

Job No.: Hyslop Homes - 2 **Address:** 546 Masterton Castlepoint Rd, Masreton, New Zealand **Date:** 30/01/2024
Latitude: -40.965323 **Longitude:** 175.757523 **Elevation:** 139 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	4.7 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	38.93 m/s
Wind Pressure	0.91 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 4.70 m $C_{p,e} = -0.9$ $p_e = -0.73$ KPa $p_{net} = -0.73$ KPa

For roof $C_{p,e}$ from 4.70 m To 9.40 m $C_{p,e} = -0.5$ $p_e = -0.41$ KPa $p_{net} = -0.41$ 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 16.40 m $C_{p,e} = 0.7$ $p_e = 0.57$ KPa $p_{net} = 0.84$ KPa

For side wall $C_{p,e}$ from 0 m To 4.70 m $C_{p,e} =$ $p_e = -0.53$ KPa $p_{net} = -0.53$ KPa

Maximum Upward pressure used in roof member Design = 0.73 KPa

Maximum Downward pressure used in roof member Design = 0.43 KPa

Maximum Wall pressure used in Design = 0.84 KPa

Maximum Racking pressure used in Design = 0.82 KPa

Design Summary

Purlin Design

Purlin Spacing = 750 mm Purlin Span = 5950 mm Try Purlin 240x45 SG8

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 = 0.94

K8 Upward = 0.46 S1 Downward = 13.82 S1 Upward = 25.02

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

Capacity Checks

$M_{1.35D}$	1.12 Kn-m	Capacity	2.73 Kn-m	Passing Percentage	243.75 %
$M_{1.2D+1.5L\ 1.2D+S_n\ 1.2D+W_nDn}$	2.63 Kn-m	Capacity	3.64 Kn-m	Passing Percentage	138.40 %
$M_{0.9D-W_nUp}$	-1.68 Kn-m	Capacity	-2.23 Kn-m	Passing Percentage	132.74 %

Pole Shed App Ver 01 2022

V _{1.35D}	0.75 Kn	Capacity	10.42 Kn	Passing Percentage	1389.33 %
V _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	1.63 Kn	Capacity	13.89 Kn	Passing Percentage	852.15 %
V _{0.9D-W_nUp}	-1.13 Kn	Capacity	-17.37 Kn	Passing Percentage	1537.17 %

Deflections

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

k₂ for Long Term Loads = 2

Deflection under Dead and Live Load = 20.44 mm

Limit by Woolcock et al, 1999 Span/240 = 24.58 mm

Deflection under Dead and Service Wind = 24.36 mm

Limit by Woolcock et al, 1999 Span/100 = 59.00 mm

Reactions

Maximum downward = 1.63 kn Maximum upward = -1.13 kn

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

Rafter Design Internal

Internal Rafter Load Width = 5150 mm

Internal Rafter Span = 7850 mm

Try Rafter 2x360x45 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 = 8.40 S₁ Upward = 8.40

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

Capacity Checks

M _{1.35D}	13.39 Kn-m	Capacity	43.44 Kn-m	Passing Percentage	324.42 %
M _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	28.96 Kn-m	Capacity	57.92 Kn-m	Passing Percentage	200.00 %
M _{0.9D-W_nUp}	-20.03 Kn-m	Capacity	-72.42 Kn-m	Passing Percentage	361.56 %
V _{1.35D}	6.82 Kn	Capacity	55.22 Kn	Passing Percentage	809.68 %
V _{1.2D+1.5L 1.2D+S_n 1.2D+W_nD_n}	14.76 Kn	Capacity	73.64 Kn	Passing Percentage	498.92 %
V _{0.9D-W_nUp}	-10.21 Kn	Capacity	-92.04 Kn	Passing Percentage	901.47 %

Deflections

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

k₂ for Long Term Loads = 2

Deflection under Dead and Live Load = 19.265 mm

Limit by Woolcock et al, 1999 Span/240 = 33.33 mm

Deflection under Dead and Service Wind = 25.51 mm

Limit by Woolcock et al, 1999 Span/100 = 80.00 mm

Reactions

Maximum downward = 14.76 kn Maximum upward = -10.21 kn

Rafter to Pole Connection check

Bolt Size = M12 Number of Bolts = 3

Calculations as per NZS 3603:1993 Amend 2005 clause 4.4

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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

K11 = 12.6 f_{ij} = 22.7 Mpa for Rafter with effective thickness = 90 mm

For Parallel to grain loading

K11 = 2.0 f_{cj} = 36.1 Mpa for Pole with effective thickness = 100 mm

Capacity under short term loads = 43.67 Kn > -10.21 Kn

Intermediate Design Front and Back

Intermediate Spacing = 3050 mm

Intermediate Span = 2393 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)

K1 Short term = 1 K4 = 1 K5 = 1 K8 Downward = 1.00

K8 Upward = 1.00 S1 Downward = 9.63 S1 Upward = 0.50

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

Capacity Checks

M _{Wind+Snow}	1.83 Kn-m	Capacity	4.2 Kn-m	Passing Percentage	229.51 %
V _{0.9D-WnUp}	3.07 Kn-m	Capacity	-24.12 Kn-m	Passing Percentage	785.67 %

Deflections

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

Deflection under Snow and Service Wind = 7.205 mm

Limit by Woolcock et al, 1999 Span/100 = 23.93 mm

Reactions

Maximum = 3.07 kn

Girt Design Front and Back

Girt's Spacing = 1200 mm

Girt's Span = 3050 mm

Try Girt 140x45 SG8

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 = 0.72 S1 Downward = 10.36 S1 Upward = 19.08

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

Capacity Checks

M _{Wind+Snow}	1.17 Kn-m	Capacity	1.18 Kn-m	Passing Percentage	100.85 %
V _{0.9D-WnUp}	1.54 Kn-m	Capacity	10.13 Kn-m	Passing Percentage	657.79 %

Deflections

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

Deflection under Snow and Service Wind = 16.47 mm

Limit by Woolcock et al, 1999 Span/100 = 30.50 mm

Sag during installation = 6.48 mm

Reactions

Maximum = 1.54 kn

Girt Design Sides

Girt's Spacing = 800 mm

Girt's Span = 4025 mm

Try Girt 140x45 SG8

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 =0.88 S1 Downward =10.36 S1 Upward =15.50

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

Capacity Checks

$M_{Wind+Snow}$	1.36 Kn-m	Capacity	1.45 Kn-m	Passing Percentage	106.62 %
$V_{0.9D-WnUp}$	1.35 Kn-m	Capacity	10.13 Kn-m	Passing Percentage	750.37 %

Deflections

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

Deflection under Snow and Service Wind = 33.31 mm

Limit by Woolcock et al. 1999 Span/100 = 40.25 mm

Sag during installation =19.65 mm

Reactions

Maximum = 1.35 kn

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

Skin Friction = 15.83 Kn

Weight of Pile + Pile Skin Friction = 19.47 Kn

Uplift on one Pile = 20.81 Kn

Uplift is ok