



CONSULTING STRUCTURAL ENGINEERS

JM/10159

14 August 2024

Mr P Batten
Floren Farm
Hophurst Hill
Crawley Down
West Sussex RH10 4LP

Dear Mr Batten

Re: Report regarding the structural adequacy of Outbuildings at Floren Farm

Following our recent site visit to the above project we would report as follows.

We were instructed to inspect the above property to confirm its suitability or otherwise to support a planning application for conversion.

The building is a substantial farm building, built with solid block walls clad in timber apart from one end elevation with timber roof trusses internally, timber purlins and lightweight sheeting. The roof covering at present is a corrugated sheeting and the original gable wall consists of a 4.5" brick wall with brick buttresses. There is some minor cracking evident to this wall but structurally it is adequate to support any wind loading and the minimal gable load from the purlins.

The existing slab shows no sign of movement, and the structure as a whole is very stable, with the roof trusses, including diagonal bracing for wind loading.

We attach calculations which justify the existing roof trusses to support a lightweight insulated timber roof for the future conversion.

In our opinion the existing structure, is adequate for conversion without any additional structural works being required.

Should you require anything further please do not hesitate to contact us.

With kind regards

Yours sincerely

John Marshall CEng MStructE

Attached Photographs Calculations

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John Marshall CEng MStructE
Jeanette Marshall

The **Institution**
of **Structural**
Engineers



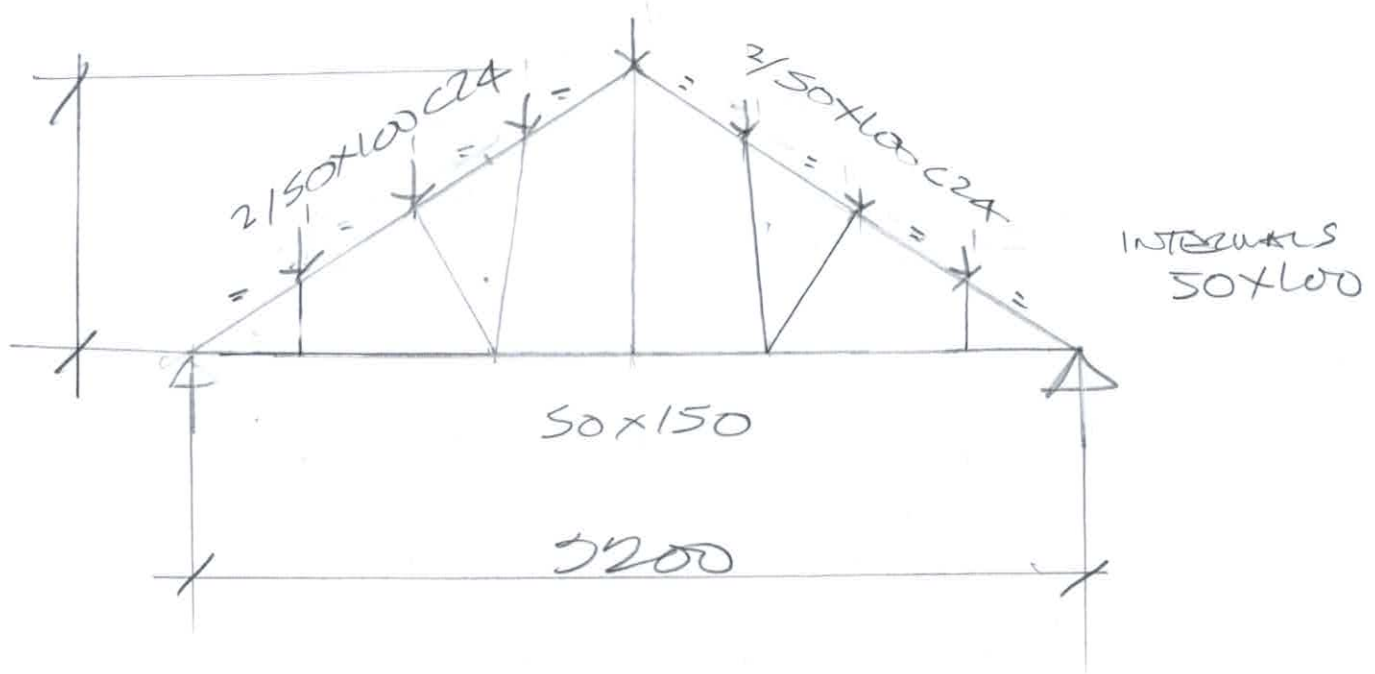


FLOZAN FARMJob No 10159Sheet No 01By JMDate Aug 2024

CHECK ON EXISTING ROOF
STRUCTURE TO SUPPORT INSULATED STEELING

FOR PURWS SEE SUPPER ~~BEAM~~
CALCULATIONS ATTACHED.

CHECK EXISTING TIMBER TRUSSES



PURWU ~~LOADING~~ FROM SUPER ~~BEAM~~
IS 1.77 kN

SEE MASTERSCROSS CALCULATION FOR
TRUSS CHECKS.

UNIT 4 RIVERVIEW BUSINESS PARK, STATION ROAD, FOREST ROW, I

Site address: Outbuilding at Floran Farm, Crawley Down

Job: Structural checks

Client: Paul Batten

Job number: 10159

Made by: JM

Page: 2

Architects copy

10159-Floran Farm.sbw

Printed 14 Aug 2024 12:17

SuperBeam 7 Project Summary

Site address: Outbuilding at Floran Farm, Crawley Down

Job: Structural checks

Client: Paul Batten

Job number: 10159

ITEMS:

- 1: Beam: Check on purlin

Span: 2.7 m.

Reactions (unfactored/factored): R1: 1.77/1.77 kN; R2: 1.77/1.77 kN

Use 50 x 150 C16

Existing 45x150 are adequate

Beam: Check on purlin

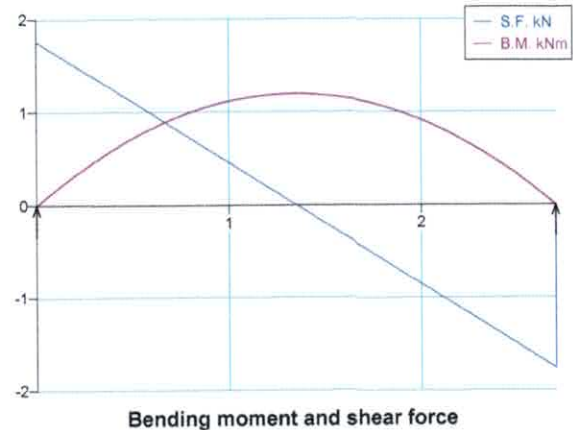
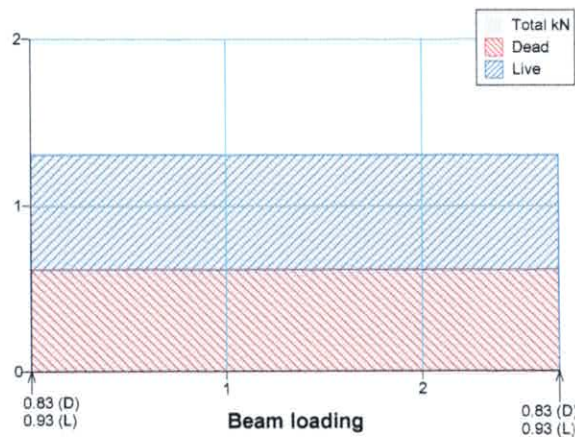
Span: 2.7 m.

