



Determination 2016/043

Regarding the compliance of weatherboards as installed to a house at 14 Te Whangai Head Road, Pataua North, Whangarei



Summary

This determination arises from a dispute regarding the installation of cedar weatherboards in a manner that is not in accordance with the building consent or with the manufacturer's instructions. The determination considers whether the weatherboards as installed comply with Clauses E2 and B2 of the Building Code.

1. The matter 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 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 licensed building practitioner, R Hilton-Jones, who was the builder of the house and is the applicant for this determination ("the builder"), acting via a lawyer
- the owners of the house, L and R Aubrey and J Dawson ("the owners")
- Whangarei District Council ("the authority"), carrying out its duties as a territorial authority or building consent authority.

1.3 This determination arises from a dispute as to whether the weatherboard wall cladding to a 1-year-old house complies with the building consent issued for the house and whether it complies with certain clauses² of the Building Code (Schedule 1, Building Regulations 1992).

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

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

- 1.4 The matter to be determined³ is whether the weatherboard cladding as installed complies with Clause E2 External Moisture and Clause B2 Durability of the Building Code. In deciding this, I must consider the components of the system (such as the fixings, the facings and the joinery trim) as well as the way components have been installed and work together.
- 1.5 The owners made an application for a separate determination on 16 October 2015 concerning other matters related to the house that are in dispute. Those matters are dealt with in a separate determination⁴ (“the second determination”).
- 1.6 In making my decision I have considered the following:
- the submissions of the parties
 - relevant parts of the reports commissioned by the parties, including the reports listed in table 1 below
 - the report of the expert commissioned by the Ministry to advise on the dispute (“the expert”)
 - the other evidence in this matter.

Table 1

Date	Report provided by:	Report provided for:	Described in this determination as:
10 Dec.15	Inspection company	owners	“the inspection company’s first report”
28 Jan.15	Inspection company	owners	“the inspection company’s second report”
3 Mar.15	Building surveyor	owners	“the building surveyor’s first report”
6 Mar.15	Building surveyor	owners	“the building surveyor’s second report”
7 Jul.15	Consultant	builder	“the consultant’s report”
11 Dec.15	Expert	Ministry	“the expert’s report”

2. The building work

- 2.1 The building work consists of a detached house situated on a flat site in a very high wind zone for the purposes of NZS 3604⁵. The two-storey house includes an upper level within the roof space. The house and garage are simple in plan and form and are assessed as having a low weathertightness risk.
- 2.2 Construction is generally conventional light timber frame, with concrete foundations and floor slab, weatherboard and plywood wall claddings and aluminium joinery. The profiled metal gabled roofs have eaves and verge overhangs of 600mm or more.

2.3 The weatherboards and their fixing

- 2.3.1 Except for small areas of plywood and vertical shiplap boards, walls are clad in bevel back western red cedar weatherboards. The wall claddings are fixed through 20mm H3 treated timber battens and the building wrap to the framing, and finished with a factory-applied coating system followed by a site-applied coloured stain. The battens form a drained cavity between the weatherboards and the building wrap.

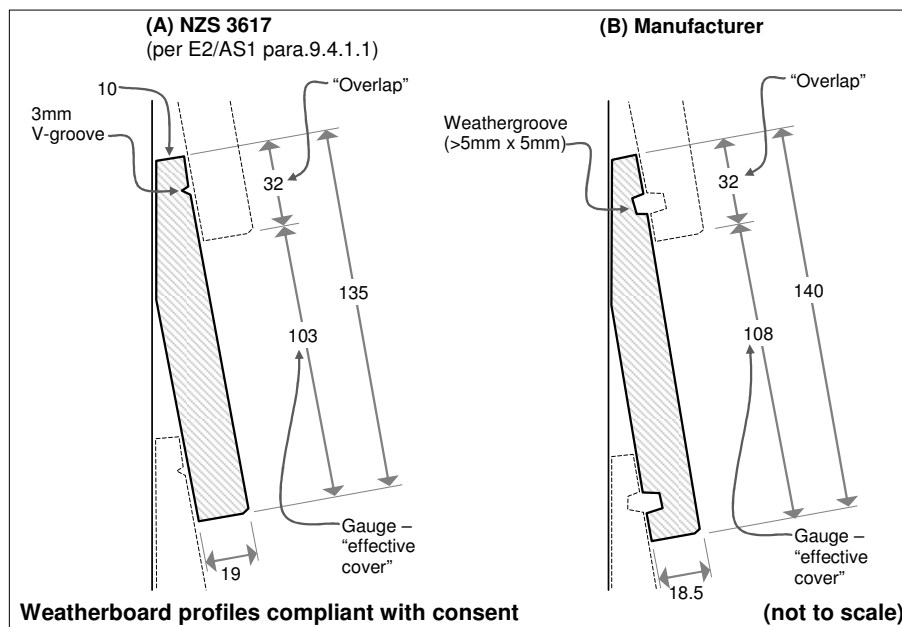
³ Under section 177(1)(a) of the Act

⁴ *Determination 2016/041 The proposed refusal to issue a code compliance certificate for a house due to variations in level and surface tolerances* (13 September 2016) Ministry of Business, Innovation and Employment

