Concrete Masonry Walls & Requirements for Partitions

Presented by:

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Cement & Concrete Association of New Zealand &
FIRTH Industries
<table>
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<th>Topic</th>
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<td>Summary</td>
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What is Concrete Masonry?
CONCRETE BLOCKS:

Block height - 200 mm nominal height, 190 mm actual height

Block length - 400 mm nominal length, 390 mm actual length

Block width -

10 series: 100 mm nominal, 90 mm actual
15 series: 150 mm nominal, 140 mm actual
20 series: 200 mm nominal, 190 mm actual
25 series: 250 mm nominal, 240 mm actual

MORTAR: bonded together by 10 mm cement mortar beddings

REBAR: structural Walls must be reinforced (eg. NZS 4229, Table 8.2.)

GROUT: infill to bonding reinforcement with wall
What is Concrete Masonry?

20 Series

- 20.02: Half
- 20.04: Plain End
- H20.04: Plain End Half High
- 20.05: Open End
- 20.08: Sill (projecting)
- 20.34: Plaster "C" Type
- 05.17: Capping
- H20.08: Sill (projecting)
- 20.09: Rebate Whole
- 20.11: Rebate Lintel
- 20.12: Lintel and Half End Closer
- 20.14: Knock-in Bond Beam
- 20.15: Corner Bond Beam
- 20.18: Open End Bond Beam
- 20.19: Three Quarter
- 20.30: Standard Column
- 20.33: Pier
- 20.44: Knock-in Half Bond Beam
Running Bond

Concrete Masonry Construction

What is Concrete Masonry?
Stack Bond
Testing

• To AS/NZS 4456
1. Natural
2. Colour
3. Split
4. Honed
5. Veneer

Details available on www.firth.co.nz
1. Natural

2. Colour

3. Split

4. Honed

5. Veneer

Details available on www.firth.co.nz
What is Concrete Masonry?

1. Natural
2. Colour
3. **Split**
4. Honed
5. Veneer

Details available on www.firth.co.nz
1. Natural
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1. Natural
2. Colour
3. Split
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5. **Veneer**

Details available on [www.firth.co.nz](http://www.firth.co.nz)
1. **Natural**

2. Colour

3. Split

4. Honed

5. Veneer

www.herbstarchitects.co.nz
1. Natural

2. **Colour**

3. Split

4. **Honed**

5. Veneer
2 Standards providing guidance to masonry construction
The following presentation contains material of **NZS 4229:2013 – Concrete masonry buildings not requiring specific engineering design.**

This material has been provided by Standards New Zealand under licence 001131.
New Zealand Standards Standards providing guidance to masonry construction:

NZS 4210:2001  Masonry construction: Materials and workmanship
  - Concrete, clay and natural stone

NZS 4229:2013  Concrete Masonry Buildings not requiring Specific Engineering Design
  - has to comply with NZS 4210

NZS 4230:2004  Design of Reinforced Masonry Structures
  - Covers masonry design that falls outside NZS 4229 scope

Other related Standards, e.g. NZS 3604, NZS 1170 etc.
NZS 4210:2001  Masonry construction: Materials and workmanship

- Cements, Aggregates, Water and Admixtures
- Material storage and handling
- Initial preparation
- Laying the units
- Reinforcement and placing
- Control joints
- Grouting
- Cleaning out
- Hot and cold weather construction
- Tolerances
- Chases, recesses, penetrations
- Bracing during construction
- Masonry strength
- Veneers
- Testing
- Maintenance
NZS 4229:2013  Concrete Masonry Buildings not requiring Specific Engineering Design

Observation by design engineer or LBP- Level B, NZS 4230
Scope:

Two stories and attic

Concrete masonry construction

Part storey, timber framed

Timber framing

Concrete or Timber floor

Concrete walls

Concrete slab

Attic

1st Floor

Ground floor

250m²

250m²

10 m max.
Scope:
**NZS 4229:2013** Concrete Masonry Buildings not requiring Specific Engineering Design

- Up to 2 ½ stories, max. 600m²
- Site Requirements
- Bracing
- Foundation
- Slab on Ground
- Walls
- Diaphragms
- Bond beams
- Lintels, Columns
- Shrinkage

**APPENDIX**

- Retaining walls
- Cantilevered walls
- Design examples
NZS 4230:2004 Design of Reinforced Masonry Structures - Observation by engineer - Level A, NZS 4230

- Design requirements, material properties
- Design for durability
- Design for fire resistance
- Reinforcement
- Structural walls
- Beam-column joints
- Secondary structural elements

APPENDIX

- Prestressed masonry
- Compressive strengths
- Bolted connections
- Partial fill requirements
- Specific design for small buildings
- Veneers
3 Foundation
Rebate required if partially filled walls except EIFS or veneer installed (CCANZ CP 01).

