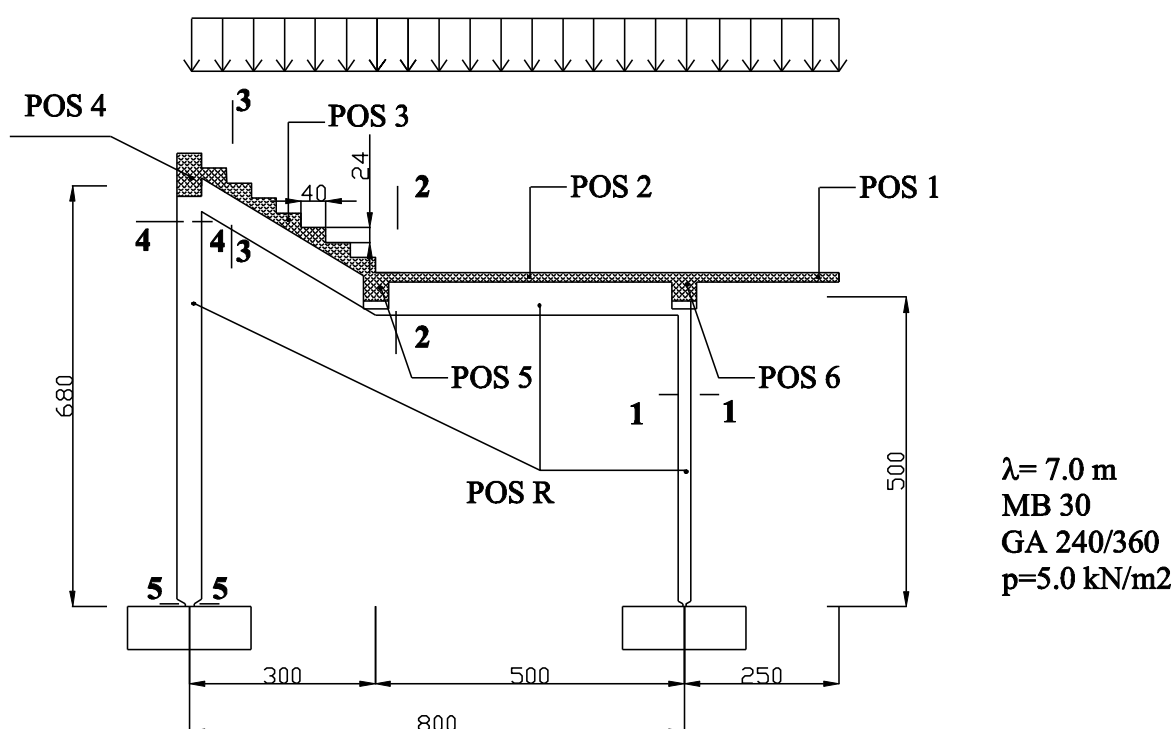


BETONSKE KONSTRUKCIJE

VJEŽBA 7.

Zadatak1.



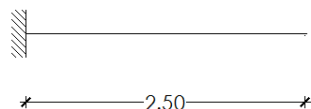
Za konstrukciju prikazanu na skici, na n polja, potrebno je uraditi sljedeće:

1. Izvršiti analizu opterećenja, sračunati statičke uticaje ploče POS 1, POS 2 i POS 3.
2. Izvršiti analizu opterećenja, sračunati statičke uticaje za grede POS 4, POS 5 i POS 5.
3. Izvršiti analizu opterećenja za središnji ram POS R.

Rješenje:

