



Determination 2018/039

The code compliance of a walk-in shower to an ensuite in a 5-year-old house at 565 Maronan Road, Ashburton

Summary

This determination considers the compliance of a wall to floor junction in a shower with Clauses E3 Internal moisture and B2 Durability of the Building Code.

1. The matters to be determined

- 1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004¹ (“the Act”) made under due authorisation by me, Katie Gordon, Manager Determinations, Ministry of Business, Innovation and Employment (“the Ministry”), for and on behalf of the Chief Executive of the Ministry.
- 1.2 The parties to the determination are:
 - the owners of the building, S and G Coustas (“the applicants”). One of the owners carried out the tiling work to the walls of the shower (“the owner/tiler”)
 - the Ashburton District Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.
- 1.3 This determination arises from a dispute as to whether an open shower area in an ensuite bathroom (“the shower”) complies with certain clauses² of the Building Code (Schedule 1, Building Regulations 1992). The authority is of the view the shower as constructed may not comply with Clauses B2 and E3 of the Building Code due to the lack of inspections.
- 1.4 The matter to be determined³ is whether the ensuite shower wall/floor junction complies with Clause E3 Internal moisture and Clause B2 Durability of the Building Code. The shower includes the components (such as the tiles, the waterproof membrane system, the substructure and associated wall framing) as well as the way components are installed and work together. In deciding this matter, I must consider Clause B1 Structure, insofar as it applies to the durability of the adjacent wall framing.
- 1.5 In making my decisions, I have considered the submissions of the parties, the report of the expert commissioned by the Ministry to advise on this dispute (“the expert”) and the other evidence in this matter.

¹ The Building Act, Building Code, compliance documents, past determinations and guidance documents issued by the Ministry are all available at www.building.govt.nz or by contacting the Ministry on 0800 242 243.

² In this determination, references to sections are to sections of the Act and references to clauses are to clauses of the Building Code.

³ Under sections 177(1)(a) of the current Act.

