

Calculation Sheet**Bland and Swift**

CONSULTING STRUCTURAL & CIVIL ENGINEERS

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Job No: 11907

Sheet No: 1

Made by: AC

Title: Mount Pleasant Farm, Jackroyd lane, Mirfield

Date: Sept 18

Conversion of Existing Driving Range to Business Premises

Check existing structure for dead & imposed
loads in accordance with BS 6399

Design loadingsRoof

dead - Cladding/Insulation	=	0.12 kNm ²
Partitions/purlins	=	0.20 "
Soffit boards	=	0.11 "
		<u>0.43 kNm²</u>
Imposed (Basic site snow)	=	0.60 "
		<u>1.03 kNm²</u>

Factored loads

	x 1.4 =	0.60 kNm ²
	x 1.6 =	0.96 "
		<u>1.56 kNm²</u>

Ground Floor

dead - Ply decking	=	0.11 kNm ²
Joists & supports	=	0.25 "
Insulation	=	0.05 "
		<u>0.41 kNm²</u>
Imposed	=	2.50 "
(work rooms without storage)		<u>2.91 kNm²</u>

	x 1.4 =	0.57 kNm ²
	x 1.6 =	4.0 "
		<u>4.57 kNm²</u>

Project Mount Pleasant Farm, Jackroyd Lane, Mirfield				Job no. 11907	
Calcs for Snow Loading				Start page no./Revision 2	
Calcs by AC	Calcs date 13/09/2018	Checked by HE	Checked date 13/09/2018	Approved by HE	Approved date 13/09/2018

SNOW LOADING TO BS6399:PART 3:1988

TEDDS calculation version 1.0.02

Site location

Location of site

Upper Hopton

Site altitude

A = 183 m

Calculate site snow load

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

Basic snow load

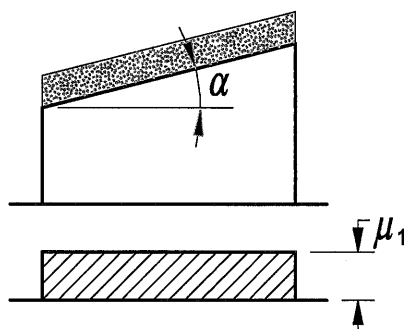
$$S_b = 0.60 \text{ kN/m}^2$$

$$S_{alt} = 0.1 \times S_b + (0.09 \text{ kN/m}^2) = 0.15 \text{ kN/m}^2$$

Site snow load

$$S_0 = S_b + S_{alt} \times (A - (100 \text{ m})) / 100 \text{ m} = 0.72 \text{ kN/m}^2$$

BS6399:Part3:1988 Cl.6.2



Uniform loading

Roof geometry

Roof type

Monopitch

Distance on plan from gutter to ridge

b = 5.300 m

Angle of pitch of roof

$\alpha = 12.5 \text{ deg}$

Calculate uniform snow load

From BS6399:Part 3: 1988 - Figure 2. Snow load shape coefficients for flat or monopitch roofs

Snow load shape coefficient

$$\mu_1 = 0.80$$

Uniform roof snow load

$$S_{d1} = \mu_1 \times S_0 = 0.58 \text{ kN/m}^2$$

BS6399:Part3:1988 Cl.5

Snow sliding down roof

Maximum uniform snow load on roof

$$S_{d_max} = 0.58 \text{ kN/m}^2$$

Force from sliding snow load

$$F_s = S_{d_max} \times b \times \sin(\alpha) = 0.66 \text{ kN/m}$$

BS6399:Part3:1988 Cl.8

Title: Mount Pleasant Farm, Jackroyd Lane, Mirfield

Date: Sept 18

Floor Structure

- Floor Joists Spm: 2.75m

Existing 50x200dp C16 @ 400c

 Design load: $2.91 \times 2.75 \times 0.40 = 3.2k$

 BM: $3.2 \times 2.75 / 8 = 1.1k$
 $Z_{reqd}: 1.1 \times 10^6 / 5.3 = 208 \times 10^3 mm^3$
 $I_{reqd}: \frac{3.2 \times 2.75^2}{0.0202 \times 10^2} = 12 \times 10^6 mm^4$
 $Z_{prov}: 333 \times 10^3 mm^3 > 208 \times 10^3 mm^3$
 $I_{prov}: 33.3 \times 10^6 mm^4 > 12 \times 10^6 mm^4$

