CALVERT BRAIN & FRAULO LTD
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Project				Job Ref.	
21, Fakenham Road, Great Ryburgh				238974	
Section				Sheet no./rev.	
Proposed Roof Design				1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
BH	09-10-2023	RWB	09-10-2023		

GENERAL CALCULATION NOTES

Dead Loads have been calculated from manufacturer's literature and standard material densities.

Imposed roof loads have been taken from BS 6399 : Part 3 : 1988 – British Standard Code of practice for imposed roof loads.

Imposed floor loads have been taken from BS 6399 - 1 : 1996 Loadings for buildings – British Standard Code of practice for dead and imposed loads.

Load combinations and load factors have been taken in accordance with BS 5950 and are detailed in the printout of the portal frame calculations.

All Timber has been designed in accordance with BS 5268 - 2 : 2002 - British Standard Code of practice for Structural Use Of Timber – permissible stress design, materials and workmanship.

GENERAL LOADS

Pitched Roof Load

Dead Loads

Pan Tiles	PT = **0.50** kN/m^2
Rafters	R = **0.14** kN/m^2
Insulation & Battens	IB = **0.05** kN/m^2
Ceilings	C = **0.15** kN/m^2
Total Roof Dead Load	TRDL = (PT + R + IB + C) = **0.84**kN/m^2

Imposed Loads

Pitched Roof Imposed Load	PRIL = **0.53** kN/m^2

Pitched Roof Load (Excluding Ceiling)

Dead Loads

Pan Tiles	PT = **0.50** kN/m^2
Rafters	R = **0.14** kN/m^2
Insulation & Battens	IB = **0.05** kN/m^2
Total Roof Excludng Ceiling Dead Load	TRECDL = (PT + R + IB) = **0.69**kN/m^2

Imposed Loads

Pitched Roof Excluding Ceiling Imposed Load	PRECIL = **0.53** kN/m^2

Ceiling Load

Dead Loads

Ceilings	C = **0.25** kN/m^2
Total Ceiling Dead Load	TCDL = (C) = **0.25**kN/m^2

Imposed Loads

Ceiling Imposed Load CIL = **0.25** kN/m^2

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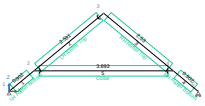
CHECK RAISED COLLAR ROOF DESIGN

ANALYSIS

Tedds calculation version 1.0.37

Geometry

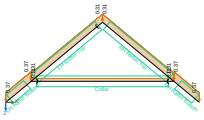
Geometry (m) - C24 (BS5268) - 47x147



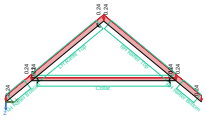
Loading

Self weight included

Permanent - Loading (kN/m)



Imposed - Loading (kN/m)



Results

Total deflection

Member results

Load combination: DL + IL (Strength)

Element	Deflection				Axial deflection			
	Pos (m)	Max (mm)	Pos (m)	Min (mm)	Pos (m)	Max (mm)	Pos (m)	Min (mm)
1	0.902	14.6	0	0	0	0	0.902	0
2	1.134	21.3	0	14.6	0	0	2.531	-0.1
3	1.396	9.3	2.53	2.6	0	14.5	2.53	14.4
4	0	2.6	0.902	-12	0	14.4	0.902	14.4
5	1.946	16.9	3.893	11.3	3.893	9.4	0	9.3

Member results

Load combination: DL (Strength)

Element	Deflection				Axial deflection			
	Pos (m)	Max (mm)	Pos (m)	Min (mm)	Pos (m)	Max (mm)	Pos (m)	Min (mm)
1	0.902	8.6	0	0	0	0	0.902	0
2	1.134	12.4	0	8.6	0	0	2.531	-0.1
3	1.396	5.4	2.53	1.5	0	8.5	2.53	8.4
4	0	1.5	0.902	-7	0	8.4	0.902	8.4
5	1.946	9.7	3.893	6.6	3.893	5.5	0	5.5

Member results

Load combination: IL (Strength)

Element	Deflection				Axial deflection			
	Pos (m)	Max (mm)	Pos (m)	Min (mm)	Pos (m)	Max (mm)	Pos (m)	Min (mm)
1	0.902	6.1	0	0	0	0	0.902	0
2	1.134	8.8	0	6.1	0	0	2.531	0
3	1.396	3.9	2.53	1.1	0	6	2.53	6
4	0	1.1	0.902	-5	0	6	0.902	6
5	1.946	7.2	3.893	4.7	3.893	3.9	0	3.9

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Node deflections

Load combination: DL + IL (Strength)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	1.00977	
2	9.3	11.3	0.69867	
3	9.4	11.4	0.39447	
4	9.4	11.3	-0.69846	
5	18.8	0	-1.00958	

Load combination: DL (Strength)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	0.59045	
2	5.5	6.6	0.40823	
3	5.5	6.7	0.23054	
4	5.5	6.6	-0.4081	
5	11	0	-0.59034	

Load combination: IL (Strength)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	0.41932	
2	3.9	4.7	0.29045	
3	3.9	4.7	0.16393	
4	3.9	4.7	-0.29036	
5	7.8	0	-0.41924	

Total base reactions

Load case/combination	Force	
	FX (kN)	FZ (kN)
DL + IL (Strength)	0	5
DL (Strength)	0	3
IL (Strength)	0	2.1

