DESIGN RIGHT

Wall bracing

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

TOM EDHOUSE, BRANZ TECHNICAL ADVISOR

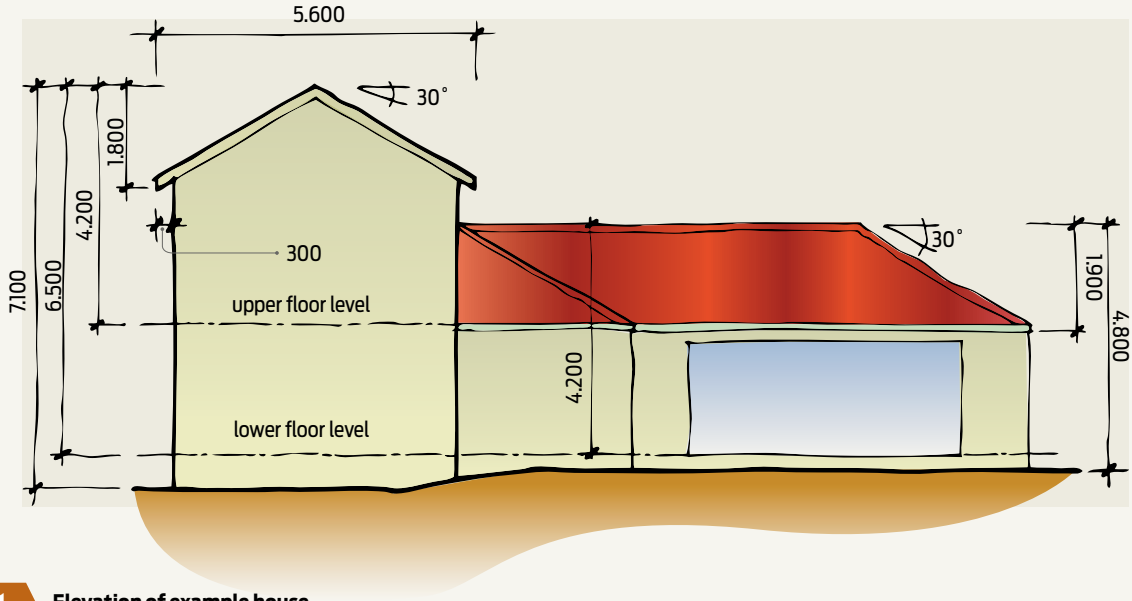


Figure 1 **Elevation of example house.**

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 × 5.0 = 53 m²
- 1-storey = 8.1 × 9.3 = 75.3 m² (for simplicity, the area has not been reduced for the porch entry)
- garage area = 6.2 × 7.040 = 43.6 m²

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 m, h = 1.8 m
- Upper storey to apex H = 4.2 m, h = 1.8 m
- 1-storey to apex H = 4.8 m, h = 1.9 m
- Garage to apex H = 4.8 m, h = 1.9 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 m
- width = 5.0 + 0.300 + 0.300 = 5.6 m
- single-storey: length = 6.2 + 3.1 = 9.3 m, width = 8.1 m (no roof overhangs)
- garage: length = 7.040 m, width = 6.2 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.

