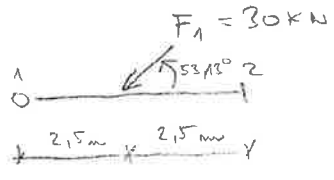


$E = 206 \text{ GPa}$
 $A = 0,045 \text{ m}^2$
 $I = 3,375 \cdot 10^{-6} \text{ m}^4$

$\{r\} = \{w_2, w_2, \varphi_2, w_3, w_3, \varphi_3\}^T$

PRWT 12



$[k_{12}^*] =$

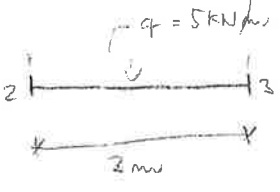
| | | | | | |
|------------------|-------------------|---|-------------------|--------------------|-------------------|
| $118 \cdot 10^8$ | 0 | 0 | $-118 \cdot 10^8$ | 0 | 0 |
| 0 | $1,62 \cdot 10^5$ | 0 | 0 | $-1,02 \cdot 10^5$ | $-8,1 \cdot 10^5$ |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | $118 \cdot 10^8$ | 0 | 0 |
| 0 | 0 | 0 | 0 | $1,62 \cdot 10^5$ | $8,1 \cdot 10^5$ |
| 0 | 0 | 0 | 0 | 0 | $4,05 \cdot 10^6$ |

$\{r_{12}^*\} = \begin{Bmatrix} w_1 \\ w_1 \\ \varphi_1 \\ w_2 \\ w_2 \\ \varphi_2 \end{Bmatrix}$

$\{R_{12}^*\} = \begin{Bmatrix} 9000 \\ -7500 \\ 0 \\ 9000 \\ -16500 \\ -22500 \end{Bmatrix}$

$\{r\} = \begin{Bmatrix} 9000 \\ -12000 \\ 15000 \\ 9000 \\ -12000 \\ -15000 \end{Bmatrix}$

PRWT 23



$[k_{23}^*] =$

| | | | | | |
|----------------|-------------------|-------------------|-----------------|------------------|-------------------|
| $3 \cdot 10^8$ | 0 | 0 | $-3 \cdot 10^8$ | 0 | 0 |
| 0 | $3 \cdot 10^6$ | $-4,5 \cdot 10^6$ | 0 | $-2 \cdot 10^6$ | $-4,5 \cdot 10^6$ |
| 0 | $-4,5 \cdot 10^6$ | $9 \cdot 10^6$ | 0 | $4,5 \cdot 10^6$ | $4,5 \cdot 10^6$ |
| 0 | 0 | 0 | $3 \cdot 10^8$ | 0 | 0 |
| 0 | 0 | 0 | 0 | $3 \cdot 10^6$ | $4,5 \cdot 10^6$ |
| 0 | 0 | 0 | 0 | $4,5 \cdot 10^6$ | $9 \cdot 10^6$ |

$[k_{34}^*] =$ SM

$\{r_{23}^*\} = \begin{Bmatrix} w_1 \\ w_2 \\ \varphi_2 \\ w_3 \\ w_3 \\ \varphi_3 \end{Bmatrix}$

$\{R_{23}^*\} = \begin{Bmatrix} 0 \\ -7500 \\ 3750 \\ 0 \\ -7500 \\ -3750 \end{Bmatrix}$

PRWT 34

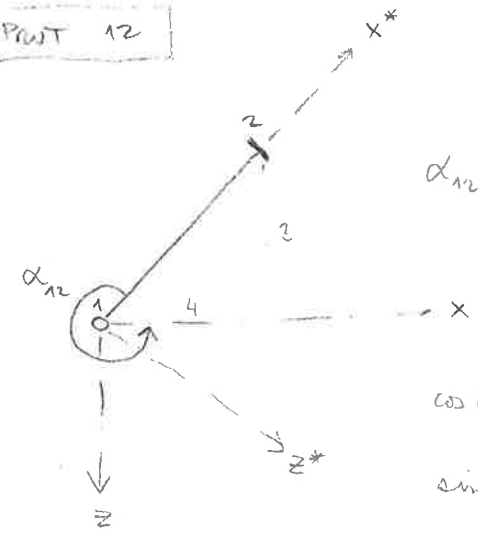


$[k_{34}^*] =$

$\{r_{34}^*\} = \begin{Bmatrix} w_3 \\ w_3 \\ \varphi_3 \\ w_4 \\ w_4 \\ \varphi_4 \end{Bmatrix}$

