Determination 2017/008

Determination regarding the compliance of cladding and timber framing to a remediated 15-year-old house at 6 Drumquin Rise, Auckland

Summary

This determination is concerned with the compliance of cladding and timber framing in a 15-year-old house that had previously been subject to moisture ingress. The determination considers the authority's reasons for refusing the code compliance certificate for alterations that involved recladding and over-cladding, and whether the house complies with the requirements of the Building Code, particularly with respect to weathertightness and durability.

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1. The matters to be determined

1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004[1] ("the current Act") made under due authorisation by me, John Gardiner, Manager Determinations and Assurance, 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 owner of the house, Ross Holyoake Family Trust ("the applicant") acting through an agent
- Auckland Council ("the authority"), carrying out its duties as a territorial authority or building consent authority[2].

1.3 I note that the applicant is also a principal in the companies that supplied and/or installed the wall cladding system, the moisture monitoring system, the injected timber preservative, and the as-built drawings of the remedial work.

[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] After the consent amendment for the repairs was granted and before this application was made, Manukau City Council was transitioned into Auckland Council. The term authority is used for both.

1.4 The initial application for this determination arose from the following:

- In 2005, the applicant purchased the 4-year-old house that did not have a code compliance certificate, and installed a moisture monitoring system. In 2006, the applicant proposed a plan for remediating areas with moisture problems.
- In 2007, the authority issued an amendment to the original building consent for remedial work ("the consent amendment"), which included new roof and wall claddings, replacement of damaged framing and treatment of retained original framing with a brushed on timber preservative ("the brush-on preservative").
- After completion in 2008, some moisture detection unit ("MDU") probes indicated rising moisture levels in framing, and further repairs were undertaken in 2009 and 2011, including the injection of timber preservative into associated areas of the original framing ("the injected preservative").
- Following a satisfactory final inspection in 2015, the authority refused to issue the code compliance certificate due to concerns about the adequacy of the structure where the framing had been injected with timber preservative in 2009 and 2011. The initial application for determination was limited to the injected timber only.

1.5 The Ministry commissioned an expert to advise on the dispute ("the expert") who reported on the framing and a first draft determination was issued to the parties for comment. The authority responded that, due to the previous history of water ingress problems, it considered it has insufficient independent evidence of code compliance from a suitably qualified person.

1.6 Due to the authority's continuing concerns about the previous history of water ingress problems, the parties requested that the scope of the determination be broadened to include cladding which had not been inspected during remediation.

1.7 The matters to be determined[3] are therefore whether:

(a) The areas of original framing retrospectively treated with the injected preservative comply with Clause B1 Structure[4], and Clause B2 Durability of the Building Code. I consider this matter in paragraph 8.2.

(b) The remediated wall claddings to this house comply with Clause B2 Durability, and Clause E2 External moisture of the Building Code. The claddings include the components of the systems (such as the monolithic cladding, the windows, the substrates and the flashings), as well as the way the components have been installed and work together. I consider this matter in paragraph 8.3.

1.8 The above matters relate to areas of the recladding and over-cladding, which formed part of the 2007 amendment to the original building consent but were not inspected by the authority.

1.9 Matters outside this determination

1.9.1 I note that the final inspection in August 2015 passed subject to a peer review and, in its refusal to issue the code compliance certificate the following month the authority restricted its concerns to the framing where the injected preservative was applied.

[3] Under section 177(1)(a) of the Act

[4] In this determination, unless otherwise stated, any references to sections are to sections of the Act and references to clauses are to clauses of the Building Code (First Schedule, Building Regulations 1992).

1.9.2 Although this determination now includes the remediated cladding associated with the latter framing, it does not consider other areas of the building envelope that were inspected by the authority during the remediation work.

1.9.3 The expert raised several questions regarding the compliance of the two upper floor balconies with Clauses B1 and F4, and the applicant provided further information on this issue. I have received no indication that this is an item in dispute between the parties and therefore this determination is limited to the matters outlined in paragraph 1.7.

1.10 In making my decision, I have considered the submissions from the parties, the expert's reports and the other evidence in this matter. This includes sample analysis carried out by four different bio deterioration laboratories; referred to as follows:

Table 1: The relevant reports

Report dates	Title given to laboratories	Comment	Reports for:	On behalf of:
14 June 07	"the first laboratory"	Sampling and testing prior to and during remediation	The building surveyor	applicant
17 June 07				
9 Sept. 07				
18 Sept. 07				
15 Jan.16	"the independent laboratory"	Preservative/decay analysis of site-injected framing samples	The expert	Ministry
8 Aug. 16	"the second laboratory"	Similar location to expert 's sampling	Moisture detection company	applicant
8 Aug. 16	"the third laboratory"	Similar location to expert 's sampling		
***Note**: Report's from the first and second laboratories are signed by the same bio deterioration expert.*				

2. The building work

2.1 The original house

2.1.1 The original two-storey detached house was built in 2000 on a gently sloping site in a very high wind zone[5] for the purposes of NZS 3604[6]. The expert takes the garage doors as facing south and this determination follows that convention.

2.1.2 Construction of the original house was generally conventional light timber frame, with concrete foundations and floor slab, monolithic-clad timber-framed walls and aluminium windows. The roof cladding consisted of mono-pitched metal roofing, with a raised central section in curved membrane roofing. Two large roof decks, with tiled floors and monolithic-clad balustrades, extended from upper level bedrooms.

2.1.3 The original wall cladding was a form of monolithic cladding system described as stucco over a solid backing, which consisted of fibre-cement sheets fixed through the building wrap directly to the framing timbers, and covered by metal-reinforced solid plaster. In the 2004 Weathertightness Report, the framing was noted as untreated and, given the date of construction in 2000 and the history of timber damage I accept that the original external framing was generally not treated[7].