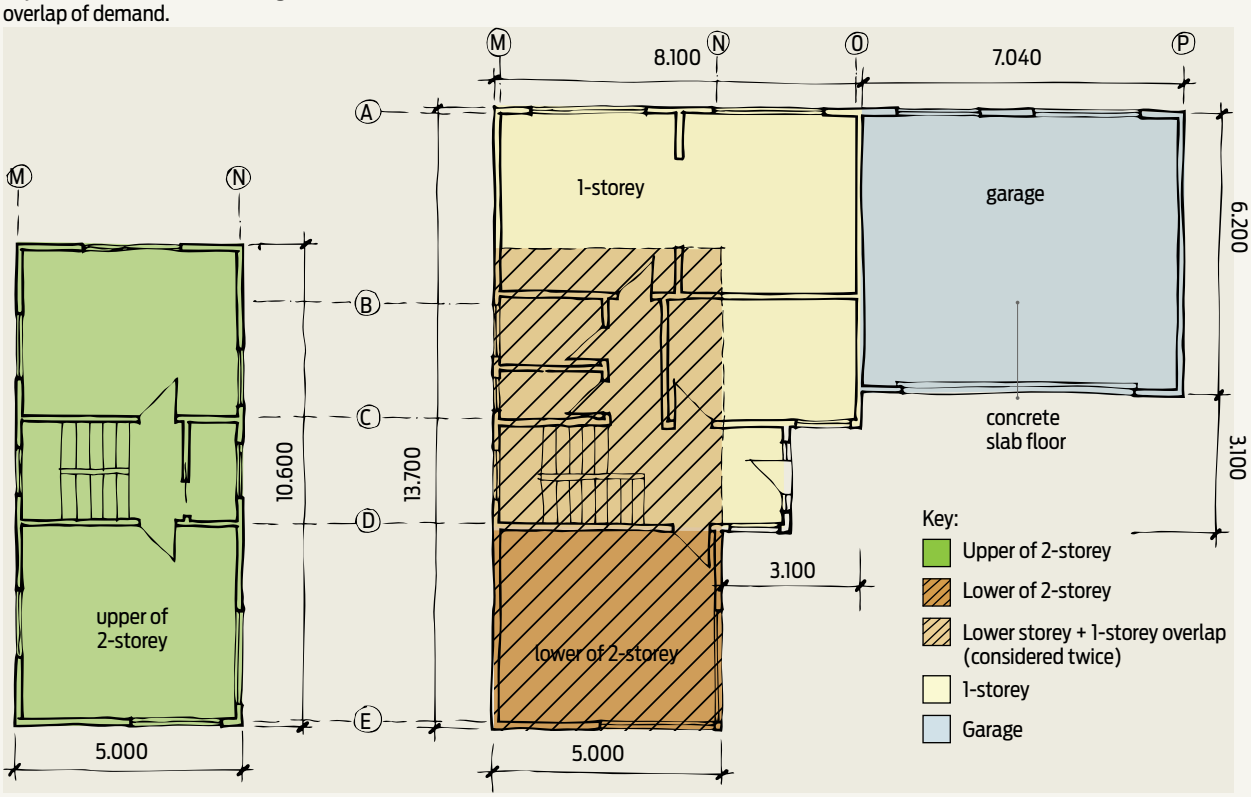


Figure 2 **Floor plan of example house.**

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):

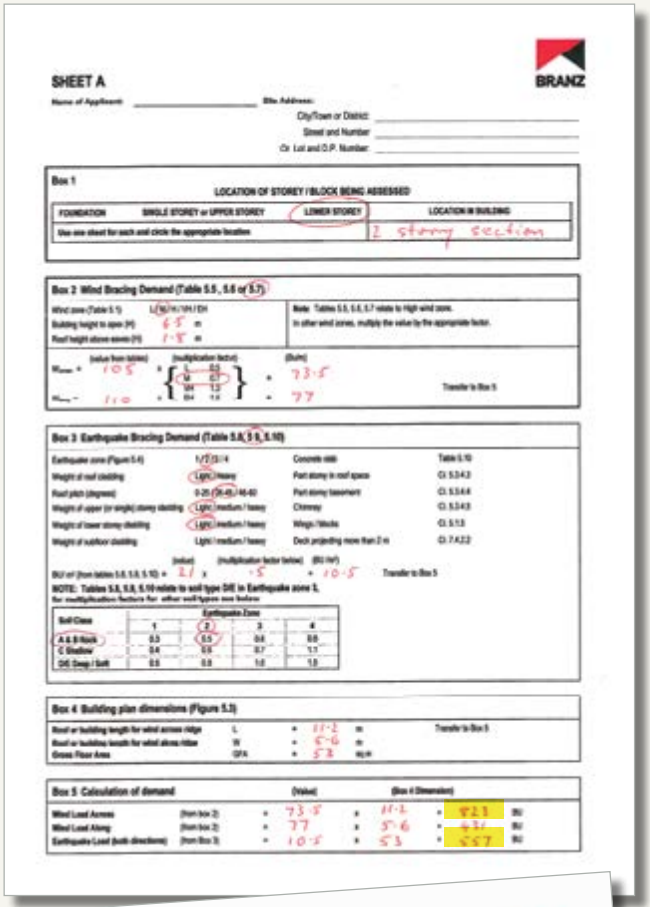
- Lines B, C, D, E = 5 m × 15 = 75 BUs or 100 BUs or 824/2 divided by 4 lines = **103 BUs**
- Lines M, N = 10.6 × 15 = **159 BUs** or 100 BUs or 557/2 divided by 2 lines = 139.2 BUs

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

- Lines B, C, D, E = 5 m × 15 = 75 BUs or **100 BUs** or 392/2 divided by 4 lines = 49 BUs
- Lines M, N = 10.6 × 15 = **159 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 × 15 = **121.5 BUs** or 100 BUs or 414/2 divided by 4 lines = 51.8 BUs
- Lines M, N, O = 9.3 × 15 = **139.5 BUs** or 100 BUs or 414/2 divided by 3 lines = 69 BUs



SHEET A

BRANZ

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 storey 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 eave [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.

