

# EASTERN CONSULTING LIMITED

## CONSULTING CIVIL & STRUCTURAL ENGINEERS

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### *Producer Statement – PS1 – Design*

Issued by: Eastern Consulting Limited  
To: Gibraltar Built, Te Puke

In respect of: Flare by Gibraltar Built, outdoor fire place.

Dr Peter Davenport, of Eastern Consulting Limited, has been engaged by Gibraltar Built to provide structural design of the outdoor fire place. These items are not covered by NZS 3604 or other building standards and it is needed to verify compliance with the requirements of clause B1 of the Building Regulations 1992 for these items.

I have carried out calculations for these components in accordance with NZBC verification method B1/VM1 of the approved documents issued by the Department of Building and Housing and the work is described on drawings titled Flare by Gibraltar Built – Metro/Tuscany, dwg # PS1-1, PS1-2, PS1-3 and PS1-4, dated 19/02/2010, the assembly instructions and the calculations to support this.

On behalf of the Design Firm, and subject to:

- (i) Site verification of suitable ground as defined in NZS3604
- (ii) Construction in accordance with the assembly instructions

I believe on reasonable grounds that the fire place, if constructed in accordance with the drawings, specifications and other documents provided, will comply with the relevant provisions of the building code.

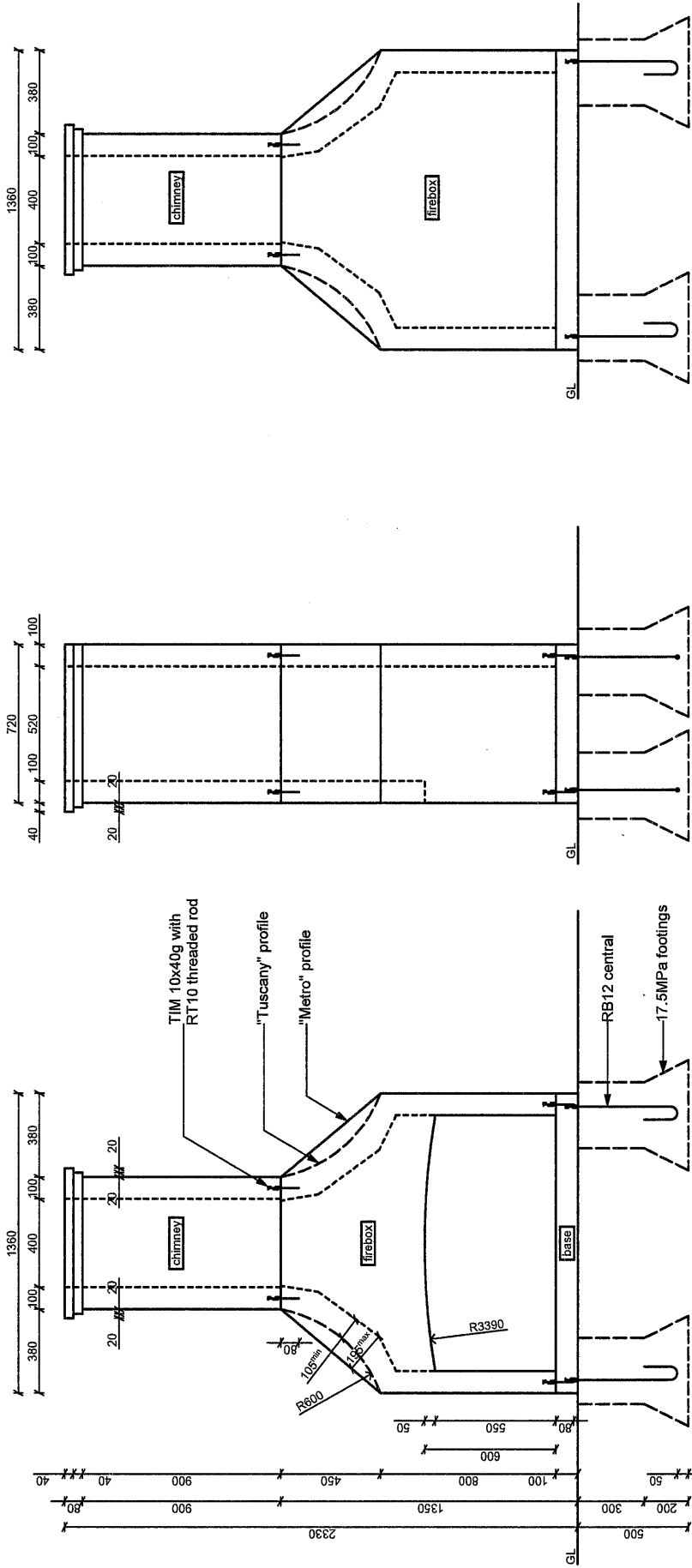
I, Peter Davenport am a CPEng, I am a member of IPENZ and hold the qualifications listed below.