⁵ New Zealand Standard NZS 3604:1999 Timber Framed Buildings

- 2.3.2 The consent specification calls for weatherboards manufactured by a named supplier, and that supplier provides recommended details for windows, edges and other junctions for weatherboard systems. Weatherboards are specified as ‘Dressed Face (DF) weatherboards, with CedarShield Factory Applied Coating System’, with a board profile of ‘J62 Standard Bevel Back, 158mm cover, 190mm x 18.5mm thick. At the owners’ request, the weatherboard profile was changed to J61 140mm x 18.5mm.
- 2.3.3 The cladding includes timber facings and scribes to window and door openings, with copper soakers installed at external corners. According to the builder, mitred cut ends of boards were treated with a penetrating protective oil. The consultant’s report (see paragraph 3.8) notes that laboratory sample testing identified copper, which is a component of the particular oil (see paragraph 3.8.5).
- 2.3.4 Figure 1(B) shows the profile of the installed weatherboards. This is compared to the board profile shown in Figure 1(A), which is that described in Acceptable Solution E2/AS1:

Figure 1: Weatherboard profiles

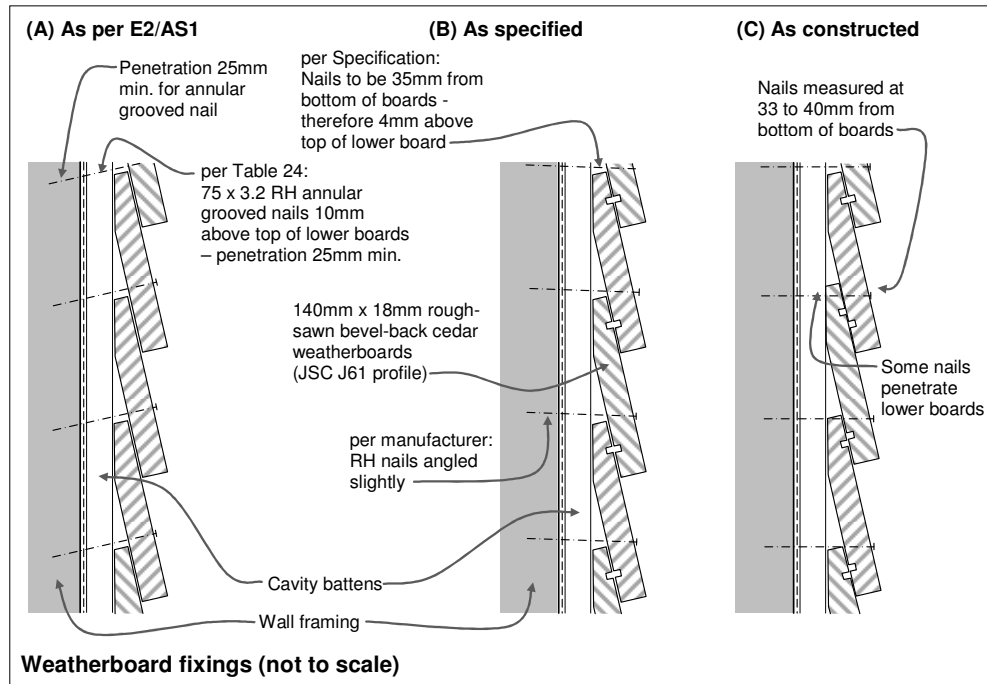


2.4 The fixings

- 2.4.1 The specification called for rose head (“RH”) nail fixings in accordance with the manufacturer’s instructions, and horizontal board overlaps to be 32mm with weather grooves in adjacent boards aligned. The specification also stated:

Single face fix weatherboards at every fixing point, with nails driven in 35mm from the bottom edge of the weatherboard... ..Do not pin laps of weatherboards.

- 2.4.2 The expert’s investigations show that the installed weatherboards are as indicated in the sketch in Figure 2(C). This can be compared to Figure 2(A), which complies with the Acceptable Solution E2/AS1, or with Figure 2(B) which aligns with the manufacturer’s instructions for the specified weatherboards.

Figure 2: Weatherboard fixings

2.4.3 As shown in Figure 2:

- Sketch 2(A): the Acceptable Solution E2/AS1 calls for nails that miss the lower board and penetrate through the battens and into framing by a minimum of 25mm, with the nail 10mm above the top of the lower board. The board profile in E2/AS1 is described ‘as given in NZS 3617⁶ or BRANZ Bulletin 411⁷’.
- Sketch 2(B): the manufacturer specifies nails angled slightly upwards. The specified 35mm above the bottom of the board would result in 4mm clearance from the top of the lower board.
- Sketch 2(C): in the as-built installation, the visible face of boards (“the effective cover”) varies from about 94mm to 107mm, with nails measured at 33mm to 40mm from the bottom of boards. The nailing combined with overlap variations mean that many nails penetrate through the top of lower boards.

3. Background

- 3.1 The following background is primarily based on the builder’s affidavit dated 23 July 2015 together with other submissions and evidence provided by the parties.
- 3.2 The authority issued building consent No. BC1300830 to the owners on 5 September 2013. The builder commenced work on the house later in September 2013 and was to undertake building work only up to the closing in stage of the house. A contractual dispute presently exists between the owner and the builder.
- 3.3 A second builder was engaged to undertake the internal fitout. Ground works were completed by another contractor in August 2013.

⁶ New Zealand Standard NZS 3617: 1979 Specification for profiles of weatherboards, fascia boards, and flooring

⁷ BRANZ Bulletin 411 Recommended Timber Cladding Profiles, April 2001

3.4 The cedar weatherboards were dispatched from the manufacturer to the treatment factory on 12 November 2013 for application of the factory-applied primer coating prior to delivery to the building site in early December 2013. Installation was undertaken in January and February 2014. The cladding was painted with three coats of owner-supplied acrylic stain in March 2014.

