| Job Number: | BWhite |
|--|---|
| Issue: | Consulting Ltd |
| PRODUCER STATEMENT-PS1-DESIGN | J |
| ISSUED BY: BWhite Consulting Ltd (Design Engineer: Bevan White) | |
| TO BE SUPPLIED TO: Upper Hutt City District Council IN RESPECT OF: Proposed NEW Farm Sh | ed |
| AT: 19 Masefield Street, Trentham, Upper Hutt, New Zealand | |
| LEGAL DESCRIPTION | |
| We have been engaged by Ezequote Pty Ltd to provide Specific Structural Engineering Design so requirements of Clause(s) B1 of the Building Code for part only (as specified in the attachment to the building work. | <u> </u> |
| ☐ ALL | l connections |
| The design has been prepared in accordance with compliance documents to NZ Building Code is su Innovation & Employment Clauses B1/VM1 and B1/VM4 | ned by Ministry of Business, |
| The proposed building work covered by the producer statement is described on Ezequote drawings numbered A101-A120 REV-1 dated 11/20/2023 together with the following specfication, and othe schedule attached to this statement: Design Featured Report Dated 11/22/2023 and numbered "So | r documents set out in the |
| On behalf of BWhite Consulting Ltd, and subject to: | |
| Site verification of the following design assumptions: an Ultimate foundation bearing press with NZS3604:2011 The building has a design life of 50 years and am Importance Level 2 Unless specifically noted, compliance of the drawings to None-Specific codes such as NZS been checked by this practice This Certificate does not cover any other building code clause including weather tightness Inspections of the building to be completed by Upper Hutt City District Council. As BWhit undertaking inspections, we cannot issue a producer Statement-PS4- Construction Review This Producer Statement-Design is valid for a building consent issued within 1 year from All proprietary products meeting their performance specification requirements | 3604 and NZS4229 have not s e Consulting Ltd are not w. |
| I believe on reasonable grounds that a) the building, if constructed in accordance with the drawings documents provided or listed in the attached schedule, will comply with the relevant provisions of the presons who have undertaken the design have the necessary competency to do so. I also reconconstruction monitoring/observation: | the Building Code and that b), |
| ☑ CM1 ☐ CM2 ☐ CM3 ☐ CM4 ☐ CM5 or as per agreement with owner/developer (stated above | ve) |
| I, Bevan White am CPEng 108276 I am Member of Engineering New Zealand and hold the following | g qualification: BE.Civil |
| BWhite Consulting Ltd holds a current policy of Professional Indemnity Insurance no less than \$20 | 00,000. |
| Signed by Bevan White on behalf of BWhite Consulting Ltd Dated: 11/22/2023 | |
| Email: hwhitecneng@gmail.com.Phone: 0211-979786 | |

This form is to accompany Form 2 of the Building (Forms) Regulations 2004 for the application of a Building Consent

whether in contract, tort or otherwise(including negligence), is limited to the sum of \$200,000.

Note: This statement shall only be relied upon by the Building Consent Authority named above. Liability under this statement accrues to the Design Firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work,

Date: 11/22/2023

BWhite

18B Jules Crescent,

Consulting Ltd

Bell Block New Plymouth 4312

New Zealand File No:

DESIGN FEATURES SUMMARY FOR PROPOSED NEW FARM SHED 19 MASEFIELD STREET, TRENTHAM, UPPER HUTT, NEW ZEALAND

Site Specific Loads

| 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 | В |
| Importance Level | 2 | Ultimate wind & EQ ARI | 500 Years | Max Height | 7 m |
| Wind Region | NZ2 | Terrain Category | 2.03 | Design Wind Speed | 37.9 m/s |
| Wind Pressure | 0.86 KPa | Lee Zone | NO | Ultimate Snow ARI | 150 Years |

Timber

Sawn Timber to be graded to the properties of SG6 and SG8 or better as mentioned on plans, with moisture content of 18% or less for dry and 25% or less for wet.

