

6237a

BARN FOR CONVERSION WESTFIELD FARM MILL LANE GREAT BRICKHILL MILTON KEYNES MK19 9BG

VISUAL INSPECTION



6236 - Barn for conversion, Westfield Farm, Mill Lane, Great Brickhill, Milton Keynes

1. Introduction

Rawlings Structural Design Ltd was appointed by Mr and Mrs Cox of Westfield Farm, Mill Lane, Great Brickhill, Milton Keynes, MK19 9BG, to carry out a visual inspection of a redundant agricultural barn on their premises.

The purpose of the inspection was to consider the condition of the structure in support of the conversion of the building into a residential unit as part of a application for prior approval under Schedule 2 Part 3 Class Q of the Town and Country Planning (General Permitted Development) Order 2015.

It should be remembered that any such visual inspection can only be considered a snapshot of the condition of the building at the time of the inspection, although I have no reason to consider that this condition should alter, providing there is no change in the ambient conditions of the property. I should also advise you that the copyright of this report rests with Rawlings Structural Design Ltd and is prepared only for those to whom this letter is addressed. Therefore, it is not to be relied upon by any third party without the express agreement, in writing, of Rawlings Structural Design Ltd.

2. Description of the building

The building consists of 4No frames spanning 9.5m at 5.7m spacing. The building is approximately 3.5m to the eaves and 4.8m to the ridge.

The structure consists of steel portal frames consisting of 178 x 102 UB rafters and 203 x 133 UB30 columns, with a small haunch at the eaves. The purlins are 200mm metal Z section, similar to the Metsec Purlins, supporting profiled metal sheeting. The external walls are also profiled metal sheets supported by sheeting rails at approximately 1000mm vertical centres.

The concrete slab is competent and intact and has been subjected to agricultural loading throughout the life of the building.

3. Impact of proposals

The proposal is to create a single-storey dwelling within the shell of the existing building. The cladding to the roof will be replaced with lightweight insulated sheeting, which will be of a similar weight to the existing material. Similarly, the external walls will be overclad on the inside with insulation. A ceiling is to be provided creating a loft void over.



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Both floors will have the necessary partitions to make up the rooms. The ground floor slab is adequate to support the ground floor partitions and then be used to support the ceiling joists.

New doors and windows are proposed for the external elevations, which can be formed using secondary steel sections similar to the sheeting rails. Additional structure is not required.

4. Conclusion

The building has robust superstructure capable of supporting lightweight roof loads and providing lateral restraint. The monolithic concrete slab is capable of supporting an additional inner leaf as required to bring the buildings up to the insulation levels required by Building Regulations and the internal partitions.

The building does not require structural intervention other than that required to create doors and windows.

KEITH RAWLINGS BSc CEng FIStructE RAWLINGS STRUCTURAL DESIGN LTD 10 JANUARY 2024 Revision A 22 January 2024



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APPENDIX 1

PHOTOGRAPHS

















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APPENDIX 2

CALCULATIONS

Dryden Rock Lane Leighton Buzzard LU7 2QQ T: 07415 461917 E: keith@rawlings.uk.net		Westfield Farn Mill Lane Great Brickhil Milton Keynes	n l s			RAWLINGS LIMITED structural design
w:rawings.uk.net	KRR	January 2024	6236	Sheet 1	Rev	

Dimensions used are for calculation purposes only. The actual overall dimensions of beams should be determined by the Contractor on site.

PROPOSAL

Consider the existing structure in support of the conversion of the building into a residential unit as part of a application for prior approval under Schedule 2 Part 3 Class Q of the Town and Country Planning (General Permitted Development) Order 2015.

