

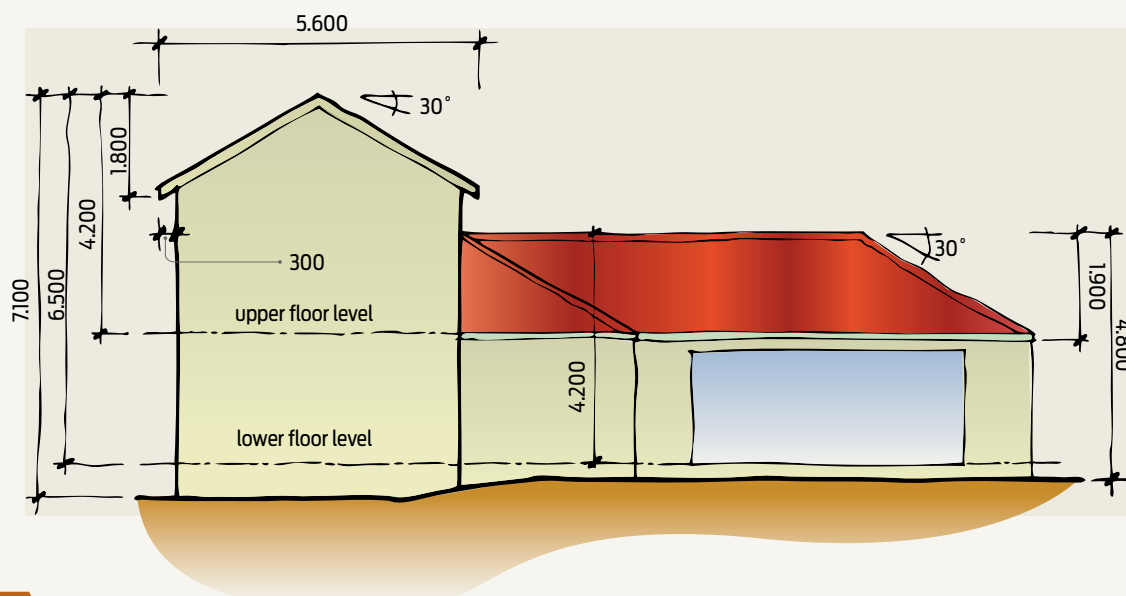


# Wall bracing



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THIS THIRD ARTICLE IN A *BUILD* SERIES ON CALCULATING BRACING REQUIREMENTS FOR A BUILDING LOOKS AT WALL BRACING.



**Figure 1** Elevation of example house.

The same building is being used as in the previous article on subfloor bracing (see *Build* 132, pages 38–41) with additional information in Figures 1 and 2.

## Data for calculation sheets for this example

**Wind zone:** Medium

**Earthquake:** Zone 2

### Floor plan areas

The example building is part 2-storey, part single-storey. The garage is on a slab, and the remainder has a subfloor. Because these have different wind and earthquake demands, the building is divided into four areas – upper of 2-storey, lower of 2-storey, single-storey and garage – and four

calculations are needed, one for each of these.

The gross floor plan area for the:

- 2-storey =  $10.6 \times 5.0 = 53 \text{ m}^2$
  - 1-storey =  $8.1 \times 9.3 = 75.3 \text{ m}^2$  (for simplicity, the area has not been reduced for the porch entry)
  - garage area =  $6.2 \times 7.040 = 43.6 \text{ m}^2$
- Soil type:** Rock
- Cladding weights:** Light lower storey, upper storey and roof

**Roof pitch:** 30 degrees, so choose 25–45 degrees

### Heights for building:

- Lower of 2-storey to apex  $H = 6.5 \text{ m}$ ,  $h = 1.8 \text{ m}$
- Upper storey to apex  $H = 4.2 \text{ m}$ ,  $h = 1.8 \text{ m}$
- 1-storey to apex  $H = 4.8 \text{ m}$ ,  $h = 1.9 \text{ m}$
- Garage to apex  $H = 4.8 \text{ m}$ ,  $h = 1.9 \text{ m}$

### Roof type and building dimension

As the roof pitch is over 25 degrees, when considering wind for the 2-storey part of the building, use the overall dimensions of the roof width and length.

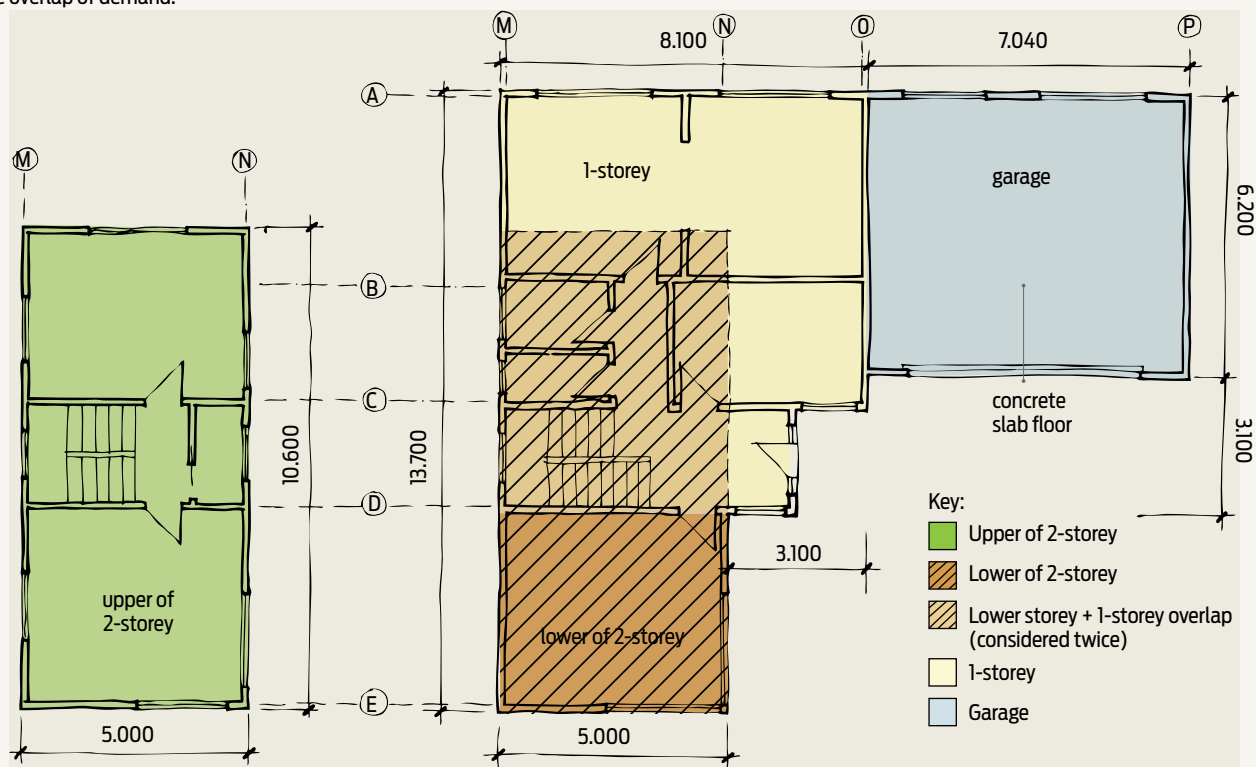
So, 2-storey section (upper and lower levels) are:

- length =  $10.6 + 0.300 + 0.300 = 11.2 \text{ m}$
- width =  $5.0 + 0.300 + 0.300 = 5.6 \text{ m}$
- single-storey: length =  $6.2 + 3.1 = 9.3 \text{ m}$ , width =  $8.1 \text{ m}$  (no roof overhangs)
- garage: length =  $7.040 \text{ m}$ , width =  $6.2 \text{ m}$  (no roof overhangs).

