

Pole Shed App Ver 01 2022

Job No.: EHB 169 - 2

Address: 17 Calder Way, Invercargill, New Zealand

Date: 16/05/2024

Latitude: -46.403107

Longitude: 168.429637

Elevation: 18 m

General Input

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N5	Ground Snow Load	0.9 KPa	Roof Snow Load	0.63 KPa
Earthquake Zone	1	Subsoil Category	D	Exposure Zone	C
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	4.2 m
Wind Region	NZ4	Terrain Category	2.2	Design Wind Speed	39.92 m/s
Wind Pressure	0.96 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 $C_{p,i} = 0.938$

For roof $C_{p,e}$ from 0 m To 3.6 m $C_{p,e} = -0.9$ $p_e = -0.48$ KPa $p_{net} = -0.93$ KPa

For roof $C_{p,e}$ from 3.6 m To 7.2 m $C_{p,e} = -0.5$ $p_e = -0.27$ KPa $p_{net} = -0.72$ KPa

For wall Windward $C_{p,i} = 0.6983$ side Wall $C_{p,i} = -0.6467$

For wall Windward and Leeward $C_{p,e}$ from 0 m To 13.2 m $C_{p,e} = 0.7$ $p_e = 0.6$ KPa $p_{net} = 1.27$ KPa

For side wall $C_{p,e}$ from 0 m To 3.6 m $C_{p,e} =$ $p_e = -0.56$ KPa $p_{net} = 0.11$ KPa

Maximum Upward pressure used in roof member Design = 0.938 KPa

Maximum Downward pressure used in roof member Design = 0.84 KPa

Maximum Wall pressure used in Design = 1.27 KPa

Maximum Racking pressure used in Design = 1.03 KPa

Design Summary

Purlin Design

Purlin Spacing = 800 mm

Purlin Span = 3450 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 = 0.96 S1 Downward = 9.63 S1 Upward = 13.24

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

Capacity Checks

M _{1.35D}	0.4 Kn-m	Capacity	1.26 Kn-m	Passing Percentage	315.00 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_{nDn}}	1.36 Kn-m	Capacity	1.68 Kn-m	Passing Percentage	123.53 %
M _{0.9D-W_{nUp}}	-0.85 Kn-m	Capacity	-2.01 Kn-m	Passing Percentage	236.47 %
V _{1.35D}	0.47 Kn	Capacity	7.24 Kn	Passing Percentage	1540.43 %

Pole Shed App Ver 01 2022

V _{1.2D+1.5L 1.2D+Sn 1.2D+WnDn}	1.57 Kn	Capacity	9.65 Kn	Passing Percentage	614.65 %
V _{0.9D-WnUp}	-0.98 Kn	Capacity	-12.06 Kn	Passing Percentage	1230.61 %

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 = 8.86 mm Limit by Woolcock et al, 1999 Span/240 = 14.17 mm

Deflection under Dead and Service Wind = 13.59 mm Limit by Woolcock et al, 1999 Span/100 = 34.00 mm

Reactions

Maximum downward = 1.57 kn Maximum upward = -0.98 kn

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

Girt Design Front and Back

Girt's Spacing = 800 mm

Girt's Span = 3600 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 = 0.95 S₁ Downward = 9.63 S₁ Upward = 13.62

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

Capacity Checks

M _{Wind+Snow}	1.65 Kn-m	Capacity	1.99 Kn-m	Passing Percentage	120.61 %
V _{0.9D-WnUp}	1.83 Kn	Capacity	12.06 Kn	Passing Percentage	659.02 %

Deflections

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

Deflection under Snow and Service Wind = 35.28 mm Limit by Woolcock et al, 1999 Span/100 = 36.00 mm

Sag during installation = 10.18 mm

Reactions

Maximum = 1.83 kn

Girt Design Sides

Girt's Spacing = 1300 mm

Girt's Span = 3100 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 = 0.97 S₁ Downward = 9.63 S₁ Upward = 12.64

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

Capacity Checks

Pole Shed App Ver 01 2022

M _{Wind+Snow}	1.98 Kn-m	Capacity	2.04 Kn-m	Passing Percentage	103.03 %
V _{0.9D-WnUp}	2.56 Kn	Capacity	12.06 Kn	Passing Percentage	471.09 %

Deflections

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

Deflection under Snow and Service Wind = 31.53 mm

Limit by Woolcock et al. 1999 Span/100 = 31.00 mm

Sag during installation = 5.60 mm

Reactions

Maximum = 2.56 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

K_s (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(1450) x K_s(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1450)

Skin Friction = 16.98 Kn

Weight of Pile + Pile Skin Friction = 20.75 Kn

Uplift on one Pile = 11.55 Kn

Uplift is ok