Figure 6.6 – Edge foundations

(c) Header block masonry edge – no recess (wall shall be solid filled)
1. **200 block fully filled**

Table 6.1

2. **Light roof**

Figure 6.1

- 2.5m high
- 2.5m gable height
### Table 6.1 – Wall types and wall weights (see 6.2.2)

<table>
<thead>
<tr>
<th>Form of construction (Type)</th>
<th>Nominal wall thickness (mm)</th>
<th>Mass of wall (kg/m²)</th>
<th>Unit weight of wall (kN/m²)</th>
<th>Factored unit weight of wall (kN/m²) (see note)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single skin block density 1850 kg/m³</td>
<td>100</td>
<td>170</td>
<td>1.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Solid filled with grout</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>270</td>
<td>2.6</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>370</td>
<td>3.6</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>465</td>
<td>4.6</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>150 + 100 veneer</td>
<td>440</td>
<td>4.3</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>200 + 100 veneer</td>
<td>540</td>
<td>5.3</td>
<td>6.4</td>
</tr>
<tr>
<td>Single skin block density 2200 kg/m³</td>
<td>100</td>
<td>185</td>
<td>1.8</td>
<td>2.2</td>
</tr>
<tr>
<td>Solid filled with grout</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>150</td>
<td>290</td>
<td>2.8</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>200</td>
<td>400</td>
<td>3.9</td>
<td><strong>4.6</strong></td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>505</td>
<td>5.0</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>150 + 100 veneer</td>
<td>460</td>
<td>4.5</td>
<td>5.4</td>
</tr>
<tr>
<td></td>
<td>200 + 100 veneer</td>
<td>570</td>
<td>5.6</td>
<td>6.7</td>
</tr>
</tbody>
</table>

4.6 kN/m² x 2.5m = 11.5 kN/m, for gable end add 4.6 kN/m² x 2.5m/2 = 5.75 kN/m  
Total = 17.25 kN/m
add 4.2 kN/m
to long side’s wall weight of 11.5 kN/m
= 15.7 kN/m

Gable wall = 17.25 kN/m
larger weight governs

NOTE –
(1) Roof weight values include a maximum ceiling weight of 0.1 kPa.
(2) A 0.75 m eaves overhang is included.

Figure 6.1 – Roof weight contribution kN/m
**Concrete Masonry Construction**

Added weight of walls, upper floors, Roof, etc. = **17.25 kN/m**

### Table 6.2 - Dimensions and reinforcement details for footings (see 6.3.1)

<table>
<thead>
<tr>
<th>Width (mm)</th>
<th>0 - 40</th>
<th>41 - 60</th>
<th>61 - 75</th>
<th>76 - 90</th>
<th>91 - 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>450</td>
<td>550</td>
<td>650</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>250</td>
<td>300</td>
<td>350</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Depth (mm)</th>
<th>0 - 40</th>
<th>41 - 60</th>
<th>61 - 75</th>
<th>76 - 90</th>
<th>91 - 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>R6 @ 600</td>
<td>R6 @ 600</td>
<td>R6 @ 600</td>
<td>R6 @ 600</td>
<td>R6 @ 600</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**

1. 2/D12 bars may be substituted for 1/D16 bar.
2. Minimum width in sand to be 400 mm (see 6.2.1).
3. Minimum width for supporting masonry walls plus masonry veneer to be 450 mm.
### Concrete Masonry Construction

**Cement & Concrete Association of New Zealand**

**FIRTH Industries**

**Foundation**

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#### Figure 6.5 – Reinforcement of footings

| Width (mm) | 300 |
| Depth (mm) | 200 |
| Steel (Grade 300) | 2/D12 |

- **Starter Bar**
  - R6 @ 600mm ctrs

- **Concrete Foundation**
  - 2 / D12
  - R6 @ 600mm ctrs

  - 2 / D16
    - 200
    - 450

  - 3 / D16
    - 250
    - 550

  - 4 / D16
    - 300
    - 650

---
4
Walls
**Mortar + block strength**
12.5 Mpa

**Tooling of joints**
Even if wall is to be plastered

**Mortar bed**
Vertical joints must be no less than the width of the face shell

**Grouting**
Compaction required for total cavity filling, 17.5 MPa
• Vertical steel is prefixed to starter bars.

• Could be tied to starter bars later through clean out openings.

• Horizontal steel is fixed during blocklaying.
Vertical bars shall be provided:

- at all corners and ends of walls
- on each side of wall openings > 400 mm
- either side of shrinkage control joints

Horizontal bars shall be provided:

- immediately below and above openings and anchored
Reinforcement:
Structural walls shall be centrally reinforced, horizontally and vertically.

