DESIGN RIGHT

BY BRUCE SEDCOLE,
ANZIA, BRANZ TECHNICAL WRITER

Designing residential internal barriers

Designing and constructing barriers inside a house begins with designers assessing any site-specific risks. The following guidance will help ensure safe barriers in houses, protecting all users but especially children.

MANY RESIDENTIAL BUILDINGS built in New Zealand must have protective barriers to prevent a person from falling or to retain, stop or guide someone.

These are required to meet the performance criteria prescribed in Building Code clauses B1 *Structure*, B2 *Durability*, D1 *Access routes*, E2 *External moisture*, F2 *Hazardous building materials* and F4 *Safety from falling*. Not all of these will apply for every barrier installation.

Designers must evaluate risks for each situation

Designers must evaluate which risks are attributable to any situation where a barrier is required to prevent a fall of 1 m or more. Although the Building Code does not require a barrier where the fall is less than 1 m, where barriers are installed in these circumstances, certain Building Code requirements will still apply, such as clause F2 *Hazardous building materials*.

Barriers must be designed to withstand the loads they are likely to experience without collapsing or becoming unstable and without deflecting unacceptably.

Clause F4 requires that they are also continuous and extend for the full extent of the hazard. Barriers must also be sufficiently durable to function as required throughout their intended life without the need for major renovation or reconstruction.

When the barrier installed incorporates a proprietary balustrade system, the manufacturer must provide evidence that the system meets the requirements of the Building Code. If the proposal is a specific engineered design, the engineer must provide producer statements for both design and subsequent construction compliance.

Minimum barrier heights vary

Minimum barrier heights are listed in Acceptable Solution F4/AS1 Table 1. For detached dwellings and within household units of multi-unit dwellings, barrier heights to:

- ramps and stair/landings must be 900 mm minimum
- balconies and edges of internal floors or mezzanine floors must be 1000 mm minimum ➤

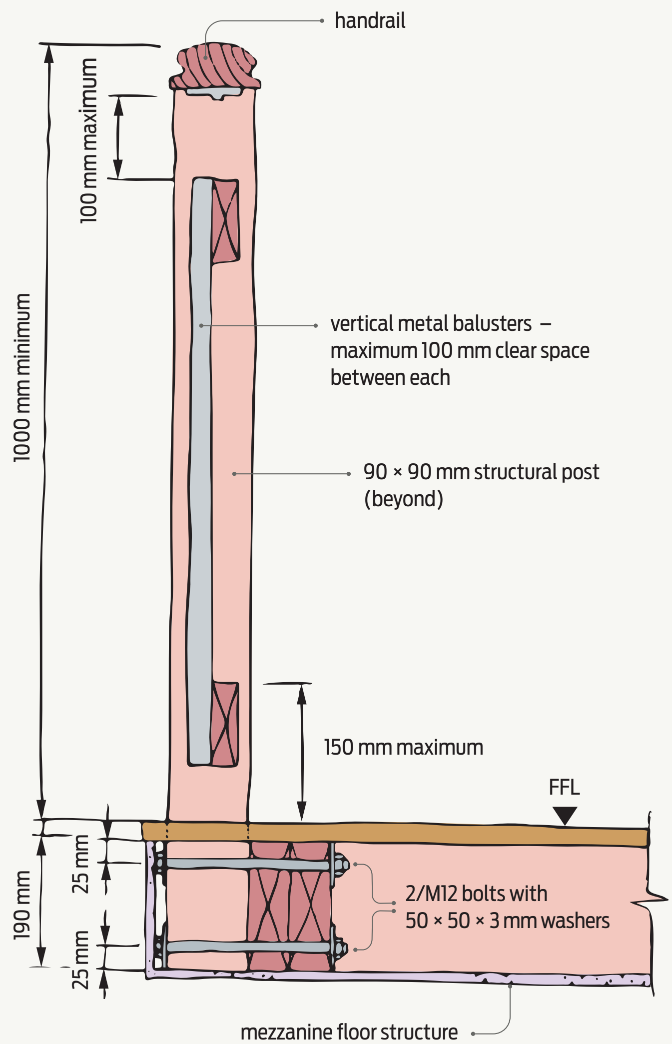

Figure 1 Typical barrier to interior residential mezzanine floor.

