CCANZ CP 01:2011

Code of Practice for Weather Tight Concrete and Concrete Masonry Construction

Cement & Concrete Association of New Zealand

June 2011
CCANZ CP 01:2011 - Code of Practice for Weathertight Concrete and Concrete Masonry Construction

Weathertightness solutions for:
Concrete slab on ground,
Concrete and concrete masonry wall systems,
Concrete flat roofs and decks, and
Concrete to timber construction junctions.

FOREWORD
This Code of Practice (CCANZ CP 01:2011) has been developed by the Cement & Concrete Association of New Zealand, working in association with other industry groups, with the intention of being cited as a means of compliance with the New Zealand Building Code (NZBC) Clause E2 - External Moisture. It makes concrete easier to use for those wishing to benefit from its weathertight credentials.

The Code of Practice covers the weathertightness of the building envelope for concrete slabs on ground, concrete walls (masonry, in situ and precast concrete) and associated methods of insulation (internal, external and integral), concrete flat roofs and decks, and concrete to timber construction junctions. Outbuildings such as detached garages are not covered by this Code of Practice.

For ease of use, the format adopted for this document is similar to that used for NZBC Clause E2, Acceptable Solution 1 (E2/AS1). However, the detail drawings are considerably larger than the Figures in E2/AS1 and have accordingly been placed at the end of this document rather than embedded in the text.

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**References**  

**Definitions**
1.0 Scope

This Code of Practice is intended as a means of compliance with the New Zealand Building Code (NZBC) Clause E2 - External Moisture.

It covers the weathertightness of the building envelope for:
- Concrete slab on ground,
- Concrete and concrete masonry wall systems,
- Concrete flat roofs and decks, and
- Concrete to timber construction junctions.

**COMMENT:** Details of the junctions between concrete walls and timber walls, and of the junctions between concrete walls and timber roofs are provided in Section 3. Weathertightness details for timber roofs and timber walls are not covered by this Code of Practice. Weathertightness details for timber roofs can be found in NZBC E2/AS1.

1.0.1 Interpretation

Instructions or specifications that must be followed to achieve compliance with this Code of Practice are given in the main text of this document. Verbs such "shall" and "require" are used to help make this clear.

Notes shown under 'COMMENT' throughout this document are for guidance purposes only and do not form part of mandatory requirements of this Code of Practice. Verbs such as "should", "may" and "recommend" are used to indicate that these are recommended practices or advice rather than compliance requirements.

1.1 Construction included

The scope of this Code of Practice is limited to the materials, and processes contained herein, for buildings within the scope of section 1.1.1.

1.1.1 Building type

The building type shall be as per the following limitations:
- a) Buildings shall comply with importance levels 1 & 2 of AS/NZS 1170,
- b) Buildings shall be built on good ground as defined in NZS 4229, but with "liquefaction and lateral spread" added to the list of excluded ground,
- c) The building configuration shall comply with NZS 4229, 1.1.3 (e) but with a total maximum floor area of 1000m² for single storey buildings, and
- d) The slope of the finished concrete roof and deck membrane shall be no less than 1.5°.
1.1.2 Walls

This Code of Practice covers three types of concrete walls:
A  Concrete masonry construction as specified in section 3.2,
B  Insitu concrete construction as specified in section 3.3, and
C  Precast concrete construction as specified in section 3.4.

Weathertightness requirements for walls shall be as specified in Table 1 and in section 4.

This Code of Practice also provides weathertightness details for four alternative positions for the wall insulation:
1. On the inner face of the wall, or
2. On the outside face of the wall (EIFS systems), or
3. Integral within the wall itself, or
4. Within a ventilated cavity.

Only the EIFS insulation forms part of the weathertightness system. Insulation in other positions (ie, internal, integral or cavity) is shown for illustrative purposes only and is not part of the weathertightness system.

Thermal insulation is determined from the requirements of NZBC Clause H1 and Clause E3 which are outside the scope of this Code of Practice.

The wall construction types shall be designated as:
A1 - Concrete masonry - Internal insulation
A2 - Concrete masonry - EIFS
A3 - Concrete masonry - Integral insulation
A4 - Concrete masonry - Masonry veneer
B1 - Insitu concrete - Internal insulation
B2 - Insitu concrete - EIFS
B3 - Insitu concrete - Integral insulation
C1 - Precast concrete - Internal insulation
C2 - Precast concrete – EIFS, and
C3 - Precast concrete - Integral insulation.

Junction details for these wall construction types shall be as specified in section 3 for:
- Concrete walls to flat concrete roofs/ decks,
- Concrete walls to concrete slab on ground,
- Openings and penetrations in concrete walls,
- Concrete walls to timber walls, and
- Concrete walls to timber roofs.

COMMENT:
Junction details for concrete slab on ground to timber walls are given in NZBC E2/AS1.
1.1.2.1 Wall weathertightness systems
Exterior finishes for wall construction types as specified in section 1.1.2 shall be as shown in Table 1.

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<th>Watertight Concrete&lt;sup&gt;3&lt;/sup&gt;</th>
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<td></td>
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<td>C1/ C3</td>
</tr>
</tbody>
</table>

**KEY TO TABLE:**
1. Masonry veneer on concrete masonry construction requires a clear cavity of at least 40 mm.
2. Acceptability of clear coatings is specified in section 4.4.2.
3. Watertight concrete, as specified in section 4.5, will meet NZBC Clause E2 without the need for a coating.
4. n/a stands for not acceptable.

1.1.3 Floors
The scope of this Code of Practice limits floors to those that are concrete slabs on ground.

Footings and foundation walls and concrete slabs on ground shall comply with NZS 4229 Sections 6 and 7, or be specifically designed by a chartered professional structural engineer.

Weathertightness details for slabs on ground and footings shall be as specified in section 7.

**COMMENT:**
Suspended floors do not influence the weathertightness system, provided the external wall surface is continuous.

1.1.4 Roofs and decks
The scope of this Code of Practice limits concrete flat roofs and decks to those specified in section 6.

Concrete roofs and decks shall be designed in accordance with AS/NZS 1170 and NZS 3101 and constructed in accordance with NZS 3109.

Weathertightness details shall be as specified in section 6.0. Openings and penetrations through concrete roofs (roof exits, gullies) shall be completed in accordance with section 6.10.

NZBC E2/AS1 provides weathertight details for timber roof constructions. These can be used with the wall construction covered by this Code of Practice. Roof junction details at the eaves and verge connections to concrete walls are specified in section 3.0.
1.2 Construction excluded
Further limitations which are specific to construction systems are given in the relevant sections that follow.

1.2.1 Outbuildings
Outbuildings, such as detached garages, are outside the scope of this Code of Practice.

COMMENT:
An attached garage that is integral within the weathertightness envelope of the building is included within the scope of this Code of Practice. While details contained in this Code of Practice may be used for outbuildings, the requirements may be in excess of the minimum required by the New Zealand Building Code.

1.2.2 Retaining walls
Retaining walls, including those used in a basement, are not covered in this Code of Practice.

COMMENT:
Such walls are subject to a solution based on NZS 4229 or to specific design.

1.3 Provisions for snow
This Code of Practice does not allow for excessive build-up of snow melt water when the open ground snow load $S_{gr}$, as defined in AS/NZS 1170, exceeds 1.0 kPa.

COMMENT:
Such a situation requires specific design. Hidden gutters, parapets and skylights are examples of features within a roof design that are likely to cause a build-up of snow.

1.4 Qualifications

COMMENT:
An understanding of the proper methods of design and installation and the importance of the correct construction sequence is essential if an NZBC-compliant building is to be achieved. Adequate training of those installing particular products and claddings is therefore highly recommended.
The design, installation and alteration of claddings will be ‘restricted building work’ under the licensed building practitioners scheme, due to take effect in 2012. Until then, the use of licensed designers, builders and installers is optional. It is important that product suppliers, manufacturers and New Zealand agents (for imported products) ensure that those handling and applying their products be adequately qualified to do so, and that site managers oversee the correct integration of adjoining building elements to achieve a complete weathertight system.
2.0 General

2.1 Specific design criteria for weathertightness
Concrete requires weathertight protection comprising either an EIFS, a plaster system, a coating system, a veneer, membranes or to be made of watertight concrete.

Concrete shall be designed to prevent cracking in service in accordance with NZS 3101 Part 1 section 2.4.4.1(c) and section 2.4.4.8 and NZS 3101 Part 2 section C2.4.4.

COMMENT: Weathertightness issues will involve not only the concrete and concrete masonry system itself, but also joints and connections with other cladding materials. Acceptable details are shown in this Code of Practice. However, where specialist fixings and flashings form part of the weathertightness envelope, these need supporting documentation or testing to demonstrate compliance with NZBC E2.

2.2 Materials
Materials used to construct the building envelope shall:
   a) For concrete and concrete masonry, comply with the durability provisions of NZS 3101 and NZS 4210 respectively, and
   b) Comply with NZBC E2/AS1 Table 20 in respect of their end use, location and environment, and comply with NZBC E2/AS1 Tables 21 and 22 in respect of their compatibility with adjoining materials.
   c) All materials must comply with NZBC B2.

2.3 Maintenance
Maintenance shall be carried out as necessary to achieve the required durability of materials, connections, flashings and other components; particularly at junctions.

COMMENT: Concrete and plaster are generally regarded as long-life materials traditionally requiring less maintenance than other cladding materials. Nevertheless, regular inspection and maintenance of associated flashings and fixings, weathertight coatings and waterproof membranes needs to be carried out.
2.3.1 Regular maintenance

Regular maintenance of a building shall entail:

a) Washing exterior surfaces to remove dirt and mould at least once in a year,
b) Inspecting surfaces and junctions at least once in a year, and repairing or replacing items as necessary,
c) Repairing cracks and surface defects, and recoating as necessary,
d) Inspecting sealants annually for loss of integrity or adhesion with the joint surfaces and replacing sealants as necessary,
e) Maintaining paint coatings by recoating at least every 10 years,
f) Inspecting clear sealers annually and recoating, if necessary, but at least every 5 years, and
g) Maintaining required clearances (as shown in the details in section 9) between wall claddings and:
   i) ground surface,
   ii) paving surface,
   iii) deck membranes, and
   iv) roof membranes.

COMMENT:

The frequency of regular maintenance depends on the degree of exposure and the robustness of the building facade system including the integrity of any coating. The maintenance interval for concrete or concrete masonry systems can range from three months to one year. Washing by rain removes most accumulated atmospheric contaminants, but sheltered areas, such as walls directly below eaves, are protected from the direct effects of rain and require regular manual washing. Some heavily textured surfaces will not be as effectively washed by rain as smoother surfaces, so may require more regular manual washing. However, it is important that high pressure water is not directed at sensitive junctions such as joinery, window surrounds and flashings. Great care should be taken to avoid water being driven into joints and potentially dislodging seals. The repair of cracks to concrete and plaster may require specialist advice to ascertain the cause of cracking and the appropriate repair methodology.
3.0 Wall construction

3.1 General
This Code of Practice is subject to the limitations of section 1.1.2. Wall construction shall comply with the provisions of sections 3.1.1 to 3.1.10 and, depending on the wall type, either 3.2 or 3.3 or 3.4.

Insitu and precast concrete walls require weathertight protection comprising either an EIFS, a plaster system, a coating system or to be made of watertight concrete.

Concrete masonry walls require weathertight protection comprising an EIFS, a plaster system, a coating system or a masonry veneer.

A weathertightness system as specified in section 4 shall be used, subject to the limitations of section 1.1.2.1.

The external wall shall be inspected (eg, visual and touch tests) to ensure concrete surfaces are clean and free of contaminants, eg curing agents, before applying the weathertightness system.

COMMENT:
The Detail drawings show alternative positions for insulation, which reflects the different details used in the industry. Only EIFS insulation forms part of the weathertightness system and must be used as specified in section 4.1. Insulation in other positions (i.e. internal, integral or cavity) is show for illustrative purposes only and is not part of the weathertightness system. The details and associated materials common to all systems which contribute to weathertight performance of the cladding system as a whole are given. Specific floor, wall, window, door, and roof details are also given for each of the three wall construction types.

3.1.1 External seals

COMMENT:
Sealants have an important role in preventing moisture ingress at joints and wall penetrations and openings.

External seals shall have a 2:1 width to depth ratio and shall be:
a) Type F, Class 20LM or 25LM of ISO 11600, or
b) Low modulus Type II Class A of Federal Specification TT-S-00230C.

The sealant shall be chosen based on:
i) Suitability for the particular application and environmental exposure,
ii) The differential movement in the adjoining materials under the extremes of thermal and moisture movement, and
iii) Compatibility with adjacent materials to which it adheres.

COMMENT:
There are a number of generic types of sealant, and advice should be sought from the manufacturer on the best type for a particular application. Some sealant types such as acid-cure silicones are not suitable for cement-based alkaline substrates. Sealants also function as a flexible gap filler for flashings and joinery. As sealants have a limited life (typically 20 years maximum) good joint detailing allowing free drainage to the exterior, for instance, will provide some additional back-up protection against water entry.

There shall be no internal air pockets or gaps in the sealant and it shall contact both sides of the joint. The contact surfaces shall be free of contaminants.

PEF backing rods complying with ASTM C1330 are required in addition where specified in the Details in section 9.
3.1.2 Air seals
Window, door and service penetrations through walls shall be provided with flexible water resistant air seals to minimise the risk of airflows carrying water into the building wall.

The air seal shall be:
   a) Provided between the concrete or concrete masonry opening and the reveal or window frame,
   b) Installed over a closed cell polyethylene foam (PEF) backing rod complying with ASTM C1330, and
   c) Made of:
      i) self-expanding polyurethane foam, or
      ii) sealant complying with:
           a. Type F, Class 20LM or 25LM of ISO 11600, or
           b. Low modulus Type II Class A of Federal Specification TT-S-00230C.

COMMENT:
Care should be taken when using self-expanding polyurethane foam as there is a danger of over-filling due to the foam expanding up to 20 times its original volume.

3.1.3 Control joints
This Code of Practice does not allow for horizontal control joints, except for a precast construction joint at eaves level on a gable end, as shown in Detail 69d, and with no vertical joint above draining into this horizontal joint.

Vertical control joints shall be provided at a maximum 6 metre centres for all construction types.

Control joints shall be positioned and designed to accommodate differential movements in the substrate whilst ensuring that the wall remains weathertight. Joints in the substrate shall be reflected through into the EIFS, plaster or coating. Control joints shall be detailed as shown in Details 69a to 69f.

Junction Details 18 to 29 and 61 to 68 shall be used where concrete or concrete masonry abuts light-weight construction (i.e. timber frame or steel frame).

3.1.4 Pipes and service penetrations

3.1.4.1 Pipes and cables
Pipes and service penetrations shall be made weathertight by using a sealant on the exterior and interior that is either:
   a) Type F, Class 20LM or 25LM of ISO 11600, or
   b) Low modulus Type II Class A of Federal Specification TT-S-00230C.

