



**Job No.:** Jason Campbell - 1**Address:** 66a Valley View Rd, Otaika, New Zealand**Date:** 04/04/2024**Latitude:** -35.785817**Longitude:** 174.293753**Elevation:** 31.5 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	2.0	Design Wind Speed	44.71 m/s
Wind Pressure	1.2 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 Pressures**

Shed Type = Mono Open

For roof  $C_{p,i} = -0.3$

For roof  $C_{p,e}$  from 0 m To 3.23 m  $C_{p,e} = -0.9$   $p_e = -0.97$  KPa  $p_{net} = -1.21$  KPa

For roof  $C_{p,e}$  from 3.23 m To 6.45 m  $C_{p,e} = -0.5$   $p_e = -0.54$  KPa  $p_{net} = -0.78$  KPa

For wall Windward  $C_{p,i} = -0.3$  side Wall  $C_{p,i} = -0.3$

For wall Windward and Leeward  $C_{p,e}$  from 0 m To 10 m  $C_{p,e} = 0.7$   $p_e = 0.76$  KPa  $p_{net} = 1.12$  KPa

For side wall  $C_{p,e}$  from 0 m To 3.23 m  $C_{p,e} =$   $p_e = -0.70$  KPa  $p_{net} = -0.70$  KPa

Maximum Upward pressure used in roof member Design = 1.21 KPa

Maximum Downward pressure used in roof member Design = 0.58 KPa

Maximum Wall pressure used in Design = 1.12 KPa

Maximum Racking pressure used in Design = 1.3 KPa

**Design Summary****Girt Design Front and Back**

Girt's Spacing = 1200 mm

Girt's Span = 2750 mm

Try Girt 190x45 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 = 0.98

K8 Upward = 0.60 S1 Downward = 12.23 S1 Upward = 21.37

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

**Capacity Checks**

$M_{Wind+Snow}$	1.27 Kn-m	Capacity	1.83 Kn-m	Passing Percentage	<b>144.09 %</b>
$V_{0.9D-WnUp}$	1.85 Kn	Capacity	13.75 Kn	Passing Percentage	<b>743.24 %</b>

**Deflections**

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

Deflection under Snow and Service Wind = 5.81 mm

Limit by Woolcock et al, 1999 Span/250 = 11.00 mm

Sag during installation = 4.28 mm

**Reactions**

Maximum = 1.85 kn

**Girt Design Sides**

Girt's Spacing = 1200 mm

Girt's Span = 2500 mm

Try Girt 190x45 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 =0.98

K8 Upward =0.65    S1 Downward =12.23    S1 Upward =20.38

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

#### Capacity Checks

$M_{Wind+Snow}$	1.05 Kn-m	Capacity	1.98 Kn-m	Passing Percentage	<b>188.57 %</b>
$V_{0.9D-WnUp}$	1.68 Kn	Capacity	13.75 Kn	Passing Percentage	<b>818.45 %</b>

#### Deflections

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

Deflection under Snow and Service Wind = 3.97 mm

Limit by Woolcock et al. 1999 Span/100 = 10.00 mm

Sag during installation =2.92 mm

#### Reactions

Maximum = 1.68 kn

#### Middle Pole Design

##### Geometry

200 SED H5 (Minimum 225 dia. at Floor Level)	Dry Use	Height	3200 mm
Area	35448 mm <sup>2</sup>	As	26585.7421875 mm <sup>2</sup>
Ix	100042702 mm <sup>4</sup>	Zx	941578 mm <sup>3</sup>
Iy	100042702 mm <sup>4</sup>	Zx	941578 mm <sup>3</sup>
Lateral Restraint	1300 mm c/c		

#### Loads

Total Area over Pole = 27.5 m<sup>2</sup>

Dead	6.88 Kn	Live	6.88 Kn
Wind Down	15.95 Kn	Snow	0.00 Kn
Moment wind	10.92 Kn-m		
Phi	0.8	K8	1.00
K1 snow	0.8	K1 Dead	0.6
K1 wind	1		

#### Material

Peeling	Steaming	Normal	Dry Use
f <sub>b</sub> =	36.3 MPa	f <sub>s</sub> =	2.96 MPa
f <sub>c</sub> =	18 MPa	f <sub>p</sub> =	7.2 MPa
f <sub>t</sub> =	22 MPa	E =	9257 MPa

#### Capacities

PhiNcx Wind	510.45 Kn	PhiMnx Wind	27.34 Kn-m	PhiVnx Wind	62.96 Kn
PhiNcx Dead	306.27 Kn	PhiMnx Dead	16.41 Kn-m	PhiVnx Dead	37.77 Kn

#### Checks

$(M_x/\Phi M_{nx}) + (N/\Phi N_{cx}) = 0.46 < 1$  OK

$(M_x/\Phi M_{nx})^2 + (N/\Phi N_{cx}) = 0.22 < 1$  OK

Deflection at top under service lateral loads = 18.56 mm < 21.33 mm

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

##### Assumed Soil Properties

Pole Shed App Ver 01 2022

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 =	1700 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 =	10.92 Kn-m
Shear Wind =	4.16 Kn

**Pile Properties**

Safety Factory	0.55	
Hu =	10.12 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	16.31 Kn-m	Ultimate Moment Capacity of Pile

**Checks**

Applied Forces/Capacities =  $0.67 < 1$  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 = Safety factor (0.55) x Density of Soil(18) x Height of Pile(1700) x Ks(1.5) x  $0.5 \times \tan(30)$  x Pi x Dia of Pile(0.6) x Height of Pile(1700)

Skin Friction = 23.34 Kn

Weight of Pile + Pile Skin Friction = 27.76 Kn

Uplift on one Pile = 27.09 Kn

Uplift is ok