

Job No.: 2409013
Latitude: -41.191323

Address: 106 Harley Ridge, Tasman, New Zealand
Longitude: 173.029599

Date: 27/09/2024
Elevation: 80 m

General Input

Roof Live Load	0.25 KPa	Roof Dead Load	0.25 KPa	Roof Live Point Load	1.1 Kn
Snow Zone	N3	Ground Snow Load	0 KPa	Roof Snow Load	0 KPa
Earthquake Zone	2	Subsoil Category	D	Exposure Zone	C
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	3.2 m
Wind Region	NZ2	Terrain Category	2.72	Design Wind Speed	44.79 m/s
Wind Pressure	1.2 KPa	Lee Zone	NO	Ultimate Snow ARI	50 Years
Wind Category	Very 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 Enclosed

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

For roof $C_{p,e}$ from 0 m To 2.95 m $C_{p,e} = -0.9$ $p_e = -0.90$ KPa $p_{net} = -0.90$ KPa

For roof $C_{p,e}$ from 2.95 m To 5.90 m $C_{p,e} = -0.5$ $p_e = -0.50$ KPa $p_{net} = -0.50$ 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 8 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 2.95 m $C_{p,e} =$ $p_e = -0.70$ KPa $p_{net} = -0.70$ KPa

Maximum Upward pressure used in roof member Design = 0.97 KPa

Maximum Downward pressure used in roof member Design = 0.47 KPa

Maximum Wall pressure used in Design = 1.12 KPa

Maximum Racking pressure used in Design = 1.20 KPa

Design Summary

Purlin Design

Purlin Spacing = 900 mm

Purlin Span = 3850 mm

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

K8 Upward = 0.53 S1 Downward = 11.27 S1 Upward = 23.16

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

Capacity Checks

M _{1.35D}	0.56 Kn-m	Capacity	2.23 Kn-m	Passing Percentage	398.21 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_{nDn}}	1.56 Kn-m	Capacity	2.97 Kn-m	Passing Percentage	190.38 %
M _{0.9D-W_{nUp}}	-1.24 Kn-m	Capacity	-1.96 Kn-m	Passing Percentage	158.06 %
V _{1.35D}	0.58 Kn	Capacity	9.65 Kn	Passing Percentage	1663.79 %

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$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	1.33 Kn	Capacity	12.86 Kn	Passing Percentage	966.92 %
$V_{0.9D-WnUp}$	-1.29 Kn	Capacity	-16.08 Kn	Passing Percentage	1246.51 %

Deflections

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

k_2 for Long Term Loads = 2

Deflection under Dead and Live Load = 6.56 mm Limit by Woolcock et al, 1999 Span/240 = 15.83 mm

Deflection under Dead and Service Wind = 8.04 mm Limit by Woolcock et al, 1999 Span/100 = 38.00 mm

Reactions

Maximum downward = 1.33 kn Maximum upward = -1.29 kn

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

Intermediate Design Front and Back

Intermediate Spacing = 2000 mm Intermediate Span = 2549 mm Try Intermediate 2x150x50 SG8 Dry

Moisture Condition = Dry (Moisture in timber is less than 16% and does not remain in continuous wet condition after installation)

K_1 Short term = 1 $K_4 = 1$ $K_5 = 1$ K_8 Downward = 1.00

K_8 Upward = 1.00 S_1 Downward = 9.63 S_1 Upward = 0.51

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

Capacity Checks

$M_{Wind+Snow}$	1.82 Kn-m	Capacity	4.2 Kn-m	Passing Percentage	230.77 %
$V_{0.9D-WnUp}$	2.86 Kn	Capacity	-24.12 Kn	Passing Percentage	843.36 %

Deflections

Modulus of Elasticity = 5400 MPa NZS3603 Amt 4, Table 2.3

Deflection under Snow and Service Wind = 8.115 mm Limit by Woolcock et al, 1999 Span/100 = 25.49 mm

Reactions

Maximum = 2.86 kn

Girt Design Front and Back

Girt's Spacing = 1300 mm Girt's Span = 2000 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)

K_1 Short term = 1 $K_4 = 1$ $K_5 = 1$ K_8 Downward = 1.00

K_8 Upward = 0.92 S_1 Downward = 9.63 S_1 Upward = 14.36

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

Capacity Checks

$M_{Wind+Snow}$	Capacity
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	0.73 Kn-m		1.94 Kn-m	Passing Percentage	265.75 %
V _{0.9D-WnUp}	1.46 Kn	Capacity	12.06 Kn	Passing Percentage	826.03 %

Deflections

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

Deflection under Snow and Service Wind = 3.22 mm Limit by Woolcock et al, 1999 Span/100 = 20.00 mm
Sag during installation = 0.97 mm

