Project

Job name : Zemeljski plaz na parceli *191 k.o. Zgornje Grušovje pri hiši Zgornje Grušovje 10b
Description : Vezna greda
Client : Občina Oplotnica
Author : GEOING d.o.o.
Date : 08/04/2025

Standard

Standard **EN 1992-1-1/Default EC**.

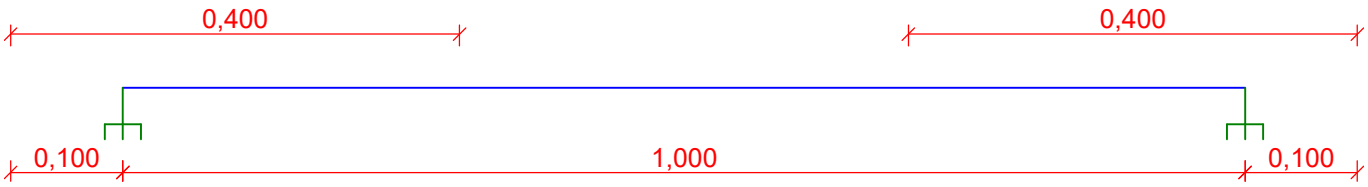
1 Beam 1

1.1 Input data

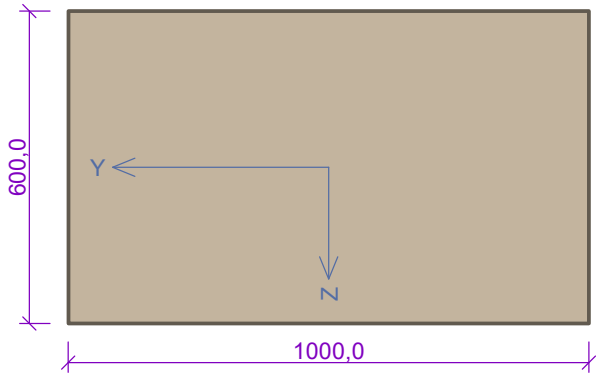
Geometry

Length = 1,00m

x [m]	Point kind	Width [m]	A/L [m]	I/L [m³]	Offset [m]
0,000	fixed support	0,400	-	-	0,100
1,000	fixed support	0,400	-	-	0,100



Cross-section



Materials

Concrete: C 30/37
f_{ck} = 30,0 MPa; f_{ctm} = 2,9 MPa; E_{cm} = 33000 MPa

Longitudinal steel: B500B
f_{yk} = 500,0 MPa; E_s = 200000 MPa

Transverse steel: B500B
f_{yk} = 500,0 MPa; E_s = 200000 MPa

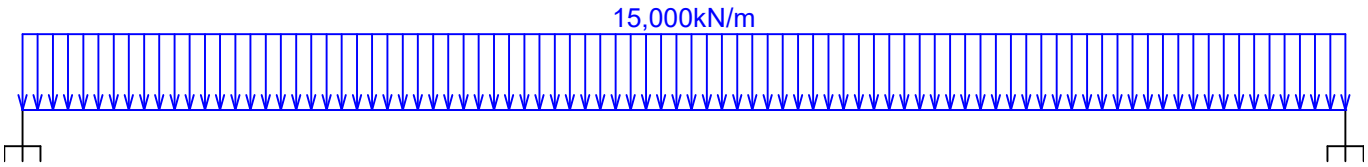
Load cases

no.	Name	Code	Type	As* main	γ_f ($\gamma_{f,inf}$)**	Factors for combinations				
						ξ	Categ.***	ψ_0	ψ_1	ψ_2
1	G1 Self weight	Self weight	Permanent	-	1,35(0,90)	0,85	-	-	-	-
2	G2 force -permanent	Force	Permanent	-	1,35(0,90)	0,85	-	-	-	-

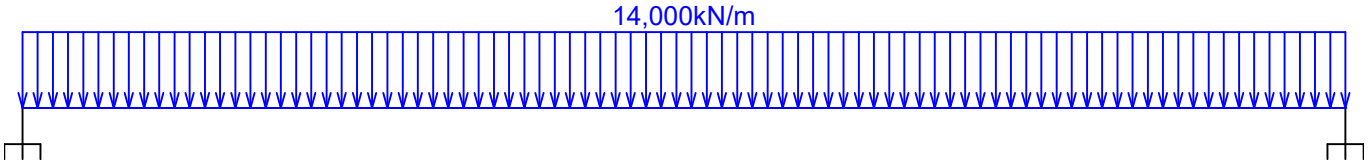
* load acts in combinations as main variable
** $\gamma_{f,inf}$ for favourable dead loads
*** Category of live loads according to table A1.1 in EN 1990

G1 Self weight - load				
Type	Coor.x [m]	Length [m]	Size1	Size2
uniform	0,000	1,000	15,000kN/m	-

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G2 force -permanent - load				
Type	Coor.x [m]	Length [m]	Size1	Size2
uniform	0,000	1,000	14,000kN/m	-



