Job Number:

Issue:

BWhite Consulting Ltd

PRODUCER STATEMENT-PS1-DESIGN

ISSUED BY: **BWhite Consulting Ltd (Design Engineer: Bevan White)**

TO BE SUPPLIED TO: **Central Otago District Council** IN RESPECT OF: **Proposed NEW Farm Shed**

AT: **845 Ida Valley-Omakau Road, Poolburn, New Zealand**

LEGAL DESCRIPTION

We have been engaged by **Ezequote Pty Ltd** to provide **Specific Structural Engineering Design** services in respect of the requirements of Clause(s) **B1** of the Building Code for part only (as specified in the attachment to this statement), of the proposed building work.

☐ ALL ☑ Part only as specified: Purlins, Rafters, Girts, Poles, Columns, Pole embedment and all connections

The design has been prepared in accordance with compliance documents to NZ Building Code issued by Ministry of Business, Innovation & Employment Clauses **B1/VM1 and B1/VM4**

The proposed building work covered by the producer statement is described on **ITM** drawings title **230710** and numbered **A101-A111 REV-1** dated **9/18/2023** together with the following specfication, and other documents set out in the schedule attached to this statement: **Design Featured Report Dated 10/3/2023 and numbered "Second Page"**

On behalf of BWhite Consulting Ltd, and subject to:

1. Site verification of the following design assumptions: **an Ultimate foundation bearing pressure of 300 kPa in accordance with NZS3604:2011**
2. **The building has a design life of 50 years and am Importance Level 1**
3. **Unless specifically noted, compliance of the drawings to None-Specific codes such as NZS3604 and NZS4229 have not been checked by this practice**
4. **This Certificate does not cover any other building code clause including weather tightness**
5. **Inspections of the building to be completed by Central Otago District Council. As BWhite Consulting Ltd are not undertaking inspections, we cannot issue a producer Statement-PS4- Construction Review.**
6. **This Producer Statement- Design is valid for a building consent issued within 1 year from the date of issue**
7. All proprietary products meeting their performance specification requirements

I believe on reasonable grounds that a) the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the attached schedule, will comply with the relevant provisions of the Building Code and that b), the presons who have undertaken the design have the necessary competency to do so. I also recommend the follow level of construction monitoring/observation:

☑ CM1 ☐ CM2 ☐ CM3 ☐ CM4 ☐ CM5 or as per agreement with owner/developer **(stated above)**

I, **Bevan White** am CPEng **108276** I am Member of Engineering New Zealand and hold the following qualification: **BE.Civil**

BWhite Consulting Ltd holds a current policy of Professional Indemnity Insurance no less than $200,000.

Signed by **Bevan White** on behalf of **BWhite Consulting Ltd** Dated: **10/3/2023**

Email: bwhitecpeng@gmail.com Phone: 0211-979786

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

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

Date: 10/3/2023

BWhite Consulting Ltd

18B Jules Crescent,

Bell Block New Plymouth 4312

New Zealand

File No:

DESIGN FEATURES SUMMARY FOR PROPOSED NEW FARM SHED 845 IDA VALLEY-OMAKAU ROAD, POOLBURN, 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	N5	Ground Snow Load	1.13 KPa	Roof Snow Load	0.79 KPa
Earthquake Zone	2	Subsoil Category	D	Exposure Zone	B
Importance Level	1	Ultimate wind & EQ ARI	100 Years	Max Height	3.6 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	39.13 m/s
Wind Pressure	0.92 KPa	Lee Zone	NO	Ultimate Snow ARI	50 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.: 230710 **Address:** 845 Ida Valley-Omakau Road, Poolburn, New Zealand **Date:** 10/3/2023

Latitude: -45.137092 **Longitude:** 169.674879 **Elevation:** 420.5 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	1.13 KPa	Roof Snow Load	0.79 KPa
Earthquake Zone	2	Subsoil Category	D	Exposure Zone	B
Importance Level	1	Ultimate wind & Earthquake ARI	100 Years	Max Height	3.6 m
Wind Region	NZ2	Terrain Category	2.0	Design Wind Speed	39.13 m/s
Wind Pressure	0.92 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 Enclosed

