



Determination 2017/009

Regarding compliance with Clause D1 in regards to the use of balustrade capping as a handrail in a house at 29 Chelmsford Avenue, Glendowie, Auckland

Summary

This determination considers whether a balustrade handrail as constructed complies with Clause D1. The determination considers the use of the balustrade capping as a handrail and discusses the relevant width measurement and whether the capping is sufficient to provide a firm grasp in the event of a fall.

1. The matters to be determined

- 1.1 This is a determination under Part 3 Subpart 1 of the Building Act 2004¹ (“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 licensed building practitioner concerned with the building work, V Wharton (“the applicant”)
 - Auckland Council (“the authority”), carrying out its duties as a territorial authority or building consent authority.
- 1.3 The matter to be determined² is whether the handrail to a stairway complies with Clause D1 Access Routes of the Building Code³ (First Schedule, Building Regulations 1992).
- 1.4 In making my decision, I have considered the submissions of the parties and the other evidence in this matter.
- 1.5 The relevant sections of the Act, clauses of the Building Code, Acceptable Solutions and referenced Standards, are set out in the Appendix.

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.

² Under section 177(1)(a) of the Act. The application for determination included the refusal to issue a code compliance certificate which is a matter that would be considered under section 177(1)(b), however no application for a code compliance certificate had been made to the authority.

³ 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.

2. The building work and background

2.1 The building work considered in this determination concerns the construction of a two-storey house built under building consent No. B/2015/9342 issued by the authority on 11 November 2015. The ground floor contains the dining, lounge, kitchen, living room and garage. The first floor level contains the bedrooms, and bathrooms.

2.2 The consented drawings detailed a frameless glazed balustrade with a 50mm tubular handrail on metal brackets fixed through the glass balustrade.

2.3 The handrail as built consists of a 25mm wide x 21mm deep hollow stainless steel interlinking rail bonded to the top edge of the balustrade as shown in Figure 1. The rail runs along the full length of the balustrade.

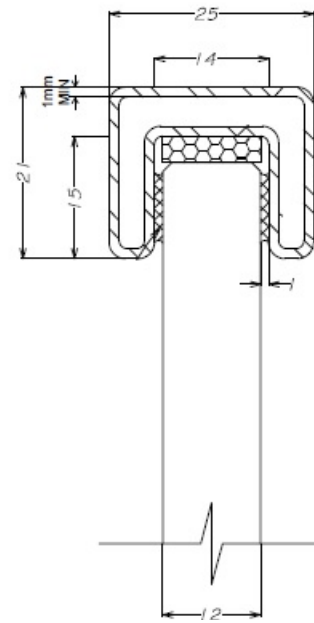


Figure 1: The interlinking rail as built

2.4 I note that while the balustrade capping is called an “interlinking handrail”, that name is derived from NZS 4223.3⁴ where interlinking rails are required for frameless glass systems and should not be confused for a compliant handrail. The applicant submitted three “interlinking handrail” designs, and apart from the referenced design in this determination, the other two designs are compliant with D1/AS1.

2.5 The final site inspection was failed by the authority due to a number of outstanding issues, one of which was the authority’s view that the handrail on the glass balustrade did not comply with Clause D1.

2.6 The applicant responded to the authority on 27 September 2016, stating the view that the handrail met the requirements of Clause D1 and requesting the authority remove the handrail issue and reissue the inspection results.

2.7 The authority emailed the applicant on the same day, setting out its view that the handrail did not comply with the relevant width (RW) dimensions set out in D1/AS1⁵ and that the glass balustrade would prevent a person from being able to fully grasp the handrail. The authority noted the applicant could propose an alternative solution, if the applicant believed an adult person could still grip and support themselves during a fall, and submit it as a minor variation. Additionally, the authority noted that the handrail constructed differed from the consented drawings.

2.8 The applicant responded by email on 28 September 2016 stating:

- the handrail was compliant and met the relevant width requirements of D1/AS1
- there is no requirement for the handrail to be designed to allow a person to have a fully enclosed grip
- all handrails have supporting structures, such as brackets or balusters, and the glass is ‘less “obstructive” than intermediate brackets or balusters’.

