

Pole Shed App Ver 01 2022

Job No.: Taupo Motor Sport Park - 1 **Address:** 463 Broadlands Road, Taupo, New Zealand **Date:** 19/12/2023

Latitude: -38.6608 **Longitude:** 176.144612 **Elevation:** 453 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 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	39.49 m/s
Wind Pressure	0.94 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 Enclosed

For roof $C_{p,i} = 0.6496$

For roof $C_{p,e}$ from 0 m To 3.50 m $C_{p,e} = -0.90$ $p_e = -0.58$ KPa $p_{net} = -1.08$ KPa

For roof $C_{p,e}$ from 3.50 m To 7.0 m $C_{p,e} = -0.5$ $p_e = -0.32$ KPa $p_{net} = -0.82$ KPa

For wall Windward $C_{p,i} = 0.6496$ side Wall $C_{p,i} = -0.2568$

For wall Windward and Leeward $C_{p,e}$ from 0 m To 10 m $C_{p,e} = 0.7$ $p_e = 0.59$ KPa $p_{net} = 1.09$ KPa

For side wall $C_{p,e}$ from 0 m To 3.50 m $C_{p,e} =$ $p_e = -0.55$ KPa $p_{net} = -0.05$ KPa

Maximum Upward pressure used in roof member Design = 1.08 KPa

Maximum Downward pressure used in roof member Design = 0.69 KPa

Maximum Wall pressure used in Design = 1.09 KPa

Maximum Racking pressure used in Design = 1.01 KPa

Design Summary

Purlin Design

Purlin Spacing = 900 mm

Purlin Span = 3850 mm

Try Purlin 150x50 SG8 Dry

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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 = 0.68 S1 Downward = 9.63 S1 Upward = 19.79

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

Capacity Checks

M _{1.35D}	0.56 Kn-m	Capacity	1.26 Kn-m	Passing Percentage	225.00 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	1.65 Kn-m	Capacity	1.68 Kn-m	Passing Percentage	101.82 %
M _{0.9D-W_nUp}	-1.43 Kn-m	Capacity	-1.43 Kn-m	Passing Percentage	100.00 %
V _{1.35D}	0.58 Kn	Capacity	7.24 Kn	Passing Percentage	1248.28 %
V _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	1.72 Kn	Capacity	9.65 Kn	Passing Percentage	561.05 %
V _{0.9D-W_nUp}	-1.48 Kn	Capacity	-12.06 Kn	Passing Percentage	814.86 %

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 = 15.56 mm Limit by Woolcock et al, 1999 Span/240 = 15.83 mm

Deflection under Dead and Service Wind = 21.91 mm Limit by Woolcock et al, 1999 Span/100 = 38.00 mm

Reactions

Maximum downward = 1.72 kn Maximum upward = -1.48 kn

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

Intermediate Design Sides

Intermediate Spacing = 2500 mm Intermediate Span = 3600 mm Try Intermediate 2x150x50 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 = 1.00 S1 Downward = 9.63 S1 Upward = 0.61

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

Capacity Checks

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$M_{Wind+Snow}$	2.21 Kn-m	Capacity	4.2 Kn-m	Passing Percentage	190.05 %
$V_{0.9D-WnUp}$	2.45 Kn-m	Capacity	24.12 Kn-m	Passing Percentage	984.49 %

Deflections

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

Deflection under Snow and Service Wind = 39.22 mm Limit by Woolcock et al, 1999 Span/100 = 36.00 mm

Reactions

Maximum = 2.45 kn

Girt Design Front and Back

Girt's Spacing = 600 mm Girt's Span = 2000 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 = 0.92 S1 Downward = 9.63 S1 Upward = 14.36

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

Capacity Checks

$M_{Wind+Snow}$	0.33 Kn-m	Capacity	1.94 Kn-m	Passing Percentage	587.88 %
$V_{0.9D-WnUp}$	0.65 Kn-m	Capacity	12.06 Kn-m	Passing Percentage	1855.38 %

Deflections

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

Deflection under Snow and Service Wind = 1.45 mm Limit by Woolcock et al, 1999 Span/100 = 20.00 mm

Sag during installation = 0.97 mm

Reactions

Maximum = 0.65 kn

Girt Design Sides

Girt's Spacing = 900 mm Girt's Span = 2500 mm Try Girt 150x50 SG8 Dry

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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 =0.86 S1 Downward =9.63 S1 Upward =16.05

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

Capacity Checks

$M_{Wind+Snow}$	0.77 Kn-m	Capacity	1.80 Kn-m	Passing Percentage	233.77 %
$V_{0.9D-WnUp}$	1.23 Kn-m	Capacity	12.06 Kn-m	Passing Percentage	980.49 %

Deflections

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

Deflection under Snow and Service Wind = 5.30 mm Limit by Woolcock et al. 1999 Span/100 = 25.00 mm
Sag during installation =2.37 mm

Reactions

Maximum = 1.23 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 = Safety factor (0.55) x Density of Soil(18) x Height of Pile(1550) x Ks(1.5) x $0.5 \times \tan(30) \times \pi \times \text{Dia of Pile}(0.6) \times \text{Height of Pile}(1550)$

Skin Friction = 19.40 Kn

Weight of Pile + Pile Skin Friction = 23.43 Kn

Uplift on one Pile = 17.10 Kn

Uplift is ok