- Floor Support beams

Existing 100x250dp - C24

- 2.2m span at main frame positions

 Design load: $2.91 \times 2.2 \times 5.5 / 2 = 17.6k$

 BM: $17.6 \times 2.2 / 8 = 4.84k$
 $Z_{reqd}: 4.84 \times 10^6 / 7.5 = 646 \times 10^3 mm^3$
 $I_{reqd}: \frac{17.6 \times 2.2^2}{0.0166 \times 10^2} = 51.3 \times 10^6 mm^4$
 $Z_{prov}: 1040 \times 10^3 mm^3 > 646 \times 10^3 mm^3$
 $I_{prov}: 130 \times 10^6 mm^4 > 51.3 \times 10^6 mm^4$

- 4.3m span (between main frames)

 Design load: $2.91 \times 4.3 \times 5.5 / 2 = 34.4k$

 BM: $34.4 \times 4.3 / 8 = 18.49k$
 $Z_{reqd}: 18.49 \times 10^6 / 7.5 = 2465 \times 10^3 mm^3$
 $I_{reqd}: \frac{34.4 \times 4.3^2}{0.0166 \times 10^2} = 383 \times 10^6 mm^4$

 Existing
Floor Joists
adequate

 Floor Support
beams at
main frame
positions
adequate

Calculation Sheet

Bland and Swift

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Job No: 11907

Sheet No: 4

Made by: KZ

Title: Mount Pleasant Farm, Jackroyd Lane, Ml. field

Date: Sept 18

$$Z_{prov} = 1040 \times 10^3 \text{ mm}^3 < 2465 \times 10^3 \text{ mm}^3$$

$$I_{prov} = 130 \times 10^4 \text{ mm}^4 < 383 \times 10^6 \text{ mm}^4$$

Inadequate for single section and also

2 N° 100 x 250 dp

$$\left(\begin{array}{l} Z_{prov} = 2080 \times 10^3 \text{ mm}^3 < 2465 \times 10^3 \text{ mm}^3 \\ I_{prov} = 260 \times 10^6 \text{ mm}^4 < 383 \times 10^6 \text{ mm}^4 \end{array} \right)$$

Provide PFC to support full load

$$\text{Factored load} = 4.57 \times 4.3 \times 5.5 / 2 = 54 \text{ kN}$$

$$\text{BM} = 54 \times 4.3 / 8 = 29 \text{ kN}$$

$$S_{reqd} = 29 \times 10^3 / 275 = 106 \text{ cm}^3$$

$$I_{reqd} = 2.02 \times 34.4 \times 4.3^2 = 1285 \text{ cm}^4$$

180 x 75 PFC

$$S_{prov} = 176 \text{ cm}^3 > 106 \text{ cm}^3$$

$$I_{prov} = 1370 \text{ cm}^4 > 1285 \text{ cm}^4$$

Intermediate floor support beams between main frames inadequate

Provide

180 x 75 PFC

Roof Structure

Check rafters. Existing 2 N° 100 x 250 dp C24

By inspection continuous section critical

$$\text{Design load} = 1.03 \times 5.5 (1.3 + 1.7) = 17 \text{ kN}$$

$$\text{BM} = 17 \times 1.7 / 2 = 14.45 \text{ kN}$$

$$Z_{reqd} = 14.45 \times 10^6 / 7.5 = 1927 \times 10^3 \text{ mm}^3$$

$$Z_{prov} = 2 \times 1040 = 2080 \times 10^3 \text{ mm}^3$$

$$> 1927 \times 10^3 \text{ mm}^3$$

Existing Rafters adequate

Title: Mount Pleasant Farm, Jackroyd Lane, Mirfield

Date: Sept 18

Timber Posts

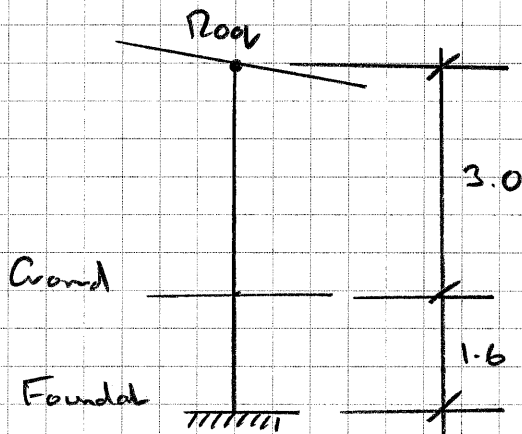
Maximum loading to Central column
 - 100 x 250 dp C24