	Load name	Loading w1	Start x1	Loading w2	End x2	R1comp	R2comp	Defl.
O D	o.w.	0.1	0		L	0.14	0.14	0.07
U D	Roof	0.45x1.15	0		L	0.70	0.70	0.36
U L	Roof	0.60x1.15	0		L	0.93	0.93	0.48
Total load (unfactored): 3.53 kN						1.77	1.77	0.90
Dead/Permanent (unfactored):						1.67 kN	0.83	0.43
Live/Variable (unfactored):						1.86 kN	0.93	0.48

Load types: O: Beam o.w.; U: UDL; Load positions: m. from R1; Load durations: D: Dead; L: Live

Maximum B.M. = 1.19 kNm (unfactored) at 1.35 m. from R1

Maximum S.F. = 1.77 kN (unfactored) at R1

Mid-span deflections: Dead: $0.43 \times 10^8/EI$ (E in N/mm^2 , I in cm^4)Live: $0.48 \times 10^8/EI$ Total: $0.90 \times 10^8/EI$ 

Timber beam calculation to BS5268 Part 2: 2002 using C16 timber

Use 50 x 150 C16 2.8 kg/m approx

 $z = 188 \text{ cm}^3$ $I = 1,406 \text{ cm}^4$ Timber grade: C16 Load sharing system: $K_8 = 1.1$ [§2.10.11] K_3 (loading duration factor) = 1.25 (medium term) K_7 (depth factor) = $(300/150)^{0.11} = 1.08$ [§2.10.6] K_8 (load sharing factor) = 1.1 [§2.9,2.10] $E = 8,800 \text{ N/mm}^2$ (E_{mean})

Bending

Permissible bending stress, $\sigma_{m,adm} = \sigma_{m,g} \cdot K_3 \cdot K_7 \cdot K_8 = 5.3 \times 1.25 \times 1.08 \times 1.1 = 7.86 \text{ N/mm}^2$ Applied bending stress, $\sigma_{m,a} = 1.19 \times 1000/188 = 6.35 \text{ N/mm}^2$ OK

Shear

Permissible shear stress, $\tau_{adm,||} = \tau_{g,||} \cdot K_3 \cdot K_8 = 0.67 \times 1.25 \times 1.1 = 0.92 \text{ N/mm}^2$ Applied shear stress, $\tau_a = 1.77 \times 1000 \times 3/(2 \times 50 \times 150) = 0.35 \text{ N/mm}^2$ OK

Deflection

Bending deflection = $0.905 \times 10^8/(8,800 \times 1,406) = 7.3 \text{ mm}$ Mid-span shear deflection = $1.2M_0/GA$ ($G=E/16$) = $1.2 \times 1.19 \times 10^6/((8800/16) \times 50 \times 150) = 0.3 \text{ mm}$ Total deflection = $7.3 + 0.3 = 7.7 \text{ mm}$ ($0.0028 L$) $\leq 0.003L$ OK

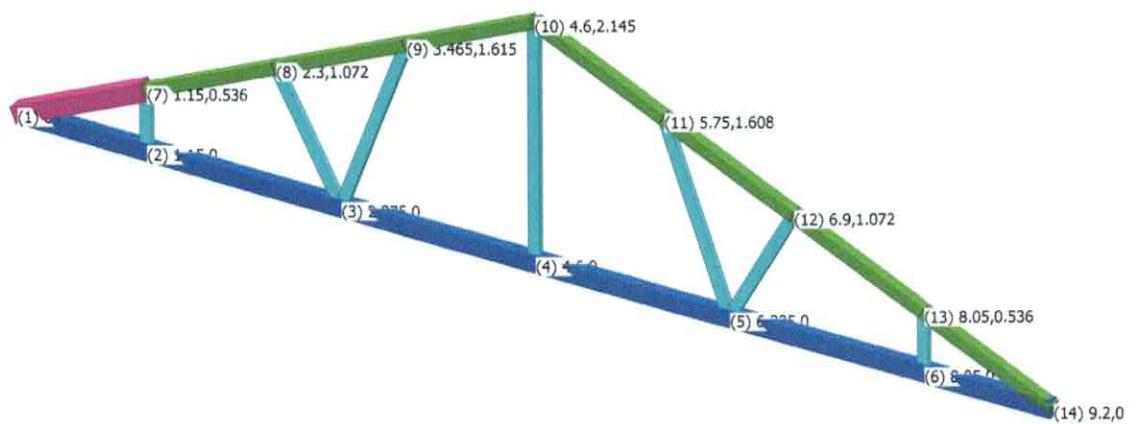
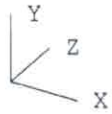
Existing 45x150 are adequate

John Marshall Associates

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Cloud 196e8

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**Frame Geometry - (Full Frame) - 3D Front View****Not to Scale**

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MasterFrame Data File

Loading Cases and Load Combination

Load Group Labels

Load Group UT	Unity Load Factor (All Cases)
Load Group D1	Dead Load
Load Group L1	Live Load

Load Case 001 : Dead plus Live (Ultimate)

Load Combination	+ 1.00 UT + 1.40 D1 + 1.60 L1
Load Duration	Long Term

Load Case 002 : Live Only (Serviceability)

Load Combination	+ 1.00 UT + 1.00 L1
Load Duration	Long Term

Load Case 003 :

Load Combination	+ 1.00 UT
Load Duration	Long Term

Load Case 004 :

Load Combination	+ 1.00 UT
Load Duration	Long Term

Load Case 005 :

Load Combination	+ 1.00 UT
Load Duration	Long Term

Load Case 006 :

Load Combination	+ 1.00 UT
Load Duration	Long Term

Load Case 007 : Dead Plus Live (Serviceability)

Load Combination	+ 1.00 UT
Load Duration	Long Term

Load Case 008 : Dead plus Live (Serviceability)

