Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**

Building and Energy Western Australia

General Inspection (Snapshot) Report Six

Waterproofing systems for wet areas

December 2021

Glossary

The following is a summary of key terms frequently used in this document. The definitions listed apply unless otherwise indicated.

Term/Acronym	Definition
Applicable building standards	In general the applicable building standard for proposed building work is the BCA (being Volumes One and Two of the NCC).
AS/NZS	Australian Standard/New Zealand Standard
AS 3740-2010	Australian Standard 3740-2010 – Waterproofing of domestic wet areas. (Since superseded by AS 3740:2021)
AS 3958.1-2007	Australian Standard 3958.1-2007 Ceramic Tiles Part 1 - Guide to the Installation of Ceramic Tiles
Complaint Resolution and Administration Act	*Building Services (Complaint Resolution and Administration) Act 2011*
Registration Act	*Building Services (Registration) Act 2011*
Building Act	*Building Act 2011*
BCA	Building Code of Australia (Volumes one and two of the NCC)
Building and Energy	A division of DMIRS.
Building permit	A permit granted by a permit authority under section 20 of the Building Act that authorises building work to be carried out
Building Regulations	Building Regulations 2012
Building surveyor	A person registered under the Building Services (Registration) Act 2012
CCC	Certificate of Construction Compliance
CDC	Certificate of Design Compliance
Compliance	Meeting the requirements of all applicable building standards, approved design documentation and manufacturers' installation instructions as appropriate
Deemed to Satisfy (DtS) provisions	Provisions which are Deemed to Satisfy the Performance Requirements of the NCC.
Deemed to Satisfy (DtS) solution	A method of satisfying the Deemed-to-Satisfy Provisions of the NCC
DMIRS	Department of Mines, Industry Regulation and Safety

IB	Industry Bulletin published by Building and Energy on the DMIRS website
NCC	National Construction Code (Volumes 1 & 2 comprise the Building Code of Australia and Volumes 3 the Plumbing Code of Australia)
Performance Requirement	A requirement which states the level of performance which a Performance Solution or Deemed-to-Satisfy Solution must meet
Performance Solution	A method of complying with the Performance Requirements other than by a Deemed-to-Satisfy Solution
Permit authority	The permit authority for the building or incidental structures as defined in section 6 of the *Building Act 2011* – unless otherwise prescribed. Usually the local government where the building or incidental structure is, or is proposed to be, located. It may be the State in some circumstances
Registered building service provider	A building contractor or practitioner and a building surveying contractor or practitioner registered under the Registration Act.
Waterproof membrane	A membrane that prevents moisture penetrating through it.
Water resistant membrane	A membrane that limits the movement of moisture and does not degrade under conditions of moisture.

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Executive summary

The objective of waterproofing wet areas is to safeguard occupants from illness or injury and protect the building from damage caused by the accumulation of internal moisture arising from the use of wet areas. Inadequate waterproofing of wet areas can cause leaks that damage adjacent rooms and contribute to the growth of moulds that can affect occupants' health. Repairing the damage and undertaking rectification work is often expensive and causes significant inconvenience to occupants.

Building and Energy undertook a snapshot general inspection into waterproofing systems in wet areas in 2018. The outcome of this is presented in GIR6.

The objective of GIR6 was to determine if waterproofing of wet areas in new residential buildings is adequately meeting the applicable building standards. The key areas of interest in GIR6 were:

- Does building approval documentation adequately demonstrate how the wet area waterproofing will comply with the applicable building standards?
- Does the constructed building adequately meet the wet area waterproofing requirements nominated in the approval?
- Which aspects of waterproofing wet areas meet the requirements and which aspects need to be improved?
- What are the most common problems experienced by occupants regarding waterproofing in wet areas?

The BCA prescribes the performance requirements that apply to waterproofing of areas such as toilets, bathrooms and laundries in houses, town houses and apartment buildings to ensure the amenity of occupants and to protect the structure of the building. The BCA requirements can be met through the development of a suitable performance solution or by meeting the DtS provisions.

GIR6 entailed:

- a site inspection of 23 buildings under construction in the Perth metropolitan area to obtain an initial 'snapshot' of whether wet areas are meeting the waterproofing requirements of the BCA and the referenced Australian Standard. The sample included 9 Class 1a buildings (houses) and 14 Class 2, 3 or 9c buildings (units, apartments and residential aged-care buildings).
- a desktop review of the relevant building documentation to assess how well building surveyors - who are responsible for ensuring all applicable building standards, including the relevant wet area requirements, are clearly demonstrated on the documentation in the CDC. Building surveyors must also be satisfied that the building (not including class 1a buildings) has been constructed in accordance with theapproval documentation prior to signing a CCC.