Pipes shall slope down to the exterior to facilitate drainage to the outside. Details for flashing pipe services shall be as shown in Details 53 to 56.

Where cables penetrate the weathertightness system, a sleeve or conduit shall be provided and all wires that pass through a conduit shall be sealed into position inside the conduit.

COMMENT:
Service penetrations through the wall should be kept to a minimum. Where practical, service pipes should be taken through the floor.
3.1.4.2  Service boxes
Details for installation of a service box, e.g. a meter box, shall be as shown in Details 57 to 60. A waterproof membrane as specified in section 3.1.5.3 shall be applied around the head, the jambs and the back of the wall setout.

A waterproof membrane as specified in section 3.1.5.4 shall be applied across the entire sill and shall be extended up the jambs and the back of the setout for at least 40mm.

COMMENT:
Waterproofing the sides of service box openings is important as service boxes cannot be assumed to be waterproof.

3.1.5   Windows and doors
Windows and doors shall comply with the requirements of NZS 4211. Window and door openings shall be made weathertight with a waterproof membrane bonded to the concrete before installation. For concrete masonry construction, rebated blocks for heads and jambs and rebated sloped sill blocks for windows shall be used.

Window details specific to particular wall constructions shall be as given in Details 11 to 15. Door details shall be as given in Details 16 and 17.

Windows shall be mechanically fixed. After installation, the flange forming the window or door facing shall have a minimum 10mm overlap over the surrounding weathertightness system. However, a minimum of 8 mm effective overlap on the sill shall be permitted where necessary to allow for on-site tolerances.

Windows and door openings shall:
  a) Deflect water away from the window/ door to wall joint by overhangs and drip edges in plaster or mouldings,
  b) Allow any water that does get into the window/ door frame to drain back out, generally through the open sill joint along the bottom edge,
  c) Allow air through this unsealed joint to aid drying and equalise air pressures thus minimising water entry, and
  d) Be provided with air seals on the inside edges of openings to restrict the passage of moist air through joints.

3.1.5.1   Scope
This Code of Practice limits windows and doors to:
  a) Windows that are fixed hinged (i.e. hinges are fixed to an immovable frame, as compared to a bifold or sliding window) or stayed and that have frame sizes of no more than 5000 mm x 5000 mm, and
  b) Doors that are fixed hinged and that have frame sizes of no more than 5000 mm x 5000 mm.

COMMENT:
Certain aluminium joinery sections (bi-fold and sliding doors and windows) will not be able to use the sill details included in this Code of Practice and achieve the required window facing cover and sill support with a sill tray. The sill details in these cases should be subject to specific design.

3.1.5.2   Weathertight treatment of openings
A waterproof membrane as specified in section 3.1.5.3 shall be applied around the head and the jambs of the window opening as shown in Details 11 to 15.

A waterproof membrane as specified in section 3.1.5.4 shall be applied across the entire sill and shall be extended up the jambs for at least 40mm.

COMMENT:
The waterproof membrane and weatherproof coatings carry out a critical role in preventing the entry of moisture through the opening into the building.
3.1.5.3 Jamb/ head membrane
The head and jambs membrane shall consist of a liquid membrane that complies with AS/NZS 4858.

Bituminous coatings shall not be used around windows as they inhibit the adhesion to concrete.

3.1.5.4 Sill membrane
The sill membrane shall consist either of:

a) A liquid membrane that complies with AS/NZS 4858, or
b) A bonded sheet membrane that complies with AS/NZS 4858, or

- A flashing tape which complies with ICBO Acceptance Criteria AC148 sections 3.2 and 4, which is compatible with the concrete substrate and finish, and which is applied to primed concrete surfaces, or
- A damp-proof course (DPC).

Sills shall be made weathertight by applying the sill membrane continuously across the concrete sill for the entire opening width of the window.

Bituminous coatings shall not be used around windows as they inhibit the adhesion to concrete.

3.1.6 Flashings
Flashings shall comply with section 5.0.

Profiled metal roof flashings shall be provided at the apron on a sloped roof as shown in Details 18 to 21 and shall run up beneath the metal over-flashing or compression seal. Over-flashings shall be chased and sealed into the wall with a sealant complying with section 3.1.1.

**COMMENT:**
A metal capping may be used to cap a parapet (see Details 31, 34a & b, 36a & b and 38) and should be clipped to a proprietary metal bracket.

3.1.7 Fixings
The attachment of fixings shall be designed so as not to compromise the integrity of the weathertightness system. Attachment of fixings into horizontal or inclined surfaces shall be avoided. The use of a metal over-flashing will provide additional weathertightness protection as shown in Detail 35.

3.2 Concrete masonry wall construction

3.2.1 Design criteria
Concrete masonry walls shall be fully or partially filled, including concrete masonry veneer walls.

Concrete masonry walls, including concrete masonry veneer walls, shall comply with NZS 4229 and NZS 4210. Cover requirements for reinforcement shall be as specified in NZS 4210 Appendix 2E.
### 3.2.2 Materials
Concrete masonry materials including blocks, grout and mortar shall comply with NZS 4210 and AS/NZS 4455.

### 3.2.3 Substrate finish
All maximum tolerances shall be in strict accordance with NZS 4210, 2.7.1.4 Table 2.2: i.e. no more than 3 mm surface alignment deviation over a 1200 mm radius.

The interstorey floors should be poured within the block structure, leaving the outer block shell continuous (i.e. over the concrete slab edge) to avoid cracking in the exterior face of the wall.

The moisture content of the wall including joints shall be below 70% relative humidity before applying the weathertight system.

**COMMENT:**
The concrete block installation, including reinforcement and concrete infill, must follow the project specifications and the block manufacturer’s technical data. In particular, the blocks must be laid true in both vertical and horizontal planes with all joinery and service openings correctly formed and waterproofed.

### 3.2.4 Mortar joints

**COMMENT:**
The mortar quality and workmanship are important to the weathertight performance of concrete masonry.

Mortar depth of horizontal and vertical joints shall be the full thickness of the face shell.

**COMMENT:**
Face shell describes the thickness of the shell of the masonry block.

Mortar shall meet the requirements of NZS 4210 and shall achieve a compressive strength of 12.5 MPa. Mortar joints shall be compressed by tooling in accordance with NZS 4210 and Detail 70. The mortar joint shall be tooled after the initial water loss, once the mortar is thumbnail hard. The depth of the vertical mortar joint shall match that of the horizontal joints.

**COMMENT:**
Flush joints may be used where plaster or EIFS is to be applied to the concrete masonry, but they should still be tooled first.

### 3.2.5 Grouting
The masonry block cells and cavities shall be cleaned to remove mortar droppings and debris from the joints before grouting.

Grouting shall comply with the requirements of NZS 4210.

Grout filling shall be in accordance with NZS 4210 clause 2.11.6 (b) using one of the three methods described.

**COMMENT:**
NZS 4210 requires the grout to have a spread of 450 mm to 530 mm and a minimum specified strength of either:
a) 25MPa at 28 days for buildings located in the NZS 3604 Zone D, or
b) 17.5MPa at 28 days in all other cases.
### 3.2.6 Control joints

**COMMENT:**
Typical control joints are shown in Detail 69a & b. The use of horizontal control joints is outside the scope of this Code of Practice.

Vertical control joints in concrete masonry shall be placed at a maximum of 6 metre centres in accordance with NZS 4229 section 13.1.1. Apart from bond beam and lintel reinforcement, horizontal reinforcement shall be discontinuous across the control joint, with a short length of de-bonded steel placed across the joint as shown in NZS 4229 Figure 13.2.

Vertical control joints shall also be provided at:
- a) Changes in wall height exceeding 600 mm,
- b) Wall intersections, and
- c) At one side of all wall openings.

Cells on either side of control joints shall be fully grouted and reinforced in accordance with NZS 4210 and NZS 4229.

### 3.2.7 Construction type A1 and A3 - Concrete masonry wall construction - internal insulation and integral insulation

Details in sections 3.2.7.1 to 3.2.7.3 shall be used for concrete masonry wall construction types A1 and A3.

**COMMENT:**
The details referred to in the following text have been drawn based on concrete masonry wall construction with internal insulation. The details for concrete masonry wall construction with integral insulation are similar except that the position of the insulation is moved into the masonry block wall.

#### 3.2.7.1 Footing detail

Footing shall be constructed as shown in Details 3a & 3b: Wall/ Footing Junction - Slab on ground. These details include a 45 mm - 100 mm deep rebate (100 mm represents a half-block height) below finished floor concrete slab level to take the base block of the wall. Rebates shall be provided as specified in Table 2.

**COMMENT:**
The inclusion of a rebate is as an additional weatherproofing measure to reduce the risk of water entry to floor level.
### Table 2
**Concrete Masonry Ground Floor Rebate Requirement**

<table>
<thead>
<tr>
<th>Building Type</th>
<th>EIFS (4.1)</th>
<th>Plaster systems (4.2)</th>
<th>Pigmented Elastomeric high build acrylic (≥180µm) (4.3.2)</th>
<th>Clear Sealer (4.4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Residential</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Residential</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fully filled block wall</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
<td>R</td>
</tr>
<tr>
<td>partially filled block wall</td>
<td>NR</td>
<td>R</td>
<td>R</td>
<td>R</td>
</tr>
</tbody>
</table>

**KEY TO TABLE:**

R = Rebate required, NR = No rebate required

**COMMENT:**

It is acceptable to provide a rebate also where Table 2 says NR: it is just not mandatory.

#### 3.2.7.2 Wall details

<table>
<thead>
<tr>
<th>Detail</th>
<th>-</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Masonry Wall/ Upper Floor Slab Junction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Window - Head, Sill, Jamb</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>44, 48</td>
<td>Roof/Deck at Wall Junction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Wall Penetration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58a</td>
<td>Wall/ Service Box</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Masonry Wall adjoining other Wall Type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Masonry Wall/ Timber Wall Upper Floor Junction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Mortar Joints</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

#### 3.2.7.3 Roof details

<table>
<thead>
<tr>
<th>Detail</th>
<th>-</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Wall/ Pitched Roof - Apron Junction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Wall/ Pitched Roof - Eaves Junction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Wall/ Pitched Roof - Verge Detail</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34a &amp; b</td>
<td>Parapet</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2.8 Construction type A2 - Concrete masonry wall construction - external insulation - EIFS

Details in sections 3.2.8.1 to 3.2.8.3 shall be used for concrete masonry wall construction type A2.

**COMMENT:**
A description of EIFS is given in section 4.1.

### 3.2.8.1 Footing detail

- **Detail 1** - Wall/ Footing Junction - Slab on Ground

### 3.2.8.2 Wall details

- **Detail 7** - Wall/ Upper Floor Slab Junction
- **Detail 11** - Window - Head, Sill, Jamb
- Details 43, 47 - Roof/ Deck at Wall Junction
- **Detail 53** - Wall Penetration
- **Detail 57a** - Wall/ Service Box
- **Detail 61** - Masonry Wall adjoining other Wall Type
- **Detail 65** - Masonry Wall/ Timber Wall Upper Floor Junction

### 3.2.8.3 Roof details

- **Detail 18** - Wall/ Pitched Roof - Apron Junction
- **Detail 22** - Wall/ Pitched Roof - Eaves Junction
- **Detail 26** - Wall/ Pitched Roof - Verge Junction
- Details 31, 32, 33 - Parapet

3.2.9 Construction type A4 - Masonry veneer on drained cavity concrete masonry wall construction

Details in sections 3.2.9.7 to 3.2.9.9 shall be used for concrete masonry wall construction type A4.

### 3.2.9.1 Limitations

This Code of Practice limits veneer construction to:

a) Concrete or clay brick veneer tied to concrete masonry construction with a minimum clear ventilated cavity of 40 mm, or

b) Concrete block veneer tied to concrete masonry construction with a minimum clear ventilated cavity of 40 mm.

**COMMENT:**
The use of natural stone bricks or blocks as a masonry veneer is outside the scope of this Code of Practice and may require specific design.

### 3.2.9.2 General

Masonry veneer construction with a minimum 40 mm clear ventilated cavity is deemed to be weathertight.

Insulation used in a drained cavity shall resist absorbing moisture. The water absorption, measured in accordance with ASTM D2842, shall be equal to or less than 2.5% by volume.

**COMMENT:**
Brick or block-layers recognised under the licensed building practitioners scheme are recommended for the installation of masonry veneer.
3.2.9.3 Installation
Masonry veneer on concrete masonry, of the types specified in section 3.2.9.1, shall be deemed to comply with this Code of Practice if:

a) The installation complies with SNZ HB 4236 and NZS 4229,
b) The masonry veneer cavity is ventilated and drained from the bottom as detailed in SNZ HB 4236, and
c) Control joints are included in accordance with section 3.2.9.4.

3.2.9.4 Control joints
Control joints shall be formed as shown in Figure A and using an external seal as specified in section 3.1.1.

Control joints in clay brick veneers shall be included at locations specified by the brick manufacturer. Control joints in concrete brick veneers shall be included as specified in the New Zealand Concrete Masonry Manual and in any other locations specified by the manufacturer.

COMMENT:
Cracks are cosmetic and not likely to cause a moisture problem because of the presence of the cavity. Manufacturers can provide additional information on control joints.

3.2.9.5 Windows and doors
Window details for masonry veneer shall be constructed as shown in Detail 15. Openings shall be as specified in section 3.1.5.2.

3.2.9.6 Ground clearances, ventilation and drainage of veneer
Clearances to ground levels at the bottom of masonry veneer shall be in accordance with Detail 6.

Vents shall be installed at the top, and drain holes provided at 1000 mm\(^2\)/m through the bottom bed joint of the masonry veneer in accordance with SNZ HB 4236 and NZS 3604.

3.2.9.7 Footing detail
Detail 6 - Masonry Veneer Wall/ Footing Junction - Slab on ground

3.2.9.8 Wall details
Detail 10 - Masonry Veneer Wall/ Upper Floor Slab
Detail 15 - Window - Head, Sill, Jamb
Details 46, 50 - Roof/ Deck at Masonry Veneer Wall Junction
Detail 56 - Masonry Veneer Wall Penetration
Detail 60 - Wall/ Service Box
Detail 64 - Masonry Veneer Wall adjoining other Wall Type
Detail 68 - Masonry Veneer Wall/ Timber Wall Upper Floor Junction
3.2.9.9 Roof details

Detail 21  -  Masonry Veneer Wall/ Pitched Roof - Apron Junction
Detail 25  -  Masonry Veneer Wall/ Pitched Roof - Eaves Junction
Detail 29  -  Masonry Veneer Wall/ Pitched Roof - Verge Junction
Detail 38  -  Parapet

3.3 Insitu concrete wall construction

3.3.1 Design criteria

Insitu concrete construction shall be designed in accordance with AS/NZS 1170, NZS 3101 and section 2.1 of this Code of Practice, and constructed in accordance with NZS 3109.