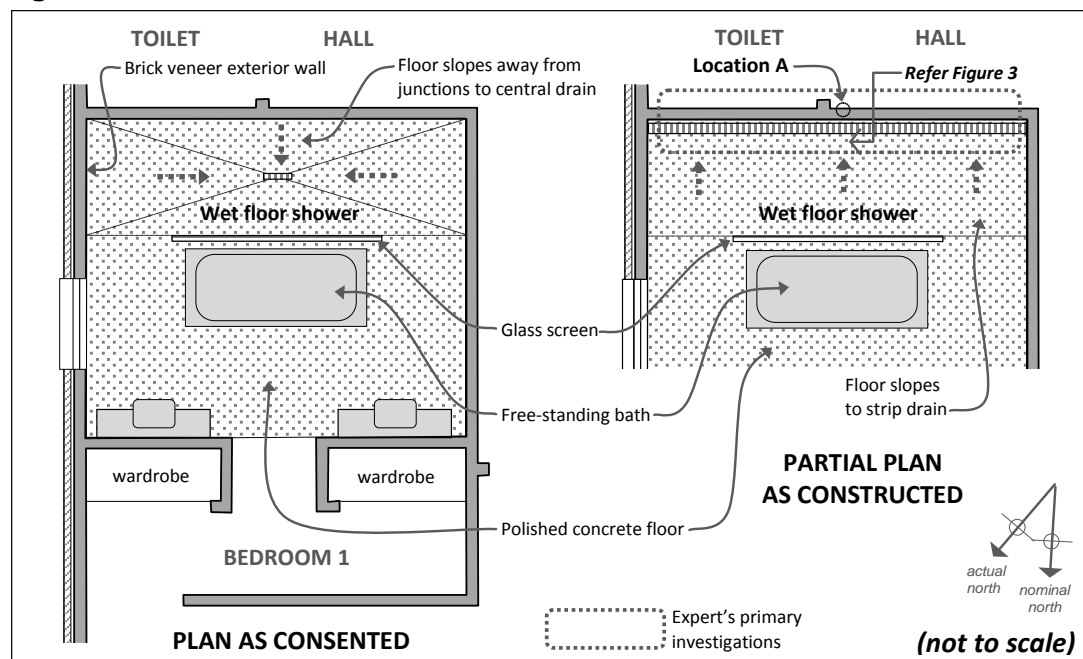
2. The building work

- 2.1 The building work consists of an ensuite bathroom in a single-storey detached house. The expert takes the main entry of the house as north-facing, and this determination follows that convention.
- 2.2 Construction is generally conventional light timber frame, with concrete foundations and floor slab, brick veneer wall cladding, aluminium joinery and a concrete tile hipped and gabled roof.
- 2.3 The specification called for the timber framing to the exterior walls to be 'H1.2 treated pinus radiata' and bottom plates to be 'H3.1 treated'; with internal walls adjoining wet areas to be 'H1.2 treated'. The expert took drill shavings from an interior bottom plate and forwarded them to a testing laboratory for analysis, which confirmed the sample as 'almost certainly' H3.2 CCA⁴ treated.

2.4 The bathroom

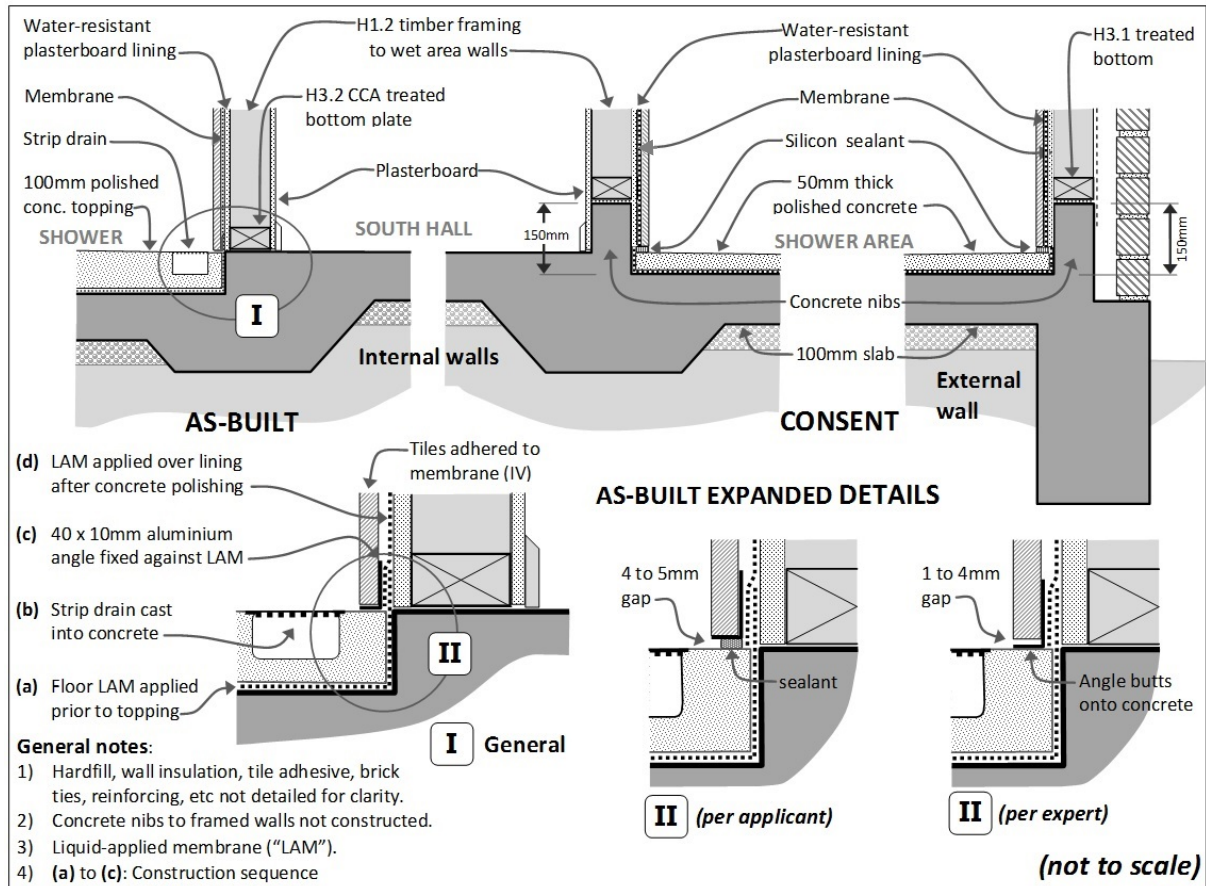
- 2.4.1 The ensuite bathroom is shown in Figure 1, with the partial as-built plan highlighting the south wall as the focus of the authority's concerns and the expert's investigations.