[5] According to the authority's LIM report (amended in the expert's second report). This is disputed by the applicant (refer paragraph 4.4.3)
[6] New Zealand Standard NZS 3604:1999 Timber Framed Buildings
[7] Untreated timber framing would not have been in accordance with the Standard NZS3602:1995 (Table 1B) current at the time of construction.

2.2 The repaired house

2.2.1 New monopitched profiled metal roofs have replaced the original roof decks, and the original timber-framed monolithic-clad chimney structures have been removed. Although reasonably simple in plan and form, complex features result in a high weathertightness risk for the repaired house[8]. It is acknowledged that some high-risk features on the house, as it was originally built, have been removed as part of the remedial work.

2.2.2 Two new steel-framed balconies with open timber floors and wire balustrades now extend from new glazed doors installed in the west walls of the upper bedrooms, which have been over-clad with new monolithic cladding.

2.3 The new claddings

2.3.1 The new wall claddings are a form of monolithic cladding system known as EIFS[9]. In this instance, the claddings are particular proprietary products that include flashings to heads, jambs, sills, trims and corners. The system incorporates expanded polystyrene backing sheets finished with a proprietary mesh reinforced product plaster system. The inside face of the polystyrene is indented by a diamond pattern of grooves at 50mm centres. Grooves are approximately 10mm deep by 14mm wide, intended to facilitate drainage via the rear face to provide additional protection against the consequences of moisture ingress.

2.3.2 In this house, about 40% of the external walls have been reclad with EIFS ("the recladding"). The recladding work consists of 60mm backing sheets fixed through building wrap directly to either existing or new timber framing.

2.3.3 The remaining original stucco cladding was overlaid with EIFS ("the over-cladding") consisting of 30mm backing sheets with 14mm wide x 6mm deep vertical grooves at 100mm spacing fixed directly to the existing stucco. The specification and as-built drawings indicate that the over-cladding included 'drying skirts', where bands of stucco were removed at mid-floor, foundation and apron flashing levels and replaced with EIFS.

2.4 The wall framing

2.4.1 The specification calls for new and replacement framing to be treated to H3.2 and I accept that new framing is treated to a level that will resist fungal decay.

2.4.2 The specification also calls for the retained original untreated timber framing to be site treated with a proprietary brush-applied boron preservative ("the brush-on preservative"). This preservative was applied to any sound original framing exposed during initial consented repairs during 2007 and to about 2m at the top of framing exposed during chimney repairs in 2011.

2.4.3 The framing injected with preservative is the two small areas on the west elevation, where the original framing was not exposed during the 2007 repairs. Window repairs to the west elevation were undertaken in 2009, with the preservative injected into to the original untreated framing.

[8] The applicant disputes this statement – refer paragraph 4.4.3
[9] Exterior Insulation and Finish System

3. Background

3.1 The original construction

3.1.1 The authority issued a building consent for the house (No. 10/1951) to the original owners on 22 June 2000 under the Building Act 1991 ("the former Act"). Inspections were carried out by a building certifier, and the project was passed back to the authority for completion of final inspections and the issue of a code compliance certificate. The final inspection was delayed until after October 2002.

3.1.2 The house developed moisture problems associated with the roof decks and in July 2004, the original owners applied for a remedial consent for 'cladding removal'. The authority required a weathertightness report for the house as a whole because of growing concerns at that time about monolithic-clad buildings.

3.1.3 A weathertightness report dated 25 August 2004 reported very high moisture levels in the flat tops to clad balustrades and to a number of other exterior walls. A building surveyor identified a number of defects in the stucco cladding, penetrations, windows and doors and other junctions; and concluded that further invasive moisture testing and investigation of framing was needed.

3.1.4 The authority refused to issue a 'remedial consent' due to concerns identified in the weathertightness report and suggested that the owners either apply to the WHRS[10] or re-clad the house under a new building consent. Although a WHRS application was made (No. 02744) and a report completed, the original owners did not pursue the matter and the applicant purchased the house in 2005 in an 'as-built' condition.

3.1.5 The applicant installed a moisture monitoring system in July 2005 using MDU probes, and moisture levels were monitored over the following year together with further investigation undertaken to determine the extent of timber damage.

3.2 The remediation proposal

3.2.1 In 2006, applicant developed a remediation plan, which included the following:

- identify extent of timber decay and remove stucco over damaged framing
- remove roof decks, north chimney[11] and any damaged framing, with new roofs to be constructed
- replace all damaged framing with H3.2 CCA framing
- remove windows to install sill tray flashings
- install new wall cladding systems that include:
  - EIFS recladding direct-fixed to repaired walls ("the recladding")
  - EIFS direct-fixed to remaining stucco walls ("the over-cladding")
  - 'drying skirts' to base of all over-clad walls[12]
  - 'eyebrows' formed from EIFS to be installed at window heads[13].

3.2.2 Consent drawings, including two new steel-framed decks from upper bedrooms, were prepared by the original house designers ("the 2007 drawings"). An experienced building surveyor ("the building surveyor") was employed to advise on

[10] Weathertight Homes Resolution Service
[11] The 2007 drawings show a new chimney constructed.
[12] 2007 consent drawings show plaster cut back from foundation to provide ground clearances
[13] Eye-brow details not shown in 2007 drawings

timber framing condition and replacement and reports from the first laboratory were obtained for framing associated with the north and south roof decks.

3.3 The remediation work

3.3.1 The authority issued an amendment to the original consent (No.101951A1) on 10 August 2007 under the current Act for:

> Re-clad, exterior alts to roof line, windows, chimney & remove decks.

