartók

1. Határozza meg: a) két-más dimenziós áttalmaxra az S_{5-7} ; S_{6-8} ; S_{6-7} rúderőket;
- b) csomóponti módszert az S_{2-3} ; S_{2-4} ; S_{2-1} rúderőket
- c) jelölje be a rakrudakat



a)

$$\Sigma M^{(7)} = 6 \cdot 10 - 1,6 \cdot S_{6-8} = 0 \quad S_{6-8} = \underline{+37,5 \text{ KN}}$$

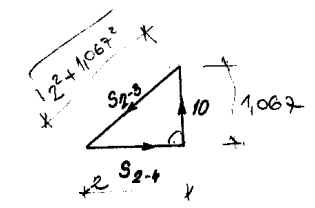
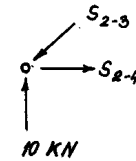
$$k_1 = \frac{1,88}{12} = \frac{(12^2 + 1,6^2)^{\frac{1}{2}} (60-7)}{12 (60-7)} \rightarrow k_1 = 1,32 \text{ m}$$

$$\Sigma M^{(6)} = 4 \cdot 10 + 1,32 \cdot S_{5-7} = 0 \quad S_{5-7} = \underline{-30,30 \text{ KN}}$$

$$\frac{(1,6^2 + 2^2)^{\frac{1}{2}}}{10} = \frac{1,6}{k_2} \rightarrow k_2 = 6,25 \text{ m}$$

$$\Sigma M^{(9)} = -6 \cdot 10 - 6,25 \cdot S_{6-7} = 0 \quad S_{6-7} = \underline{-9,6 \text{ KN}}$$

b) 2. csf.



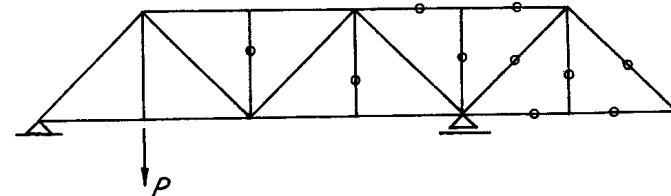
$$\frac{10}{1,067} = \frac{S_{2-4}}{2}$$

$$S_{2-4} = \underline{18,74 \text{ KN}}$$

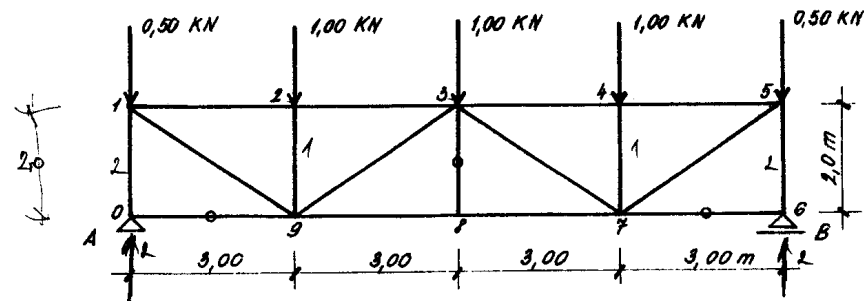
$$\frac{10}{1,067} = \frac{S_{2-3}}{(2^2 + 1,067^2)^{\frac{1}{2}}}$$

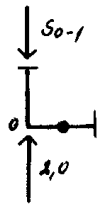
$$S_{2-3} = \underline{21,24 \text{ KN}}$$

2. # rázott rácsos tarték jelölje be a rakrudakat!

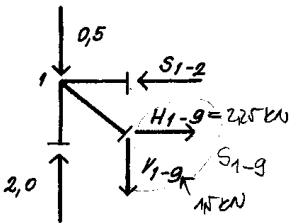


3. Határozza meg a rúderőket csomóponti módszertel, készítsen eredményváslátót!





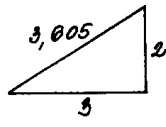
$\Sigma V = 0$, tehát $S_{0-1} = 2,0 \text{ KN}$ nyomóerő



