

**GLT Data**

Supplier ASH	Grade MASSLAM 40	b 450 (mm)	h 730 (mm)
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**Design Methodologies**

Design Method Eurocode 5	Loading Code Eurocode 1	Load Combinations Default Load Combination	Vibration Method FP Innovations
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**Fire Data**

FRL 90 (mins)	Char Rate 0.7 (mm/min)	Exposed Faces (b) Both Faces	Exposed Faces (d) Bottom Face	ZSL 7 (mm)
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**Design Data Eurocode 5**

$\Psi_{2,1}$ 0.6	Service Class 1.0	$W_c$ 0.0 (mm)	$k_{sys}$ 1.00	$k_h$ 1.00
$k_{crit}$ 1.00	$k_v$ 1.00	$k_{cr}$ 0.67	Deflection Ratio (Inst) 300	Deflection Ratio (net, fin) 250

**Loading Data**

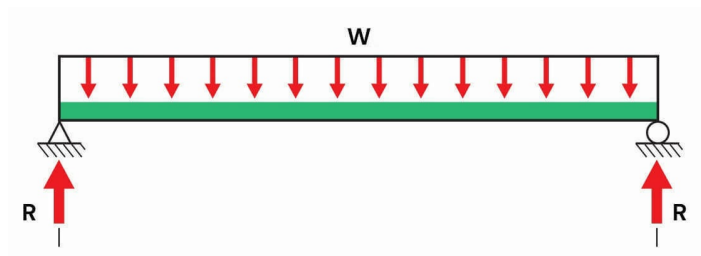
Slab Thickness 240.0 (mm)	Slab Density 500.0 (kg/m <sup>3</sup> )	$G_{SDL}$ (kN) 2.0 kN	Q (kN) 3.0 kN
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**Loading Conditions**

Condition Simply Supported	Load Breadth 6.0 (m)	Span 9.0 (m)
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**Outputs Summary**

Deflection	Vibration Support	Ambient Shear	Ambient Bending	Fire Shear	Fire Bending
<b>OK</b>	<b>OK</b>	<b>OK</b>	<b>OK</b>	<b>OK</b>	<b>OK</b>
56.8%	96.5%	84.6%	73.3%	29.7%	31.9%

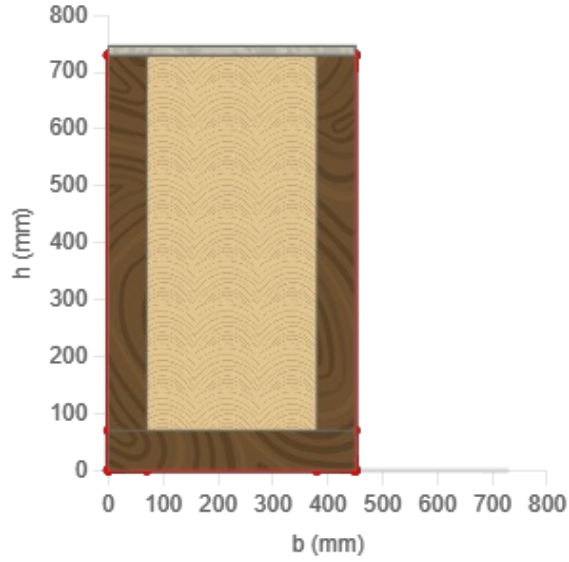


**Panel Properties**

Grade	$E_{mean}$ (MPa)	$G_{mean}$ (MPa)	$f_{m,k}$ (MPa)	$f_{v,k}$ (MPa)	$f_{c,0,k}$ (MPa)	$f_{t,0,k}$ (MPa)	$\rho_k$ (kg/m <sup>3</sup> )
MASSLAM 40	16700	1110	40	4.2	33	20	600