### Bracing lines and spacings

Use the same bracing layout as for the subfloor in *Build* 132 (see Figures 2 and 7). The maximum

For simplicity, the bracing demand for the 1-storey area has not had the area of overlap with the 2-storeys deducted. Blue entries in Figure 5 indicate overlap of demand.



**Figure 2** Floor plan of example house.

allowed spacing of bracing lines for walls is 6 m (NZS 3604:2011 clause 5.4.6).

The garage bracing lines are greater than 6 m apart so the garage will require a diaphragm ceiling. Diaphragm ceiling requirements are covered in NZS 3604:2011 clause 13.5 and minimum BUs requirements are in clause 5.6.2.

Alternatively, it may be possible to use dragon ties, which allow bracing lines spacing to be extended to 7.5 m. For walls with dragon ties attached, see clauses 8.3.3.1 to 8.3.3.4.

Bracing lines less than 1 m apart and parallel are considered to be in the same bracing line.

Wall bracing maximum ratings for attachment to:

- timber framed floors = 120 BUs/m
- concrete floors = 150 BUs/m.

See Figure 7 for the layout of the various braced sections.

### Bracing demand per line

Complete the bracing calculation sheets (see Figures 3–6) to obtain bracing demand. Always use whichever has the higher demand for wind or earthquake – these have been highlighted in the calculation sheets as the minimum bracing demand required.

The minimum bracing demand per bracing line is the greater of:

- 15 BUs/m of bracing line or
- 100 BUs or
- 50% of the total demand, divided by the number of bracing lines in the direction being considered.

### Minimum BUs per line in example

Lower level of the 2-storey (see Figure 3b):

- Lines B, C, D, E =  $5 \text{ m} \times 15 = 75 \text{ BUs}$  or 100 BUs or  $824/2$  divided by 4 lines = **103 BUs**
- Lines M, N =  $10.6 \times 15 = 159 \text{ BUs}$  or 100 BUs or  $557/2$  divided by 2 lines = 139.2 BUs

Upper level of 2-storey (see Figure 4b):

- Lines B, C, D, E =  $5 \text{ m} \times 15 = 75 \text{ BUs}$  or **100 BUs** or  $392/2$  divided by 4 lines = 49 BUs
- Lines M, N =  $10.6 \times 15 = 159 \text{ BUs}$  or 100 BUs or  $318/2$  divided by 2 lines = 79.5 BUs

Single level (see Figure 5b):

- Lines A, B, C, D =  $8.1 \times 15 = 121.5 \text{ BUs}$  or 100 BUs or  $414/2$  divided by 4 lines = 51.8 BUs
- Lines M, N, O =  $9.3 \times 15 = 139.5 \text{ BUs}$  or 100 BUs or  $414/2$  divided by 3 lines = 69 BUs ➔

Box 1			
LOCATION OF STOREY / BLOCK BEING ASSESSED			
FOUNDATION	SINGLE STOREY or UPPER STOREY	<u>LOWER STOREY</u>	LOCATION IN BUILDING
Use one sheet for each and circle the appropriate location			2 story section

**Box 2 Wind Bracing Demand (Table 5.5, 5.6 or 5.7)**

Wind zone (Table 5.5)  $1.5$  or  $2$  or  $3$  or  $4$  or  $5$  or  $6$  or  $7$  or  $8$  or  $9$  or  $10$  or  $11$  or  $12$  or  $13$  or  $14$  or  $15$  or  $16$  or  $17$  or  $18$  or  $19$  or  $20$  or  $21$  or  $22$  or  $23$  or  $24$  or  $25$  or  $26$  or  $27$  or  $28$  or  $29$  or  $30$  or  $31$  or  $32$  or  $33$  or  $34$  or  $35$  or  $36$  or  $37$  or  $38$  or  $39$  or  $40$  or  $41$  or  $42$  or  $43$  or  $44$  or  $45$  or  $46$  or  $47$  or  $48$  or  $49$  or  $50$  or  $51$  or  $52$  or  $53$  or  $54$  or  $55$  or  $56$  or  $57$  or  $58$  or  $59$  or  $60$  or  $61$  or  $62$  or  $63$  or  $64$  or  $65$  or  $66$  or  $67$  or  $68$  or  $69$  or  $70$  or  $71$  or  $72$  or  $73$  or  $74$  or  $75$  or  $76$  or  $77$  or  $78$  or  $79$  or  $80$  or  $81$  or  $82$  or  $83$  or  $84$  or  $85$  or  $86$  or  $87$  or  $88$  or  $89$  or  $90$  or  $91$  or  $92$  or  $93$  or  $94$  or  $95$  or  $96$  or  $97$  or  $98$  or  $99$  or  $100$  or  $101$  or  $102$  or  $103$  or  $104$  or  $105$  or  $106$  or  $107$  or  $108$  or  $109$  or  $110$  or  $111$  or  $112$  or  $113$  or  $114$  or  $115$  or  $116$  or  $117$  or  $118$  or  $119$  or  $120$  or  $121$  or  $122$  or  $123$  or  $124$  or  $125$  or  $126$  or  $127$  or  $128$  or  $129$  or  $130$  or  $131$  or  $132$  or  $133$  or  $134$  or  $135$  or  $136$  or  $137$  or  $138$  or  $139$  or  $140$  or  $141$  or  $142$  or  $143$  or  $144$  or  $145$  or  $146$  or  $147$  or  $148$  or  $149$  or  $150$  or  $151$  or  $152$  or  $153$  or  $154$  or  $155$  or  $156$  or  $157$  or  $158$  or  $159$  or  $160$  or  $161$  or  $162$  or  $163$  or  $164$  or  $165$  or  $166$  or  $167$  or  $168$  or  $169$  or  $170$  or  $171$  or  $172$  or  $173$  or  $174$  or  $175$  or  $176$  or  $177$  or  $178$  or  $179$  or  $180$  or  $181$  or  $182$  or  $183$  or  $184$  or  $185$  or  $186$  or  $187$  or  $188$  or  $189$  or  $190$  or  $191$  or  $192$  or  $193$  or  $194$  or  $195$  or  $196$  or  $197$  or  $198$  or  $199$  or  $200$  or  $201$  or  $202$  or  $203$  or  $204$  or  $205$  or  $206$  or  $207$  or  $208$  or  $209$  or  $210$  or  $211$  or  $212$  or  $213$  or  $214$  or  $215$  or  $216$  or  $217$  or  $218$  or  $219$  or  $220$  or  $221$  or  $222$  or  $223$  or  $224$  or  $225$  or  $226$  or  $227$  or  $228$  or  $229$  or  $230$  or  $231$  or  $232$  or  $233$  or  $234$  or  $235$  or  $236$  or  $237$  or  $238$  or  $239$  or  $240$  or  $241$  or  $242$  or  $243$  or  $244$  or  $245$  or  $246$  or  $247$  or  $248$  or  $249$  or  $250$  or  $251$  or  $252$  or  $253$  or  $254$  or  $255$  or  $256$  or  $257$  or  $258$  or  $259$  or  $260$  or  $261$  or  $262$  or  $263$  or  $264$  or  $265$  or  $266$  or  $267$  or  $268$  or  $269$  or  $270$  or  $271$  or  $272$  or  $273$  or  $274$  or  $275$  or  $276$  or  $277$  or  $278$  or  $279$  or  $280$  or  $281$  or  $282$  or  $283$  or  $284$  or  $285$  or  $286$  or  $287$  or  $288$  or  $289$  or  $290$  or  $291$  or  $292$  or  $293$  or  $294$  or  $295$  or  $296$  or  $297$  or  $298$  or  $299$  or  $300$  or  $301$  or  $302$  or  $303$  or  $304$  or  $305$  or  $306$  or  $307$  or  $308$  or  $309$  or  $310$  or  $311$  or  $312$  or  $313$  or  $314$  or  $315$  or  $316$  or  $317$  or  $318$  or  $319$  or  $320$  or  $321$  or  $322$  or  $323$  or  $324$  or  $325$  or  $326$  or  $327$  or  $328$  or  $329$  or  $330$  or  $331$  or  $332$  or  $333$  or  $334$  or  $335$  or  $336$  or  $337$  or  $338$  or  $339$  or  $340$  or  $341$  or  $342$  or  $343$  or  $344$  or  $345$  or  $346$  or  $347$  or  $348$  or  $349$  or  $350$  or  $351$  or  $352$  or  $353$  or  $354$  or  $355$  or  $356$  or  $357$  or  $358$  or  $359$  or  $360$  or  $361$  or  $362$  or  $363$  or  $364$  or  $365$  or  $366$  or  $367$  or  $368$  or  $369$  or  $370$  or  $371$  or  $372$  or  $373$  or  $374$  or  $375$  or  $376$  or  $377$  or  $378$  or  $379$  or  $380$  or  $381$  or  $382$  or  $383$  or  $384$  or  $385$  or  $386$  or  $387$  or  $388$  or  $389$  or  $390$  or  $391$  or  $392$  or  $393$  or  $394$  or  $395$  or  $396$  or  $397$  or  $398$  or  $399$  or  $400$  or  $401$  or  $402$  or  $403$  or  $404$  or  $405$  or  $406$  or  $407$  or  $408$  or  $409$  or  $410$  or  $411$  or  $412$  or  $413$