Reactions

Maximum = 1.46 kn

Girt Design Sides

Girt's Spacing = 1300 mm Girt's Span = 2710 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 =0.83 S1 Downward =9.63 S1 Upward =16.72

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

Capacity Checks

M _{Wind+Snow}	1.34 Kn-m	Capacity	1.74 Kn-m	Passing Percentage	129.85 %
V _{0.9D-WnUp}	1.97 Kn	Capacity	12.06 Kn	Passing Percentage	612.18 %

Deflections

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

Deflection under Snow and Service Wind = 10.85 mm Limit by Woolcock et al. 1999 Span/100 = 27.10 mm
Sag during installation =3.27 mm

Reactions

Maximum = 1.97 kn

Middle Pole Design

Geometry

150 SED H5 (Minimum 175 dia. at Floor Level)	Dry Use	Height	2950 mm
Area	20729 mm ²	As	15546.6796875 mm ²
I _x	34210793 mm ⁴	Z _x	421056 mm ³
I _y	34210793 mm ⁴	Z _y	421056 mm ³
Lateral Restraint	3400 mm c/c		

Loads

Total Area over Pole = 14 m²

Dead	3.50 Kn	Live	3.50 Kn
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Wind Down	6.58 Kn	Snow	0.00 Kn
Moment wind	6.13 Kn-m		
Phi	0.8	K8	0.63
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	186.64 Kn	PhiMnx Wind	7.65 Kn-m	PhiVnx Wind	36.81 Kn
PhiNcx Dead	111.98 Kn	PhiMnx Dead	4.59 Kn-m	PhiVnx Dead	22.09 Kn

Checks

$(M_x/\Phi M_{nx}) + (N/\Phi N_{cx}) = 0.87 < 1$ OK

$(M_x/\Phi M_{nx})^2 + (N/\Phi N_{cx}) = 0.72 < 1$ OK

Deflection at top under service lateral loads = 25.67 mm < 29.50 mm

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

Assumed Soil Properties

Gamma	18 Kn/m ³	Friction angle	30 deg	Cohesion	0 Kn/m ³
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 =	1300 mm	Pile embedment length
f1 =	2400 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	6.13 Kn-m
Shear Wind =	2.55 Kn

Pile Properties

Safety Factory	0.55	
Hu =	5.29 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	7.63 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.80 < 1 OK

End Pole Design

Geometry For End Bay Pole

Geometry

150 SED H5 (Minimum 175 dia. at Floor Level)	Dry Use	Height	2950 mm
Area	20729 mm ²	As	15546.6796875 mm ²
Ix	34210793 mm ⁴	Zx	421056 mm ³
Iy	34210793 mm ⁴	Zy	421056 mm ³
Lateral Restraint	mm c/c		

Loads

Total Area over Pole = 5.420054200542005 m²

Dead	1.36 Kn	Live	1.36 Kn
Wind Down	2.55 Kn	Snow	0.00 Kn
Moment Wind	2.57 Kn-m		
Phi	0.8	K8	0.76
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	227.10 Kn	PhiMnx Wind	9.30 Kn-m	PhiVnx Wind	36.81 Kn
PhiNcx Dead	136.26 Kn	PhiMnx Dead	5.58 Kn-m	PhiVnx Dead	22.09 Kn

Checks

$(M_x/\Phi M_{nx}) + (N/\Phi N_{cx}) = 0.30 < 1$ OK

$(M_x/\Phi M_{nx})^2 + (N/\Phi N_{cx}) = 0.10 < 1$ OK

Deflection at top under service lateral loads = 11.63 mm < 31.92 mm

Ds =	0.6 mm	Pile Diameter
L =	1300 mm	Pile embedment length
f1 =	2400 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Total Area over Pole = 5.420054200542005 m²

Moment Wind =	2.57 Kn-m
Shear Wind =	1.07 Kn

Pile Properties

Safety Factory	0.55	
Hu =	5.29 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	7.63 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.34 < 1 OK

Drained Lateral Strength of End 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 End Bay Pole

Ds =	0.6 mm	Pile Diameter
L =	1300 mm	Pile embedment length
f1 =	2400 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	2.57 Kn-m
Shear Wind =	1.07 Kn

Pile Properties

Safety Factory	0.55	
Hu =	5.29 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	7.63 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.34 < 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 (1300) x Ks (1.5) x 0.5 x tan(30) x Pi x Dia of Pile (0.6) x Height of Pile (1300)

Skin Friction = 13.65 Kn

Weight of Pile + Pile Skin Friction = 17.91 Kn

Uplift on one Pile = 10.43 Kn

Uplift is ok