Health and amenity

The goal of the BCA is to enable the achievement of nationally consistent, minimum standards of safety, health, amenity and sustainability. Part 3.8 of Volume 2 focuses on the construction practices that will satisfy the performance requirements for health and amenity for Class 1 and 10 buildings. The section is divided into the following topic areas:

- wet areas and external waterproofing
- room heights
- facilities
- light
- ventilation, and
- sound insulation.

Wet areas and waterproofing

Wet area floor detailing is an important area for your knowledge of construction methods in residential building. Its relationship to other parts of construction means that a thorough understanding of the requirements as laid out in the BCA is essential. In addition, inspection of waterproofing is a mandatory inspection for development approval in some states.

An essential aspect of waterproofing is that the tiniest flaw is unacceptable because, for example, just a pinprick in the membrane can produce a lot of damage to structural members in addition to the unsightliness and health issues associated with damp and mouldy walls, floors and ceilings.

The BCA, Australian Standards and Master Builders Association Guidelines

The Building Code of Australia (BCA) specifies a performance requirement for wet areas which can be satisfied by carrying out construction in accordance with AS 3740 \textit{Waterproofing of domestic wet areas}, and by complying with Table 3.8.1.1.

The Australian Standard AS 3740 addresses construction details in wet areas by looking at

- the design criteria which need to be met,
- the materials and their appropriate use in various areas,
- correct installation techniques, and
- the degree of risk of water damage that can be caused by failure of the waterproofing system.

Table 3.8.1.1 of the BCA specifies

- the building elements in wet areas that need to be waterproof, and
• the building elements in wet areas that need to be water resistant.

Master Builders Association “Guide to Internal Wet Area Waterproofing”

In response to the widespread incidence of poor waterproofing installations, the Master Builders Association Waterproofing Council Technical Committee published a guide that details industry best practice for internal wet area waterproofing. The aim of producing this document was to provide an easy to use reference for builders and waterproofing installation specialists as an initial step toward improving this aspect of construction. All aspects of internal wet area waterproofing are addressed in this booklet.

The Master Builders Association also produces a publication called “Guide to External Wet Area Waterproofing – Balcony and Decks”

Read the BCA Part 3.8.1 Wet Areas and external waterproofing.

The waterproofing elements in wet areas in residential buildings are designed according to the potential risk of water damage to the structure and finishing systems. Depending on the degree of risk, the types of materials used and their locations in the construction, there are some general principles that should be considered when resolving details. In particular, the following potential problem areas should be considered:

**Leakage through finishes**

Finishes in wet areas are required to be water resistant, but water will almost always penetrate wall and floor finishes in wet areas. The amount will depend on the frequency, intensity and duration of the exposure. This water must be directed away from moisture sensitive elements, otherwise damage could occur to the materials underneath and adjacent to the wet area. Structural elements could be damaged and mould growth could occur.

Water penetration often occurs at joints where cracks are common if detailing has not been performed carefully. Water can also pass over a sound waterproof membrane if it has not been detailed correctly.

**Movement**

Joints between units of lining materials are the main source of water penetration. At floor and wall corner junctions in particular, minute cracks can occur and these will draw in water. This cracking usually occurs as a result of movement of structural elements to which linings and then finishes are attached. For example, as unseasoned timber members dry out, movement from shrinkage can occur. This is typically observed at corner studs and bottom plates of walls.

**Natural drainage**

Cracks at grouted joints can provide a safety valve. In some instances, the horizontal joint at the bottom of the tiled area of the wall is able to drain water that has penetrated the wall finish.

**Aspects of waterproofing design**

**Walls**

Potential movement of corner studs is restricted if the studs are fastened to blocking pieces. In seasoned softwood or metal, this is usually done anyway, to restrict structural deflection.
In hardwood members (which are usually unseasoned), blocking is required to reduce the shrinkage effect not necessarily for structural reasons.

Generally, linings are impervious enough to shield wall framing against damage from water that penetrates tiled finishes in wet areas. However, the joints between sheets and their junctions with other materials require special attention. Therefore, vertical corner joints should be provided with flashing angles and flexible sealant, and perimeter joints should be protected by the use of a shower tray or continuous waterproof membrane. The bottom edge of wall sheets should be installed to overlap adjoining materials.

