

Project				Job Ref.	
West Wyke Farm Barn				20855	
Section				Sheet no./rev.	
Typical Portal				1	
Calc. by	Date	Chk'd by	Date	App'd by	Date
TC	08/09/2020	BW	01/10/20		

**LOADINGS**

Wind load 1.0 kN/m<sup>2</sup> Factor of safety 1.2

Roof: Sheeting 0.15  
 Timber 0.10  
 Insulation 0.01  
 Soffit 0.15  
 0.41 Kn/m<sup>2</sup> on slope

Pitch = 32.0 deg. 1.18 Kn/m<sup>2</sup> plan load

Live Load 0.75 Kn/m<sup>2</sup>

Total Load 1.93 Kn/m<sup>2</sup> Factor of safety 1.48

Maximum bay width say 4.6m

Wind load 5.5 Kn/m

Roof load 13.1 Kn/m

Maximum allowable deflection  $4800\text{mm} / 180 = 26\text{mm} > 23\text{mm}$

**Maximum allowable moment in column  $203 \times 102 \times 23 = 64.4 \text{ Kn/m} > 50.0 \text{ Kn/m}$**

**Maximum allowable tension  $50 \times 50 \times 8$  with m16 bolt  $= 164.4 \text{ Kn} > 114 \text{ Kn}$**  (note maximum load doesn't occur on this angle)

Bracing of bays

Load area  $14.6\text{m}^2 \times 1.0 \text{ Kn/m}^2 \times 1.2 = 17\text{Kn}$

**Section  $60 \times 60 \times 8 \text{ EA}$   $265 \text{ n/mm}^2 \times 1810 \text{ mm}^2 = 480 \text{ Kn} > 17 \text{ Kn}$**

Therefore the structure can be converted for domestic use.

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**ANALYSIS**

Tedds calculation version 1.0.28

**Geometry**

**Materials**

Name	Density (kg/m <sup>3</sup> )	Youngs Modulus kN/mm <sup>2</sup>	Shear Modulus kN/mm <sup>2</sup>	Thermal Coefficient °C <sup>-1</sup>
Steel (BS5950)	7850	205	78.8	0.000012

**Sections**

Name	Area (cm <sup>2</sup> )	Moment of inertia		Shear area parallel to	
		Major (cm <sup>4</sup> )	Minor (cm <sup>4</sup> )	Minor (cm <sup>2</sup> )	Major (cm <sup>2</sup> )
RSA 90x65x8	11.8	94.3	41.1	0	0
RSA 60x60x8	9.1	29.6	29.6	0	0
RSA 50x50x8	7.4	16.5	16.5	0	0
UKB 203x102x23	29.4	2104.9	163.9	11	17
Euro A 70x70x7	9.4	42.3	42.3	0	0

**Nodes**

Node	Co-ordinates		Freedom			Coordinate system		Spring		
	X (m)	Z (m)	X	Z	Rot.	Name	Angle (°)	X (kN/m)	Z (kN/m)	Rot. kNm/°
1	0	0	Fixed	Fixed	Fixed		0	0	0	0
2	0	3.7	Free	Free	Free		0	0	0	0
3	0	4.839	Free	Free	Free		0	0	0	0
4	4.369	7.526	Free	Free	Free		0	0	0	0
5	1.099	5.16	Free	Free	Free		0	0	0	0
6	1.369	5.674	Free	Free	Free		0	0	0	0
7	2.469	5.574	Free	Free	Free		0	0	0	0
8	2.869	6.6	Free	Free	Free		0	0	0	0
9	4.369	6.147	Free	Free	Free		0	0	0	0
10	5.869	6.6	Free	Free	Free		0	0	0	0
11	6.269	5.574	Free	Free	Free		0	0	0	0
12	7.648	5.16	Free	Free	Free		0	0	0	0

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Node	Co-ordinates		Freedom			Coordinate system		Spring		
	X (m)	Z (m)	X	Z	Rot.	Name	Angle (°)	X (kN/m)	Z (kN/m)	Rot. kNm/°
13	7.369	5.674	Free	Free	Free		0	0	0	0
14	8.738	4.839	Free	Free	Free		0	0	0	0
15	8.738	3.7	Free	Free	Free		0	0	0	0
16	8.738	0	Fixed	Fixed	Fixed		0	0	0	0

