

**Job No.:** Guy Raleigh

**Address:**

**Date:** 10/11/2023

**Latitude:** -45.232627

**Longitude:** 169.414901

**Elevation:** 203 m

### General Input

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N0	Ground Snow Load	0 KPa	Roof Snow Load	0 KPa
Earthquake Zone	3	Subsoil Category	D	Exposure Zone	B
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	4.7 m
Wind Region	NZ2	Terrain Category	2.12	Design Wind Speed	52.24 m/s
Wind Pressure	1.64 KPa	Lee Zone	NO	Ultimate Snow ARI	50 Years
Wind Category	extra High	Earthquake ARI	100		

Note: Wind lateral loads are governing over Earthquake loads, So only wind loads are considered in calculations

### Pressure Coefficients and Pressures

Shed Type = Mono Enclosed

For roof  $C_{p,i} = -0.3$

For roof  $C_{p,e}$  from 0 m To 2.10 m  $C_{p,e} = -0.92$   $p_e = -1.36$  KPa  $p_{net} = -1.36$  KPa

For roof  $C_{p,e}$  from 2.10 m To 4.20 m  $C_{p,e} = -0.89$   $p_e = -1.31$  KPa  $p_{net} = -1.31$  KPa

For wall Windward  $C_{p,i} = -0.3$  side Wall  $C_{p,i} = -0.3$

For wall Windward and Leeward  $C_{p,e}$  from 0 m To 11.80 m  $C_{p,e} = 0.7$   $p_e = 1.03$  KPa  $p_{net} = 1.52$  KPa

For side wall  $C_{p,e}$  from 0 m To 4.20 m  $C_{p,e} =$   $p_e = -0.96$  KPa  $p_{net} = -0.96$  KPa

Maximum Upward pressure used in roof member Design = 1.36 KPa

Maximum Downward pressure used in roof member Design = 0.64 KPa

Maximum Wall pressure used in Design = 1.52 KPa

Maximum Racking pressure used in Design = 1.63 KPa

### Design Summary

#### Purlin Design

Purlin Spacing = 0 mm

Purlin Span = 3850 mm

Try Purlin 150x50 SG8 Dry

Moisture Condition = Dry (Moisture in timber is less than 16% and does not remain in continuous wet condition after

installation)

K1 Short term = 1    K1 Medium term = 0.8    K1 Long term = 0.6    K4 = 1    K5 = 1    K8 Downward = 1.00

K8 Upward = 0.00    S1 Downward = 9.63    S1 Upward = Infinity

Shear Capacity of timber = 3 MPa    Bending Capacity of timber = 14 MPa NZS3603 Amt 4, table 2.3

#### Capacity Checks

M <sub>1.35D</sub>	0 Kn-m	Capacity	1.26 Kn-m	Passing Percentage	<b>Infinity %</b>
M <sub>1.2D+1.5L 1.2D+S<sub>n</sub> 1.2D+W<sub>n</sub>D<sub>n</sub></sub>	1.06 Kn-m	Capacity	1.68 Kn-m	Passing Percentage	<b>158.49 %</b>
M <sub>0.9D-W<sub>n</sub>Up</sub>	0 Kn-m	Capacity	-0.00 Kn-m	Passing Percentage	<b>NaN %</b>
V <sub>1.35D</sub>	0.00 Kn	Capacity	7.24 Kn	Passing Percentage	<b>Infinity %</b>
V <sub>1.2D+1.5L 1.2D+S<sub>n</sub> 1.2D+W<sub>n</sub>D<sub>n</sub></sub>	0.00 Kn	Capacity	9.65 Kn	Passing Percentage	<b>Infinity %</b>
V <sub>0.9D-W<sub>n</sub>Up</sub>	0.00 Kn	Capacity	-12.06 Kn	Passing Percentage	<b>Infinity %</b>

#### Deflections

Modulus of Elasticity = 6700 MPa NZS3603 Amt 4, Table 2.3 considering at least 4 members acting together

k<sub>2</sub> for Long Term Loads = 2

Deflection under Dead and Live Load = 0.00 mm    Limit by Woolcock et al, 1999 Span/240 = 15.83 mm

Deflection under Dead and Service Wind = 0.00 mm    Limit by Woolcock et al, 1999 Span/100 = 38.00 mm

#### Reactions

Maximum downward = 0.00 kn    Maximum upward = 0.00 kn

Number of Blocking = -1    if 0 then no blocking required, if 1 then one midspan blocking required

#### Rafter Design Internal

Internal Rafter Load Width = 4000 mm    Internal Rafter Span = 11650 mm    Try Rafter 2x450x63 LVL13

Moisture Condition = Dry (Moisture in timber is less than 16% and timber does not remain in continuous wet condition after installation)

K1 Short term = 1    K1 Medium term = 0.8    K1 Long term = 0.6    K4 = 1    K5 = 1    K8 Downward = 1.00

K8 Upward = 1.00    S1 Downward = 6.68    S1 Upward = 6.68

Shear Capacity of timber = 5.3 MPa    Bending Capacity of timber = 48 MPa NZS3603 Amt 4, table 2.3

