Wellan

Structural Appraisal

For Residential Conversion of

Agricultural Barn at Sibford Ferris

For

Mr M Blackman
St Nicholas Developments Ltd

December 2019

Wellan Ltd
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Approved 

Date December 2019

Project No……..……**19/203**

Contents

1.0 Introduction

This appraisal and report has been commissioned by Mr K Bishop who owns the building and wishes to convert it for residential use. The report will comment on the existing structural condition of the building and feasibility of the proposed conversion to residential use.

A site visit was made on Thursday 5th September 2019 by Mr M Walker, B.Sc C.Eng. M.I.C.E. Mr Walker is a Chartered Engineer with more than 30 years of experience, much of which has involved investigating buildings, identifying defects and specifying remedial/alteration measures.

An external and internal inspection of the visible parts of the buildings was carried out. Inspection of the buildings was carried out from ground level and with the aid of a 2.4 metre ladder. Close examination of the upper parts of the upper surface of the roof was, therefore, not possible. No opening up of the structure or foundations was carried out and the comments in this report are therefore based only on a visual inspection.

The comments in this report are illustrated by the sketches in Appendix A together with photographs.

This report has been produced for the use of Mr K Bishop and those working on his behalf in connection with structural issues associated with proposed conversion of this barn and should not be relied upon by any other party or any other context.

2.0 Background and Form of Construction

This barn is located approximately 0.5 km to the east of the village of Sibford Ferris. It is accessed via a farm track from Grange Lane which is a minor residential road linking Sibford Ferris to Tadmarton. The barn being considered for residential conversion is part of a small development of redundant farm buildings which includes a second building and some silos. The farmhouse is approximately 200 metres further to the east but its use is no longer related to agriculture.

The building is on a gentle slope that extends to the south. The site is relatively open with no trees or other significant vegetation in the immediate vicinity.

The building is typical of relatively modern farm buildings with a steel portal frame and clad with a mixture of profile metal and fibre-reinforced cement.

The building is clad on all faces. The front (eastern) end of the building has sliding doors that are no longer functional. The former use of the building is not clear but is assumed to have been for storage rather than animal use. Its original construction is estimated to have been approximately 50 years ago but it is understood that the building was relocated to its current position approximately 30 years ago.

3.0 Structural Condition And Load Capacity

The layout of the building is shown in Appendix A. There are currently five frames at a spacing of approximately 4.5 metres

A check has been carried out on the verticality of the steel frame and for settlement. The existing frame members are within 1 in 200 of vertical which is within tolerance for a new building of this sort and there is no evidence of settlement. The structure is currently performing satisfactorily. There is some degree of surface corrosion on the steel framing but this can be easily dealt with as a matter of routine maintenance. The timber purlins are in good condition and there is no evidence of sagging.

Calculations are included in Appendix B and confirm adequacy of the steel frame in its current form and as proposed, all as discussed below

3.1 Proposed Conversion Work

The structure of the existing building is to be retained. There is to be no alteration to the existing steel portal frames or the roof structure but some new doors and windows will be introduced into the walls.

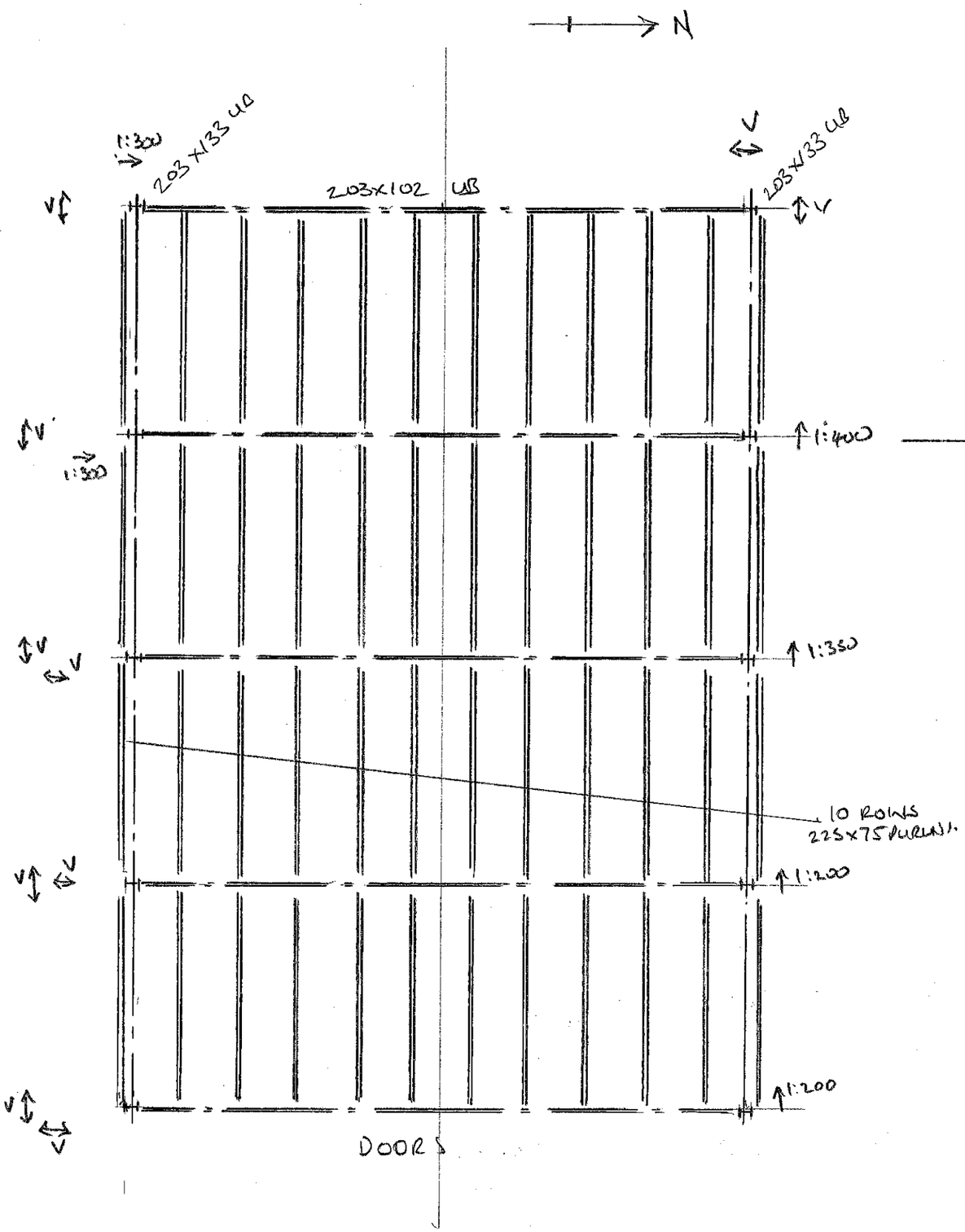
A capacity check on the existing frame members has been carried out to establish that the frame will be adequate to support the proposed building envelope using an insulated profiled composite metal cladding system (Kingspan or similar). The calculations in Appendix B consider both strength and deflection requirements. This indicates that the frame satisfactory. There is considerable spare capacity in the stanchions if a mezzanine floor is required.

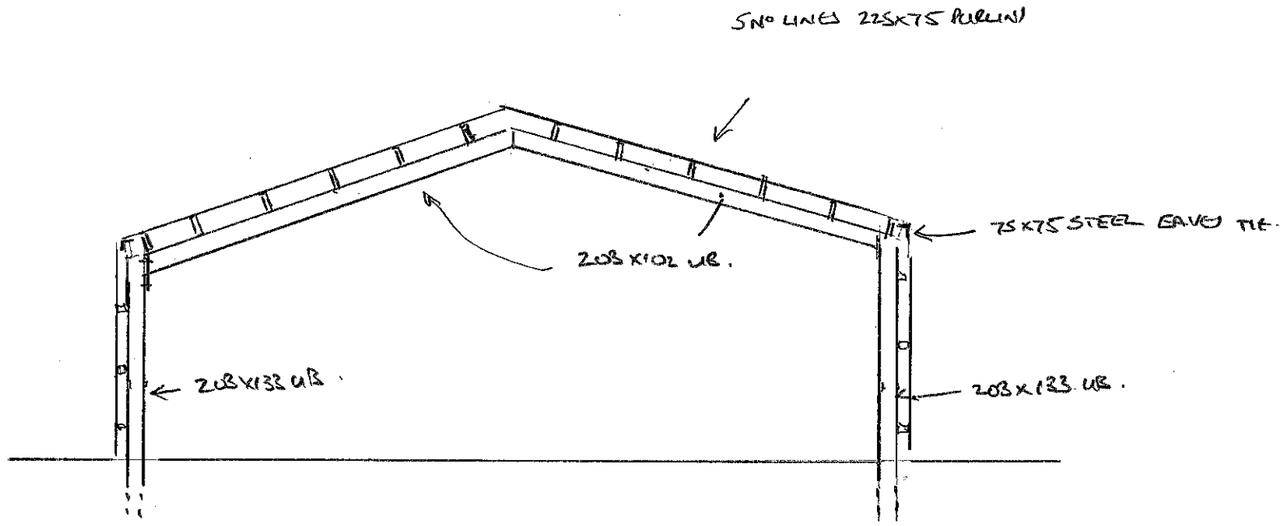
4.0 Conclusion

The existing building is in fair condition and is structurally suitable for conversion to residential use, as proposed, without strengthening of the existing envelope.

