

Determination 2024/051

Compliance of roof cladding on a house with clause E2 External moisture

57A Bayview Road, Charteris Bay, Governors Bay

Summary

This determination considers whether a roof cladding system as installed on a house complies with Building Code Clause E2 *External moisture*. Specifically, the determination considers how the perimeter edges of the profile metal cladding have been finished where it overhangs the gutters, along with the associated eaves flashing.



Figure 1: Rear elevation of dwelling looking northwest¹

¹ Photograph taken by the authority on 19 March 2024.

In this determination, unless otherwise stated, references to “sections” are to sections of the Building Act 2004 (“the Act”) and references to “clauses” are to clauses in Schedule 1 (“the Building Code”) of the Building Regulations 1992.

The Act and the Building Code are available at www.legislation.govt.nz. Information about the legislation, as well as past determinations, compliance documents (eg, Acceptable Solutions) and guidance issued by the Ministry, is available at www.building.govt.nz.

1. The matter to be determined

- 1.1. This is a determination made under due authorisation by me, Peta Hird, for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment (“the Ministry”).²
- 1.2. The parties to the determination are:
 - 1.2.1. S M and P N Melville, the owners of the property who applied for this determination (“the owners”)
 - 1.2.2. Christchurch City Council, carrying out its duties as a territorial authority or building consent authority (“the authority”)
 - 1.2.3. C Rogers, the licensed building practitioner concerned with the relevant building work (“the builder”).
- 1.3. This determination arises from the owners’ concerns about the compliance of the as-built lightweight profiled metal roof cladding installed on their dwelling.
- 1.4. The owners’ concerns include the extent to which the roof cladding overhangs the gutters, the size of the eaves flashing installed, the absence of a cladding flashing, the lack of turn-downs to the edge of the roof cladding, and the extent to which the installed gutters baffle³ the exposed cladding edges.
- 1.5. The matter to be determined, under section 177(1)(a), is the compliance of the as-built roof cladding and associated flashings with Building Code Clause E2 *External Moisture*.

² The Building Act 2004, section 185(1)(a) provides the Chief Executive of the Ministry with the power to make determinations.

³ I have used the term ‘baffle’ to describe the modification of wind action by a gutter that can otherwise affect uplift of a roof’s projecting overhang and weathertightness.

2. The building work

- 2.1. The owners' property is a steep section in a coastal residential area. The property is located in an extra high wind zone⁴ and in exposure zone D (high),⁵ which relates to 'Coastal areas with high risk of wind blown sea-spray salt deposits'.
- 2.2. In December 2019, the authority issued building consent BCN/2019/8090 for the construction of a 'New Hillside Dwelling with attached garage'. The application for building consent stated the means of demonstrating compliance with clause E2 was Acceptable Solution E2/AS1.
- 2.3. The building consent plans show a two-storey asymmetrically shaped dwelling, built down and across the contour of the hillside.
- 2.4. The roof is a mono-pitch construction, with a 5° pitch and flush eaves with a soffit projection of 100mm or less. The line of the eaves is set at various angles to the alignment of the roof cladding ranges between 90 degrees to 23 degrees. The eastern side of the building is approximately 23 degrees to the alignment of the roof, creating an oblique cut to the end of the roof cladding.

The proposed roof cladding

- 2.5. A proprietary system of profiled metal roofing, and an associated rainwater guttering system was specified in the building consent.
- 2.6. The roof cladding system was lightweight trapezoidal (asymmetrical) profiled metal roof cladding, to be installed over thermal roof underlay onto the roof framing. Refer to figure 2.
- 2.7. The specifications referred to the manufacturer's trade literature for the roof cladding, Acceptable Solution E2/AS1, and the New Zealand Metal Roofing Manufacturers' *New Zealand Metal Roof and Wall Cladding Code of Practice* ("the NZMRM code of practice")⁶ (among other documents) as the means of establishing compliance of the roof cladding.
- 2.8. In addition, the specifications referred to section 4.0 of Acceptable Solution E2/AS1 regarding the roof flashings, and the use of closure strips⁷, and turn-downs 'at the gutter line where the roof pitch is less than 8 degrees'⁸.