Building and Energy inspected 89 'inspection points' - items of waterproofing that relate to compliance of wet areas. Only the inspection points visible to the inspector at the time of inspection were assessed.

GIR6 found 58 per cent of the inspection points inspected complied with the requirements of the BCA and AS 3740-2010.

Many aspects of waterproofing wet areas were installed appropriately in the buildings inspected. Building and Energy assessed the following items as often installed satisfactorily, i.e. more than 85 percent of the inspection points inspected for these items demonstrated satisfactory performance:

- Floor waste set ups in wet areas were done appropriately in 20 out of 22 cases (91 percent).
- Screed falls to floor waste were done appropriately in 9 out of 9 (100 percent) wet areas and 8 out of 9 (89 percent) shower areas.
- Wall sheeting met the requirements of AS 3740-2010 in 14 out of 15 cases (93 percent).
- Compressed fibre cement wall linings were the required thickness in 4 out of 4 cases (100 percent).
- Suitable float was used on rendered walls in 9 out of 9 cases (100 percent).
- Suitable waterproofing membranes were used in 13 out of 14 cases (93 percent).
- Bond breaker for waterproof membranes was installed as required in 25 out of 27 cases (93 percent).
- In shower areas, the wall junctions and joints, wall to floor junctions, floors and walls were satisfactorily done in more than 90 percent of cases inspected (average of 14 cases inspected.
- Floors and horizontal surfaces in areas outside showers were adequate in 11 out of 13 cases (85 percent).

Although some aspects of waterproofing wet areas were done well, GIR6 identified instances where the details on the plans and specifications were inadequate or the waterproofing of the wet areas inspected did not meet the requirements in the BCA or comply with the requirements in AS 3740-2010. These issues included:

- Insufficient details for wet areas on plans and specifications. The approval documentation did not show how the wet area requirements would be achieved. In cases where a performance solution was required, it was not detailed as such or satisfactorily documented.
- Falls on shower floors were inadequate, which caused water to pond on the finished tiled surfaces and did not adequately drain away.
- Substrates and render under waterproof membranes were not correctly prepared in accordance with the applicable building standards and membrane manufacturers' installation instructions.
- Drainage flanges were not installed or reinforced correctly in shower areas.
- Waterproof membranes were not the correct thickness or had not been installed in accordance with the manufacturers' recommendations.
- Waterproof membranes were not adequately protected after they were installed and were damaged by tilers or other tradespeople working in the wet area. Any damage was not repaired appropriately.

- There was insufficient sealant in the wall-to-wall and wall-to-floor junctions in showers. Suitable gaps had not been left at these junctions to allow enough sealant to be applied.
- The areas surrounding baths were poorly prepared.

As part of GIR6, Building and Energy also surveyed 23 strata property managers about their views with regard to waterproofing in wet areas to determine common problems, the areas most affected and the extent of any damage.

Building and Energy has already addressed some of the findings of the GIR6 by contacting the relevant builders to undertake rectification work. It has also delivered information sessions to the building industry and developed an Industry Bulletin to bring the issues identified to industry's attention and provided advice about how to comply with the requirements in the BCA.

Although the snapshot inspection highlighted problems with waterproofing in wet areas, due to the small sample size of buildings included in GIR6, it is not possible to draw conclusions as to the broader levels of compliance across in the industry. Building and Energy intends to undertake a follow-up general inspection and provide further information and training to the building industry regarding the requirements for waterproofing systems in wet areas.

1. Background

GIR6 presents the findings of Building and Energy's snapshot inspection into waterproofing systems in wet areas carried out in 2018. The findings mentioned in this report along with other Building and Energy activities has led to it being identified in the Audit Priorities Statement as an area of risk.

The requirements for waterproofing systems in wet areas are set out in BCA Volume two which contains waterproofing performance requirements that apply to areas such as toilets, bathrooms and laundries in houses, town houses and apartment buildings to ensure the amenity of occupants and to protect the structure of the building.

Water must be prevented from penetrating:

- behind fittings and linings
- into concealed spaces
- into adjoining bedrooms
- to the storey below or into public spaces in apartment buildings

The BCA waterproofing performance requirements can be met through the development of a suitable performance solution or by complying with the following DtS provisions:

- BCA Volume two Part 3.8.1 (Table 3.8.1.1 specifies the areas to be water resistant and waterproof)
- AS 3740-2010 (details the requirements for waterproofing wet areas)

As part of its preparations for undertaking GIR6, Building and Energy examined information and data from several sources that showed evidence of ongoing poor performance of wet areas. These sources include:

- Building and Energy's complaints data based on building service complaints from home owners about problems with leaks in wet areas, particularly in showers.
- A survey of 23 strata property managers conducted in 2019 about waterproofing in wet areas which identified several common problems across most surveyed participants. The results of the survey are summarised in Appendix B and provide information on the most common problems, the wet areas most affected, and the extent of damage.
- Discussions with contractors repairing wet areas which indicated that many wet areas did not initially meet the applicable building standards resulting in complete replacement of waterproofing systems in some instances.
- Concern from some sections of the building industry that the increased use of timber and steel framing in residential buildings may lead to an increased risk that any moisture lost from the wet areas will cause deterioration of adjacent structural building elements.

