POSITION 44: PBS DOWEL CIRCLE

1. Input parameters

2. General statements

double shear plane connection, exact verification acc. to DIN EN 1995, 8.2.2
crossing angle δ = 105.0 °

3. materials

3.1. outer timber members

NKL 1, glue laminated timber DIN GL28c (BS14), ρ_k = 380 kg/m³, t/b = 100.0/1000.0 mm
angle between force and the grain direction α = -15.0 °
bar on one side left with overhang $ü_{right}$ = 620.0mm (measured from the node)

3.2. central timber member

NKL 1, glue laminated timber DIN GL28c (BS14), ρ_k = 380 kg/m³, t/b = 200.0/1000.0 mm
bar on one side right with overhang $ü_{left}$ = 750.0mm (measured from the node)

4. fasteners Kreis 1

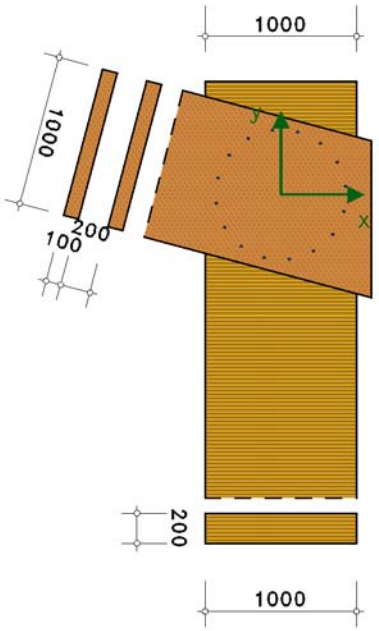
dowel 20 mm, S235 (1052)

4.1. load combinations (design internal forces)

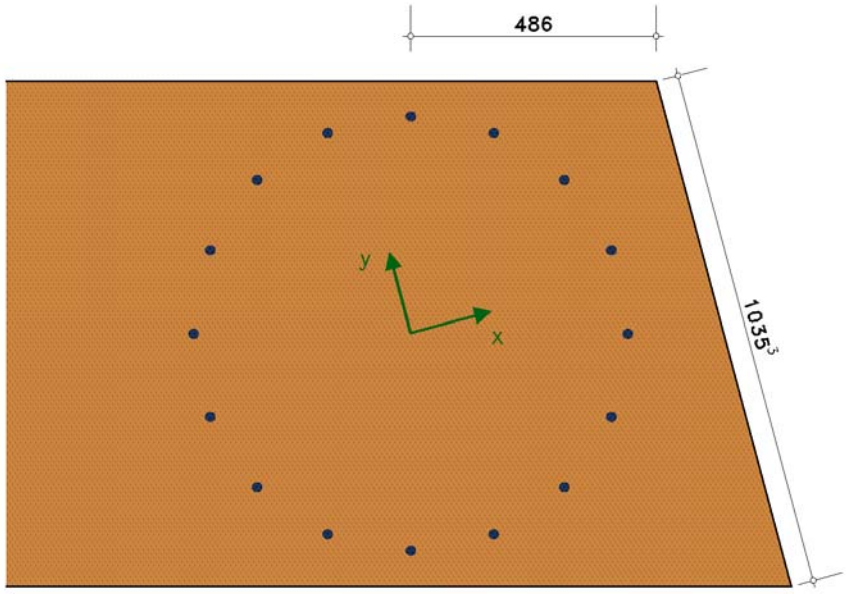
4.1.1. load, KLED: short-term

Nr	bar	N_d kN	M_d kNm	V_d kN	k_{mod} -	γ -
1	outer t.memb. left	-47.690	95.000	-23.450	0.900	1.30
2	ctr. t.mem. right	-35.000	-95.000	40.000	0.900	1.30
3	ΣH, ΣM, ΣV	0.006	0.000	-0.004	---	---

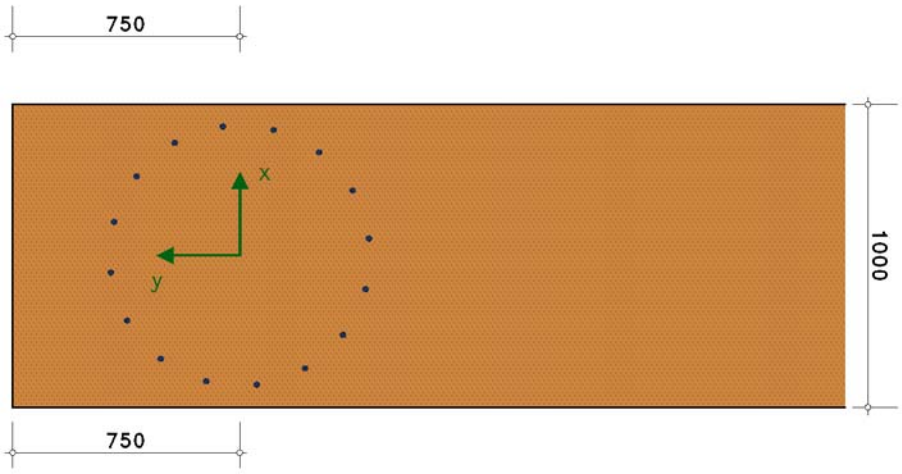
5. view



6. view outer timber members



7. view central timber member



8. Results only decisive load case combination

8.1. Results fasteners

8.2. fasteners

8.2.1. load

N_d = -34.994 kN, V_d = 39.996 kN, $M_{v,d}$ = 95.000 KNm

forces per connection centre point, case = decisive failure case acc. to DIN EN 1995-1-1, 8.2.2

