10

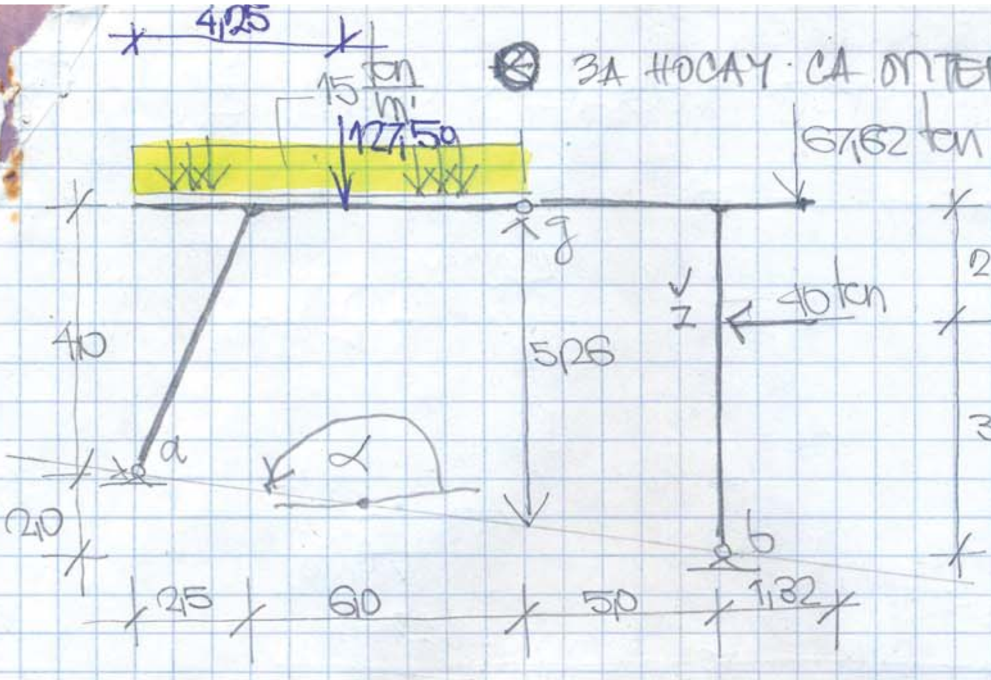
СТАТИКА КОНСТРУКЦИЈА

Модул: Хидротехника и водно инжењерство околине, Саобраћајнице, Архитектонско инжењерство

– материјал за вежбе –

2024.

③ ЗА НОСАЧ СА ОПТЕРЕЋЕЊЕМ НА СКИЦИ



1° СРАЧУНАТИ И НАЦРТАТИ ДИЈАГРАМЕ ПРЕСЕЧНИХ СИЛА.

2° ОБРТАЊЕ ПРЕСЕКА У ЧВОРУ „2".

$E=2\cdot 10^7$ kN/m²

b/h = 0,2/0,4 m.

$\Sigma M_a=0$: $Y_b\cdot 13,5+40\cdot 1,8-67,62\cdot 14,82-127,5\cdot 4,25=0$

$Y_b=\frac{-40\cdot 1,8+67,62\cdot 14,82+127\cdot 4,25}{13,5}$ $Y_b=108,71$ tn

$\Sigma M_b=0$:

$-Y_a\cdot 13,5+127,5\cdot 9,25+40\cdot 3,8-67,62\cdot 1,32$

$Y_a=\frac{127,5\cdot 9,25+40\cdot 3,8-67,62\cdot 1,32}{13,5}$

$Y_a=92,00$ tn.

$\Sigma M_g^l=0$:

$-Y_a\cdot 8,5+127,5\cdot 4,25+H_a\cdot 5,26=0$

$H_a=\frac{92,0\cdot 8,5-127,5\cdot 4,25}{5,26}$ $H_a=45,65$ tn

$\Sigma M_g^d=0$: $H_b\cdot 5,26-Y_b\cdot 5,0+40\cdot 2,2+67,62\cdot 6,32=0$

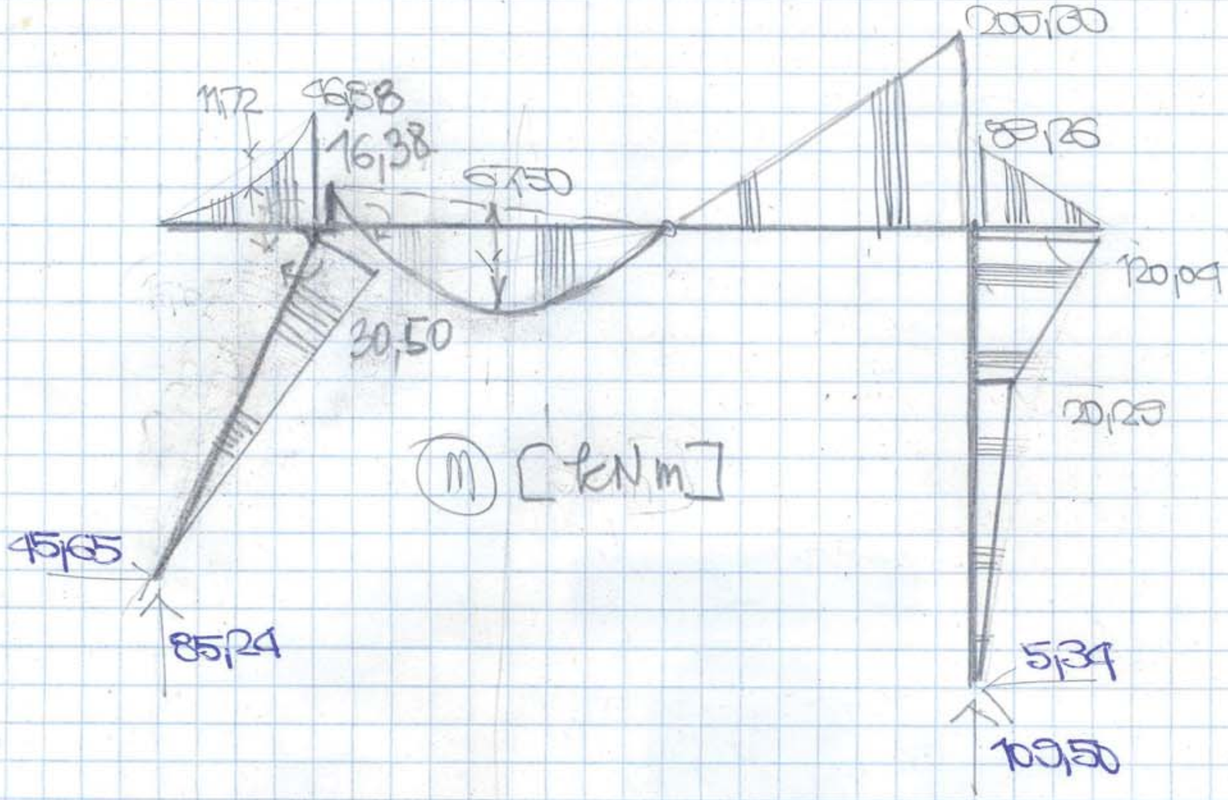
$H_b=\frac{108,71\cdot 5,0-40\cdot 2,2-67,62\cdot 6,32}{5,26}$

