Pole Shed App Ver 01 2022

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Job No.: Nicole Howe - 1   **Address:** 138 Addison Road, Pataua South 0192, New Zealand   **Date:** 14/04/2025

Latitude: -35.740978   **Longitude:** 174.505717   **Elevation:** 35 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	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	3.6 m
Wind Region	NZ1	Terrain Category	2.54	Design Wind Speed	46.51 m/s
Wind Pressure	1.3 KPa	Lee Zone	NO	Ultimate Snow ARI	50 Years
Wind Category	Very 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 $C_{p,i}$ = 0.6936

For roof $C_{P,e}$ from 0 m To 3.6 m C_{pe} = -0.9   pe = -0.94 KPa   pnet = -1.81 KPa

For roof $C_{P,e}$ from 3.60 m To 7.20 m C_{pe} = -0.5   pe = -0.52 KPa   pnet = -1.39 KPa

For wall Windward $C_{p,i}$ = 0.6936   side Wall $C_{p,i}$ = -0.638

For wall Windward and Leeward $C_{P,e}$ from 0 m To 8 m C_{pe} = 0.7   pe = 0.82 KPa   pnet = 1.52 KPa

For side wall $C_{P,e}$ from 0 m To 3.60 m C_{pe} =   pe = -0.76 KPa   pnet = -0.06 KPa

Maximum Upward pressure used in roof member Design = 1.81 KPa

Maximum Downward pressure used in roof member Design = 0.98 KPa

Maximum Wall pressure used in Design = 1.52 KPa

Maximum Racking pressure used in Design = 1.40 KPa

Design Summary

Rafter Design Internal

Internal Rafter Load Width = 4000 mm   Internal Rafter Span = 7850 mm   Try Rafter 2x360x45 LVL13

Moisture Condition = Dry (Moisture in timber is less than 16% and timber does not remain in continuous wet condition after installation)

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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 =8.40   S1 Upward =8.40

Shear Capacity of timber =5.3 MPa   Bending Capacity of timber =48 MPa NZS3603 Amt 4, table 2.3

Capacity Checks

$M_{1.35D}$	10.40 Kn-m	Capacity	43.44 Kn-m	Passing Percentage	**417.69 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	39.44 Kn-m	Capacity	57.92 Kn-m	Passing Percentage	**146.86 %**
$M_{0.9D-WnUp}$	-48.84 Kn-m	Capacity	-72.42 Kn-m	Passing Percentage	**148.28 %**
$V_{1.35D}$	5.30 Kn	Capacity	55.22 Kn	Passing Percentage	**1041.89 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	20.10 Kn	Capacity	73.64 Kn	Passing Percentage	**366.37 %**
$V_{0.9D-WnUp}$	-24.88 Kn	Capacity	-92.04 Kn	Passing Percentage	**369.94 %**

Deflections

Modulus of Elasticity = 11000 MPa NZS3603 Amt 4, Table 2.3

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 14.965 mm   Limit by Woolcock et al, 1999 Span/240 = 33.33 mm

Deflection under Dead and Service Wind = 27.435 mm   Limit by Woolcock et al, 1999 Span/100 = 80.00 mm

Reactions

Maximum downward =20.10 kn   Maximum upward = -24.88 kn

Rafter to Pole Connection check

Bolt Size = M16 Number of Bolts = 3

Calculations as per NZS 3603:1993 Amend 2005 clause 4.4

Joint Group for Rafters =J2 Joint Group for Pole = J5

Minimum Bolt edge, end and spacing for Load perpendicular to grains = 76.25 mm

Factor of Safety = 0.7

For Perpendicular to grain loading

K11 = 12.6 fpj = 22.7 Mpa for Rafter with effective thickness = 90 mm

For Parallel to grain loading

K11 = 2.0 fcj = 36.1 Mpa for Pole with effective thickness = 100 mm

Capacity under short term loads = 68.64 Kn > -24.88 Kn

Girt Design Front and Back

Girt's Spacing = 0 mm   Girt's Span = 2000 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	Capacity	0.00 Kn	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/100 = 20.00 mm
Sag during installation = NaN mm

Reactions

Maximum = 0.00 kn

Girt Design Sides

Girt's Spacing = 0 mm   Girt's Span = 2000 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	Capacity	0.00 Kn	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/100 = 20.00 mm
Sag during installation =NaN mm

Reactions

Maximum = 0.00 kn

Middle Pole Design

Geometry

175 SED H5 HIGH DENSITY (Minimum 200 dia. at Floor Level) Dry Use   Height 3240 mm

Area		27598 mm2	As 20698.2421875 mm2
Ix		60639381 mm4	Zx 646820 mm3
Iy		60639381 mm4	Zx 646820 mm3
Lateral Restraint		3240 mm c/c	

Loads

Total Area over Pole = 16 m2

Dead	4.00 Kn	Live	4.00 Kn
Wind Down	15.68 Kn	Snow	0.00 Kn
Moment wind	13.57 Kn-m		
Phi	0.8	K8	0.80
K1 snow	0.8	K1 Dead	0.6
K1wind	1		

Material

Peeling	Steaming	Normal	Dry Use
fb =	49.725 MPa	fs =	2.84 MPa
fc =	28.125 MPa	fp =	8.66 MPa
ft =	29.64 MPa	E =	12874 MPa

Capacities

PhiNcx Wind	498.13 Kn	PhiMnx Wind	20.64 Kn-m	PhiVnx Wind	47.03 Kn
PhiNcx Dead	298.88 Kn	PhiMnx Dead	12.38 Kn-m	PhiVnx Dead	28.22 Kn

Checks

$(M_x/\text{PhiMnx}) + (N/\text{phiNcx}) = 0.71 < 1$ OK

$(M_x/\text{PhiMnx})^2 + (N/\text{phiNcx}) = 0.48 < 1$ OK

Deflection at top under service lateral loads = 28.50 mm < 32.40 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

$K_0 = $ $(1-\sin(30)) / (1+\sin(30))$

$K_p = $ $(1+\sin(30)) / (1-\sin(30))$

Geometry For Middle Bay Pole

$D_s = $ 0.6 mm   Pile Diameter

$L = $ 1700 mm   Pile embedment length

$f_1 = $ 2700 mm   Distance at which the shear force is applied

$f_2 = $ 0 mm   Distance of top soil at rest pressure

Loads

Moment Wind =   13.57 Kn-m

Shear Wind =   5.03 Kn

Pile Properties

Safety Factory   0.55

$H_u = $ 9.95 Kn   Ultimate Lateral Strength of the Pile, Short pile

$M_u = $ 16.43 Kn-m   Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.83 < 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(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 = 28.31 Kn

Uplift on one Pile = 25.36 Kn

Uplift is ok

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