3.5 The authority carried out a pre-line inspection on 20 November 2014 and the inspection record makes no reference to weatherboards, although the record notes the need for ‘amended plans for all changes from [the building consent].’

3.6 The inspection company’s reports

3.6.1 The owners engaged a property inspection company to inspect the weatherboard installation and to comment on the nail fixings.

The inspection company’s first report

3.6.2 The inspection company visited the house on 10 December 2014 and provided a report dated 5 January 2015. The inspection company compared the installed fixings to the weatherboard manufacturer’s requirements and to Section 9.4 of E2/AS1, commenting as follows:

- Paragraph 9.4.4.1 of E2/AS1 requires 32mm lap for non-rebated bevel-back boards with single fixing 10mm above top of lower board. The above results in nail fixings at 42mm from lower edge of weatherboard; in contrast to the relatively consistent on-site measurement of 37mm.
- Fixing to E2/AS1 would result in an effective cover of 108mm for a 140mm weatherboard; on-site measurement of cover varies from 94mm to 107mm. Cover below 103mm risks nails penetrating the lower board and weather grooves will not align.

3.6.3 The inspection company sought advice from the weatherboard manufacturer and in an email dated 19 December 2014 (copied to the builder), the manufacturer noted:

- Nails touching the lower board should not affect performance, but if the lower board is penetrated this risks splitting which could affect future weatherproofing.
- Misalignment of weather grooves should not affect weatherproofing because each groove is larger than 5mm x 5mm and can act as a capillary break on its own.
- There is some tolerance in the weatherboard system. Failure to follow specifications exactly does not necessarily result in failure.

3.6.4 The inspection company considered that it was ‘very difficult’ to predict the long term performance of the weatherboard cladding, as splitting could occur long after installation from ongoing thermal movement of the boards. The inspection company therefore recommended the removal of the cladding with re-installation to comply with the manufacturer’s recommendations and E2/AS1.

The inspection company’s second report

3.6.5 When provided with a copy of the above report, the owners queried:

...whether any assumption or allowance has been made for the angle of the fixings and thus whether there is any impact on [the measurements shown in Report 1] and the incidence of penetration and/or insufficient clearance found.

- 3.6.6 The inspection company provided a follow-up report dated 28 January 2015. The second report attached a revised drawing that explored different scenarios based on the site measurements shown in its second report because it was impossible to measure the actual nail angle on site.
- 3.6.7 The drawing showed 85mm nails fixed horizontally and at varying upward angles from the board. The drawing showed that in order to clear the upper edge of the lower board by 10mm from a nail would need to be angled upward at angles varying from 4° to over 44°. The second report noted that extreme angles would be difficult to achieve, and would mean that the minimum framing penetration would not be achieved.

3.7 The building surveyor's reports

- 3.7.1 The owners engaged the building surveyor to photograph and inspect the building site prior the second builder commencing work. The building surveyor was also engaged to review and comment on various reports, including the inspection company's reports on the weatherboard fixings.

The building surveyor's first report

- 3.7.2 The building surveyor visited the house on 22 December 2014 and 5 January 2015; providing a report dated 3 March 2015. Commenting on the inspection company's first report, the building surveyor noted that:
- the drawings clearly show nailing 10mm above the top of the lower board and note a weatherboard lap of 32mm as per E2/AS1
 - discussion with another weatherboard manufacturer confirmed that the concern with 'double-nailing' is the potential for the lower board to split at the top and compromise the overlap
 - the risk of splitting will be higher on the north and northwest elevations due to higher temperature range and thermal movement
 - the amount of movement is dependent on the type of timber grain and the sealing of the board, so with good sealing and maintenance the boards would be less likely to split if double-nailed.

- 3.7.3 The building surveyor concluded that:

The timber weatherboards have not been installed in accordance with the manufacturer's technical literature and therefore a manufacturer's warranty is unlikely to be given. In these circumstances the weatherboards should be replaced to comply.

The building surveyor's second report

- 3.7.4 In a letter to the owners dated 6 March 2015, the building surveyor provided further comment on the various reports, including the following comments on the weatherboard fixings:
- The installed weatherboard is 140mm wide and should have a 32mm lap and a 108mm effective cover – which requires nails to penetrate 42mm up from the bottom edge of the upper board to avoid penetrating the lower board.
 - If nail fixings are less than 42mm from the bottom edge and likely to penetrate the lower boards, the manufacturer is unlikely to provide a warranty for the cladding weathertightness – without which the authority may not issue a code compliance certificate.

- The effective cover varies between 95mm and 116mm – with cover over 108mm increasing risks of water ingress due to reduced overlap.

3.8 The consultant's report

3.8.1 The builder engaged a property consultancy to carry out a review. The consultant reviewed the inspection company's reports (see paragraph 3.6), the building surveyor's reports (see paragraph 3.7) and visited the site on 6 May 2015

3.8.2 The owners raised a number of concerns with the consultant, including:

- inconsistent horizontal lap to boards
- insufficient coating of cut ends to boards behind the copper soakers.

3.8.3 The consultant provided a letter dated 7 July 2015, noting that the weatherboard cladding needs to comply with Clauses E2 and B2 of the Building Code, which requires the building to be weathertight for a minimum of 15 years.

