Pole Shed App Ver 01 2022

First Page

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Job No.: EHB 248-1 **Address:** 94 Brookdale Road,Kaka Point 9271,New Zealand **Date:** 03/09/2024

Latitude: -46.374119 **Longitude:** 169.76568 **Elevation:** 12.5 m

General Input

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N5	Ground Snow Load	0.9 KPa	Roof Snow Load	0.63 KPa
Earthquake Zone	1	Subsoil Category	D	Exposure Zone	C
Importance Level	2	Ultimate wind & Earthquake ARI	500 Years	Max Height	5.2 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	41.82 m/s
Wind Pressure	1.05 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 = Gable Open

For roof Cp,i = 0.5616

For roof CP,e from 0 m To 3.47 m Cpe = -0.9 pe = -0.73 KPa pnet = -1.23 KPa

For roof CP,e from 3.47 m To 6.94 m Cpe = -0.5 pe = -0.41 KPa pnet = -0.90 KPa

For wall Windward Cp,i = 0.5616 side Wall Cp,i = -0.5771

For wall Windward and Leeward CP,e from 0 m To 12 m Cpe = 0.7 pe = 0.66 KPa pnet = 1.27 KPa

For side wall CP,e from 0 m To 3.47 m Cpe = pe = -0.61 KPa pnet = 0.00 KPa

Maximum Upward pressure used in roof member Design = 1.23 KPa

Maximum Downward pressure used in roof member Design = 0.80 KPa

Maximum Wall pressure used in Design = 1.27 KPa

Maximum Racking pressure used in Design = 1.07 KPa

Design Summary

Girt Design Front and Back

Girt's Spacing = 600 mm Girt's Span = 3000 mm Try Girt 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 K4 =1 K5 =1 K8 Downward =1.00

K8 Upward =0.79 S1 Downward =9.63 S1 Upward =17.59

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

Capacity Checks

$M_{Wind+Snow}$	0.86 Kn-m	Capacity	1.65 Kn-m	Passing Percentage	**191.86 %**
$V_{0.9D-WnUp}$	1.14 Kn	Capacity	12.06 Kn	Passing Percentage	**1057.89 %**

Deflections

Second page

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

Deflection under Snow and Service Wind = 12.76 mm Limit by Woolcock et al, 1999 Span/250 = 12.00 mm
Sag during installation = 4.91 mm

Reactions

Maximum = 1.14 kn

Girt Design Sides

Girt's Spacing = 700 mm Girt's Span = 2325 mm Try Girt 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 K4 =1 K5 =1 K8 Downward =1.00

K8 Upward =0.88 S1 Downward =9.63 S1 Upward =15.48

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

Capacity Checks

$M_{Wind+Snow}$	0.60 Kn-m	Capacity	1.85 Kn-m	Passing Percentage	**308.33 %**
$V_{0.9D-WnUp}$	1.03 Kn	Capacity	12.06 Kn	Passing Percentage	**1170.87 %**

Deflections

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

Deflection under Snow and Service Wind = 5.37 mm Limit by Woolcock et al. 1999 Span/100 = 9.30 mm
Sag during installation =1.77 mm

Reactions

Maximum = 1.03 kn

Middle Pole Design

Geometry

300 SED H5 (Minimum 325 dia. at Floor Level)	Dry Use	Height	5450 mm
Area	76660 mm2	As	57495.1171875 mm2
Ix	467896461 mm4	Zx	2994537 mm3
Iy	467896461 mm4	Zx	2994537 mm3
Lateral Restraint	1300 mm c/c		

Loads

Total Area over Pole = 27.900447460006433 m2

Dead	6.98 Kn	Live	6.98 Kn
Wind Down	22.32 Kn	Snow	17.58 Kn
Moment wind	14.69 Kn-m	Moment snow	3.17 Kn-m
Phi	0.8	K8	1.00
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	1103.91 Kn	PhiMnx Wind	86.96 Kn-m	PhiVnx Wind	136.15 Kn
PhiNcx Dead	662.34 Kn	PhiMnx Dead	52.18 Kn-m	PhiVnx Dead	81.69 Kn
PhiNcx Snow	883.13 Kn	PhiMnx Snow	69.57 Kn-m	PhiVnx Snow	108.92 Kn

Checks

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

(Mx/PhiMnx)^2+(N/phiNcx) = 0.06 < 1 OK

Deflection at top under service lateral loads = 13.51 mm < 36.33 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 =	2000 mm	Pile embedment length
f1 =	3900 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	14.69 Kn-m	Moment Snow =	Kn-m
Shear Wind =	3.77 Kn	Shear Snow =	3.17 Kn

Pile Properties

Safety Factory	0.55	
Hu =	12.08 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	28.13 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.52 < 1 OK

End Pole Design

Geometry For End Bay Pole

Geometry

Pole Shed App Ver 01 2022

250 SED H5 (Minimum 275 dia. at Floor Level)	Dry Use	Height	4900 mm
Area	54091 mm2	As	40568.5546875 mm2
Ix	232952248 mm4	Zx	1774874 mm3
Iy	232952248 mm4	Zx	1774874 mm3
Lateral Restraint	mm c/c		

Loads

Total Area over Pole = 13.950223730003216 m2

Dead	3.49 Kn	Live	3.49 Kn
Wind Down	11.16 Kn	Snow	8.79 Kn
Moment Wind	7.35 Kn-m	Moment snow	1.58 Kn-m
Phi	0.8	K8	0.74
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	573.14 Kn	PhiMnx Wind	37.93 Kn-m	PhiVnx Wind	96.07 Kn
PhiNcx Dead	343.88 Kn	PhiMnx Dead	22.76 Kn-m	PhiVnx Dead	57.64 Kn
PhiNcx Snow	458.51 Kn	PhiMnx Snow	30.34 Kn-m	PhiVnx Snow	76.85 Kn

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.23 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.07 < 1 OK

Deflection at top under service lateral loads = 12.91 mm < 34.58 mm

Ds =	0.6 mm	Pile Diameter
L =	1500 mm	Pile embedment length
f1 =	3900 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Total Area over Pole = 13.950223730003216 m2

Moment Wind =	7.35 Kn-m	Moment Snow =	1.58 Kn-m
Shear Wind =	1.88 Kn	Shear Snow =	1.58 Kn

Pile Properties

Safety Factory	0.55	
Hu =	5.57 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	12.64 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.58 < 1 OK

Drained Lateral Strength of End 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 End Bay Pole

Ds =	0.6 mm	Pile Diameter
L =	1500 mm	Pile embedment length
f1 =	3900 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	7.35 Kn-m	Moment Snow =	1.58 Kn-m
Shear Wind =	1.88 Kn	Shear Snow =	1.58 Kn

Pile Properties

Safety Factory	0.55	
Hu =	5.57 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	12.64 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.58 < 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(2000) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(2000)

Skin Friction = 32.31 Kn

Weight of Pile + Pile Skin Friction = 35.33 Kn

Uplift on one Pile = 28.04 Kn

Uplift is ok