

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 290x45 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 = 0.89

K8 Upward = 0.89 S1 Downward = 15.23 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 _{1.35D}	2.00 Kn-m	Capacity	3.78 Kn-m	Passing Percentage	189.00 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	4.00 Kn-m	Capacity	5.04 Kn-m	Passing Percentage	126.00 %
M _{0.9D-W_nUp}	-3.23 Kn-m	Capacity	-6.29 Kn-m	Passing Percentage	194.74 %
V _{1.35D}	2.05 Kn	Capacity	12.59 Kn	Passing Percentage	614.15 %
V _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	4.09 Kn	Capacity	16.79 Kn	Passing Percentage	410.51 %
V _{0.9D-W_nUp}	-3.30 Kn	Capacity	-20.98 Kn	Passing Percentage	635.76 %

Deflections

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

k₂ for Long Term Loads = 2

Deflection under Dead and Live Load = 6.92 mm Limit by Woolcock et al, 1999 Span/240 = 17.08 mm

Deflection under Dead and Service Wind = 7.67 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 = J5 Joint Group for Pole = J5

Factor of Safety = 0.7

For Perpendicular to grain loading

K₁₁ = 14.9 f_{pj} = 12.9 Mpa for Rafter with effective thickness = 45 mm

For Parallel to grain loading

K₁₁ = 2.0 f_{cj} = 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) = -21.73 kn > -3.30 Kn

Single Shear Capacity under short term loads = -9.75 Kn > -3.30 Kn

Intermediate Design Front and Back

Intermediate Spacing = 3095 mm Intermediate Span = 5163 mm Try Intermediate 2x240x45 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 =0.94

K8 Upward =1.00 S1 Downward =13.82 S1 Upward =1.05

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

Capacity Checks

M _{Wind+Snow}	8.04 Kn-m	Capacity	9.68 Kn-m	Passing Percentage	120.40 %
V _{0.9D-WnUp}	6.23 Kn	Capacity	-34.74 Kn	Passing Percentage	557.62 %

Deflections

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

Deflection under Snow and Service Wind = 39.88 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 _{Wind+Snow}	0.84 Kn-m	Capacity	1.65 Kn-m	Passing Percentage	196.43 %
V _{0.9D-WnUp}	1.09 Kn	Capacity	13.75 Kn	Passing Percentage	1261.47 %

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	152.70 %
V _{0.9D-WnUp}	1.44 Kn	Capacity	13.75 Kn	Passing Percentage	954.86 %

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/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

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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 π 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