



Determination 2010/79

The code compliance of a 7-year-old monolithic-clad house with a moisture detection system at 4 Peach Parade, Remuera, Auckland



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, John Gardiner, Manager Determinations, Department of Building and Housing (“the Department”), for and on behalf of the Chief Executive of that Department.

1.2 The parties to the determination are:

- the owners, S and D Rudez (“the applicants”) acting through a building consultant (“the consultant”)
- the Auckland City Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.

1.3 I also consider that the supplier of the moisture monitoring system, the Moisture Detection Company (“the remediation company”), is as a person with an interest in the determination.

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

- 1.4 This determination arises from the decision of the authority to refuse to issue a code compliance certificate and to issue a notice to fix for a 7-year-old house because it was not satisfied that it complied with Clause B2 Durability and Clause E2 External Moisture². Following the issue of an earlier notice, the consultant submitted a response proposing that the presence of a moisture detection system demonstrated compliance with the Building Code. The authority did not accept that proposal and issued a notice to fix.
- 1.5 I take the view that the matters to be determined³ are whether the authority was correct to:
- refuse to issue a code compliance certificate
 - issue a notice to fix.
- 1.6 In deciding this I must consider whether the external envelope to the house (“the external envelope”), as constructed and monitored by a moisture detection system, complies with Clause B2 Durability and Clause E2 External Moisture of the Building Code. The external envelope includes the components of the systems, such as the cladding systems, the windows, the roof claddings and the flashings, as well as the way the components have been installed and work together.
- 1.7 The notice to fix cited non-compliance with Clause B1 Structure, although the details of the contraventions appear to relate to weathertightness defects. I have taken the view that the authority’s structural concerns are limited to possible damage as a result of moisture penetration through the external envelope into the timber framing via the identified defects. .

1.8 Matters outside this determination

- 1.8.1 The notice to fix stated that the applicants may apply to the authority for a modification in respect of the durability provisions of Clause B2 Durability. I leave this matter to the parties to resolve once the cladding and all associated work has been made code compliant as summarised in paragraph 11.1).
- 1.8.2 The notice to fix cited non-compliance with Clause E1 Surface water but no specific contravention of Clause E1 was given in the body of the notice, other than a down pipe not meeting E2/AS1. The determination therefore deals with the matter in terms of Clause E2, and not Clause E1.
- 1.8.3 The expert and the authority have also identified various changes from the consent documents, and I leave this matter to the parties to resolve.
- 1.9 In making my decision, I have considered:
- the submissions of the parties
 - the ‘MDC House Evidential Report’ dated 15 September 2009 (“the monitoring report”) which provides the results of monitoring the moisture detection system installed by the applicants (refer paragraph 7)

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

³ Under sections 177(b)(i) and 177(b)(iii) of the Act

- the report of the expert commissioned by the Department to advise on this dispute (“the expert”) and the other evidence in this matter.

2. The building work

- 2.1 The building work consists of a three-level house situated on a sloping excavated site in a wind zone assumed to be medium for the purposes of NZS 3604⁴. Construction is generally conventional light timber frame, with concrete foundations and floor slabs, concrete block retaining walls, monolithic wall cladding, aluminium windows, and concrete tile roofs.
- 2.2 Most of the house is two storeys high and steps down to include a partial basement level to the west. The basement provides garage and entry areas, with living areas on the ground floor and bedrooms in the upper level. A small section of the south elevation is three storeys high, where a stairwell provides access between the three levels. The house is fairly complex in plan and form, with 20° pitch gable roofs at multiple levels. Eaves are generally about 450mm overall, with verges of 100mm.
- 2.3 A deck, supported on monolithic-clad columns, extends to the south from the upper level. The deck has a tiled membrane floor and open metal balustrades. The house is assessed as having a moderate to high weathertightness risk (refer paragraph 8.2).
- 2.4 The wall cladding is a monolithic cladding system described as stucco plaster over a solid backing. In this instance it consists of 4.5mm fibre-cement sheets fixed through the building wrap directly to the framing timbers, and covered by a slip layer of building wrap, metal-reinforced solid plaster and a flexible paint coating.

2.5 Timber framing

- 2.5.1 The timber supplier has provided a producer statement dated 21 October 2008 stating that the timber framing for the exterior walls, which was supplied in 2002, was ‘H1.2 LOSP treated’. The expert provided evidence from a technologist that samples taken from the exterior framing contained no detectable treatment. However the technologist added that:
- For pre-2003 buildings this is indicative of untreated perishable radiata pine wood. However, if the building was 2003 or later it is possible that wood was H1.2 LOSP treated (this possibility fits with the presence of superficial soft rot i.e. other types and distributions of decay are more typical for untreated framing).
- 2.5.2 Although the framing was installed prior to the pre-line inspection on 10 April 2002, I note that there is limited timber damage in the samples despite ongoing elevated moisture levels. I therefore accept that the exterior framing is likely to have been treated to a level that will provide some resistance to decay.

⁴ New Zealand Standard NZS 3604:1999 Timber Framed Buildings.

3. Background

- 3.1 The authority issued a building consent for the house (No. AC/01/17484) on 31 January 2002 under the Building Act 1991, and carried out various inspections during construction, including preline and postline inspections in April 2002.
- 3.2 The authority carried out a 'stucco plaster' inspection on 30 April 2002. The record for this inspection records this as a 'pass', noting 'proprietary plaster system (substrate to manufacturers specification)'. The building work appears to have been completed by about September 2002, as inspections of exterior retaining walls were 'passed' on 31 August 2002.
- 3.3 The authority did not carry out a final inspection until 17 February 2005. The inspection record lists outstanding items to be completed and notes that the cladding would need to be assessed. A re-inspection was undertaken on 2 March 2005, and the record noted that items previously identified had been rectified. However, the record also noted that the code compliance certificate was 'dependent on [a] weathertightness inspection' by the authority.