Appendix A

Sketch SK/01 Structural Plans and Details





A3 DRAWING

Wellan Tel 01608 685753	Wellan House. Aylesmore, Warks, CV36 5EJ
Scale 1:100 @ A3 Proj No 19-203	Title STRUCTURAL PLAN & DETAILS
Date DEC '12 Drg No SK/01	Project BARN CONVERSION, FOLLY FARM SIBFORD FERRIS

Appendix B

Calculation Pages P1-P24

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Calc sheet no.	1
Prepared by	MW
Date	Dec '19
Project no.	19-203

Title of scheme: FOLLY FARM, GRANGE LANE, SIBFORD FERRIS

INTRODUCTION

THE FOLLOWING CALCULATIONS ARE TO CHECK THE STRUCTURAL CAPACITY FOR AN EXISTING STEEL FRAME BARN TO BE CONVERTED FOR RESIDENTIAL USE.

THE BARN COMPRISES STEEL PORTAL FRAME WITH TIMBER PURLINS SPANNING BETWEEN THEM. IT IS ANTICIPATED THAT THE EXISTING FIBRE CEMENT ROOF SHEETING WILL BE REPLACED BY A LIGHTWEIGHT INSULATED PROFILED METAL SHEET WITH A SUSPENDED PLASTERBOARD CEILING.

THE CONDITION OF THE STEEL FRAME HAS BEEN INSPECTED AND FOUND TO BE IN GOOD CONDITION, THERE IS NO EVIDENCE OF STRUCTURAL DISTORTION OR SETTLEMENT. THE EXISTING FRAME IS CLAD IN SHEETING TO THE WALLS AND THIS IS ALSO IN GOOD CONDITION ALONG WITH THE ROOF.

DESIGN WILL BE IN ACCORDANCE WITH:

1) LOADING — BS 6399
2) STEELWORK — BS 5950 (& BLUE BOOK)

COMPUTER ANALYSIS WILL UTILISE TEDDS BY TEKLA

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Calc sheet no.	2
Prepared by	MW
Date	DEC '19
Project no.	19-203

Title of scheme: FOLLYFARM, GRANGE LANE, SIBFORD FERRIS

LOADING

ROOF (PROPOSED).

INSULATED PROFILED SHEETING	=	0.12kN/m²
STEEL FRAME	=	0.05
CEILING	=	0.12 kN/m²
		0.29 kN/m²

SNOW LOAD (SEE TEDDS OUTPUT). 0.32kN/m²

WIND LOADING

- SEE TEDDS OUTPUT

NETT ROOF PRESSURE

C = -0.36
G = -0.34. } INT SUCTION

C = 0.22
G = -0.06.. } INT PRESSURE

DOWN FOR INT SUCTION.

WALLS.

W = 0.44
L = -0.108 } INT SUCTION.

W = 0.20
L = -0.37 } INT PRESSURE

DOWN FOR INT SUCTION.

SNOW LOADING TO BS6399:PART 3:1988

TEDDS calculation version 1.0.03

Site location

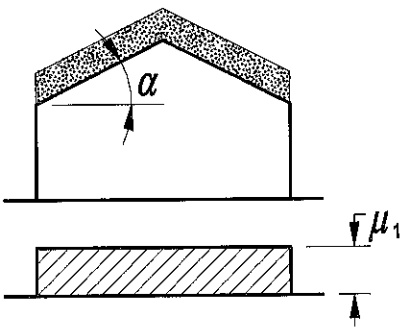
Location of site	**Oxford**
Site altitude	A = **100** m

Calculate site snow load

From BS6399:Part 3: 1988 - Figure 1. Basic snow load on the ground

Basic snow load	s_b = **0.40** kN/m^2
	s_{alt} = 0.1 × s_b + (0.09 kN/m^2) = **0.13** kN/m^2
Site snow load	s_0 = max(s_b, s_b + s_{alt} × (A - (100 m)) / 100 m) = **0.40** kN/m^2

BS6399:Part3:1988 Cl.6.2



Uniform loading

Roof geometry

Roof type	**Pitched**
Distance on plan from gutter to ridge	b = **6.000** m
Angle of pitch of roof	α = **10.0** deg

Calculate uniform snow load

From BS6399:Part 3: 1988 - Figure 3. Snow load shape coefficients for pitched roofs

Snow load shape coefficient	μ_1 = **0.80**
Uniform roof snow load	s_{d1} = μ_1 × s_0 = **0.32** kN/m^2

BS6399:Part3:1988 Cl.5

Roof pitch α is not greater than 15 degrees so there is no asymmetric loadcase

Snow sliding down roof

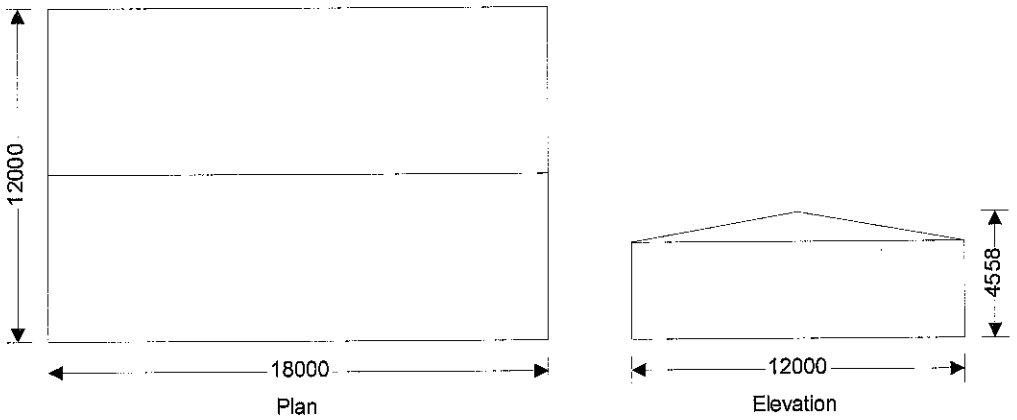
Maximum uniform snow load on roof	s_{d_max} = **0.32** kN/m^2
Force from sliding snow load	F_s = s_{d_max} × b × sin(α) = **0.33** kN/m

BS6399:Part3:1988 Cl.8

WIND LOADING (BS6399)

In accordance with BS6399

Tedds calculation version 3.0.17



Building data

Type of roof	Duopitch		
Length of building	L = **18000** mm	Width of building	W = **12000** mm
Pitch of roof	α_0 = **10.0** deg		
Reference height	H_r = **4558** mm		

Dynamic classification

Building type factor (table 1)	K_b = **1.0**	Dynamic augmentation factor (1.6.1)	C_r = **0.01**

Site wind speed

Location	Oxford	Basic wind speed	V_b = **19.7** m/s
Site altitude	Δ_S = **64** m	Upwind dist from sea to site	d_{sea} = **108** km
Direction factor	S_d =**1.00**	Seasonal factor	S_s = **1.00**
Probability factor	S_p = **1.00**	Critical gap between buidlings	g = **5000** mm
Topography not significant			
Altitude factor	S_a = **1.06**	Site wind speed	V_s = **21.0** m/s
Terrain category	Country		
Displacement height	H_d = 0mm		

The velocity pressure for the windward face of the building with a 0 degree wind is to be considered as 1 part as the height h is less than b (cl.2.2.3.2)

The velocity pressure for the windward face of the building with a 90 degree wind is to be considered as 1 part as the height h is less than b (cl.2.2.3.2)

Dynamic pressure - windward wall - Wind 0 deg and roof

Reference height	H_e = **3500** mm		
Fetch factor (Table 22)	S_c = **0.803**	Turbulence factor (Table 22)	S_t = **0.204**
Gust peak factor	g_t = **3.44**	Terrain and building factor	S_b = **1.36**
Effective wind speed	V_e = **28.6** m/s	Dynamic pressure	q_s = **0.501** kN/m^2

Dynamic pressure - windward wall - Wind 90 deg and roof

Reference height	H_e = **4558** mm		
Fetch factor (Table 22)	S_c = **0.859**	Turbulence factor (Table 22)	S_t = **0.195**
Gust peak factor	g_t = **3.44**	Terrain and building factor	S_b = **1.44**
Effective wind speed	V_e = **30.1** m/s	Dynamic pressure	q_s = **0.555** kN/m^2

Size effect factors

Diag dim for gablewall	a_{eg} = **12.0** m	Exte size effect factor	C_{aeg} = **0.934**
Diag dim for side wall	a_{es} = **18.0** m	Exte size effect factor	C_{aes} = **0.903**
Diag dim for roof	a_{er} = **19.0** m	Exte size effect factor	C_{aer} = **0.899**
Volume for int size effect	V_i = **0.1** m^3	Diag dim for int size effect	a_i = **5.0** m
Internal size effect factor	C_{ai} = **1.000**		

