

Pole Shed App Ver 01 2022

Job No.: 2502034 - 1

Address: 659 Long Plain Road, Tākaka 7183, New Zealand

Date: 02/04/2025

Latitude: -40.910046

Longitude: 172.762292

Elevation: 93.5 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 | 2 | Subsoil Category | D | Exposure Zone | B |
| Importance Level | 1 | Ultimate wind & Earthquake ARI | 100 Years | Max Height | 4.7 m |
| Wind Region | NZ2 | Terrain Category | 2.0 | Design Wind Speed | 38.22 m/s |
| Wind Pressure | 0.88 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 = Gable Enclosed

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

For roof $C_{p,e}$ from 0 m To 4.05 m $C_{p,e} = -0.9$ $p_e = -0.71$ KPa $p_{net} = -0.71$ KPa

For roof $C_{p,e}$ from 4.05 m To 8.10 m $C_{p,e} = -0.5$ $p_e = -0.39$ KPa $p_{net} = -0.39$ 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 13.5 m $C_{p,e} = 0.7$ $p_e = 0.55$ KPa $p_{net} = 0.81$ KPa

For side wall $C_{p,e}$ from 0 m To 4.05 m $C_{p,e} =$ $p_e = -0.51$ KPa $p_{net} = -0.51$ KPa

Maximum Upward pressure used in roof member Design = 0.71 KPa

Maximum Downward pressure used in roof member Design = 0.42 KPa

Maximum Wall pressure used in Design = 0.81 KPa

Maximum Racking pressure used in Design = 0.79 KPa

Design Summary

Girt Design Front and Back

Girt's Spacing = 0 mm

Girt's Span = 2250 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)

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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 = 22.50 mm

Sag during installation = NaN mm

Reactions

Maximum = 0.00 kn

Girt Design Sides

Girt's Spacing = 0 mm

Girt's Span = 3000 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 = 30.00 mm

Sag during installation =NaN mm

Reactions

Maximum = 0.00 kn

Middle Pole Design

Geometry

| | | | |
|--|---------------------------|--------|-------------------------------|
| 200 SED H5 (Minimum 225 dia. at Floor Level) | Dry Use | Height | 4340 mm |
| Area | 35448 mm ² | As | 26585.7421875 mm ² |
| Ix | 100042702 mm ⁴ | Zx | 941578 mm ³ |
| Iy | 100042702 mm ⁴ | Zx | 941578 mm ³ |
| Lateral Restraint | 4340 mm c/c | | |

Loads

Total Area over Pole = 27.0000000000675 m²

| | | | |
|-------------|------------|---------|---------|
| Dead | 6.75 Kn | Live | 6.75 Kn |
| Wind Down | 11.34 Kn | Snow | 0.00 Kn |
| Moment wind | 12.59 Kn-m | | |
| Phi | 0.8 | K8 | 0.65 |
| K1 snow | 0.8 | K1 Dead | 0.6 |
| K1 wind | 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 | 331.45 Kn | PhiMnx Wind | 17.76 Kn-m | PhiVnx Wind | 62.96 Kn |
| PhiNcx Dead | 198.87 Kn | PhiMnx Dead | 10.65 Kn-m | PhiVnx Dead | 37.77 Kn |

Checks

$(M_x/\Phi M_{nx}) + (N/\Phi N_{cx}) = 0.78 < 1$ OK

$(M_x/\Phi M_{nx})^2 + (N/\Phi N_{cx}) = 0.58 < 1$ OK

Deflection at top under service lateral loads = 38.96 mm < 43.40 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
K₀ = $(1 - \sin(30)) / (1 + \sin(30))$
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
f₁ = 3525 mm Distance at which the shear force is applied
f₂ = 0 mm Distance of top soil at rest pressure

Loads

Moment Wind = 12.59 Kn-m
Shear Wind = 3.57 Kn

Pile Properties

Safety Factory 0.55
Hu = 8.38 Kn Ultimate Lateral Strength of the Pile, Short pile
Mu = 17.52 Kn-m Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.72 < 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

K_s (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 K_s(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 = 27.76 Kn

Uplift on one Pile = 13.10 Kn

Uplift is ok