Figure 1: The ensuite bathroom



- 2.4.2 The shower is located adjacent to the south wall of the ensuite, with a glass screen separating the shower area from a free-standing bath. The floor is polished concrete and the walls are tiled. Although consent drawings showed the shower floor falling away from wall/floor junctions towards a central drain, the shower floor was constructed with a slope towards a strip drain positioned adjacent to the south wall as shown in Figure 1.
- 2.4.3 Figure 2 shows junction details in the consent drawings and compares these to the as-built junctions. The expanded detail [I] shows the junction, while details [II] show the expanded junction as described by the applicants and as observed by the expert.

⁴ Chromated copper arsenate timber preservative

Figure 2: Simplified sketches of shower junctions

2.5 The waterproofing system

2.5.1 The specification called for walls to be lined with 10mm water-resistant plasterboard and the liquid-applied membrane ("the membrane") to be '[proprietary] waterproofing membrane system'. The consented details show:

- for the walls:
Ceramic tiles laid on latex thin set mortar over 3 coats of waterproofing membrane on 10mm [plasterboard] lining.
- for the floor:
100mm thick concrete floor slab set 50mm below FFL
3 coats of waterproofing membrane [over the concrete floor slab recess].

2.5.2 Based on the expert's report, the owner/tiler's statements, the membrane applicator's producer statement (see paragraph 3.3.2) and the other evidence; walls and floor to the ensuite appear to be constructed as follows:

- the substrates:
 - 10mm water-resistant plasterboard substrate to walls
 - the 100mm recess to the concrete floor slab
- the membrane waterproofing system:
 - primer applied to the substrates
 - PVC fabric tape applied to all corners and junctions
 - 2 coats of membrane to walls and floor recess
 - polypropylene fabric reinforcing included in the floor membrane

- the finishes:
 - walls - ceramic wall tiles, adhesives and mortar
 - floor - polished concrete topping slab.

2.6 The products

2.6.1 Based on the information provided, the waterproofing system is based on the following underlying products:

- The water-resistant plasterboard has a BRANZ Appraisal that describes the product as a ‘paper-bound, modified water-resistant gypsum plaster core sheet lining material’. If used in showers, the product ‘must include a wet area waterproofing membrane system under the tiles’. The appraisal concludes that, if installed in accordance with the conditions within the appraisal, the lining system will comply with Clauses B1, B2, C3⁵, E3, F2⁶ and G6⁷.
- The membrane has a BRANZ Appraisal that concludes if installed in accordance with the conditions within the appraisal, the membrane system will comply with Clauses B2, E3, and F2. The appraisal describes the products specified for the ensuite bathroom as follows:
 - an acrylic primer for absorbent surfaces
 - ‘a one-part, fast drying, polymer-based, ready-to-use, liquid-applied membrane’
 - 120mm wide ‘PVC fabric tape used to reinforce wall/wall and floor/wall joints’ available as preformed angles. This is a self-adhesive tape applied over the substrates prior to the application of the membrane.
 - non-woven polypropylene reinforcement fabric embedded into the membrane during application
- A flexible tile adhesive suitable for tiling over approved waterproofing membranes. Although unwilling to guarantee compatibility, both the adhesive and waterproofing suppliers advised that no adverse effects were expected from using the different products together.

3. Background

3.1 The authority issued the building consent (No. BC0755/10) for the house on 31 August 2010 under the Building Act 2004 and inspected foundations and floor slab during November and December 2010. Construction appeared to stall during 2011.

3.2 The 2012 refusal to issue a code compliance certificate

3.2.1 In a letter to the applicants dated 7 March 2012, the authority noted the building consent had been ‘granted approximately 18 months ago and has yet to have a Code Compliance Certificate issued’.

3.2.2 In a letter to the applicants, dated 3 September 2012, the authority stated the code compliance certificate was refused under section 95A. It noted its refusal was due to

⁵ Clause C3 Fire affecting areas beyond the fire source

⁶ Clause F2 Hazardous building materials

⁷ Clause G6 Airborne and impact sound

not receiving an application for code compliance certificate or a request for a final inspection.

