

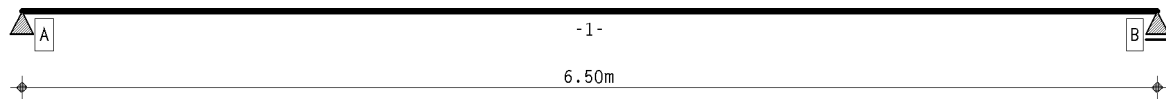
1. Options for Calculations

calculation DIN EN 1995:2010, Germany

service class 2

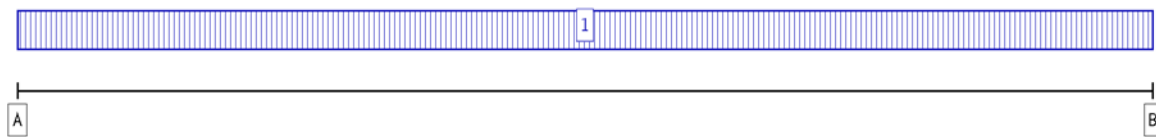
coefficient of thermal expansion for timber $\alpha_t = 0.500 \cdot 10^{-5}/^{\circ}\text{K}$

2. Structural system

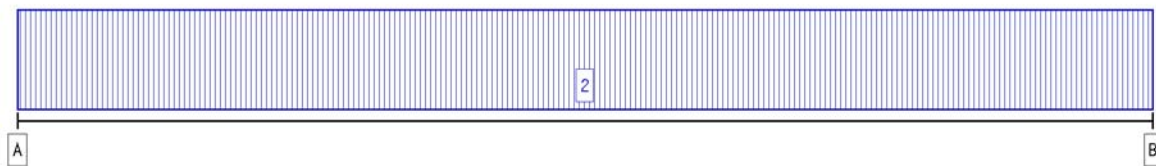


main beam

3. Loading



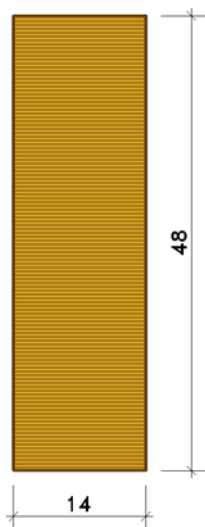
action effect 1: permanent loads (permanent, 1 load cases)



action effect 2: live loads (1) (transient, 1 load cases)

4. main beam

section scale 1: 8



timber grade web glue lam. timber DIN, GL32c (BS16)

char. bend. strength $f_{m,k}$: 32.7 N/mm² with $k_h = 1.023$

char. shear strength $f_{v,k}$: 3.5 N/mm²

char. ten. strength $f_{t,k}$: 19.5 N/mm²

char. compr. strength $f_{c,0,k}$: 26.5 N/mm²

char. compr. strength $f_{c,90,k}$: 3.0 N/mm²

k_{cr} : 0.71 mm²/N

modulus of elasticity $E_{0,mean}$: 13700 N/mm²

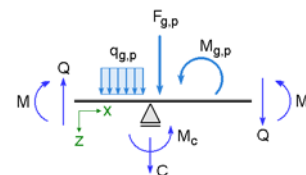
Dichte ρ_k/ρ_m : 410 / 492 kg/m³

deformation factor k_{def} : 0.60 -

area A_{flange} : 672.000 cm²

moment of inertia I_{flange} : 129024.000 cm⁴

definition of internal forces and moments:



5. Beam sections

beam sections

section	x_A m	x_E m	l m	l_v m	cantil.	s_{ef} mm
1	0.00	6.50	6.50	6.50	-	0.0

6. Supports

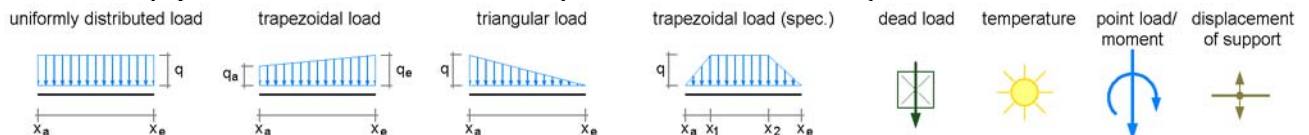
coordinates of supports

supp.name	x m	width mm	depth mm	c_F kN/m	c_M kNm/-	restraint (F) (M)	
A	0.00	150	140	fix	----	X	-
B	6.50	150	140	fix	----	X	-

7. Action effects

Attention! Acc. to DIN EN 1995-1-1, annex B.1

mechanically jointed cross-sections are only allowed to be loaded by line loads



Permanent action effect: permanent loads

1. additive load case: dead load (1)

→ unif.distr.load: $q = 4.00$ kN/m from $x_a = 0.00$ m to $x_e = 6.50$ m

2. **Transient action effect: live loads (1)**

2. additive load case: live loads (1/1)

→ unif.distr.load: $q = 8.00$ kN/m from $x_a = 0.00$ m to $x_e = 6.50$ m

8. verifications

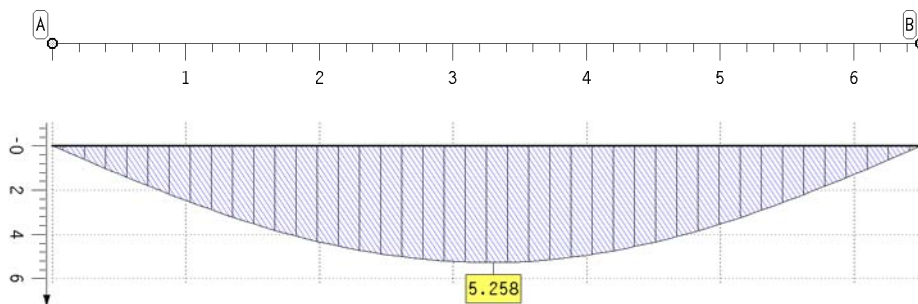
1: EC 5 load-carrying capacity

verification of bearing stress DIN EN 1995, 6.1.5 will be executed
Extreme rule 1

9. Results of action effects

9.1. Action effect 1: permanent loads

extremal deflections of main beam (characteristic)

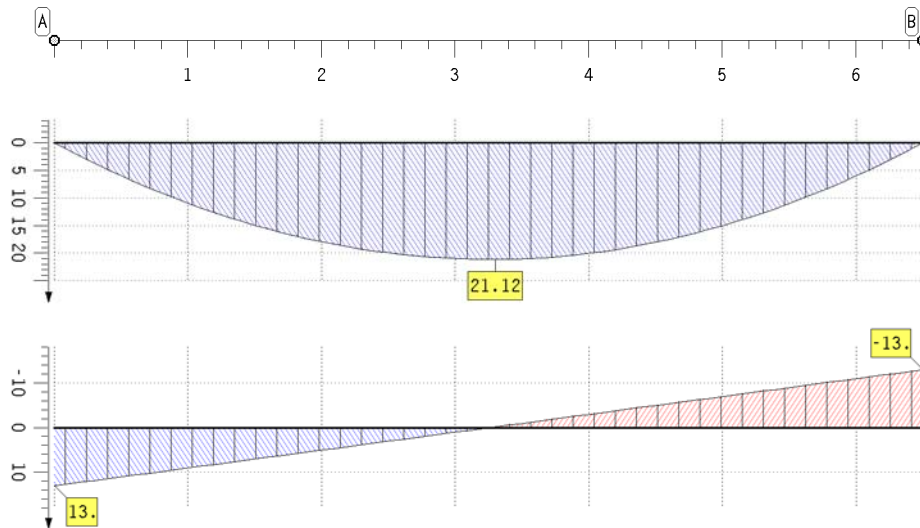


deflection
main beam
characteristic
 w in mm
Min: 0.00
Max: 5.26

extremal deflections of main beam (characteristic)