3.4 The notice to rectify

- 3.4.1 The authority carried out a weathertightness inspection on 23 March 2005, and produced a 'photo file' of defects identified in the building, which covered the following general concerns (in summary):
- lack of control joints
 - lack of anti-capillary gaps and drip edges at the bottom of the cladding
 - inadequate cladding clearances from ground and paving
 - cracks to the cladding
 - lack of spreaders to downpipes from upper roofs
 - inadequate flashings to some areas
 - unflushed and/or unsealed penetrations
 - lack of drainage to window sills and to cladding above heads
 - unflushed junctions between deck barrier and wall.
- 3.4.2 The authority wrote to the applicant on 31 March 2005, stating that it was not satisfied that the building work complied with the Building Code in 'a number of respects'. The authority attached a notice to rectify and recommended that:
- ... you engage the services of a suitably qualified person to review the attached NTR and to develop a proposed scope of work, which in their view would address all the areas of contravention. Council will then review this proposal and if it agrees with it, will then advise you as to whether a building consent needs to be applied for.

3.5 The response to the notice to rectify

- 3.5.1 In response to the notice to rectify, the applicants wrote to the authority on 13 April 2005. While they accepted that some remedial work was required, they noted that the house had passed inspections during construction ‘in accordance with the rules that were in place at that time’ and therefore considered it unfair to ‘apply new building rules and practices’. The applicants also explained that while the consented wall cladding system was changed to a stucco plaster system as described in paragraph 2.4, the backing sheets had been inspected and ‘signed off’ as satisfactory. The applicants had therefore thought that this was sufficient and were not aware that an amendment was required.
- 3.5.2 The authority responded to the applicant’s 13 April letter on 16 May 2005, explaining that the building consent had been issued based on ‘the latest information available’ at that time. However a ‘lot of new information’ had become available since then, which had led to the authority significantly changing its requirements for buildings using monolithic claddings. The authority concluded:
- Council must be satisfied on reasonable grounds that your building is code-compliant. To issue a Code Compliance Certificate in the knowledge that there are areas of doubt or non-compliance would be negligent of Council, and in breach of the statutory obligations the Council have under the Building Act.
- 3.5.3 In a letter to the authority dated 26 October 2005, the applicants’ lawyer noted that the change in cladding had been accepted and passed during inspections and asserted that the authority could not then ‘re-open that aspect’. The lawyer asked the authority to confirm that it ‘will issue the Code Compliance Certificate once the additional remedial matters have been completed’.
- 3.5.4 The authority responded in a letter to the lawyer dated 1 November 2005 confirming that a code compliance certificate could not be issued until it was satisfied that ‘the building works in their entirety are code compliant’.
- 3.5.5 I am not aware of any further correspondence over the next four years.

3.6 The moisture detection system

- 3.6.1 In October 2008 a moisture detection system was installed in the exterior wall framing. This involved the installation of more than 90 permanent moisture detection units (“MDUs”) by the remediation company into the bottom plates at each of the three levels of the house. The MDUs are periodically monitored and provide information on the moisture content of the timber at those locations at about 4mm in from the outer face of the bottom plates.
- 3.6.2 During installation of the system, a ‘timber strength comparative measurement tool’ was inserted to provide a comparative indication of the residual timber strength at the inner and outer sides of the bottom plate. This was carried out only once, in contrast to the MDUs which continually measure variations in moisture levels.
- 3.6.3 The remediation company recommends that MDUs are read at least every six months to monitor moisture levels against natural seasonal equilibrium levels in order to ‘be warned of maintenance requirements and leaks that have developed subsequent to construction or last repair’. Guidance by a ‘suitably qualified building professional’

is recommended for interpretation of probe data. I discuss the monitoring results in paragraphs 5.4.3 and 7.4.3.

3.6.4 The results are provided in four colour-coded groups as follows:

Colour coding	Condition described as	Moisture level (range)	Residual timber strength (range)
Green	'OK'	up to 15%	over 7.5
Yellow	'Watch'	15% to 18%	5.5 – 7.5
Orange	'Warning'	18% to 25%	4.5 – 5.5
Red	'Danger'	over 25%	below 4.5

3.7 The applicants then engaged the consultant to assist them in the interpretation of the monitoring results and to act as their agent in seeking a code compliance certificate for the house. The authority visited the house on 15 July 2009 and met with the consultant who provided a “moisture report” dated 14 July 2009 (that I have not seen), which included analysis of data from the MDUs. It appears that the moisture report was a proposal that the consultant considered would enable a code compliance certificate to be issued.

3.8 The authority’s record of the site meeting noted:

1. ... Moisture report received. ‘Notice to Rectify’ ... has not been satisfied.
2. Photographed dwelling & peer review will be required as to what council will do next.
3. Internal areas are OK.

3.9 The authority’s response

3.9.1 Following some email correspondence between the authority and the consultant (which I have not seen), the authority wrote to the consultant on 4 September 2009, noting that:

... when the notice to rectify was issued there were a number of areas within the cladding system which were non-compliant, to date I am not aware of any proposal to Council to address these, other than your proposal and the MDU readings...

3.9.2 The authority also noted its concern that a large number of readings from the installed MDUs were within ‘warning’ or ‘danger’ zones, noting:

... even if any moisture ingress is arrested, the damage to the framing may have already been done and its structural strength and integrity compromised.

3.9.3 Given the time that had elapsed since the final inspection in March 2005, and its concerns arising from the moisture report, the authority suggested a full inspection be undertaken so that any areas of non-compliance could be identified in a notice to fix.

3.10 The notice to fix

3.10.1 Further email correspondence followed about the use of the moisture detection system as a means to establish compliance of the cladding system. However, a full inspection was not requested by the applicants and the situation remained unresolved.

