

SNZ HB 4102:2011

New Zealand Handbook

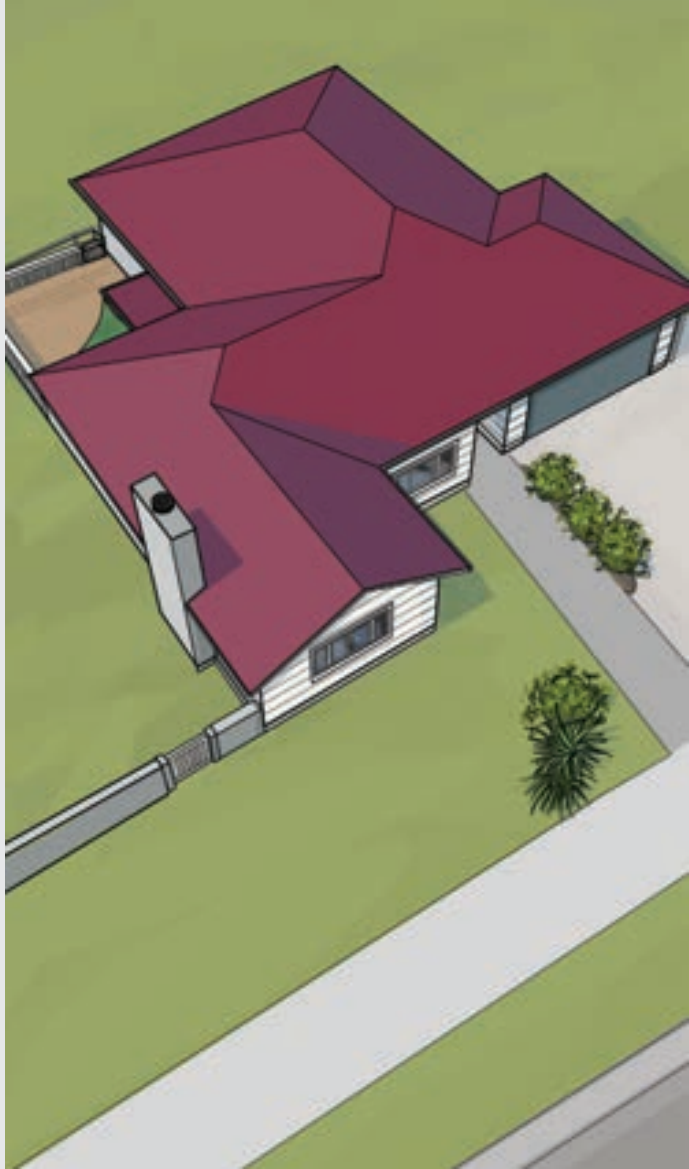
# Safety in the home

A guide to reducing injuries through home design, building, and maintenance

Superseding NZS 4102:1996



SNZ HB 4102:2011



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New Zealand Handbook

# Safety in the home

**A guide to reducing injuries through home design, building, and maintenance**

Superseding NZS 4102:1996

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## NOTES

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## Foreword

In New Zealand more people are injured in the home than any other environment. On average 12 New Zealanders lose their lives every week as a result of accidents they have at home and many more people are seriously injured (Source: Safety NZ Week 2010). Beyond the personal costs for individuals, families, and friends that these injuries and deaths cause, there is also a social and economic toll to home injuries. According to a report published by the University of Otago, Wellington in 2011 the social costs of injury in the home are about \$13 billion a year.

This guide has been developed to address this issue by reducing hazards in the home through better design, building, and maintenance.

This easy-to-use guide provides a general overview of steps that can be taken through design, building, and maintenance to reduce hazards in the home. The guide is recommended for people who undertake do-it-yourself projects, homeowners, tenants, and real estate agents, as well as a wide range of people in the building industry such as builders, architects, engineers, plumbers, electricians, glaziers, and landscapers.

In discussing common safety hazards in the home, the guide identifies what actions are required under the New Zealand Building Code (NZBC) or other legislation. It also provides design, building, and maintenance recommendations that are beyond minimum legal requirements, but are considered good practice for reducing hazards in the home. It is strongly recommended that when undertaking a building or major home renovation project certified professionals should be consulted with through the design and building process.

As part of the scoping review for the guide, it was agreed a series of brochures should also be produced for consumers to promote awareness about safe home design, building, and maintenance practices. These consumer brochures are to be available online at no cost through the ACC website and, while supplies last, in hard copy through various home improvement stores.

This guide has been completely revised from the previous NZS 4102:1996.

## Outcome statement

By using a guide that promotes practical form and functional design, in addition to the minimum requirements of relevant legislation, injuries will be reduced in the home environment.

## Abbreviations

The following abbreviations are used in this guide:

°C	degrees Celsius
CCA	copper, chromium, and arsenic
CO	carbon monoxide
CO <sub>2</sub>	carbon dioxide
EPOD	electrical portable outlet devices
ha	hectares
HRV units	heat recovery ventilation systems
IGU	insulated glass unit
kg	kilogram
LED	light-emitting diode
LOSP	light organic solvent preservative
m	metre
mm	millimetre
NZBC	New Zealand Building Code
PVC	Polyvinyl Chloride (thermoplastic polymer)
RCBO	residual current breaker with overload
RCCB	residual current circuit breaker
RCD	residual current device

# 1 Site layout

## 1.1 General

Site layout is an important consideration when building or renovating a home. To ensure a healthy and safe living environment, factors such as the location of the sun, and the prevailing wind direction need to be considered.

Layout considerations should also include placement of children's play areas, indoor to outdoor flow, landscaping, position of driveway, and street access. As a general rule, access around a home needs to allow for general maintenance, with room for ladders, scaffolding, repair work, and window washing.

Many new homes in New Zealand are sold as a package design or as a prefabricated unit transported to the site. The suitability of any individual site for a building should be considered in relation to the type of home intended to be placed on it.

### PASSIVE DESIGN

Passive design is the control of ventilation and temperature without using any products that consume energy (such as heaters, dehumidifiers, fans, or fires). (See 2.9 for more on passive design.)