Pressures and forces

Net pressure $p = q_s \times c_{pe} \times C_{ae} - q_s \times c_{pi} \times C_{ai}$

Net force $F_w = p \times A_{ref}$

Roof load case 1 - Wind 0, c_{pi} 0.20, -c_{pe}

Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m²)	External size factor, C_{ae}	Net Pressure, p (kN/m²)	Area, A_{ref} (m²)	Net force, F_w (kN)
A (-ve)	-1.45	0.56	0.899	-0.83	8.44	-7.04
B (-ve)	-1.00	0.56	0.899	-0.61	8.22	-5.02
C (-ve)	-0.50	0.56	0.899	-0.36	93.00	-33.54
E (-ve)	-1.10	0.56	0.899	-0.66	8.44	-5.57
F (-ve)	-0.60	0.56	0.899	-0.41	8.22	-3.38
G (-ve)	-0.45	0.56	0.899	-0.34	93.00	-31.22

Total vertical net force $F_{w,v}$ = **-84.46** kN Total horizontal net force $F_{w,h}$ = **-0.94** kN

Walls load case 1 - Wind 0, c_{pi} 0.20, -c_{pe}

Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m²)	External size factor, C_{ae}	Net Pressure, p (kN/m²)	Area, A_{ref} (m²)	Net force, F_w (kN)
A	-1.57	0.56	0.934	-0.93	6.67	-6.18
B	-0.89	0.56	0.934	-0.57	30.85	-17.66
C	-0.86	0.56	0.934	-0.56	10.83	-6.04
w	0.65	0.50	0.903	0.19	63.00	12.16
l	-0.50	0.50	0.903	-0.33	63.00	-20.58

Overall loading

Leeward force overall F_l = **-20.6** kN Windward force overall F_w = **12.2** kN

Overall loading overall $F_{w,w}$ = **27.4** kN

Roof load case 2 - Wind 0, c_{pi} -0.3, +c_{pe}

Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m²)	External size factor, C_{ae}	Net Pressure, p (kN/m²)	Area, A_{ref} (m²)	Net force, F_w (kN)
A (+ve)	0.10	0.56	0.899	0.22	8.44	1.83
B (+ve)	0.10	0.56	0.899	0.22	8.22	1.78
C (+ve)	0.10	0.56	0.899	0.22	93.00	20.13
E (+ve)	-1.10	0.56	0.899	-0.38	8.44	-3.23
F (+ve)	-0.60	0.56	0.899	-0.13	8.22	-1.09
G (+ve)	-0.45	0.56	0.899	-0.06	93.00	-5.40

Total vertical net force $F_{w,v}$ = **13.80** kN Total horizontal net force $F_{w,h}$ = **5.81** kN

Walls load case 2 - Wind 0, c_{pi} -0.3, +c_{pe}

Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m^2)	External size factor, C_{ae}	Net Pressure, p (kN/m^2)	Area, A_{ref} (m^2)	Net force, F_w (kN)
A	-1.57	0.56	0.934	-0.65	6.67	-4.32
B	-0.89	0.56	0.934	-0.29	30.85	-9.10
C	-0.86	0.56	0.934	-0.28	10.83	-3.03
w	0.65	0.50	0.903	0.44	63.00	27.95
l	-0.50	0.50	0.903	-0.08	63.00	-4.79

Overall loading

Leeward force overall F_l = **-4.8** kN Windward force overall F_w = **27.9** kN

Overall loading overall $F_{w,w}$ = **33.2** kN

Roof load case 3 - Wind 90, c_{pi} 0.20, -c_{pe}

Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m^2)	External size factor, C_{ae}	Net Pressure, p (kN/m^2)	Area, A_{ref} (m^2)	Net force, F_w (kN)
A (-ve)	-1.80	0.56	0.899	-1.01	5.55	-5.61
B (-ve)	-1.30	0.56	0.899	-0.76	5.55	-4.22
C (-ve)	-0.60	0.56	0.899	-0.41	44.43	-18.24
D (-ve)	-0.45	0.56	0.899	-0.34	163.79	-54.98

Total vertical net force $F_{w,v}$ = **-81.78** kN Total horizontal net force $F_{w,h}$ = **0.00** kN

Walls load case 3 - Wind 90, c_{pi} 0.20, -c_{pe}

Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m^2)	External size factor, C_{ae}	Net Pressure, p (kN/m^2)	Area, A_{ref} (m^2)	Net force, F_w (kN)
A	-1.47	0.50	0.903	-0.77	4.90	-3.76
B	-0.86	0.50	0.903	-0.49	19.60	-9.57
C	-0.73	0.50	0.903	-0.43	38.50	-16.56
w	0.60	0.56	0.934	0.20	48.35	9.78
l	-0.50	0.56	0.934	-0.37	48.35	-17.90

Overall loading

Leeward force overall F_l = **-17.9** kN Windward force overall F_w = **9.8** kN

Overall loading overall $F_{w,w}$ = **23.8** kN

Roof load case 4 - Wind 90, c_{pi} -0.3, -c_{pe}

Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m^2)	External size factor, C_{ae}	Net Pressure, p (kN/m^2)	Area, A_{ref} (m^2)	Net force, F_w (kN)
A (-ve)	-1.80	0.56	0.899	-0.73	5.55	-4.07
B (-ve)	-1.30	0.56	0.899	-0.48	5.55	-2.68
C (-ve)	-0.60	0.56	0.899	-0.13	44.43	-5.91
D (-ve)	-0.45	0.56	0.899	-0.06	163.79	-9.51

Total vertical net force $F_{w,v}$ = **-21.83** kN Total horizontal net force $F_{w,h}$ = **0.00** kN

Walls load case 4 - Wind 90, c_{pi} -0.3, -c_{pe}

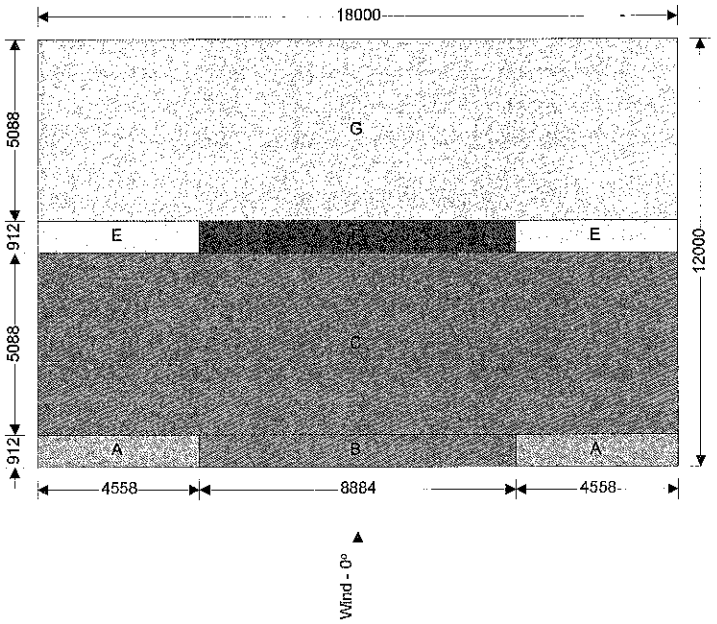
Zone	Ext pressure coefficient, c_{pe}	Dynamic pressure, q_s (kN/m^2)	External size factor, C_{ae}	Net Pressure, p (kN/m^2)	Area, A_{ref} (m^2)	Net force, F_w (kN)
A	-1.47	0.50	0.903	-0.52	4.90	-2.53
B	-0.86	0.50	0.903	-0.24	19.60	-4.66
C	-0.73	0.50	0.903	-0.18	38.50	-6.91
w	0.60	0.56	0.934	0.48	48.35	23.19
l	-0.50	0.56	0.934	-0.09	48.35	-4.48

Overall loading

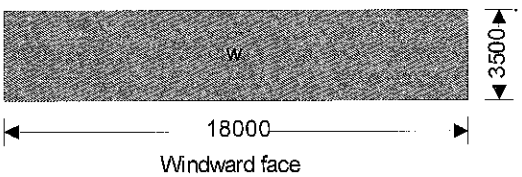
Leeward force overall F_l = **-4.5** kN

Windward force overall F_w = **23.2** kN

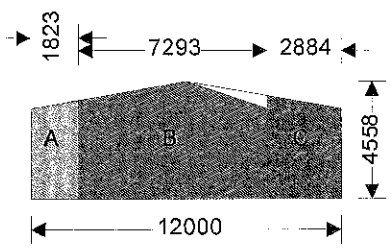
Overall loading overall $F_{w,w}$ = **23.8** kN