$\{R_{34}^*\} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix}$

Prvst 12



$$\alpha_{12} = -\arccos\left(\frac{3}{4}\right) + 360^\circ = 323,1301^\circ$$

$$\cos \alpha_{12} = 0,8$$

$$\sin \alpha_{12} = -0,6$$

$$[T_{12}] =$$

$$\begin{bmatrix} 0,8 & -0,6 & 0 & 0 \\ 0,6 & 0,8 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$[T_{12}]^T [K_{12}^*] = \begin{bmatrix} 1,44 & 9,72 & 0 & 0 \\ 1,08 & 1,296 & 0 & 0 \\ -1,08 & -1,296 & 0 & 0 \\ -8,1 & 4,05 & 0 & 0 \end{bmatrix} \cdot 10^4$$

$$c_{ij} = \sum_{k=1}^n a_{ik} \cdot b_{kj}$$

ŘÁDKY SLoupce

$$[T_{12}]^T [K_{12}^*] [T_{12}] =$$

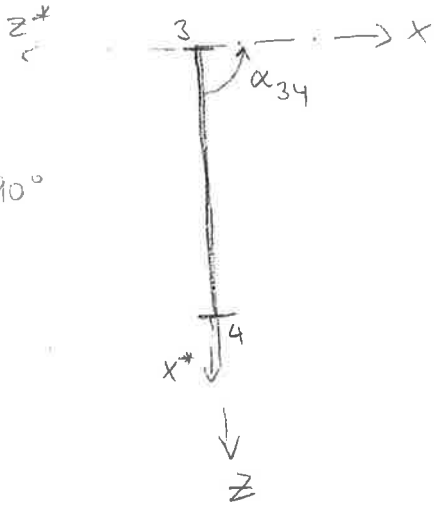
$$\begin{bmatrix} 1,153 & -8,632 & 0 & 0 & 0 & 0 \\ 0 & 6,490 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} \cdot 10^8$$

$$= [K_{12}] \begin{Bmatrix} w_1 \\ w_2 \\ w_3 \\ w_4 \\ w_5 \\ w_6 \end{Bmatrix}$$

$$[T_{12}]^T \{ \bar{R}_{12}^* \} = \begin{Bmatrix} 2700 \\ -11400 \\ 0 \\ -2700 \\ -18600 \\ -22500 \end{Bmatrix} = \{ \bar{R}_{12} \}$$

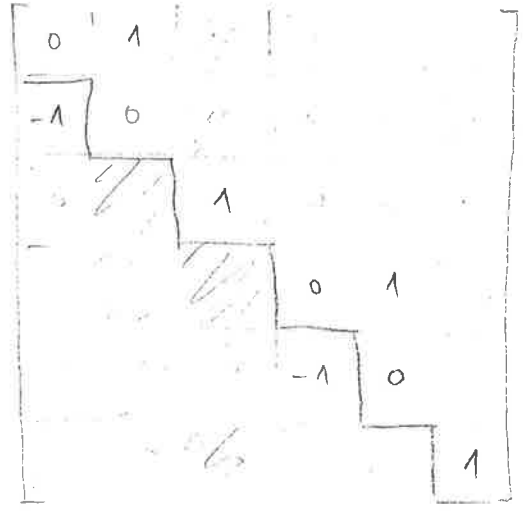
$$\varphi = \begin{Bmatrix} 0 \\ -15000 \\ 15000 \\ 0 \\ -15000 \\ -15000 \end{Bmatrix}$$