Nr	F_{Mi} kN	F_{MHi} kN	F_{MVi} kN	F_{totHi} kN	F_{totVi} kN	F_{toti} kN	α_{toti} °	$f_{h,\alpha,k}$ N/mm²	case	$F_{v,Rd}$ kN	$U_{n,ef}$ -	$U_{F,v}$ -
1	13.808	6.904	11.958	4.717	14.458	15.208	71.9	24.88	Gl.(k)	25.6476	0.59	0.59
2	13.808	10.955	8.406	8.768	10.906	13.993	51.2	22.54	Gl.(k)	24.4122	0.53	0.57
3	13.808	13.338	3.574	11.151	6.074	12.697	28.6	18.59	Gl.(j)	21.6243	0.52	0.59
4	13.808	13.690	-1.802	11.503	0.697	11.524	3.5	15.73	Gl.(j)	18.8255	0.61	0.61
5	13.808	11.958	-6.904	9.771	-4.404	10.718	-24.3	15.26	Gl.(j)	18.3680	0.53	0.58
6	13.808	8.406	-10.955	6.219	-8.455	10.496	-53.7	17.85	Gl.(j)	20.9061	0.47	0.50
7	13.808	3.574	-13.338	1.387	-10.838	10.926	-82.7	22.80	Gl.(k)	24.5492	0.44	0.45
8	13.808	-1.802	-13.690	-3.989	-11.190	11.880	-109.6	24.82	Gl.(k)	25.6175	0.46	0.46
9	13.808	-6.904	-11.958	-9.091	-9.458	13.119	-133.9	21.65	Gl.(k)	23.9234	0.48	0.55
10	13.808	-10.955	-8.406	-13.142	-5.906	14.408	-155.8	17.93	Gl.(j)	20.9807	0.63	0.69
11	13.808	-13.338	-3.574	-15.525	-1.074	15.562	-176.0	15.76	Gl.(j)	18.8583	0.82	0.83
12	13.808	-13.690	1.802	-15.877	4.302	16.450	164.8	15.11	Gl.(j)	18.2151	0.87	0.90
13	13.808	-11.958	6.904	-14.145	9.404	16.986	146.4	15.74	Gl.(j)	18.8353	0.75	0.90

Nr	F_{Mi} kN	F_{MHi} kN	F_{MVi} kN	F_{totHi} kN	F_{totVi} kN	F_{toti} kN	α_{toti} °	$f_{h,\alpha,k}$ N/mm²	case	$F_{v,Rd}$ kN	$U_{n,ef}$ -	$U_{F,v}$ -
14	13.808	-8.406	10.955	-10.593	13.454	17.124	128.2	17.59	Gl.(j)	20.6517	0.76	0.83
15	13.808	-3.574	13.338	-5.761	15.837	16.853	110.0	20.54	Gl.(k)	23.3019	0.72	0.72
16	13.808	1.802	13.690	-0.385	16.190	16.194	91.4	23.71	Gl.(k)	25.0340	0.63	0.65

maximum utilisation of the fasteners $U_{max} = 0.90 \leq 1$ => **verification fulfilled**

8.3. results bars

8.3.1. outer timber member mit A_n = 192000 mm², W_n = 31853545 mm³, I_n = 15926772667 mm⁴, k_h = 1.000

load	$f_{m,d}$ N/mm²	$f_{t,d}$ N/mm²	$f_{c,d}$ N/mm²	$f_{v,d}$ N/mm²	N_d kN	M_d kNm	$\sigma_{0,d}$ N/mm²	$\sigma_{mo,d}$ N/mm²	$\sigma_{mu,d}$ N/mm²	V_d kN	τ_d N/mm²	U_σ -	U_τ -
1	19.38	11.42	16.62	2.42	-47.690	95.000	-0.25	2.98	2.98	58.599	0.80	0.15	0.33

maximum utilisation of the bar $U_{max} = 0.33 \leq 1$ => **verification fulfilled**

8.3.2. central timber member mit A_n = 192000 mm², W_n = 33207949 mm³, I_n = 16603974625 mm⁴, k_h = 1.000

load	$f_{m,d}$ N/mm²	$f_{t,d}$ N/mm²	$f_{c,d}$ N/mm²	$f_{v,d}$ N/mm²	N_d kN	M_d kNm	$\sigma_{0,d}$ N/mm²	$\sigma_{mo,d}$ N/mm²	$\sigma_{mu,d}$ N/mm²	V_d kN	τ_d N/mm²	U_σ -	U_τ -
1	19.38	11.42	16.62	2.42	-35.000	-95.000	-0.18	-2.86	-2.86	50.324	0.69	0.15	0.28

maximum utilisation of the bar $U_{max} = 0.28 \leq 1$ => **verification fulfilled**