The following standards have been used in the design of this structure

- NZS 3603:1993 Timber Structures Standard
- NZS 3604:2011 Timber Framed Buildings. Standards New Zealand, 2011
- NZS 3404:1997 Steel Structures
- AS/NZS 1170 2003 Structural Design Actions
- AS/NZS 1170.2 2021 Structural Design Actions-Wind Action
- Branz. "Engineering Basis of NZS 3604". April 2013

Yours Faithfully

BWhite CONSULTING LTD

Bevan White

Director | BE Civil . CMengNZ CPEng

Email: bwhitecpeng@gmail.com Contact: 0211 979 786

Second page

Job No.: Total build 490- Address: 19 Masefield Street, Trentham, Upper Hutt, Date: 11/22/2023

New Zealand

Latitude: -41.117985 **Longitude:** 175.049881 **Elevation:** 54 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 | В |
| Importance Level | 2 | Ultimate wind & Earthquake ARI | 500 Years | Max Height | 7 m |
| Wind Region | NZ2 | Terrain Category | 2.03 | Design Wind Speed | 37.9 m/s |
| Wind Pressure | 0.86 KPa | Lee Zone | NO | Ultimate Snow ARI | 150 Years |
| Wind Category | High | Earthquake ARI | 500 | | |

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 3.28 m Cpe = -0.8981 pe = -0.70 KPa pnet = -0.70 KPa

For roof CP,e from 3.28 m To 6.56 m Cpe = -0.8981 pe = -0.70 KPa pnet = -0.70 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 10 m Cpe = 0.7 pe = 0.54 KPa pnet = 0.80 KPa

For side wall CP,e from 0 m To 6.56 m Cpe = pe = -0.50 KPa pnet = -0.50 KPa

Maximum Upward pressure used in roof member Design = 0.70 KPa

Maximum Downward pressure used in roof member Design = 0.26 KPa

Maximum Wall pressure used in Design = 0.80 KPa

Maximum Racking pressure used in Design = 0.93 KPa

Design Summary

Purlin Design

Purlin Spacing = 900 mm Purlin Span = 4183 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 =0.33 S1 Downward =13.82 S1 Upward =29.61

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

Capacity Checks

| M1.35D | 0.66 Kn-m | Capacity | 2.73 Kn-m | Passing Percentage | 413.64 % |
|-------------------------------|------------|----------|------------|--------------------|-----------|
| M1.2D+1.5L 1.2D+Sn 1.2D+WnDn | 1.74 Kn-m | Capacity | 3.64 Kn-m | Passing Percentage | 209.20 % |
| $M_{0.9D\text{-W}n\text{U}p}$ | -0.94 Kn-m | Capacity | -1.61 Kn-m | Passing Percentage | 171.28 % |
| V _{1.35D} | 0.64 Kn | Capacity | 10.42 Kn | Passing Percentage | 1628.13 % |
| V1.2D+1.5L 1.2D+Sn 1.2D+WnDn | 1.27 Kn | Capacity | 13.89 Kn | Passing Percentage | 1093.70 % |
| $ m V_{0.9D	ext{-}WnUp}$ | -0.89 Kn | Capacity | -17.37 Kn | Passing Percentage | 1951.69 % |

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 = 5.91 mm

Limit by Woolcock et al, 1999 Span/360 = 11.48 mm

Deflection under Dead and Service Wind = 6.20 mm

Limit by Woolcock et al, 1999 Span/250 = 27.55 mm

Reactions

Maximum downward = 1.27 kn Maximum upward = -0.89 kn

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

Rafter Design Internal

Internal Rafter Load Width = 4333 mm Internal Rafter Span = 9850 mm Try Rafter 2x400x63 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 = 6.26 S1 Upward = 6.26

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

Capacity Checks

| M1.35D | 17.74 Kn-m | Capacity | 73.78 Kn-m | Passing Percentage | 415.90 % |
|------------------------------|------------|----------|------------|--------------------|----------|
| M1.2D+1.5L 1.2D+Sn 1.2D+WnDn | 35.47 Kn-m | Capacity | 98.38 Kn-m | Passing Percentage | 277.36 % |

| $M_{0.9D\text{-W}nUp}$ | -24.96 Kn-m | Capacity | -122.98 Kn-m | Passing Percentage | 492.71 % |
|------------------------------|-------------|----------|--------------|--------------------|-----------|
| V _{1.35D} | 7.20 Kn | Capacity | 85.9 Kn | Passing Percentage | 1193.06 % |
| V1.2D+1.5L 1.2D+Sn 1.2D+WnDn | 14.40 Kn | Capacity | 114.54 Kn | Passing Percentage | 795.42 % |
| $ m V_{0.9D	ext{-}WnUp}$ | -10.14 Kn | Capacity | -143.18 Kn | Passing Percentage | 1412.03 % |

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 20.61 mm Limit by Woolcock et al, 1999 Span/360 = 27.78 mm Deflection under Dead and Service Wind = 24.04 mm Limit by Woolcock et al, 1999 Span/250 = 66.67 mm

Reactions

Maximum downward = 14.40 kn Maximum upward = -10.14 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 =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 = 126 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 = 43.67 Kn > -10.14 Kn