PRUT 34

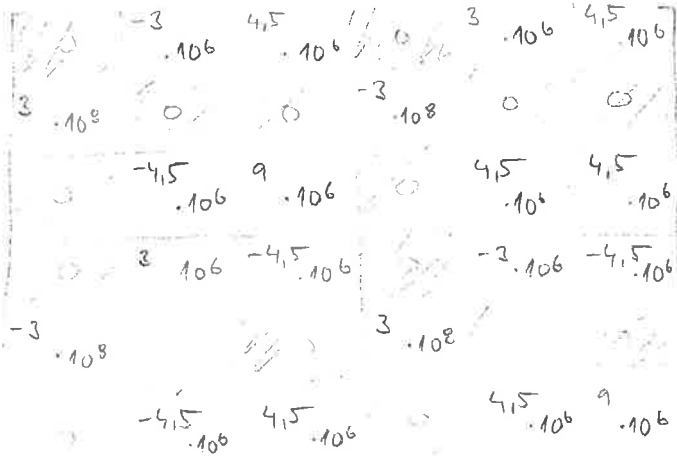


$\alpha_{34} = 90^\circ$

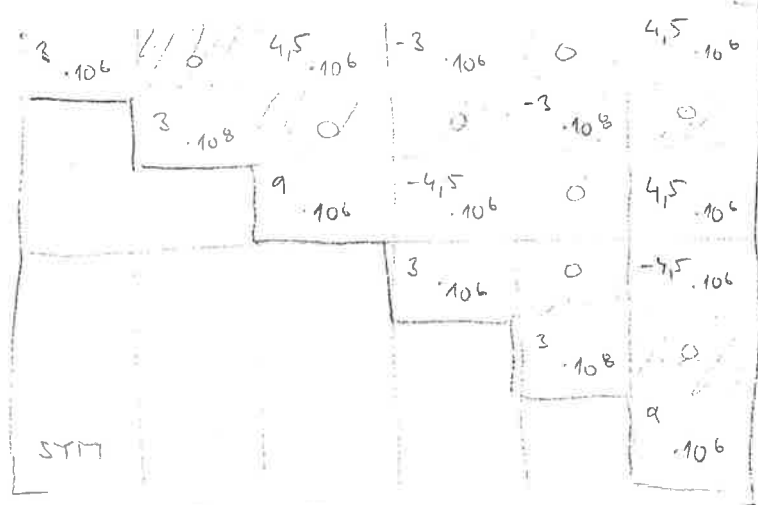
$[T_{34}] =$



$[T_{34}]^T [K_{34}^*] =$



$[T_{34}]^T [K_{34}^*] [T_{34}] =$

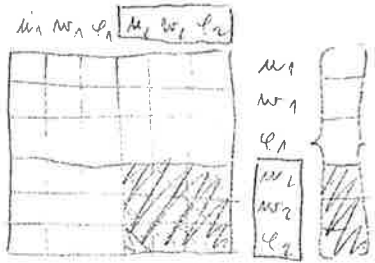


$= [K_{34}] \{r_{34}\} =$

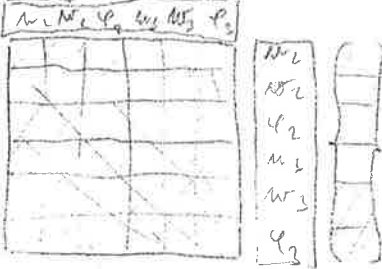


$[T_{34}]^T \{R_{34}^*\} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \end{Bmatrix} = \{R_{34}\}$

