



**Job No.:** 2405053 - 4**Address:** 270 Mt Heslington Road, Brightwater, New Zealand**Date:** 22/07/2024**Latitude:** -41.403304**Longitude:** 173.101144**Elevation:** 82 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  | 2        | Subsoil Category               | D         | Exposure Zone        | B         |
| Importance Level | 1        | Ultimate wind & Earthquake ARI | 100 Years | Max Height           | 7.2 m     |
| Wind Region      | NZ2      | Terrain Category               | 2.0       | Design Wind Speed    | 40.91 m/s |
| Wind Pressure    | 1 KPa    | Lee Zone                       | NO        | Ultimate Snow ARI    | 50 Years  |
| Wind Category    | 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 = Gable Enclosed

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

For roof  $C_{p,e}$  from 0 m To 2.67 m  $C_{p,e} = -0.9272$   $p_e = -0.84$  KPa  $p_{net} = -0.84$  KPa

For roof  $C_{p,e}$  from 2.67 m To 5.34 m  $C_{p,e} = -0.8864$   $p_e = -0.80$  KPa  $p_{net} = -0.80$  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 19.6 m  $C_{p,e} = 0.7$   $p_e = 0.63$  KPa  $p_{net} = 0.63$  KPa

For side wall  $C_{p,e}$  from 0 m To 5.34 m  $C_{p,e} =$   $p_e = -0.59$  KPa  $p_{net} = -0.59$  KPa

Maximum Upward pressure used in roof member Design = 0.84 KPa

Maximum Downward pressure used in roof member Design = 0.28 KPa

Maximum Wall pressure used in Design = 0.63 KPa

Maximum Racking pressure used in Design = 0.91 KPa

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

Purlin Spacing = 700 mm

Purlin Span = 4850 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 = 0.56 S1 Downward = 9.63 S1 Upward = 22.25

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

**Capacity Checks**

|                                      |            |          |            |                    |                  |
|--------------------------------------|------------|----------|------------|--------------------|------------------|
| $M_{1.35D}$                          | 0.69 Kn-m  | Capacity | 1.26 Kn-m  | Passing Percentage | <b>182.61 %</b>  |
| $M_{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}$ | 1.95 Kn-m  | Capacity | 1.68 Kn-m  | Passing Percentage | <b>86.15 %</b>   |
| $M_{0.9D-W_nUp}$                     | -1.27 Kn-m | Capacity | -1.18 Kn-m | Passing Percentage | <b>92.91 %</b>   |
| $V_{1.35D}$                          | 0.57 Kn    | Capacity | 7.24 Kn    | Passing Percentage | <b>1270.18 %</b> |

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|                                     |          |          |           |                    |                  |
|-------------------------------------|----------|----------|-----------|--------------------|------------------|
| $V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 1.15 Kn  | Capacity | 9.65 Kn   | Passing Percentage | <b>839.13 %</b>  |
| $V_{0.9D-WnUp}$                     | -1.04 Kn | Capacity | -12.06 Kn | Passing Percentage | <b>1159.62 %</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 = 30.81 mm                      Limit by Woolcock et al, 1999 Span/240 = 20.00 mm

Deflection under Dead and Service Wind = 32.87 mm                      Limit by Woolcock et al, 1999 Span/100 = 48.00 mm

**Reactions**

Maximum downward = 1.15 kn    Maximum upward = -1.04 kn

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

**Intermediate Design Sides**

Intermediate Spacing = 2570.0003855000577 mm                      Intermediate Span = 6376 mm                      Try Intermediate 2x250x50 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 = 0.97

$K_8$  Upward = 1.00     $S_1$  Downward = 12.68     $S_1$  Upward = 1.07

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

**Capacity Checks**

|                 |           |          |            |                    |                  |
|-----------------|-----------|----------|------------|--------------------|------------------|
| $M_{Wind+Snow}$ | 4.11 Kn-m | Capacity | 11.66 Kn-m | Passing Percentage | <b>283.70 %</b>  |
| $V_{0.9D-WnUp}$ | 2.58 Kn   | Capacity | 40.2 Kn    | Passing Percentage | <b>1558.14 %</b> |

**Deflections**

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

Deflection under Snow and Service Wind = 49.555 mm                      Limit by Woolcock et al, 1999 Span/100 = 63.76 mm

**Reactions**

Maximum = 2.58 kn

**Girt Design Front and Back**

Girt's Spacing = 1300 mm                      Girt's Span = 2500 mm                      Try Girt 150x50 SG8 Dry

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

$K_1$  Short term = 1     $K_4$  = 1     $K_5$  = 1     $K_8$  Downward = 1.00

$K_8$  Upward = 0.86     $S_1$  Downward = 9.63     $S_1$  Upward = 16.05

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

**Capacity Checks**

|                 |          |
|-----------------|----------|
| $M_{Wind+Snow}$ | Capacity |
|-----------------|----------|

|                        |           |          |           |                    |                  |
|------------------------|-----------|----------|-----------|--------------------|------------------|
|                        | 0.64 Kn-m |          | 1.80 Kn-m | Passing Percentage | <b>281.25 %</b>  |
| V <sub>0.9D-WnUp</sub> | 1.02 Kn   | Capacity | 12.06 Kn  | Passing Percentage | <b>1182.35 %</b> |

**Deflections**

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

Deflection under Snow and Service Wind = 4.42 mm

Limit by Woolcock et al, 1999 Span/100 = 25.00 mm

Sag during installation = 2.37 mm

**Reactions**

Maximum = 1.02 kn

**Girt Design Sides**

Girt's Spacing = 1300 mm

Girt's Span = 2570 mm

Try Girt 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    K4 = 1    K5 = 1    K8 Downward = 1.00

K8 Upward = 0.85    S1 Downward = 9.63    S1 Upward = 16.28

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> | 0.68 Kn-m | Capacity | 1.78 Kn-m | Passing Percentage | <b>261.76 %</b>  |
| V <sub>0.9D-WnUp</sub> | 1.05 Kn   | Capacity | 12.06 Kn  | Passing Percentage | <b>1148.57 %</b> |

**Deflections**

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

Deflection under Snow and Service Wind = 4.94 mm

Limit by Woolcock et al. 1999 Span/100 = 25.70 mm

Sag during installation = 2.65 mm

**Reactions**

Maximum = 1.05 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 (1600) x Ks (1.5) x 0.5 x tan(30) x Pi x Dia of Pile (0.6) x Height of Pile (1600)

Skin Friction = 20.68 Kn

Weight of Pile + Pile Skin Friction = 24.34 Kn

Uplift on one Pile = 24.60 Kn

Uplift is ok