The Design Firm issuing this statement holds a current policy of Professional Indemnity Insurance to a minimum value of \$200,000.

**This producer statement was issued on 28 June 2011.  
It will be valid for 15 months until 28 September 2012.**

Signed by Peter Davenport on behalf of Eastern Consulting Limited

Dr Peter Davenport  
BE(hons), PhD, MIPENZ(civil,structural), MNZWWA, MNZSEE, CPEng  
Registration number 35198



Rear Elevation

Side Elevation

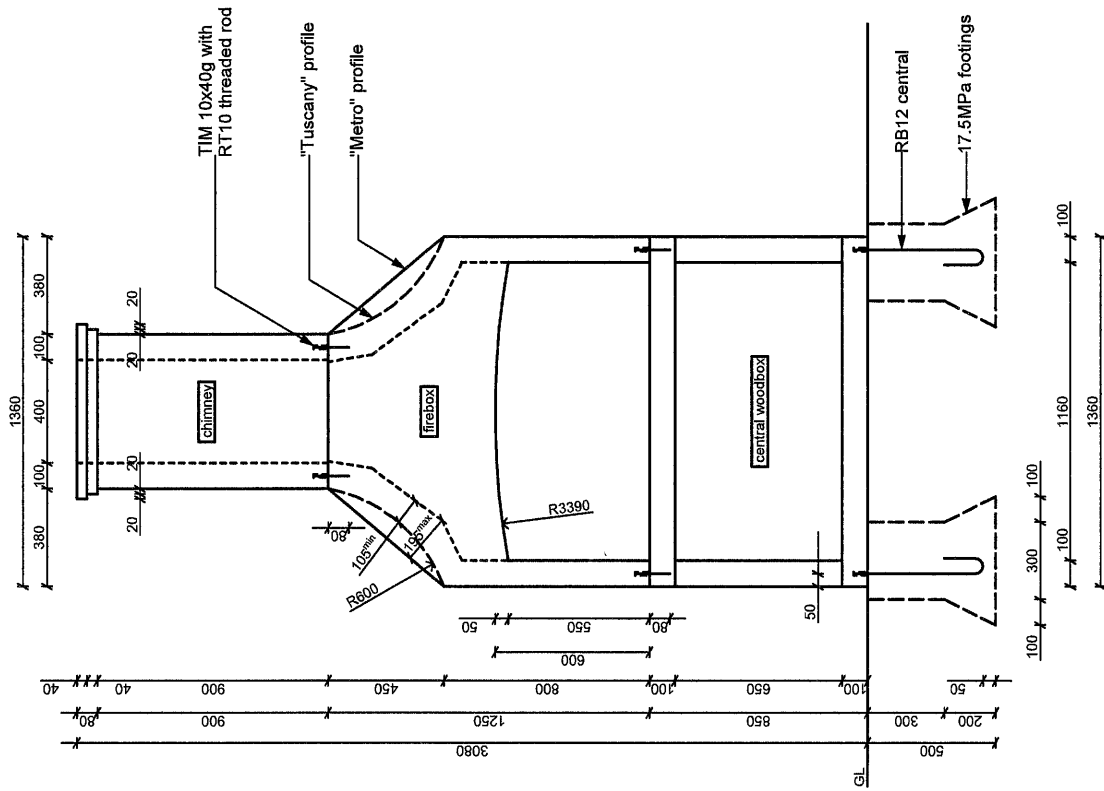
Front Elevation

Notes:

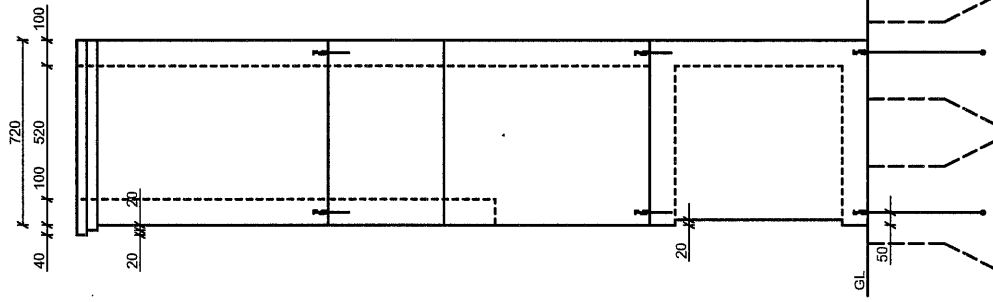
1. All concrete work shall comply with the requirements of NZS3109:1997.
2. Concrete panels shall be 25MPa concrete and footings shall be 17.5MPa concrete.
3. Maximum slump shall be 100mm unless noted otherwise.
4. All panels shall be 100mm thick unless noted otherwise.
5. All panels shall have 668 mesh central and 30mm minimum cover from edges.
6. All inserts shall be TIM10x40g with RT10 galvanised threaded rod unless noted otherwise.
7. All steelwork shall be hot dip galvanised after fabrication.

**Flare by Gibraltar Built - METRO/TUSCANY 1**

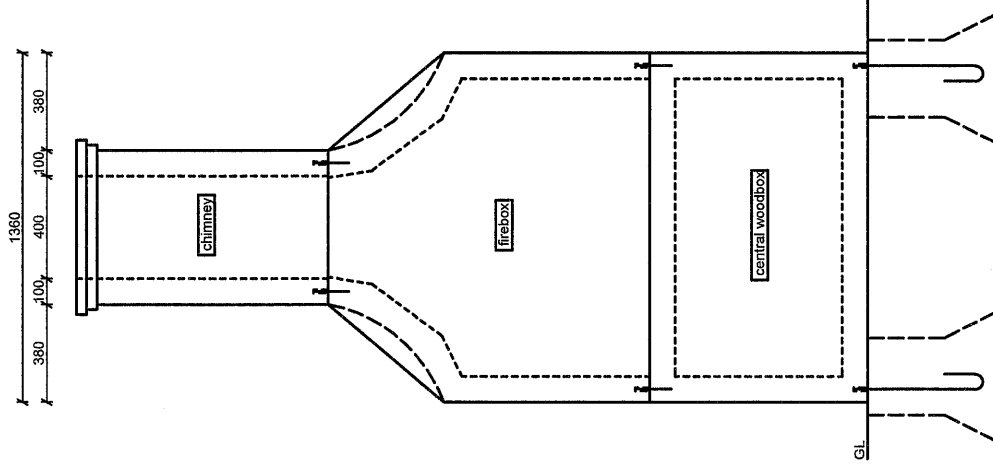
dwg # PS-1-1 19/02/2010 1:20 @ A3



Front Elevation



Side Elevation



Rear Elevation

Notes:

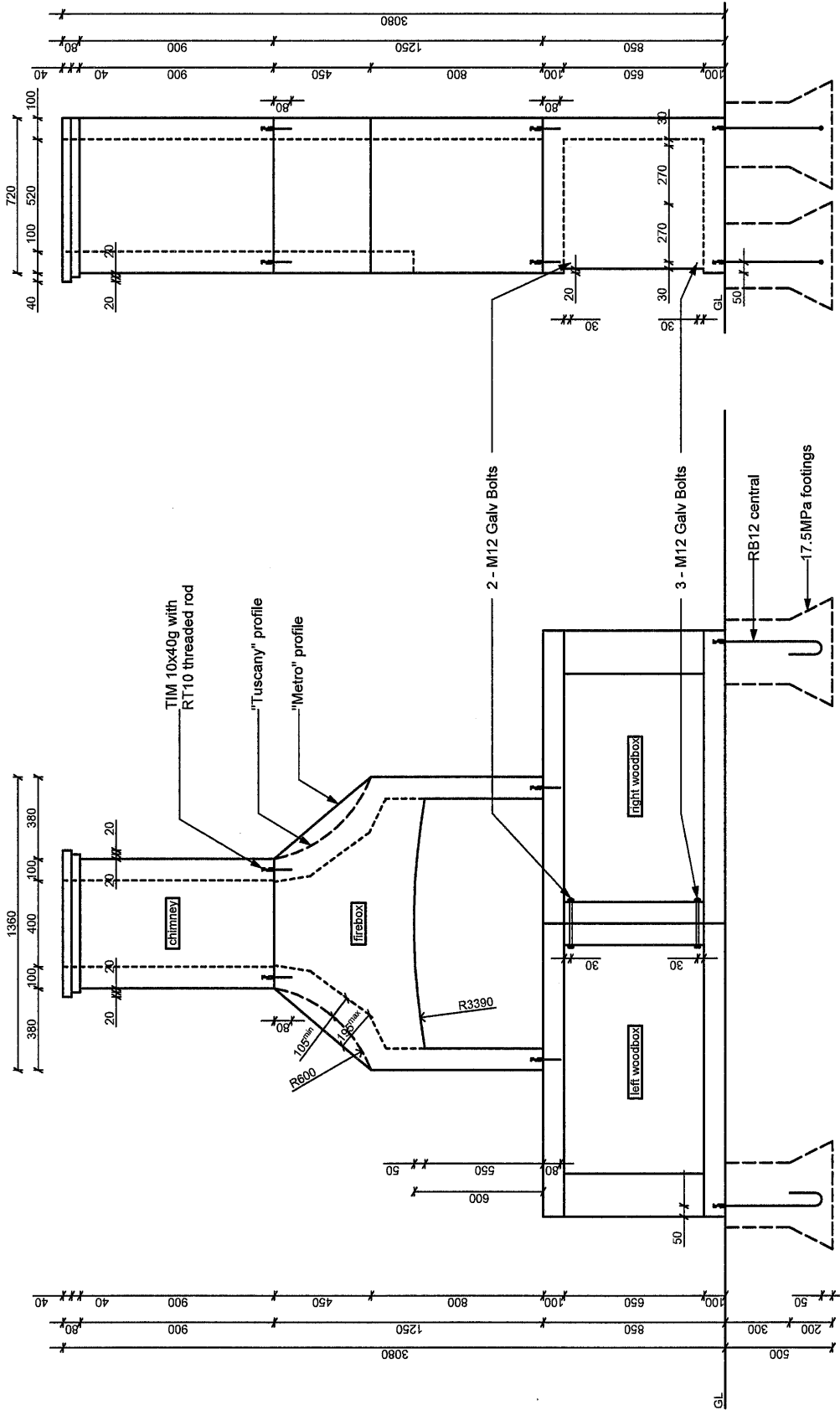
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**Flare by Gibraltar Built - METRO/TUSCANY 2**