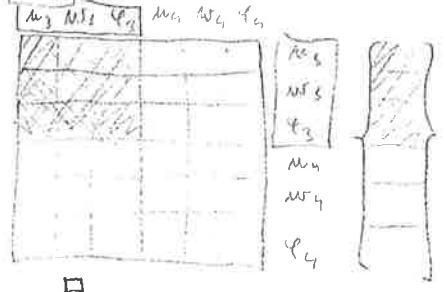
12



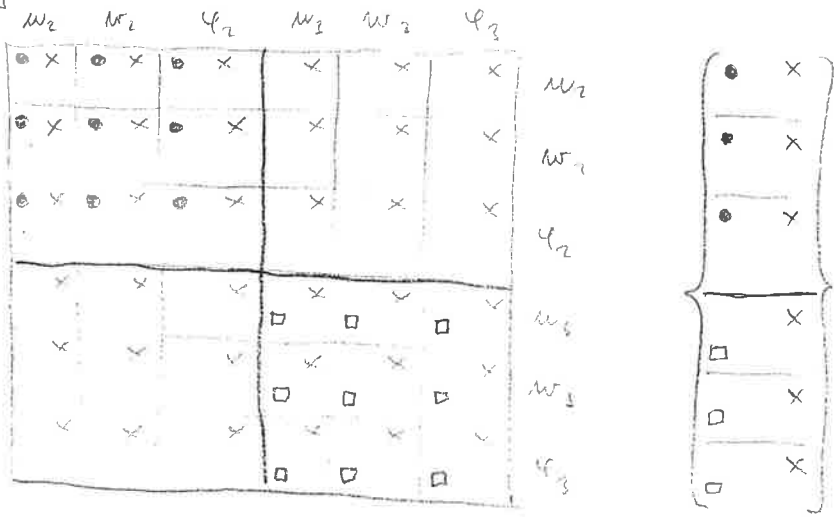
23



34



KCE



| | w_2 | w_2 | φ_2 | w_3 | w_3 | φ_3 |
|-------------|---|--|--|--|--|--|
| w_2 | $\begin{matrix} 1,153 \\ \cdot 10^8 \end{matrix}$ | $\begin{matrix} 3 \\ \cdot 10^8 \end{matrix}$ | $\begin{matrix} -8,632 \\ \cdot 10^7 \end{matrix}$ | $\begin{matrix} 4,86 \\ \cdot 10^5 \end{matrix}$ | 0 | 0 |
| w_1 | $\begin{matrix} 4,153 \\ \cdot 10^8 \end{matrix}$ | $\begin{matrix} -8,622 \\ \cdot 10^7 \end{matrix}$ | $\begin{matrix} 4,86 \\ \cdot 10^5 \end{matrix}$ | $\begin{matrix} -3 \\ \cdot 10^8 \end{matrix}$ | 0 | 0 |
| φ_2 | $\begin{matrix} 6,49 \\ \cdot 10^7 \end{matrix}$ | $\begin{matrix} 3 \\ \cdot 10^6 \end{matrix}$ | $\begin{matrix} 6,48 \\ \cdot 10^5 \end{matrix}$ | $\begin{matrix} -4,5 \\ \cdot 10^6 \end{matrix}$ | 0 | $\begin{matrix} -4,5 \\ \cdot 10^6 \end{matrix}$ |
| w_4 | | $\begin{matrix} 6,79 \\ \cdot 10^7 \end{matrix}$ | $\begin{matrix} -3,852 \\ \cdot 10^6 \end{matrix}$ | 0 | $\begin{matrix} -3 \\ \cdot 10^6 \end{matrix}$ | $\begin{matrix} -4,5 \\ \cdot 10^6 \end{matrix}$ |
| w_5 | | $\begin{matrix} 4,05 \\ \cdot 10^6 \end{matrix}$ | $\begin{matrix} 9 \\ \cdot 10^6 \end{matrix}$ | 0 | $\begin{matrix} 4,5 \\ \cdot 10^6 \end{matrix}$ | $\begin{matrix} 4,5 \\ \cdot 10^6 \end{matrix}$ |
| φ_3 | | $\begin{matrix} 1,305 \\ \cdot 10^7 \end{matrix}$ | 0 | 0 | $\begin{matrix} 4,5 \\ \cdot 10^6 \end{matrix}$ | $\begin{matrix} 4,5 \\ \cdot 10^6 \end{matrix}$ |
| w_6 | | | $\begin{matrix} 3 \\ \cdot 10^8 \end{matrix}$ | 0 | 0 | 0 |
| w_7 | | | $\begin{matrix} 3 \\ \cdot 10^6 \end{matrix}$ | $\begin{matrix} 3,02 \\ \cdot 10^8 \end{matrix}$ | 0 | $\begin{matrix} 4,5 \\ \cdot 10^6 \end{matrix}$ |
| w_8 | | | | $\begin{matrix} 3 \\ \cdot 10^6 \end{matrix}$ | 0 | $\begin{matrix} 4,5 \\ \cdot 10^6 \end{matrix}$ |
| w_9 | | | | $\begin{matrix} 3 \\ \cdot 10^8 \end{matrix}$ | $\begin{matrix} 3,03 \\ \cdot 10^8 \end{matrix}$ | $\begin{matrix} 4,5 \\ \cdot 10^6 \end{matrix}$ |
| w_{10} | | | | | | $\begin{matrix} 9 \\ \cdot 10^6 \end{matrix}$ |
| φ_4 | | | | | | $\begin{matrix} 1,8 \\ \cdot 10^7 \end{matrix}$ |

syn

$\{R\}$

$\{S\}$

$\{F\} = \{S\} - \{R\}$

| | |
|--------|--------|
| -2700 | 0 |
| | -2700 |
| -18600 | -7500 |
| | -26100 |
| -22500 | 3750 |
| | -18750 |
| 0 | 0 |
| 0 | 0 |
| | -7500 |
| 0 | -7500 |
| | -3750 |
| 0 | -3750 |