3.3.2 Materials

All concrete shall be produced in accordance with NZS 3104.

Concrete supply shall:

a) For watertight concrete, comply with NZS 3104 for 'special concrete' and shall have a specified 28 day concrete strength of 50 MPa and meet the performance requirement for watertightness, and

b) For all other concrete, comply with NZS 3104 for 'normal concrete' and shall have a minimum specified 28 day concrete strength of 25 MPa.

Concrete shall either be certified by the New Zealand Ready Mixed Concrete Association (NZRMCA) Plant Audit Scheme or by a Chartered Professional Engineer confirming the concrete complies with NZS 3104.

Reinforcement shall comply with AS/NZS 4671. The reinforcement cover shall comply with NZS 3101 section 3 to meet NZBC B2 durability provisions.

3.3.3 Substrate finish

The exterior face of the concrete wall shall:

a) For EIFS and plaster systems as specified in sections 4.1 and 4.2, be finished to a minimum F4 standard in accordance with NZS 3114, and

b) For coating and clear sealer systems as specified in sections 4.3 and 4.4, be finished to a minimum F5 standard in accordance with NZS 3114.

At least 28 days shall be allowed after concrete placement as per AS/NZS 2311 for curing and stabilisation to take place before commencing the weathertight system. The moisture content of the wall shall be below 70% relative humidity before applying the weathertight system.

The substrate design needs to detail adequate reinforcement to prevent cracking in service.

COMMENT:

Particular attention should be paid to vibration and curing in and around edges of the wall.
It is important that all insitu concrete work has close quality control.
3.3.4 Control joints
Vertical control joints shall be placed at a maximum of 6 metre centres as shown in Details 69e & 69f.

3.3.5 Construction type B1 - Insitu concrete wall construction - internal insulation
Details in sections 3.3.5.1 to 3.3.5.3 shall be used for insitu concrete wall construction type B1.

3.3.5.1 Footing detail
Detail 4 - Wall/ Footing Junction - Slab on ground

3.3.5.2 Wall details
Detail 8 - Wall/ Upper Floor Slab
Detail 13 - Window - Head, Sill, Jamb
Details 44, 48 - Roof/Deck at Wall Junction
Detail 54 - Wall Penetration
Detail 58b - Wall/ Service Box
Detail 62 - Concrete Wall adjoining other Wall Type
Detail 66 - Concrete Wall/Timber Wall Upper Floor Junction

3.3.5.3 Roof details
Detail 19 - Wall/ Pitched Roof - Apron Junction
Detail 23 - Wall/ Pitched Roof - Eaves Junction
Detail 27 - Wall/ Pitched Roof - Verge Junction
Details 34a & b, 35 - Parapet

3.3.6 Construction type B2 - Insitu concrete wall construction - external insulation - EIFS
Details in sections 3.3.6.1 to 3.3.6.3 shall be used for insitu concrete wall construction type B2.

3.3.6.1 Footing detail
Detail 1 and 2 - Wall/ Footing Junction - Slab on ground

3.3.6.2 Wall details
Detail 7 - Wall/ Upper Floor Slab Junction
Detail 11 - Window - Head, Sill, Jamb
Details 43, 47 - Roof/ Deck at Wall Junction
Detail 53 - Wall Penetration
Detail 57b - Wall/ Service Box
Detail 61 - Concrete Wall adjoining other Wall junction
Detail 65 - Concrete Wall/ Timber Wall Upper Floor Junction

3.3.6.3 Roof details
Detail 18 - Wall/ Pitched Roof - Apron Junction
Detail 22 - Wall/ Pitched Roof - Eaves Junction
Detail 26 - Wall/ Pitched Roof - Verge Junction
Details 31, 32, 33 - Parapet
3.3.7 Construction type B3 - Insitu concrete wall construction - integral insulation
Details in sections 3.3.7.1 to 3.3.7.3 shall be used for insitu concrete wall construction type B3.

3.3.7.1 Footing detail
Detail 5 - Wall/ Footing Junction - Slab on ground

3.3.7.2 Wall details
Detail 9 - Wall/ Upper Floor Slab Junction
Detail 14 - Window - Head, Sill, Jamb
Details 45, 49 - Roof/Deck at Wall Junction
Detail 55 - Wall Penetration
Detail 59 - Concrete Wall/ Service Box
Detail 63 - Concrete Wall adjoining other Wall Type
Detail 67 - Concrete Wall/ Timber Wall Upper Floor Junction

3.3.7.3 Roof details
Detail 20 - Wall/ Pitched Roof - Apron Junction
Detail 24 - Wall/ Pitched Roof - Eaves Junction
Detail 28 - Wall/ Pitched Roof - Verge Junction
Details 36a &b, 37 - Parapet

3.4 Precast concrete wall construction

COMMENT:
Panels with integral insulation may also be called composite panel construction or sandwich panel construction.

3.4.1 Design criteria
Precast concrete walls shall be designed in accordance with AS/NZS 1170, NZS 3101 and section 2.1 of this Code of Practice, and constructed in accordance with NZS 3109.

Tilt up construction shall be designed and constructed in accordance with the CCANZ Tilt Up Technical Manual TM 34.

COMMENT:
The construction of concrete walls to provide weathertightness requires close quality control. Particular attention should be paid to vibration and curing in and around edges of the panel, to ensure that the joints are sound for adherence of the sealant.
3.4.2 Materials
All concrete shall be produced in accordance with NZS 3104.

Concrete supply shall:
a) For watertight concrete, comply with NZS 3104 for 'special concrete' and shall have a specified 28 day concrete strength of 50 MPa and meet the performance requirement for watertightness, and
b) For all other concrete, comply with NZS 3104 for 'normal concrete' and shall have a minimum specified 28 day concrete strength of 25 MPa.

Concrete shall either be certified by the New Zealand Ready Mixed Concrete Association (NZRMCA) Plant Audit Scheme or by a Chartered Professional Engineer confirming the concrete complies with NZS 3104.

Reinforcement shall comply with AS/NZS 4671. The reinforcement cover shall comply NZS 3101 section 3 to meet NZBC B2 durability provisions.

3.4.3 Substrate finish
The exterior face of the concrete wall shall:
a) For EIFS and plaster systems as specified in sections 4.1 and 4.2, be finished to a minimum F4 standard in accordance with NZS 3114, and
b) For coating and clear sealer systems as specified in sections 4.3 and 4.4, be finished to a minimum F5 standard in accordance with NZS 3114.

At least 28 days shall be allowed after concrete placement as per AS/NZS 2311 for curing and stabilization to take place before commencing the weathertight system. The moisture content of the wall shall be below 70% relative humidity before applying the weathertight system.

The substrate design needs to detail adequate reinforcement to prevent cracking in service.

3.4.4 Control joints
Control joints shall be placed at a maximum of 6 metre centres as shown in Details 69a, c & d.

3.4.5 Construction type C1 - Precast concrete wall construction - internal insulation
Details in sections 3.4.4.1 to 3.4.4.3 shall be used for precast concrete wall construction type C1.

3.4.5.1 Footing detail
Detail 4 - Wall/ Footing Junction - Slab on ground

3.4.5.2 Wall details
Detail 8 - Wall/ Upper Floor Slab Junction
Detail 13 - Window - Head, Sill, Jamb
Detail 44 - Roof/ Deck at Wall Junction
Detail 54 - Wall Penetration
Detail 58b - Wall/ Service Box
Detail 62 - Concrete Wall adjoining other Wall Type
Detail 66 - Concrete Wall/ Timber Wall Upper Floor Junction
3.4.5.3 Roof details
Detail 19 - Wall/ Pitched Roof - Apron Junction
Detail 23 - Wall/ Pitched Roof - Eaves junction
Detail 27 - Wall/ Pitched Roof - Verge Junction
Details 34a &b, 35 Parapet

3.4.5.4 Precast panel to panel joints
Detail 69b - Vertical control joint; plastered wall, horizontal section
Detail 69c - Vertical control joint; precast wall, horizontal section
Detail 69d - Horizontal panel joint; precast wall, vertical section

3.4.6 Construction type C2 - Precast concrete wall construction - external insulation - EIFS
Details in sections 3.4.5.1 to 3.4.5.3 shall be used for precast concrete wall construction type C2.

3.4.6.1 Footing detail
Detail 2 - Wall/ Footing Junction - Slab on ground

3.4.6.2 Wall details
Detail 7 - Wall/ Upper Floor Slab Junction
Detail 11 - Window - Head, Sill, Jamb
Details 43, 47 - Roof/ Deck at Wall Junction
Detail 53 - Wall Penetration
Detail 57b - Wall/ Service Box
Detail 61 - Concrete Wall adjoining other Wall Type
Detail 65 - Wall/ Timber Wall Upper Floor Junction

3.4.6.3 Roof details
Detail 18 - Wall/ Pitched Roof - Apron Junction
Detail 22 - Wall/ Pitched Roof - Eaves Junction
Detail 26 - Wall/ Pitched Roof - Verge Junction
Details 31, 32, 33 Parapet

3.4.7 Construction type C3 - Precast concrete wall construction - integral insulation
Details in sections 3.4.6.1 to 3.4.6.3 shall be used for precast concrete wall construction type C3.

3.4.7.1 Footing detail
Detail 5 - Wall/ Footing Junction - Slab on ground
3.4.7.2 Wall details
Detail 9 - Wall/ Upper Floor Slab
Detail 14 - Window - Head, Sill, Jamb
Details 45, 49 - Roof/ Deck at Wall Junction
Detail 55 - Wall Penetration
Detail 59 - Wall/ Service Box
Detail 63 - Wall adjoining other Wall Type
Detail 67 - Wall/ Timber Wall Upper Floor Junction

3.4.7.3 Roof details
Detail 20 - Wall/ Pitched Roof - Apron Junction
Detail 24 - Wall/ Pitched Roof - Eaves Junction
Detail 28 - Wall/ Pitched Roof - Verge Junction
Details 36a &b, 37 - Parapet
4.0 Wall weathertightness systems

This section provides specifications for the following five weathertightness systems:
1. EIFS (Exterior Insulation and Finish System) (see section 4.1),
2. Plaster system (see section 4.2),
3. Pigmented coating system (see section 4.3),
4. Clear coating system (see section 4.4), and
5. Watertight concrete (see section 4.5).

4.1 EIFS system – external insulation

This section specifies Exterior Insulation and Finish Systems (EIFS) applied directly to either:
a) A Concrete Masonry Wall type A2, or
b) An Insitu Concrete Wall type B2, or
c) A Precast Concrete Wall type C2.

4.1.1 Limitations

EIFS shall be:
a) Designed and tested as a total system, to meet NZBC E2,
b) Supplied by a single supplier who takes responsibility for the system as a whole encompassing the durability, weathertight detailing and overall weathertightness, and
c) Not fixed:
   i) so as to form a horizontal surface, or
   ii) in such a way as to allow water to pond.

4.1.2 General

COMMENT:
It is recommended that installation and finishing of EIFS is carried out by trained applicators who are approved by the New Zealand supplier of the system.

4.1.3 Materials

EIFS shall comprise:
a) A polystyrene rigid insulation board,
b) A polymer-modified cement-based base plaster or a polymer-based base plaster, reinforced with fibreglass mesh, and
c) A polymer-modified cement finishing plaster system or polymer-based finishing plaster system in one or more coats.
4.1.3.1 Polystyrene board  
Polystyrene boards shall be either:  
a) Expanded polystyrene (EPS) complying with AS 1366: Part 3, Class H or Class S, or  
b) Extruded polystyrene (XPS) that complies with AS 1366: Part 4.

**COMMENT:**  
The minimum board thickness will be determined by structural and thermal requirements.  
For some EIFS, polystyrene boards are available with the base coat plaster factory-applied.

The polystyrene boards shall be mechanically fixed at no greater than 600 mm centres and adhered to the wall using a cement-based mineral adhesive coat, tested for bond strength between polystyrene and concrete or masonry substrate, in accordance with ASTM E2134-01(2006).

The concrete or masonry wall shall be free of contaminates prior to application of the adhesive.

4.1.3.2 Fibreglass reinforcing mesh  
The entire exterior surface of the polystyrene sheet (including corners) shall be continuously reinforced with an alkali-resistant fibreglass mesh, which shall:  
a) Weigh no less than 150 grams per m²,  
b) Have an aperture size from a minimum 3 mm x 3 mm to a maximum of 6 mm x 6 mm square,  
c) Comply with the requirements of EIMA 101.91 test No. 6.3 and ASTM E2098,  
d) Be tested for alkali resistance by 28 days immersion in 5% sodium hydroxide with no visual degradation at the end of the test, and  
e) Overlap at mesh to mesh joints for at least 75 mm.

4.1.3.3 Base coat plaster  
The base coat plaster shall:  
a) Be at least 3 mm thick and form a flat plane surface and be either:  
   i) polymer-modified cement-based plaster, or  
   ii) polymer based plaster,  
b) Be reinforced with an alkali-resistant fibreglass mesh as specified in section 4.1.3.2,  
c) Cover the mesh by at least 1.0 mm,  
d) Be applied out of direct sunlight at temperatures between 5°C and 30°C, and with the expectation that the temperature will be within that range for the following 24 hours, and  
e) Have a bond strength with the polystyrene board tested in accordance with ASTM E2134-01(2006).

4.1.3.4 Finish coat  
The finish coat shall comprise either:  
a) A polymer-modified cement-based plaster or a polymer-based plaster, finished in both cases with a paint coating, or  
b) Either a pre-coloured polymer-modified cement-based plaster, or a pre-coloured polymer-based plaster with the top coat applied as a decorative plaster that is sealed or glazed.

Finish colours for EIFS shall have a reflectivity of 25% or more when measured in accordance with ASTM C1549 or ASTM E903.

**COMMENT:**  
Dark colours cause finishes to reach higher temperatures, which results in more thermal expansion and a greater risk of cracking. Coating manufacturers can supply reflectance values.
4.1.3.5 Openings and penetrations
a) All window/door openings shall have waterproof membranes as specified in section 3.1.5.2,
b) All wall recesses shall have waterproof membranes as specified in section 3.1.5.2,
c) All window/door openings, wall recesses and penetrations shall have sealant, or air seals as detailed in sections 3.1.1 to 3.1.2, and
d) Openings and penetrations in EIFS shall be completed as shown in Details 11, 53, 57a & 57b.

COMMENT:
This is the minimum standard, and additional elements required by the system supplier should not be excluded on the basis of this Code of Practice.

