



Consulting Engineers

BC

26 - 012748

Structural + Geotechnical + Civil



STRUCTURAL CALCULATIONS

PROJECT: Structural Review of Carport
ADDRESS: 177 Old Taupo Road, Rotorua

Our Ref: 26471
Date: 2/03/2026



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177 Old Tapanui Road

Job Ref 26421

Date

WIND LOADS

Sheet of

SITE WIND PRESSURE:

- CHECK WIND

$$\begin{aligned} q_{sit,B} &= 0.62 \text{ kPa}, & V_{sit,B} &= 32.2 \text{ m/s} & < 37 \text{ m/s} \\ q_{serv,B} &= 0.47 \text{ kPa}, & V_{serv,B} &= 27.9 \text{ m/s} & \text{Medium wind zone} \end{aligned}$$

SHAPE FACTOR:

- NZS1170.2:2021

$$\begin{aligned} C_{sp} &= C_{pi} k_a k_z & k_z & \text{Eq B.3(c)} \\ C_{pi} &= -1.2 & \text{Table B.5} & - \alpha < 15^\circ, C_{pw}, \text{ blocked} \\ k_a &= 1.0 \\ k_z &= \text{Table B.1} & \text{Purlins} & \text{elsewhere} \\ C_{sp} &= -1.2 \end{aligned}$$

DESIGN WIND PRESSURE:

$$\begin{aligned} P_{des, whs} &= -0.75 \text{ kPa} \\ P_{des, sls} &= -0.57 \text{ kPa} \end{aligned}$$

LIVE LOAD:

$$Q = 0.25 \text{ kPa}, 1.1 \text{ kN} \quad - 1170.1:2002 - \text{Table 3.2}$$

GRAVITY LOAD:

$$\begin{aligned} \text{TRUSSES} &= 0.15 \text{ kPa} \\ \text{PURLINS} &= 0.03 \text{ kPa} \\ \text{ROOFING} &= 0.02 \text{ kPa} \\ G_{CMS} &= 0.23 \text{ kPa} & \text{FOR UPLIFT CASE'S} & \text{(ROOF)} \\ \text{BRACES/FITTINGS} &= 0.03 \text{ kPa} \\ \text{SDL} &= 0.05 \text{ kPa} \\ G_{CMS} &= 0.31 \text{ kPa} & \text{FOR DOWNWARD CASE'S} & \text{(ROOF)} \\ \text{POSTS} &= \frac{5 \text{ kN}}{\text{m}^2} \times 0.125 \text{ m}^2 \times 2.5 \text{ m} \\ &= 0.156 \text{ kN ea} \\ &= 1.6 \text{ kN TOTAL (8x)} \end{aligned}$$

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PURLINS:

Rowd = 90x45 S&B H1.2 on FLAT @ 600 c/s
 SPAN = 1550 mm - OUTSIDE SCOPE OF NZS3604

DEMAND:

$$\begin{aligned}
 1.2 G &= 0.11 \text{ kPa} \times 0.6 \text{ m} \times 1.2 \\
 &= 0.08 \text{ kN/m}
 \end{aligned}$$

$$\begin{aligned}
 1.5 Q &= 0.375 \text{ kPa} \times 0.6 \text{ m} = 0.23 \text{ kN/m} \\
 \text{or } 1.5 \times 1.1 \text{ kN} &= 1.7 \text{ kN}
 \end{aligned}$$

$$\begin{aligned}
 m^* &= 0.024 \text{ kNm} + 0.07 \text{ kNm} \text{ or } 0.66 \text{ kNm} \\
 &= 0.69 \text{ kNm}
 \end{aligned}$$

$$V^* = 1.8 \text{ kN}$$

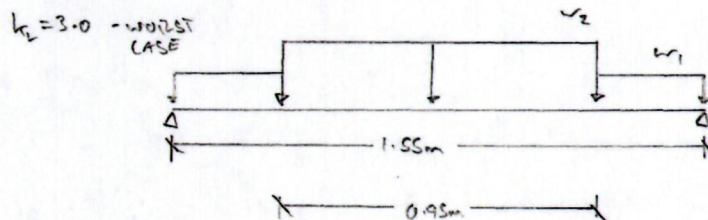
WIND: (k_z)

$$\begin{aligned}
 a &= 0.2 \times 7.5 \text{ m} \\
 &= 1.5 \text{ m}
 \end{aligned}$$

$$\frac{a}{0.6 \text{ m}} = 2.5 \quad - \quad k_z = 1.5 \quad - \quad \text{over whole purlin}$$

$$0.25 a^2 = 0.57 \text{ m}^2$$

$$\frac{0.25 a^2}{0.6} = 0.95 \text{ m} \quad - \quad k_z = 3.0 \quad - \quad \text{over } 0.95 \text{ m of span}$$



$$w_e = \left[\frac{0.75 \text{ kPa} \times 3.0 \times 0.95}{1.55} + \frac{0.75 \text{ kPa} \times 0.6}{1.55} \right] \times 0.6 \text{ m}$$

$$= 1.01 \frac{\text{kN}}{\text{m}} \quad (\text{ULS})$$

$$= 0.77 \frac{\text{kN}}{\text{m}} \quad (\text{SLS})$$

$$\begin{aligned}
 0.9 G - w_n &= 0.9 \times (0.11 \text{ kPa} \times 0.6 \text{ m}) - 1.01 \frac{\text{kN}}{\text{m}} \\
 &= -0.96 \frac{\text{kN}}{\text{m}}
 \end{aligned}$$

$$m^* = 0.29 \text{ kNm}$$

$$V^* = 0.75 \text{ kN} \quad - \quad 1.2 G + 1.5 Q \quad \text{GOVERNS STRENGTH}$$

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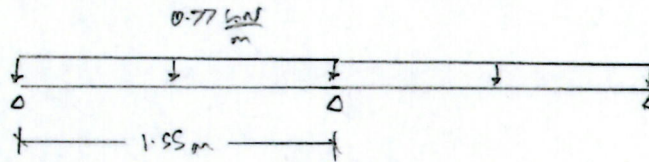
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SLS:



$$\Delta = \frac{wL^4}{185 EI}$$

$$= 4.4 \text{ mm}$$

$$L/\Delta = 351, \text{ ok}$$

$$E = 20.0 \text{ GPa}$$

$$I = \frac{90 \times 45^3}{12}$$

NOTE $\Rightarrow$ a pt load not checked, as this is not deemed a typical service level loading.

