<u>Pole Shed App Ver 01 2022</u>

Job No.: Apiti Shed - 1	**Address:** 101 Table Flat Rd, Apiti, New Zealand	**Date:** 10/3/2023
Latitude: -39.948308	**Longitude:** 175.912963	**Elevation:** 558 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	1.11 KPa	Roof Snow Load	0.75 KPa
Earthquake Zone	3	Subsoil Category	D	Exposure Zone	B
Importance Level	2	Ultimate wind & Earthquake ARI	500 Years	Max Height	5.4 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	48.36 m/s
Wind Pressure	1.4 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 6.20 m Cpe = -0.9 pe = -1.14 KPa pnet = -1.14 KPa

For roof CP,e from 6.20 m To 12.40 m Cpe = -0.5 pe = -0.63 KPa pnet = -0.63 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 28.8 m Cpe = 0.7 pe = 0.88 KPa pnet = 1.30 KPa

For side wall CP,e from 0 m To 6.20 m Cpe = pe = -0.82 KPa pnet = -0.82 KPa

Maximum Upward pressure used in roof member Design = 1.14 KPa

Maximum Downward pressure used in roof member Design = 0.67 KPa

Maximum Wall pressure used in Design = 1.30 KPa

Maximum Racking pressure used in Design = 1.26 KPa

Design Summary

Girt Design Front and Back

Girt's Spacing = 600 mm Girt's Span = 4800 mm Try Girt 250x50 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 =0.97

K8 Upward =0.64 S1 Downward =12.68 S1 Upward =20.70

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

Capacity Checks

$M_{Wind+Snow}$	2.25 Kn-m	Capacity	3.71 Kn-m	Passing Percentage	**164.89 %**
$V_{0.9D-WnUp}$	1.87 Kn-m	Capacity	20.10 Kn-m	Passing Percentage	**1074.87 %**

Deflections

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

Deflection under Snow and Service Wind = 19.49 mm Limit by Woolcock et al, 1999 Span/250 = 19.20 mm
Sag during installation = 32.19 mm

Reactions

Maximum = 1.87 kn

Girt Design Sides

Girt's Spacing = 600 mm Girt's Span = 5000 mm Try Girt 250x50 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 =0.97

K8 Upward =0.62 S1 Downward =12.68 S1 Upward =21.13

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

Capacity Checks

$M_{Wind+Snow}$	2.44 Kn-m	Capacity	3.59 Kn-m	Passing Percentage	**147.13 %**
$V_{0.9D-WnUp}$	1.95 Kn-m	Capacity	20.10 Kn-m	Passing Percentage	**1030.77 %**

Deflections

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

Deflection under Snow and Service Wind = 22.95 mm Limit by Woolcock et al. 1999 Span/100 = 20.00 mm

Second page

Sag during installation =37.90 mm

Reactions

Maximum = 1.95 kn

Middle Pole Design

Geometry

350 SED H5 (Minimum 375 dia. at Floor Level)	Dry Use	Height	5100 mm
Area	103154 mm2	As	77365.4296875 mm2
Ix	847191750 mm4	Zx	4674161 mm3
Iy	847191750 mm4	Zx	4674161 mm3
Lateral Restraint	5100 mm c/c		

Loads

Total Area over Pole = 36 m2

Dead	9.00 Kn	Live	9.00 Kn
Wind Down	24.12 Kn	Snow	27.00 Kn
Moment wind	32.98 Kn-m	Moment snow	7.17 Kn-m
Phi	0.8	K8	0.93
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	1385.84 Kn	PhiMnx Wind	126.64 Kn-m	PhiVnx Wind	183.20 Kn
PhiNcx Dead	831.50 Kn	PhiMnx Dead	75.98 Kn-m	PhiVnx Dead	109.92 Kn
PhiNcx Snow	1108.67 Kn	PhiMnx Snow	101.31 Kn-m	PhiVnx Snow	146.56 Kn

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.30 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.11 < 1 OK

Deflection at top under service lateral loads = 16.28 mm < 34.00 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 =	2200 mm	Pile embedment length
f1 =	4050 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	32.98 Kn-m	Moment Snow =	Kn-m
Shear Wind =	8.14 Kn	Shear Snow =	7.17 Kn

Pile Properties

Safety Factory	0.55	
Hu =	15.18 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	36.94 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.89 < 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(2200) x Ks(1.5) x

0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(2200)

Skin Friction = 39.09 Kn

Weight of Pile + Pile Skin Friction = 41.52 Kn

Uplift on one Pile = 32.94 Kn

Uplift is ok