2. Objectives and scope

The objective of GIR6 was to carry out a small number of inspections of randomly selected residential buildings (single dwellings, apartment and residential care buildings) at varying stages of construction to determine how well registered building service providers are applying the building standards to wet area waterproofing.

The key areas of interest were:

- Does the approval documentation for buildings provide sufficient information for construction and adequately show compliance?
- Do the constructed buildings adequately meet the wet area waterproofing deemed-to-satisfy provisions in the BCA and AS 3740-2010
- Do performance solutions adequately address the applicable performance requirements?
- What are the most common problems experienced by occupants regarding waterproofing in wet areas of buildings?

The inspection addressed the applicable building standards, the building solution nominated in the building permit and CDC documentation and where applicable Australian Standard and manufacturers' guidelines and instruction. It did not include requirements set out in the *WA Health Act 1911* covering mould and dampness-related public health risks in buildings.

3. Methodology

An authorised officer from Building and Energy (Building Inspector) with appropriate qualifications and experience inspected a sample of 23 buildings under construction in the Perth metropolitan area. The sample included nine Class 1a buildings (houses) and 14 Class 2, 3 and 9c buildings (dwellings, apartments and residential aged-care buildings). A table setting out the BCA building classifications can be viewed in Appendix E of this report.

All buildings in the sample had been issued a building permit by the relevant permit authority. Building and Energy reviewed the CDCs and the plans and specifications to assess whether they demonstrated compliance with the waterproofing requirements of the BCA and AS 3740-2010.

For the purposes of GIR6, wet areas included shower enclosures, the area outside showers, areas adjacent to baths and spas, laundries and toilets.

The Building Inspector examined the following items:

- Plans and specifications
- Waterproof membrane
- Shower area
- Area outside showers
- Area adjacent to baths
- Floor wastes
- Shower wet area set-up
- Penetrations
- Wall sheeting
- Tiling
- Plasterboard wall linings
- Compressed fibre cement wall linings
- Render to wet areas
- Screeds

Each item had several inspection points. These are listed in Appendix A.

The requirements of BCA 2016 and the building approval documentation were used during GIR6.

3.1 Inspection limitations

The inspections for GIR6 were carried out prior to Building and Energy finalising its Audit Strategy 2021-24. The number of buildings inspected was 23 allowing a snapshot report only.

The 23 buildings inspected were at various stages of construction, so the number of buildings assessed for each inspection point was often less than 10. Some of the inspection points were not applicable to some buildings and others were not visible at the time of inspection.

The statistics in this report do not include inspection points where less than three buildings were assessed, or items that were unable to be inspected due to a site or safety constraint.

4. Findings

A summary of the findings of GIR6 is set out below. The detailed results can be found in Appendix A of this report.

Many aspects of waterproofing wet areas were installed appropriately in the buildings inspected. Building and Energy assessed the following items as often installed satisfactorily, i.e. more than 85 percent of the inspection points inspected for these items demonstrated satisfactory performance:

- Floor waste set ups in wet areas were done appropriately in 20 out of 22 cases (91 percent).
- Screed falls to floor waste were done appropriately in 9 out of 9 (100 percent) wet areas and 8 out of 9 (89 percent) shower areas.
- Wall sheeting met the requirements of AS 3740-2010 in 14 out of 15 cases (93 percent).
- Compressed fibre cement wall linings were the required thickness in 4 out of 4 cases (100 percent).
- Suitable float was used on rendered walls in 9 out of 9 cases (100 percent).
- Suitable waterproofing membranes were used in 13 out of 14 cases (93 percent).
- Bond breaker for waterproof membranes was installed as required in 25 out of 27 cases (93 percent).
- In shower areas, the wall junctions and joints, wall to floor junctions, floors and walls were satisfactorily done in more than 90 percent of cases inspected (average of 14 cases inspected.
- Floors and horizontal surfaces in areas outside showers were adequate in 11 out of 13 cases (85 percent).

The following sections summarise the compliance issues identified during the inspection.

4.1 Insufficient details for wet areas on plans and specifications

Building and Energy assessed the plans and specifications for 23 buildings. Documentation was found to be satisfactory for less than 10 percent of the buildings inspected.

For the two buildings where a performance solution was required, the performance solution was not satisfactorily documented. For the 21 buildings where a DtS was specified, the approval documentation for 19 buildings did not demonstrate how the wet area requirements would be achieved. Also, the documentation did not refer to the manufacturer's specifications.