For roof Cp,i = -0.3

For roof CP,e from 0 m To 1.65 m Cpe = -0.94 pe = -0.78 KPa pnet = -0.78 KPa

For roof CP,e from 1.65 m To 3.30 m Cpe = -0.88 pe = -0.73 KPa pnet = -0.73 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 6 m Cpe = 0.7 pe = 0.58 KPa pnet = 0.86 KPa

For side wall CP,e from 0 m To 3.30 m Cpe = pe = -0.54 KPa pnet = -0.54 KPa

Maximum Upward pressure used in roof member Design = 0.78 KPa

Maximum Downward pressure used in roof member Design = 0.45 KPa

Maximum Wall pressure used in Design = 0.86 KPa

Maximum Racking pressure used in Design = 0.49 KPa

Design Summary

Purlin Design

Purlin Spacing = 900 mm Purlin Span = 4100 mm Try Purlin 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 K1 Medium term = 0.8 K1 Long term = 0.6 K4 =1 K5 =1 K8 Downward =0.97

K8 Upward =0.40 S1 Downward =12.68 S1 Upward =26.89

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

Capacity Checks

$M_{1.35D}$	0.64 Kn-m	Capacity	3.40 Kn-m	Passing Percentage	**531.25 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	2.06 Kn-m	Capacity	4.53 Kn-m	Passing Percentage	**219.90 %**
$M_{0.9D-WnUp}$	-1.05 Kn-m	Capacity	-2.34 Kn-m	Passing Percentage	**222.86 %**
$V_{1.35D}$	0.62 Kn	Capacity	12.06 Kn	Passing Percentage	**1945.16 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	2.01 Kn	Capacity	16.08 Kn	Passing Percentage	**800.00 %**
$V_{0.9D-WnUp}$	-1.02 Kn	Capacity	-20.10 Kn	Passing Percentage	**1970.59 %**

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 = 4.34 mm	Limit by Woolcock et al, 1999 Span/240 = 16.88 mm
Deflection under Dead and Service Wind = 5.24 mm	Limit by Woolcock et al, 1999 Span/100 = 40.50 mm

Reactions

Maximum downward =2.01 kn Maximum upward = -1.02 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 = 4250 mm Internal Rafter Span = 5850 mm Try Rafter 2x400x45 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 =8.88 S1 Upward =8.88

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

Capacity Checks

$M_{1.35D}$	6.14 Kn-m	Capacity	52.7 Kn-m	Passing Percentage	**858.31 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	19.82 Kn-m	Capacity	70.26 Kn-m	Passing Percentage	**354.49 %**

$M_{0.9D\text{-}WnUp}$	-10.09 Kn-m	Capacity	-87.84 Kn-m	Passing Percentage	**870.56 %**
$V_{1.35D}$	4.20 Kn	Capacity	61.36 Kn	Passing Percentage	**1460.95 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	13.55 Kn	Capacity	81.82 Kn	Passing Percentage	**603.84 %**
$V_{0.9D\text{-}WnUp}$	-6.90 Kn	Capacity	-102.26 Kn	Passing Percentage	**1482.03 %**

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 3.665 mm Limit by Woolcock et al, 1999 Span/240 = 25.00 mm
Deflection under Dead and Service Wind = 4.925 mm Limit by Woolcock et al, 1999 Span/100 = 60.00 mm

Reactions

Maximum downward =13.55 kn Maximum upward = -6.90 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 > -6.90 Kn

Rafter Design External

External Rafter Load Width = 2125 mm External Rafter Span = 5830 mm Try Rafter 400x45 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 =0.77

