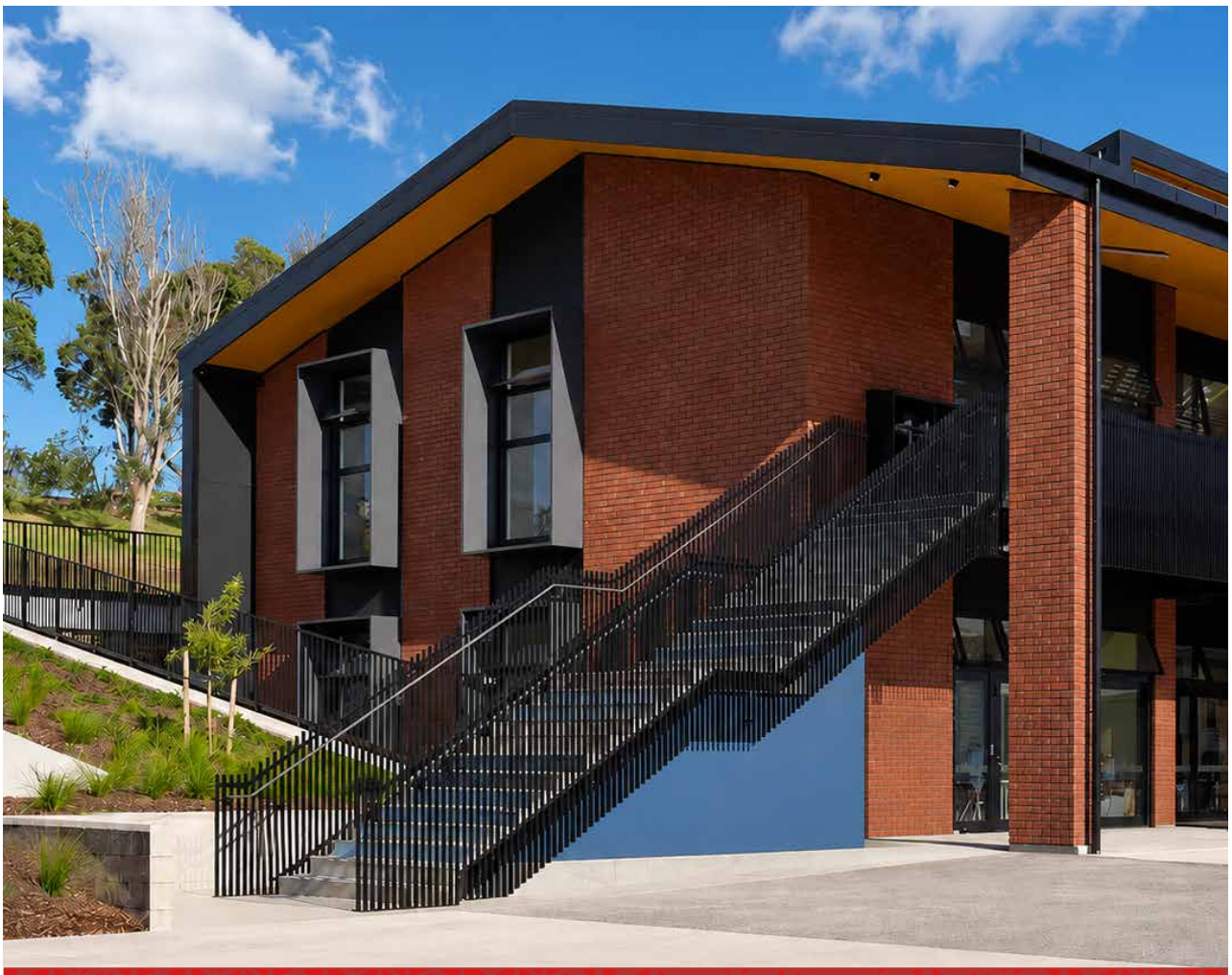

A QUICK GUIDE TO BALUSTRADES & HANDRAILS ON STAIRWAYS

ENSURING SAFETY AND COMPLIANCE IN NEW ZEALAND

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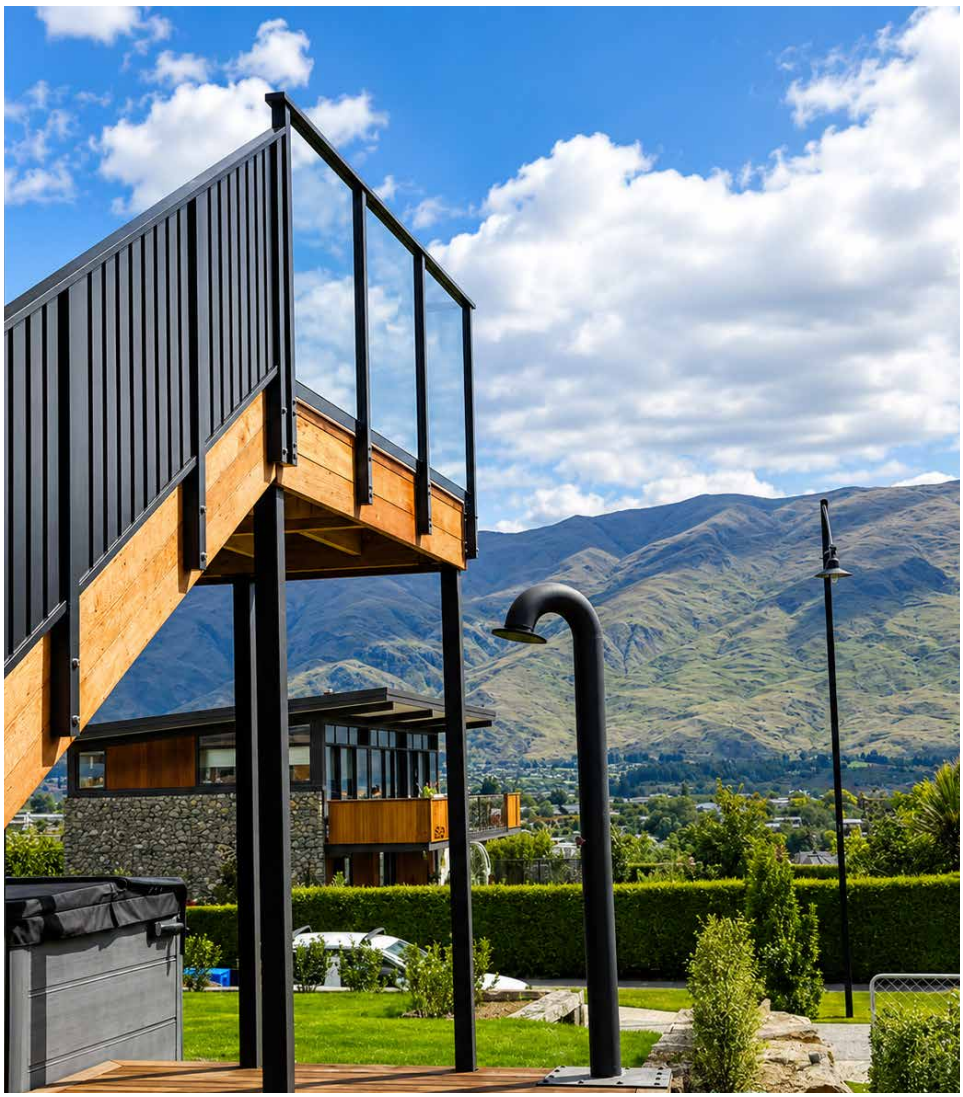


INTRODUCTION

Designing balustrades and handrails for stairways, maybe challenging as there are multiple areas of the NZ Building Code that need to be considered holistically. Furthermore, there often conflicting geometrical constraints adding a further layer of complexity.

This Guide is intended to be a brief overview of some of the key aspects to be considered for compliance, along with some practical tips that maybe useful to Designers.

It is not intended as a complete or comprehensive reflection of the relevant legal regulations.

Balustrades and handrails are often considered as interchangeable terms. However, it is important to understand they fundamentally perform different purposes and there are different areas of the NZ Building Code that apply to them.

Simply put; a balustrade is effectively a barrier to prevent someone from falling, whereas a handrail is an object for a person to hold on to when transiting a stair or ramp. In some situations, the top rail of the balustrade may be able to act as the handrail, but nevertheless their core purpose is always different.

BALUSTRADES

As mentioned in the previous Introduction, a balustrade is effectively a safety-barrier to prevent someone from falling. In this respect there are two key principles incorporated in the NZ Building Code, which should be understood. Below these two principles are outlined in simplistic terms.

Strength

The balustrade must be of a certain strength to resist persons pushing on the top edge of the balustrade and/or falling through the infill. If the balustrade has a solid infill such as glass, wind-load may also be a consideration.

