

POSITION 29: RAUTENSTRAUCH S. 316A

1. Input parameters

2. General statements

double shear plane connection, simplified verification acc. to NA.8.2.5
crossing angle $\delta = 180.0^\circ$

3. materials

3.1. steel plate

steel plate S235 (St37), $t = 3.0$ mm, steel plate acc. to NA 8.2.5(NA.1)
bar on one side left with overhang $\bar{u}_{\text{right}} = 190.0$ mm (measured from the node)

3.2. central timber member

NKL 1, solid coniferous timber C30, $\rho_k = 380$ kg/m³, $t/b = 120.0/160.0$ mm
bar on one side right with overhang $\bar{u}_{\text{left}} = 120.0$ mm (measured from the node)

4. fasteners

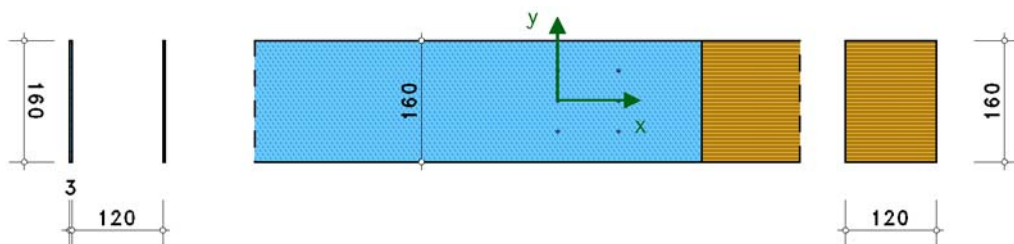
nail, 5.1×80.0 mm, $d_k = 10.0$ mm, not predrilled
double-sided arrangement

4.1. load combinations (design internal forces)

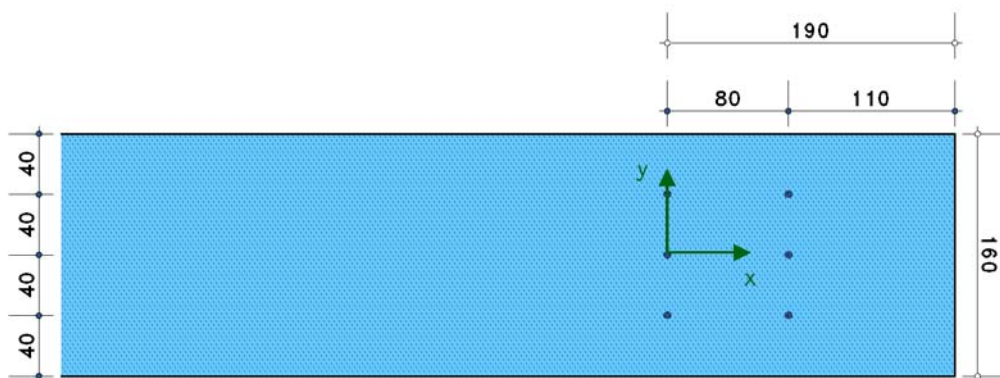
4.1.1. load, KLED: short-term

Nr	bar	N_d kN	M_d kNm	V_d kN	k_{mod} -	γ -
1	outer t.memb. left	15.530	0.000	0.000	0.900	1.30
2	ctr. t.mem. right	15.530	0.000	0.000	0.900	1.30
3	$\Sigma H, \Sigma M, \Sigma V$	0.000	0.000	0.000	---	---

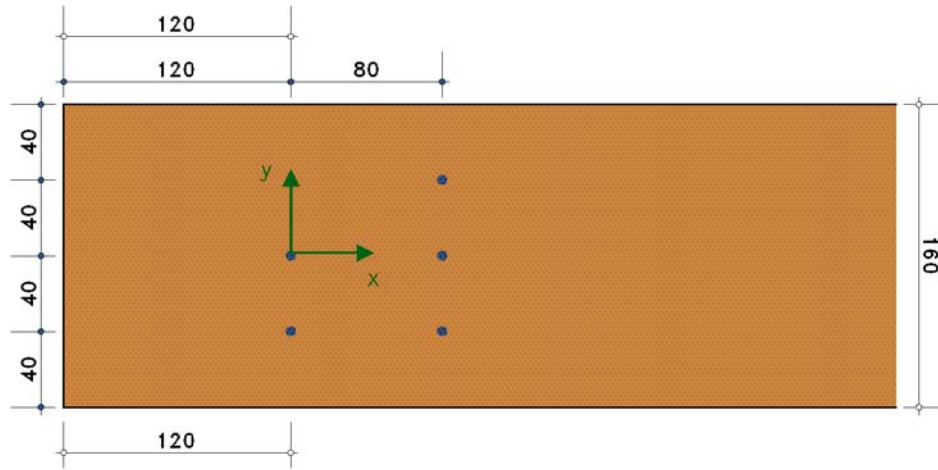
5. view



6. view side plates



7. view central timber member



8. Results only decisive load case combination

8.1. Results fasteners

8.2. fasteners

8.2.1. load

$N_d = 15.530 \text{ kN}$, $V_d = 0.000 \text{ kN}$, $M_{v,d} = 0.000 \text{ kNm}$

forces per connection centre point ($f_{red} = t_{vorh} / t_{req}$)

