

DESIGNING SAFE BUILDINGS

More people are injured in their homes than on the road or playing sport. So how can we design buildings and their surroundings to be safer?

By Trevor Pringle, BRANZ Principal Writer

New Zealand has a high number of in-home injuries. A slip, trip or fall injury occurs every 3 minutes of every day. This affects around 400,000 adults and children each year – more than all sports and road injuries and about the same as workplace injuries. Approximately 550 people are admitted to hospital each year for treatment of scalds from hot liquids or vapours. There are also a small but significant number of fatalities from domestic fires. Other hazards include breaking glass or swimming pools. Here we summarise some accident prevention requirements for building design.

High-risk slippage areas

Slips usually result from wet or greasy surfaces, shiny floors, stair edges with no grip or smooth-soled footwear. Even dry floors can be slippery if they have loose floor coverings or are of polished tile, stone/concrete or gloss timber. Most slips result in loss of balance and a fall.

A coefficient of friction not less than 0.4 (see Building Code Clause D1/AS1, 2.1.1) is mandatory for the:

- deck, patio and steps on the access route to the main entrance of stand-alone domestic buildings
- common areas of communal residential and multi-unit dwellings.

Stairs are the only floor surface within individual dwelling units that have a mandatory slip resistance requirement. However, spaces with a higher risk of slipping include:

- kitchens, laundries and bathrooms
- inside and outside entry points
- paths and driveways
- decks and balconies
- stairs and outdoor steps.

Shiny floors and smooth timber decking can be slippery when wet. Grooved decking has better slip resistance when the direction of travel is at right angles to the grooves – when the travel direction is parallel to the grooves it is actually more slippery because there is less contact area between shoes and the ridges.

ACHIEVING SLIP RESISTANCE

To achieve satisfactory slip resistance around the home, BRANZ recommends that the coefficient of friction should be no less than:

- 0.4–0.6 where there is high risk, as in showers or swimming pool surrounds (because users tend to have bare feet or move fast around the pool)
- 0.4 where the floor surface is likely to have water on it during normal use, such as:
 - floor areas adjacent to external doors
 - changing or drying areas immediately adjacent to a shower
 - bathrooms



The minimum requirements for barrier construction are covered in F4/AS1.

- kitchens
- decks and balconies.
- 0.25 for all other areas that remain permanently dry. This is generally considered the minimum coefficient of friction necessary to provide a relatively safe non-slip floor surface.

Barrier provision and design

Building Code Clause F4 *Safety from falling* sets the requirements to prevent injury to occupants as a result of falling (1 m or more) from elevated structures. F4/AS1 sets out the minimum requirements for heights, maximum opening sizes and other critical dimensions for barrier construction.

Barriers should:

- be continuous and extend for the full length of the hazard →



Grade A safety glass is required in places that may be subject to human impact, such as sliding doors and glass barriers.

- be a minimum height of 1 m
- have adequate rigidity
- have enough strength to withstand human impact and, where required, the static force from people pressing against them – refer to current loadings standards such as AS/NZS 1170.1:2002 *Structural design actions – Permanent, imposed and other actions* for specific design criteria or B1/AS2 for an Acceptable Solution
- prevent people, including children, falling through or climbing over them.

Handrail design

Graspable handrails are essential safety features for all stair and ramp design. Accessible stairways must have handrails on both sides; all other stairways with 2 or more risers that are less than 2.0 m wide must have at least one handrail. A stairway with no more than 3 risers that gives access to a household unit is an exception to this requirement and does not require a handrail. Where any stairway is wider than 2.0 m, handrails are required on both sides, and when the width exceeds 4.0 m, a central handrail is also needed.

Stair handrails must be between 900 mm and 1.0 m high measured from the pitchline and must have the same slope as the pitchline. BRANZ

recommends a handrail height of 930 mm. Handrails must be continuous from the top to the bottom of each flight, and for accessible stairways, must extend horizontally for 300 mm beyond the top nosing and the bottom riser. These extensions serve as locating aids to sight-impaired people and as a balancing aid to ambulant people with disabilities.

The handrail shape should have a profile with dimensions shown in Building Code D1/AS1 Figure 26 to allow it to be easily grasped. It should be securely fixed so that a person's hand will not contact adjacent walls, supporting brackets and fixings, or any other obstructions. Handrail materials should not get excessively hot or cold.

Hot water storage and delivery temperatures

The New Zealand Building Code requires stored hot water to be kept at a temperature that prevents the growth of *Legionella* bacteria. The water must be heated to at least 60°C once a day to neutralise the bacteria and provide safe hot water. However, hot water delivered straight from the heating appliance (whether storage or continuous flow) can cause serious burns. The greatest risk is to children, who have sensitive skin, and to the elderly, who have slow reaction times.

To reduce the risk of scalding, the Building Code requires hot water to be tempered so that it is delivered to outlets (baths, basins, showers) at:

- 45°C in retirement homes, schools and early childhood education centres, hospitals and other institutions
- 55°C in other buildings.

Fire and fire risk

The Building Code requires that smoke alarms be installed in all new dwellings and for any renovation requiring a consent. For preference, these should be mains wired rather than battery powered.

Other design considerations for enhancing fire safety should include:

- avoiding a single point of exit from the building
- selecting finishes, fabrics and furnishings to minimise flammability
- installing sprinklers in buildings remote from the local fire service.

Glass selection

Injuries caused by breaking glass can be horrific. Acceptable Solution F2/AS1 requires glazing likely to be subject to human impact to comply with NZS 4223.3:1999 *Code of practice for glazing in buildings – Human impact safety requirements* as modified by Paragraph 1.2 of the Acceptable Solution.

This means grade A safety glass (toughened or laminated) is typically required (refer to F2/AS1 and NZS 4223.3 for full details) in:

- shower doors and screens
- sliding doors
- glazed hinged doors and side panels
- low-level glazing
- floor to ceiling glazing
- large mirrors
- glazed panels that can be mistaken for an open or unimpeded path of travel
- window seats
- glazing within 2 m of the floor (in bathrooms, within 1.5 m of the floor)
- glass barriers
- roof glazing.



Fencing round a swimming pool must be permanent and comply with NZS 8500:2006.

Glass can also be made safer if it is made more visible by the addition of transfers or branding.

Fencing to swimming pools

The Fencing of Swimming Pools Act 1987 promotes the safety of young children by making it compulsory for all pools to be fenced. NZS 8500:2006 *Safety barriers and fences around swimming pools, spas and hot tubs* clarifies the requirements of the Act by defining such things as 'the immediate pool area'. The fencing must be permanent and comply with NZS 8500:2006.

A pool is defined as any excavation, structure or product that is used, or is capable of being used, for the purpose of swimming, wading, paddling or bathing. This includes spa pools and hot tubs. Excavations, ornamental or indoor pools containing more than 400 mm of water also meet this definition and so are required to meet the fencing requirements.

Access to the house from outside shall not be through the immediate pool area, except by special exemption from the Building Consent Authority. Where the wall of a house forms part of the isolation barrier (including internal walls where the pool is partially or fully enclosed), it may include a door with a child-proof door set or a child-resistant openable portion of a window. ◀