This aspect of the balustrade is covered under the Acceptable Solutions B1/VM1 of the New Zealand Building Code, which cites an engineering standard AS/NZS 1170.1:2002 as a means of compliance.

If the balustrade incorporates glass, it also needs to comply with section F2 of the NZ Building Code. The Acceptable Solutions F2/AS1 is commonly used a means of compliance.

A balustrade design should always be checked by an appropriate engineer that it complies with the regulations for strength. Usually, the Building Consent authorities will require a PS1 as a form of proof in this regard.

Geometry

Clause F4.2 of the NZ Building Code states: "Buildings shall be constructed to reduce the likelihood of accidental fall." Obviously, the geometry of the balustrade is a critical part of the design to achieve this, and the specific requirements are set out in the Acceptable Solutions F4/AS1.

There are three key aspects of the balustrade geometry that bear on safety:

- The balustrade minimum height to reduce likelihood of "falling over" the top edge of the balustrade.
- Maximum size gaps within the balustrade to reduce the likelihood of someone "falling through" the balustrade. This is particularly taken into consideration for children under 6 years of age.
- To make the balustrade "difficult for a child to climb", which in turn could result in a child falling over the top edge. The geometry of making the balustrade difficult for a child to climb, largely comes down to restricting projections or ledges (commonly referred to as "toeholds"), that would assist a child in climbing. This includes ensuring toeholds are outside certain zones, likely to be easily used for a child climbing. Also, if the toehold is within the forbidden zone, it is minimised to make it more difficult for a child to use it to climb.

Further details on the geometrical requirements to satisfy Acceptable Solutions F4/AS1, can be found under the Critical Dimensions section of this publication.