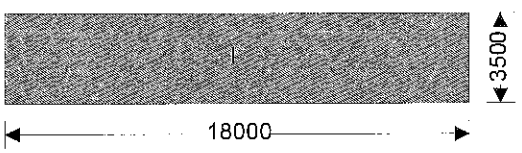
Plan view - Duopitch roof



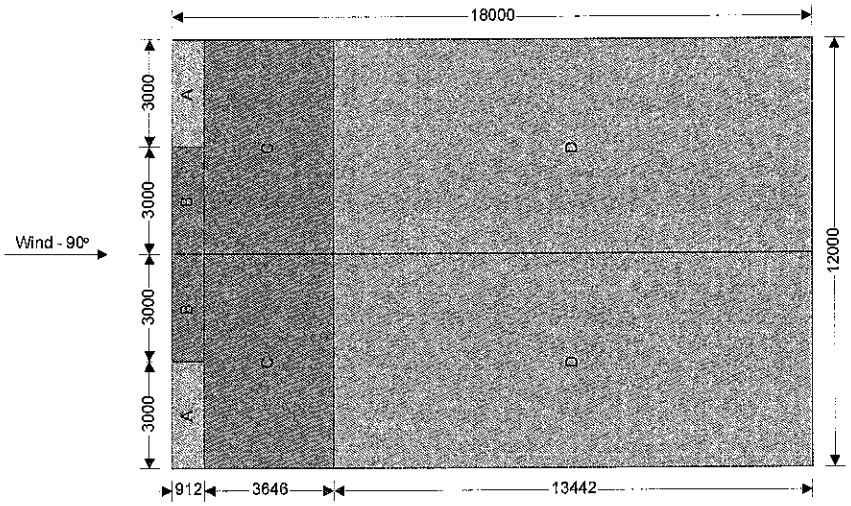
Windward face



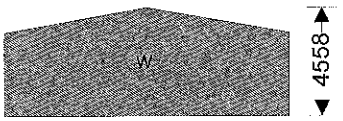
Side face



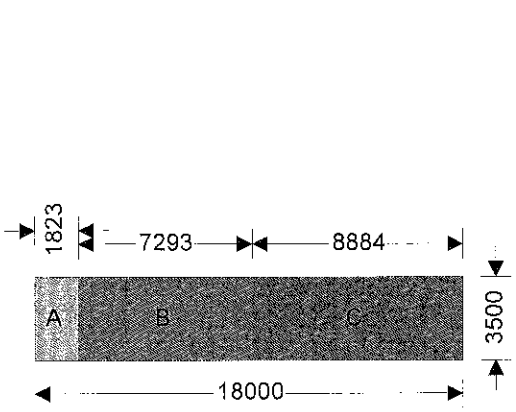
Leeward face



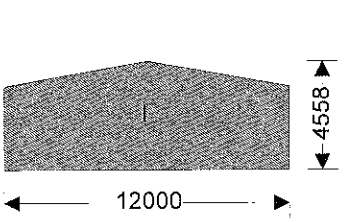
Plan view - Duopitch roof



Windward face



Side face



Leeward face

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Calc sheet no.	9
Prepared by	MW
Date	DEC 19
Project no.	19-208

Title of scheme: FOLLY FARM, GRANGE LANE, SIBFORD FERRIS

MEMBER LOADS

FRAME SPACING = 4.5m.

ROOF DEAD = 4.5 × 0.29 = 1.31 kN/m.

ROOF IMP = 4.5 × 0.32 = 1.44.

INWARD WALL WINDWARD = 4.5 × 0.44 = 1.98

LEEWARD WALL = 4.5 × 0.08 = 0.36.

ROOF WINDWARD = 4.5 × 0.36 = 1.62

ROOF LEEWARD = 4.5 × 0.34 = 1.53.

SEE TEDDS OUTPUT FOR RESULTS (ATTACHED)

STRENGTH: MAX BM (AT CENTRE) = 55.7kN.

CHECK 203×102 UB (Le = 0.85 × 1200 = 1020) = 63.4 kNm OK.

SERVICE: MAX DEAD/IMP/WIND = 65.4 = SPAN/183. = OK

IMP/WIND = 43.0 = SPAN/280 = OK

MAX VERT REACTION DEAD + IMP = 19.2kN.
DEAD, IMP & WIND = 27.9kN.

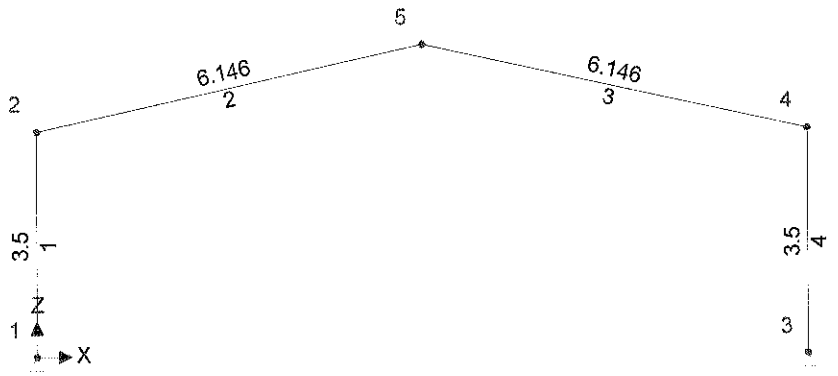
∴ NECK BEAM REQD = 27.9/100 = 0.28m OK (BY INSPECTION).

ANALYSIS

Tedds calculation version 1.0.28

Geometry

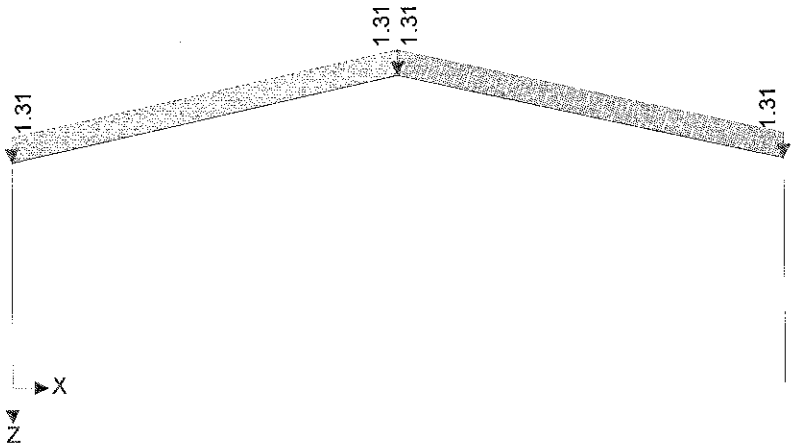
Geometry (m) - Steel (BS5950)



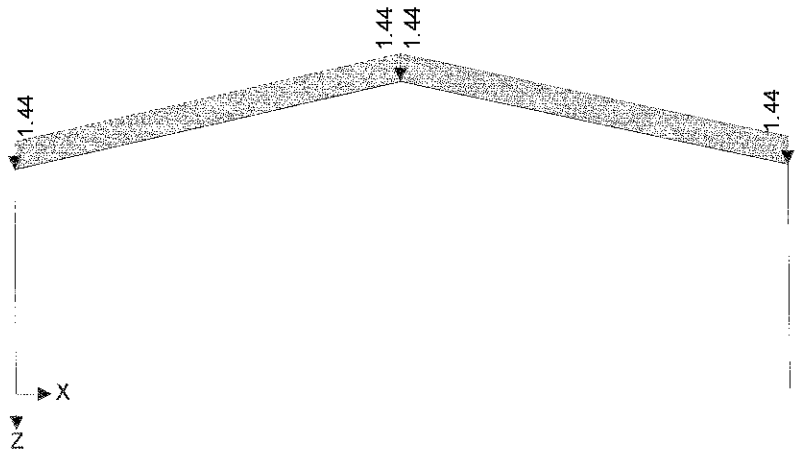
Loading

Self weight included

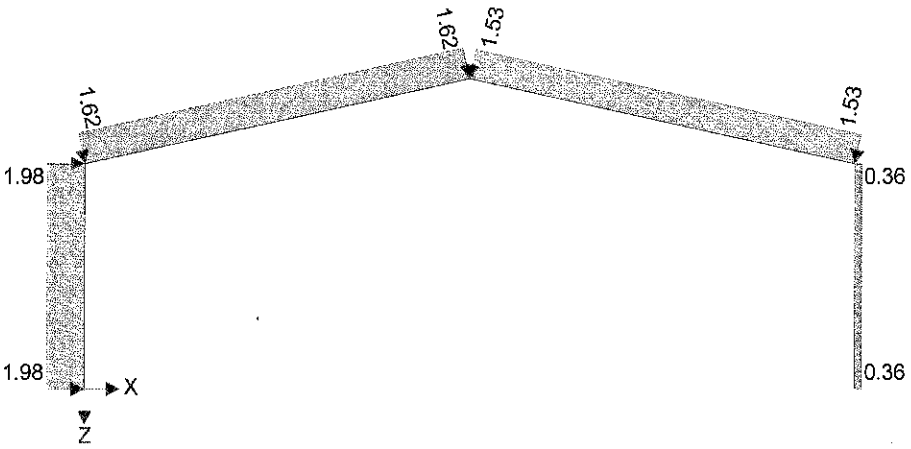
Permanent - Loading (kN/m)



Imposed - Loading (kN/m)