w_2

w_2

φ_2

w_3

w_3

φ_3

| |
|---------|
| 0 |
| 0 |
| 0 |
| 0 |
| 10 000 |
| -10 000 |

| |
|--------|
| 2700 |
| 26 100 |
| 18 750 |
| 0 |
| 17 500 |
| -6250 |

ÚSLEDNÁ SOUSTAVA A ŘEŠENÍ

$[K]$

$\{r\}$

$\{F\}$

φ_1

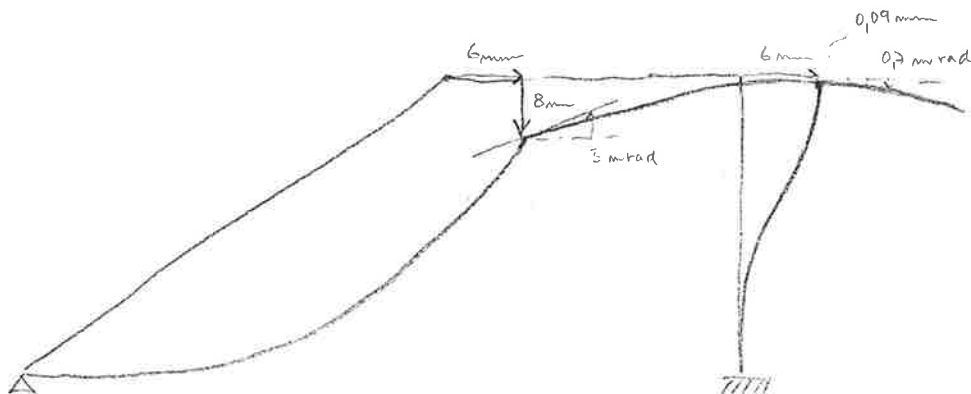
$-7,883 \cdot 10^{-3}$

| | | | | | |
|-----------------------|------------------------|------------------------|----------------------|----------------------|----------------------|
| 4,153 $\cdot 10^8$ | -8,622 $\cdot 10^7$ | 4,86 $\cdot 10^5$ | -3 $\cdot 10^8$ | 0 | 0 |
| | 6,79 $\cdot 10^7$ | -3,852 $\cdot 10^6$ | 0 | -3 $\cdot 10^6$ | -4,5 $\cdot 10^6$ |
| | | 1,305 $\cdot 10^7$ | 0 | 4,5 $\cdot 10^6$ | 4,5 $\cdot 10^6$ |
| | | | 3,03 $\cdot 10^8$ | 0 | 4,5 $\cdot 10^6$ |
| | | | | 3,03 $\cdot 10^8$ | 4,5 $\cdot 10^6$ |
| sym | | | | | 1,8 $\cdot 10^7$ |

| |
|-------------|
| w_2 |
| w_2 |
| φ_2 |
| w_3 |
| w_3 |
| φ_3 |

| |
|--------|
| 2700 |
| 26 100 |
| 18 750 |
| 0 |
| 17 500 |
| -6250 |

| | |
|-------------|------------------------|
| w_2 | $6,199 \cdot 10^{-2}$ |
| w_2 | $8,434 \cdot 10^{-2}$ |
| φ_2 | $-3,932 \cdot 10^{-3}$ |
| w_3 | $6,144 \cdot 10^{-3}$ |
| w_3 | $9,440 \cdot 10^{-3}$ |
| φ_3 | $-7,815 \cdot 10^{-4}$ |

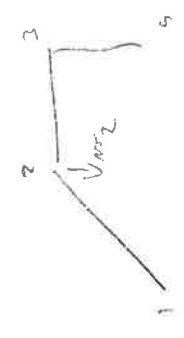


| | | | | | | |
|-------------|--------------|--------------|--------------|--------------|--------------|-------------|
| 4,1526 E8 ✓ | -8,6322 E7 ✓ | -4,8600 E5 ✓ | -3,0000 E8 ✓ | 0 ✓ | 0 ✓ | 2,7000 E3 ✓ |
| 6,7904 E7 ✓ | 3,8526 E6 ✓ | 0 ✓ | 0 ✓ | -3,0000 E6 ✓ | 4,5000 E6 ✓ | 2,6100 E4 ✓ |
| 1,3050 E7 ✓ | 0 ✓ | 0 ✓ | 0 ✓ | -4,5000 E6 ✓ | 4,5000 E6 ✓ | -18750 E4 ✓ |
| 3,0300 E8 ✓ | 3,0300 E8 ✓ | 0 ✓ | 0 ✓ | -4,5000 E6 ✓ | 0 ✓ | 0 ✓ |
| | | | | 3,0300 E8 ✓ | -4,5000 E6 ✓ | 1,7500 E4 ✓ |
| | | | | 1,8000 E7 ✓ | 6,2500 E3 ✓ | |

RESENI 3 NIESTA RESENI 4 NIESTA RESENI 12 NIEST

- 6,157 E-3
- 8,387 E-3
- 3,920 E-3
- 6,108 E-3
- 9,418 E-5
- 2,1810 E-4
- 6,194 E-3
- 8,434 E-3
- 3,032 E-3
- 6,144 E-3
- 9,446 E-5
- 7,845 E-4

→ WYSTABILITA' WIE SNIŻENI WNI



ZMIEN: WYST. WYSTABILITA'

$\{r_{12}\}$

$$\begin{Bmatrix} 0 \\ 0 \\ 0 \\ 6,194 \cdot 10^{-3} \\ 8,434 \cdot 10^{-3} \\ 3,932 \cdot 10^{-3} \end{Bmatrix}$$

$\{r_{23}\}$

$$\begin{Bmatrix} 6,194 \cdot 10^{-3} \\ 8,434 \cdot 10^{-3} \\ 3,932 \cdot 10^{-3} \\ 6,144 \cdot 10^{-3} \\ 9,446 \cdot 10^{-5} \\ -7,812 \cdot 10^{-4} \end{Bmatrix}$$