Design loads

$$\begin{aligned} \text{Roof dead} &= 0.43 \times 5.5 \times (3.0 + 2.2/2) = 9.7 \text{ k} \\ \text{Imposed} &= 0.60 \times 5.5 \times (3.0 + 2.2/2) = 13.5 \text{ k} \end{aligned}$$

$$\begin{aligned} \text{Ground floor dead} &= 0.41 \times 5.5/2 \times 4.4/2 = 2.5 \text{ k} \\ \text{Imposed} &= 2.50 \times 5.5/2 \times 4.4/2 = 15.1 \text{ k} \end{aligned}$$

$$\left. \begin{array}{l} \text{Total} \\ = 40.8 \text{ k} \end{array} \right\}$$



Existing timber posts adequate

See attached analysis & design

Check existing foundation

2 No Trial pits confirmed minimum
 700 x 700 x 250 mm pad foundations under
 posts extending onto dense brown clay
 Minimum GBP: 150 kNm²

$$\text{Self wt base} = 24 (0.7 \times 0.7 \times 0.25) = 3.0 \text{ k}$$

$$\text{Total load} = 40.8 + 3.0 = 43.8 \text{ Say } 45 \text{ k}$$

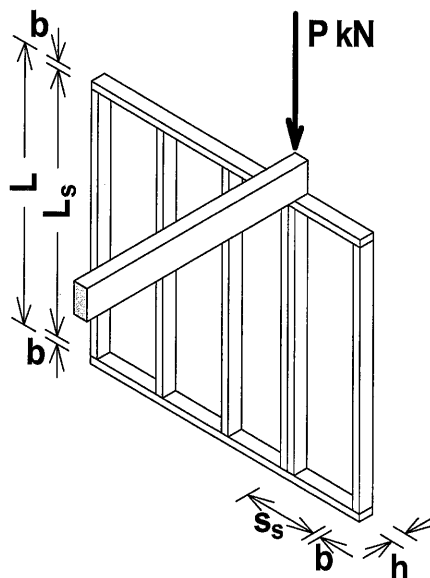
$$\text{GBP} = 45 / 0.7 \times 0.7 = \underline{\underline{92 \text{ kNm}^2}} \text{ o.k.}$$

Existing foundations adequate

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Calcs for Timber Post-Roof to Ground		Start page no./Revision 6	
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TIMBER STUD DESIGN (BS5268-2:2002)

TEDDS calculation version 1.0.05



Stud details

Stud breadth	$b = 100 \text{ mm}$ ✓
Stud depth	$h = 250 \text{ mm}$ ✓
Number of studs	$N_s = 1$

Strength class C24 timber (Table 8 BS5268:Pt 2:2002) ✓

Section properties

Cross sectional area	$A = N_s \times b \times h = 25000 \text{ mm}^2$
Section modulus	$Z = N_s \times b \times h^2 / 6 = 1041667 \text{ mm}^3$
Moment of inertia in the major axis	$I_x = N_s \times b \times h^3 / 12 = 130208333 \text{ mm}^4$
Moment of inertia in the minor axis	$I_y = N_s \times h \times b^3 / 12 = 20833333 \text{ mm}^4$
Radius of gyration in the major axis	$r_x = \sqrt{I_x / A} = 72.2 \text{ mm}$
Radius of gyration in the minor axis	$r_y = \sqrt{I_y / A} = 28.9 \text{ mm}$

Panel details - Studs unrestrained in the plane of the panel

Panel height	$L = 3200 \text{ mm}$
Stud length	$L_s = L - (2 \times b) = 3000 \text{ mm}$ ✓
Standard stud spacing	$s_s = 5500 \text{ mm}$
Panel opening	$O = 0 \text{ mm}$
Loaded panel length	$s = \max(s_s, (O + s_s) / 2) = 5500 \text{ mm}$
Effective length of stud	$L_e = 1.00 \times L_s = 3000 \text{ mm}$
Slenderness ratio	$\lambda = \max(L_e / r_x, L_e / r_y) = 103.92$

Vertical loading details

Roof point loads	Dead loads	Imposed loads
	$P_{r,d} = 9.70 \text{ kN}$ ✓	$P_{r,i} = 13.50 \text{ kN}$ ✓

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Calcs for Timber Post-Roof to Ground				Start page no./Revision 7	
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Modification factors

Section depth factor $K_7 = (300 \text{ mm} / h)^{0.11} = 1.02$

Load sharing factor $K_8 = 1.00$

Consider axial compression without bending under medium term loads

Load duration factor $K_3 = 1.25$

Vertical loading $F = P_{r,d} + P_{r,j} = 23.20 \text{ kN}$

Check compressive stress on stud

Compression member factor $K_{12} = 0.33$

Compression parallel to grain $\sigma_c = 7.900 \text{ N/mm}^2$

Permissible compressive stress $\sigma_{c,adm} = \sigma_c \times K_3 \times K_8 \times K_{12} = 3.262 \text{ N/mm}^2$

