

The logo consists of the letters "KLH" in a bold, white, sans-serif font, centered within a solid red square.

KLH[®]

MADE FOR BUILDING
BUILT FOR LIVING

STRUCTURAL PRE-ANALYSIS TABLES



IMPRINT

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STRUCTURAL PRE-ANALYSIS TABLES

The calculation model for KLH® solid wood panels must consider the influence of the layup (thickness, material, orientation), the internal stress distributions and local stress concentrations. Due to the shear flexible transverse layers, shear deformation may no longer be disregarded and the layup of the panel has to be taken into account.

Dimensioning and structural design follow Eurocode 5 (EN 1995-1-1 and EN 1995-1-2), taking into account the national standards set forth in ÖNORM B 1995-1-1 and ÖNORM B 1995-1-2. It should be pointed out that the national standards in various European countries differ from each other in some detailed aspects (e.g. different partial factors γ_M for “cross laminated timber” material). The material properties of KLH® solid wood panels required for structural design can be taken from the European Technical Assessment (ETA-06/0138).

The structural design of KLH® solid wood panels has to be carried out project-based and locally applicable standards and regulations have to be taken into account.

Due care is also advised when comparing panel thicknesses of KLH® elements with products from other manufacturers: due to different production processes, the cross laminated timber products may well have different properties, e.g. with respect to bending stiffness or shear strength. Please mind the relevant properties in the respective product approvals and take into account the differences in a comparative analysis.

For the structural analysis of cross laminated timber, different models have been developed in the past. The structural analysis of KLH® solid wood panels is based on the shear-elastic beam theory (according to Timoshenko) or the shear-elastic orthotropic plate (according to Reissner-Mindlin). The properties of the composite cross section are thereby described appropriately. To receive correct results (internal forces and moments as well as deformations) is the use of suitable software for the purpose of structural analysis. The software provided on the website by KLH Massivholz GmbH is based on the above mentioned theory and thus a good choice.

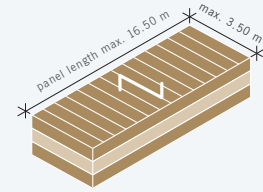
STANDARD PANELS AND PANEL STRUCTURES

01 KLH®-CLT | STANDARD PANEL TYPES AND STRUCTURES

FOR THE WALL

Covering layer in the transverse panel direction TT

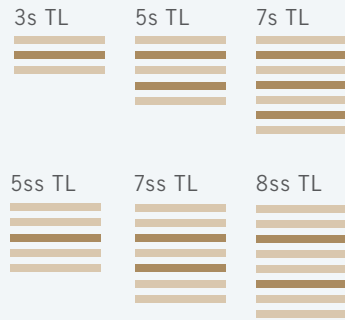
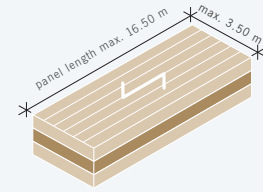
Nominal thickness	Layers	Type	Lamella structure in [mm]					
			T	L	T	L	T	L
KLH 60 mm	3s	TT	20	20	20			
KLH 70 mm	3s	TT	20	30	20			
KLH 80 mm	3s	TT	30	20	30			
KLH 90 mm	3s	TT	30	30	30			
KLH 100 mm	3s	TT	30	40	30			
KLH 110 mm	3s	TT	40	30	40			
KLH 120 mm	3s	TT	40	40	40			
KLH 100 mm	5s	TT	20	20	20	20	20	
KLH 110 mm	5s	TT	20	20	30	20	20	
KLH 120 mm	5s	TT	30	20	20	20	30	
KLH 130 mm	5s	TT	30	20	30	20	30	
KLH 140 mm	5s	TT	30	20	40	20	30	
KLH 150 mm	5s	TT	30	30	30	30	30	
KLH 160 mm	5s	TT	40	20	40	20	40	



FOR FLOOR AND ROOF

Covering layer in the longitudinal panel direction TL

Nominal thickness	Layers	Type	Lamella structure in [mm]					
			L	T	L	T	L	T
KLH 60 mm	3s	TL	20	20	20			
KLH 70 mm	3s	TL	20	30	20			
KLH 80 mm	3s	TL	30	20	30			
KLH 90 mm	3s	TL	30	30	30			
KLH 100 mm	3s	TL	40	20	40			
KLH 110 mm	3s	TL	40	30	40			
KLH 120 mm	3s	TL	40	40	40			
KLH 100 mm	5s	TL	20	20	20	20	20	
KLH 110 mm	5s	TL	20	20	30	20	20	
KLH 120 mm	5s	TL	30	20	20	20	30	
KLH 130 mm	5s	TL	30	20	30	20	30	
KLH 140 mm	5s	TL	40	20	20	20	40	
KLH 150 mm	5s	TL	40	20	30	20	40	
KLH 160 mm	5s	TL	40	20	40	20	40	
KLH 170 mm	5s	TL	40	30	30	30	40	
KLH 180 mm	5s	TL	40	30	40	30	40	
KLH 190 mm	5s	TL	40	40	30	40	40	
KLH 200 mm	5s	TL	40	40	40	40	40	
KLH 160 mm	5ss	TL	30+30	40	30+30			
KLH 180 mm	7s	TL	20	40	20	20	20	40
KLH 200 mm	7s	TL	20	40	20	40	20	40
KLH 220 mm	7s	TL	30	40	30	20	30	40
KLH 240 mm	7s	TL	30	40	30	40	30	40
KLH 180 mm	7ss	TL	30+30	20	20	20	30+30	
KLH 200 mm	7ss	TL	30+30	20	40	20	30+30	
KLH 220 mm	7ss	TL	40+40	20	20	20	40+40	
KLH 240 mm	7ss	TL	40+40	20	40	20	40+40	
KLH 260 mm	7ss	TL	40+40	30	40	30	40+40	
KLH 280 mm	7ss	TL	40+40	40	40	40	40+40	
KLH 300 mm	8ss	TL	40+40	30	40+40	30	40+40	
KLH 320 mm	8ss	TL	40+40	40	40+40	40	40+40	



Special panel layouts are available on request. By using double layers, for example the longitudinal or transverse stiffness of the panel can be further enhanced. The fire resistance of the KLH® solid wood panel can also be influenced by modifying the structures and can eventually be improved in relation to specific project requirements.