The inadequate documentation meant that it was not clear to tradespeople how the wet areas needed to be installed, and many of the inspected wet areas did not meet the requirements of the approved building solution.

In addition, an inspection of modular units manufactured offsite showed that wet areas did not meet all the DtS wet area requirements nominated in the approved plans and specifications. In some cases, the plans and specifications did not contain clear and appropriate details to demonstrate compliance. For example, falls of the finished tiled surfaces, and the number and location of floor grates/wastes were often not documented.

4.2 Shower recess floors had inadequate falls

The falls on shower recess floors were adequate in only two out of six (33 percent) wet areas inspected. The falls in floors outside shower recesses were not done adequately in any of the four cases assessed for this inspection point. Water ponded on finished tiled surfaces and did not drain away adequately**.**

This is contrary to AS 3740-2010 Section 3.4 Shower floor, which states (in part): *"Falls in shower floors shall be sufficient to prevent: (a) Surface water from being retained on the shower floor (except residual water remaining due to surface tension.)…"*

4.3 Render on walls was not applied in a manner that would support the waterproof membrane

The render on walls in wet areas was not applied in a way that would satisfactorily support the waterproof membrane in 46 percent (6 out of 13) wet areas inspected for render quality.

4.4 Substrates under waterproof membranes were not correctly prepared

The substrates under waterproof membranes were not correctly prepared in accordance with the standards and manufacturers' installation instructions in
50 percent of the wet areas inspected for this item.

Figure 1 below shows some examples of substrates that had holes, unfilled cracks, sandy screeds, and rough surfaces.

Figure 1 Examples of poorly prepared substrates

For substrates in wet areas of framed construction, Building and Energy found that in more than 60 percent of cases (9 out of 13) the following aspects were incorrect:

- Fixing appropriate to the finished weight of tiles per m^2
- The type and spacing of the supporting frame
- Fixing spacing in the edge and field areas of the sheet

4.5 Drainage flanges were not installed or reinforced correctly in showers

Building and Energy inspected seven wet areas where the drainage flanges in showers did not comply with the specifications in AS 3740-2010

Figure 2 below shows an example of a shower floor where a drainage flange was not installed.

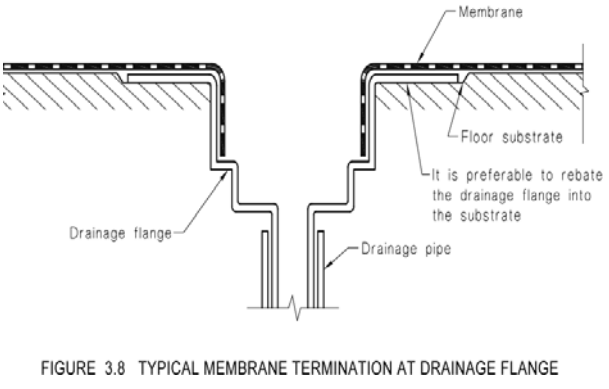

FIGURE 3.8 TYPICAL MEMBRANE TERMINATION AT DRAINAGE FLANGE

Figure 2 Example of a missing drainage flange

Figure 3 below shows an incorrectly installed waterproof membrane. The membrane was not carried across the top of the flange and the protrusion in the pipe could cause blockages.

Figure 3 Incorrectly installed membrane at drainage flange

Reinforcement was installed around drainage flanges as required in only two out of seven (29 percent) of the buildings inspected for this item.

4.6 Installers did not follow manufacturers' instructions for the application of waterproof membranes

In the nine buildings where it was possible to check, only two out the nine installers followed the manufacturers' instructions or met the DtS requirements for the application of waterproof membranes.

4.7 Incompatible or incorrect primers were used

Building and Energy observed instances where installers mixed waterproof membranes or primers from different manufacturers without checking their compatibility. In 40 percent of cases, they were incompatible.

In other cases, water resistant moisture barriers rather than waterproof membranes were used. These wet areas did not comply with the requirements in AS 3740-2010.

4.8 Waterproof membranes were not the correct thickness

Building and Energy cut samples from several dried waterproof membranes. In all nine wet areas inspected for appropriate dry film thickness, the measured sample did not have the dry film thicknesses recommended by the manufacturers. In one case, the dry film thickness was only 0.25 mm.

Figure 4 below shows an example where the thickness of waterproof membrane in the corner of a shower was inadequate.