K8 Upward =0.77 S1 Downward =17.94 S1 Upward =17.94

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

Capacity Checks

$M_{1.35D}$	3.05 Kn-m	Capacity	20.31 Kn-m	Passing Percentage	**665.90 %**
$M_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	9.84 Kn-m	Capacity	27.08 Kn-m	Passing Percentage	**275.20 %**
$M_{0.9D-WnUp}$	-5.01 Kn-m	Capacity	-33.85 Kn-m	Passing Percentage	**675.65 %**
$V_{1.35D}$	2.09 Kn	Capacity	30.68 Kn	Passing Percentage	**1467.94 %**
$V_{1.2D+1.5L\ 1.2D+Sn\ 1.2D+WnDn}$	6.75 Kn	Capacity	40.91 Kn	Passing Percentage	**606.07 %**
$V_{0.9D-WnUp}$	-3.44 Kn	Capacity	-51.13 Kn	Passing Percentage	**1486.34 %**

Deflections

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

k2 for Long Term Loads = 2

Deflection under Dead and Live Load = 4.07 mm Limit by Woolcock et al, 1999 Span/240= 25.00 mm

Deflection under Dead and Service Wind = 4.92 mm Limit by Woolcock et al, 1999 Span/100 = 60.00 mm

Reactions

Maximum downward =6.75 kn Maximum upward = -3.44 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

Factor of Safety = 0.7

For Perpendicular to grain loading

K11 = 12.6 fpj = 22.7 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) = -56.76 kn > -3.44 Kn

Single Shear Capacity under short term loads = -14.56 Kn > -3.44 Kn

Intermediate Design Front and Back

Intermediate Spacing = 2125 mm Intermediate Span = 3450 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 =0.70

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

Capacity Checks

$M_{Wind+Snow}$	3.57 Kn-m	Capacity	7.46 Kn-m	Passing Percentage	**208.96 %**
$V_{0.9D\text{-}WnUp}$	4.14 Kn-m	Capacity	-32.16 Kn-m	Passing Percentage	**776.81 %**

Deflections

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

Deflection under Snow and Service Wind = 21.67 mm Limit byWoolcock et al, 1999 Span/100 = 34.50 mm

Reactions

Maximum = 4.14 kn

Intermediate Design Sides

Intermediate Spacing = 3000 mm Intermediate Span = 3150 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 =0.67

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

Capacity Checks

$M_{Wind+Snow}$	2.10 Kn-m	Capacity	7.46 Kn-m	Passing Percentage	**355.24 %**
$V_{0.9D\text{-}WnUp}$	2.67 Kn-m	Capacity	32.16 Kn-m	Passing Percentage	**1204.49 %**

Deflections

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

Deflection under Snow and Service Wind = 21.245 mm   Limit by Woolcock et al, 1999 Span/100 = 31.50 mm

Reactions

Maximum = 2.67 kn

Girt Design Front and Back

Girt's Spacing = 1200 mm   Girt's Span = 2125 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 =0.80   S1 Downward =11.27   S1 Upward =17.32

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

Capacity Checks

$M_{Wind+Snow}$	0.58 Kn-m	Capacity	2.99 Kn-m	Passing Percentage	**515.52 %**
$V_{0.9D-WnUp}$	1.10 Kn-m	Capacity	16.08 Kn-m	Passing Percentage	**1461.82 %**

Deflections

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

Deflection under Snow and Service Wind = 2.35 mm   Limit by Woolcock et al, 1999 Span/100 = 21.25 mm
Sag during installation = 1.24 mm

Reactions

Maximum = 1.10 kn

Girt Design Sides

Girt's Spacing = 1200 mm   Girt's Span = 3000 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 =0.64   S1 Downward =11.27   S1 Upward =20.58

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

Capacity Checks

$M_{Wind+Snow}$	1.16 Kn-m	Capacity	2.40 Kn-m	Passing Percentage	**206.90 %**
$V_{0.9D-WnUp}$	1.55 Kn-m	Capacity	16.08 Kn-m	Passing Percentage	**1037.42 %**

Deflections

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

Deflection under Snow and Service Wind = 9.35 mm   Limit by Woolcock et al. 1999 Span/100 = 30.00 mm
Sag during installation =4.91 mm