3.8.4 In regard to the weatherboard fixings, the consultant considered the inspection company's second report and noted (in summary):

- Table⁸ in the report shows only 7 out of 102 readings where likely nail penetration through the top of lower boards will be between 5mm and 11mm.
- The relatively consistent measurement of nail heads at 37mm from the bottom of boards means that any splitting for the majority of instances where the nail penetration is less than 5mm from the top of the lower board would still provide an overlap of 32mm in accordance with paragraph 9.4.4.1 of E2/AS1.
- The installation does not include the 10mm clearance called for in Table 24 of E2/AS1, so the cladding must be considered as an alternative solution.
- The risk score for the house using the E2/AS1 risk matrix indicated that the weatherboards could have been direct-fixed. The inclusion of a drained cavity behind the boards will improve long-term performance.

3.8.5 In regard to the coating of cut ends, the consultant noted:

- The cut ends are well protected by the corner soakers and the builder advised that cut ends had been treated with a proprietary oil preservative⁹.
- Two samples of boards from behind corner soakers were forwarded for analysis, and the laboratory reported that spot tests gave strong positive results for copper, which is one of the ingredients of the preservative.
- The laboratory said the preservative would be 'a good product for cedar' and would be better than the common site-applied alternatives.
- NZS 3602¹⁰ states that Western Red Cedar is one of the timber species that do not require treatment to meet the durability requirements of the Building Code.

⁸ I note this is prior to adjusting for likely upward angle of nails, so the Table results are expected to be conservative

⁹ The named preservative contains copper oxinate.

¹⁰ New Zealand Standard NZS 3602:2003 Timber and wood-based products for use in building

3.8.6 The consultant concluded:

The weatherboard cladding is currently meeting the performance requirements of the Building Code even though it has not been installed in accordance with the Consented plans.

3.9 In a letter to the owners dated 20 July 2015, the builder, via his lawyer, offered to fix the weatherboards below the kitchen window, and an upstairs attic window. The owners acknowledged these matters needed addressing.

3.10 The Ministry received an application for this determination on 27 July 2015.

3.11 At the time of the application for this determination, no final inspection had been carried out. However, the authority carried out a final inspection prior to the 2-year anniversary of the issue of the building consent on 25 August 2015. The inspection record noted:

Exterior wall cladding not as per Building Consent and requires solution.

3.12 The owners made a separate application for determination on 16 October 2015, concerning other matters that are in dispute relating to the house. That determination was issued on 13 September 2016.

4. The submissions, the hearing, and the draft determinations

4.1 The initial submissions

The builder's submission

4.1.1 The builder made a submission in the form of a sworn affidavit dated 23 July 2015. The builder described the weatherboard cladding, accepting that the installation method used meant that weather grooves do not align and that 'it may be that there are several weatherboards which have been double fixed'. An offer to replace some weatherboards that were 'visually wrong' was apparently refused as the owners maintained that 'the entire dwelling should be re-clad'.

4.1.2 The builder believed that despite not being installed in accordance with the manufacturer's guidelines the weatherboard cladding complies with the Building Code. The builder also noted there was no visible sign of splitting or cupping of the boards after several summers and winters.

4.1.3 The builder provided copies of:

- the consent drawings and specifications
- correspondence with the weatherboard manufacturer
- correspondence with the owners
- copies of various reports (as listed in Table 1)
- copies of determinations on similar matters
- various technical specifications and invoices.

The owners' submission

4.1.4 The owners made a submission in an email dated 16 October 2015, noting that the cladding has not been installed in accordance with the manufacturer's specifications, the building consent, the approved building specification, or accepted common tradesman-like practice. The owners described the findings of the inspection company, where no boards were found to comply with the minimum 10mm

separation, noting that the builder did not dispute that the weatherboards were fixed contrary to the manufacturer's instructions.

4.1.5 The owners commented that no evidence had been provided for the use of penetrating oil to cut ends, adding that the particular oil had not been chosen due to non-compatibility with the applied stain. Defects had been identified at corners, where boards had been tapered presumably to accommodate 'level problems'.

4.1.6 The owners also raised other matters that are outside those considered in this determination.

The authority's submission

4.1.7 In an email to the Ministry dated 16 September 2015, the authority explained that a final inspection had been carried out; there were several matters to be completed and some items were not as per the consent documents, in particular the installation of the cedar weatherboards. The authority stated that because of the outstanding items, and the current determination, it was unable to issue a code compliance certificate.

4.2 The first draft determination

4.2.1 A first draft of this determination was issued to the parties for comment on 21 March 2016.

4.2.2 The builder's lawyer responded on 22 March 2016 accepting the draft, noting two typographic and similar errors, and providing clarification on the scope of the contract with the builder and that one of the owners made the query referred to in paragraph 3.6.5.

4.2.3 The authority responded on 4 April 2016, accepting the draft with the following comments:

- The weatherboards as installed were an alternative solution. It had reservations arising from the double nailing, particularly on the northern elevation, and that the manufacturer's warranty may be void.
- A code compliance certificate would be issued 'expressly in reliance' on the determination's findings.

4.2.4 The owners responded on 26 April 2016. The owners did not accept the draft and requested a hearing. The owners made the following submissions, in summary:

- The weatherboards were left exposed on site following delivery.
- Failure was now observed in the paint finish.
- The determination does not take account of the extent of non-compliance with E2/AS1 and the manufacturer's specification. The manufacturer's warranty is likely void.
- 55% of the nails touch or penetrate the lower board. The determination does not examine the potential for thermal expansion 'in a meaningful sense'.
- The draft determination places undue emphasis on the "cladding system", rather than examining the actual extent of non-compliance with proven, tested standards and the manufacturer's own requirements.'
- The owners questioned the expert's acceptance of the builder's advice that the mitred cut ends of the weatherboards were painted with protective oil and this matter was disputed.

