



Determination 2018/053

Regarding the compliance of an aluminium and glass barrier with Building Code Clause F4 Safety from falling at 19 Spray Crescent, Leigh



Summary

This determination considers the performance of a proprietary aluminium barrier installed on a timber-framed veranda in an existing house. The determination considers the performance of the barrier in respect of its strength, and the authority's decision to refuse to issue a code compliance certificate in respect of the work.

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, Katie Gordon, Manager Determinations, Ministry of Business, Innovation and Employment (“the Ministry”), for and on behalf of the Chief Executive of the Ministry.
- 1.2 The parties to this determination are:
 - J van Campfort, the owner of the property (“the applicant”)
 - Auckland City Council, carrying out its duties as a territorial authority or building consent authority (“the authority”).
- 1.3 The determination concerns an aluminium and glass barrier that was installed along the edge of the applicant's veranda in place of the original wooden balustrade. The authority does not consider that the new barrier complies with the Building Code. The applicant is of the opinion that while the barrier may not be “100% compliant” it is otherwise “safe and sound”.

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.

- 1.4 I consider the matter to be determined² is whether the as-built barrier complies with Clause F4 Safety from falling³ of the Building Code. There is no dispute that the barrier meets Clause F4 other than with respect to its ability to withstand the impact of people as required by Clause F4.3.4(d).
- 1.5 In making my decision I have considered the parties' submissions, the report of the expert commissioned by the Ministry, who is a chartered professional engineer with specialist expertise in civil/structural engineering ("the expert"), and the other evidence in this matter.

2. The building work and background

- 2.1 The applicant's house is located in the coastal community of Leigh, about an hour's drive north of Auckland. The house was built in 1958 and is on two levels. The lower level includes basement garaging, while the upper level includes living and sleeping areas and opens onto a large veranda with timber decking.
- 2.2 In 2011 the applicant had the veranda's original timber balustrade replaced with a proprietary aluminium and glass barrier. This comprises a powder-coated aluminium frame with a balustrade of glass panels along the front of the house, and a balustrade of vertical aluminium bars along the side of the house. The expert noted on his site visit that the barrier was situated about two metres above established gardens.
- 2.3 A continuous aluminium top rail spans between the 100x100mm posts to the veranda. This rail is fixed to the veranda posts at each end via a socket-type bracket with countersunk stainless-steel screws.
- 2.4 50x50mm aluminium baluster posts are evenly spaced between the veranda posts at approximately 900mm centres. The baluster posts are fixed via a baseplate to the timber deck framing with 8x170mm stainless-steel coach screws.
- 2.5 The deck framing comprises 100x50mm joists at 450mm centres. The outside edge of the deck has a 100x50mm trimmer, solid blocking between each joist, with 100x50mm timber plates above and below to receive the 170mm long coach screws.
- 2.6 As noted in paragraph 2.3, the top rail of the balustrade spans between the veranda posts, and the three longest spans are the subject of this determination. For the shorter spans, there is no dispute that the top rail of the balustrade is adequate to span between the veranda posts.
- 2.7 The three longest spans are described below as measured on site by the expert.

Section adjoining:	Section length	Number of glass panels	Number of aluminium baluster posts
Bedroom	4.43m	5	4 at 886mm centres
Bay window	3.57m	5	3 at 892mm centres
Living room	3.56m	4	3 at 890mm centres

- 2.8 In late 2017 the applicant engaged a civil and structural engineering firm ("the engineer") to assess the barrier. Its report dated 15 December 2017 ("the engineer's report") said:

² Under section 177(1)(a) of the Act

³ References to clauses in this determination are to clauses of the Building Code and to sections are to sections of the Building Act, unless otherwise specified.

It is not practicable to transfer the bending moments out of the base of the balusters (posts) of the barrier from falling back into the “shallow” 90mm deep joists (ex. 100x50). Hence, the top rail of the barrier needs to span from veranda post to veranda post.