⁴ As defined in NZS 3604:2011 *Timber-framed buildings*, table 5.4 – Determination of wind zone.

⁵ Ibid., paragraph 4.2.3.3.

⁶ For the purposes of this determination, I refer to the 2008 version of the Code of Practice that was referenced in the relevant version of Acceptable Solution E2/AS1 at the time the building consent was issued.

⁷ Specification section 4311S, paragraph 2.11 'closure strips – compressible, profiled, closed cell foam strips to fit the sheet profile', and paragraph 4.4.

⁸ Ibid., paragraph 3.11.

- 2.9. The cladding was to be installed and fixed in accordance with the NZMRM code of practice.
- 2.10. The eaves construction incorporates an eaves flashing installed below the roof underlay, and it was to include a metal cladding flashing installed under the guttering system across the surface of the fascia board (refer to figure 2).
- 2.11. The guttering system used metal quarter round gutters fixed to the fascia with internal brackets. The guttering was to be installed on five of the roof's eight sides, but not on the three sides along the dwelling's uphill southern elevation.⁹ A metal mesh gutter guard has been installed, fixed in place with screws and silicone.

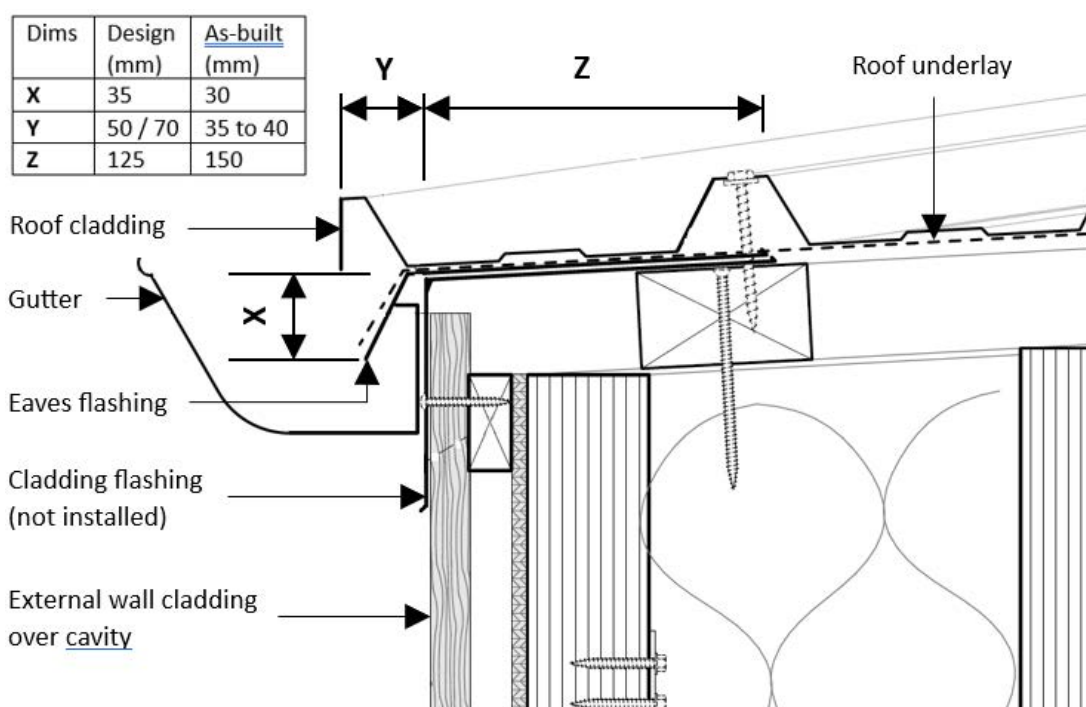


Figure 2: Eaves construction¹⁰ (not to scale)

- 2.12. Several changes were made during the installation of the roof cladding system that departed from the building consent plans and specifications, including:
- 2.12.1. substituting an alternative lightweight trapezoidal (asymmetrical) proprietary metal roof cladding system
 - 2.12.2. substituting an alternative eaves flashing
 - 2.12.3. not installing the cladding flashing

⁹ As detailed on building consent plan A-07.