- The relevance of the expert referring to the standard of workmanship was questioned.

4.3 The hearing

- 4.3.1 A hearing on the matter was held in Whangarei on 6 July 2016. The hearing was attended by the three owners plus a representative of the inspection company, two representatives of the builder and the builder's lawyer, and two officers of the authority. I was accompanied by a referee engaged by the chief executive under section 187(2) of the Act, the independent expert, and an officer of the Ministry.
- 4.3.2 All the attendees spoke at the hearing to clarify various matters of law and fact and were of assistance to me preparing this determination. The hearing considered matters in relation to both this determination and the second determination (refer paragraph 1.5).
- 4.3.3 The views put forward at the hearing and evidential submissions provided at the hearing in relation to this determination are summarised below:

The owners

- The determination's rationale for deciding that the deficiencies in the weatherboard fixings were 'OK' was because there is a cavity. This is not accepted. If the weatherboards fail, the cavity becomes the 'primary defence'
- The requirements of BRANZ Bulletin 468¹¹ have not been referred to; this was 'the most applicable document'. In a cavity situation, the Bulletin says weatherboards were the primary means of defence against water ingress which should only be breached in 'extreme circumstances'. The cavity was not an 'excuse for poor cladding installation'.
- The paint coating is now failing, due to the time between delivery of the factory-primed boards to site (early December 2013) and the top coat being applied (mid-March 2014). The paint manufacturer had inspected the boards and advised 'the issue is with the top coat'.
- The manufacturer's warrantee is 'clearly void'. The various warrantees that should have applied will now not do so. The correct application of the paint system would have provided an 'added degree of assurance' in relation to durability.
- All documentation on the subject says weatherboard fixings are critical, permitting little or no deviation from this.
- Not one of the weatherboards has been installed in accordance with E2/AS1. In 55% of cases, the nails either penetrate or touch the lower board.
- The house is an 'extreme wind zone', the eaves will not protect house.

¹¹ BRANZ Bulletin 468 Fixing timber weatherboards, December 2005

The Builder

- The cavity is a ‘relevant factor’ but is not the primary means of defence. The cavity is only one of a number of mitigating factors.
- The boards as installed have a greater overlap than that shown in E2/AS1. The weatherboards were set out with a full board over the head flashing, the ‘story rod’ used for set out dropped at one location.
- There is no evidence of any failure (splitting and cupping) to date. There is ‘minimal risk’ of failure to comply with the Building Code.
- Narrower boards now more common: these are more stable and experience limited movement across the width. Wider boards have experienced problems (cupping).
- Any split in a weatherboard will be above the weather groove in the lower board. The nails were horizontal or slightly above horizontal.
- The weatherboards were kept ‘out of the weather’ after delivery to site, and the paint was to be supplied by the owners. The paint manufacturer’s data sheets give no time limit in which to install the paint, this only appears on the paint tin. No expert looking at the house has raised concerns regarding deterioration of the paint.
- Provision of warranties is separate to the establishment of compliance.

The authority

- Installation is not in accordance with the consent and not as per E2/AS1. Paint finish would ‘add to E2 and B2’ compliance.
- Painting would lessen the effect of the local high humidity. Unpainted cedar will fade over time.
- Any splitting will occur at feathered (covered) edge of board. Splitting is seen in native timber weatherboards where splitting can occur on the feathered edge. Older versions of NZS 3604 showed the nails ‘just above’ the lower board.
- The as-built cladding system is not as robust as was designed.

4.4 The site visit

- 4.4.1 A visit to the site was undertaken following the hearing; this was attended by representatives of the Ministry and the authority only.
- 4.4.2 The paint defects to the weatherboards referred to by owners at the hearing were not apparent. Variations in the colour and density of the stain was noted, but in my opinion this arises from variations in the timber and its surface roughness.

4.5 Further submissions

- 4.5.1 Following the hearing the builder’s lawyer provided copies of:
- BRANZ Bulletin 531 “Designing for thermal and moisture movement”
 - Article from BRANZ Build, Issue 133 “Do walls actually breathe?”
 - Article from BRANZ Build, February/March 2009 “Ventilation-Drying-In-Cavities”

- BRANZ ‘Powerpoint’ slides from a NZIBS¹² training day
- Information about ‘JSC Western Red Cedar’.

4.5.2 These documents consider recent investigative work about leaks and cavities generally. They support the view that cavities can be depended upon to dissipate leaks that may occur through the primary cladding, and that contemporary joint and flashing designs can be depended upon to provide effective first line of defence in all but the most extreme conditions.

4.6 The second draft determination

4.6.1 A second draft of this determination was issued to the parties for comment on 5 August 2016.

4.6.2 The builder responded on 19 August 2016, accepting the second draft but noting a typographical error.

4.6.3 The authority accepted the second draft without comment in a response received on 19 August 2016.

4.6.4 The owners responded to the second draft determination on 29 August 2016. The draft was not accepted and the owners made the following comment (in summary):

- The site observation noted at paragraph 4.4.2 does not take account of the observations and report by the coating manufacturer and it was ‘likely that an extensive weathering period between priming and top coating has contributed to the early breakdown of the coating system’.
- The coating manufacturer reported ‘A patchy, thin or faded appearance can be seen’ and ‘Minor areas of peeling or flaking coating are visible on the timber corner mouldings’. The coating manufacturer recommended the application of a different product to that presently used.
- BRANZ Bulletin 468 says that the way timber weatherboards are installed is critical. The ‘Bulletin emphasises the importance of correct installation of weatherboards as opposed to reliance on secondary measures.’ The determination has ‘failed to consider this in spite of the significant non-compliance with E2/AS1 and the Specification.’

