Pole Shed App Ver 01 2022

Job No.:	511-5025142 - 1	**Address:**	3219 Arundel Rakaia Gorge Road, Cavendish, New Zealand	**Date:**	18/09/2024
Latitude:	-43.720174	**Longitude:**	171.387041	**Elevation:**	365.5 m

General Input

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N4	Ground Snow Load	1.68 KPa	Roof Snow Load	1.06 KPa
Earthquake Zone	2	Subsoil Category	D	Exposure Zone	B
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	5.3 m
Wind Region	NZ2	Terrain Category	2.09	Design Wind Speed	50.1 m/s
Wind Pressure	1.51 KPa	Lee Zone	YES	Ultimate Snow ARI	50 Years
Wind Category	extra High	Earthquake ARI	100		

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

Pressure Coefficients and Pressues

Shed Type = Mono Enclosed

For roof Cp,i = -0.3

For roof CP,e from 0 m To 6.05 m Cpe = -0.9 pe = -1.22 KPa pnet = -1.22 KPa

For roof CP,e from 6.05 m To 12.10 m Cpe = -0.5 pe = -0.68 KPa pnet = -0.68 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 11.50 m Cpe = 0.7 pe = 0.95 KPa pnet = 1.40 KPa

For side wall CP,e from 0 m To 6.05 m Cpe = pe = -0.88 KPa pnet = -0.88 KPa

Maximum Upward pressure used in roof member Design = 1.22 KPa

Maximum Downward pressure used in roof member Design = 0.59 KPa

Maximum Wall pressure used in Design = 1.40 KPa

Maximum Racking pressure used in Design = 1.36 KPa

Design Summary

Intermediate Design Sides

Intermediate Spacing = 2875 mm Intermediate Span = 4400 mm Try Intermediate 2x140x45 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 =1.00

K8 Upward =1.00 S1 Downward =10.36 S1 Upward =0.72

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

Capacity Checks

$M_{Wind+Snow}$	5.84 Kn-m	Capacity	3.3 Kn-m	Passing Percentage	**56.51 %**
$V_{0.9D-WnUp}$	5.31 Kn	Capacity	20.26 Kn	Passing Percentage	**381.54 %**

Deflections

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

Deflection under Snow and Service Wind = 388.69 mm Limit by Woolcock et al, 1999 Span/100 = 44.00 mm

Reactions

Maximum = 5.31 kn

Girt Design Front and Back

Girt's Spacing = 1300 mm Girt's Span = 2667 mm Try Girt 140x45 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 =1.00

K8 Upward =0.00 S1 Downward =10.36 S1 Upward =Infinity

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

Capacity Checks

$M_{Wind+Snow}$	1.62 Kn-m	Capacity	0.00 Kn-m	Passing Percentage	**0.00 %**
$V_{0.9D-WnUp}$	2.43 Kn	Capacity	10.13 Kn	Passing Percentage	**416.87 %**

Deflections

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

Deflection under Snow and Service Wind = 30.53 mm Limit by Woolcock et al, 1999 Span/100 = 26.66 mm
Sag during installation = 3.78 mm

Reactions

Maximum = 2.43 kn

Girt Design Sides

Girt's Spacing = 1300 mm Girt's Span = 2875 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

$M_{Wind+Snow}$	1.88 Kn-m	Capacity	NaN Kn-m	Passing Percentage	**NaN %**
$V_{0.9D-WnUp}$	2.62 Kn	Capacity	0.00 Kn	Passing Percentage	**0.00 %**

Deflections

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

Deflection under Snow and Service Wind = Infinity mm Limit by Woolcock et al. 1999 Span/100 = 28.75 mm
Sag during installation =NaN mm

Reactions

Maximum = 2.62 kn

Middle Pole Design

Geometry

300 SED H5 (Minimum 325 dia. at Floor Level)	Dry Use	Height	6500 mm
Area	76660 mm2	As	57495.1171875 mm2
Ix	467896461 mm4	Zx	2994537 mm3
Iy	467896461 mm4	Zx	2994537 mm3
Lateral Restraint	6500 mm c/c		

Loads

Total Area over Pole = 30.66475 m2

Dead	7.67 Kn	Live	7.67 Kn
Wind Down	18.09 Kn	Snow	32.50 Kn
Moment wind	38.10 Kn-m	Moment snow	11.84 Kn-m
Phi	0.8	K8	0.63
K1 snow	0.8	K1 Dead	0.6
K1wind	1		

Material

Peeling	Steaming	Normal	Dry Use
fb =	36.3 MPa	fs =	2.96 MPa
fc =	18 MPa	fp =	7.2 MPa
ft =	22 MPa	E =	9257 MPa

Capacities

PhiNcx Wind	696.74 Kn	PhiMnx Wind	54.89 Kn-m	PhiVnx Wind	136.15 Kn
PhiNcx Dead	418.04 Kn	PhiMnx Dead	32.93 Kn-m	PhiVnx Dead	81.69 Kn
PhiNcx Snow	557.39 Kn	PhiMnx Snow	43.91 Kn-m	PhiVnx Snow	108.92 Kn

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.77 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.56 < 1 OK

Deflection at top under service lateral loads = 42.58 mm < 65.00 mm

Drained Lateral Strength of Middle pile in cohesionless soils Free Head short pile

Assumed Soil Properties

Gamma	18 Kn/m3	Friction angle	30 deg	Cohesion	0 Kn/m3
K0 =	(1-sin(30)) / (1+sin(30))				
Kp =	(1+sin(30)) / (1-sin(30))				

Geometry For Middle Bay Pole

Ds =	0.6 mm	Pile Diameter
L =	2300 mm	Pile embedment length
f1 =	3975 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	38.10 Kn-m	Moment Snow =	Kn-m
Shear Wind =	9.59 Kn	Shear Snow =	11.84 Kn

Pile Properties

Safety Factory	0.55	
Hu =	17.28 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	41.57 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.92 < 1 OK

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(2300) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(2300)

Skin Friction = 42.72 Kn

Weight of Pile + Pile Skin Friction = 46.20 Kn

Uplift on one Pile = 30.51 Kn

Uplift is ok