POSITION 5: EINSCHNITTIGES HALF LAP

1. Input parameters

1.1. Fasteners

dowel 8 mm, S235 (1052)
$F_{v,Rk}$ increased acc. to DIN EN 1995-1-1, 8.2.2(2)
$F_{v,Rd}$ calculated with the exact verification acc. to DIN EN 1995-1-1, 8.2.2
12 x dowel

1.2. design loads (splice in bending)

service class 2

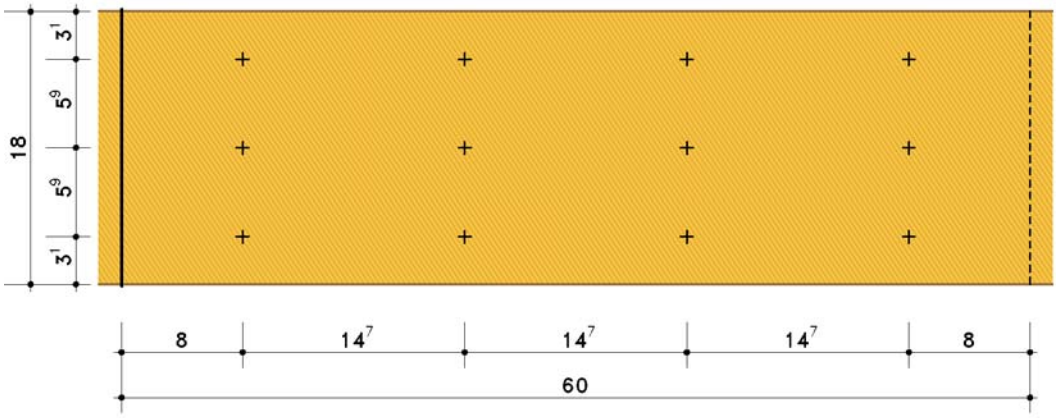
Nr	M_d kNm	N_d kN	V_d kN	k_{mod} -	A	comment
1	2.00	9.00	4.00	0.90		

2. System visualisation

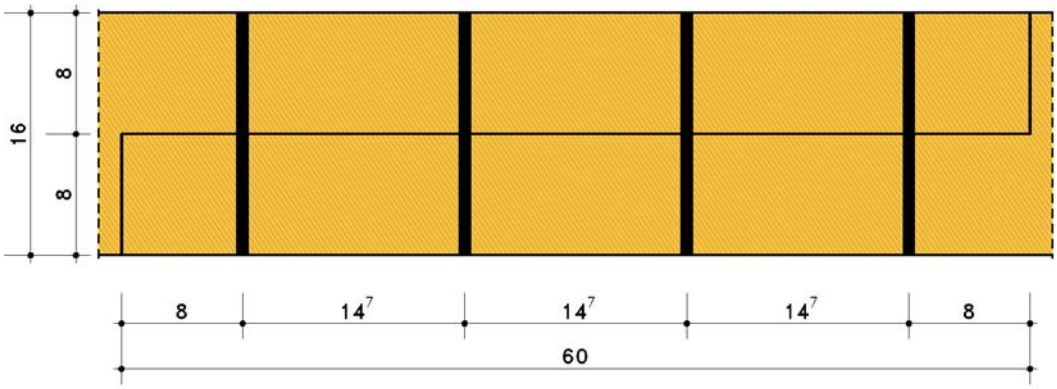
2.1. Static values and constructive boundary conditions

half lap splice
Important! secondary moments from splice asymmetry are not considered!
timber members from solid coniferous timber C24 with ρ_k = 350 kg/m³
timber: 16.0/18.0 cm, A_n = 124.80 cm², W_n = 383.14 cm³, I_n = 3448.28 cm⁴
min α = 4.5 ° => minimum spacings
a_1 = 4.0 cm, a_2 = 2.4 cm, $a_{3,t}$ = 8.0 cm, $a_{3,c}$ = 4.0 cm, $a_{4,t}$ = 2.4 cm, $a_{4,c}$ = 2.4 cm
$a_{1,exist}$ = 14.67 cm, $a_{2,exist}$ = 5.85 cm
polar moment of inertia I_p = 3500.68 cm²
centroid of fasteners S at x_s = 0.00 cm, y_s = 0.00 cm