HANDRAILS

The formal definition of a handrail in section D1 of NZBC is: "A rail to provide support to, or assist with the movement of a person." This should not be confused with a balustrade which is designed to prevent someone from falling.

There are varying requirements for handrails on stairs, depending on what classification the stairway is. Below are the more common stairway types often referred to (not all types listed), along with a description, as stated in section D1 of NZBC:

Accessible Stairway

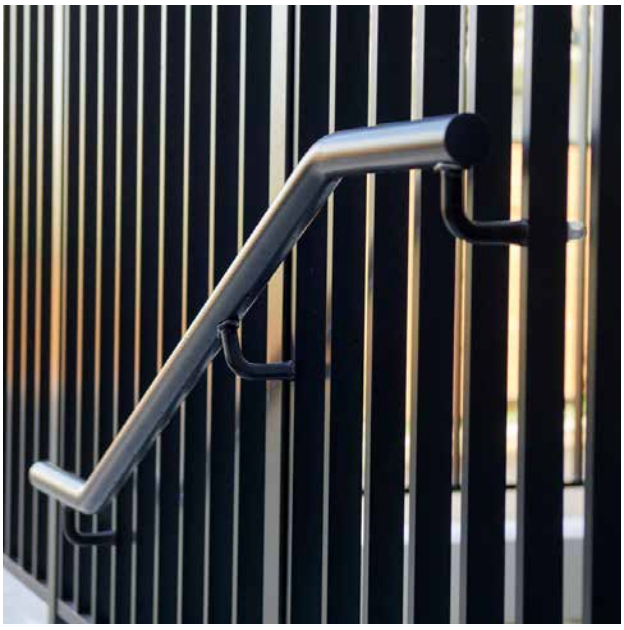
A stairway having features for use by people with disabilities. Buildings required to be accessible shall have at least one accessible stairway leading off an accessible route whether or not a lift is provided.

Common Stairway

A stairway which is used, or intended to be used, by the public whether as of right or not, and is not a private stairway, service stairway or accessible stairway.

Private Stairway

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



HANDRAILS (CONTINUED)

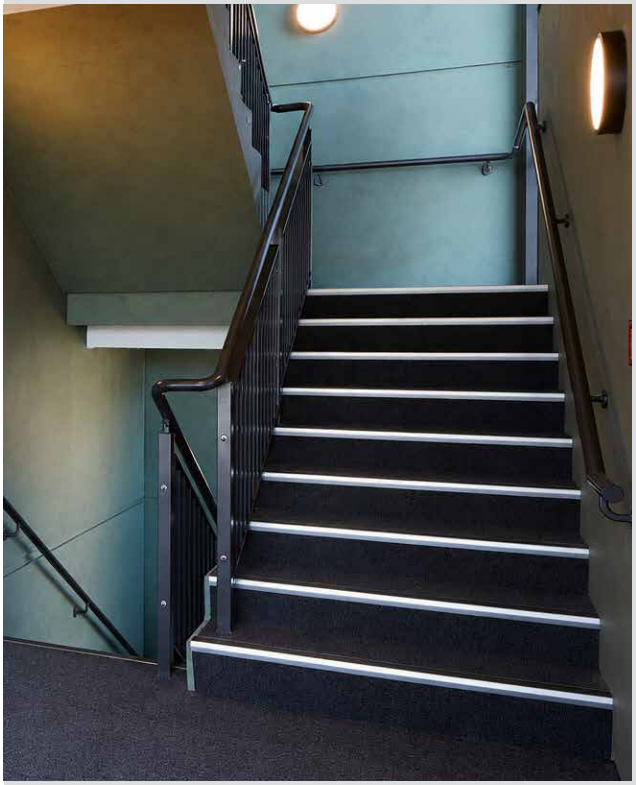
An Accessible Stairway has more stringent requirements than a Common or Private Stairway, as it specifically intended to be used by persons with disabilities.

Below is some key points on where handrails on stairways are required, as stated in section D1 of NZBC:

- All accessible stairways shall have handrails on both sides.
- 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.
- Handrails may be omitted on stairways of two or three risers within or giving access to a household unit.
- Where the stairway exceeds 2.0m in width, it shall have handrails on both sides.
- Where the stairway exceeds 4.0m in width, it shall also have an intermediate handrail provided at the centre of the stairway.
- There are some exceptions to the above, if the stairway is essentially an outdoor architectural feature and not required to be an accessible stairway. Refer to clause 6.0.2 (b) of D1/AS1 for more details.

The profile of the handrail is an important requirement, as it relates to how it can be practically grasped by the hand of the user.

The requirements of the profile for an Accessible Stairway are more stringent than a Private or Common Stairway.