Table 8.2 – Reinforcement for partially filled masonry structural walls (see 8.3.1 and 8.3.2)

<table>
<thead>
<tr>
<th>All earthquake zones</th>
<th>Vertical reinforcement</th>
<th>Horizontal reinforcement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max. spacing of vertical bars (mm)</td>
<td>Block used</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>D12</td>
</tr>
<tr>
<td></td>
<td>15 series</td>
<td>20 series</td>
</tr>
</tbody>
</table>
Reinforcement:
Where solid fill is used
the spacing of horizontal reinforcing
shall be reduced to 1.2 m.
Grout specification

As per NZS 4210
Strength usually 17.5 MPa but for durability requirements near coast 25 MPa [ Sea spray zone ]

Special Expanding Admixture may be specified

Workability is measured by Spread (not slump)
450 mm to 530 mm
FOUR methods in NZS 4210:

1. High lift grouting with expansive admixtures (3.6m)
2. High lift grouting without expansive admixture (1.2m)
3. Low lift grouting (1.2m)
4. High lift grouting with reduced compaction (2.4m)

Preferred method:

1. High Lift grouting with expansive admixture
High Lift Grout with Expansive Admixture

Step 1
Clean out grout spaces

Step 2
Add expansion admixture to grout.

Grout wall in a semi continuous operation to a max height of 3.6m
High Lift Grout with Expansive Admixture

**Step 3**
Consolidate the grout

**Step 4**
Wait for expansion and then trowel down top after expansion
Figure 12.1
Location of control joints for shrinkage

@ ≤ 600mm of L-shaped corners or at ≤ 3.2m at both sides of the L.

@ ≤ 600mm of return angle of T- and U- shaped floors.

@ Changes in wall height exceeding 600mm

@ Changes in wall thickness
Wall Reinforcement Discontinuous - NZS 4229 Fig 12.2

Figure 12.2 – Control joint detail for solid-filled walls and partially filled walls where horizontal bars are placed between floors but not bond beams (see 12.1.3)

**CONTINUOUS Reinforcement** at Bond Beams and Lintels !!
Earthquake and wind bracing - to resist earthquakes and winds

Braced wall panel - wall used for bracing:

- Maximum allowed opening: 400 mm x 400 mm
- Maximum height: 3 m
- Minimum length: 800 mm

Bracing unit (BU) - Unit of force used to value the overall bracing performance of a panel

- 1 BU = 5kg, 20 BU = 1kN (200 BU = 1 t or 10kN)
**Bracing line** - Line drawn along a bracing wall:

- Is parallel to external walls
- Shall be within 1 m of a bracing wall
- Spaced at no more than 6 m centres unless bond beam is provided
- \( \geq 60\% \) of total required BUs (and at least 100 Bus)
- or \( \geq 30\% \) of total required BUs if other line provides 100%
Earthquake bracing demand (EQbd) is determined by:

- **EQ zone** from NZS 4229:2013, Table 4.1
- **Subsoil Type** from NZS 4229:2013, Table 4.3
- **Floor level** considered as per NZS 4229:2013, Table 4.3
- **Dead loads** (roofing as per NZS 4229:2013, Table 4.3)
- **Live loads** NZS 4229, Table 4.3 considers already 2 kPa
- **Footprint size**
1. Located in Wellington
   Table 4.1

2. 200 block fully filled
   Table 6.1

3. Roof light
   Figure 6.1

4. Subsoil Class C
   Table 4.3
### Table 4.1 – Earthquake zones (see 4.2)

<table>
<thead>
<tr>
<th>Locality</th>
<th>Earthquake zone</th>
</tr>
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<tbody>
<tr>
<td><strong>North Island</strong></td>
<td></td>
</tr>
<tr>
<td>Kaitaia</td>
<td>1</td>
</tr>
<tr>
<td>Whangarei</td>
<td>1</td>
</tr>
<tr>
<td>Dargaville</td>
<td>1</td>
</tr>
<tr>
<td>Helensville</td>
<td>1</td>
</tr>
<tr>
<td>Auckland</td>
<td>1</td>
</tr>
<tr>
<td>Thames</td>
<td>1</td>
</tr>
<tr>
<td>Paeroa</td>
<td>1</td>
</tr>
<tr>
<td>Coromandel</td>
<td>1</td>
</tr>
<tr>
<td>Whitianga</td>
<td>1</td>
</tr>
<tr>
<td>Hamilton</td>
<td>1</td>
</tr>
<tr>
<td>Waihi</td>
<td>1</td>
</tr>
<tr>
<td>Tauranga</td>
<td>1</td>
</tr>
<tr>
<td>Rotorua</td>
<td>2</td>
</tr>
<tr>
<td>Taumarunui</td>
<td>2</td>
</tr>
<tr>
<td>Taupo</td>
<td>2</td>
</tr>
<tr>
<td>Gisborne</td>
<td>3</td>
</tr>
<tr>
<td>Napier</td>
<td>3</td>
</tr>
<tr>
<td>Hastings</td>
<td>3</td>
</tr>
<tr>
<td>New Plymouth</td>
<td>1</td>
</tr>
<tr>
<td>Whanganui</td>
<td>2</td>
</tr>
<tr>
<td>Palmerston North</td>
<td>3</td>
</tr>
<tr>
<td>Dannevirke</td>
<td>3</td>
</tr>
<tr>
<td><strong>Wellington</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td><strong>South Island</strong></td>
<td></td>
</tr>
<tr>
<td>Nelson</td>
<td>2</td>
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<tr>
<td>Blenheim</td>
<td>3</td>
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<td>Christchurch</td>
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<td>Lyttleton</td>
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<tr>
<td>Timaru</td>
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</tr>
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<td>Oamaru</td>
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</tr>
<tr>
<td>Westport</td>
<td>3</td>
</tr>
<tr>
<td>Greymouth</td>
<td>3</td>
</tr>
<tr>
<td>Hokitika</td>
<td>3</td>
</tr>
<tr>
<td>Dunedin</td>
<td>1</td>
</tr>
<tr>
<td>Invercargill</td>
<td>1</td>
</tr>
<tr>
<td>Alexandra</td>
<td>2</td>
</tr>
</tbody>
</table>
**EQ:** NZS 4229, T 4.3 - Floor level, Dead loads (roof), Live loads (floors), EQ zone, Subsoil Class