**Box 3 Earthquake Bracing Demand (Table S.A.5, S.6, S.10)**

Earthquake zone (Figure S.4) 1-2 (3-4) Concrete wall Table S.10  
 Weight of roof cladding 1.50 / medium / heavy Part stony in roof space G1 S.243  
 Fixed plate (diagonal) 0-25 (26-40 / 40-60) Part stony in basement G1 S.244  
 Weight of upper (or weight) stony cladding 1.50 / medium / heavy Chimney G1 S.243  
 Weight of lower stony cladding 1.50 / medium / heavy Whips / Masts G1 S.13  
 Weight of tower cladding 1.50 / medium / heavy Deck projecting more than 2 m G1 S.242

Detail of (from tables S.A, S.6, S.10) =  $2.1 \times (-0.5) + 10.5$  Transverse to Box 5

NOTE: Tables S.A, S.6, S.10 relate to wall type C in Earthquake zone 1.  
 For non-cladding bracing for other wall types see Section 5

Soil Class	Earthquake Zone			
	1	2	3	4
A.S-B-Soft	0.3	0.5	0.6	0.8
C-Medium	0.4	0.6	0.7	1.1
D-Deep / Soft	0.6	0.9	1.0	1.9

Box 4 Building plan dimensions (Figure 3.2)					
Roof or building length for wind across ridge	L	=	11'-2"	ft	Transfer to Box 3
Roof or building width for wind across ridge	W	=	6'-6"	ft	
Roof, Floor Area	CFR	=	5'-2"	sq ft	

Box 5: Calculation of demand		(Value)		(Box 4 Dimension)	
Wind Load Across	(from Box 2)	73.8	11.2	823	20
Wind Load Along	(from Box 2)	77	5.6	431	50
Earthquake Load (both directions)	(from Box 3)	10.5	5.3	557	50

Box 1			
LOCATION OF STOREY / BLOCK BEING ASSESSED			
FOUNDATION	GROUND STOREY OR UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
Use one sheet for each and circle the appropriate location			2 Storey sections

**Box 2: Wind Bracing Demand (Table 5.9, 5.9.1 & 5.9.7)**

Wind zone (Table 5.1): **1** ( $10 \text{ mph} < W \leq 14$ )  
 Building height to eave (ft): **4** ( $4 \leq h \leq 10$ )  
 Four-sided design winds (ft): **1** ( $1 \leq S \leq 10$ )

Note: Tables 5.1, 5.6, 5.7 relate to right wind zone. In other wind zones, multiply the values by the appropriate factor.

	Design Pressure (psf)	(psf)
Winds from: <b>3</b> ( $30^\circ$ )	$\left\{ \begin{array}{l} \text{EW: } -1.8 \\ \text{SW: } -1.8 \end{array} \right\}$	<b>3</b> ( $30^\circ$ )
Winds from: <b>5</b> ( $50^\circ$ )	$\left\{ \begin{array}{l} \text{EW: } -1.8 \\ \text{SW: } -1.8 \end{array} \right\}$	<b>3</b> ( $30^\circ$ )

Transfer to Box 3

**Box 3 Earthquake Bracing Demand (Table 5.8, 5.9, 5.10)**

Earthquake zone of type I/II:  $1/2/3/4$  Concrete wall Table 5.10  $A/B/C$   
 Height of roof slabbing  $1/2/3/4$  Heavy Post slabs in roof space G1 5.3.4.3  $A/B/C$   
 Roof slab (rigid)  $0.25$  (or  $0.4/0.4/0.4/0.4$ ) Slab joist beam/beam G1 5.3.4.9  $A/B/C$   
 Height of open or single story slabbing  $1/2/3/4$  medium Heavy Chimney G1 5.3.4.3  $A/B/C$   
 Height of lower story slabbing  $1/2/3/4$  medium Heavy Slabs /beams G1 5.1.5  $A/B/C$   
 Height of medium slabbing  $1/2/3/4$  medium Heavy Deep projecting more than 2 m G1 7.4.2.2  $A/B/C$

(G1) or (G2) above 5.8, 5.9, 5.10 =  $2/3/4$  (multiplication factor below) (G2) only  
 Transfer to Box 5

NOTE: Tables 5.8, 5.9, 5.10 relate to wall type DE in Earthquake zone 3, for modification factors for other soil types see below