STRENGTH CHECK:

$$\phi M_u = \phi k f_c Z$$

$$= 0.34 \text{ kNm}$$

$$\phi V_u = \phi k f_c A_s$$

$$= 2.0 \text{ kN}$$

$$\phi = 0.8$$

$$k_1 = 1.0$$

$$k_2 = 1.0$$

$$k_3 = 1.0$$

$$k_4 = 1.0$$

$$k_{12} = 1.0 \quad - p = 0.26$$

$$f_c = 14 \text{ MPa} \quad S = 4.2$$

$$Z = 90 \times 45^2 / 6$$

$$= 30375 \text{ mm}^3$$

$$f_s = 3.7 \text{ MPa}$$

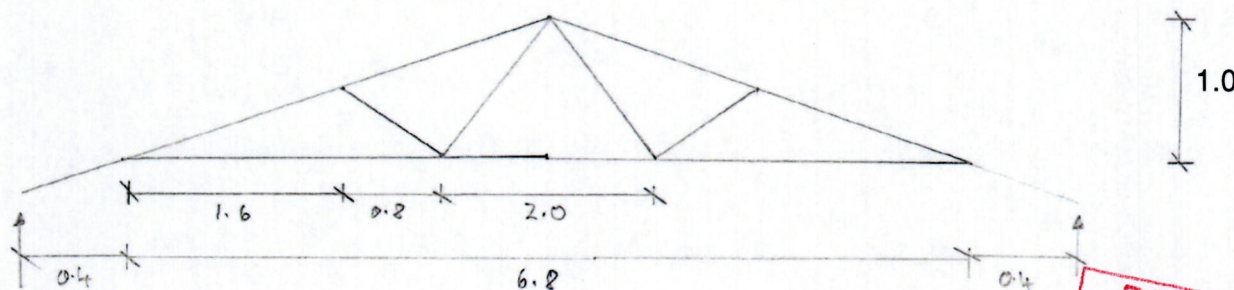
$$A_s = 2/3 b d$$

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GEOMETRY

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TOP/BOTTOM CHORDS - 90 x 45
STRUTS - 70 x 45

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LOADS

G_{up}	=	0.08 kPa	=	0.13
G_d	=	0.16 kPa	=	0.25
Q	=	0.25 kPa	=	0.39
W_u	=	-0.75 kPa	=	1.17
W_s	=	-0.57 kPa	=	0.89

$TW = 1.55m$

$\frac{kN}{m}$

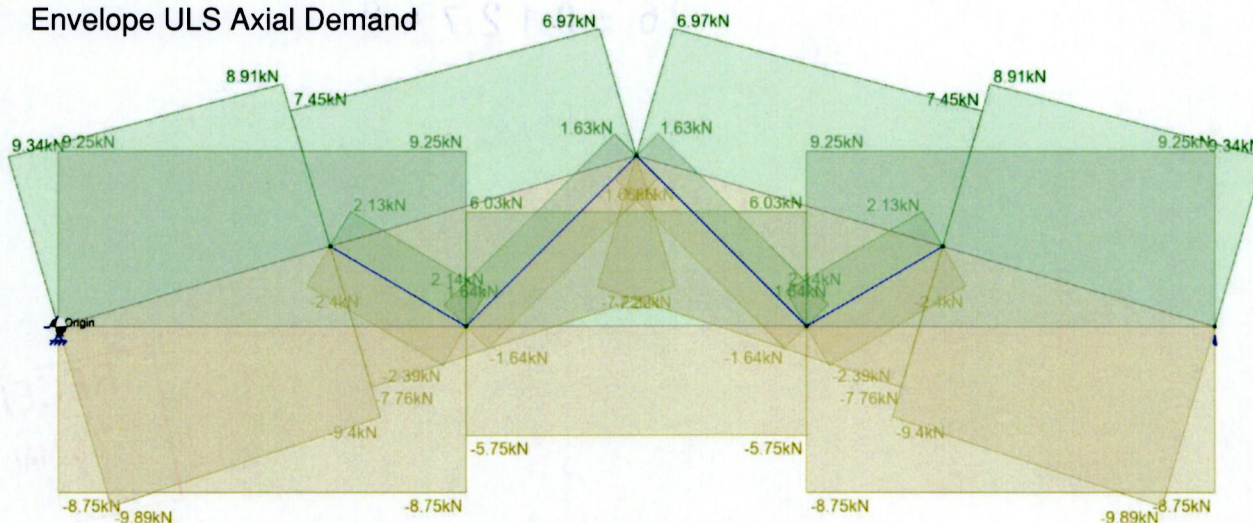
LOAD COMBINATIONS

$1.2G_d + 1.5Q$	=	0.89 kN/m	
$0.9G_{up} - W_u$	=	-1.1 kN/m	- ULS Governing Case
$0.9G_{up} - W_s$	=	-0.77 kN/m	- SLS Governing Case.
$G_d + Q$	=	0.64 kN/m	

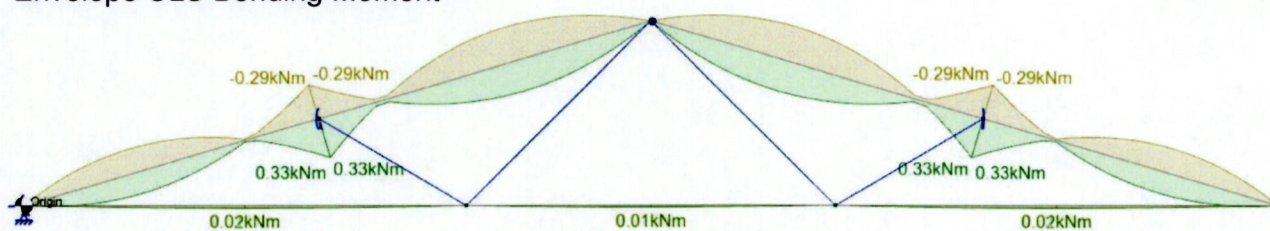
DEMANDS

M^*	=	0.44 kNm	TOP CHORD - L = 1.9m
V^*	=	1.0 kN	"
N^*	=	9.4 kN (C)	BOTTOM CHORD - L = 2.4m
		9.9 kN (T)	
N^*	=	2.2 kN (C)	STRUTS - L = 1.4m
		2.4 kN (T)	