Good passive design involves making a number of decisions at the site layout stage, including:

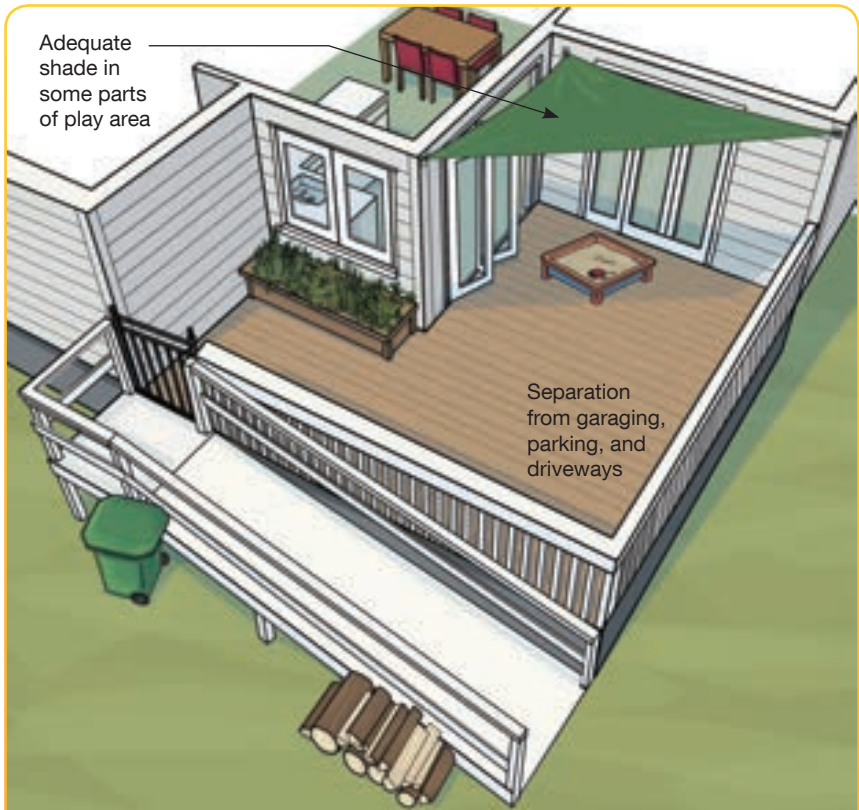
- (a) **home orientation** – for example, positioning the home to allow maximum sun in the winter and coolness in the summer, and deciding which rooms are to be the sunniest
- (b) **renewable energy** – for example, using photovoltaic (solar) and wind energy
- (c) **use of shading elements** – for example, wide eaves provide sun protection in summer and provide increased weather protection in winter
- (d) **placement and glazing of windows** – for example, larger windows should face the sun to capture the warmth and insulating glass can be used to stop heat escaping.

## 1.2 Children's outdoor play spaces

Children visit or live in most homes. At the site layout stage good planning is important to ensure a safe and usable play space. Homes should be placed on the site so that there are suitable play areas for children of various ages and abilities, including children with disabilities (see Figure 1).

Things to consider when siting play areas include:

- (a) separation from garaging, parking, and driveways
- (b) sun especially at times of day when children are likely to be playing outside
- (c) shelter from the wind
- (d) adequate shade in parts of the play area  
NOTE – Shade structures, such as shade sails, need to be securely tied down to reduce hazards.
- (e) level ground at least in some parts and easily accessible to children and adults with disabilities
- (f) good drainage
- (g) supervision of play area from inside, from areas such as the kitchen and living room
- (h) separation from any electrical hazards, vents of on-site effluent treatment systems, and outdoor cooking areas (such as barbecues)
- (i) non-poisonous plants
- (j) separation from the garden, wood or tool shed
- (k) separation from rubbish storage areas
- (l) **a barrier, such as a fence, or some other means of restricting child access, shall be provided to any pool, and should be provided for any structure or excavation capable of containing water (such as fish ponds, gully traps, and open drains). (See 10.4 and refer to NZS 8500.)**



**Figure 1 – Suitable outdoor play space for children, visible from kitchen, living, and dining areas**

Copy

## 1.3 Home entries

### 1.3.1 Away from driveways

To reduce the likelihood of injuries involving vehicles, it is recommended the main entrance of a home is separated from the driveway. Use different surface treatments for driveways and pathways to provide a visual and physical separation.

### 1.3.2 Exposed entrance

Entries exposed to the prevailing wind and rain may cause a person to hurry on slippery surfaces or up or down any outside steps greatly increasing the chance of slips and falls. It is recommended that entries to the home should not be exposed to the prevailing wind and the possibility of driven rain.

### 1.3.3 Slip-resistant walking surfaces

Consider materials that provide adequate slip-resistant walking surfaces under all conditions of normal use (see Appendix A).

### 1.3.4 Stepless entrance

At least one stepless entrance is essential to enable people with disabilities to safely and independently enter and leave a home. (See section 4.)

Other benefits of a stepless entrance include:

- (a) easier to move furniture and appliances in and out
- (b) easier to use baby strollers and wheelchairs.

When designing or redesigning entry ways consider creating a stepless entryway with materials (such as brick and concrete) that are integrated into the landscaping to create a seamless entry into the home.

It is important to note that depending on how stepless entries are constructed, however, they may make the home more susceptible to water entry. It is strongly recommended that homeowners engage a competent architect or designer to advise them on how buildings should be designed and built to achieve weathertightness. (See 2.15.)

When a stepless entrance is not possible, entries should have stairs that:

- (a) provide a uniform rise and tread within each flight and for consecutive flights
- (b) have a leading edge that can be easily seen
- (c) are constructed so that children are not able to fall through spaces or become stuck
- (d) have handrails that are easy to reach and grasp, and are strong.

See 1.11 for additional information on external steps.

### 1.3.5 Visibility

Public visibility of entrances can allow observation by neighbours and discourages intruders. For this reason, a home should be oriented on its site so that entries are visible from the street.

## 1.4 Exterior decking and balconies

The position of the home in relation to sun and boundaries will generally dictate the size and shape of the deck. There may be local authority restrictions on how much ground a deck can cover. Other matters to consider are shading and shelter from the prevailing wind. (Refer to NZS 3604 and see 2.3 and 4.2.)

Certain types of decks and balconies are at risk of rotting when water has leaked into them. This may cause the structure to become unstable and dangerous. The main concerns about leaking are with certain types of timber construction. Unless correctly designed, constructed, and maintained, water may leak in behind the cladding or through the waterproof surfacing and create conditions that encourage timber to decay and fasteners to corrode. (Refer to New Zealand Building Code (NZBC) Compliance Documents for E2 External Moisture and B2 Durability. Refer also to NZS 3604.)

Build decks and balconies with a slope to allow water to run off to a collection point such as a downpipe. Drainage outlets must be kept clear of leaves and other items that might block them.

## 1.5 Exterior lighting

### 1.5.1 Diffused light

Lighting of paths and steps should deliver adequate diffused light at ground level. (See 5.9.5 and refer to NZS 6703 and AS 4299.)