Invoicing widths

2.45 | 2.50 | 2.73 | 2.95 |
3.10 | 3.20 | 3.30 | 3.40 | 3.50 [m]

Maximum length 16.50 [m]

Maximum thickness 0.5 [m]

02 GENERAL REMARKS

Dimensioning according to
 ETA-06/0138 together with
 ÖNORM EN 1995-1-1:2019 and ÖNORM B 1995-1-1:2019 or
 ÖNORM EN 1995-1-2:2011 and ÖNORM B 1995-1-2:2011
 per m wall length resp. per m² floor area

Impacts

Service class 1 ($k_{def} = 0,6$)
 Self-weight of KLH® - CLT G_1 and the build-up G_2 : $k_{mod} = 0,6$
 Imposed load category A and B ($\psi_0 = 0,7$ and $\psi_2 = 0,3$): $k_{mod} = 0,8$
 Imposed load category C ($\psi_0 = 0,7$ and $\psi_2 = 0,6$): $k_{mod} = 0,9$
 Imposed load category H ($\psi_0 = 0,0$ and $\psi_2 = 0,0$): $k_{mod} = 0,9$
 Snow load at an altitude ≤ 1000 m S_2 ($\psi_0 = 0,5$ and $\psi_2 = 0,0$): $k_{mod} = 0,9$
 Wind load W ($\psi_0 = 0,0$ and $\psi_2 = 0,0$): $k_{mod} = 1,1$

Verification of Ultimate Limit States (ULS)

Verification of column stability, bending and shear resistance
 Verification in case of fire (with charring rates according to ETA-06/0138 for minimum panel widths of 30 cm)

Verification in the Servicability Limit States (SLS)

Limitation of deflection
 Verification of vibration

Verification criteria in detail

ULS tensions: limitation of the utilisation to 90 %
 Fire case: limitation of the utilisation to 100 % and deformation limit to $\ell/80$

SLS deformation: limitation of the utilisation to 90 %

- characteristic design situation: $w_{inst} \leq \ell/300$
- quasi-permanent structural design situation: $w_{net,fin} \leq \ell/250$

SLS vibration:

- floor class I (e.g. separating floor slabs for apartments or offices); 6 cm wet screed floating on heavy filler or dry screed floating on heavy filler (at least 60 kg/m²)
- floor class II (e.g. detached house); 6 cm floating wet screed (even without filler) or dry screed, floating on heavy filler (at least 60 kg/m²)
- modal damping ratio $\zeta = 4,0$ %
- ratio floor slab width to span width $b/\ell \geq 1,2$

Cladding

For the cladding directly to the KLH® surface, screw-fastened fire rated gypsum plasterboards type F (GtF according to ÖNORM EN 520 and ÖNORM B 3410 or DIN 18180) or equivalent panels respectively free-standing studworks are required.

The fastening needs to comply with the state of the art and the current KLH® installation guidelines.

STRUCTURAL PRE-ANALYSIS TABLES

2.2 SYMBOL EXPLANATION



Service class 1 (deformation factor $k_{def} = 0,6$)



KLH® - CLT as **wall**



KLH® - CLT as **floor**



Single-sided fire exposed wall



Double-sided fire exposed wall



Single-sided fire exposed ceiling



Self-weight of the **KLH® - CLT panel**: $k_{mod} = 0,6$



Self-weight of the **build-up**: $k_{mod} = 0,6$



Imposed load **category A** ($\psi_0 = 0,7$ and $\psi_2 = 0,3$): $k_{mod} = 0,8$



Imposed load **category B** ($\psi_0 = 0,7$ and $\psi_2 = 0,3$): $k_{mod} = 0,8$



Imposed load **category C** ($\psi_0 = 0,7$ and $\psi_2 = 0,6$): $k_{mod} = 0,9$



Imposed load **category H** ($\psi_0 = 0,0$ and $\psi_2 = 0,0$): $k_{mod} = 0,9$



Snow load at an **altitude ≤ 1000 m** S_2 ($\psi_0 = 0,5$ and $\psi_2 = 0,0$): $k_{mod} = 0,9$



Wind load W ($\psi_0 = 0,0$ and $\psi_2 = 0,0$): $k_{mod} = 1,1$

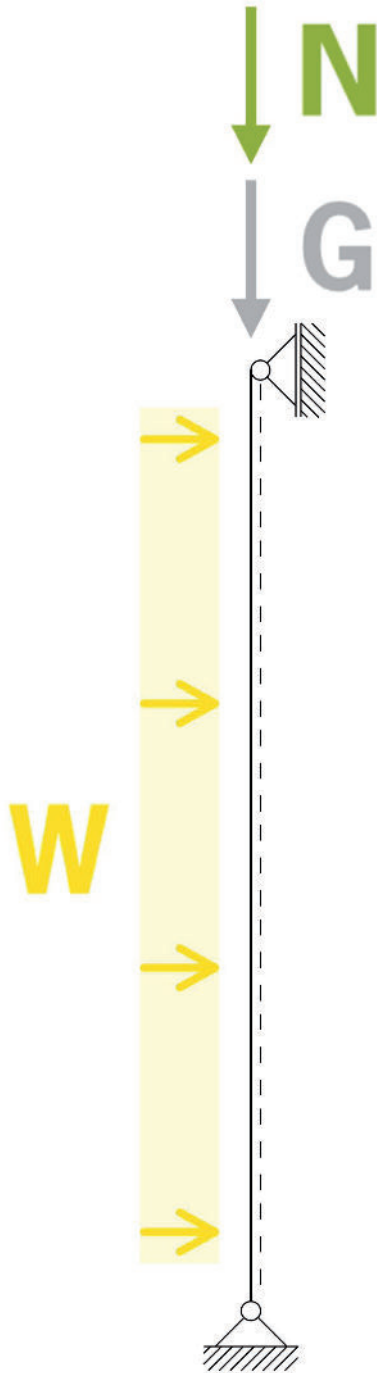


Floor class I (e.g. separating floor slabs for apartments or offices)



Floor class II (e.g. detached house)

03 KLH® AS WALL



STRUCTURAL PRE-ANALYSIS TABLES

Range for loads

Permanent load:	$G_{2,k} = 20 - 100 \text{ kN/m}$
Imposed load category A:	$N_{A,k} = 20 - 100 \text{ kN/m}$
Wind load:	$W_k = 1.0 \text{ kN/m}^2$