Note in the figure above, that the water resistant wall lining extends down below and inside of the top edge of the shower tray. Any water that penetrates the grout of the tiled finish will drain down the face of the water resistant wall lining and finally into the shower floor waste.

In the figure above, the wall lining extends below the level of the lip on the bath edge, so that any water that penetrates the tiled finish will drain into the bath and not into the wall.
Floors

It is recommended that floors have a fall of between 1 in 80 and 1 in 100, so that most surface water flows directly into the floor waste.

Some water will penetrate floor finishes, and the screeds beneath them tend to retain moisture. An impervious barrier or waterproof membrane is required to prevent downward and sideways travel of water into adjoining construction elements or rooms. A drainage system within the tile bed should be provided to allow this moisture to discharge into the waste fitting or pipe.

It is vital that the moisture barrier is installed to allow for the expected movements of the framing previously discussed. In-situ trays and angle flashings should be able to cover floor to wall joints without tearing or breaking when the framing members move. As some materials are not sufficiently elastic to stretch without tearing, installation of a bond breaker at the wall/floor junction is vital. Bond breakers can be either a flexible foam backing rod combined with a suitable bond breaker tape or a suitable flexible sealant (see Waterproofing system components heading later, for more information on bond breakers). External prefabricated trays and flashing angles should only be fixed to the floor, allowing the sides to accommodate movement.

Shower recesses

The fall within a shower recess should be between 1 in 60 and 1 in 80, to allow water to drain directly into the shower floor waste. It is difficult to obtain this fall with large tiles especially in what is usually a very small area unless the shower floor waste is a linear drain.

The wall and floor tiles are intended to direct water to the outlet, but significant amounts of water will penetrate these surfaces and accumulate in the tile bed. It is important that a waterproof membrane is able to contain this water and allow it to also drain into the floor waste.

Surfaces that are to be coated with a waterproofing membrane should be smooth and continuous because cavities, voids and protrusions can damage or impair these coatings.

Waterproofing system components

Main Waterproofing Materials

Waterproofing systems can be classified into 3 different types. These are:

1. Rigid System
   These include fibreglass (resin based), metal based systems and water based epoxies.

2. Flexible system
   These consist mostly of acrylic membranes and bitumen based emulsion or mastic.

3. Elastomeric system
   These consist of water-based and solvent-based polyurethane, flexible sheet PVC and sheet rubber membranes.
**Wall and floor linings**

Walls and floors in wet areas may be required to be **water resistant** or **waterproof**. A water resistant material will restrict water movement and will not degrade when subjected to moisture for prolonged periods. A waterproof material will not allow any penetration of moisture. Where components are required to be waterproof, a waterproof membrane or sheet, or a metal lining is required that will be integrated into the waterproofing system.

The walls in shower recesses and above wet area fixtures will generally be required to be water resistant as a minimum requirement. Materials commonly used for this purpose in conjunction with a water resistant surface material include:

- concrete and masonry, treated to resist moisture if for walls,
- fibre cement sheeting (CFC) for walls and floors,
- water-resistant plasterboard or particleboard sheeting, and
- structural plywood for floors.
- Water resistant surface materials (finishes) include:
  - pre-decorated fibre cement sheeting,
  - water-resistant flexible sheet material with sealed joints, and
  - grouted tiles.

**Flashing angles**

The perimeter of wet area rooms at the wall/floor junction should be sealed with flashing angles to prevent moisture penetration to adjoining surfaces or building elements. In conjunction with the waterproof or water resistant flooring material to which the base of the angle is sealed, this angle forms a fully contained vessel that can hold and drain water to a floor waste.

The image above shows the perimeter flashing angle at the door to the wet area. The angle is continuous with a water stop that finishes level with the top surface of the tile floor finish. The angle is continuous around the rest of the room.
Flashing is also required at internal and external corners of wall to wall junctions to prevent moisture penetrating joints.

The type of flashing angle required and the method of installation will vary depending upon the type of adjoining material and the chosen wet area design.

Flashing angles can be either preformed or formed in-situ. Preformed products are generally plastic; in-situ products include fibreglass reinforced plastic, epoxy resins and acrylics.

