



Pole Shed App Ver 01 2022

**Job No.:** Lisa Welch and Daniel Mouatt  
**Address:** Lot 10 DP 535188 Te Kapua Rise,  
Puketapu, New Zealand

**Date:** 17/04/2025

**Latitude:** -39.483081

**Longitude:** 176.817103

**Elevation:** 29.5 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               | 0 KPa     | Roof Snow Load       | 0 KPa     |
| Earthquake Zone  | 3        | Subsoil Category               | D         | Exposure Zone        | C         |
| Importance Level | 1        | Ultimate wind & Earthquake ARI | 100 Years | Max Height           | 6.03 m    |
| Wind Region      | NZ2      | Terrain Category               | 1.78      | Design Wind Speed    | 37.68 m/s |
| Wind Pressure    | 0.85 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 = Mono Open

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

For roof  $C_{p,e}$  from 0 m To 2.68 m  $C_{p,e} = -1.035$   $p_e = -0.77$  KPa  $p_{net} = -0.77$  KPa

For roof  $C_{p,e}$  from 2.68 m To 5.35 m  $C_{p,e} = -0.8325$   $p_e = -0.62$  KPa  $p_{net} = -0.62$  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  $C_{p,e} = 0.7$   $p_e = 0.53$  KPa  $p_{net} = 0.78$  KPa

For side wall  $C_{p,e}$  from 0 m To 5.35 m  $C_{p,e} =$   $p_e = -0.49$  KPa  $p_{net} = -0.49$  KPa

Maximum Upward pressure used in roof member Design = 0.77 KPa

Maximum Downward pressure used in roof member Design = 0.33 KPa

Maximum Wall pressure used in Design = 0.78 KPa

Maximum Racking pressure used in Design = 0.89 KPa

**Design Summary**

**Rafter Design External**

External Rafter Load Width = 3095 mm External Rafter Span = 3916 mm Try Rafter 240x45 LVL11

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

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K1 Short term = 1    K1 Medium term = 0.8    K1 Long term = 0.6    K4 = 1    K5 = 1    K8 Downward = 0.94

K8 Upward = 0.94    S1 Downward = 13.82    S1 Upward = 13.82

Shear Capacity of timber = 5 MPa    Bending Capacity of timber = 38 MPa NZS3603 Amt 4, table 2.3

#### **Capacity Checks**

|   |            |          |             |                    |                 |
|---|------------|----------|-------------|--------------------|-----------------|
| M <sub>1.35D</sub>  | 2.00 Kn-m  | Capacity | 7.41 Kn-m   | Passing Percentage | <b>370.50 %</b> |
| M <sub>1.2D+1.5L 1.2D+S<sub>n</sub> 1.2D+W<sub>n</sub>D<sub>n</sub></sub> | 4.00 Kn-m  | Capacity | 9.89 Kn-m   | Passing Percentage | <b>247.25 %</b> |
| M <sub>0.9D-W<sub>n</sub>Up</sub>   | -3.23 Kn-m | Capacity | -12.36 Kn-m | Passing Percentage | <b>382.66 %</b> |
| V <sub>1.35D</sub>  | 2.05 Kn    | Capacity | 17.37 Kn    | Passing Percentage | <b>847.32 %</b> |
| V <sub>1.2D+1.5L 1.2D+S<sub>n</sub> 1.2D+W<sub>n</sub>D<sub>n</sub></sub> | 4.09 Kn    | Capacity | 23.16 Kn    | Passing Percentage | <b>566.26 %</b> |
| V <sub>0.9D-W<sub>n</sub>Up</sub>   | -3.30 Kn   | Capacity | -28.94 Kn   | Passing Percentage | <b>876.97 %</b> |

#### **Deflections**

Modulus of Elasticity = 9900 MPa NZS3603 Amt 4, Table 2.3

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

Deflection under Dead and Live Load = 6.66 mm      Limit by Woolcock et al, 1999 Span/240 = 17.08 mm

Deflection under Dead and Service Wind = 7.38 mm      Limit by Woolcock et al, 1999 Span/100 = 41.00 mm

#### **Reactions**

Maximum downward = 4.09 kn    Maximum upward = -3.30 kn

#### **Rafter to Pole Connection check**

Bolt Size = M12 Number of Bolts = 2

Calculations as per NZS 3603:1993 Amend 2005 clause 4.4

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

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 = 45 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

Eccentric Load check

V =  $\phi \times k_1 \times k_4 \times k_5 \times f_s \times b \times d_s$  ..... (Eq 4.12) = -28.35 kn > -3.30 Kn

Single Shear Capacity under short term loads = -14.56 Kn > -3.30 Kn

### **Intermediate Design Front and Back**

Intermediate Spacing = 3095 mm      Intermediate Span = 5163 mm      Try Intermediate 2x300x50 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      K4 =1      K5 =1      K8 Downward =0.94

K8 Upward =1.00      S1 Downward =13.93      S1 Upward =1.06

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> | 8.04 Kn-m | Capacity | 16.8 Kn-m | Passing Percentage | <b>208.96 %</b> |
| V <sub>0.9D-WnUp</sub> | 6.23 Kn   | Capacity | -48.24 Kn | Passing Percentage | <b>774.32 %</b> |

#### **Deflections**

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

Deflection under Snow and Service Wind = 18.38 mm      Limit by Woolcock et al, 1999 Span/100 = 51.63 mm

#### **Reactions**

Maximum = 6.23 kn

### **Girt Design Front and Back**

Girt's Spacing = 900 mm      Girt's Span = 3095 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 =0.55      S1 Downward =12.23      S1 Upward =22.68

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> | 0.84 Kn-m | Capacity | 1.65 Kn-m | Passing Percentage | <b>196.43 %</b>  |
| V <sub>0.9D-WnUp</sub> | 1.09 Kn   | Capacity | 13.75 Kn  | Passing Percentage | <b>1261.47 %</b> |

### **Deflections**

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

Deflection under Snow and Service Wind = 4.87 mm      Limit by Woolcock et al, 1999 Span/100 = 30.95 mm  
Sag during installation = 6.87 mm

### **Reactions**

Maximum = 1.09 kn

### **Girt Design Sides**

Girt's Spacing = 900 mm                      Girt's Span = 4100 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 = 0.75      S1 Downward = 12.23      S1 Upward = 18.45

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

### **Capacity Checks**

|                 |           |          |           |                    |                 |
|-----------------|-----------|----------|-----------|--------------------|-----------------|
| $M_{Wind+Snow}$ | 1.48 Kn-m | Capacity | 2.26 Kn-m | Passing Percentage | <b>152.70 %</b> |
| $V_{0.9D-WnUp}$ | 1.44 Kn   | Capacity | 13.75 Kn  | Passing Percentage | <b>954.86 %</b> |

### **Deflections**

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

Deflection under Snow and Service Wind = 14.99 mm      Limit by Woolcock et al. 1999 Span/100 = 41.00 mm  
Sag during installation = 21.15 mm

### **Reactions**

Maximum = 1.44 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

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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(2200) x Ks(1.5) x  $0.5 \times \tan(30)$  x  $\pi$  x Dia of Pile(0.6) x Height of Pile(2200)

Skin Friction = 39.09 Kn

Weight of Pile + Pile Skin Friction = 42.94 Kn

Uplift on one Pile = 13.83 Kn

Uplift is ok