⁴ New Zealand Standard NZS 4223.3:2016, Glazing in buildings - Part 3: Human impact safety requirements

⁵ Acceptable Solution D1/AS1: Compliance Document for New Zealand Building Code, Clause D1, Access Routes – Second Edition

- 2.9 The authority responded on 29 September 2016, saying that it was seeking further guidance regarding the compliance of the handrail. On the 4 October 2016 the authority emailed the applicant, setting out its view that the handrail was not “graspable” as required by Clause D1.3.3(j) and suggesting the applicant apply for a determination on the matter.

3. The submissions

- 3.1 The Ministry received the application for a determination on 12 December 2016. The applicant provided copies of:

- photographs of the installed handrail
- technical drawings from the manufacturer of the frameless glass balustrade handrail (these show three interlinking rails of various sizes)
- correspondence between the applicant, the authority, and the manufacturer.

- 3.2 The authority acknowledged the application for determination on 23 December 2016 and submitted a response on 17 January 2017, also providing copies of the approved consented drawings.

- 3.3 The authority is of the view that the handrail does not comply with Clause D1, and submitted (in summary):

- The handrail installed on the glass barrier differs from the consented plans which complied with D1/AS1, and a minor variation has not been sought.
- As ‘nearly half of all serious injuries that occur in the home happen on stairways’ (as taken from the Accident Compensation Corporation) the authority is of the view that falling is a concern.
- It was agreed that the stairway is not required to be accessible but it is required to give access and therefore it is classified as a ‘private stairway’.
- The handrail is not graspable as the glass interferes with the ‘ability to effectively wrap the hand around, and grasp the handrail.’
- The authority’s decision was based on Figure 26(a)(iv) of D1/AS1 as the relevant handrail profile. The width of the capping met the 20mm minimum, but the diagram ‘shows a finite relevant width (“RW”) is not achieved [by] the current set up’ (see paragraph 6.0.8 of D1/AS1 – shown at Appendix A.2). As the capping is mounted on top of the glass, the RW measurement continues down the glass and this exceeds the 80mm maximum for the RW.

- 3.4 A draft of this determination was issued to the parties on 8 February 2017. The draft concluded that the handrail was not graspable and did not meet the requirement of Clause D1.

- 3.5 The applicant responded on 9 February 2017, stating that they did not accept the determination and provided the following comments (in summary):

- The applicant disagreed with the interpretation presented in the determination of D1/AS1 and the definition of “graspable” by the Ministry and the authority.
- The glass cannot be classified as an obstruction, as D1/AS1 does not explicitly consider glass.
- The applicant disagreed with the use of the phrase “in the event of a fall” because the requirement of the Building Code is for the handrail to be graspable “to prevent a fall”.

- The applicant queried the discussion around “pinch grip” and stated that they believed this, alongside the authority’s requirements, meant that there were profiles in Figure 26 that were not compliant.
- The applicant disagrees with the profile used as comparison and feels that Figure 26(a)(iii) is more appropriate given the rectangular profile, and the RW noted in the determination should be adjusted accordingly.
- Clearance of the handrail to the balustrade is not considered in D1/AS1; there is no indication of how handrails are to be mounted, and this issue ‘is outside of the code’.

3.6 I have amended the determination to address the points raised by the applicant where I consider appropriate.

3.7 The authority accepted the draft determination on 8 February 2017, and supplied additional information from Accident Compensation Corporation (ACC) regarding falls in the home.

3.8 In response to the authority’s submission, the applicant made a further submission on 15 February 2017. The applicant raised their concern that the determination was based upon ACC policy rather than Clause D1. I note that the Acceptable Solution D1/AS1 would have been developed using information from a variety of sources, likely including accident statistics to inform the direction of handrail design. However, I have not considered accident statistics in writing this determination; I have only considered whether the building work satisfies D1/AS1 as a means of establishing compliance with Clause D1.