3.3.2 I have seen no detailed records of individual inspections, but an untitled handwritten summary indicates that the authority carried out inspections during August and September 2007, with the last inspection of some areas of framing, plasterboard bracing and cladding dated 19 September 2007.

3.3.3 The expert's second investigation found further evidence of the authority's inspections in the form of dated handwritten signed notes recorded on drawings on site. These notes indicate that the authority carried out the following inspections:

- Framing to former roof decks on 17 August 2007
- Nailing of backing sheets on 5 September 2007
- Nailing of backing sheets on 5 September 2007
- Plaster and family room pre-line on 11 September 2007
- Building wrap and flashings to east wall on 17 September 2007
- Gib-nailing to family room, backing sheets to east wall on 19 September 2007.

3.3.4 During September 2007, the building surveyor advising on timber replacement took 44 further timber samples and reports on decay and boron analysis were completed by the first laboratory in 18 September 2007.

3.3.5 Over-cladding and plastering apparently continued for some time without any record of further inspections, with the cladding installer's 'Advice of Completion of Building Work' dated 23 October 2008.

3.4 Subsequent repairs

3.4.1 Moisture monitoring using the MDU probes continued, which identified problems in a ground floor bi-fold door and lead to all bi-fold doors being re-sited and reframed in 2009. West walls adjacent to the upper bi-fold doors had been over-clad during the 2007 repairs, so had not been treated with preservative. During the 2009 repairs, some areas of original framing were therefore treated with the injected preservative.

3.4.2 The following year, when moisture levels had stabilised and all significant repairs and alterations appeared to be completed, as-built drawings were prepared.

3.4.3 The chimney structure above the upper curved roof had not been altered and by 2011, substantial cracks had developed in its stucco cladding. The stucco was removed and the chimney structure lowered in height and re-clad. Associated internal framing had brush-on preservative applied and MDU probes were installed. The as-built drawings were updated to reflect the chimney alteration.

3.5 The 2015 application for a code compliance certificate

3.5.1 Moisture monitoring continued but no final inspection was carried out until the applicant sought a CCC in 2015. Documentation was forwarded to the authority under cover of a memorandum which noted:

> Works were done with council inspections mainly 2009[14]. Due to some incomplete works further as detailed building work was undertaken by way of amendment in the attached as built drawings together with revised specifications. Please add these to the property file.

3.5.2 The attached documentation included (in summary):

- the as-built drawings and updated specification
- the handwritten inspection summary
- producer statements for EIFS and decks
- advice of completion for the EIFS
- a maintenance plan prepared by the moisture detection company
- applications for CCC and B2 modification dated 1 May 2014.

3.5.3 The authority carried out a final inspection on 11 August 2015 and the inspection record passed the items checked but noted:

> Inspection subject to peer Review and Vetting.
> Pass subject to Review.
> Ground clearance... ...100mm
> Rot Stop treatment complete as indicated on documentation provided – for peer Review
> Moisture readings between 9-16% – control cf 14-16% taken from inside walls.

3.6 Subsequent correspondence

3.6.1 The authority emailed the applicant on 9 September 2015 stating:

> Subject to [the authority's] peer review process, [the authority] is not satisfied on reasonable grounds that the structure is performing where the [preservative] was applied to the framing.
> Thus under SEC95A of the Building Act, [the authority] cannot at this stage issue a CCC.

3.6.2 The applicant responded on the same day asking for further information and explanations as to what evidence lead to the authority's refusal. In an email dated 14 September 2015, the authority raised further 'points for clarification. The following table shows the authority's queries along with the applicant's responses:

[14] Assumed to be a typographic error, as inspections were recorded only in 2007.

Table 2: Correspondence

Authority's queries	Applicant's response dated 14 September 2015
What inspections were carried out from 2007 to 2011	Last inspection was in September 2007. All later building work can be visually seen.
Whether later refurbishment of windows in 2009 was inspected as failure implies that reclad had not been successful	Windows had sill trays so are OK. Original leak was in ground floor bifolds, as sill drainage overflowed during high winds, causing elevated moisture levels in adjacent bottom plate. Drainage altered successfully. To avoid similar problems elsewhere, all bifold doors similarly altered, including the upper doors to the west decks. In the process, to protect the underlying untreated framing, [injected preservative] was applied.
Elevated moisture levels during 2009 also indicate that reclad was not successful	[Injected preservative] was applied to prevent damage occurring during the drying process in the future. Each injection involved removing a timber sample and all were free from decay.

3.7 The application for a determination

3.7.1 In the meantime, the applicant had completed an application for a determination, which was received by the Ministry on 14 September 2015. The Ministry accepted the application in a letter to the applicant dated 23 September 2015, which asked for clarification on a number of matters.

3.7.2 In an email to the authority dated 9 November 2015, the Ministry also sought copies of the property file and clarification of the refusal to issue a code compliance certificate for the repairs. The property file information was received on 10 November 2015.

4. The submissions

4.1 The initial submissions

4.1.1 Within the initial application, the applicant identified the authority's refusal to accept the application of the injected preservative into some original framing (see paragraph 2.4.3) and provided copies of:

- the as-built drawings dated 2011 and 2012
- the as-built specification updated on April 2011 and June 2015
- the application for a code compliance certificate, including:
  - handwritten inspection summary
  - producer statement for EIFS
  - producer statement for steel decks
  - maintenance plan for house
  - application for B2 modification
  - the authority's final inspection record dated 11 August 2015
- the authority's refusal to issue a CCC dated 9 September 2015

- in response to the request for further information:
  - the 2006 drawings for the consent amendment
  - other correspondence with the authority.