$\Sigma V = 0$; $V_{1-9} = 2,0 - 0,5 = 1,5 \text{ KN} \downarrow$

mivel S_{1-9} rúdaxárvány, $H_{1-9} = \frac{3}{2} \cdot V_{1-9}$

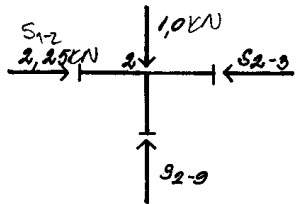
$H_{1-9} = 2,25 \text{ KN} \rightarrow$



$S_{1-9} = V_{1-9} \cdot \frac{3,605}{2}$

$S_{1-9} = 2,70 \text{ KN}$ húzóerő

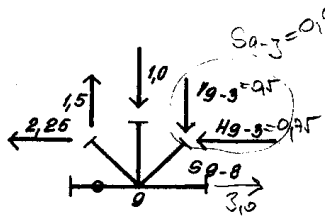
és csomópontban $\Sigma H = 0$, tehát $S_{1-2} = -H_{1-9} = -2,25 \text{ KN}$ nyomóerő



Térfelt T-csomópont

$S_{2-3} = S_{1-2} = 2,25 \text{ KN} \leftarrow$ nyomóerő

$S_{2-9} = 1,0 \text{ KN} \uparrow$ nyomóerő



$S_{g-3} = 0,90$

Támaszt erők: S_{1-9} komponensei, és S_{2-9}

Támasztónyomások: egy vertikális és két horizontális erő

$\Sigma V = 0$; $V_{g-3} = 1,5 - 1,0 = 0,5 \text{ KN} \downarrow$

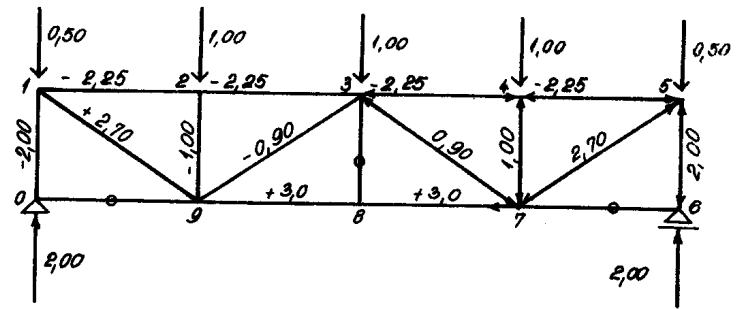
Átdomóssággal:

$H_{g-3} = \frac{3}{2} V_{g-3} = 0,75 \text{ KN} \leftarrow \frac{0,5 \cdot 3}{2} = \frac{1,5 \cdot 3}{2}$

$S_{g-3} = V_{g-3} \cdot \frac{3,605}{2}$

$S_{g-3} = 0,90 \text{ KN}$ nyomóerő

$\Sigma H = 0$; $S_{g-8} = H_{1-9} + H_{g-3} = 2,25 + 0,75 = 3,00 \text{ KN}$ húzóerő

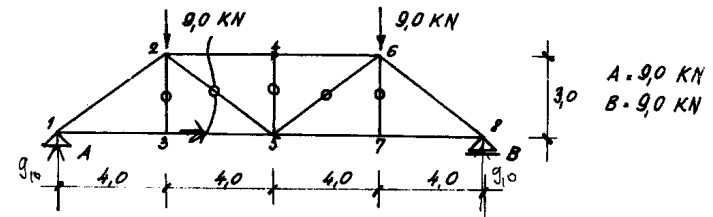


4. Határozza meg a rúdos tartó S_{2-4} , S_{2-5} , S_{3-5} rúderőit

a.) kétféle módszerrel,

b.) csomóponti módszerekkel az összes rúderőt

c.) jelölje be a rúderőket!



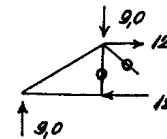
a.)

$\Sigma M^{(4)} = 8 \cdot 9,0 - 4 \cdot 9 - 3 \cdot S_{3-5} = 0$

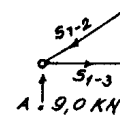
$S_{3-5} = \frac{36}{3} = 12,0 \text{ KN} \oplus$

$\Sigma M^{(5)} = 8 \cdot 9,0 - 4 \cdot 9 + 3 \cdot S_{2-4} = 0$

$S_{2-4} = -12 \text{ KN} \ominus$

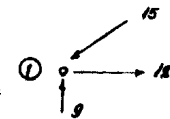


b.) 1. csf.

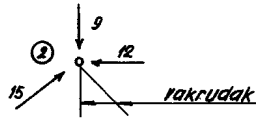
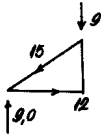


$S_{1-2} = \frac{5 \cdot 9}{3} = 15 \text{ KN}$

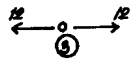
$S_{1-3} = \frac{4 \cdot 9}{3} = 12,0 \text{ KN}$



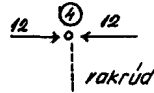
2. esp.



