



## Determination 2011/019

# Compliance of a proposed safety barrier to a house deck at Rawhiti Road, Little Taupiri Bay

## 1. The matters to be determined

1.1 This is a Determination under Part 3 Subpart 1 of the Building Act 2004<sup>1</sup> (“the Act”) made under due authorisation by me, John Gardiner, Manager Determinations, Department of Building and Housing (“the Department”), for and on behalf of the Chief Executive of that Department.

1.2 The parties to this determination are:

- the owners of the property, Mr B and Mrs A Garnett (“the applicants”) acting through an architectural designer as their agent (“the designer”)
- the Far North District Council (“the authority”) carrying out its duties and functions as a territorial authority and a building consent authority.

1.3 The matter to be determined<sup>2</sup> is whether the proposed deck barrier (“the proposed barrier”) complies with Clause<sup>3</sup> F4 Safety from Falling of the Building Code (Schedule 1 of the Building Regulations 1992).

1.4 In making my decision, I have considered the submissions of the parties and the other evidence in this matter. I have not considered any other aspects of the Act or of the Building Code.

## 2. The proposed building work

2.1 The applicants propose to build a house for which a building consent has been issued. The property is sloping and the house is to be set into the hill. The house will be two-storeys with a deck on the upper floor. The deck runs the length of the front (eastern side) of the house and is approximately 2.8m above ground. The

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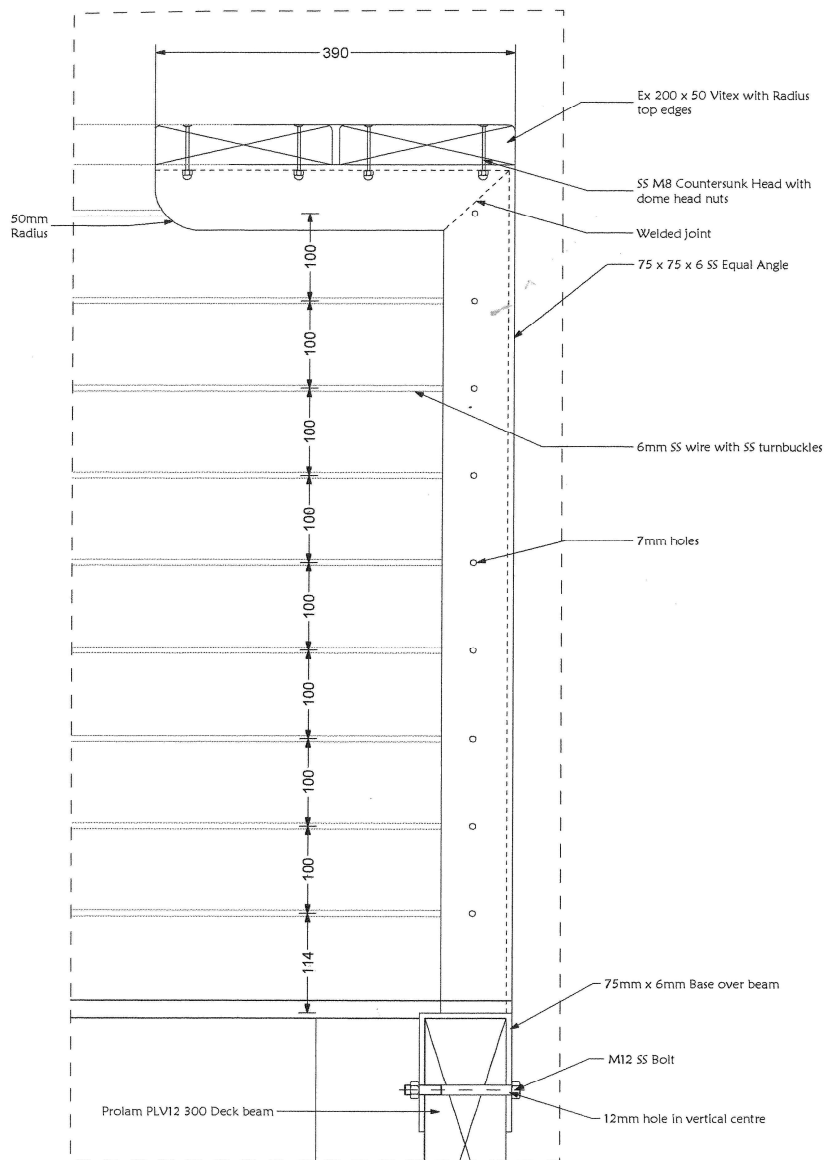
<sup>1</sup> The Building Act 2004, Building Code, compliance documents, past determinations and guidance documents issued by the Department are all available at [www.dbh.govt.nz](http://www.dbh.govt.nz) or by contacting the Department on 0800 242 243

<sup>2</sup> In terms of section 177(1)(a) of the Building Act 2004.

<sup>3</sup> 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.

consented plans show the balustrade to the deck to be made of toughened glass panels, although I have not seen a copy of the approved consent plans.

