

Job No 20/111	Date Aug 20	For Diss Town Council	GRIFFITHS &TAYLOR STRUCTURAL ENGINEERS 7 Cobbs Yard, St Nicholas Street, Diss, Norfolk, Ip22 4LB Tel: 01379 772902 mail@griffithsandtaylor.co.uk	
Subject Diss Cemetery Chapel. Survey Structural Calculations.				
Contents			1. Design Information	Sheet No Rev 1 0
			2. Loading	
			3. Roof	
1. Design Information				
1.01 Revision History		Rev	Date	Pages
1.02 Related Documents:				
Drawings:		20/111/D1-0		
Reports/Docs:		-		
1.03 Scope of Works				
To provide structural calculations for repairs to cemetery.				
1.04 Design Codes & Standards * Delete as applicable				
Imposed loads		BS 6399: Part 1	/	BS EN 1991-1-1 (Eurocode 1)
Snow loads		BS 6399: Part 3	/	BS EN 1991-1-3 (Eurocode 1)
Wind loads		BS 6399: Part 2	/	BS EN 1991-1-4 (Eurocode 1)
Steel		BS 5950-1	/	BS EN 1993-1-1 (Eurocode 3)
Concrete		BS 8110: Part 1	/	BS EN 1992-1-1 (Eurocode 2)
Timber		BS 5268-2	/	BS EN 1995-1-1 (Eurocode 5)
Masonry		BS 5628-1	/	BS EN 1996-1-1 (Eurocode 6)
Other				
1.05 Design Review				
Design Prepared By:			Reviewed By:	
James Griffiths CEng MICE			Angus Taylor BSc	

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2. Loading

Main roof

Pitch	59.00 deg.		
Dead:		Live: So=	0.60 KN/sqm
Tiles	45.00 kg/sqm	Sb=	0.02 KN/sqm
Felt/batts	5.00 kg/sqm		
Rafters	15.00 kg/sqm		
Insulation	0.00 kg/sqm		
Sarking	10.00 kg/sqm		
total (slope)	75.00 kg/sqm		
total (plan)	1.43 KN/sqm		

3. Roof

Roof span	4.92 m		
Roof pitch	59.00 deg		
roof load	1.45 kN/sqm on plan		
load to be supported	3.56 kN/m		
Support spacing	4.15 m	assuming simply supported	

i. Ridge beam

Consider	1.00 No. piece	C16		
	200.00 x	25.00 mm		
composite	200.00 x	25.00 mm		
Modulus E	5800.00 N/sqmm		K9	1.00
Ixx	16.67 mm ⁴ x10 ⁶			

ii. Wall plate

Consider	1.00 No. piece	C24		
	400.00 x	45.00 mm		
composite	400.00 x	45.00 mm		
Modulus E	7200.00 N/sqmm		K9	1.00
Ixx	240.00 mm ⁴ x10 ⁶			

Deflection resistances

from wall plates	3456.00 Nmm ² x10 ³
from ridge beam	96.67 Nmm ² x10 ³

Proportion of loads

on wall plates	97.3%
on ridge beam	2.7%

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Check bending in ridge beam

Load	0.10 KN/m	Medium term loading
Moment	0.21 KNm	K3 1.25
0m allow	5.30 N/sqmm f C16	K7 1.05
0m allow	6.93 N/sqmm	K8 1.00
Z req'd	30.13 cu.cm	
Z prov'd	166.67 cu.cm	553% of Z req'd OK
Allow deflection	0.0030 x span	
deflection	3.87 mm	= span x 0.0009 OK

Check bending in wall plate

	Consider	1.00 No. piece	C24	
		400.00 x	45.00 mm	
	composite	400.00 x	45.00 mm	
Max Span	4.15 m	simply supported		
Load Mx	1.04 KN/m	Medium term loading		
Load My	0.00 KN/m	supported by wall		
Moment Mx	2.24 KNm			
Moment My	0.00 KNm			
0m allow	7.50 N/sqmm f C24	K3 1.25		
0m allow	9.38 N/sqmm	K8 1.00		
Modulus E	7200.00 N/sqmm	K9 1.00		
Deflection<	12.45 mm	0.003 x span		
Ix req'd	44.87 mm ⁴ x10 ⁶			
Ix prov'd	240.00 mm ⁴ x10 ⁶	535% of I req'd	OK	
Iy req'd	0.04 mm ⁴ x10 ⁶			
Iy prov'd	3.04 mm ⁴ x10 ⁶	7050% of I req'd	OK	
Zx	1200.00 cu.cm			
Zy	135.00 cu.cm			
Max 0m applied	1.88 N/sqmm	OK		