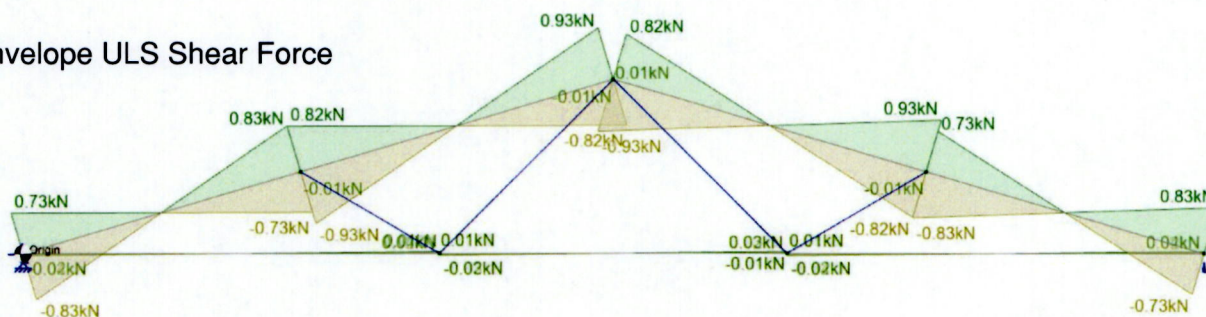
Envelope ULS Axial Demand



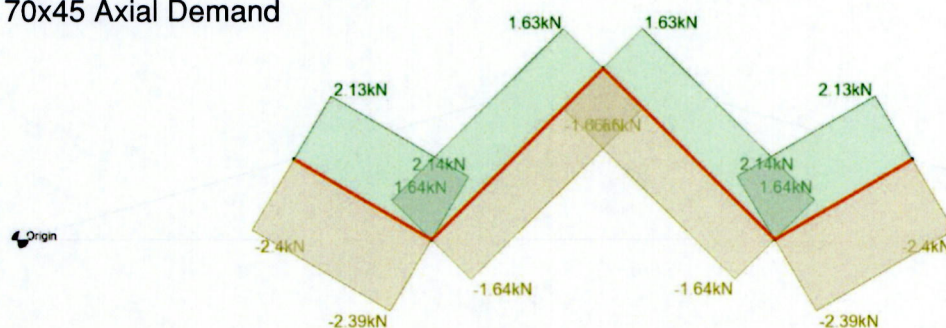
Envelope ULS Bending Moment



Envelope ULS Shear Force

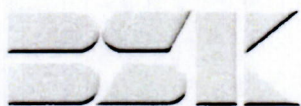


70x45 Axial Demand



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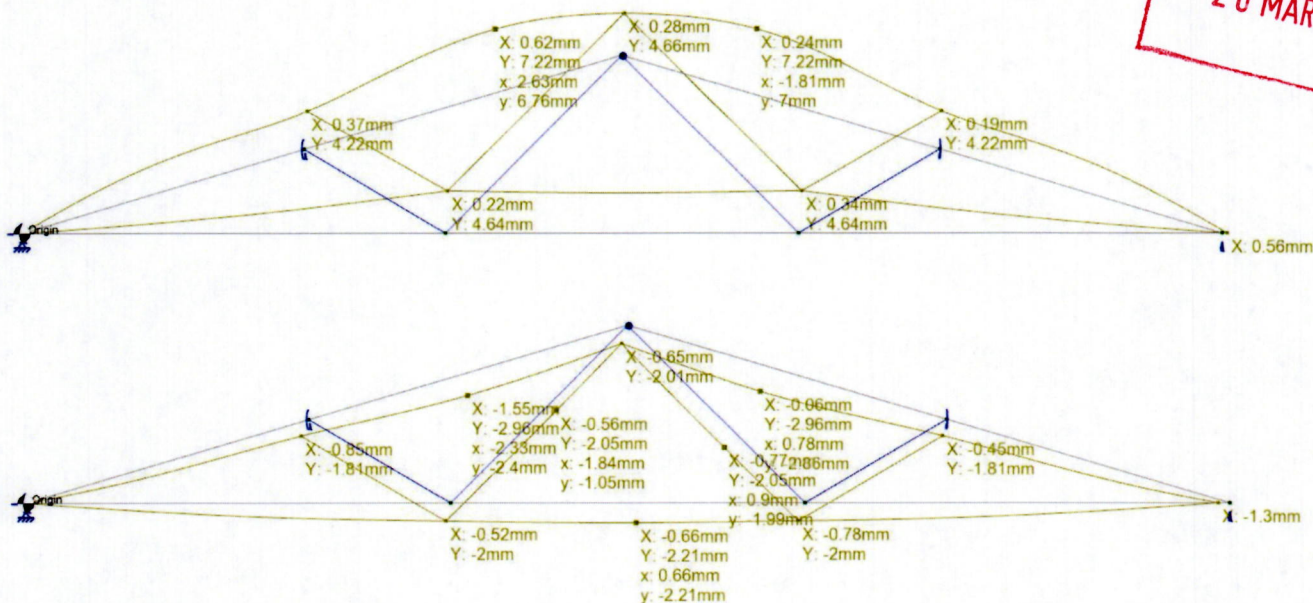
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Envelope SLS Deflection

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Global Deflection:

6.0 m / 5 mm = 1200, OK

Local Deflection:

3.5m / 7 mm = 500, OK

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TRUSS MEMBER CAPACITY

goals

$$\begin{aligned}\phi M_n &= \phi k f_b Z \\ &= 0.46 \text{ kNm}, \text{ ok} \\ \phi V_n &= \phi k f_c A_s \\ &= 2.2 \text{ kN}, \text{ ok} \\ \phi N_c &= \phi k f_c A_c \\ &= 7.3 \text{ kN}, \text{ NOT ok}\end{aligned}$$

goals

$$\begin{aligned}\phi N_c &= \phi k f_c A_c \\ &= 26 \text{ kN}, \text{ ok}\end{aligned}$$

No. 1 FRAMING:

$$\begin{aligned}\phi &= 0.8 \\ f_b &= 10 \text{ MPa} \\ f_c &= 3.8 \text{ MPa} \\ f_t &= 15.0 \text{ MPa} \\ k_1 &= 1.0 \\ k_{x1} &= 1.0 \\ k_4 &= 1.0 \\ k_{12} &= 0.95 \quad (B) \\ Z &= bd^2/6 \\ A_s &= 2/3 \times bd \\ f_c &= 15 \text{ MPa} \\ A_c &= bd \\ k_b &= 1.0 \\ k_{12} &= 0.15 \quad (C) \\ S &= 2.44 \times 10^6 \text{ mm}^3 \\ &= 53 \\ k_{12} &= 0.7 \\ A_c &= 70 \times 45\end{aligned}$$

Truss chord fixings:

$V^* = 1.1 \text{ kN/m}$ - see loads, worst case is uplift combination.

