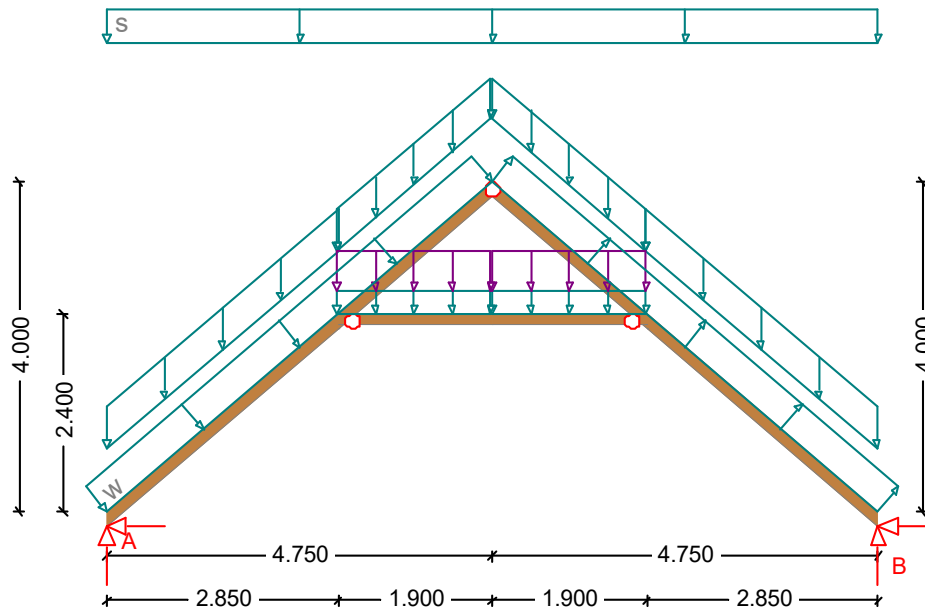


Collar Beam Roof



Design standard : DIN EN 1995-1
 Wood quality : C24
 Utilization class: 1
 Live load category: A

$E_{mean} / G_{mean} = 11000 / 690 \text{ N/mm}^2$, $\gamma_M = 1.30$
 $f_{m,k} / f_{c,k} / f_{c90,k} / f_{v,k} = 24.0 / 21.0 / 2.5 / 2.0 \text{ N/mm}^2$
 adm. Deflection $w_{inst} = L/300$, $w_{fin} = L/250$, $k_{def} = 0.60$

Factors:	gam.sup	gam.inf	psi.0	psi.1	psi.2
Permanent	1.35	1.00	1.00	1.00	1.00
Live load	1.50	0.00	0.70	0.50	0.30
Snow	1.50	0.00	0.50	0.20	0.00
Wind	1.50	0.00	0.60	0.20	0.00

Rafter left $b/h = 8 / 18 \text{ cm}$ Rafter right $b/h = 8 / 18 \text{ cm}$
 Collar beam $b/h = 6 / 14 \text{ cm}$ two-parts
 Rafter spacing $a = 80.0 \text{ cm}$ Roof inclination $le/re = 40.1 / 40.1^\circ$

Load

Permanent load $lu \ g1 = 1.04 \text{ kN/m}^2$ Df1 (x = 0.00 to 2.85 m)
 Permanent load $lo \ g2 = 1.04 \text{ kN/m}^2$ Df1 (x = 0.00 to 1.90 m)
 Permanent load $ro \ g3 = 1.04 \text{ kN/m}^2$ Df1 (x = 0.00 to 1.90 m)
 Permanent load $ru \ g4 = 1.04 \text{ kN/m}^2$ Df1 (x = 0.00 to 2.85 m)
 Permanent load $Cl \ g5 = 0.60 \text{ kN/m}^2$ (x = 0.00 to 1.90 m)
 Permanent load $Cl \ g6 = 0.60 \text{ kN/m}^2$ (x = 0.00 to 1.90 m)
 Live load $Cl \ q1 = 1.00 \text{ kN/m}^2$ (x = 0.00 to 1.90 m)
 Live load $Cl \ q2 = 1.00 \text{ kN/m}^2$ (x = 0.00 to 1.90 m)
 Accidental combination with $C_{es1} = 2.30$, $s_{Ad} = 1.95 \text{ kN/m}^2$
 is being considered in the analyses.
 Snow load $s = 0.45 \text{ kN/m}^2$ Gf1 ($s_k = 0.85 \text{ kN/m}^2$) < 1000 m a.s.l.
 Wind impact pressure $q = 0.86 \text{ kN/m}^2$ Roofage
 Wind pressure $FG0 \ wd = 0.60 \text{ kN/m}^2$ Roofage (x = 0.00 to 1.20 m)