Combinations

Combination for check of ultimate limit state (ULS), 1st order

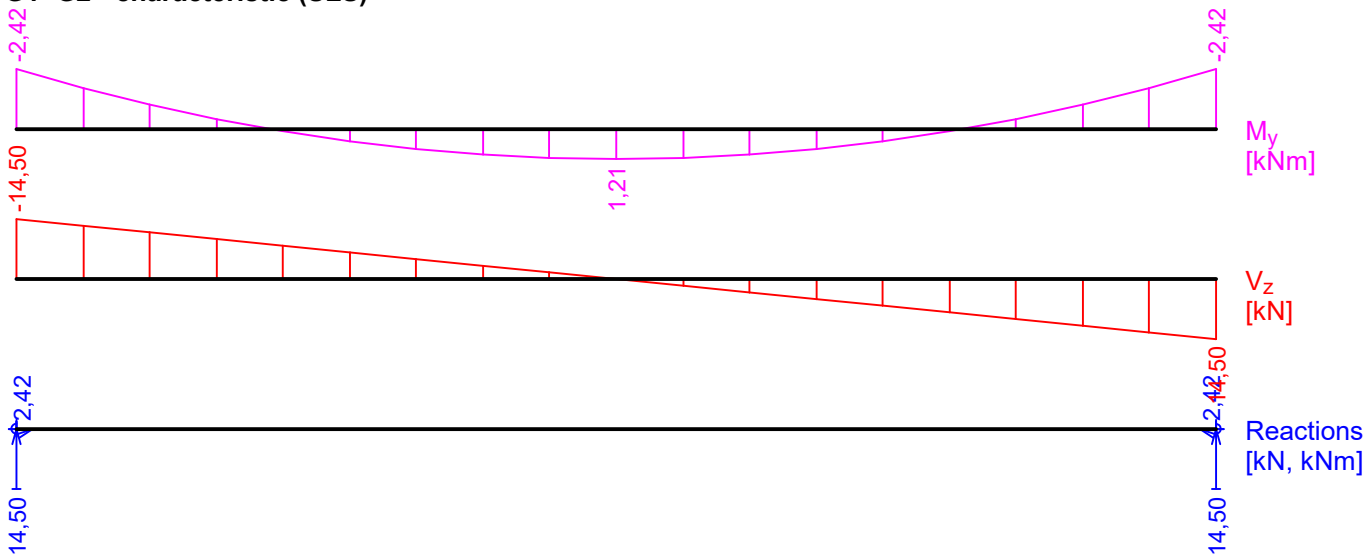
Number	Comb. name and type
	Composition
1	G1+G2; basic combination
	$\gamma_{f,sup,1}(1,35)$*G1 + $\gamma_{f,sup,2}(1,35)$*G2
2	G1+G2; accidental combination
	G1 + G2

Combination for check of serviceability limit state (SLS), 1st order

Number	Comb. name and type
	Composition
1	G1+G2; characteristic combination
	G1 + G2

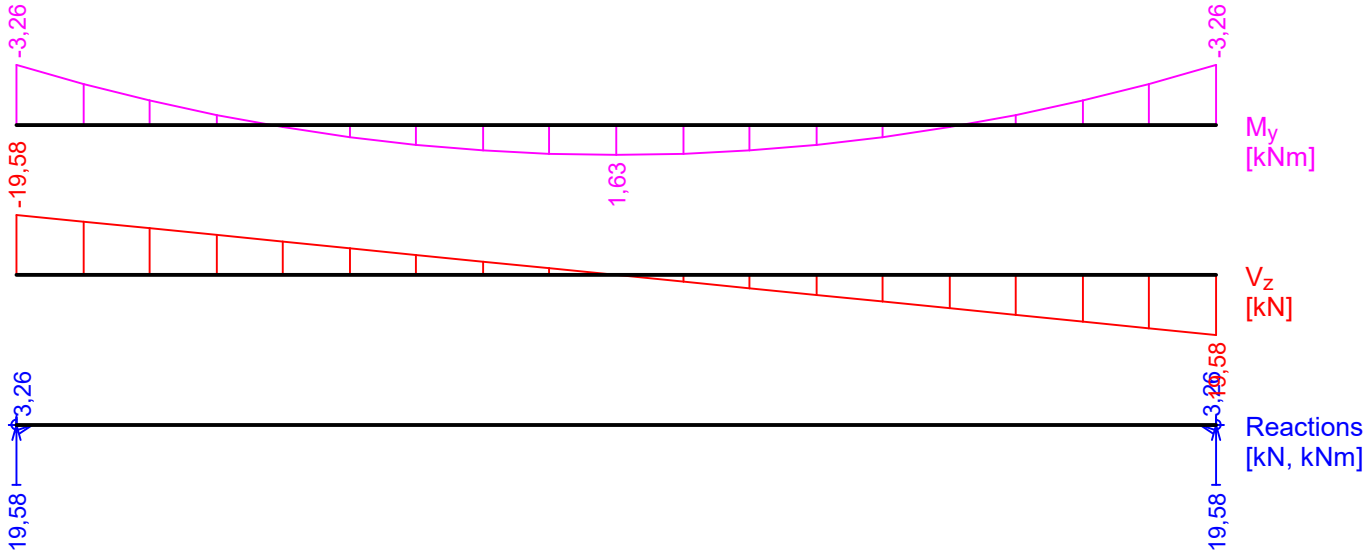
Internal forces

G1+G2 - characteristic (SLS)