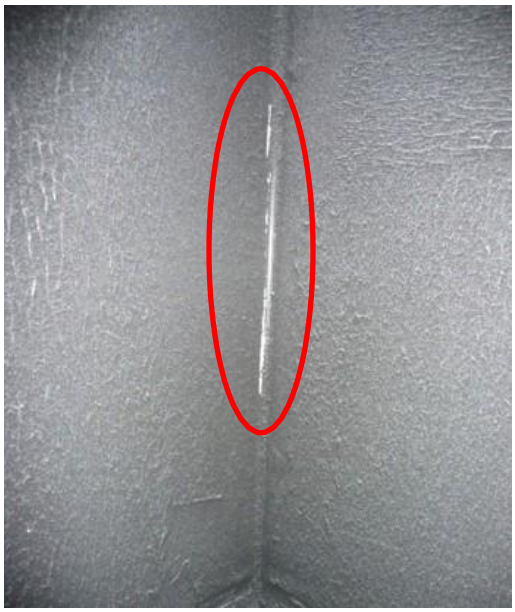

Figure 4 Example of a waterproof membrane in a shower that did not have the required thickness

Inadequate waterproof membrane thickness is a problem because thin membranes are more easily damaged. They are also less elastic and do not accommodate building movement as well as membranes that are the recommended thickness. Manufacturers' warranties may also be invalid if the membrane is not applied according to the manufacturers' recommendations. In one case, no waterproof membrane was installed in a shower.

4.9 Wall to floor junctions (except in showers) were inadequate

In more than 40 percent of wet areas inspected, the waterproof treatment of the floor was not extended at least 25mm up the wall as required. In some cases, the waterproofing was also not extended beyond the doorway to the wet area. These wet areas did not comply with the requirements of AS 3740-2010.

4.10 Waterproof membranes were not adequately protected after they were installed

Building and Energy inspected 11 wet areas to assess protection for waterproof membranes. Only one waterproof membrane (<10 percent) was appropriately protected. Some waterproof membranes were damaged by tilers or other tradespeople working in the wet area, and the damage was not repaired appropriately.

AS 3740-2010 Section 3.5 requires that the *"... membrane should be protected from physical and/or chemical damage until covered by the finished surfaces."*

4.11 Tiling in wet areas not installed adequately

Building and Energy inspected several aspects of tiling in wet areas. The following items were not completed satisfactorily:

- There was insufficient sealant in the wall-to-wall and wall-to-floor junctions in showers.
- Suitable gaps had not been left at these junctions to allow enough sealant to be applied in all nine tiled wet areas inspected.
- The tiled junctions were not filled with flexible sealant in two out of six wet areas inspected.

These items led to tile installations not meeting AS 3958.1-2007 Ceramic Tiles Part 1. Guide to the Installation of Ceramic Tiles.

4.12 The areas surrounding baths were poorly prepared

Building and Energy inspected several apartments (Class 2 buildings) where the workmanship in wet areas that contained baths was extremely poor. Figure 5 below shows an example of this.

The areas surrounding the baths were rough and cracked, tape was exposed, and gaps were visible. The waterproof membrane was also not installed correctly between the bath and walls in all eight cases inspected.

AS 3740-2010 specifies that the waterproof membrane must extend under the lip of the bath. This was done satisfactorily in only one of the seven (14 percent) inspected wet areas with baths.

Figure 5 Example of poor workmanship around a bath

5. Conclusion

The findings of GIR6 support the anecdotal information collected by Building and Energy that those responsible for carrying out and supervising waterproofing wet areas were not consistently meeting the applicable building standards or complying with the requirements in AS 3958.1-2007 or manufacturer's instructions. However, due to the small sample size of GIR6, it is not possible to draw conclusions as to the broader levels of compliance in the industry. Despite the small sample size there is little doubt that waterproofing wet areas is a cause of building complaints and consumer dissatisfaction with remediation of wet areas imposing considerable costs and causing major inconvenience for building occupants.

6. Actions taken in response to findings

During GIR6 Building and Energy sought to ensure that buildings assessed as unsatisfactory were brought to the attention of the person(s) undertaking the work, who were given the opportunity to respond to the issue and explain how compliance with the applicable building standards was, or would be, achieved. This also provided an opportunity to remind those responsible for waterproofing about the applicable building standards and ensure the buildings inspected complied.

6.1 Industry education

In 2018 and 2019, Building and Energy facilitated technical meetings and presented the findings of GIR6 to the building industry. The presentations detailed the BCA performance requirements for wet areas, highlighted the problems with design and construction discovered during GIR6, and provided recommendations to improve design and installation practices.

6.2 Development of educational resources

Building and Energy released *Industry Bulletin 130 – Improving the performance of internal wet areas* in May 2020. The IB provides information for builders, building surveyors, membrane applicators, tilers, inspectors and others involved in the specification, installation and inspection of internal wet areas in Western Australia. It focuses on shower areas, highlighting the requirements for waterproofing systems in wet areas, how they can be achieved, and where improvements are required.