	(value from tables)	(multiplication factor)		(Bu/m)
W_{Across} =	105	x { L 0.8 / M 1.0 / VH 1.3 / EH 1.6 }	=	73.5
W_{Along} =	110	x { L 0.8 / M 1.0 / VH 1.3 / EH 1.6 }	=	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

Weight of roof cladding: Light / Heavy

Roof pitch (degrees): 0-25 (30-45) / 46-60

Weight of upper (or single) storey cladding: Light / medium / heavy

Weight of lower storey cladding: Light / medium / heavy

Weight of subfloor cladding: Light / medium / heavy

Concrete slab: Table 5.10

Part storey in roof space: Cl. 5.3.4.3

Part storey basement: Cl. 5.3.4.4

Chimney: Cl. 5.3.4.5

Wings / blocks: Cl. 5.1.5

Deck projecting more than 2 m: Cl. 7.4.2.2

	(value)	(multiplication factor below)	(BU /m²)
BU /m² (from tables 5.8, 5.9, 5.10) =	21	x .5	= 10.5

Transfer to Box 5

NOTE: Tables 5.8, 5.9, 5.10 relate to soil type DE 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	0.8	0.8
C Shallow	0.4	0.6	0.7	1.1
DE Deep / Soft	0.6	0.8	1.0	1.5

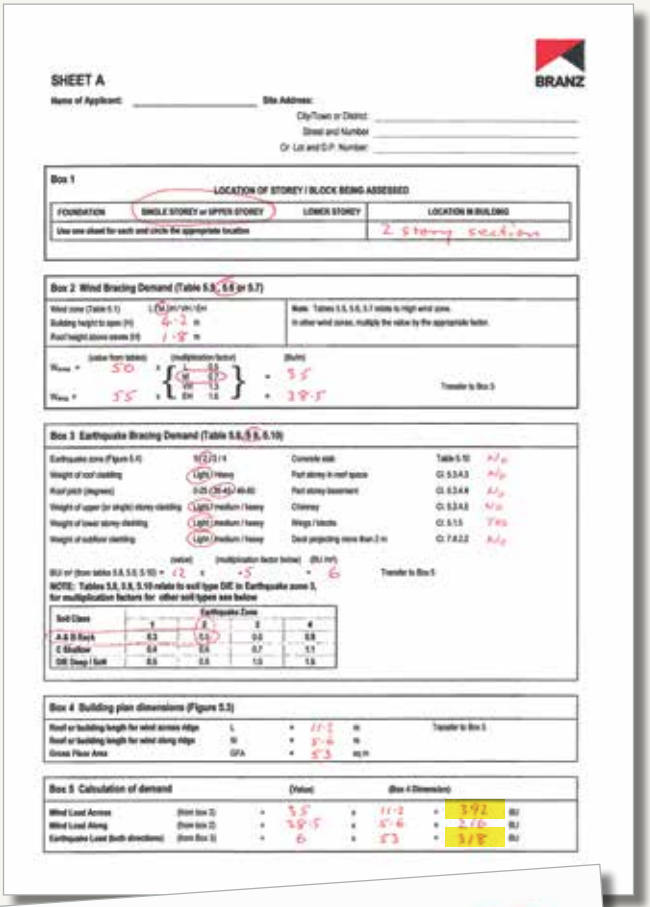
Box 4 Building plan dimensions (Figure 5.3)

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

Transfer to Box 5

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 A

BRANZ

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 storey 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 eave [H]: 4.2 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.

	(value from tables)	(multiplication factor)		(Bu/m)
W_{Across} =	50	x { L 0.8 / M 1.0 / VH 1.3 / EH 1.6 }	=	35
W_{Along} =	55	x { L 0.8 / M 1.0 / VH 1.3 / EH 1.6 }	=	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

Weight of roof cladding: Light / Heavy

Roof pitch (degrees): 0-25 (30-45) / 46-60

Weight of upper (or single) storey cladding: Light / medium / heavy

Weight of lower storey cladding: Light / medium / heavy

Weight of subfloor cladding: Light / medium / heavy

Concrete slab: Table 5.10 N/A

Part storey in roof space: Cl. 5.3.4.3 N/A

Part storey basement: Cl. 5.3.4.4 N/A

Chimney: Cl. 5.3.4.5 N/A

Wings / blocks: Cl. 5.1.5 Yes

Deck projecting more than 2 m: Cl. 7.4.2.2 N/A

	(value)	(multiplication factor below)	(BU /m²)
BU /m² (from tables 5.8, 5.9, 5.10) =	12	x .5	= 6