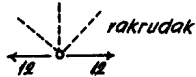
3. esp.



4. esp.

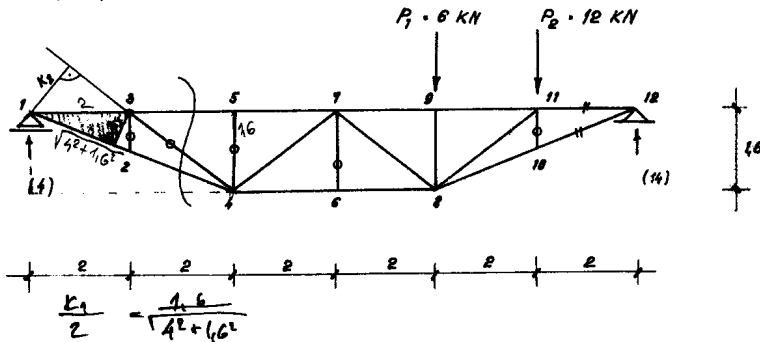


5. esp.



5. Határozza meg a rúdszétet:

- a) kármag álmérsékével az S₃₋₅, S₃₋₄, S₂₋₄ rudakban,
- b) csomóponti módszerrel az S₁₁₋₁₂, S₁₀₋₁₂ rudakban,
- c) jelölje be a rakrudakat!



a)

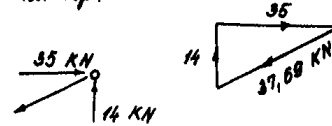
$$\sum M^{(4)} = 4 \cdot 4 + 1,6 \cdot S_{3-5} = 0 \quad S_{3-5} = -10 \text{ KN}$$

$$\frac{k_1}{1,6} = \frac{2}{(4^2 + 1,6^2)^{\frac{1}{2}}} \quad k_1 = 0,7428$$

$$\sum M^{(3)} = 2 \cdot 4 - 0,7428 \cdot S_{2-4} = 0 \quad S_{2-4} = +10,77 \text{ KN}$$

$$\sum M^{(1)} = k_2 \cdot S_{3-4} = 0 \quad k_2 \neq 0 \quad S_{3-4} = 0$$

f.) 12. esp.

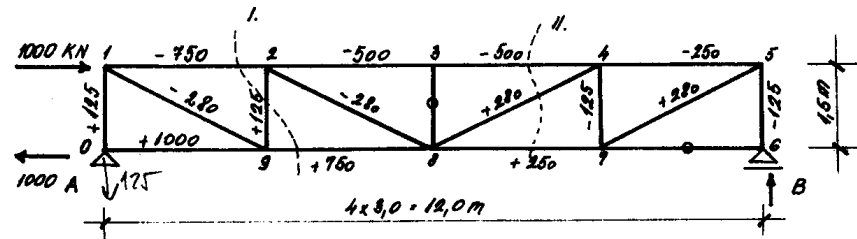


$$\frac{0,8}{14} = \frac{2}{S_{11-12}} \quad S_{11-12} = 35 \text{ KN}$$

$$\frac{0,8}{14} = \frac{(2^2 + 0,8^2)^{\frac{1}{2}}}{S_{10-12}}$$

$$S_{10-12} = 37,68 \text{ KN}$$

6.) Határozza meg a rúdszétet



$$\sum M_B = 0; \quad A_V = \frac{1000 \cdot 1,5}{12,0} = 125 \text{ KN} \downarrow$$

$$A_H = 1000 \text{ KN} \leftarrow$$

$$\sum V = 0; \quad S_{2-9} = -A_V = 125 \text{ KN} \text{ húzóerő}$$

$$\sum M_C = 0; \quad -125 \cdot 3,0 + 1000 \cdot 1,5 - 9,0 \cdot S_{3-8} = 0 \quad S_{3-8} = 750 \text{ KN} \text{ húzóerő}$$

$$\sum V = 0 \quad V_{4-8} = 125 \text{ KN} \uparrow$$

$$S_{4-8} = \frac{\sqrt{1,5^2 + 3,0^2}}{1,5} \cdot V_{4-8} = 280 \text{ KN} \text{ húzóerő}$$