Wall height (buckling length)

2.95 m
3.50 m

Surfaces

Wood; KLH® - CLT visible

1 x 12.5 mm Gt-F
1 x 15 mm Gt-F
2 x 12.5 mm Gt-F

Studwork; free-standing (build-up: 15 mm Gt-F + 50 mm metal studwall/rock wool + 5 mm air gap)

Verification criteria in case of fire

Single-sided fire exposure

Remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 10 mm (calculated with global charring)

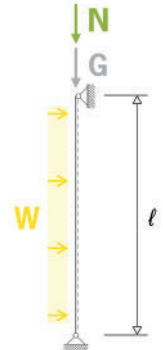
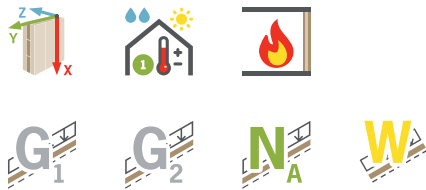
Double-sided fire exposure

30/60 minutes: remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 3 mm (calculated with local charring)

90/120 minutes: remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 7 mm (calculated with global charring)

STRUCTURAL PRE-ANALYSIS TABLES

3.1 SINGLE-SIDED FIRE EXPOSURE (FOR EXTERIOR WALLS)



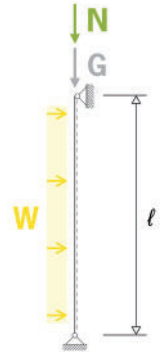
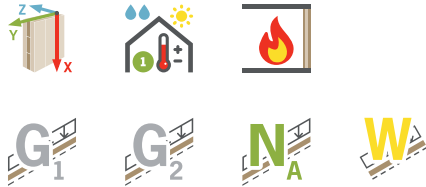
Minimum panel thicknesses for various fire resistances (R 0 to R 120), wall height 2.95 m

Surface	$G_{2,k} \mid N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 2,95$ m)				
				REI 0	REI 30	REI 60	REI 90	REI 120
side 1	[kN/m]	[kN/m]	[kN/m]					
Wood	20 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT	5s 140 TT
	40 40	114	52	3s 70 TT	3s 90 TT		5s 110 TT	5s 130 TT
	60 60	171	78	3s 80 TT		5s 140 TT		
	80 80	228	104	3s 110 TT				
	100 100	285	130		3s 90 TT	5s 140 TT		
1 x 12.5 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT
	40 40	114	52	3s 70 TT	3s 70 TT			
	60 60	171	78	3s 80 TT	3s 80 TT	3s 100 TT	5s 110 TT	5s 130 TT
	80 80	228	104					5s 140 TT
	100 100	285	130	3s 90 TT	3s 90 TT	3s 110 TT	5s 140 TT	
1 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 110 TT
	40 40	114	52	3s 70 TT	3s 70 TT			5s 120 TT
	60 60	171	78	3s 80 TT	3s 80 TT	3s 90 TT	5s 110 TT	5s 130 TT
	80 80	228	104					
	100 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	5s 110 TT	
2 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT
	40 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 70 TT	3s 80 TT
	60 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 80 TT	
	80 80	228	104					
	100 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT
Studwork	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT
	40 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT		
	60 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 90 TT	5s 110 TT
	80 80	228	104					
	100 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	3s 110 TT	

Wind pressure: $W_k = 1.0 \text{ kN/m}^2$

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES



Minimum panel thicknesses for various fire resistances (R 0 to R 120), wall height 3.50 m

Surface	$G_{2,k} \mid N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 3,50$ m)				
				REI 0	REI 30	REI 60	REI 90	REI 120
side 1	[kN/m]	[kN/m]	[kN/m]					
Wood	20 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT	5s 140 TT
	40 40	114	52	3s 80 TT	3s 100 TT	5s 110 TT	5s 130 TT	5s 160 TT
	60 60	171	78		5s 140 TT			
	80 80	228	104	3s 90 TT	3s 110 TT	5s 120 TT	5s 170 TT	
	100 100	285	130	3s 100 TT				
1 x 12.5 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT
	40 40	114	52	3s 80 TT	3s 80 TT			5s 110 TT
	60 60	171	78			3s 90 TT	3s 100 TT	
	80 80	228	104	3s 90 TT	3s 100 TT	5s 120 TT		5s 140 TT
	100 100	285	130	3s 100 TT			3s 100 TT	
1 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT	5s 110 TT
	40 40	114	52	3s 80 TT	3s 80 TT			5s 120 TT
	60 60	171	78			3s 90 TT	3s 90 TT	
	80 80	228	104	3s 90 TT	3s 100 TT	5s 130 TT		
	100 100	285	130	3s 100 TT			3s 100 TT	
2 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT	3s 80 TT
	40 40	114	52	3s 80 TT	3s 80 TT	3s 80 TT	3s 80 TT	
	60 60	171	78					3s 90 TT
	80 80	228	104	3s 90 TT	3s 100 TT	3s 100 TT	3s 100 TT	
	100 100	285	130	3s 100 TT				3s 100 TT
Studwork	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 80 TT	5s 100 TT
	40 40	114	52	3s 80 TT	3s 80 TT	3s 80 TT	3s 90 TT	
	60 60	171	78				3s 100 TT	3s 90 TT
	80 80	228	104	3s 90 TT	3s 100 TT	3s 100 TT	3s 110 TT	
	100 100	285	130	3s 100 TT				3s 100 TT