Transfer to Box 5

NOTE: Tables 5.8, 5.9, 5.10 relate to soil type DE 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	0.8	0.8
C Shallow	0.4	0.6	0.7	1.1
DE Deep / Soft	0.6	0.8	1.0	1.5

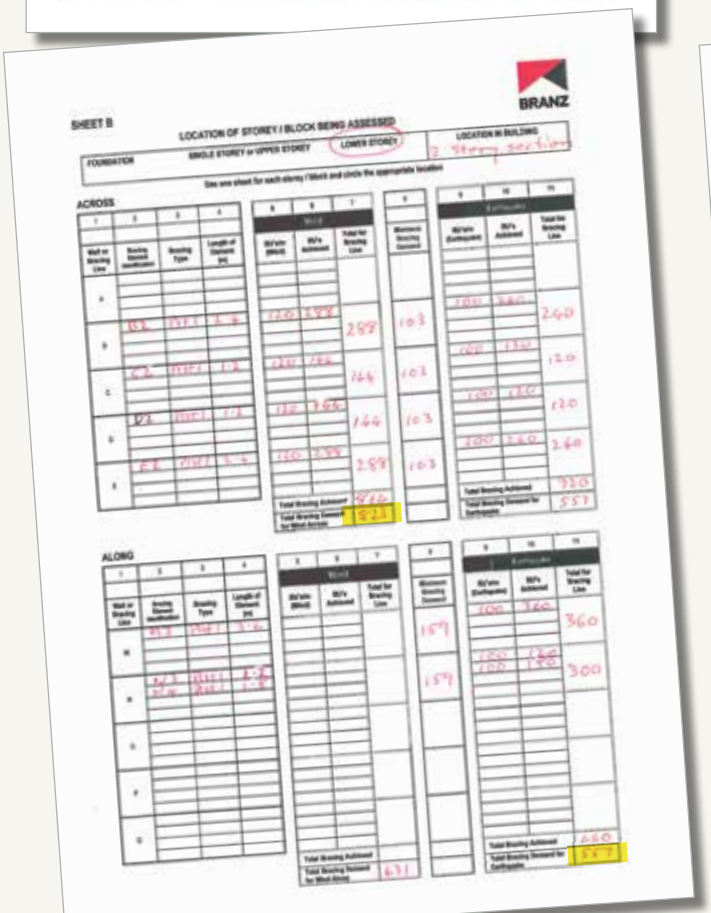
Box 4 Building plan dimensions (Figure 5.3)

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

Transfer to Box 5

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

BRANZ

LOCATION OF STOREY / BLOCK BEING ASSESSED

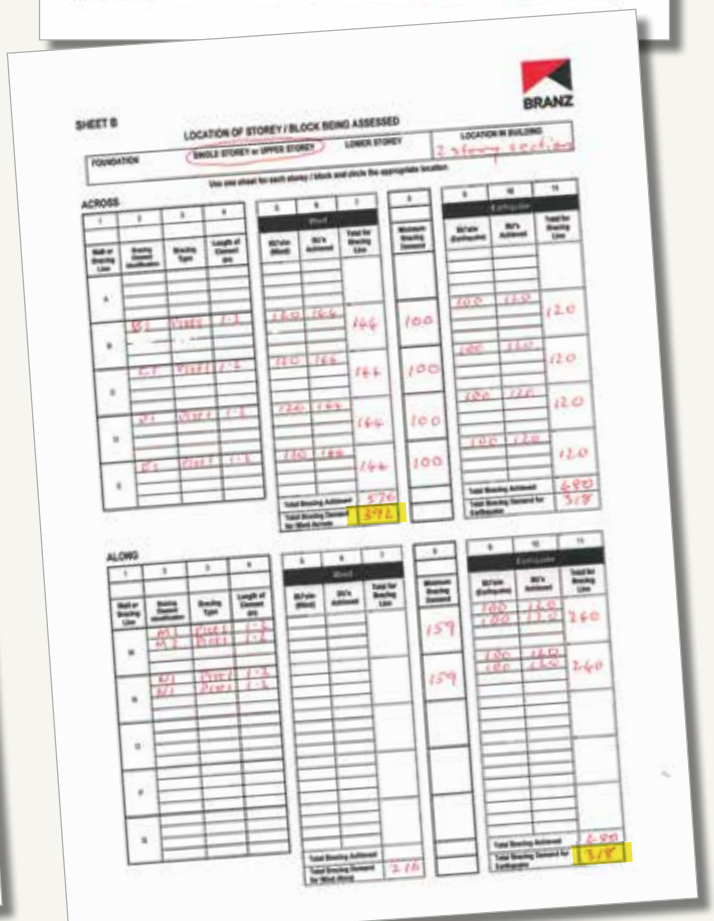
FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
See one sheet for each storey / block and circle the appropriate location			2 storey section

