

Pole Shed App Ver 01 2022

Job No.: MFB Projects - 1

Address: 50 Whitecliffs Drive, Waiau Pa, New Zealand

Date: 3/6/2025

Latitude: -37.153688

Longitude: 174.775368

Elevation: 21 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	D
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	4.8 m
Wind Region	NZ1	Terrain Category	2.23	Design Wind Speed	37.97 m/s
Wind Pressure	0.87 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 $C_{p,i} = -0.3$

For roof $C_{p,e}$ from 0 m To 4.40 m $C_{p,e} = -0.9$ $p_e = -0.70$ KPa $p_{net} = -0.70$ KPa

For roof $C_{p,e}$ from 4.40 m To 8.80 m $C_{p,e} = -0.5$ $p_e = -0.39$ KPa $p_{net} = -0.39$ 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 10 m $C_{p,e} = 0.7$ $p_e = 0.54$ KPa $p_{net} = 0.80$ KPa

For side wall $C_{p,e}$ from 0 m To 4.40 m $C_{p,e} =$ $p_e = -0.50$ KPa $p_{net} = -0.50$ KPa

Maximum Upward pressure used in roof member Design = 0.70 KPa

Maximum Downward pressure used in roof member Design = 0.38 KPa

Maximum Wall pressure used in Design = 0.80 KPa

Maximum Racking pressure used in Design = 0.93 KPa

Design Summary

Purlin Design

Purlin Spacing = 900 mm

Purlin Span = 5850 mm

Try Purlin 290x45 SG8 Dry

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

Second page

Pole Shed App Ver 01 2022

K1 Short term = 1 K1 Medium term = 0.8 K1 Long term = 0.6 K4 = 1 K5 = 1 K8 Downward = 0.89

K8 Upward = 0.39 S1 Downward = 15.23 S1 Upward = 27.34

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

Capacity Checks

M _{1.35D}	1.3 Kn-m	Capacity	3.78 Kn-m	Passing Percentage	290.77 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	3.57 Kn-m	Capacity	5.04 Kn-m	Passing Percentage	141.18 %
M _{0.9D-W_nUp}	-1.83 Kn-m	Capacity	-2.74 Kn-m	Passing Percentage	149.73 %
V _{1.35D}	0.89 Kn	Capacity	12.59 Kn	Passing Percentage	1414.61 %
V _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	1.79 Kn	Capacity	16.79 Kn	Passing Percentage	937.99 %
V _{0.9D-W_nUp}	-1.25 Kn	Capacity	-20.98 Kn	Passing Percentage	1678.40 %

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 = 18.12 mm Limit by Woolcock et al, 1999 Span/240 = 24.17 mm

Deflection under Dead and Service Wind = 14.93 mm Limit by Woolcock et al, 1999 Span/100 = 58.00 mm

Reactions

Maximum downward = 1.79 kn Maximum upward = -1.25 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 = 6000 mm Internal Rafter Span = 9850 mm Try Rafter 2x290x45 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 = 7.47 S1 Upward = 7.47

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

Capacity Checks

M _{1.35D}	24.56 Kn-m	Capacity	8.48 Kn-m	Passing Percentage	34.53 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	49.48 Kn-m	Capacity	11.3 Kn-m	Passing Percentage	22.84 %

Pole Shed App Ver 01 2022

M _{0.9D-WnUp}	-34.56 Kn-m	Capacity	-14.12 Kn-m	Passing Percentage	40.86 %
V _{1.35D}	9.97 Kn	Capacity	25.18 Kn	Passing Percentage	252.56 %
V _{1.2D+1.5L 1.2D+Sn 1.2D+WnDn}	20.09 Kn	Capacity	33.58 Kn	Passing Percentage	167.15 %
V _{0.9D-WnUp}	-14.04 Kn	Capacity	-41.96 Kn	Passing Percentage	298.86 %

Deflections

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

k₂ for Long Term Loads = 2

Deflection under Dead and Live Load = 213.555 mm Limit by Woolcock et al, 1999 Span/240 = 41.67 mm
Deflection under Dead and Service Wind = 272.875 mm Limit by Woolcock et al, 1999 Span/100 = 100.00 mm

Reactions

Maximum downward = 20.09 kn Maximum upward = -14.04 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 f_{pj} = 12.9 Mpa for Rafter with effective thickness = 90 mm

For Parallel to grain loading

K₁₁ = 2.0 f_{cj} = 36.1 Mpa for Pole with effective thickness = 100 mm

Capacity under short term loads = 19.50 Kn > -14.04 Kn

Rafter Design External

External Rafter Load Width = 3000 mm External Rafter Span = 9832 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)