6.3 Further actions

Building and Energy plans to undertake a more comprehensive general inspection on a larger number of buildings in 2022-23 to gain further data and information on how building standards are being applied to waterproofing in wet areas, the level of compliance with codes and standards, and whether the actions implemented following GIR6 have been effective in improving compliance relating to both the design and construction of wet areas.

Building and Energy will also continue to work with building industry associations such as the Australian Institute of Building Surveyors, the Housing Industry Association and the Master Builders Association, the Institution of Engineers Australia and permit authorities to provide further information, education and training based on the findings of GIR6.

Appendix A – Inspection data

Table 1 below presents the findings from the general snapshot inspection where at least 3 wet areas were inspected for each inspection point.

Table 1 Summary of findings from the general snapshot inspection

Items	Inspection point	No. assessed	No. Satisf'y	No. Unsatisf'y	% Satisf'y
Plans and specifications (P&S)	Do P&S contain adequate information that would result in compliance if followed?	21	2	19	9.5%
	Valid performance solution referenced in P&S where required (Class 2-9 buildings only)	2	0	2	0%
	Sufficient details within P&S for specialist system?	5	0	5	0%
Substrate of waterproof membrane	Bond breaker installed as required	12	10	2	83%
	Dry Film Thickness	9	0	9	0%
	Membrane applied as per manufacturer's instructions	9	2	9	18%
	Membrane appropriately protected after installation	11	1	10	9%
	Primer consistent with WPM manufacturer's recommendations	7	4	3	57%
	Suitable membrane used	14	13	1	93%
Shower areas	Floors and horizontal surfaces	15	13	2	87%
	Penetrations	12	11	1	92%
	Wall junctions and joints	15	14	1	93%
	Wall/floor junctions	14	13	1	93%
	Walls	15	14	1	93%
Area outside showers	Floors and horizontal surfaces	13	11	2	85%
	Wall / floor junctions	11	6	5	54%
Area adjacent to baths and spas	Floors and horizontal surfaces	5	2	3	40%
	Wall junctions and joints	3	0	3	0%
	Wall/floor junctions	4	1	3	25%
	Walls	8	2	6	25%
Laundries and toilets	Floors and horizontal surfaces	10	6	4	60%
	Penetrations	5	2	3	40%
	Wall/floor junctions	8	3	5	38%
Floor wastes (Class 2-9)	Floors and horizontal surfaces	7	5	2	71%
	Penetrations	4	4	0	100%
	Wall/floor junctions	7	5	2	71%
Shower area set-up	Bond breaker around drainage flange as required	4	4	0	100%
	Fall to floor waste in the screed	9	8	1	89%
	Reinforcement installed around drainage flange as required	7	2	5	29%
Shower hob detail	Assessment of shower floor set up	17	7	10	41.2%
Floor waste	Compliance of floor waste	22	20	2	90.9%
	Screed fall to floor waste	9	9	0	100.0%
Baths and spas	Baths to be recessed into a wall	8	0	8	0.0%
	Baths with and without a down-turn lip	7	1	6	14.3%

Items	Inspection point	No. assessed	No. Satisf'y	No. Unsatisf'y	% Satisf'y
Penetrations	Recesses soap holders- fall in the base of the holder to drain to shower recess	6	1	5	16.7%
	Recesses soap holders- Junctions flashed and complete holder WP	4	4	0	100.0%
	Tap penetrations through horizontal surfaces	3	0	3	0.0%
Wall sheeting	Wall sheeting complies with AS3740	15	14	1	93.3%
General shower area requirements to AS 3740	Bond breaker installation for bonded membranes	11	11	0	100.0%
	Enclosed showers without hobs or set-downs	3	0	3	0.0%
	Floor area lower than FFL outside shower for step down showers (	17	15	2	88.2%
	Hob construction	3	2	1	66.7%
	Membrane class	9	9	0	100.0%
	Surface preparation	16	8	8	50.0%
Tiling	Depth/width ratio of sealant to tiled junctions	9	0	9	0.0%
	Fall in floor finish outside of the shower recess	4	0	4	0.0%
	Falls within shower recess	6	2	4	33.3%
	Filling of tiled junctions with flexible sealant	6	4	2	66.7%
Plasterboard wall lining	Fixing centres based on tile weight and stud spacing	3	0	3	0.0%
Compressed fibre cement lining	Lining thickness	4	4	0	100.0%
	Steel frame (min 64 mm deep BMT)	3	3	0	100.0%
	Stud centres (max 600)	3	1	2	33.3%
	Timber fixing centres (200 mm max around edges and filed of sheet 50 mm min from corners)	4	0	4	0.0%
Rendered walls	Drummy areas	9	8	1	88.9%
	Has the render been applied in a manner to support the performance membrane	13	7	6	53.8%
	Suitability of float	9	9	0	100.0%
Screed	Assessment of screed other than for falls	9	6	3	66.7%

Appendix B – Summary of survey results for strata buildings

Building and Energy surveyed 23 strata managers between 20 March and 7 August 2019 about problems with waterproofing wet areas. A summary of the results is provided below.