4.1.2 In an email to the Ministry dated 12 January 2016, the authority confirmed that its refusal applied to both the original consent and the 2007 amendment, but did not consider it had sufficient evidence 'to be able to sign off either at this time.' The authority expressed its concerns regarding the lack of independent authoritative testing of the injected timber preservative and also of the wall cladding, stating:

> In particular, it is known that there has previously been water ingress problems associated with the property, and [the authority] requires persuasive evidence that any defects and damage have been identified and remediated to a proper standard. Such evidence as a thorough, independent and satisfactory investigation by a properly qualified person such as a member of the NZIBS may be sufficient.

4.1.3 The authority forwarded a CD-Rom, entitled 'Property File', which contained documents pertinent to this determination including:

- the original 2000 consent documentation
- some correspondence with the original owners
- the weathertightness report dated 25 August 2004
- the 2004 refusal to issue a consent for repairs, dated 1 October 2004
- the 2006 consent amendment documentation.

4.2 The first draft determination

4.2.1 A first draft of this determination was issued to the parties for comment on 1 March 2016 and the parties responded as shown in the following paragraphs.

The authority's response

4.2.2 The authority responded to the draft determination by email on 17 March 2016, noting it did not accept the findings of the draft and considered that the scope of the draft did not adequately address the cladding concerns. The authority requested the determination consider not only the compliance of the framing, but also the current weathertightness performance of the building envelope.

4.2.3 The authority also considered that, as the as-built repairs do not accord with the building consent amendment documentation the authority cannot issue a code compliance certificate. In addition, the authority is of the view that regular monitoring of moisture levels and undertaking repairs in response is not 'normal maintenance'.

The applicant's response

4.2.4 The applicant responded by email on 18 March 2016, expressing concern that the scope of the determination was limited and requested the scope of the determination be broadened to address the authority's concerns regarding weathertightness of the altered cladding.

4.2.5 The applicant provided additional information and details regarding the alterations, which I have taken into account as I consider appropriate. The applicant also submitted that (in summary):

- as-built plans embody all the changes made
- the high weathertightness risk referred to in the draft is disputed

- over-clad areas are all on the top level under a generous soffit, with windows in the walls reinstalled with sill trays – these low risk areas are monitored
- during the expert's cut-outs he noticed H3 CCA framing to studs and bottom plates (I note that this was not included in the expert's first report, but I accept that the new framing is treated to a level that will resist fungal decay.)
- sufficient historical moisture readings establish seasonal moisture variations
- the injected preservative provides greater protection than H1.2.
- it is not clear how the independent laboratory results could include fungal growth in recent months when moisture readings have been below the threshold for moulds and decay fungi germination and growth phases
- reference to recent fungal activity is contradicted by the expert's observations.
- years of acceptable moisture readings recorded by MDU probes provide adequate proof of compliance with Clause E2.

4.2.6 Following the issue of the first draft of this determination the applicant sought information from the authority under LGOIMA[15] relating to the authority's assessment of the building work.

4.2.7 Following the receipt of responses to the first draft determination, I engaged the expert to revisit the house and to provide a second report as outlined in paragraph 6.

4.3 The second draft determination

4.3.1 A second draft of this determination was issued to the parties for comment on 27 July 2016. The authority responded on 9 August 2016 accepting the draft without comment.

4.3.2 Following receipt of the second draft determination and the expert's second report, the applicant provided further information 'to address issues raised' in the first two reports. In order to investigate the additional information, I engaged the expert to revisit the house and to provide a third report, as outlined in paragraph 7.

4.4 The third draft determination

4.4.1 A third draft of this determination was issued to the parties on 23 November 2016.

4.4.2 The authority responded on 19 January 2017, accepting the draft without further comment.

4.4.3 The applicant provided a further submission on 17 January 2017, clarifying the ownership structure and correcting some details. The applicant also submitted (in summary):

- The alterations involved more than just the cladding and timber and this should be reflected in the title of the determination.
- There is no conclusion in the draft determination regarding the balcony wires that were raised by the expert and responded to by the applicant.
- The draft failed to include any statement regarding the original framing being retained even though it is treated to less than H3. NZS 3604 cites NZS 3602 for

[15] The Local Government Official Information and Meetings Act 1987

preservative treatment of timber framing: Table 1B of NZS 3602 would have required treatment to H3 for the framing timber behind the original cladding, which was an absorbent cladding.

- Table 1 in the determination omits the third laboratory tests and statement in respect to the testing and use of the probes.
- Of the risk features that were identified in the WHRS report four have been removed and the applicant disputes the reference in the determination to complex features that result in a high weathertightness risk (refer paragraph 2.2.1)
- The WHRS report states that the authority's files identify the site as a medium wind zone (refer paragraphs 2.1.1 and 6.1.3).
- While the expert is technically correct that there are three different cladding types, the risks inherent in using different cladding types such as brick to plaster is mitigated in this case by the fact that the claddings are not dissimilar materials.
- The applicant advised that the modifications referred to in paragraphs 8.3.2 and 8.3.3 were carried out in response to earlier monitoring results rather than as a result of the expert's first and second visits.

4.4.4 In response to some of the points raised in the applicant's submission to the third draft, I note the following:

- The determination does not consider compliance of all of the building work; the authority's concerns and resulting disputed matters centred on the compliance of the cladding and timber as set out in paragraph 1.7.
- Table 1 of this determination (see paragraph 1.10) is simply a list of the reports received – the third laboratory report is summarised in paragraph 7.4.3.

5. The expert's first report

5.1 General

5.1.1 As mentioned in paragraph 1.10, I engaged an independent expert to assist me who is a member of the New Zealand Institute of Architects. The expert inspected the house on 17 December 2015, providing a report completed on 17 February 2016, which was sent to the parties on the same day.

