



Pole Shed App Ver 01 2022

**Job No.:** J Vanek - 2  
**Latitude:** -41.076688

**Address:** 38 Wilkie St, Greytown, New Zealand  
**Longitude:** 175.440854

**Date:** 3/2/2025  
**Elevation:** 65.5 m

**General Input**

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N1	Ground Snow Load	0 KPa	Roof Snow Load	0 KPa
Earthquake Zone	3	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	2.61	Design Wind Speed	37.66 m/s
Wind Pressure	0.85 KPa	Lee Zone	YES	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  $C_{p,i} = 0.6714$

For roof  $C_{p,e}$  from 0 m To 3.0 m  $C_{p,e} = -0.9103$   $p_e = -0.26$  KPa  $p_{net} = -0.78$  KPa

For roof  $C_{p,e}$  from 3.0 m To 6.0 m  $C_{p,e} = -0.529$   $p_e = -0.34$  KPa  $p_{net} = -0.86$  KPa

For wall Windward  $C_{p,i} = 0.6714$  side Wall  $C_{p,i} = -0.5969$

For wall Windward and Leeward  $C_{p,e}$  from 0 m To 13.50 m  $C_{p,e} = 0.7$   $p_e = 0.54$  KPa  $p_{net} = 1.09$  KPa

For side wall  $C_{p,e}$  from 0 m To 3.50 m  $C_{p,e} =$   $p_e = -0.50$  KPa  $p_{net} = 0.05$  KPa

Maximum Upward pressure used in roof member Design = 1.10 KPa

Maximum Downward pressure used in roof member Design = 0.70 KPa

Maximum Wall pressure used in Design = 1.09 KPa

Maximum Racking pressure used in Design = 0.77 KPa

**Design Summary**

**Purlin Design**

Purlin Spacing = 800 mm

Purlin Span = 3450 mm

Try Purlin 150x50 SG8 Dry

Moisture Condition = Dry (Moisture in timber is less than 16% and 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 = 0.73    S1 Downward = 9.63    S1 Upward = 18.72

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

#### **Capacity Checks**

M <sub>1.35D</sub>	0.4 Kn-m	Capacity	1.26 Kn-m	Passing Percentage	<b>315.00 %</b>
M <sub>1.2D+1.5L 1.2D+Sn 1.2D+WnDn</sub>	1.31 Kn-m	Capacity	1.68 Kn-m	Passing Percentage	<b>128.24 %</b>
M <sub>0.9D-WnUp</sub>	-1.04 Kn-m	Capacity	-1.54 Kn-m	Passing Percentage	<b>51.51 %</b>
V <sub>1.35D</sub>	0.47 Kn	Capacity	7.24 Kn	Passing Percentage	<b>1540.43 %</b>
V <sub>1.2D+1.5L 1.2D+Sn 1.2D+WnDn</sub>	1.38 Kn	Capacity	9.65 Kn	Passing Percentage	<b>699.28 %</b>
V <sub>0.9D-WnUp</sub>	-1.21 Kn	Capacity	-12.06 Kn	Passing Percentage	<b>996.69 %</b>

#### **Deflections**

Modulus of Elasticity = 6700 MPa NZS3603 Amt 4, Table 2.3 considering at least 4 members acting together

k<sub>2</sub> for Long Term Loads = 2

Deflection under Dead and Live Load = 8.86 mm    Limit by Woolcock et al, 1999 Span/240 = 14.17 mm

Deflection under Dead and Service Wind = 12.56 mm    Limit by Woolcock et al, 1999 Span/100 = 34.00 mm

#### **Reactions**

Maximum downward = 1.38 kn    Maximum upward = -1.21 kn

Number of Blocking = 0    if 0 then no blocking required, if 1 then one midspan blocking required

#### **Rafter Design Internal**

Internal Rafter Load Width = 3600 mm    Internal Rafter Span = 5850 mm    Try Rafter 2x240x45 LVL13

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    K1 Medium term = 0.8    K1 Long term = 0.6    K4 = 1    K5 = 1    K8 Downward = 1.00

K8 Upward = 1.00    S1 Downward = 6.71    S1 Upward = 6.71

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

#### **Capacity Checks**

M <sub>1.35D</sub>	5.20 Kn-m	Capacity	19.9 Kn-m	Passing Percentage	<b>382.69 %</b>
M <sub>1.2D+1.5L 1.2D+Sn 1.2D+WnDn</sub>	15.40 Kn-m	Capacity	26.54 Kn-m	Passing Percentage	<b>172.34 %</b>