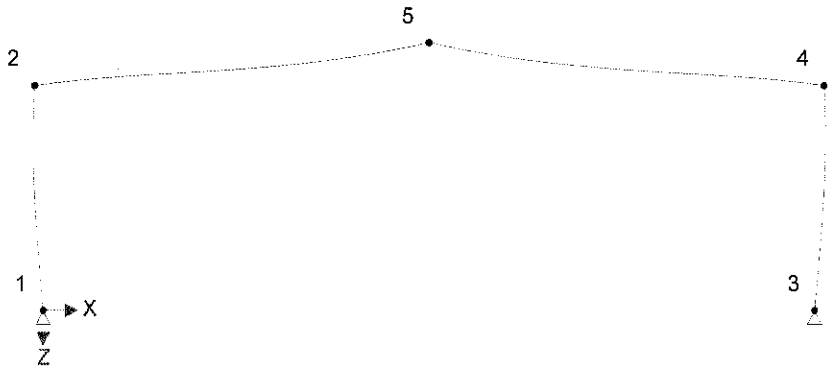
Wind - Loading (kN/m)



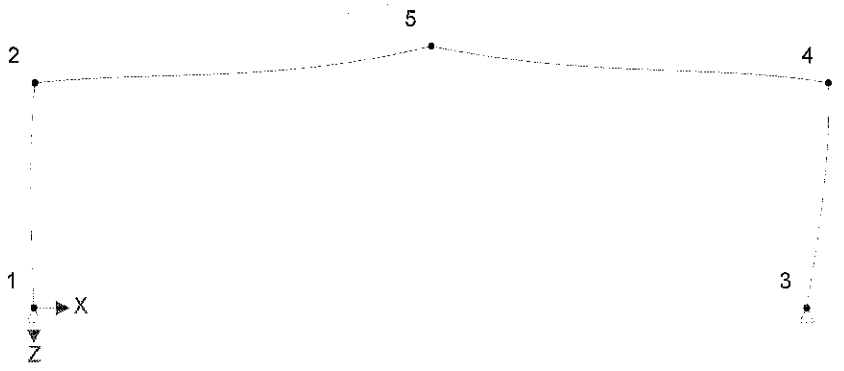
Results

Total deflection

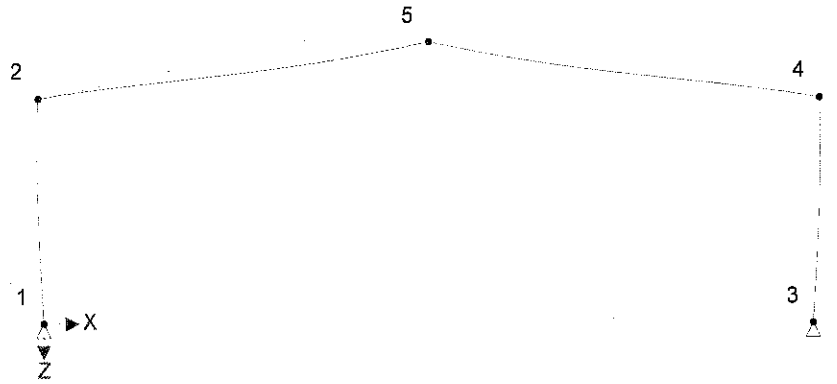
Dead and Imp (Strength) - Total deflection



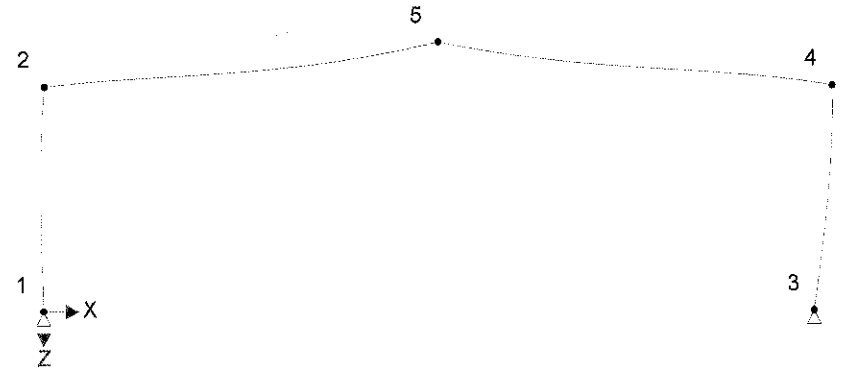
Dead Imp and wind (Strength) - Total deflection



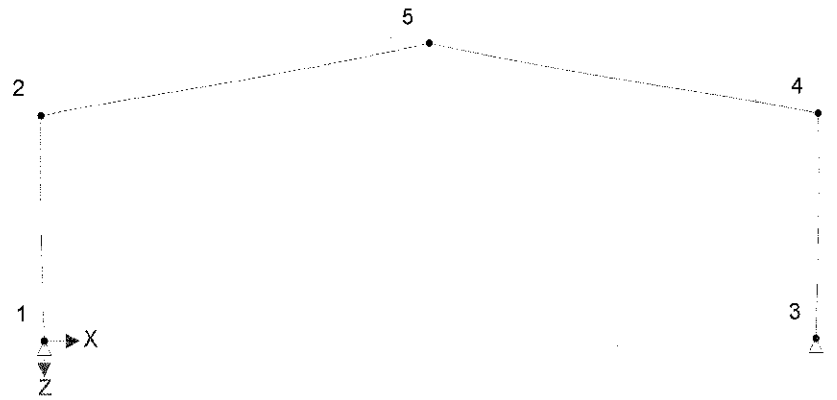
Dead and Imposed (Service) - Total deflection



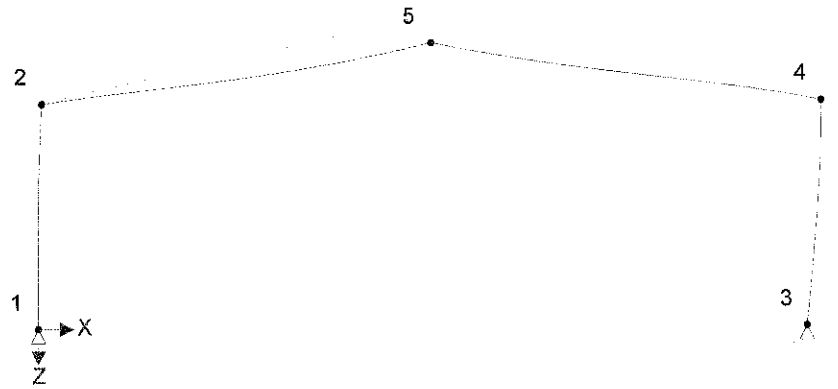
Dead Imposed and Wind (Service) - Total deflection



Imposed (Service) - Total deflection



Imposed and Wind (Service) - Total deflection



Node deflections

Load combination: Dead and Imp (Strength)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	-0.51563	
2	-14.3	0.1	0.35099	
3	0	0	0.51563	
4	14.3	0.1	-0.35099	
5	0	65.4	0	

Load combination: Dead Imp and wind (Strength)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	-0.22864	
2	0.9	0.2	0.57551	
3	0	0	0.92383	
4	33.9	0.2	-0.22265	
5	17.4	75.6	-0.0906	

Load combination: Dead and Imposed (Service)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	-0.35164	
2	-9.8	0.1	0.23936	
3	0	0	0.35164	
4	9.8	0.1	-0.23936	
5	0	44.6	0	

Load combination: Dead Imposed and Wind (Service)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	-0.19499	
2	0.6	0.1	0.48263	
3	0	0	0.77431	
4	28.4	0.2	-0.18857	
5	14.5	63.5	-0.0755	

Load combination: Imposed (Service)

Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	-0.17013	
2	-4.7	0	0.11581	
3	0	0	0.17013	
4	4.7	0	-0.11581	
5	0	21.6	0	

Load combination: Imposed and Wind (Service)

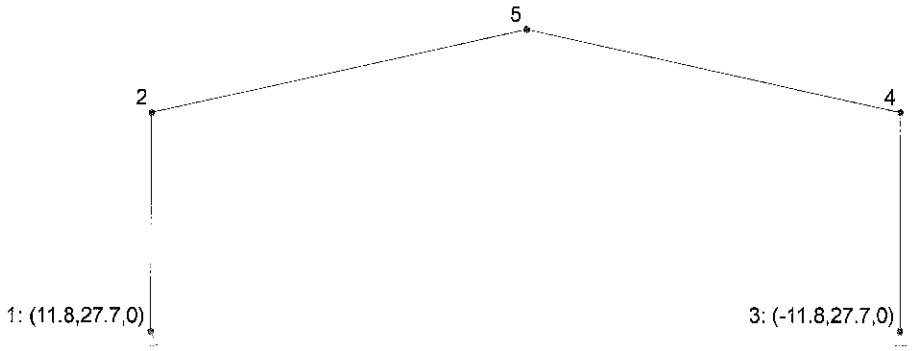
Node	Deflection		Rotation	Co-ordinate system
	X (mm)	Z (mm)	(°)	
1	0	0	-0.01348	
2	5.7	0.1	0.35907	
3	0	0	0.5928	
4	23.3	0.1	-0.06502	
5	14.5	40.5	-0.0755	

