# Pole Shed App Ver 01 2022

Date: **3/13/2025**

Council: **Council**

BWhite
Consulting Ltd

## Subject: B2 compliance in respect of Proposed shed at Q2Q9+MCQ Upper Moutere, New Zealand

Council typically requests a Producer Statement/Other means of compliance for Design for Clause B2 of the Building Code-Durability

We are not able to provide a Producer Statement for durability because compliance needs to be shown on material-by-material basis using a variety of compliance methods, and not all materials used have a clear compliance path.

We can confirm that for the structural elements shown in our documentation under Clause B1:

**Timber**

Timber treatment has been selected to meet or exceed the requirements of table 1A of B2/AS1 and NZS3602

**Steel fixing**

Steel fixings are protected against weather as per table 4.1 and 4.2 of NZS3604-2011. Exposure Zone C

Yours Faithfully

**BWhite CONSULTING LTD**

**Bevan Whiite**

Director | BE Civil . CMengNZ CPEng

Email: bwhitecpeng@gmail.com

Contact: 0211 979 786

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Note: This letter shall only be relied on by the Building Consent Authority named in Engineering New Zealand/ACE New Zealand Producer Statement PS1(B1) - Design in relation to the Building Work. Liability under this letter accrues to the Design Review Firm only. The total maximum amount of damages payable arising from this letter and all other statements provided to the Building Consent Authority in relation to this Building Work whether in contract, tort or otherwise (including negligence), is limited to the sum of $200,000

| | | |
|---|---|---|
| **Job No.:** 2502052 | **Address:** Q2Q9+MCQ Upper Moutere, New Zealand | **Date:** 3/13/2025 |
| **Latitude:** -41.210786 | **Longitude:** 173.018608 | **Elevation:** 66.5 m |

## General Input

| | | | | | |
|---|---|---|---|---|---|
| Roof Live Load | 0.25 KPa | Roof Dead Load | 0.25 KPa | Roof Live Point Load | 1.1 Kn |
| Snow Zone | 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 | 3.725 m |
| Wind Region | NZ2 | Terrain Category | 2.57 | Design Wind Speed | 47.37 m/s |
| Wind Pressure | 1.35 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 Pressues

Shed Type = Mono Enclosed

For roof Cp,i = -0.3

For roof CP,e from 0 m To 3.73 m Cpe = -0.9 pe = -1.09 KPa pnet = -1.09 KPa

For roof CP,e from 3.73 m To 7.45 m Cpe = -0.5 pe = -0.61 KPa pnet = -0.61 KPa

For wall Windward Cp,i = -0.3 side Wall Cp,i = -0.3

For wall Windward and Leeward CP,e from 0 m To 3.73 m Cpe = -0.65 pe = -0.79 KPa pnet = -0.79 KPa

For side wall CP,e from 0 m To 3.73 m Cpe = pe = -0.79 KPa pnet = -0.79 KPa

Maximum Upward pressure used in roof member Design = 1.09 KPa

Maximum Downward pressure used in roof member Design = 0.65 KPa

Maximum Wall pressure used in Design = 1.25 KPa

Maximum Racking pressure used in Design = 1.46 KPa

## Design Summary

### Purlin Design

Purlin Spacing = 1000 mm    Purlin Span = 4350 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 =0.80 S1 Downward =11.27 S1 Upward =17.42

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

**Capacity Checks**

| | | | | | |
|---|---|---|---|---|---|
| $M_{1.35D}$ | 0.8 Kn-m | Capacity | 2.23 Kn-m | Passing Percentage | **278.75 %** |
| $M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 2.5 Kn-m | Capacity | 2.97 Kn-m | Passing Percentage | **118.80 %** |
| $M_{0.9D-WnUp}$ | -2.05 Kn-m | Capacity | -2.97 Kn-m | Passing Percentage | **144.88 %** |
| $V_{1.35D}$ | 0.73 Kn | Capacity | 9.65 Kn | Passing Percentage | **1321.92 %** |
| $V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 2.07 Kn | Capacity | 12.86 Kn | Passing Percentage | **621.26 %** |
| $V_{0.9D-WnUp}$ | -1.88 Kn | Capacity | -16.08 Kn | Passing Percentage | **855.32 %** |

**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 = 18.12 mm | Limit by Woolcock et al, 1999 Span/240 = 17.92 mm |
| Deflection under Dead and Service Wind = 16.44 mm | Limit by Woolcock et al, 1999 Span/100 = 43.00 mm |

**Reactions**

Maximum downward =2.07 kn Maximum upward = -1.88 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 = 4500 mm Internal Rafter Span = 8850 mm Try Rafter 2x610x45 LVL11

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 =11.05 S1 Upward =11.05

Shear Capacity of timber =5 MPa Bending Capacity of timber =38 MPa NZS3603 Amt 4, table 2.3