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Component: Collar Beam Roof

Wind pressure	H0	wd =	0.46 kN/m ²	Roofage	(x =	1.20 to	4.75 m)
Wind suction	FG0	ws =	-0.14 kN/m ²	Roofage	(x =	0.00 to	1.20 m)
Wind suction	H0	ws =	-0.06 kN/m ²	Roofage	(x =	1.20 to	4.75 m)
Wind suction	I0	ws =	-0.34 kN/m ²	Roofage	(x =	0.00 to	3.55 m)
Wind suction	J0	ws =	-0.43 kN/m ²	Roofage	(x =	3.55 to	4.75 m)
Wind suction	F90	ws =	-0.95 kN/m ²	Roofage	(x =	0.00 to	2.38 m)
Wind suction	G90	ws =	-1.20 kN/m ²	Roofage	(x =	2.38 to	4.75 m)

Characteristic stress resultants max/min M

Span Lc	x	maxMk	Nk	Vk	x	minMk	Nk	Vk
	[m]	[kNm]	[kN]	[kN]	[m]	[kNm]	[kN]	[kN]
lu sum M	1.60	2.77	-9.27	-0.01	2.85	-3.32	-9.74	-1.76
lo sum M	0.61	1.60	-0.46	-0.01	0.00	-3.32	-3.40	1.88
ro sum M	1.29	1.60	-0.46	0.01	1.90	-3.32	-3.40	-1.88
ru sum M	1.25	2.77	-9.27	0.01	0.00	-3.32	-9.74	1.76
Cl sum M	1.90	2.32	-2.78	-0.00	0.00	0.00	-2.78	2.44
Cl sum M	0.00	2.32	-2.78	-0.00	1.90	0.00	-2.78	-2.44

Characteristic stress resultants max/min N

Span Lc	x	Mk	maxNk	Vk	x	Mk	minNk	Vk
	[m]	[kNm]	[kN]	[kN]	[m]	[kNm]	[kN]	[kN]
lu sum N	2.85	0.25	-1.30	0.41	0.00	0.00	-14.05	0.34
lo sum N	1.90	0.00	0.60	-0.07	0.00	-3.15	-3.52	1.94
ro sum N	0.00	0.00	0.60	0.07	1.90	-3.15	-3.52	-1.94
ru sum N	0.00	0.25	-1.30	-0.41	2.85	0.00	-14.05	-0.34
Cl sum N	0.00	0.00	0.33	0.91	0.00	0.00	-8.42	2.44
Cl sum N	0.00	0.87	0.33	0.00	0.00	2.32	-8.42	-0.00

Characteristic stress resultants max/min V

Span Lc	x	Mk	Nk	maxVk	x	Mk	Nk	minVk
	[m]	[kNm]	[kN]	[kN]	[m]	[kNm]	[kN]	[kN]
lu sum V	0.00	0.00	-10.76	2.70	2.85	-0.06	-8.33	-2.32
lo sum V	0.00	-3.15	-3.52	1.94	1.90	0.00	0.51	-1.96
ro sum V	0.00	0.00	0.51	1.96	1.90	-3.15	-3.52	-1.94
ru sum V	0.00	-0.06	-8.33	2.32	2.85	0.00	-10.76	-2.70
Cl sum V	0.00	0.00	-2.78	2.44	1.90	1.60	-1.88	-0.38
Cl sum V	0.00	1.60	-1.88	0.38	1.90	0.00	-2.78	-2.44

Characteristic deflection

Span Lc	L'	x	w,inst.min	x	w,inst.max
	[m]	[m]	[cm]	[m]	[cm]
lu sum	6.21	2.57	-2.00	2.00	2.27
lo sum	6.21	0.00	-1.97	0.00	2.05
ro sum	6.21	1.90	-1.97	1.90	2.05
ru sum	6.21	0.29	-2.00	0.86	2.27
Cl sum	3.80	0.00	-1.49	0.00	1.58
Cl sum	3.80	1.90	-1.49	1.90	1.58

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Verification of deflections

w,inst : wG,inst + wQ,inst,s
 wG,fin : wG,inst * (1 + k,def)
 wQ,fin,s : wQ,inst,s * (1 + k,def * psi.2)
 w,fin.s : wG,fin + wQ,fin,s
 w,fin.q : wG,fin + wQ,fin,q