point	x m	min w mm	max w mm	point	x m	min w mm	max w mm
A	0.000	0.00	0.00	B	6.500	0.00	0.00
	1.800	4.05	4.05	minimum		0.00	0.00
	3.200	5.26	5.26	maximum		5.26	5.26
	4.700	4.05	4.05				

extremal internal forces



extremal internal forces

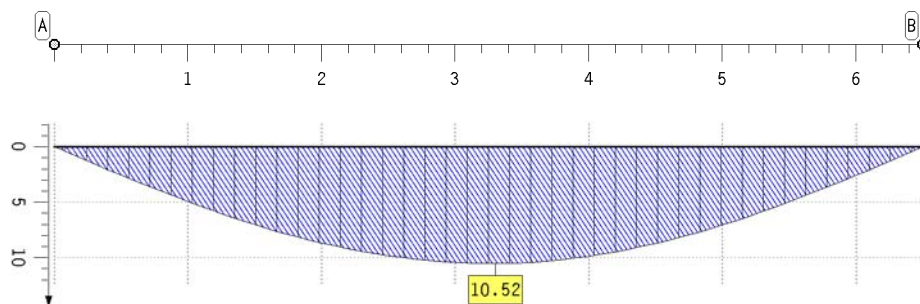
point	x	min M	max M	min V	max V	point	x	min M	max M	min V	max V
-	m	kNm	kNm	kN	kN	-	m	kNm	kNm	kN	kN
A	0.000	-0.00	-0.00	13.00	13.00	B	6.500	0.00	0.00	-13.00	-13.00
	1.600	15.68	15.68	6.60	6.60	minimum		-0.00	-0.00	-13.00	-13.00
	3.200	21.12	21.12	0.20	0.20	maximum		21.12	21.12	13.00	13.00
	4.900	15.68	15.68	-6.60	-6.60						

extremal support forces

point	x	min AP	max AP
-	m	kN	kN
A	0.000	-13.00	-13.00
B	6.500	-13.00	-13.00

9.2. Action effect 2: live loads (1)

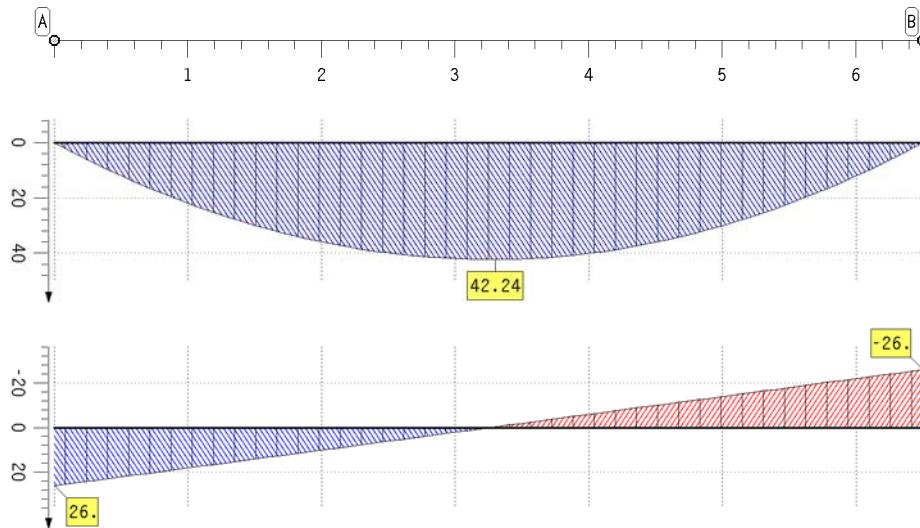
extremal deflections of main beam (characteristic)



extremal deflections of main beam (characteristic)