Soil Class	Earthquake Zone			
	1	2	3	4
A & B Rock	0.5	0.5	0.5	0.5
C Shallow	0.6	0.6	0.7	0.7
DE Deep / Soft	0.8	0.8	1.0	1.0

Box 4 Building plan dimensions (Figure 5.2)				
Roof or building length for wind across ridge	L	=	$L(1-\frac{2}{n})$	Transfer to Box 3
Roof or building length for wind along ridge	W	=	$S(1-\frac{1}{n})$	
Gross Floor Area	GFA	=	$S^2(1-\frac{1}{n^2})$ sq ft	

Box 5 Calculation of demand		(Value)		(Box 4 Dimension)	
Wind Load Across	(from box 2)	=	3.5	×	11.2 = 392 (k)
Wind Load Along	(from box 2)	=	38.5	×	5.6 = 216 (k)
Earthquake Load (both directions)	(from box 3)	=	6	×	53 = 318 (k)

[illegible]

ACROSS					DOWN					
1	2	3	4	5	Word			Minimum Starting Element		
Word or Starting Line	Starting Element (abbreviation)	Starting Type	Length of Element (in)		80%ile (90%ile)	90%ile (90%ile)	Word for Starting Line	Minimum Starting Element	80%ile (80%ile)	90%ile (90%ile)
A										
B										
C										
D										
E										
F										
G										
H										
I										
J										
K										
L										
M										
N										
O										
P										
Q										
R										
S										
T										
U										
V										
W										
X										
Y										
Z										
Total Starting Element for Word Above					570		376		570	

DOWN					ACROSS					
1	2	3	4	5	Word			Minimum Starting Element		
Word or Starting Line	Starting Element (abbreviation)	Starting Type	Length of Element (in)		80%ile (90%ile)	90%ile (90%ile)	Word for Starting Line	Minimum Starting Element	80%ile (80%ile)	90%ile (90%ile)
A										
B										
C										
D										
E										
F										
G										
H										
I										
J										
K										
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N										
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S										
T										
U										
V										
W										
X										
Y										
Z										
Total Starting Element for Word Above					570		376		570	

ACROSS					DOWN				
1	2	3	4	5	Word			Minimum Starting Element	
Word or Starting Line	Starting Element (abbreviation)	Starting Type	Length of Element (in)		80%ile (90%ile)	90%ile (90%ile)	Word for Starting Line	Minimum Starting Element	

**Figure 3** Calculation sheet bracing achieved – lower level of 2-storey.

**Figure 4** Calculation sheet for bracing achieved – upper level of 2-storey.



## SHEET A

Name of Applicant: \_\_\_\_\_

Site Address: \_\_\_\_\_

City/Town or District: \_\_\_\_\_

Street and Number: \_\_\_\_\_

Or Lot and D.P. Number: \_\_\_\_\_



## Box 1

## LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	<u>SINGLE STOREY or UPPER STOREY</u>	LOWER STOREY	LOCATION IN BUILDING
Use one sheet for each and check the appropriate location			<u>1 story section</u>

## Box 2

## Wind Bracing Demand (Table 5.5, 5.6 or 5.7)

Wind zone (Table 5.1)	<u>LOW 1a / 1b / 1c</u>	Notes: Tables 5.5, 5.6, 5.7 relate to high wind zones. In other wind zones, multiply the value by the appropriate factor.
Building height in zone (m)	<u>4.8</u>	
Roof height above zone (m)	<u>1.9</u>	
W <sub>max</sub> =	<u>5.0</u>	
W <sub>min</sub> =	<u>5.0</u>	
Transfer to Box 3		

## Box 3

## Earthquake Bracing Demand (Table 5.8, 5.9, 5.10)

Earthquake zone (Figure 5.4)	<u>1/23/1</u>	Concrete slab	Table 5.10
Weight of roof cladding	<u>0.05 / heavy</u>	Part along in roof space	CI 5.3.4.3
Roof plan (diagonal)	<u>0-25 (25-45) (45-60)</u>	Part along basement	CI 5.3.4.4
Weight of upper (or single) storey cladding	<u>0.05 / medium / heavy</u>	Chimney	CI 5.3.4.5
Weight of lower storey cladding	<u>0.05 / medium / heavy</u>	Wings / bleeds	CI 5.1.3
Weight of outdoor cladding	<u>0.05 / medium / heavy</u>	Deck projecting more than 2 m	CI 7.4.2.2
W <sub>1</sub> or (from Table 5.8, 5.9, 5.10) =	<u>1.1</u>	(W <sub>2</sub> ) (W <sub>3</sub> )	
NOTE: Tables 5.8, 5.9, 5.10 relate to soil type DSE in Earthquake zone 1. For multiplication factors for other soil types see below.			
Soil Class		Earthquake Zone	
A & B Shallow	0.2	1	0.8
C Shallow	0.4	0.8	0.8
DSE Deep / Soft	0.8	0.8	1.0

## Box 4

## Building plan dimensions (Figure 5.3)

Roof or building length for wind across ridge	<u>7.3</u>	
Roof or building length for wind along ridge	<u>5.2</u>	
Roof Floor Area	<u>75.3</u>	
Transfer to Box 5		

## Box 5

## Calculation of demand

Wind Load Across	(from Box 2)	<u>3.5</u>	<u>7.3</u>	<u>32.6</u>	W
Wind Load Along	(from Box 2)	<u>3.5</u>	<u>5.2</u>	<u>18.2</u>	W
Earthquake Load (both directions)	(from Box 3)	<u>5.5</u>	<u>75.3</u>	<u>416</u>	W