4.6.5 I have taken account of the submissions received. In response to the defects observed by the coating manufacturer referred to above, I note the following:

- The visit to site after the hearing observed a sound coating, of uniform colour except where the rough texture of the band-sawn surface resulted in a build-up of paint and hence a darker appearance where the grain was raised or the underlying wood was darker. The same variation in colour was noted on the areas of band-sawn plywood cladding. None of the defects noted by the coating manufacturer were observed.
- The Appendix to the expert’s report has photographs of the weatherboards that are also free from the paint defects described here. Peeling of the paint coating was only evident on the copper soakers.

¹² NZIBS – New Zealand Institute of Building Surveyors

- Clear coatings are generally not as durable as ‘solid colour’ paint systems. With respect to maintenance, the coating manufacturer says for this product:

A patchy, thin, faded and uneven appearance or eroded coating on edges indicates the need for recoating. Bandsawn ply and exposed timber will move with the seasonal wet and dry action of the weather. Highly exposed areas may require an additional topcoat after 18-36 months to maintain the coating integrity due to movement of the substrate...

4.6.6 In response to the owner’s contention with respect to non-compliance with E2/AS1: the weatherboards used are not as described in E2/AS1 (refer Figure 1) and the means of installation as specified in the consent is also not consistent with E2/AS1. In my view these variations, of themselves, cannot be used solely to determine whether the cladding satisfies the mandatory performance requirements of the Building Code.

5. The expert’s report

5.1 General

5.1.1 As mentioned in paragraph 1.6, 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 18 November and 1 December 2015. The expert provided a report dated 11 December 2015, which was provided to the parties on 14 December 2015.

5.1.2 The expert noted that his investigation was limited to assessing whether the weatherboard cladding complies with the relevant parts of Clauses E2 and B2 of the Building Code. This assessment considered the adequacy of the installed weatherboard fixings as an alternative solution to fixings called for in E2/AS1.

5.2 The weatherboards

5.2.1 The expert noted that the cedar weatherboards had been installed in early 2014 and ‘no evidence of failure or premature deterioration’ was observed during his investigation. Facing boards, plumbing penetrations, and meter box installations appeared satisfactory.

5.2.2 However, the expert also observed that although boards appeared uniform from a distance, variation in the effective cover became noticeable on closer inspection, particularly on the west wall of the kitchen.

5.2.3 The expert noted that the owners and the building surveyor had referred to tapered weatherboards; and identified two boards at a corner that had been trimmed 3mm over a short distance to align boards at corners. Although not good practice, the expert considered this ‘infringement is relatively minor.’

5.2.4 The expert considered that the following fixing details comply with E2/AS1:

- scarfed joints located over stud
- ventilated plaster cavity closers below the drained cavity
- copper corner soakers
- general ground clearances (except for an area on the north elevation)
- joinery details generally, with metal head flashings and scribes at jambs.

5.2.5 The expert noted that the western red cedar from which the boards were cut meets E2/AS1 paragraph 9.4.2(b), which requires compliance with NZS 3602. The latter states that this species may be used without preservative treatment¹³ and without priming of cut ends or elsewhere¹⁴. Because the weatherboard timber satisfied NZS 3602, the expert did not investigate the dispute as to the priming of cut ends.

5.2.6 Commenting generally on the weatherboard cladding, the expert observed that:

- boards are 'J61' bevel back cedar clears with a band sawn finish, with board ends covered by tight-fitted scribes at jambs and copper soakers at corners.
- the builder had provided a sample panel of weatherboards, which aligned with the board layout on the west elevation and assisted in assessing profiles, typical nailing and weather groove alignment
- the boards in the sample measured as 139mm x 18mm, slightly smaller than the nominal size noted by the manufacturer – likely due to drying shrinkage and considered to be of no consequence to compliance.

5.3 Installation

5.3.1 The expert considered board profiles and fixings described in the following:

- E2/AS1 as an Acceptable Solution to Clause E2
- Figure 3 of NZS 3617
- BRANZ Bulletin 411 as good trade practice
- the weatherboard manufacturer's installation instructions.

5.3.2 Taking the above into account, the expert noted:

- the above details differ in minor aspects of profile, overlaps and fixings; while all comply with the performance requirements of the Building Code, all require nails to clear the tops of lower boards
- if the J61 boards were fitted with weather grooves aligned, the effective cover (gauge) would be 107mm and the clearance between a 3.2mm diameter nail and the top of the lower board would be 35mm above the bottom edge of the upper board
- alignment of weather grooves to J61 boards would result in 4mm clearance of nails above lower boards, in contrast with 10mm clearance called for in E2/AS1.

5.4 Measurement of effective cover and nail position

5.4.1 In order to clarify actual weatherboard installation, a sample board had been made to dimensions reported by the inspection company, which assumed that all nails were fixed 37mm from the bottom of boards.