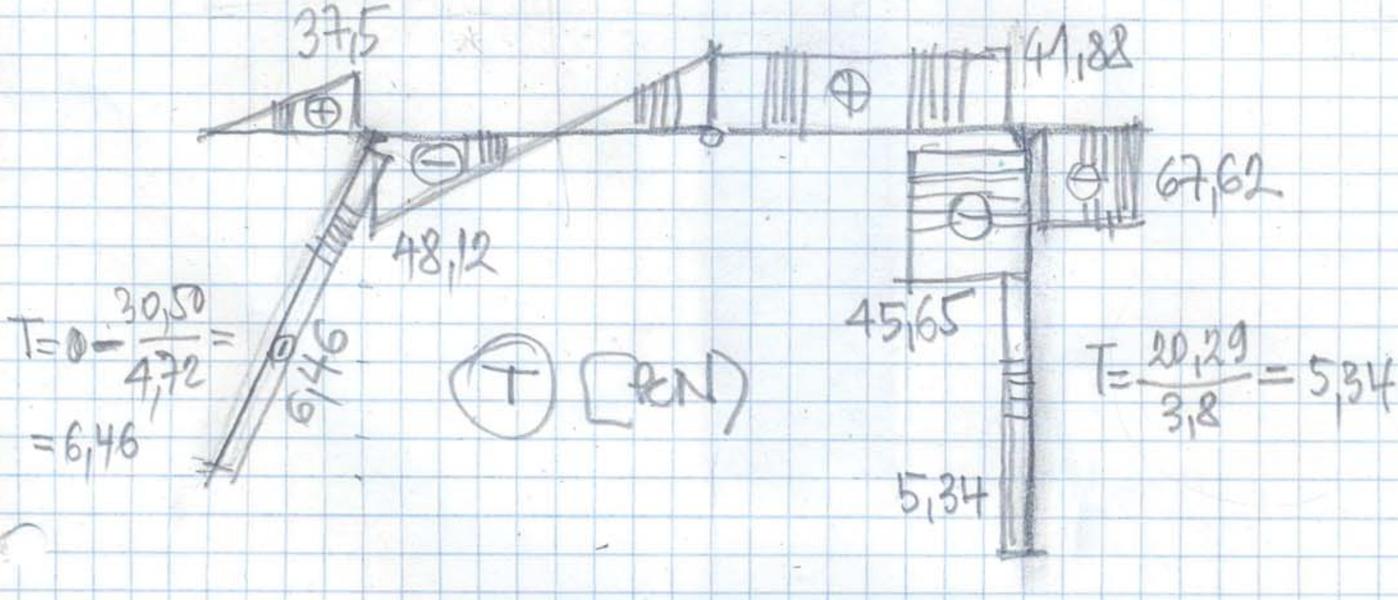
$H_b=5,34$ tn

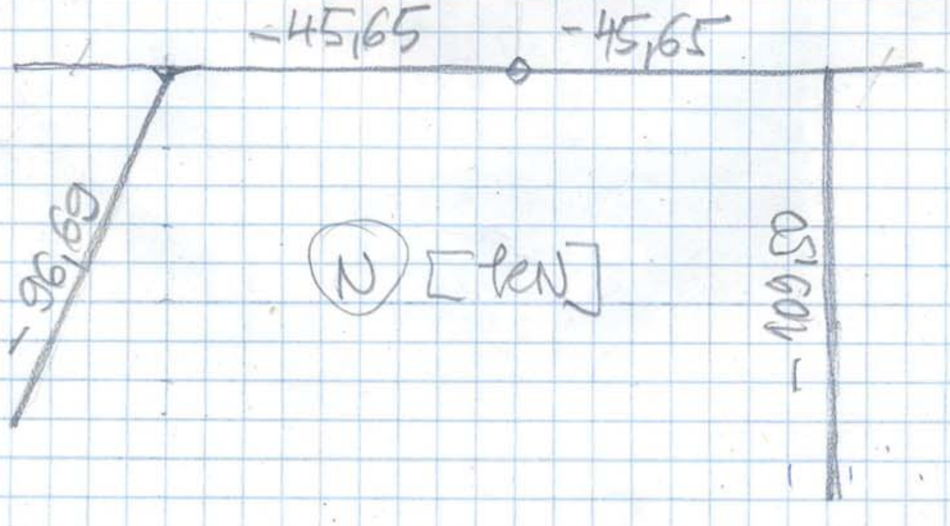
$tg\,\alpha_0=-0,148$

$A=92,00+45,65(-0,148)=85,24$ tn

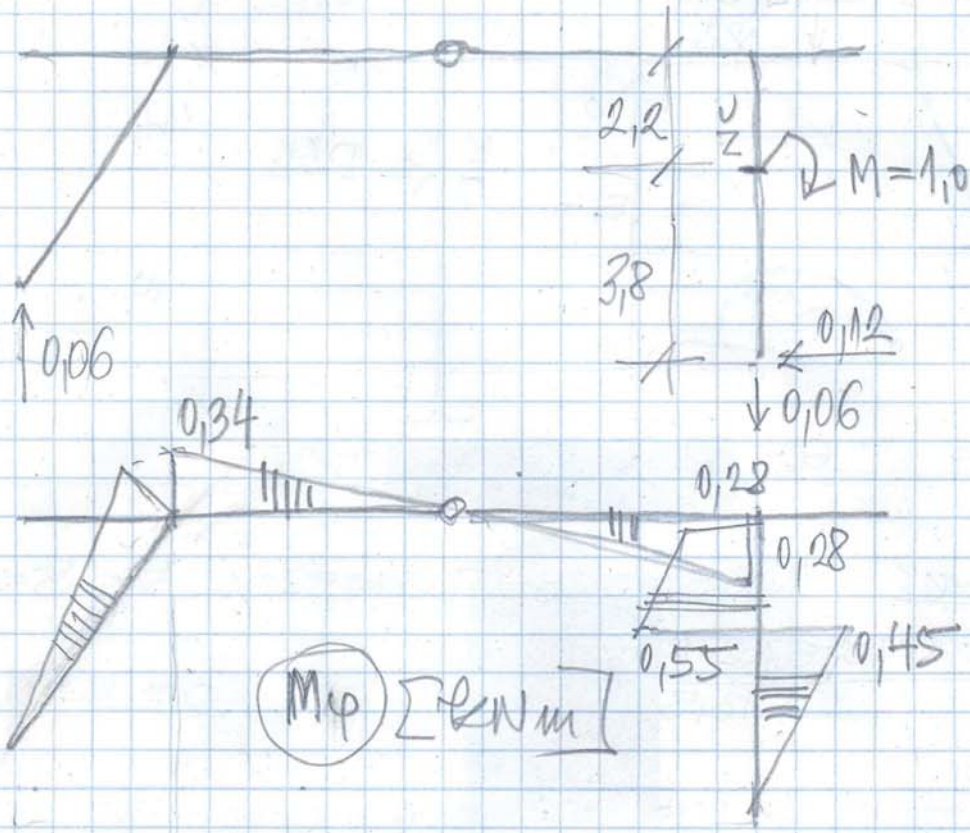
$B=108,71+5,34\cdot 0,148=109,50$ tn.


200,20
11,72
46,88
16,38
57,50
88,26
120,09
30,50
20,29
M [kNm]
45,65
85,24
5,34
109,50


37,5
41,88
⊕
⊕
⊖
⊖
⊖
67,62
48,12
45,65
$T = 0 - \frac{30,50}{4,72} = -6,46$
6,46
T [kN]
$T = \frac{20,29}{3,8} = 5,34$
5,34


-45,65
-45,65
-96,69
N [kN]
-109,50

*ОБРТАЊЕ ПОПРЕЧНОГ ПРЕСЕКА У ЧВОРУ „Z"



$$EI\delta_\varphi = \int_S M \cdot M_\varphi \, ds =$$

$$= -\frac{1}{3} 30,5 \cdot 0,34 \cdot 4,72 +$$

$$+ \frac{1}{3} 0,34 \cdot 16,38 \cdot 6 - \frac{1}{3} \cdot 0,34 \cdot 67,5 \cdot 6 -$$

$$- \frac{1}{3} 209,30 \cdot 0,28 \cdot 5 -$$

$$- \frac{1}{6} [0,55 \cdot (2 \cdot 20,29 + 120,04) + 0,28 (20,29 + 2 \cdot 120,04) \cdot 2,2 +$$

$$+ \frac{1}{3} 0,45 \cdot 20,29 \cdot 3,8 = -196,308$$

$$EI\delta_\varphi = -196,308$$

$$\delta_\varphi = -\frac{196,308}{3 \cdot 10^7 \cdot \frac{0,2 \cdot 0,4^3}{12}} = -\frac{196,308}{3,2 \cdot 10^4} =$$

$$\delta_\varphi = -0,006135 \text{ rad.}$$

ZADATAK: Za rešetku na slici sračunati

a) vertikalno pom. čvora (2)

b) dobijanje štapa U2

c) razmicanje čvorova 1 i (2)