**Capacity Checks**

| | | | | | |
|---|---|---|---|---|---|
| $M_{1.35D}$ | 14.87 Kn-m | Capacity | 90.18 Kn-m | Passing Percentage | **606.46 %** |
| $M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 41.85 Kn-m | Capacity | 120.24 Kn-m | Passing Percentage | **287.31 %** |
| $M_{0.9D-WnUp}$ | -38.11 Kn-m | Capacity | -150.28 Kn-m | Passing Percentage | **394.33 %** |
| $V_{1.35D}$ | 6.72 Kn | Capacity | 88.28 Kn | Passing Percentage | **1313.69 %** |
| $V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 18.92 Kn | Capacity | 117.7 Kn | Passing Percentage | **622.09 %** |
| $V_{0.9D-WnUp}$ | -17.22 Kn | Capacity | -147.14 Kn | Passing Percentage | **854.47 %** |

**Deflections**

Modulus of Elasticity = 9900 MPa NZS3603 Amt 4, Table 2.3

k2 for Long Term Loads = 2

| | |
|---|---|
| Deflection under Dead and Live Load = 6.16 mm | Limit by Woolcock et al, 1999 Span/240 = 37.50 mm |
| Deflection under Dead and Service Wind = 9.41 mm | Limit by Woolcock et al, 1999 Span/100 = 90.00 mm |

**Reactions**

Maximum downward =18.92 kn   Maximum upward = -17.22 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

K11 = 12.6 fpj = 22.7 Mpa for Rafter with effective thickness = 90 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 = 29.11 Kn > -17.22 Kn

## Rafter Design External

External Rafter Load Width = 2250 mm      External Rafter Span = 4310 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)

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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**

| | | | | | |
|---|---|---|---|---|---|
| $M_{1.35D}$ | 1.76 Kn-m | Capacity | 4.72 Kn-m | Passing Percentage | **268.18 %** |
| $M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 4.96 Kn-m | Capacity | 6.30 Kn-m | Passing Percentage | **127.02 %** |
| $M_{0.9D-WnUp}$ | -4.52 Kn-m | Capacity | -7.87 Kn-m | Passing Percentage | **174.12 %** |
| $V_{1.35D}$ | 1.64 Kn | Capacity | 14.47 Kn | Passing Percentage | **882.32 %** |
| $V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$ | 4.61 Kn | Capacity | 19.30 Kn | Passing Percentage | **418.66 %** |
| $V_{0.9D-WnUp}$ | -4.19 Kn | Capacity | -24.12 Kn | Passing Percentage | **575.66 %** |

**Deflections**

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

k2 for Long Term Loads = 2

| | |
|---|---|
| Deflection under Dead and Live Load = 5.93 mm | Limit by Woolcock et al, 1999 Span/240= 18.75 mm |
| Deflection under Dead and Service Wind = 8.16 mm | Limit by Woolcock et al, 1999 Span/100 = 45.00 mm |

**Reactions**

Maximum downward =4.61 kn   Maximum upward = -4.19 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 > -4.19 Kn

Single Shear Capacity under short term loads = -10.84 Kn > -4.19 Kn

## Girt Design Front and Back

Girt's Spacing = 1100 mm Girt's Span = 4500 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 =0.97 S1 Downward =11.27 S1 Upward =12.60

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

#### Capacity Checks

| | | | | | |
|---|---|---|---|---|---|
| $M_{Wind+Snow}$ | 3.48 Kn-m | Capacity | 3.63 Kn-m | Passing Percentage | **104.31 %** |
| $V_{0.9D-WnUp}$ | 3.09 Kn | Capacity | 16.08 Kn | Passing Percentage | **520.39 %** |

#### Deflections

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

Deflection under Snow and Service Wind = 32.87 mm Limit by Woolcock et al, 1999 Span/100 = 45.00 mm
Sag during installation = 24.86 mm

#### Reactions

Maximum = 3.09 kn

## Girt Design Sides

Girt's Spacing = 1100 mm Girt's Span = 4500 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 =0.97 S1 Downward =11.27 S1 Upward =12.60

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

#### Capacity Checks

| | | | | | |
|---|---|---|---|---|---|
| $M_{Wind+Snow}$ | 3.48 Kn-m | Capacity | 3.63 Kn-m | Passing Percentage | **104.31 %** |

| | | | | | |
|---|---|---|---|---|---|
| $V_{0.9D\text{-}WnUp}$ | 3.09 Kn | Capacity | 16.08 Kn | Passing Percentage | **520.39 %** |

**Deflections**

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

Deflection under Snow and Service Wind = 32.87 mm Limit by Woolcock et al. 1999 Span/100 = 45.00 mm
Sag during installation =24.86 mm

