Job No.: Jason Hiku - 1   **Address:** 29.. Old Highway, Whakamarama, New Zealand   **Date:** 10/30/2023

Latitude: -37.658231   **Longitude:** 175.99912   **Elevation:** 33 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	1	Subsoil Category	D	Exposure Zone	C
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	4.2 m
Wind Region	NZ1	Terrain Category	2.5	Design Wind Speed	41 m/s
Wind Pressure	1.01 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 = Mono   Open

For roof $C_{p,i}$ = 0.6615

For roof $C_{P,e}$ from 0 m To 3.6 m C_{pe} = -0.9   pe = -0.71 KPa   pnet = -1.34 KPa

For roof $C_{P,e}$ from 3.60 m To 7.20 m C_{pe} = -0.5   pe = -0.39 KPa   pnet = -1.02 KPa

For wall Windward $C_{p,i}$ = 0.6615   side Wall $C_{p,i}$ = -0.5784

For wall Windward and Leeward $C_{P,e}$ from 0 m To 10.0 m C_{pe} = 0.7   pe = 0.58 KPa   pnet = 1.08 KPa

For side wall $C_{P,e}$ from 0 m To 3.6 m C_{pe} =   pe = -0.54 KPa   pnet = -0.04 KPa

Maximum Upward pressure used in roof member Design = 1.34 KPa

Maximum Downward pressure used in roof member Design = 0.62 KPa

Maximum Wall pressure used in Design = 1.08 KPa

Maximum Racking pressure used in Design = 1.0 KPa

Design Summary

Purlin Design

Purlin Spacing = 900 mm   Purlin Span = 3850 mm   Try Purlin 200x50 SG8 Dry

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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 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	1.56 Kn-m	Capacity	2.97 Kn-m	Passing Percentage	**190.38 %**
$M_{0.9D-WnUp}$	-1.86 Kn-m	Capacity	-1.96 Kn-m	Passing Percentage	**105.38 %**
$V_{1.35D}$	0.58 Kn	Capacity	9.65 Kn	Passing Percentage	**1663.79 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	1.59 Kn	Capacity	12.86 Kn	Passing Percentage	**808.81 %**
$V_{0.9D-WnUp}$	-1.93 Kn	Capacity	-16.08 Kn	Passing Percentage	**833.16 %**

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 = 6.56 mm   Limit by Woolcock et al, 1999 Span/240 = 15.83 mm
Deflection under Dead and Service Wind = 8.86 mm   Limit by Woolcock et al, 1999 Span/100 = 38.00 mm

Reactions

Maximum downward =1.59 kn   Maximum upward = -1.93 kn

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

Rafter Design External

External Rafter Load Width = 2000 mm   External Rafter Span = 5318 mm   Try Rafter 300x50 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 =0.94

K8 Upward =0.94   S1 Downward =13.93   S1 Upward =13.93

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

Capacity Checks

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$M_{1.35D}$	2.39 Kn-m	Capacity	4.72 Kn-m	Passing Percentage	**197.49 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	6.50 Kn-m	Capacity	6.30 Kn-m	Passing Percentage	**96.92 %**
$M_{0.9D-WnUp}$	-7.88 Kn-m	Capacity	-7.87 Kn-m	Passing Percentage	**99.87 %**
$V_{1.35D}$	1.79 Kn	Capacity	14.47 Kn	Passing Percentage	**808.38 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	4.89 Kn	Capacity	19.30 Kn	Passing Percentage	**394.68 %**
$V_{0.9D-WnUp}$	-5.93 Kn	Capacity	-24.12 Kn	Passing Percentage	**406.75 %**

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 11.77 mm   Limit by Woolcock et al, 1999 Span/240= 22.92 mm

Deflection under Dead and Service Wind = 15.89 mm   Limit by Woolcock et al, 1999 Span/100 = 55.00 mm

Reactions

Maximum downward =4.89 kn   Maximum upward = -5.93 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 =J5 Joint Group for Pole = J5

Factor of Safety = 0.7

For Perpendicular to grain loading

K11 = 14.9 fpj = 12.9 Mpa for Rafter with effective thickness = 50 mm

For Parallel to grain loading

K11 = 2.0 fcj = 36.1 Mpa for Pole with effective thickness = 100 mm

Eccentric Load check

V = phi x k1 x k4 x k5 x fs x b x ds .... (Eq 4.12) = -25.20 kn > -5.93 Kn

Single Shear Capacity under short term loads = -10.84 Kn > -5.93 Kn

Intermediate Design Sides

Intermediate Spacing = 2750 mm   Intermediate Span = 3830 mm   Try Intermediate 2x200x50 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 =1.00   S1 Downward =11.27   S1 Upward =0.74

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

Capacity Checks

$M_{Wind+Snow}$	2.72 Kn-m	Capacity	7.46 Kn-m	Passing Percentage	**274.26 %**
$V_{0.9D-WnUp}$	2.84 Kn-m	Capacity	32.16 Kn-m	Passing Percentage	**1132.39 %**

Deflections

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

Deflection under Snow and Service Wind = 23.11 mm   Limit by Woolcock et al, 1999 Span/100 = 38.30 mm

Reactions

Maximum = 2.84 kn

Girt Design Front and Back

 Girt's Spacing = 800 mm   Girt's Span = 4000 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 =0.50   S1 Downward =11.27   S1 Upward =23.76

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

Capacity Checks

$M_{Wind+Snow}$	1.73 Kn-m	Capacity	1.87 Kn-m	Passing Percentage	**108.09 %**
$V_{0.9D-WnUp}$	1.73 Kn-m	Capacity	16.08 Kn-m	Passing Percentage	**929.48 %**

Deflections

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

Deflection under Snow and Service Wind = 12.90 mm   Limit by Woolcock et al, 1999 Span/100 = 40.00 mm
Sag during installation = 15.52 mm

Reactions

Maximum = 1.73 kn

Girt Design Sides

Girt's Spacing = 1300 mm   Girt's Span = 2750 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 =0.68   S1 Downward =11.27   S1 Upward =19.70

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

Capacity Checks

$M_{Wind+Snow}$	1.33 Kn-m	Capacity	2.56 Kn-m	Passing Percentage	**192.48 %**
$V_{0.9D-WnUp}$	1.93 Kn-m	Capacity	16.08 Kn-m	Passing Percentage	**833.16 %**

Deflections

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

Deflection under Snow and Service Wind = 4.68 mm   Limit by Woolcock et al. 1999 Span/100 = 27.50 mm
Sag during installation =3.47 mm

Reactions

Maximum = 1.93 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 = Safecty factor (0.55) x Density of Soil(18) x Height of Pile(1500) x Ks(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 = 22.31 Kn

Uplift on one Pile = 24.53 Kn

Uplift is ok

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