Total base reactions

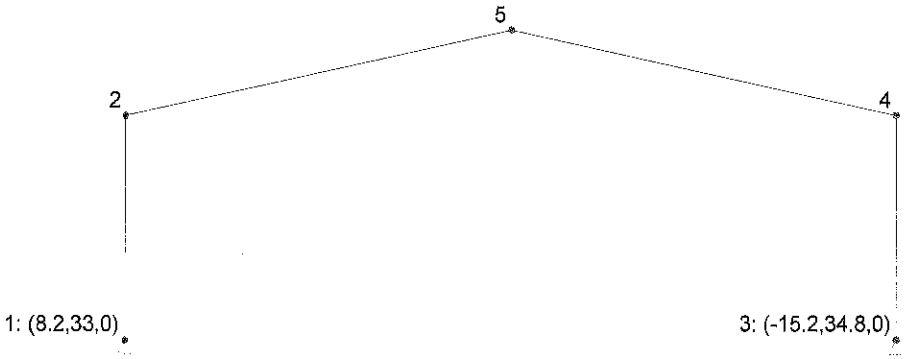
Load case/combination	Force	
	FX (kN)	FZ (kN)
Dead and Imp (Strength)	0	55.4
Dead Imp and wind (Strength)	-6.9	67.7
Dead and Imposed (Service)	0	38.3
Dead Imposed and Wind (Service)	-5.8	57.2
Imposed (Service)	0	17.7
Imposed and Wind (Service)	-5.8	36.6

Reactions

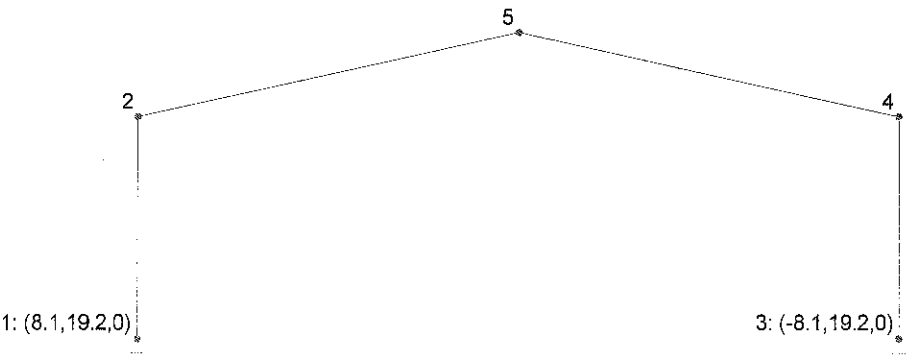
Dead and Imp (Strength) - Local node reactions - Node: (Horiz (kN), Vert (kN), Mom (kNm))



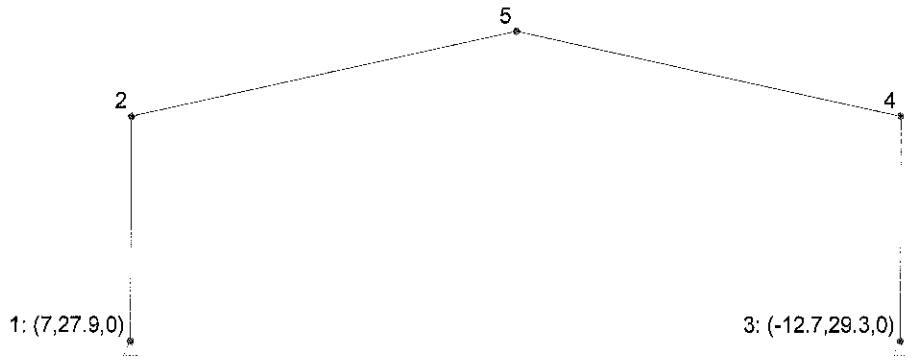
Dead Imp and wind (Strength) - Local node reactions - Node: (Horiz (kN), Vert (kN), Mom (kNm))



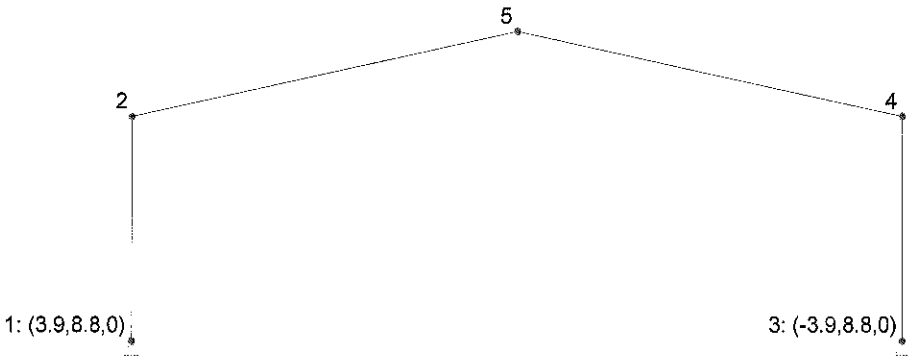
Dead and Imposed (Service) - Local node reactions - Node: (Horiz (kN), Vert (kN), Mom (kNm))



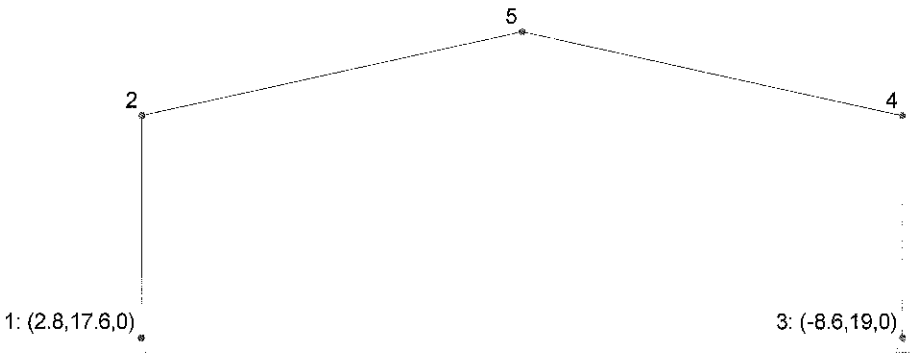
Dead Imposed and Wind (Service) - Local node reactions - Node: (Horiz (kN), Vert (kN), Mom (kNm))



Imposed (Service) - Local node reactions - Node: (Horiz (kN), Vert (kN), Mom (kNm))



Imposed and Wind (Service) - Local node reactions - Node: (Horiz (kN), Vert (kN), Mom (kNm))



Element end forces

Load combination: Dead and Imp (Strength)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	3.5	1	-27.7	11.8	0
		2	26.8	-11.8	-41.5
2	6.146	2	-17.4	-23.6	41.5
		5	11.6	-2.6	23.2
3	6.146	5	-11.6	-2.6	-23.2
		4	17.4	-23.6	-41.5

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
4	3.5	3	-27.7	-11.8	0
		4	26.8	11.8	41.5

Load combination: Dead Imp and wind (Strength)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	3.5	1	-33	8.2	0
		2	32.1	-16.5	-43.3
2	6.146	2	-23.1	-27.8	43.3
		5	18.4	-5.3	25.7
3	6.146	5	-18.9	-3	-25.7
		4	23.6	-29.5	-55.7
4	3.5	3	-34.8	-15.2	0
		4	33.9	16.7	55.7

Load combination: Dead and Imposed (Service)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	3.5	1	-19.2	8.1	0
		2	18.3	-8.1	-28.3
2	6.146	2	-11.8	-16.1	28.3
		5	7.9	-1.7	15.9
3	6.146	5	-7.9	-1.7	-15.9
		4	11.8	-16.1	-28.3
4	3.5	3	-19.2	-8.1	0
		4	18.3	8.1	28.3

Load combination: Dead Imposed and Wind (Service)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	3.5	1	-27.9	7	0
		2	27	-13.9	-36.5
2	6.146	2	-19.4	-23.4	36.5
		5	15.4	-4.5	21.7
3	6.146	5	-15.9	-2.5	-21.7
		4	19.8	-24.8	-46.8
4	3.5	3	-29.3	-12.7	0
		4	28.5	14	46.8

Load combination: Imposed (Service)

Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	3.5	1	-8.8	3.9	0
		2	8.8	-3.9	-13.7
2	6.146	2	-5.7	-7.8	13.7
		5	3.8	-0.8	7.7
3	6.146	5	-3.8	-0.8	-7.7
		4	5.7	-7.8	-13.7
4	3.5	3	-8.8	-3.9	0