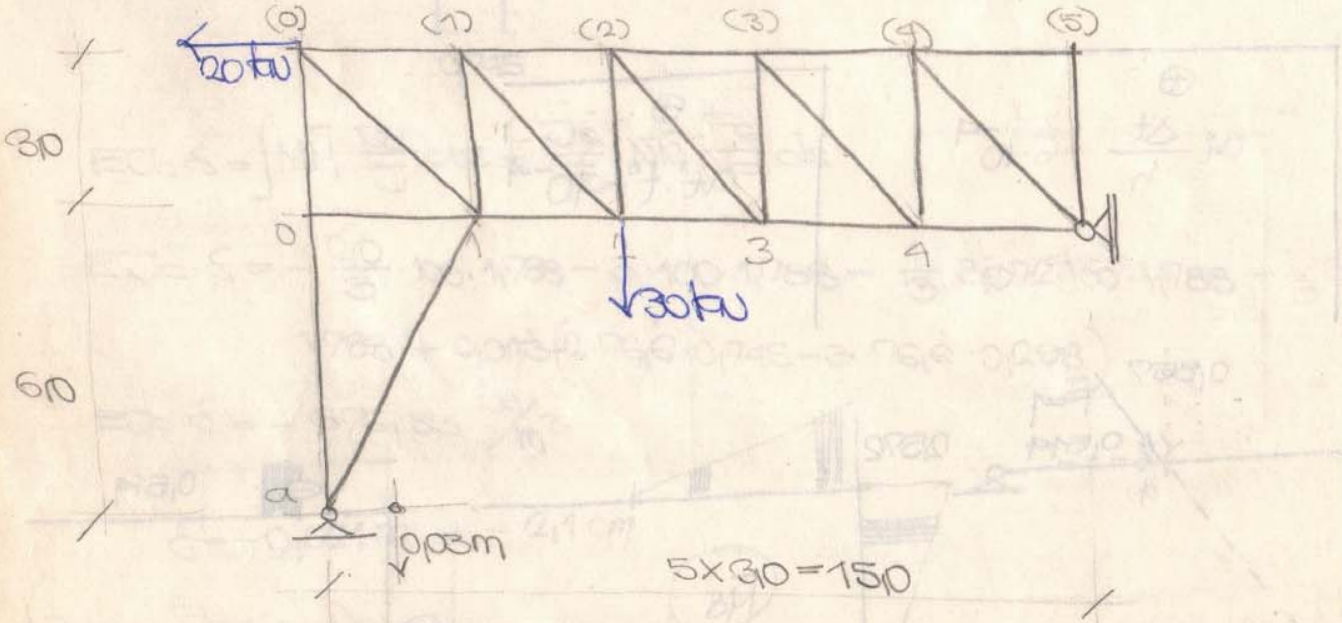
d) promena ugla između štapova U2 i D2

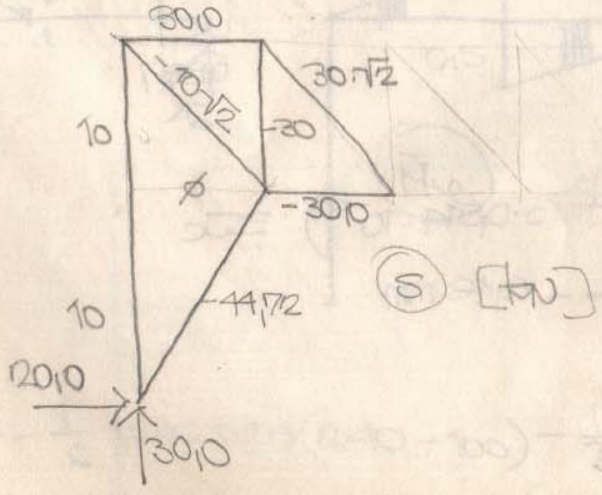
usled

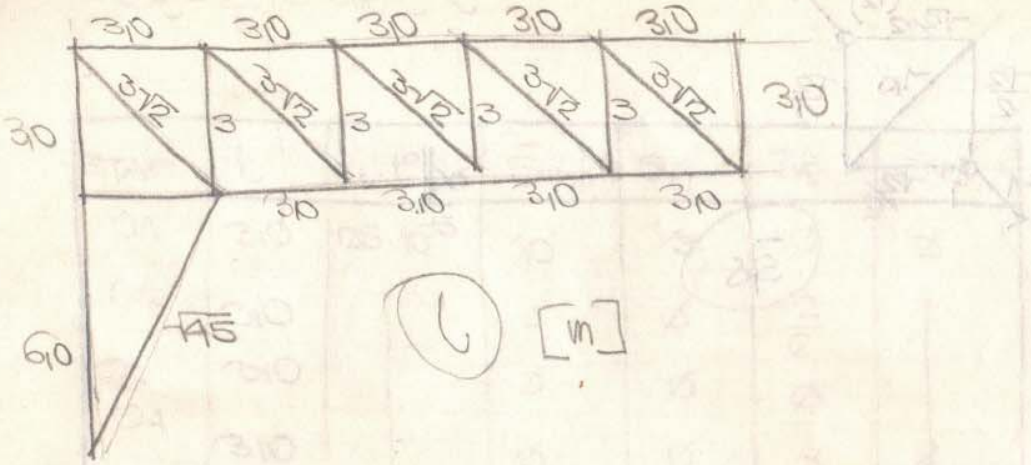
A - datog opterećenja