POS 1

1. Statička šema



2. Analiza opterećenja

soptvena težina ploče

$$\frac{0.14 \cdot 25 = 3.5 \text{ kN/m}^2}{g = 3.5 \text{ kN/m}^2}$$

korisno

$$p = 5.0 \text{ kN/m}^2$$

Granicno opterećenje

$$q = 1.6 \cdot g + 1.8 \cdot p = 14.6 \text{ kN/m}^2$$

3. Statički uticaji

$$M_u^0 = 14.6 \cdot 2.5^2 / 2 = 45.62 \text{ kNm/m}$$

$$T_u = 14.6 \cdot 2.5 = 36.5 \text{ kN/m}$$

$$M_g = 10.94 \text{ kNm/m}$$

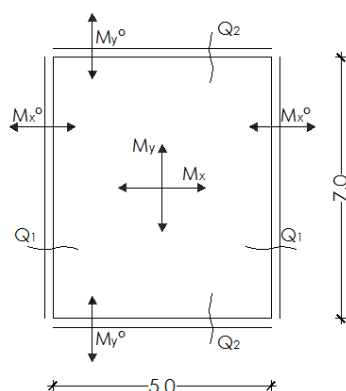
$$R_g = 8.75 \text{ kN/m}$$

$$M_p = 15.62 \text{ kNm/m}$$

$$R_p = 12.5 \text{ kN/m}$$

POS 2

1. Statička šema



2. Analiza opterećenja

soptvena težina ploče

$$\frac{0.14 \cdot 25 = 3.5 \text{ kN/m}^2}{g = 3.5 \text{ kN/m}^2}$$

korisno

$$p = 5.0 \text{ kN/m}^2$$

Granicno opterećenje

$$q = 1.6 \cdot g + 1.8 \cdot p = 14.6 \text{ kN/m}^2$$

3. Statički uticaji

Od stalnog opterećenja

$$M_x = 0.02 \cdot 3.5 \cdot 5.0 \cdot 7.0 = 2.45 \text{ kNm/m}$$

$$M_y = 0.013 \cdot 3.5 \cdot 5.0 \cdot 7.0 = 1.59 \text{ kNm/m}$$

$$M_x^0 = 0.052 \cdot 3.5 \cdot 5.0 \cdot 7.0 = 6.37 \text{ kNm/m}$$

$$M_y^0 = 0.0412 \cdot 3.5 \cdot 5.0 \cdot 7.0 = 5.02 \text{ kNm/m}$$

$$Q_1 = 0.302 \cdot 3.5 \cdot 5.0 \cdot 7.0 / 7.0 = 5.28 \text{ kN/m}$$

Od povremenog opterećenja

$$M_x = 0.02 \cdot 5 \cdot 5.0 \cdot 7.0 = 3.5 \text{ kNm/m}$$

$$M_y = 0.013 \cdot 5 \cdot 5.0 \cdot 7.0 = 2.275 \text{ kNm/m}$$

$$M_x^0 = 0.052 \cdot 5 \cdot 5.0 \cdot 7.0 = 9.1 \text{ kNm/m}$$

$$M_y^0 = 0.0412 \cdot 5 \cdot 5.0 \cdot 7.0 = 7.175 \text{ kNm/m}$$

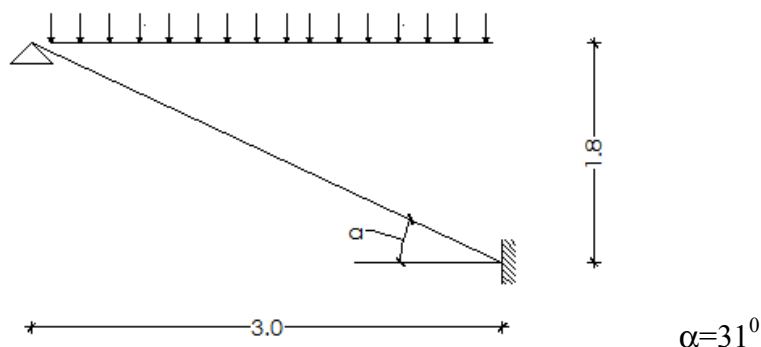
$$Q_1 = 0.302 \cdot 5 \cdot 5.0 \cdot 7.0 / 7.0 = 7.55 \text{ kN/m}$$

$$Q_2 = 0.198 \cdot 3.5 \cdot 5.0 \cdot 7.0 / 5.0 = 4.85 \text{ kN/m}$$

$$Q_2 = 0.198 \cdot 5 \cdot 5.0 \cdot 7.0 / 5.0 = 6.93 \text{ kN/m}$$

POS 3

1. Statička šema



2. Analiza opterećenja

soptvena težina ploče
od stepenika

$$\begin{aligned} 0.14 \cdot 25 / \cos 31^\circ &= 4.08 \text{ kN/m}^2 \\ \frac{0.24 \cdot 25 / 2}{2} &= 3.0 \text{ kN/m}^2 \\ g &= 7.08 \text{ kN/m}^2 \end{aligned}$$