5.1.2 The expert noted that the scope of his inspection was to provide an opinion about the authority's section 95A refusal dated 9 September 2015 and to assess code compliance of those areas of the west wall that had been treated with the preservative injected into framing in 2009.

5.1.3 The expert observed variations from the 2006 consent amendment. His observations have now been replaced with those outlined in his second report (see paragraph 6.2).

5.1.4 The expert also considered that the risk assessment shown in the drawings significantly under-estimated the risk level for the wall cladding. (I have assessed the house as having a high weathertightness risk; some individual elevations have a medium weathertightness risk.)

5.2 Moisture testing and destructive investigations

5.2.1 The expert inspected the internal linings of the external walls, observing that these were 'free from mould, stains, swelling or other signs of moisture ingress.' The expert took invasive moisture readings using the existing moisture probes at the bottom of the four subject walls, with readings ranging from 11% to 12%. The expert noted that these were taken during summer and higher readings would be expected during the winter months.

5.2.2 The expert also removed small sections of lining from the inside of two of the walls ("the cut-outs") and was able to observe new framing and the original framing that was injected with preservative in 2009.

5.3 The first laboratory's timber analysis

5.3.1 The expert took three timber samples from site-injected framing as follows:

- Sample 1 from a stud to the south of the deck doors to Bedroom 2
- Sample 2 from a bottom plate to the south of the deck doors to Bedroom 1
- Sample 3 from a stud to the south of the deck doors to Bedroom 1.

5.3.2 The samples were forwarded to the independent laboratory for analysis and the report dated 15 January 2016 noted that preservative analysis suggested that the samples were treated with boron to Hazard Class 1 of MP3640:1992, equivalent to H1.2.

5.3.3 The report noted that all of the samples contained traces of 'fungal growths and/or fungal remnants, but no structurally significant decay was detected'. The preliminary replacement guide was that the framing did not need replacement and could remain in situ 'provided that other provisos are applied.'

5.3.4 In a follow up email on 10 February, the independent laboratory advised that:

> ...there was some fungal morphology indicative of very recent activity. Difficult to be sure in this instance that it was decay fungi but certainly moisture had been high enough in recent months for fungal growth per se, i.e., not clear if moisture had been sustained enough for decay but certainly fungal growth.

5.4 Moisture monitoring history

5.4.1 The expert assessed the data collected from the moisture probes from 2008 to 2015, in particular regard to probes within the subject framing or below the framing. Table 3 summarises moisture readings for those areas:

Table 3: Moisture probe reading history for injected framing

Probe No.	Jan 2008 to Feb 2009	20 to 29 March 2009	April 2009 to Jan 2010[(1)]	May 2011 to May 15
103	11% to 12%	92% to 99%	58% down to 17%	10% to 13%
104	12% to 13%	92% to 99%	64% down to 18%	9% to 11%
117	11% to 17%	92% to 99%	21% to 24%	11% to 13%
118	11% to 13%	92% to 99%	69% down to 19%	11% to 13%
70	15% to 21%	66%[(2)] down to 32%	27% to 22%	10% to 15%[(3)]
71	11% to 13%	10% to 11%	10% to 12%	9% to 11%

Probe No.	Jan 2008 to Feb 2009	20 to 29 March 2009	April 2009 to Jan 2010(1)	May 2011 to May 15
80	9% to 14%	11% to 12%	11% to 14%	10% to 11%
81	12% to 14%	12% to 16%	12% to 18%	11% to 14%

Key	
	Probes adjacent to upper deck doors (103, 104, 117, 118)
	Ground floor probes below subject framing (70, 71, 80, 81)
	Moisture levels when water-borne preservative injected into framing
	Moisture in preservative drying out

Notes:

1. For simplicity, November 2010 and January 2011 readings not included in table.
2. Probe 70 affected by preservative leaking from injections to framing above
3. Probe 70 read at 27% in May 2011. Considered to be anomaly as very low readings were recorded several weeks earlier and a month later – therefore not shown in above summary.

5.4.2 The expert noted that the pattern of readings was similar to those taken during his investigation, with the exception of the period when the injected preservative was applied to framing. He also noted that moisture levels have never been sufficient to cause decay at MDU probe locations in the subject framing.

5.5 Durability of the framing

5.5.1 The expert noted that his investigation did not include a general review of the cladding details and was limited to the condition of framing that had been injected with the preservative in 2009.

5.5.2 With regard to the subject framing, the expert noted that:

- no visual signs of decay were revealed at the cut-outs
- the timber sample analysis showed no structurally significant decay
- analysis confirmed the presence of boron in the samples
- moisture readings recorded over 7 years in service are low.

5.6 Summary

5.6.1 The expert noted that fungal growths in the samples (see paragraph 5.3.4) gave 'some cause for concern', but he considered that this is mitigated by:

- the lack of evidence of decay after 15 years in service
- low moisture readings recorded over 7 years in service
- confirmation of boron preservative in the framing.

5.6.2 Taking account of the above, the expert concluded that the subject framing:

> ...can be expected to perform adequately and to comply with the NZBC providing normal maintenance is carried out, including repairs to any areas where high moisture levels are measured at the MDU probes in the future.

5.6.3 The expert also noted that there were clear differences in the as-built repairs from the approved drawings and the authority could have refused to issue the code compliance

certificate because the completed building work did not comply with the building consent amendment.

6. The expert's second report

6.1 General

6.1.1 Following the receipt of responses to the first draft determination, the expert revisited the house on 12 April 2016, providing an addendum report completed on 22 April 2016. The parties were provided with a copy of the report on 27 April 2016.