This image shows the installation of an acrylic waterproofing material to an internal corner joint.

**Membranes**
Membranes are used in wet areas to form an impervious barrier to moisture; in other words, to form a waterproof layer.

There are a vast number of membrane products available for use in residential wet area construction. Recent research conducted by the CSIRO has established a classification system for membranes based on the extent to which they will stretch before breaking. This flexibility is important for avoiding breakage of the membrane if the substance to which it is attached moves. The classifications are as follows:

Class 1 – this class of membrane breaks before it reaches an extension of 65% (that is, it stretches to a length 65% more than its original length). These membranes are relatively rigid and break or tear quite easily once stretched. Examples of this type of membrane include:

- fibreglass
- metal, such as a shower tray
- water based epoxies
Class 2 – this membrane type breaks at an elongation of between 65% and 200%. These membranes are relatively flexible and can withstand a greater degree of elongation before breaking or tearing. Examples of this type of membrane include:

- acrylic membranes (a water based system that is applied in coats)
- bitumen based membranes. These products are more suitable to external usage such as balconies because the bitumen can leach into adjoining materials and cause staining.

Class 3 – have a membrane elongation at break of greater than 200%. These are highly flexible membranes. Examples include:

- water based polyurethane
- solvent based polyurethane
- sheet rubber
- PVC sheet membrane

**Bond breakers**

A continuous membrane that is applied to the wall and floor of a wet area is bridging a gap that is susceptible to movement. Movement may cause the membrane to stretch and possibly to fail. The ability of a membrane to withstand movement and subsequent damage will depend upon the flexibility, as mentioned above, and also on the amount of *unbonded* membrane that is available to stretch or move with the joint separation.

A *bond breaker* is used to isolate sufficient length of the membrane to allow for reasonable movement in the joint. Three different techniques are commonly used depending on the flexibility of the membrane that is used and the degree of movement expected.

The three types of bond breaker are illustrated above: - backing rod with masking tape to hold in place, masking tape alone, and silicone or polyurethane fillet. The type that is most suitable depends on the type of membrane that is used, and the length of un-bonded membrane required.
**Preformed shower trays and bases**

Preformed shower trays are usually made of copper or stainless steel and are installed with the wall lining extending into the tray. If there is a hob, it is constructed inside the shower tray, and the floor and wall linings are installed over the metal of (or inside) the tray.

A problem that can occur with shower trays is that water can be drawn up behind the wall lining by capillary action and therefore seep outside of the tray and onto adjacent structural members or into adjacent living areas. This is because the sides of the tray are not high enough or the overlap of the wall lining is not low enough to prevent water moving upward by capillary action over the edge of the tray.

*Shower bases* are usually acrylic or metal prefabricated bases that are installed as the shower floor. They must be fixed securely to the floor and the floor under them should be waterproofed. The wall lining is installed to lap over the top edge of the base, so that water drains directly into the waste. However, capillary action can also be a problem with prefabricated bases, so careful sealing at the base of the wall lining is required.
This image above shows an acrylic shower base in a partly completed shower recess. Note that the wall lining finishes over the lip of the base, so that water that penetrates the wall finish will drain directly into the base and into the floor waste.

Careful attention must be paid to the compatibility of materials in contact with each other at the floor waste.

**Water stops**
A water stop is an angle usually made of aluminium or brass that is attached to the floor (or hob), and projects up so that the top is level with or projects above the level of the tile surface. The purpose of the water stop is to prevent water movement across or over this barrier and into a non-waterproofed area.
Sealants
The purpose of a sealant is to provide a waterproof joint between two materials. Sealants should be compatible with the materials to which they are adhered and be flexible and mould-resistant.

Read also Acceptable Standards of Construction – Class 1 & 10 Buildings Section 17

Room heights
The performance provisions of the BCA require that the height of a room or space does not unduly interfere with the intended function of that space.

Read Part 3.8.2 of Volume 2 of the BCA and examine the diagram. Answer the following:

1. What is meant by a habitable room?
2. Is a kitchen a habitable room?
3. What is the general requirement for the ceiling height for a habitable room?
4. What are the exceptions to the above rule for habitable rooms?
5. An attic with a one-way sloping roof is 4.2 m wide and is 3.00 m high on one side and 1.72 m high on the other side. Will this room satisfy the requirements of the BCA?