LOADS

Roof dead load Roof live load = **0.30** kN/m²

= **0.75** kN/m²

WIND LOADS

WIND LOADING (BS6399) In accordance with BS6399

	Tedds calculation version 3.0.18
● ● ● ● ● ● ● ● ● ● ● ● ● ●	5 5 Elevation
Building data Type of roof; Length of building; Width of building; Height to eaves; Pitch of roof; Reference height;	Duopitch L = 18145 mm W = 9500 mm H = 3500 mm α_0 = 15.0 deg H _r = 4773 mm
Dynamic classification Building type factor (Table 1); Dynamic augmentation factor (1.6.1);	
Site wind speed Location; Basic wind speed (Figure 6 BS6399:Pt 2) Site altitude Upwind distance from sea to site Direction factor Seasonal factor Probability factor Critical gap between buildings; Topography not significant Altitude factor; Site wind speed Terrain category; Displacement height (sheltering effect excluded);	$\begin{array}{l} \text{Bedford} \\ V_b = 21.5 \text{ m/s} \\ \Delta_S = 31 \text{ m} \\ d_{sea} = 126 \text{ km} \\ S_d = 1.00 \\ S_s = 1.00 \\ S_p = 1.00 \\ g = 5000 \text{ mm} \\ \end{array}$ $\begin{array}{l} S_a = 1 + 0.001 \times \Delta_S \ / \ 1m = 1.03 \\ V_s = V_b \times S_a \times S_d \times S_s \times S_p = 22.2 \text{ m/s} \\ \text{Country} \\ H_d = 0 \text{mm} \end{array}$