$\{r_{34}\}$

$$\begin{Bmatrix} 6,144 \cdot 10^{-3} \\ 9,446 \cdot 10^{-5} \\ -7,812 \cdot 10^{-4} \\ 0 \\ 0 \\ 0 \end{Bmatrix}$$

$$[T_1] \{r_{12}\} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ -1,052 \cdot 10^{-4} \\ 1,046 \cdot 10^{-2} \\ 3,932 \cdot 10^{-3} \end{Bmatrix} = \{r_{12}^*\} ; \quad \{r_{23}^*\} = \{r_{23}\}$$

$$[T_2] \{r_{34}\} = \begin{Bmatrix} 9,446 \cdot 10^{-5} \\ -6,144 \cdot 10^{-3} \\ -7,812 \cdot 10^{-4} \\ 0 \\ 0 \\ 0 \end{Bmatrix} = \{r_{34}^*\}$$

VÝPOČET SEKUNDÁRNÍCH KONCOVÝCH SIL

$[P_{12}]$

$[K_{12}^*]$

$\{r_{12}^*\}$

$\{\hat{R}_{12}^*\}$

$$\begin{Bmatrix} \dots \\ \dots \\ \dots \end{Bmatrix} = \begin{Bmatrix} 18929 \\ -4880 \\ 0 \\ -18929 \\ 4880 \\ 24401 \end{Bmatrix}$$

PRNT 23

$$[K_{23}^*] \cdot \{r_{23}^*\} = \begin{Bmatrix} 14915 \\ 15000 \\ 10838 \\ -5659 \\ -14915 \\ 15000 \\ -10838 \\ -26864 \end{Bmatrix} = \{\hat{R}_{23}^*\}$$

PRNT 24

$$[K_{34}^*] \cdot \{r_{34}^*\} = \begin{Bmatrix} 28338 \\ -14915 \\ 20614 \\ -28338 \\ 14915 \\ 24131 \end{Bmatrix} = \{\hat{R}_{34}^*\}$$

KONKRETE SIEB GELASSEN

PRNT 12

$$\{\hat{R}_{12}^*\} + \{\bar{R}_{12}^*\} = \begin{Bmatrix} 27929 \\ -12380 \\ 0 \\ -9929 \\ -11620 \\ 1901 \end{Bmatrix} = \{R_{12}^*\}$$