3.3 Continuing inspections

3.3.1 Construction resumed in 2012 and the authority recorded the following inspections:

- framing during August and September 2012
- brick veneer in November 2012
- pre-line in December 2012
- post-line in February 2013
- foul water drains in May 2013 (the last recorded inspection).

3.3.2 Although it appears the house was partially completed and occupied during 2013, completion of the ensuite bathroom appears to have been delayed. A producer statement dated June 2014 provided by the membrane applicator for waterproofing to the shower walls stated:

System/Product used: [proprietary] Waterproofing System
Primed area with Primer ...
All internal corners installed with [PVC fabric tape]
Applied 2 coats of [membrane] to walls
Applied 2 coats of [membrane] to floor
Applied [reinforcement fabric] to Floors.

3.3.3 The owner/tiler completed the ensuite tiling, but the first final inspection was not undertaken until 2017 (some 7 years after the building consent was issued).

3.4 The 2017 inspections

3.4.1 The authority carried out the first final inspection on 14 July 2017 and identified a number of outstanding items. In regard to the ensuite bathroom, the record noted:

Polished concrete floor with tile walls to the shower fitted to the ensuite.
The home owner and builder have both advised the bathroom floor was poured 100mm lower than the house floor then a membrane applied to the floor and up the wall, a concrete floor has then been poured in the bathroom and the floor has been polished.
[The authority] has no record on (*sic*) any inspections or any documentation approving this shower design ... It is also unknown the type of membrane used or its suitability to have concrete poured over it.

3.4.2 During the inspection, the authority took a series of photographs, which included the ensuite shower. The photographs showed the strip drain against the south wall of the ensuite.

3.4.3 A producer statement titled 'E3 Internal Moisture' and dated 13 September 2017 was also provided by the builder for the installation of the '[proprietary] system under 100mm concrete slab in ensuite area.' This was similar to the 2014 PS3 (see paragraph 3.3.2), except that it was restricted to the floor membrane.

3.4.4 The authority re-inspected the house on 28 November 2017; with the entry for 'shower facilities' repeating the July record note. A simplified sketch identifying the under-topping membrane was subsequently submitted to the authority together with photographs of the south ensuite wall framing, where the owner had removed sections of plasterboard to reveal the bottom plate.

3.5 The February 2018 inspection

3.5.1 Most remaining outstanding items were subsequently attended to and the authority re-inspected the house on 9 February 2018, with the inspection record noting:

Inspection failed due to further work required to the ensuite shower and 2 small areas of painting to complete to the soffits at the front entry.

3.5.2 In regard to the ensuite bathroom, the record noted:

base of the tiles where they meet the polished concrete floor has not been sealed, ... an aluminium tile angle has been sealed to the floor. This is a potential leak area, no moisture testing was carried out at the time of inspection as the shower has not been used for approximately 4 months.

... it is not known if the tile adhesive used was compatible with the membrane that was applied.

3.6 Response to the inspection

3.6.1 The applicants emailed the authority on 11 March 2018 to 'clarify the methods implemented in the installation process of the waterproofing and tiling of the shower.' The owner/tiler included the following comments (in summary):

- The owner/tiler outlined his past experience in installing showers and wet rooms.
- The ensuite bathroom was 'entirely tanked/waterproofed under the top layer of concrete all the way up the wall behind the tiling adhesive', so all moisture will therefore be contained regardless of how the 'tiling/siliconing has been done.'
- A 10 x 50mm aluminium angle is installed over silicon sealant at the wall/floor junction, some 4 to 5mm above floor level to allow sealant to remain invisible.

3.6.2 In regard to questions of membrane/adhesive compatibility, the owner/tiler noted that:

- both products have 'outperformed the task' set for them in that the 'waterproofing has provided a lasting membrane and the tile adhesive has secured the tiles in place'
- there is no indication from either manufacturer that 'they are in fact incompatible with each other'.

3.6.3 The applicants also corresponded with the tile adhesive supplier and the membrane supplier regarding the compatibility of their products. Although unwilling to guarantee compatibility, both suppliers advised that no adverse effects were expected from using the different products together.

3.7 The March 2018 inspection

3.7.1 The remaining outstanding items were subsequently attended to and the authority re-inspected the house on 20 March 2018, with the record noting 'Inspection failed due to further work required to the ensuite shower'.