19/02/2010

1:20 @ A3

dwg # PS1-2



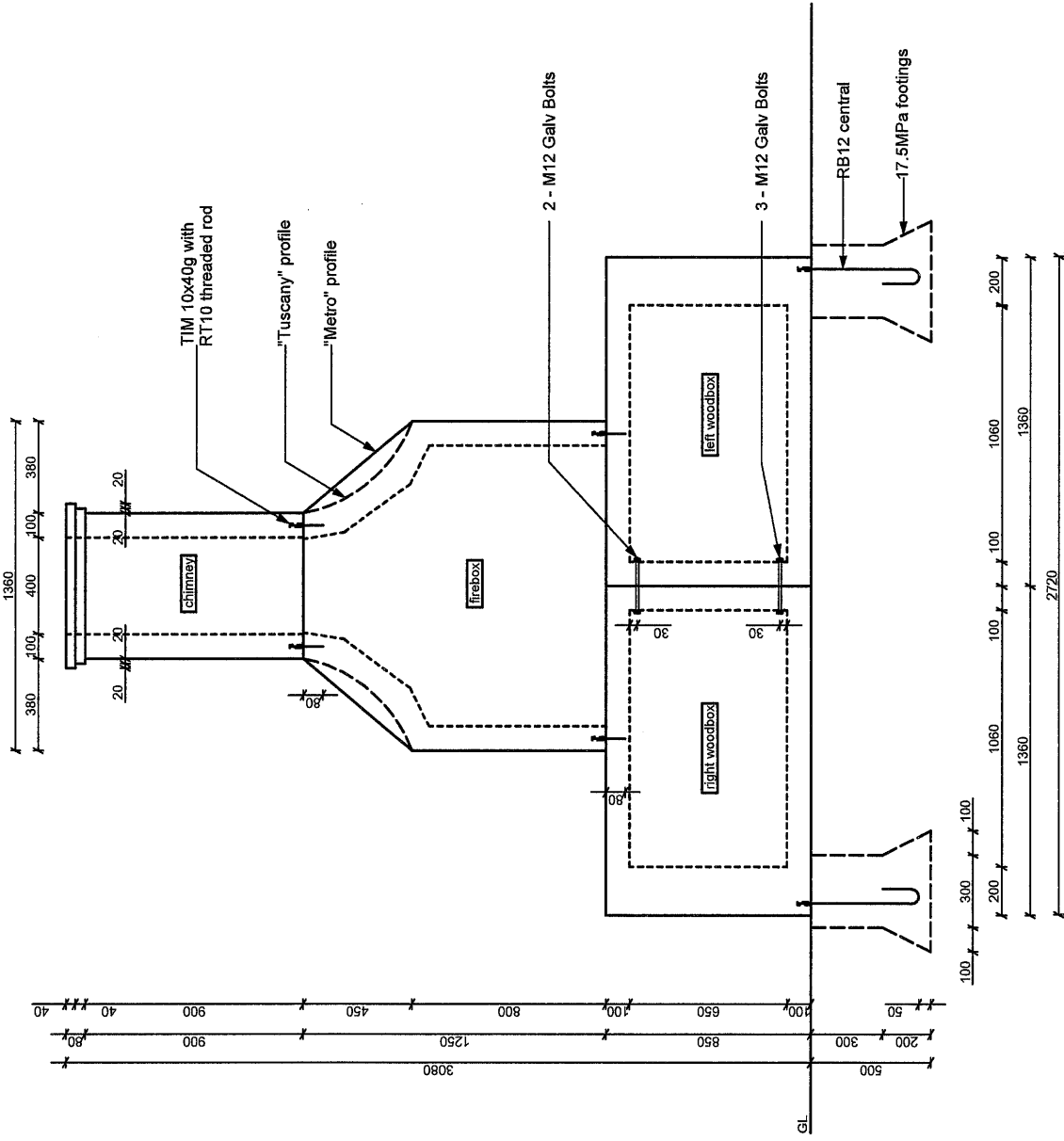
Side Elevation

Notes:

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7. All steelwork shall be hot dip galvanised after fabrication.

Front Elevation

Flare by Gibraltar Built - METRO/TUSCANY 3  
 dwg # PS1-3 19/02/2010 1:20 @ A3



Notes:

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2. Concrete panels shall be 25MPa concrete and footings shall be 17.5MPa concrete.
3. Maximum slump shall be 100mm unless noted otherwise.
4. All panels shall be 100mm thick unless noted otherwise.
5. All panels shall have 668 mesh central and 30mm minimum cover from edges.
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7. All steelwork shall be hot dip galvanised after fabrication.