2.2 The applicants have sought an amendment to the consent to use a wire barrier and balustrade in place of the glass panels, with a timber return to the top of the barrier. The proposed barrier comprises stainless steel balusters set at about 1.2 metre centres along the edge of the deck. Tensioned 6mm stainless steel wires at 76mm centres will run horizontally between the balusters. An inward return to the balusters has 2x50mm x 200mm timber fixed to it forming a top 390mm wide. A cross section through the proposed barrier is shown in Figure 1. The barrier is approximately 1000mm high.



**Figure 1: cross section through the barrier (note the wires are shown at 100mm centres, not at 76mm as proposed)**

### 3. The submissions

3.1 The applicants applied for a determination on 15 November 2010, requesting a determination as to 'Whether the handrail as detailed complies with F4 of the NZ Building Code'. The application included a submission from the designer setting out why the proposed barrier is 'an alternative method of complying with clause F4.3.4(g) of the New Zealand Building Code'. The submission also stated that the design complies with paragraph 1.2.1(b) of Acceptable Solution F4/AS1:

With the balustrade as designed, both these requirements will be achieved by:

1. The overhanging top rail on the inside of the posts will restrict the ability of children under six to climb over the top
2. The closely spaced tensioned wires will restrict the ability of children under six to climb out between the wires.

The design is based on the maximum gap of 100mm will not be reached until a force of 20 Newtons up and 20 Newtons down on the adjacent wires is exerted by a child attempting to climb through. This gap will only be reached at one point and the gap will reduce to 76mm at the posts.

3.2 The application also included:

- a producer statement PS1, issued by a company of structural engineers, for the 'baluster posts for the deck'. The statement states that the posts comply with Verification Method B1/VM1 for structure subject to certain conditions.
- copies of the plans for the proposed new deck barrier.

3.3 The authority acknowledged the application but advised it did not wish to make a submission.

3.4 The draft determination was sent to the parties for comment on 14 February 2011. Both parties accepted the draft without comment.

## 4. Discussion

### 4.1 Generally

4.1.2 The proposed barrier has horizontal wires, spaced 76mm apart, which run between the balustrade posts along its length. This is a proposed alternative solution to the 'acceptable barrier constructions' shown in the Acceptable Solution F4/AS1. As such, the proposed barrier must be considered as a proposed alternative solution, and assessed for compliance against the performance requirements in Clause F4. In evaluating the design, a proposed alternative solution can be compared against the solutions given by F4/AS1.

4.1.3 In my opinion, the aspects of the proposed barrier that need to be considered in order to assess compliance with Clause F4 are:

- (a) the height of the barrier (F4.3.4(b))
- (b) the ability of the barrier to restrict the passage of children aged under 6 years (F4.3.4(g))

(c) and the rigidity and strength of the barrier (F4.3.4(c), (d) & (e)).

I note that I must also consider the platform formed by the 390mm wide inward return.

## **4.2 The height of the barrier**

4.2.1 Although I have not been provided with exact measurements for the finished height of the proposed barrier, it appears from the plans that it will be 1000mm. Paragraph 1.1 of F4/AS1 gives minimum heights for barriers; for balconies and decks to dwellings this height is 1000mm. Accordingly, it appears that the finished height of the proposed barrier complies with Clause F4.3.4(b).

## **4.3 The ability of the proposed barrier to restrict the passage of children under 6 years of age**

4.3.1 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 them. As the building in question is a house, the assumption as stated in F4/AS1 is that children, including young children, are likely to frequent it.

4.3.2 Paragraph 1.2.1 of F4/AS1 sets out the requirements for barriers in houses and other areas likely to be frequented by children, including the acceptable barrier constructions that will achieve this. It also specifies 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'.

4.3.3 As I have stated earlier, although the applicant's proposed design is not being assessed for compliance against the acceptable solution, it should achieve at least the equivalent degree of protection for children. In my opinion, there are two aspects of the proposed design that require comparison with the requirements of Paragraph 1.2.1 of F4/AS1 to assess whether they afford protection; the horizontal wires and the toeholds afforded by the wires.

### **The horizontal wires**

4.3.4 The openings in the barrier are formed by the spaces between the horizontal wires. I consider that the spacing at the midpoint of any given span, under pressure, must be no greater than 100mm in order to adequately restrict the passage of children under the age of six.

4.3.5 I note the assertion in the submission from the designer that a maximum opening of 100mm will only be capable of being created at one point between the wires (I assume at the midpoint of any given span) and then only after the '20 Newton force ... exerted by a child attempting to climb through'. According to this submission, the gap between the wires 'reduce[s] to 76mm at the posts'. (I note a force of 20 Newtons can be applied by a mass of 2 kilograms.)

4.3.6 There is some discrepancy between this assertion, and the proposed barrier design as shown on the plans. The plans currently show the wires 100mm apart.