(Answers at the end of this topic)

Facilities
According to the BCA, a Class 1 building MUST be provided with:

- a kitchen sink and food preparation and cooking facilities; and
- a bath OR shower; and
- clothes washing facilities, with a washtub and space for a washing machine in the same room, and
- a closet pan and washbasin.
There are additional requirements for facilities for people with a disability for Class 1b and Class 10 buildings. These requirements are set out in Volume 1 of the BCA.

Clause 3.8.3.3 in Volume 2 of the BCA specifies the requirements for the door to an enclosed sanitary compartment.

Read Clause 2.4.3 and Part 3.8.3 of Volume 2 of the BCA. Answer the following:

1. What is the purpose of the door requirements of a sanitary compartment?

2. Can a washbasin in a bathroom be considered as fulfilling the requirements for a washtub if there is space for a washing machine in the bathroom and there is no separate laundry?

(Answers at the end of this topic)

Light

The BCA Volume 2 requires that every habitable room in a Class 1 building must have natural lighting, and that it must be provided by a window or a roof light or a combination of the two. In addition, the light transmitting area must be equal to or greater than a specified proportion of the floor area of the room.

Read Clause P2.4.4 and Part 3.8.4 and answer the following questions:

1. A living area that measures 10 m by 5.5 m on the drawings for a development application has no 'windows' or 'roof lights', but has glazed stacking doors measuring 2.4 m high by 6.42 m wide that open directly to the back garden. Will the glazed doors satisfy the performance provision detailed in Clause P2.4.4?

2. If the aggregate light transmitting area of the glazed doors is estimated to be 13.2 m², will the deemed to satisfy requirements of clause 3.8.4.2 be satisfied?

3. Is natural lighting required for a bathroom?

(Answers at the end of this topic)

Ventilation

A space inside a building that is used by occupants must have ventilation from the outside to maintain adequate air quality. This is stated in the performance provisions P2.4.5 of the BCA. This ventilation may be provided via:

- permanent openings into the space that is occupied, such as doors or windows;
- an opening from an adjoining room;
- an exhaust fan;

providing that other requirements as stated in Clause 3.8.5.2 are met, or provided an alternative solution is provided that satisfies the performance provisions.

Read clause P2.4.5 and Part 3.8.5 and answer the following questions:

1. A room on the floor plans for a residential development application has no direct ventilation. However it is adjacent to a room that has a window opening to the outside air. The area of the windowless room is 15 m², and that of the adjacent room is 18 m². What area is required for a door or other opening between the rooms to ventilate the windowless room? Can this be provided by a standard 820 x 2040 mm door?
2. In the problem above, the window is 2650 x 2100, but only two panes of 1350 mm x 675 mm are openable. Is this sufficient to fulfil the deemed to satisfy provisions of the BCA?

(Answers at the end of this topic)

Sound insulation

To prevent illness or loss of amenity to the occupants of a building, a building element which separates dwellings is to be constructed to prevent undue sound transmission between those dwellings. For Class 1, this is most usually between adjoining dwellings such as town houses, terrace houses and duplexes. P2.4.6 of the BCA specifies the performance requirements as:

a. walls that separate dwellings must be insulated to reduce the transmission of airborne sound such that there is no illness or loss of amenity to the adjoining occupants,

b. walls that separate a bathroom, sanitary compartment, laundry or kitchen in one dwelling from any habitable room in an adjacent dwelling must be insulated such that airborne sound transmission is reduced to prevent illness or loss of amenity to the occupants of the adjacent dwelling,

c. any sound insulation requirement must not be compromised by the incorporation or penetration in the wall of any pipes or other service installations.