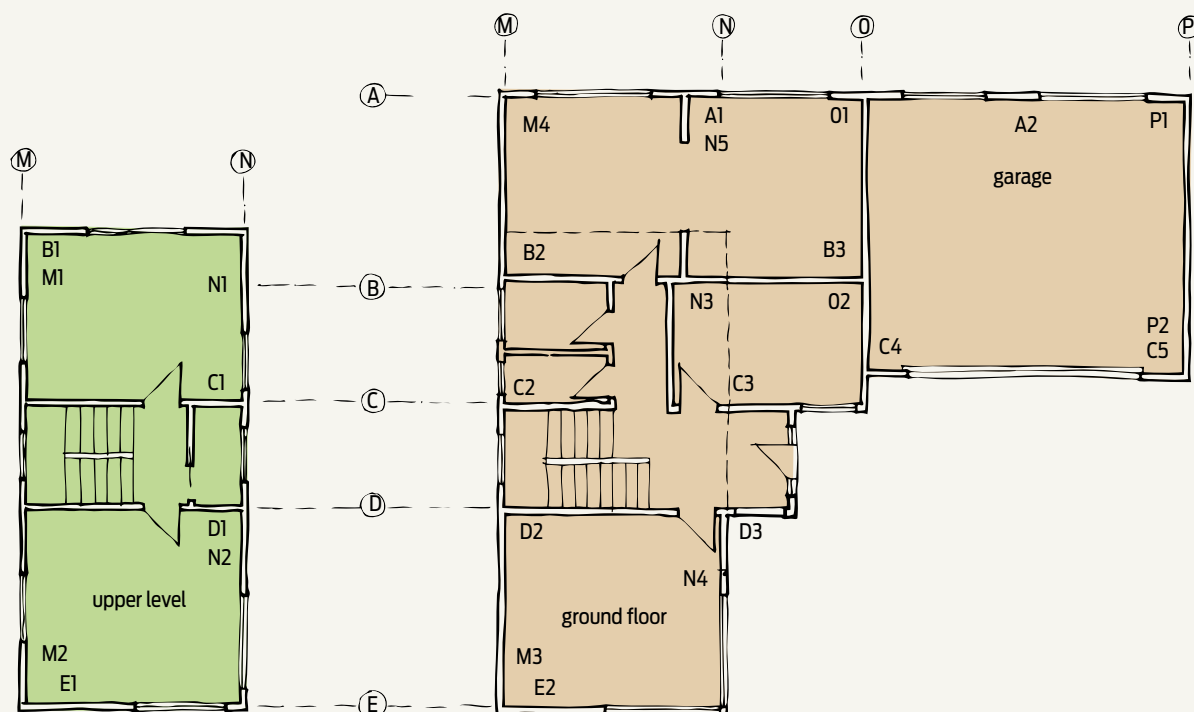
## SHEET B

## LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	<u>SINGLE STOREY or UPPER STOREY</u>	LOWER STOREY	LOCATION IN BUILDING
Use one sheet for each storey / block and check the appropriate location			<u>1 story section</u>

## ACROSS

W11				W12		W13		W14		W15	
Wall or Bracing Line	Bracing member identification	Bracing Type	Length of member (m)	W1 (W2) (W3)	W1 (W2) (W3)	Total for Bracing Line	Minimum Bracing Demand	W1 (W2) (W3)	W1 (W2) (W3)	Total for Bracing Line	Minimum Bracing Demand
A	1.1	1.1	1.1					1.1	1.1		
B	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
C	1.1	1.1	1.1					1.1	1.1		
D	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
E	1.1	1.1	1.1					1.1	1.1		
F	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
G	1.1	1.1	1.1					1.1	1.1		
H	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
I	1.1	1.1	1.1					1.1	1.1		
J	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
K	1.1	1.1	1.1					1.1	1.1		
L	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
M	1.1	1.1	1.1					1.1	1.1		
N	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
O	1.1	1.1	1.1					1.1	1.1		
P	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
Q	1.1	1.1	1.1					1.1	1.1		
R	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
S	1.1	1.1	1.1					1.1	1.1		
T	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
U	1.1	1.1	1.1					1.1	1.1		
V	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
W	1.1	1.1	1.1					1.1	1.1		
X	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
Y	1.1	1.1	1.1					1.1	1.1		
Z	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AA	1.1	1.1	1.1					1.1	1.1		
AB	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AC	1.1	1.1	1.1					1.1	1.1		
AD	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AE	1.1	1.1	1.1					1.1	1.1		
AF	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AG	1.1	1.1	1.1					1.1	1.1		
AH	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AI	1.1	1.1	1.1					1.1	1.1		
AJ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AK	1.1	1.1	1.1					1.1	1.1		
AL	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AM	1.1	1.1	1.1					1.1	1.1		
AN	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AO	1.1	1.1	1.1					1.1	1.1		
AP	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AQ	1.1	1.1	1.1					1.1	1.1		
AR	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AS	1.1	1.1	1.1					1.1	1.1		
AT	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AU	1.1	1.1	1.1					1.1	1.1		
AV	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AW	1.1	1.1	1.1					1.1	1.1		
AX	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
AY	1.1	1.1	1.1					1.1	1.1		
AZ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BA	1.1	1.1	1.1					1.1	1.1		
BB	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BC	1.1	1.1	1.1					1.1	1.1		
BD	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BE	1.1	1.1	1.1					1.1	1.1		
BF	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BG	1.1	1.1	1.1					1.1	1.1		
BH	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BI	1.1	1.1	1.1					1.1	1.1		
BJ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BK	1.1	1.1	1.1					1.1	1.1		
BL	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BM	1.1	1.1	1.1					1.1	1.1		
BN	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BO	1.1	1.1	1.1					1.1	1.1		
BP	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BQ	1.1	1.1	1.1					1.1	1.1		
BR	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BS	1.1	1.1	1.1					1.1	1.1		
BT	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BU	1.1	1.1	1.1					1.1	1.1		
BV	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BW	1.1	1.1	1.1					1.1	1.1		
BX	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
BY	1.1	1.1	1.1					1.1	1.1		
BZ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CA	1.1	1.1	1.1					1.1	1.1		
CB	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CC	1.1	1.1	1.1					1.1	1.1		
CD	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CE	1.1	1.1	1.1					1.1	1.1		
CF	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CG	1.1	1.1	1.1					1.1	1.1		
CH	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CI	1.1	1.1	1.1					1.1	1.1		
CJ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CK	1.1	1.1	1.1					1.1	1.1		
CL	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CM	1.1	1.1	1.1					1.1	1.1		
CN	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CO	1.1	1.1	1.1					1.1	1.1		
CP	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CQ	1.1	1.1	1.1					1.1	1.1		
CR	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CS	1.1	1.1	1.1					1.1	1.1		
CT	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CU	1.1	1.1	1.1					1.1	1.1		
CV	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CW	1.1	1.1	1.1					1.1	1.1		
CX	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
CY	1.1	1.1	1.1					1.1	1.1		
CZ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DA	1.1	1.1	1.1					1.1	1.1		
DB	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DC	1.1	1.1	1.1					1.1	1.1		
DD	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DE	1.1	1.1	1.1					1.1	1.1		
DF	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DG	1.1	1.1	1.1					1.1	1.1		
DH	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DI	1.1	1.1	1.1					1.1	1.1		
DJ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DK	1.1	1.1	1.1					1.1	1.1		
DL	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DM	1.1	1.1	1.1					1.1	1.1		
DN	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DO	1.1	1.1	1.1					1.1	1.1		
DP	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DQ	1.1	1.1	1.1					1.1	1.1		
DR	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DS	1.1	1.1	1.1					1.1	1.1		
DT	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DU	1.1	1.1	1.1					1.1	1.1		
DV	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DW	1.1	1.1	1.1					1.1	1.1		
DX	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
DY	1.1	1.1	1.1					1.1	1.1		
DZ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EA	1.1	1.1	1.1					1.1	1.1		
EB	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EC	1.1	1.1	1.1					1.1	1.1		
ED	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EE	1.1	1.1	1.1					1.1	1.1		
EF	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EG	1.1	1.1	1.1					1.1	1.1		
EH	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EI	1.1	1.1	1.1					1.1	1.1		
EJ	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EK	1.1	1.1	1.1					1.1	1.1		
EL	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EM	1.1	1.1	1.1					1.1	1.1		
EN	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EO	1.1	1.1	1.1					1.1	1.1		
EP	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EQ	1.1	1.1	1.1					1.1	1.1		
ER	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
ES	1.1	1.1	1.1					1.1	1.1		
ET	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EU	1.1	1.1	1.1					1.1	1.1		
EV	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EW	1.1	1.1	1.1					1.1	1.1		
EX	1.1	1.1	1.1				1.2	1.1	1.1	1.50	
EY	1.1	1.1	1.1					1.1	1.1		
EZ	1.1	1.1	1.1				1.2				



**Figure 7** Final bracing plan.

Garage (see Fig 6b):

- Lines A, C =  $7.040 \times 15 = 105.6$  BUs or 100 BUs or  $247/2$  divided by 2 lines = 62 BUs
- Lines O, P =  $6.2 \times 15 = 93$  BUs or **100 BUs** or  $217/2$  divided by 2 lines = 54.25 BUs

Transfer these values to the appropriate bracing sheets.