Dispersed light sources are preferred. Intense light sources should be avoided for uses other than security lighting. This is because intense lighting can reduce visibility by causing glare and casting deep shadows onto step treads.

### 1.5.2 Location of external lighting

Exterior circulation routes, especially in areas with exterior steps, should be lit. Lighting for exterior steps should fall directly on the treads, preferably from below handrail level. Lighting is important in areas that are used for barbecuing or outdoor living areas so that people can see and stay away from hot equipment. The greatest intensity of light should be at work surfaces where food is being prepared and at ground surfaces used as assembly areas and major thoroughfares.

To avoid the potential for temporary blindness, light fittings should be positioned so that the light bulb filament is not directly visible to the naked eye.

### 1.5.3 Lighting control

Lighting between the home, parking, and garaging should be controlled by two-way switching or motion sensors, and light switches located outside should have appropriate protection from the weather. (See 5.9.5.)

## 1.6 Foundations

### 1.6.1 Access

Easy access to the subfloor can reduce injuries and makes it easier to maintain this important part of a home. For this reason, suspended wooden or wood-based floors should have an access door or be open to provide for subfloor access. Access should be secured so that unsupervised children and pets do not get into this space.

### 1.6.2 Slope

**Ground levels shall allow ground surface water to flow freely away from the home and not flow under it.** Sometimes kerbs, cut-off drains, and subsoil drains are needed to divert water away from the home. (Refer to NZS 3604 and the NZBC.)

To reduce moisture build-up in subfloor spaces, foundations should be built on gently sloping ground. This ensures that water does not collect and remain under the home. Landscaping should be arranged so that water is prevented from flowing under the home and is instead directed around the building and off the site. A gentle slope also allows ground surface water that does flow under the home to flow through under gravity.

## 1.7 Landscaping

### 1.7.1 Proper ventilation

When landscaping, maintain vents around the perimeter of the building to allow for adequate subfloor air flow. (Refer to NZBC Compliance Document E2 External Moisture.) Good air flow reduces moisture build-up in subfloor spaces which can help reduce the risk of illness.

### 1.7.2 Reduce break-ins

Landscaping should be planned and maintained to reduce the opportunity for intruders to hide on the site.

### 1.7.3 Reduce falls

To reduce dangerous falls, use slip-resistant materials near barbecue grills and outdoor eating areas. (See Appendix A.)

### 1.7.4 Reduce fire risk

Make landscaping choices that reduce the chance of the home acting as fuel for fire, especially if the home is in a rural setting. The choice of plants and their spacing can help reduce the threat of fire. Talk with a qualified landscape designer for suggestions.

## 1.8 Orientation

Cold and moisture in a home can lead to the growth of moulds which can lead to illness. If building or altering a home the risk of mould growth can be reduced by orienting the home to receive the right amount of sun (this will vary depending on where the home is located). The home should also be oriented so that it is protected from strong winds while still being able to take advantage of gentle breezes for ventilation. (See 2.9.)

Consult with a professional expert when determining the orientation of a new home or potential ways to take advantage of the orientation of an existing home.

## 1.9 Glazing

The amount of glazing required for a home will depend on site orientation, the climate, the view, how well insulated a home is, and how energy efficient the glazing is. (Refer to NZBC Compliance Document H1 Energy Efficiency and NZS 4218. See also 2.8 and 3.6.)

When renovating there may be ways to improve the use of sun, including increasing the size of north-facing windows and the thermal performance of the glazing. Consult with a professional expert on glazing needs when renovating or building. More information can be found at [www.branz.org.nz](http://www.branz.org.nz).

In general, the direction a room faces can make a difference to the amount and type of glazing that should be used.

### 1.9.1 East facing

East-facing glazing captures morning sun. The number and size of windows may vary based on the need for natural light, heat, and ventilation in summer. East-facing rooms are often considered best for kitchens and breakfast eating areas.

### 1.9.2 North facing

To make the most of the sun for warmth and natural light, a home's main living areas and glazing (such as windows, skylights, and glass doors) should face north.

### 1.9.3 South facing

South-facing glazing receives the least amount of sun. South-facing glazing should be insulated glass units (IGUs) to avoid head loss, while south-facing rooms are often the coolest in the home and best for bedrooms.

### 1.9.4 West facing

Plan for solar-control glazing in west-facing rooms as there is greater potential for glare and overheating from the late afternoon sun.

## 1.10 Energy sources

If possible, energy sources for the home should be decided at the site layout stage. While this guide is focused on safety in the home, it is suggested that efficient and renewable energy sources be considered. Discuss options, including any safety considerations, with an expert. For more information visit [www.eeca.govt.nz](http://www.eeca.govt.nz). (See 1.1, 1.8, and 2.9.)

To learn more about electricity see section 5.

## 1.11 Paths, paving, and steps

To reduce tripping, slipping, and falling hazards on outdoor paths and steps a number of factors should be taken into consideration including location, materials, and slope. Refer to NZS 4121 for additional information on designing for access and mobility.

### 1.11.1 Location

Paths should not be placed directly under outward opening windows, shutters, or awnings unless a minimum 2.1 m head height clearance on the path is provided. In existing homes with outward opening windows with less than a 2.1 head height clearance over paths consider window restrictors or changing windows to sliding sash. Alternatively, consider plantings or other barriers that would limit people from unintentionally colliding with the open window.

Paths should be separated from driveways and parking areas. This can be achieved through creating a garden barrier or ensuring that the surface material for paths is different from the surface material used for vehicle areas.

### 1.11.2 Maintenance

Paths and steps should be maintained free from moss and mould to reduce the risk of falls. There are a number of treatments and products available to assist with this maintenance.

### 1.11.3 Materials

Stable material such as slip-resistant concrete, asphalt, perforated rubber or plastic matting, and outdoor carpet are preferable to gravel or other loose granular materials. Surface slip resistance degrades significantly in areas where snow, ice, or frost occurs. (See Appendix A and refer to AS/NZS 3661.2.)

Paths should be even and have a textured slip-resistant finish, such as concrete with a soft broom finish. Surface U5 described in NZS 3114 is one example. (See Appendix A and refer to NZBC Compliance Document D1 Access Routes.)

#### 1.11.4 Slip resistance

All exterior surfaces should be slip resistant, stable, and free draining to shed water away from the home. There should be no gaps between exterior steps and the face of the building, other than to allow water to drain away. (See Appendix A.)

#### 1.11.5 Slope

Where practical, exterior path slopes should not exceed a slope of 1 in 12, and should have a surface texture that will minimise slippery conditions. This will safeguard from trips and falls and make paths more accessible to older people and people with disabilities. Refer to NZS 4121 for additional information on designing for access and mobility.