#### Capacity Checks

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M <sub>1.35D</sub>	22.90 Kn-m	Capacity	91.56 Kn-m	Passing Percentage	<b>399.83 %</b>
M <sub>1.2D+1.5L 1.2D+Sn 1.2D+WnDn</sub>	63.79 Kn-m	Capacity	122.08 Kn-m	Passing Percentage	<b>191.38 %</b>
M <sub>0.9D-WnUp</sub>	-77.02 Kn-m	Capacity	-152.6 Kn-m	Passing Percentage	<b>198.13 %</b>
V <sub>1.35D</sub>	7.86 Kn	Capacity	96.64 Kn	Passing Percentage	<b>1229.52 %</b>
V <sub>1.2D+1.5L 1.2D+Sn 1.2D+WnDn</sub>	21.90 Kn	Capacity	128.86 Kn	Passing Percentage	<b>588.40 %</b>
V <sub>0.9D-WnUp</sub>	-26.45 Kn	Capacity	-161.08 Kn	Passing Percentage	<b>609.00 %</b>

**Deflections**

Modulus of Elasticity = 11000 MPa NZS3603 Amt 4, Table 2.3

k<sub>2</sub> for Long Term Loads = 2

Deflection under Dead and Live Load = 25.905 mm      Limit by Woolcock et al, 1999 Span/240 = 49.17 mm

Deflection under Dead and Service Wind = 39.335 mm      Limit by Woolcock et al, 1999 Span/100 = 118.00 mm

**Reactions**

Maximum downward = 21.90 kn    Maximum upward = -26.45 kn

**Rafter to Pole Connection check**

Bolt Size = M16 Number of Bolts = 3

Calculations as per NZS 3603:1993 Amend 2005 clause 4.4

Joint Group for Rafters = J2 Joint Group for Pole = J5

Minimum Bolt edge, end and spacing for Load perpendicular to grains = 80 mm

Factor of Safety = 0.7

For Perpendicular to grain loading

K<sub>11</sub> = 12.6 f<sub>pj</sub> = 22.7 Mpa for Rafter with effective thickness = 126 mm

For Parallel to grain loading

K<sub>11</sub> = 2.0 f<sub>cj</sub> = 36.1 Mpa for Pole with effective thickness = 100 mm

Capacity under short term loads = 77.63 Kn > -26.45 Kn

**Girt Design Front and Back**

Girt's Spacing = 0 mm

Girt's Span = 2000 mm

Try Girt SG8 Dry

Moisture Condition = Wet (Moisture in timber is less than 18% and timber does not remain in continuous wet condition after installation)

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K1 Short term = 1    K4 =1    K5 =1    K8 Downward =NaN

K8 Upward =NaN    S1 Downward =NaN    S1 Upward =NaN

Shear Capacity of timber =3 MPa    Bending Capacity of timber =14 MPa NZS3603 Amt 4, table 2.3

**Capacity Checks**

M <sub>Wind+Snow</sub>	0.00 Kn-m	Capacity	NaN Kn-m	Passing Percentage	NaN %
V <sub>0.9D-WnUp</sub>	0.00 Kn-m	Capacity	0.00 Kn-m	Passing Percentage	NaN %

**Deflections**

Modulus of Elasticity = 6700 MPa NZS3603 Amt 4, Table 2.3

Deflection under Snow and Service Wind = NaN mm    Limit by Woolcock et al, 1999 Span/100 = 20.00 mm

Sag during installation = NaN mm

**Reactions**

Maximum = 0.00 kn

**Girt Design Sides**

Girt's Spacing = 0 mm

Girt's Span = 1967 mm

Try Girt SG8 Dry

Moisture Condition = Wet (Moisture in timber is less than 18% and timber does not remain in continuous wet condition after installation)

K1 Short term = 1    K4 =1    K5 =1    K8 Downward =NaN

K8 Upward =NaN    S1 Downward =NaN    S1 Upward =NaN

Shear Capacity of timber =3 MPa    Bending Capacity of timber =14 MPa NZS3603 Amt 4, table 2.3

**Capacity Checks**

M <sub>Wind+Snow</sub>	0.00 Kn-m	Capacity	NaN Kn-m	Passing Percentage	NaN %
V <sub>0.9D-WnUp</sub>	0.00 Kn-m	Capacity	0.00 Kn-m	Passing Percentage	NaN %

**Deflections**

Modulus of Elasticity = 6700 MPa NZS3603 Amt 4, Table 2.3

Deflection under Snow and Service Wind = NaN mm    Limit by Woolcock et al. 1999 Span/100 = 19.67 mm

Sag during installation =NaN mm

**Reactions**

Maximum = 0.00 kn

**Uplift Check**

Density of Concrete = 24 Kn/m<sup>3</sup>

Density of Timber Pole = 5 Kn/m<sup>3</sup>

Due to cast in place pile, the surface interaction between soil and pile will be rough thus angle of friction between both is taken equal to soil angle of internal friction

Ks (Lateral Earth Pressure Coefficient) for cast into place concrete piles = 1.5

Formula to calculate Skin Friction = Safety factor (0.55) x Density of Soil(18) x Height of Pile() x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile()

Skin Friction = 0.00 Kn

Weight of Pile + Pile Skin Friction = 0.00 Kn

Uplift on one Pile = 26.79 Kn

Uplift is ok