<table>
<thead>
<tr>
<th>Single-storey or top storey</th>
<th>Masonry wall series</th>
<th>Concrete slab-on-ground Minimum bracing units /m² in Earthquake zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partially filled masonry</td>
<td></td>
<td>Zone 1</td>
</tr>
<tr>
<td>15</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>20</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>25</td>
<td>Multiply</td>
<td>15</td>
</tr>
<tr>
<td>For solid-filled masonry</td>
<td>Multiply</td>
<td>x 1.4</td>
</tr>
<tr>
<td>For heavy roof</td>
<td>Add</td>
<td>4</td>
</tr>
<tr>
<td>Veneer with partially filled masonry</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>20</td>
<td>Multiply</td>
<td>17</td>
</tr>
<tr>
<td>For solid-filled masonry</td>
<td>Multiply</td>
<td>x 1.4</td>
</tr>
<tr>
<td>For heavy roof</td>
<td>Add</td>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bottom of two-storey (with light roof)</th>
<th>Masonry wall series</th>
<th>Concrete slab-on-ground Minimum bracing units /m² in Earthquake zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partially filled masonry for both storeys</td>
<td>15</td>
<td>Zone 1</td>
</tr>
<tr>
<td>For solid-filled masonry</td>
<td>Multiply</td>
<td>1.3</td>
</tr>
<tr>
<td>For heavy roof</td>
<td>Add</td>
<td>4</td>
</tr>
<tr>
<td>First storey partially filled masonry, No veneer with a second storey timber with veneer</td>
<td>15</td>
<td>52</td>
</tr>
<tr>
<td>20</td>
<td>Multiply</td>
<td>53</td>
</tr>
<tr>
<td>25</td>
<td>Multiply</td>
<td>56</td>
</tr>
<tr>
<td>For solid-filled masonry</td>
<td></td>
<td>x 1.1</td>
</tr>
<tr>
<td>For heavy roof</td>
<td>Add</td>
<td>4</td>
</tr>
<tr>
<td>First storey partially filled masonry, No veneer with a second storey timber lightweight cladding</td>
<td>15</td>
<td>41</td>
</tr>
<tr>
<td>20</td>
<td>Multiply</td>
<td>42</td>
</tr>
<tr>
<td>25</td>
<td>Multiply</td>
<td>45</td>
</tr>
<tr>
<td>For solid-filled masonry</td>
<td></td>
<td>x 1.15</td>
</tr>
<tr>
<td>For heavy roof</td>
<td>Add</td>
<td>4</td>
</tr>
</tbody>
</table>

NOTE – Table 4.3 has been derived for a Site Subsoil Class of ‘D’ or ‘E’. For sites where it can be proven (from geotechnical investigation) that the site subsoil class is better than ‘D’ then the values in Table 4.3 may be multiplied by the factors given opposite, with the exception that for all rows that have multipliers, the multipliers do not change.

- Site Subsoil Class A: 0.63
- Site Subsoil Class B: 0.63
- Site Subsoil Class C: 0.79

28 x 1.4 = 39.2 BU/m²
39.2 x 0.79 = 31 BU/m²
102.4 m² x 31 BU/m² = **3174 BUs**
### Table 5.1 – Bracing capacity of panels (bracing units)

#### 20 Series Partial Fill

<table>
<thead>
<tr>
<th>Panel height (m)</th>
<th>Panel length (m)</th>
<th>0.8</th>
<th>1.2</th>
<th>1.4</th>
<th>1.6</th>
<th>2.0</th>
<th>2.4</th>
<th>2.8</th>
<th>3.2</th>
<th>3.6</th>
<th>4.0</th>
<th>4.4</th>
<th>4.8</th>
<th>5.2</th>
<th>5.6</th>
<th>6.0</th>
</tr>
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<tbody>
<tr>
<td>0.8</td>
<td></td>
<td>390</td>
<td>655</td>
<td>1015</td>
<td>1445</td>
<td>1955</td>
<td>2535</td>
<td>2560</td>
<td>3145</td>
<td>3800</td>
<td>4510</td>
<td>5285</td>
<td>6120</td>
<td>7015</td>
<td>7970</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td>335</td>
<td>565</td>
<td>875</td>
<td>1245</td>
<td>1690</td>
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<td>2215</td>
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<td>350</td>
<td>500</td>
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<td>1890</td>
<td>2195</td>
<td>2520</td>
<td>2865</td>
<td></td>
</tr>
</tbody>
</table>
Combined bracing lines have to achieve calculated BUs (across & aligned) = 3174.