3.7.2 During the inspection, the authority took photographs of surface moisture readings of the polished concrete floor, which showed:

- 4 base readings ranging from 25% to 34%
- 4 readings at the south wall of the shower, ranging from 54% to 80%.

3.8 The application for determination

- 3.8.1 The Ministry received an application for a determination from the applicants on 12 April 2018. The Ministry sought clarification on construction of the ensuite shower base and whether the authority had formally refused to issue a code compliance certificate.
- 3.8.2 In an email to the Ministry dated 14 May 2018, the authority attached a copy of the building consent and the 2012 refusal to issue a code compliance certificate. The authority also noted the floor to the ensuite bathroom is approximately '200mm thick in that area, with 2 pours.'

4. The submissions

- 4.1 The applicants provided copies of:
- the final inspection record dated 20 March 2018
 - the email to the authority dated 11 March 2018
 - correspondence with the tile adhesive and membrane suppliers
 - the builder's producer statement dated 13 September 2017
 - an undated sketch of the floor membrane
 - the membrane applicator's producer statement dated July 2014
 - Sheet 5 and Sheet 24 of the consent drawings
- 4.2 The authority made no submission, but forwarded copies of the following documents:
- the consent documentation
 - the inspection records
 - the refusal to issue a code compliance certificate dated 3 September 2012
 - photographs taken during final inspections.
- 4.3 A draft determination was issued to the parties for comment on 20 July 2018.
- 4.4 On 24 July 2018 both the authority and the applicant accepted the draft determination without further comment.

5. The expert's report

5.1 General

- 5.1.1 As mentioned in paragraph 1.5, I engaged an independent expert to assist me. The expert is a member of the New Zealand Institute of Building Surveyors and inspected the house on 16 May 2018, providing a report completed on 19 June 2018. The parties were provided with a copy of the report on 22 June 2018.
- 5.1.2 The expert noted he was to assess code compliance of matters raised by the authority and to form a view on the as-built ensuite shower in regard to:
- compliance with Clauses B1, B2 and E3
 - whether wall/floor junctions will comply and continue to comply with the code

- whether the membrane is likely to have been damaged, and the likely effect of any damage on code compliance
- the authority's concerns on compatibility of the membrane and tile adhesive.

5.1.3 Although the 'architectural shape and form of the building appears to be largely in accordance with the architectural design drawings reviewed', the expert noted that (in regard to the ensuite bathroom):

- 100mm concrete nibs to ensuite walls have not been installed, so bottom plates are set at finished floor level
- a strip drain is installed at the base of the south wall in lieu of a central drain.

5.2 The south wall/floor junction (see Figure 2)

5.2.1 The expert discussed the membrane with the installer, who provided two construction photographs that showed the south wall/floor junction prior to installation of the wall membrane. The photographs show:

- wall plasterboard stopped and ready for priming
- a grey upstand of floor membrane extended some 30mm up the plasterboard
- the concrete polishing completed.

5.2.2 The expert reviewed the photographs, the consent drawings, and then visually inspected the junction, noting the construction sequence appears to have been (in summary):

- floor slab poured, with recess incorporated
- wall framing erected and wall linings installed
- membrane applied over the floor substrate and extended up onto the linings
- shower concrete poured, with strip drain cast into the concrete about 30mm off south wall (not inspected by the authority)
- membrane applied to walls and overlapped onto upstand of floor membrane
- aluminium angle installed at wall base, with short leg hard onto the concrete topping and long leg behind the wall tiles
- tiling and mortaring completed.

5.2.3 The expert discussed construction with the builder and membrane installer, noting:

- The builder had installed floor membrane under topping slab and had issued a producer statement for that part of the work (see paragraph 3.4.3).
- The membrane installer had installed wall membrane and had issued a producer statement for that part of the work (see paragraph 3.3.2).
- The builder had last seen the building before the shower floor was polished and before the walls had been tiled.
- The membrane installer provided photographs and confirmed the shower floor had been polished before the wall membrane was applied.
- The membrane upstand had therefore not been protected during floor polishing – and the polisher could have touched and damaged the membrane.