- 3.10.2 The authority issued a notice to fix dated 5 November 2009, which stated that the authority's site visit to inspect the house on 15 July 2009 had revealed that some building work did not comply with the consent, with some clauses of the Building Code, or with the Building Act and that:
- ... remedial works had been carried out to the dwelling without council approval and that [MDUs] had been installed to the dwelling in 2008.
- 3.10.3 The notice to fix listed defects and requirements under the same headings as used in the 2005 notice to rectify and again required the applicants to prepare a proposed scope of work to address the areas of non-compliance. The list included the items identified in the earlier notice to rectify together with some additional items. The list is summarised in paragraph 9.1.
- 3.10.4 The notice to fix also stated that the applicants could apply to the authority for a waiver and modification⁵ to allow the durability requirements of Clause B2 (Durability) to 'commence from the date of substantial completion, as opposed to the date of the Code Compliance Certificate' (refer paragraph 1.8.1).
- 3.11 The Department received an application for a determination from the consultant on 25 November 2009. In a letter to the consultant dated 10 December 2009, I confirmed that the Department would follow its 'normal process and have an independent expert inspect the building envelope' noting that:
- While we have sufficient evidence that the house currently does not comply with E2, we need additional evidence regarding B2 as it applies to E2.
- In order to make this B2 assessment we must learn as much as we can about the design and construction of the house to understand the nature and causes of any present or possible future failures.
- 3.12 Further discussions and correspondence followed with the consultant in regard to the use of MDUs, the need for an expert's inspection and the extent of invasive testing. An acceptance of limited testing by the expert was received on 21 December 2009.

4. The initial submissions

4.1 The consultant's submission

- 4.1.1 The consultant made a detailed submission that focused on using a moisture detection system as 'evidence of actual performance', to show that the building envelope complies with Clause B2 by providing early warnings when moisture levels rise, thus allowing an owner to undertake maintenance before damage occurs.
- 4.1.2 The consultant also considered that the Department should not be undertaking evidence gathering but should instead play a 'judicial' role by considering evidence provided by the parties. A similar approach was addressed in Determination 2009/55, and I hold to the view that:

I do not accept that opinion. In *Auckland CC v NZ Fire Service* [1996] 1 NZLR 330, it was held that the predecessor to the Department (the Building Industry Authority under the Building Act 1991, now the Chief Executive) was entitled to obtain reports from experts, so long as the rules of natural justice were followed.

⁵ Under section 67

4.1.3 The consultant forwarded copies of:

- the consent drawings and specifications
- the authority's inspection records
- the notice to fix dated 5 November 2009
- the correspondence with the authority
- the monitoring report dated 15 September 2009
- various property file extracts, photographs and other information.

4.2 The authority's submission

4.2.1 The authority made a submission in the form of a letter to the Department dated 30 November 2009, noting that it believed the cladding system to be non-compliant. The authority disagreed with the consultant's position that '[the authority] acted unreasonably in discounting the information the moisture detection system provides in identifying and supporting code compliance.'

4.2.2 In its letter, the authority stated:

It is acknowledged the building code is performance based, however buildings must be constructed to provide adequate resistance to penetration of moisture from outside. Do [MDUs] do this? No, only once the moisture has penetrated the cladding will the owner become aware of an issue, and this will depend on how often the [MDUs] are read, if at all. How do the [MDUs] prevent dampness and /or undue damage to other building elements? How does the installation of [MDUs] negate the necessity for control joints?

4.2.3 The authority forwarded a CD-Rom, entitled 'Property File', which contained documents pertinent to this determination.

4.3 Copies of the submissions and other evidence were provided to each of the parties.

5. The expert's report

5.1 As mentioned in paragraph 1.9, I engaged an independent expert to assist me. The expert is a member of the New Zealand Institute of Architects. The expert inspected the house on 20 January 2010 and provided a report dated 4 February 2010 which was provided to the parties for comment.

5.2 General

5.2.1 The expert noted the following variations to the consent documents:

- the addition of exterior retaining walls to the south
- deck balustrades were changed from glass to open metal
- gable ventilators were not installed
- EIFS cladding was replaced with stucco
- the installation of a moisture detection system.

5.2.2 The expert noted that the stucco walls had been repainted in 2008, at which time some plaster cracks had been repaired. Apart from items outlined in paragraph 5.6.1, the plaster surface was ‘flat with a uniform texture and free of cracks indicating a good standard of plaster application’. The roof flashings were generally ‘good’ except for the ends of some apron flashings.

5.3 The windows and doors

5.3.1 The expert noted that the aluminium windows and doors are bordered by decorative bands formed out of the plaster, with a plaster rebate provided around the opening. This results in the windows and doors being recessed by the thickness of the band, with metal head and sill flashings that project to the face of the plaster at the sill and extend past the jambs by about 30mm.

5.3.2 The bottom of an uPVC flashing behind door jamb flanges (with a “hook” at the end) was visible below door sills. Silicon sealant had been recently applied to some window jambs. The expert cut away a small section of this at the bottom of a typical window jamb which revealed a concealed uPVC jamb flashing.

5.3.3 At the request of the consultant, the expert did not remove cladding at the jamb to sill, so was unable to confirm the underlying junction. However, he noted that the detailing appeared to be similar to that recommended at the time of construction⁶, with jamb and sill rebates provided by the plaster.

5.3.4 The sealant appears to be effective in controlling moisture ingress under some windows. The expert was able to view framing at an existing cut-out of lining below a recently repaired upper south bedroom window, noting that there was no visible sign of timber damage to that area of framing.

5.3.5 The garage door opening is bordered by plastered bands and reveals. In an attempt to remedy high moisture readings at bottom plates, stainless steel angles had been recently installed over the inside corners of the jamb reveals, with sealant applied to seal the angle against the plaster reveal.

5.4 Moisture levels

5.4.1 The expert took interior non-invasive readings and noted six elevated readings which he confirmed by taking invasive readings. Due to the consultant’s request to minimise invasive readings, the expert restricted further invasive testing to beneath sill to jamb junctions of three windows in exposed positions and found no elevated readings. The readings varied from 10% to 13% indicating the likely equilibrium moisture levels. Moisture testing that records significant variation in moisture levels generally indicates that external moisture is entering the structure and further investigation is required.