ACROSS

Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element [m]	Wind: Bu's/m (Wind)	Bu's Achieved	Total for Bracing Line	Minimum Bracing Demand	Earthquake: Bu's/m (Earthquake)	Bu's Achieved	Total for Bracing Line
A										
B	B2	15mm GIB	1.8	120	133	239	103	100	120	240
C	C2	15mm GIB	1.8	120	133	144	103	100	120	120
D	D2	15mm GIB	1.8	120	133	144	103	100	120	240
E	E2	15mm GIB	1.8	120	133	239	103	100	120	240
						Total Bracing Achieved: 760				Total Bracing Achieved: 720
						Total Bracing Demand for Wind Across: 823				Total Bracing Demand for Earthquake: 557

ALONG

Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element [m]	Wind: Bu's/m (Wind)	Bu's Achieved	Total for Bracing Line	Minimum Bracing Demand	Earthquake: Bu's/m (Earthquake)	Bu's Achieved	Total for Bracing Line
W	W1	15mm GIB	1.8				159	100	120	360
X	X1	15mm GIB	1.8				159	100	120	300
Y										
Z										
						Total Bracing Achieved: 631				Total Bracing Achieved: 660
						Total Bracing Demand for Wind Along: 431				Total Bracing Demand for Earthquake: 557



SHEET B

BRANZ

LOCATION OF STOREY / BLOCK BEING ASSESSED

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

ACROSS

Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element [m]	Wind: Bu's/m (Wind)	Bu's Achieved	Total for Bracing Line	Minimum Bracing Demand	Earthquake: Bu's/m (Earthquake)	Bu's Achieved	Total for Bracing Line
A										
B	B1	15mm GIB	1.8	120	136	144	100	100	120	120
C	C1	15mm GIB	1.8	120	136	144	100	100	120	120
D	D1	15mm GIB	1.8	120	136	144	100	100	120	120
E	E1	15mm GIB	1.8	120	136	144	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

Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element [m]	Wind: Bu's/m (Wind)	Bu's Achieved	Total for Bracing Line	Minimum Bracing Demand	Earthquake: Bu's/m (Earthquake)	Bu's Achieved	Total for Bracing Line
W	W1	15mm GIB	1.8				159	100	120	240
X	X1	15mm GIB	1.8				159	100	120	240
Y										
Z										
						Total Bracing Achieved: 216				Total Bracing Achieved: 480
						Total Bracing Demand for Wind Along: 216				Total Bracing Demand for Earthquake: 318