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$\begin{aligned} & \text{Figh factor (Table 22);} & \text{S}_{c} = 0.870 \\ & \text{inductive factor (Table 22);} & \text{S}_{i} = 0.194 \\ & \text{bust peak factor;} & \text{g}_{i} = 3.44 \\ & \text{errain and building factor;} & \text{S}_{b} = S_{c} \times (1 + (g_{1} \times S_{1}) + S_{h}) = 1.45 \\ & \text{we wind speed;} & \text{W}_{c} = V_{a} \times S_{b} = 32.1 \text{ m/s} \\ \hline \text{Dynamic pressure } \mathbf{G}_{e} = 0.613 \text{ kg/m}^{3} \times V_{c}^{2} = 0.633 \text{ kN/m}^{2} \\ \hline \text{iffective wind speed;} & \text{Unitar Table 7} \\ \hline \text{iffective wind speed;} & \text{Unitar Table 7} \\ \hline \text{Unitar factor result} & \text{Gauge 10.1 m} \\ \hline \text{Size effect factors} \\ \hline \text{liagonal dimension for gablewall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for gablewall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for side wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for side wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Gauge 0.940} \\ \hline \text{load fact factor roof;} & \text{Gauge 0.947} \\ \hline \text{liagonal dimension for ride wall;} & \text{Intermal size effect factor;} \\ \hline \text{ressures and forces} \\ \hline \text{let fraces:} & \text{Fw} = 0.926 \text{ K}^{2} \text{ C}^{2} \text{ C}^{2$	-ffective height	q is sought	J, Irer Ha :	= 4775 mm = max(H _{rof} – H _d	$0.4 \times H_{rof}$	= 4773 m	m				
urbulence factor (Table 22); bust peak factor; ierrain and building factor; isflective wind speed;S _i = 0.194 g = 3.44 is S _i = 5. s (1 + (g ₁ × S ₁) + S _n) = 1.45 V _e = V _s × S _b = 32.1 m/s Dynamic pressure; q _s = 0.613 kg/m ³ × V _s ² = 0.633 kN/m ² Size effect factors Niagonal dimension for gablewall; waternal size effect factor gablewall; waternal size effect factor side wall; isternal size effect factor side wall; case = 0.901 Niagonal dimension for or of; case = 0.901 Niagonal dimension for internal size effect factor; V = 0.125 m ³ Niagonal dimension for internal size effect factor; V = 0.125 m ³ Niagonal dimension for internal size effect factor; V = 0.125 m ³ Niagonal dimension for internal size effect factor; V = 0.125 m ³ Niagonal dimension for internal size effect factor; V = 0.125 m ³ Niagonal dimension for internal size effect factor; Case = 0.900 Noom/storey volume for internal size effect factor; V = 0.125 m ³ Niagonal dimension for internal size effect factor; ressures and forces let pressure; $P = q_{s} \times c_{pe} \times C_{ae} + q_{s} \times C_{pi} \times C_{ai};$ Fressure $\frac{10 \times (V_{1})^{1/3} = 5.000 \text{ m}}{(kN/m2)}$ $\frac{10 \times (V_{10})^{1/3} = \frac{1.000}{(kN/m2)}$ Tool foad case 1 - Wind 0, c _{pi} 0.20, -c _{pe} Net (kN/m ²) factor, Case (kN/m ²)Net factor, Case factor, Case p (kN/m ²)Area, Area, Net force, Fw (kN) Fw (kN) $\frac{10 \times (V_{10})^2}{13 \times (V_{10})^2}$ Mathematic let pressure, 0.80 (kN/m ²)Net factor, Case factor, CaseNet p (kN/m ²)Area, Area, Area, Net force, Fw (kN) $\frac{10 \times (V_{10})^2}{13 \times (V_{10})^2}$ Definition let pressure, 0.80 (kV/m ²)P = (P = 77.55 kN w, h = 1.45 kNNet	Fetch factor (Table 22);		S _c =	$S_c = 0.870$							
bust peak factor; ierrain and building factor; iffective wind speed; Dynamic pressure; $q_s = 3.44$ $S_b = S_c \times (1 + (g_t \times S_t) + S_t) = 1.45$ $V_a = V_a \times S_b = 32.1 \text{ m/s}$ Dynamic pressure; $q_s = 0.613 \text{ kg/m^3} \times V_s^2 = 0.633 \text{ kN/m^2}$ Size effect factors Nagonal dimension for gablewall; isternal size effect factor gablewall; isternal size effect factor side wall; isternal size effect factor or of; Care = 0.901 Nagonal dimension for internal size effect factor; isternal size effect factor rof; Care = 0.900 isternal size effect factor or of; Care = 0.900 isternal size effect factor; isternal size e	Turbulence factor (Table 2	2);	St =	0.194							
ierrain and building factor; Sb = Sb × (1 + (gt × Sb) = 51.45 Va = Va × Sb = 32.1 m/s Dynamic pressure; qs = 0.613 kg/m ³ × Vs ² = 0.633 kN/m ² istee effect factors istee effect factor gablewall; Sc = g = 0.947 Sternal size effect factor gablewall; Sc = g = 0.947 Sternal size effect factor side wall; Sc = g = 0.900 Sc = 10.00 Sc = 10.00	Gust peak factor;		g _t =	3.44							
V_e = V_s × S_b = 32.1 m/s Dynamic pressure; $q_s = 0.613 \text{ kg/m}^3 \times V_s^2 = 0.633 \text{ kN/m}^2$ District pressure: $q_s = 0.613 \text{ kg/m}^3 \times V_s^2 = 0.633 \text{ kN/m}^2$ District pressure: $q_s = 0.613 \text{ kg/m}^3 \times V_s^2 = 0.633 \text{ kN/m}^2$ District pressure: $q_s = 0.613 \text{ kg/m}^3 \times V_s^2 = 0.633 \text{ kN/m}^2$ District pressure: $q_s = 0.613 \text{ kg/m}^3 \times V_s^2 = 0.633 \text{ kN/m}^2$ District pressure: $q_s = 0.613 \text{ kg/m}^3 \times V_s^2 = 0.633 \text{ kN/m}^2$ District pressure: $q_s = 0.613 \text{ kg/m}^3 \times V_s^2 = 0.633 \text{ kN/m}^2$ District pressure of the track of track of the track of track of the track of track of the track of	Ferrain and building factor;		Sb =	= $S_c \times (1 + (g_t \times$	S_t) + S_h) = r	1.45					