Wind pressure: $W_k = 1.0 \text{ kN/m}^2$

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

3.2 DOUBLE-SIDED FIRE EXPOSURE (FOR INTERIOR WALLS)



Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 2.95 m

Surface	Surface	$G_{2,k} \mid N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 2,95$ m)			
					side 1	side 2	[kN/m]	[kN/m]
Wood	Wood	20 20	57	26	3s 60 TT	3s 90 TT	5s 140 TT	5s 180 TT
		40 40	114	52	3s 70 TT	3s 100 TT		
		60 60	171	78	3s 80 TT	3s 110 TT	7s 180 TT	7s 180 TT
		80 80	228	104				7s 200 TT
		100 100	285	130	3s 90 TT			
Wood	1 x 12.5 mm Gt-F	20 20	57	26	3s 60 TT	3s 80 TT	5s 120 TT	5s 160 TT
		40 40	114	52	3s 70 TT		5s 120 TT	
		60 60	171	78	3s 80 TT	3s 90 TT	5s 130 TT	5s 180 TT
		80 80	228	104			3s 110 TT	5s 140 TT
		100 100	285	130	3s 90 TT			
Wood	1 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 80 TT	5s 110 TT	5s 160 TT
		40 40	114	52	3s 70 TT		5s 120 TT	
		60 60	171	78	3s 80 TT	3s 90 TT	5s 130 TT	5s 180 TT
		80 80	228	104			3s 110 TT	5s 140 TT
		100 100	285	130	3s 90 TT			
Wood	2 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 120 TT
		40 40	114	52	3s 70 TT		5s 100 TT	5s 130 TT
		60 60	171	78	3s 80 TT	3s 90 TT	5s 110 TT	5s 140 TT
		80 80	228	104			3s 110 TT	5s 120 TT
		100 100	285	130	3s 90 TT			
Wood	Studwork	20 20	57	26	3s 60 TT	3s 80 TT	5s 100 TT	5s 130 TT
		40 40	114	52	3s 70 TT		5s 110 TT	5s 150 TT
		60 60	171	78	3s 80 TT	3s 90 TT	5s 120 TT	5s 160 TT
		80 80	228	104				
		100 100	285	130	3s 90 TT	3s 110 TT		

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES



Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 2.95 m

Surface	Surface	$G_{2,k} \mid N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 2,95$ m)			
					side 1	side 2	[kN/m]	[kN/m]
1 x 12.5 mm Gt-F	1 x 12.5 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	5s 140 TT
		40 40	114	52	3s 70 TT	3s 70 TT	3s 90 TT	
		60 60	171	78	3s 80 TT	3s 80 TT	3s 100 TT	5s 160 TT
		80 80	228	104			3s 110 TT	
		100 100	285	130	3s 90 TT	3s 90 TT		
1 x 15 mm Gt-F	1 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	3s 110 TT
		40 40	114	52	3s 70 TT	3s 70 TT		3s 120 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 90 TT	5s 160 TT
		80 80	228	104			3s 100 TT	
		100 100	285	130	3s 90 TT	3s 90 TT		
1 x 15 mm Gt-F	Studwork	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	3s 110 TT
		40 40	114	52	3s 70 TT	3s 70 TT		3s 120 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 90 TT	5s 140 TT
		80 80	228	104			3s 90 TT	
		100 100	285	130	3s 90 TT	3s 90 TT		
2 x 15 mm Gt-F	2 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT
		40 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 70 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 80 TT
		80 80	228	104				3s 90 TT
		100 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT
Studwork	Studwork	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 90 TT
		40 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 100 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	3s 110 TT
		80 80	228	104				
		100 100	285	130	3s 90 TT	3s 90 TT	3s 90 TT	

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES



Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 3.50 m

Surface	Surface	$G_{2,k} \mid N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 3,50$ m)			
					side 1	side 2	[kN/m]	[kN/m]
Wood	Wood	20 20	57	26	3s 60 TT	3s 90 TT	5s 180 TT	5s 180 TT
		40 40	114	52	3s 70 TT	3s 110 TT		7s 180 TT
		60 60	171	78	3s 80 TT		7s 180 TT	7s 200 TT
		80 80	228	104	3s 90 TT		7s 200 TT	
		100 100	285	130	3s 100 TT	3s 120 TT	7s 200 TT	
Wood	1 x 12.5 mm Gt-F	20 20	57	26	3s 60 TT	3s 80 TT	5s 120 TT	5s 160 TT
		40 40	114	52	3s 70 TT	3s 90 TT	5s 130 TT	5s 180 TT
		60 60	171	78	3s 80 TT	3s 100 TT	5s 140 TT	7s 200 TT
		80 80	228	104	3s 90 TT	3s 110 TT		
		100 100	285	130	3s 100 TT		5s 150 TT	
Wood	1 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 80 TT	5s 120 TT	5s 160 TT
		40 40	114	52	3s 70 TT			
		60 60	171	78	3s 80 TT	3s 90 TT	5s 130 TT	
		80 80	228	104	3s 90 TT	3s 100 TT	5s 140 TT	5s 200 TT
		100 100	285	130	3s 100 TT	3s 110 TT		7s 200 TT
Wood	2 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 80 TT	5s 110 TT	5s 130 TT
		40 40	114	52	3s 70 TT			5s 140 TT
		60 60	171	78	3s 80 TT	3s 90 TT	5s 120 TT	5s 150 TT
		80 80	228	104	3s 90 TT	3s 100 TT		
		100 100	285	130	3s 100 TT	3s 110 TT		
Wood	Studwork	20 20	57	26	3s 60 TT	3s 80 TT	5s 110 TT	5s 140 TT
		40 40	114	52	3s 70 TT			5s 150 TT
		60 60	171	78	3s 80 TT	3s 90 TT	5s 120 TT	5s 160 TT
		80 80	228	104	3s 90 TT	3s 100 TT		
		100 100	285	130	3s 100 TT	3s 110 TT		

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

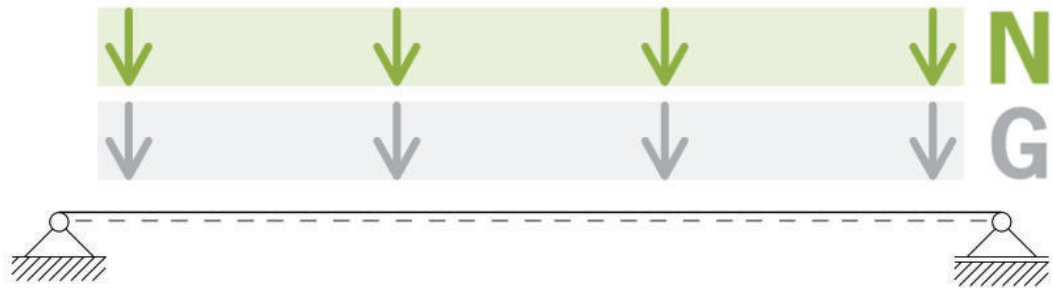


Minimum panel thicknesses for various fire resistances (R 0 to R 90), wall height 3.50 m