¹³ Table 2.2A.1 of NZS 3602

¹⁴ Paragraphs 111.2.1 and 111.2.5 of NZS 3602

- 5.4.2 The expert noted that nail locations were variable and the sample was therefore of limited value in assessing clearance above the lower boards. The expert observed that nail heads are generally flush at the top and recessed at the bottom, indicating that nails are close to horizontal, so the expert's calculations were based on that assumption
- 5.4.3 The expert measured effective cover and nail positions using a digital calliper at the same locations used by the inspection company, together with an additional location at the northwest corner. Measurements were recorded and calculations showed that out of a total of 205 pairs:
- clearances above lower boards were all less than 10mm, with 55% of nails touching or penetrating the lower board
 - board overlaps were 32mm or more in 87%, with most of the remaining being only 1 or 2mm short - only 4 in total (2%) ranged from 25mm to 28mm.

5.5 Review of results

- 5.5.1 The expert reviewed the results and assessed their significance as follows:

Table 2: risks and mitigating factors

Issue	Potential risk	Mitigating factors
Overlaps below 32mm	Water penetrates lap	Most short laps are very close to 32mm, with only 4% less than 30mm and the lowest measured at 25mm. Despite low risk design, cladding installed over cavity.
	Weather grooves misaligned	Weather grooves much larger than in NZS 3617 Each groove is large enough to act as anti-capillary gap on its own, without alignment. Large grooves will improve resistance to moisture ingress through laps
Nails touch or penetrate lower board	Splitting of the lower board	Splitting would be as a result of thermal and moisture movement of the boards. Clearance requirements apply to both ex150 and ex200mm wide boards. The narrower boards as installed are subject to less thermal and moisture movement than wider boards. Where found, nail penetration is above the weather groove of the lower board. Any potential splitting would be sheltered from direct rain and protected from capillary action by overlap and grooves.

5.6 The expert's conclusions

- 5.6.1 Taking the particular circumstances of this particular house and its installed board profiles, the expert considered that:

...any minor water ingress due to the departures from E2/AS1 details is likely to drain safely to the exterior via the cavity.

My conclusion taking into account the mitigation features, is that the deviations from E2/AS1 are unlikely to lead to failure to comply [with] the NZBC in this case.

5.7 The builder's responses to the expert's report

5.7.1 The builder responded on 20 January 2016, commenting (in summary) that:

- the consultant's report noted that samples tested positive for copper
- the builder has offered to remedy the uneven kitchen weatherboards.

5.8 The owners' responses to the expert's report

5.8.1 The owners responded on 9 February 2016 (in summary):

- The external paint finish has prematurely deteriorated, as confirmed by the timber stain manufacturer during a site inspection.
- The likelihood of a lack of sealing to cut ends of boards was not investigated.
- To place particular reliance on the drained cavity overlooks the functional requirements of the [Building Code] by placing reliance on a single part of a system, rather than on the primary mechanism being the cladding itself, with secondary reliance on the cavity. 'There is no certainty the cavity ... has not been compromised'.
- The expert considers it 'unlikely' that there will be a durability failure but the 15-year durability requirements mean there will not be a failure.

5.8.2 The expert responded to the owners' comments in an email to the Ministry on 15 February 2016 as follows (in summary):

- The paint finish was not within the scope of inspection. Significant deterioration was not evident.
- Any small amount of water penetrating past the soakers to the mitred ends will carry copper salts that can be expected to inhibit fungal activity.

6. Discussion

6.1 General

6.1.1 An Acceptable Solution provides a prescriptive design solution that sets out one way of complying with the Building Code; but use of an Acceptable Solution is not the only way of achieving compliance. The weatherboard fixing does not comply with E2/AS1, recommended good trade practice, or the manufacturer's instructions; it must therefore be considered as an alternative solution and this requires an assessment of the likely performance within the context of this particular house.

6.1.2 In evaluating the design of a building and its construction, it is useful to make some comparisons with the relevant Acceptable Solutions, which will assist in determining whether this weatherboard installation is code-compliant. However, in making this comparison, the following general observations are valid:

- Some Acceptable Solutions cover the worst case, so that they may be modified in less extreme cases and the resulting alternative solution will still comply with the Building Code.
- Usually, when there is non-compliance with one provision of an Acceptable Solution, it will be necessary to add some other provision to compensate for that in order to comply with the Building Code.

6.2 Evaluation of weatherboards for E2 and B2 Compliance

6.2.1 The weatherboard cladding as a system is required to satisfy performance requirement Clause E2.3.2 and the construction of the components with E2.3.7:

E2.3.2 Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to *building elements*, or both.

E2.3.7 *Building elements* must be constructed in a way that makes due allowance for the following:

- (a) the consequences of failure:
- (b) the effects of uncertainties resulting from construction or from the sequence in which different aspects of construction occur:
- (c) variation in the properties of materials and in the characteristics of the site.

6.2.2 The approach in determining whether the cladding is weathertight and durable and is likely to remain so, is to apply the principles of weathertightness. This involves the examination of the design of the building, the surrounding environment, the design features intended to prevent water ingress, and the robustness of the construction. A building with a high weathertightness risk will require a more robust cladding solution than a building with a low weathertightness risk.

6.3 Weathertightness risk

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

Increasing risk

- the house is built in a very high wind zone

Decreasing risk

- the house is simple in plan and form, with the upper level within the roof line
- there are generous roof overhangs to shelter the walls
- walls have cedar weatherboards fixed over a drained cavity
- external wall framing is treated to a level that provides some resistance to decay if it absorbs and retains moisture.