1 nail @ 300 cr's

$\phi Q_n = \phi k n Q$

$\phi = 0.8$

$k = 0.85 \times 0.8$ (green)

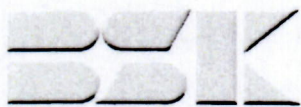
$n = 1/0.3$

$q_k = 0.863 \text{ kN/j4 } 3.15 \text{ mm dia}$

$\phi Q_k = 1.5 \text{ kN/m}$

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TRUSS END CANTILEVER:

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$$\begin{aligned} L &= 0.45m \\ F^* &= 3.5 kN \\ M^* &= 1.6 kNm \\ V^* &= 3.5 kN \end{aligned}$$

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140x45:

$$\begin{aligned} \phi M_n &= \phi k f_b Z \\ &= 1.31 kNm, \text{ NOT OK.} \\ \phi V_n &= \phi k f_b A_g \\ &= 9.9 kN, \text{ OK} \end{aligned}$$

$\Rightarrow 1 \times 140 \times 45 / \text{SIDE}:$

$$\phi M_n = 2.62 kNm, \text{ OK.}$$

$\Rightarrow$ STITCH 140x45 S68 TO EITHER SIDE TO TRANSFER LOADS TO BEAMS.

OR:

L_x 90x45 TOP CHORD:

$$\begin{aligned} \phi M_n &= \phi k f_b Z \\ &= 0.39 kNm \end{aligned}$$

$$\begin{aligned} f_b &= 10 MPa \\ Z &= 45 \times 90^2 / 6 \end{aligned}$$

$\pm 1 \times 140 \times 45$

$$= 1.7 kNm, \text{ OK}$$

CONNECT TO BEAM WITH MP66L PRYDA MULTIGRIP = 4.6 kN (132 mm LENGTH), ONE SIDE.

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BEAMS

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LOADS

$$P^* = 3.5 \text{ kN ULS}, \quad 3.2 \text{ kN}$$

FROM TRUSS MODEL - INCLUDES TRUSS SELF WEIGHT.

$$L = 3.0 \text{ m}$$

$$M^* = \frac{3.5 \text{ kN} \times 3.0 \text{ m}}{4} = 2.6 \text{ kNm}$$

$$V^* = \frac{3.5 \text{ kN}}{2} = 1.8 \text{ kN}$$

$$\text{PROVID} \Rightarrow 2 \times 140 \times 45 \text{ SLB}$$

$$d = \frac{PL^3}{48EI} = 11 \text{ mm}$$

$$E = 8.0 \text{ GPa}$$

$$I = \frac{2 \times 45 \times 140^3}{12}$$

$$L/d = 273$$

→ BEAMS HAVE SOME CONTINUITY TO NEXT SPAN, SO OK

$$\phi M_n = \phi k f_b Z$$

$$= 2.63 \text{ kNm}, \quad \text{OK}$$

$$\phi V_n = \phi k f_s A_s$$

$$= 20.4 \text{ kN}, \quad \text{OK}$$

$$\phi = 0.8$$

$$k_1 = 0.8$$

$$k_2 = 1.0$$

$$f_b = 14 \text{ MPa}$$

$$Z = \frac{40 \times 140^2}{6}$$

$$f_s = 3.8 \text{ MPa}$$

$$A_s = \frac{2}{3} \times 90 \times 140$$

→ BEAMS OK.

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LOADS

$$N^* = 2 \times P^* = 7.0 \text{ kN ULS}, 6.4 \text{ kN SLS}$$

$$h = 2.4 \text{ m}$$

$$\phi N_c = \phi k f_c A = 36 \text{ kN}, \text{ ok}$$

$$\begin{aligned} \phi &= 0.8 \\ k_1 &= 0.8 \\ f_c &= 18 \text{ MPa} \\ A &= 125 \text{ mm}^2 \\ k_{10} &= 2.0 \\ k_2 &= 0.25 \end{aligned}$$

BEARING

$$A = \pi \left(\frac{0.5}{2} \right)^2 = 0.19 \text{ m}^2$$

$$P_s^* = 36 \text{ kPa}$$

UPLIFT

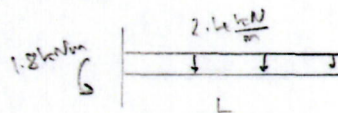
$$G_{\text{foot}} = \frac{2.4 \text{ kN}}{\text{m}^2} \times 1.0 \text{ m} \times \pi \left(\frac{0.5}{2} \right)^2 = 4.7 \text{ kN}, \text{ NOT ok}$$

If slab is connected to footings:

$$\text{Slab: } G_{\text{slab}} = 1.8 \text{ kNm}$$

$$G_{\text{slab}} = \frac{2.4 \text{ kN}}{\text{m}^2} \times 0.1 \text{ m} = 2.4 \text{ kPa}$$

$$A_{\text{reqd}} = \frac{7.0 \text{ kN} - 4.7 \text{ kN}}{2.4 \text{ kPa}} = 0.95 \text{ m}^2$$



$$L_{\text{reqd}} = 1.0 \text{ m}$$

$$L_{\text{available}} = 1.2 \text{ m}, \text{ ok.}$$

$$\sum G_{\text{foot}} + G_{\text{slab}} = 4.7 \text{ kN} + 2.4 \text{ kPa} \times 1.2 \text{ m} \times 1.0 \text{ m} = 7.6 \text{ kN}, \text{ ok.}$$

RC Beam Flexural Strength Capacity

rebar dia =	6.1 mm
# bars =	5
f_y =	500 MPa
f'_c =	20 MPa
ϕ =	0.85
t =	100 mm
w =	1000 mm
Cover =	50 mm
d =	$(t - \text{Cover}) - (\text{rebar dia}/2)$ 46.95 mm
A_s =	146 mm ²
α =	0.85
a =	$T/\alpha \cdot f'_c \cdot w$ 4 mm
ϕM_n =	$\phi \cdot A_s \cdot f_y \cdot (d - a/2)$ 2.8 kNm

Note:

1.8 kNm used in calcs, negative moment demand, so cover of 50 mm is conservative.