Surface	Surface	$G_{2,k} \mid N_{A,k}$	F_d	$F_{d,fi}$	Wall height (buckling length $\ell_k \leq 3,50$ m)			
					side 1	side 2	[kN/m]	[kN/m]
1 x 12.5 mm Gt-F	1 x 12.5 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 90 TT	5s 160 TT
		40 40	114	52	3s 70 TT	3s 70 TT	3s 100 TT	
		60 60	171	78	3s 80 TT	3s 80 TT	3s 110 TT	
		80 80	228	104	3s 90 TT	3s 90 TT		
		100 100	285	130	3s 100 TT	3s 100 TT		5s 180 TT
1 x 15 mm Gt-F	1 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	3s 120 TT
		40 40	114	52	3s 70 TT	3s 70 TT	3s 90 TT	5s 140 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 100 TT	
		80 80	228	104	3s 90 TT	3s 90 TT	3s 110 TT	
		100 100	285	130	3s 100 TT	3s 100 TT		5s 160 TT
1 x 15 mm Gt-F	Studwork	20 20	57	26	3s 60 TT	3s 60 TT	3s 80 TT	3s 110 TT
		40 40	114	52	3s 70 TT	3s 70 TT		3s 120 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 90 TT	
		80 80	228	104	3s 90 TT	3s 90 TT		
		100 100	285	130	3s 100 TT	3s 100 TT		5s 150 TT
2 x 15 mm Gt-F	2 x 15 mm Gt-F	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 60 TT
		40 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 80 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	
		80 80	228	104	3s 90 TT	3s 90 TT	3s 90 TT	3s 90 TT
		100 100	285	130	3s 100 TT	3s 100 TT	3s 100 TT	3s 100 TT
Studwork	Studwork	20 20	57	26	3s 60 TT	3s 60 TT	3s 60 TT	3s 100 TT
		40 40	114	52	3s 70 TT	3s 70 TT	3s 70 TT	3s 110 TT
		60 60	171	78	3s 80 TT	3s 80 TT	3s 80 TT	
		80 80	228	104	3s 90 TT	3s 90 TT	3s 90 TT	
		100 100	285	130	3s 100 TT	3s 100 TT	3s 100 TT	

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

04 KLH® AS FLOOR



STRUCTURAL PRE-ANALYSIS TABLES

Range for loads

Permanent load:	$G_{2,k} = 1.0 - 3.5 \text{ kN/m}^2$
Imposed load category A:	$N_{A,k} = 2.8 \text{ kN/m}^2$
Imposed load category B:	$N_{B,k} = 3.8 \text{ kN/m}^2$
Imposed load category C:	$N_{C,k} = 4.0 - 5.0 \text{ kN/m}^2$

Spans

3.00 m to 7.00 m - in 0.50 m steps

Surface

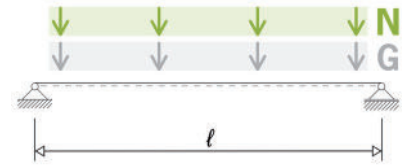
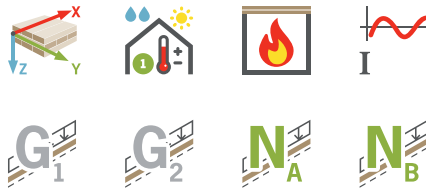
Wood; KLH® - CLT visible

Verification criteria in case of fire**Single-sided fire exposure**

Remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 10 mm (calculated with global charring)

STRUCTURAL PRE-ANALYSIS TABLES

4.1 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (WET SCREED)



Minimum panel thickness for a specific load-span-combination

Perma- nent load	Imposed load		Span of single-span beam l								
	$G_{z,k}$	N_k	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
	[kN/m ²]	CAT [kN/m ²]									
1,50	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 200 TL	7ss 220 TL	7ss 250 TL	7ss 280 TL
	B	3,80				5s 150 TL					
	C	4,00	5s 110 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL				
		5,00									
2,00	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 150 TL	5s 180 TL	7ss 210 TL	7ss 230 TL	7ss 260 TL	7ss 280 TL
	B	3,80									
	C	4,00	5s 110 TL	5s 140 TL	5s 160 TL						
		5,00									
2,50	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 160 TL	5s 200 TL	7ss 220 TL	7ss 240 TL	7ss 260 TL	7ss 280 TL
	B	3,80									
	C	4,00	5s 120 TL	5s 130 TL	5s 150 TL	5s 170 TL	5s 200 TL				
		5,00									
3,00	A	2,80	5s 100 TL	5s 120 TL	5s 140 TL	5s 170 TL	7ss 200 TL	7ss 230 TL	7ss 250 TL	7ss 280 TL	7ss 280 TL
	B	3,80									
	C	4,00	5s 120 TL	5s 130 TL							
		5,00									
3,50	A	2,80	5s 110 TL	5s 120 TL	5s 150 TL	5s 180 TL	7ss 210 TL	7ss 240 TL	7ss 250 TL	7ss 280 TL	7ss 280 TL
	B	3,80									
	C	4,00	5s 120 TL	5s 140 TL							
		5,00									

R 0

R 30

R 60

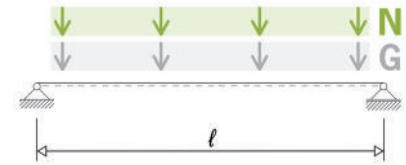
R 90

R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

4.2 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (DRY SCREED)