### Elements

Element	Length (m)	Nodes		Section	Material	Releases			Rotated
		Start	End			Start moment	End moment	Axial	
1	1.604	3	6	Euro A 70x70x7	Steel (BS5950)	Free	Fixed	Fixed	
2	1.763	6	8	Euro A 70x70x7	Steel (BS5950)	Fixed	Fixed	Fixed	
3	1.763	8	4	Euro A 70x70x7	Steel (BS5950)	Fixed	Free	Fixed	
4	1.763	4	10	Euro A 70x70x7	Steel (BS5950)	Free	Fixed	Fixed	
5	1.763	10	13	Euro A 70x70x7	Steel (BS5950)	Fixed	Fixed	Fixed	
6	1.604	13	14	Euro A 70x70x7	Steel (BS5950)	Fixed	Free	Fixed	
7	3.7	1	2	UKB 203x102x23	Steel (BS5950)	Fixed	Fixed	Fixed	
8	1.139	2	3	UKB 203x102x23	Steel (BS5950)	Fixed	Fixed	Fixed	
9	3.7	16	15	UKB 203x102x23	Steel (BS5950)	Fixed	Fixed	Fixed	
10	1.139	15	14	UKB 203x102x23	Steel (BS5950)	Free	Fixed	Fixed	
11	1.145	3	5	Euro A 70x70x7	Steel (BS5950)	Free	Fixed	Fixed	
12	1.431	5	7	Euro A 70x70x7	Steel (BS5950)	Fixed	Fixed	Fixed	
13	1.985	7	9	Euro A 70x70x7	Steel (BS5950)	Fixed	Free	Fixed	
14	1.985	9	11	Euro A 70x70x7	Steel (BS5950)	Free	Fixed	Fixed	
15	1.44	11	12	Euro A 70x70x7	Steel (BS5950)	Fixed	Fixed	Fixed	
16	1.136	12	14	Euro A 70x70x7	Steel (BS5950)	Fixed	Free	Fixed	
17	2.402	2	6	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	

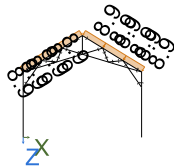
Project <b>West Wyke Farm Barn</b>				Job Ref. <b>20855</b>	
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Calc. by <b>TC</b>	Date <b>08/09/2020</b>	Chk'd by <b>BW</b>	Date <b>01/10/20</b>	App'd by	Date

Element	Length (m)	Nodes		Section	Material	Releases			Rotated
		Start	End			Start moment	End moment	Axial	
18	1.105	6	7	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	
19	1.101	7	8	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	
20	1.567	8	9	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	
21	1.379	9	4	RSA 50x50x8	Steel (BS5950)	Fixed	Fixed	Fixed	
22	1.101	10	11	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	
23	1.105	11	13	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	
24	2.402	15	13	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	
25	1.567	10	9	RSA 50x50x8	Steel (BS5950)	Free	Free	Fixed	

**Loading**

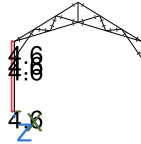
Self weight included

**Permanent - Loading (kN/m)**



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**Imposed - Loading (kN/m)**



**Load combination factors**

Load combination	Self Weight	Permanent	Imposed
LoadCombination1 (Strength)	1.40	1.48	1.20

**Element Loads**

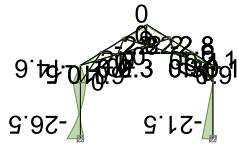
Element	Load case	Load Type	Orientation	Description
1	Permanent	UDL	LocalZ	8.9 kN/m
2	Permanent	UDL	LocalZ	8.9 kN/m
3	Permanent	UDL	LocalZ	8.9 kN/m
4	Permanent	UDL	LocalZ	8.9 kN/m
5	Permanent	UDL	LocalZ	8.9 kN/m
6	Permanent	UDL	LocalZ	8.9 kN/m
7	Imposed	UDL	LocalZ	4.6 kN/m
8	Imposed	UDL	LocalZ	4.6 kN/m

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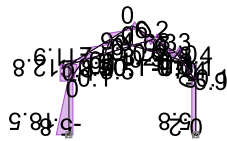
**Results**

**Forces**

**All load cases - Moment envelope (kNm)**

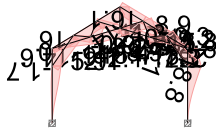


**All load cases - Shear envelope (kN)**



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**All load cases - Deflection envelope (mm)**