- 2.9 The engineer’s report concluded that the top rail was “possibly a bit under-sized” to span the three longest sections of the barrier. The report recommended “back-analysis’ to assess the spanning capabilities of the aluminium rails relative to the loadings in the superseded loadings standard, NZS 4203⁴, which it said the original wooden rails should have complied with, and then strengthening the rails if required.
- 2.10 The applicant sent this report to the authority, which responded on 30 January 2018 noting the shortcoming in the barrier, and advising that “it is ... incumbent on [the engineer] to provide calculations to support this or to suggest any remediation necessary”.
- 2.11 On 1 February 2018 the applicant sent the engineer further information about the top rail’s dimensions and asked him to go ahead with the calculations.
- 2.12 On 29 May 2018 the engineer replied that there was some uncertainty about the aluminium alloy used in the top rail and its strength, and asked if the applicant could verify these details. The engineer said that even if the aluminium was high strength the longer spans still appeared to be under-strength and recommended looking at options for strengthening the barrier.
- 2.13 The applicant held further discussions with the engineer but was not satisfied with the response. He applied to the Ministry for a determination which was received on 2 July 2018.

3. Submissions, the draft determination

3.1 The initial submissions

- 3.1.1 The applicant included the following with his application:
- the engineer’s report and its appendices: a PS1 (Producer Statement – Design) for the barrier installation signed 7 May 2009 by a consulting engineer; a PS3 (Producer Statement – Construction) dated 11 August 2011 from the installation company; and the company’s quotation for the installation dated 22 June 2011
 - correspondence with the authority on 30 January 2018 and with the engineer 30 January - 29 May 2018.
- 3.1.2 The applicant said the engineer’s report considered that the aluminium top rail of the barrier was not strong enough to span the space between some of the timber veranda posts.
- 3.1.3 On 9 July 2018 I asked the applicant if he accepted the engineer’s advice and, if not, to provide any other information to support the position the rail and/or the barrier was compliant.
- 3.1.4 The applicant responded the next day that, following his conversations with the engineer and after receiving the latest calculations (refer paragraph 2.12), he was not confident the engineer knew how to strengthen the top rail or was able to provide a practical solution to strengthen it.

⁴ New Zealand Standard 4203: Code of practice for general structural design and design loadings for buildings. This was published in 1976 and updated in 1984 and 1992 before being superseded by AS/NZS 1170:2002: Structural design actions.

- 3.1.5 The authority emailed on 17 August 2018 and said its position on the information available was that it did not accept the barrier as compliant with Clause F4.3.4(d). It supplied a copy of the engineer's report that was also sent by the applicant.

3.2 The draft determination and responses received

- 3.2.1 The draft determination was issued to the parties for comment on 9 October 2018.
- 3.2.2 The applicant responded on 19 October 2018. The applicant did not accept the draft but noted that remedial work suggested by the expert would be undertaken after which the code compliance certificate would be sought.
- 3.2.3 The authority accepted the draft determination without comment on 23 October 2018.

4. The expert's report

- 4.1 On 31 July 2018 I engaged the expert described in paragraph 1.5 to assess the barrier with regard to its code compliance. I gave him copies of the information provided by parties.
- 4.2 The expert visited the property on 7 August 2018 and provided his final report on 27 September 2018 which was sent to the parties for comment on the same day. Before completing his report the expert obtained additional technical information from the barrier suppliers.
- 4.3 In the expert's view the barrier would comply with Clause B1 and Clause F4 with the addition of some deeper joists near each baluster post on the three longest sections. His report concluded:

Our on-site testing showed that in "practical terms" the existing balustrade does work. However, with respect to clause B1 of the [Building Code], and more specifically clause F4.3.4(d), to demonstrate compliance of the existing balustrade components it is necessary to install additional new 140x45 joists to the existing joists adjacent to the baluster posts as we have outlined... and detailed in [diagrams appended to the report]. It is our recommendation that the new joist upgrade is applied to all three larger sections of balustrade.