Applied compressive stress $\sigma_{c,max} = F / (N_s \times b \times h) = 0.928 \text{ N/mm}^2$

PASS - Applied compressive stress under medium term loads is within permissible limits

Check compressive stress on rail

Bearing stress modification factor $K_4 = 1.14$

Compression perpendicular to grain (no wane) $\sigma_{cp1} = 2.400 \text{ N/mm}^2$

Permissible compressive stress $\sigma_{cp1,adm} = \sigma_{cp1} \times K_3 \times K_4 = 3.420 \text{ N/mm}^2$

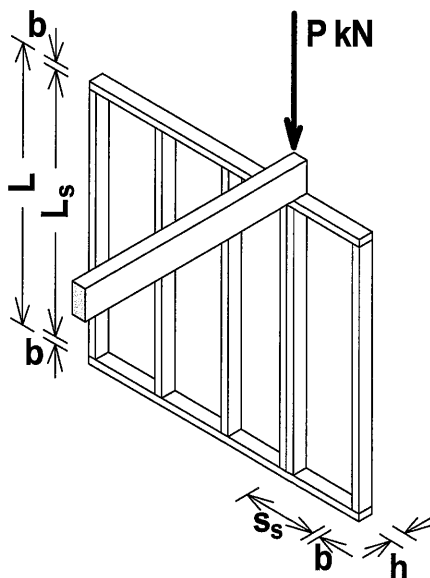
Applied compressive stress $\sigma_{cp1,max} = F / (N_s \times b \times h) = 0.928 \text{ N/mm}^2$

PASS - Applied compressive stress under medium term loads is within permissible limits

Project Mount Pleasant Farm, Jackroyd Lane, Mirfield				Job no. 11907	
Calcs for Timber Post-Ground to Foundation				Start page no./Revision 8	
Calcs by AC	Calcs date 26/09/2018	Checked by HE	Checked date 24/09/2018	Approved by HE	Approved date 24/09/2018

TIMBER STUD DESIGN (BS5268-2:2002)

TEDDS calculation version 1.0.05



Stud details

Stud breadth	$b = 100 \text{ mm}$
Stud depth	$h = 250 \text{ mm}$
Number of studs	$N_s = 1$

Strength class C24 timber (Table 8 BS5268:Pt 2:2002)

Section properties

Cross sectional area	$A = N_s \times b \times h = 25000 \text{ mm}^2$
Section modulus	$Z = N_s \times b \times h^2 / 6 = 1041667 \text{ mm}^3$
Moment of inertia in the major axis	$I_x = N_s \times b \times h^3 / 12 = 130208333 \text{ mm}^4$
Moment of inertia in the minor axis	$I_y = N_s \times h \times b^3 / 12 = 20833333 \text{ mm}^4$
Radius of gyration in the major axis	$r_x = \sqrt{I_x / A} = 72.2 \text{ mm}$
Radius of gyration in the minor axis	$r_y = \sqrt{I_y / A} = 28.9 \text{ mm}$

Panel details - Studs unrestrained in the plane of the panel

Panel height	$L = 1800 \text{ mm}$
Stud length	$L_s = L - (2 \times b) = 1600 \text{ mm}$
Standard stud spacing	$s_s = 5500 \text{ mm}$
Panel opening	$O = 0 \text{ mm}$
Loaded panel length	$s = \max(s_s, (O + s_s) / 2) = 5500 \text{ mm}$
Effective length of stud	$L_e = 1.00 \times L_s = 1600 \text{ mm}$
Slenderness ratio	$\lambda = \max(L_e / r_x, L_e / r_y) = 55.43$

Vertical loading details

	Dead loads	Imposed loads
Roof point loads	$P_{r,d} = 9.70 \text{ kN}$ ✓	$P_{r,i} = 13.50 \text{ kN}$ ✓
Floor point load	$P_{f,d} = 2.50 \text{ kN}$ ✓	$P_{f,i} = 15.10 \text{ kN}$ ✓

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Imposed floor load duration **Long term**