4.1.3.6 Decorative mouldings
Decorative mouldings formed from polystyrene shall be glued onto the base coat plaster and in addition meshed on at the top edge. The adhesive bond strength shall be tested in accordance with ASTM E2134-01(2006). Control joints shall be reflected through the mouldings.

COMMENT:
Decorative mouldings formed from other materials are available, but due to unknown weight and rigidity of the mouldings specific design of the fixing is required.

4.1.4 Movement joints
Control joints shall be provided to coincide with the control joints in the masonry or concrete substrate. The joint shall be 8 to 15 mm wide as shown in Detail 69a.

The front of the joint shall use either a sealant as specified in section 3.1.1 or an EIFS joint profile as per Detail 69a. The sealant shall have a width to depth ratio of 2:1.
At junctions between concrete walls and timber or metal frame walls, a control joint and back flashing as shown in Details 61 to 64 shall be provided.

4.1.5 EIFS/floor slab junction
The bottom of the EIFS shall run at least 100 mm into ground as shown in Details 1 and 2 and incorporate a waterproofing capillary break in the insulation.

The capillary break shall be formed by a continuous cut through the insulation board. The bottom section of the insulation board shall be made watertight by applying a membrane as specified in 4.2.3 and as shown in Details 1 and 2.

COMMENT:
If the EIFS terminates above ground, no capillary break is required but the bottom edge of the EIFS should be finished using a PVC cap incorporating a drip profile.

4.1.6 Parapets and balustrades
Parapets and balustrades shall comply with section 6.11. Balustrades shall use the same weathertightness details and specifications as for parapets.
4.1.7 Fixings
Fixings of downpipes brackets, garden taps and other outside fittings shall be in accordance with NZBC E2/AS1 Paragraph 9.9.4.4.

Designs of fixing brackets for connecting items carrying substantial loads such as stringers for decks are outside the scope of this Code of Practice and will require specific design.

4.2 Plaster system
This section specifies plaster systems applied directly to either:
a) A Concrete Masonry Wall type A1 or A3 (internal or integral insulation), or  
b) An Insitu Concrete Wall type B1 or B3 (internal or integral insulation), or  
c) A Precast Concrete Wall type C1 or C3 (internal or integral insulation).

The exterior plaster system shall comprise a combination of plaster layers as specified in Table 3 and as detailed in section 4.2.1. All layers specified for a given option shall be used.

The substrate shall be free of contaminates prior to the application of the base coat. Plaster shall be applied out of direct sunlight at temperatures between 5°C and 30°C, with the expectation that the temperature will be within that range for the following 24 hours.

<table>
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<th>Wall type</th>
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Table 3: Acceptable weathertight plaster systems
4.2.1 Plaster types
The plaster types to be used as specified in section 4.2 and the associated Table 3 shall be as follows.

**Type A:**
Polymer based plaster base coat comprising:
  i) Plaster of at least 3 mm thickness to form a flat plane surface,
  ii) Reinforcing with an alkali-resistant fibreglass mesh as specified in section 4.1.3.2,
  iii) Cover to the mesh of at least 1.0 mm of plaster, and
  iv) A minimum bond strength of 0.1 MPa to the concrete or concrete masonry substrate.

**Type B:**
Polymer modified cement-based plaster base coat comprising:
  i) Plaster of at least 3 mm thickness to form a flat plane surface,
  ii) Reinforcing with an alkali-resistant fibreglass mesh as specified in section 4.1.3.2,
  iii) Cover to the mesh of at least 1.0 mm of plaster, and
  iv) A minimum bond strength of 0.1 MPa to the concrete or concrete masonry substrate.

**Type C:**
Solid plaster base coat comprising:
  i) Bond or scratch coat 3 to 4 mm thick, reinforced with an alkali-resistant fibreglass mesh as specified in section 4.1.3.2, and
  ii) Flanking coat 9 to 15 mm thick in accordance with NZS 4251.

**Type D:**
Polymer based plaster finish coat with a standard acrylic coating of no less than 80µm Dry Film Thickness.

**Type E:**
Polymer modified cement-based plaster finish coat with a standard acrylic coating of no less than 80µm Dry Film Thickness.

**Type F:**
Pre-coloured polymer based plaster finish coat with a clear coat as specified in section 4.4 and with a permeability of less than 3 mm/hr.

**Type G:**
Pre-coloured polymer modified cement-based plaster finish coat with a clear coat as specified in section 4.4 and with a permeability of less than 3 mm/hr.

**Type H:**
Solid plaster finish coat, 2 to 3 mm thick, applied in accordance with NZS 4251.

**Type I:**
Three coat cement-based solid plaster in accordance with NZS 4251 Section 3: Plaster system for concrete masonry walls.

4.2.2 Movement control joints
Control joints shall be provided to coincide with the control joints in the masonry or concrete substrate. The joint shall be 8 to 20 mm wide as shown in Detail 69b. The sealant, as specified in section 3.1.1, shall have a width:depth ratio of 2:1.
4.2.3 Membrane for plaster
An additional layer of waterproofing shall be applied to:
a) Window and Door Openings as per Details 11 and 12,
b) Footings and Wall to Ground Junctions as per Details 1, 2, 3a, 3b, 4, and 5, and
c) Parapets as per Details 32 and 33.

The waterproofing membrane for plaster shall consist of a reinforced liquid membrane that complies with AS/NZS 4858 and which is suitable for the application of plaster.

4.3 Pigmented coating system
This section specifies pigmented coating systems applied directly to either:
a) A Concrete Masonry Wall type A1 or A3, or
b) An In situ Concrete Wall type B1 or B3, or
c) A Precast Concrete Wall type C1 or C3.

Concrete walls shall be sufficiently dry to give a relative humidity reading of less than 70% at the time of coating application.

The substrate shall be free of contaminates prior to the application of the coating system.

**COMMENT:**
If a release agent has been used, make sure that no contaminants remain on the concrete surface.

Coating shall be applied out of direct sunlight and at temperatures between 5°C and 30°C, with the expectation that the temperature will be in that range for the following 12 hours. Coating shall not be applied in damp conditions.

4.3.1 Pigmented acrylic coating
Pigmented acrylic coatings for exterior use shall have a Dry Film Thickness of at least 80 µm.
No less than two coats shall be applied.

Pigmented acrylic coatings shall not be applied to concrete masonry walls.

**COMMENT:**
Pigmented acrylic coatings are suitable for concrete precast and concrete in situ walls.

4.3.2 Pigmented elastomeric high build acrylic coating
Pigmented elastomeric high build acrylic coatings for exterior use shall have a dry film thickness of at least 180 µm.
No less than two coats shall be applied.

**COMMENT:**
Pigmented elastomeric high build acrylic coatings are suitable for concrete masonry walls, concrete precast and concrete in situ walls.
4.4 Clear coating system
This section specifies clear coating systems applied directly to either:
a) A Concrete Masonry Wall type A1 or A3, or  
b) An Insitu Concrete Wall type B1 or B3, or  
c) A Precast Concrete Wall type C1 or C3.

Clear coating systems complying with section 4.4.2 are weathertight.

The coating system shall be supplied by a single supplier who takes responsibility for the system as a whole, encompassing the weathertight coating. The system shall be applied by the coating manufacturer’s approved applicator.

Clear coating systems are to be recoated every five years at a minimum or in accordance with the manufacturer’s specifications.

The clear coating system shall be designed to prevent water ingress into the pores of the concrete or masonry. The system shall allow the passage of water vapour from the interior to the exterior.

COMMENT: 
Clear coatings have been included in this Code of Practice recognising the move to ‘minimalist architecture’ using unpainted concrete and masonry. Clear coatings do not always have the flexible film forming ability that acrylic coatings have. Therefore they require a strict maintenance regime and need recoating at shorter intervals.

4.4.1 Permeability test
Clear coating system shall be tested for permeability in accordance with AS/NZS 4456.16. The test shall be conducted on a standard masonry block with a density of between 1350 –1500 kg/m³ over a test period of two hours.

4.4.2 Acceptable clear coating systems
Clear sealers for insitu and precast concrete walls shall have a permeability of 3 mm/hr or less when tested in accordance with section 4.4.1.

Clear sealers for concrete masonry walls shall have:
a) A permeability of 1 mm/hr or less when tested in accordance with section 4.4.1, or  
b) A permeability of 3 mm/hr or less when tested in accordance with section 4.4.1 if the wall is constructed of low permeability blocks. Low permeability blocks shall have a permeability of less than 10 mm/hr when tested in accordance with section 4.4.1.
4.5 Watertight concrete

This section specifies watertight concrete used to construct either:

i) An Insitu Concrete Wall type B1 or B3, or
ii) A Precast Concrete Wall type C1 or C3.

The use of watertight concrete which is impervious to the passage of water will provide weathertightness without the need for exterior plaster or coating.

Watertight concrete shall:

a) Comply with NZS 3104 Clause 2.10.2,
b) Have a minimum specified 28 day concrete strength of 50 MPa,
c) Have a water/cementitious (w/c) ratio (by weight) less than 0.50,
d) Incorporate a permeability reducing admixture complying with AS 1478.1 Appendix F,
e) Be designed to prevent cracking in service in accordance with section 2.1, and
f) Be verified as watertight by passing an AVPV (Apparent Volume of Permeable Voids) test on the hardened concrete in accordance with section 4.5.1.

COMMENT:
A limiting tensile stress of 150 MPa in the reinforcing steel under service loads as determined in AS/NZS 1170 prevents cracking. The term ‘watertight concrete’ is used in this case as it is the term used by the Concrete Institute of Australia in its Practice Note on watertight concrete structures. Watertight concrete will not prevent the passage of water vapour. Silane or siloxane sealers can be used to further protect and enhance water repellent properties.

4.5.1 Apparent Volume of Permeable Voids (AVPV) test requirements

The AVPV test shall be carried out in accordance with AS 1012.21 on three cylinders cast in accordance with NZS 3112 Part 2. The maximum permitted AVPV value based on the average of 3 cylinders shall be 13%.
5.0 Flashings

5.1 Required properties of flashing materials

5.1.1 Durability requirements
All flashings shall comply with the requirements of NZBC B2 Durability.

COMMENT:
The durability requirements for flashings specified in NZBC B2 are:
a) 50 years, where flashings are:
   i) completely hidden behind claddings or
   ii) not accessible, or
b) 15 years, where flashings are:
   i) exposed, or
   ii) accessible.

5.1.2 Environmental requirements
Flashing materials shall be selected according to the relevant exposure conditions as defined in either:
a) AS/NZS 2728, or
b) NZBC E2/AS1 Table 20.

COMMENT:
The exposure zone in which a building is located can affect the durability of flashings.
Exposure zones for flashing materials are defined in NZS 3604 Chapter 4, based on the likely exposure to wind-driven sea-salt.
Exposure due to geothermal or industrial gases, as defined in NZS 3604, is outside the scope of this Code of Practice and will require specific design.

5.1.3 Specific conditions of use
Flashing materials shall be selected according to the specific conditions of their use from NZBC E2/AS1 Table 20 to minimise the effects of corrosion.

COMMENT:
The specific location of a material on a building can substantially affect the durability of that material.
In particular, many metals can undergo accelerated corrosion if they are exposed to wind-driven sea-salt in sheltered locations, where they are not exposed to being washed by rainwater.

5.1.4 Surrounding materials
Flashings which are adjacent to other materials shall be selected in accordance with NZBC E2/AS1 Tables 21 and 22.

Uncoated metals shall not be used where carbon deposits or chemical contaminants may accumulate.

COMMENT:
Undesirable effects can occur when some materials are in contact with each other. Examples are corrosion of metals, stress cracking of plastics and staining of glass. Carbon deposits such as soot can cause accelerated corrosion of damp, uncoated metal.
5.2 Acceptable flashing materials

COMMENT:
Additional guidance on flashing materials can be found in the New Zealand Metal Roofing Manufacturers’ Roof and Wall Cladding Code of Practice.

5.2.1 uPVC flashings
uPVC flashings shall be a minimum of 0.75 mm thick and shall comply with the requirements of the following Clauses of AS/NZS 4256: Part 2:
   a) Clause 9.2 Impact resistance,
   b) Clause 9.3 Tensile strength, and
   c) Clause 9.4 Colourfastness and impact resistance following ultraviolet light exposure.

Where uPVC flashings are exposed to the weather, they shall also comply with Section 8 of AS/NZS 4256: Part 2.

COMMENT:
Manufacturers of uPVC flashings which have a proven performance in use may be able to show compliance with NZBC B2 Durability as detailed in NZBC B2/VM1.

5.2.2 Metallic flashings
Metallic flashings (aluminium flashings, galvanised steel flashings, aluminium-zinc coated steel flashings, stainless steel flashings, copper flashings, lead sheet flashings and zinc sheet flashings) shall be as specified in NZBC E2/AS1 Paragraphs 4.3.2 to 4.3.8 respectively, except that aluminium flashings shall not be used in contact with fresh cement plaster or green concrete (ie concrete which has cured less than 28 days).

5.3 Fixings
Fixings of metal flashings shall comply with NZBC E2/AS1 Tables 20, 21 and 22.

Where fixings that penetrate flashings, self-tapping nails or screws provided with a watertight underlay disc shall be used.

COMMENT:
Fixings that penetrate flashings should be avoided wherever possible.
6.0 Concrete roofs and decks

Concrete roofs and decks shall be made weathertight by applying a roof membrane as specified in section 6.5.

The following details, as shown in section 10, shall be used for concrete roof and deck construction:

- Detail 16 - Door/Threshold at Deck, external roof insulation
- Detail 17 - Door/Threshold at Deck, internal roof insulation
- Detail 30a - Flat Roof, general built up, internal roof insulation
- Detail 30b - Flat Roof, general built up, external roof insulation
- Detail 39 - Roof Gully, external roof insulation
- Detail 40 - Roof Gully, internal roof insulation
- Detail 41 - Roof Exit, AOV, external roof insulation
- Detail 42 - Roof Exit, AOV, internal roof insulation
- Detail 51 - Decking Options, external roof insulation
- Detail 52 - Decking Options, internal roof insulation

Junctions of roofs or decks to walls shall be as specified in section 6.9. Parapets and balustrades shall be as specified in section 6.11.

COMMENT:
Sections through a typical insulated flat roof showing the arrangement of the vapour barrier, insulation and membrane are shown in Detail 30a (internal or under-slab insulation) and Detail 30b (external insulation).
In Detail 30a, either a single torch on membrane or an adhesive membrane could be used.
In Detail 30b, the vapour barrier below the insulation keeps the insulation dry from vapour arising from the inside of the building.
A double membrane could be used directly over the insulation where the lower membrane is adhesive fixed to the insulation and the top membrane is being torched on.

Concrete used for roof and deck construction shall either be certified by the New Zealand Ready Mixed Concrete Association (NZRMCA) Plant Audit Scheme or by a Chartered Professional Engineer confirming the concrete complies with NZS 3104.