Load Combination	+ 1.00 UT + 1.00 D1 + 1.00 L1
Load Duration	Long Term

The Nodal Co-ordinates

Node	X (m)	Y (m)	Z (m)	Node	X (m)	Y (m)	Z (m)
1	0.000	0.000	0.000	2	1.150	0.000	0.000
3	2.875	0.000	0.000	4	4.600	0.000	0.000
5	6.325	0.000	0.000	6	8.050	0.000	0.000
7	1.150	0.536	0.000	8	2.300	1.072	0.000
9	3.465	1.615	0.000	10	4.600	2.145	0.000
11	5.750	1.608	0.000	12	6.900	1.072	0.000
13	8.050	0.536	0.000	14	9.200	0.000	0.000

Member Properties**Member 1**

M	150x150 C35 E 13.40E6 G .838E6 TG C35	1000000
A 225.0E-4	Ix 4219E-8	Iy 4219E-8 J 16875E-8

Members 2, 4, 6 & 8-11

M	100x100 C35 E 13.40E6 G .838E6 TG C35	1001000
A 100.0E-4	Ix 833.3E-8	Iy 833.3E-8 J 3333E-8

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Members 3, 5, 7 & 12-15

M	...	...	50x100 C35 E 13.40E6 G .838E6 TG C35	1001000
A	50.0E-4		Ix 416.7E-8	Iy 104.2E-8 J 416.7E-8

Members 16-21

M	...	...	100x150 C35 E 13.40E6 G .838E6 TG C35	1001000
A	150.0E-4		Ix 2813E-8	Iy 1250E-8 J 5000E-8

Member Loading

Member Self Weight Density Load Included in Load Group D1, defined by Modulus of Elasticity

E kN/mm ²	Density kN/m ³
>= 200.00	77.01
>= 20.00	24.00
>= 2.00	10.00

Nodal Loading and Support Conditions

NODES 1 & 7-14

L1 Ls +0000.000 -0000.760 +0000.000 +0000.000 +0000.000 +0000.000

NODES 7-14

D1 Ls +0000.000 -0000.930 +0000.000 +0000.000 +0000.000 +0000.000

NODES 1 & 14

UT Rs 1 1 1 0 0 0 (Pinned)

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Nodal Deflections (007 : Dead Plus Live (Serviceability))

Node	Nodal Def. (mm and Degrees)				Node	Nodal Def. (mm and Degrees)			
	$\delta X \rightarrow$	$\delta Y \uparrow$	$\Phi Z \curvearrowright$	δXY		$\delta X \rightarrow$	$\delta Y \uparrow$	$\Phi Z \curvearrowright$	δXY
1	0.00	0.00	0.00	0.00	2	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	4	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	10	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	12	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	14	0.00	0.00	0.00	0.00

Nodal Deflections (Maximum Values)

Node	Nodal Def. (mm and Degrees)				Node	Nodal Def. (mm and Degrees)			
	$\delta X \rightarrow$	$\delta Y \uparrow$	$\Phi Z \curvearrowright$	δXY		$\delta X \rightarrow$	$\delta Y \uparrow$	$\Phi Z \curvearrowright$	δXY
1	0.00	0.00	-0.21	0.00	2	0.01	-3.94	-0.16	3.94
3	0.03	-5.39	0.06	5.39	4	0.00	-1.79	0.00	1.79
5	-0.03	-5.58	-0.07	5.58	6	-0.02	-4.21	0.17	4.21
7	1.73	-3.94	-0.16	4.30	8	1.80	-4.55	-0.08	4.89
9	2.35	-6.17	0.10	6.60	10	0.07	-1.62	0.00	1.62
11	-2.29	-6.32	-0.10	6.72	12	-1.76	-4.76	0.09	5.07
13	-1.72	-4.22	0.13	4.56	14	0.00	0.00	0.24	0.00

Nodal Deflections (Minimum Values)

Node	Nodal Def. (mm and Degrees)				Node	Nodal Def. (mm and Degrees)			
	$\delta X \rightarrow$	$\delta Y \uparrow$	$\Phi Z \curvearrowright$	δXY		$\delta X \rightarrow$	$\delta Y \uparrow$	$\Phi Z \curvearrowright$	δXY
1	0.00	0.00	0.00	0.00	2	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	4	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	6	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	8	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	10	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	12	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	14	0.00	0.00	0.00	0.00

Member Forces Serviceability (007 : Dead Plus Live (Serviceability))

Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
1	1	0.000C	0.000	0.000		0.000
	7	0.000C	0.000	0.000	@	0.000
2	7	0.000C	0.000	0.000		0.000
	8	0.000C	0.000	0.000	@	0.000
3	3	0.000C	0.000	0.000		0.000
	8	0.000C	0.000	0.000	@	0.000
4	8	0.000C	0.000	0.000		0.000
	9	0.000C	0.000	0.000	@	0.000
5	3	0.000C	0.000	0.000		0.000
	9	0.000C	0.000	0.000	@	0.000

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Cloud 196e8

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Member Forces Serviceability (007 : Dead Plus Live (Serviceability))

Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
6	9 10	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
7	5 12	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
8	10 11	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
9	11 12	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
10	12 13	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
11	13 14	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
12	2 7	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
13	4 10	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
14	6 13	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
15	5 11	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
16	1 2	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
17	2 3	0.000C 0.000C	0.000 0.000	0.000 0.000		
18	3 4	0.000C 0.000C	0.000 0.000	0.000 0.000		
19	4 5	0.000C 0.000C	0.000 0.000	0.000 0.000		
20	5 6	0.000C 0.000C	0.000 0.000	0.000 0.000		
21	6 14	0.000C 0.000C	0.000 0.000	0.000 0.000		

Members ordered by parts of physical members. Member numbers in Italic are part of the preceeding regular member number.

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Member Forces Serviceability (Maximum Values)

Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
20	5	0.886T	0.219	0.494		
	6	0.886T	-0.040	0.648		
21	6	1.849T	-0.253	0.440		
	14	1.849T	-0.425	0.050		

Members ordered by parts of physical members. Member numbers in *Italic* are part of the preceeding regular member number.**Member Forces Serviceability (Minimum Values)**

Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
1	1	0.000C	0.000	0.000		0.000
	7	0.000C	0.000	0.000		@ 0.000
2	7	0.000C	0.000	0.000		0.000
	8	0.000C	0.000	0.000		@ 0.000
3	3	0.000C	0.000	0.000		0.000
	8	0.000C	0.000	0.000		@ 0.000
4	8	0.000C	0.000	0.000		0.000
	9	0.000C	0.000	0.000		@ 0.000
5	3	0.000C	0.000	0.000		0.000
	9	0.000C	0.000	0.000		@ 0.000
6	9	0.000C	0.000	0.000		0.000
	10	0.000C	0.000	0.000		@ 0.000
7	5	0.000C	0.000	0.000		0.000
	12	0.000C	0.000	0.000		@ 0.000
8	10	0.000C	0.000	0.000		0.000
	11	0.000C	0.000	0.000		@ 0.000
9	11	0.000C	0.000	0.000		0.000
	12	0.000C	0.000	0.000		@ 0.000
10	12	0.000C	0.000	0.000		0.000
	13	0.000C	0.000	0.000		@ 0.000
11	13	0.000C	0.000	0.000		0.000
	14	0.000C	0.000	0.000		@ 0.000
12	2	0.000C	0.000	0.000		0.000
	7	0.000C	0.000	0.000		@ 0.000
13	4	0.000C	0.000	0.000		0.000
	10	0.000C	0.000	0.000		@ 0.000
14	6	0.000C	0.000	0.000		0.000
	13	0.000C	0.000	0.000		@ 0.000