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POSTS

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If slab is not connected to footings, consider skin friction on footing:



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Pile design as per NZ Building Code B1/VM4

GROUND MODEL

Soil type	Depth to Base, z (m)	Thickness, H (m)	Unit Weight, γ (kN/m ³)	Friction Angle, Φ (°)	Effective Cohesion, c' (kPa)	Undrained Shear Strength, S_u (kPa)
Loose Pumice Sand	10	10	16	26	0	Not Applicable
Cohesion less soil, conservative values used						

Depth to groundwater (m)	1
--------------------------	---

PILE

Pile type	Pile Length (m)	Pile Diameter (mm)	Ultimate End Bearing Capacity (kN)	Ultimate Shaft Friction (kN)	Allowable/ Design Capacity (kN)
Anchor	1	500	25.6	4.6	15.1
			0.0	0.0	0.0
			0.0	0.0	0.0

Strength Reduction Factor	0.5
Design Cases	Drained
	Cohesionless
	Bored
	<40% Relative Density

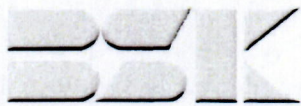
Cut-off is 3 Blows per 100mm

Ultimate shaft friction = $0.5 \times 4.6 \text{ kN} = 2.3 \text{ kN}$

Total Uplift resistance = $4.7 \text{ kN} + 2.3 \text{ kN} = 7.0 \text{ kN}$, OK

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LATERAL LOADS

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$$\begin{aligned} q_{act} &= 0.72, \mu = 1.0 - \text{FOUNDATIONS} \\ &= 0.24, \mu = 2.0 - \text{TIMBER POSTS} \\ q &= 0.31 \text{ kPa} \\ TA &= \frac{9.7 \text{ m}}{3} \times \frac{7.6 \text{ m}}{2} \\ &= 12.3 \text{ m}^2 \end{aligned}$$

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POST DEMAND

$$\begin{aligned} F^* &= 0.24 \times 0.31 \text{ kPa} \times 12.3 \text{ m}^2 \\ &= 0.92 \text{ kN} = V^* \\ M^* &= 2.2 \text{ kNm} \\ \phi M_n &= \phi k f_b Z \\ &= 2.9 \text{ kNm} \end{aligned}$$

FOOTING:

BROMS EQUATION:

$$\begin{aligned} \phi H_n &= \frac{\phi \gamma d L^3 k_p}{2(e + L)} \\ &= 1.9 \text{ kN} \\ F^* &= 0.72 \times 0.31 \text{ kPa} \times 12.3 \text{ m}^2 \\ &= 2.75 \text{ kN} \end{aligned}$$

$$\begin{aligned} \phi &= 0.8 \\ k_1 &= 0.8 \\ k_2 &= 1.0 \\ f_b &= 14 \text{ MPa} \\ Z &= bd^2/6 \\ \phi &= 0.5 \\ \gamma &= 17 \text{ kN/m}^3 \\ d &= 0.5 \text{ m} \\ L &= 1.0 \text{ m} \\ e &= 2.4 \text{ m} \\ k_p &= 3.0, \phi = 30^\circ \end{aligned}$$

⇒ POSTS CANNOT CANTILEVER UNDER SEISMIC LOADS

BRACE:

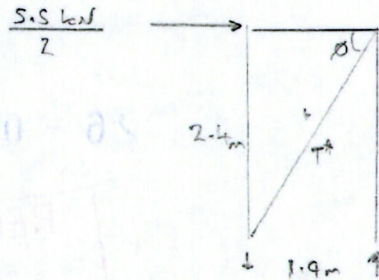
$$\begin{aligned} N^* &= 0.24 \times 0.31 \text{ kPa} \times 7.6 \text{ m} \times 9.7 \text{ m} \\ &= 5.5 \text{ kN} \\ \phi N^* &= 6.2 \text{ kN} - 91 \times 25 \text{ mm Sheet Brace Strap, OK.} \end{aligned}$$

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WALL BRACES

WORST DIMS:



2x Brace units per direction

$$b = \sqrt{2.4^2 + 1.9^2}$$

$$= 3.1m$$

$$T^* = \frac{S.S kN}{2} \times \frac{3.1m}{1.9m}$$

$$= 4.5 kN$$

$$\phi N_t = \phi k f_t A$$

$$= 12.0 kN, ok.$$

$$\phi = 0.8$$

$$k_t = 0.8$$

$$f_t = 6 MPa$$

$$A = 90 \times (45 - 10) mm^2$$

(-10 to allow for slot for brackets)

FIXING

BILTS POLE BRACE BRACKET - 30 kN

→ Require 90 mm end distance for connection.
→ reduce ϕN_t from 12.0 kN to $\frac{60}{90} \times \phi N_t = 9 kN, ok$

Check compression = 90x90 posts.

$$N^* = \frac{S.S kN}{2} \times \frac{2.4m}{1.9m}$$

$$= 3.5 kN$$

$$\phi N_c = \phi k f_c A$$

$$= 51.3 kN, ok$$

$$\phi = 0.8$$

$$k_c = 0.8$$

$$k_{c0} = 1.0$$

$$k_{c2} = 0.55$$

$$f_c = 18 MPa$$

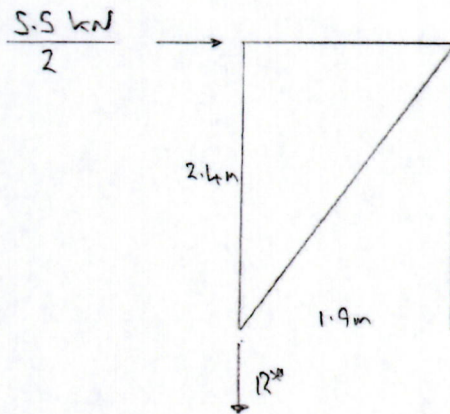
$$A = 90 mm^2$$

→ Other direction has lower demands

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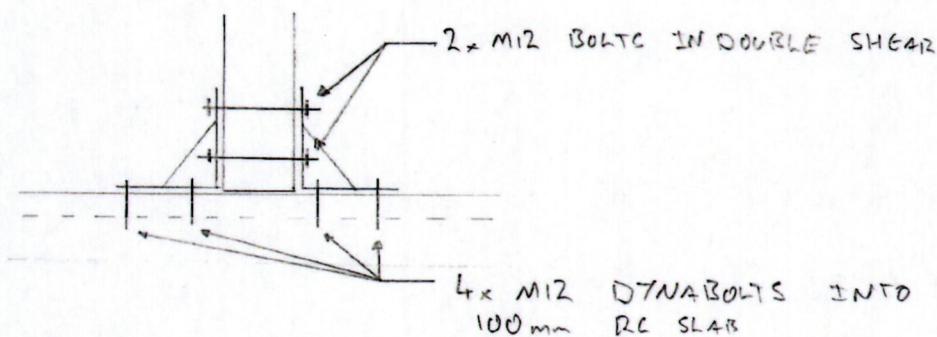


$$R^* = \frac{5.5 \text{ kN}}{2} \times \frac{2.4 \text{ m}}{1.9 \text{ m}}$$

$$= 3.5 \text{ kN}$$



CAPACITY:



Bolts - Ok by inspection

Dynabolts - 4x M12 - TYP CAPACITY RANGE 2.7 - 16.6 kN TENSION
⇒ Ok

Bracket - TENSION Ok by inspection
BENDING ⇒ $e' \approx 30 \text{ mm}$

$$m^* = \frac{3.5 \text{ kN}}{L_e} \times 30 \text{ mm} = 0.026 \text{ kNm}$$

$$\phi M_n = \phi f_y Z$$

$$= 0.028 \text{ kNm}$$

Ok

$$\phi = 0.9$$

$$f_y = 250 \text{ MPa}$$

$$Z = 30 \times 5^3 / 6$$

⇒ FIXING Ok.

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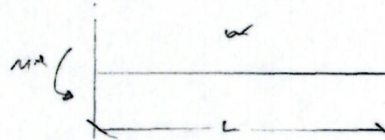
$$M^* = 1.6 \text{ kNm}$$

$$\phi_{Q_n} = 0.5 \text{ kN} \quad - \quad 3.15 \text{ mm } \phi \text{ nail}$$

$$@ 50 \text{ mm}$$

$$w = \frac{0.5 \text{ kN}}{50 \text{ mm}}$$

$$= \frac{10 \text{ kN}}{\text{m}}$$



$$L_{\text{reqd}} = \sqrt{\frac{2M^*}{w}}$$

$$= 0.57 \text{ m}$$

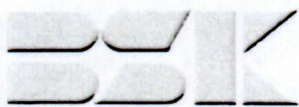
⇒ BACKSPAN 140x45 SGL 1.0 m min
NAIL OFF WITH 3.15 mm ϕ NAILS @ 50 mm c/c's
(IF STRENGTHENING TRUSSES WITH 90x45)

OR:

STRENGTHEN TRUSSES $\Rightarrow$ 140x45, EXTEND OUT TO
ACT AS CANTILEVER, ONLY REQUIRED ON ONE
SIDE.

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Job Ref 26471

Date

'END WALL' TRUSS

Sheet of

→ NO TRUSS ACTION FROM INSTALLED TRUSS.
→ IGNORE EXISTING.

Try: 140x45 TRUSS

$$N^* = 9.4 \text{ kN}$$

$$Q^* = 13.6 \text{ kN, ok.}$$

$$\phi = 0.8$$

$$k_1 = 1.0$$

$$k_{12} = 0.15$$

$$f_c = 18 \text{ MPa}$$

$$A_c = 140 \times 45$$

⇒ BUILD NEW TRUSS COPING TYPICAL TRUSS GEOMETRY & 140x45 SGB.
STITCH TO 'END WALL' TRUSS TOP AND BOTTOM CHORDS = 3.15 mm ϕ nails @ 400 mm C/S.

* SEE MAIN TRUSS DEMANDS.

BC

26 - 012748

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BETWEEN TRUSS BRACING

Sheet of

$$C_{d, CTD} = 0.24, \text{ ULS, } \mu = 3.0$$

$$G = 0.81 \text{ kPa}$$

$$A = 67 \text{ m}^2$$

$$F_{LAT}^* = 5.0 \text{ kN}$$

$$F_{BRACE}^* = F_{LAT}^* / n.bays$$

$$n.bays = 6$$

$$= 0.83 \text{ kN}$$

$$L = \sqrt{1.5^2 + 1.7^2}$$

$$= 2.3 \text{ m}$$

$$N_{BRACE}^* = F_{BRACE}^* \times \frac{2.3 \text{ m}}{1.5 \text{ m}}$$

$$= 1.3 \text{ kN}$$

$$\phi N_t = \phi k f_t A$$

$$8 \times 5 \times 10 = 12 \text{ kN}$$

→ Governed by connections.

Tension Compression Brace:

$$\phi N_c = \phi k f_c A$$

$$= 2.9 \text{ kN, OK}$$

⇒ Shear nails OK.

$$\phi = 0.8$$

$$k_1 = 0.8$$

$$f_t = 6 \text{ MPa}$$

$$A = 90 \times 35$$

$$f_c = 18 \text{ MPa}$$

$$k_{10} = 1.0$$

$$S = 2.3 / 0.035$$

$$= 65$$

$$k_2 = 0.08$$

$$A = 90 \times 35$$

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Date

Purlin Strengthening

Sheet of

DEMAND:

$$P^* = 1.1 \text{ kN}$$

$$M^* = 0.69 \text{ kNm}$$

$$\phi M_n = 0.84 \text{ kNm}$$

$$M_{req'd} = 0.85 \text{ kNm}$$

Try: Screw extra 90x45 on EDGE under ex purlins.

$$\phi M_n = \phi k_f Z$$

$$= 0.84 \text{ kNm}$$

$$\Sigma \phi M = 0.88 \text{ kNm}$$

BC 26 - 012748

- See purlin calc.