Rafter Design External

External Rafter Load Width = 2166.5 mm External Rafter Span = 4819 mm Try Rafter 290x45 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 = 0.89

K8 Upward =0.89 S1 Downward =15.23 S1 Upward =15.23

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

Capacity Checks

| M1.35D | 2.12 Kn-m | Capacity | 3.78 Kn-m | Passing Percentage | 178.30 % |
|------------------------------|------------|----------|------------|--------------------|----------|
| M1.2D+1.5L 1.2D+Sn 1.2D+WnDn | 4.25 Kn-m | Capacity | 5.04 Kn-m | Passing Percentage | 118.59 % |
| $M_{0.9D\text{-W}nUp}$ | -2.99 Kn-m | Capacity | -6.29 Kn-m | Passing Percentage | 210.37 % |
| $V_{1.35D}$ | 1.76 Kn | Capacity | 12.59 Kn | Passing Percentage | 715.34 % |
| V1.2D+1.5L 1.2D+Sn 1.2D+WnDn | 3.52 Kn | Capacity | 16.79 Kn | Passing Percentage | 476.99 % |
| $ m V_{0.9D	ext{-}WnUp}$ | -2.48 Kn | Capacity | -20.98 Kn | Passing Percentage | 845.97 % |

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 10.71 mm

Limit by Woolcock et al, 1999 Span/360= 13.89 mm

Deflection under Dead and Service Wind = 11.25 mm

Limit by Woolcock et al, 1999 Span/250 = 33.33 mm

Reactions

Maximum downward = 3.52 kn Maximum upward = -2.48 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 = 45 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) = -21.73 kn > -2.48 Kn

Single Shear Capacity under short term loads = -9.75 Kn > -2.48 Kn

6/12

Girt Design Front and Back

Girt's Spacing = 900 mm Girt's Span = 4333 mm Try Girt 250x50 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 = 0.97

K8 Upward =0.38 S1 Downward =12.68 S1 Upward =27.82

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

Capacity Checks

Mwind+Snow 1.69 Kn-m Capacity 2.19 Kn-m Passing Percentage 129.59 % V_{0.9D-WnUp} 1.56 Kn-m Capacity 20.10 Kn-m Passing Percentage 1288.46 %

Deflections

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

Deflection under Snow and Service Wind = 7.58 mm Limit by Woolcock et al, 1999 Span/250 = 17.33 mm Sag during installation = 21.37 mm

Reactions

Maximum = 1.56 kn

Girt Design Sides

Girt's Spacing = 900 mm Girt's Span = 5000 mm Try Girt 250x50 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 = 0.97

K8 Upward =0.33 S1 Downward =12.68 S1 Upward =29.88

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

Capacity Checks

Mwind+Snow 2.25 Kn-m Capacity 1.91 Kn-m Passing Percentage **84.89 %**Vo.9D-WnUp 1.80 Kn-m Capacity 20.10 Kn-m Passing Percentage **1116.67 %**

Deflections

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

Deflection under Snow and Service Wind = 13.43 mm Limit by Woolcock et al. 1999 Span/100 = 20.00 mm Sag during installation = 37.90 mm

Reactions

Maximum = 1.80 kn

Middle Pole Design

Geometry

| 350 SED H5 (Minimum 375 dia. at Floor Level) | Dry Use | Height | 6700 mm |
|--|---------------|--------|-------------------|
| Area | 103154 mm2 | As | 77365.4296875 mm2 |
| Ix | 847191750 mm4 | Zx | 4674161 mm3 |
| Iy | 847191750 mm4 | Zx | 4674161 mm3 |
| Lateral Restraint | 6700 mm c/c | | |

Loads

Total Area over Pole = 21.665 m2

| Dead | 5.42 Kn | Live | 5.42 Kn |
|-------------|------------|---------|---------|
| Wind Down | 5.63 Kn | Snow | 0.00 Kn |
| Moment wind | 36.93 Kn-m | | |
| Phi | 0.8 | K8 | 0.74 |
| K1 snow | 0.8 | K1 Dead | 0.6 |
| K1wind | 1 | | |

Material

| Peeling | Steaming | Normal | Dry Use |
|---------|----------|---------|----------|
| fb = | 36.3 MPa | $f_S =$ | 2.96 MPa |
| fc = | 18 MPa | fp = | 7.2 MPa |
| ft = | 22 MPa | E = | 9257 MPa |