We are satisfied that the balustrade itself, including its fixings, complies with clause B1 of the NZBC but that the deck structure requires minor remedial works to ensure that balustrade loadings can be transferred satisfactorily.

- 4.4 The expert's observations from his site visit included that the existing veranda posts appeared securely fixed, the barrier was in very good condition, and the top rails were very firmly fixed. The expert measured the horizontal deflection of the top rail at mid-span of the longest (4.43 m) section using a string line and under a maximum sustained horizontal load of approximately 1kN could only achieve an absolute maximum deflection of 10 mm, which he said was acceptable for a handrail.
- 4.5 The expert said he had obtained section properties and material grades (for both the baluster posts and the top rail sections) from the barrier suppliers. He said it appeared the applicant's engineer did not have these details so had used more conservative values when analysing/checking the barrier.

4.6 The expert added:

- He had reviewed each aluminium baluster post and found that the posts themselves easily satisfied the barrier's loading requirements.
- He had reviewed the baluster baseplate connection with the existing deck framing/joists, and had proven by calculation that the existing connection would satisfy the bending moment requirement if a new 140x45mm joist was fixed alongside the two 100x50mm joists closest to each baluster post location. He also provided details of how these should be installed.
- He had reviewed the aluminium top rail and found that all except the 4.43m span satisfied the loading requirements, and that span only marginally failed. Therefore, he said the 4.43m span was to be considered acting in conjunction with the baluster posts, with the remedial details (additional joists) as described.

4.7 Discussions Ministry staff held with the expert confirmed that while the barrier top rail could span all but the largest opening between the veranda posts, it could not be confirmed that the posts themselves, as well as the rail's fixings to the posts, would be adequate to take the load from the rail. For this reason, the remedial work described above was to be applied to the three longest spans, and not only the longest span.

5. Discussion

5.1 Clause F4 Safety from falling requires the presence of barriers where people could fall one metre or more from an opening in the external envelope or floor of a building⁵. There is no dispute that the barrier meets Clause F4 other than its with respect to its ability to withstand the impact of people as required by Clause F4.3.4(d). In addition, the only spans that are in dispute are the three longest spans (being 3.56, 3.57, and 4.43m long).

5.2 Clause F4.3.4(d) says that barriers shall:

be of adequate strength to withstand the foreseeable impact of people and, where appropriate, the static pressure of people pressing against them,

5.3 It is apparent that the barrier as-built is reliant on a combination of the top rail being sufficiently stiff to span between the original veranda posts, and the aluminium baluster posts being able to resist the bending moments imposed on them.

5.4 However, the proprietary barrier has been designed as a cantilevered barrier being reliant on the performance of the aluminium baluster posts able to resist any force applied horizontally. This is reliant on connection of the posts on the timber deck and the stiffness of the deck itself. The top rail plays a subservient role in the structural performance of the barrier. The performance of the top rail is itself reliant on its stiffness, and equally importantly, on the critical connection of either end of the rail to the veranda posts.

5.5 The expert has found that the barrier is not adequate to span the three longest spans and I accept this position. I therefore do not consider the three longest spans to the barrier satisfy Clause F4.3.4(d).

⁵ Clause F4.3.1

- 5.6 As described in paragraph 4.6, 2nd bullet point; the expert concluded that the three largest spans could be made code-compliant with some remedial work to the deck framing. In other words, this remedial work would ensure that the baluster posts would contribute to the barrier's performance with respect to Clause F4.3.4(d) as intended. I make no decision in respect of the remedial work suggested by the expert and leave this to the parties to action if they wish.

6. The decision

- 6.1 In accordance with section 188 of the Building Act 2004 I hereby determine that the as-built barrier does not comply with Building Code Clause F4 Safety from falling.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 2 November 2018.

Katie Gordon
Manager Determinations