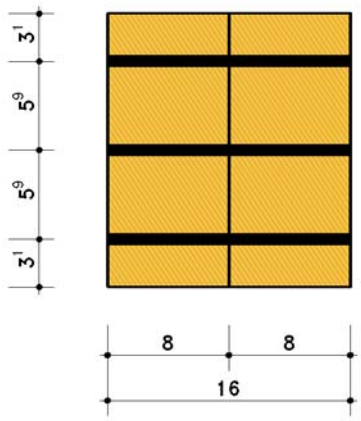
elevation scale 1: 5, unit of length [cm]



longitudinal section scale 1: 5, unit of length [cm]



cross section scale 1: 5, unit of length [cm]



3. verifications acc. to DIN EN 1995, Germany

γ_M = 1.30, γ_s = 1.00

3.1. Load combination 1

3.1.1. Strengths and design resistances

$f_{t,d}$ = 10.04 N/mm², $f_{m,d}$ = 16.62 N/mm², $f_{c,d}$ = 14.54 N/mm², $f_{v,d}$ = 2.77 N/mm²

3.1.2. Fasteners

N_d = 9.00 kN, V_d = 4.00 kN, $M_{v,d}$ = |2.00| + |0.00 x 4.00| = 2.00 KNm, k_{mod} = 0.90
$F_{Hi,d}$ = 9.00 / (1 x 12) = 0.75 kN
$F_{Vi,d}$ = 4.00 / (1 x 12) = 0.33 kN
α_{min} = 4.52, a_1 = 147 mm, n = 4 => n_{ef} = 3.81
forces per shear plane, mode = decisive failure mode 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	mode	$F_{v,Rk}$ kN	$F_{v,Rd}$ kN	u -
1	1.30	-0.33	-1.26	0.42	-0.92	1.01	65.77	18.98	Eq.(k)	3.1094	2.0478	0.49
2	1.26	0.00	-1.26	0.75	-0.92	1.19	50.92	20.58	Eq.(k)	3.2372	2.1319	0.56
3	1.30	0.33	-1.26	1.08	-0.92	1.42	40.42	22.05	Eq.(k)	3.3509	2.2068	0.65
4	0.54	-0.33	-0.42	0.42	-0.09	0.42	11.64	25.91	Eq.(k)	3.6325	2.3922	0.18
5	0.42	0.00	-0.42	0.75	-0.09	0.75	6.51	26.25	Eq.(k)	3.6561	2.4077	0.31
6	0.54	0.33	-0.42	1.08	-0.09	1.09	4.52	26.33	Eq.(k)	3.6618	2.4115	0.45
7	0.54	-0.33	0.42	0.42	0.75	0.86	61.08	19.41	Eq.(k)	3.1444	2.0708	0.42
8	0.42	0.00	0.42	0.75	0.75	1.06	45.09	21.37	Eq.(k)	3.2988	2.1725	0.49
9	0.54	0.33	0.42	1.08	0.75	1.32	34.75	22.91	Eq.(k)	3.4155	2.2493	0.59
10	1.30	-0.33	1.26	0.42	1.59	1.64	75.35	18.34	Eq.(k)	3.0560	2.0125	0.82
11	1.26	0.00	1.26	0.75	1.59	1.76	64.75	19.07	Eq.(k)	3.1166	2.0525	0.86
12	1.30	0.33	1.26	1.08	1.59	1.92	55.71	19.99	Eq.(k)	3.1908	2.1013	0.92

maximum utilization of fasteners u_{max} = 0.92 ≤ 1 => **verification successful**

3.1.3. timber members

timber lamellas : $\sigma_{t,d}$ = 0.72 N/mm², $\sigma_{m,d}$ = 5.22 N/mm², τ_d = 1.69 N/mm² (mit V_d = 7.03 kN) ⇒ u = 0.61
maximum utilization of timber lamellas u_{max} = 0.61 ≤ 1 ⇒ **verification successful**

4. Summary

maximum utilization of all verifications u_{max} = 0.92 ≤ 1 => **all verifications successful**