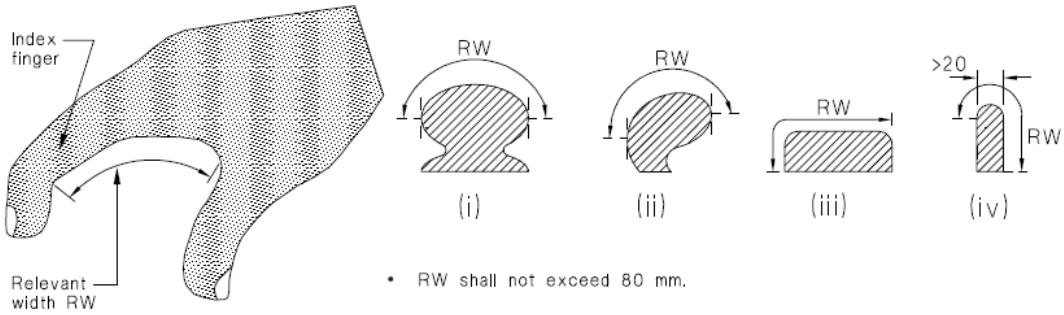


HANDRAIL PROFILE FOR PRIVATE OR COMMON STAIRWAYS

D1/AS1 illustrates a typical clasped hand (see excerpt below) and indicates the relevant width of perimeter that is used for grasping a handrail (referred to as RW)

D1/AS1 also illustrates four typical handrail profiles (see excerpt below) and indicates where the RW should be measured from. It then states that this RW dimension should not exceed 80mm.

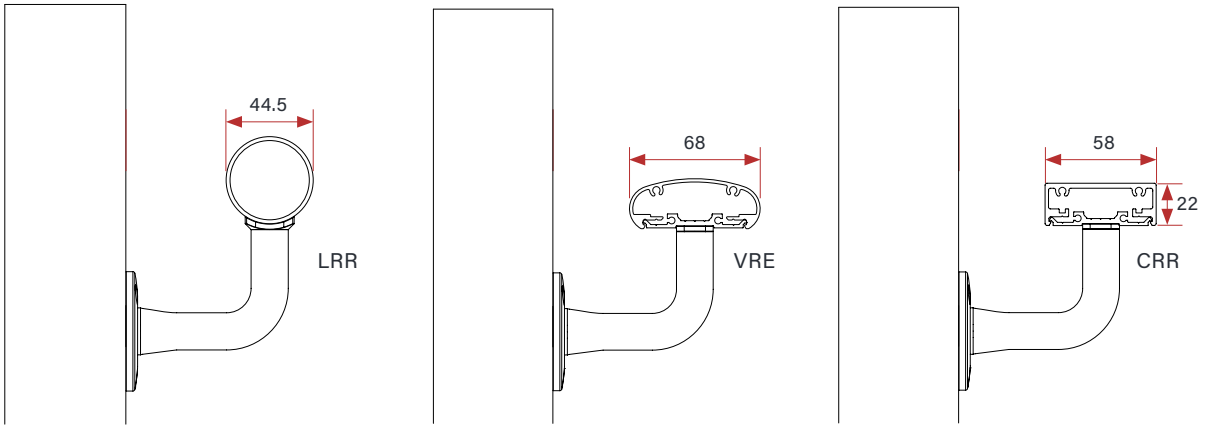
Requirements - NZBC



- RW shall not exceed 80 mm.
- RW (relevant width) is measured around the upper surface perimeter of the handrail section between the vertical tangents on either side.
- Variations in shape are acceptable provided the effective grip is not reduced. For example, the side faces shown as vertical in details (iii) and (iv) are still acceptable even if slightly curved or sloped up to 5° from vertical.

Determination of relevant width for private and common stairways

Compliant Handrails for Private or Common Stairways - UNEX LRR, VRE and CRR

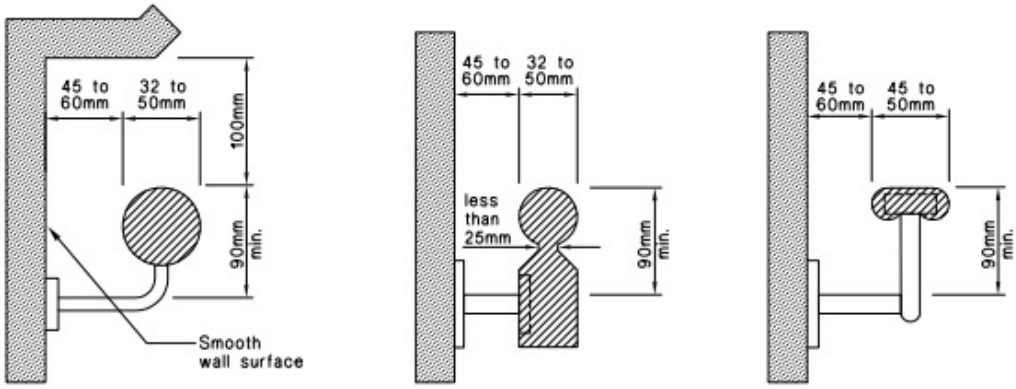


HANDRAIL PROFILE AND CLEARANCES FOR AN ACCESSIBLE STAIRWAY

D1/AS1 illustrates three acceptable profiles and clearances for Accessible Stairways (refer excerpt below). However, in practise the one on the left with a complete circle between 32mm - 50mm diameter is by far the most used.

The other two would be difficult to achieve in situations like a hair-pin bend between two flights of stairs, as the handrail is required to be continuous.

Requirements - NZBC

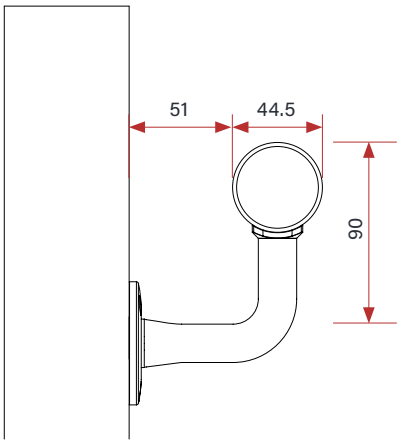


The profiles shown comply with the provisions for accessible handrails.