### Choose bracing element

Bracing materials used are sheet products (ply, plasterboard, fibre cement and so on), concrete, concrete blocks or metal components. All bracing units are achieved using proprietary products that have had their bracing rating validated by

the P21 test. The rating may vary for earthquake, wind and also for the length used. For example, a sheet material that is rated as achieving 120 BUs for wind, may have a lesser rating when used for earthquake or the sheet width is less than the manufacturer's minimum width.

BUs ratings are all derived from testing elements at 2.4 m high. Bracing elements of other heights will require the BUs achieved to be calculated for the height used using clause 8.3.1.4 of NZS 3604:2011.

### In this example

For this exercise, a generic plasterboard has been used with a rating of 120 BUs for wind and

100 BUs for earthquake. This has been given the designation 'Plstr 1' in the worksheets.

For the bracing sheets either side of the garage door in bracing line C, a generic ply has been chosen, designated in the worksheet as 'Ply 1'. This has a rating of 150 BU/m for wind and earthquake. Proprietary sheet linings tested by manufacturers usually require some form of hold-downs – always follow the manufacturer's details. Never mix details from different systems.

**Note** Having trouble reading Figures 3–6? You can download these with this article from [www.branz.co.nz/welcome\\_to\\_build](http://www.branz.co.nz/welcome_to_build), then The Right Stuff. ◀

# SHEET A



Name of Applicant: \_\_\_\_\_ Site Address: \_\_\_\_\_  
 City/Town or District: \_\_\_\_\_  
 Street and Number: \_\_\_\_\_  
 Or Lot and D.P. Number: \_\_\_\_\_

## Box 1

### LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
Use one sheet for each and circle the appropriate location			2 story section

## Box 2 Wind Bracing Demand (Table 5.5, 5.6 or 5.7)

Wind zone (Table 5.1) L / M / H / VH / EH  
 Building height to apex (H) 6.5 m  
 Roof height above eaves (H) 1.8 m

Note: Tables 5.5, 5.6, 5.7 relate to High wind zone.  
 In other wind zones, multiply the value by the appropriate factor.

$$W_{cross} = \text{(value from tables)} \times \text{(multiplication factor)} \text{ (Bu/m)}$$

$$W_{cross} = 105 \times \begin{Bmatrix} L & 0.5 \\ M & 0.7 \\ VH & 1.3 \\ EH & 1.6 \end{Bmatrix} = 73.5$$

$$W_{along} = 110 \times \begin{Bmatrix} L & 0.5 \\ M & 0.7 \\ VH & 1.3 \\ EH & 1.6 \end{Bmatrix} = 77$$

Transfer to Box 5

## Box 3 Earthquake Bracing Demand (Table 5.8, 5.9, 5.10)

Earthquake zone (Figure 5.4)	1 / 2 / 3 / 4	Concrete slab	Table 5.10
Weight of roof cladding	Light / Heavy	Part storey in roof space	Cl 5.3.4.3
Roof pitch (degrees)	0-25 / 26-45 / 46-60	Part storey basement	Cl 5.3.4.4
Weight of upper (or single) storey cladding	Light / medium / heavy	Chimney	Cl 5.3.4.5
Weight of lower storey cladding	Light / medium / heavy	Wings / blocks	Cl 5.1.5
Weight of subfloor cladding	Light / medium / heavy	Deck projecting more than 2 m	Cl 7.4.2.2

$$BU / m^2 \text{ (from tables 5.8, 5.9, 5.10)} = 21 \times \text{(value)} \times \text{(multiplication factor below)} \text{ (BU / m}^2\text{)}$$

$$BU / m^2 = 21 \times 0.5 \times 1.0 = 10.5$$

Transfer to Box 5

NOTE: Tables 5.8, 5.9, 5.10 relate to soil type D/E in Earthquake zone 3, for multiplication factors for other soil types see below

Soil Class	Earthquake Zone			
	1	2	3	4
A & B Rock	0.3	0.5	0.6	0.9
C Shallow	0.4	0.6	0.7	1.1
D/E Deep / Soft	0.5	0.8	1.0	1.5

## Box 4 Building plan dimensions (Figure 5.3)

Roof or building length for wind across ridge	L	= 11.2 m	Transfer to Box 5
Roof or building length for wind along ridge	W	= 5.6 m	
Gross Floor Area	GFA	= 53 sq m	

## Box 5 Calculation of demand

(Value) (Box 4 Dimension)

Wind Load Across	(from box 2)	= 73.5	x 11.2	= 823	BU
Wind Load Along	(from box 2)	= 77	x 5.6	= 431	BU
Earthquake Load (both directions)	(from Box 3)	= 10.5	x 53	= 557	BU

## SHEET B



## LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	<u>LOWER STOREY</u>	LOCATION IN BUILDING
			2 story section

Use one sheet for each storey / block and circle the appropriate location

## ACROSS

1	2	3	4	5	6	7	8	9	10	11
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	Wind			Minimum Bracing Demand	Earthquake		
				BU's/m (Wind)	BU's Achieved	Total for Bracing Line		BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A										
B	B2	Pst+I	2.4	120	288	288	103	100	240	240
C	C2	Pst+I	1.2	120	144	144	103	100	120	120
D	D2	Pst+I	1.2	120	144	144	103	100	120	120
E	E2	Pst+I	2.4	120	288	288	103	100	240	240
				Total Bracing Achieved				Total Bracing Achieved		
				864				720		
				Total Bracing Demand for Wind Across				Total Bracing Demand for Earthquake		
				823				557		

## ALONG

1	2	3	4	5	6	7	8	9	10	11
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	Wind			Minimum Bracing Demand	Earthquake		
				BU's/m (Wind)	BU's Achieved	Total for Bracing Line		BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
M	M3	Pst+I	3.6				159	100	360	360
N	N3 N4	Pst+I Pst+I	2.2 1.8				159	100 100	120 180	300
O										
P										
Q										
				Total Bracing Achieved				Total Bracing Achieved		
				431				660		
				Total Bracing Demand for Wind Along				Total Bracing Demand for Earthquake		
								557		



# SHEET A



Name of Applicant: \_\_\_\_\_ Site Address: \_\_\_\_\_  
 City/Town or District: \_\_\_\_\_  
 Street and Number: \_\_\_\_\_  
 Or Lot and D.P. Number: \_\_\_\_\_

