



Determination 2016/005

The durability of a substitute metal roofing material on a house located close to a tidal estuary at 79 Prestidge Road, Katikati



Summary

This determination considers the compliance of a substitute metal roofing material with respect to durability. The determination includes the expert opinion of a specialist in corrosion engineering, and discusses the exposure and corrosion zones relevant to the site.

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 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 building owner, Mr B Parr, who applied for the determination (“the applicant”)
- Western Bay of Plenty District Council carrying out its duties and functions as a territorial authority or a building consent authority (“the authority”)
- Mr D Skipper, the roofing installer and licensed building practitioner concerned with the relevant building work (“the LBP”).

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.

- 1.3 I consider that the following are persons with an interest in the matter:
- the builder, NZ Design & Build Ltd (in receivership, “the builder”)
 - Kiwisteel NZ Ltd (“the steel supplier”) as the company supplying the pre-finished roofing material.
- 1.4 This determination arises from the substitution of roof cladding to a house built in a coastal area within 100m of a tidal estuary. The applicant’s concern relates to the durability of the substitute roofing given the location of the house.
- 1.5 The matter to be determined² is therefore whether the substitute roofing material will satisfy Clause B2 – Durability³; that is whether the roofing material will perform satisfactorily for a minimum 15 years as required by Clause B2.3.1(b).

1.6 Matters outside this determination

- 1.6.1 This determination addresses the substitute roofing material in terms of compliance with the performance requirements of the Building Code. The contract the applicant has with the builder may be for a material that is in excess of the minimum performance required by the Building Code; however contractual matters are outside the matters that can be determined under section 177 of the Act.
- 1.6.2 I have not considered any other building elements in the house or other clauses of the Building Code. A code compliance certificate has not been issued for the house and the issue of the code compliance certificate is not considered in this determination.
- 1.7 In making my decision, I have considered the submissions of the parties, the reports of the experts commissioned by the Ministry to advise on this dispute (“the engineer” and “the building surveyor”), and the other evidence in this matter.

2. The building work

- 2.1 The building work considered in this determination consists of a new single-storey house situated on a gently sloping site close to a tidal estuary. I have assumed it is located in a high wind zone for the purposes of NZS 3604⁴.
- 2.2 The house is light timber frame construction on a concrete foundation. The roof is pitched at approximately 10° with projecting eaves on most elevations. The upper main house roof slopes to the east and the lower garage/laundry roof slopes to the north and south.
- 2.3 The roof cladding is a proprietary corrugated steel roof cladding, 0.4mm base metal thickness with matching soft edge flashings. The roof is fastened with 50 x 6mm self-tapping Class 4 roof screws with sealing washers. Roof penetrations are formed using EPDM⁵ boot flashings.

² Under section 177(1)(a) of the Act

³ In this determination references to sections are to sections of the Act, and references to Clauses are to Clauses of the Building Code (First Schedule, Building Regulations 1992)

⁴ New Zealand Standard NZS3604: 2011 Timber framed buildings

⁵ Ethylene propylene diene terpolymer – a synthetic rubber roofing membrane

3. Background

3.1 On 22 November 2012 the authority issued building consent No. 84009 for the house. A proprietary long-run profiled steel roof cladding was specified in the documents supporting the building consent application, but a different proprietary product was installed instead. Approval for the substitution was not sought from the owner, and a building consent amendment was not lodged with the authority.

3.2 I note that the authority sought clarification from the architect on 3 September 2012 regarding the exposure zone, stating

Please confirm exposure zone, Zone D: High as defined in NZS 3604:2011: Coastal area within 500 m of the sea including harbours, or 100 m from tidal estuaries and sheltered inlets, as this project seems to be within 100m from estuary.

I have not seen a response to this request.

3.3 A 15-year material warranty was issued for the roof cladding by the steel supplier on 18 February 2013. The warranty conditions state that

[The proprietary product] will not be warranted under any circumstances if used in the Severe Marine, or Very Severe environments.

3.4 Manufacturer product information accessed on the Internet on 24 December 2013 by the applicant indicates that the roofing is only suitable for installation in moderate non-marine environments, stating that

... The [proprietary] products are intended to be used in a moderate everyday environment at least 500m from any marine environments and environments that are not subject to severe weather conditions.