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

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

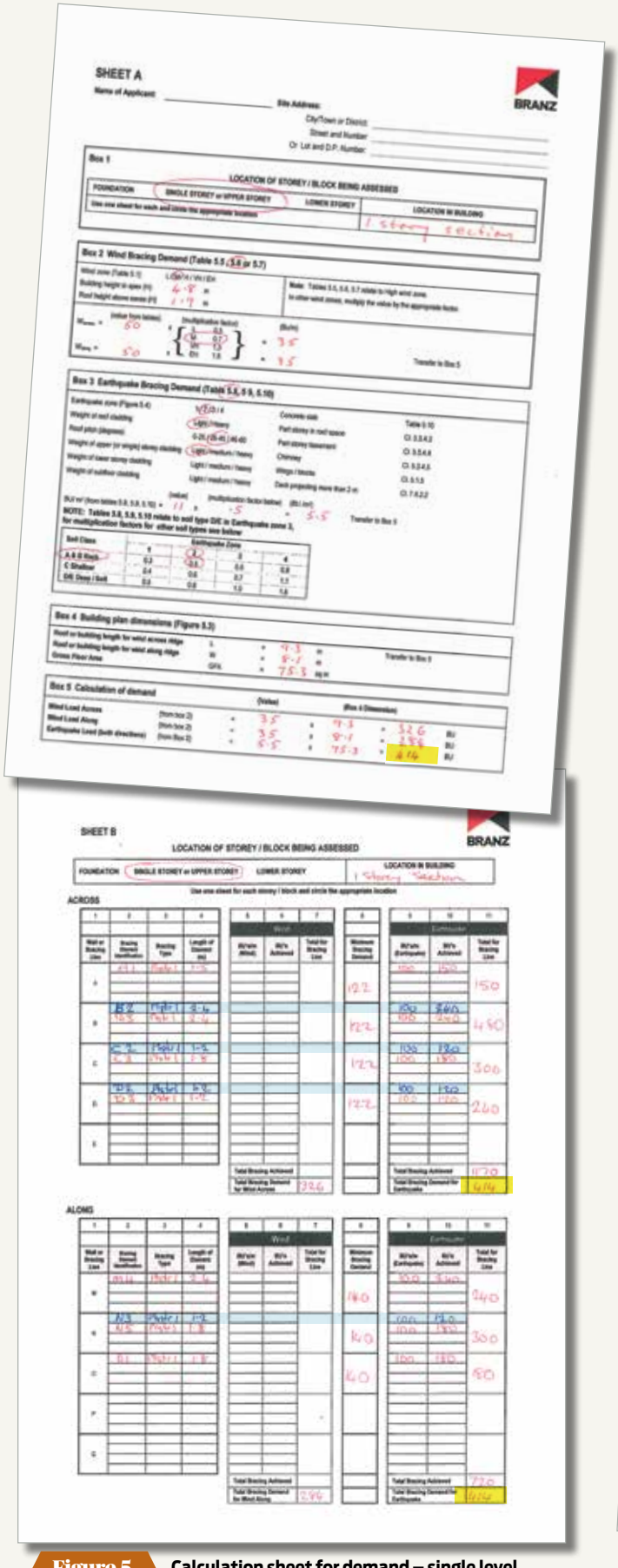


Figure 5 Calculation sheet for demand – single level. Blue entries indicate overlap with 2-storey.

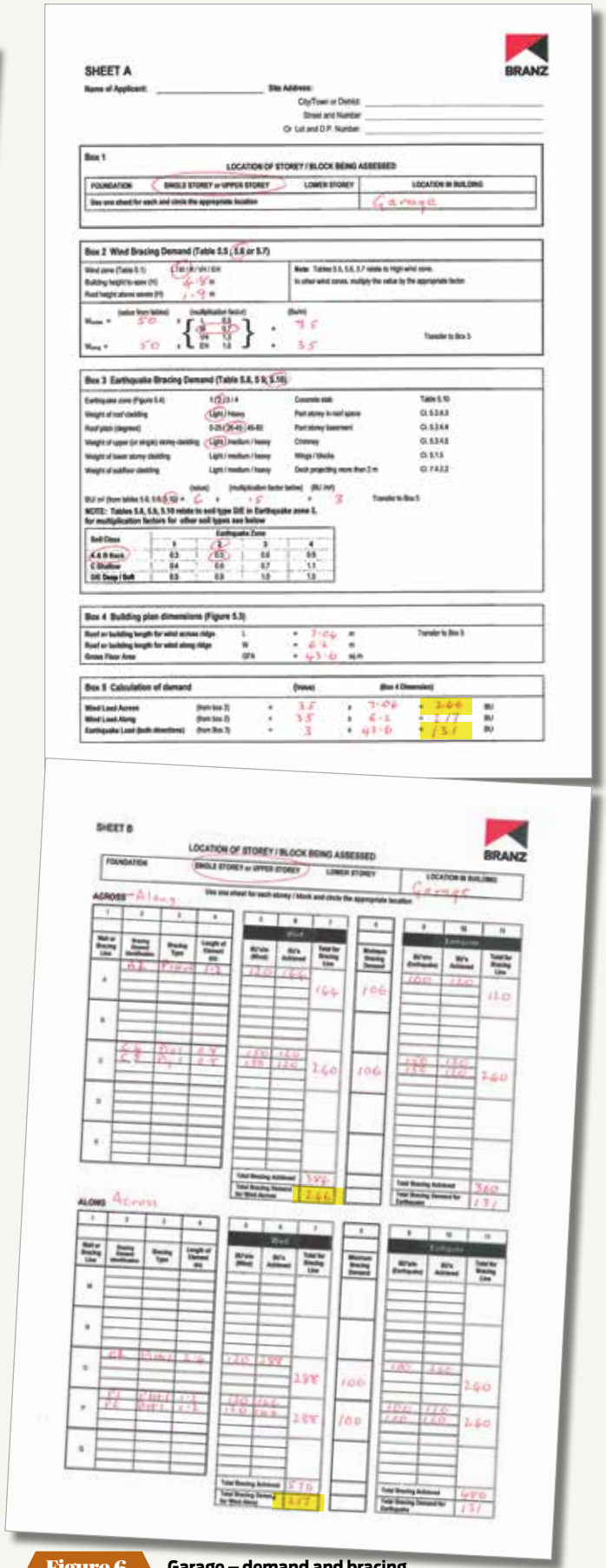


Figure 6 Garage – demand and bracing.