K₁ Short term = 1 K₁ Medium term = 0.8 K₁ Long term = 0.6 K₄ = 1 K₅ = 1 K₈ Downward = 0.89

Pole Shed App Ver 01 2022

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}	12.23 Kn-m	Capacity	3.78 Kn-m	Passing Percentage	30.91 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	24.65 Kn-m	Capacity	5.04 Kn-m	Passing Percentage	20.45 %
M _{0.9D-W_nUp}	-17.22 Kn-m	Capacity	-6.29 Kn-m	Passing Percentage	36.53 %
V _{1.35D}	4.98 Kn	Capacity	12.59 Kn	Passing Percentage	252.81 %
V _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	10.03 Kn	Capacity	16.79 Kn	Passing Percentage	167.40 %
V _{0.9D-W_nUp}	-7.01 Kn	Capacity	-20.98 Kn	Passing Percentage	299.29 %

Deflections

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

k₂ for Long Term Loads = 2

Deflection under Dead and Live Load = 237.28 mm Limit by Woolcock et al, 1999 Span/240= 41.67 mm

Deflection under Dead and Service Wind = 272.87 mm Limit by Woolcock et al, 1999 Span/100 = 100.00 mm

Reactions

Maximum downward =10.03 kn Maximum upward = -7.01 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 x k₁ x k₄ x k₅ x f_s x b x d_s (Eq 4.12) = -21.73 kn > -7.01 Kn

Single Shear Capacity under short term loads = -9.75 Kn > -7.01 Kn

Intermediate Design Front and Back

Intermediate Spacing = 3000 mm Intermediate Span = 4650 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 =0.99

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

Capacity Checks

M _{Wind+Snow}	6.49 Kn-m	Capacity	9.68 Kn-m	Passing Percentage	149.15 %
V _{0.9D-WnUp}	5.58 Kn	Capacity	-34.74 Kn	Passing Percentage	622.58 %

Deflections

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

Deflection under Snow and Service Wind = 26.095 mm Limit by Woolcock et al, 1999 Span/100 = 46.50 mm

Reactions

Maximum = 5.58 kn

Intermediate Design Sides

Intermediate Spacing = 5000 mm Intermediate Span = 4249 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 =0.95

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

Capacity Checks

M _{Wind+Snow}	4.51 Kn-m	Capacity	9.68 Kn-m	Passing Percentage	214.63 %
V _{0.9D-WnUp}	4.25 Kn	Capacity	34.74 Kn	Passing Percentage	817.41 %

Deflections

Pole Shed App Ver 01 2022

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

Deflection under Snow and Service Wind = 30.335 mm Limit by Woolcock et al, 1999 Span/100 = 42.49 mm

Reactions

Maximum = 4.25 kn

Girt Design Front and Back

Girt's Spacing = 1300 mm

Girt's Span = 3000 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 = 0.56 S1 Downward = 12.23 S1 Upward = 22.32

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

Capacity Checks

M _{Wind+Snow}	1.17 Kn-m	Capacity	1.70 Kn-m	Passing Percentage	145.30 %
V _{0.9D-WnUp}	1.56 Kn	Capacity	13.75 Kn	Passing Percentage	881.41 %

Deflections

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

Deflection under Snow and Service Wind = 6.36 mm Limit by Woolcock et al, 1999 Span/100 = 30.00 mm

Sag during installation = 6.06 mm

Reactions

Maximum = 1.56 kn

Girt Design Sides

Girt's Spacing = 0 mm

Girt's Span = 5000 mm

Try Girt SG8 Dry

Moisture Condition = Wet (Moisture in timber is less than 18% and timber does not remain in continuous wet condition after installation)

K1 Short term = 1 K4 = 1 K5 = 1 K8 Downward = NaN

K8 Upward = NaN S1 Downward = NaN S1 Upward = NaN

Pole Shed App Ver 01 2022

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

Capacity Checks

$M_{Wind+Snow}$	0.00 Kn-m	Capacity	NaN Kn-m	Passing Percentage	NaN %
$V_{0.9D-WnUp}$	0.00 Kn	Capacity	0.00 Kn	Passing Percentage	NaN %

Deflections

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

Deflection under Snow and Service Wind = NaN mm Limit by Woolcock et al. 1999 Span/100 = 50.00 mm
Sag during installation = NaN mm

Reactions

Maximum = 0.00 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(2000) x $K_s(1.5)$ x $0.5 \times \tan(30)$ x π x Dia of Pile(0.6) x Height of Pile(2000)

Skin Friction = 32.31 Kn

Weight of Pile + Pile Skin Friction = 36.89 Kn

Uplift on one Pile = 14.25 Kn

Uplift is ok