Add BU for one bracing line up!
Exp: Line A: 820 + 398 + 398 + 820 = 2436

Each bracing line shall achieve at least 60% of total BUs.
Exp: ≥ 60% of 3174 = 1904
6 Weathertightness
CCANZ CP 01: 2014

CITED: NZBC E2/AS3

WWW.CCANZ.ORG.NZ

(FREE DOWNLOAD)
### Wall construction types:

<table>
<thead>
<tr>
<th></th>
<th>construction type</th>
<th>insulation type</th>
</tr>
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<tbody>
<tr>
<td>A1</td>
<td>Concrete masonry</td>
<td>Internal insulation</td>
</tr>
<tr>
<td>A2</td>
<td>Concrete masonry</td>
<td>EIFS</td>
</tr>
<tr>
<td>A3</td>
<td>Concrete masonry</td>
<td>Integral insulation</td>
</tr>
<tr>
<td>A4</td>
<td>Concrete masonry</td>
<td>Masonry veneer</td>
</tr>
<tr>
<td>B1</td>
<td>Insitu concrete</td>
<td>Internal insulation</td>
</tr>
<tr>
<td>B2</td>
<td>Insitu concrete</td>
<td>EIFS</td>
</tr>
<tr>
<td>B3</td>
<td>Insitu concrete</td>
<td>Integral insulation</td>
</tr>
<tr>
<td>C1</td>
<td>Precast concrete</td>
<td>Internal insulation</td>
</tr>
<tr>
<td>C2</td>
<td>Precast concrete</td>
<td>EIFS, and</td>
</tr>
<tr>
<td>C3</td>
<td>Precast concrete</td>
<td>Integral insulation</td>
</tr>
</tbody>
</table>
1. EIFS - Exterior Insulation and Finish Systems

2. Plaster Systems

3. Pigmented Coatings

4. Clear Sealers

5. Masonry Veneer
EIFS

Exterior Insulation and Finish Systems

Foundation
EIFS
Exterior Insulation and Finish Systems

Deck / Wall Joint

Double layer membrane as specified in section 6.5
Rigid roof insulation capable of taking pedestrian traffic loads
Vapour barrier as specified in 6.4.1

EXTERIOR
EIFS as specified in section 4.1
Drip profile to match EIFS
Tile decking on Chairs on membrane protection pads,
(pads not req. if pebble bed used)

INTERIOR
Timber support beneath membrane fixing. Roof underlay membrane,
to run up and round timber batten
Membrane to run up at wall for at least 50mm behind EIFS
From top of interior finished floor to top of horizontal roof membrane
Insulation wedge to internal corner of membrane
45° chamfer to screed
Slab or screed to fall to roof gullies, min. fall 1.5°
EIFS
Exterior Insulation and Finish Systems
Insulation strip
Ext. moisture seal
Drip edge compression tape
Render end section
Window – EIFS sill
Veneer

Masonry veneer

Clear cavity, 40mm min

Thermal insulation (indicative only, not required for weathertightness)

Brick tie (design shown indicative only, could also be cast into the inner masonry joints)
Wall ties

Type and location as per NZS 4210

Ties to be fully embedded in mortar

Typical spacing:
600mm horizontally x 400mm vertically

except stack bond

Stack bond requires specific design
### Table 5

<table>
<thead>
<tr>
<th>Earthquake zone</th>
<th>Masonry veneer area/tie</th>
<th>Veneer less than 180 kg/m²</th>
<th>Veneer 180 kg/m² – 220 kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EL</td>
<td>EM</td>
<td>EH</td>
</tr>
<tr>
<td>1</td>
<td>0.24</td>
<td>0.24</td>
<td>0.24</td>
</tr>
<tr>
<td>2</td>
<td>0.16</td>
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<td>0.24</td>
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<tr>
<td>3</td>
<td>0.11</td>
<td>0.16</td>
<td>0.24</td>
</tr>
<tr>
<td>4</td>
<td>0.08*</td>
<td>0.12</td>
<td>0.23</td>
</tr>
</tbody>
</table>

**NOTES:**

a) The earthquake zones are as defined in NZS 4229, section 4.2.

b) Type B veneer ties are specified in AS/ NZS 2699.1, section 1.4.15.2.

c) EL, EM, EH = Earthquake classification of Type B ties in accordance with AS/ NZS 2699.1, 2.7.3.

d) Minimum strengths for tie fixings to blockwork are: 0.5 kN (EL), 0.75 kN (EM), and 1.5 kN (EH).

e) The horizontal tie spacing multiplied by the vertical tie spacing selected shall be equal or less than the area of masonry veneer given for the earthquake zone and the veneer mass. The maximum spacing of ties shall be 600 mm horizontal and 400 mm vertical.

f) Using higher strength ties does not permit the maximum spacing of ties to be increased.

g) Ties shall be face fixed to blockwork or fully embedded in the structural masonry wall joint.