Exterior steps and slopes of a rise steeper than 1 in 20 should be provided with a secure handrail from 850 mm to 1000 mm from the slope or the pitch line of the steps.

Crossfall slope should be 1:50 and consistent across the full width of the path surface.

Exterior steps should be avoided if a ramped slope of no steeper than 1 in 14 and 3 m long is achievable.

#### 1.11.6 Steps

Steps can be a safety hazard, although well-formed steps are safer than steep ramps. It is sometimes possible to eliminate exterior steps through landscaping, even to homes with suspended timber floors, while remaining mindful of a building's exterior wall cladding weathertightness requirements and any subfloor air-flow requirements. (See section 4.)

Nosings of exterior steps should be clearly visible by the use of colour contrast. White is often used, but yellow is often easier to see. If paint is used it should have a slip-resistant coating.

Single steps are difficult to see. Groupings of stairs have a greater visual presence and reduce the potential for user misperception of a small change in level. Exterior steps should be grouped in flights of three or more steps.

To reduce the chance of children falling down stairs, steps with a rise of over 1200 mm should incorporate a stair gate.

The NZBC Compliance Document D1 Access Routes, Acceptable Solution 1, comments that a riser variation of more than 10 mm can cause someone to stumble. To minimise this, exterior steps should have a variation of riser height in any flight of no greater than 5 mm.

#### **1.11.7 Visual or physical cues for steps and slopes**

Weather conditions and variable outdoor lighting can greatly impact on a person's ability to see slopes and steps. For this reason visual cues help to make people aware of a change in surface. For people who are visually impaired, textural changes in surface finish can provide an important cue of the proximity of steps or a change in slope.

Steps and slopes should be distinguishable from level surfaces by adding a handrail or changing the surface colour or type of paving. A vertical element such as a lighting post can serve as a visual cue to the existence of a change in slope.

#### **1.11.8 Width**

Where practical, a width of 1200 mm is recommended for all exterior paths and paving. This improves access to the exterior of the home for maintenance and for more efficient movement of goods and maintenance materials.

## 1.12 Retaining walls

Retaining walls may be used to hold up unstable banks. They can also be used to terrace a sloping section of a site. It is important to get engineering advice about designing and building a retaining wall, such as foundations, drainage, and other engineering issues.

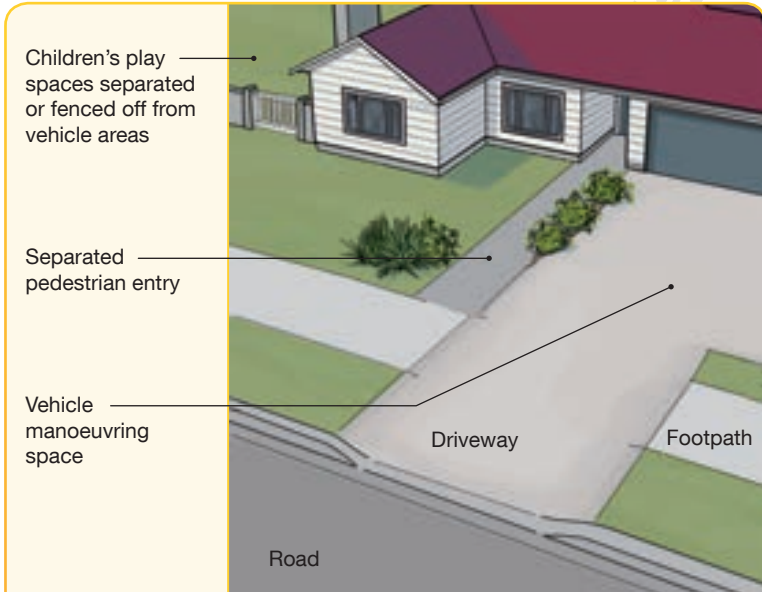
There are a number of inherent safety risks with retaining walls including individuals falling from the top or being injured if the wall slips or falls. A safety barrier may be required under NZBC Compliance Document F4 Safety from Falling where there is a fall of 1 m or more. Ideally, all retaining walls on a site should have a protective barrier along the top to reduce falling.

Factors to consider include:

- (a) how accessible the retaining wall is
- (b) the purpose and use of the retaining wall
- (c) whether the top of the wall is frequented by young children.

### 1.13 Vehicle access

Garages, driveways, and parking areas, should be separated from children's play areas. (See Figure 2.)



**Figure 2 – Separation of vehicle and pedestrian uses of site**

Driveways and parking areas should be clearly identified and the following done where possible.

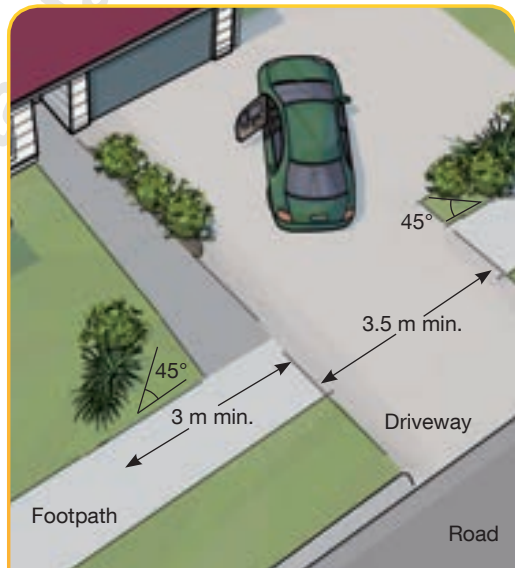
- Vehicle access routes should allow a vehicle to be driven on and off the site rather than having to be reversed on or off it.
- The entry to a driveway should not be located immediately adjacent to a side boundary. This is because visibility will be reduced if a fence is built or if a neighbour builds or plants on the boundary.
- Fencing should allow for the visibility of children, particularly between the driveway and the footpath. If it is necessary to fence immediately adjacent to the driveway, then consideration should be given to reducing the height of the fence on any corners between the driveway and boundary.

- (d) Vehicle crossings of footpaths and kerbs should allow a line of clear sight between vehicles using the driveway and pedestrians on footpaths and vehicle and bicycle traffic on roads.

If possible, vehicle crossings of kerbs and footpaths should allow for a vehicle to pause safely on a relatively flat gradient before crossing the kerb or footpath. There should be a level area at least 3 m, and preferably 5 m, long at the end of a sloping driveway to allow a vehicle to approach the crossing with adequate caution. NZBC Compliance Document D1 Access Routes, Acceptable Solution 1 requires a 6 m space with a maximum gradient of 1:20.

