

1a Na podlagi podanih obremenitev (stalni vpliv, veter, sneg) določite potrebno višino obravnavanega lepljenega nosilca. Širina nosilca je 20 cm, debelina lamele pa 2 cm.

Upoštevajte vse pogoje mejnih stanj nosilnosti, pogoje mejnih stanj uporabnosti (pomiki) pa lahko zanemarite!

Nosilec je ustrezno bočno podprt!

**Material:**

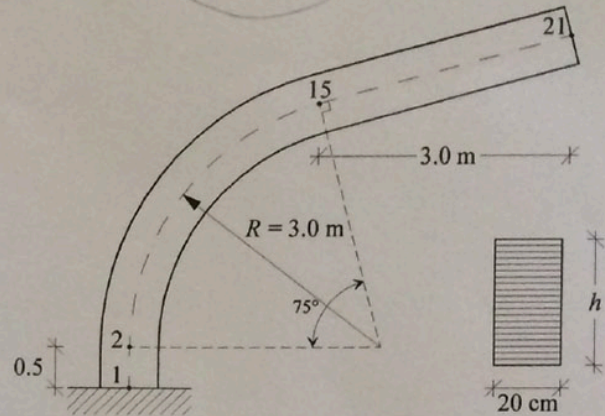
lepljeni les vrste GL28h

$$f_{m,g,k} = 2.8 \text{ kN/cm}^2$$

$$f_{t,90,k} = 0.045 \text{ kN/cm}^2$$

$$f_{v,g,k} = 0.32 \text{ kN/cm}^2$$

$$f_{c,0,g,k} = 2.65 \text{ kN/cm}^2$$



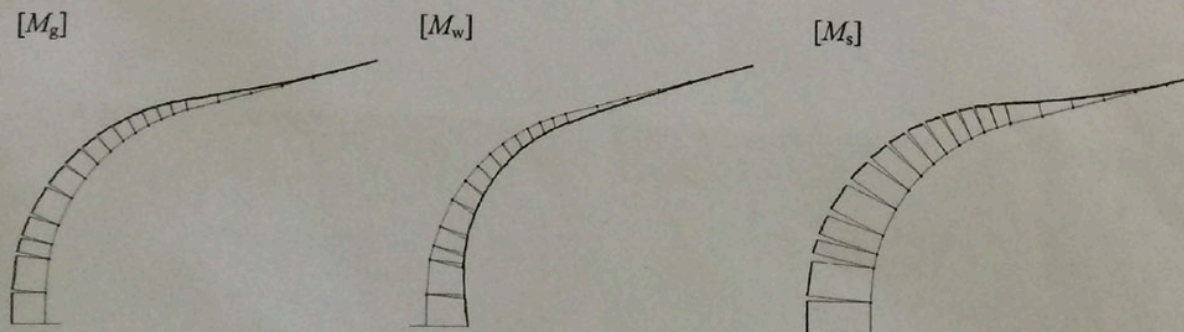
osnovna kombinacija vplivov:

$$\sum_{j \geq 1} \gamma_{G,j} G_{k,j} + \gamma_{Q,1} Q_{k,1} + \sum_{i > 1} \gamma_{Q,i} \Psi_{0,i} Q_{k,i}$$

Opomba: veter in sneg sta kratkotrajna vpliva!