5.3 Moisture investigations

- 5.3.1 The expert checked the calibration of two moisture meters by placing them side by side (in capacitance mode) at various areas throughout the house, including at 500mm centres on the hall concrete adjacent to the ensuite south wall – noting that the maximum variance was 2%, with no indication of elevated moisture in the slab.
- 5.3.2 The expert investigated the south wall of the ensuite by removing skirtings and 7 small cut-outs of lining from the adjacent hall and toilet (see Figure 1), observing:
- no evidence of swelling or mould on MDF skirtings
 - no evidence of mould on the back of lining
 - bottom plate installed at the finished floor level
 - no evidence of mould on bottom plates
 - no evidence of mould on the back of shower plasterboard.
- 5.3.3 The expert took surface readings on the back of shower plasterboard just above the bottom plate and obtained consistent results from three different moisture meters. Readings were ‘well within an acceptable range’, except for one area towards the toilet door which was ‘slightly elevated at 17%’ (see Figure 1, Location A).
- 5.3.4 The expert drilled 80mm into the bottom plate and took invasive readings close to the shower plasterboard and noted a similar pattern to the above; with readings ‘well within an acceptable range’ except for the same Location A, which had a moisture level of 18% (when corrected to account for CCA treatment). The expert also noted the moisture readings dropped to below 16% some 100mm away from Location A.
- 5.3.5 The expert forwarded drill shavings from Location A for analysis and the laboratory report dated 23 May 2018 noted the sample:
- was ‘almost certainly’ treated with a copper chrome arsenate preservative to an equivalent of H3.2 level
 - contained ‘traces of fungal growths’ but ‘no structurally significant decay was detected’.
- 5.3.6 The expert also investigated the equilibrium relative humidity (“ERH”) of the concrete floor behind the ensuite south wall. The expert drilled two 12mm diameter holes 50mm deep where skirtings were removed; one at Location A and the other about 500mm from behind the toilet door (where moisture levels were below 12%). ERH levels were the same in both locations.

5.4 Guidance on shower wall/floor junctions

- 5.4.1 The expert considered BRANZ guidance on similar junctions and noted several wall/floor junctions that include sealant at the joints.
- 5.4.2 Taking account of the minimal amount of moisture ingress at the shower wall/floor junction, the expert considered a bead of mould-inhibitive sealant applied to the gap would likely prevent moisture penetration, although this would require regular maintenance to remain durable.

5.5 The expert’s conclusions

- 5.5.1 The expert concluded moisture had penetrated through the shower floor/wall junction to the lining and bottom plate in one area of the south wall, which does not comply

with Clauses E3 and B2. In regard to Clause B1 Structure, the expert considered the CCA treatment and the minimal amount of moisture penetration made the risk of structural failure very low.

- 5.5.2 The expert noted that shower surfaces and junctions had already lasted 5 years with no damage to the underlying construction and (providing the wall/floor gap is appropriately sealed) he considered the ensuite bathroom should remain durable for the remaining period as required by Clause B2.
- 5.5.3 The expert also noted discussions with the authority identified that ‘concerns regarding the compatibility of the tile adhesive with the wet area membrane have been resolved to the [authority’s] satisfaction’.

6. Discussion

6.1 General

- 6.1.1 The authority did not inspect the shower substrates and membrane installation during construction and is also concerned the consent details have changed and the concrete nibs around the bathroom were not constructed (see Figure 2).
- 6.1.2 The authority is concerned the ensuite bathroom does not meet certain functional and performance requirements of Clause E3 Internal moisture and Clause B2 Durability. The question is therefore whether, as installed, the shower lining complies with the relevant requirements of Clause E3 to the extent required by Clause B2.

6.2 Clause E3.3.6

- 6.2.1 Functional requirement Clause E3.2 calls for buildings to be constructed in a way that avoids ‘damage to building elements caused by the presence of moisture’.
- 6.2.2 Performance requirement Clause E3.3.6 says:

Surfaces of building elements likely to be splashed must be constructed in a way that prevents water splash penetrating behind linings or into concealed spaces.

This is to avoid the likelihood of internal moisture penetrating behind linings and, in this case, into the underlying plasterboard and timber framing where it may cause damage. Clause E3.3.6 must therefore be considered for the wall/floor junction as a whole.