- common areas of multi-unit dwellings ramps and stair/landing barriers must be 900 mm minimum
- other locations must be 1100 mm minimum.

Barriers may be constructed of glass, timber, metal, concrete or combinations of these systems.

Stop falling or children climbing over

Buildings classified as housing are likely to be regularly used by children under 6 years of age. The barrier geometry and infill construction serve the dual purposes of preventing a person from falling through the barrier and restricting a child from climbing on or over the barrier. To do this, the barrier:

- must not provide toeholds between 150 and 760 mm above the finished floor level and offer no easy or obvious means of climbing
- must not have any openings over the full height of the barrier that would allow a 100 mm diameter sphere to pass through.

Examples of complying barriers are shown in Figures 1 to 3 in Building Code Acceptable Solution F4/AS1. While vertical balusters and inclined rails are relatively difficult for children to climb, solid infill panels are even more difficult. Consequently, solid infill panels may provide a better solution for barriers in areas with children.

Working out barrier design loadings

Designing the barrier to prevent a person from falling through is a more complex engineering calculation.

Design loadings

The main reference document is AS/NZS 1170.1:2002 *Structural design actions – Part 1: Permanent, imposed and other actions*. Section 3.6 specifically addresses the design of barriers, together with members and connections that provide structural support to sustain the imposed actions given in Table 3.3 *Minimum imposed actions for barriers*.

Design loadings for barriers in areas of domestic and residential activity are tabulated, and the range for the crucial top edge horizontal force varies from 0.35 kN/m to as high as 3.0 kN/m of barrier length.

For domestic and residential buildings, Table 3.3 makes a distinction for the magnitude of loads between barriers within a single dwelling and in multi-unit or group residential dwellings, specifically where areas may be susceptible to overcrowding.

Choose the right occupancy classification

The magnitude of the barrier loads that need to be applied in the design depends on the occupancy of that part of the building or structure.

It is critical to select the correct occupancy classification when designing barrier elements. This is the responsibility of the owner/designer to determine. If there is any doubt regarding the appropriate occupancy, it is recommended that the designer seek the advice of the building consent authority.

Useful reference document to help

MBIE provides an invaluable document – *Guidance on barrier design* – to facilitate the interpretation of the standard and the detail design of barriers in the various situations where their use is required.

Remember the supporting structure

Finally, when determining the barrier geometry required, consider any potential limitations imposed by the supporting structure and substrate. These limitations may include factors such as the floor, substrate structure and post positions.

Barriers need to be designed and constructed so that they can provide the strength and stiffness required for the proposed location and occupancy. Therefore, the supporting structure must also have adequate strength and stability to safely sustain all applied loads without excessive stress, deflection or distortion.

Fixings and connections

The fixings and connections securing the barrier system to the supporting structure must have at least equivalent strength to that of the rest of the barrier system.

It is recommended that all member joints in the barrier be designed to provide the full strength of the members being connected. This is to ensure that, under extreme loading, the barrier will indicate failure by deflection and distortion rather than by rupture and sudden collapse, as would occur by failure of a fixing or connection.

When designing fixings, the strength and properties of the substrate must be considered. The substrate, including material and strength and fixing (type, edge distance and spacing) all affect the capacity of the connection.

When details illustrating the capacity of the fixing to substrate connection cannot be confirmed with reasonable accuracy, load testing should be carried out to validate the design. This is often the case when the substrate is existing, and of unknown strength.

General safety details of the barrier should also be considered. The barrier should have no sharp edges or projections that could cause injury when restraining people . Also think about mitigating the possibility of tampering and vandalism when designing for safety.

Compliance documentation

Make sure that any producer statements used (such as PS1) are site and job specific. Ensure that the PS3 and PS4 provided are for the same system as approved on the building consent documentation for the project.

Be prepared to provide any other evidence and documentation to show that the barrier is compliant.

Leave details for ongoing maintenance

A frequently overlooked aspect is the ongoing maintenance of the barrier system.

Make sure the manufacturer's requirements for maintenance are known and recorded.

It is especially important that the property owner is notified of the maintenance requirements. This is to ensure that a well-designed and constructed safety barrier continues to function and protect the users of the building and remains fit for purpose for the duration of its expected life.