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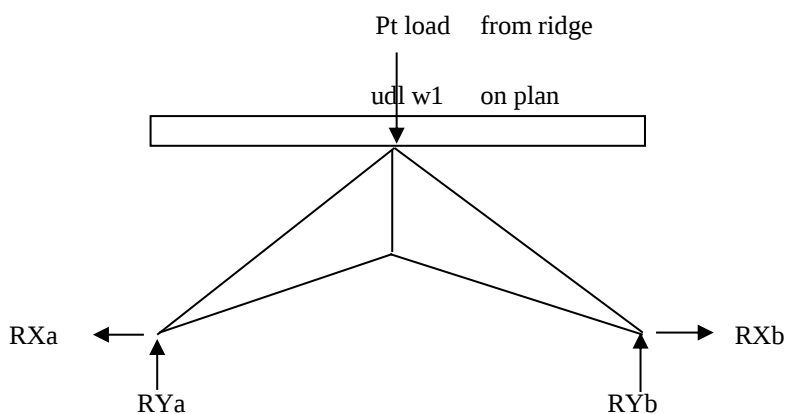
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iii. Common Rafter

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	Consider	Mean	(load share, C16		
		100.00	x	119.00	mm
	composite	100.00	x	119.00	mm
span	2.46	m on plan			
spacing	0.60	m			
load	0.87	KN/m		Medium	term loading
Eff length lx	4776.35	mm	(restraint from tile battens)		
E min	8800.00		K9	mean	E value
Moment	0.66	KNm			
Compression	1.21	KN			
0m allow	5.30	N/sqmm fo: C16	K3		1.25
0m allow	8.22	N/sqmm	K7		1.13
L/r	165.45		K8		1.10
0call	6.80	N/sqmm fo: C16			
0call	9.35	N/sqmm			
E/0call	941.18				
0c allow	1.72	N/sqmm	K12		0.18 Table 22
Z	198.33	cu.cm.			
0m applied	3.31	N/sqmm			
0c applied	0.10	N/sqmm			
0e	3.17	N/sqmm			
combined	0.47	OK	0mapp/0madm(1-1.50cappK12/0e)+0capp/0call<1.0		
Ixx	9.92	mm ⁴ x10 ⁶			
Allow deflection	0.0030	x span			
deflection	17.90	mm	= span x 0.0073	Accept with scissor collars	

iv. Truss



PR angle to horiz	59.00	deg
Tie angle to horiz	9.00	deg
Angle A between	50.00	deg
Truss Spacing	4.15	m
Load w1.	0.87	KN/m
Pt load from ridge	0.40	KN
Total vert load	4.56	KN
WP Reacs RXa & RXb	4.32	KN
Reactions RYa & RYb	2.28	KN

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Output Fom RFEM Model

RX RY Resolved (a)	3.20	KN
Tension in tie	7.42	KN
Compression in PR	4.59	KN
Bending inPR	0.78	kNm
Hanger tension	2.18	KN

Principal rafter

Consider	1.00	No. piece	C24	
	100.00	x	119.00	mm
composite	100.00	x	119.00	mm
	Try		x	
Eff length lx	4776.35	mm	(restraint from tile battens)	
E value	7200.00			
Moment	0.78	kNm		
Compression	4.59	KN	MEDIUM	term loading
0m allow	7.50	N/sqmm fo: C24	K3	1.25
0m allow	9.38	N/sqmm	K7	1.13
L/r	165.45		K8	1.00
0call	7.90	N/sqmm fo: C24	K9	1.00
0call	9.88	N/sqmm		
E/0call	729.11			
0c allow	1.48	N/sqmm	K12	0.15 Table 22
Z	198.33	cu.cm.		
0m applied	3.93	N/sqmm		
0c applied	0.39	N/sqmm		
0e	2.60	N/sqmm		
combined	0.69	O.K.	0mapp/0madm(1-1.50cappK12/0e)+0capp/0call<1.0	

Tie

Consider	12.00	mm diam stainless steel bar	X area	113.10	sqmm
X area	63.62	sqmm with thread allowance			
Tension	7.42	KN			
Load factor	1.50				
Stress	174.95	N/sqmm	O.K. For Stainless Steel		

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Check connection to rafter/wall plate					<u>6</u>	<u>0</u>
Load	7.42	KN	99.00	deg to principal rafter		
Wall plate	C24					
Basic Load // to grain	7.90	N/sqmm (allow)	1.70	N/sqmm (allow)		
Basic Load ⊥ to grain	1.90	N/sqmm (allow)				
N	1.94	N/sqmm (allow)				
Consider	M16					
K3	1.25	Medium	term loading			
Bolt hole area	254.47	sqmm				
	Allow compression Spreader plate req'd		dia (mm)	square (mm)		
Principal rafter	2.42	N/sqmm	3066.14	sqmm	70.00	60.00
Consider	70.00	mm dia plate				
Moment	64.93	KNmm				
Ult moment	0.10	KNm				
allowable stress	190.00	N/sqmm				
Z req'd	0.51	cu.cm				
minimum plate thickness	6.63	mm				
Therefore adopt	8.00	mm spreader plate				
shear	7.42	KN	i	C16 timber.		
screw dia	8.00	mm		K46	1.00	
basic shear load	1.29	KN		K52	1.12	
				K54	1.00	
Min No reqd	6.00					
spacing along grain	80.00	mm				
spacing across grain	24.00	mm				
edge dist	40.00	mm				