Modification factors

Section depth factor $K_7 = (300 \text{ mm} / h)^{0.11} = 1.02$

Load sharing factor $K_8 = 1.00$

Consider axial compression without bending under medium term loads

Load duration factor $K_3 = 1.25$

Vertical loading $F = P_{r,d} + P_{f,d} + P_{r,i} + P_{f,i} = 40.80 \text{ kN}$

Check compressive stress on stud

Compression member factor $K_{12} = 0.67$

Compression parallel to grain $\sigma_c = 7.900 \text{ N/mm}^2$

Permissible compressive stress $\sigma_{c,adm} = \sigma_c \times K_3 \times K_8 \times K_{12} = 6.642 \text{ N/mm}^2$

Applied compressive stress $\sigma_{c,max} = F / (N_s \times b \times h) = 1.632 \text{ N/mm}^2$

PASS - Applied compressive stress under medium term loads is within permissible limits

Check compressive stress on rail

Bearing stress modification factor $K_4 = 1.14$

Compression perpendicular to grain (no wane) $\sigma_{cp1} = 2.400 \text{ N/mm}^2$

Permissible compressive stress $\sigma_{cp1,adm} = \sigma_{cp1} \times K_3 \times K_4 = 3.420 \text{ N/mm}^2$

Applied compressive stress $\sigma_{cp1,max} = F / (N_s \times b \times h) = 1.632 \text{ N/mm}^2$

PASS - Applied compressive stress under medium term loads is within permissible limits

Consider axial compression without bending under long term loads

Load duration factor $K_3 = 1.00$

Vertical loading $F = P_{r,d} + P_{f,d} + P_{r,i} = 27.30 \text{ kN}$

Check compressive stress on stud

Compression member factor $K_{12} = 0.70$

Compression parallel to grain $\sigma_c = 7.900 \text{ N/mm}^2$

Permissible compressive stress $\sigma_{c,adm} = \sigma_c \times K_3 \times K_8 \times K_{12} = 5.518 \text{ N/mm}^2$

Applied compressive stress $\sigma_{c,max} = F / (N_s \times b \times h) = 1.092 \text{ N/mm}^2$

PASS - Applied compressive stress under long term loads is within permissible limits

Check compressive stress on rail

Bearing stress modification factor $K_4 = 1.14$

Compression perpendicular to grain (no wane) $\sigma_{cp1} = 2.400 \text{ N/mm}^2$

Permissible compressive stress $\sigma_{cp1,adm} = \sigma_{cp1} \times K_3 \times K_4 = 2.736 \text{ N/mm}^2$

Applied compressive stress $\sigma_{cp1,max} = F / (N_s \times b \times h) = 1.092 \text{ N/mm}^2$

PASS - Applied compressive stress under long term loads is within permissible limits

Calculation Sheet**Bland and Swift**

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Job No: 11907

Sheet No: 10

Made by: *AE*

Title: Mount Pleasant Farm, Jackroyd Lane, Moxfield

Date: Sept 18

Check existing timber to timber connections

- Generally 2 N° M16 bolts + washer plate per timber.

Roof LevelOuter Column

$$\text{Roof load: } 1.03 \times 5.5 \times 2.2/2 = 6.2 \text{ k}$$

$$\text{SWL } 4 \text{ N° M16 bolts} = 4 \times 5.21 = 20.8 \text{ k} > 6.2 \text{ k}$$

into 100 thick Grade C24 Timber

Connections at roof level adequate

Inner Column

$$\text{Roof load: } 1.03 \times 5.5 \times (3.0 + 2.2/2) = 23.2 \text{ k}$$

$$\text{load/bolt: } 23.2/4 = 5.8 \text{ k} \text{ Considered adequate.}$$

Floor level

- Main frame positions

Outer Column

$$\text{Floor load: } 2.91 \times 2.2/2 \times 5.5/2 = 8.8 \text{ k}$$

$$\text{SWL } 2 \text{ N° M16 bolt} = 2 \times 5.21 = 10.42 \text{ k} > 8.8 \text{ k}$$

into 100 thick Grade C24 Timber

Inner Column

$$\text{Floor load: } 2.91 \times 5.5/2 \times 4.4/2 = 17.6 \text{ k}$$

Introduce 2 N° additional M16 bolts

$$\therefore \text{Connection capacity} = 4 \times 5.21 = 20.8 \text{ k} > 17.6 \text{ k}$$

At floor level introduce additional 2 N° M16 bolts to beam to central column connection at main frame positions.

Title: Mount Pleasant Farm, Sackroyd Lane, M. Field

Lateral Stability

Existing lateral wind loads transferred into individual frames and fully boarded existing end & rear elevations.

New lightweight timber framing & boarding proposed to front elevation which will enhance rigidity of structure together with new internal walls forming individual kennel enclosures

- Refer to Architect proposed plans for layouts

Lateral Stability adequate