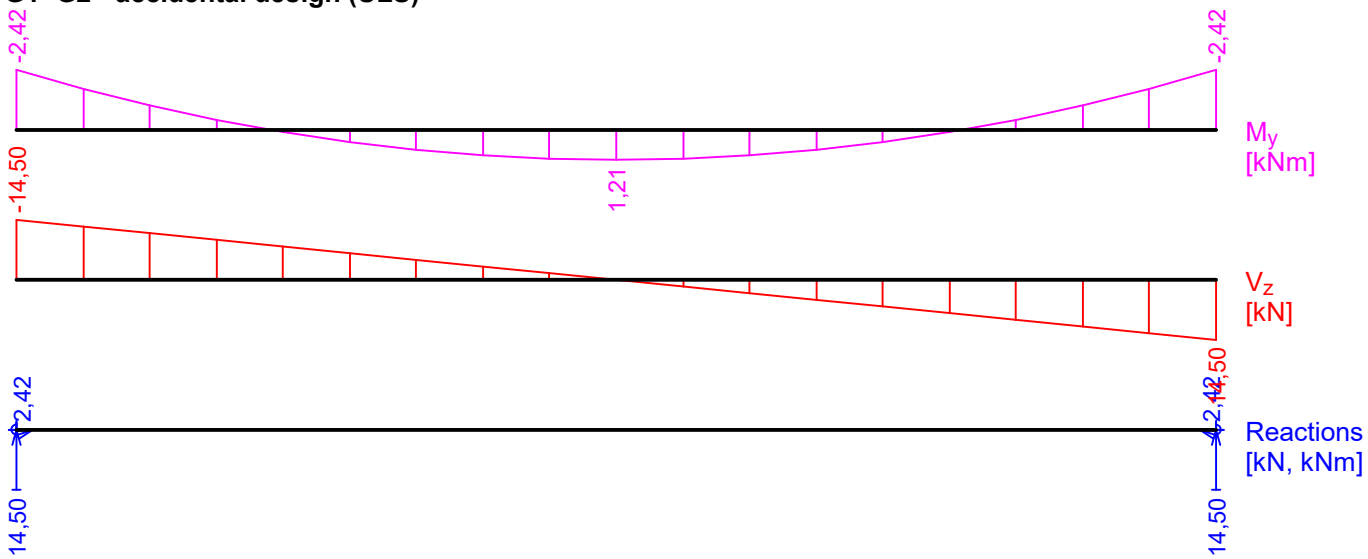


G1+G2 - basic design (ULS)

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G1+G2 - accidental design (ULS)