¹⁰ Figure 2 has been reproduced from building consent plan A-20, detail D-1. It does not show the as-built gutter guard. The "Design" dimensions were taken from Acceptable Solution E2/AS1, the NZMRM code of practice, and manufacturer's instructions. The "As-built" dimensions were provided by the owners and the builder and are approximate.

- 2.12.4. not forming turn-downs at the lower ends of the roof cladding sheets
- 2.12.5. not installing foam closure strips.
- 2.13. On 18 February 2022, the authority carried out a final inspection of the building work. Regarding the roof cladding, the inspection record noted this passed, and the flashings had been sighted at an earlier 'pre-cladding inspection'. This may have been a reference to an inspection conducted on 18 May 2021, although the 'site notice' for that inspection does not mention the eaves or cladding flashings.
- 2.14. On 31 August 2023, the authority carried out a further final inspection. The inspection report noted several variations to the building work that would require a full amendment to the building consent including the "change of barge/eave...flashing details – differ in construction/design on site verses in consent plans details. Include in amendment".
- 2.15. On 17 March 2024 the owners contacted the authority about their concerns with the as-built roof cladding. On 19 March 2024 the authority conducted a further inspection. It noted the previous inspection had requested amendments for the changes to the flashing and roof cladding supplier and these would require approval. The authority requested that these amendments now be provided.
- 2.16. I understand no amendment to the building consent was applied for, and the authority has not issued a code compliance certificate.

3. Submissions

The owners

- 3.1. The owners submit (in summary):
- 3.1.1. The as-built roof cladding and gutters do not comply with clause E2.
- 3.1.2. The following items have been changed from the building consent, and do not comply with the approved plans and specifications, the Acceptable Solution E2/AS1, the manufacturer's guidelines,¹¹ or the NZMRM code of practice:
- (1) The roof cladding has been substituted by a different product from a different manufacturer.
 - (2) The lower ends of the trapezoidal profile roofing have not been turned down at the gutters.

¹¹The manufacturer's trade literature referred to in the building consent specifications differs from the roof cladding that was installed. The owners submitted copies of some of the manufacturer's trade literature for the roof cladding that was installed.

- (3) The roofing only has a minimal 35mm to 40mm overhang into the guttering.¹²
 - (4) The overlap of the eaves flashing into the gutter is only 30mm, possibly less, when Figure 45(a) in E2/AS1 and the manufacturer's plan indicates a minimum of 35mm is required.¹³
 - (5) The cladding flashing shown in the building consent plans has not been installed.¹⁴
 - (6) The manufacturer's "specify that foam closures are used as required" but it is not clear whether they have been installed.
- 3.1.3. The manufacturer's guidelines for the roof cladding provide specifications for the installation of the cladding, the eaves flashings and the guttering, and state the cladding should be installed in accordance with the NZMRM code of practice.
- 3.1.4. The manufacturer's guidelines specify a minimum roof overhang of 50mm for roofs with pitches between 10° and 35°, where the roof is not baffled by the spouting. The owners contacted the manufacturer, seeking clarification of the required overhang for a roof with a 5° pitch. The manufacturer advised their specifications were the same as those in the NZMRM code of practice and 'When the ends of the ribs are not baffled by a spouting and the pitch is below 10° the overhang should be increased to 70 mm to avoid blow-back'.¹⁵
- 3.1.5. The exposed open roof ridges are not baffled by the guttering, as the gutters are lower than the level of the roof ribs. At the southeast corner of the dwelling the roof ribs are approximately 8mm higher than the top of the outer edge of the guttering.

The authority

3.2. The authority submits (in summary):

- 3.2.1. The building work is an alternative solution, and the authority has not been provided with any evidence that it complies with clause E2.