- Apartments of four storeys or greater were ranked the most common types of buildings that typically experience issues with waterproofing to internal wet areas.
- The age of buildings where issues are first apparent is one to three years.
- Order of ranking from most common to least common where waterproofing issues originated: 1) showers, 2) bathrooms, 3) toilets, 4) laundries, 5) others.
- Order of ranking from most common to least common where leaks first present themselves: 1) apartment below, 2) adjoining apartment, 3) damage presenting within the room.
- Occupants affected by the leaking wet area were often able to keep living within the property but were unable to use all rooms.
- Order of ranking of damage from most common to least common: - 1) superficial damage (bubbling paint and deteriorating plaster), 2) health issues such as mould and 3) major damage.
- Waterproofing contractors usually carry out rectification of waterproofing work.
- 34.78 percent of respondents said that waterproofing issues were rectified within six months after the initial request was made to the builder or contractor.
- 60.87 percent of respondents said that the waterproofing issues ‘sometimes’ reoccurred after remedial works were undertaken.
- 34.78 percent of respondents said that the highest cost of repairs to rectify defective waterproofing to internal areas in a building was between $1000 and $10,000.
- 63.64 percent of respondents said that typical average cost of repairs to rectify defective waterproofing to internal areas in buildings was between $1000 and $10,000.
- 39.13 percent of respondents said that ‘sometimes’ the cost of repairs resulted in a requirement for a special strata levy; 13.04 percent said ‘Frequently’.
- 34.78 percent of respondents said that disputes over the rectification works result in a formal complaint being lodged with the Building Commissioner; 8.70 percent said ‘Frequently’.
- 52.17 percent of respondents said a dispute over the rectification works ‘never’ involved further legal action such a court/ SAT action. 4.35 percent said ‘Frequently’.

Appendix C – Role and powers of Building and Energy

WA has a suite of laws governing building control, including the Building Act), the Complaint Resolution and Administration Act, and the Registration Act.

The Complaint Resolution and Administration Act empowers the Building Commissioner to monitor buildings to check that building standards are applied appropriately and that buildings comply with the NCC. The Building Commissioner can authorise Building and Energy officers to inspect buildings during and after construction and review approval documentation.

The Registration Act provides a framework for registering building surveyors and builders, and contains disciplinary provisions to manage sub-standard work and poor conduct by a registered building service provider. Building and Energy has powers to investigate complaints about the work and conduct of builders and building surveyors and, where necessary, take disciplinary action. Building and Energy does not however have legislative powers to issue building orders to rectify building work; this is the responsibility of the permit authority.

For new building work that requires a building permit, the Building Act requires a registered building surveyor to sign a CDC for the building design. The CDC is required to, "*contain a statement of the building surveyor signing the certificate to the effect that if the building or incidental structure that is the subject of the application is completed in accordance with the plans and specifications that are specified in the certificate, and complies with each applicable standard*."

Additionally, the Building Act requires builders to construct the building in accordance with the plans and specifications listed in the applicable CDC and requires the builder to ensure, on completion of the building or incidental structure that the building complies with each applicable building standard. Builders have a responsibility to comply with both requirements under the Building Act.

Further information about the role of Building and Energy is available on the DMIRS website.

Appendix D – Building approvals

The building approval process for WA is legislated under the Building Act and associated Building Regulations. This legislation controls the application of building standards for the design and construction of buildings and incidental structures and sets out when a building permit is needed for building work.

The Building Act generally requires a building permit for the construction of a new building and an occupancy permit to allow a building to be occupied (applies to class 2-9 only). As part of the process for getting a building permit, a building surveyor needs to sign a CDC stating that if the building is completed in accordance with the plans and specifications, the building will comply with each applicable building standard that applies to it. For an occupancy permit, a building surveyor needs to sign a CCC stating the building has been completed in accordance with the plans and specification specified in the CDC.

The permit authority (usually the local government in whose district the dwelling will be built) can grant building permits and occupancy permits if satisfied that the application for a permit addresses the requirements of the Building Act and Building Regulations 2012 (Building Regulations). The permit authority can request further information to assist it in considering an application (if there is an error) and impose conditions on the grant of a building permit if necessary.

The builder named on the building permit is responsible for ensuring that the building is constructed in accordance with the building permit (including any conditions) and the applicable building standards.

Building surveyors must be satisfied that the building has been constructed in accordance with the approval documentation prior to signing a CCC.