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Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
15	5 11	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
16	1 2	0.000C 0.000C	0.000 0.000	0.000 0.000		0.000 @ 0.000
17	2 3	0.000C 0.000C	0.000 0.002	0.000 0.000		
18	3 4	0.000C 0.000C	0.000 0.000	0.000 0.000		
19	4 5	0.000C 0.000C	0.000 0.000	0.000 0.000		
20	5 6	0.000C 0.000C	0.000 0.025	0.000 0.000		
21	6 14	0.000C 0.000C	0.000 0.000	0.000 0.000		

Members ordered by parts of physical members. Member numbers in *Italic* are part of the preceeding regular member number.

Support Reactions Serviceability (007 : Dead Plus Live (Serviceability))

Node	Support Reactions (kN and kN.m)			Node	Support Reactions (kN and kN.m)		
	Rx→ (kN)	Ry↑ (kN)	Mz↻ (kN.m)		Rx→ (kN)	Ry↑ (kN)	Mz↻ (kN.m)
1	0.000	0.000	0.000	Total	0.000	0.000	0.000

Support Reactions Serviceability (Maximum Values)

Node	Support Reactions (kN and kN.m)			Node	Support Reactions (kN and kN.m)		
	Rx→ (kN)	Ry↑ (kN)	Mz↻ (kN.m)		Rx→ (kN)	Ry↑ (kN)	Mz↻ (kN.m)
1	12.314	8.245	0.000	Total	0.000	17.288	0.000

Support Reactions Serviceability (Minimum Values)

Node	Support Reactions (kN and kN.m)			Node	Support Reactions (kN and kN.m)		
	Rx→ (kN)	Ry↑ (kN)	Mz↻ (kN.m)		Rx→ (kN)	Ry↑ (kN)	Mz↻ (kN.m)
1	0.000	0.000	0.000	Total	0.000	0.000	0.000

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Member Forces Serviceability (Maximum Values)

Mem ber No.	Node End1 End2	Axial Force (kN)	Shear Force (kN)	Bending Moment (kN.m)	Maximum Moment (kN.m @ m)	Maximum Deflection (mm @ m)
1	1	15.583C	0.502	0.019		0.105
	7	15.463C	0.244	0.493	@	0.711
2	7	14.235C	-0.882	0.665		0.248
	8	14.181C	-0.997	-0.528	@	0.343
3	3	3.465C	0.421	-0.340		0.319
	8	3.411C	0.450	0.190	@	0.389
4	8	12.827C	0.851	-0.338		0.400
	9	12.772C	0.735	0.681	@	0.848
5	3	1.770T	0.444	-0.360		0.379
	9	1.851T	0.415	0.379	@	1.324
6	9	10.454C	-1.818	1.060		0.390
	10	10.401C	-1.931	-1.288	@	0.939
7	5	3.349C	-0.417	0.343		0.334
	12	3.295C	-0.445	-0.181	@	0.401
8	10	10.412C	1.909	-1.288		0.398
	11	10.466C	1.794	1.062	@	0.317
9	11	12.751C	-0.727	0.678		0.401
	12	12.805C	-0.842	-0.317	@	0.444
10	12	14.148C	0.891	-0.499		0.179
	13	14.202C	0.776	0.559	@	0.952
11	13	15.710C	-0.180	0.251		0.217
	14	15.764C	-0.295	-0.050	@	0.520
12	2	0.178C	0.637	-0.169		0.015
	7	0.151C	0.637	0.172	@	0.423
13	4	3.529T	-0.001	0.001		0.000
	10	3.636T	-0.001	-0.001	@ 0.001 0.000	@ 0.000
14	6	0.213C	-0.963	0.208		0.046
	13	0.186C	-0.963	-0.308	@	0.381
15	5	1.721T	-0.456	0.369		0.371
	11	1.802T	-0.427	-0.384	@	1.315
16	1	1.598T	0.447	-0.019		4.011
	2	1.598T	0.274	0.395	@ -1.614 4.600	@ 6.877
17	2	0.961T	0.097	0.565		
	3	0.961T	-0.162	0.509		
18	3	2.073C	-1.506	1.209		
	4	2.073C	-1.765	-1.613		
19	4	2.073C	1.764	-1.614		
	5	2.073C	1.505	1.206		

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Cloud 196e8

Job Ref : Floran Farm

Sheet : Tusses with insulated she /

Made by : JM

Date : 14 August 2024 / Ver. 2022.13.18

Checked :

Approved :

MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 4 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 150, h = 150, 150x150 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 225, Z _x 562.5, Z _y 562.5, r _x 4.33, r _y 4.33
Specification	1 : Internal use in continuously heated building
	Long term loading
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 15.583 kN, L = 1.269 m, L _x = 1.269 m, L _y = 1.269 m, L _{ex} = 1.0 L _x , L _{ey} = 1.0 L _y
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.08 x 1.00 x 12.00	12.95 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.08 x 1.00 x 12.00	12.95 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.00 x 8.70	8.70 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.00 x 2.40	2.74 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.00 x 1.30	1.30 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(L_{ex}/r_x, L_{ey}/r_y)$	Max(127/4.330, 127/4.330) ≤ 180	29.3	OK
$K_{12} = \text{fn}(\lambda, K_1, \sigma_c, E)$	29.31, 8.70, 9000	0.859	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.859 x 8.70	7.47 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	15.583 / 225 ≤ 7.47	0.69 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 1.269		
$\sigma_{mx,a} = M_x/Z_x$	0.493 / 562.5 ≤ 12.95	0.88 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	12.95 (1 - 1.5 x 0.859 x 0.69 / 103.42)	12.84 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	0.69 / 7.47 + 0.88 / 12.84	0.161	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.502 / 225 ≤ 1.30	0.03 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot B_x)$	0.502 / (150 x 75) ≤ 2.74	0.04 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.11 ≤ L/333	0.11 mm	OK