Span	L'	x	w,inst	adm L'/w	x	w,fin.s	adm L'/w	x	w,fin.q	L'/w		
	[m]	[m]	[cm]	[-]	[m]	[cm]	[-]	[m]	[cm]	[-]		
lu	6.21	2.00	2.04	2.07	305	2.00	2.20	2.48	282	1.71	0.75	282
lo	6.21	0.00	1.83	2.07	338	0.00	1.91	2.48	325	0.00	0.51	325
ro	6.21	1.90	1.83	2.07	338	1.90	1.91	2.48	325	1.90	0.51	325
ru	6.21	0.86	2.04	2.07	305	0.86	2.20	2.48	282	1.14	0.75	282
Cl	3.80	0.00	1.42	1.27	268*	1.52	1.73	1.52	219*	1.90	1.84	206*
Cl	3.80	1.90	1.42	1.27	268*	0.38	1.73	1.52	219*	0.00	1.84	206*

Longitudinal stress verification

Rafter : A = 144 cm², Wy = 432 cm³, Iy = 3888 cm⁴

Collar beam : A = 168 cm², Wy = 392 cm³, Iy = 2744 cm⁴

Buckling about y about z Lateral buckling

Span	l,ef	lambda,rel	kc,y	l,ef	lambda,rel	kc,z	km
lu	4.97	1.63	0.33				
lo	4.97	1.63	0.33				
ro	4.97	1.63	0.33				
ru	4.97	1.63	0.33				
Cl	3.80	1.60	0.34	3.80	1.30	0.48	0.95
Cl	3.80	1.60	0.34	3.80	1.30	0.48	0.95

Span	x	Md	Nd	sig-o/adm <=1.00	x	Md	Nd	sig-u/adm <=1.00
	[m]	[kNm]	[kN]	[N/mm ²]	[m]	[kNm]	[kN]	[N/mm ²]
maximal								
lu	2.85	-4.3	-13.9	9.06/11.25= 0.80	1.62	3.7	-2.2	8.32/15.37= 0.54
lo	0.00	-4.3	-4.5	9.71/14.53= 0.67	0.48	2.2	-0.0	5.11/16.59= 0.31
ro	1.90	-4.3	-4.5	9.71/14.53= 0.67	1.42	2.2	-0.0	5.11/16.59= 0.31
ru	0.00	-4.3	-13.9	9.06/11.25= 0.80	1.23	3.7	-2.2	8.32/15.37= 0.54
Cl	0.00	0.0	-6.8	-0.40/ 3.28= 0.12	1.90	3.4	-6.8	8.15/12.29= 0.66
Cl	1.90	0.0	-5.0	-0.30/ 3.28= 0.09	0.00	3.4	-6.8	8.15/12.29= 0.66
minimal								
lu	1.60	3.7	-2.2	-8.62/15.92= 0.54	2.85	-4.3	-13.9	-10.98/13.64= 0.80
lo	0.46	2.2	-0.0	-5.11/16.59= 0.31	0.00	-4.3	-4.5	-10.33/15.46= 0.67
ro	1.44	2.2	-0.0	-5.11/16.59= 0.31	1.90	-4.3	-4.5	-10.33/15.46= 0.67
ru	1.25	3.7	-2.2	-8.62/15.92= 0.54	0.00	-4.3	-13.9	-10.98/13.64= 0.80
Cl	1.90	3.4	-6.8	-8.96/13.50= 0.66	0.00	0.0	-10.7	-0.64/ 4.91= 0.13
Cl	0.00	3.4	-6.8	-8.96/13.50= 0.66	1.90	0.0	-10.7	-0.64/ 4.91= 0.13

Check of shear stresses

Span	x	Vd	tau/zul <= 1.00
	[m]	[kN]	[N/mm ²]
lu	0.00	3.56	0.37/ 1.38 = 0.27
lo	1.90	-2.58	0.27/ 1.38 = 0.19
ro	0.00	2.58	0.27/ 1.38 = 0.19
ru	2.85	-3.56	0.37/ 1.38 = 0.27
Cl	0.00	3.52	0.31/ 1.23 = 0.26
Cl	1.90	-3.52	0.31/ 1.23 = 0.26

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Component: Collar Beam Roof

Support reactions

Column	Lc	max Avk [kN/m]	max Ahk [kN/m]	min Avk [kN/m]	min Ahk [kN/m]	max Ad [kN]	Rafter base point		
							a1 [cm]	sig-90 [N/mm2]	adm
A	sum	12.28	-3.29	2.49	-13.16				
B	sum	12.28	13.16	2.49	3.29				

Characteristic coupling forces

Lf **Crown hinge:**

sum max V = 1.82 kN max/min H = 0.48 / -0.95 kN

Lf **Collar beam connection:**

sum max V li = 2.44 kN max/min H li = 0.33 / -8.42 kN

max V re = 2.44 kN max/min H re = 0.33 / -8.42 kN

Resulting compressive force: R le/ri = 8.77 / 8.77 kN

angle with resp. to rafter: phi li/re = 23.96 / 23.96 degrees

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Result graphic