4. Discussion

4.1 The Building Code

4.1.1 Clause D1.3.3(j) of the Building Code requires that access routes shall:

Have smooth, reachable and **graspable** handrails to provide support and assist with movement along a stair or ladder (my emphasis)

4.1.2 The term “graspable” is not defined in the Building Code, and must be interpreted in light of the objective and functional requirements of Clause D1 to safeguard people from injury and enable safe and easy movement. In regards to the handrail profile and the ability of a user to “grasp” the handrail, I am of the view the handrail must be adequate to support and assist a person in movement up or down the stairs, as well as to assist in arresting an accidental fall should one occur.

4.1.3 In considering the interpretation of “graspable” in Clause D1.3.3(j), I have considered its natural ordinary meaning as well how the criterion set out in D1/AS1.

4.1.4 The ordinary meaning of the term⁶ “graspable” is “that may be grasped”, with definitions for “grasp” that are relevant to this issue being:

3.a To seize and hold firmly with the hand.

5. To hold firmly as with the fingers; to grip

4.1.5 Paragraph 6.0.8 of the Acceptable Solution D1/AS1⁷ sets out criterion that a “graspable handrail” must have (refer paragraph 4.2.2).

⁶ OED Third Edition, November 2010.

⁷ D1/AS1 2nd edition, amendment 5

- 4.1.6 The parties have disputed whether the handrail can be considered graspable and how relevant width is measured.
- 4.1.7 The authority stated that the user needed be able to ‘effectively wrap’ the hand around and ‘effectively grip’ the handrail, including that the underside of the rail for additional support was necessary. I discuss this further in paragraph 4.2.9.
- 4.1.8 The authority also noted that it viewed the glass panes as an obstruction that would ‘interfere’ with a person’s ability to grasp the handrail.

4.2 The Acceptable Solution

- 4.2.1 The Acceptable Solution D1/AS1 is a prescribed means, though not the only means, of achieving compliance with the Building Code. The version that was current at the time the authority granted consent was 2nd edition, amendment 5 (effective from 10 October 2011).
- 4.2.2 Paragraphs 6.0.7 to 6.0.9 of D1/AS1 set out the profiles for handrails that would comply with the Building Code:

6.0.7 Handrail profiles – Handrails shall have a profile which can be readily grasped by an adult hand and shall be installed in a way that avoids the likelihood of personal injury. An acceptable handrail shall be shaped and located to ensure that, under normal usage, a person’s hand will not contact adjacent walls, supporting brackets or fixings, or any other obstruction.

COMMENT: It is important that in the event of stumbling on a stairway or ramp an adult, even with a small hand, can firmly grasp the handrail to prevent a fall.

6.0.8 A graspable handrail profile shall have:

- a) A flat or convex upper surface,
- b) Arrised or radiused edges,
- c) A minimum cross section width of 20 mm, and
- d) A “relevant width” (as illustrated in Figure 26(a)) across the top surface of no greater than 80 mm. Figure 26 (a) and (b) indicates some acceptable profiles but others may also be acceptable.