* Some small veneer areas may be impracticable.
Veneer

Window - ventilated cavity jamb
Veneer

Window - ventilated cavity head
Veneer

Window - ventilated cavity sill
**Solid to light weight**

**Veneer - horizontal section**

**Detail 64**
Concrete Wall Adjoining Other Wall Construction
Cavity Insulation
Wall type: A4
Solid to light weight

Veneer - vertical section

Detail 68 (vertical section)
Concrete Wall adjoining other material above.
Concrete Masonry Cavity Wall: Cavity Insulation
Wall type: A4

Comment 1: Structural layout is indicative only and subject to individual project design.
Comment 2: Insulation shown is indicative only, not required for weathertightness.
Solid to light weight

EIFS - horizontal section

Detail 61
Concrete Wall Adjoining Other Wall Construction
EIFS
Wall type: A2, B2, C2
Solid to light weight

External cladding of lightweight structure
Wall underlay
Wall underlay to lap over continuous metal flashing at least 70mm
Continuous metal flashing clip fixed over steel bracket, slope of flashing min. 10°

EIFS as specified in 4.1

Comment: Structural layout is indicative only and subject to individual project design.

Detail 65  (vertical section)
Concrete Wall adjoining other material above.
Concrete Masonry, Precast or Insitu: EIFS
Wall type: A2, B2, C2
Solid to light weight

Plaster, coating - horizontal section

Comment 1: Structural layout is indicative only and subject to individual project design.
Comment 2: Insulation shown is indicative only, not required for weathertightness.

Detail 62
Concrete Wall Adjoining Other Wall Construction
Internal Insulation
Wall type: A1, A3, B1, C1
Solid to light weight

Exterior
External cladding of lightweight structure
Wall underlay

DPC to extend down and overlap the wall weathertight system by at least 30mm

Weathertightness system as specified in 4.2, 4.3, 4.4 or 4.5

Interior
Light weight wall as specified in E2/AS1 (direct fixed or cavity wall)
Timber structure to project over slab edge max. 20mm

DPC to separate timber and slab
Concrete slab
Concrete wall

Comment 1: Structural layout is indicative only and subject to individual project design.
Comment 2: Insulation shown is indicative only, not required for weathertightness.

Detail 66 (vertical section)
Concrete Wall adjoining other material above.
Concrete Masonry, Precast or Insitu: Internal Insulation
Wall type: A1, A3, B1, C1

Plaster, coating - vertical
**Maintenance**

Wash exterior surfaces to remove dirt and mould at least once in a year.

Inspect surfaces and junctions at least once in a year.

Repair cracks and surface defects, and recoat as soon as discovered.

Inspect sealants annually and replace sealants as necessary.

Inspect paints annually, recoat at least every 10 years.

Inspect clear sealers annually, recoat at least every 5 years.

Maintain required clearances as shown in the details in section 9 of CP 01.
Intertenancy Partitions
INTERTENANCY WALLS - VERTICAL BARRIER BETWEEN RESIDENTIAL UNITS

LOAD BEARING OR NON LOAD BEARING

INTERTENANCY FLOORS - HORIZONTAL BARRIER BETWEEN RESIDENTIAL UNITS

LOAD BEARING - ALWAYS
INTER TENANCY WALLS

REQUIREMENTS:

1. Sound Barrier
INTER TENANCY FLOORS

REQUIREMENTS:

1. Impact Sound
INTERTENANCY WALLS + FLOORS

REQUIREMENTS:

2 Fire Protection
INTER TENANCY WALLS + FLOORS

REQUIREMENTS:

3 Light and vision proof
INTER TENANCY WALLS + FLOORS

REQUIREMENTS:

4 Impact resistant
INTERTENANCY WALLS

REQUIREMENTS:

5 Durable against moisture and water
INTER TENANCY FLOORS

REQUIREMENTS:

5 Durable against moisture and water
INTERTENANCY WALLS + FLOORS

REQUIREMENTS:

6 Capable to support fixtures
INTERTENANCY WALLS + FLOORS

REQUIREMENTS:

7. Security,
   eg. burglarproof
INTER TEN ANCY PARTITIONS

REQUIREMENTS:

1. Sound barrier, (airborne)

2. Fire protection

3. Light and vision proof

4. Impact resistant

5. Durable against moisture and water

6. Capable to support fixtures

7. Security, eg burglarproof
Sound Performance
SOUND PERFORMANCE

APARTMENT DWELLERS SURVEYS

Medical research - Noise disturbance: negative effect to health

Wellington Council Survey - Biggest nuisance: noise from city and neighbours

CRESA Survey - 12% dwellers stated to have moved because of sound disturbance
NOISE DISTURBANCE

1. AIRBORNE SOUND: TRAFFIC
   ROAD WORKS
   PEOPLE GATHERING

2. IMPACT SOUND: FOOTSTEPS
   DOORS SLAMMING
   PLANT DEVICE VIBRATING
AIRBORNE SOUND NUISANCE
SOUND NUISANCE
# Sound Sources

<table>
<thead>
<tr>
<th>Noise source</th>
<th>Decibels (db)</th>
<th>Distance (m)</th>
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<tbody>
<tr>
<td>Whisper (library)</td>
<td>30</td>
<td>1</td>
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<tr>
<td>Conversation</td>
<td>60</td>
<td>1</td>
</tr>
<tr>
<td>Loud music/ singing</td>
<td>75</td>
<td>1</td>
</tr>
<tr>
<td><strong>SLIGHTLY PAINFUL</strong></td>
<td><strong>90</strong></td>
<td></td>
</tr>
<tr>
<td>Pneumatic (jack) hammer</td>
<td>90</td>
<td>15</td>
</tr>
<tr>
<td>Underground train or truck</td>
<td>100</td>
<td>3</td>
</tr>
<tr>
<td>Drums played loudly or trumpet</td>
<td>110</td>
<td>3</td>
</tr>
<tr>
<td><strong>PAINFUL, DEAFENING</strong></td>
<td><strong>120</strong></td>
<td></td>
</tr>
<tr>
<td>Plane</td>
<td>130</td>
<td>30</td>
</tr>
<tr>
<td>Military jet</td>
<td>150</td>
<td>30</td>
</tr>
<tr>
<td><strong>DESTROYING HEARING TISSUE</strong></td>
<td><strong>180</strong></td>
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</tr>
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</table>

**Table A: Acceptable noise levels in sound-receiving rooms**

| 1. Bedroom                          |               |             |
| permanent noise                     | ≤ 30          |
| interval peak noise                 | ≤ 35          |
| 2. Living room                      |               |             |
| permanent noise                     | ≤ 35          |
| interval peak noise                 | ≤ 40          |
| 3. Kitchen                          |               |             |
| permanent noise                     | ≤ 40          |
| interval peak noise                 | ≤ 45          |
| 4. Bathroom                         |               |             |
| permanent noise                     | ≤ 45          |
| interval peak noise                 | ≤ 50          |
NZBC G6/AS1 REQUIRES

55dB AIRBORNE SOUND ATTENUATION

STC 55 - 150 mm concrete wall
STC 55 - 200 mm concrete masonry
STC 55 - 150 mm concrete slab
Figure 2: Acceptable Wall Assemblies for Noise Control

**Paragraph 1.0.3**

**DETAIL 1**
**STC 55**
- 200mm nominal width normal weight concrete masonry units complying with NZS 3102
- All unit cavities to be filled with concrete

**DETAIL 2**
**STC 56**
- Double row of 100 x 50mm studs at 600mm centres on separate plates 25mm apart
- Two layers of 9.5mm plasterboard
- 75mm glass fibre insulation min density 10kg/m³
- Air space

**DETAIL 3**
**STC 60**
- Double row of 100 x 50mm studs at 400mm centres on separate plates 25mm apart
- Two layers of 16mm plasterboard
- 75mm glass fibre insulation minimum density 10kg/m³
- Air space

**DETAIL 4**
**STC 55**
- Concrete wall
- Minimum thickness 150mm
- Minimum density 400kg/m² of face area
NZBC G6/AS1 Requires

55dB Impact Sound Attenuation

IIC 55 - 150 mm concrete slab with underlay and carpet on top
Figure 2: Acceptable Wall Assemblies for Noise Control

Paragraph 1.0.3

DETAIL 6
STC 55
IIC 55

- Concrete floor
  - Minimum thickness 150mm
  - Minimum density 400kg/m² of face area

- Carpet on underlay

DETAIL 5
STC 55
IIC 55

- Carpet on underlay
- 20mm high density particle board
- Separate floor joist and ceiling joist construction (excluding end walls)
- 75mm glass fibre insulation minimum density 10kg/m³
- Two layers of 12.5mm plasterboard

250mm min.
Floating Screed

- Concrete wall
- Sound insulation strip
to avoid flanking via walls
- Floating screed
- Impact sound insulation
- Concrete slab
SOUND ATTENUATION