- 6.2.3 In regard to the south wall/floor junction, as shown in Figure 2, I note the following:
- It appears the shower has only been in use for a limited period of time and only limited account can be taken of its present performance in use.
 - Although the drain is adjacent to the south wall/floor junction, it is positioned within the floor topping slab and is separated from the junction. However, the location of the drain means water is directed towards the south wall.
 - There is no reinforcement of (or detailed information about) the membrane at the junction of the vertical face of the concrete foundation slab and the plasterboard above. These are very dissimilar materials subject to the normal construction tolerances, and the timber frame to which the plasterboard is fixed will be subject to movement from variations in moisture content. This junction is critical to the performance of the shower membrane.
 - The 30mm overlap of the floor and wall membranes is small.

- The membrane upstand may have suffered damage when the shower floor concrete was polished but whether this has occurred is not known. No information has been provided that records how the membrane was protected during the polishing of the concrete floor.
- The aluminium angle at the wall/floor junction is fixed onto the shower floor concrete.
- Water is able to access the tiling adhesive at the rear of the tiles at the gap between the tiles and the aluminium angle at the base of the wall, and will also be drawn into any gap between the angle and the floor.
- Notwithstanding the minor moisture penetration at Location A, testing has confirmed that bottom plates are H3.2 CCA-treated, which has resulted in no structural damage to the timber to date. While the bottom plate may be treated, the moisture may have an adverse impact on adjacent timber, and plasterboard linings.
- Apart from Location A, the expert's moisture testing and destructive investigation has confirmed that the south wall/floor junction has remained watertight and protected by the underlying membrane layers to date.

6.3 Summary

- 6.3.1 The first barrier to moisture ingress (the tiling) is compromised by an unsealed gap between the wall tiles and the planted aluminium angle, and capillary action can draw water through the tile adhesive above the aluminium angle as well as under the aluminium angle at floor level.
- 6.3.2 The second barrier to moisture ingress, (the membrane), may have been compromised by damage to the membrane upstand when the concrete surface was polished. The ongoing durability of the membrane is likely to be affected by the performance of the membrane along the junction of the face of the concrete foundation slab and the plasterboard above.
- 6.3.3 The expert's report establishes the current performance of the south wall/floor junction is not adequate because there is evidence of moisture penetration into the underlying timber in one location. I am therefore satisfied the ensuite bathroom does not comply with Clause E3 and Clause B2 of the Building Code.
- 6.3.4 In addition, Clause B2 requires a building to satisfy all the objectives of the Building Code throughout its effective life, and that includes the requirement for the shower to remain watertight. The shower linings and underlying structure are required to be durable for the periods required by Clause B2.
- 6.3.5 While the current defect appears to only occur in one location, I have insufficient information to draw any conclusions about the likely ongoing compliance of the tiled wall/floor junction to the remainder of the shower.

7. The decision

- 7.1 In accordance with section 188 of the Building Act 2004, I hereby determine the ensuite shower south wall/floor junction does not comply with Building Code Clauses E3 Internal moisture and B2 Durability.
- 7.2 I have insufficient information to determine whether the remaining ensuite shower wall/floor junctions comply with Clauses E3 and B2.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 30 August 2018.

Katie Gordon
Manager Determinations

Appendix A

A.1 The relevant legislation

A1.1 Parts of Clause E3 Internal Moisture most relevant to this shower are:

Functional requirement

- E3.2** Buildings must be constructed to avoid the likelihood of –
- (a) fungal growth or the accumulation of contaminants on linings and other building elements; and ...
 - (c) damage to building elements caused by the presence of moisture.

Performance

- E3.3.4** Wall surfaces adjacent to sanitary fixtures or sanitary appliances must be impervious and easily cleaned.
- E3.3.5** Surfaces of building elements likely to be splashed or become contaminated in the course of the intended use of the building, must be impervious and easily cleaned.
- E3.3.6** Surfaces of building elements likely to be splashed must be constructed in a way that prevents water splash penetrating behind linings or into concealed spaces.

A1.2 Parts of Clause B2 Durability most relevant to this shower are:

Functional requirement

- B2.2** Building materials, components and construction methods shall be sufficiently durable to ensure that the building, without reconstruction or major renovation, satisfies the other functional requirements of this code throughout the life of the building.

Performance

- B2.3.2** Individual building elements which are components of a building system and are difficult to access or replace must either:
- (a) all have the same durability, or
 - (b) be installed in a manner that permits the replacement of building elements of lesser durability without removing building elements that have greater durability and are not specifically designed for removal and replacement.