5.4.2 The expert also took invasive readings using long probes from the inside on either side of two MDUs to compare the results with the MDUs, and noted a 2% difference, which is within the manufacturer’s stated range of accuracy. The expert concluded that the MDUs could be used to provide reliable readings.

⁶ NZS 4251:1998 Code of Practice for solid plastering and BRANZ Good Practice Guide: 1996.

5.4.3 The expert also recorded readings from 63 of the installed MDUs. Elevated readings and comparisons with readings from September 2009, where available, are set out in the following table:

General	MDU readings September 2009⁷	Expert's readings January 2010
ground floor framing to the south stairwell wall		22%
beside the garage door	26% and 23%	22% and 23%
east wall of the family room	21%	19%
Bottom plates below roof/wall intersections		
garage wall/retaining wall junction		24%
south west corner of the garage	23%	18%
under the entry canopy	over 35%	17%
study/stairwell junction	21%	17%
lounge/dining junction	24%	18%
The deck		
an east deck joist		20%
wall framing below the deck sides		18% and 23%
at the top of a monolithic-clad deck column		22%

5.4.4 The expert noted that his invasive readings were taken during summer after a prolonged dry spell and were likely to be higher during winter months. He also considered that, in areas where repairs were inadequate or had not been made, the moderate and higher moisture levels recorded by the MDUs in October 2008 and September 2009 would be likely to recur during winter months.

5.4.5 With regard to likely seasonal variation, I note that the September 2009 MDU readings (corrected for timber treatment) show the following:

- in the basement level, 19 of the 22 MDUs recorded moisture levels over 18%, with 7 of these over 25%
- in the ground floor level, 23 of the 46 MDUs recorded moisture levels from 18% to 24%
- in the first floor level, only 1 of the 27 MDUs recorded moisture levels over 18%.

5.5 Decay analysis

5.5.1 The expert removed three timber samples and forwarded them to a biodeterioration consultant for analysis. The samples were taken from the following repaired areas:

- the bottom plate and the stud beside the garage door (samples 1 and 2)
- the bottom plate below the entry canopy (sample 3).

⁷ Corrected for timber treatment to allow comparison

- 5.5.2 The biodeterioration consultant's report, dated 3 February 2010, found that all samples contained dense fungal growth 'suggestive of growth over a prolonged period including recent activity'. Samples 1 and 2 also contained traces of early soft rot, although no structurally significant established decay was detected. However, these samples had 'come very close to conditions conducive to serious decay', and the report warned that serious decay could be present in nearby timber.
- 5.5.3 The report concluded that the results suggested that all of the samples 'had been exposed to moisture conditions that are inconsistent with sound building practice and/or weathertight design, and appropriate remediation is needed to correct this.'

5.6 The external envelope

5.6.1 Commenting specifically on the external envelope, the expert noted that:

- there are no vertical or horizontal joints provided in the cladding
- there are cracks in the cladding, some which are concealed by recent paintwork
- although cladding overlaps to the foundation are adequate, an anti-capillary gap behind the cladding had not been consistently provided
- clearances from the exterior paving to inside floor levels and to the bottom of the stucco cladding are insufficient in some areas
- despite repairs, the garage door jambs are not weathertight; moisture still penetrates into adjacent bottom plates
- the meter box lacks a head flashing

The deck

- the deck to wall junctions at the sides of the deck are not weathertight, allowing moisture to enter the framing below
- moisture is entering the clad column framing at the edge of the deck, possibly via the balustrade posts which are recessed into the deck edge

Roof

- the end of the horizontal apron flashing above the entry canopy has been repaired using a surface-mounted corner cover flashing which is unlikely to be weathertight as moisture levels are still high under that junction and other similar junctions
- inadequate kickouts at the bottom of apron flashings are formed from sealant
- there are no spreaders provided to downpipes discharging onto lower roofs

Retaining walls

- the east end of the garage roof intersects with an external retaining wall and balustrade, resulting in a complex junction that is inadequately weatherproofed
- the junction of the stairwell wall to the south with the external retaining wall is not weathertight; elevated moisture levels have been recorded in the framing below.

- 5.7 I note that the expert could not inspect the disposal of water from behind the retaining walls. However, the paved areas to the top of the two retaining walls are concrete and limited moisture is therefore expected. As outlined in paragraph 3.2, I also note that the authority inspected and ‘passed’ the retaining wall construction. Given these circumstances, I therefore consider that the retaining walls will, on balance, meet the requirements of Clause E2.
- 5.8 The expert also included the following comments on some items identified in the notice to fix, which I have taken into account in my conclusions in paragraph 9.1:
- The top of the stucco is generally protected by the eaves and verge projections.
 - The only flat plastered surfaces are to the tops of exterior retaining walls.
 - Penetrations through the cladding are generally well sealed.
 - Flashings appear to slope satisfactorily away from the building.
- 5.9 A copy of the expert’s report was provided to the parties on 11 February 2010.
- 5.10 The authority acknowledged the report without comment. The consultant commented on the report in a submission received on 23 February 2010.

5.11 The consultant’s response to the expert’s report

- 5.11.1 The consultant’s submission included general descriptions of the moisture detection system and the advantages of installed MDUs in monitoring a building’s performance in order to ‘support E2 compliance’. The consultant considered that the expert’s report ‘validates the role of a moisture detection system in this dwelling as a way of ensuring ongoing compliance’. I have considered the consultant’s response in the preparation of this determination.
- 5.11.2 The consultant also included the following points about the expert’s report:
- The moisture readings should have been corrected for timber treatment.
 - Paved areas extend around the building and all slope away from the walls.
 - Fungal growth in the timber does not constitute damage, but rather it shows that the treatment is effective in resisting the effects of moisture penetration.
 - There is no damage to timber to date so the timber framing has been code compliant. With moisture monitoring of future conditions, steps can be taken to mitigate risks.
 - The few stucco cracks present are not consistent with ‘panellizing issues’, indicating that control joints may be present under the top plaster coats.
 - The authority’s satisfactory inspections during construction are disregarded.
 - The expert did not clarify which matters in the notice to fix were code compliance issues and which were ‘variations from prescriptive standards that may not be material to performance’.
 - The expert notes some conclusions are made in regard to manufacturers’ recommendations and prescriptive solutions, which are ‘irrelevant’, should be ‘set aside’.