¹² The owners referred to the manufacturer's plan sheet A 14/29 dated January 2023, and this corresponds with plan sheet 09/24, dated 2014, titled 'Flush eave with internal gutter bracket' that was current at the time the building consent was granted and issued and when the roof cladding was installed.

¹³ Ibid.

¹⁴ Plan sheet A-20, detail D1. Refer to Figure 2.

¹⁵ The owners referred to section 14.11 'Overhang' from the 2024 version of the Code of Practice this is from the 2024 version, and I note the corresponding section in the 2008 version is 7.1.4.

- 3.2.2. The building work relating to “the roof to gutter junction has not been carried out in accordance with the building consent” and does not comply with Acceptable Solution E2/AS1, in particular figure 45.
- 3.2.3. Compliance with the NZMRM code of practice had also not been achieved.
- 3.2.4. The dwelling is located in an area where there is a high-risk potential of moisture entry. The site is in an extra high wind zone, and with a low-pitch roof, consequently “there is a high risk of water being blown under the roofing and into the house”. In this situation, the authority “would normally expect to see some robust reasons” why the building work complies, “including testing on site or expert opinion”.
- 3.2.5. The authority does not have reasonable grounds to believe that the detail as constructed complies with the Building Code and is not confident that compliance could be demonstrated as it is.

The builder

- 3.3. The builder submits (in summary):
 - 3.3.1. The compressed foam closure strips had not been installed and given the irregular nature of the dwelling’s design they “would not have fitted anyway”.
 - 3.3.2. The as-built width of the eaves flashing (measured from the edge of the external wall to the top of the flashing) was 150mm and there was a “flat crush fold” at the top, as shown on the consented plans¹⁶.
- 3.4. The builder provided a ‘record of building work’ for the building work to the authority. In respect of the roof cladding, the record of building work confirms the builder supervised the installation of the metal profiled roof as per the manufacturer’s specifications.¹⁷

4. Discussion

Legislation

- 4.1. Section 17 provides that all building work must comply with the Building Code to the extent required by the Act. The Building Code prescribes functional requirements for buildings and the performance criteria with which buildings must comply.

¹⁶ Detail D1 on plan A-20.

¹⁷ The Ministry requested a copy of the manufacturer’s instructions from the builder that were relied on to undertake the building work. These have not been provided to Ministry by the builder. A set of manufacturer’s plans dated 2014 were provided by the owners, and in the absence of any contrary information, I have relied on these for the purposes of this determination.

4.2. The functional requirement of clause E2 is that “Buildings must be constructed to provide adequate resistance to penetration by, and the accumulation of, moisture from the outside.”

4.3. Performance clause E2.3.2 states:

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

4.4. The terms “undue dampness” and “damage” are not defined in the Building Act or Building Code. However, “undue dampness” has been considered in previous determinations¹⁸ “to be a level of moisture that has, or will, result in detrimental effects on building elements, or the building occupants, or both”. That determination also noted that “damage” such as decay in framing, did not need to have occurred to satisfy the test of “undue dampness”.

4.5. I note the terms “undue dampness” and “damage” as it relates to clause E2, were also considered by the High Court in *Minister of Education v H Construction North Island Limited (formerly Hawkins Construction North Island Limited)*¹⁹ as follows:

[116] “... cl E2.3.2 provides roofs and exterior walls must prevent the penetration of water that “could” cause damage to building elements. Anticipation and prohibition of potential damage makes clear actual damage is not required for a breach of the Code...”

...

[118] It follows the Code does not contemplate “reasonable” damage in consequence of water ingress. Rather, it seeks to prevent damage.

Compliance with the Building Code

4.6. Some elements of the building work have not been completed in accordance with the building consent.²⁰ For example, the specified cladding flashing has not been installed, and the turn-downs to the edge of the roof sheets have not been formed.

Acceptable Solution E2/AS1

4.7. Section 19 of the Act sets various methods that can be used to establish compliance with the Building Code, and one method is by adherence to Acceptable Solutions.