Dynamic pressure; $q_s = 0.613 \text{ kg/m}^3 \times V_s^4 = 0.633 \text{ kN/m}^4$ bigonal dimension for gablewall;Caseg = 0.947bigonal dimension for side wall;Caseg = 0.947bigonal dimension for roide wall;Caseg = 0.901bigonal dimension for roof;Caseg = 0.901bigonal dimension for roof;Caser = 0.900bigonal dimension for internal size effect factor;V i = 0.125 m ³ bigonal dimension for internal size effect factor;Caser = 0.900bigonal dimension for internal size effect factor;Caser = 0.900Caser = 0.900big	Effective wind speed;		Ve =	= V _s × S _b = 32.1	m/s						
Size effect factorsWagonal dimension for gablewall; $a_{eg} = 10.1 \text{ m}$ External size effect factor gablewall; $a_{eg} = 18.5 \text{ m}$ Wagonal dimension for side wall; $a_{eg} = 18.5 \text{ m}$ External size effect factor roof; $a_{er} = 18.8 \text{ m}$ External size effect factor roof; $C_{aers} = 0.901$ Notomic torm of internal size effect factor; $V_i = 0.125 \text{ m}^3$ Nagonal dimension for internal size effect factor; $V_i = 0.125 \text{ m}^3$ Nagonal dimension for internal size effect factor; $C_{air} = 1.000$ Pressures and forces $p = q_8 \times C_{pe} \times C_{ae} - q_8 \times C_{pi} \times C_{ai}$;Let pressure; $p = q_8 \times C_{pe} \times C_{ae} - q_8 \times C_{pi} \times C_{ai}$;Let force; $F_w = p \times A_{tef}$;Pressures and forces $p = (kN/m^2)$ Let $p = 0.200 - 0.20$, $-C_{pe}$ $\boxed{2 \text{ One } Coefficient, pressure, q_6} factor, C_{ae} pressure, Area, Net force, p (kN/m^2)A(-ve) - 1.10 - 0.63 - 0.900 - 0.75 - 9.43 - 7.11B(-ve) - 0.80 - 0.63 - 0.900 - 0.35 - 71.30 - 25.28E(-ve) - 1.30 - 0.63 - 0.900 - 0.35 - 71.30 - 25.28E(-ve) - 1.30 - 0.63 - 0.900 - 0.87 - 9.43 - 8.18F(-ve) - 0.50 - 0.63 - 0.900 - 0.41 - 71.30 - 29.34otal vertical net force;F_{w,v} = -77.55 \text{ kN}row vertical net force;F_{w,h} = 1.45 \text{ kN}$			<u>Dynamic pressu</u>	<u>re; q_s = 0.613 k</u>	<u>kg/m³ x Ve²</u>	= 0.633	<u>kN/m²</u>				
Zone Ext pressure, coefficient, pressure, qs External size factor, Cae Net pressure, pressure, pressure, qs Net force, factor, Cae Net pressure, pressure, pressure, qs Net force, factor, Cae Net pressure, pressure, pressure, qs Net force, factor, Cae Net force, factor, Cae	Size effect factors Diagonal dimension for gal External size effect factor of Diagonal dimension for sid External size effect factor s Diagonal dimension for roc External size effect factor r Room/storey volume for int Diagonal dimension for internal size effect factor;	olewall; ablewall; e wall; ide wall; f; oof; ernal size ef ernal size ef	$\begin{array}{c} a_{eg}\\ C_{aeg}\\ a_{es}\\ C_{aeg}\\ a_{er}:\\ C_{aeg}\\ e_{r}:\\ C_{aeg}\\ ffect factor; V_{i}=\\ fect factors; a_{i}=\\ C_{ai}:\\ \end{array}$	= 10.1 m g = 0.947 = 18.5 m s = 0.901 = 18.8 m = 0.900 t 0.125 m ³ 10 × (V _i) ^{1/3} = 4 = 1.000	5.000 m						
Termination forces $p = q_s \times c_{pe} \times C_{ae} - q_s \times c_{pi} \times C_{ai};$ termination force; $p = q_s \times c_{pe} \times C_{ae} - q_s \times c_{pi} \times C_{ai};$ Termination force is the state of the state in the state is the sta	Prossures and forces										
Coof load case 1 - Wind 0, c_{pi} 0.20, $-c_{pe}$ ZoneExt pressure coefficient, c_{pe} Dynamic pressure, q_s (kN/m2)External size factor, C_{ae} Net Pressure, p (kN/m2)Area, Aref (m2)Net force, Fw (kN)A (-ve)-1.100.630.900-0.759.43-7.11B (-ve)-0.800.630.900-0.588.50-4.95C (-ve)-0.400.630.900-0.3571.30-25.28E (-ve)-1.300.630.900-0.648.50-5.43G (-ve)-0.500.630.900-0.4171.30-29.34otal vertical net force; otal horizontal net force;F _{w,h} = 1.45 kNF _{w,h} = 1.45 kNF	Vet pressure; Vet force;		p = F _w =	$q_s \times c_{pe} \times C_{ae}$ - = $p \times A_{ref}$;	$q_s imes c_{pi} imes C_a$	ı;					
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Roof load case 1 - Wind (), c _{pi} 0.20, -	Cpe								
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Ext	pressure	Dynamic	External aiz	۱ <u>۱</u>	let	Area	Net force			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Zone co	efficient,	pressure, q₅	factor Coo	Pres	ssure,	A_{ref} (m ²)	F_w (kN)			
A (-ve)-1.100.030.900-0.759.43-7.11B (-ve)-0.800.630.900-0.588.50-4.95C (-ve)-0.400.630.900-0.3571.30-25.28E (-ve)-1.300.630.900-0.648.50-5.43F (-ve)-0.900.630.900-0.648.50-5.43G (-ve)-0.500.630.900-0.4171.30-29.34otal vertical net force; $F_{w,v}$ = -77.55 kN $F_{w,h}$ = 1.45 kN $F_{w,h}$ = 1.45 kN		Cpe	(KN/m²)	0.000	p (k	N/M²)	0.40	7 4 4			
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	A (-ve)	-1.10	0.03	0.900		58	9.43	-/.11			
E (-ve) -1.30 0.63 0.900 -0.87 9.43 -8.18 F (-ve) -0.90 0.63 0.900 -0.64 8.50 -5.43 G (-ve) -0.50 0.63 0.900 -0.41 71.30 -29.34 otal vertical net force; $F_{w,h} = 1.45 \text{ kN}$	C (-ve)	-0.40	0.03	0.900	-0	.35	71.30	-25.28			
F (-ve) -0.90 0.63 0.900 -0.64 8.50 -5.43 G (-ve) -0.50 0.63 0.900 -0.41 71.30 -29.34 otal vertical net force; Fw.v = -77.55 kN Fw.h = 1.45 kN Fw.h = 1.45 kN Fw.h = 1.45 kN	E (-ve)	-1.30	0.63	0.900	-0	.87	9.43	-8.18			
G (-ve) -0.50 0.63 0.900 -0.41 71.30 -29.34 otal vertical net force; F _{w,v} = -77.55 kN Fwe = -77.55 k	F (-ve)	F (-ve) -0.90 0.63 0.900 -0.64 8.50 -5.43									
Total vertical net force; $F_{w,v} = -77.55 \text{ kN}$ Total horizontal net force; $F_{w,h} = 1.45 \text{ kN}$	G (-ve)	-0.50	0.63	0.900	-0	.41	71.30	-29.34			
Total horizontal net force; $F_{w,h} = 1.45 \text{ kN}$	otal vertical net force;		F _{w,v}	= -77.55 kN							
	otal horizontal net force;		Fw,h	= 1.45 kN							
	,										