3.5 In a letter dated 17 July 2014, the applicant advised the authority that the roofing was not suitable for the environment, describing the site conditions as follows:

The House is sited 60 metres from the sea. This is a raised Site, highly exposed to Easterly & North Easterly winds. There are no obstructions across the Harbour waters to the distant Matakana Island Easterly winds often create turbulent water conditions, resulting in white caps close in to shore & quite salty smelling air

3.6 On 11 August 2014, the steel supplier advised the authority that the site location was considered to be Moderate Coastal – ISO Category 3⁶, which was described as:

- Little or no salt deposits
- The occasional smell of salt spray in the air
- Typically starts 500 - 1000 meters from breaking surf such as is found on exposed coasts
- OR in the immediate vicinity of calm salt water such as estuaries

3.7 The steel supplier cited various mitigating factors such as wind direction, distance from breaking surf, definition of an estuary, and the simple design of the house. The steel supplier stated that in its view the product 'will perform as expected, and will meet the durability requirements of the Building Code'.

3.8 In a letter to the authority dated 17 August 2014, the applicant disputed the steel supplier's justification, citing high site exposure, roofing material restrictions in severe environments, and possible consequential problems related to future sale of the property. The applicant believed that the authority should reject the application to amend the building consent to substitute the roofing material.

⁶ International Standard ISO 9223:2012 Corrosion of metals and alloys – Corrosivity of atmospheres – Classification, determination and estimation. (This standard is cited in Acceptable Solution E2/AS1 and in NZS 3604:2011)

- 3.9 In an email copied to the applicant dated 22 October 2014, the authority advised that the roofing change was among items yet to be resolved to complete processing of the amendment application, stating that:
- ... we do not have reasonable ground to be satisfied the [substitute] metal roofing will comply with the building code Clause 82 Durability. The site assessment regarding corrosion zone and environment severity provided by [the steel supplier] ... is required to be independently reviewed by a suitably qualified person. Alternatively, you can apply for a Determination with the Ministry...
- 3.10 The authority confirmed its concerns about the durability of the roofing material in a letter to the applicant dated 4 December 2014, stating that:
- ... on the basis of the information submitted, [the authority] does not believe the product will comply with the building code Clause B2 Durability and therefore compliance with the approved consent has not been achieved.
- 3.11 In an email dated 3 June 2015 to the steel supplier, the applicant reiterated previously expressed concerns related to site conditions, durability and warranty limitations. A postscript noted that several sheets of roofing still needed to be removed because:
- The [LBP] installed the roof over sections where all the timber fixings were not in place. The fireplace chimney was not installed to [the authority's] approval. (Flashings & support)
- 3.12 The steel supplier responded by email on 8 June 2015, advising that there may be some confusion related to the material selection, as the steel supplier was not involved in any part of the process, communication, knowledge of material specified or substitution taking place. The steel supplier reiterated that a specific warranty had been issued stating that the material will exceed the 15-year durability requirement. The steel supplier advised that installation issues should be taken up with the LBP.
- 3.13 The steel supplier provided the applicant with further information by email on 17 June 2015, referring to the results of an independent New Zealand laboratory assessment of compliance with the AS/NZS 2728⁷ performance requirements as follows:
- In accordance to AS/NZS 2728:2007 Product Type 4 is suggested for use in corrosivity environments up to and including ISO 9223 Category 4 'High' (coastal/ low salinity). Most populated areas of New Zealand fall within this category and only off-shore installations, geothermal areas, specific industrial environments, direct beach fronts and beach fronts with high wind and surf exceed this corrosivity category in New Zealand.
- From the results available [the substitute] products confirm (sic) to the performance requirements of Product Type 4 in all aspects of salt spray performance and humidity resistance. Other product specific properties such as coating thickness, gloss and cross hatch adhesion also fall within the requirements of Product Type 4 (Gloss Category 2).
- 3.14 The steel supplier also advised that although the general warranty guidelines suggest that the substitute product should not be used in severe marine environments, the site was assessed as a moderate coastal environment and a material warranty was issued accordingly.
- 3.15 The Ministry received an application for a determination on 2 July 2015.