Rear Elevation

**Flare by Gibraltar Built - METRO/TUSCANY 3**  
 19/02/2010  
 1:20 @ A3  
 dwg # PS1-4

Date: Mon 2010

Calc: PD

Chkd:

Structural check on fire place

Loading to NZS 1170.

Precast concrete "kitset". Heavy weight indicates that seismic load is most critical

Refer to drawings for sizes of component.

Wind Load. NZS/AS 1170.2

$$V_{sit, \beta} = V_R M_d (M_z, cat \ M_s \ M_t)$$

Not a specific location, but choose an exposed site to cover worst case.

$$V_R = 47 \text{ m/s} \quad \left\{ \begin{array}{l} \text{Importance level 1} \rightarrow \text{design life say} \\ R = 100 \text{ years} \\ \text{region A7, A6 or W} \end{array} \right.$$

$$M_d = 1.0 \quad \text{- any direction}$$

$$M_{z, cat} = 0.91 \quad \text{Terrain 2, ht} < 5\text{m}$$

$$M_s = 1.0 \quad \text{no shielding}$$

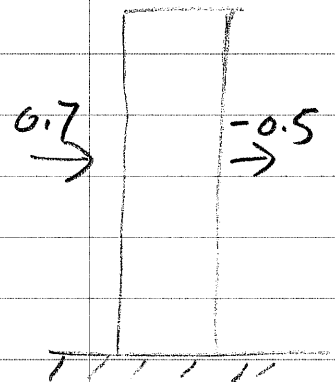
$$M_t = 1.0 \quad \text{no terrain effects}$$

$$V_{sit, \beta} = 47 \cdot 0.91 = 42.8 \text{ m/s}$$

pressure on face

$$= \frac{1}{2} \times 1.2 \times (42.8)^2 \times (0.7 + 0.5)$$

$$= 1.32 \text{ kPa}$$



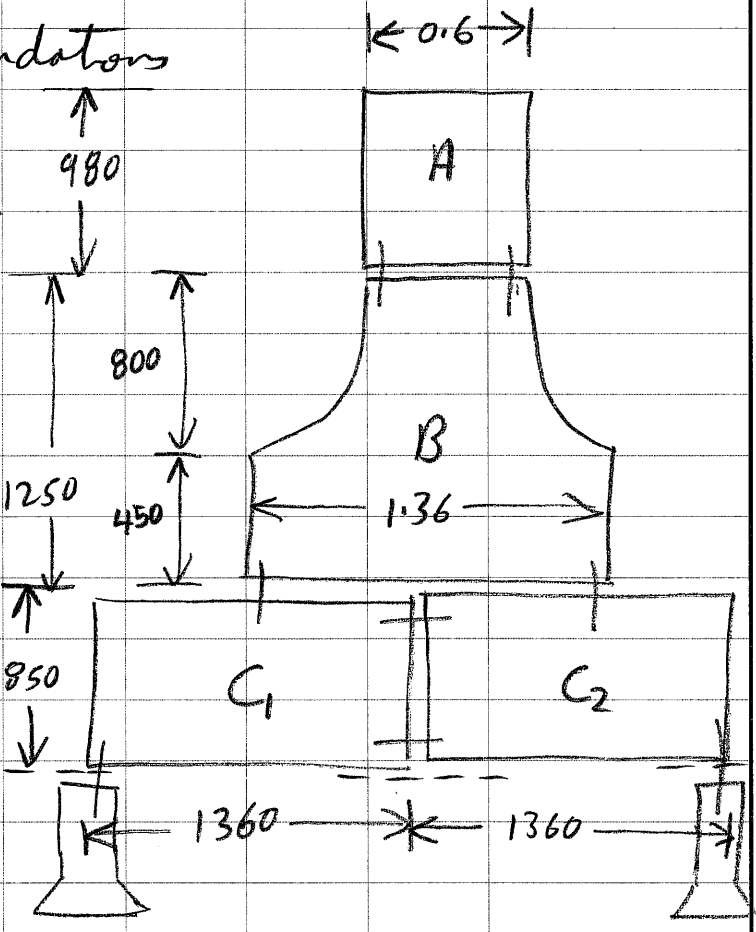
$$\text{face area} = (0.6 \times 0.98) + \left( \frac{0.6 + 1.36}{2} \times 0.45 + 1.36 \times 0.8 \right)$$