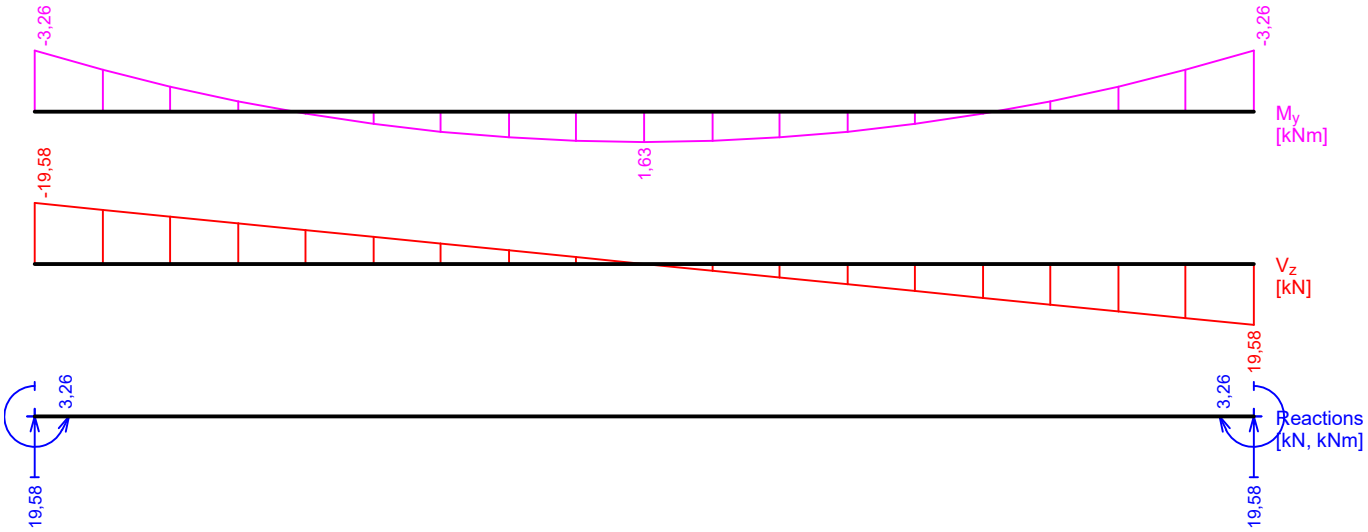


Envelopes

Envelope basic design (ULS)								
x [m]	Max M_{Edy} [kNm]	Min M_{Edy} [kNm]	Max V_{Edz} [kN]	Min V_{Edz} [kN]	Max R_z [kN]	Min R_z [kN]	Max RO_x [kNm]	Min RO_x [kNm]
0,000	-3,26	-3,26	-19,58	-19,58	19,58	19,58	3,26	3,26
0,056	-2,23	-2,23	-17,38	-17,38	-	-	-	-
0,111	-1,34	-1,34	-15,23	-15,23	-	-	-	-
0,167	-0,54	-0,54	-13,04	-13,04	-	-	-	-
0,222	0,11	0,11	-10,88	-10,88	-	-	-	-
0,278	0,66	0,66	-8,69	-8,69	-	-	-	-
0,333	1,09	1,09	-6,54	-6,54	-	-	-	-
0,389	1,39	1,39	-4,35	-4,35	-	-	-	-
0,444	1,57	1,57	-2,19	-2,19	-	-	-	-
0,500	1,63	1,63	0,00	0,00	-	-	-	-
0,556	1,57	1,57	2,19	2,19	-	-	-	-

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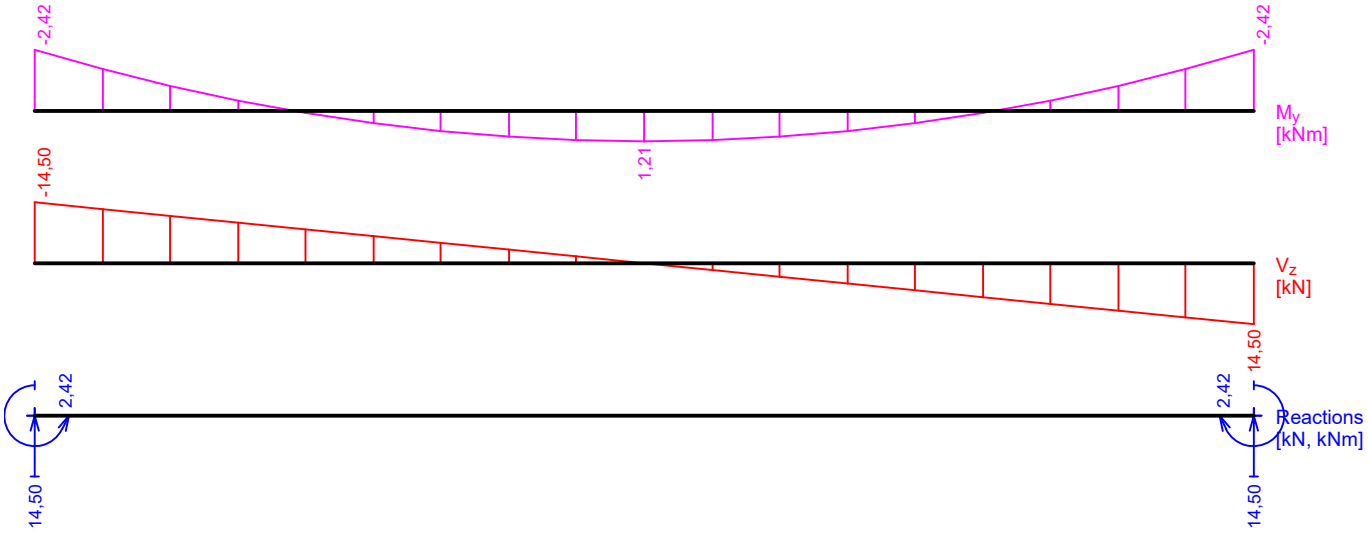
Envelope basic design (ULS)								
x [m]	Max M_{Edy} [kNm]	Min M_{Edy} [kNm]	Max V_{Edz} [kN]	Min V_{Edz} [kN]	Max R_z [kN]	Min R_z [kN]	Max RO_x [kNm]	Min RO_x [kNm]
0,611	1,39	1,39	4,35	4,35	-	-	-	-
0,667	1,09	1,09	6,54	6,54	-	-	-	-
0,722	0,66	0,66	8,69	8,69	-	-	-	-
0,778	0,11	0,11	10,88	10,88	-	-	-	-
0,833	-0,54	-0,54	13,04	13,04	-	-	-	-
0,889	-1,34	-1,34	15,23	15,23	-	-	-	-
0,944	-2,23	-2,23	17,38	17,38	-	-	-	-
1,000	-3,26	-3,26	19,58	19,58	19,58	19,58	-3,26	-3,26