korisno

$$p = 5.0 \text{ kN/m}^2$$

Granicno opterećenje

$$q = 1.6 \cdot g + 1.8 \cdot p = 20.33 \text{ kN/m}^2$$

3. Statički uticaji

$$M_u^0 = -20.33 \cdot 3.0^2 / 8 = -22.87 \text{ kNm/m}$$

$$M_g^0 = -7.96 \text{ kNm/m} \quad M_p^0 = -5.62 \text{ kNm/m}$$

$$M_u = -9/128 \cdot 20.33 \cdot 3.0^2 = 12.87 \text{ kNm/m}$$

$$M_g = 4.48 \text{ kNm/m} \quad M_p = 3.16 \text{ kNm/m}$$

$$A_g = 3/8 \cdot 7.08 \cdot 3.0 = 7.96 \text{ kN/m}$$

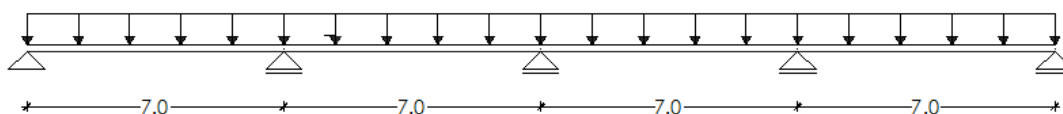
$$B_g = 5/8 \cdot 7.08 \cdot 3.0 = 13.3 \text{ kN/m}$$

$$A_p = 3/8 \cdot 5.0 \cdot 3.0 = 5.62 \text{ kN/m}$$

$$B_p = 5/8 \cdot 5.0 \cdot 3.0 = 9.37 \text{ kN/m}$$

POS 4

1. Statička šema



2. Analiza opterećenja

soptvena težina grede
od POS 3

$$\begin{aligned} 0.30 \cdot 0.6 \cdot 25 &= 4.5 \text{ kN/m} \\ \frac{7.96 \text{ kN/m}}{2} & \\ g &= 12.46 \text{ kN/m} \end{aligned}$$

od POS 3

$$\begin{aligned} \frac{5.62 \text{ kN/m}}{2} & \\ p &= 5.62 \text{ kN/m} \end{aligned}$$

3. Statički uticaji

Uraditi šahovsku raspodjelu

$$M_g = 0.042 \cdot 12.46 \cdot 7.0^2 = 25.64 \text{ kNm}$$

$$M_p = 0.083 \cdot 5.62 \cdot 7.0^2 = 22.8 \text{ kNm}$$

$$M_g^0 = 0.083 \cdot 12.46 \cdot 7.0^2 = 50.6 \text{ kNm}$$

$$M_p^0 = 0.114 \cdot 5.62 \cdot 7.0^2 = 31.4 \text{ kNm}$$

$$T_{1g} = 0.5 \cdot 12.46 \cdot 7.0 = 43.6 \text{ kN}$$

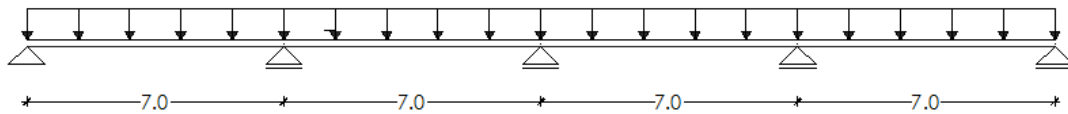
$$T_{1p} = 0.591 \cdot 5.62 \cdot 7.0 = 23.25 \text{ kN}$$

$$R_g = 1.0 \cdot 12.46 \cdot 7.0 = 87.22 \text{ kN}$$

$$R_p = 1.184 \cdot 5.62 \cdot 7.0 = 46.5 \text{ kN}$$

POS 5

1. Statička šema



2. Analiza opterećenja

soptvena težina grede	$0.30 \cdot 0.6 \cdot 25 = 4.5 \text{ kN/m}$
od POS 2	5.28 kN/m
od POS 3	13.3 kN/m
	<hr/>
	$g = 23.08 \text{ kN/m}$

od POS 2	7.55 kN/m
od POS 3	9.37 kN/m
	<hr/>
	$p = 16.92 \text{ kN/m}$

3. Statički uticaji

Uraditi šahovsku raspodjelu

$$M_g = 0.042 \cdot 23.08 \cdot 7.0^2 = 47.5 \text{ kNm}$$

$$M_g^0 = 0.083 \cdot 23.08 \cdot 7.0^2 = 93.86 \text{ kNm}$$

$$M_p = 0.083 \cdot 16.92 \cdot 7.0^2 = 68.8 \text{ kNm}$$

$$M_p^0 = 0.114 \cdot 16.92 \cdot 7.0^2 = 94.51 \text{ kNm}$$

$$T_{1g} = 0.5 \cdot 23.08 \cdot 7.0 = 80.78 \text{ kN}$$

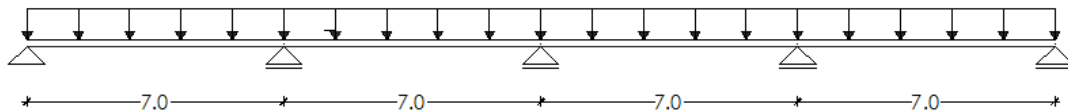
$$R_g = 1.0 \cdot 23.08 \cdot 7.0 = 161.56 \text{ kN}$$