6.1.2 The expert noted that his second report covered 'a change in scope of the investigation to include areas of the cladding that formed part of the 2007 work but were not inspected during construction.' The expert found additional evidence of inspections as outlined in paragraph 3.3.3, including handwritten inspection notes recorded by the authority on site drawings.

6.1.3 Based on his further investigations and information collected, the expert amended some sections of his first report, including:

- wind zone amended to 'very high' (see paragraph 2.1.1)
- description of decks changed to 'Juliet balconies'
- description of injected preservative as including boron and other preservatives
- as-built construction compared to consent documents (see paragraph 5.1.3)
- the risk assessment (see paragraph 5.1.4).

6.2 Variations from the consent drawings

6.2.1 Although the applicant informed the expert that 'several changes were made on site' with the approval of the authority, there is no record that the submitted as-built drawings have been approved.

6.2.2 The expert noted the following differences between the approved consent drawings and the as-built construction:

- consent drawings were ambiguous as to the extent of recladding:
  - plan drawings notes state 'all existing...plaster etc to be removed' and 'reclad building in Hitex 50 Diamond Cladding...'
  - elevations show some walls hatched and others clear, but with no key to the shading is provided
  - details show both recladding and over-cladding.
- as-built construction was a combination of:
  - recladding with 60mm direct-fixed Hitex EIFS Diamond Cavity direct-fixed cladding
  - over-cladding of original direct-fixed stucco with 30mm Hitex, which included 'drying skirts' where bands of stucco were removed at mid-floor, foundation and apron flashing levels and replaced with EIFS
- application of the injected preservative not in consent drawings
- various alterations to joinery, including:
  - additional window to upper west elevation

- garage window changed to door
- bedroom 3 window fully glazed in lieu of part louvered.

- north chimney shown in consent drawings was not constructed
- the Juliet balconies were different with respect to structure and the balustrades.

6.3 Weathertightness risk

6.3.1 The expert noted that the weathertightness risk score shown on the as-built drawings appears not to reflect the following:

- junctions of lower roofs with upper roofs
- upper floor eaves widths to south elevation above entrance
- envelope complexity.

6.3.2 The expert noted that the steel framing to the Juliet balconies do not penetrate the cladding with the only penetration being the bolt connections. The expert considered the Juliet balconies did not fall within the type of deck contemplated in E2/AS1.

6.4 The 2007 decay analysis

6.4.1 The expert reported that the building surveyor experienced in 'timber replacement' had been employed for the remediation work, with analysis by the first laboratory of the original framing obtained and recommendations for timber replacement made. The expert obtained copies of four reports by the first laboratory.

6.4.2 Two reports had been completed prior to the commencement of repair work (see paragraph 3.2.2), which provided the results of sample testing of the original north and south roof deck framing as follows:

- 14 June 2007 report provided results of tests for preservative in 4 timber samples, showing mix of untreated and boric-treated deck and wall framing
- 17 June 2007 report provided results of decay analysis in 7 timber samples, showing moderate brown roof in 3 samples and fungal growth in 4 samples.

6.4.3 Two further laboratory reports dated 9 and 18 September 2007 tested a total of 44 timber samples taken from unidentified locations during the repair work. The reports included the following (in summary):

- Only 3 samples tested 'weakly positive for boron'
- 20 samples showed varying types and levels of decay, with 13 samples considered to be 'unsound' and
- 2 samples contained 'incipient to light brown rot' and whether framing needed replacement was a 'judgement call'.
- 24 samples contained fungal growth but no established decay.

6.5 Timber replacement during remediation work

6.5.1 The expert noted that no report had been produced by the building surveyor on completion of the repair work. The expert therefore based the following on discussions with the surveyor and the applicant, together with any available records.

6.5.2 The expert considered that consent documents imply the consent of an injected preservative by referring to its use where access precludes the application of brush-

on preservative. The expert noted that 'specific notes' in the consent plans refer to the use of brush-on preservative on retained original framing as follows (emphasis added):

> Apply 2 coats of [preservative] to all exposed faces of the timber framing and the back of all existing gib surfaces. Where [brush-on preservative] cannot be applied experimental post treatment technique will be carried out involving pressure injection through holes drilled in selected locations. [The authority] to inspect building following re instatement of timber.

6.5.3 The expert noted that (in summary):

- the applicant stated that the authority inspected timber replacement and treatment, although there are no specific records of those inspections
- the applicant's 2007 construction photographs clearly show new framing in some areas, with others showing original framing treated with a pink preservative, assumed to be the specified brush-on product
- the construction photographs clearly show that all of the original north chimney framing was removed and replaced with new treated framing.

6.6 Moisture testing

6.6.1 The expert inspected the internal linings of the external walls, observing that these were 'free from mould, stains, swelling or other signs of moisture ingress.' Because there was no evidence of inspections of the over-cladding applied to the original stucco, the expert focussed on the timber framing within those walls.

6.6.2 The expert took invasive moisture readings using the existing MDU probes at sample locations in over-clad walls within the east and west elevations and recorded low moisture levels of:

- 12% to 14% on the west elevation
- 13% to 16% on the east elevation

6.6.3 The expert compared his readings with those recorded by the MDUs on 21 April 2016 and noted a variance of 0% to 4%, 'likely due to some probes being replaced and use of different moisture readings'. All MDU readings were in the low range.

6.6.4 The expert noted that moisture readings into new treated timber or original framing treated with site-applied preservative needed to be adjusted to take account of the preservative, which would result in a correction of up to 4%.

6.6.5 The expert also queried the laboratory which had undertaken sample testing for his first report and the laboratory provided an updated report that expanded the description of what was meant by 'traces of fungal growths' and also corrected a typographical error. The independent laboratory also noted that:

> The low level of fungal activity found in the samples could have been caused by fungal types which sequester water from water vapour in the air, rather than liquid water resulting from moisture penetration.