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Walls load case 1 - Wind 0, cpi 0.20, -cpe

Zone	Ext pressure coefficient, c _{pe}	Dynamic pressure, q _s (kN/m²)	External size factor, Cae	Net Pressure, p (kN/m²)	Area, A _{ref} (m²)	Net force, F _w (kN)
A	-1.59	0.63	0.947	-1.08	7.17	-7.72
В	-0.90	0.63	0.947	-0.66	32.13	-21.30
W	0.71	0.56	0.901	0.25	63.51	15.57
	-0.50	0.56	0.901	-0.36	63.51	-23.17

Overall loading

Equiv leeward net force for overall section; Net windward force for overall section; Overall loading overall section;

Roof load case 2 - Wind 0, cpi -0.3, +cpe

Zone	Ext pressure coefficient, c _{pe}	Dynamic pressure, q₅ (kN/m²)	External size factor, C _{ae}	Net Pressure, p (kN/m²)	Area, A _{ref} (m²)	Net force, F _w (kN)
A (+ve)	0.20	0.63	0.900	0.30	9.43	2.87
B (+ve)	0.20	0.63	0.900	0.30	8.50	2.58
C (+ve)	0.20	0.63	0.900	0.30	71.30	21.67
E (+ve)	-1.30	0.63	0.900	-0.55	9.43	-5.20
F (+ve)	-0.90	0.63	0.900	-0.32	8.50	-2.74
G (+ve)	-0.50	0.63	0.900	-0.09	71.30	-6.77

Total vertical net force;

Total horizontal net force;

F_{w,v} = **11.98** kN F_{w,h} = **10.83** kN

Walls load case 2 - Wind 0, cpi -0.3, +cpe

Ext pressure Dynamic Net External size Area, Net force, Zone coefficient, Pressure. pressure, qs factor, Cae $A_{ref} \left(m^2 \right)$ F_w (kN) (kN/m^2) <u>p (kN/m²)</u> Cpe -1.59 0.947 7.17 -5.45 A 0.63 -0.76 В 0.947 32.13 -0.90 0.63 -0.35 -11.14 63.51 33.37 0.71 0.56 0.901 0.53 w -0.50 0.56 0.901 -0.08 63.51 -5.36 1

Overall loading

Equiv leeward net force for overall section; Net windward force for overall section; Overall loading overall section; $F_{I} = F_{w,wl} = -5.4 \text{ kN} \\ F_{w} = F_{w,ww} = 33.4 \text{ kN} \\ F_{w,w} = 0.85 \times (1 + C_{r}) \times (F_{w} - F_{I} + F_{w,h}) = 43.3 \text{ kN}$