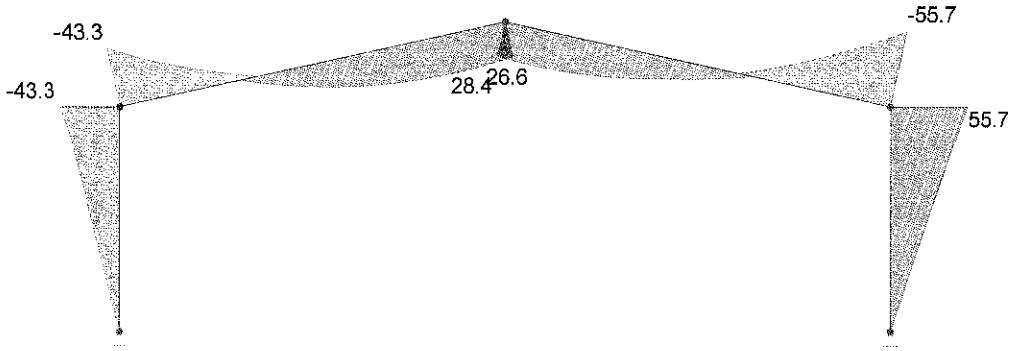
Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
		4	8.8	3.9	13.7

Load combination: Imposed and Wind (Service)

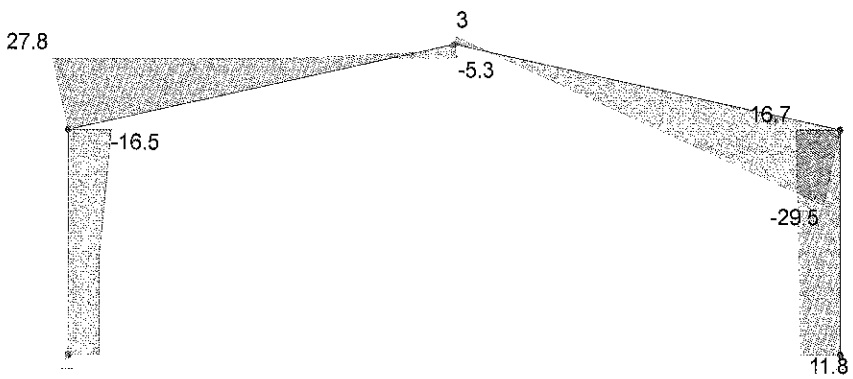
Element	Length (m)	Nodes Start/End	Axial force (kN)	Shear force (kN)	Moment (kNm)
1	3.5	1	-17.6	2.8	0
		2	17.6	-9.7	-21.9
2	6.146	2	-13.3	-15	21.9
		5	11.4	-3.5	13.5
3	6.146	5	-11.8	-1.6	-13.5
		4	13.7	-16.5	-32.2
4	3.5	3	-19	-8.6	0
		4	19	9.8	32.2

Forces

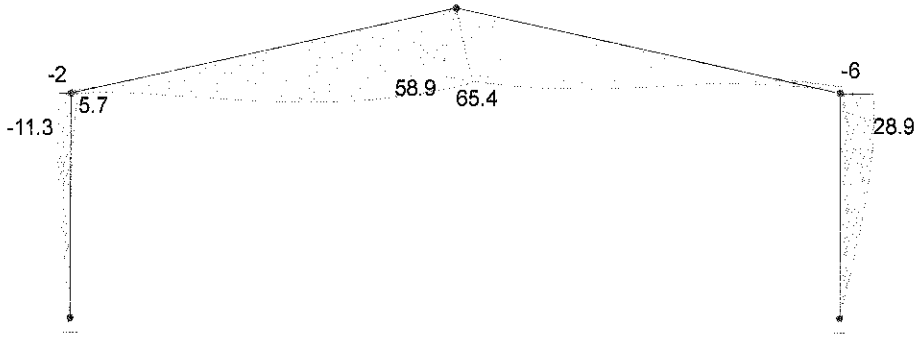
Strength combinations - Moment envelope (kNm)



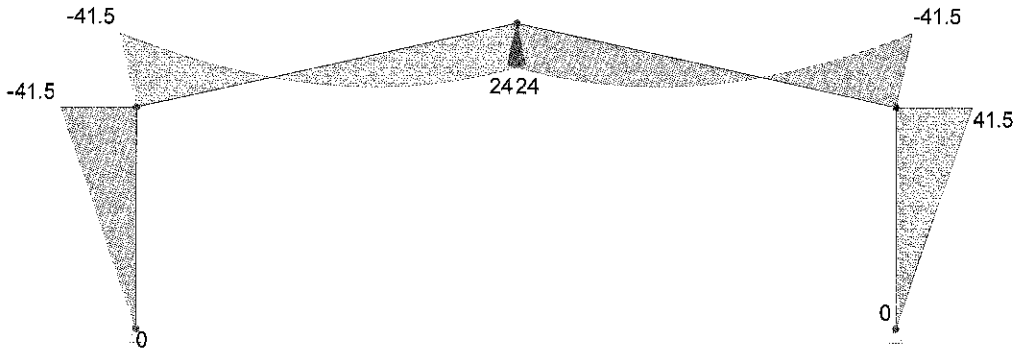
Strength combinations - Shear envelope (kN)



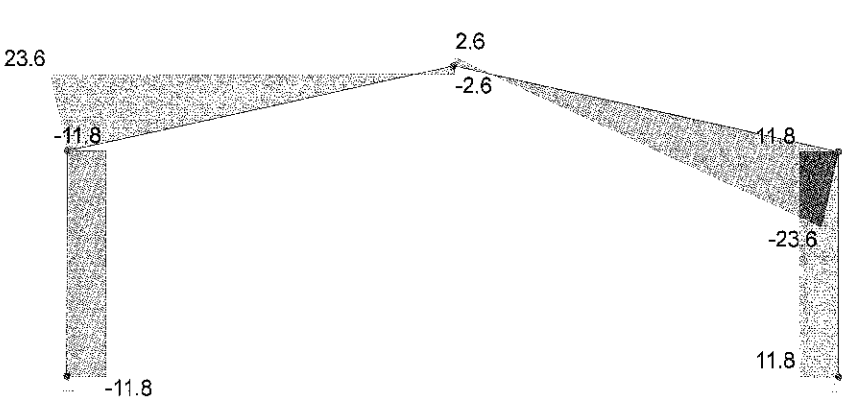
Service combinations - Deflection envelope (mm)



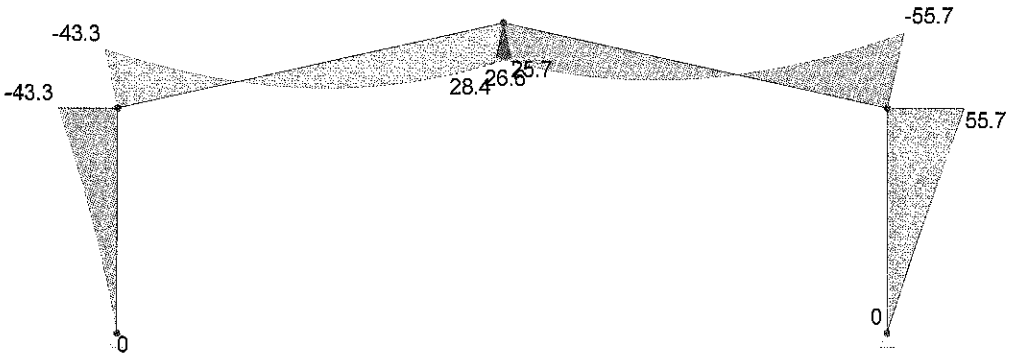
Dead and Imp (Strength) - Moment (kNm)



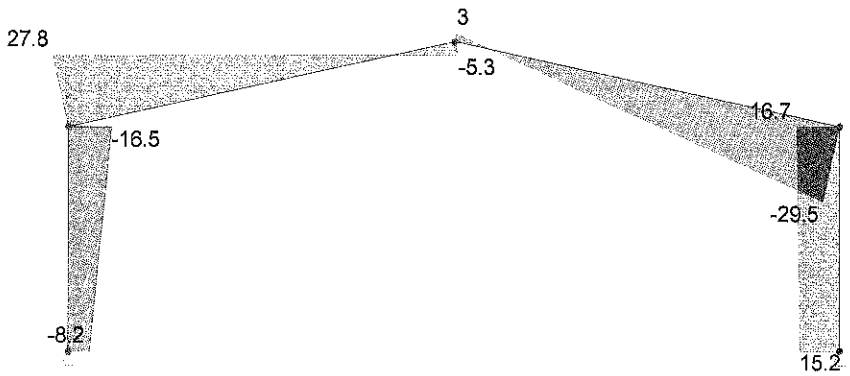
Dead and Imp (Strength) - Shear (kN)



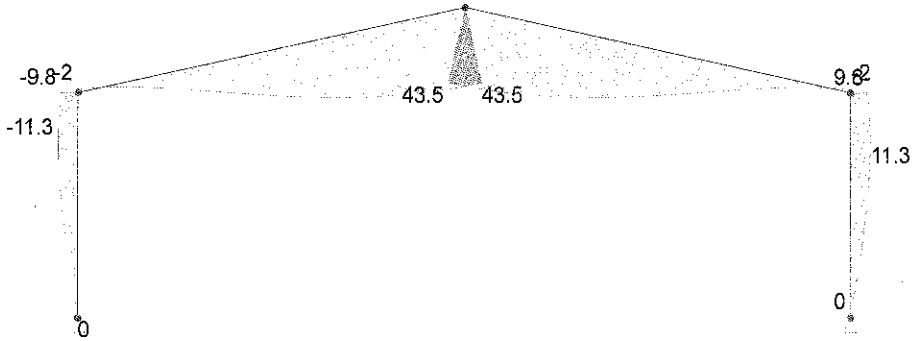
Dead Imp and wind (Strength) - Moment (kNm)