B - temperaturne promene u štapovima donjeg pojasa $t° = 25°C$

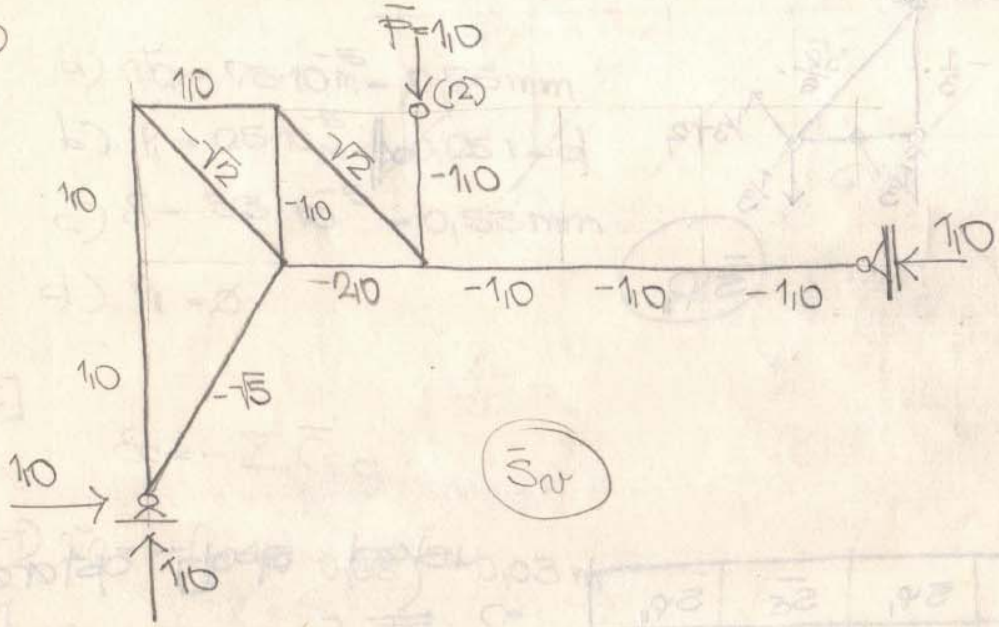
C - pom. oslonca A za 0,03m.





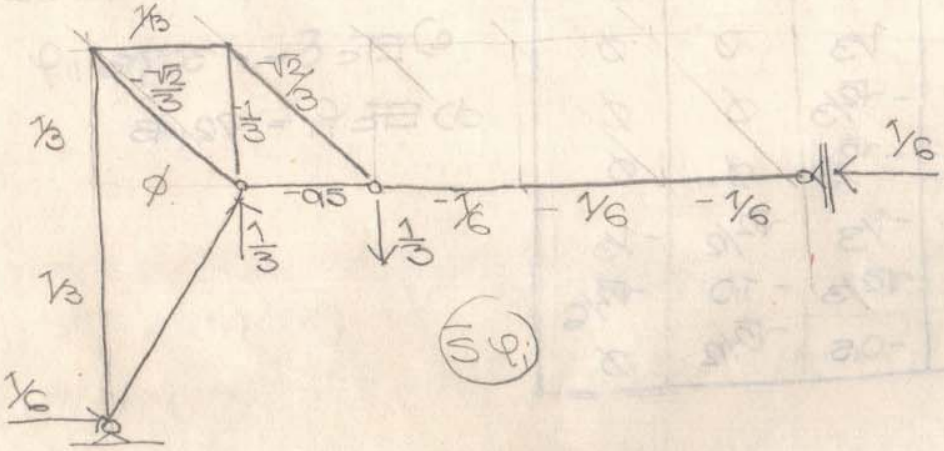


a)