Roof load case 3 - Wind 90, cpi 0.20, -cpe

Zone	Ext pressure coefficient, _{Cpe}	Dynamic pressure, q₅ (kN/m²)	External size factor, C _{ae}	Net Pressure, p (kN/m²)	Area, A _{ref} (m²)	Net force, F _w (kN)
A (-ve)	-1.60	0.63	0.900	-1.04	4.67	-4.85
B (-ve)	-1.50	0.63	0.900	-0.98	4.67	-4.58
C (-ve)	-0.60	0.63	0.900	-0.47	37.37	-17.51
D (-ve)	-0.40	0.63	0.900	-0.35	131.74	-46.70
otal vertical net forc	e:	Fwv	= -71.14 kN			

Total horizontal net force;

```
F<sub>w,v</sub> = -71.14 kN
F<sub>w,h</sub> = 0.00 kN
```

Walls load case 3 - Wind 90, cpi 0.20, -cpe

Zone	Ext pressure coefficient, c _{pe}	Dynamic pressure, q₅ (kN/m²)	External size factor, C _{ae}	Net Pressure, p (kN/m²)	Area, A _{ref} (m²)	Net force, F _w (kN)
А	-1.47	0.56	0.901	-0.86	4.90	-4.19
В	-0.86	0.56	0.901	-0.55	19.60	-10.69
С	-0.73	0.56	0.901	-0.48	39.01	-18.73
W	0.62	0.63	0.947	0.24	39.30	9.54
I	-0.50	0.63	0.947	-0.43	39.30	-16.75

Overall loading

Equiv leeward net force for overall section; Net windward force for overall section; Overall loading overall section; Fı =F_{w,wl} = **-16.8** kN F_w = F_{w,ww} = **9.5** kN

 $F_{w,w} = 0.85 \times (1 + C_r) \times (F_w - F_l + F_{w,h}) = 23.0 \text{ kN}$

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Roof load case 4 - Wind 90, cpi -0.3, -cpe

Zone	Ext pressure coefficient, _{Cpe}	Dynamic pressure, q _s (kN/m²)	External size factor, Cae	Net Pressure, p (kN/m²)	Area, A _{ref} (m²)	Net force, F _w (kN)
A (-ve)	-1.60	0.63	0.900	-0.72	4.67	-3.37
B (-ve)	-1.50	0.63	0.900	-0.66	4.67	-3.11
C (-ve)	-0.60	0.63	0.900	-0.15	37.37	-5.68
D (-ve)	-0.40	0.63	0.900	-0.04	131.74	-5.00
otal vertical net for	ce;	F _{w,v}	= -16.58 kN			

Total vertical net force;

Total horizontal net force;

Walls load case 4 - Wind 90, cpi -0.3, -cpe

F_{w,h} = **0.00** kN

Zone	Ext pressure coefficient, c _{pe}	Dynamic pressure, q _s (kN/m²)	External size factor, Cae	Net Pressure, p (kN/m²)	Area, A _{ref} (m²)	Net force, F _w (kN)
А	-1.47	0.56	0.901	-0.58	4.90	-2.82
В	-0.86	0.56	0.901	-0.26	19.60	-5.19
С	-0.73	0.56	0.901	-0.20	39.01	-7.80
W	0.62	0.63	0.947	0.56	39.30	21.98
	-0.50	0.63	0.947	-0.11	39.30	-4.31

Overall loading

Equiv leeward net force for overall section; Net windward force for overall section; Overall loading overall section;

$$F_{I} = F_{w,wI} = -4.3 \text{ kN}$$

 $F_{w} = F_{w,wI} = 22.0 \text{ kN}$

$$F_{w,w} = 0.85 \times (1 + C_r) \times (F_w - F_l + F_{w,h}) = 23.0 \text{ kN}$$