6. The draft determinations, the hearing, and submissions made in response

6.1 The first draft determination

6.1.1 The first draft determination was issued to the parties for comment on 2 March 2010.

6.1.2 The authority responded on 10 March 2010, requesting the clarification of conflicting statements about the need for control joints in the stucco cladding. I have clarified this matter in the second draft determination.

6.1.3 The consultant responded to the first draft determination in a submission dated 16 March 2010. The consultant commented in detail on all parts of the determination, and included the following points:

- The matter as stated does not correctly reflect the matter in the application and should include whether the authority ‘acted unreasonably in discounting the information the moisture detection system provides in identifying and supporting code compliance’.
- The treated timber’s resistance to decay indicates that MDUs and their routine inspection allow the owner to be confident that moisture levels remain below levels that would result in damage to the treated timber and allow time to react to raised levels should these occur in the future.
- The authority should be able to rely on its previous satisfactory inspections as ‘reasonable grounds’ for code compliance, and not have the right ‘to change its mind when the data supports the performance’. Reasonable grounds is not the same as ‘absolute certainty or some excuse to decline issuing the CCC’.
- The items photographed during the authority’s weathertightness inspection in 2005 are generally inactive defects which are ‘better described as practices now understood as better built in a different way’. The 2005 and the 2009 notices both provide ‘a list of prescriptive comments that have no direct relationship to code clauses’.
- Initial correspondence between the consultant and the Department following the application for determination suggests that the Department had pre-judged the compliance issues, whereas it should be open-minded to the ‘considerable supporting evidence’ of general compliance.
- The defects identified by the expert are (at worst) matters that need future monitoring, rather than being considered current failures. If the defects associated with future moisture penetration, then MDUs will show this and allow rectification before undue dampness and damage occurs.
- The level of damage to the timber framing after six years has been shown to be negligible, even where moisture levels have been unacceptable. The requirement for further investigations is ‘irrelevant as the expert has already satisfied this aspect and there isn’t any damage’.

6.1.4 The remediation company responded to the first draft determination in a submission dated 22 March 2010. The company provided an explanation of its role in installing the 98 MDUs with damage confirmed at a possible 17 locations. The remediation

company's remediation system was described at length as was the potential for using the MDUs to demonstrate code compliance. The nature of "damage" and the need for remedial work was also discussed.

6.1.5 I have considered the consultant's and the remediation company's comments and have amended the draft as I consider appropriate. I comment on the above points as follows:

- Although other matters stem from the notice to rectify, these are peripheral to the initial decisions of the authority leading to this determination. The results from the MDUs form part of the evidence considered.
- Although the biodeterioration consultant considered that the timber samples had possibly been treated to H1.2, this level of treatment provides only limited resistance to decay, and decay may already have occurred prior to the installation of the moisture detection system (refer paragraph 5.5.2 and 7.4.4).
- The cladding inspection was carried out in 2002 (refer paragraph 3.2). When the final inspection was carried out in 2005, it was reasonable for the authority to take into account any additional knowledge about the weathertightness performance, and risks associated with this cladding, before making a decision on code compliance.
- Initial correspondence between the consultant and the Department referred to submissions that indicated moisture penetration and therefore evidence (at least in part) of past non-compliance with Clause E2, while the likely future E2 compliance (B2 insofar as it applies to E2) required further evidence in the form of the expert's report.
- The purpose of the expert's inspection is to assist me in reaching a decision. I note that the inspection does not constitute a comprehensive diagnosis of the building. However the expert's report, the decay analysis and the timber strength figures have satisfied me that future investigation is needed.

6.2 The second draft determination and the hearing

6.2.1 The second draft determination was issued to the parties for comment on 29 March 2010. At the request of the applicant a hearing was held on 23 April 2010. All parties were present. The hearing included a visit to the house. Remedial work carried out to date to date was discussed, along with outcome of investigations into the condition of the timber framing where leaks had occurred.

6.2.2 The consultant made a submission, which I summarise as follows:

- MDU's facilitate the monitoring of a building's performance and can identify weathertightness failure, and therefore support maintenance.
- The presence of MDU's make this house code compliant and can allow the owner to effect repairs before damage occurs.
- The nature of damage is more than the incidence of decay, but can include economic loss. Therefore any process which can minimise economic loss will make the house compliant.

- A building has not failed the durability requirements where, as part of normal maintenance, a failure of Clause E2 can be repaired. Therefore an appropriate maintenance program that includes monitoring will result in a house complying with Clause B2 of the Building Code.

6.2.3 The authority's representatives presented their position that included the following key points:

- The authority would not issue a code compliance certificate for this house today because it does not comply with Clause E2 of the Building Code.
- The authority cannot enforce maintenance. A maintenance schedule cannot be submitted as part of the building consent application, and a future owner of the house could ignore the presence of MDUs.
- The authority is developing a new approach to building consent applications for remedial work for water ingress damage, especially where alternative solutions are involved. If monitoring for two seasonal cycles shows a house is meeting Clause E2 requirements, a code compliance certificate will be issued. This will introduce a monitoring concept into the consent process.

6.2.4 The remediation company led a broader discussion regarding the use of monitoring systems, the nature of damage and maintenance. I have summarised the key points from that discussion as follows:

- MDUs are useful in an ongoing review of the compliance of a building.
- There is no perfect house and all houses leak at some time. How is this situation taken into account and what are the implications for normal maintenance?
- The authority should issue a building consent for the proposed work as it is supported by a maintenance plan.
- Normal maintenance is anything that is not major reconstruction. For example, the installation of control joints was considered to be maintenance
- The industry as a whole wants to move on, part of this will require a 'statement' regarding how to decide if potentially damaged timber should be left, treated in situ or replaced.

