**Job No.:** Andrew Griffiths - 1 **Address:** 96 Jones Road, Grovetown, Blenheim 7273, New Zealand **Date:** 29/10/2024
**Latitude:** -41.495912 **Longitude:** 173.992544 **Elevation:** 2 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 | 3 | Subsoil Category | D | Exposure Zone | B |
| Importance Level | 1 | Ultimate wind & Earthquake ARI | 100 Years | Max Height | 4.2 m |
| Wind Region | NZ2 | Terrain Category | 1.0 | Design Wind Speed | 42.77 m/s |
| Wind Pressure | 1.1 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 Pressues

Shed Type = Gable Enclosed

For roof Cp,i = -0.3

For roof CP,e from 0 m To 5.6 m Cpe = -0.9 pe = -0.89 KPa pnet = -0.89 KPa

For roof CP,e from 5.6 m To 11.2 m Cpe = -0.5 pe = -0.49 KPa pnet = -0.49 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 10 m Cpe = 0.7 pe = 0.69 KPa pnet = 1.02 KPa

For side wall CP,e from 0 m To 5.6 m Cpe = pe = -0.64 KPa pnet = -0.64 KPa

Maximum Upward pressure used in roof member Design = 0.89 KPa

Maximum Downward pressure used in roof member Design = 0.43 KPa

Maximum Wall pressure used in Design = 1.02 KPa

Maximum Racking pressure used in Design = 1.18 KPa

## Design Summary

## Girt Design Front and Back

Girt's Spacing = 900 mm Girt's Span = 4500 mm Try Girt 200x50 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 =1.00

K8 Upward =0.78 S1 Downward =11.27 S1 Upward =17.82

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

#### Capacity Checks

| | | | | | |
|---|---|---|---|---|---|
| $M_{Wind+Snow}$ | 2.32 Kn-m | Capacity | 2.90 Kn-m | Passing Percentage | **125.00 %** |
| $V_{0.9D-WnUp}$ | 2.07 Kn | Capacity | 16.08 Kn | Passing Percentage | **776.81 %** |

#### Deflections

Second page

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

Deflection under Snow and Service Wind = 35.50 mm Limit by Woolcock et al, 1999 Span/100 = 45.00 mm
Sag during installation = 24.86 mm

#### Reactions

Maximum = 2.07 kn

### Girt Design Sides

Girt's Spacing = 1300 mm Girt's Span = 2500 mm Try Girt 200x50 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 =1.00

K8 Upward =0.73 S1 Downward =11.27 S1 Upward =18.79

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

#### Capacity Checks

| | | | | | |
|---|---|---|---|---|---|
| $M_{Wind+Snow}$ | 1.04 Kn-m | Capacity | 2.72 Kn-m | Passing Percentage | **261.54 %** |
| $V_{0.9D-WnUp}$ | 1.66 Kn | Capacity | 16.08 Kn | Passing Percentage | **968.67 %** |

#### Deflections

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

Deflection under Snow and Service Wind = 4.89 mm Limit by Woolcock et al. 1999 Span/100 = 25.00 mm
Sag during installation =2.37 mm

#### Reactions

Maximum = 1.66 kn

### Middle Pole Design

#### Geometry

| | | | |
|---|---|---|---|
| 300 SED H5 (Minimum 325 dia. at Floor Level) | Dry Use | Height | 3800 mm |
| Area | 15625 mm2 | As | 11718.75 mm2 |
| Ix | 127156576 mm4 | Zx | 813802 mm3 |
| Iy | 127156576 mm4 | Zx | 813802 mm3 |
| Lateral Restraint | 3800 mm c/c | | |

#### Loads

Total Area over Pole = 22.5 m2

| | | | |
|---|---|---|---|
| Dead | 5.63 Kn | Live | 5.63 Kn |
| Wind Down | 9.68 Kn | Snow | 14.18 Kn |
| Moment wind | 17.52 Kn-m | Moment snow | 4.24 Kn-m |
| Phi | 0.8 | K8 | 0.98 |
| 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 | 221.03 Kn | PhiMnx Wind | 23.22 Kn-m | PhiVnx Wind | 27.75 Kn |
| PhiNcx Dead | 132.62 Kn | PhiMnx Dead | 13.93 Kn-m | PhiVnx Dead | 16.65 Kn |
| PhiNcx Snow | 176.83 Kn | PhiMnx Snow | 18.57 Kn-m | PhiVnx Snow | 22.20 Kn |

**Checks**

(Mx/PhiMnx)+(N/phiNcx) = 0.89 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.70 < 1 OK

Deflection at top under service lateral loads = 33.38 mm < 38.00 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 = | 1800 mm | Pile embedment length |
| f1 = | 3150 mm | Distance at which the shear force is applied |
| f2 = | 0 mm | Distance of top soil at rest pressure |

**Loads**

| | | | |
|---|---|---|---|
| Moment Wind = | 17.52 Kn-m | Moment Snow = | Kn-m |
| Shear Wind = | 5.56 Kn | Shear Snow = | 4.24 Kn |

**Pile Properties**

| | | |
|---|---|---|
| Safety Factory | 0.55 | |
| Hu = | 10.50 Kn | Ultimate Lateral Strength of the Pile, Short pile |
| Mu = | 19.98 Kn-m | Ultimate Moment Capacity of Pile |

**Checks**

Applied Forces/Capacities = 0.88 < 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(1800) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1800)

Skin Friction = 26.17 Kn

Weight of Pile + Pile Skin Friction = 28.89 Kn

Uplift on one Pile = 14.96 Kn

Uplift is ok