The clearances apply to all handrails and the maximum dimension must be used for rough textured wall surfaces.

Acceptable profiles and clearance for accessable stairways

Compliant Handrails for Accessible Stairways - UNEX LRR



CRITICAL KEY DIMENSIONS

Acceptable Solutions D1/AS1 and F4/AS1, contain many dimensional requirements. Below are extracts from certain clause which incorporate some key dimensions for balustrades and handrails on stairs. Note the clauses quoted below are not necessarily the whole clause, but an extract containing a critical dimension.

- D1/AS1: 4.2.1
  The **width between handrails** on an accessible stairway or between handrail and wall on a common stairway shall be no less than **900mm**.

  COMMENT: While no minimum width is given for **stairways within household units** it should be noted that C/AS2 Paragraph 3.3.2 for risk group SM (multi-unit dwellings requires a minimum stair width of **850mm**. This is also a practical minimum requirement for any private stairway. Narrow private stairways can make the movement of furniture difficult, if not impossible.

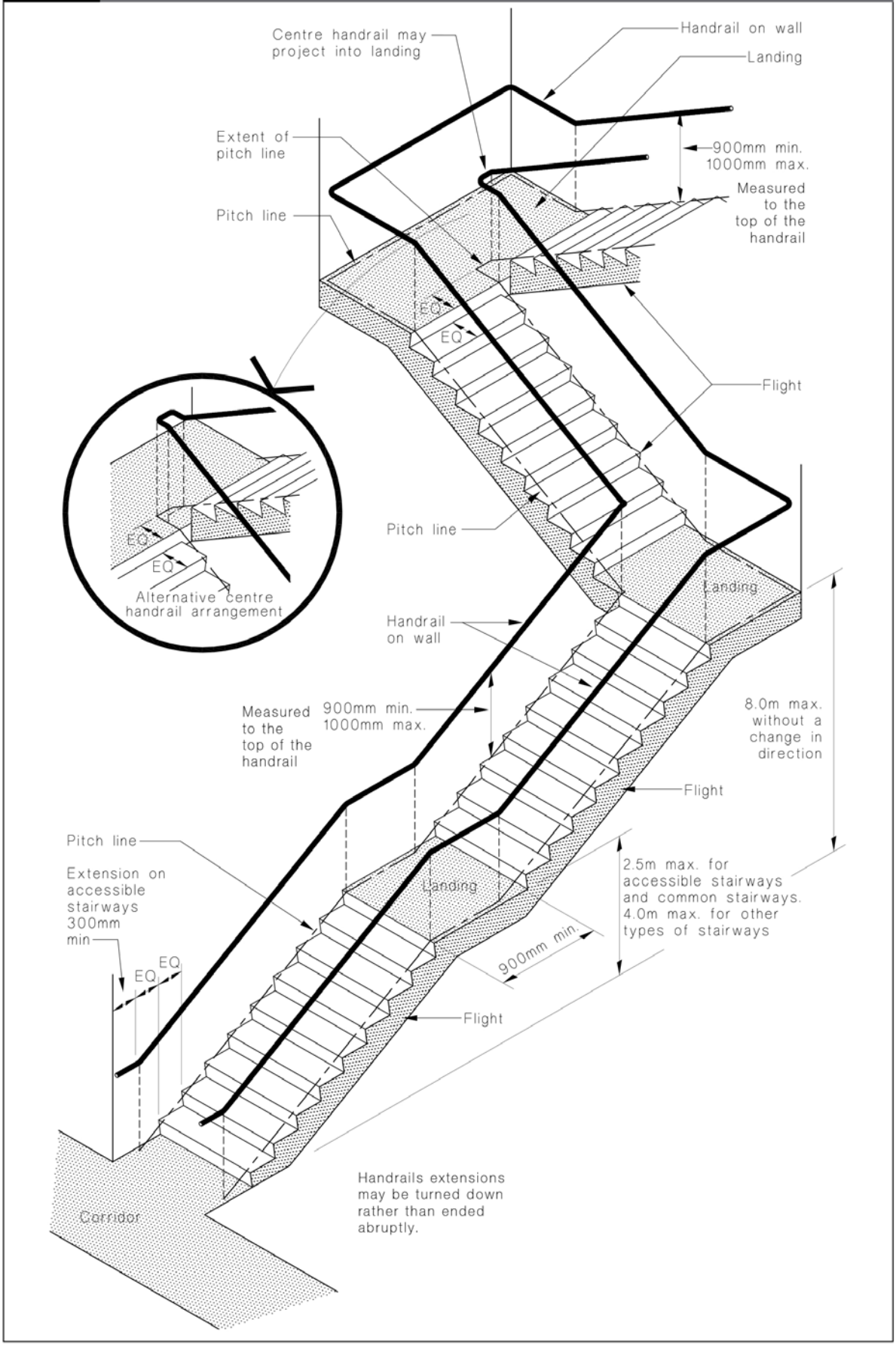
- D1/AS1: 6.0.4
  Where the handrail serves an **accessible stairway** or accessible ramp, a **300 mm (minimum) horizontal extension** shall be provided at each end of the handrail.