Nr	F_{M1} kN	F_{MH1} kN	F_{MV1} kN	F_{totH1} kN	F_{totV1} kN	F_{tot1} kN	α_{tot1} °	f_{red} -	$F_{v,Rd}$ kN	$U_{n,ef}$ -	$U_{F,v}$ -
1	0.000	0.000	-0.000	2.588	0.000	2.588	0.0	1.000	3.2743	0.79	0.79
2	0.000	0.000	-0.000	2.588	0.000	2.588	0.0	1.000	3.2743	0.79	0.79
3	0.000	-0.000	-0.000	2.588	0.000	2.588	0.0	1.000	3.2743	0.79	0.79
4	0.000	0.000	0.000	2.588	0.000	2.588	0.0	1.000	3.2743	0.79	0.79
5	0.000	0.000	0.000	2.588	0.000	2.588	0.0	1.000	3.2743	0.79	0.79
6	0.000	-0.000	0.000	2.588	0.000	2.588	0.0	1.000	3.2743	0.79	0.79

maximum utilisation of the fasteners $U_{max} = 0.79 \leq 1 \Rightarrow$ **verification fulfilled**

8.3. results bars

8.3.1. outer timber member mit $A_n = 960 \text{ mm}^2$, $W_n = 25600 \text{ mm}^3$, $I_n = 2048000 \text{ mm}^4$, $k_h = 0.000$

dimensioning as tension joint acc. to NCI NA.8.1.6 (NA.1) (red. of tensile load-bear. cap. by one third)

load	$f_{y,d}$ N/mm ²	$f_{v,d}$ N/mm ²	N_d kN	M_d kNm	$\sigma_{y,d}$ N/mm ²	V_d kN	$\tau_{v,d}$ N/mm ²	$\sigma_{sv,d}$ N/mm ²	$U_{\sigma sv}$ -	U_{σ} -	U_{τ} -
1	235.00	135.68	15.530	0.000	16.18	0.000	0.00	16.18	0.07	0.07	0.00

maximum utilisation of the bar $U_{max} = 0.07 \leq 1 \Rightarrow$ **verification fulfilled**

8.3.2. central timber member mit $A_n = 19200 \text{ mm}^2$, $W_n = 512000 \text{ mm}^3$, $I_n = 40960000 \text{ mm}^4$, $k_h = 1.000$

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	$\sigma_{0,d}$ N/mm ²	$\sigma_{mo,d}$ N/mm ²	$\sigma_{mu,d}$ N/mm ²	V_d kN	τ_d N/mm ²	U_{σ} -	U_{τ} -
1	20.77	5.26	16.62	2.77	15.530	0.000	0.81	0.00	0.00	0.000	0.00	0.15	0.00

maximum utilisation of the bar $U_{max} = 0.15 \leq 1 \Rightarrow$ **verification fulfilled**

8.4. Punched hole forces

$p_1 = 80 \text{ mm}$, $e_1 = 40 \text{ mm}$, $e_2 = 40 \text{ mm}$, $p_2 = 40.00 \text{ mm}$, $\alpha_b = 1.00$, $k_1 = 2.50 \Rightarrow F_{b,Rk} = 13.77 \text{ kN}$

$e_1 = 40 \text{ mm}$, $e_2 = 40 \text{ mm}$, $p_2 = 40 \text{ mm}$, $\alpha_b = 1.00$, $k_1 = 2.50 \Rightarrow F_{b,Rk,Rand} = 13.77 \text{ kN}$

8.4.1. load

Nr	F_{tot1} kN	$F_{v,Rd}$ kN	U -	Nr	F_{tot1} kN	$F_{v,Rd}$ kN	U -
1	1.29	11.02	0.12	4	1.29	11.02	0.12
2	1.29	11.02	0.12	5	1.29	11.02	0.12
3	1.29	11.02	0.12	6	1.29	11.02	0.12

maximum utilisation of the punched hole forces $U_{max} = 0.12 \leq 1 \Rightarrow$ **verification fulfilled**

8.5. verification of block shear failure acc. to DIN EN 1995-1-1, annex A

$L_{net,t} = 80 \text{ mm}$, $t_1 = 60 \text{ mm} \Rightarrow A_{net,t} = 4800 \text{ mm}^2$, $M_{y,k} = 12443.9 \text{ Nmm}$

$L_{net,v} = 400 \text{ mm}$, $t_{ef} = 60 \text{ mm} \Rightarrow A_{net,v} = 24000 \text{ mm}^2$ (failure mechanism c,f,j/l,k,m)

$L_{net,v} = 400 \text{ mm} \Rightarrow A_{net,v} = 24000 \text{ mm}^2 \Rightarrow F_{bs,Rk} = 136.80 \text{ kN}$

8.5.1. load

load	Nd kN	F _{bs,Rd} kN	U _{bs} -
1	7.765	94.708	0.08

maximum utilisation block shear failure $U_{max} = 0.08 \leq 1 \Rightarrow$ **verification fulfilled**