



**Job No.:** GSH398a  
**Latitude:** -45.613129

**Address:** 24 Langlea Road, Ettrick 9572, New Zealand  
**Longitude:** 169.329188

**Date:** 13/04/2024  
**Elevation:** 102 m

### General Input

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N4	Ground Snow Load	0.9 KPa	Roof Snow Load	0.63 KPa
Earthquake Zone	1	Subsoil Category	D	Exposure Zone	B
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	3.5 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	39.61 m/s
Wind Pressure	0.94 KPa	Lee Zone	NO	Ultimate Snow ARI	50 Years
Wind Category	High	Earthquake ARI	100		

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  $C_{p,i} = 0.6663$

For roof  $C_{p,e}$  from 0 m To 3.75 m  $C_{p,e} = -0.9$   $p_e = -0.58$  KPa  $p_{net} = -1.09$  KPa

For roof  $C_{p,e}$  from 3.75 m To 7.50 m  $C_{p,e} = -0.5$   $p_e = -0.32$  KPa  $p_{net} = -0.383$  KPa

For wall Windward  $C_{p,i} = 0.6663$  side Wall  $C_{p,i} = -0.5875$

For wall Windward and Leeward  $C_{p,e}$  from 0 m To 14 m  $C_{p,e} = 0.7$   $p_e = 0.59$  KPa  $p_{net} = 1.19$  KPa

For side wall  $C_{p,e}$  from 0 m To 3.75 m  $C_{p,e} =$   $p_e = -0.55$  KPa  $p_{net} = -0.05$  KPa

Maximum Upward pressure used in roof member Design = 1.09 KPa

Maximum Downward pressure used in roof member Design = 0.77 KPa

Maximum Wall pressure used in Design = 1.19 KPa

Maximum Racking pressure used in Design = 1.01 KPa

### Design Summary

#### Girt Design Front and Back

Girt's Spacing = 900 mm

Girt's Span = 2500 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 = 0.86 S1 Downward = 9.63 S1 Upward = 16.05

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

#### Capacity Checks

$M_{Wind+Snow}$	0.84 Kn-m	Capacity	1.80 Kn-m	Passing Percentage	214.29 %
$V_{0.9D-WnUp}$	1.34 Kn	Capacity	12.06 Kn	Passing Percentage	900.00 %

#### Deflections

### Pole Shed App Ver 01 2022

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

Deflection under Snow and Service Wind = 8.84 mm

Limit by Woolcock et al, 1999 Span/100 = 25.00 mm

Sag during installation = 2.37 mm

#### Reactions

Maximum = 1.34 kn

#### Girt Design Sides

Girt's Spacing = 900 mm

Girt's Span = 2250 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 =0.89   S1 Downward =9.63   S1 Upward =15.23

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

#### Capacity Checks

$M_{Wind+Snow}$	0.68 Kn-m	Capacity	1.87 Kn-m	Passing Percentage	<b>275.00 %</b>
$V_{0.9D-WnUp}$	1.20 Kn	Capacity	12.06 Kn	Passing Percentage	<b>1005.00 %</b>

#### Deflections

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

Deflection under Snow and Service Wind = 5.80 mm

Limit by Woolcock et al. 1999 Span/100 = 22.50 mm

Sag during installation =1.55 mm

#### Reactions

Maximum = 1.20 kn

#### End Pole Design

##### Geometry For End Bay Pole

##### Geometry

150 SED H5 (Minimum 175 dia. at Floor Level)	Dry Use	Height	3200 mm
Area	20729 mm <sup>2</sup>	As	15546.6796875 mm <sup>2</sup>
I <sub>x</sub>	34210793 mm <sup>4</sup>	Z <sub>x</sub>	421056 mm <sup>3</sup>
I <sub>y</sub>	34210793 mm <sup>4</sup>	Z <sub>y</sub>	421056 mm <sup>3</sup>
Lateral Restraint	mm c/c		

#### Loads

Total Area over Pole = 11.25 m<sup>2</sup>

Dead	2.81 Kn	Live	2.81 Kn
Wind Down	8.66 Kn	Snow	7.09 Kn
Moment Wind	3.86 Kn-m	Moment snow	1.31 Kn-m
Phi	0.8	K <sub>8</sub>	0.69

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K1 snow	0.8	K1 Dead	0.6
K1 wind	1		

**Material**

Peeling	Steaming	Normal	Dry Use
$f_b =$	36.3 MPa	$f_s =$	2.96 MPa
$f_c =$	18 MPa	$f_p =$	7.2 MPa
$f_t =$	22 MPa	$E =$	9257 MPa

**Capacities**

PhiNcx Wind	204.58 Kn	PhiMnx Wind	8.38 Kn-m	PhiVnx Wind	36.81 Kn
PhiNcx Dead	122.75 Kn	PhiMnx Dead	5.03 Kn-m	PhiVnx Dead	22.09 Kn
PhiNcx Snow	163.67 Kn	PhiMnx Snow	6.70 Kn-m	PhiVnx Snow	29.45 Kn

**Checks**

$$(M_x/\Phi M_{nx}) + (N/\Phi N_{cx}) = 0.53 < 1 \text{ OK}$$

$$(M_x/\Phi M_{nx})^2 + (N/\Phi N_{cx}) = 0.28 < 1 \text{ OK}$$

$$\text{Deflection at top under service lateral loads} = 20.91 \text{ mm} < 34.91 \text{ mm}$$

$D_s =$	0.6 mm	Pile Diameter
$L =$	1300 mm	Pile embedment length
$f_l =$	2625 mm	Distance at which the shear force is applied
$f_2 =$	0 mm	Distance of top soil at rest pressure

**Loads**

$$\text{Total Area over Pole} = 11.25 \text{ m}^2$$

Moment Wind =	3.86 Kn-m	Moment Snow =	1.31 Kn-m
Shear Wind =	1.47 Kn	Shear Snow =	1.31 Kn

**Pile Properties**

Safety Factor	0.55	
$H_u =$	4.99 Kn	Ultimate Lateral Strength of the Pile, Short pile
$M_u =$	7.79 Kn-m	Ultimate Moment Capacity of Pile

**Checks**

$$\text{Applied Forces/Capacities} = 0.50 < 1 \text{ OK}$$

**Drained Lateral Strength of End pile in cohesionless soils Free Head short pile**

**Assumed Soil Properties**

Gamma	18 Kn/m <sup>3</sup>	Friction angle	30 deg	Cohesion	0 Kn/m <sup>3</sup>
$K_0 =$	$(1 - \sin(30)) / (1 + \sin(30))$				
$K_p =$	$(1 + \sin(30)) / (1 - \sin(30))$				

**Geometry For End Bay Pole**

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Ds =	0.6 mm	Pile Diameter
L =	1300 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 =	3.86 Kn-m	Moment Snow =	1.31 Kn-m
Shear Wind =	1.47 Kn	Shear Snow =	1.31 Kn

**Pile Properties**

Safety Factor	0.55	
Hu =	4.99 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	7.79 Kn-m	Ultimate Moment Capacity of Pile

**Checks**

Applied Forces/Capacities = 0.50 < 1 OK

**Uplift Check**

Density of Concrete = 24 Kn/m<sup>3</sup>

Density of Timber Pole = 5 Kn/m<sup>3</sup>

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(1400) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1400)

Skin Friction = 15.83 Kn

Weight of Pile + Pile Skin Friction = 19.92 Kn

Uplift on one Pile = 19.46 Kn

Uplift is ok