

Determination 2014/008

Regarding the compliance of a wire balustrade to a house deck at 12B Broadview Road, Opuia



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
- Alan Simpkin, the architectural designer, who is a licensed building practitioner under the Building Act and who is the applicant in this case (“the designer”)
 - Far North District Council (“the authority”), carrying out its duties and functions as a territorial authority or a building consent authority
- 1.3 This determination arises from the view of the authority that insufficient information was provided in a building consent application to establish compliance with certain clauses² of the Building Code (Schedule 1 of the Building Regulations 1992).
- 1.4 The matter to be determined³ therefore is whether the proposed deck barrier (“the proposed barrier”) complies with Clauses F4 – Safety from falling, B1 – Structure, and B2 – Durability.

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

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

³ Under sections 177(1)(a) of the Act

1.5 In making my decision, I have considered the submissions of the parties, the report of an independent expert commissioned by the Ministry to advise on this dispute (“the expert”), and the other evidence in this matter.

1.6 The relevant clauses of the Building Code are set out in Appendix A.

2. The background and the proposed barrier

2.1 The designer submitted a set of documents to the authority for building consent for a new house. The proposed house is part single-storey and party two-storey, set into a sloping site in a very high wind zone and high corrosion zone for the purposes of NZS3604⁴. The open decks include a large deck running the full length of the north elevation and wrapping around part of the west elevation, and two smaller decks on the east and west elevations: all decks use the same proposed barrier.

2.2 The authority did not grant consent and in a request for further information stated:

Barrier Detail is not acceptable, (Apart from no PS1 or calculations) the information provided concludes that the barrier does not comply with F4 of the New Zealand Building Code, so please redesign this barrier and show any new barrier to be face fixed and not through the membrane.

2.3 The designer maintained the view that the proposed barrier complies with the Building Code and made an application for a determination on the matter. The application was received by the Ministry on 26 September 2013.

2.4 In a covering letter to the application, the designer noted his view that issues of non-compliance raised in a previous determination⁵ (that also considered compliance of a proposed wire barrier) had been addressed in the design.

2.5 The designer provided copies of:

- a producer statement PS1 – Design, dated 10 September 2013, for compliance with B1/VM1 and B2/AS2 for the barrier to the decks, dated 10 September 2013 and signed by a chartered professional engineer (“the engineer”)
- a covering letter to the producer statement noting that the posts to the deck barrier are to be hot dip galvanised not quenched and coated with a two pot epoxy, and that the horizontal wires are to be stainless steel ‘and tensioned so that a load of 20N produces less than 4 mm of deflection’
- the engineer’s calculations dated 9 September 2013 and detail drawing dated 18 September 2013.

2.6 I sought further information from both parties by email on 28 October 2013 including clarification of some details in the plans.

2.7 The authority initially responded on 30 October 2013, noting that the reason for ‘refusal’ of the barrier was stated in the request to the designer for further information.

⁴ New Zealand Standard NZS3604:2011 Timber framed buildings

⁵ Determination 2011/019: Compliance of a proposed safety barrier to a house deck at Rawhiti Road, Little Taupiri Bay

2.8 In a further email to the Ministry on 31 October 2013, the authority stated that it was unable to approve the wire balustrade detail as:

1. The [designer] has not provided supporting calculations (PS1) for this design required to demonstrate tensioning adequacy, for example what tension is required to assure that the gaps are not opened beyond 100mm and with this tension are the corner posts able to cope with the forces imposed.
2. [Determination 2011/019] correctly identified that a force of 20 Newtons is the equivalent of a 2kg mass, a five year olds average weight is 15kg therefore the calculations must reflect this potential mass for the wire deflection
3. Durability – B2. Running stainless steel cable through a galvanised post has compatibility implications that should be addressed.