- D1/AS1: 6.0.6
  Height of handrails - **Handrails shall be positioned between 900 mm and 1m [1000mm]** above the pitchline measured to the top of the handrail.

  COMMENT: Where a handrail is located on top of the barrier of a stairway flight it may **transition to a height of 1100mm** on an intermediate landing.

- D1/AS1: FIGURE 25
  Figure 25 as shown on the next page, illustrates some of these key dimensions referred to above, and is helpful to view in a pictorial form.

Figure 25: **Handrails and Landings for Stairways and Ramps**
Paragraphs 1.5.2, 4.3.2, 6.0.2, 6.0.3, 6.0.4 and 6.0.5



CRITICAL KEY DIMENSIONS (CONTINUED)

- F4/AS1: 1.1.1 Minimum barrier heights are given in Table 1.

Table 1: Minimum Barrier Heights
Paragraph 1.1.1, Figures 1-5

Building type	Location	Barrier height (mm) (Note 1)
Detached dwellings and within *household units* of multi-unit dwellings	Stairs and ramps and their intermediate landings	900
	Balconies and decks, and edges of internal floors or mezzanine floors	1000
All other *buildings*, and common areas of multi-unit dwellings	Stairs or ramps	900
	Barriers within 530 mm of the front of fixed seating	800
	All other locations	1100

Note:

1. Heights are measured vertically from finished floor level (ignoring carpet or vinyl, or similar thickness coverings) on floors, landings and ramps. On stairs the height is measured vertically from the *pitch line* or stair *nosings*.
2. A landing is a platform with the sole function of providing access.
3. Clause F4.3.1 has a limit on its application that may exclude the need for barriers in certain locations such as working wharves and loading docks.
4. An 800 mm high barrier in front of fixed seating would be appropriate in cinemas, *theatres*, and stadiums.
5. Where a *handrail* is mounted on top of a stairway barrier it may transition up to a height of 1100 mm on the intermediate landings.

CRITICAL KEY DIMENSIONS (CONTINUED)

- F4/AS1: 1.2.1 In **housing** and other areas likely to be frequented by children under 6 years of age:

  a) Figures 1-4 show acceptable barrier constructions. The following can be noted regarding **"toe-holds"** as referred to under the Balustrade Geometrical section of this publication.

  i. Figure 1 (a) below, illustrates a balustrade with four rails and note the absence of toeholds in the zone between the 150mm and 760mm high.

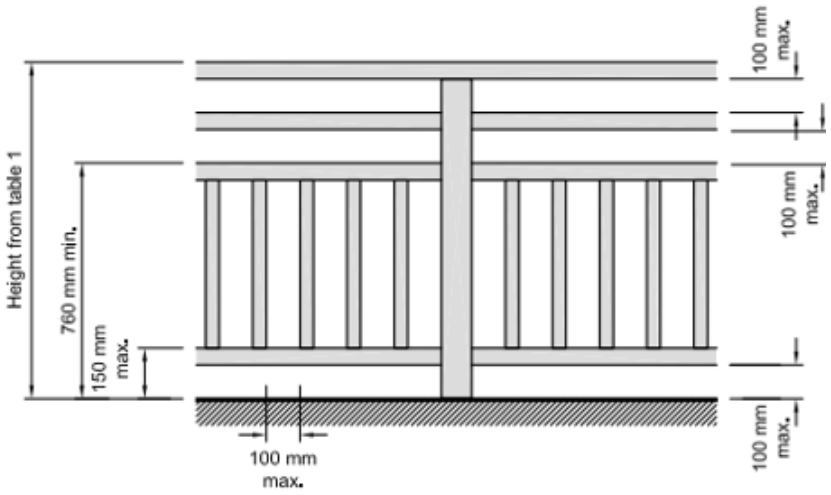


Figure 1 (a)

  ii. Figure 1 (b) bellow, illustrates a balustrade with a grid infill and note the maximum of 35mm opening in the grid.

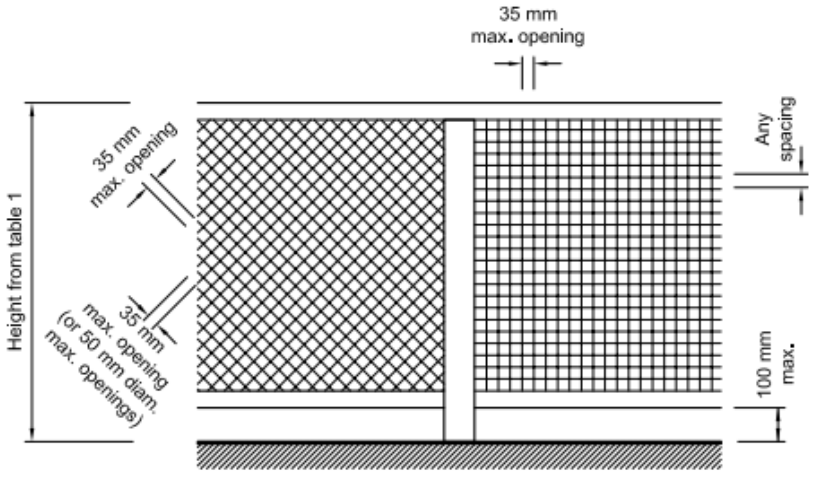


Figure 1 (b)

CRITICAL KEY DIMENSIONS (CONTINUED)

iii. Figure 2 (a) below, illustrates a balustrade with two rails and note the absence of toeholds in the zone above 200mm.

