Pole Shed App Ver 01 2022

Job No.:	Atkins - 2	**Address:**	102 Ranfurly Road, Feilding, New Zealand	**Date:**	10/3/2023
Latitude:	-40.223779	**Longitude:**	175.547117	**Elevation:**	114 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	B
Importance Level	2	Ultimate wind & Earthquake ARI	500 Years	Max Height	3.9 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	44.26 m/s
Wind Pressure	1.18 KPa	Lee Zone	NO	Ultimate Snow ARI	150 Years
Wind Category	Very High	Earthquake ARI	500		

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

Pressure Coefficients and Pressues

Shed Type = Gable Enclosed

For roof Cp,i = -0.3

For roof CP,e from 0 m To 3.90 m Cpe = -0.9 pe = -0.89 KPa pnet = -1.11 KPa

For roof CP,e from 3.90 m To 7.80 m Cpe = -0.5 pe = -0.50 KPa pnet = -0.72 KPa

For wall Windward Cp,i = -0.3 side Wall Cp,i = -0.3

For wall Windward and Leeward CP,e from 0 m To 10 m Cpe = 0.7 pe = 0.74 KPa pnet = 1.09 KPa

For side wall CP,e from 0 m To 3.90 m Cpe = pe = -0.69 KPa pnet = -0.69 KPa

Maximum Upward pressure used in roof member Design = 1.11 KPa

Maximum Downward pressure used in roof member Design = 0.53 KPa

Maximum Wall pressure used in Design = 1.09 KPa

Maximum Racking pressure used in Design = 1.27 KPa

Design Summary

Rafter Design Internal

Internal Rafter Load Width = 5100 mm Internal Rafter Span = 4850 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

$M_{1.35D}$	5.06 Kn-m	Capacity	10.08 Kn-m	Passing Percentage	**199.21 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	12.45 Kn-m	Capacity	13.44 Kn-m	Passing Percentage	**107.95 %**
$M_{0.9D-WnUp}$	-13.27 Kn-m	Capacity	-16.8 Kn-m	Passing Percentage	**126.60 %**
$V_{1.35D}$	4.17 Kn	Capacity	28.94 Kn	Passing Percentage	**694.00 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	10.27 Kn	Capacity	38.6 Kn	Passing Percentage	**375.85 %**
$V_{0.9D-WnUp}$	-10.95 Kn	Capacity	-48.24 Kn	Passing Percentage	**440.55 %**

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 9.225 mm	Limit by Woolcock et al, 1999 Span/360 = 13.89 mm
Deflection under Dead and Service Wind = 13.065 mm	Limit by Woolcock et al, 1999 Span/250 = 33.33 mm

Reactions

Maximum downward =10.27 kn Maximum upward = -10.95 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

Second page

Capacity under short term loads = 21.67 Kn > -10.95 Kn

Rafter Design External

External Rafter Load Width = 3000 mm   External Rafter Span = 4835 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

$M_{1.35D}$	2.96 Kn-m	Capacity	4.72 Kn-m	Passing Percentage	**159.46 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	7.28 Kn-m	Capacity	6.30 Kn-m	Passing Percentage	**86.54 %**
$M_{0.9D-WnUp}$	-7.76 Kn-m	Capacity	-7.87 Kn-m	Passing Percentage	**101.42 %**
$V_{1.35D}$	2.45 Kn	Capacity	14.47 Kn	Passing Percentage	**590.61 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	6.02 Kn	Capacity	19.30 Kn	Passing Percentage	**320.60 %**
$V_{0.9D-WnUp}$	-6.42 Kn	Capacity	-24.12 Kn	Passing Percentage	**375.70 %**

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 12.06 mm   Limit by Woolcock et al, 1999 Span/360= 13.89 mm

Deflection under Dead and Service Wind = 15.37 mm   Limit by Woolcock et al, 1999 Span/250 = 33.33 mm

Reactions

Maximum downward =6.02 kn   Maximum upward = -6.42 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 > -6.42 Kn

Single Shear Capacity under short term loads = -10.84 Kn > -6.42 Kn

Girt Design Front and Back

Girt's Spacing = 0 mm   Girt's Span = 3000 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

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-m	Capacity	0.00 Kn-m	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/250 = 12.00 mm
Sag during installation = NaN mm

Reactions

Maximum = 0.00 kn

Girt Design Sides

Girt's Spacing = 1200 mm   Girt's Span = 2500 mm   Try Girt 200x50 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   K4 =1   K5 =1   K8 Downward =1.00

K8 Upward =0.73   S1 Downward =11.27   S1 Upward =18.79

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

Capacity Checks

$M_{Wind+Snow}$	1.02 Kn-m	Capacity	2.72 Kn-m	Passing Percentage	**266.67 %**
$V_{0.9D\text{-}WnUp}$	1.64 Kn-m	Capacity	16.08 Kn-m	Passing Percentage	**980.49 %**

Deflections

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

Deflection under Snow and Service Wind = 2.98 mm   Limit by Woolcock et al. 1999 Span/100 = 10.00 mm
Sag during installation =2.37 mm

Reactions

Maximum = 1.64 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 = 27.24 Kn

Uplift on one Pile = 22.57 Kn

Uplift is ok