Envelope accidental design (ULS)								
x [m]	Max M_{Edy} [kNm]	Min M_{Edy} [kNm]	Max V_{Edz} [kN]	Min V_{Edz} [kN]	Max R_z [kN]	Min R_z [kN]	Max RO_x [kNm]	Min RO_x [kNm]
0,000	-2,42	-2,42	-14,50	-14,50	14,50	14,50	2,42	2,42
0,056	-1,65	-1,65	-12,88	-12,88	-	-	-	-
0,111	-0,99	-0,99	-11,28	-11,28	-	-	-	-
0,167	-0,40	-0,40	-9,66	-9,66	-	-	-	-
0,222	0,08	0,08	-8,06	-8,06	-	-	-	-
0,278	0,49	0,49	-6,44	-6,44	-	-	-	-
0,333	0,80	0,80	-4,84	-4,84	-	-	-	-
0,389	1,03	1,03	-3,22	-3,22	-	-	-	-
0,444	1,16	1,16	-1,62	-1,62	-	-	-	-
0,500	1,21	1,21	0,00	0,00	-	-	-	-
0,556	1,16	1,16	1,62	1,62	-	-	-	-
0,611	1,03	1,03	3,22	3,22	-	-	-	-
0,667	0,80	0,80	4,84	4,84	-	-	-	-
0,722	0,49	0,49	6,44	6,44	-	-	-	-
0,778	0,08	0,08	8,06	8,06	-	-	-	-
0,833	-0,40	-0,40	9,66	9,66	-	-	-	-
0,889	-0,99	-0,99	11,28	11,28	-	-	-	-
0,944	-1,65	-1,65	12,88	12,88	-	-	-	-

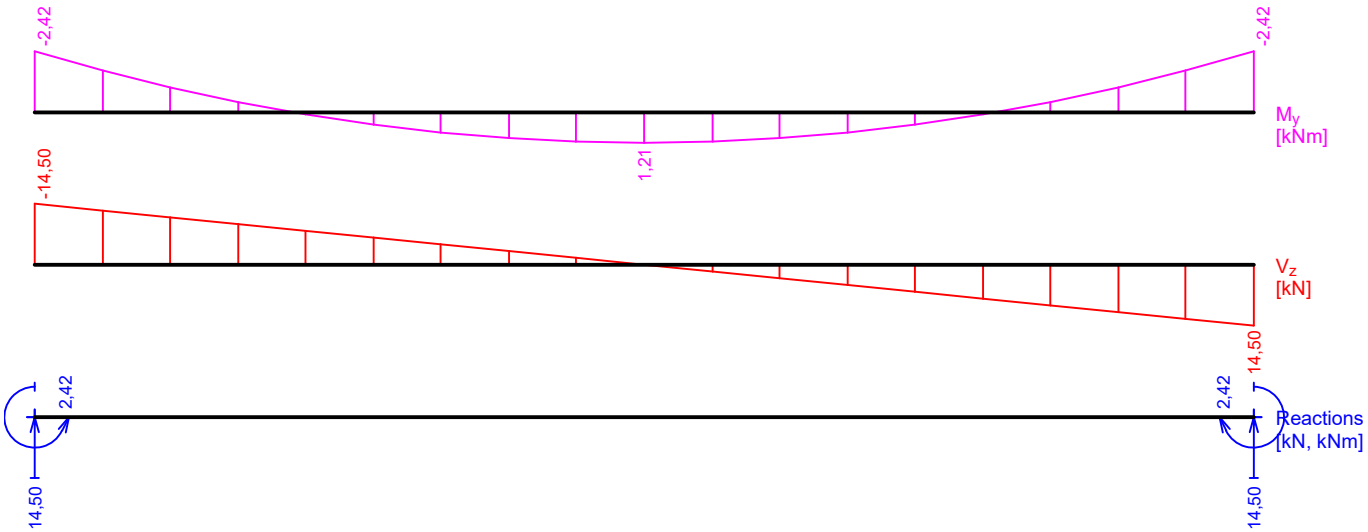
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Envelope accidental design (ULS)								
x [m]	Max M_{Edy} [kNm]	Min M_{Edy} [kNm]	Max V_{Edz} [kN]	Min V_{Edz} [kN]	Max R_z [kN]	Min R_z [kN]	Max RO_x [kNm]	Min RO_x [kNm]
1,000	-2,42	-2,42	14,50	14,50	14,50	14,50	-2,42	-2,42



Envelope characteristic (SLS)								
x [m]	Max M_{Edy} [kNm]	Min M_{Edy} [kNm]	Max V_{Edz} [kN]	Min V_{Edz} [kN]	Max R_z [kN]	Min R_z [kN]	Max RO_x [kNm]	Min RO_x [kNm]
0,000	-2,42	-2,42	-14,50	-14,50	14,50	14,50	2,42	2,42
0,056	-1,65	-1,65	-12,88	-12,88	-	-	-	-
0,111	-0,99	-0,99	-11,28	-11,28	-	-	-	-
0,167	-0,40	-0,40	-9,66	-9,66	-	-	-	-
0,222	0,08	0,08	-8,06	-8,06	-	-	-	-
0,278	0,49	0,49	-6,44	-6,44	-	-	-	-
0,333	0,80	0,80	-4,84	-4,84	-	-	-	-
0,389	1,03	1,03	-3,22	-3,22	-	-	-	-
0,444	1,16	1,16	-1,62	-1,62	-	-	-	-
0,500	1,21	1,21	0,00	0,00	-	-	-	-
0,556	1,16	1,16	1,62	1,62	-	-	-	-
0,611	1,03	1,03	3,22	3,22	-	-	-	-
0,667	0,80	0,80	4,84	4,84	-	-	-	-
0,722	0,49	0,49	6,44	6,44	-	-	-	-
0,778	0,08	0,08	8,06	8,06	-	-	-	-
0,833	-0,40	-0,40	9,66	9,66	-	-	-	-
0,889	-0,99	-0,99	11,28	11,28	-	-	-	-
0,944	-1,65	-1,65	12,88	12,88	-	-	-	-
1,000	-2,42	-2,42	14,50	14,50	14,50	14,50	-2,42	-2,42