## Box 1

### LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
Use one sheet for each and circle the appropriate location			2 story section

## Box 2 Wind Bracing Demand (Table 5.5, 5.6 or 5.7)

Wind zone (Table 5.1)	L / M / H / VH / EH	Note: Tables 5.5, 5.6, 5.7 relate to High wind zone. In other wind zones, multiply the value by the appropriate factor.	
Building height to apex (H)	4.2 m		
Roof height above eaves (H)	1.8 m		
$W_{cross}$ = (value from tables)	50	x (multiplication factor)	(BU/m)
		$\begin{Bmatrix} L & 0.5 \\ M & 0.7 \\ VH & 1.3 \\ EH & 1.6 \end{Bmatrix}$	= 35
$W_{along}$ =	55	x	= 38.5
Transfer to Box 5			

## Box 3 Earthquake Bracing Demand (Table 5.8, 5.9, 5.10)

Earthquake zone (Figure 5.4)	1 / 2 / 3 / 4	Concrete slab	Table 5.10	No
Weight of roof cladding	Light / Heavy	Part storey in roof space	Cl 5.3.4.3	No
Roof pitch (degrees)	0-25 / 26-45 / 46-60	Part storey basement	Cl 5.3.4.4	No
Weight of upper (or single) storey cladding	Light / medium / heavy	Chimney	Cl 5.3.4.5	No
Weight of lower storey cladding	Light / medium / heavy	Wings / blocks	Cl 5.1.5	Yes
Weight of subfloor cladding	Light / medium / heavy	Deck projecting more than 2 m	Cl 7.4.2.2	No
$BU/m^2$ (from tables 5.8, 5.9, 5.10) =	12	x (multiplication factor below)	0.5	= 6
NOTE: Tables 5.8, 5.9, 5.10 relate to soil type D/E in Earthquake zone 3, for multiplication factors for other soil types see below				
Transfer to Box 5				

Soil Class	Earthquake Zone			
	1	2	3	4
A & B Rock	0.3	0.5	0.6	0.9
C Shallow	0.4	0.6	0.7	1.1
D/E Deep / Soft	0.5	0.8	1.0	1.5

## Box 4 Building plan dimensions (Figure 5.3)

Roof or building length for wind across ridge	L	=	11.2	m	Transfer to Box 5
Roof or building length for wind along ridge	W	=	5.6	m	
Gross Floor Area	GFA	=	53	sq m	

## Box 5 Calculation of demand

	(Value)	(Box 4 Dimension)		
Wind Load Across (from box 2)	= 35	x 11.2	= 392	BU
Wind Load Along (from box 2)	= 38.5	x 5.6	= 216	BU
Earthquake Load (both directions) (from Box 3)	= 6	x 53	= 318	BU



## SHEET B



## LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	<u>SINGLE STOREY or UPPER STOREY</u>	LOWER STOREY	LOCATION IN BUILDING <i>2 story section</i>
------------	--------------------------------------	--------------	--

Use one sheet for each storey / block and circle the appropriate location

## ACROSS

1	2	3	4	5	6	7	8	9	10	11
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	Wind			Minimum Bracing Demand	Earthquake		
				BU's/m (Wind)	BU's Achieved	Total for Bracing Line		BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A										
B	B1	Pist1	1.2	120	164	164	100	100	120	120
C	C1	Pist1	1.2	120	164	164	100	100	120	120
D	D1	Pist1	1.2	120	164	164	100	100	120	120
E	E1	Pist1	1.2	120	164	164	100	100	120	120
Total Bracing Achieved						576		Total Bracing Achieved		480
Total Bracing Demand for Wind Across						392		Total Bracing Demand for Earthquake		318

## ALONG

1	2	3	4	5	6	7	8	9	10	11	
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	Wind			Minimum Bracing Demand	Earthquake			
				BU's/m (wind)	BU's Achieved	Total for Bracing Line		BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line	
M	M1	Pist1	1.2				159	100	120	240	
	M2	Pist1	1.2					100	120		
N	N1	Pist1	1.2				159	100	120	240	
	N1	Pist1	1.2					100	120		
O											
P											
Q											
Total Bracing Achieved								Total Bracing Achieved			480
Total Bracing Demand for Wind Along				216				Total Bracing Demand for Earthquake			318

# SHEET A



Name of Applicant: \_\_\_\_\_

Site Address: \_\_\_\_\_

City/Town or District: \_\_\_\_\_

Street and Number: \_\_\_\_\_

Or Lot and D.P. Number: \_\_\_\_\_

## Box 1

### LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
Use one sheet for each and circle the appropriate location			1 story section

## Box 2 Wind Bracing Demand (Table 5.5, 5.6 or 5.7)

Wind zone (Table 5.1) L/M/H/VH/EH  
 Building height to apex (H) 4.8 m  
 Roof height above eaves (H) 1.9 m

Note: Tables 5.5, 5.6, 5.7 relate to High wind zone.  
 In other wind zones, multiply the value by the appropriate factor.

$$W_{area} = \text{(value from tables)} \times \text{(multiplication factor)} = \text{(Bu/m)}$$

$$W_{area} = 50 \times \begin{Bmatrix} L & 0.5 \\ M & 0.7 \\ VH & 1.3 \\ EH & 1.6 \end{Bmatrix} = 35$$

Transfer to Box 5

## Box 3 Earthquake Bracing Demand (Table 5.8, 5.9, 5.10)

Earthquake zone (Figure 5.4)	1/2/3/4	Concrete slab	Table 5.10
Weight of roof cladding	Light / Heavy	Part storey in roof space	Cl 5.3.4.3
Roof pitch (degrees)	0-25 / 26-45 / 46-60	Part storey basement	Cl 5.3.4.4
Weight of upper (or single) storey cladding	Light / medium / heavy	Chimney	Cl 5.3.4.5
Weight of lower storey cladding	Light / medium / heavy	Wings / blocks	Cl 5.1.5
Weight of subfloor cladding	Light / medium / heavy	Deck projecting more than 2 m	Cl 7.4.2.2

$$BU / m^2 \text{ (from tables 5.8, 5.9, 5.10)} = 11 \times \text{(multiplication factor below)} = 5.5$$

Transfer to Box 5

NOTE: Tables 5.8, 5.9, 5.10 relate to soil type D/E in Earthquake zone 3,  
 for multiplication factors for other soil types see below

Soil Class	Earthquake Zone			
	1	2	3	4
A & B Rock	0.3	0.5	0.6	0.9
C Shallow	0.4	0.6	0.7	1.1
D/E Deep / Soft	0.5	0.8	1.0	1.5

## Box 4 Building plan dimensions (Figure 5.3)

Roof or building length for wind across ridge	L	=	9.3	m	Transfer to Box 5
Roof or building length for wind along ridge	W	=	8.1	m	
Gross Floor Area	GFA	=	75.3	sq m	

## Box 5 Calculation of demand

	(Value)	(Box 4 Dimension)	
Wind Load Across (from box 2)	= 35	x 9.3	= 326 BU
Wind Load Along (from box 2)	= 35	x 8.1	= 284 BU
Earthquake Load (both directions) (from Box 3)	= 5.5	x 75.3	= 414 BU