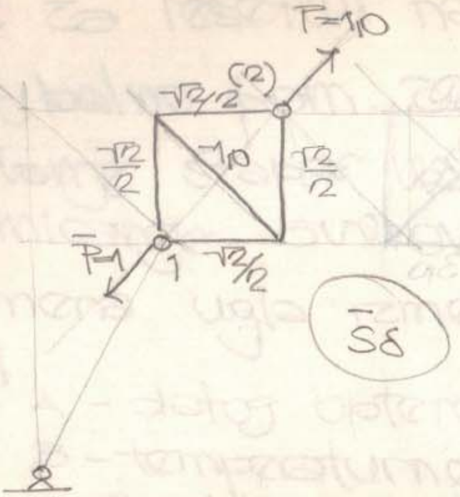
$\bar{S}_{2V}$

b)

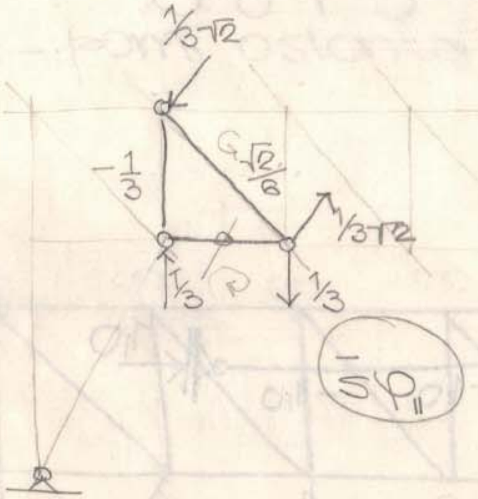


$\bar{S}_{\varphi_i}$

c)



d)



A]

STAP	l	S	$\bar{S}v$	$\bar{S}\varphi_1$	$\bar{S}\delta$	$S\varphi_{II}$
V_a	6	10	1	$1/3$	∅	∅
V_0	3	10	1	$1/3$	∅	∅
O_1	3	30	1	$1/3$	∅	∅
D_1	$3\sqrt{2}$	$-10\sqrt{2}$	$-\sqrt{2}$	$-\sqrt{2}/3$	∅	∅
U_1	3	$-44,72$	$-\sqrt{5}$	$-\sqrt{2}/6$	∅	∅
V_1	3	-30	-1	$-1/3$	$\sqrt{2}/12$	$-1/3$
D_2	$3\sqrt{2}$	$-30\sqrt{2}$	$-\sqrt{2}$	$\sqrt{2}/3$	$-1,0$	$\sqrt{2}/6$
U_2	3	-30	-2	$-0,5$	$-\sqrt{2}/12$	∅
$EF_0\delta$						

usled spolj. opterećenja,

a) $EF_c\delta = 1460,20$

b) $EF_c\varphi_1 = 359,94$

c) $EF_c\delta = -307,3$

d) $EF_c\varphi_{II} = 72,43$

B] $\varepsilon_t = \sum_s \bar{S} \cdot \alpha_t \cdot t^\circ \cdot l$

STAP	l	$\alpha_t \cdot t^\circ$	$\bar{S}_V$	S_{φ_I}	$\bar{S}_S$	$S_{\varphi_{II}}$
01	310	$125 \cdot 10^{-5}$	1/0	1/3	$\varnothing$	$\varnothing$
02	310	↓	$\varnothing$	$\varnothing$	$\frac{\sqrt{2}}{2}$	↓
03	310		$\varnothing$	$\varnothing$	$\varnothing$	
04	310		$\varnothing$	$\varnothing$	$\varnothing$	
05	310		$\varnothing$	$\varnothing$	$\varnothing$	

a) $v_2 = 75 \cdot 10^{-5}\,m = 0{,}75\,mm$

b) $\varphi_I = 25 \cdot 10^{-5}\,m - 0{,}25\,rad$

c) $\delta = 53 \cdot 10^{-5} = 0{,}53\,mm$

d) $\varphi_{II} = \varnothing$

C] $\delta_0 = -\sum \bar{C}_i \, a_i$

a) $v_2 = -(-1/0 \cdot 0{,}03) = 0{,}03\,m$

b) $\varphi_I = \varnothing$

c) $\delta = \varnothing$

d) $\varphi_{II} = \varnothing$