

POSITION 55: RAUTENSTRAUCH S. 369 ECKE (NEU)

1. Input parameters

2. General statements

double shear plane connection, exact verification acc. to DIN EN 1995, 8.2.2
crossing angle $\delta = 104.0^\circ$

3. materials

3.1. outer timber members

NKL 1, glue laminated timber DIN GL24h (BS11), $\rho_k = 380 \text{ kg/m}^3$, $t/b = 120.0/1100.0 \text{ mm}$
angle between force and the grain direction $\alpha = -14.0^\circ$
bar on one side left with overhang $\bar{u}_{\text{right}} = 825.0 \text{ mm}$ (measured from the node)

3.2. central timber member

NKL 1, glue laminated timber DIN GL24h (BS11), $\rho_k = 380 \text{ kg/m}^3$, $t/b = 200.0/1100.0 \text{ mm}$
bar on one side right with overhang $\bar{u}_{\text{left}} = 825.0 \text{ mm}$ (measured from the node)

4. fasteners Kreis 1

dowel 20 mm, S235 (1052)

5. fasteners Kreis 2

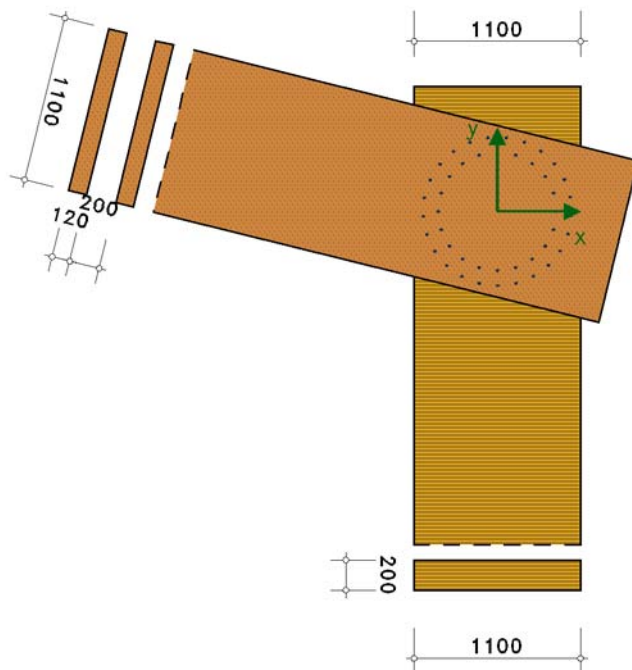
dowel 20 mm, S235 (1052)

5.1. load combinations (design internal forces)

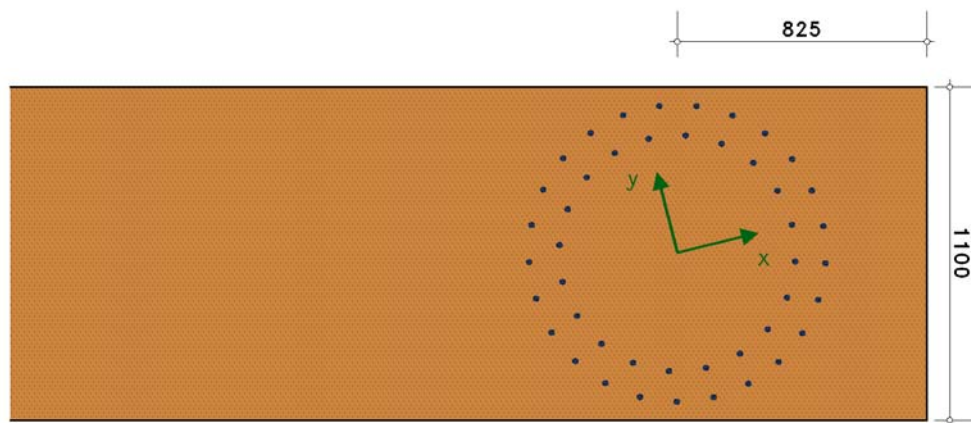
5.1.1. load, KLED: short-term

Nr	bar	N_d kN	M_d kNm	V_d kN	k_{mod} -	γ -
1	outer t.memb. left	-138.000	275.000	-94.500	0.900	1.30
2	ctr. t.mem. right	-125.100	-275.000	111.100	0.900	1.30
3	$\Sigma H, \Sigma M, \Sigma V$	0.022	0.000	-0.061	---	---