4.3.7 I consider the adequacy of the wire's tensioning in paragraph 4.4.5.

## **Toeholds**

- 4.3.8 The second aspect of the barrier's design to be considered is the toeholds provided by the horizontal wires. This differs from the designs shown in F4/AS1 which can be used as a guide to assess alternative designs. The commentary to Paragraph 1.2 of F4/AS1 states that:

Barriers with full height vertical members are the hardest for children to climb. Horizontal or near horizontal rails can easily be climbed by 2 years olds if the rails extend the full height of a barrier, even if the barrier includes a 200mm wide top rail or if it slopes inwards at 15°.

- 4.3.9 However, it is important to note that even the designs given in the F4/AS1 will not be incapable of being climbed by all children under the age of six years. Most of them will not be capable of being climbed by children under three years, but older children will climb them if they really want to. For these children, the barrier acts as a deterrent.
- 4.3.10 I must therefore consider whether the proposed barrier will restrict children under six years from climbing over it to the same extent as an F4/AS1 barrier would. I consider that horizontal wires would provide toeholds that would make it easier to climb than a F4/AS1 barrier with vertical members. However, the proposed barrier has inward-facing return at the barriers top.
- 4.3.11 I note that in the past, the Department has carried out tests on various barrier constructions, and how easy they were for children of various ages to climb. The results showed that the difficulty of climbing the barriers was not materially affected by an overhang of 150mm.
- 4.3.12 However, in this case, I consider the inward return is a satisfactory compensating feature, which would make the proposed barrier as difficult to climb as a barrier described in F4/AS1.

## **4.4 The rigidity and strength of the proposed barrier**

- 4.4.1 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.
- 4.4.2 A producer statement (PS1), including calculations and engineering details, has been provided for the balustrade posts that says the balustrade will comply with Clause B1 Structure subject to certain conditions. One condition is that the 'minimum beam connected to is 90 wide and beam is secured against twisting'. The plans for the proposed barrier show the timber beam supporting the balustrade posts is shown to be 75mm wide, which is less than the minimum required by engineering details.
- 4.4.3 The engineering details also show the maximum centres for the balustrade posts (1200mm), the weld joint of the post to the bracket (4mm fillet), and bracket fixing to support beam (4xM12 bolts). In my view the proposed plans need to include these details.

- 4.4.4 The barrier needs to be checked to show it is capable of supporting the tensioned wires as the calculations appended to the PS1 do not cover this aspect.
- 4.4.5 The Building Code of Australia<sup>4</sup> contains provisions for the construction of barriers with horizontal wire systems which may be helpful in determining the maximum wire spacing, the required wire tension, and the maximum deflection. In this instance the wire tension is not sufficient if a force of only 20 Newtons (the equivalent of a 2 kilogram mass) is required to create a gap between the wires of 100mm. With the barrier as proposed, 20 Newtons will bring about a wire displacement of about 12mm, but in the Building Code of Australia and for a similar situation, a 20 Newton force is only permitted to cause a displacement of less than 4mm.
- 4.4.6 If the wires are to be relied upon to restrict the passage of children under the age of six (by not allowing the passage of a 100 diameter sphere) then further justification of the proposal is necessary.
- 4.4.7 The tensioning of the wires, the ability of the balustrade posts to support the tensioned wires, and the discrepancies between the engineering details and the plans will need to be resolved before the proposed barrier can be said to comply with Clauses F4.3.4(c) and (d) of the Building Code.

#### **4.5 The platform formed by the 390mm wide inward return**

- 4.5.1 The 390mm wide inward return itself provides a platform that, in my view, invites people to get onto and traverse. The desire to do so will be reduced if the elements making up the platform are altered in such a way as to make the ability to sit on or walk along the platform difficult or uncomfortable.
- 4.5.2 I consider the inward return as proposed needs to be modified, for example; by limiting any adjacent elements that can be walked on to an overall width of 150mm, by replacing the timber members with tubular elements or tensioned wires, or by combination of these methods. If tensioned wires are used, a solid member could be positioned along the inner edge of the return.

#### **4.6 Conclusion**

- 4.6.1 For the reasons set out above, I consider that the proposed barrier, as currently designed, does not comply with Clauses F4.3(c), (d) and (g) of the Building Code.
- 4.6.2 The applicants should address the matters discussed herein and re-apply to the authority for an amendment to the building consent. The authority may agree to the amendment once it is satisfied that compliance will be achieved.

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<sup>4</sup> Building Code of Australia BCA 2008 Class Two to Class Nine Buildings, Volume One

## **5. The decision**

- 5.1 In accordance with section 188 of the Act, I hereby determine that the proposed barrier does not comply with Building Code Clause F4 Safety from Falling.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 9 March 2011.

John Gardiner  
**Manager Determinations**

## Appendix A: The relevant legislation

A.1 The relevant performance requirements of the Building Code Clause F4 Safety from falling include:

### **F4.3.4** Barriers shall:

- (a) ...
- (b) Be of appropriate height,
- (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.
- (e) Be constructed to prevent people from falling through them, and
- (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.