**Vehicle driveways and access shall be at least 3.5 m wide. (See Figure 3.) This width will allow access by emergency vehicles and allow any motor vehicle to fully open one of its doors.** (Compliance Document D1 Access Routes, Acceptable Solution 1, requires 3.5 m minimum width, for one-way circulation and 6.5 m minimum width, for two-way circulation.)

Vehicle garaging or parking should be located as close as possible to an entry to the home, and direct, covered, and adequately lit access from the garage to the home is preferable. (See 1.5.)



**Figure 3 – Visibility factors at driveway entrance**

## REDUCING THE RISK OF CHILD DEATH AND INJURY IN DRIVEWAYS

According to recent research, the risk of child death and injury from being driven over by a slow-moving vehicle is increased with:

- (a) a driveway length of greater than 12 m
- (b) more parking areas on the property (accessed from the driveway)
- (c) a driveway running along the property boundary
- (d) a driveway exiting directly onto a local road or cul de sac.

The presence of a separate pedestrian pathway to the home is associated with a decreased risk in child death and injury.

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*Source: Shepherd, M. et al 'Driveway runover, the influence of the built environment: a case control study'. Journal of Paediatrics and Child Health. December 2010.*

### 1.14 Wing walls or other features

To prevent unintended and unsafe access to the roof, wing walls or similar building features should not be used.

### 1.15 Other outside amenities

#### 1.15.1 Barbecues and outdoor cooking

Barbecues and other outdoor cooking or heating devices should not be accessible to young children when in use. Do not locate barbecues within children's play spaces.

Generous circulation spaces should be provided around exterior cooking areas. Place barbecues on level ground to reduce the risk of them falling onto people while in use.

If using wood ensure it is only clean-burning and dry and extinguish fires after cooking. If having a hangi, umu, or open fire check with your local authority to ensure a fire ban is not in place. Do not light fires within 3 m of property boundaries, buildings, trees, hedges, and shrubs.

### 1.15.2 Clothes lines

If on an access route, clothes lines are required to be located at a height above ground to provide adequate head clearance and to prevent a strangulation hazard to children. NZBC Compliance Document D1 Access Routes, Acceptable Solution 1, states that this height is 2100 mm. Fix adjustable height clothes lines so the lowest height adjustment is at least 1200 mm above ground level.

As people are often carrying laundry baskets, avoid steps on the access route from the laundry to the clothes line to minimise the risk of trips and falls.

### 1.15.3 Electrical and gas socket-outlets

Electrical socket-outlets outside or in a garage or workshop should be protected by a residual current device (RCD). RCDs provide additional protection for people using electrical appliances in these spaces or outdoors, especially in wet conditions. (See section 5.)

Ensure all outdoor electrical and gas socket-outlets have waterproof covers.

### 1.15.4 Incinerators

Incinerators are allowed only in rural areas. **Check with the local authority to find out what the rules are in your area.**

As a general rule, incinerators must be 3 m from the property boundary and 12 m from any building to minimise the risk of uncontrolled fire. Incinerators should not be accessible to young children and should be located outside areas where children play.

There should be adequate water supplies available to put out an uncontrolled fire. Incinerators should be supervised while in use.

### 1.15.5 Meters

Placement of electric, gas, and water meters should ensure easy access for meter readers. (See 5.2.4.)

### 1.15.6 Sheds

Any shed or lockable outside unit where hazardous substances (including swimming and garden chemicals) and gardening implements are stored should have a keyed lock and be located as far away as possible from sources of ignition, such as electricity.

## 2 Structure design

Unintended injuries in a home can be greatly reduced if safety is considered at the building design stage. The phrase ‘structure design’ is used in this guide to refer to general design principles for homes and associated structures such as decks and sheds.

New Zealand’s geography and weather patterns exert many natural forces on our buildings. These forces must be considered during the manufacture, use, and maintenance of building materials. Good design will consider how to resist these forces to ensure a safe and healthy home environment. Check the appropriate district plan for more information, particularly to learn about special design and building considerations for areas that may be prone to flooding, tsunami, or other conditions.

Some of the many forces acting on homes in New Zealand that should be considered at the design, building, and renovation stages include the following.

- (a) **Wind** – New Zealand is in the ‘roaring forties’ latitudes and experiences strong winds. This, combined with high rainfall, places a lot of stress on our buildings. Wind can cause movement in building structures and pressure differences can cause moisture to be forced through quite small gaps.
- (b) **Temperature** – Although New Zealand has a temperate climate, temperature changes can still occur quite quickly. These temperature changes cause building materials to expand and contract at different rates. This places stress where materials with differing rates of expansion and contraction meet, for example, aluminium window frames with timber trims.
- (c) **Moisture** – When absorbent building materials (for example, timber) become wet or their moisture content changes due to humidity, they will expand. Different materials expand and contract at different rates. As with temperature, this causes stress where different materials meet.



- (d) **Earthquakes** – New Zealand experiences frequent earthquakes. Our homes are designed and built to reduce the effects of earthquakes. At times, however, earthquakes may cause joints to open up and cracking to occur in the structure.
- (e) **Salt-laden air** – Most New Zealanders live relatively close to the coast. Buildings within 500 m of the coast are subject to some salt-laden sea spray. Even buildings further inland (up to several kilometres) can be subject to moderate amounts of salt-laden air. This means building materials need to be carefully chosen to prevent corrosion. Even quite durable materials will need regular cleaning to prevent film or salt build-up causing a breakdown of paint and other protective coatings. In geothermal areas the corrosive effects of sulphur must also be considered during the design process.
- (f) **Ultraviolet light** – The sun's ultraviolet light can cause the deterioration of many building materials. Plastics and paints are particularly vulnerable to deterioration by ultraviolet light.

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*Source: ConsumerBuild*

## 2.1 Chimneys (and other flues)

Ensure that solid fuel burning devices and their associated floor protectors and flue systems are installed correctly and safely, including minimum clearances from heat-sensitive materials and where flues discharge in relation to buildings. (See 2.10.1.2 and refer to NZBC and AS/NZS 2918.)

Contact the local building consent authority to learn requirements for installing solid fuel burning devices.

Secure chimneys to ensure safety during earthquakes and other natural disasters. If the home's chimney is brick, particularly unreinforced brick, contact a builder or structural engineer to check it to make sure it won't fail in an earthquake.

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*Source: Energy Safety and Department of Building and Housing*

## 2.2 Claddings

The main purpose of a home is to provide shelter to protect its inhabitants from the weather. The first line of defence against the weather is the outer skin, or claddings. How claddings are designed and applied to a home is important, because over a home's lifetime some water will inevitably get in. With good design this will be managed so that small amounts of moisture do not cause serious damage or risk ill health for residents. Under the NZBC, claddings have to meet performance requirements for the following.