Section 3.8 Part 6 then provides examples of deemed to satisfy construction methods to fulfil the requirements for sound insulation. Read all of 3.8.6 and do some additional research (e.g. 2004 ABCB Sound Insulation Handbook) to answer the following questions:

1. What is ‘RW + Ctr’?
2. What does the value of Ctr account for that RW does not?
3. Can you name some good design practices for the planning stages for multi-residential buildings with respect to sound insulation?
4. What Standards are to be followed in determining values of RW + Ctr?
5. What does discontinuous construction mean?
6. Is staggered stud wall construction considered to be discontinuous construction?
7. Give a description of the attenuation of noise for an RW + Ctr value of 50.
8. Sketch an acceptable separating wall between the bathroom of one dwelling and the lounge room of an adjacent dwelling.

(Answers at the end of this topic)

Additional reading:

For some general information about the practical issues associated with planning and design relating to the issues covered in this topic, read Building Your Own Home, Topics:

- 43: Windows
- 60: Kitchens
- 61: Bathrooms
<table>
<thead>
<tr>
<th><strong>Glossary</strong></th>
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<tbody>
<tr>
<td><strong>capillary action</strong></td>
<td>movement of a liquid upwards (against gravity) due to its adhesion to the walls of a narrow gap</td>
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<tr>
<td><strong>closet pan</strong></td>
<td>the bowl of what is commonly called a toilet</td>
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<tr>
<td><strong>construction detail</strong></td>
<td>a section or component of a construction project that requires particular attention, and that is usually given specific consideration with respect to drawings and installation or construction aspects</td>
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<tr>
<td><strong>external tray</strong></td>
<td>a shower tray where the wall lining comes down into the tray and overlaps the sides of the tray on the inside</td>
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<tr>
<td><strong>finish</strong></td>
<td>the final surface covering on a wall or floor; for example, tiles and grout</td>
</tr>
<tr>
<td><strong>flashing</strong></td>
<td>a barrier that is used to prevent moisture movement from one area to another that may be sensitive to moisture</td>
</tr>
<tr>
<td><strong>in-situ tray</strong></td>
<td>a waterproof shower lining that is formed in place, unlike a pre-formed tray that is actually made before it is put in place</td>
</tr>
<tr>
<td><strong>internal tray</strong></td>
<td>a shower tray where the wall lining is outside the tray; the tray is applied onto the wall lining</td>
</tr>
<tr>
<td><strong>sanitary compartment</strong></td>
<td>a room or space containing a closet pan or urinal. See Section 1.1.1 Definitions in the BCA Volume 2.</td>
</tr>
<tr>
<td><strong>screed</strong></td>
<td>Layer (usually cement based) over the floor base that is accurately finished to produce a smooth, appropriately graded surface for the tiles or other surface finish; also referred to as the mortar bed</td>
</tr>
<tr>
<td><strong>shower base</strong></td>
<td>a prefabricated product that provides a full, waterproof shower floor; no floor tiling or floor finish is required</td>
</tr>
<tr>
<td><strong>shower tray</strong></td>
<td>a waterproof lining that is installed before the floor and wall finishes; may be pre-formed such as a copper tray, or formed in-situ such as an applied acrylic membrane</td>
</tr>
<tr>
<td><strong>tile bed / mortar bed</strong></td>
<td>the mortar base on which the tile adhesive is applied and the tiles are laid on a floor; the waterproof membrane may be under or on top of the tile bed. Recommended minimum tile bed thickness is 25 millimetres.</td>
</tr>
</tbody>
</table>
**wall lining** material that is attached to the wall frame or to the wall substrate; may be the water resistant base for the wall finish eg. tiles, or may be the water resistant base and the finish in one

**wash basin** a basin typically attached to a wall or pedestal for washing one’s hands and face

**washtub** a basin or container generally for the washing of clothes or linen

**waterproof** does not allow water to penetrate, for example, plastic or fibreglass

**water resistant** resists water penetration, but with prolonged wetting could become wet or allow moisture to penetrate, for example, plywood or painted surfaces

**window** in the BCA definitions (clause 1.1.1), a window is a device which transmits natural light directly from outside a building when in the closed position, and includes a roof light, glass panel, glazed door, etc.
Answers to questions within this topic

Answers to questions on **room heights**:

1. A habitable room is a room used for normal domestic activities. See Part 1.1.1 Definitions in the BCA Volume 2.
2. Yes, a kitchen is a habitable room.
3. Generally, the ceiling height for a habitable room must be at not less than 2.4 metres.
4. A kitchen may have a ceiling height of 2.1 m, and an attic must have a height of not less than 2.2 m for at least 2/3 of the floor area of the room.
5. No. The ceiling height will be 2.2m for only 2.625 m which is not 2/3 of the width of the room (2/3 x 4.2 = 2.8 m)

Answers to questions on **facilities**:

1. A door to a sanitary compartment must be so constructed that an unconscious occupant is able to be removed from the compartment.
2. No. There must be a washtub for the washing of clothes as well as a washbasin for the washing of hands. A washbasin cannot be counted as a laundry washtub.