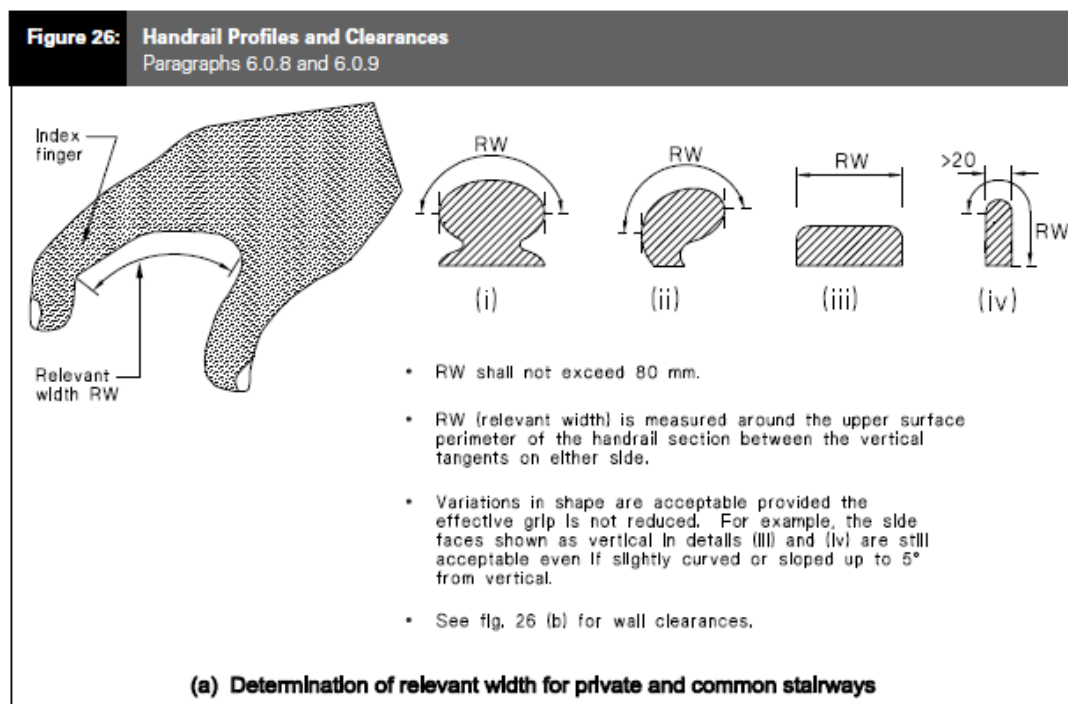


Figure 2: Figure 26 of D1/AS1 2nd edition, amendment 5

- 4.2.3 Paragraph 6.0.9 relates to accessible stairways and accessible ramps. I consider the stairway does not form an accessible route and I note the classification of the stair is not in dispute.
- 4.2.4 The applicant has submitted that compliance is achieved when compared to profile (iii) of Figure 26(a).
- 4.2.5 The authority has identified profile (iv) of Figure 26(a) as the one against which compliance has been assessed. This profile notes the RW as measured along the top surface and down the side of the handrail.
- 4.2.6 I note that D1/AS1 amendment 6 took effect on 1 January 2017, with alterations to profile (iii) in Figure 26(a), with the side dimension included in the RW measurement. I consider it important that the amended diagram shows the RW is taken from the side and top, which is similar to profile (iv). However, as profile (iv) has a similar narrow width, I consider the constructed handrail is closer to (iv) in comparison.

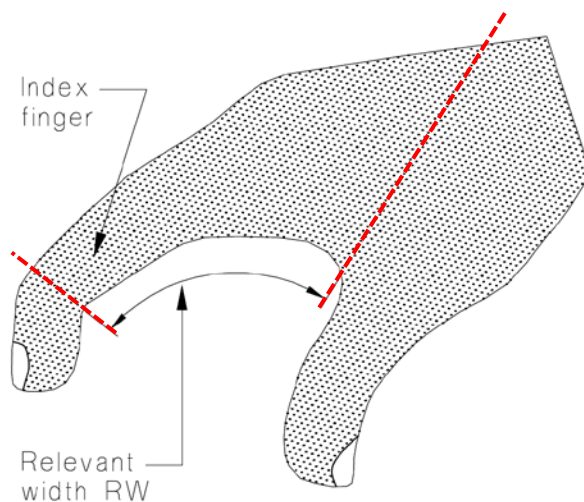


Figure 3:
Relevant width measurement to hand

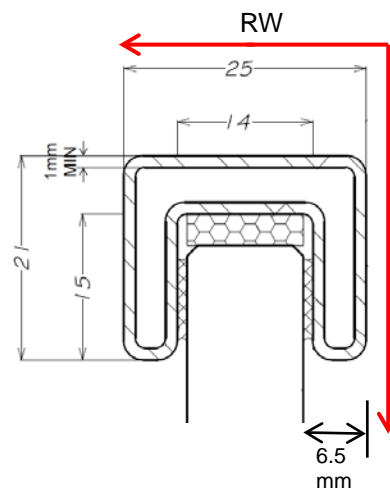


Figure 4:
Relevant width of the as-built handrail

- 4.2.7 The proposed handrail submitted by the applicant has a width of 25mm (greater than the 20mm shown in Figure 26(a)(iv)) and the side profile length of 21mm. However, there is no gap between the lower edge of the handrail and glass, and only a 6.5mm indent below the rail. I am of the view that the RW continues down the balustrade, and therefore the handrail exceeds the maximum RW of 80mm set out in paragraph 6.0.8 of D1/AS1.
- 4.2.8 Profile (iv) shows that the RW, including the length of the side, must not exceed 80mm to enable the user's fingers to be in sufficient contact with the handrail. I note that it is not explicitly stated in D1/AS1 that the user must be able to grasp the underside of the handrail, but the design is required to permit a firm grasp. I consider this as requiring adequate contact of the hand to the handrail, as demonstrated in the relevant width diagram which highlights the segments of the hand that should be in contact with the handrail (see Figure 3).