¹⁸ For example, Determination 2014/062 “*Regarding the refusal to issue a code compliance certificate and the issue of a notice to fix*” (17 December 2014).

¹⁹ CIV-2013-404-1504 [2018] NZHC 871, Downs J.

²⁰ It appears no amendment to the building consent, to address the proposed variations to the building work, had been applied for in accordance with section 45(4).

- 4.8. If building work complies with an Acceptable Solution, it must be treated as having complied with the provisions of the Building Code to which the Acceptable Solution relates.²¹
- 4.9. Section 8.4 of E2/AS1 provides a solution for the installation of profiled metal roof cladding and associated flashings. Paragraph 8.4.14 details the requirement for turn-downs at gutters:²²

The lower ends of trapezoidal and trough profile roofing shall be turned down at gutters, where the roof pitch is less than 10°.

The turn-down shall be 30° from the plane of the sheet.

- 4.10. The owners' roof cladding has a trapezoidal profile and a roof pitch of 5°, therefore, turn-downs at the gutter are required if constructed in accordance with Acceptable Solution E2/AS1. No turn-downs have been formed, and so the as-built building work does not comply with clause E2 by way of E2/AS1.

An alternative solution

- 4.11. Having established the building work does not comply with E2/AS1, I will now consider if compliance with the performance requirements of the Building Code has been demonstrated in another way (referred to as an 'alternative solution').
- 4.12. Various documents have been cited in the building consent plans and specifications and the parties' submissions. These documents provide a starting point for considering the compliance of the roof cladding and associated flashings as installed. These include the manufacturer's trade literature and the NZMRM code of practice.
- 4.13. With reference to the manufacturer's literature that was current when the roof cladding was installed:²³
- 4.13.1. The literature specifies the installation of a minimum 125mm wide eave flashing where a roof pitch is less than 10°, or the soffit width is less than 100mm, or in extra high wind zones; all these criteria apply to the owners' roof and the eave flashings as installed are 150mm.
- 4.13.2. Contrary to the literature, the cladding does not have the turn-downs at the gutter.
- 4.13.3. The cladding only extends over the gutter by between 35mm and 40mm, in contrast to the manufacturer's stated minimum of 50mm.

²¹ Section 22.

²² A turn-down to the edge of the roof cladding is also depicted in Figure 45(a) of E2/AS1.

²³ Plan sheet 09/24, dated 2014, titled 'Flush eave with internal gutter bracket'.

- 4.13.4. The overlap to the gutter / fascia board is less than the manufacturer's minimum 35mm. (Refer paragraph 3.1.2(4).)
- 4.14. Based on the information provided by the owners, the as-built building work also does not fully comply with the NZMRM code of practice in the following respects (section reference numbers below are those applicable to the code of practice).
- 4.14.1. The eaves flashing has been installed but only extends 35mm to 40mm into the gutter, in contrast to the 50mm set out in section 5.3.5.4.
- 4.14.2. No profile closures have been installed, which according to section 5.7 should be used on all roof pitches below 10° when the wind design load is high or very high, and they should be compressed between the roofing sheets and supports or the flashing.
- 4.14.3. No turn-downs have been formed, though section 7.1.2 states all roof cladding with a pitch less than 8° must be provided with turn-downs.
- 4.14.4. The guttering only partially baffles the edge of roof cladding sheets, the roof pitch is 5°, and the sheets only overhang the gutter by between 35mm to 40mm. Section 7.1.4, states that where the ends of the cladding ribs are not baffled by guttering and the pitch is below 10°, the cladding overhang into the gutter should be increased to 70mm. In addition, in areas of very high wind load (which this dwelling is) additional methods (filler blocks, end-caps, over-flashings, baffles) are also required.
- 4.14.5. Section 8.4.1 states roof cladding must overhang the gutter by not less than 50mm, with a down-turned drip edge when the roof pitch is less than 8°, and a separate over flashing is recommended to be used. Although eaves flashings have been installed, the roof cladding sheets only overhang the gutter by between 35mm to 40mm, and no turn-downs have been formed at the edges.
- 4.15. Other industry documents useful for establishing compliance of an alternative solution include various building supplements and best practice guides produced by BRANZ.²⁴ However, I note that in general these documents mirror the requirements of the NZMRM code of practice.
- 4.16. In summary, it is apparent the roof cladding and its associated flashings do not accord with the manufacturer's trade literature, the NZMRM code of practice, or other industry documents that may otherwise support the compliance of the as-built building work by way of an alternative solution.