PRNT 30

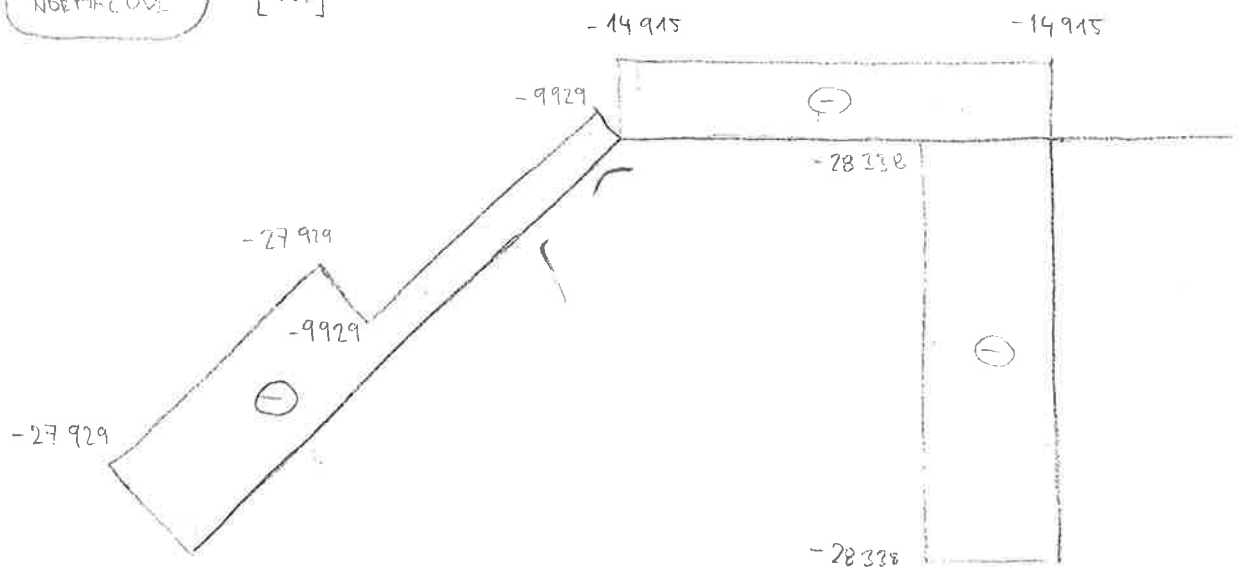
$$\{\bar{R}_{34}^*\} = \{0\}$$

$$\{\hat{R}_{34}^*\} = \{R_{34}^*\}$$

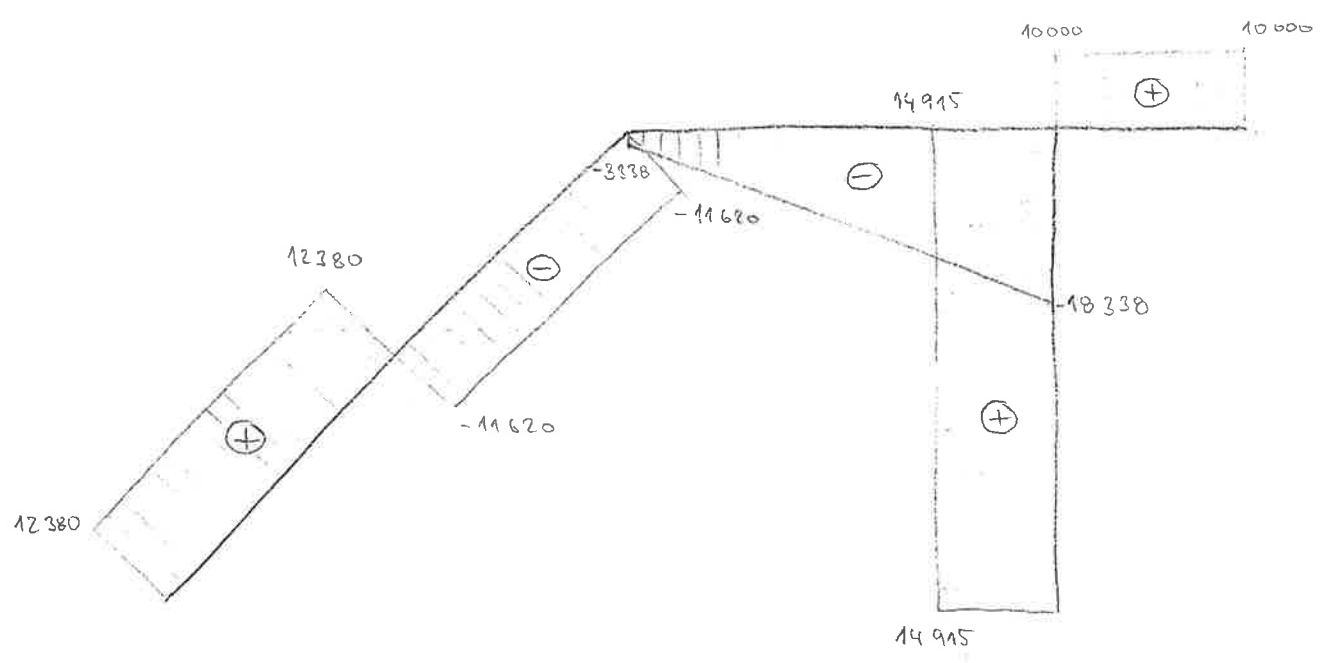
PRNT 23

$$\{\hat{R}_{23}^*\} + \{\bar{R}_{23}^*\} = \begin{Bmatrix} 14915 \\ 3338 \\ -1901 \\ -14915 \\ -18338 \\ -30614 \end{Bmatrix} = \{R_{23}^*\}$$

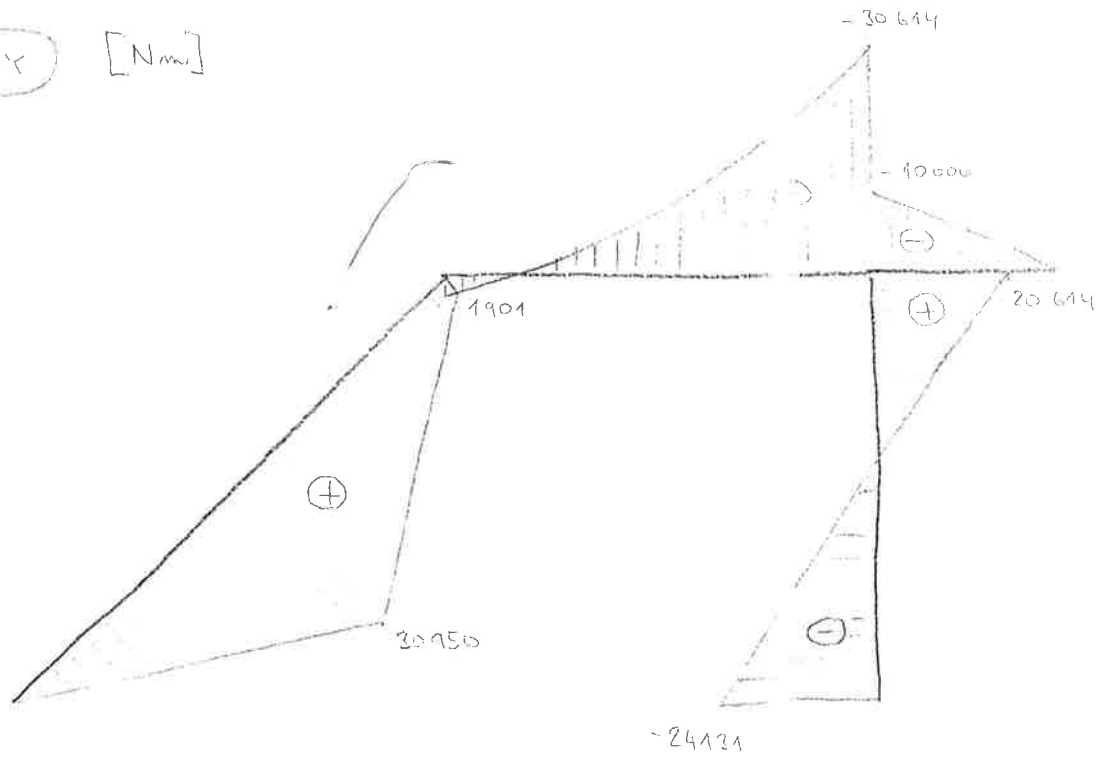
NORMÁLOVÉ [N]