Element end forces

Load combination: DL + IL (Strength)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	0.902	1	-1.6	-1.9	0
		2	1.2	1.5	1.6
2	2.531	2	-2.4	0	-1.6
		3	1.4	-1.2	0
3	2.53	3	-1.4	-1.2	0
		4	2.4	0.1	1.6
4	0.902	4	-1.2	1.5	-1.6
		5	1.6	-1.9	0
5	3.893	2	1.8	-0.5	0
		4	-1.8	-0.5	0

Load combination: DL (Strength)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	0.902	1	-0.9	-1.1	0
		2	0.7	0.9	0.9
2	2.531	2	-1.4	0	-0.9
		3	0.8	-0.7	0
3	2.53	3	-0.8	-0.7	0
		4	1.4	0	0.9
4	0.902	4	-0.7	0.9	-0.9
		5	0.9	-1.1	0
5	3.893	2	1.1	-0.3	0
		4	-1.1	-0.3	0

Load combination: IL (Strength)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	0.902	1	-0.7	-0.8	0
		2	0.5	0.6	0.6
2	2.531	2	-1	0	-0.6
		3	0.6	-0.5	0
3	2.53	3	-0.6	-0.5	0
		4	1	0	0.6
4	0.902	4	-0.5	0.6	-0.6
		5	0.7	-0.8	0
5	3.893	2	0.8	-0.2	0
		4	-0.8	-0.2	0

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Forces

Element results

Envelope - Strength combinations

Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
1	0	1.9	0.902	1.6 (max)	0	0 (min)
2	2.531	-1.2	0	1.6 (max)	2.531	0 (min)
3	0	1.2	2.53	1.6 (max)	0	0 (min)
4	0.902	-1.9 (max abs)	0	1.6 (max)	0.902	0 (min)
5	3.893	-0.5	1.947	0.5	3.893	0 (min)

Envelope - All combinations

Element	Axial force			
	Pos (m)	Max (kN)	Pos (m)	Min (kN)
1	0	1.6	0.902	0.5
2	0	2.4 (max)	2.531	0.6
3	2.53	2.4 (max)	0	0.6
4	0.902	1.6	0	0.5
5	0	-0.8	0	-1.8 (min)

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DESIGN RAFTERS

The rafters span from the wall plate to the ridge plate and from the analysis above the maximum bending moment is 1.6kNm and the maximum shear force is 1.5kN.

TIMBER MEMBER DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.03

Analysis results

Design moment in major axis	M_x = **1.600** kNm
Design shear	F = **1.500** kN
Design axial tension	P = **2.400** kN

Timber section details

Breadth of section	b = **47** mm	Depth of section	h = **147** mm
Number of sections	N = **1**	Breadth of beam	b_b = **47** mm
Timber strength class	**C24**		

Member details

Service class of timber	**1**	Load duration	**Medium term**

The beam is part of a load-sharing system consisting of four or more members

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	**4.00**	Actual depth-to-breadth ratio	**3.13**

PASS - Lateral support is adequate

Bending parallel to grain

Permissible bending stress	σ_{m_adm} = **11.154** N/mm^2	Applied bending stress	σ_{m_a} = **9.452** N/mm^2

PASS - Applied bending stress is less than permissible bending stress

Tension parallel to grain

Permissible tensile stress	σ_{t_adm} = **6.693** N/mm^2	Applied tensile stress	σ_{t_a} = **0.347** N/mm^2

PASS - Applied tensile stress is less than permissible tensile stress

Members subject to axial tension and bending - cl.2.12.3

Comb.tension and bending	**0.899 < 1**

PASS - Combined tensile and bending stresses are within permissible limits

Shear parallel to grain

Permissible shear stress	τ_{adm} = **0.976** N/mm^2	Applied shear stress	τ_a = **0.326** N/mm^2

PASS - Applied shear stress is less than permissible shear stress

Existing rafters are adequate.

PROJECT 21, FAKENHAM ROAD, GREAT RYBURGH

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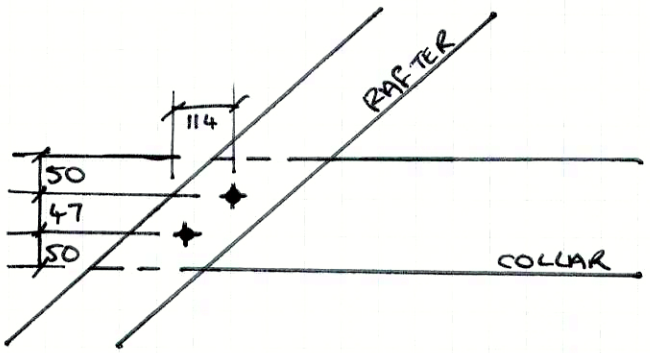
RAFTER TO COLLAR CONNECTION.



2No M10 Bolts with 38mm Round DSTPC.

Consider Collar

$f_{adm} = f \times k_{58} \times k_{59} \times k_{60} \times k_{61}$

$f_{adm} = 2.55kN \times 1.12 \times 1 \times 1 \times 0.97 \times 2$

$f_{adm} = 5.54\ kN$

$k_{61} = 1 - \left(\frac{3(n-1)}{100}\right)$

$k_{61} = 0.97$

Actual load = 2.4kN

f_{adm} > Actual load, Collar ok.

Consider Rafter

$f_{adm} = f \times k_{58} \times k_{59} \times k_{60} \times k_{61}$

$f_{adm} = 1.74kN \times 1.12 \times 1 \times 1 \times 2$

$f_{adm} = 3.9kN$

Actual load = 2.4kN

f_{adm} > Actual load, Rafter ok.