Job No.: EHB 294 **Address:** 547 West Plains Road, West Plains 9874, New Zealand **Date:** 02/12/2024
Latitude: -46.370015 **Longitude:** 168.283352 **Elevation:** 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	N5	Ground Snow Load	0.9 KPa	Roof Snow Load	0.63 KPa
Earthquake Zone	1	Subsoil Category	D	Exposure Zone	C
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	4 m
Wind Region	NZ4	Terrain Category	2.27	Design Wind Speed	41.75 m/s
Wind Pressure	1.05 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 Cp,i = 0.6472

For roof CP,e from 0 m To 3.7 m Cpe = -0.9 pe = -0.47 KPa pnet = -0.88 KPa

For roof CP,e from 3.7 m To 7.4 m Cpe = -0.5 pe = -0.26 KPa pnet = -0.67 KPa

For wall Windward Cp,i = 0.6472 side Wall Cp,i = -0.552

For wall Windward and Leeward CP,e from 0 m To 19.2 m Cpe = 0.7 pe = 0.66 KPa pnet = 1.29 KPa

For side wall CP,e from 0 m To 3.7 m Cpe = pe = -0.61 KPa pnet = 0.02 KPa

Maximum Upward pressure used in roof member Design = 0.88 KPa

Maximum Downward pressure used in roof member Design = 0.82 KPa

Maximum Wall pressure used in Design = 1.29 KPa

Maximum Racking pressure used in Design = 1.13 KPa

Design Summary

Rafter Design Internal

Internal Rafter Load Width = 4800 mm Internal Rafter Span = 4650 mm Try Rafter 2x300x50 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 =1.00 S1 Downward =6.81 S1 Upward =6.81

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

Capacity Checks

$M_{1.35D}$	4.38 Kn-m	Capacity	10.08 Kn-m	Passing Percentage	**230.14 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	14.53 Kn-m	Capacity	13.44 Kn-m	Passing Percentage	**92.50 %**
$M_{0.9D-WnUp}$	-8.50 Kn-m	Capacity	-16.8 Kn-m	Passing Percentage	**197.65 %**
$V_{1.35D}$	3.77 Kn	Capacity	28.94 Kn	Passing Percentage	**767.64 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	12.50 Kn	Capacity	38.6 Kn	Passing Percentage	**308.80 %**
$V_{0.9D-WnUp}$	-7.31 Kn	Capacity	-48.24 Kn	Passing Percentage	**659.92 %**

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 7.375 mm Limit by Woolcock et al, 1999 Span/240 = 20.00 mm
Deflection under Dead and Service Wind = 12.425 mm Limit by Woolcock et al, 1999 Span/100 = 48.00 mm

Reactions

Maximum downward =12.50 kn Maximum upward = -7.31 kn

Rafter to Pole Connection check

Bolt Size = M12 Number of Bolts = 3

Calculations as per NZS 3603:1993 Amend 2005 clause 4.4

Joint Group for Rafters =J5 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 = 14.9 fpj = 12.9 Mpa for Rafter with effective thickness = 100 mm

For Parallel to grain loading

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

Capacity under short term loads = 32.51 Kn > -7.31 Kn

Intermediate Design Sides

Second page

Intermediate Spacing = 2400 mm Intermediate Span = 3700 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 =0.72

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

Capacity Checks

$M_{Wind+Snow}$	2.65 Kn-m	Capacity	7.46 Kn-m	Passing Percentage	**281.51 %**
$V_{0.9D-WnUp}$	2.86 Kn	Capacity	32.16 Kn	Passing Percentage	**1124.48 %**

Deflections

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

Deflection under Snow and Service Wind = 35.625 mm Limit by Woolcock et al, 1999 Span/100 = 37.00 mm

Reactions

Maximum = 2.86 kn

Girt Design Front and Back

Girt's Spacing = 700 mm Girt's Span = 2400 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 =0.96 S1 Downward =11.27 S1 Upward =13.02

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

Capacity Checks

$M_{Wind+Snow}$	0.65 Kn-m	Capacity	3.60 Kn-m	Passing Percentage	**553.85 %**
$V_{0.9D-WnUp}$	1.08 Kn	Capacity	16.08 Kn	Passing Percentage	**1488.89 %**

Deflections

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

Deflection under Snow and Service Wind = 2.60 mm Limit by Woolcock et al, 1999 Span/100 = 24.00 mm
Sag during installation = 2.01 mm

Reactions

Maximum = 1.08 kn

Girt Design Sides

Girt's Spacing = 1300 mm Girt's Span = 2400 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 =0.75 S1 Downward =11.27 S1 Upward =18.41

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

Capacity Checks

$M_{Wind+Snow}$	1.21 Kn-m	Capacity	2.79 Kn-m	Passing Percentage	**230.58 %**
$V_{0.9D-WnUp}$	2.01 Kn	Capacity	16.08 Kn	Passing Percentage	**800.00 %**

Deflections

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

Deflection under Snow and Service Wind = 4.83 mm Limit by Woolcock et al. 1999 Span/100 = 24.00 mm
Sag during installation =2.01 mm

Reactions

Maximum = 2.01 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 = 22.07 Kn

Uplift on one Pile = 15.09 Kn

Uplift is ok