Capacities

| PhiNex Wind | 1105.99 Kn | PhiMnx Wind | 101.07 Kn-m | PhiVnx Wind | 183.20 Kn |
|-------------|------------|-------------|-------------|-------------|-----------|
| PhiNcx Dead | 663.60 Kn | PhiMnx Dead | 60.64 Kn-m | PhiVnx Dead | 109.92 Kn |

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.38 < 1 OK

 $(Mx/PhiMnx)^2 + (N/phiNcx) = 0.15 < 1 OK$

Deflection at top under service lateral loads = 31.03 mm < 44.67 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

 $K0 = \frac{(1-\sin(30))}{(1+\sin(30))}$ $Kp = \frac{(1+\sin(30))}{(1-\sin(30))}$

Geometry For Middle Bay Pole

Ds = 0.6 mm Pile Diameter

L= 2200 mm Pile embedment length

f1 = 5250 mm Distance at which the shear force is applied

f2 = 0 mm Distance of top soil at rest pressure

Loads

Moment Wind = 36.93 Kn-m

Shear Wind = 7.03 Kn

Pile Properties

Safety Factory 0.55

Hu = 12.73 Kn Ultimate Lateral Strength of the Pile, Short pile

Mu = 39.17 Kn-m Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.94 < 1 OK

End Pole Design

Geometry For End Bay Pole

Geometry

300 SED H5 (Minimum 325 dia. at Floor Level) Dry Use Height 6800 mm

| Area | 76660 mm2 | As | 57495.1171875 mm2 |
|-------------------|---------------|----|-------------------|
| Ix | 467896461 mm4 | Zx | 2994537 mm3 |
| Iy | 467896461 mm4 | Zx | 2994537 mm3 |
| Lateral Restraint | mm c/c | | |

Loads

Total Area over Pole = 10.8325 m^2

| Dead | 2.71 Kn | Live | 2.71 Kn |
|-------------|------------|---------|---------|
| Wind Down | 2.82 Kn | Snow | 0.00 Kn |
| Moment Wind | 12.31 Kn-m | | |
| Phi | 0.8 | K8 | 0.59 |
| K1 snow | 0.8 | K1 Dead | 0.6 |
| K1 wind | 1 | | |

Material

| Peeling | Steaming | Normal | Dry Use |
|---------|----------|---------|----------|
| fb = | 36.3 MPa | $f_S =$ | 2.96 MPa |
| fc = | 18 MPa | fp = | 7.2 MPa |
| ft = | 22 MPa | E = | 9257 MPa |

Capacities

| PhiNex Wind | 647.27 Kn | PhiMnx Wind | 50.99 Kn-m | PhiVnx Wind | 136.15 Kn |
|-------------|-----------|-------------|------------|-------------|-----------|
| PhiNcx Dead | 388.36 Kn | PhiMnx Dead | 30.59 Kn-m | PhiVnx Dead | 81.69 Kn |

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.25 < 1 OK

 $(Mx/PhiMnx)^2+(N/phiNcx) = 0.07 < 1 \text{ OK}$

Deflection at top under service lateral loads = 19.52 mm < 46.55 mm

| $D_S =$ | 0.6 mm | Pile Diameter |
|---------|---------|--|
| L = | 1600 mm | Pile embedment length |
| f1 = | 5250 mm | Distance at which the shear force is applied |
| f2 = | 0 mm | Distance of top soil at rest pressure |

Loads

Total Area over Pole = 10.8325 m2

Moment Wind = 12.31 Kn-mShear Wind = 2.34 Kn

Pile Properties

Safety Factory 0.55

Hu = 5.33 Kn Ultimate Lateral Strength of the Pile, Short pile

Mu = 16.03 Kn-m Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.77 < 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

 $K0 = \frac{(1-\sin(30))}{(1+\sin(30))}$ $Kp = \frac{(1+\sin(30))}{(1-\sin(30))}$

Geometry For End Bay Pole

 $D_S = 0.6 \text{ mm}$ Pile Diameter

L= 1600 mm Pile embedment length

fl = 5250 mm Distance at which the shear force is applied

f2 = 0 mm Distance of top soil at rest pressure

Loads

Moment Wind = 12.31 Kn-m Shear Wind = 2.34 Kn

Pile Properties

Safety Factory 0.55

Hu = 5.33 Kn Ultimate Lateral Strength of the Pile, Short pile

Mu = 16.03 Kn-m Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.77 < 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(2200) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(2200)

Skin Friction = 39.09 Kn

Weight of Pile + Pile Skin Friction = 41.52 Kn

Uplift on one Pile = 10.29 Kn

Uplift is ok