## SHEET B

## LOCATION OF STOREY / BLOCK BEING ASSESSED



FOUNDATION	<u>SINGLE STOREY or UPPER STOREY</u>	LOWER STOREY	LOCATION IN BUILDING <u>1 Storey Section</u>
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Use one sheet for each storey / block and circle the appropriate location

## ACROSS

1	2	3	4	5	6	7	8	9	10	11
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	Wind			Minimum Bracing Demand	Earthquake		
				BU's/m (Wind)	BU's Achieved	Total for Bracing Line		BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A	A1	Plastr	1.5				122	100	150	150
B	B2	Plastr	2.4				122	100	240	480
	B3	Plastr	2.4					100	240	
C	C2	Plastr	1.2				122	100	120	300
	C3	Plastr	1.8					100	180	
D	D2	Plastr	1.2				122	100	120	240
	D3	Plastr	1.2					100	120	
E										
Total Bracing Achieved								Total Bracing Achieved		
Total Bracing Demand for Wind Across				326				Total Bracing Demand for Earthquake		

# SHEET A



Name of Applicant: \_\_\_\_\_ Site Address: \_\_\_\_\_  
 City/Town or District: \_\_\_\_\_  
 Street and Number: \_\_\_\_\_  
 Or Lot and D.P. Number: \_\_\_\_\_

**Box 1**

**LOCATION OF STOREY / BLOCK BEING ASSESSED**

FOUNDATION	<u>SINGLE STOREY or UPPER STOREY</u>	LOWER STOREY	LOCATION IN BUILDING
Use one sheet for each and circle the appropriate location			<u>Garage</u>

**Box 2 Wind Bracing Demand (Table 5.5 (5.6 or 5.7))**

Wind zone (Table 5.1)	<u>L / M / H / VH / EH</u>	Note: Tables 5.5, 5.6, 5.7 relate to High wind zone. In other wind zones, multiply the value by the appropriate factor.
Building height to apex (H)	<u>4.8</u> m	
Roof height above eaves (H)	<u>1.9</u> m	

$W_{max} = 50 \times \left\{ \begin{array}{l} L \\ M \\ VH \\ EH \end{array} \right\} \begin{array}{l} 0.5 \\ 0.7 \\ 1.3 \\ 1.5 \end{array} = 35$  (Bu/m)  
 $W_{avg} = 50 \times \left\{ \begin{array}{l} L \\ M \\ VH \\ EH \end{array} \right\} \begin{array}{l} 0.5 \\ 0.7 \\ 1.3 \\ 1.5 \end{array} = 35$

Transfer to Box 5

**Box 3 Earthquake Bracing Demand (Table 5.8, 5.9, 5.10)**

Earthquake zone (Figure 5.4)	<u>1 (2, 3, 4)</u>	Concrete slab	Table 5.10
Weight of roof cladding	<u>Light / Heavy</u>	Part storey in roof space	Cl. 5.3.4.3
Roof pitch (degrees)	<u>0-25 (26-45 / 46-60)</u>	Part storey basement	Cl. 5.3.4.4
Weight of upper (or single) storey cladding	<u>Light / medium / heavy</u>	Chimney	Cl. 5.3.4.5
Weight of lower storey cladding	<u>Light / medium / heavy</u>	Wings / blocks	Cl. 5.1.5
Weight of subfloor cladding	<u>Light / medium / heavy</u>	Deck projecting more than 2 m	Cl. 7.4.2.2

$BU / m^2 \text{ (from tables 5.8, 5.9, 5.10)} = 6 \times 1.5 = 3$  (BU / m<sup>2</sup>)  
 NOTE: Tables 5.8, 5.9, 5.10 relate to soil type D/E in Earthquake zone 3, for multiplication factors for other soil types see below

Soil Class	Earthquake Zone			
	1	<u>2</u>	3	4
<u>A &amp; B Rock</u>	0.3	<u>0.5</u>	0.6	0.9
C Shallow	0.4	0.6	0.7	1.1
D/E Deep / Soft	0.5	0.8	1.0	1.5

**Box 4 Building plan dimensions (Figure 5.3)**

Roof or building length for wind across ridge	L	= <u>7.04</u> m	Transfer to Box 5
Roof or building length for wind along ridge	W	= <u>6.2</u> m	
Gross Floor Area	GFA	= <u>43.6</u> sq m	

**Box 5 Calculation of demand**

	(Value)	(Box 4 Dimension)		
Wind Load Across	(from box 2) = <u>35</u>	x <u>7.04</u>	= <u>246</u>	BU
Wind Load Along	(from box 2) = <u>35</u>	x <u>6.2</u>	= <u>217</u>	BU
Earthquake Load (both directions)	(from Box 3) = <u>3</u>	x <u>43.6</u>	= <u>131</u>	BU



## SHEET B



## LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	<u>SINGLE STOREY or UPPER STOREY</u>	LOWER STOREY	LOCATION IN BUILDING <i>Garage</i>
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Use one sheet for each storey / block and circle the appropriate location

ACROSS *Along*

1	2	3	4	5	6	7	8	9	10	11
Well or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	Wind			Minimum Bracing Demand	Earthquake		
				BU's/m (Wind)	BU's Achieved	Total for Bracing Line		BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A	<i>A2</i>	<i>Pistr</i>	<i>1.2</i>	<i>120</i>	<i>144</i>	<i>144</i>	<i>106</i>	<i>100</i>	<i>120</i>	<i>120</i>
B										
C	<i>C4</i>	<i>Ply</i>	<i>0.8</i>	<i>150</i>	<i>120</i>	<i>240</i>	<i>106</i>	<i>150</i>	<i>120</i>	<i>240</i>
	<i>C5</i>	<i>Ply</i>	<i>0.8</i>	<i>150</i>	<i>120</i>			<i>150</i>	<i>120</i>	
D										
E										
Total Bracing Achieved				<i>384</i>				Total Bracing Achieved		
Total Bracing Demand for Wind Across				<i>246</i>				Total Bracing Demand for Earthquake		
								<i>131</i>		

ALONG *Across*

1	2	3	4	5	6	7	8	9	10	11
Well or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	Wind			Minimum Bracing Demand	Earthquake		
				BU's/m (Wind)	BU's Achieved	Total for Bracing Line		BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
M										
N										
O	<i>O2</i>	<i>Pistr</i>	<i>2.4</i>	<i>120</i>	<i>288</i>	<i>288</i>	<i>100</i>	<i>100</i>	<i>240</i>	<i>240</i>
P	<i>P1</i>	<i>Pistr</i>	<i>1.2</i>	<i>120</i>	<i>144</i>	<i>288</i>	<i>100</i>	<i>100</i>	<i>120</i>	<i>240</i>
	<i>P2</i>	<i>Pistr</i>	<i>1.2</i>	<i>120</i>	<i>144</i>			<i>100</i>	<i>120</i>	
Q										
Total Bracing Achieved				<i>576</i>				Total Bracing Achieved		
Total Bracing Demand for Wind Along				<i>217</i>				Total Bracing Demand for Earthquake		
								<i>131</i>		