- 90x45 S&B on FLAT @ 600

$$\phi = 0.8$$

$$L_{tr} = 0.8$$

$$L_{te} = 1.0$$

$$f_u = 14 \text{ MPa}$$

$$Z = 45 \times 90^2 / 6 \text{ mm}^3$$

CONNECTION:

$$UDL_{EK} = \frac{8 \times M^*}{L^2}$$

$$= 2.5 \frac{\text{kN}}{\text{m}} \quad \text{- shear load on fixings.}$$

Try Screws @ 300 mm c/s

$$N_d = \phi 4.3 \text{ kN}$$

$$= 1.15 \text{ kN}$$

$$N_x = \frac{2.5 \text{ kN}}{\text{m}} \times 0.3 \text{ m}$$

$$= 0.75 \text{ kN}, \text{ OK.}$$

$$\phi = 0.8$$

$$L_{tr} = 1.0$$

$$L_{pn} = 30 \text{ mm}$$

$$Q_u = 48 \frac{\text{N}}{\text{mm}} 12g$$

⇒ 90x45 S&B on EDGE FIXED UNDER EXISTING PURLINS
 ⇒ 12g x 120mm MINIMUM SCREWS @ 300 mm c/s

Not what has been shown on the drawings,
 see further calculations in the updates section

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END TRUSSES

$$L = 1.6 \text{ m}$$

$$w = -1.1 \frac{\text{kN}}{\text{m}}$$

$$= -0.77 \frac{\text{kN}}{\text{m}}$$

ULS
SLS

For $T_w = 1.55 \text{ m}$
END WALL $T_w = 0.8 \text{ m}$

$$w = -0.55 \frac{\text{kN}}{\text{m}}, -0.39 \frac{\text{kN}}{\text{m}} \quad \text{ULS, SLS}$$

140 x 45:

ULS

$$M^* = 0.35 \text{ kNm} \quad 0.18 \text{ kNm}$$

$$V^* = 0.88 \text{ kN} \quad 0.44 \text{ kN}$$

$$\phi M_u = 0.33 \text{ kNm}, \quad \text{ok}$$

$$\phi V_u = 9.9 \text{ kN}, \quad \text{ok}$$

SLS

$$\Delta = \frac{5 w L^4}{384 EI}$$

$$= 0.4 \text{ mm}$$

$$L/\Delta = \sim 4000, \quad \text{ok}$$

$$\phi = 0.8$$

$$k_1 = 0.8$$

$$k_2 = 0.25$$

$$L/b = 36$$

$$b/d = 3$$

$$f_b = 14 \text{ MPa}$$

$$z = 45 \times 140^2 / 6$$

$$A_v = 4200 \text{ mm}^2$$

$$f_s = 3.7 \text{ MPa}$$

$$E = 8 \text{ GPa}$$

$$I = bd^3/12$$

FIXINGS

$$V^* = 0.55 \frac{\text{kN}}{\text{m}} \times \frac{1.6 \text{ m}}{\text{m}}$$

$$= 0.9 \text{ kN}$$

$$Q_k = 0.78 \text{ kN} - 3.75 \text{ mm } \phi$$

$$N_{d,2} = \phi k_1 k_{13} k_{14} k_{16} k_{17} n Q_k$$

$$= 1.0 \text{ kN}, \quad \text{ok}$$

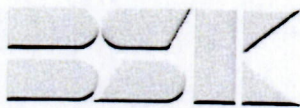
$$\phi = 0.8$$

$$k_1 = 0.8$$

$$k_{13/14/16} = 1.0$$

$$k_{17} = 1.0$$

$$n = 2$$



Consulting Engineers

177 Old Tapanui Rd.

Job Ref 26471

Date

Updates

Sheet of

Rafter Nailed Connection:

BC 26-012748

→ for fixing of further rafter members.

$$V_{ax} = 2.5 \frac{kN}{m}$$

→ 2 x 7.75 x 90 mm Nails @ 200 c/s

$$M_{ds} = \phi k_1 k_2 k_3 k_4 k_5 k_6 k_7 n Q_k$$

$$= 3.3 \frac{kN}{m}, \text{ OK}$$

Not what has been provided in the drawings, see the following page for justification of provided fixings

$$\begin{aligned} Q &= 0.8 \\ k_1 &= 0.8 \\ k_2 &= 1.0 \\ k_3 &= 1.0 \\ k_4 &= 1.0 \\ k_5 &= 1.0 \\ k_6 &= 1.0 \\ n &= 2 \times 1.0m / 0.3m \\ Q_k &= 0.78 kN \end{aligned}$$

Beam

→ Additional 140 x 45 SHB

$$p_{ax} = \begin{matrix} 3.5 & kN & ULS \\ 3.2 & kN & SLS \end{matrix}$$

$$M_{ax} = 2.63 \text{ kNm}$$

$$\phi M_{ax} = \phi k_1 k_2 k_3 k_4 k_5 k_6 k_7 n Q_k$$

$$= 3.95 \text{ kNm}, \text{ OK}$$

V ok - see previous calc.

$$\Delta = 7.3 \text{ mm} = \frac{PL^3}{48EI}$$

$$L/\Delta = 409$$

$$\begin{aligned} Q &= 0.8 \\ k_1 &= 0.8 \\ k_2 &= 1.0 \\ k_3 &= 1.0 \\ k_4 &= 1.0 \\ k_5 &= 1.0 \\ k_6 &= 1.0 \\ k_7 &= 1.0 \\ n &= 2 \times 1.0m / 0.3m \\ Q_k &= 0.78 kN \end{aligned}$$

$$\begin{aligned} E &= 210 \text{ GPa} \\ I &= \frac{3 \times 45 \times 140^3}{6} \\ L &= 3.0m \end{aligned}$$

→ Total 3 x 45 x 140 SHB Beams, OK

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Partial nailed connection

Provided : 90x3.75 @ 300 c/s + 2x 90x3.75 shear nails/end.

$$M_{ed} = 0.69 \text{ kNm} \quad \cdot \text{ See partial calcs}$$

$$M_{ed} = 0.34 \text{ kNm} \quad \cdot \text{ See partial calcs}$$

90x3.75 on edge flat

$$M_{resd} = 0.35 \text{ kNm}$$

$$\phi N_{di} = \phi k_n Q_k$$

$$= 1.0 \text{ kN}$$

$$V_{ed} = \frac{M_{resd} \times 4}{L}$$

$$= 0.93 \text{ kN}$$

⇒ Shear load on shear nails from bending - when pt load is above support, ex partial on flat can take this load through shear.

$$\phi N_{di} \Rightarrow 0.54 \text{ kNm}, \text{ etc}$$

90x3.75 on edge

⇒ There will also be load transfer w/ the nails @ 300 c/s - shear flow that will reduce the load on these connections ⇒ Therefore this is a conservative approach.

$$\begin{aligned} \phi &= 0.8 \\ k_n &= 0.8 \\ n &= 2 \\ Q_k &= 0.78 \text{ kN} \end{aligned}$$

$$L = 1.5 \text{ m}$$

**PRODUCER STATEMENT – PS1
DESIGN**

BC

26 CANCELLED
26-01-27-48



association of
consulting
engineers



BUILDING CODE CLAUSE(S): B1
ISSUED BY: BSK Consulting Engineers Limited
(Engineering Design Firm)
TO: Bruce Nickalls
(Owner/Developer)
TO BE SUPPLIED TO: Rotorua Lakes Council
(Building Consent Authority)
IN RESPECT OF: Carport Remediation Works
(Description of Building Work)
AT: 177 Old Taupo Road, Utuhina, Rotorua
(Address, Town/City)
LEGAL DESCRIPTION: Lot 11 DP 5265

JOB NUMBER: 26471



N/A ☐

We have been engaged by the owner/developer referred to above to provide (Extent of Engagement):

Structural design for remedial works on partially constructed carport

in respect of the requirements of the Clause(s) of the Building Code specified above for Part only, as specified in the Schedule, of the proposed building work.