**Reactions**

Maximum = 3.09 kn

## Middle Pole Design

**Geometry**

| | | | |
|---|---|---|---|
| 175 SED H5 (Minimum 200 dia. at Floor Level) | Dry Use | Height | 3725 mm |
| Area | 27598 mm2 | As | 20698.2421875 mm2 |
| Ix | 60639381 mm4 | Zx | 646820 mm3 |
| Iy | 60639381 mm4 | Zx | 646820 mm3 |
| Lateral Restraint | 3725 mm c/c | | |

**Loads**

Total Area over Pole = 20.25 m2

| | | | |
|---|---|---|---|
| Dead | 5.06 Kn | Live | 5.06 Kn |
| Wind Down | 13.16 Kn | Snow | 0.00 Kn |
| Moment wind | 17.05 Kn-m | | |
| Phi | 0.8 | K8 | 0.68 |
| 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 | 268.86 Kn | PhiMnx Wind | 12.71 Kn-m | PhiVnx Wind | 49.01 Kn |

| | | | | | |
|---|---|---|---|---|---|
| PhiNcx Dead | 161.32 Kn | PhiMnx Dead | 7.62 Kn-m | PhiVnx Dead | 29.41 Kn |

**Checks**

(Mx/PhiMnx)+(N/phiNcx) = 1.43 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 1.89 < 1 OK

Deflection at top under service lateral loads = 59.22 mm < 37.25 mm

## Drained Lateral Strength of Middle 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 Middle Bay Pole**

| | | |
|---|---|---|
| Ds = | 0.6 mm | Pile Diameter |
| L = | 1500 mm | Pile embedment length |
| f1 = | 2794 mm | Distance at which the shear force is applied |
| f2 = | 0 mm | Distance of top soil at rest pressure |

**Loads**

| | |
|---|---|
| Moment Wind = | 17.05 Kn-m |
| Shear Wind = | 6.10 Kn |

**Pile Properties**

| | | |
|---|---|---|
| Safety Factory | 0.55 | |
| Hu = | 7.00 Kn | Ultimate Lateral Strength of the Pile, Short pile |
| Mu = | 11.74 Kn-m | Ultimate Moment Capacity of Pile |

**Checks**

Applied Forces/Capacities = 1.45 < 1 OK

### End Pole Design

**Geometry For End Bay Pole**

**Geometry**

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| | | | |
|---|---|---|---|
| 175 SED H5 (Minimum 200 dia. at Floor Level) | Dry Use | Height | 3425 mm |
| Area | 27598 mm2 | As | 20698.2421875 mm2 |
| Ix | 60639381 mm4 | Zx | 646820 mm3 |
| Iy | 60639381 mm4 | Zx | 646820 mm3 |
| Lateral Restraint | mm c/c | | |

**Loads**

Total Area over Pole = 10.125 m2

| | | | |
|---|---|---|---|
| Dead | 2.53 Kn | Live | 2.53 Kn |
| Wind Down | 6.58 Kn | Snow | 0.00 Kn |
| Moment Wind | 5.68 Kn-m | | |
| Phi | 0.8 | K8 | 0.76 |
| 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 | 300.17 Kn | PhiMnx Wind | 14.19 Kn-m | PhiVnx Wind | 49.01 Kn |
| PhiNcx Dead | 180.10 Kn | PhiMnx Dead | 8.51 Kn-m | PhiVnx Dead | 29.41 Kn |

**Checks**

(Mx/PhiMnx)+(N/phiNcx) = 0.44 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.20 < 1 OK

Deflection at top under service lateral loads = 19.69 mm < 37.16 mm

| | | |
|---|---|---|
| Ds = | 0.6 mm | Pile Diameter |
| L = | 1300 mm | Pile embedment length |
| f1 = | 2794 mm | Distance at which the shear force is applied |
| f2 = | 0 mm | Distance of top soil at rest pressure |

**Loads**

Total Area over Pole = 10.125 m2

| | |
|---|---|
| Moment Wind = | 5.68 Kn-m |
| Shear Wind = | 2.03 Kn |

**Pile Properties**

| | | |
|---|---|---|
| Safety Factory | 0.55 | |
| Hu = | 4.78 Kn | Ultimate Lateral Strength of the Pile, Short pile |
| Mu = | 7.90 Kn-m | Ultimate Moment Capacity of Pile |

**Checks**

Applied Forces/Capacities = 0.72 < 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 = | 2794 mm | Distance at which the shear force is applied |
| f2 = | 0 mm | Distance of top soil at rest pressure |

**Loads**

| | |
|---|---|
| Moment Wind = | 5.68 Kn-m |
| Shear Wind = | 2.03 Kn |

**Pile Properties**

| | | |
|---|---|---|
| Safety Factory | 0.55 | |
| Hu = | 4.78 Kn | Ultimate Lateral Strength of the Pile, Short pile |
| Mu = | 7.90 Kn-m | Ultimate Moment Capacity of Pile |

**Checks**

Applied Forces/Capacities = 0.72 < 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 = 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 = 22.56 Kn

Uplift on one Pile = 17.52 Kn

Uplift is ok