MASS - AIRBORNE SOUND

DECOUPLING - IMPACT SOUND
Fire Performance
FIRE SAFETY
**NZBC Clause C/AS2**

60 minutes - structural stability and material integrity

30 minutes - **Sprinkler** with smoke detection and alarm system installed

**Problem with Sprinkler**

**Auto Shut Valves** at water reservoirs prevent water loss in earthquake events

**No Water** supply during/after **Earthquakes**
STEEL FIRE PROTECTION:

Intumescent paint - max 3hrs
LIGHT FRAME FIRE PROTECTION:

4hrs - 4 boards each side - 210mm
Fire Performance

• NZS 4320

<table>
<thead>
<tr>
<th>Fire Resistance rating (minutes)</th>
<th>Type A aggregate</th>
<th>Type B aggregate</th>
<th>Type C aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>50</td>
<td>45</td>
<td>40</td>
</tr>
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<td>60</td>
<td>75</td>
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<td>120</td>
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<td>80</td>
</tr>
<tr>
<td>180</td>
<td>140</td>
<td>135</td>
<td>105</td>
</tr>
<tr>
<td>240</td>
<td>165</td>
<td>160</td>
<td>120</td>
</tr>
</tbody>
</table>

Aggregate types:
A - quartz, greywacke, basalt and all others not listed
B - dacite, phonolite, andesite, rhyolite, limestone
C - pumice and selected lightweight aggregates
11 Durability
• Anticipated 70% of apartment buildings leak during life time.

• 13 year old building. Leaked from day One. 80% structural timber replacement.

• Five years old building. Leaks caused rust of steel structure. Structural replacements.

• Leaking water hardly compromises solid structures. Solution = sealing of leaks.
WATER DAMAGE
CHOOSING A SUITABLE MATERIAL
WHAT

IF

THE

PROTECTION

WILL BE DAMAGED?

THE STRUCTURE IS UNPROTECTED AND WILL NOT PERFORM AS REQUIRED
**PARTITIONS COSTS - PROPORTIONAL**  
BASED ON RAWLINSON HANDBOOK 2014

<table>
<thead>
<tr>
<th></th>
<th>Concrete</th>
<th>Masonry</th>
<th>Metal</th>
<th>Timber</th>
</tr>
</thead>
<tbody>
<tr>
<td>F 60 + STC 55</td>
<td>100 %</td>
<td>94 %</td>
<td>85 %</td>
<td>90 %</td>
</tr>
<tr>
<td>F 180 + STC 55</td>
<td>100 %</td>
<td>94 %</td>
<td>115 %</td>
<td>120 %</td>
</tr>
</tbody>
</table>

**CONCRETE MASONRY + CONCRETE OFFER DURABLE SOLUTION!**
NEW CLAUSE G6 EXPECTED
LININGS FOR ADDITIONAL SOUND ATTENUATION

ALTERNATIVE TO CONCRETE OR MASONRY FINISH LININGS FOR FINE FINISHES

REMEDIAL WORK, PLUMBING, ELECTRICAL LININGS TO HIDING INSTALLATIONS

INTERNAL UNIT DIVISIONS LININGS LIGHTWEIGHT, EASY TO INSTALL
SUMMARY
• More immigrants
- Sugar Tree (stage 2), Q3 2017
- Queen Residences, Q3 2016
- One Three Chesse, Q3 2016
- Forty Three Apartments, Q1 2016
- Shoji, Q4 2016
- Hopetown Residences, Q4 2015
- Hereford Residences, Q3 2016
- UPPA Residences, Q4 2015
- 9 Farham Street, Q2 2016
- Queen Square, 2018
- Skyview, Q4 2017
- Oasis Apartments, Q4 2016
- Aria Apartments, Q3 2016
- Western Park Apartments, Q1 2016
- Sol Apartments, Q4 2016

• Smaller households
- North (Stage 1), Q2 2016
- North (Stage 2), Q3 2016
- 217 North, Q3 2015
- The Dylan, Q2 2016
- Parkview Residences, Q4 2015
- The Orange, Q4 2015
- Hypatia, Q4 2016

• Lack of land

AUCKLAND HERALD: 7 SEP 2015
New developments

BUYERS DON’T KNOW WHAT THEY BUY

St James Suites: 308 apartments at 302 Queen St, CBD, by developer Relianz Holdings. Completion mid-2018, 90 per cent sold.

Queens Square: 226 apartments at 438 Queen St, CBD, by developer Conrad Properties. Completion early 2018, 25 per cent sold in first four weeks of marketing.

LIFE SAVINGS AT RISK

CBD, by developer Conrad Properties. Completion mid-next year, 100 per cent sold.

IMPORTANCE OF DURABILITY

One’s 148 Prima apartments (completed) and Stage Two’s 259 Centro apartments (under construction; 95 per cent sold.

Completion Dec 2017, 25 per cent sold.
MORE INFORMATION:

CCANZ APARTMENT DESIGN GUIDE

WWW.CCANZ.ORG.NZ
Thanks for your attention!

Ralf Kessel Architect (NZ + Ger)
Cement & Concrete Association of New Zealand
www.ccanz.org.nz