⁷ Australian/New Zealand Standard AS/NZS 2728:2007 Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements

4. The submissions

- 4.1 The applicant provided the following information with the application for determination:
- Background to the dispute.
 - The authority's request for further consent application information dated 3 September 2012.
 - Correspondence between the parties.
 - An article on roofing materials in coastal areas⁸.
 - Product information.
- 4.2 The following additional information was provided by mail on 5 August 2015:
- Building consent letter from the authority.
 - Drawings as submitted to the authority showing changes.
 - Excerpts from the specification.
- 4.3 In an email dated 24 September 2015, the applicant requested that cut edges of the valley roofing sheets be inspected for corrosion as it was believed the roofing had been cut with a friction blade.
- 4.4 In an email dated 21 September 2015 the LBP provided an invoice indicating that Class 4 roof fasteners were installed. The LBP advised by email on 28 September 2015 that the roofing was cut with a mechanical nibbler.
- 4.5 The builder made no submission. The authority acknowledged the application for determination but made no submission in response.
- 4.6 As noted in paragraph 3.13, the steel supplier had commissioned independent laboratory testing of the roofing material. In an email dated 30 July 2015 the Ministry requested a copy of the test report and technical information related to the coating system applied to the product. The steel supplier provided the information requested via email on 31 July 2015 and attached a letter from a research laboratory also dated 31 July 2015. The letter reproduced some of the test results and referred the reader to the main report for further details. The Ministry requested the full report on 27 August 2015 and this was provided by email on 10 September 2015.
- 4.7 A draft determination was issued to the parties for comment on 24 November 2015.
- 4.8 By email on 5 and 7 December 2015 respectively the LBP and authority accepted the draft without further comment.
- 4.9 The applicant responded by email on 5 January 2016, noting that he still had concerns regarding the difference in views in respect of weather conditions and that the roof colour had already faded when compared to the flashings. The applicant maintains that the site is subject to 'strong weather conditions', with northerly through to easterly winds blowing across open salt water, and that the low profile of Matakana Island has a limited effect on the winds. The applicant considered the prevailing wind direction (refer paragraph 5.2.2) was 'debateable', and that the site is much closer to the salt water than provided for in the manufacturer's parameters.

⁸ Bartlett, Britton. "Roofing Materials in Coastal Areas." *South Walton Panama City Beach FL Roofing Services Articles*. 20 Jan. 2011. Web. 24 Nov. 2015.

- 4.10 No response to the draft nor further submissions were received from the builder or the steel supplier.

5. The expert's reports

- 5.1 As described in paragraph 1.7, I engaged an engineer and a building surveyor to assist me with the determination.

5.2 The engineer's report

- 5.2.1 The engineer is chartered professional engineer with specialist expertise in corrosion engineering. He is a member of several national and international organisations for corrosion engineering. The engineer reviewed the documentation and produced a report that was completed on 3 November 2015. Copies of this report were sent to the parties on 5 November 2015.
- 5.2.2 The report considered the local topography and site corrosivity, and compared the substitute roof cladding with that specified. In respect of the site corrosivity, the engineer noted the following:

- The site appears to be adjacent to a tidal estuary at the mouth of the Wainui River which is sheltered from the North-east by Te Hopai Island and further north by a peninsular forming Matahui Point. It is sheltered from significant wave action from the East by a sandbank or low island approximately 2 km away and is protected from ocean storms by Matakana Island. The site is approximately 6 km southwest from its nearest point (Matakana Point/Flat Point) while the closest part of the eastern shore of Matakana Island, which is a Pacific Ocean surf beach, is approximately 12 km away. Wave action from the estuary and upper Tauranga Harbour will also be reduced by the shallow water depth and beds of mangroves growing in the large tidal area in front of the property. In summary, while the site is adjacent to a large body of salt water, it is some distance from the source of large breaking waves (i.e. ocean and surf beach) where the corrosive marine aerosol is generated, and is also partially protected from wave action in the harbour which has its influence further reduced by the prevailing wind direction blowing away from the house.
- Corrosion rates recorded by BRANZ⁹ at test sites located within 100m of the sea and surf beaches have an ISO 9223 category rating of C4, which was equivalent to NZS 3604 Zone D: High (refer Appendix A.2 for summary of environmental classifications). Although the site in question is subject to some salt spray at high tide during Easterly storms, it should receive significantly less wind-borne marine salts than other C4-rated sites, placing it in the ISO category C3 (equivalent to NZS3604 Zone C: Medium).
- Based on the broad categories in the Standards, the house site is zoned Zone D as described by NZS 3604 since it is less than 100m from the edge of a tidal estuary. However, given the BRANZ corrosivity data, and allowing for shelter from prevailing winds and the distance from any significant wave action, this would be an overly conservative classification for assessing durability of rain-washed steel roofing sites which are rated as ISO C4.

