Pole Shed App Ver 01 2022

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**Job No.:** 412-Cover **Address:** 555 Hutchinson Road, Richmond Downs 3371, New Zealand **Date:** 02/04/2025

**Latitude:** -37.712492 **Longitude:** 175.639468 **Elevation:** 67 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 | 1 | Subsoil Category | D | Exposure Zone | B |
| Importance Level | 1 | Ultimate wind & Earthquake ARI | 100 Years | Max Height | 4.15 m |
| Wind Region | NZ1 | Terrain Category | 2.0 | Design Wind Speed | 44.63 m/s |
| Wind Pressure | 1.2 KPa | Lee Zone | NO | Ultimate Snow ARI | 50 Years |
| Wind Category | Very High | Earthquake ARI | 100 | | |

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

**Pressure Coefficients and Pressues**

Shed Type = Mono Open

For roof Cp,i = 0.6409

For roof CP,e from 0 m To 4.15 m Cpe = -0.9 pe = -0.70 KPa pnet = -1.30 KPa

For roof CP,e from 4.15 m To 8.30 m Cpe = -0.5 pe = -0.39 KPa pnet = -0.99 KPa

For wall Windward Cp,i = 0.6409 side Wall Cp,i = -0.5402

For wall Windward and Leeward CP,e from 0 m To 9 m Cpe = 0.7 pe = 0.75 KPa pnet = 1.38 KPa

For side wall CP,e from 0 m To 4.15 m Cpe = pe = -0.70 KPa pnet = -0.07 KPa

Maximum Upward pressure used in roof member Design = 1.30 KPa

Maximum Downward pressure used in roof member Design = 0.74 KPa

Maximum Wall pressure used in Design = 1.38 KPa

Maximum Racking pressure used in Design = 1.29 KPa

**Design Summary**

**Purlin Design**

Purlin Spacing = 900 mm Purlin Span = 4450 mm Try Purlin 200x50 SG8 Dry

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 =1.00

K8 Upward =0.79 S1 Downward =11.27 S1 Upward =17.62

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

**Capacity Checks**

| | | | | | |
|---|---|---|---|---|---|
| $M_{1.35D}$ | 0.75 Kn-m | Capacity | 2.23 Kn-m | Passing Percentage | **297.33 %** |
| $M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 2.5 Kn-m | Capacity | 2.97 Kn-m | Passing Percentage | **118.80 %** |
| $M_{0.9D-WnUp}$ | -2.39 Kn-m | Capacity | -2.93 Kn-m | Passing Percentage | **122.59 %** |
| $V_{1.35D}$ | 0.68 Kn | Capacity | 9.65 Kn | Passing Percentage | **1419.12 %** |
| $V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 2.08 Kn | Capacity | 12.86 Kn | Passing Percentage | **618.27 %** |
| $V_{0.9D-WnUp}$ | -2.15 Kn | Capacity | -16.08 Kn | Passing Percentage | **747.91 %** |

**Deflections**

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

k2 for Long Term Loads = 2

| | |
|---|---|
| Deflection under Dead and Live Load = 18.57 mm | Limit by Woolcock et al, 1999 Span/240 = 18.33 mm |
| Deflection under Dead and Service Wind = 17.11 mm | Limit by Woolcock et al, 1999 Span/100 = 44.00 mm |

**Reactions**

Maximum downward =2.08 kn Maximum upward = -2.15 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 = 4600 mm Internal Rafter Span = 4350 mm Try Rafter 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 K1 Medium term = 0.8 K1 Long term = 0.6 K4 =1 K5 =1 K8 Downward =1.00

K8 Upward =1.00 S1 Downward =6.81 S1 Upward =6.81

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

**Capacity Checks**

| | | | | | |
|---|---|---|---|---|---|
| $M_{1.35D}$ | 3.67 Kn-m | Capacity | 10.08 Kn-m | Passing Percentage | **274.66 %** |
| $M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 11.32 Kn-m | Capacity | 13.44 Kn-m | Passing Percentage | **118.73 %** |

| | | | | | |
|---|---|---|---|---|---|
| $M_{0.9D-WnUp}$ | -11.70 Kn-m | Capacity | -16.8 Kn-m | Passing Percentage | **143.59 %** |
| $V_{1.35D}$ | 3.38 Kn | Capacity | 28.94 Kn | Passing Percentage | **856.21 %** |
| $V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 10.41 Kn | Capacity | 38.6 Kn | Passing Percentage | **370.80 %** |
| $V_{0.9D-WnUp}$ | -10.76 Kn | Capacity | -48.24 Kn | Passing Percentage | **448.33 %** |

**Deflections**

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

k2 for Long Term Loads = 2

| | |
|---|---|
| Deflection under Dead and Live Load = 5.46 mm | Limit by Woolcock et al, 1999 Span/240 = 18.75 mm |
| Deflection under Dead and Service Wind = 8.795 mm | Limit by Woolcock et al, 1999 Span/100 = 45.00 mm |