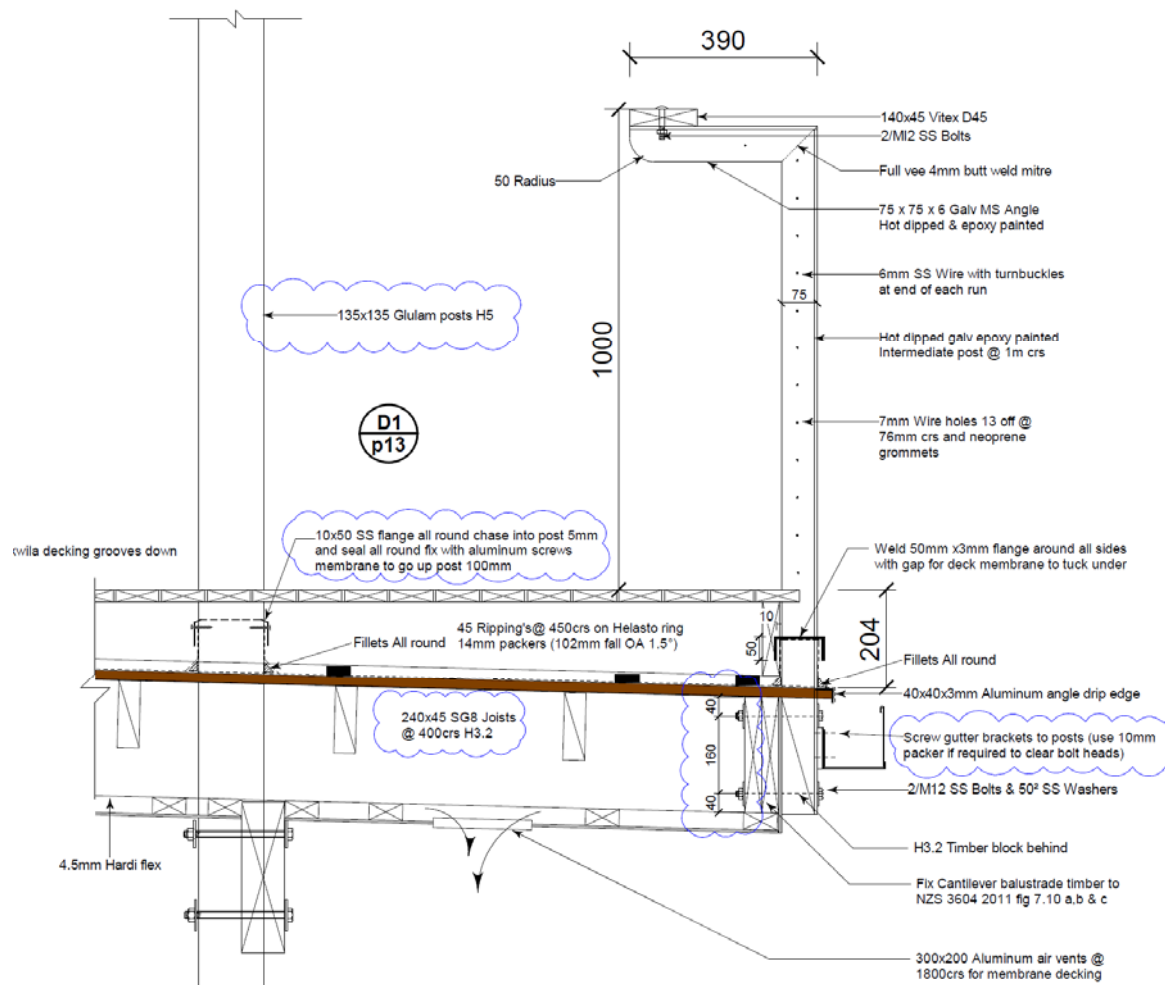


Figure 1: Cross section through the proposed barrier as amended

2.9 The authority also stated that it considered the following aspects in assessing compliance with Clause F4 as an alternative solution:

1. Height of the barrier – (F4.3.4(b)) – Deemed to comply
2. The ability of the barrier to restrict the passage of children under the age of 6 years (F4.3.4(g)) – Not demonstrated in application
3. The rigidity and strength of the barrier (F4.3.4(c), (d) & (e)) – Not demonstrated in application

4. Table 1, B2/AS1 requires the barrier to achieve a 50 year durability – PS1 required to adequately address NZBC – F4, B1 & B2

2.10 In an email on 4 November 2013, the designer responded to the Ministry’s request with a set of revised deck barrier details, along with floor plans, elevations and perspective views of the proposed house. The revised plans show the balustrade to the deck to consist of 75x75x6mm galvanised and epoxy coated steel angle posts fixed at 1m centres at the perimeter, with horizontal stainless steel wires at 76mm centres. There is a 390mm wide inward return. A cross section through the proposed barrier is shown in Figure 1 above.

3. The expert’s report

3.1 General

3.1.1 As described in paragraph 1.5, I engaged the services of an expert, who is a registered architect, to assist me. The expert undertook a review of the building consent application documents and produced a report completed on 11 December 2013. Copies of the report were forwarded to the parties on the same day.

3.2 Clauses F4 and B1

3.2.1 The expert sought an opinion from a structural engineer (“the engineering adviser”) on the adequacy of the calculations provided with the application for consent. The engineering adviser considered that further information was required to demonstrate compliance, noting that:

- the moments in the balusters due to the barrier loads are calculated but the baluster itself is not checked
- the wire tension loads to the end balusters and top rail are based on 11 strands, whereas the drawings specify 13
- the moments in the end balusters due to tensioning loads are calculated but the baluster itself is not checked including any torsion due to the eccentricity between the tension loads in the strands and the compression load in the top rail
- clarification is required of the span used to calculate the moment in the balusters due to the tensioning load; 1.3m used for barrier loads, 1.0m for tensioning loads
- the connection of the top rail to the end balusters is not checked; the detail calls up 2xM12 bolts but shows only one
- the bolt spacing for the baluster fixings is not specified
- the plan view requires clarification; the balusters are indicated as 75x75x6 steel angles but the plan view appears to indicate a T-section with staggered bolts.