6.7 The history of MDU probe readings

6.7.1 The expert also reassessed data collected by the MDU probes for the period 2008 to 2015. Moisture levels recorded in probes into preservative-injected framing or below that framing are shown in Table 3 (see paragraph 5.4.1).

6.7.2 In regard to the other external walls, the expert noted intermittent maximum readings recorded in bottom plates at four probes as follows:

- 20% at a wall/roof junction near the end of an apron flashing
- 18% and 19% adjacent to two ground floor doors (see paragraph 6.8.2)
- 19% beside the garage door (see paragraph 6.8.2)

6.7.3 The expert considered that further investigation is necessary to the above locations, because an elevated reading could be due to un-corrected readings into treated timber, contamination of the probes, or defect(s) causing moisture ingress. (I note that these areas were subsequently modified as outlined in paragraph 7.3.2 of the expert's third report.)

6.8 Durability of the remediated claddings

6.8.1 The expert also considered the general weathertightness and durability of intersections and junctions associated with the remediation work and its compliance with the consent documents. His assessments are outlined in the paragraphs below.

6.8.2 In regard to the joinery details in the remediated walls, the expert noted that:

- aluminium head flashings are fitted and include a drainage gap in accordance with the consent detail
- jambs appear to comply with the limited requirements shown in the consent detail sealant, with sealant visible at jambs
- although window sill trays are not visible, the authority observed flashings during an inspection of the rear wall on 17 September 2007
- MDU readings generally indicate adequate performance of window details
- no door sill tray was visible at ground level doors and no door sill details were provided in the consent drawings
- intermittently elevated readings were recorded in the moisture probes at two ground floor doors and the garage door, which are not explained.

6.8.3 In regard to other junctions and details, the expert commented as follows:

- The base details of reclad and over-clad walls generally comply with the consent details and there is no evidence of non-compliance
- Wall cladding junctions with roofs appear adequate and generally conform to consent details, with stop-ends as shown in the as-built drawings. However, one location needs further investigation to explain intermittent elevated moisture levels recorded by one moisture probe.
- Mid-floor junctions were not detailed in the consent drawings, but appear to correspond to details in the as-built drawings. Junctions appear satisfactory and were inspected by the authority on 5 September 2007.

6.9 Except for the areas outlined in paragraph 6.7.2, the expert considered that recladding and over-cladding generally appear compliant, with adequate performance demonstrated during the period prior to his investigation.

7. The expert's third report

7.1 General

7.1.1 Following receipt of additional information from the applicant, the expert revisited the house on 12 August 2016, providing an addendum report completed on 26 September 2016, which should be read in conjunction with his earlier reports. The addendum report was sent to the parties on 26 September 2016.

7.1.2 The expert noted that his third report was to consider the additional information provided by the applicant following his second report, which included:

- The building surveyor's letter regarding frame replacement inspections
- Updated moisture readings
- Further timber sampling and laboratory test reports on timber samples.

7.2 The building surveyor's letter

7.2.1 In response to the expert's comments regarding the lack of timber replacement records (see paragraph 6.5.3), the applicant stated that the authority's records 'had been lost or destroyed' and provided a letter from the building surveyor.

7.2.2 In the letter to the applicant dated 23 April 2015, the building surveyor noted that the letter served 'to be a Producer Statement for the work we observed on site' between early 2007 until the last site visit on about 18 September 2007. The surveyor included the following comments (in summary):

- Some cladding removal was observed, with exposed timber marked for removal and replacement or site-treated with the specified preservative.
- New replacement H3.2 CCA-treated framing was viewed as well as the site-treated framing.
- Subject to appropriate maintenance, the viewed framing remediation 'will satisfy the durability requirements of the Building Code.'
- Some wall and roof construction and junctions were viewed, but site visits could not cover all aspects of the works or construction that was concealed.

7.2.3 The expert noted that the building surveyor's letter provided reliable evidence of timber replacement, but did not cover all of the remediation work undertaken.

7.3 Updated MDU probe readings

7.3.1 The applicant provided a new set of MDU readings taken in August 2016. The expert observed that readings in external walls ranged from 10% to 17%; noting that these were recorded after periods of heavy rain during the previous month and indicated adequate performance of the cladding.

7.3.2 In regard to intermittently elevated readings noted in his second report (see paragraph 6.7.2), the expert observed modifications made to those areas since his last visit, noting that:

- the applicant believed that the standard drainage moulding to the bottom of door frames was insufficient and glazing beads had been trimmed to provide additional drainage
- at the garage door, the slab has been lowered (ground down) to lessen the likelihood of water from reaching the bottom plate.

7.3.3 The expert considered that 'both these explanations may be plausible and are supported by the low readings' in recent MDU probe readings (from 15% to 16%).

7.4 Further timber sampling

7.4.1 The expert witnessed the removal of two new timber samples removed from the bottom of framing to the south of the deck doors to Bedroom 2, close to the location where the expert had extracted a sample during investigations for his first report (see paragraph 5.3.1). The samples were forwarded to the second and third laboratories for analysis (see Table 1).

7.4.2 The second laboratory provided a report dated 8 August 2016, which noted that the sample 'tested strongly positive for Boron preservative' and concluded that the wood 'was sound and could be left in situ.' The report also noted that the sample 'exhibited occasional hyphae', adding that this:

> ...means that only a few scattered hyphae were observed. Their occurrence is too sparse to constitute incipient decay. Sound wood purchased from the supplier often exhibits occasional hyphae.

7.4.3 The third laboratory provided a report dated 17 August 2016, which noted 'no obvious loss of strength' in the sample and detected 'small clusters' of spores and slight superficial fungal growth 'likely occurring as a result of a raised relative humidity', adding that 'these fungi do not affect the integrity of timber'.