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<u>FR</u>	AME LOADS					
Ro Ro	of dead load = of live load =	0.30 x 5.7m 0.75 x 5.7m	= 1.7 kN/m = 4.3 kN/m			
Wir Wir Lee Lee Wir Wir Lee Lee Wir Wir	ad Case 1 – Wind at 0 de adward wall = adward roof = eward roof = eward wall = adward wall = adward wall = adward roof = eward roof = eward roof = eward vall = adward sold = eward wall = eward wall = eward wall = eward wall = adward wall = adwa	grees, negative coe = 0.25 x 5.7m = -0.35 x 5.7m = -0.41 x 5.7m = -0.36 x 5.7m grees, positive coeff = 0.53 x 5.7m = 0.09 x 5.7m = -0.09 x 5.7m = -0.08 x 5.7m egrees, negative coeff = 0.24 x 5.7m	fficient = 1.4 kN/m = -2.0 kN/m = -2.3 kN/m = -2.1 kN/m icient = 3.0 kN/m = 1.7 kN/m = -0.5 kN/m = -0.5 kN/m = 1.4 kN/m			
Wir Lee Lee	ndward roof = eward roof = eward wall =	-0.35 x 5.7m -0.35 x 5.7m -0.43 x 5.7m	= -2.0 kN/m = -2.0 kN/m = -2.5 kN/m			
Wir Wir Wir Lee Lee	nd case 4 – Wind at 90 de ndward wall = ndward roof = ward roof = ward wall =	egrees, positive coe : 0.56 x 5.7m : -0.04 x 5.7m : -0.04 x 5.7m : -0.11 x 5.7m	fficient = 3.2 kN/m = 0.2 kN/m = -0.2 kN/m = -0.6 kN/m			

FRAME ANALYSIS

ANALYSIS

<u>Results</u> Forces Tedds calculation version 1.0.37



Strength combinations - Moment envelope (kNm)



Strength combinations - Shear envelope (kN)



All combinations - Axial force envelope (kN)



Element results

Envelope - Strength combinations

Element	Shear force		Moment						
	Pos	Max abs	Pos	Max	Pos	Min			
	(m)	(kN)	(m)	(kNm)	(m)	(kNm)			
1	3.5	-17.6	0	0	3.5	-59.2 (min)			
2	0	39.5 (max abs)	4.425	28.2 (max)	0	-59.2 (min)			
3	4.925	-39.5	0.5	28.2 (max)	4.925	-59.2 (min)			
4	0	17.6	3.5	0	0	-59.2 (min)			

Envelope - All combinations

Element 1	Axial force						
	Pos	Мах	Pos	Min			
	(m)	(kN)	(m)	(kN)			
1	0	45.6 (max)	0	20.5			
2	0	28.4	4.925	6.7 (min)			
3	4.925	28.4	0	8.4			
4	0	45.6 (max)	0	22.8			

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··· rawingsonariet	KRR	January 2024	6236	Sheet Rev 8	r	
RAFTER CHECK						
Design moment at eaves Design moment at ridge		= 59.2 kNm = 28.2 kNm				
Change across length of rafte	er	= 59.2 + 28.2	=	87.4 kNm		
Length of rafters Length of haunch		= 4.95 m = 0.5 m				
Drop in moment across haun	ch	= 87.4 x 0.5 / 4	.95 =	50.0 kNm		
STEEL MEMBER DESIGN (I In accordance with BS5950	<u>385950)</u> -1:2000 incorpora	ating Corrigendum	No.1			
Section details						TEDDS calculation version 3.0.0
Section type; Steel grade;		UB 178x102x1 S275	9 (British S	Steel Sect	ion Range 2022	(BS4-1))
From table 9: Design streng Thickness of element; Design strength; Modulus of elasticity;	jth pγ	max(T, t) = 7.9 py = 275 N/mm E = 205000 N/r	mm nm ²			
Lateral restraint Distance between major axis Distance between minor axis	restraints; restraints;	L _x = 1000 mm L _y = 0 mm				
Effective length factors Effective length factor in major Effective length factor in minor Effective length factor for later	or axis; or axis; ral-torsional buckli	$\begin{array}{l} K_x = {\bf 0.70} \\ K_y = {\bf 0.70} \\ \text{ing;} K_{\text{LT}} = {\bf 1.00}; \end{array}$				
Classification of cross sect	ions - Section 3.	5 ε = √[275 N/mn	n² / p _y] = 1. 0	00		
Internal compression parts Depth of section;	- Table 11	d = 146.8 mm d / t = 30.6 × ε	<= 80 × ε;	С	Class 1 plastic	
Outstand flanges - Table 11 Width of section;		b = B / 2 = 50.6 b / T = 6.4 × ε <	i mm <= 9 × ε;	С	Class 1 plastic	Section is class 1 plast



Moment capacity - Section 4.2.5 Design bending moment;

Moment capacity low shear - cl.4.2.5.2;