The design carried out by us has been prepared in accordance with:

- ☒ Compliance documents issued by the Ministry of Business, Innovation & Employment (Verification method/acceptable solution) B1/VM1 and/or;
- ☐ Alternative solution as per the attached Schedule.

The proposed building work covered by this producer statement is described on the drawings specified in the Schedule, together with the specification, and other documents set out in the Schedule.

On behalf of the Engineering Design Firm, and subject to:

- Site verification of the following design assumptions: Current construction as shown on drawings/details.
- All proprietary products meeting their performance specification requirements;

I believe on reasonable grounds that:

- the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the Schedule, will comply with the relevant provisions of the Building Code and that;
- the persons who have undertaken the design have the necessary competency to do so.

I recommend the CM 3 level of construction monitoring.

I, (Name of Engineering Design Professional) Bradley Noel Christie, am:

- ☒ CPEng number 1019704

and hold the following qualifications BE Civil (Hons), NZDE Civil

The Engineering Design Firm holds a current policy of Professional Indemnity Insurance no less than \$200,000
The Engineering Design Firm is a member of ACE New Zealand.

SIGNED BY (Name of Engineering Design Professional): Bradley Noel Christie
(Signature below):

ON BEHALF OF (Engineering Design Firm): BSK Consulting Engineers Limited

Date: 24/03/26

Note: This statement has been prepared solely for the Building Consent Authority named above and shall not be relied upon by any other person or entity. Any liability in relation to this statement accrues to the Engineering Design Firm only. As a condition of reliance on this statement, the Building Consent Authority accepts that the total maximum amount of liability of any kind arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in tort or otherwise, 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.

Job Number 26471
PRODUCER STATEMENT PS1

Page 1 of 3

Received

November 2021

26 MAR 2026

Rotorua Lakes Council
Customer Centre

0311570112

SCHEDULE to PS1

Please include an itemised list of all referenced documents, drawings, or other supporting materials in relation to this producer statement below:

ASSOCIATED DOCUMENTATION:

- 26471 - B2 Compliance Letter
- 26471 - Calculations
- 26471 - Drawings - Trevor Rowson #2603

ENGINEER TO INSPECT REMEDIAL WORKS UPON COMPLETION IN ACCORDANCE WITH THE BSK DESIGN.

GUIDANCE ON USE OF PRODUCER STATEMENTS

Information on the use of Producer Statements and Construction Monitoring Guidelines can be found on the Engineering New Zealand website

<https://www.engineeringnz.org/engineer-tools/engineering-documents/producer-statements/>

Producer statements were first introduced with the Building Act 1991. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects (NZIA), Institution of Professional Engineers New Zealand (now Engineering New Zealand), Association of Consulting and Engineering New Zealand (ACE NZ) in consultation with the Building Officials Institute of New Zealand (BOINZ). The original suite of producer statements has been revised at the date of this form to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with part of the reasonable grounds necessary for the issue of a Building Consent or a Code Compliance Certificate, without necessarily having to duplicate review of design or construction monitoring undertaken by others.

PS1 DESIGN Intended for use by a suitably qualified independent engineering design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

PS2 DESIGN REVIEW Intended for use by a suitably qualified independent engineering design review professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

PS3 CONSTRUCTION Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2013 or Schedules E1/E2 of NZIA's SCC 2011²

PS4 CONSTRUCTION REVIEW Intended for use by a suitably qualified independent engineering construction monitoring professional who either undertakes or supervises construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.

This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACE New Zealand and Engineering New Zealand to interpret the Producer Statement.

Competence of Engineering Professional

This statement is made by an engineering firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its personnel.

The person signing the Producer Statement on behalf of the engineering firm will have a professional qualification and proven current competence through registration on a national competence-based register such as a Chartered Professional Engineer (CPEng).

Membership of a professional body, such as Engineering New Zealand provides additional assurance of the designer's standing within the profession. If the engineering firm is a member of ACE New Zealand, this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent engineering professional".

Professional Indemnity Insurance

As part of membership requirements, ACE New Zealand requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI Insurance minimum stated on the front of this form reflects standard practice for the relationship between the BCA and the engineering firm.

Professional Services during Construction Phase

There are several levels of service that an engineering firm may provide during the construction phase of a project (CM1-CM5 for engineers³). The building Consent Authority is encouraged to require that the service to be provided by the engineering firm is appropriate for the project concerned.

Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

Refer Also:

- ¹ Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2013
- ² NZIA Standard Conditions of Contract SCC 2011
- ³ Guideline on the Briefing & Engagement for Consulting Engineering Services (ACE New Zealand/Engineering New Zealand 2004)
- ⁴ PN01 Guidelines on Producer Statements

www.acenz.org.nz
www.engineeringnz.org

RECEIVED
26 MAR 2026

November 2021

25 March 2026

Rotorua Lakes Council
Private Bag 3029
Rotorua Mail Centre
ROTORUA 3046



Attention: Building Consents Department

Dear Sir

RE: PROPOSED CARPORT AT 177 OLD TAUPŌ ROAD, ROTORUA

BSK REF: 26471

The purpose of this letter is to discuss structural performance with regards to Clause B2 of the Building Code - Structural Durability

We are not able to provide a design Producer Statement - PS1 for clause B2 as there is no effective verification method for B2 contained within the Building Code.

However, we can confirm the following for the structural elements shown in our documentation.

Concrete

Concrete covers have been selected in accordance with NZS3101, Part 1, Section 3

Timber

Timber treatment has been selected in accordance with Table 1A of B2/AS1

We trust this provides the information required. Please contact the undersigned if you wish to discuss this matter further.

Yours faithfully,

Brad Christie
BE Civil (Hons), CMEngNZ, CPEng, NZDE Civil
BSK CONSULTING ENGINEERS LTD

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