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Cloud 196e8

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Made by : JM
Date : 14 August 2024 / Ver. 2022.13.18
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MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 5 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 100, 100x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 100, Zx 166.7, Zy 166.7, rx 2.89, ry 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 14.235 kN, L = 1.269 m, Lx = 1.269 m, Ly = 1.269 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx, adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my, adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{c, adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c, adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(\text{Lex}/r_x, \text{Ley}/r_y)$	Max(127/2.887, 127/2.887) ≤ 180	44.0	OK
$K_{12} = \text{fn}(\lambda, K_1, \sigma_c, E)$	43.96, 8.70, 9000	0.780	
$\sigma_{c, adm} = K_{12} \cdot \sigma_{c, adm}$	0.780 x 9.57	7.46 N/mm ²	
$\sigma_{c, a} = F/\text{Area}$	14.235 / 100 ≤ 7.46	1.42 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 0.000		
$\sigma_{mx, a} = M_x/Z_x$	0.665 / 166.67 ≤ 14.90	3.99 N/mm ²	OK
$\sigma_{mx, adm} = \sigma_{mx, adm} (1 - 1.5 K_{12} \cdot \sigma_{c, a} / \sigma_c)$	14.90 (1 - 1.5 x 0.780 x 1.42 / 45.97)	14.36 N/mm ²	
$\sigma_c / \sigma_{c, adm} + \sigma_{mx} / \sigma_{mx, adm}$	1.42 / 7.46 + 3.99 / 14.36	0.469	OK

Shear and Bearing Check

Critical Design Location	X = 0.936		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.967 / 100 ≤ 1.43	0.15 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot B_x)$	0.967 / (100 x 75) ≤ 3.01	0.13 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.25 ≤ L/333	0.25 mm	OK

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Cloud 196e8

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Made by : JM
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Checked :
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MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 17 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 50, h = 100, 100x50 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 50, Zx 83.3, Zy 41.7, rx 2.89, ry 1.44
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 3.465 kN, L = 1.216 m, Lx = 1.216 m, Ly = 1.216 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	$1.00 \times 1.00 \times 1.13 \times 1.10 \times 12.00$	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	$1.00 \times 1.00 \times 1.17 \times 1.10 \times 12.00$	15.44 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	$1.00 \times 1.00 \times 1.10 \times 8.70$	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	$1.00 \times 1.00 \times 1.14 \times 1.10 \times 2.40$	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	$1.00 \times 1.00 \times 1.10 \times 1.30$	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean}(\text{Compression})$	$1.00 \times 1.00 \times 13400$	9000.0 N/mm ²
$E = K_2 \cdot E_{mean}(\text{Deflection})$	1.00×13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(L_{ex}/r_x, L_{ey}/r_y)$	$\text{Max}(122/2.887, 122/1.443) \leq 180$	84.2	OK
$K_{12} = \text{fn}(\lambda, K_3, \sigma_c, E)$	84.25, 8.70, 9000	0.521	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.521×9.57	4.98 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	$3.465 / 50 \leq 4.98$	0.69 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 0.000		
$\sigma_{mx,a} = M_x/Z_x$	$0.340 / 83.33 \leq 14.90$	4.08 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	$14.90 (1 - 1.5 \times 0.521 \times 0.69 / 12.52)$	14.25 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	$0.69 / 4.98 + 4.08 / 14.25$	0.425	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	$1.5 \times 0.421 / 50 \leq 1.43$	0.13 N/mm ²	OK
$\sigma_{cax} = F_{vx} / (b \cdot B_x)$	$0.421 / (50 \times 75) \leq 3.01$	0.11 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span $0.32 \leq L/333$	0.32 mm	OK

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Cloud 1968

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Job Ref : Floran Farm

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Made by : JM

Date : 14 August 2024 / Ver. 2022.13.18

Checked :

Approved :

MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 6 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 100, 100x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 100, Z _x 166.7, Z _y 166.7, r _x 2.89, r _y 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 12.827 kN, L = 1.285 m, L _x = 1.285 m, L _y = 1.285 m, L _{ex} = 1.0 L _x , L _{ey} = 1.0 L _y
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(\text{Lex/rx}, \text{Ley/ry})$	$\text{Max}(129/2.887, 129/2.887) \leq 180$	44.5	OK
$K_{12} = \text{fn}(\lambda, K_3, \sigma_c, E)$	44.51, 8.70, 9000	0.777	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.777 x 9.57	7.43 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	12.827 / 100 $\leq$ 7.43	1.28 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 1.285		
$\sigma_{mx,a} = Mx/Zx$	0.681 / 166.67 $\leq$ 14.90	4.09 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	14.90 (1 - 1.5 x 0.777 x 1.28 / 44.83)	14.40 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	1.28 / 7.43 + 4.09 / 14.40	0.457	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.851 / 100 $\leq$ 1.43	0.13 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot B_x)$	0.851 / (100 x 75) $\leq$ 3.01	0.11 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.40 $\leq$ L/333	0.40 mm	OK

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Cloud 196e8

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MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 18 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 50, h = 100, 100x50 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 50, Zx 83.3, Zy 41.7, rx 2.89, ry 1.44
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = -1.851 kN, L = 1.719 m, Lx = 1.719 m, Ly = 1.719 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	$1.00 \times 1.00 \times 1.13 \times 1.10 \times 12.00$	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	$1.00 \times 1.00 \times 1.17 \times 1.10 \times 12.00$	15.44 N/mm ²
$\sigma_{t,adm} = K_2 \cdot K_3 \cdot K_8 \cdot K_{14} \cdot \sigma_t$	$1.00 \times 1.00 \times 1.10 \times 1.13 \times 7.20$	8.94 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	$1.00 \times 1.00 \times 1.14 \times 1.10 \times 2.40$	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	$1.00 \times 1.00 \times 1.10 \times 1.30$	1.43 N/mm ²
$E = K_2 \cdot E_{mean}$	1.00×13400	13400.0 N/mm ²

Tensile Resistance

$\sigma_{t,a} = F / \text{Area}$	$1.851 / 50 \leq 8.94$	0.37 N/mm ²	OK
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Axial Load with Moments Check

Critical Design Location	X = 1.719		
$\sigma_{mx,a} = Mx / Zx$	$0.379 / 83.33 \leq 14.90$	4.55 N/mm ²	OK
$\sigma_t / \sigma_{t,adm} + \sigma_{mx} / \sigma_{mx,adm}$	$0.37 / 8.94 + 4.55 / 14.90$	0.347	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	$1.5 \times 0.444 / 50 \leq 1.43$	0.13 N/mm ²	OK
$\sigma_{cax} = F_{vx} / (b \cdot Bx)$	$0.444 / (50 \times 75) \leq 3.01$	0.12 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span $0.38 \leq L/333$	0.38 mm	OK