²⁴ Building Research Association of New Zealand. For example, BRANZ (2017) *Build 162 Supplement: Flashings*, retrieved from <https://www.buildmagazine.org.nz/issues/show/162-supplement>; BRANZ (2013) *BU567: E2/AS1 Flashing requirements*, retrieved from <https://www.branz.co.nz/pubs/bulletins/bu567/>; BRANZ (2013) *Good practice guide: Long-run metal roofing* (second edition). Available at https://www.branz.co.nz/shop/catalogue/good-practice-guide-long-run-metal-roofing_95/.

- 4.17. The roof cladding is only partially baffled by the height of the gutter which is lower than the profile of the roof cladding sheet, and the building is located in an extra high wind zone in a coastal area, with flush eaves (less than 100mm wide). Overall, this means there is an increasing risk of blow-back of external moisture and wind driven salt-laden air to the underside of the roof cladding sheets where these unwashed areas become susceptible to corrosion over
- 4.18. The ability of the as-built roof cladding system as a whole to deflect water effectively is compromised by the minimal overhang of the roof cladding into the gutter, lack of turn-downs to the edge of the roof claddings sheets, and the minimal overlap of eave flashing. time.
- 4.19. Further, the 23-degree alignment of the gutter widens the open area of the rib from 25mm at the top and 60mm at the bottom to approximately 64mm and 154mm respectively, creating a much larger opening for moisture entry and the possibility of funnelling wind accelerations up the rib.
- 4.20. The inadequate overhang of the roof cladding sheets, the lack of turn-downs, and the inadequate overlap of the eaves flashing, all contribute to compromising the ability of the roof cladding system to drain external moisture effectively that would otherwise accumulate in the space under the profile of the roof cladding sheets, such as condensation on the underside of the sheets dripping onto the roof underlay.
- 4.21. An element of drying will be afforded by the asymmetric trapezoidal profile of the cladding, with the crests of the profile being slightly higher than the gutters and the absence of profile closures. However, cross-ventilation will be minimised due to the barge flashing installed at the higher end of the roof. Overall, I consider the drying capability of the low pitch roof cladding will not be sufficient to minimise the effects of salt-laden wind-driven external moisture or condensation on the underside of the roof cladding.
- 4.22. With the increased risk of blow-back of external moisture and wind driven salt-laden air to the underside of the roof cladding sheets, these unwashed areas will be susceptible to corrosion over time. This situation would be further exacerbated if condensation formed on the underside of the roof cladding sheets is not able to be adequately drained or dried by ventilation. Further, since no turn-downs have been formed, the exposed edges of the roof underlay will be subjected to UV light and will begin to degrade over a relatively short period of time.
- 4.23. The lack of turn-downs at the edge of the roof cladding sheets, the minimal overhang of the cladding into the gutter, the inadequate overlap of the eaves into the gutter flashing, and partial baffle of the roof cladding system by the gutter, means there will be an accumulation of salt-laden wind driven water and condensation to the underside of the cladding profile, leading to undue dampness in the roof assembly. I am of the view the roof cladding as installed will not be

effective in draining and drying that moisture, and this will result in damage to the roof cladding material and the roof underlay.

4.24. Consequently, I conclude that the roof cladding system and associated flashings do not comply with clause E2.3.2.

5. Decision

5.1. In accordance with section 188 of the Building Act 2004, I determine the as-built roof cladding and associated flashings at 57a Bayview Road, Charteris Bay, do not comply with the Building Code Clause E2 *External Moisture*.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 27 September 2024.

Peta Hird

Lead Determinations Specialist