point	x	min w	max w	point	x	min w	max w
-	m	mm	mm	-	m	mm	mm
A	0.000	0.00	0.00	B	6.500	0.00	0.00
	1.800	0.00	8.09	minimum		0.00	0.00
	3.200	0.00	10.52	maximum		0.00	10.52
	4.700	0.00	8.09				

extremal internal forces



extremal internal forces

point	x m	min M kNm	max M kNm	min V kN	max V kN	point	x m	min M kNm	max M kNm	min V kN	max V kN
A	0.000	-0.00	-0.00	0.00	26.00	B	6.500	0.00	0.00	-26.00	-0.00
	1.600	0.00	31.36	0.00	13.20	minimum		-0.00	-0.00	-26.00	-0.00
	3.200	0.00	42.24	0.00	0.40	maximum		0.00	42.24	0.00	26.00
	4.900	0.00	31.36	-13.20	-0.00						

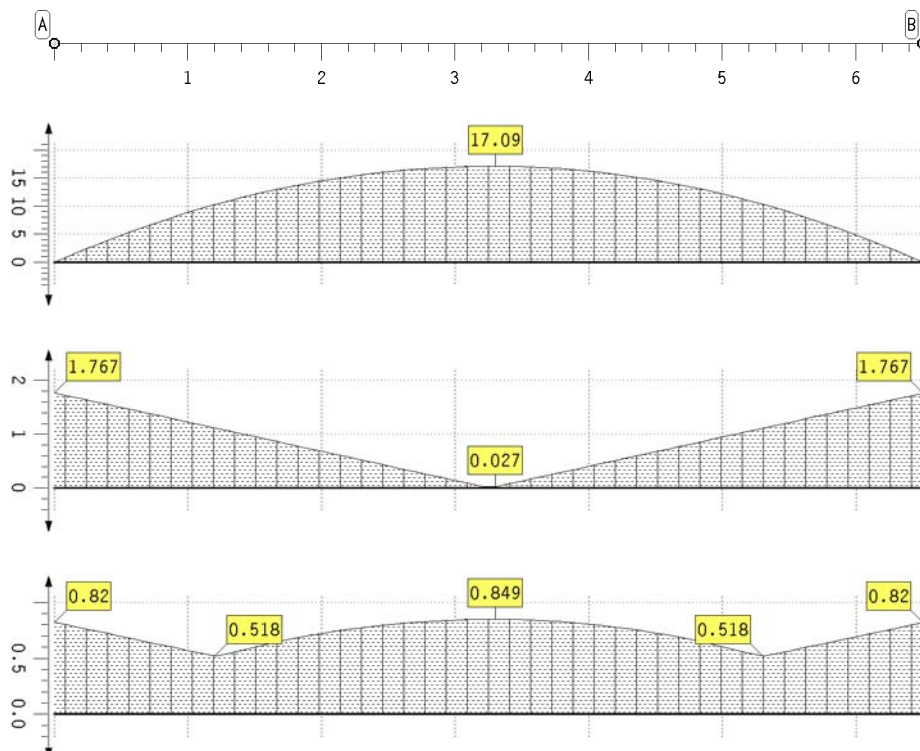
extremal support forces

point	x m	min AP kN	max AP kN
A	0.000	-26.00	-0.00
B	6.500	-26.00	-0.00

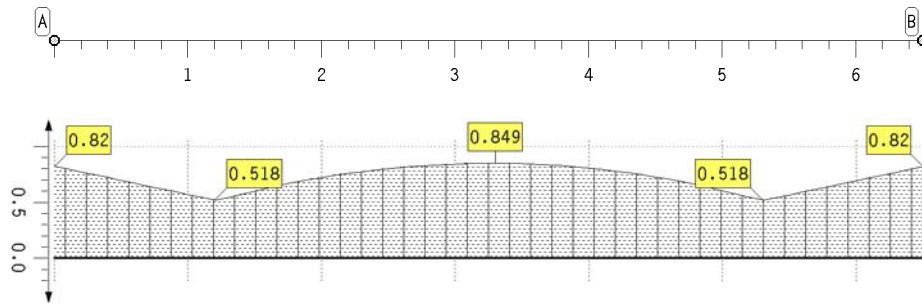
10. Results of verification of ultimate limit state