6.1 Limitations
This Code of Practice limits concrete flat roofs and decks to those with:

a) Parapets at all edges,
b) Bituminous or butyl and EDPM sheet roof membranes installed over concrete or insulation board,
c) A fall of between 1.5° (1:40) and 5° (1:11),
d) No integral roof gardens,
e) No downpipe directly discharging to the roof or deck,
f) No cantilevering in their construction, and
g) Decks with removable raised surfaces to protect the roof membrane, as shown in Details 16, 17, 51 and 52.

COMMENT:
Discharging gutters directly onto decks increases the chances of water entry into sensitive areas. Direct discharge may be allowed into gutters calculated to have sufficient water-carrying capacity, but this is outside the scope of this Code of Practice.
6.2 Design criteria
Concrete roofs and decks shall be designed in accordance with AS/NZS 1170, NZS 3101 and section 2.1 of this Code of Practice, and constructed in accordance with NZS 3109.

Parapets and balustrades form part of the roof or deck design and construction. Parapets and balustrades formed of concrete masonry shall be designed in accordance with NZS 4230 and constructed in accordance with NZS 4210.

The slab shall be formed from insitu concrete, or precast concrete with an insitu concrete topping. Drainage falls shall be provided by either a sloped screed or by sloped thermal insulation boards.

**COMMENT:**
Concrete used to construct roofs and decks shall be designed as a suspended concrete floor in accordance with NZS 3101 and 3109. Suspended concrete floors used as a diaphragm shall meet the requirements of NZS 4229 for horizontal loads. If they perform other structural functions, they shall be subject to specific design in accordance with NZS 3101. In all cases, the dead load of suspended concrete floors shall not exceed 6.0 kPa.

6.3 Substrate finish
The finish of the concrete surface to take the roof membrane shall be a light broom or a U2 wood float to NZS 3114 or U3 steel trowel.

At the time of laying the roof membrane, the concrete shall be either:
a) More than 28 days old, or
b) Sufficiently dry so as to give a relative humidity reading of less than 75%.

The concrete shall be cleaned and any contaminants such as curing compound or release agents shall be removed.

**COMMENT:**
Curing compounds should not be used unless necessary. The contractor is responsible for ensuring that moisture content of the substrate comes within the membrane supplier’s requirements. Substrate ventilation of the membrane to substrate interface may be required where there is excess moisture present in building materials at the time of laying the membrane.

6.4 External roof insulation
The external roof insulation functions as substrate for the bituminous roof membrane and shall be a rigid type of either:
a) Extruded polystyrene foam (XPS), or
b) Polyurethane foam, or
c) Cellular foamed glass.

The specification of the external roof insulation shall be specifically designed to support the loads from the decking system as specified in section 6.7 plus the live loads as specified in AS/NZS 1170.

The external roof Insulation shall be adhered to the substrate over a vapour control layer by:
a) Cold adhered with bond strength of 4 kPa when tested in accordance with ASTM D7105, or
b) Bedded in, melted down, or
c) Self- adhesive vapour barrier sheet, or
d) Mechanical fixing.

The insulation board shall be installed in dry weather.
6.4.1 Vapour control layer
A vapour control layer shall be installed under the external roof insulation to prevent the entrapment of moisture. The vapour control layer shall be specified in accordance with ASTM C755.

The vapour control layer shall be installed in dry weather.

6.5 Roof membrane
Roof and deck membranes shall be either:

a) an EPDM or butyl rubber membrane as specified in section 6.5.1, or
b) a bituminous membrane as specified in section 6.5.2.

6.5.1 EPDM and butyl rubber roof membrane
The membrane shall:

a) Be a minimum thickness of:
   i) 1 mm for roofing, or
   ii) 1.5 mm for decks,

b) Comply with the following parts of Table 1 in ASTM D6134:
   i) tensile strength,
   ii) elongation,
   iii) water absorption,
   iv) water vapour permeance, and
   v) heat aging followed by:
      a. tensile strength, and
      b. elongation,

c) Have adhesives, primers and seam tapes that:
   i) comply with BRANZ EM 5 section 3.1, and
   ii) have bond strength of 4 kPa when tested in accordance with ASTM D903 and ASTM D7105, and
   iii) are part of a complete system approved by the manufacturer or supplier of the membrane, and

d) be UV resistant unless the membrane is protected from sunlight, and

e) Have a membrane colour with a light reflectance greater than 40%.

COMMENT:
If non UV-resistant membranes are used, then recommended methods of protection from sunlight include:

1) Embedded mineral granules - selecting mineral membranes which comply with the technical requirements of the Membrane Group of New Zealand’s Code of Practice for Torch-on Membrane Systems for Roofs and Decks will ensure the mineral is well embedded (rolled-in) into the membrane to ensure non-shedding of mineral, with can result in bald patches, and

2) Using a high-performance reflective coating system as part of the membrane system to provide long-term protection.

For installation, adhesives shall be applied to both the membrane and the substrate. When tack-dry, the membrane shall be rolled into the substrate. Seam tapes shall be used on all joints. Seams should be aligned parallel to the fall of the deck to minimise ponding.

COMMENT:
It is recommended that installation of membrane roofs and decks be carried out by trained installers, approved by the manufacturer or the New Zealand agent (in the case of imported membrane). Membrane adhesives should be selected for the applicable substrate, concrete or rigid insulation. Penetrations made through the membrane subsequent to laying require specific design.
6.5.2 Bituminous roof membrane

The membrane shall:

a) Meet the performance requirements of the Code of Practice for Torch-on Membrane Systems for Roofs and Decks, sections 4.2 and 4.3,

b) Have adhesives, primers and seam tapes that:
   i) comply with BRANZ EM 5 section 3.1, and
   ii) have bond strength of 4 kPa when tested in accordance with ASTM D903 and ASTM D7105, and
   iii) are part of a complete system approved by the manufacturer or supplier of the membrane, and

c) be UV resistant unless the membrane is protected from sunlight.

The membrane installation shall follow the Code of Practice for Torch-on Membrane Systems for Roofs and Decks, sections 7.2, 7.3 (excluding 7.3.1 and 7.3.2), 7.4, 7.6.2, 7.6.4 and 7.6.8.

For externally insulated roofs and decks, a double layer waterproofing membrane on top of the insulation shall be used. The first layer shall be a self adhesive or cold-fixed layer to avoid damage from torching flame, and the second layer (top layer) shall be torched on. All laps shall be heat welded on the second layer.

Additionally a vapour barrier, either liquid or self adhesive, shall be applied between the concrete roof/deck and the insulation boards to prevent vapour from inside the building diffusing into the insulation.

6.6 Roof and deck drainage

Roofs and decks shall be constructed so that:

a) The highest point of the waterproofing membrane on a roof or deck shall be at least 100 mm below an adjoining interior floor,

b) A minimum clear drainage gap of 12 mm shall be provided between the decking edge and the wall or parapet or balustrade cladding,

c) A minimum 150mm upstand of the roof/deck membrane shall be provided at all roof/deck to wall and parapet junctions, except at thresholds where this can be reduced to 100mm. No penetrations shall be made through this membrane upstand.

d) Water discharges directly into roof outlets with a minimum diameter of 75 mm as shown in Detail 39 and 40,

e) External corner upstands in the membrane are formed in accordance with NZBC E2/AS1 Figure 57,

f) Allowance for additional run-off shall be provided by an extra outlet, with both outlets sized to take the full required capacity, and

g) The number of rainwater outlets is no less than two.

6.7 Additional deck requirements

In addition to the requirements of section 6.5, a deck shall have:

a) A raised removable decking system of tiles or timber slats in accordance with Details 16, 17, 43 to 52 and E2/AS1 Figure 17A, with a minimum clear drainage gap of 12 mm that shall be provided between the decking edge and the wall or parapet or balustrade cladding, or

b) Paving on a rounded pebble drainage layer (that can be removed for maintenance) in accordance with Details 51 and 52.

Doors for level access shall be constructed in accordance with Detail 16 or 17 or E2/AS1 Figure 17A and:

a) Have a minimum clear drainage gap of 12 mm between the decking edge and the door sill or the door frame, or

b) Have an external linear drainage grille along the length of the door opening.
6.8 Control joints
The design of control joints for membrane roofs and decks is subject to specific design and is outside the scope of this Code of Practice. All control joints in the substrate shall be accommodated in the membrane.

6.9 Junctions
All junctions of roofs or decks to walls and doors shall be constructed in accordance with the following Details and Figures where relevant:

- Detail 16 - Door/Threshold at Deck, external deck insulation
- Detail 17 - Door/Threshold at Deck, internal deck insulation
- Detail 43 - Roof/Deck at Wall, masonry, insitu or precast walls, external roof insulation, external wall insulation (EIFS)
- Detail 44 - Roof/Deck at Wall, masonry, insitu or precast walls, external roof insulation, internal wall insulation
- Detail 45 - Roof/Deck at Wall, insitu or precast walls, external roof insulation, integral wall insulation
- Detail 46 - Roof/Deck at Wall, masonry walls, external roof insulation, cavity wall insulation
- Detail 47 - Roof/Deck at Wall, masonry, insitu or precast walls, internal roof insulation, external wall insulation (EIFS)
- Detail 48 - Roof/Deck at Wall, masonry, insitu or precast walls, internal roof insulation, internal wall insulation
- Detail 49 - Roof/Deck at Wall, insitu or precast walls, internal roof insulation, integral wall insulation
- Detail 50 - Roof/Deck at Wall, masonry walls, internal roof insulation, cavity wall insulation

NZBC E2/AS1 Figure 62.

COMMENT:
Adding wearing surfaces over the membrane effectively reduces clearances and should be allowed for when setting membrane levels.

6.10 Penetrations
Penetrations for external and internal insulation options shall be constructed in accordance with Details 39 to 42.

No fixing shall penetrate the exposed horizontal roof membrane or any exposed non vertical applied roof membrane.

6.10.1 Handrails
Connections of stanchions for handrails and other fixtures (such as TV aerials or satellite dishes) shall be side-fixed to a vertical surface and shall have the junction with the exterior wall made weathertight by using the connections shown in Details 31 to 38.

Fixing of posts through non vertical roof membrane areas shall be avoided.

COMMENT:
Any fixings of posts through roof or deck membranes require specific design.
6.11 Parapets

Parapets shall be constructed in accordance with the following Details:

- **Detail 31** - Parapet, profiled capping, external roof insulation, masonry, insitu or precast walls, EIFS
- **Detail 32** - Parapet, integral capping, Option A, external roof insulation, masonry, insitu or precast walls, EIFS
- **Detail 33** - Parapet, integral capping, Option B, external roof insulation, masonry, insitu or precast walls, EIFS
- **Detail 34a** - Parapet, profiled capping, Option A, internal roof insulation, masonry, insitu or precast walls, internal insulation
- **Detail 34b** - Parapet, profiled capping, Option B, internal roof insulation, masonry, insitu or precast walls, internal insulation
- **Detail 35** - Parapet of insitu or precast wall, internal roof and wall insulation
- **Detail 36a** - Parapet of composite insitu or precast wall, Option A, external roof insulation, integral wall insulation
- **Detail 36b** - Parapet of composite insitu or precast wall, Option B, external roof insulation, integral wall insulation
- **Detail 37** - Parapet of composite insitu or precast wall, integral capping, external roof insulation, integral wall insulation
- **Detail 38** - Parapet with profiled capping for masonry wall

6.11.1 Capping materials

Cappings for concrete parapets shall be formed either:

a) As an integral capping by continuing the weathertight system up and over the parapet top, or
b) By using a metal capping.

Capping materials shall be selected in accordance with section 5.0.

Integral cappings for EIFS and plaster weathertight systems shall incorporate an additional waterproof membrane, as specified in section 4.2.3, beneath the plaster and as shown in Details 32, 33, 35 and 37.

Cappings for parapets constructed from concrete masonry shall use a metal capping system only.

6.11.2 Metal cappings

Metal cappings shall be either clipped to steel brackets, bolted to the top of the parapet or fixed with self tapping screws to the sides of the parapet as shown in Details 31, 34a, 34b and 38.

Metal cappings shall also comply with all the following requirements:

a) Tops of cappings shall be free of any penetrations,
b) Slope of top shall be 5° (1:12) minimum and sloped packers under cappings shall be timber treated to NZS 3602 or 9 mm H3 plywood on packers,
c) All cappings shall have drip edges, with minimum drip edges the same as those specified in Details 31,34a & b, 36a, 36b & 38,
d) Lengths of capping shall be joined in accordance with NZBC E2/AS1 Figure 9 (b) or Figure 9 (d),
e) External corners of cappings shall be in accordance with NZBC E2/AS1 Figure 9 (e),
f) Expansion joints shall be provided for joined cappings with a combined length exceeding either:
   i) 12 m for light coloured steel and stainless steel, or
   ii) 8 m for dark coloured steel, or
   iii) 8 m for copper, or
   iv) 8 m for aluminium,
g) Where both ends of a capping are constrained, allowance shall be made for expansion,
h) Where necessary, expansion joints shall be formed as shown in NZBC E2/AS1 Figure 9 (g), and with:
   i) minimum 200 mm laps,
   ii) sliding clips at both sides of the lap, and
   i) Where a capping finishes against a wall, a saddle flashing with a 100mm overlap extending 50mm up the wall shall be provided as shown in NZBC E2/AS1 Figure 12 (a).

Joints and corners of metal cappings shall be constructed in accordance with NZBC E2/AS1 Figure 9.
7.0 Concrete slab-on-ground and footings

7.1 Design criteria
Concrete slab on ground and wall footings shall:
a) Comply with NZS 4229 section 6 and 7 and NZS 4210, or
b) Be designed in accordance with AS/NZS 1170, NZS 3101 and section 2.1 of this Code of Practice, and constructed in accordance with NZS 3109.

The minimum acceptable ground floor level for the concrete floor shall be in accordance with NZBC E1/AS1 Section 2.0.

**COMMENT:**
Concrete curing requirements in NZS 4229 specify a minimum 28 day concrete strength in accordance with NZS 3604 exposure zones as follows:
(a) 17.5 MPa for reinforced concrete either not exposed to weather or exposed to the weather in Zone B, or
(b) 20.0 MPa for reinforced concrete exposed to weather in zone C, or
(c) 25.0 MPa for reinforced concrete exposed to weather in Zone D.

NZS 4229 specifies slab thicknesses in clause 7.8 and requires slabs to be reinforced with 665 mesh.

Concrete used for footing and floor construction shall either be certified by the New Zealand Ready Mixed Concrete Association (NZRMCA) Plant Audit Scheme or by a Chartered Professional Engineer confirming the concrete complies with NZS 3104.

7.2 Wall footing details
The wall/floor junction shall be constructed in accordance with Details 1 to 6.

7.3 Finished floor level
The ground directly adjacent to the building shall be sloped no less than 1:25 for at least 1 m to carry water away from the building.