3.2.2 The expert noted that the Ministry’s guidance is not mandatory and another means of demonstrating compliance could be used.

3.2.3 The expert noted that the ‘cone test’ as described in the Ministry’s guide on barrier design⁶ could be used after the barrier had been erected to verify the adequacy of the barrier in terms of the wire deflection.

3.3 Clause B2

3.3.1 The expert noted the requirements of Clause B2 were durability periods of 50 years for the balustrade posts and 15 years for balusters. The expert considered that the wires, as balusters, can be expected to exceed the 15 year period provided they are grade 304, or 316 if no surface rusting is acceptable.

3.3.2 In respect of the balustrade posts, the expert noted that the posts are exposed, visible, and not difficult to access. The expert noted that the epoxy coating would reach the end of its service life sometime after 15 years but before 50 years and that the galvanising would protect the balustrade for a further period. The expert was of the view that if the steel was exposed it would very soon rust, and that the rust stains would be visible and attended to as normal maintenance.

3.3.3 The expert noted that the design includes separation between the wires and the posts by way of neoprene grommets and the epoxy coating applied to the posts and therefore little risk of galvanic corrosion from direct contact.

3.3.4 The expert observed that H3.2 treated blocks are shown between the posts and the supporting structure, and that the CCA treatment of the blocks would lead to erosion of galvanising if they were in contact, though the epoxy coating should prevent this. The expert considered better separation could be provided.

3.4 Clause E2

3.4.1 In regards to possible leaks from penetrations through the deck membranes, the expert noted that there were mitigating factors that allowed for compliance with Clause E2 to be achieved, these included:

- there is no accommodation under the decks
- there are 50mm deep flanges to protect the top edge of the membrane at the penetrations
- the deck framing is treated to H3.2 and connected with stainless steel bolts; this type of construction can be used for open slat decks which are exposed to rainfall.

4. The draft and submissions

4.1 A draft determination was issued to the parties for comment on 10 January 2014.

4.2 The authority accepted the draft without further comment in a response received on 27 January 2014.

4.3 The designer responded by email on 5 February 2014, noting that the rail design had been revisited and attaching a revised handrail design in response to the determination. The designer provided the revised design and a PS1 dated 4 February 2014, and also noted that the posts are not in contact with CCA treated timber as there is 6mm fibre-cement sheet in between (refer paragraph 3.3.4).

⁶ Guidance on Barrier Design (March 2012) Department of Building and Housing

- 4.4 On 5 February 2014 I provided the revised handrail design to the engineering advisor for his review. The engineering advisor responded by email on 13 February 2014, stating that he was satisfied that the revised documents addressed the compliance issues with regard to Clause B1. However, the advisor also commented that there was a ‘minor practical issue’ that remained:

The tension required in the wires is not specified on the drawings and even if it was how does the builder measure that unless the turnbuckles on the wires are load calibrated (and you can buy them but they are very expensive). It seems to me that the only way of checking if the tension in the wires is sufficient to satisfy the 100mm requirement is an on site check after construction with the test following the procedure outlined in Appendix C NZS 8500:2006⁷.

5. Discussion

5.1 General

- 5.1.1 The following considers the compliance of the barrier in terms of:

- (a) respecting the passage of children under six (Clause F4)
- (b) the strength of the barrier (compliance with Clause B1)
- (c) the barrier’s durability (Clause B2)
- (d) the barrier’s fixing details with respect to Clause E2.

5.2 Clause F4 Safety from falling: restricting the passage of children under 6 years of age

- 5.2.1 Clause F4.3.4(g) requires that barriers must restrict the passage of children under 6 years of age in areas likely to be frequented by them. As the building in question is a house, the assumption as stated in F4/AS1 is that young children are likely to frequent it.
- 5.2.2 The barrier elements include the horizontal wires spaced 76mm apart, and the 390mm inward return at the top of the barrier. Determination 2011/019⁸ considered the compliance of an almost identical barrier and came to the view that the inward return was a satisfactory compensating feature for the toe-holds provided by the horizontal wires. I consider that finding also applies to the present case.
- 5.2.3 Paragraph 1.2.1 b) of F4/AS1 says that ‘Openings anywhere over the full height of the barrier shall be of such a size that a 100mm diameter sphere cannot pass through them’.
- 5.2.4 I consider the only outstanding matter relating to the compliance of the barrier with Clause F4 arises from possible deflection of the horizon wires: the spacing at the midpoint of any given span under a given pressure, must be no greater than 100mm in order to adequately restrict the passage of children under the age of six.
- 5.2.5 The covering letter to the producer statement PS1 Design dated 10 September 2013 stated that the wires are to be ‘tensioned so that a load of 20N produces less than 4mm of deflection’. The engineering adviser’s initial comments, based on the documents provided to the authority, led me to conclude that it was unclear whether the barrier as a whole was sufficiently strong to withstand the required tension on the

⁷ New Zealand Standard 8500:2006, *Safety Barriers and Fences Around Swimming Pools, Spas and Hot Tubs*

⁸ Determination 2011/019 : Compliance of a proposed safety barrier to a house deck

wires. However, I accept the adviser's opinion in respect of the revised design (refer paragraph 4.4).