Answers to questions on **lighting**:

1. Yes. The definition of window in the BCA includes glazed doors.
2. Yes. 10% of the floor area of the room must be provided as light transmitting area. The room area is 10 m x 5.5 m = 55 m². 10% of this is 5.5 m². The area of the glazing that is able to transmit light is 13.2 m² which exceeds the required 5.5 m².
3. No. A bathroom is not a habitable room and does not need to have natural lighting. However, if natural lighting is not available, then artificial lighting must be installed to enable safe movement of occupants (as per clause 3.8.4.3).

Answers to questions on **ventilation**:

1. The area opening into the ventilated room is required to be not less than 5% x 15 m², so 0.75 m². A standard door measuring 820 x 2040 mm, has an area equal to 0.82 m x 2.04 m = 1.67 m². This is greater than that required, so satisfies.
2. Required area of window in the adjacent room is 5% of (15 + 18) m² = 1.65 m². The openable window area is two panes of 1350 mm x 675 mm, which equates to a ventilating area of 2 x 1.35 m x 0.675 m = 1.82 m² which is sufficient.
Answers to questions on sound insulation:

1 ‘\(R_w + C_t\)’ is the “weighted sound reduction index with spectrum adaptation term”. \(R_w\) is a measure of the sound insulation performance of a building element. It is measured in very controlled conditions in a laboratory. \(C_t\) is a value used to modify the measured sound insulation performance or \(R_w\) of a wall or floor. \(R_w\) is not accurate for all noises, especially for low frequency bass noise from modern stereo systems. \(C_t\) is referred to as a spectrum adaptation value and is added to the \(R_w\). \(C_t\) values are negative values, so reduce the value of \(R_w\).

2 The \(C_t\) value accounts for low frequency noise.

3 Good design practices:
   a. Plan quiet areas in a unit adjacent to quiet areas in adjoining units.
   b. Plan quiet areas in a unit away from services.
   c. Plan buffer areas between units where possible.
   d. Locate services away from sensitive areas in a unit.

4 The Standards for the determination of \(R_w + C_t\) values are AS/NZ 1276.1 Acoustics—Rating of sound installation in buildings and of building elements Airborne Sound Insulation or ISO 717.1 Acoustics — Rating of sound insulation in buildings and of building elements, Airborne Sound Insulation.

5 Discontinuous construction means a wall system having a minimum 20 mm cavity between two separate leaves, with
   a. for masonry, where wall ties are required to connect leaves, the ties are of the resilient type; and
   b. for other than masonry, there is no mechanical linkage between leaves except at the periphery.

6 No, a staggered stud wall is not deemed to be discontinuous construction.

7 The attenuation of noise for an \(R_w + C_t\) value of 50 is equivalent to blocking out the noise of loud speech.
An example of an acceptable separating wall between the bathroom of one dwelling and the lounge room of an adjacent dwelling:

The wall can be, for example:

Cavity brick –

Two leaves of 110 mm clay brick masonry with—
(a) "cavity" not less than 50 mm between leaves; and
(b) 13 mm cement render on each outside face.


8
Or brick veneer –

Single leaf of 110 mm clay brick masonry with—
(a) a row of 70 mm x 35 mm timber studs or 64 mm steel studs at 600 mm centres, spaced 20 mm from the masonry wall; and
(b) 50 mm thick mineral insulation or glass wool insulation with a density of 11 kg/m³ positioned between studs; and
(c) one layer of 13 mm plasterboard fixed to outside face of studs and outside face of masonry.

or another type of construction as long as it is a discontinuous construction.