- (a) Structural Stability (Clause B1)
- (b) Durability (Clause B2)
- (c) Means of Escape and Spread of Fire (Clause C3)
- (d) Ground or Surface Water (Clause E1)
- (e) Weathertightness or External Moisture (Clause E2)
- (f) Hazardous Building Materials (Clause F3)
- (g) Ventilation (Clause G4)
- (h) Interior Environment (Clause G5)
- (i) Airborne and Impact Sound (Clause G6)
- (j) Energy Efficiency (Clause H1)

## 2.3 Decks and balconies

**Build decks and balconies in accordance with the NZBC to ensure they are safe for people to use.**

A building owner needs to confirm whether a building consent for building work on a deck or balcony is required for compliance with local building consent authority requirements.

Rotting balconies, decks, and balustrades have been identified as significant safety hazards. Below are tips for reducing these hazards at the design and building stage. (See sections 1, 2.16, and 4.2.)

Decks or balconies that have a waterproof coating or membrane over them can become slippery when wet. ➤

To reduce slips and falls, incorporate:

- (a) sufficient slope so water drains off the surface and there are no areas of ponding
- (b) a waterproofing membrane or surface finish that provides good slip resistance when wet
- (c) a clearly defined entrance from the deck or balcony into the home.

### 2.3.1 Barriers

**Protect exterior decking and balconies by a barrier at least 1000 mm high to prevent climbing and the associated risk of falls. Where the hazard is extreme the balustrade should be at least 1100 mm high. (See 4.2.)**

Any change in deck or ground level should be protected with a barrier as small drops in level can cause falling and serious injury.

Balusters should be vertical. Balusters should have a maximum spacing of 80 mm between them to prevent the possibility of children squeezing between them.

### 2.3.2 Decks

If building a deck as part of a renovation, a building consent is required if the deck is more than 1 m above the ground. Contact the local authority for advice. Decks more than 1 m above the ground must have a barrier (of at least 1 m high – NZBC F4.3.1). The local authority will be able to advise about fencing requirements, any boundary restrictions, and any resource consents required. (See 1.4 and 4.3.)

Make sure the correct grade of timber treatment is used. Also ensure that there are the right gaps between decking boards (approximately 6 mm between decking boards and 12 mm between the deck and building walls). This is important to allow drainage and prevent rotting.

Use bolts and flashing suitable for decks and make sure barriers comply with the NZBC.

### 2.3.3 Balconies

There are important design and construction requirements for balconies to make sure they don't leak and rot, such as:

- (a) a step-down from the doorsill
- (b) a slope on the balcony floor
- (c) a gap between the balcony and the wall claddings
- (d) taking care around junctions to ensure weathertightness
- (e) using correctly treated timber.

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*Source: ConsumerBuild*

## 2.4 Eaves and gutters

Consider the design of eaves and gutters so they will efficiently channel water from the roof towards a downpipe which in turn carries it down to ground level and then into the drainage system. This system helps to stop the walls of the home becoming saturated and causing problems with dampness. (See 2.15 and refer to SAA/SNZ HB 114.)

## 2.5 Fire safety

Smoke alarms, sprinkler systems, fire-resistant materials, and designing for evacuation are some of the ways to make a home safer in the event of fire. Consider getting advice from an architect or builder to determine what warning system would be best for a specific home. (See sections 5 and 2.9.)

All new homes and consented alterations are required to have a 'means of detection and warning' in the event of a fire. Whenever work is carried out on a home that requires a building consent, to meet the requirements of the Building Act the whole home, not just the altered area, must be fitted out with a means of detection and warning of fire.

Fire mats and extinguishers are important to have in the kitchen. Make sure adults and older children in the home know how to use the fire extinguisher. It is also recommended that fire extinguishers be located in the garage and any workshop areas.

## 2.5.1 Smoke alarms

Smoke alarms are essential safety devices for the home. To learn about the most effective smoke alarms visit the New Zealand Fire Service website at [www.fire.org.nz](http://www.fire.org.nz). (See 5.6.1.1.)

### 2.5.1.1 Smoke alarm locations

Install smoke alarms on the escape routes on all levels within the home, and in areas where people sleep, either: in every sleeping area or within 3 m of every bedroom door. If smoke alarms are placed outside the bedrooms, the alarms must be audible to sleeping occupants even when the bedroom door is closed.

Install smoke alarms on or near the ceiling, in accordance with the manufacturer's instructions.

Avoid installing a smoke alarm in a kitchen or bathroom because of the increased likelihood of unwanted alarms caused by cooking, or steam from baths and showers.

NZS 4514 sets out requirements for the installation and commissioning of externally powered interconnected smoke alarms.

#### SMOKE DETECTION IN THE HOME

For optimum smoke detection, the New Zealand Fire Service recommends long-life photoelectric smoke alarms should be installed in every bedroom, living area, and hallway in the home – on every level. However, this is not always practical. That's why the New Zealand Fire Service suggests, at an absolute minimum, that a long-life photoelectric smoke alarm should be installed in the hallway closest to the bedrooms. This should be supplemented with other alarms as soon as circumstances permit.

*Source: New Zealand Fire Service*

### 2.5.1.2 Smoke alarms for people with hearing impairments

For residents with a hearing impairment, an extra loud alarm or an alarm with a flashing light may help. Contact Deaf Aotearoa – New Zealand or Hearing Association of New Zealand Inc. for more information.

## 2.5.2 Sprinkler systems

Sprinkler systems should be considered as they can save lives and prevent injuries by containing and controlling a fire in its early stages. Domestic sprinkler systems are available which will activate automatically and spray water on a fire. Sprinklers are installed by plumbers and connect to the domestic water supply.

Sprinkler systems are heat activated so only the sprinkler head is affected if it is activated by fire. Sprinklers won't flood the whole home and won't be activated by smoke (for example, from the toaster). Ninety per cent of fires are controlled by just one sprinkler.

Fire sprinklers will not provide early warning so smoke alarms will still be required.

NZS 4517 specifies minimum requirements for the design, materials, and installation of fire sprinkler systems for households.

## 2.5.3 Using fire-resistant materials

There are wall-lining and insulation materials that have fire-resistant properties. Consider specially manufactured fire-resistant wall linings in those areas of the home where extra protection is wanted.

## 2.5.4 Designing for evacuation

Ideally, people should be able to escape from a home by two evacuation routes at opposite ends of the home. At least one escape from upper levels should not rely on the main stairs. Design separate escape routes for areas with a higher fire risk, for example, the kitchen.