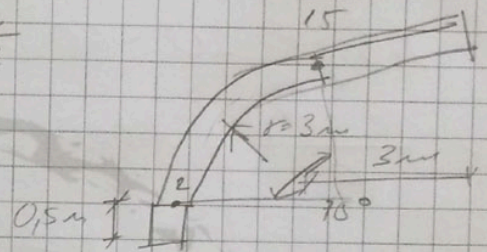
vozlišče	X [m]	Z [m]	stalni vpliv			vpliv vetra ( $\psi_0 = 0.6$ )			obtežba snega ( $\psi_0 = 0.5$ )		
			$N_g$ [kN]	$V_g$ [kN]	$M_g$ [kNm]	$N_w$ [kN]	$V_w$ [kN]	$M_w$ [kNm]	$N_s$ [kN]	$V_s$ [kN]	$M_s$ [kNm]
1	0.00	0.00	-25.9	0.0	-52.2	15.7	-12.6	67.3	-37.9	0.0	-99.5
2	0.00	0.50	-23.9	2.2	-52.2	14.6	-12.5	61.4	-37.6	3.5	-99.4
3	0.05	1.05	-22.1	5.0	-51.0	13.1	-12.6	55.0	-36.4	8.3	-97.5
4	0.10	1.27	-20.6	6.7	-49.9	11.9	-13.1	52.2	-35.0	11.4	-95.6
5	0.20	1.58	-18.3	8.7	-47.7	10.2	-13.6	48.1	-32.2	15.5	-91.9
6	0.40	2.00	-15.7	10.4	-43.6	8.5	-13.5	42.1	-28.5	19.0	-84.7
7	0.60	2.30	-13.5	11.3	-39.9	7.0	-13.2	37.4	-25.1	21.1	-77.8
8	0.80	2.54	-11.5	11.8	-36.3	5.8	-12.9	33.4	-21.8	22.5	-71.2
9	1.00	2.74	-9.8	12.1	-33.0	4.7	-12.6	29.9	-18.8	23.3	-64.9
10	1.20	2.90	-8.3	12.1	-29.9	3.7	-12.1	26.8	-16.0	23.6	-58.9
11	1.40	3.04	-6.9	12.0	-26.9	2.7	-11.7	23.9	-13.3	23.5	-53.1
12	1.60	3.15	-5.6	11.8	-24.2	1.9	-11.1	21.3	-11.0	23.1	-47.7
13	1.80	3.25	-4.4	11.4	-21.6	1.1	-10.6	18.9	-8.6	22.6	-42.6
14	2.00	3.33	-3.4	10.9	-19.1	0.5	-10.0	16.7	-6.7	21.6	-37.7
15	2.22	3.40	-2.6	9.8	-16.6	0.0	-9.3	14.5	-5.0	19.3	-32.8
16	2.72	3.53	-2.1	8.0	-11.5	0.0	-7.8	10.0	-4.1	15.8	-22.7
17	3.22	3.67	-1.6	6.2	-7.4	0.0	-6.2	6.4	-3.2	12.3	-14.6
18	3.72	3.80	-1.2	4.4	-4.1	0.0	-4.7	3.6	-2.3	8.8	-8.2
19	4.22	3.93	-0.7	2.7	-1.8	0.0	-3.1	1.6	-1.4	5.3	-3.6
20	4.72	4.07	-0.2	0.9	-0.5	0.0	-1.6	0.4	-0.5	1.8	-0.9
21	5.22	4.20	0.0	0.0	0.0	0.0	0.0	-42.0	0.0	0.0	0.0

Potek upogibnih momentov za posamezen vpliv:



SOL. L.:	LETNIK:	IME IN PRIIMEK:	PREDMET:	VAJA ŠT.:	LIST ŠT.:
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①	$h_{sp} = 2$	GL 289	Nider + smog	5
	$b = 20 \text{ cm}$	$f_{m,ig,b} = 2,8 \frac{\text{bar}}{\text{cm}^2}$	$b_{HOB} = 0,9$	
	$t = 2 \text{ cm}$	$f_{c,90,b} = 0,045 \frac{\text{bar}}{\text{cm}^2}$	$f_M = 1,25$	
		$f_{v,ig,b} = 0,32 \frac{\text{bar}}{\text{cm}^2}$		
		$f_{c,90,b} = 2,65 \frac{\text{bar}}{\text{cm}^2}$		



→ Kontrola debeline lonce

$$t \leq \frac{r}{250} \left( 1 + \frac{r}{80} \right) = \frac{3}{250} \left( 1 + \frac{28}{80} \right) = \underline{\underline{1,62 \text{ cm}}}$$

Vidimo, da debelina lonce  $t = 2 \text{ cm}$  NE USTREJA.