6.2.5 In May 2010, the consultant submitted a 'Maintenance Plan' for the house, which presented a strategy 'to support and underpin ongoing building code compliance' based on monitoring moisture levels in the wall framing, with the principle being to:

...address any evidence of water ingress provided by readings, consider the possibility of wear and tear (if any) to structural elements (current or future likely damage) and whether performance is impaired or reduced. A response to that possibility with an assessment of whether the work is critical, urgent, advisable or low priority, and a plan that can then implemented that, recognises this, with work being either reactive or planned maintenance or rebuilding (or a combination of all three overtime).

6.2.6 The maintenance plan described how the monitoring of moisture levels fitted into the 'normal maintenance of the house, along with the actions to be carried out should 'anomalous' readings be recorded. Various flow charts were included to assist in explaining the process.

6.3 The third draft determination

- 6.3.1 A third draft determination was issued to the parties for comment on 7 July 2010. The consultant forwarded a submission on the third draft that was received on 26 July 2010.
- 6.3.2 The consultant's submission included a series of laboratory analyses of timber samples for general discussion but which did not relate to the subject house. The submission largely reiterated arguments submitted in previous submissions and did not introduce any matters not covered in earlier drafts of the determination
- 6.3.3 The remediation company made a submission dated 22 July 2010. Though most of the 30 comments included in the submission were brief, they were not within the scope and intent of the determination commentary and no new information was introduced. The remediation company suggested that the moisture detection installation process be included and described in the determination in detail however I consider the existing description (refer paragraph 3.6) is appropriate for the determination
- 6.3.4 The authority advised in a letter dated 11 August 2010 that the draft was accepted.

7. Discussion

(Discussion on the weathertightness performance of the external envelope is contained in paragraph 8.)

- 7.1 In response to the consultant's submission at the hearing (refer paragraph 6.2.2), I do not accept the consultant's view that 'damage' can include economic loss. The nature of timber damage, as it has been considered in past determinations, is based on actual and potential decay and the consequent loss of performance and amenity. Economic loss is not currently a direct performance measure used to determine compliance with the Building Code.
- 7.2 The contention by the remediation company that 'all houses leak' (refer paragraph 6.2.4) is not a useful statement. It may be technically correct but it does not mean, by extension, that all houses fail to meet the performance requirements of Clause E2. The extent of water ingress as encapsulated in the statement may in fact be very little and infrequent, and the likelihood of occurrence and any consequent damage may come within the bounds of what is an acceptable risk.

7.3 Maintenance and monitoring in relation to compliance

- 7.3.1 The range of issues and matters discussed at the hearing provided a wider framework within which to consider the matters for determination. In consideration of the nature of weathertightness failure, damage, ongoing monitoring and maintenance I have summarised my views relating to maintenance and code compliance as below;
- 7.3.2 In previous determinations, when considering whether a building complies or will continue to comply with Clause E2 (reflecting durability requirements), I have considered how easily an item can be seen and replaced. That is, the more readily accessible an item is, the less the durability requirement.

- 7.3.3 Consideration of building failure may start with a high risk design which results in a symptom or leak (I note that the subject house is high risk). The causes should be identified, potential effects considered and appropriate repairs undertaken. An understanding of, and report on, the nature of failure that has occurred is an essential first step.
- 7.3.4 MDU's are helpful in identifying a problem or, alternatively, assisting in demonstrating how effective repairs have been. MDUs are a useful monitoring tool but will not stop water ingress or necessarily result in effective repairs. The nature of the fault must be identified before a remedial plan is developed.
- 7.3.5 I acknowledge the authority's recently adopted approach to seasonal monitoring prior to issue of a code compliance certificate. However, in my view the start point in that process must be that the building work complies with Clause E2. The authority's process is silent on the nature of the maintenance required, or undertaken, during the monitoring period.
- 7.3.6 I also acknowledge the progress made by the applicant in investigating the condition of timber framing within the house.

7.4 The evidence gathered by the moisture detection system

- 7.4.1 The applicants have provided a monitoring report dated 15 September 2009, which provides the results of moisture level monitoring since October 2008, as outlined in paragraph 3.6. The expert has tested two sample MDUs installed in this particular house, concluding that their moisture readings appeared to provide reliable results (refer paragraph 5.4.2).
- 7.4.2 In the case of this particular house, I consider that the monitoring report has provided me with some useful evidence about the performance of the cladding since the installation of the monitoring system in 2008. However, I note that the house was about six years old at the time of installation of the MDUs.
- 7.4.3 As outlined in paragraph 3.6.2, tests carried out during the installation of the MDUs also provided a relative indication of the residual timber strength at the inner and outer sides of the bottom plate. The residual timber strength results for the building at the time of installation of the moisture detection system in October 2008 were:

Indicative colour coding	Condition described as	Residual timber strength (range)	No. of MDUs in this range	% of total MDUs in this range
Green	'OK'	over 7.5	0	0
Yellow	'Watch'	5.5 – 7.5	6	6%
Orange	'Warning'	4.5 – 5.5	51	54%
Red	'Danger'	below 4.5	38	40%

- 7.4.4 The range of values provided in the monitoring report (particular those within the 'Danger' zone) indicates a risk that the timber strength at the outer level of some of the bottom plates may have deteriorated significantly due to moisture ingress in the six years prior to installation of the MDUs in 2008. I therefore consider that this possibility needs to be further explored as part of an investigation into the extent and level of timber damage in the framing (refer paragraph 8.3.2).