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Reactions extremes

Reactions extremes basic design (ULS)	
x [m]	**Reaction**
0,000	Max R_Z = 19,58kN - G1+G2
0,000	Min R_Z = 19,58kN - G1+G2
0,000	Max RO_X = 3,26kNm - G1+G2
0,000	Min RO_X = 3,26kNm - G1+G2
1,000	Max R_Z = 19,58kN - G1+G2
1,000	Min R_Z = 19,58kN - G1+G2
1,000	Max RO_X = -3,26kNm - G1+G2
1,000	Min RO_X = -3,26kNm - G1+G2

Reactions extremes accidental design (ULS)	
x [m]	**Reaction**
0,000	Max R_Z = 14,50kN - G1+G2
0,000	Min R_Z = 14,50kN - G1+G2
0,000	Max RO_X = 2,42kNm - G1+G2
0,000	Min RO_X = 2,42kNm - G1+G2
1,000	Max R_Z = 14,50kN - G1+G2
1,000	Min R_Z = 14,50kN - G1+G2
1,000	Max RO_X = -2,42kNm - G1+G2
1,000	Min RO_X = -2,42kNm - G1+G2

Reactions extremes characteristic (SLS)	
x [m]	**Reaction**
0,000	Max R_Z = 14,50kN - G1+G2
0,000	Min R_Z = 14,50kN - G1+G2
0,000	Max RO_X = 2,42kNm - G1+G2
0,000	Min RO_X = 2,42kNm - G1+G2
1,000	Max R_Z = 14,50kN - G1+G2
1,000	Min R_Z = 14,50kN - G1+G2

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Reactions extremes characteristic (SLS)	
x [m]	Reaction
1,000	Max RO_x = -2,42kNm - G1+G2
1,000	Min RO_x = -2,42kNm - G1+G2

Longitudinal reinf.

Bar type	Beginning [m]	End [m]	Cover [mm]	Profile [mm]	Count
Upper	0,000	1,000	40,0	16	5
Bottom	0,000	1,000	40,0	16	5

Reinforcement in compression not considered.

Shear reinf.

Sector no.: 1, (0,00m - 1,00m)
Ties, inner stirrups
Profile: 10 mm; Distance: 250,0 mm; Legs: 4

Minimum cover

Structural class: S4
c_{min} = max($c_{min,b}$; $c_{min,dur}$; 10) = max(0; 10; 10) = 10 mm
c_{nom} = c_{min} + Δc_{dev} + $\varnothing_s$ = 10 + 10 + 0 = 20 mm

1.2 Check of ultimate limit state

Ultimate limit state is checked for envelope of extreme loads

Bent-up bar

Reinforcement in compression not considered; moment reduction - no; shear effect not considered

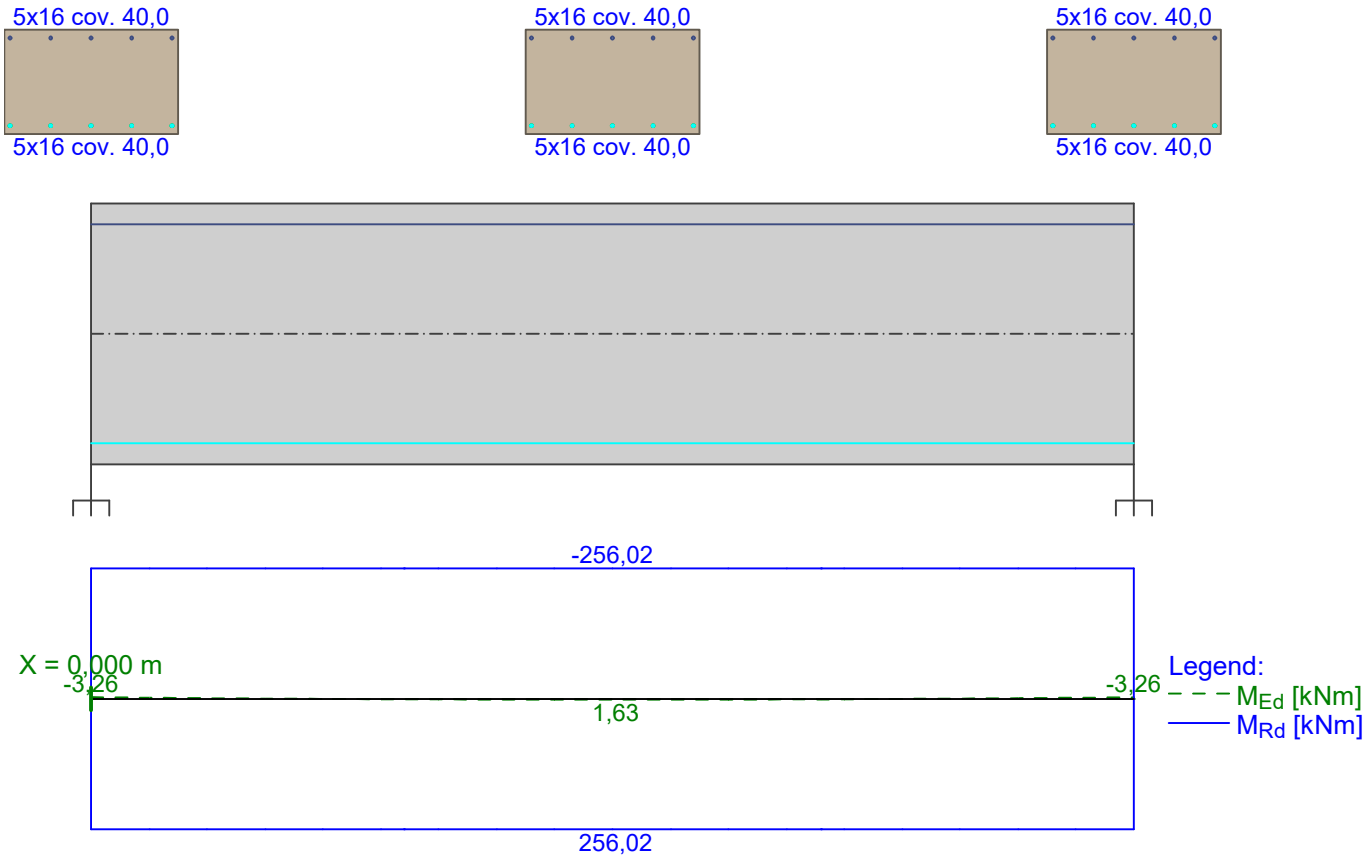
Check of min and max reinforcement level