Minimum panel thickness for a specific load-span-combination

Perma- nent load	Imposed load		Span of single-span beam ℓ								
	$G_{z,k}$	N_k	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
	[kN/m ²]	CAT [kN/m ²]									
1,00	A	2,80	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 180 TL	7ss 200 TL	7ss 230 TL	7ss 280 TL
	B	3,80		5s 140 TL				5s 190 TL			
	C	4,00		5s 150 TL							
		5,00		5s 150 TL							
1,50	A	2,80	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 220 TL	7ss 260 TL	7ss 280 TL
	B	3,80		5s 140 TL				5s 200 TL			
	C	4,00		5s 150 TL							
		5,00		5s 200 TL							
2,00	A	2,80	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 190 TL	7ss 210 TL	7ss 240 TL	7ss 260 TL	7ss 280 TL
	B	3,80			5s 150 TL						
	C	4,00			5s 150 TL						
		5,00			5s 160 TL						
2,50	A	2,80	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 200 TL	7ss 220 TL	7ss 250 TL	7ss 280 TL	7ss 280 TL
	B	3,80			5s 150 TL						
	C	4,00			5s 150 TL						
		5,00			5s 200 TL						
3,00	A	2,80	5s 130 TL	5s 140 TL	5s 150 TL	5s 180 TL	7ss 200 TL	7ss 230 TL	7ss 260 TL	7ss 280 TL	7ss 280 TL
	B	3,80									
	C	4,00									
		5,00									

R 0

R 30

R 60

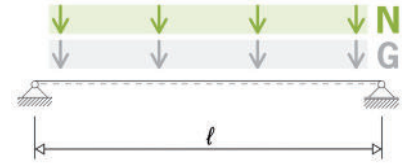
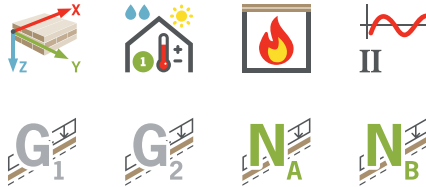
R 90

R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

4.3 VERIFICATION OF VIBRATION WITH LOW REQUIREMENTS



Minimum panel thickness for a specific load-span-combination

Perma- nent load	Imposed load		Span of single-span beam l									
	$G_{z,k}$	N_k	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m	
	[kN/m ²]	CAT [kN/m ²]										
1,00	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 210 TL	
	B	3,80				5s 140 TL	5s 150 TL	5s 170 TL	5s 180 TL	5s 200 TL		
	C	4,00		5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 210 TL	7ss 220 TL	
		5,00		5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	7ss 230 TL		
1,50	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 220 TL	
	B	3,80		5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	
	C	4,00				5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	7ss 230 TL	
		5,00		5s 110 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 210 TL		7ss 240 TL	
2,00	A	2,80	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 220 TL	7ss 240 TL	
	B	3,80		5s 120 TL	5s 130 TL		5s 160 TL	5s 180 TL	5s 200 TL			
	C	4,00		5s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL		7ss 220 TL
		5,00				5s 130 TL			5s 150 TL	7ss 200 TL		7ss 220 TL
2,50	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 230 TL	7ss 240 TL	
	B	3,80				5s 110 TL	5s 140 TL	5s 150 TL	5s 170 TL			5s 190 TL
	C	4,00		5s 130 TL	5s 150 TL			5s 160 TL	5s 180 TL	7ss 200 TL		7ss 210 TL
		5,00				5s 120 TL	5s 150 TL	5s 170 TL	5s 190 TL			7ss 220 TL
3,00	A	2,80	5s 100 TL	5s 120 TL	5s 130 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 210 TL	7ss 230 TL	7ss 240 TL	
	B	3,80						5s 110 TL				5s 140 TL
	C	4,00		5s 120 TL	5s 130 TL	5s 150 TL	5s 170 TL		7ss 200 TL			
		5,00						5s 120 TL				5s 130 TL

R 0

R 30

R 60

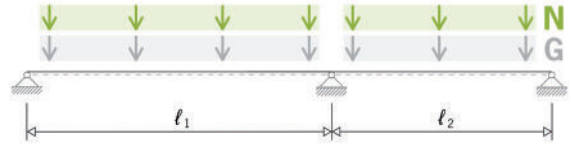
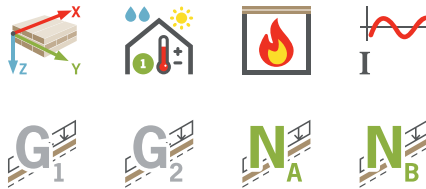
R 90

R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

4.4 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (WET SCREED)



Minimum panel thickness for a specific load-span-combination

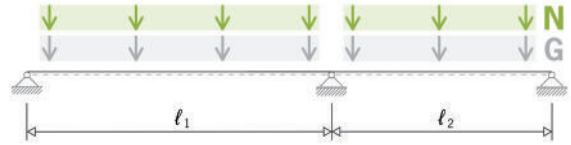
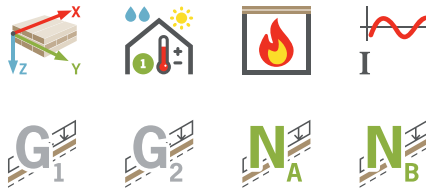
Perma- nent load	Imposed load		Span of double-span beam ℓ_1 $\ell_2 = 0,8*\ell_1$ to $1,0*\ell_1$									
	$G_{z,k}$ [kN/m ²]	N_k [kN/m ²]	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m	
1,50	A	2,80	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 200 TL	7s 210 TL	7s 220 TL	
		3,80										
	C	4,00										
		5,00										7s 230 TL
2,00	A	2,80	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 190 TL	5s 200 TL	7s 210 TL	7s 220 TL	
		3,80										
	C	4,00										
		5,00										7s 230 TL
2,50	A	2,80	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 170 TL	5s 190 TL	5s 200 TL	7s 220 TL	7s 230 TL	
		3,80										
	C	4,00										
		5,00										7s 240 TL
3,00	A	2,80	5s 110 TL	5s 120 TL	5s 130 TL	5s 150 TL	5s 180 TL	5s 190 TL	7s 200 TL	7s 220 TL	7s 230 TL	
		3,80										
	C	4,00				5s 150 TL			7s 210 TL			
		5,00				7s 230 TL			7ss 250 TL			
3,50	A	2,80	5s 110 TL	5s 120 TL	5s 130 TL	5s 150 TL	5s 180 TL	5s 200 TL	7s 200 TL	7s 220 TL	7s 230 TL	
		3,80										
	C	4,00				5s 150 TL			7s 210 TL			7s 230 TL
		5,00				7s 240 TL			7ss 250 TL			