**Panel Properties (Fire)**

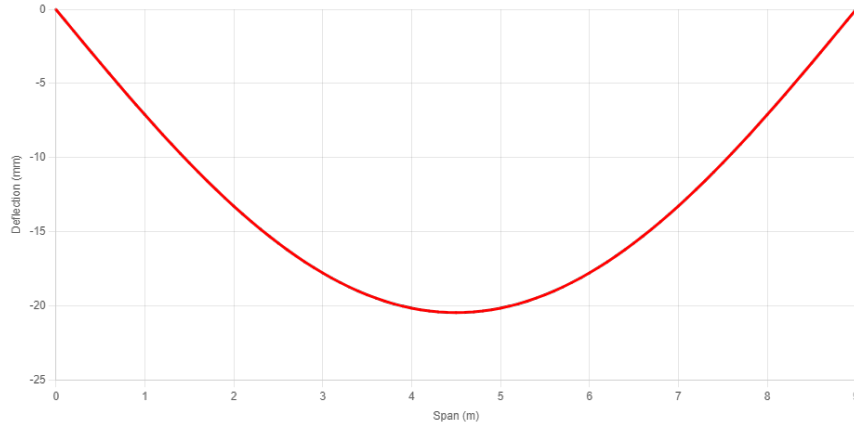
Char Layer (mm)	63.0
ZSL (mm)	7.0
Residual Section (mm)	70.0



Beam Properties		Ambient	Post Fire Case
b (mm)	Breadth of beam	450	380
h (mm)	Depth of beam	730	590

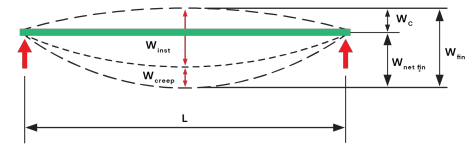
Updated Section Properties		Ambient	Post Fire Case
$EI_{eff}$ (Nmm <sup>2</sup> )	Bending Stiffness	2.436e+14	1.09e+14
$Z_{eff}$ (mm <sup>3</sup> )	Section Modulus	$Z_{eff}$ (mm <sup>3</sup> )	2.205e+7
$A_s$ (mm <sup>2</sup> )	Area of shear plane	2.190e+5	1.495e+5

Deflection : Eurocode 5



$G_{beam\ sw}$ (kN/m)	1.97
$G_{slab\ sw}$ (kN/m)	7.20
$G_{sdl}$ (kN/m)	12.00
$G_{total}$ (kN/m)	21.17
$Q_{total}$ (kN/m)	18.00
$\psi_{2,1}$	0.60
$k_{def}$	0.60
$E_{eff}$ (Nmm <sup>2</sup> )	2.436e+14

Ambient Conditions



	w (kN/m)	Deflection (mm)	Limit (mm)	
$w_{inst}$	39.2	13.74	30.00	Instantaneous deflection
$w_{creep}$	19.2	6.7		Creep deformation
$w_c$		0.00		Pre-camber (if any)
$w_{fin}$	58.4	20.5		
$w_{net,fin}$		20.46	36.00	57%

Vibration (Stiff Support Reqs)

FP Innovations 2019 S7.3.3

The support conditions for any floor need to be considered 'rigid' (negligible flexibility), to fulfill the assumption of a simple support. If there is not adequate stiffness from the support, the floor vibration will be affected by the support's flexibility, irrespective of the stiffness and mass properties of the CLT floors.

$$(EI)_{beam} \geq F_{span} 132.17 l_{beam}^{(6.55)}$$

$F_{span}$	1.00
$L_{beam}$ (m)	9.00
$E_{beam, des}$ (Nmm <sup>2</sup> )	2.436e+14
$E_{beam, req}$ (Nmm <sup>2</sup> )	2.352e+14

Ratio 97%

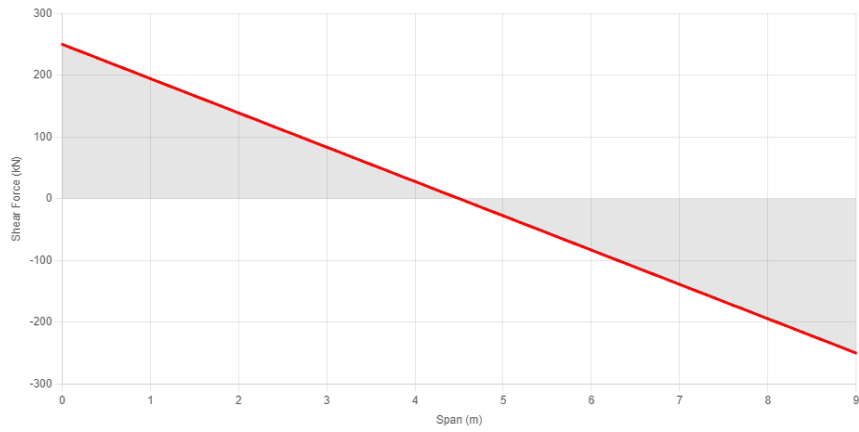
**Loading**

$G_{\text{beam sw}}$ (kN/m)	1.97
$G_{\text{slab sw}}$ (kN/m)	7.20
$G_{\text{sdl}}$ (kN/m)	12.00
$G_{\text{total}}$ (kN/m)	21.17
$Q$ (kN/m)	18.00