→ Kontrola upogibne napetosti in dolocitev kraj.

Obtežba:

$$1,35 \cdot G + 1,5 \cdot Q_s + 1,5 \cdot 0,6 \cdot Q_w$$

TOČNA ①  $M_{min}$

$$1,35 \cdot (-52,71) + 1,5 \cdot (-99,5) + 1,0 \cdot 0,6 \cdot (67,3) = -179,34 \text{ kNm}$$

②  $1,35 \cdot (-52,2) + 1,5 \cdot (-99,4) + 1,0 \cdot 0,6 \cdot (64,4) = -182,73 \text{ kNm}$

$M_{max}$  ②  $1,0 \cdot (-0,5) + 1,0 \cdot 0,5 \cdot (-0,9) + 1,5 \cdot 0,6 = -0,35 \text{ kNm} < 0$

→ Kontrola upogiba

$$l_{up} = \sqrt{\frac{Mod \cdot 100 \cdot G}{1,5 \cdot f_{m,d}}} = \sqrt{\frac{182,73 \cdot 100 \cdot G}{20 \cdot 2,016}} = 52,15 \text{ cm}$$

$$f_{m,d} = 0,9 \cdot \frac{2,8}{1,25} = 2,016 \text{ kN/cm}^2$$

Izbrano  $l_{up} = 60 \text{ cm}$

$$M_{min} = -182,73 \text{ kNm}; \quad N_{pby} = -79,905 \text{ kN}$$

Klancek.si

$$N_{pby} = 1,35 \cdot (-23,9) + 1,5 \cdot (-37,6) + 1,0 \cdot 0,6 \cdot (14,6) = \underline{\underline{-79,905 \text{ kN}}}$$

Interakcija aksial/napajanje

$$\left( \frac{N_{ed}}{A_{ef} \cdot f_{c,0,9,d}} \right)^2 + \frac{b_{sl} \cdot \sigma_{ed}}{W \cdot b_{sl} \cdot f_{m,d}} \leq 1$$

$$A = b \cdot b_{ef} = 20 \cdot 60 \text{ cm} = 1200 \text{ cm}^2$$

$$W = \frac{20 \cdot 60^2}{6} = 12000 \text{ cm}^3$$

$$f_{c,0,9,d} = 0,9 \cdot \frac{24,5}{1,25} = 1,908 \frac{\text{kN}}{\text{cm}^2}$$

$$f_{m,d} = 0,9 \cdot \frac{2,8}{1,25} = 2,016 \text{ kN/cm}^2$$

$$b_{sl} = b_1 + b_2 \cdot \left( \frac{b_{ef}}{s} \right)^2 + b_3 \cdot \left( \frac{b_{ef}}{s} \right)^2 + b_4 \cdot \left( \frac{b_{ef}}{s} \right)^3$$

$$s = 3 \text{ m}$$

$$b_1 = 1 \quad b_2 = 0,35 \quad b_3 = 0,6; \quad b_4 = \emptyset$$

$$b_{sl} = 1 + 0,35 \cdot \left( \frac{0,6}{3} \right) + 0,6 \cdot \left( \frac{0,6}{3} \right)^2 = \underline{\underline{1,094}}$$

$$\frac{v_{in}}{t} = \frac{w_{ef} - \frac{v_{ef}}{2}}{t} = \frac{3 - \frac{0,6}{2}}{0,04} = \underline{\underline{135}}$$

$$\frac{v_{in}}{t} < 260 \Rightarrow b_2 = 0,76 + 0,001 \frac{v_{in}}{t} = 0,76 + 0,001 \cdot \frac{135}{0,02} = \underline{\underline{0,895}}$$

KONTROLA

$$\left( \frac{79,905}{1200 \cdot 1,908} \right)^2 + \left( \frac{1,094 \cdot 182,73}{12000 \cdot 0,895 \cdot 2,016} \right) = \underline{\underline{0,924 \leq 1 \quad \checkmark}}$$