R 0 R 30 R 60 R 90 R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

4.5 VERIFICATION OF VIBRATION WITH HIGH REQUIREMENTS (DRY SCREED)



Minimum panel thickness for a specific load-span-combination

Perma- nent load	Imposed load		Span of double-span beam ℓ_1 $\ell_2 = 0,8 \cdot \ell_1$ to $1,0 \cdot \ell_1$								
	$G_{z,k}$ [kN/m ²]	N_k [kN/m ²]	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m
1,00	A	2,80	5s 110 TL	5s 130 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 160 TL	5s 190 TL	7s 210 TL	7s 220 TL
		3,80									
	C	4,00									
		5,00									
1,50	A	2,80	5s 110 TL	5s 130 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7s 210 TL	7s 230 TL
		3,80									
	C	4,00									
		5,00									
2,00	A	2,80	5s 110 TL	5s 130 TL	5s 130 TL	5s 150 TL 5s 150 TL	5s 160 TL	5s 190 TL	7s 200 TL	7s 220 TL	7s 230 TL 7s 240 TL
		3,80									
	C	4,00									
		5,00									
2,50	A	2,80	5s 110 TL	5s 130 TL	5s 130 TL	5s 150 TL 5s 150 TL	5s 180 TL	5s 200 TL	7s 200 TL 7s 210 TL	7s 220 TL	7s 230 TL 7s 240 TL
		3,80									
	C	4,00									
		5,00									
3,00	A	2,80	5s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7s 210 TL	7s 220 TL 7s 230 TL	7s 230 TL 7s 240 TL 7s 260 TL
		3,80									
	C	4,00									
		5,00									

R 0

R 30

R 60

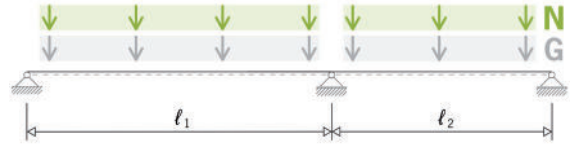
R 90

R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

4.6 VERIFICATION OF VIBRATION WITH LOW REQUIREMENTS



Minimum panel thickness for a specific load-span-combination

Permanent load	Imposed load		Span of double-span beam ℓ_1 $\ell_2 = 0,8 \cdot \ell_1$ to $1,0 \cdot \ell_1$									
	$G_{z,k}$ [kN/m ²]	N_k [kN/m ²]	3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m	
0,50	A	2,80	5s 100 TL	5s 100 TL	5s 100 TL	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	
		3,80			5s 110 TL	5s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL		
	C	4,00	5s 120 TL		5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL		
		5,00	5s 120 TL		5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL		
1,00	A	2,80	5s 100 TL	5s 100 TL	5s 100 TL	5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	
		3,80			5s 110 TL	5s 120 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 190 TL	
	C	4,00	5s 120 TL		5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 190 TL	5s 200 TL	
		5,00	5s 120 TL		5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 170 TL	5s 190 TL	7ss 200 TL	
1,50	A	2,80	5s 100 TL	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 190 TL	
		3,80			5s 120 TL	5s 130 TL			5s 160 TL	5s 170 TL	5s 190 TL	
	C	4,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
		5,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	
2,00	A	2,80	5s 100 TL	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 190 TL	
		3,80			5s 120 TL	5s 130 TL			5s 160 TL	5s 170 TL	5s 180 TL	5s 200 TL
	C	4,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
		5,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 210 TL
2,50	A	2,80	5s 100 TL	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 190 TL	
		3,80			5s 120 TL	5s 130 TL			5s 160 TL	5s 170 TL	5s 180 TL	5s 200 TL
	C	4,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
		5,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 140 TL	5s 150 TL	5s 170 TL	5s 200 TL	7ss 220 TL
3,00	A	2,80	5s 100 TL	5s 100 TL	5s 110 TL	5s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 180 TL	5s 200 TL	
		3,80			5s 120 TL	5s 130 TL			5s 160 TL	5s 170 TL	5s 180 TL	5s 200 TL
	C	4,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 210 TL
		5,00	5s 110 TL		5s 120 TL	5s 130 TL		5s 140 TL	5s 150 TL	5s 170 TL	5s 200 TL	7ss 230 TL

R 0

R 30

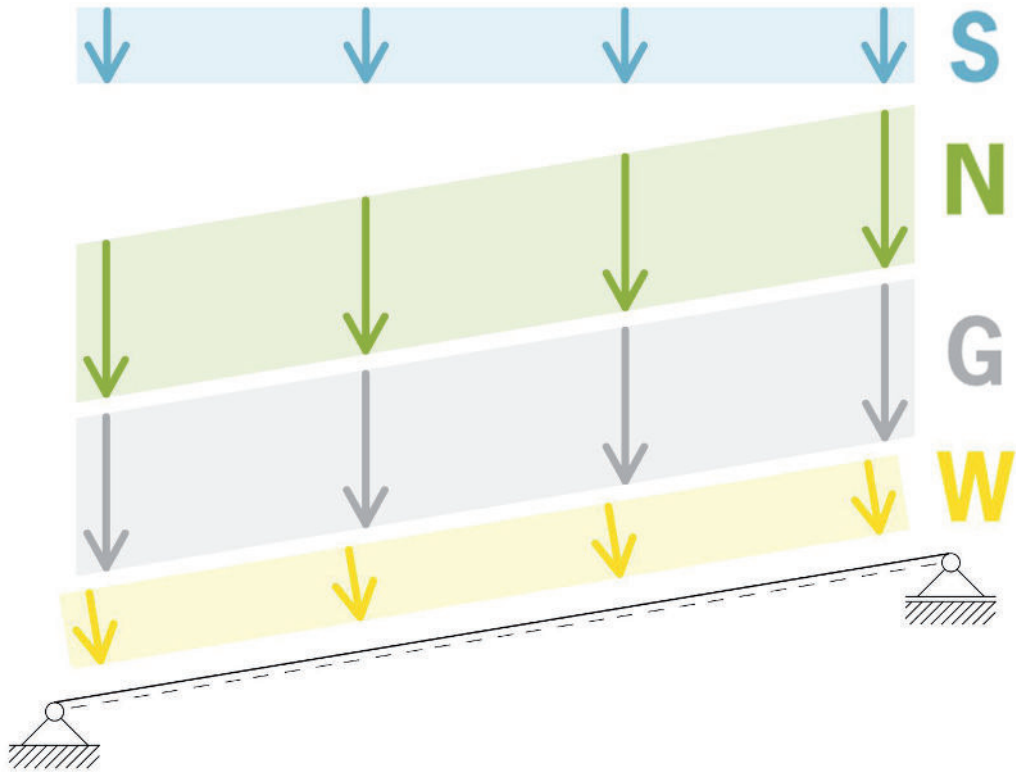
R 60

R 90

R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

05 KLH® AS ROOF



STRUCTURAL PRE-ANALYSIS TABLES

Range for loads

Permanent load:	$G_{2,k} = 0.5 - 2.5 \text{ kN/m}^2$
Imposed load category H:	$N_{H,k} = 1.0 \text{ kN/m}^2$
Snow load at an altitude $\leq 1000 \text{ m}$:	$S_k = 0.5 - 5.0 \text{ kN/m}^2$
Wind load:	$W_k = 0.4 \text{ kN/m}^2$