The height of the finished floor level above adjacent final landscaped ground levels shall comply with NZS 4229 Clause 7.2.1 and be no less than 100 mm if the ground is permanently paved, or 150 mm if the ground is unpaved.

**COMMENT:**
It is important that ground clearances are maintained after completion and occupation of the building. The likely final landscaped ground levels should be taken into account when planning foundations and earthworks to avoid reductions in minimum ground levels in the finished building.

It is recommended that the building platform be formed at a level of at least 300 mm below the finished floor level, with the exterior ground sloped to carry water away from the exterior walls. This allows landscaping and paving to be built up while still maintaining the required clearances.
7.4 Damp-proof membranes (DPM)
Every concrete floor slab cast on the ground shall have a damp-proof membrane (DPM), which shall be either:
i) Laid between the ground and the slab as shown in Details 1 to 6, or
ii) Laid between the top of the slab and a concrete floor topping that is no less than 50 mm thick.

The DPM shall:
a) Be in accordance with NZS 4229, section 7.4 - 7.7,
c) Continue to remain waterproof for a minimum of 50 years, and
d) Be continuous over the whole slab area or under a concrete floor topping.

To avoid damage to the damp-proof membrane, a granular base in accordance with NZS 4229 Section 7.3.3 shall be placed.

7.4.1 Wall footings in poorly drained sites
For poorly drained sites, the DPM shall be extended vertically up the external face of the footings as specified in Details 1 to 6. In this case a sheet applied self adhesive DPM shall be used. The DPM shall be overlapped with the wall weathertightness system for at least 50 mm as shown in Details 1 to 6.

7.5 Protection of timber
Timber shall be separated from the concrete slab by a damp-proof course (DPC).

7.6 Control joints
Control joints shall be placed in accordance with NZS 4229 section 7.8.5 or as specified by specific design in accordance with AS/NZS 1170 and NZS 3101.
8.0 Construction moisture

Moisture in the building structure at completion of construction shall be limited to avoid damage to the building elements.

**COMMENT:**
Excessive moisture content in concrete floors may inhibit bonding of subsequent floor coatings.

Construction moisture includes the moisture contained in:
- a) Timber products as a result of a treatment or manufacturing process,
- b) Timber or other materials as a result of exposure to the weather, and
- c) Concrete, mortar or plaster that is not completely cured.

8.1 Maximum acceptable moisture
The maximum moisture contents shall:
- a) For concrete floors, have a relative humidity of less than 75% at the time of applying wall membranes, sealants, weathertightness systems or fixed floor coverings, and
- b) For concrete walls, have a relative humidity reading of less than 70% at the time of applying wall membranes, sealants or weathertightness systems.

8.2 Measuring moisture content in concrete
Measurement of moisture content shall be made in accordance with BRANZ Bulletin 424 “Measuring moisture on building sites” using hygrometers calibrated to ASTM E104: 2002 “Standard practice for maintaining constant relative humidity by means of aqueous solutions”.

**COMMENT:**
Measurement of moisture content in timber should be made in accordance with NZBC E2/AS1 Paragraph 10.3.
9.0 Detail Drawings
Concrete masonry or insitu wall (shown as masonry)

EXTERIOR

EIFS as specified in section 4.1

Weatherproofing as specified in 4.1.5 shall overlap DPM for at least 50mm. Angle of capillary break not critical for weathertightness. Plaster continues across capillary break

Clearance to top of slab

Vertical DPM is only required for poorly drained sites, otherwise can be stopped here

INTERIOR

Concrete masonry or insitu wall (shown as masonry)

DPM

Concrete slab

Sand blinding

Compacted hardfill

Comment 1: Underfloor insulation not required for weathertightness, but may be required to improve the floor's R value.
Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 1
Wall/ Footing Junction: Slab on Ground
Concrete Masonry or Insitu Wall: EIFS
Wall type: A2, B2
Detail 2

Wall/ Footing Junction: Slab on Ground
Insitu or Precast Wall: EIFS

Wall type: B2, C2
A rebate of 45mm to 100mm is required under conditions as specified in Table 2 of section 3.2.

**EXTERIOR**

- Weathertightness as specified in section 4.2 or 4.3

**INTERIOR**

- Insulation/strapping and lining (indicative only, not required for weathertightness)

**Detail 3a** (for weathertightness system 4.2 and 4.3) (not to scale)

- Wall/Footing Junction: Slab on Ground (no rebate)
- Concrete Masonry Wall: Internal & integral Insulation Wall with external plaster or coating

Wall type: A1, A3

Comment 1: Underfloor insulation not required for weathertightness, but may be required to improve the floor's R value.

Comment 2: Structural layout is indicative only and subject to individual project design.
Comment 1: Underfloor insulation not required for weathertightness, but may be required to improve the floor’s R value.
Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 3b (for weathertightness system 4.4) (not to scale)

Wall/ Footing Junction: Slab on Ground
Concrete Masonry Wall: Internal & integral Insulation
Wall with external clear coating

Wall type: A1, A3
Comment 1: Underfloor insulation not required for weathertightness, but may be required to improve the floor's R value.
Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 4
Wall/ Footing Junction: Slab on Ground
Insitu or Precast Wall: Internal Insulation

Wall type: B1, C1
Weathertightness system as specified in section 4.2, 4.3, 4.4 or 4.5

Membrane as specified in 4.2.3 shall extend above ground by at least 100mm and if DPM is applied to external face of footing it shall overlap DPM by at least 50mm

Clearance to top of slab

Continuous chamfered grout

Precast packers to suit (not required for insitu)

DPM extension only required for poorly drained sites, otherwise can be stopped here

EXTERIOR

INTERIOR

Concrete wall

Insulation (indicative only, not required for weathertightness)

DPM

Concrete slab

Sand blinding

Compacted hardfill

Comment 1: Underfloor insulation not required for weathertightness, but may be required to improve the floor's R value.

Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 5

Wall/ Footing Junction: Slab on Ground

Insitu or Precast Wall: Integral Insulation

Wall type: B3, C3
Comment 1: Underfloor insulation not required for weathertightness, but may be required to improve the floor's R value.
Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 6
Wall/ Footing Junction: Slab on Ground
Concrete Masonry Wall With Drained Cavity
Wall type: A4
Detail 7
Wall/ Upper Floor Slab Junction
Concrete Masonry, Precast or Insitu: External Insulation
Wall type: A2, B2, C2  (not to scale)

Detail 8
Wall/ Upper Floor Slab Junction
Concrete Masonry, Precast or Insitu: Internal Insulation
Wall type: A1, B1, C1  (not to scale)
Comment: If masonry block with integral insulation applies, internal insulation may be ignored depending on required wall R value

Detail 9
Wall/ Upper Floor Slab Junction
Precast or Insitu Wall: Integral Insulation
Wall type: A3, B3, C3  (not to scale)

Detail 10
Wall/ Upper Floor Slab Junction
Concrete Masonry Cavity Wall: Cavity Insulation
Wall type: A4  (not to scale)
Note 1: Structural layout is indicative only and subject to individual project design.
Detail 11
Window - Head, Sill and Jamb
Concrete Masonry, Insitu or Precast: EIFS
Wall type: A2, B2, C2
Waterproof coating or membrane continuous at head and jamb as specified in section 3.1.5.3

Plaster or coating finish as specified in section 4.2, 4.3, 4.4

Drip edge formed from plaster or pvc angle

Additional weathertightness as specified in 4.2.3 (not required for weathertightness system 4.3 and 4.4)

Continuous head and jamb seal as specified in section 3.1.2 backed by a PEF rod

EXTERIOR

Window frame fixed to blockwork, and packed as required.

Sill membrane as specified in 3.1.5.4 beneath window/ door to run along the entire sill and down the external face of the sill and min. 40mm up jamb

Sill profile to provide min. 10mm overhang, with 5mm drainage clearance (vertical and horizontal)

Additional weathertightness as specified in section 4.2.3 (not required for weathertightness system 4.3 and 4.4)

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

INTERIOR

Water resistant ‘Air Seal’ as specified in section 3.1.2 backed by a PEF rod to perimeter of trim cavity

SILL

30mm

5mm

30mm

10mm

5mm

30mm

5mm

Comment 1: Structural layout is indicative only and subject to individual project design.

Comment 2: Thermal insulation is not required for weathertightness.

Details 12

Window - Head, Sill and Jamb

Concrete Masonry: Internal or integral Insulation

Wall type: A1, A3
Details 13
Window - Head, Sill and Jamb
Insitu or Precast Walls: Internal Insulation
Wall type: B1, C1

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

Detail 14
Window - Head, Sill and Jamb
Insitu or Precast Wall: Integral Insulation

Wall type: B3, C3
Comment 1: Structural layout is indicative only and subject to individual project design.
Comment 2: Thermal insulation is not required for weathertightness.

Detail 15
Window - Head, Sill and Jamb
Concrete Masonry Wall With Drained Cavity
Wall type: A4
Rigid roof insulation capable of taking pedestrian traffic loads

Linear drainage grill along length of door opening. Alternatively, a 12mm gap between deck and sill is required

Tile decking on Chairs on membrane protection pads, (pads not req. if pebble bed used)

Packer

Sill tray

Sill to provide minimum 10mm overhang, with 5mm drainage clearance (vertically and horizontally)

Roof membrane to be sealed and fixed to slab beneath door sill

Minimum 100mm upstand to membrane around deck perimeter

EXTERIOR

INTERIOR

Sill tray & packers

Roof/ deck membrane fixed below window/ door frame and threshold board

Timber threshold board

Water resistant 'Air Seal' as specified in section 3.1.2 backed by a PEF rod to perimeter of trim cavity

Minimum 100mm upstand to membrane around deck perimeter

45° chamfer to insulation

45° chamfer to screed

Vapour barrier

Roof screed to fall to roof gullies, fall ≥ 1.5°

Comment 1: Refer to detail 52 for deck types and setdown requirements.
Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 16
Door Threshold at Deck, External Deck Insulation
EXTERIOR
 Linear drainage grille along length of door opening. Alternatively, a 12mm gap between deck and sill is required
 Tile decking on Chairs on membrane protection pads, (pads not req. if pebble bed used)
 Sill to provide minimum 10mm overhang, with 5mm drainage clearance (vertically and horizontally)
 Roof membrane to be sealed and fixed to slab beneath door sill

Sill tray

Packer

INTERIOR
 Sill tray & packers
 Roof membrane fixed below window frame
 Timber threshold board
 Water resistant 'Air Seal' as specified in section 3.1.2 backed by a PEF rod to perimeter of trim cavity

45° chamfer to screed
 Roof membrane as specified in section 6.5
 Roof screed to fall to roof gullies, fall ≥1.5°

Minimum 100mm upstand to membrane around deck perimeter

≥100mm

≥100mm

Internal insulation, strapping and lining (indicative only, not req. for E2)

Comment 1: Refer to detail 52 for deck types and setdown requirements.
Comment 2: Structural layout is indicative only and subject to individual project design.
OPTION A:
With insulation beneath flashing to prevent cold bridging

- Drip profile to match EIFS
- Seal as specified in 3.1.1 backed by a PEF rod
- Compression seal to fix roof flashing and roof underlay
- Timber batten beneath compression seal
- Metal roof flashing to be fixed with compression seal
- Roof underlay, to run up 50mm behind EIFS base profile
- DPC to separate timber and wall

OPTION B:
Without insulation beneath flashing

- Seal as specified in 3.1.1 backed by a PEF rod
- Drip profile to match EIFS
- Compression seal to fix roof flashing and roof underlay
- Metal roof flashing to be fixed with compression seal
- 110mm min. upstand on metal roof flashing.
- Roof underlay

DPC strip to separate timber from concrete

Roof underlay

Fixing of rafters subject to structural design and indicative only

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

Detail 18
Wall/ Pitched Roof Junction: Apron Flashing
Concrete Masonry, In situ or Precast: EIFS

Wall type: A2, B2, C2
Drip profile, metal or PVC angle (only for plaster)

Chase to panel 5-10mm x 20mm deep

Metal over-flashing to be chased and sealed into wall with sealant as specified in section 3.1.1. Secured with self tapping screw

Profiled roof flashing and underlay to run up beneath over-flashing and to be mechanically fixed to wall.

All penetrating fixings to be beneath over-flashing

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

Finishing profile in case of external plaster

Metal over-flashing to be chased and sealed into wall with sealant as specified in section 3.1.1

Metal flashing to run up beneath over-flashing

Upstand of flashing to be at least 110mm from corner to top of flashing/ membrane

Roof sheeting with underlay beneath. Underlay to run up wall and be sealed beneath over-flashing

Light weight roof construction as specified in E2/AS1

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

Detail 19
Wall/ Pitched Roof Junction: Apron Flashing
Concrete Masonry, Insitu or Precast: Internal Insulation

Wall type: A1, A3, B1, C1
Comment: Structural layout is indicative only and subject to individual project design.

Detail 20

Wall/ Pitched Roof Junction: Apron Flashing

Insitu or Precast Walls: Integral Insulation

Wall type: B3, C3
Upstand of flashing to be at least 110mm from corner to penetration of compression seal.

Roof sheeting with underlay beneath.

Roof underlay:
- 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)
- Vertical joints to be open between bricks every 800mm max. to provide ventilation/weep openings of 1000mm²/m min.

Minimum dimensions as specified in E2/AS1, Table 7.

INTERIOR

Membrane as specified in 3.1.5.4 over insulation wedge to ensure water flow out through weep holes, provide stop ends at lintel ends.

DPC run up behind steel angle and timber support.

Roof underlay run up at least 100mm behind steel angle.

Steel angle to support brick veneer.

Seal as specified in 3.1.1 backed by a PEF rod, between steel angle and compression seal.

Compression seal to fix roof flashing and roof underlay.

Timber support beneath compression seal. Roof underlay membrane, to run up and round timber batten.

Fixing of rafter subject to structural design and indicative only.