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M <sub>0.9D-WnUp</sub>	-13.48 Kn-m	Capacity	-33.18 Kn-m	Passing Percentage	<b>246.14 %</b>
V <sub>1.35D</sub>	3.55 Kn	Capacity	36.82 Kn	Passing Percentage	<b>1037.18 %</b>
V <sub>1.2D+1.5L 1.2D+Sn 1.2D+WnDn</sub>	10.53 Kn	Capacity	49.08 Kn	Passing Percentage	<b>466.10 %</b>
V <sub>0.9D-WnUp</sub>	-9.21 Kn	Capacity	-61.36 Kn	Passing Percentage	<b>666.23 %</b>

**Deflections**

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

k<sub>2</sub> for Long Term Loads = 2

Deflection under Dead and Live Load = 14.38 mm      Limit by Woolcock et al, 1999 Span/240 = 25.00 mm

Deflection under Dead and Service Wind = 22.64 mm      Limit by Woolcock et al, 1999 Span/100 = 60.00 mm

**Reactions**

Maximum downward = 10.53 kn    Maximum upward = -9.21 kn

**Rafter to Pole Connection check**

Bolt Size = M12 Number of Bolts = 2

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 = 60 mm

Factor of Safety = 0.7

For Perpendicular to grain loading

K<sub>11</sub> = 12.6 fpj = 22.7 Mpa for Rafter with effective thickness = 90 mm

For Parallel to grain loading

K<sub>11</sub> = 2.0 fcj = 36.1 Mpa for Pole with effective thickness = 100 mm

Capacity under short term loads = 29.11 Kn > -9.21 Kn

**Girt Design Front and Back**

Girt's Spacing = 0 mm

Girt's Span = 1800 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)

K<sub>1</sub> Short term = 1    K<sub>4</sub> = 1    K<sub>5</sub> = 1    K<sub>8</sub> Downward = NaN

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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 <sub>Wind+Snow</sub>	0.00 Kn-m	Capacity	NaN Kn-m	Passing Percentage	NaN %
V <sub>0.9D-WnUp</sub>	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 = 18.00 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 <sub>Wind+Snow</sub>	0.00 Kn-m	Capacity	NaN Kn-m	Passing Percentage	NaN %
V <sub>0.9D-WnUp</sub>	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

175 SED H5 (Minimum 200 dia. at Floor Level)	Dry Use	Height	3500 mm
Area	27598 mm <sup>2</sup>	As	20698.2421875 mm <sup>2</sup>
Ix	60639381 mm <sup>4</sup>	Zx	646820 mm <sup>3</sup>
Iy	60639381 mm <sup>4</sup>	Zx	646820 mm <sup>3</sup>
Lateral Restraint	1300 mm c/c		

### Loads

Total Area over Pole = 10.8 m<sup>2</sup>

Dead	2.70 Kn	Live	2.70 Kn
Wind Down	7.56 Kn	Snow	0.00 Kn
Moment wind	6.35 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
fb =	36.3 MPa	fs =	2.96 MPa
fc =	18 MPa	fp =	7.2 MPa
ft =	22 MPa	E =	9257 MPa

### Capacities

PhiNcx Wind	397.41 Kn	PhiMnx Wind	18.78 Kn-m	PhiVnx Wind	49.01 Kn
PhiNcx Dead	238.44 Kn	PhiMnx Dead	11.27 Kn-m	PhiVnx Dead	29.41 Kn

### Checks

$$(M_x/\Phi M_{nx}) + (N/\Phi N_{cx}) = 0.37 < 1 \text{ OK}$$

$$(M_x/\Phi M_{nx})^2 + (N/\Phi N_{cx}) = 0.15 < 1 \text{ OK}$$

$$\text{Deflection at top under service lateral loads} = 19.47 \text{ mm} < 35.00 \text{ mm}$$

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

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### Assumed Soil Properties

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

### Geometry For Middle Bay Pole

D<sub>s</sub> = 0.6 mm Pile Diameter  
L = 1500 mm Pile embedment length  
f<sub>1</sub> = 2625 mm Distance at which the shear force is applied  
f<sub>2</sub> = 0 mm Distance of top soil at rest pressure

### Loads

Moment Wind = 6.35 Kn-m  
Shear Wind = 2.42 Kn

### Pile Properties

Safety Factory 0.55  
H<sub>u</sub> = 7.29 Kn Ultimate Lateral Strength of the Pile, Short pile  
M<sub>u</sub> = 11.57 Kn-m Ultimate Moment Capacity of Pile

### Checks

Applied Forces/Capacities = 0.55 < 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

K<sub>s</sub> (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(1500) x K<sub>s</sub>(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1500)

Skin Friction = 18.17 Kn

Weight of Pile + Pile Skin Friction = 22.56 Kn

Uplift on one Pile = 9.45 Kn

Uplift is ok