⁹ The Building Research Association of New Zealand

5.2.3 In respect of the cladding material, the engineer noted the following:

- Product data sheets supplied for the specified roofing claim that the specified material is suitable for Category D (the equivalent of ISO C4), whereas marketing information provided for the substitute roofing suggest that the substitute material is not.
- Manufacturer information indicates that both products are factory coated with 45% zinc and 55% aluminium coatings with a nominal mass of 150 g/m², followed by oven baked paint systems.
- Accelerated testing of samples of both products showed the durability related test performance of the specified and substitute materials to be very similar. It was noted, however, that the supplied test data only demonstrates that the substitute roofing is suitable for use in an ISO C3 environment. 48 months of outdoor exposure testing is required to confirm compliance with Type 4 (i.e. suitable for an ISO C4 environment).
- Both product manufacturers rely on rain washing to remove atmospheric contaminants from roofs. The manufacturer of the substitute product also requires bi-annual manual washing of high risk areas such as around flues, under television aerials and trees, and sites prone to mould, lichen, bird droppings, or debris.

5.2.4 The engineer concluded that the installed roofing material should comply with Clause B2 of the New Zealand Building Code, as qualified by the following answers to questions asked:

Question 1: Assuming normal maintenance, will the as-built roof satisfy the 15-year durability period required by NZBC Clause B2.3.1?

Yes, provided it has been installed in accordance with the recommendations of the manufacturer and the Code of Practice issued by the NZ Metal Roofing Manufacturers Inc.

Question 2: What corrosion zone is the house in, as described in NZS 3604?

Zone D, but a corrosion engineering assessment would place it in Category C3 as defined by ISO 9223 (equivalent to Zone C) where a Type 3 roofing material is suitable.

Question 3: What is the expected life of the roof?

More than 25 years, provided it has been installed and is maintained in accordance with the recommendations of the manufacturer and the Code of Practice issued by the NZ Metal Roofing Manufacturers Inc.

Question 4: Does the manufacturer's instructions adequately describe what maintenance is required and/or necessary?

Yes.

5.3 The building surveyor's report

5.3.1 The building surveyor is an independent expert who is a Registered Building Surveyor. The building surveyor was asked to provide comment on the general condition of the roof as installed and provide his opinion on the method used to cut the roof sheets onsite as referred to in paragraph 4.3.

5.3.2 The building surveyor inspected the roof on 2 October 2015 and produced a report that was completed on 22 October 2015. Copies of this report were sent to the parties on 23 October 2015.

5.3.3 The report described the house location and roof structure. In respect of the roof cladding installation the building surveyor noted the long run roofing was generally tidily installed and noted the following matters of concern:

- The roofing has been splay cut at the valley gutter flashing on the main upper roof. The roofing edges have been cut tidily and reasonably straight, consistent with being cut by a mechanical nibbler. There is minor cosmetic corrosion in a few locations on the cut edge of the roofing, one of them being on a short section of roofing where the cut edge is ragged. No significant corrosion issues were observed.
- Fasteners at the lower edge of the roof cladding are required to be installed through the crest of every second corrugation. Two significant exceptions were noted either side of the main roof valley gutter. In these areas there are a total of six locations where fixing penetrations are formed but the fasteners are missing, 11 locations where fasteners were never installed, and one location where there is a loose fastener. There was also an area on the lower garage roof where five fasteners were installed at every third corrugation at the lower edge of the cladding.
- Overdriven fasteners were noted in various locations, resulting in split sealing washers. This was typical in approximately 10-15% of roof fasteners spread over both levels of roofing on the house and garage. No deformation of corrugation crests was observed. An under-driven fastener was noted in one location.

5.3.4 The building surveyor also observed:

- swarf left on the roof which has caused minor cosmetic corrosion adjacent to penetrations in a few locations
- minor corrosion on the barge flashing soft edges, probably due to swarf being left on the roof
- vegetation on the garage roof and growing in the gutter.

5.3.5 The building surveyor summarised the above as follows:

- The roofing is generally well installed with Class 4 fasteners, with the exception of missing fasteners in two significant locations.
- Minor issues such as overdriven fasteners, missing fasteners, minor cosmetic corrosion and ponding were evident.
- Vegetation on the garage roof and growing in the gutter should be removed.

6. Discussion

6.1 The durability required by Clause B2

6.1.1 The objective of Clause B2 of the Building Code is that a building continues to satisfy all the objectives of the Building Code throughout its effective life, and that includes the requirement under Clause B2.3.1 for the roof cladding to meet the performance requirements of the Building Code for a period of 15 years from the date a code compliance certificate is issued.