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Cloud 196e8

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MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 11 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 100, 100x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 100, Z _x 166.7, Z _y 166.7, rx 2.89, ry 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 10.454 kN, L = 1.253 m, L _x = 1.253 m, L _y = 1.253 m, L _{ex} = 1.0 L _x , L _{ey} = 1.0 L _y Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean}$ (Compression)	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean}$ (Deflection)	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(\lambda_{ex/rx}, \lambda_{ey/ry})$	$\text{Max}(125/2.887, 125/2.887) \leq 180$	43.4	OK
$K_{12} = \text{fn}(\lambda, K_3, \sigma_c, E)$	43.41, 8.70, 9000	0.783	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.783 x 9.57	7.49 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	10.454 / 100 $\leq$ 7.49	1.05 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 1.253		
$\sigma_{mx,a} = M_x/Z_x$	1.288 / 166.67 $\leq$ 14.90	7.73 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	14.90 (1 - 1.5 x 0.783 x 1.05 / 47.15)	14.51 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	1.05 / 7.49 + 7.73 / 14.51	0.672	OK

Shear and Bearing Check

Critical Design Location	X = 0.924		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 1.902 / 100 $\leq$ 1.43	0.29 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot B_x)$	1.902 / (100 x 75) $\leq$ 3.01	0.25 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.39 $\leq$ L/333	0.39 mm	OK

John Marshall Associates

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Unit 4, Riverview Business Park

Station Road, Forest Row

East Sussex, RH18 5FS

Tel: (01342) 826226

Job Ref : Floran Farm

Sheet : Tusses with insulated she /

Made by : JM

Date : 14 August 2024 / Ver. 2022.13.18

Checked :

Approved :

MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 15 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, 1.0 D1 - 1.0 L1
Section Size	b = 50, h = 100, 100x50 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 50, Zx 83.3, Zy 41.7, rx 2.89, ry 1.44
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 3.349 kN, L = 1.216 m, Lx = 1.216 m, Ly = 1.216 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.17 x 1.10 x 12.00	15.44 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(\text{Lex/rx}, \text{Ley/ry})$	$\text{Max}(122/2.887, 122/1.443) \leq 180$	84.2	OK
$K_{12} = f_n(\lambda, K_3 \cdot \sigma_c, E)$	84.25, 8.70, 9000	0.521	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.521 x 9.57	4.98 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	3.349 / 50 $\leq$ 4.98	0.67 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 0.000		
$\sigma_{mx,a} = Mx/Zx$	0.343 / 83.33 $\leq$ 14.90	4.12 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	14.90 (1 - 1.5 x 0.521 x 0.67 / 12.52)	14.27 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	0.67 / 4.98 + 4.12 / 14.27	0.423	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.417 / 50 $\leq$ 1.43	0.13 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot Bx)$	0.417 / (50 x 75) $\leq$ 3.01	0.11 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.33 $\leq$ L/333	0.33 mm	OK

John Marshall Associates

Cloud 196e8

Unit 4, Riverview Business Park

Station Road, Forest Row

East Sussex, RH18 5FS

Tel: (01342) 826226

Job Ref : Floran Farm

Sheet : Tussets with insulated she /

Made by : JM

Date : 14 August 2024 / Ver. 2022.13.18

Checked :

Approved :

MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 10 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 100, 100x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 100, Z _x 166.7, Z _y 166.7, rx 2.89, ry 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 10.466 kN, L = 1.269 m, L _x = 1.269 m, L _y = 1.269 m, L _{ex} = 1.0 L _x , L _{ey} = 1.0 L _y
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx, adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my, adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{c, adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c, adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(\lambda_{ex/rx}, \lambda_{ey/ry})$	$\text{Max}(127/2.887, 127/2.887) \leq 180$	44.0	OK
$K_{12} = \text{fn}(\lambda, K_1, \sigma_c, E)$	43.96, 8.70, 9000	0.780	
$\sigma_{c, adm} = K_{12} \cdot \sigma_{c, adm}$	0.780 x 9.57	7.46 N/mm ²	
$\sigma_{c, a} = F/\text{Area}$	10.466 / 100 $\leq$ 7.46	1.05 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 0.000		
$\sigma_{mx, a} = M_x/Z_x$	1.288 / 166.67 $\leq$ 14.90	7.73 N/mm ²	OK
$\sigma_{mx, adm} = \sigma_{mx, adm} (1 - 1.5 K_{12} \cdot \sigma_{c, a} / \sigma_c)$	14.90 (1 - 1.5 x 0.780 x 1.05 / 45.97)	14.50 N/mm ²	
$\sigma_c / \sigma_{c, adm} + \sigma_{mx} / \sigma_{mx, adm}$	1.05 / 7.46 + 7.73 / 14.50	0.673	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 1.909 / 100 $\leq$ 1.43	0.29 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot B_x)$	1.909 / (100 x 75) $\leq$ 3.01	0.25 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.40 $\leq$ L/333	0.40 mm	OK

John Marshall Associates

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Cloud 196e8

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Made by : JM
Date : 14 August 2024 / Ver. 2022.13.18
Checked :
Approved :

MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 8 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 100, 100x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 100, Zx 166.7, Zy 166.7, rx 2.89, ry 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 12.805 kN, L = 1.269 m, Lx = 1.269 m, Ly = 1.269 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean}(\text{Compression})$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean}(\text{Deflection})$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(L_{ex}/r_x, L_{ey}/r_y)$	$\text{Max}(127/2.887, 127/2.887) \leq 180$	44.0	OK
$K_{12} = \text{fn}(\lambda, K_3, \sigma_c, E)$	43.96, 8.70, 9000	0.780	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.780 x 9.57	7.46 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	12.805 / 100 $\leq$ 7.46	1.28 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 0.000		
$\sigma_{mx,a} = M_x/Z_x$	0.678 / 166.67 $\leq$ 14.90	4.07 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	14.90 (1 - 1.5 x 0.780 x 1.28 / 45.97)	14.41 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	1.28 / 7.46 + 4.07 / 14.41	0.454	OK

Shear and Bearing Check

Critical Design Location	X = 1.189		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.835 / 100 $\leq$ 1.43	0.13 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot B_x)$	0.835 / (100 x 75) $\leq$ 3.01	0.11 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.40 $\leq$ L/333	0.40 mm	OK

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Member TBL1Id 9 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 100, 100x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 100, Zx 166.7, Zy 166.7, rx 2.89, ry 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 14.202 kN, L = 1.269 m, Lx = 1.269 m, Ly = 1.269 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7X} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7Y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(\text{Lex/rx}, \text{Ley/ry})$	$\text{Max}(127/2.887, 127/2.887) \leq 180$	44.0	OK
$K_{12} = \text{fn}(\lambda, K_1 \cdot \sigma_c, E)$	43.96, 8.70, 9000	0.780	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.780 x 9.57	7.46 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	14.202 / 100 $\leq$ 7.46	1.42 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 1.269		
$\sigma_{mx,a} = Mx/Zx$	0.559 / 166.67 $\leq$ 14.90	3.35 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	14.90 (1 - 1.5 x 0.780 x 1.42 / 45.97)	14.36 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	1.42 / 7.46 + 3.35 / 14.36	0.424	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.891 / 100 $\leq$ 1.43	0.13 N/mm ²	OK
$\sigma_{cax} = F_v x / (b \cdot B_x)$	0.891 / (100 x 75) $\leq$ 3.01	0.12 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.18 $\leq$ L/333	0.18 mm	OK