7.5 The nature of building maintenance

- 7.5.1 The purpose of maintenance under Clause B2 is to ensure an ongoing compliance of a building that is already code compliant.
- 7.5.2 The need for maintenance arises from the normally expected deterioration of the building elements due to their exposure and in-service use. The extent of maintenance required for any particular cladding will be dependant on the nature of the cladding, the complexity of building envelope, the building's exposure, its location, and similar.
- 7.5.3 Normal maintenance is not defined. However, this can be considered to include, regular inspections, repair of faults that may have developed, or the replacement of items that have come to the end of their life.
- 7.5.4 I consider that the rectification of construction defects (including design defects), such as the installation of flashings or movement joints, is not maintenance. Construction defects should, wherever possible, be rectified before a code compliance certificate is issued. However, if defects are latent, or not immediately evident, they may be identified during maintenance. The discovery of defects at a later stage does not make the correction of these defects 'maintenance'.
- 7.5.5 I accept that ongoing monitoring of a building's cladding by a system such as that offered by the moisture detection system can be an effective means of demonstrating that that maintenance is effective and a building continues to comply with Clause E2.

7.6 Maintenance schedules (as part of a building consent application)

- 7.6.1 I consider that the information contained in the consultant's maintenance plan, or schedule, (refer paragraph 6.2.5) provides assistance to current and future owners in understanding the use of the monitoring system as part of ongoing maintenance. However this assistance can only apply once the remedial work and investigations identified in this determination have been satisfactorily carried out and the house is made weathertight and durable.
- 7.6.2 I do not accept the authority's position (refer paragraph 6.2.3) that a maintenance schedule cannot be submitted as part of an application for building consent, and therefore form part of an approved consent. I accept that the future maintenance of any building is an owner's responsibility and does not fall to the authority.
- 7.6.3 For buildings such as the subject house, there is no statutory mechanism to ensure the ongoing code compliance of a building once a code compliance certificate is issued, unless the building becomes unsafe and insanitary. However, this is true of all Building Code clauses and not just Clause E2.
- 7.6.4 The decision an authority needs to make with respect to it being satisfied on reasonable grounds that work will continue to comply with Clauses B2 and E2 will be based upon the evidence available to it. The evidence will be based on its assessment of the completed work, plus its belief that ongoing compliance with Clause E2 as required by Clause B2 will be satisfied though the completion of 'normal maintenance'. In my opinion if the required maintenance is described and defined in the approved consent documents this could be considered required or scheduled maintenance and should be taken account of by the authority.

8. The weathertightness performance of the external envelope

8.1 The approach in determining whether building work is weathertight and durable and is likely to remain so, is to examine the design of the building, the surrounding environment, the design features that are intended to prevent penetration of water, the cladding system and its installation, and the moisture tolerance of the external framing.

8.2 Weathertightness risk

8.2.1 This house has the following environmental and design features, which influence its weathertightness risk profile:

Increasing risk

- the house is generally two-storeys high and fairly complex in plan and form
- the house has three levels, with roofs at varying levels and complex junctions
- some walls have only limited verges to shelter the cladding
- there is a tiled deck to the upper level
- the walls have monolithic cladding fixed directly to the framing.

Decreasing risk

- the house is in a medium wind zone
- the external wall framing is likely to be treated to a level that provides some limited resistance to decay if it absorbs and retains moisture.

8.2.2 Using the E2/AS1 risk matrix to evaluate these features, one elevation of the house is assessed as having a medium weathertightness risk rating and the remaining elevations a high rating. If the details shown in the current E2/AS1 were adopted to show code compliance, a drained cavity would be required for stucco cladding at all risk levels. However, I note that this stucco cladding was generally in accordance with the acceptable solution at the time the house was constructed.

8.3 Weathertightness performance

8.3.1 Generally the claddings appear to have been installed in accordance with good trade practice at the time. However, taking account of the expert's report, I conclude that remedial work is necessary in respect of the comments outlined in paragraph 5.6.1, although there is no need to retrofit control joints after this period of time.

8.3.2 As described in paragraph 7.4, the moisture monitoring results have also provided me with evidence on weathertightness performance since the installation of the monitoring system in 2008. However, in the six years prior to installation unrecorded levels of moisture entry were occurring via various defects, leading to an unknown level of damage to the framing. Taking account of the monitoring report I therefore conclude that the following is also required:

- A full investigation into the cause(s) of the high levels of moisture penetration into the framing recorded over the past two years, including exposure of the underlying construction where necessary.
- A full investigation of the extent and level of decay and timber damage likely to be present due to prolonged moisture penetration, given the early decay identified in two of the three samples taken by the expert (this investigation must take into account the reported timber strength figures as explained in paragraph 7.4).

8.3.3 Notwithstanding the fact that the stucco backing sheets are fixed directly to the timber framing, thus inhibiting drainage and ventilation behind the cladding, I note that there are certain factors that assist the performance of the cladding in this case:

- The stucco cladding is generally installed according to good trade practice.
- The windows appear to be adequately flashed.

8.4 Weathertightness conclusion

8.4.1 I consider that the expert's report and the monitoring report establish that the current performance of the external envelope is not adequate because it is allowing water penetration into the house at present and this has resulted in damage to the house. In particular I note that the areas of elevated moisture below the deck which are not being monitored by MDUs and for which there are no remedial proposals to date. Consequently, I am satisfied that the building does not comply with Clause E2 External Moisture.

8.4.2 The submissions have described the moisture detection system and how it is monitored. The extent of failure of the house to comply with Clause E2 has been demonstrated. However, the proposition that the presence of a moisture detection system results in compliance has not been sustained and the presence of the MDUs does not change the extent of failure.

8.4.3 In addition, the building work is also required to comply with the durability requirements of Clause B2. Clause B2 requires that a building continue to satisfy all the objectives of the Building Code throughout its effective life, and that includes the requirement for the house to remain weathertight. Because the cladding faults on the house are likely continue to allow the ingress of moisture in the future, the building work does not comply with the durability requirements of Clause B2.