Load Combination	1.35G + 1.50Q	1.00G + 0.60Q
$w$ (kN/m)	55.58	31.97

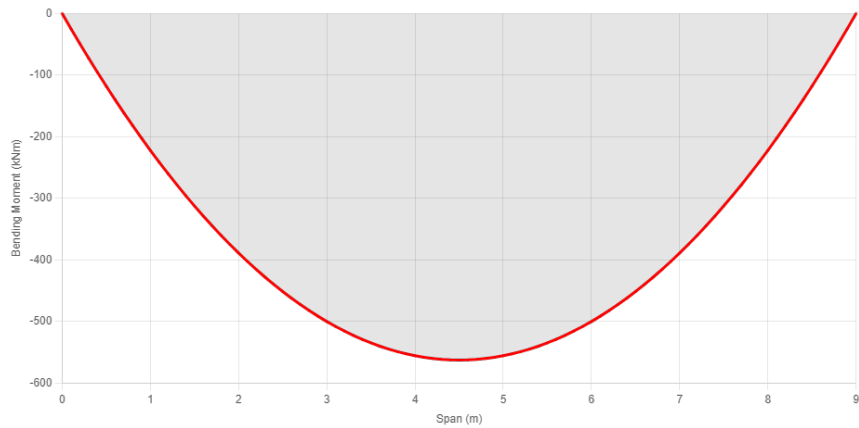
**Shear Force**

Loading Combination : 1.35G + 1.50Q



	Ambient	Fire
Load Combination	1.35G + 1.50Q	1.00G + 0.60Q
$V_{\text{max}}$ (kN)	250.11	143.87

**Bending Moment**



	Ambient	Fire
Load Combination	1.35G + 1.50Q	1.00G + 0.60Q
$M^*_{\text{max+}}$ (kNm)	0.00	0.00
$M^*_{\text{max-}}$ (kNm)	-562.76	-323.71

**Bending Design**

$$f_{m,0,d} = k_{crit} k_{sys} k_h k_{mod} \left( \frac{f_{m,k}}{\gamma_m} \right)$$

EC1995.1.1 ART.6.1.6  
EC1995.1.2 ART.2.3

$\gamma_M$	$k_{sys}$	$k_h$	$k_{crit}$	$k_v$
1.25	1	1	1.00	1

Z Ambient (mm <sup>3</sup> )	Z <sub>eff,ambient</sub> (mm <sup>3</sup> )
Z <sub>eff,fire</sub> (mm <sup>3</sup> )	2.205e+7
f <sub>m</sub>	40

	Ambient	Fire
	1.35G + 1.50Q	1.00G + 0.60Q
k <sub>mod</sub> OR k <sub>mod,fi</sub>	0.60	1.00
$\gamma_M$ OR $\gamma_{M,fi}$	1.25	1.00
M <sub>d</sub>	-562.76	-323.71
f <sub>m,y,d</sub> (MPa)	19.2	46.0
σ <sub>m,y,d</sub> (MPa)	-14.08	-14.68
Ratio	73%	32%

73%	Ambient
32%	Fire

**Shear Design**

$$f_{v,d} = k_{mod} k_{sys} k_v \left( \frac{f_{v,k}}{\gamma_m} \right) \quad \tau_d = \frac{1.5V}{k_{cr} A_s}$$

EC1995.1.1 ART.6.1.7  
EC1995.1.2 ART.2.3

		Ambient	Fire
b (mm)	Breadth of beam	450	380
h (mm)	Depth of beam	730	590
f <sub>v,k</sub> (MPa)	Characteristic shear strength	4.2	4.2

	Ambient	Fire
	1.35G + 1.50Q	1.00G + 0.60Q
k <sub>mod</sub> OR k <sub>mod,fi</sub>	0.60	1.00
$\gamma_M$ OR $\gamma_{M,fi}$	1.25	1.00
V <sub>d</sub>	250.11	143.87
f <sub>v,d</sub> (MPa)	2.02	4.83
τ <sub>d</sub>	1.7	1.4
Ratio	85%	30%

85%	Ambient
30%	Fire