**Element results**

**Envelope - All load cases**

Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
1	1.604	-8.5	0.647	1.9	1.604	-2.2
2	1.763	-8.2	0.845	1	1.763	-2.8
3	0	9.4	1.059	2.2	0	-2.8
4	1.763	-9.4	0.702	2.2	1.763	-2.8
5	0	8.3	0.93	1	0	-2.8
6	0	8.4	0.946	1.9	0	-2.1
7	0	18.5 (max abs)	3.7	10.5 (max)	0	-26.5 (min)
8	0	12.8	0	10.5 (max)	0	-14.6
9	0	5.8	3.7	0	0	-21.5
10	0	0	1.139	0	0	0
11	0	-0.1	0.966	0	1.145	-0.2
12	0	0.3	1.431	0.3	0	-0.2
13	0	-0.1	0	0.3	0	0
14	0	0.2	1.985	0.3	1.985	-0.1
15	0	-0.3	0	0.3	1.44	-0.1
16	0	0.1	0.146	0	0	-0.1
17	0	0	1.201	0	0	0
18	1.105	0	0.552	0	1.105	0
19	1.101	0	0.551	0	0	0
20	0	0	0.783	0	0	0

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Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
21	0	0	1.379	0	1.379	0
22	1.101	0	0.551	0	0	0
23	1.105	0	0.552	0	0	0
24	0	0	1.201	0	0	0
25	1.567	0	0.783	0	1.567	0

**Envelope - All load cases**

Element	Deflection			
	Pos (m)	Max (mm)	Pos (m)	Min (mm)
1	0.981	12.1	0	0.1
2	1.021	14.6	0	0.3
3	0.989	21.6	0	0.4
4	0.801	11.1	1.763	-8.9
5	0.824	5.6	1.441	-9.3
6	0.543	3.1	0	-9.2
7	3.7	14.6	2.423	-1.7
8	1.139	16	0	0
9	3.7	23 (max)	0	0
10	0	23 (max)	1.139	0.4
11	1.145	5.9	0	0.1
12	1.431	12.1	1.431	0.4
13	1.524	14	0.017	0.4
14	1.041	8.9	1.784	-5.4
15	0	7.7	0	-5.3
16	0	1.3	0	-4.8
17	2.402	14	0	0
18	1.105	9.1	1.105	-0.9
19	0	15.4	0	0.3
20	1.567	8.2	1.567	-4.8
21	0	16.1	0	0.3
22	0.177	-0.1	1.101	-15.3
23	0	12.2	1.105	0.3
24	1.464	0.1	0	-18.8 (min)
25	1.567	14	0	0.4

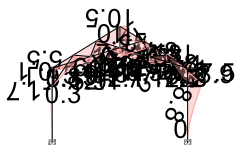


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Calc. by <b>TC</b>	Date <b>08/09/2020</b>	Chk'd by <b>BW</b>	Date <b>01/10/20</b>	App'd by	Date

**Self Weight - Deflection (mm)**



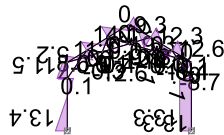
**Permanent - Deflection (mm)**





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**Strength combinations - Shear envelope (kN)**



**Element results**

**Envelope - Strength combinations**

Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
1	1.604	-12.6	0.652	2.8	1.604	-3.2
2	1.763	-12.2	0.839	1.5	1.763	-4.2
3	0	14.1	1.06	3.3 (max)	0	-4.2
4	1.763	-14.1 (max abs)	0.702	3.3	1.763	-4.2
5	0	12.3	0.927	1.5	0	-4.2
6	0	12.6	0.949	2.8	0	-3.1
7	0	13.4	2.427	-5.1	0	-21.3
8	0	11.5	1.139	0	0	-9.5
9	0	13.3	3.7	0	0	-49.3 (min)
10	0	0	1.139	0	0	0
11	1.145	-0.3	0	0	1.145	-0.2
12	0	0.5	1.431	0.4	0	-0.2
13	1.985	-0.3	0	0.4	1.985	0
14	0	0.3	1.985	0.4	0	0
15	1.44	-0.4	0	0.4	1.44	-0.1
16	0	0.1	1.136	0	0	-0.1
17	0	0.1	1.201	0	0	0
18	1.105	0	0.552	0	1.105	0
19	1.101	0	0.551	0	0	0
20	0	0.1	0.783	0	0	0

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Element	Shear force		Moment			
	Pos (m)	Max abs (kN)	Pos (m)	Max (kNm)	Pos (m)	Min (kNm)
21	0	0	1.379	0	0	0
22	1.101	0	0.551	0	0	0
23	0	0	0.552	0	0	0
24	0	0.1	1.201	0	0	0
25	1.567	-0.1	0.783	0	1.567	0

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