M = **50** kNm

 $M_{c} = min(p_{y} \times S_{xx}, \ 1.2 \times p_{y} \times Z_{xx}) = \textbf{47.1 kNm}$

ACCEPT 6% overstress

Existing rafter adequate

HAUNCH CHECK

CALCULATION OF SECTION PROPERTIES



COLUMN CHECK

Design moment Design axial force



Dryden Rock Lane Leighton Buzzard LU7 2QQ T: 07415 461917 E: keith@rawlings.uk.net W: rawlings.uk.net	Westfield Farm Mill Lane Great Brickhill Milton Keynes				R.	AW u c t u	MITE ral	NG d e s i g	S n	
w. fawings.uk.net	KRR	January 2024	6236	Sheet R 11	Rev					
Shear capacity - Section 4.2. Design shear force;	3	F _{x,v} = 0 kN								
Moment capacity - Section 4 Design bending moment; Moment capacity low shear - c	.2.5 I.4.2.5.2;	M = 59.2 kNm M _c = min(p _y × S	o _{xx} , 1.2 × py PASS	× Z _{xx}) = 8 5 - Mome	86.5 ent c	kNm apacity	v exceeds	s design i	bending m	nomen
Compression members - Sec Design compression force;	ction 4.7	Fc = 45.6 kN								
Effective length for major (x- Effective length for buckling; Slenderness ratio - cl.4.7.2;	x) axis buckling	- Section 4.7.3 L _{Ex} = L _x × K _x = 3 λ _x = L _{Ex} / r _{xx} = 4	3500 mm 0.206							
Compressive strength - Sect Limiting slenderness; Strut curve - Table 23; Robertson constant; Perry factor; Euler stress; Compressive strength - Annex	i on 4.7.5 C.1;	$\lambda_0 = 0.2 \times (\pi^2 \times a)$ $\alpha_x = 2.0$ $\eta_x = \alpha_x \times (\lambda_x - \lambda)$ $p_{Ex} = \pi^2 \times E / \lambda_y$ $\phi_x = (p_y + (\eta_x + b))$ $p_{cx} = p_{Ex} \times p_y / (h)$	$E / p_y)^{0.5} =$ $_{0}) / 1000 =$ $_{2}^{2} = 1251.6$ $1) \times p_{Ex}) / 2$ $\phi_x + (\phi_x^2 - p_y)^2$	17.155 0.046 N/mm ² 2 = 792.1 Dex × py) ^{0.}	N/m ^{.5}) = 2	m² 259.9 N	/mm²			
Compression resistance - Se Compression resistance - cl.4.	ection 4.7.4 7.4;	$P_{cx} = A \times p_{cx} = S$	993 kN S - Compr	ression r	resis	tance e	exceeds o	design co	ompressio	n force
Compression members with Comb.compression & bending	moments - Secti check - cl.4.8.3.2	o n 4.8.3 ; F _c / (A × p _y) + N	1 / Mc = 0.7 PASS - C	28 ombinec	d ber	nding a	nd comp	ression d	check is sa	atisfiec
Member buckling resistance Max major axis moment govern Equiv uniform mnt factor - majo Buckling resistance check - cl.	- Section 4.8.3.3 ning M₅; or axis flex bucklir 4.8.3.3.2;		20 kNm M / Mc × (1 <i>PA</i>	+ 0.5 × F SS - Mer	=₀ / ₽₀ mber	cx) = 0.7 S buckli	46 ng resist	ance che	ecks are sa	atisfied
		<u>Column is</u>	adequate	l						
PURLINS										
Roof dead load Roof live load Roof wind load		= 0.3 x 1.0m = 0.75 x 1.0m = 0.3 x 1.0m	= = =	0.3 kN/m 0.8 kN/m 0.3 kN/m	3 kN/m 8 kN/m 3 kN/m					
Span		= 5.7 m								
Load from dead + live		= ((1.4 x 0.3) + = (0.42 + 1.28)	(1.6 x 0.8)) x 5.7m =	x 5.7m 9.7 kN						
Load from dead + live + wind		= (0.3 + 0.8 + 0 = 1.4 x 1.2 x 5.	= (0.3 + 0.8 + 0.3) x 1.2 x 5.7m = 1.4 x 1.2 x 5.7 = 9.6 kN							
Capacity of 2000mm Z purlin o	over 6.0m	= 19.57 kN								
		Purlins are	e adequate	<u>}</u>						