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

Detail 21
Wall/ Pitched Roof Junction: Apron Flashing
Concrete Masonry Cavity Wall: Cavity Insulation

Wall type: A4
Light weight roof construction as specified in E2/A51

EXTERIOR

Soffit framing
Soffit lining board

DPC under top plate
DPC behind soffit framing
Concrete wall, Insitu, precast or concrete masonry

INTERIOR

EIFS as specified in section 4.1

Option A: Scotia with drip edge
Option B: Sealant as specified in section 3.1.1 over PEF rod

Option A: Scotia protecting plaster to soffit joint, or
Option B: Sealant over PEF rod

Option A: Scotia protecting plaster to soffit joint, or
Option B: Sealant over PEF rod

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

Detail 22
Wall/ Pitched Roof: Eaves Junction
Concrete Masonry, Precast or Insitu: EIFS
Wall type: A2, B2, C2
Weathertightness system as specified in section 4.2, 4.3, 4.4 or 4.5

Option A: Scotia with drip edge
Option B: Sealant as specified in section 3.1.1

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

Detail 23
Wall/ Pitched Roof: Eaves Junction
Concrete Masonry, Precast or Insitu: Internal Insulation
Wall type: A1, A3, B1, C1
Detail 24
Wall/ Pitched Roof: Eaves Junction
Precast or Insitu Wall: Integral Insulation
Wall type: B3, C3

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

Light weight roof construction as specified in E2/AS1

Concrete wall with integral insulation (insulation is indicative only, not required for weather tightness)

DPC under top plate

DPC behind soffit framing

Option A: Scotia protecting plaster to soffit joint, or Option B: Sealant

Weather tightness system as specified in section 4.2, 4.3, 4.4 or 4.5

EXTERIOR

Option A: Scotia with drip edge

Option B: Sealant as specified in section 3.1.1

10mm

Precast or Insitu Wall: Integral Insulation
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Comment: Structural layout is indicative only and subject to individual project design.

Detail 25

Wall/ Pitched Roof: Eaves Junction
Concrete Masonry Cavity Wall: Cavity Insulation
Wall type: A4
Detail 26
Wall/ Pitched Roof Junction: Verge Detail
Concrete Masonry, Precast or Insitu: EIFS
Wall type: A2, B2, C2

Comment: Structural layout is indicative only and subject to individual project design.
Soffit framing
Soffit board
Sealant
Scotia board protecting plaster to soffit joint or for soffit board lowered to top of concrete wall use Option A and B
Weathertightness system as specified in section 4.2, 4.3, 4.4 or 4.5

Option A: Scotia with drip edge
Option B: Sealant as specified in section 3.1.1

Soffit board lowered and depth of fascia extended to top of concrete wall (here Option A, scotia)

Light weight roof construction as specified in E2/AS1

DPC to separate timber and concrete wall
Internal insulation, strapping and lining (indicative only, not required for weathertightness)

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

Detail 27
Wall/ Pitched Roof Junction: Verge Detail
Concrete Masonry, Precast or Insitu: Internal Insulation
Wall type: A1, A3, B1, C1
Detail 28
Wall/ Pitched Roof Junction: Verge Detail
Insitu or Precast: Integral Insulation

Wall type: B3, C3
Light weight roof construction as specified in E2/AS1

DPC to separate timber and concrete wall

10-20mm

VENTILATION GAP

Soffit framing

Soffit lining board

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)

Concrete masonry wall

EXTERIOR

INTERIOR

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

Detail 29
Wall/ Pitched Roof Junction: Verge Detail
Concrete Masonry Cavity Wall: Cavity Insulation
Wall type: A4
Detail 30 b. Flat roof general built up, external insulation

- Roof membrane as specified in section 6.5, torched over bottom membrane.
- If membrane is not UV resistant a protection layer or pebbles shall be applied on top of the membrane.
- Double layer membrane as specified in section 6.5
- Rigid insulation capable of carrying pedestrian traffic loads
- Vapour barrier as specified in section 6.4.1, to keep insulation dry from vapour generated inside the building
- Slab or additional screed sloped to roof outlets, = 1.5°
- Concrete slab

Detail 30 a. Flat roof general built up, internal insulation

- Roof membrane as specified in section 6.5, if membrane is not UV resistant a protection layer or pebbles shall be applied on top of the membrane.
- Slab or additional screed sloped to roof outlets, = 1.5°
- Concrete slab
- (Thermal roof insulation applied underneath slab or in ceiling void (insulation is indicative only, not req. for E2))

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

Detail 31
Parapet with Profiled Capping
Concrete masonry, insitu or precast with external insulation
Wall type: A2, B2, C2
**Detail 32**

Parapet with Integral Capping, Option A

Concrete Masonry, Insitu or Precast: External Insulation

Wall type: A2, B2, C2

Comment: Structural layout is indicative only and subject to individual project design.
Detail 33
Parapet with Integral Capping, Option B
Concrete Masonry, Insitu or Precast: External Insulation
Wall type: A2, B2, C2

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

Detail 34a
Parapet with Profiled Capping, Option A
Concrete Masonry, Insitu or Precast: Internal Insulation
Wall type: A1, A3, B1, C1
**Detail 34b**

Parapet with Profiled Capping, Option B

Concrete Masonry, Insitu or Precast: Internal Insulation

Wall type: A1, A3, B1, C1

**Comment:** Structural layout is indicative only and subject to individual project design.
Detail 35
Parapet of In situ or Precast Wall
Internal Wall and Roof Insulation
Wall type: B1, C1

Comment: Structural layout is indicative only and subject to individual project design.
Detail 36a
Parapet with Profiled Capping, Option A
Insitu or Precast Wall: Integral Insulation
Wall type: B3, C3
**Detail 36b**

Parapet with Profiled Capping, Option B

Insitu or Precast Wall: Integral Insulation

Wall type: B3, C3
**Detail 37**
**Parapet of composite Insitu or Precast Wall**
(Wall with Integral Insulation)

Wall type: B3, C3

---

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

Detail 38
Parapet with Profiled Capping
Concrete Masonry Cavity Wall: Cavity Insulation
Wall type: A4
Double layer membrane as specified in section 6.5

Non-UV resistant membranes can be used when ballast, pavers or other covering layers protect the membrane

Roof gully (proprietary drainage gully as part of roof drainage system)

Roof membrane s to overlap and to be sealed onto roof outlet flange

Vapour barrier as specified in 6.4.1 to overlap and to be sealed to roof gully flange

Thermal roof insulation

Slab or screed to fall to roof gullies, fall min 1.5 dgr.

Concrete roof slab

Comment 1: Roof gullies to be located at lowest points of roof
Comment 2: At least two roof outlets required for each flat roof section
Comment 3: Structural layout is indicative only and subject to individual project design

Detail 39
Roof Gully
Concrete Roof/ Deck with External Insulation

(not to scale)
Roof Gully
Concrete Roof/ Deck with internal insulation

Comment 1: Roof gullies to be located at lowest points of roof
Comment 2: At least two roof outlets required for each flat roof section
Comment 3: Structural layout is indicative only and subject to individual project design

Detail 40
Roof Gully
Concrete Roof/ Deck with internal insulation
Detail 41
Roof Penetration (Light Dome/ AOV/ Hatch)
Concrete Roof/ Deck with External Insulation

Comment: Structural layout is indicative only and subject to individual project design.
Proprietary roof dome/ AOV, with prefabricated upstands and thermally insulated frame

Minimum membrane upstand of 150mm above finished roof level

Slab or screed to fall to roof gullies, fall min. 1.5°

Concrete slab

Roof membrane as specified in section 6.5

Non-UV resistant membranes can be used when ballast, pavers or other covering layers protect the membrane

Membrane shall extend to underside of frame overhang/drip edge of roof access unit

Insulation and strapping and lining or suspended ceiling with thermal insulation (indicative only, not required for weather tightness)

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

Detail 42
Roof Penetration (Light Dome/ AOV/ Hatch)
Concrete Roof/ Deck with Internal Insulation
**Roof/ Deck at Wall: Externally Insulated Deck**

**Concrete Masonry, Precast or Insitu Wall: External Insulation**

Wall type: A2, B2, C2

**Comment 1:** Refer to detail 51 for deck types and setdown requirements

**Comment 2:** Structural layout is indicative only and subject to individual project design.
Comment 1: Refer to detail 51 for deck types and setdown requirements
Comment 2: Structural layout is indicative only and subject to individual project design.

**Detail 44**

**Roof/Deck at Wall: Externally Insulated Deck**

**Concrete Masonry, Precast or Insitu Wall: Internal Insulation**

**Wall type:** A1, A3, B1, C1
**Detail 45**

**Roof/Deck at Wall: Externally Insulated Roof**

**Precast or Insitu Wall: Integral Insulation**

Wall type: B3, C3

Comment 1: Refer to detail 51 for deck types and setdown requirements

Comment 2: Structural layout is indicative only and subject to individual project design.
**EXTERIOR**

- Masonry veneer
- Clear cavity, 40mm min
- Brick tie (design shown indicative only, could also be cast into the inner masonry joints)
- Vertical joints to be open between bricks every 800mm max. to provide ventilation/weep openings of 1000mm²/m min.
- Tile decking on Chairs on membrane protection pads, (pads not req. if pebble bed used)
- 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

**INTERIOR**

- Thermal insulation (indicative only, not req. for E2)
- Concrete masonry wall
- DPC to base of cavity, set on insulation wedge, to direct cavity drainage through weep holes
- Vapour barrier to run up behind steel angle
- Steel angle to support brick veneer
- Roof membranes to run up 150mm and fixed to wall by compression seal
- Timber support between compression seal and wall. Roof membrane to run over top of timber batten
- Optional rebate of 25-100mm
- From top of interior finished floor to top of horizontal roof membrane
- Insulation wedge to internal corner of membrane
- 45° chamfer to screed
- Roof screed to fall to roof gullies, min. fall 1.5°

**Comment 1:** Refer to detail 51 for deck types and setdown requirements

**Comment 2:** Structural layout is indicative only and subject to individual project design.

**Detail 46**

*Roof/Deck at Wall: Externally Insulated Roof*

*Concrete Masonry Cavity Wall: Cavity Insulation*

Wall type: A4
**Detail 47**
**Roof/ Deck at Wall: Internally Insulated Roof**

Concrete Masonry, Precast or Insitu Wall: External Insulation

Wall type: A2, B2, C2

---

Comment 1: Refer to detail 52 for deck types and setdown requirements

Comment 2: Structural layout is indicative only and subject to individual project design.
Weathertightness system as specified in section 4.1, 4.2, 4.3, 4.4 or 4.5

Minimum 150mm upstand to membrane around deck perimeter

Roof membrane to run up 150mm and torched onto wall

Min. 12mm drainage gap btw. wall and deck at perimeter

Comment 1: Refer to detail 52 for deck types and setdown requirements
Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 48
Roof/ Deck at Wall: Internally Insulated Roof
Concrete Masonry, Precast or Insitu Wall: Internal Insulation
Wall type: A1, A3, B1, C1
Comment 1: Refer to detail 52 for deck types and setdown requirements
Comment 2: Structural layout is indicative only and subject to individual project design.

Detail 49
Roof/Deck at Wall: Internally Insulated Roof
Precast or Insitu Wall: Integral Insulation
Wall type: B3, C3
**Detail 50**

**Roof/ Deck at Wall: Internally Insulated Roof**

**Concrete Masonry Cavity Wall: Cavity Insulation**

Wall type: A4

---

Comment 1: Refer to detail 52 for deck types and setdown requirements

Comment 2: Structural layout is indicative only and subject to individual project design.
Comment 1: Where a clear gap of at least 12mm between the raised decking and the wall is provided, the deck can be level with internal floor (provided the level of the waterproofing layer is min 100mm below floor level). Where water may collect on the deck surface, the deck should be min 100mm below internal floor level.
A min. 150mm upstand of the roof membrane with no penetrations at all roof to wall and parapet junctions (except at thresholds this can be reduced to 100mm) is also required.
Comment 2: A 12mm perimeter gap is required between edge of deck and wall surface
Comment 3: Roof or Deck to wall junctions and membrane specifications are specified in Details 43 to 50

Detail 51
Decking Options
External Roof Insulation
Comment 1: Where a clear gap of at least 12mm between the raised decking and the wall is provided, the deck can be level with internal floor (provided the level of the waterproofing layer is min 100mm below floor level). Where water may collect on the deck surface, the deck should be min 100mm below internal floor level.

A min. 150mm upstand of the roof membrane with no penetrations at all roof to wall and parapet junctions (except at thresholds this can be reduced to 100mm) is also required.

Comment 2: A 12mm perimeter gap is required between edge of deck and wall surface

Comment 3: Roof or Deck to wall junctions and membrane specifications are specified in Details 43 to 50

Detail 52

Decking Options

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

Detail 53
Penetration Through Wall
Concrete Masonry, Insitu or Precast wall: EIFS

Wall type: A2, B2, C2
Comment: Structural layout is indicative only and subject to individual project design.

**Detail 54**

**Penetration Through Wall**

Concrete Masonry, Insitu or Precast wall: Internal Insulation

Wall type: A1, A3, B1, C1
Comment: Structural layout is indicative only and subject to individual project design.

Detail 55
Penetration Through Wall
Insitu or Precast wall: Integral Insulation

Wall type: B3, C3
Comment: Structural layout is indicative only and subject to individual project design.

Detail 56
Penetration Through Wall
Concrete Masonry Cavity Wall: Cavity Insulation
Wall type: A4
**Detail 57a**

**Service Box Set Into Wall**

**Concrete Masonry: EIFS**

Wall type: A2, B2, C2

---

Comment: Structural layout is indicative only and subject to individual project design.
Detail 57b
Service Box Set Into Wall
Precast or In situ: EIFS

Wall type: A2, B2, C2

Comment: Structural layout is indicative only and subject to individual project design.
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 58a**

**Service Box Set Into Wall**

**Concrete Masonry: Internal Insulation**

Wall type: A1, A3
Detail 58b
Service Box Set Into Wall
Insitu and Precast: Internal Insulation
Wall type: B1, C1
**EXTERIOR**

- Weathertightness system as specified in section 4.2, 4.3, 4.4 or 4.5
- Closed cell foam (not req. for E2) to isolate outer from inner concrete layers
- Continuous head and jamb seal over PEF backing rod. Sealant as specified in section 3.1.1
- Top of panel to slope at least 5 dgr.