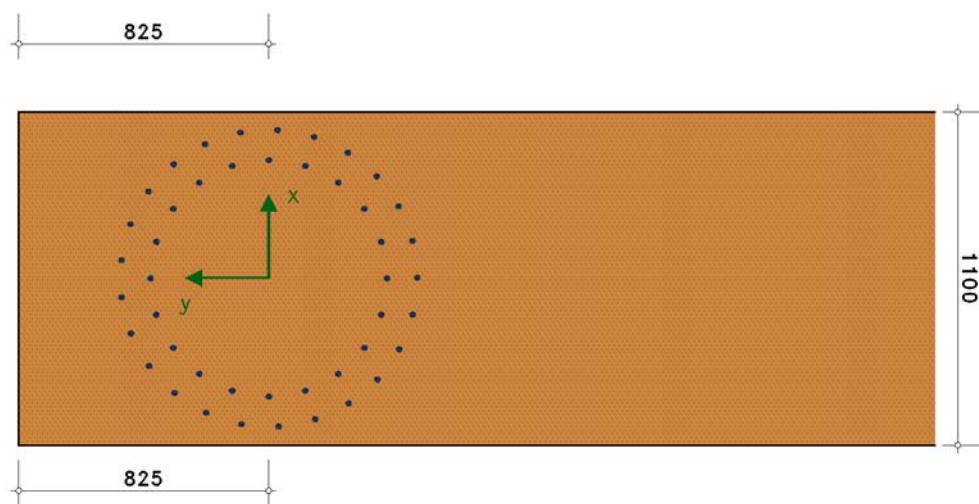
6. view



7. view outer timber members



8. view central timber member



9. Results only decisive load case combination

9.1. Results fasteners

9.2. fasteners

9.2.1. load

$N_d = -125.078$ kN, $V_d = 111.039$ kN, $M_{v,d} = 275.000$ 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_{MV_i} kN	F_{totHi} kN	F_{totVi} kN	F_{toti} kN	α_{toti} °	$f_{h,\alpha,k}$ N/mm ²	case	$F_{v,Rd}$ kN	$U_{n,ef}$ -	$U_{F,v}$ -
1	14.899	2.843	14.625	0.063	17.092	17.092	89.8	24.04	G1.(k)	21.4288	0.77	0.80
2	14.899	6.391	13.458	3.611	15.926	16.330	77.2	24.92	G1.(k)	21.8176	0.86	0.75
3	14.899	9.537	11.446	6.757	13.914	15.468	64.1	24.26	G1.(k)	21.5252	0.84	0.72
4	14.899	12.084	8.715	9.304	11.183	14.547	50.2	22.20	G1.(k)	20.5931	0.64	0.71
5	14.899	13.871	5.436	11.092	7.904	13.620	35.5	19.56	G1.(k)	19.3288	0.61	0.70
6	14.899	14.788	1.816	12.008	4.283	12.749	19.6	17.18	G1.(k)	18.1173	0.66	0.70
7	14.899	14.774	-1.919	11.995	0.549	12.007	2.6	15.61	G1.(k)	17.2680	0.69	0.70
8	14.899	13.833	-5.533	11.054	-3.065	11.471	-15.5	15.11	G1.(k)	16.9898	0.65	0.68
9	14.899	12.023	-8.799	9.243	-6.332	11.204	-34.4	15.87	G1.(k)	17.4097	0.53	0.64
10	14.899	9.457	-11.513	6.677	-9.045	11.243	-53.6	17.98	G1.(k)	18.5329	0.56	0.61
11	14.899	6.296	-13.503	3.517	-11.035	11.582	-72.3	21.14	G1.(k)	20.0941	0.58	0.58
12	14.899	2.741	-14.644	-0.039	-12.177	12.177	-90.2	24.04	G1.(k)	21.4272	0.55	0.57
13	14.899	-0.987	-14.866	-3.767	-12.398	12.958	-106.9	24.89	G1.(k)	21.8027	0.59	0.59
14	14.899	-4.653	-14.153	-7.433	-11.686	13.849	-122.5	23.40	G1.(k)	21.1428	0.62	0.66
15	14.899	-8.027	-12.551	-10.806	-10.084	14.780	-137.0	20.90	G1.(k)	19.9811	0.64	0.74
16	14.899	-10.896	-10.161	-13.676	-7.693	15.691	-150.6	18.55	G1.(k)	18.8251	0.77	0.83
17	14.899	-13.081	-7.132	-15.860	-4.664	16.532	-163.6	16.80	G1.(k)	17.9144	0.90	0.92
18	14.899	-14.443	-3.655	-17.223	-1.187	17.264	-176.1	15.69	G1.(k)	17.3142	0.99	1.00