$$T_{1p} = 0.591 \cdot 16.92 \cdot 7.0 = 70 \text{ kN}$$

$$R_p = 1.184 \cdot 16.92 \cdot 7.0 = 140.23 \text{ kN}$$

POS 6

1. Statička šema



2. Analiza opterećenja

soptvena težina grede	$0.30 \cdot 0.6 \cdot 25 = 4.5 \text{ kN/m}$
od POS 1	8.75 kN/m
od POS 3	5.28 kN/m
	<hr/>
	$g = 18.53 \text{ kN/m}$

od POS 1	12.5 kN/m
od POS 3	7.55 kN/m
	<hr/>
	$p = 20.05 \text{ kN/m}$

3. Statički uticaji

Uraditi šahovsku raspodjelu

$$M_g = 0.042 \cdot 18.53 \cdot 7.0^2 = 38.13 \text{ kNm}$$

$$M_g^0 = 0.083 \cdot 18.53 \cdot 7.0^2 = 75.36 \text{ kNm}$$

$$M_p = 0.083 \cdot 20 \cdot 7.0^2 = 81.34 \text{ kNm}$$

$$M_p^0 = 0.114 \cdot 20 \cdot 7.0^2 = 111.72 \text{ kNm}$$

$$T_{1g} = 0.5 \cdot 18.53 \cdot 7.0 = 64.85 \text{ kN}$$

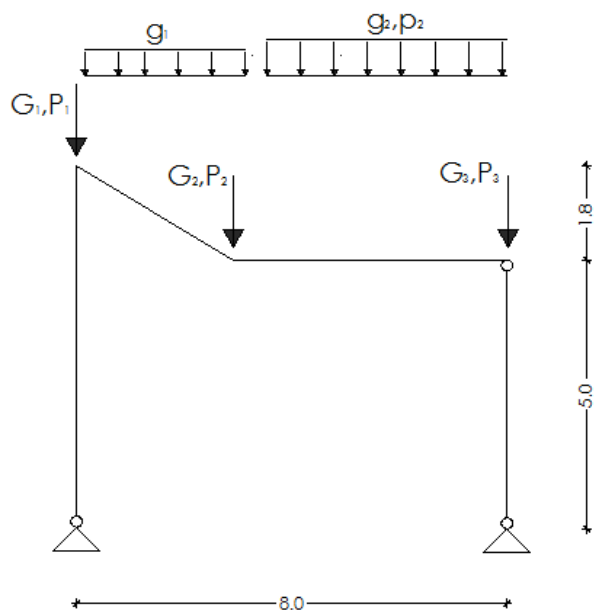
$$R_g = 1.0 \cdot 18.53 \cdot 7.0 = 129.7 \text{ kN}$$

$$T_{1p} = 0.591 \cdot 20 \cdot 7.0 = 82.74 \text{ kN}$$

$$R_p = 1.184 \cdot 20 \cdot 7.0 = 165.48 \text{ kN}$$

POS R

1. Statička šema



2. Analiza opterećenja

Stalno opterećenje:

g1

soptvena težina grede rama $0.40 \cdot 0.9 \cdot 25 / \cos 31 = 10.5 \text{ kN/m}$
 $g_1 = 10.5 \text{ kN/m}$

g2

soptvena težina grede rama $0.40 \cdot 0.9 \cdot 25 = 9.0 \text{ kN/m}$
od POS 2 $4.85 \cdot 2 = 9.7 \text{ kN/m}$
 $g_2 = 18.7 \text{ kN/m}$

G1

od POS 4 $R_g = 87.22 \text{ kN}$

G2

od POS 5 $R_g = 161.56 \text{ kN}$

G3

od POS 6 $R_g = 129.7 \text{ kN}$

Povremeno opterećenje:

p2

od POS 2 $6.93 \cdot 2 = 13.86 \text{ kN/m}$
 $p_2 = 13.86 \text{ kN/m}$

P1

od POS 4 $R_p = 46.58 \text{ kN}$

P2

od POS 5 $R_p = 140.23 \text{ kN}$

P3

od POS 6 $R_p = 165.48 \text{ kN}$