Spans

3.00 m to 7.00 m - in 0.50 m steps

Surfaces

Wood; KLH® - CLT visible

Roof inclination

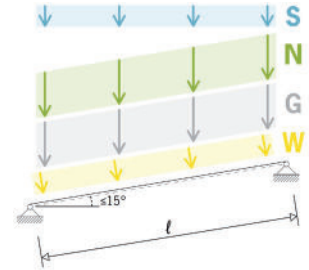
Maximum roof inclination of 15°

Verification criteria in case of fire**Single-sided fire exposure**

Remaining of an at least 3-layers residual cross-section with two load-bearing layers, where each layer must have at least 10 mm (calculated with global charring)

STRUCTURAL PRE-ANALYSIS TABLES

5.1 SINGLE-SPAN BEAM



Minimum panel thickness for a specific load-span-combination

Permanent load	Snow load on roof	Span of single-span beam ℓ									
		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m	
$G_{2,k}$	$S_2 = \mu \cdot S_{2,k}$										
[kN/m ²]	[kN/m ²]										
0,50	0,5	3s 60 TL	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	1,0									5s 160 TL	
	1,5	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	
	2,0			3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL
	3,0	3s 80 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL
	4,0	3s 90 TL		3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	5s 200 TL	7ss 200 TL
1,00	0,5										
	1,0	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	
	1,5			3s 100 TL	3s 110 TL	5s 120 TL	5s 140 TL		5s 160 TL	5s 180 TL	
	2,0	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 180 TL	
	3,0		3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 170 TL	5s 190 TL	7ss 200 TL	
	4,0	3s 90 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 210 TL	
1,50	0,5										
	1,0	3s 70 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	
	1,5										
	2,0	3s 80 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	
	3,0	3s 90 TL	3s 100 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	
	4,0	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	7ss 220 TL	
2,00	0,5										
	1,0	3s 80 TL	3s 90 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	
	1,5										
	2,0		3s 100 TL		5s 130 TL	5s 160 TL					
	3,0	3s 90 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 210 TL		
	4,0	3s 100 TL	3s 110 TL	5s 130 TL	5s 150 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 210 TL	7ss 220 TL	
2,50	0,5										
	1,0	3s 80 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	
	1,5										
	2,0	3s 90 TL	3s 100 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 220 TL	
	3,0		3s 110 TL	5s 130 TL	5s 140 TL	5s 160 TL	5s 180 TL	5s 200 TL	7ss 200 TL	7ss 220 TL	
	4,0	3s 100 TL	3s 120 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL	7ss 200 TL	7ss 210 TL	7ss 230 TL	
5,0			5s 160 TL	5s 180 TL	5s 200 TL	7ss 210 TL	7ss 220 TL	7ss 240 TL			

R 0

R 30

R 60

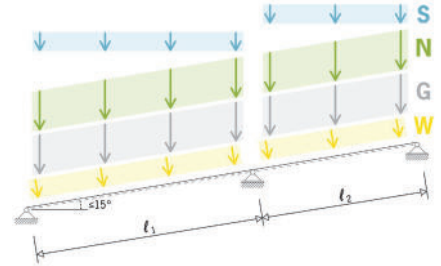
R 90

R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.

STRUCTURAL PRE-ANALYSIS TABLES

5.2 DOUBLE-SPAN BEAM



Minimum panel thickness for a specific load-span-combination

Permanent load $G_{2,k}$ [kN/m ²]	Snow load on roof $S_2 = \mu \cdot S_{2,k}$ [kN/m ²]	Span of double-span beam l_1 $l_2 = 0,8 \cdot l_1$ to $1,0 \cdot l_1$									
		3,00 m	3,50 m	4,00 m	4,50 m	5,00 m	5,50 m	6,00 m	6,50 m	7,00 m	
0,50	0,5	3s 60 TL	3s 60 TL	3s 60 TL	3s 70 TL	3s 80 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	
	1,0		3s 70 TL	3s 80 TL	3s 90 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL		
	1,5		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL		
	2,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 120 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
	3,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 180 TL
	4,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 180 TL
1,00	0,5	3s 60 TL	3s 60 TL	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 130 TL	
	1,0		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	1,5		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	2,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	
	3,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 160 TL	5s 170 TL	
	4,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 170 TL	5s 190 TL
1,50	0,5	3s 60 TL	3s 60 TL	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	
	1,0		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	1,5		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	2,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
	3,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
	4,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
2,00	0,5	3s 60 TL	3s 60 TL	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 130 TL	
	1,0		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	1,5		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	2,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
	3,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
	4,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
2,50	0,5	3s 60 TL	3s 60 TL	3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 130 TL	
	1,0		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	1,5		3s 70 TL	3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	3s 120 TL	5s 140 TL	5s 150 TL	
	2,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
	3,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	
	4,0		3s 80 TL	3s 90 TL	3s 100 TL	3s 110 TL	5s 130 TL	5s 140 TL	5s 150 TL	5s 160 TL	

R 0 R 30 R 60 R 90 R 120

The self-weight $G_{1,k}$ of the load-bearing KLH® elements is included in the tables.



NOTES

A large, empty grid of small squares, typical of graph paper, occupying the majority of the page below the 'NOTES' header.



NOTES

A large rectangular area filled with a fine grid of small squares, intended for taking notes. The grid is composed of approximately 30 columns and 40 rows of squares.

NOTES

A large grid of small squares, suitable for taking notes or drawing. The grid consists of 20 columns and 30 rows of small squares.



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