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Member TBL1Id 7 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 100, 100x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 100, Zx 166.7, Zy 166.7, rx 2.89, ry 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 15.764 kN, L = 1.269 m, Lx = 1.269 m, Ly = 1.269 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(L_{ex}/r_x, L_{ey}/r_y)$	Max(127/2.887, 127/2.887) ≤ 180	44.0	OK
$K_{12} = \text{fn}(\lambda, K_1, \sigma_c, E)$	43.96, 8.70, 9000	0.780	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.780 x 9.57	7.46 N/mm ²	
$\sigma_{c,a} = F/\text{Area}$	15.764 / 100 ≤ 7.46	1.58 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 0.000		
$\sigma_{mx,a} = M_x/Z_x$	0.251 / 166.67 ≤ 14.90	1.51 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	14.90 (1 - 1.5 x 0.780 x 1.58 / 45.97)	14.30 N/mm ²	
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	1.58 / 7.46 + 1.51 / 14.30	0.317	OK

Shear and Bearing Check

Critical Design Location	X = 0.603		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.234 / 100 ≤ 1.43	0.04 N/mm ²	OK
$\sigma_{cax} = F_{vx} / (b \cdot Bx)$	0.234 / (100 x 75) ≤ 3.01	0.03 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.22 ≤ L/333	0.22 mm	OK

John Marshall Associates

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Cloud 196e8

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MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TCL1Id 13 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 – 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 – 1.0 L1
Section Size	b = 50, h = 100, 100x50 in Strength Class C35
Section Properties (cm²,cm³,cm)	Area 50, Zx 83.3, Zy 41.7, rx 2.89, ry 1.44
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 0.178 kN, L = 0.536 m, Lx = 0.536 m, Ly = 0.536 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2.K_3.K_{7X}.K_8.\sigma_m$	$1.00 \times 1.00 \times 1.13 \times 1.10 \times 12.00$	14.90 N/mm²
$\sigma_{my,adm} = K_2.K_3.K_{7Y}.K_8.\sigma_m$	$1.00 \times 1.00 \times 1.17 \times 1.10 \times 12.00$	15.44 N/mm²
$\sigma_{c,adm} = K_2.K_3.K_8.\sigma_c$	$1.00 \times 1.00 \times 1.10 \times 8.70$	9.57 N/mm²
$\sigma_{c,adm} = K_2.K_3.K_4.K_8.\sigma_c$	$1.00 \times 1.00 \times 1.14 \times 1.10 \times 2.40$	3.01 N/mm²
$\tau_{adm} = K_2.K_3.K_8.\tau$	$1.00 \times 1.00 \times 1.10 \times 1.30$	1.43 N/mm²
$E = K_2.K_{20}.E_{mean}(\text{Compression})$	$1.00 \times 1.00 \times 13400$	9000.0 N/mm²
$E = K_2.E_{mean}(\text{Deflection})$	1.00×13400	13400.0 N/mm²

Compression Resistance

$\lambda = \text{Max}(L_{ex}/r_x, L_{ey}/r_y)$	$\text{Max}(54/2.887, 54/1.443) \leq 180$	37.1	OK
$K_{12} = \text{fn}(\lambda, K_3, \sigma_c, E)$	37.14, 8.70, 9000	0.818	
$\sigma_{c,adm} = K_{12}.\sigma_{c,adm}$	0.818×9.57	7.83 N/mm²	
$\sigma_{c,a} = F/\text{Area}$	$0.178 / 50 \leq 7.83$	0.04 N/mm²	OK

Axial Load with Moments Check

Critical Design Location	$X = 0.536$		
$\sigma_c/\sigma_{c,adm}$	$0.04/7.83$	0.005	OK
$\sigma_{cax} = F_{vx} / (b.Bx)$	$0.637 / (50 \times 75) \leq 3.01$	0.17 N/mm²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span $0.01 \leq L/333$	0.01 mm	OK

John Marshall Associates

Cloud 196e8

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MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TCL1Id 12 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 50, h = 100, 100x50 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 50, Zx 83.3, Zy 41.7, rx 2.89, ry 1.44
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = -3.636 kN, L = 2.145 m, Lx = 2.145 m, Ly = 2.145 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.17 x 1.10 x 12.00	15.44 N/mm ²
$\sigma_{t,adm} = K_2 \cdot K_3 \cdot K_8 \cdot K_{14} \cdot \sigma_t$	1.00 x 1.00 x 1.10 x 1.13 x 7.20	8.94 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot E_{mean}$	1.00 x 13400	13400.0 N/mm ²

Tensile Resistance

$\sigma_{t,a} = F/Area$	3.636 / 50 ≤ 8.94	0.73 N/mm ²	OK
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Axial Load with Moments Check

Critical Design Location	X = 0.000		
$\sigma_v / \sigma_{t,adm}$	0.73/8.94	0.081	OK

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Job Ref : Floran Farm

Sheet : Tusses with insulated she /

Made by : JM

Date : 14 August 2024 / Ver. 2022.13.18

Checked :

Approved :

MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TCL1Id 20 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1,, 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1,, 1.0 D1 - 1.0 L1
Section Size	b = 50, h = 100, 100x50 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 50, Zx 83.3, Zy 41.7, rx 2.89, ry 1.44
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 0.213 kN, L = 0.536 m, Lx = 0.536 m, Ly = 0.536 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx, adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_{my, adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.17 x 1.10 x 12.00	15.44 N/mm ²
$\sigma_{c, adm} = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c, adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(L_{ex}/r_x, L_{ey}/r_y)$	Max(54/2.887, 54/1.443) ≤ 180	37.1	OK
$K_{12} = \text{fn}(\lambda, K_3, \sigma_c, E)$	37.14, 8.70, 9000	0.818	
$\sigma_{c, adm} = K_{12} \cdot \sigma_{c, adm}$	0.818 x 9.57	7.83 N/mm ²	
$\sigma_{c, a} = F/\text{Area}$	0.213 / 50 ≤ 7.83	0.04 N/mm ²	OK