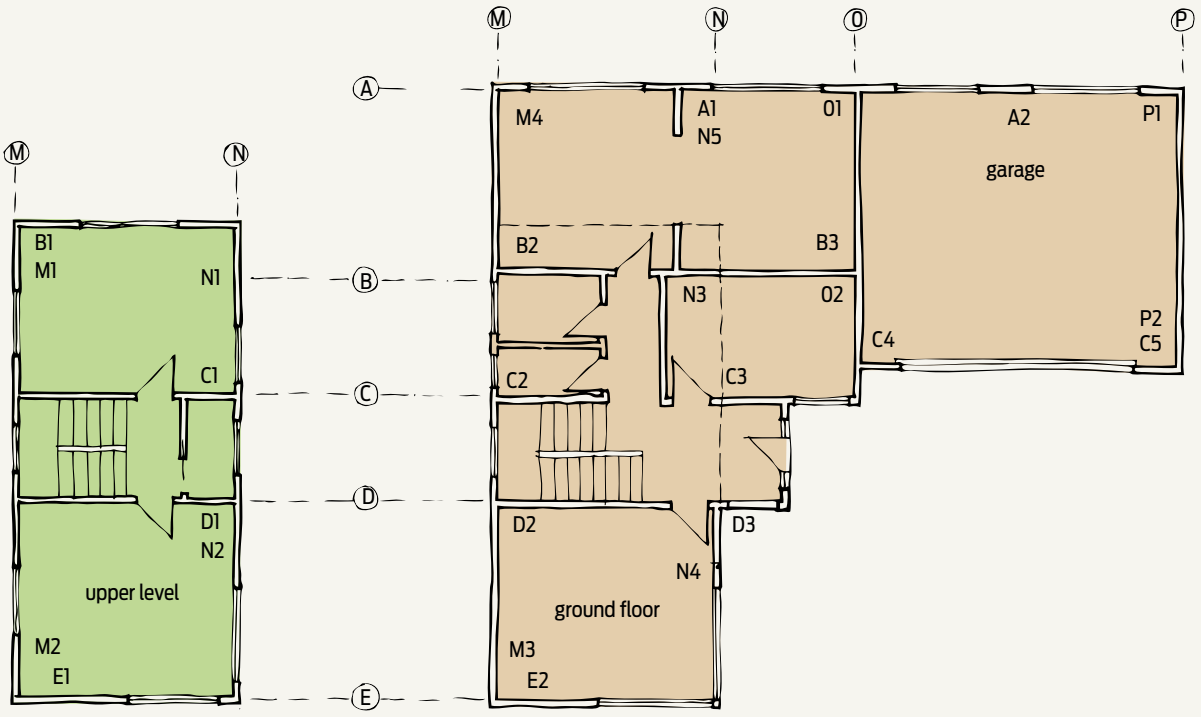


Figure 7 **Final bracing plan.**

Garage (see Fig 6b):

- Lines A, C = 7.040 × 15 = **105.6 BUs** or 100 BUs or 247/2 divided by 2 lines = 62 BUs
- Lines O, P = 6.2 × 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, then The Right Stuff.**

SHEET A

BRANZ

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 storey 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.

	(value from tables)		(multiplication factor)		(Bu/m)
W_{across} =	105	x	L 0.5 M 0.7 VH 1.3 EH 1.6	=	73.5
W_{along} =	110	x		=	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

	(value)		(multiplication factor below)	(BU /m²)	
BU/ m² (from tables 5.8, 5.9, 5.10) =	21	x	.5	= 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

BRANZ

SHEET B

LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
		(circled)	2 storey 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
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A										
B	B2	Pst 1	2.4	120	288	288	103	100	240	240
C	C2	Pst 1	1.2	120	144	144	103	100	120	120
D	D2	Pst 1	1.2	120	144	144	103	100	120	120
E	E2	Pst 1	2.4	120	288	288	103	100	240	240
				Total Bracing Achieved		864		Total Bracing Achieved		720
				Total Bracing Demand for Wind Across		823		Total Bracing Demand for Earthquake		557

ALONG

1	2	3	4	5	6	7	8	9	10	11
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
M	M3	Pst 1	3.6				159	100	360	360
N	N3	Pst 1	1.2				159	100	120	300
	N4	Pst 1	1.8					100	180	
O										
P										
Q										
				Total Bracing Achieved				Total Bracing Achieved		660
				Total Bracing Demand for Wind Along		431		Total Bracing Demand for Earthquake		557

SHEET A

BRANZ

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) 4.2 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.