6.3.2 The house has been evaluated using the E2/AS1 risk matrix. The risk matrix allows the summing of a range of design and location factors applying to a specific building design. The resulting level of risk can range from 'low' to 'very high'. The risk level is applied to determine what claddings can be used on a building in order to comply with E2/AS1. Higher levels of risk require more rigorous weatherproof detailing; for example, a high risk level is likely to require a particular type of cladding to be installed over a drained cavity.

6.3.3 When evaluated using the E2/AS1 risk matrix, the weathertightness features outlined in paragraph 6.3.1 show that all elevations of the house demonstrate a low weathertightness risk rating. I note that, if the details shown in E2/AS1 were adopted to show code-compliance, the weatherboard cladding on this house would not require a drained cavity. Drained cavities would not be required for bevel-back weatherboards unless an elevation reached a high weathertightness risk rating.

6.4 Weathertightness performance

6.4.1 Taking account of the expert's report, I make the following observations on compensating circumstances for this particular house:

- Most weatherboard cladding has been installed with an adequate standard of workmanship, with satisfactory junctions and penetrations.
- While the reports have identified departures from the approved consent, in my view they have not identified any failure to satisfy Clauses B2 and E2. The authority has not identified any non-compliance during its final inspection.
- Weatherboard walls are sheltered beneath roof overhangs that limit exposure to rain and direct sunlight. In addition, boards are installed in short lengths, except for the east elevation where thermal movement from sun will be less than for north and west elevations.
- The short lengths and the narrow 140mm board profile reduces the likelihood of thermal movement being sufficient to cause significant damage.
- Western red cedar is a durable timber that does not require either treatment, priming, or an applied finish to achieve its durability as a cladding under Clause B2.
- The expert has outlined features of the weatherboards which I accept mitigate potential risks of the particular installation – these include:
 - the same 10mm nail clearance above the lower boards described in E2/AS1, also applies to wider boards than are used here
 - the weather grooves are much larger than described in NZS 3617, and grooves in adjacent boards do not need alignment to be effective
 - any splitting in the upper portion of the lower boards is still covered by upper board and weather groove.
- Despite the low weathertightness risk, weatherboards are installed over a drained cavity

6.4.2 Taking account of the above, I have reasonable grounds to conclude that the weatherboards installed to exterior walls of this particular house are compliant in this case.

6.5 Conclusions

6.5.1 I consider the expert's report establishes that the weatherboard installation was not in accordance with the building consent and must therefore be assessed as an alternative solution. However, as described in the expert's report, the consent documentation itself is not wholly consistent in that it refers to E2/AS1 as the means of establishing compliance but the cladding solution described in the approved consent varies from the Acceptable Solution – I do not consider the variations are significant.

6.5.2 The expert's report and the other evidence provide me with reasonable grounds to conclude the weatherboard cladding is currently weathertight and I am therefore able to conclude that the cladding complies with Clause E2 of the Building Code.

6.5.3 The performance of the weatherboard cladding does not rest on the performance of one part of the system alone. The performance of the cladding as a system includes the weatherboards, the drained and ventilated cavity, the durability of the elements used, the building's risk features and the environmental factors (refer paragraph 6.2).

- 6.5.4 I do not accept the owners' contention that the cavity becomes the primary means of defence. The cavity is intended to provide drainage and ventilation in the event that weatherboards allow the passage of water in extreme circumstances. If the weatherboards were allowing the passage of water as a reasonably expected occurrence the cladding system would not be compliant; this is consistent with the position taken in previous determinations.
- 6.5.5 Clause E2.3.2 says that claddings 'must prevent the penetration of water that could cause undue dampness, damage to building elements, or both' (my emphasis). This does not require claddings to be weathertight in every circumstance, but requires that water that may penetrate the cladding does not cause undue dampness and damage to the building elements.
- 6.5.6 The owners contend that BRANZ Bulletin 468 should have been referred to. Bulletin 468 contains very similar advice to that described in E2/AS1. The Bulletin says weatherboards 'will perform better' when listed criteria are met – the criteria applicable to this case include profile, overlap, paint coating, and setout. The Bulletin makes no allowance for different board widths and timber species. The widest plain bevel back weatherboard profile described in NZS 3617 is 180mm wide; this compares with the width of the installed board at 140mm.
- 6.5.7 I note that if the boards were a wide rusticated and / or rebated profile made of Pinus Radiata used in a more exposed situation, then the risks of bowing or splitting of the larger boards at the thinner overlap would be greater. The departures from guidance information and the Acceptable Solution regarding fixing would be of more concern and my decision may well have been different.
- 6.5.8 The durability requirements of Clause B2 require wall claddings to remain compliant for a minimum period of 15 years with normal maintenance. Due to mitigating factors that compensate for any possible shortcomings with the installation of the weatherboard cladding system, I am able to conclude that there are no defects likely to allow the ingress of moisture through the cladding system within the 15-year period required by the Building Code to the extent that it would cause undue dampness or damage. Consequently, I am satisfied that the weatherboard cladding as installed complies with Clause B2 of the Building Code.
- 6.5.9 It is emphasised that each determination is conducted on a case-by-case basis. Accordingly, the fact that a particular weatherboard cladding system has been established as being code-compliant in a specific instance, does not of itself mean that the same system will be code-compliant in other situations.
- 6.5.10 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 Ministry has previously described these maintenance requirements (for example, Determination 2007/60).

7. The decision

- 7.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the weatherboard system as installed complies with Clause B2 and Clause E2 of the Building Code.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 19 September 2016.

John Gardiner
Manager Determinations and Assurance