Reactions

Maximum = 1.55 kn

Middle Pole Design

Geometry

225 SED H5 (Minimum 250 dia. at Floor Level)	Dry Use	Height	3200 mm
Area	44279 mm2	As	33209.1796875 mm2
Ix	156100441 mm4	Zx	1314530 mm3
Iy	156100441 mm4	Zx	1314530 mm3
Lateral Restraint	3400 mm c/c		

Loads

Total Area over Pole = 12.75 m2

Dead	3.19 Kn	Live	3.19 Kn
Wind Down	5.74 Kn	Snow	10.07 Kn
Moment wind	5.05 Kn-m	Moment snow	4.31 Kn-m
Phi	0.8	K8	0.92
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	589.62 Kn	PhiMnx Wind	35.30 Kn-m	PhiVnx Wind	78.64 Kn
PhiNcx Dead	353.77 Kn	PhiMnx Dead	21.18 Kn-m	PhiVnx Dead	47.18 Kn
PhiNcx Snow	471.69 Kn	PhiMnx Snow	28.24 Kn-m	PhiVnx Snow	62.91 Kn

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.18 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.06 < 1 OK

Deflection at top under service lateral loads = 5.65 mm < 32.00 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 =	1300 mm	Pile embedment length
f1 =	2700 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	5.05 Kn-m	Moment Snow =	Kn-m
Shear Wind =	1.87 Kn	Shear Snow =	4.31 Kn

Pile Properties

Safety Factory	0.55	
Hu =	4.89 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	7.84 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.88 < 1 OK

End Pole Design

Geometry For End Bay Pole

Geometry

225 SED H5 (Minimum 250 dia. at Floor Level)	Dry Use	Height	3200 mm
Area	44279 mm2	As	33209.1796875 mm2
Ix	156100441 mm4	Zx	1314530 mm3
Iy	156100441 mm4	Zx	1314530 mm3
Lateral Restraint	mm c/c		

Loads

Total Area over Pole = 12.75 m2

Dead	3.19 Kn	Live	3.19 Kn
Wind Down	5.74 Kn	Snow	10.07 Kn
Moment Wind	2.52 Kn-m	Moment snow	2.16 Kn-m
Phi	0.8	K8	0.95
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	606.59 Kn	PhiMnx Wind	36.32 Kn-m	PhiVnx Wind	78.64 Kn
PhiNcx Dead	363.95 Kn	PhiMnx Dead	21.79 Kn-m	PhiVnx Dead	47.18 Kn
PhiNcx Snow	485.27 Kn	PhiMnx Snow	29.05 Kn-m	PhiVnx Snow	62.91 Kn

Checks

(Mx/PhiMnx)+(N/phiNcx) = 0.11 < 1 OK

(Mx/PhiMnx)^2+(N/phiNcx) = 0.04 < 1 OK

Deflection at top under service lateral loads = 3.17 mm < 35.91 mm

Ds =	0.6 mm	Pile Diameter

L =	1300 mm	Pile embedment length
f1 =	2700 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Total Area over Pole = 12.75 m2

Moment Wind =	2.52 Kn-m	Moment Snow =	2.16 Kn-m
Shear Wind =	0.93 Kn	Shear Snow =	2.16 Kn

Pile Properties

Safety Factory	0.55	
Hu =	4.89 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	7.84 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.44 < 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 =	2700 mm	Distance at which the shear force is applied
f2 =	0 mm	Distance of top soil at rest pressure

Loads

Moment Wind =	2.52 Kn-m	Moment Snow =	2.16 Kn-m
Shear Wind =	0.93 Kn	Shear Snow =	2.16 Kn

Pile Properties

0.55

Safety Factory

Hu =	4.89 Kn	Ultimate Lateral Strength of the Pile, Short pile
Mu =	7.84 Kn-m	Ultimate Moment Capacity of Pile

Checks

Applied Forces/Capacities = 0.44 < 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(1300) x Ks(1.5) x 0.5 x tan(30) x Pi x Dia of Pile(0.6) x Height of Pile(1300)

Skin Friction = 13.65 Kn

Weight of Pile + Pile Skin Friction = 16.63 Kn

Uplift on one Pile = 7.08 Kn

Uplift is ok