ŘEZOVÉ [N]



MOMENTY [Nm]



ÚPŘEČET S VYŘOVNÁVACÍM VLIVU SPŘÍSKU

PŘIDANÉ PARAMETRY

$\mu = 0,25$

$A_{ge} = \frac{5}{6} A = 0,0375 \text{ m}^2$

ŘEŠENÍ

$$\{r\}^{SPR} = \begin{Bmatrix} 6,293 \cdot 10^{-3} \\ 8,566 \cdot 10^{-3} \\ 3,924 \cdot 10^{-3} \\ 6,243 \cdot 10^{-3} \\ 9,452 \cdot 10^{-5} \\ -7,613 \cdot 10^{-4} \end{Bmatrix}$$

$$\{r\} = \begin{Bmatrix} 6,194 \cdot 10^{-3} \\ 8,439 \cdot 10^{-3} \\ 3,937 \cdot 10^{-3} \\ 6,144 \cdot 10^{-3} \\ 9,439 \cdot 10^{-5} \\ -7,815 \cdot 10^{-4} \end{Bmatrix}$$

MAY ODCHYLKA
 2,65%
 PŘÍPĚRNÁ ODCHYLKA
 1,27%
 (SPOLÍČENO RELATIV. ROZDÍLŮ)

SROVNÁNÍ

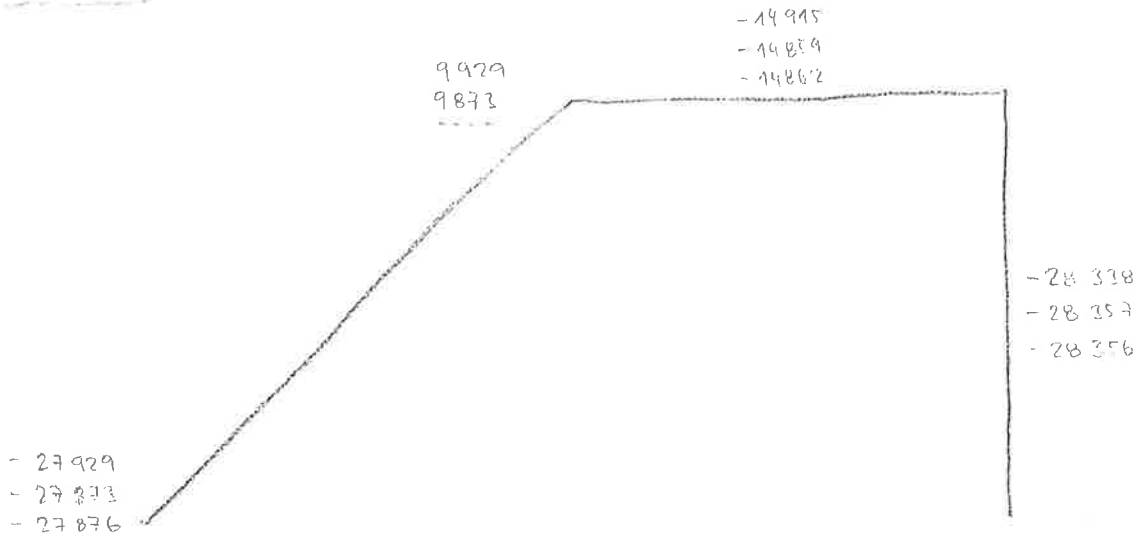
ODM - ODM + SPMK - MHP

11

VŠETČIVĚ

- ODM
- SPMK
- MHP

NORMALOVE



POSOVNÁK I