10.1. Verification of ultimate limit state

results of verification of ultimate limit state



results of verification of ultimate limit state



maximal utilization
Max: 0.85

maximal utilization

point	x	U	point	x	U	point	x	U
-	m	-	-	m	-	-	m	-
A	0.000	0.820	3.200	0.849	B	6.500	0.820	
	1.200	0.518	4.200	0.776	minimum		0.518	
	2.200	0.760	5.300	0.518	maximum		0.849	

extremal support forces

point	x	min AP	max AP
-	m	kN	kN
A	0.000	-56.55	-13.00
B	6.500	-56.55	-13.00

verification of bearing stress

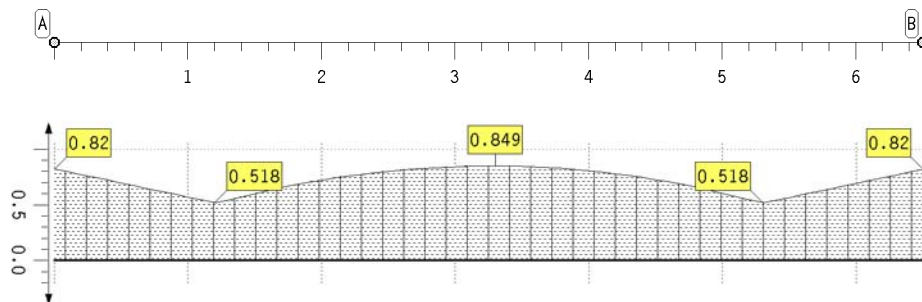
support	l_{ef}	A_{ef}	A_P	k_{c90}	k_{mod}	f_{c90d}	σ_{c90d}	u
	mm	mm ²	N			N/mm ²	N/mm ²	-
A	180	25200	56550	1.00	0.80	1.85	2.24	1.22
B	180	25200	56550	1.00	0.80	1.85	2.24	1.22

verification of bearing stresses für den main beam(u = 1.216) does not meet the requirements!

11. Summary

11.1. Summary of all verifications

maximal utilization



utilization
Max: 0.85

maximal utilization

point	x	U	point	x	U	point	x	U
-	m	-	-	m	-	-	m	-
A	0.000	0.820		3.200	0.849	B	6.500	0.820
	1.200	0.518		4.200	0.776	minimum		0.518
	2.200	0.760		5.300	0.518	maximum		0.849

verification of bearing stress

support	l_{ef}	A_{ef}	A_P	k_{c90}	k_{mod}	f_{c90d}	σ_{c90d}	u
	mm	mm ²	N			N/mm ²	N/mm ²	-
A	180	25200	56550	1.00	0.80	1.85	2.24	1.22
B	180	25200	56550	1.00	0.80	1.85	2.24	1.22

verification of bearing stresses für den main beam(u = 1.216) does not meet the requirements!

12. Utilizations of all verifications

verification of load-carrying capacity ($u = 1.216$) does not meet the requirements!

13. Detailed verification piont

13.1. Verification of load-carrying capacity at $x = 0.00$ m

internal forces and moments

state	M kNm	V kN
start,min	-0.00	13.00
start,max	-0.00	56.55
end,min	-0.00	13.00
end,max	-0.00	56.55

stresses and utilization

state	k_{mod} -	σ_m N/mm ²	σ_c N/mm ²	u_σ -	τ N/mm ²	u_τ -	u_2 -
start	0.8	0.00	0.00	0.00	1.77	0.82	0.82
end	0.8	0.00	0.00	0.00	1.77	0.82	0.82

resulting utilization at verification point $u_{res} = 0.820$