Beam (reinforcement in tension - min, total reinforcement - max):
$\rho_{s,t}$ = 0,00182 $\geq$ $\rho_{s,min}$ = 0,00151 $\Rightarrow$ **Pass**
ρ_s = 0,00335 $\leq$ $\rho_{s,max}$ = 0,04 $\Rightarrow$ **Pass**

Critical cut at point x = 0,000m
M_{Ed} = -3,26kNm $\leq$ M_{Rd} = -256,02kNm $\Rightarrow$ Pass

Member bending PASS

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Shear

Member type: beam
Critical cut at point x = 0,000m

Shear reinforcement ratio

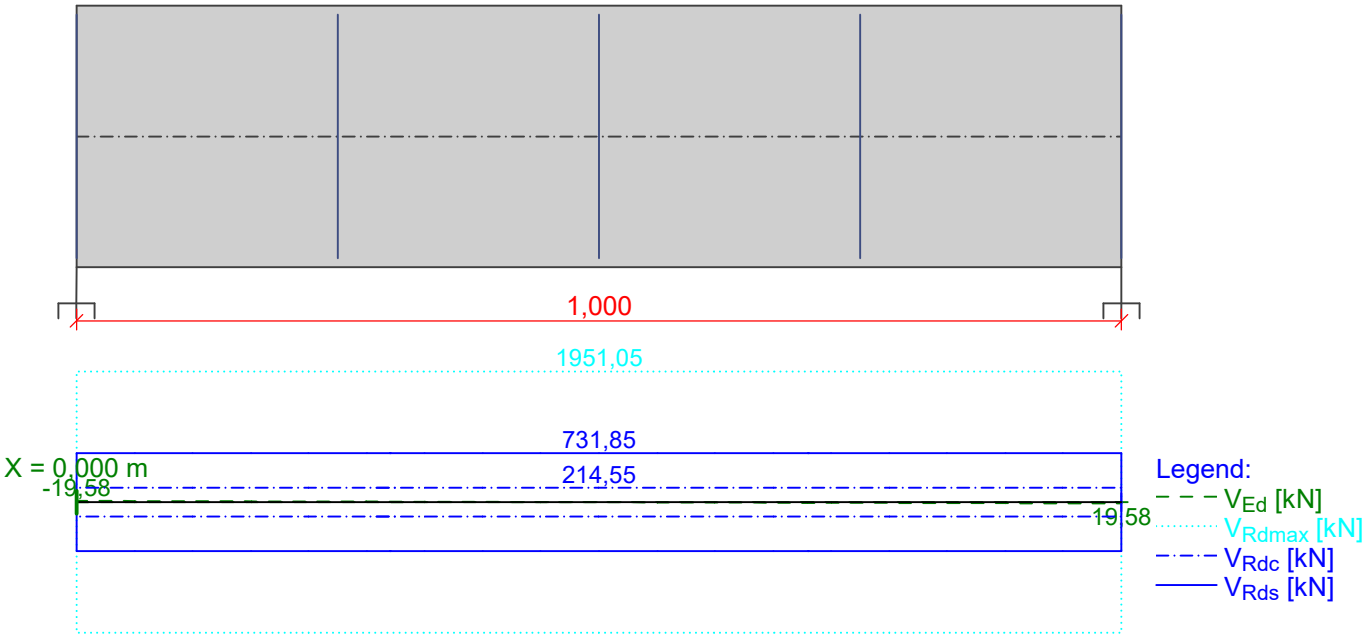
$\rho_{w,min} = 0{,}000876 \leq \rho_w = 0{,}00126 \Rightarrow$ **Pass**
Max stirrup spacing $s_{l,max} = 414{,}0$ mm $\geq 250{,}0$ mm $\Rightarrow$ **Pass**
Max stirrup legs spacing $s_{t,max} = 414{,}0$ mm $\geq 312{,}7$ mm $\Rightarrow$ **Pass**