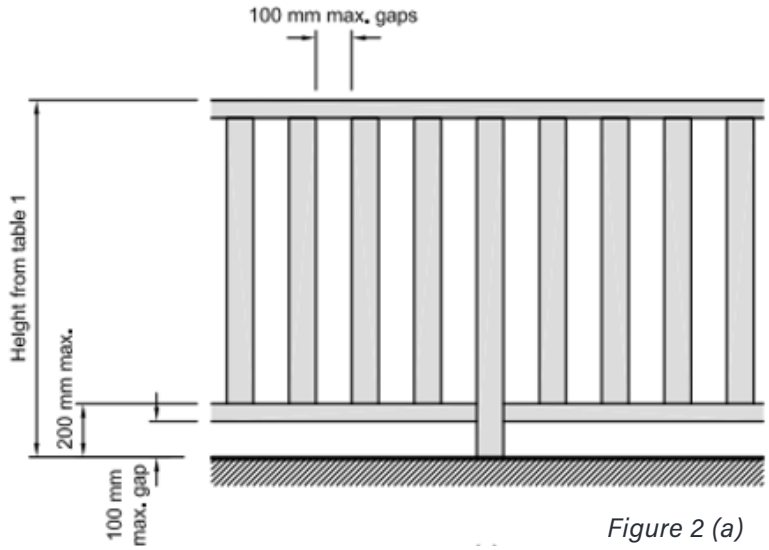


Figure 2 (a)

iv. Figure 2 (b) below, illustrates a balustrade with longitudinal slats and note the maximum gaps between the slats is 15mm.

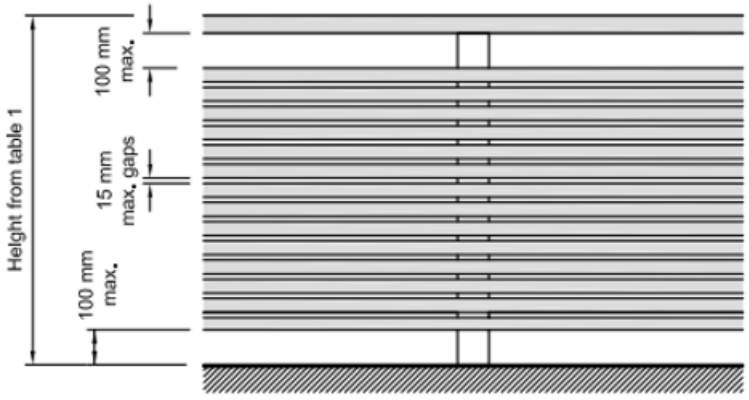


Figure 2 (b)

CRITICAL KEY DIMENSIONS (CONTINUED)

v. Figure 3 below, illustrates a balustrade with a glass or solid infill. Note how the ledge (at any height) can be a maximum of 15mm, or use a fillet with a slope of 60°.

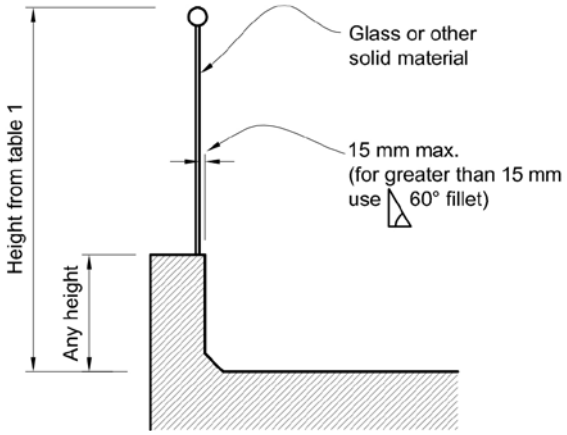
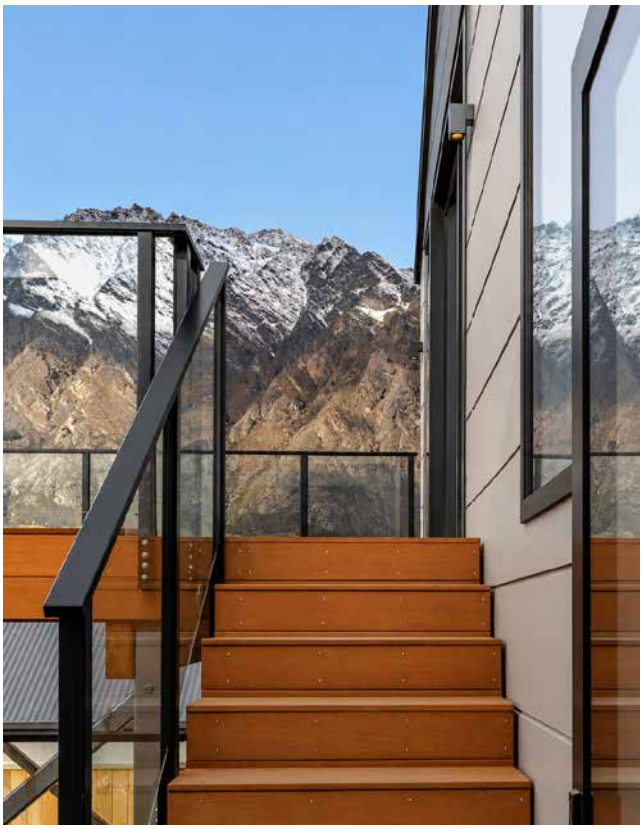


