Pole Shed App Ver 01 2022

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Job No.: TEST J - 2 **Address:** **Date:** 28/08/2024

Latitude: -37.685058 **Longitude:** 176.247142 **Elevation:** 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	N0	Ground Snow Load	0 KPa	Roof Snow Load	0 KPa
Earthquake Zone	1	Subsoil Category	D	Exposure Zone	C
Importance Level	2	Ultimate wind & Earthquake ARI	500 Years	Max Height	3.5 m
Wind Region	NZ1	Terrain Category	3.0	Design Wind Speed	37.35 m/s
Wind Pressure	0.84 KPa	Lee Zone	NO	Ultimate Snow ARI	150 Years
Wind Category	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 = Mono Enclosed

For roof Cp,i = -0.3

For roof CP,e from 0 m To 3.13 m Cpe = -0.9167 pe = -0.69 KPa pnet = -0.69 KPa

For roof CP,e from 3.13 m To 6.25 m Cpe = -0.8917 pe = -0.67 KPa pnet = -0.67 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 12 m Cpe = 0.7 pe = 0.53 KPa pnet = 0.78 KPa

For side wall CP,e from 0 m To 6.25 m Cpe = pe = -0.49 KPa pnet = -0.49 KPa

Maximum Upward pressure used in roof member Design = 0.69 KPa

Maximum Downward pressure used in roof member Design = 0.40 KPa

Maximum Wall pressure used in Design = 0.78 KPa

Maximum Racking pressure used in Design = 0.91 KPa

Design Summary

Purlin Design

Purlin Spacing = 800 mm Purlin Span = 4350 mm Try Purlin 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 K1 Medium term = 0.8 K1 Long term = 0.6 K4 =1 K5 =1 K8 Downward =1.00

K8 Upward =0.62 S1 Downward =9.63 S1 Upward =21.06

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

Capacity Checks

$M_{1.35D}$	0.64 Kn-m	Capacity	1.26 Kn-m	Passing Percentage	**196.88 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	1.76 Kn-m	Capacity	1.68 Kn-m	Passing Percentage	**95.45 %**
$M_{0.9D-WnUp}$	-0.88 Kn-m	Capacity	-1.30 Kn-m	Passing Percentage	**147.73 %**
$V_{1.35D}$	0.59 Kn	Capacity	7.24 Kn	Passing Percentage	**1227.12 %**

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$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	1.22 Kn	Capacity	9.65 Kn	Passing Percentage	**790.98 %**
$V_{0.9D-WnUp}$	-0.81 Kn	Capacity	-12.06 Kn	Passing Percentage	**1488.89 %**

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 = 22.68 mm Limit by Woolcock et al, 1999 Span/360 = 11.94 mm

Deflection under Dead and Service Wind = 26.46 mm Limit by Woolcock et al, 1999 Span/250 = 28.67 mm

Reactions

Maximum downward =1.22 kn Maximum upward = -0.81 kn

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

Girt Design Front and Back

Girt's Spacing = 1300 mm Girt's Span = 4500 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 =0.67 S1 Downward =12.68 S1 Upward =20.04

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

Capacity Checks

$M_{Wind+Snow}$	2.57 Kn-m	Capacity	3.90 Kn-m	Passing Percentage	**151.75 %**
$V_{0.9D-WnUp}$	2.28 Kn	Capacity	20.10 Kn	Passing Percentage	**881.58 %**

Deflections

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

Deflection under Snow and Service Wind = 12.41 mm Limit by Woolcock et al, 1999 Span/250 = 18.00 mm

Sag during installation = 24.86 mm

Reactions

Maximum = 2.28 kn

Girt Design Sides

Girt's Spacing = 900 mm Girt's Span = 6000 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 =0.27 S1 Downward =12.68 S1 Upward =32.73

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

Capacity Checks

$M_{Wind+Snow}$	3.16 Kn-m	Capacity	1.60 Kn-m	Passing Percentage	**50.63 %**
$V_{0.9D-WnUp}$	2.11 Kn	Capacity	20.10 Kn	Passing Percentage	**952.61 %**

Deflections

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

Deflection under Snow and Service Wind = 27.16 mm Limit by Woolcock et al. 1999 Span/100 = 24.00 mm
Sag during installation =78.58 mm

Reactions

Maximum = 2.11 kn

Middle Pole Design

Geometry

250x250 SG8 Dry	Dry Use	Height	5640 mm
Area	62500 mm2	As	46875 mm2
Ix	325520833 mm4	Zx	2604167 mm3
Iy	325520833 mm4	Zx	2604167 mm3
Lateral Restraint	5640 mm c/c		

Loads

Total Area over Pole = 27 m2

Dead	6.75 Kn	Live	6.75 Kn
Wind Down	10.80 Kn	Snow	0.00 Kn
Moment wind	6.25 Kn-m		
Phi	0.8	K8	0.55
K1 snow	0.8	K1 Dead	0.6
K1wind	1		

Material

Shaving	Steaming	Normal	Dry Use
fb =	14 MPa	fs =	3 MPa
fc =	18 MPa	fp =	8.9 MPa
ft =	6 MPa	E =	8000 MPa

Capacities

PhiNcx Wind	495.48 Kn	PhiMnx Wind	16.06 Kn-m	PhiVnx Wind	112.50 Kn
PhiNcx Dead	297.29 Kn	PhiMnx Dead	9.63 Kn-m	PhiVnx Dead	67.50 Kn

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.44 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.20 < 1 OK

Deflection at top under service lateral loads = 6.66 mm < 37.60 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 =	1500 mm	Pile embedment length
f1 =	2625 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	6.25 Kn-m
Shear Wind =	2.38 Kn

Pile Properties

Safety Factory	0.55	
Hu =	7.29 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	11.57 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.54 < 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(1500) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1500)

Skin Friction = 18.17 Kn

Weight of Pile + Pile Skin Friction = 21.39 Kn

Uplift on one Pile = 12.55 Kn

Uplift is ok