$V_{Ed} = 19{,}58\text{kN} \leq V_{Rd} = 731{,}85\text{kN} \Rightarrow$ Pass
Member shear PASS

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Ties, inner stirrups: 4x10mm
pc: 4; 0,250m



Anchorage

End adjustment of bars - Straight bar

Type	profile	Beginning		End		Eff. length	Total length
		σ_{sd}	l_{bd}	σ_{sd}	l_{bd}		
	[mm]	[MPa]	[m]	[MPa]	[m]	[m]	[m]
Upper	16	434,78	0,642	434,78	0,642	1,000	2,284
Bottom	16	10,54	0,160	10,35	0,160	0,400	0,720

Ultimate limit state PASS

1.3 Check of serviceability limit state

Deflection

Serviceability limit state (deflection control) is checked for all characteristic loads

Start of drying: t_s = 7 [days]
End of drying: t = 29200 [days]
Start of loading: t_0 = 28 [days]
End of loading: t = 29200 [days]

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Legend:

Stress

Serviceability limit state (stress restriction) is checked for all characteristic loads

Maximum compressive stress in concrete:

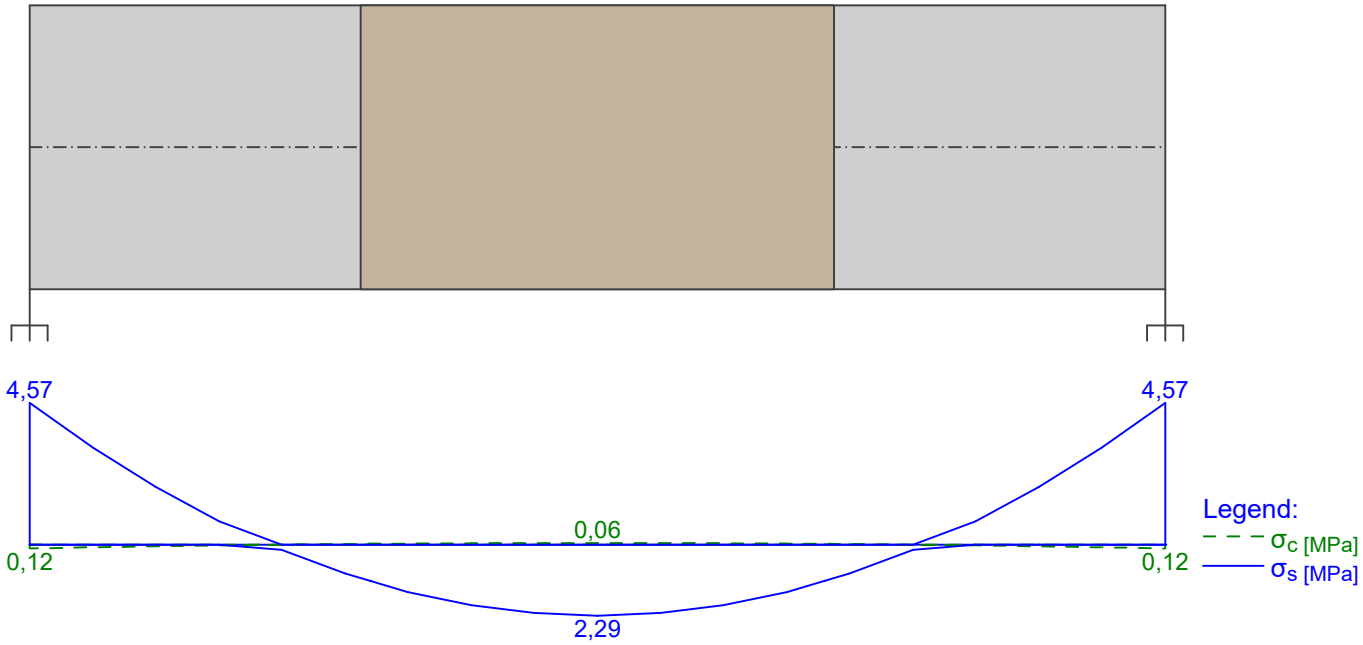
$\sigma_c = 0{,}1\text{MPa} < k_1 \times f_{ck} = 18{,}0\text{MPa} \Rightarrow$ Value for environment XD, XF, XS fulfilled

$\sigma_c = 0{,}1\text{MPa} < k_2 \times f_{ck} = 13{,}5\text{MPa} \Rightarrow$ Linear creep

Maximum tensile stress in reinforcement:

$\sigma_s = 4{,}6\text{MPa} < k_3 \times f_{yk} = 400{,}0\text{MPa} \Rightarrow$ Neither unacceptable cracks nor deformations will occur

Stress on member PASS



Serviceability limit state PASS

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