Figure 3



CRITICAL KEY DIMENSIONS (CONTINUED)

vi. Figure 4 below, illustrates a stair balustrade with longitudinal rails running at the same pitch as the stairs. Please note that whilst F4/AS1 permits this configuration, in the opinion of Unex Systems this option is **NOT** recommended, as it arguably contradicts the requirements of making the balustrade difficult for a child to climb. In particular, the V-shaped ledges on the upper side of the posts seem to fundamentally form toeholds.

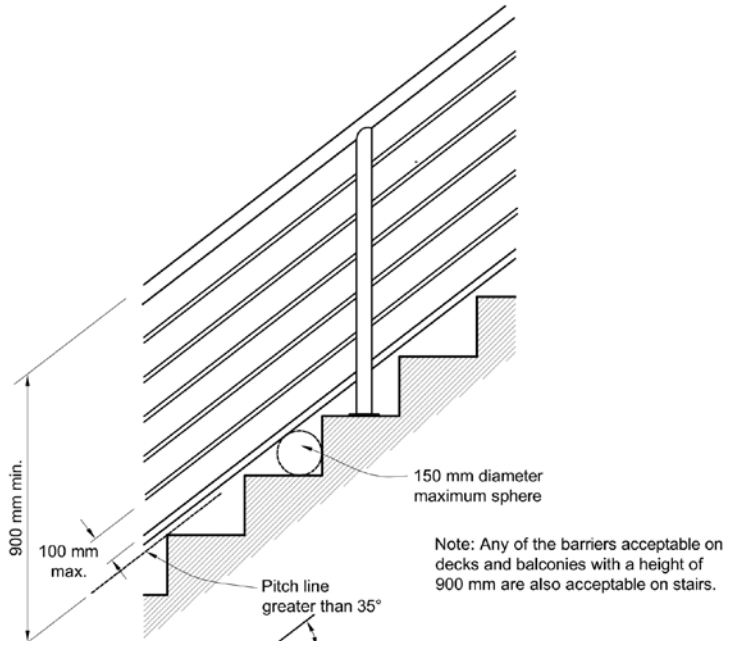
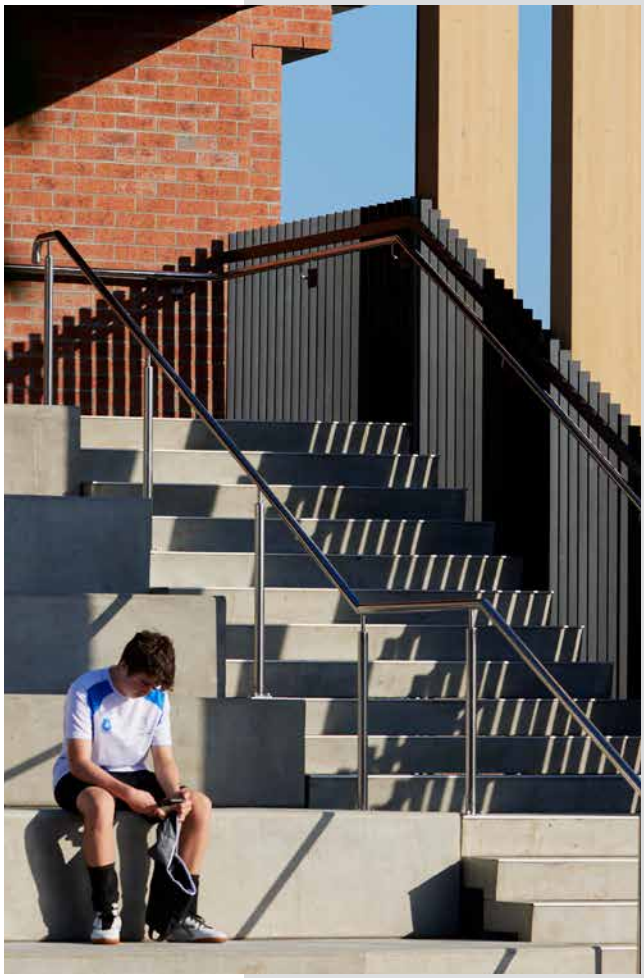


Figure 4

b) Openings anywhere over the full height of the barrier shall be such a size that **a 100mm diameter sphere cannot pass through** them, and

c) **The triangular opening** formed by the riser, tread, and bottom rail of the barrier on a stair shall be of such a size that a **150mm diameter sphere cannot pass through** it (see Figure 4).



EARLY CHILDHOOD EDUCATION AND CARE CENTRES

Early Childhood Education and Care Centres must meet Building Act and Ministry of Education requirements.

A guidance about early childhood education centres, can be obtained from the link below.

https://www.building.govt.nz/building-code-compliance/specific-buildings/early-childhood-education-centres

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Wherever you are in New Zealand, UNEX is here to help.

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