6.2 Corrosion zone and the durability of the substitute roofing material

6.2.1 Coastal areas within 100m from tidal estuaries and sheltered inlets are defined in NZS3604:2011 as being in the Zone D: High exposure zone. The site is located less than 100m from the edge of a tidal estuary, placing it in Zone D. This corresponds to the ISO 9223 category rating C4.

6.2.2 However, I accept the engineer's opinion that although the house is less than 100m from a tidal estuary, there are significant mitigating factors as follows:

- The estuary is shallow and wave action is reduced. The site is sheltered from significant wave action by a sandbank or low island approximately 2 km away
- The prevailing wind blows away from the house.
- The house will receive significantly less wind-borne marine salts than other C4 sites. An ISO C4 classification for this location is conservative.
- The accelerated testing for the specified and substitute materials were very similar, and according to product data sheets, the specified material was suitable for ISO C4 exposure.

6.2.3 Given the shelter from prevailing winds and the distance from significant wave action, I consider that category C4 is overly conservative in respect to the likelihood and frequency of salt-laden aerosols to this property. I am of the view that Category C3 (equivalent to NZS 3604 Zone C) is appropriate for this location.

6.2.4 The test performance of the specified roofing samples indicates suitability for use in an ISO C3 (Zone C) environment. I therefore conclude that the substitute roofing material complies with Clause B2.3.1.

6.3 Defects observed on site

6.3.1 While outside the matter being determined I note that the building surveyor observed some issues relating to installation that may affect the compliance of the roof cladding with Clause E2.3.2. I urge the parties to address the following:

- missing roof fasteners
- overdriven roof fasteners where the neoprene seal to the fastener has deformed or split.

6.3.2 In addition, 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 building surveyor observed the following items which should be addressed as a matter of maintenance:

- removal of minor cosmetic corrosion
- removal of vegetation from roof and gutters.

6.3.3 In addition I note that with the roof being close to the minimum pitch for this roofing material, and the reliance on rain wash-down to remove atmospheric contaminants, there is a greater importance placed on manual washing, particularly of high risk areas, and this should be carried out as part of the normal maintenance for this roof.

6.3.4 I am of the view that the cosmetic corrosion caused by swarf left on the roof is a minor aesthetic issue only. Good roofing practice is to remove swarf every day to eliminate the risk of damage to the coating if it gets trodden on.

7. The decision

- 7.1 In accordance with section 188 of the Building Act 2004, I determine that, if maintained in accordance with the manufacturer's maintenance requirements, the substitute roofing material will satisfy the 15-year minimum durability period described in the New Zealand Building Code Clause B2.3.1(b).

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 15 February 2016.

John Gardiner
Manager Determinations and Assurance

Appendix A: The relevant legislation

A.1 The relevant provisions of the Building Code include:

B2 Durability

B2.3.1 Building elements must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the specified intended life of the building, if stated, or:

- (a) The life of the building, being not less than 50 years, if:
 - (i) Those building elements (including floors, walls, and fixings) provide structural stability to the building, or
 - (ii) Those building elements are difficult to access or replace, or
 - (iii) Failure of those building elements to comply with the building code would go undetected during both normal use and maintenance of the building.
- (b) 15 years if:
 - (i) Those building elements (including the building envelope, exposed plumbing in the subfloor space, and in-built chimneys and flues) are moderately difficult to access or replace, or
 - (ii) Failure of those building elements to comply with the building code would go undetected during normal use of the building, but would be easily detected during normal maintenance.
- (c) 5 years if:
 - (i) The building elements (including services, linings, renewable protective coatings, and fixtures) are easy to access and replace, and
 - (ii) Failure of those building elements to comply with the building code would be easily detected during normal use of the building.

A.2 Summary of environmental classifications¹⁰

Table 1
SUMMARY OF ENVIRONMENTAL CLASSIFICATIONS

CORROSION RISK	NZS 3604:2011	E2/AS1	AS/NZS 2312:2002	ISO 9223 CATEGORY	AS/NZS 2728:2013 PRODUCT TYPE
Very low	–	–	A	C1	1
Low	B	B	B	C2	2
Medium	C	C	C	C3	3
High	D	D	D	C4	4
Very high/Industrial	–	E	E-I	C-5I	5
Very high/marine/geothermal	–	E	E-M	C-5M	6
Inland tropical –	–	–	F	–	–

¹⁰ Pringle, Trevor. "Coast guard for metal components." *Build 136*. 1 June 2013. Web. 24 Nov. 2015.