$$+ (2 \times 1.36 \times 0.95) = 0.59 + 1.53 + 2.31 = 4.43 \text{ m}^2$$

$$\text{Force} = 1.32 \times 4.43 = 5.8 \text{ kN}$$

3 basic precast parts + foundations

Piece	Vol (m <sup>3</sup> )	W <sub>gt</sub> (kN)	centroid $\bar{x}$ (mm)	$W\bar{x}$
A	0.20	4.80	2590	12.43
B	0.37	8.88	1550	13.76
C <sub>1</sub>	0.36	8.64	425	3.67
C <sub>2</sub>	0.36	8.64	425	3.67
	<u>30.96</u>		<u>33.53</u>	



overall  $\bar{x} = \frac{\sum W\bar{x}}{\sum W} = \frac{33.53}{30.96} = 1.08 \text{ m above base}$

for top 2 items (A & B)

$\bar{x} = 26.18 / 13.68 = 1.91 \text{ m above base of B}$

Seismic load NZS 1170.5

This is essentially a very stiff structure & will respond as a rigid body - ie very short period & as an elastic/non-ductile mode i.e.  $\mu = 1.25$   
 Use site subsoil C - shallow soil.

$$C_h(T) = 2.26 \quad \text{- soil C, short period}$$

$$Z = 0.42 \quad \text{- worst case for NZ populated areas}$$

$$R = 0.5 \quad \begin{array}{l} \text{- 100 year return period} \\ \text{- no fault effects as short period.} \end{array}$$

$$C(T) = 2.26 \times 0.42 \times 0.5 = 0.47$$

$$S_p = 1.3 - 0.3 \times 1.25 = 0.92$$

$$R_u = \frac{(1.25-1) \times 0.4}{0.7} + 1 = 1.14$$

$$C_d(T_i) = 0.47 \times 0.92 / 1.14 = 0.38$$

$$\text{total weight} = 31 \text{ kN}$$

$$\text{lateral force} = 0.38 \times 31 = 11.8 \text{ kN}$$

This is greater than wind, as expected.

C of g is 1.08 m above base

$$\text{overturning moment} = 11.8 \times 1.08 = 12.7 \text{ kNm}$$

Check fixings

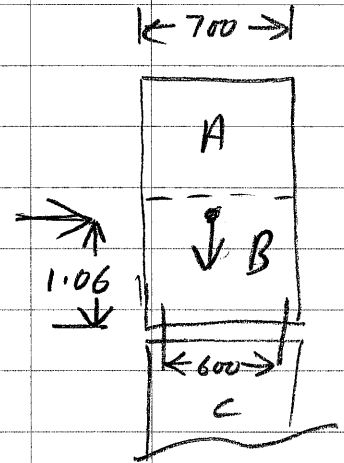
base of units A & B (to lower unit C)

weight of A & B = 13.7 kN

ht of col g = 1.06

lateral load =  $0.38 \times 13.7 = 5.2$  kN

moment =  $5.2 \times 1.06 = 5.5$  kNm



$$\text{force in fixings} = \left( \frac{+5.5}{0.6m} + \frac{13.7}{2} \right) \times \frac{1}{2} = \left( \pm 9.2 + 6.8 \right) / 2$$

separator
2 fixings
2 rows

ie 8.0 kN compression

or 1.2 kN tension

capacity of 10 mm fixings Reid TIM 10 x 40 insert  
 characteristic load 17 kN } → 10.2 kN  
 material factor 0.6 } (tension)

capacity of Sika Anchor Fix-1 adhesive

M10 threaded rod, 90 deep

characteristic tensile load = 24.6 kN

recommended tensile load 8.2 kN

This is more than adequate

fixings between A & B have lower loads & thus also OK.