- 5.2.6 I therefore conclude that the compliance of the revised barrier with Clause F4.3.4(g) can be verified using the test method described in the Ministry's guidance document (refer paragraph 3.2.3).

5.3 Compliance with Clause B1 Structure

- 5.3.1 The proposed barrier is constructed from tensioned wires strung between regularly spaced balustrade posts. As such, the overall rigidity and strength of the barrier will depend upon the balustrade posts being strong enough to enable the wires to be adequately tensioned.
- 5.3.2 A producer statement (PS1), calculations, and design details were provided with the application for determination for the balustrade posts that stated the balustrade complies with B1/VM1.
- 5.3.3 In reviewing the application documentation the engineering adviser noted a number of deficiencies in the calculations provided. The adviser noted that the tensioning of the wires, and the ability of the balustrade posts to support the tensioned wires, and the discrepancies between the engineering details and the plans would need to be resolved before the proposed barrier can be said to comply with Clause B1 (and also Clauses F4.3.4(c) and (d)) of the Building Code.
- 5.3.4 The designer has subsequently provided a revised design and a new PS1, dated 4 February 2014, which has been reviewed. I accept the opinion of the engineering adviser and conclude that the revised design complies with Clause B1 of the Building Code.

5.4 Compliance with Clause B2 Durability

- 5.4.1 The authority raised two concerns regarding durability; the compatibility of the stainless steel wires running through galvanised posts, and penetrations through the deck membrane.
- 5.4.2 I note that the drawings dated 18 September 2013 show neoprene grommets to be used and I concur with the expert's view that with the grommets and epoxy coating to the posts there is little risk of galvanic corrosion from direct metal-to-metal contact. I also consider that deterioration of the materials will be visible and can be attended to as part of normal maintenance of the barrier.
- 5.4.3 In respect of possible erosion of galvanising due to the CCA treatment of the block between the posts and the supporting structure; I accept that separation by way of the fibre-cement sheet is adequate. I am of the view therefore that this element will comply with Clause B2 of the Building Code.

5.5 Compliance with Clause E2 External moisture

- 5.5.1 In respect of water ingress via penetrations through the deck membrane; I concur with the expert's view in respect of the mitigating features and consider that the proposed barrier complies with Clause E2.

5.6 Conclusion

- 5.6.1 For the reasons set out above, I consider that the proposed barrier, as detailed in the revised design complies with Clauses B1, B2, and F4.3.4(c) and (d) of the Building Code. I also consider that compliance with Clause F4.3.4(g) can be verified using the test method described in the Ministry's guidance document.

6. The Decision

- 6.1 In accordance with section 188 of the Building Act 2004 I hereby determine that the revised design of the proposed barrier complies with Clauses B1, B2, F4.3.4(c) and F4.3.4(d). I also determine that compliance with Clause F4.3.4(g) can be verified using the test method described in the Ministry's guidance document.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 14 February 2014.

John Gardiner
Manager Determinations and Assurance

Appendix A

A.1 The relevant Clauses of the Building Regulations 1992 are:

CLAUSE B1 — STRUCTURE

B1.3.1 Buildings, building elements and sitework shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during construction or alteration and throughout their lives

B1.3.3 Account shall be taken of all physical conditions likely to affect the stability of buildings, building elements and sitework, including:

(a) self-weight,

...

(j) impact,

...

B1.3.4 Due allowance shall be made for:

(a) the consequences of failure,

(b) the intended use of the building,

...

(d) variation in the properties of materials and the characteristics of the site, and

...

CLAUSE 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.

B2.3.2 Individual building elements which are components of a building system and are difficult to access or replace must either:

(a) all have the same durability, or

- (b) be installed in a manner that permits the replacement of building elements of lesser durability without removing building elements that have greater durability and are not specifically designed for removal and replacement.

CLAUSE F4 – Safety from falling

F4.3.4 Barriers shall:

...

- (c) Be constructed with adequate rigidity,
- (d) Be of adequate strength to withstand the foreseeable impact of people and, where appropriate, the static pressure of people pressing against them.
- (f) ...
- (g) Restrict the passage of children under 6 years of age when provided to guard a change of level in areas likely to be frequented by them.