Axial Load with Moments Check

Critical Design Location	X = 0.536		
$\sigma_{mx, a} = M_x/Z_x$	0.308 / 83.33 ≤ 14.90	3.70 N/mm ²	OK
$\sigma_{mx, adm} = \sigma_{mx, adm} (1 - 1.5 K_{12} \cdot \sigma_{c, a} / \sigma_c)$	14.90 (1 - 1.5 x 0.818 x 0.04 / 64.41)	14.88 N/mm ²	
$\sigma_c / \sigma_{c, adm} + \sigma_{mx} / \sigma_{mx, adm}$	0.04 / 7.83 + 3.70 / 14.88	0.254	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / \text{Area}$	1.5 x 0.963 / 50 ≤ 1.43	0.29 N/mm ²	OK
$\sigma_{cax} = F_{vx} / (b \cdot B_x)$	0.963 / (50 x 75) ≤ 3.01	0.26 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.05 ≤ L/333	0.05 mm	OK

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MasterKey : Timber Design
Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 21 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 – 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 – 1.0 L1
Section Size	b = 50, h = 100, 100x50 in Strength Class C35
Section Properties (cm²,cm³,cm)	Area 50, Zx 83.3, Zy 41.7, rx 2.89, ry 1.44
Specification	1 : Internal use in continuously heated building Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = -1.802 kN, L = 1.708 m, Lx = 1.708 m, Ly = 1.708 m, Lex = 1.0 Lx, Ley = 1.0 Ly Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx.adm} = K_2.K_3.K_{7x}.K_8.\sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm²
$\sigma_{my.adm} = K_2.K_3.K_{7y}.K_8.\sigma_m$	1.00 x 1.00 x 1.17 x 1.10 x 12.00	15.44 N/mm²
$\sigma_{t.adm} = K_2.K_3.K_8.K_{14}.\sigma_t$	1.00 x 1.00 x 1.10 x 1.13 x 7.20	8.94 N/mm²
$\sigma_{c.adm} = K_2.K_3.K_4.K_8.\sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm²
$\tau_{adm} = K_2.K_3.K_8.\tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm²
$E = K_2.E_{mean}$	1.00 x 13400	13400.0 N/mm²

Tensile Resistance

$\sigma_{t.a} = F/Area$	1.802 / 50 ≤ 8.94	0.36 N/mm²	OK
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Axial Load with Moments Check

Critical Design Location	X = 1.708		
$\sigma_{mx.a} = Mx/Zx$	0.384 / 83.33 ≤ 14.90	4.61 N/mm²	OK
$\sigma_t/\sigma_{t.adm} + \sigma_{mx}/\sigma_{mx.adm}$	0.36/8.94+4.61/14.90	0.350	OK

Shear and Bearing Check

Critical Design Location	X = 0.000		
$\tau_a = 1.5 F_v / Area$	1.5 x 0.456 / 50 ≤ 1.43	0.14 N/mm²	OK
$\sigma_{cax} = Fvx / (b.Bx)$	0.456 / (50 x 75) ≤ 3.01	0.12 N/mm²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 0.37 ≤ L/333	0.37 mm	OK

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Axial Load With Moment Design to BS 5268 : Part 2
Member TBL1Id 22 @ Level 1

Summary Design Data

Design Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Deflection Cases Covered	1.0 L1, , , , , 1.0 D1 - 1.0 L1
Section Size	b = 100, h = 150, 150x100 in Strength Class C35
Section Properties (cm ² , cm ³ , cm)	Area 150, Zx 375, Zy 250, rx 4.33, ry 2.89
Specification	1 : Internal use in continuously heated building
	Long term loading, Load sharing
Integrated Design Critical Case	: Dead plus Live (Serviceability)
Member Details	F = 2.073 kN, L = 9.2 m, Lx = 9.2 m, Ly = 9.2 m, Lex = 1.0 Lx, Ley = 1.0 Ly
	Bearing length B 75, Distance to Bearing 150 mm

Grade and Admissible Stresses (Strength Class C35)

$\sigma_{mx,adm} = K_2 \cdot K_3 \cdot K_{7x} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.08 x 1.10 x 12.00	14.25 N/mm ²
$\sigma_{my,adm} = K_2 \cdot K_3 \cdot K_{7y} \cdot K_8 \cdot \sigma_m$	1.00 x 1.00 x 1.13 x 1.10 x 12.00	14.90 N/mm ²
$\sigma_c,adm = K_2 \cdot K_3 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.10 x 8.70	9.57 N/mm ²
$\sigma_{c,adm} = K_2 \cdot K_3 \cdot K_4 \cdot K_8 \cdot \sigma_c$	1.00 x 1.00 x 1.14 x 1.10 x 2.40	3.01 N/mm ²
$\tau_{adm} = K_2 \cdot K_3 \cdot K_8 \cdot \tau$	1.00 x 1.00 x 1.10 x 1.30	1.43 N/mm ²
$E = K_2 \cdot K_{20} \cdot E_{mean} \text{ (Compression)}$	1.00 x 1.00 x 13400	9000.0 N/mm ²
$E = K_2 \cdot E_{mean} \text{ (Deflection)}$	1.00 x 13400	13400.0 N/mm ²

Compression Resistance

$\lambda = \text{Max}(L_{ex}/r_x, L_{ey}/r_y)$	Max(920/4.330, 920/2.887) ≤ 180	318.7	Warning
$K_{12} = f_n(\lambda, K_3 \cdot \sigma_c, E)$	318.70, 8.70, 9000	0.060	
$\sigma_{c,adm} = K_{12} \cdot \sigma_{c,adm}$	0.060 x 9.57	0.58 N/mm ²	OK
$\sigma_{c,a} = F/\text{Area}$	2.073 / 150 ≤ 0.58	0.14 N/mm ²	

Axial Load with Moments Check

Critical Design Location	X = 4.600		
$\sigma_{mx,a} = M_x/Z_x$	1.614 / 375 ≤ 14.25	4.30 N/mm ²	OK
$\sigma_{mx,adm} = \sigma_{mx,adm} (1 - 1.5 K_{12} \cdot \sigma_{c,a} / \sigma_c)$	14.25 (1 - 1.5x0.060x0.14/0.87)	14.04 N/mm ²	OK
$\sigma_c / \sigma_{c,adm} + \sigma_{mx} / \sigma_{mx,adm}$	0.14/0.58 + 4.30/14.04	0.546	

Shear and Bearing Check

Critical Design Location	X = 4.600		
$\tau_n = 1.5 F_v / \text{Area}$	1.5 x 1.765 / 150 ≤ 1.43	0.18 N/mm ²	OK
$\sigma_{cax} = F_{vx} / (b \cdot B_x)$	1.765 / (100 x 75) ≤ 3.01	0.24 N/mm ²	OK

Deflection Check (Shear Deflection NOT Included)

Critical Load Case 008 : Dead plus Live (Serviceability)			
$\delta = \delta_m$	In-span 4.01 ≤ L/333	4.01 mm	OK