Check corrections to pile

Total weight 31 kN

$$\text{seismic load} = 0.38 \times 31 = 11.8 \text{ kN}$$

height of cofg = 1.08m

$$\text{overturning moment} = 11.8 \times 1.08 = 12.7 \text{ kNm}$$

Tension forces on piles

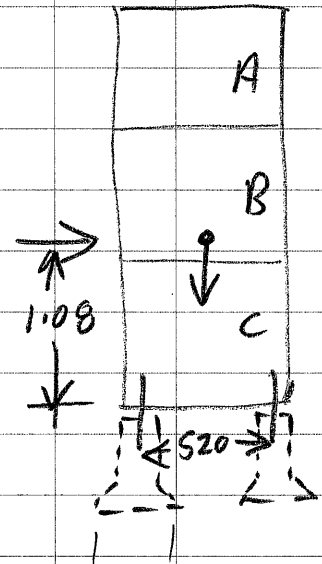
$$= \frac{1}{2} \left( \frac{\pm 12.7}{0.52} + \frac{31.}{2} \right) = \pm 12.2 + 7.8$$

2 rows ↑

↳ 2 piles in each row

$$= + 20.0 \text{ kN (compression)}$$

$$\text{or } - 4.4 \text{ (tension)}$$



pressure on pile at base. (500 diam)

$$= 20. / \left( \frac{\pi \cdot (0.5)^2}{4} \right) = \frac{20}{0.196} = 102 \text{ kPa}$$

OK under seismic ultimate load

tension on pile

$$\text{- weight } 0.5 \times \pi \times (0.3)^2 / 4 \times 24 = 0.8 \text{ kN}$$

$$\text{- side friction (at 10 kPa)} = \frac{0.3 \times \pi \times 0.5}{* 10} = 4.7 \text{ kN}$$

$$\text{Total } \underline{\underline{5.5 \text{ kN.}}}$$

OK

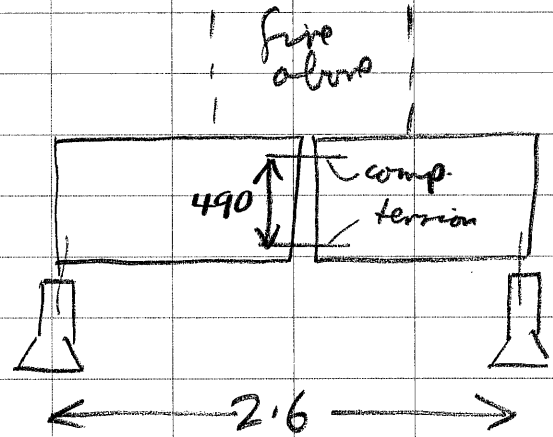
fixings adequate for tension force.

Date: Mon 2010

Calc: PD

Chkd:

Check fixings of base units.  
Assume soil settles in middle  
& span across between piles  
- not expect it to be this  
severe



total weight of concrete  
components = 31 kN.

live load of fire wood & people sitting on it  
- say 5 kPa over area of  $0.7m \times 2.6m = 9kN$ .

$$1.2G + 1.5Q = 1.2 \times 31 + 1.5 \times 9 = 51 kN.$$

assume as UDL

$$\text{Moment at "centre of beam"} = \frac{wl^2}{8} = \frac{(51/2.6) \times (2.6)^2}{8} = 16.6 kNm/m$$

check joint at centre  
tension at bottom =  $\frac{16.6}{0.49} = 33.8 kN$ .

have 3 - M12 bolts at bottom

capacity =  $3 \times \frac{\pi \times (0.012)^2}{4} \times 300 MPa \times 0.7 = 71 kN$   
OK.