The Building Act gives the permit authority powers to monitor and inspect building work to ensure compliance with these requirements. The Building Act also provides permit authorities with the power to issue building orders to remedy or stop building work, and to prosecute builders and owners for non-compliance.

Further information about the Permit Process is available on the DMIRS website.

Appendix E – Building Standards

The Building Regulations made under the Building Act, set out a general position as to applicable building standards, as well as a series of qualifications for particular circumstances and types of building. The general position is that the applicable building standards are those set out as the Performance Requirements in the BCA in effect at the time the building application is made or were in effect 12 months before the building permit application was made.

The BCA is a comprehensive set of building standards that is the product of a series of efforts by the Commonwealth and state and territory governments during the 1960s, 70s and 80s to develop a uniform national position on building standards.

The BCA was first published in 1988 and has been revised several times since. In 2008, the Council of Australian Governments agreed to develop a national code covering building, plumbing, electrical, and telecommunications standards. The National Construction Code (the NCC) was published in 2011. To date the NCC only encompasses building and plumbing standards.

The NCC consists of three volumes. Volume One of the NCC deals with building standards for Class 2 to Class 9 buildings (multi-residential, commercial, industrial and public buildings); Volume Two deals with building standards for Class 1 and Class 10 buildings (residential and non-habitable buildings and structures); and Volume Three deals with plumbing standards. The term BCA refers to volumes one and two of the NCC.

The BCA sets out minimum Performance Requirements that buildings must achieve. A Performance Requirement can be satisfied through the use of a deemed-to-satisfy (DTS) solution, a performance solution (previously known as an alternative solution) or a combination of DTS and performance solutions.

A DTS solution is one that follows the prescriptive DTS requirements contained in the BCA. These requirements may cover materials, components and/or construction methods that are to be used and design factors that are to be considered.

A performance solution is any solution other than a DTS solution that satisfies the stated Performance Requirement. Deemed-to-satisfy solutions are typically the ‘time proven’ methods of construction that are known to produce an acceptable outcome. Such methods may, however, prove to be inefficient or come with other intrinsic limitations. Performance solutions, by contrast, are flexible and allow for the development of innovative construction methods and products.

For a DTS solution these assessment methods are:

- Show compliance with the DTS provisions of the BCA.

For a performance solution these assessment methods are:

- provision of certain types of documentary evidence;
- verification through the conduct of tests, inspections, calculations;
- expert judgement; and
- comparison with the DTS requirements.

Part A2 of the BCA Volume One contains the acceptance of design and construction provisions. This outlines the options that can be used as evidence to support that the use of materials, products or forms of construction meet the NCC requirements.

Before considering the BCA's performance requirements the primary classification system used for buildings must be considered (the BCA 'Class'). Table 2 details the ten classes of buildings and a number of subclasses. Their defining characteristics are summarised in the table below.

Table 2: BCA building classifications

Class	Description
1a	A detached house or a group of attached dwellings separated by fire resistant walls (for example, town houses or villa units) which is not located above or below another building other than a private garage
1b	A boarding house, guest house or hostel with a floor area not exceeding 300m^2 which ordinarily accommodates not more than 12 people and which is not located above or below another building other than a private garage
2	An apartment building or group of single storey units located above a communal basement or garage
3	A building, other than a Class 1 or 3 building, which is a common place of long term or transient residence such as (for example, a boarding house, guest house or backpackers accommodation or residential part of a hotel, school or detention centre
4	A dwelling within a building that is otherwise a Class 6, 7, 8 or 9 building (for example, a caretaker's residence or an apartment above a workshop)
5	An office building used for commercial purposes not otherwise captured in Class 6, 7, 8 or 9
6	A shop or other building through which the public is sold goods or services
7a	A carpark structure
7b	A warehouse or a building for the display of goods to be sold on a wholesale basis
8	A laboratory, factory or workshop where business is carried out for trade, sale or commercial gain
9a	A healthcare facility where occupants or patients generally need assistance to evacuate during an emergency (for example, a hospital or care facility)
9b	A building where people assemble for civic, educational, entertainment or transportation purposes
9c	An aged care building
10a	A non-habitable building being a private garage, shed or the like
10b	A non-habitable structure being a fence, swimming pool, retaining wall or the like
10c	A private bushfire shelter

Appendix F – Additional resources

Building Code of Australia

- Section F1.7
- Part 3.8.1

Australian Standards

AS 3740-2010

AS 3958.1-2007

Building and Energy publications

Industry Bulletin 61 – Residential wet area floor wastes – this document addresses key issues about the installation of floor wastes in wet areas and grading to floor wastes.

Industry Bulletin 134 – Improving compliance of wet areas – this document provides information and guidance for builders, wet area installers, architects, building designers and building surveyors to achieve compliance of wet areas.

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