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Source: *ConsumerBuild*

## 2.6 Foundations

Reduce moisture build-up in subfloor spaces by building foundations on gently sloping ground. This ensures that water does not collect and remain under the home. A gentle slope also allows ground surface water that does flow under the home to flow through under gravity.

Ground levels should allow ground surface water to flow freely away from the home. In some cases, kerbs, cut-off drains, and subsoil drains are needed to divert water away from the home.

## 2.7 Framing

Multi-storey, timber-framed homes should be either platform framed or should include alternative ways to stop smoke and fire at the upper levels. Balloon framing, especially without dwangs, can provide a smoke path from the ground floor to upper-level rooms. (See 2.5 and 2.13.4.)

## 2.8 Glazing

NZS 4223 has three parts that set out the requirements for glass selection and glazing; human impact safety; and wind, dead, snow, and live actions. (See 1.9 and 2.9.)

There is a range of glazing to choose from and many types provide:

- (a) thermal insulation and condensation control
- (b) solar and glare control
- (c) sound control
- (d) safety and security
- (e) privacy and fading protection.

Some glazing will do all of these things, for example, double glazing that incorporates laminated glass.

### 2.8.1 Double glazing

Double glazing is made using two panes of glass with an air cavity between to reduce heat loss, heat gain, and help prevent the formation of condensation. The advantage of double glazing is that it is possible to have more window area with less heat loss and the home is warmer in winter and cooler in summer. Double glazing can also reduce noise from outside depending on the glass and air space combination.

Other points to note about different types of glazing include:

- (a) insulating glass is available with a high performance low emissivity (Low E) coating and argon gas
- (b) noise reduction is best achieved with thick glass and laminated glass combined with double glazing
- (c) safety glass should be used in those areas where human impact is likely, for example, doors, ranchsliders, shower enclosures, or around stairs, and in furniture
- (d) toughened and laminated security glass and IGUs can deter break-ins
- (e) self-cleaning glass is available and is useful for some external windows that are hard to reach
- (f) decorative glass, such as frosted, leadlight, coloured, glass blocks, or textured glass is available for special effects and because it can more readily be seen, this glass may prevent people from unintentionally running into it
- (g) window stickers or strips can be used to make clear glass more visible (known as manifestation).

For new building work or replacement glazing, NZS 4223.3 should be followed or safety glass used to meet the requirement of NZBC Compliance Document F2 Hazardous Building Materials.

### 2.8.2 Cleaning

High-level windows should be able to be cleaned from inside the home without having to lean too far out of the window, or over any decking and balconies. This is particularly important where windows are exposed to salt-laden air and there is a need for frequent cleaning.

Overhead glazing should be able to be cleaned without the risk of falling or breaking of the glazing. (Refer to NZS 4223.) Risk of falling or breakage when cleaning overhead glazing can be reduced by:

- (a) using translucent rather than transparent roof lights (which require more cleaning)
- (b) incorporating exterior glazing that can be cleaned from the eaves without the need to climb to the roof
- (c) using a pivoting roof window that permits cleaning from the inside
- (d) designing the roof so that the roof light can be safely cleaned from a window above it
- (e) designing in hazard-free access to the roof and anchor points for safety lines and harness
- (f) designing the roof glass for maintenance live loads.

## 2.9 Heat control

Household air temperature should ideally be between 20°C and 24°C, and not drop below 18°C. New Zealand homes are often much colder than this. When temperatures drop below 16°C, levels of condensation, along with mould and mildew increase, resulting in an increased risk of respiratory diseases. Keeping the home warm while having some ventilation reduces moisture build-up.

Good insulation, ventilation, heating, and cooling make a home more comfortable and healthy to live in.

There are two types of home heating – passive and non passive.

### 2.9.1 Passive

Passive design is the control of ventilation and temperature without using any products that consume energy (such as heaters, dehumidifiers, or fires). (See section 1.)

Good passive design includes the following.

- (a) **Home orientation** – Position the home to allow maximum sun in the winter and coolness in the summer. Decide which rooms are to be the sunniest.
- (b) **Renewable energy** – Use solar panels for water heating or photovoltaics to produce electricity directly from the sun.
- (c) **Shading elements** – Use wide eaves or other shading elements to protect from the sun in summer and provide increased weather protection in winter.
- (d) **Placement and glazing of windows** – Larger windows should face the sun to capture the warmth and insulating glass can be used to stop heat escaping. (Refer to [www.wanz.co.nz](http://www.wanz.co.nz).)
- (e) **Ventilation** – Use window joinery that allows ventilation, such as security catches allowing windows to remain partially open, or vents in the joinery. (See 2.14.)
- (f) **Insulation** – Use to reduce heat loss. (See 2.10.)
- (g) **Thermal mass** – Use heavy building materials (such as a concrete floor slab) to store solar energy and limit overheating during the day but then release energy during the night to provide heating.

### 2.9.2 Non-passive heating options

Non-passive heating uses artificially supplied energy sources. There are several options.

### 2.9.2.1 Underfloor heating

In new homes the underfloor heating is usually laid in the concrete floor slab during construction. Underfloor heating can be installed with a wooden floor, which makes it possible to install it into an existing home. The advantage of this type of heating is that it distributes heat evenly and does not create any draught. It is important to insulate the floor to stop the heat escaping.

### 2.9.2.2 Central heating

Central heating either heats water, which is then pumped around the home to radiators, or uses gas or oil to heat air which is then circulated through grilles throughout the home. It is effective for heating the entire home, and can also be controlled to just heat some rooms.

### 2.9.2.3 Gas heaters

There are three main types of gas heating: room sealed, flued, and unflued.

Because room sealed gas heaters draw air from outside, rather than from the room, they are more effective and less likely to create draughts in the room. This also means that spilling combustion products into the room is not possible.

Flued gas heaters have a number of advantages over unflued heaters, including:

- (a) the discharge of waste combustion products to the outside environment
- (b) a reduction in the amount of condensation build-up in a room, which is often a common symptom of gas heating.

Flued gas appliances need to have the flue checked regularly, as blockages of any type can be dangerous.

Signs that an appliance is not working correctly or that the flue is blocked may include:

- (a) a yellow flame, rather than a blue flame  
NOTE – Some 'flame effect' heaters are designed to burn with a yellow flame.
- (b) soot deposits in or around the appliance
- (c) an unpleasant, distinctive smell, similar to that of a car exhaust.

If you notice any of these signs, turn off the appliance and contact a licensed gas worker immediately.

Unflued gas appliances have no vent or chimney. They draw the air they need from the space around them and discharge the waste combustion products directly into that space. As a result it is extremely important that unflued gas appliances are used in well-ventilated areas with plenty of fresh air circulating.

