



**Job No.:** Robbie Thompson -1**Address:** 44 River Rd, Ohakune, New Zealand**Date:** 15/07/2024**Latitude:** -39.407297**Longitude:** 175.401267**Elevation:** 589 m**General Input**

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N1	Ground Snow Load	1.22 KPa	Roof Snow Load	0.68 KPa
Earthquake Zone	2	Subsoil Category	D	Exposure Zone	B
Importance Level	2	Ultimate wind & Earthquake ARI	500 Years	Max Height	5.783 m
Wind Region	NZ2	Terrain Category	2.02	Design Wind Speed	44.47 m/s
Wind Pressure	1.19 KPa	Lee Zone	NO	Ultimate Snow ARI	150 Years
Wind Category	Very High	Earthquake ARI	500		

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

**Pressure Coefficients and Pressures**

Shed Type = Gable Enclosed

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

For roof  $C_{p,e}$  from 0 m To 4.69 m  $C_{p,e} = -0.9$   $p_e = -0.96$  KPa  $p_{net} = -0.96$  KPa

For roof  $C_{p,e}$  from 4.69 m To 9.38 m  $C_{p,e} = -0.5$   $p_e = -0.53$  KPa  $p_{net} = -0.53$  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 12 m  $C_{p,e} = 0.7$   $p_e = 0.75$  KPa  $p_{net} = 1.11$  KPa

For side wall  $C_{p,e}$  from 0 m To 4.69 m  $C_{p,e} =$   $p_e = -0.69$  KPa  $p_{net} = -0.69$  KPa

Maximum Upward pressure used in roof member Design = 0.96 KPa

Maximum Downward pressure used in roof member Design = 0.56 KPa

Maximum Wall pressure used in Design = 1.11 KPa

Maximum Racking pressure used in Design = 1.18 KPa

**Design Summary****Purlin Design**

Purlin Spacing = 800 mm

Purlin Span = 5850 mm

Try Purlin 290x45 SG8 Dry

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 = 0.89

K8 Upward = 0.39 S1 Downward = 15.23 S1 Upward = 27.34

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>	1.16 Kn-m	Capacity	3.78 Kn-m	Passing Percentage	<b>325.86 %</b>
M <sub>1.2D+1.5L 1.2D+S<sub>n</sub> 1.2D+W<sub>n</sub>D<sub>n</sub></sub>	3.35 Kn-m	Capacity	5.04 Kn-m	Passing Percentage	<b>150.45 %</b>
M <sub>0.9D-W<sub>n</sub>Up</sub>	-2.52 Kn-m	Capacity	-2.74 Kn-m	Passing Percentage	<b>108.73 %</b>
V <sub>1.35D</sub>	0.79 Kn	Capacity	12.59 Kn	Passing Percentage	<b>1593.67 %</b>

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$V_{1.2D+1.5L\ 1.2D+S_n\ 1.2D+W_nD_n}$	2.29 Kn	Capacity	16.79 Kn	Passing Percentage	<b>733.19 %</b>
$V_{0.9D-W_nUp}$	-1.72 Kn	Capacity	-20.98 Kn	Passing Percentage	<b>1219.77 %</b>

**Deflections**

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

$k_2$  for Long Term Loads = 2

Deflection under Dead and Live Load = 11.54 mm                      Limit by Woolcock et al, 1999 Span/360 = 16.11 mm

Deflection under Dead and Service Wind = 15.00 mm                      Limit by Woolcock et al, 1999 Span/250 = 38.67 mm

**Reactions**

Maximum downward = 2.29 kn    Maximum upward = -1.72 kn

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

**Intermediate Design Front and Back**

Intermediate Spacing = 3000 mm                      Intermediate Span = 3449 mm                      Try Intermediate 2x190x45 SG8

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

$K_1$  Short term = 1     $K_4 = 1$      $K_5 = 1$      $K_8$  Downward = 0.98

$K_8$  Upward = 1.00     $S_1$  Downward = 12.23     $S_1$  Upward = 0.76

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

**Capacity Checks**

$M_{Wind+Snow}$	5.44 Kn-m	Capacity	6.06 Kn-m	Passing Percentage	<b>111.40 %</b>
$V_{0.9D-W_nUp}$	6.31 Kn	Capacity	-27.5 Kn	Passing Percentage	<b>435.82 %</b>

**Deflections**

Modulus of Elasticity = 5400 MPa NZS3603 Amt 4, Table 2.3

Deflection under Snow and Service Wind = 46.375 mm                      Limit by Woolcock et al, 1999 Span/250 = 13.80 mm

**Reactions**

Maximum = 6.31 kn

**Intermediate Design Sides**

Intermediate Spacing = 3000 mm                      Intermediate Span = 4541 mm                      Try Intermediate 2x290x45 SG8 Dry

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

$K_1$  Short term = 1     $K_4 = 1$      $K_5 = 1$      $K_8$  Downward = 0.89

$K_8$  Upward = 1.00     $S_1$  Downward = 15.23     $S_1$  Upward = 1.08

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

**Capacity Checks**

$M_{Wind+Snow}$	Capacity
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	4.72 Kn-m		14.12 Kn-m	Passing Percentage	<b>299.15 %</b>
V <sub>0.9D-WnUp</sub>	4.16 Kn	Capacity	41.96 Kn	Passing Percentage	<b>1008.65 %</b>

#### Deflections

Modulus of Elasticity = 5400 MPa NZS3603 Amt 4, Table 2.3

Deflection under Snow and Service Wind = 39.185 mm Limit by Woolcock et al, 1999 Span/250 = 18.16 mm

#### Reactions

Maximum = 4.16 kn

#### Girt Design Front and Back

Girt's Spacing = 1000 mm Girt's Span = 3000 mm Try Girt 190x45 SG8

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 K4 =1 K5 =1 K8 Downward =0.98

K8 Upward =0.56 S1 Downward =12.23 S1 Upward =22.32

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>	1.25 Kn-m	Capacity	1.70 Kn-m	Passing Percentage	<b>136.00 %</b>
V <sub>0.9D-WnUp</sub>	1.67 Kn	Capacity	13.75 Kn	Passing Percentage	<b>823.35 %</b>

#### Deflections

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

Deflection under Snow and Service Wind = 10.95 mm Limit by Woolcock et al, 1999 Span/250 = 12.00 mm  
Sag during installation = 6.06 mm

#### Reactions

Maximum = 1.67 kn

#### Girt Design Sides

Girt's Spacing = 1000 mm Girt's Span = 3000 mm Try Girt 190x45 SG8

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 K4 =1 K5 =1 K8 Downward =0.98

K8 Upward =0.56 S1 Downward =12.23 S1 Upward =22.32

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>	1.25 Kn-m	Capacity	1.70 Kn-m	Passing Percentage	<b>136.00 %</b>
V <sub>0.9D-WnUp</sub>	1.67 Kn	Capacity	13.75 Kn	Passing Percentage	<b>823.35 %</b>

#### Deflections

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

Deflection under Snow and Service Wind = 10.95 mm

Limit by Woolcock et al. 1999 Span/100 = 12.00 mm

Sag during installation = 6.06 mm

#### Reactions

Maximum = 1.67 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(1750) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1750)

Skin Friction = 24.73 Kn

Weight of Pile + Pile Skin Friction = 28.74 Kn

Uplift on one Pile = 26.46 Kn

Uplift is ok