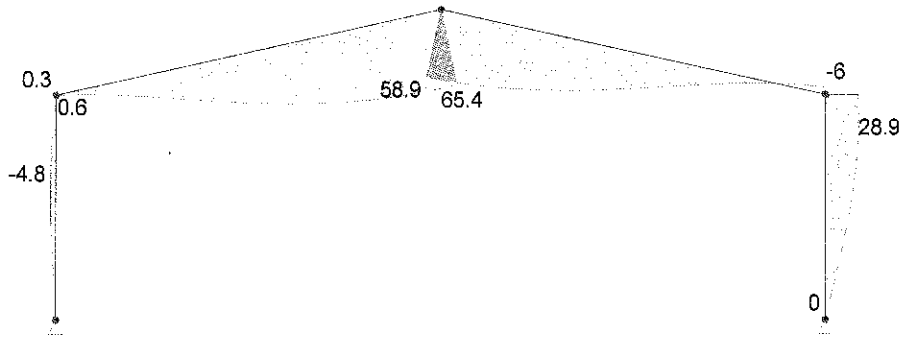
Dead Imp and wind (Strength) - Shear (kN)



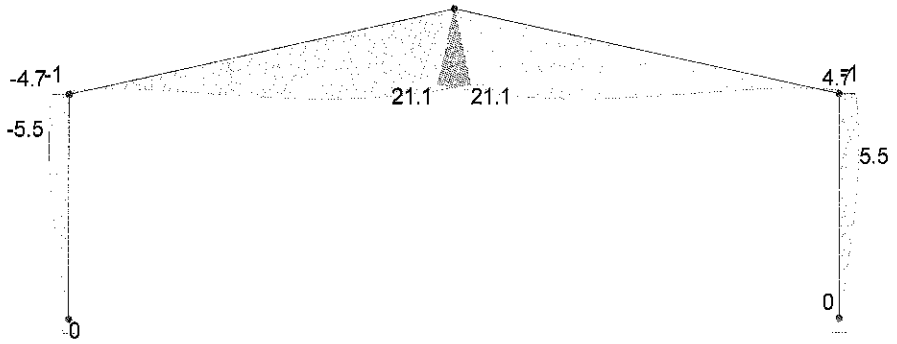
Dead and Imposed (Service) - Deflection (mm)



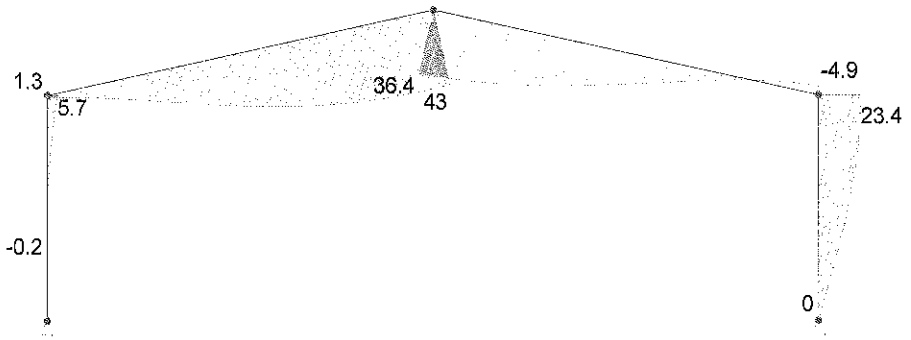
Dead Imposed and Wind (Service) - Deflection (mm)



Imposed (Service) - Deflection (mm)



Imposed and Wind (Service) - Deflection (mm)



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Tel: 01608 685753

Calc sheet no.	Prepared by	Date	Project no.
22	NW	Dec '19	19-203

Title of scheme: FOLLYFIELD, GREENLOE LANE, SIBFORD FERRIS

CHECK PURLINS.

DEAD LOAD = 0.12kN/m²
IMP = 0.32
WIND = 0.36

} 0.44 } 0.8kN/m²

0.14kN/m²
0.38
0.43

PURLIN SPACING = 1.2m.

LONG TERM LOAD = 0.12(1.2 = 0.14kN/m.

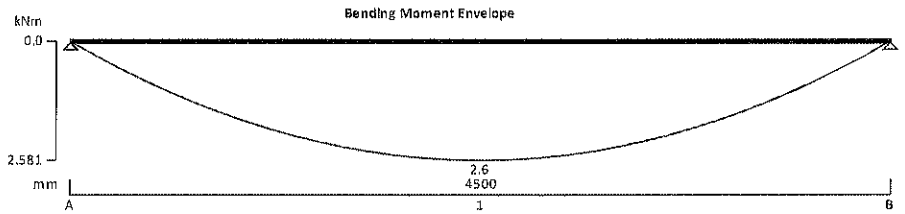
MED = 0.44.1.2 = 0.52kN/m.

SHORT = 0.8 1.2 = 0.96

OK - SEE TEDDS OUTPUT

TIMBER BEAM ANALYSIS & DESIGN TO BS5268-2:2002

TEDDS calculation version 1.7.01



Applied loading

Beam loads

Dead self weight of beam × 1
Dead full UDL 0.140 kN/m
Imposed full UDL 0.380 kN/m
Wind full UDL 0.430 kN/m

Load combinations

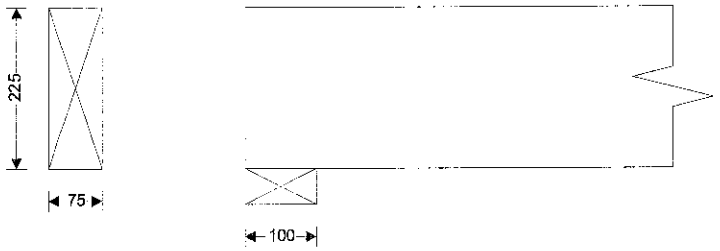
Load combination 1	Support A	Dead × 1.00
		Imposed × 1.00
		Wind × 1.00
	Span 1	Dead × 1.00
		Imposed × 1.00
		Wind × 0.00
	Support B	Dead × 1.00
		Imposed × 1.00
		Wind × 1.00
Load combination 2	Support A	Dead × 1.00
		Imposed × 1.00
		Wind × 1.00
	Span 1	Dead × 1.00
		Imposed × 1.00
		Wind × 1.00
	Support B	Dead × 1.00
		Imposed × 1.00
		Wind × 1.00

Analysis results

Design moment	M = **2.581** kNm	Design shear	F = **2.294** kN
Total load on beam	W_{tot} = **4.588** kN		
Reactions at support A	R_{A_max} = **2.294** kN	R_{A_min} = **1.326** kN	
Unfactored dead load reaction at support A	R_{A_Dead} = **0.471** kN		
Unfactored imposed load reaction at support A	$R_{A\_Imposed}$ = **0.855** kN		
Unfactored wind load reaction at support A	R_{A_Wind} = **0.968** kN		
Reactions at support B	R_{B_max} = **2.294** kN	R_{B_min} = **1.326** kN	
Unfactored dead load reaction at support B	R_{B_Dead} = **0.471** kN		

Unfactored imposed load reaction at support B $R_{B\_Imposed}$ = **0.855** kN

Unfactored wind load reaction at support B R_{B_Wind} = **0.968** kN



Timber section details

Breadth of section	b = **75** mm	Depth of section	h = **225** mm
Number of sections	N = **1**	Breadth of beam	b_b = **75** mm
Timber strength class	**C24**		

Member details

Service class of timber	**1**	Load duration	**Short term**
Length of span	L_{s1} = **4500** mm		
Length of bearing	L_b = **100** mm		

Lateral support - cl.2.10.8

Permiss.depth-to-breadth ratio	**6.00**	Actual depth-to-breadth ratio	**3.00**

PASS - Lateral support is adequate

Check bearing stress

Permissible bearing stress	σ_{c_adm} = **3.600** N/mm²	Applied bearing stress	σ_{c_a} = **0.306** N/mm²

PASS - Applied compressive stress is less than permissible compressive stress at bearing

Bending parallel to grain

Permissible bending stress	σ_{m_adm} = **11.612** N/mm²	Applied bending stress	σ_{m_a} = **4.078** N/mm²

PASS - Applied bending stress is less than permissible bending stress

Shear parallel to grain

Permissible shear stress	τ_{adm} = **1.065** N/mm²	Applied shear stress	τ_a = **0.204** N/mm²

PASS - Applied shear stress is less than permissible shear stress

Deflection

Permissible deflection	δ_{adm} = **13.500** mm	Total deflection	δ_a = **11.028** mm

PASS - Total deflection is less than permissible deflection