**INTERIOR**

- Thermal insulation (indicative only, not required for weathertightness)
- Membrane as specified in section 3.1.7.3 continuous at head and jambs
- Service box
- Sealant as specified in 3.1.1
- Membrane as specified in 3.1.7.4 to run along the entire sill, down the face to overlap weathertightness system for min. 30mm and min. 40mm up jambs

**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 59**

**Service Box Set Into Wall**

**Precast or In situ Wall: Integral Insulation**

Wall type: B3, C3
Detail 60
Service Box Set Into Wall
Concrete Masonry, cavity wall
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.
**Detail 61**
Concrete Wall Adjoining Other Wall Construction
EIFS
Wall type: A2, B2, C2

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

**Detail 62**
Concrete Wall Adjoining Other Wall Construction
Internal Insulation
Wall type: A1, A3, B1, C1

**Comment 1**: Structural layout is indicative only and subject to individual project design.
**Comment 2**: Insulation shown is indicative only, not required for weathertightness.
Lightweight wall construction, refer to E2/AS1

Detail 63
Concrete Wall Adjoining Other Wall Construction
Integral Insulation
Wall type: B3, C3

Detail 64
Concrete Wall Adjoining Other Wall Construction
Cavity Insulation
Wall type: A4
Detail 65  (vertical section)
Concrete Wall adjoining other material above.
Concrete Masonry, Precast or Insitu: EIFS
Wall type: A2, B2, C2

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

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

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 67** (vertical section)
Concrete Wall adjoining other material above.
Insitu or Precast Wall: Integral Insulation
Wall type: B3, C3

**EXTERIOR**
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°
DPC to extend down and overlap the wall weathertight system by at least 30mm
Weathertightness system as specified in section 4.2, 4.3, 4.4 or 4.5

**INTERIOR**
Light weight wall as specified in E2/AS1 (direct fixed or cavity wall)
DPC to separate steel bracket and timber and sealed over top of weathertightness system
Steel bracket every 600mm, bolted to slab
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 68** (vertical section)
Concrete Wall adjoining other material above.
Concrete Masonry Cavity Wall: Cavity Insulation
Wall type: A4

**EXTERIOR**
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°
Cavity ventilation gap of at least 10mm at narrowest section
Brick tie (design shown indicative only, could also be cast into the inner masonry joints)
Masonry veneer
Clear Cavity, 40mm min
Thermal insulation

**INTERIOR**
Light weight wall as specified in E2/AS1 (direct fixed or cavity wall)
DPC to separate steel bracket and timber
Steel bracket every 600mm, bolted to slab
Timber structure to project over slab edge max. 20mm
DPC to extend down and overlap the insulation by at least 30mm
Concrete slab
Concrete masonry 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.
Sealant as specified in 3.1.1 over PEF rod to ex- and interior PVC trim

Detail 69a Vertical control Joint: EIFS, horizontal section

Sealant as specified in 3.1.1 over PEF rod to ex- and interior

Detail 69b Vertical control Joint: Plastered masonry wall, horizontal section

Sealant as specified in 3.1.1 over PEF rod to ex- and interior

Detail 69c Vertical control Joint: Precast wall, horizontal section

Sealant as specified in 3.1.1 over PEF rod to ex- and interior

Detail 69d Horizontal Panel Joint: Precast, vertical section

Applies also to internal and integral insulation.
Joint does not show in internal insulation.

Comment 1: all joints to be primed prior to sealant installation

Comment 2: all sealant joints to be sized 2:1 (width equals two times depth)

Comment 3: drawings are not to scale

Sealant as specified in 3.1.1 over PEF rod to ex- and interior

Detail 69e Vertical control Joint: Insitu with weathertightness system 4.2, 4.3, 4.4 and 4.5, horizontal section
Joints are planned for cracks

Applies also to internal and integral insulation.
Joint does not show in internal insulation.

Sealant as specified in 3.1.1 over PEF rod to ex- and interior

Detail 69f Vertical control Joint: Insitu with EIFS, horizontal section
Joints are planned for cracks

Applies also to internal and integral insulation.
Joint does not show in internal insulation.
a) Concave

Suitable for weathertightness systems as specified in section: 4.1, 4.2, 4.3 and 4.4

b) Vee

Suitable for weathertightness systems as specified in section: 4.1 and 4.2

c) Flushed after tooling

Suitable for weathertightness systems as specified in section: 4.1, 4.2, 4.3 and 4.4

Detail 70
Mortar joints

All joint profiles - to be tooled and retooled
REFERENCES

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in this Code of Practice shall be the editions, along with their specific amendments, listed below. Where these primary reference documents refer to other Standards or documents (secondary reference documents), which in turn may also refer to other Standards or documents, and so on (lower-order reference documents), then the version in effect at the date of publication of this document shall be used.

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Amend: 1, 2, 3 |
| NZS 4229: 1999      | Concrete masonry buildings not requiring specific design |
| NZS 4230: 2004      | Design of reinforced concrete masonry structures |
| SNZ HB 4236: 2002   | Masonry Veneer Wall Cladding       |
| NZS 4251            | Solid plastering

Part 1: 2007
Cement plasters for walls, ceilings and soffits |
| AS/NZS 4256         | Plastic roof and wall cladding materials

Part 2: 1994
Unplasticized polyvinyl chloride (uPVC) building sheets |
| AS/NZS 4455: 2008   | Masonry units, pavers, flags and segmental retaining wall units |
Where quoted in CCANZ CP 01: 2011

AS/NZS 4456.16: 2003 Masonry units, segmental pavers and flags - Methods of test

AS/NZS 4671: Steel reinforcing materials

AS/NZS 4858: 2004 Wet area membranes

Australian Standards

AS 1012.21: Method 21: Determination of water absorption and apparent volume of permeable voids in hardened concrete (AVPV method)


American Society for Testing and Materials


ASTM C755-10 Standard Practice for Selection of Water Vapor Retarders for Thermal Insulation

ASTM D2842-06 Standard Test Method for Water Absorption of Rigid Cellular Plastics

ASTM D903: 2010 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds


ASTM D7105: 2006 Standard Test Method for Determining the Adhesive and Cohesive Strength Between Materials in Roofing or Waterproofing Membranes and Systems


Where quoted in CCANZ CP 01: 2011


Building Research Association of New Zealand

BRANZ EM 5: 2005 Evaluation method for adhesives and seam tapes for butyl and EPDM rubber membranes 6.5.1, 6.5.2

BRANZ Bulletin 424 "Measuring moisture on building sites" 8.2

Cement and Concrete Association of New Zealand

TM 34 Tilt Up Technical Manual: 3.4.1

TM 35: 2010 New Zealand Guide to Concrete Construction 3.3.3

New Zealand Concrete Masonry Manual: 1999 3.2.9.4

Other organisations and references

Concrete Institute of Australia: 4.5

Watertight Concrete Structures - Current Practice Note 28

Membrane Group New Zealand: 6.5.1, 6.5.2

Code of Practice for Torch-on Membrane Systems for Roofs and Decks

New Zealand Metal Roofing Manufacturers Inc: 5.2

New Zealand Metal Roof and Wall Cladding Code of Practice: 2008

EIMA 101.91: 1992 EIFS Industry Members Association: Standard Guide for resin of resin coated glass fibre mesh in exterior insulation and finish systems (EIFS), Class PB. 4.1.3.2

ISO 11600: 2002 Building Construction – Jointing products Classification and requirements for sealants 3.1.1, 3.1.2, 3.1.4.1

Federal Specification Standard TT-S-00230C Elastomeric type, cold applied single component for caulking, sealing, and glazing in buildings, building areas (plazas, decks, pavements), and other structures 3.1.1, 3.1.2, 3.1.4.1

ICBO Evaluation Services Inc AC148 Acceptance criteria for flashing materials 3.1.5.4
Additional key resources

Standards New Zealand

NZS 3151: 1974  Precast lightweight concrete panels and slabs
AS/NZS 2904: 1995  Damp-proof courses and flashings
AS/NZS 4284: 2008  Testing of building facades
AS/NZS 4680: 1999  Hot-dip galvanized (zinc) coatings on fabricated ferrous articles

Australian Standards

AS 3706  Geotextiles - Methods of test (13 Parts)
AS 3730  Guide to the properties of paints for buildings

British Standards Institution

BS 6538: 1987  Air permeance of paper and board
  Part 3: 1987  Method for determination of air permeance using the Garley apparatus
BS 6925: 1988  Specification for mastic asphalt for building and civil engineering (limestone aggregate)
BS EN 988: 1997  Zinc and zinc alloys. Specification for rolled flat products for building

American Society for Testing and Materials


Building Research Association of New Zealand

BRANZ Bulletin 330: 1995  Thin flooring materials (2)
  Preparation and laying. Appendix 1
BRANZ Weathertight Solutions Volume 4: Section 2

Other organisations and references

National Precast Concrete Association of Australia and Concrete Institute of Australia: Precast Concrete Handbook (2002), republished in 2004 with a commentary for New Zealand users by CCANZ and Precast New Zealand Inc

ISO 9223: 1992  Corrosion of metals and alloys; corrosivity of atmospheres; classification
DEFINITIONS
This is an abbreviated list of definitions for words or terms particularly relevant to this Code of Practice.

Air seal A continuous water resistant seal fitted between a window or door reveal and the surrounding wall framing to prevent the flow of air into the interior of the building.

AOV Automatic opening vent.

Apron flashing A near flat or sloping flashing with a vertical upstand, used at junctions between roofs and walls.

Balustrade A barrier to prevent people from falling over the edge of a roof/ deck. Balustrades may be formed from concrete or masonry wall around a roof/ deck or from a handrail and stanchions fixed to a parapet. See also Parapet.

Building A building has the meaning given to it by Sections 8 and 9 of the Building Act 2004.

Building element Any structural and non-structural component and assembly incorporated into or associated with a building. Included are fixtures, services, drains, permanent mechanical installations for access, glazing, partitions, ceilings and temporary supports.

Capping A flashing formed to cover the exposed top of a balustrade or parapet. Also known as a coping.

Cladding An exterior weathertight system used to prevent water entry into the building.

COMMENT:
Includes any supporting substrate and, if applicable, weathertight coatings or membranes.

Cladding system The weathertight enclosure of a building, including claddings and their fixings, windows, doors and all penetrations, flashings, seals, joints and junctions.

Concrete A combination of graded aggregates, cement, water, sand and admixtures manufactured in accordance with NZS 3104,

Concrete masonry Construction using concrete masonry blocks manufactured using cement and aggregates in accordance with AS/NZS 4455, which are reinforced and either fully or partially filled with grout in accordance with NZS 4210. This definition excludes aerated concrete blocks.

Composite precast panel A precast panel where insulation is placed integrally within the thickness of the panel.

Control joint A joint designed to prevent damage by accommodating movement. See also Expansion joint.

Damp-proof course (DPC) A narrow strip (generally up to 300 mm wide) of durable vapour barrier placed between building elements to prevent the passage of moisture from one element to another.

Damp-proof membrane (DPM) A sheet material or coating, as specified in section 7.4, used to prevent water ingress from the ground into the concrete.

Deck A roof designed for pedestrian traffic.

COMMENT:
This definition of ‘deck’ has a narrower scope than is commonly used, eg cantilevered balconies are not part of this definition.
**Drip edge** horizontal edge formed from plaster, metal profile or PVC profile to deflect water away from the cladding system.

**Durable** Resistant to wear and decay.

**Eaves** That part of the roof construction, including cladding, fascia and gutter, that extends beyond the exterior face of the wall.

**EIFS (Exterior Insulation and Finish System)** A polystyrene sheet-based weatherproof finish system that uses mesh reinforced polymer modified cement-based or polymer-based plaster base coats and a protective top coating.

**Expansion joint** A joint designed to prevent damage by accommodating movement. See also **Control joint**.

**External wall** Any exterior face of a building within 30° of vertical, consisting of primary and/or secondary elements intended to provide protection against the outdoor environment, but which may also contain unprotected areas.

**COMMENT:**
A roof is an external wall if within 30° of the vertical.

**Flashing** A component, formed from a rigid or flexible waterproof material, that drains or deflects water away from the cladding system and from junctions.

**Insitu concrete construction** Construction where concrete is cast into formwork on site into its final position.

**Integral insulation** Insulation placed integrally within the thickness of a precast panel, insitu concrete or masonry element.

**Lining** The rigid sheet covering for a wall, ceiling or other interior surface.

**Masonry veneer** Clay or concrete block veneer cladding.

**Membrane** A pliable sheetlike waterproofing layer, applied as a fluid or as a sheet

**NZRMCA Plant Audit Scheme** an independent verification that concrete complies with NZS 3104.

**Outlet (drainage)** A proprietary downpipe cover to secure a deck or roof membrane transition.

**Parapet** The exposed top of a concrete or concrete masonry wall that extends above the level of the roof or deck. See also **Balustrade**.

**PEF Rod** Closed cell polyethylene foam in accordance with ASTM C1330 used as joint backing material in conjunction with elastomeric sealant.

**Plaster** Mixture of dry mineral materials including cement and polymers as required that when mixed with water sets hard.

**Polymer Plaster** Mixture of wet mineral and polymer material that sets hard on exposure to air.

**Poorly Drained Site** Ground where a hole of size 0.3 m/ 0.3 m/ 0.3 m (length/ width/ depth) filled with water takes more than 6 hours to drain
**Precast Concrete Construction** Construction where prefabricated concrete elements are assembled on site into their final position.

**COMMENT:**
Precast concrete is typically cast offsite but can sometimes be cast onsite; for example, as tilt-up panels cast adjacent to their final position.

**Proprietary** A product or system manufactured or distributed by one owner of the patent, formula, brand name or trade mark associated with the product.

**Rebate** A recess in a wall joint, opening or floor slab to restrict water entry.

**Render** A term synonymous with plaster.

**Roof** That part of a building having its upper surface exposed to the outside and at an angle of 60 degrees or less to the horizontal.

**Roof underlay** An absorbent permeable building paper that absorbs or collects condensation or water that may penetrate the roof cladding or metal wall cladding.

**Saddle flashing** A flashing used to make a weathertight junction between the horizontal top of a wall and the vertical face.

**Sandwich Panel Construction** See Composite precast panel construction.

**Screed** A layer of thin plaster or concrete as a floor topping.

**Specific design** Design and detailing of a proposed building or parts of a building, which are outside the scope of this Code of Practice.

**Special concrete** Concrete with a compressive strength over 50 MPa, or concrete where a property other than compressive strength forms the basis of a specification.

**Stanchion** A pole or other connecting device, fixed into the structure of a building, which provides support for handrails, aerials and similar structures.

**Storey** That portion of a building included between the upper surface of any floor and the upper surface of the floor immediately above, except the top storey shall be that portion of a building included between the upper surface of the topmost floor and the ceiling or roof above.

**Wall** A vertical structure closing in part of the building, or dividing the internal space.

**Waterproof** and **waterproofing** The complete and total resistance of a building element to the ingress of any water in either liquid or vapour state.

**Waterproof membrane** A membrane impervious to water which is placed to prevent the passage of water and water vapour through a concrete or concrete masonry element.

**Watertight concrete** Concrete which itself is impermeable to water except when under a hydrostatic pressure greater than 5KPa. Such concrete does not stop the passage of water vapour. Watertight concrete has a low water/cementitious (w/c) ratio and contains a permeability reducing admixture.
**Weathertightness** and **weathertight** Terms used to describe the resistance of a building to the weather. Weathertightness is a state where water is prevented from entering and accumulating behind the cladding in amounts that can cause undue dampness or damage to the building elements.

**COMMENT:**
A weathertight building, even under severe weather conditions, is expected to limit moisture ingress to inconsequential amounts, insufficient to cause undue dampness inside buildings and damage to building elements. Moisture that may occasionally enter is able to harmlessly escape or evaporate.

**Weatherproof** A term synonymous with weathertight and usually referring to a component of a weathertight system. In general, this document uses the terms 'weathertight' and 'weathertightness' in preference.

**Weathertight coating** A multi-coat liquid applied coating system applied to exterior walls to make them weathertight.