7.4.4 The expert noted that the above reports were very similar to those received from the independent laboratory, which had noted that the sample taken from the vicinity had contained traces of 'fungal growths and/or fungal remnants, but no structurally significant decay' was detected' (see paragraph 5.3.3) and had subsequently clarified (see paragraph 6.6.5) that:

> The low level of fungal activity found in the samples could have been caused by fungal types which sequester water from water vapour in the air, rather than liquid water resulting from moisture penetration.

8. Discussion

8.1 General

8.1.1 The 2000 building consent was issued under the former Act, and accordingly the transitional provisions of the Act apply when considering the issue of a code compliance certificate for those remaining parts of the house completed under that original consent. Section 436(3)(b)(i) of the transitional provisions of the current Act requires an authority to issue a code compliance certificate if it 'is satisfied that the building work concerned complies with the building code that applied at the time the building consent was granted'.

8.1.2 I note that the 2007 amendment to the original consent for the repairs and alterations was issued in under the current Act, which says that an authority 'must issue a code compliance certificate if it is satisfied, on reasonable grounds... … that the building work complies with the building consent. In this case, the documentation stamped as approved by the authority on 7 August 2007. In the case of the consent amendment, the expert observed significant as-built variations from the approved consent documentation, and has noted that the as-built drawings have not yet been approved by the authority.

8.2 Performance of the injected timber framing

8.2.1 In the case of the walls repaired in 2009 (see paragraph 1.7(a)), I note that the wall framing is part of the original building consent, and the over-cladding is part of the 2007 consent amendment. In order to determine the compliance of those walls, I must therefore consider whether the original framing treated with the injected preservative complies with the Building Code, taking into account the framing's current and anticipated likely exposure to moisture penetration following the repairs.

8.2.2 I must therefore consider whether that framing complies with the structural and durability provisions of the Building Code that applied at the time the original building consent was issued in 2000; taking into account the preservative injected into the timber in 2009.

8.2.3 In evaluating that timber, the expert carried out invasive investigations that assist in determining whether the framing as installed and later treated is code compliant. Taking account of the laboratory reports, the expert's comments in his three reports and the pattern of moisture readings over the past seven years, I accept the expert's opinion that the framing is currently structurally sound despite the presence of fungal growths in some samples tested. Reports by three different laboratories have noted these fungal growths are likely to have arisen from airborne moisture, rather than liquid water.

8.2.4 I also note the expert's comments in paragraph 5.6.1 regarding factors likely to mitigate the future consequences of that fungal growth. I agree with the expert's conclusion that the framing is likely to remain structurally adequate for the period required in the Building Code, providing moisture levels continue to be monitored regularly and repairs carried out promptly as part of ongoing maintenance of this house.

8.3 Performance of the remediated cladding

8.3.1 In his second report, the expert carried out additional investigations that assist in determining whether the recladding and over-cladding installed under the 2007 consent amendment is code-compliant. Taking account of the expert's second report and the other evidence, I accepted the expert's opinion that the majority of the wall cladding is performing adequately and has been weathertight since completion of repairs in 2011.

8.3.2 In his second report, the expert identified several areas where intermittent elevated moisture levels recorded by MDUs required further investigation to establish the cause(s) of the elevated readings. The applicant carried out minor modifications which the expert considered in his third report.

8.3.3 In his third report, the expert noted the recent low moisture readings recorded in those areas and considered the rationale for the modifications; concluding that the applicant's explanations could be plausible. Taking account of these modifications and the associated low moisture readings that followed, I have reasonable grounds to be satisfied that these areas are now also performing adequately.

8.4 Maintenance of the remediated wall claddings

8.4.1 A modification of durability provisions of the Building Code for the original elements remaining in the house will allow the durability periods stated in B2.3.1 for those elements to commence from the date of substantial completion in 2001. However, the expected life of the timber-framed structure is considerably longer than

the 15 years since substantial completion, and ongoing maintenance is required to ensure that the wall claddings continue to protect the underlying framing for the minimum life of 50 years required by the Building Code.

8.4.2 Effective maintenance of claddings is important to ensure ongoing compliance with the Building Code and is the responsibility of the building owner. The Ministry has previously described these maintenance requirements (for example, Determination 2007/60[16]).

8.5 Conclusions

8.5.1 The expert's first report, the established in-service record of timber framing treated with the injected preservative and the absence of any evidence to the contrary provide me with reasonable grounds to conclude that the preservative-injected timber framing complies with Clauses B1 and B2 of the Building Code.

8.5.2 I also consider that the expert's second report established that the majority of the remediated cladding was performing adequately, although several areas were exhibiting intermittent elevated moisture readings. I now consider that the expert's third report has provided sufficient additional evidence to satisfy me that the remediated wall claddings as a whole comply with Clauses B2 and E2.

8.5.3 It is emphasised that each determination is conducted on a case-by-case basis. Accordingly, the fact that a particular site-applied timber treatment or cladding system has been established as being code compliant in relation to a particular situation within a particular building does not necessarily mean that the same system will be code compliant in another situation.

9. The decision

9.1 In accordance with section 188 of the Building Act 2004, I hereby determine that:

(a) The areas of original framing treated with site-injected timber preservative comply with Clause B1 Structure and Clause B2 Durability of the Building Code.

(b) The remediated wall claddings comply with Clauses B2 Durability, and E2 External moisture.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 7 February 2017.

John Gardiner
Manager Determinations and Assurance

[16] Determination 2007/60 Regarding code compliance certificate for a house with monolithic and weatherboard wall cladding systems *(Department of Building and Housing)* 11 June 2007.