**Reactions**

Maximum downward =10.41 kn  Maximum upward = -10.76 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 =J5 Joint Group for Pole = J5

Minimum Bolt edge, end and spacing for Load perpendicular to grains = 60 mm

Factor of Safety = 0.7

For Perpendicular to grain loading

K11 = 14.9 fpj = 12.9 Mpa for Rafter with effective thickness = 100 mm

For Parallel to grain loading

K11 = 2.0 fcj = 36.1 Mpa for Pole with effective thickness = 100 mm

Capacity under short term loads = 21.67 Kn > -10.76 Kn

## Rafter Design External

External Rafter Load Width = 2300 mm  External Rafter Span = 4323 mm  Try Rafter 300x50 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 =0.94

K8 Upward =0.94 S1 Downward =13.93 S1 Upward =13.93

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

**Capacity Checks**

| | | | | | |
|---|---|---|---|---|---|
| $M_{1.35D}$ | 1.81 Kn-m | Capacity | 4.72 Kn-m | Passing Percentage | **260.77 %** |
| $M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 5.59 Kn-m | Capacity | 6.30 Kn-m | Passing Percentage | **112.70 %** |
| $M_{0.9D-WnUp}$ | -5.78 Kn-m | Capacity | -7.87 Kn-m | Passing Percentage | **136.16 %** |
| $V_{1.35D}$ | 1.68 Kn | Capacity | 14.47 Kn | Passing Percentage | **861.31 %** |
| $V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 5.17 Kn | Capacity | 19.30 Kn | Passing Percentage | **373.31 %** |
| $V_{0.9D-WnUp}$ | -5.34 Kn | Capacity | -24.12 Kn | Passing Percentage | **451.69 %** |

**Deflections**

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

k2 for Long Term Loads = 2

| | |
|---|---|
| Deflection under Dead and Live Load = 6.06 mm | Limit by Woolcock et al, 1999 Span/240= 18.75 mm |
| Deflection under Dead and Service Wind = 8.79 mm | Limit by Woolcock et al, 1999 Span/100 = 45.00 mm |

**Reactions**

Maximum downward =5.17 kn Maximum upward = -5.34 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 =J5 Joint Group for Pole = J5

Factor of Safety = 0.7

For Perpendicular to grain loading

K11 = 14.9 fpj = 12.9 Mpa for Rafter with effective thickness = 50 mm

For Parallel to grain loading

K11 = 2.0 fcj = 36.1 Mpa for Pole with effective thickness = 100 mm

Eccentric Load check

V = phi x k1 x k4 x k5 x fs x b x ds ..... (Eq 4.12) = -25.20 kn > -5.34 Kn

Single Shear Capacity under short term loads = -10.84 Kn > -5.34 Kn

## Girt Design Front and Back

Girt's Spacing = 1300 mm  Girt's Span = 2300 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 =0.88  S1 Downward =9.63  S1 Upward =15.40

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

#### Capacity Checks

| | | | | | |
|---|---|---|---|---|---|
| $M_{Wind+Snow}$ | 1.19 Kn-m | Capacity | 1.86 Kn-m | Passing Percentage | **156.30 %** |
| $V_{0.9D-WnUp}$ | 2.06 Kn | Capacity | 12.06 Kn | Passing Percentage | **585.44 %** |

#### Deflections

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

Deflection under Snow and Service Wind = 6.94 mm  Limit by Woolcock et al, 1999 Span/100 = 23.00 mm

Sag during installation = 1.70 mm

#### Reactions

Maximum = 2.06 kn

## Girt Design Sides

Girt's Spacing = 1300 mm  Girt's Span = 2250 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 =0.89  S1 Downward =9.63  S1 Upward =15.23

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

#### Capacity Checks

| | | | | | |
|---|---|---|---|---|---|
| $M_{Wind+Snow}$ | 1.14 Kn-m | Capacity | 1.87 Kn-m | Passing Percentage | **164.04 %** |
| $V_{0.9D-WnUp}$ | 2.02 Kn | Capacity | 12.06 Kn | Passing Percentage | **597.03 %** |

**Deflections**

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

Deflection under Snow and Service Wind = 6.35 mm  Limit by Woolcock et al. 1999 Span/100 = 22.50 mm

Sag during installation =1.55 mm

**Reactions**

Maximum = 2.02 kn

## Uplift Check

Density of Concrete = 24 Kn/m3

Density of Timber Pole = 5 Kn/m3

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 = Safecty factor (0.55) x Density of Soil(18) x Height of Pile(1700) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1700)

Skin Friction = 23.34 Kn

Weight of Pile + Pile Skin Friction = 27.76 Kn

Uplift on one Pile = 22.25 Kn

Uplift is ok