Nr	F _{Mi} kN	F _{MHi} kN	F _{MVi} kN	F _{totHi} kN	F _{totVi} kN	F _{toti} kN	α _{toti} °	f _{h,α,k} N/mm ²	case	F _{v,Rd} kN	U _{n,ef} -	U _{F,v} -
19	14.899	-14.898	0.052	-17.678	2.520	17.857	171.9	15.17	G1.(k)	17.0228	1.04	1.05
20	14.899	-14.417	3.755	-17.197	6.223	18.288	160.1	15.17	G1.(k)	17.0229	1.01	1.07
21	14.899	-13.031	7.223	-15.810	9.691	18.544	148.5	15.67	G1.(k)	17.2985	0.93	1.07
22	14.899	-10.825	10.237	-13.604	12.704	18.614	137.0	16.65	G1.(k)	17.8354	0.88	1.04
23	14.899	-7.939	12.607	-10.719	15.075	18.497	125.4	18.13	G1.(k)	18.6096	0.93	0.99
24	14.899	-4.554	14.185	-7.334	16.653	18.196	113.8	20.04	G1.(k)	19.5654	0.92	0.93
25	14.899	-0.884	14.872	-3.663	17.340	17.723	101.9	22.17	G1.(k)	20.5795	0.86	0.86
26	11.858	0.000	11.858	-2.780	14.326	14.593	101.0	22.34	G1.(k)	20.6563	0.71	0.71
27	11.858	3.664	11.278	0.885	13.745	13.774	86.3	24.42	G1.(k)	21.5968	0.63	0.64
28	11.858	6.970	9.593	4.190	12.061	12.768	70.8	24.80	G1.(k)	21.7637	0.59	0.59
29	11.858	9.593	6.970	6.814	9.438	11.640	54.2	22.87	G1.(k)	20.9018	0.55	0.56
30	11.858	11.278	3.664	8.498	6.132	10.479	35.8	19.62	G1.(k)	19.3578	0.46	0.54
31	11.858	11.858	0.000	9.079	2.468	9.408	15.2	16.67	G1.(k)	17.8449	0.51	0.53
32	11.858	11.278	-3.664	8.498	-1.197	8.582	-8.0	15.17	G1.(k)	17.0239	0.50	0.50
33	11.858	9.593	-6.970	6.814	-4.502	8.167	-33.5	15.80	G1.(k)	17.3713	0.40	0.47
34	11.858	6.970	-9.593	4.190	-7.126	8.267	-59.5	18.90	G1.(k)	19.0008	0.42	0.44
35	11.858	3.664	-11.278	0.885	-8.810	8.854	-84.3	23.21	G1.(k)	21.0545	0.42	0.42
36	11.858	0.000	-11.858	-2.780	-9.390	9.793	-106.5	24.90	G1.(k)	21.8074	0.45	0.45
37	11.858	-3.664	-11.278	-6.444	-8.810	10.915	-126.2	22.81	G1.(k)	20.8751	0.48	0.52
38	11.858	-6.970	-9.593	-9.749	-7.126	12.076	-143.8	19.68	G1.(k)	19.3877	0.53	0.62
39	11.858	-9.593	-6.970	-12.373	-4.502	13.167	-160.0	17.23	G1.(k)	18.1413	0.69	0.73
40	11.858	-11.278	-3.664	-14.057	-1.197	14.108	-175.1	15.76	G1.(k)	17.3485	0.81	0.81
41	11.858	-11.858	-0.000	-14.638	2.468	14.844	170.4	15.14	G1.(k)	17.0075	0.86	0.87
42	11.858	-11.278	3.664	-14.057	6.132	15.336	156.4	15.27	G1.(k)	17.0807	0.82	0.90
43	11.858	-9.593	6.970	-12.373	9.438	15.561	142.7	16.10	G1.(k)	17.5381	0.71	0.89
44	11.858	-6.970	9.593	-9.749	12.061	15.509	129.0	17.63	G1.(k)	18.3501	0.77	0.85
45	11.858	-3.664	11.278	-6.444	13.745	15.181	115.1	19.80	G1.(k)	19.4493	0.77	0.78

maximum utilisation of the fasteners $U_{\max} = 1.07 > 1 \Rightarrow$ verification not fulfilled

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9.3. results bars

9.3.1. outer timber member mit $A_n = 244800 \text{ mm}^2$, $W_n = 47274869 \text{ mm}^3$, $I_n = 26001177782 \text{ mm}^4$, $k_h = 1.000$

load	f _{m,d} N/mm ²	f _{t,d} N/mm ²	f _{c,d} N/mm ²	f _{v,d} N/mm ²	N _d kN	M _d kNm	σ _{0,d} N/mm ²	σ _{mo,d} N/mm ²	σ _{mu,d} N/mm ²	V _d kN	τ _d N/mm ²	U _σ -	U _τ -
1	16.62	11.42	16.62	2.42	-138.000	275.000	-0.56	5.82	5.82	146.800	1.57	0.35	0.65

maximum utilisation of the bar $U_{\max} = 0.65 \leq 1 \Rightarrow$ verification fulfilled

9.3.2. central timber member mit $A_n = 200000 \text{ mm}^2$, $W_n = 38911365 \text{ mm}^3$, $I_n = 21401250787 \text{ mm}^4$, $k_h = 1.000$

load	f _{m,d} N/mm ²	f _{t,d} N/mm ²	f _{c,d} N/mm ²	f _{v,d} N/mm ²	N _d kN	M _d kNm	σ _{0,d} N/mm ²	σ _{mo,d} N/mm ²	σ _{mu,d} N/mm ²	V _d kN	τ _d N/mm ²	U _σ -	U _τ -
1	16.62	11.42	16.62	2.42	-125.100	-275.000	-0.63	-7.07	-7.07	138.500	1.82	0.43	0.75

maximum utilisation of the bar $U_{\max} = 0.75 \leq 1 \Rightarrow$ verification fulfilled