4.3 Compliance of the handrail

- 4.3.1 When using the constructed handrail, due to the narrow width and side length, only a small segment of the user's fingers can be in contact with the actual handrail and, unless an awkward grip is used, the majority will be in contact with the glass balustrade underneath. If the glass was not present immediately below the handrail, the user could achieve a firm grip of the handrail.
- 4.3.2 The 6.5mm indent at the below the handrail where it meets the glass requires the user to grip the glass or pinch the handrail when support is required. I note in the commentary of D1/AS1 paragraph 6.0.7 it states that it is important that an adult can 'firmly grasp the *handrail* to prevent a fall.' (emphasis added). A handrail design that allows more of the finger and hand segments into contact with the handrail is likely to permit a stronger grasp than a "pinch grip"⁸. I am of the view that the profile of the handrail as constructed does not provide for a firm grasp, and I consider that it would be inadequate in assisting the arrest of a fall.
- 4.3.3 I conclude therefore that the authority was correct in requiring the handrail design to allow the user to firmly grasp the handrail in the event of a fall, which the handrail profile in conjunction with the glass balustrade does not permit.

4.4 Conclusions

- 4.4.1 The proposed handrail does not meet the requirements for a graspable handrail as described in D1/AS1 for relevant width.
- 4.4.2 In my view the proposed handrail does not satisfy the requirements of Clause D1.3.3(j).
- 4.4.3 I suggest that the applicant install a handrail design that complies with the Building Code and submit this as a minor variation to the building consent.

5. The decision

- 5.1 In accordance with section 188 of the Building Act 2004, I hereby determine that the handrail as described in paragraph 2.3 of this determination does not comply with Clause D1.3.3(j) of the Building Code.

Signed for and on behalf of the Chief Executive of the Ministry of Business, Innovation and Employment on 18 February 2017.

John Gardiner
Manager Determinations and Assurance

⁸ The Staircase, Studies of Hazards, Falls and Safer Design, John A Templer, 1992, Massachusetts Institute of Technology ISBN 0-262-20083-X

Appendix A: The Building Code and the Acceptable Solution

A.1 The relevant provisions of Building Code Clause D1 - Access routes, include:

D1.3.3 Access routes shall:

- (j) have smooth, reachable and graspable *handrails* to provide support and to assist with movement along a stair or ladder

A.2 The relevant paragraphs and figures from Acceptable Solution for Clause D1 Access, D1/AS1, include:

Definitions

Handrail

A rail to provide support to, or assist with the movement of a person.

Private stairway

A stairway used, or intended to be used, by the occupants of a single household unit.

Paragraphs:

6.0 Handrails

6.0.1 All *accessible stairways* shall have *handrails* on both sides (see Paragraph 6.0.3). All other *stairways* with a width of 2.0 m or less and having two or more risers, shall have *handrails* on at least one side. For a *stairway* of two or three risers within, or giving access to a *household unit*, the *handrail* may be omitted.

6.0.7 Handrail profiles – *Handrails* shall have a profile which can be readily grasped by an adult hand and shall be installed in a way that avoids the likelihood of personal injury. An acceptable *handrail* shall be shaped and located to ensure that, under normal usage, a person's hand will not contact adjacent walls, supporting brackets or fixings, or any other obstruction.

6.0.8 A graspable *handrail* profile shall have:

- a) A flat or convex upper surface,
- b) Arrised or radiused edges,
- c) A minimum cross section width of 20 mm,
and
- d) A "relevant width" (as illustrated in Figure 26 (a)) across the top surface of no greater than 80 mm. Figure 26 (a) and (b) indicates some acceptable profiles but others may also be acceptable.