8.4.4 In the case of this particular house, due to the likely damage to the underlying framing, I consider that final decisions on whether code compliance can be achieved by either remediation or re-cladding, or a combination of both, can only be made after a more thorough investigation of the framing and cladding as noted in paragraph 8.3.2. This will require a careful analysis by an appropriately qualified expert. Once that decision is made, the chosen remedial option should be submitted to the authority for its approval. (I note that initial investigations of the framing in areas where leaks had occurred from windows have shown the timber to be sound.)

8.4.5 Satisfactory investigations as outlined in paragraph 8.3.2 and rectification of the items described in paragraph 9.1 should result in the building being brought into compliance with Clauses B2 and E2. I consider that when the remedial work is

complete the MDUs may well prove useful in showing whether the repairs have been satisfactorily carried out.

- 8.4.6 The Department has produced a guidance document on weathertightness remediation⁸. I consider that this guide will assist the owners in understanding the issues and processes involved in remediation work to the stucco cladding in particular, and in exploring various options that may be available to them when considering the work that will be required to bring the house into code compliance.
- 8.4.7 Effective maintenance of claddings is important to ensure ongoing compliance with Clauses B2 and E2 of the Building Code and is the responsibility of the building owner. The Department has previously described these maintenance requirements, including examples where the external wall framing of the building may not be treated to a level that will resist the onset of decay if it gets wet (for example, Determination 2007/60).

9. The notice to fix

- 9.1 The following table summarises conclusions on the items listed within the notice to fix dated 5 November 2009, referring to related paragraphs within this determination:

Notice to fix		My conclusions	Paragraph references
Item	Summarised issue		
2.1	Not to manufacturer's specifications		
a)	Lack of vertical control joints	Adequate	5.6.1 and 8.3.1
b)	Lack of horizontal control joints	Adequate	5.6.1 and 8.3.1
c)	Cladding not extended behind fascias, etc	Adequate	5.8
d)	Inadequate window flashings	Adequate	5.3
e)	Lack of anti-capillary gap to cladding base	Remedial work required	5.6.1 and 8.3.1
f)	Lack of overlaps and clearances to cladding base	Remedial work required to some clearances, overlaps adequate	5.6.1 and 8.3.1
2.2	Not to acceptable solutions		
a)	Cracks in stucco	Remedial work required	5.6.1 and 8.3.1
b)	Inadequate roof/wall junctions	Remedial work required to aprons	5.6.1 and 8.3.1
c)	Lack of slope to horizontal surfaces	Adequate	5.8
d)	Inadequate junctions of parapet-type walls with cladding	Remedial work required to retaining wall/cladding junctions	5.6.1 and 8.3.1
e)	Silicone used as jamb waterproofing	Adequate	5.3.2
f)	Inadequately sealed penetrations Unflashed meter box	Adequate Remedial work required	5.8 5.6.1 and 8.3.1
g)	Deck membrane not accessible for maintenance due to tiles	Further investigation required to check source of moisture.	5.6.1 and 8.3.1
h)	Inadequate step up to floor levels	Remedial work required to some areas	5.6.1 and 8.3.1
2.3	Not to accepted trade practice		
a)	Lack of spreaders from upper roofs	Remedial work required	5.6.1 and 8.3.1
b)	No roof underlay under downpipes	Further investigation required	

⁸ External moisture – A guide to weathertightness remediation. This guide is available on the Department's website, or in hard copy by phoning 0800 242 243.

Notice to fix		My conclusions	Paragraph references
Item	Summarised issue		
c)	Flashings to direct water away from building	Adequate	5.8
d)	Inadequate step up to floor levels	Remedial work required to some areas	5.6.1 and 8.3.1
e)	Verification of discharge disposal from drainage behind retaining walls	Adequate	5.7
2.4	Drainage and ventilation		
a)	Inadequate drainage & ventilation of cladding	Dependent on results of investigations	8.3.3, 8.4.5, 10.1
3.0	Changes to building consent		
a)	EIFS changed to stucco	Not considered – Parties to resolve	1.8.3
b)	Paved areas changed	Not considered – Parties to resolve	1.8.3

- 9.2 I am satisfied that the building does not comply with the Building Code and that the authority made an appropriate decision to issue the notice to fix. However, I am of the view that some items identified in the notice are, in fact, adequate and I have also identified some additional items that need to be addressed, so the notice should be modified accordingly.

10. What is to be done now?

- 10.1 I note that the earlier notice to rectify and the recent notice to fix both required provision for adequate ventilation and drainage. Under the Act, a notice to fix can require the owner to bring the additions into compliance with the Building Code. The Building Industry Authority (the predecessor to the Department) has found in a previous Determination (2000/1) that a notice to rectify (the equivalent to a notice to fix under the Building Act 2004) cannot specify how that compliance can be achieved. I concur with that view.
- 10.2 The notice to fix should be modified and reissued to the owner to take account the findings of this determination, identifying the items listed in paragraph 9.1 and the investigations in paragraph 8.3.2 and referring to any further defects that might be discovered in the course of investigation and rectification, but not specifying how those defects are to be fixed. It is not for the notice to fix to stipulate directly how the defects are to be remedied and the house brought to compliance with the Building Code. That is a matter for the owner to propose and for the authority to accept or reject. It is important to note that the Building Code allows for more than one means of achieving code compliance.
- 10.3 I suggest that the parties adopt the following process to meet the requirements of paragraph 10.2. Initially, the authority should revise and reissue the notice to fix. The applicant should then produce a response to this in the form of a detailed proposal for the house as a whole. This should be based on a remediation programme to make good the identified defects. The use of MDU's may be appropriate to monitor aspects of the remediation work. Any outstanding items of disagreement can then be referred to the Chief Executive for a further binding determination.

11. The decision

11.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the exterior wall envelope, supported by the moisture detection system, does not comply with Clauses E2 and Clause B2 of the Building Code, and accordingly:

- I confirm that the decision of the authority to decline to issue a code compliance certificate was correct, and
- the decision of the authority to issue the notice to fix was correct, however, the authority is to modify the notice to fix, dated 5 November 2009, to take account of the findings of this determination.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 6 September 2010.

John Gardiner
Manager Determinations