	(value from tables)		(multiplication factor)			(Bu/m)
W_{across} =	50	x	L	0.5	=	35
			M	0.7		
			VH	1.3		
W_{along} =	55	x	EH	1.6	=	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

	(value)		(multiplication factor below)		(BU /m²)
BU/ m² (from tables 5.8, 5.9, 5.10) =	12	x	.5	=	6

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
Roof or building length for wind along ridge	W	=	5.6	m
Gross Floor Area	GFA	=	53	sq m

Transfer to Box 5

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

BRANZ

SHEET B

LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
	(SINGLE STOREY or UPPER STOREY)		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
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A										
B	B1	Plst1	1·2	120	164	144	100	100	120	120
C	C1	Plst1	1·2	120	164	144	100	100	120	120
D	D1	Plst1	1·2	120	164	144	100	100	120	120
E	E1	Plst1	1·2	120	164	144	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
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
M	M1	Plst1	1·2				159	100	120	240
	M2	Plst1	1·2					100	120	
N	N1	Plst1	1·2				159	100	120	240
	N1	Plst1	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

BRANZ

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 storey 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.

	(value from tables)		(multiplication factor)		(Bu/m)
W_{across} =	50	x	L 0.5 M 0.7 VH 1.3 EH 1.6	=	35
W_{along} =	50	x		=	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

	(value)		(multiplication factor below)	(BU /m²)	
BU/ m² (from tables 5.8, 5.9, 5.10) =	11	x	.5	= 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

BRANZ

LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
	(circled)		1 Storey 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
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A	M1	Mstr1	1.5				122	100	150	150
B	B2	Mstr1	2.4				122	100	240	480
	B3	Mstr1	2.4					100	240	
C	C2	Mstr1	1.2				122	100	120	300
	C3	Mstr1	1.8					100	180	
D	D2	Mstr1	1.2				122	100	120	240
	D3	Mstr1	1.2					100	120	
E										
				Total Bracing Achieved				Total Bracing Achieved		1170
				Total Bracing Demand for Wind Across		326		Total Bracing Demand for Earthquake		414

ALONG

1	2	3	4	5	6	7	8	9	10	11
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
M	M4	Mstr1	2.4				140	100	240	240
N	N3	Mstr1	1.2				140	100	120	300
	N5	Mstr1	1.8					100	180	
O	O1	Mstr1	1.8				140	100	180	180
P										
Q										
				Total Bracing Achieved				Total Bracing Achieved		720
				Total Bracing Demand for Wind Along		284		Total Bracing Demand for Earthquake		414

SHEET A

BRANZ

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			Garage

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.

	(value from tables)		(multiplication factor)		(Bu/m)
W_{across} =	50	x	L 0.5 / M 0.7 / VH 1.3 / EH 1.6	=	35
W_{along} =	50	x	L 0.5 / M 0.7 / VH 1.3 / EH 1.6	=	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

	(value)		(multiplication factor below)		(BU /m²)
BU/ m² (from tables 5.8, 5.9, 5.10) =	6	x	.5	=	3

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	= 7.04	m	Transfer to Box 5
Roof or building length for wind along ridge	W	= 6.2	m	
Gross Floor Area	GFA	= 43.6	sq m	

Box 5 Calculation of demand

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

SHEET B

BRANZ

LOCATION OF STOREY / BLOCK BEING ASSESSED

FOUNDATION	SINGLE STOREY or UPPER STOREY	LOWER STOREY	LOCATION IN BUILDING
	(circled)		Garage

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
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
A	A2	Plyw	1.2	120	144	144	106	100	120	120
B										
C	C4	Plyw	0.8	150	120	240	106	150	120	240
	C5	Plyw	0.8	150	120			150	120	
D										
E										
				Total Bracing Achieved		384		Total Bracing Achieved		360
				Total Bracing Demand for Wind Across		246		Total Bracing Demand for Earthquake		131

~~ALONG~~ Across

1	2	3	4	5	6	7	8	9	10	11
				Wind				Earthquake		
Wall or Bracing Line	Bracing Element Identification	Bracing Type	Length of Element (m)	BU's/m (Wind)	BU's Achieved	Total for Bracing Line	Minimum Bracing Demand	BU's/m (Earthquake)	BU's Achieved	Total for Bracing Line
M										
N										
O	O2	Plyw	2.4	120	288	288	100	100	240	240
P	P1	Plyw	1.2	120	144	288	100	100	120	240
	P2	Plyw	1.2	120	144			100	120	
Q										
				Total Bracing Achieved		576		Total Bracing Achieved		480
				Total Bracing Demand for Wind Along		217		Total Bracing Demand for Earthquake		131