### UNFLUED GAS HEATERS

Unflued gas heaters release many toxic gases and nearly two kilos of water for every kilo of gas burnt. Moisture rapidly builds up in the room being heated, leading to the growth of moulds and dust mites.

Do not use unflued gas appliances, such as LPG cabinet heaters or instantaneous water heaters, in bedrooms, bathrooms, or small rooms.

Portable gas heaters such as LPG cabinet heaters and other unflued space heaters need special care, including the following.

- (a) **Test connections (cabinet heaters)** – After securely connecting a new or refilled cylinder, apply soapy water to the cylinder connections and turn on the cylinder. If bubbles appear there is a leak. Close the valve and either call an LPG service agent or take the heater to the agent.
- (b) **Safe space** – Always keep the heater at least 1 m away from anything that could catch on fire. Put a safety guard around a heater if there are young children in the home or there is a lot of foot traffic.



- (c) **Fresh air** – Keep a window open when using an unflued heater, to help remove heater emissions (combustion products) and to keep the air fresh and reduce condensation. Never use unflued heaters in bedrooms and bathrooms.
- (d) **Burner** – If soot builds up on the burner it is a sign there is something wrong and the heater should not be used. Call an appliance service agent or gasfitter to have the appliance checked.
- (e) **Use your nose** – **If you smell fumes turn off the heater and cylinder immediately. Call an appliance service agent or gasfitter, or take the heater to the agent to have the appliance checked.**
- (f) **Get a check up** – Get heaters checked and serviced before winter every year by a service agent to ensure they are in a safe condition for winter.

**Outdoor gas appliances should never be used indoors. This includes patio heaters, barbecues, and camping cookers.**

Source: [www.energysafety.govt.nz](http://www.energysafety.govt.nz)

#### 2.9.2.4 Woodburners and fireplaces

These are often installed for their ambience, or because people have a good supply of wood to burn, but many are relatively inefficient as a large percentage of the heat goes up the ducts or chimney. Other heating will usually be necessary to reach areas away from the fire, or flues can be installed to transfer heat to other areas of the home. Solid fuel heaters may only be installed with a building consent.

Improve woodburner and fireplace safety by:

- (a) opening flues before fireplaces are used
- (b) using screens or glass doors to keep embers inside the fireplace (use only fire-rated glass that meets NZS 4232.2 or AS 1530.4)
- (c) using a properly installed fireguard or other appropriate barrier to keep young children away from operating woodburners and fireplaces to avoid burn injuries
- (d) removing all tripping hazards (such as rugs that are not fixed to the floor)

- (e) not burning weather-treated ('tanalised') wood, rubbish, or cardboard boxes as they may contain poisons that will be released into the air
- (f) having the chimney inspected and cleaned every autumn to make sure there are no blockages, leaks, or build-up that could cause a fire.

Since 1 September 2005 all woodburners installed in buildings on a section smaller than 2 ha must be designed to have a discharge of less than 1.5 grams of particles for each kilogram of dry wood burnt, and a thermal efficiency of not less than 65%. (See Regulation 22 of the Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations.) For more information about National Environment Standards see the Ministry for the Environment website at [www.mfe.govt.nz](http://www.mfe.govt.nz). It includes information about woodburners that meet the regulations.

Woodburners can also be used with a 'wetback' which heats the domestic water supply. As water heated by wetbacks can get extremely hot, the hot water system should be installed to the manufacturer's specifications to ensure hot water at the taps is at a safe temperature. (See Appendix B.)

#### **2.9.2.5 Heat pumps**

Heat pumps are mechanical devices that transfer heat from one place to another. They can be used to heat or cool areas. To get the most out of a heat pump, it's important to choose the right one and use it properly. Always follow the manufacturer's instructions for installation, use, and maintenance of a heat pump.

#### **2.9.2.6 Ceiling fans to cool and heat**

Ceiling fans cool in the summer and circulate warm air in the winter. Always follow the manufacturer's instructions for installation, use, and maintenance of a ceiling fan. (See 5.10.4.2.)

#### **2.9.2.7 Electric heaters**

There is a variety of electric heaters available. Each type of electric heater has different uses which should be considered. (See 5.10.4.3.)

## 2.10 Insulation

Well-insulated homes can improve people's health by stabilising the temperature of a home and reducing internal condensation.

Insulation is most effective when there is unbroken coverage around the home. If there are any breaks in the insulating material, heat can escape. Insulation must also be installed properly for safety reasons by having the right clearances around downlights, chimneys, and flues so the heat from these sources does not create a hazard.

It is recommended that insulation is installed by a professional to ensure it is done correctly and safely. Information from 2.10.1 to 2.10.4 is meant to provide an overview of issues that should be considered when insulation is to be installed in a home. (Refer to NZS 4246.)

Insulation is provided by a variety of materials, some of which are better for different areas of the home. When choosing insulation, consider products which:

- (a) are non-combustible and fire resistant
- (b) are vermin resistant
- (c) stay mould free and will not rot
- (d) perform over time
- (e) are independently verified or tested
- (f) are non-toxic/non-irritant.

Ensure safe work practices are followed when insulation products are installed, especially in underfloor or ceiling areas. Some of the safety considerations are outlined below, but more comprehensive information is available in Appendix B of NZS 4246.

### 2.10.1 Ceiling insulation – safe installation around heat sources

To minimise the risk of fire, insulation must have the correct gaps around heat sources – such as recessed downlights, chimneys, flues, or extractor fans.

### 2.10.1.1 Downlights

For recessed downlights consider both safety and effectiveness when it comes to insulation.

As the downlights can get very hot, there must be a 150 mm safety gap between the insulation and most downlights.

These are three options when it comes to safe installation of insulation with downlights.

- (a) **The simple option** – Keep existing downlight fittings and leave the required safety gap. Leave a gap of 150 mm between existing downlight fittings and insulation. Never place insulation over the top of the light or any transformers. This will ensure the rising heat from the downlights is not a fire hazard. Once installed, check ceiling insulation occasionally to be sure it hasn't slumped towards downlights.
- (b) **The better option** – Replace standard downlight fittings with fittings that don't require a safety gap. These can have insulation fitted right up to them (but not over the top). There are a few different options on the market. If unsure of the type necessary, check with a registered electrician.
- (c) **The best option** – Replace standard downlights with non-downlight fittings. Even with a good downlight, heat will be lost through the ceiling of the home. The best solution is to remove recessed downlights or don't put them in the first place.

### 2.10.1.2 Chimneys and flues

Chimneys and flues can also get very hot. Leave a gap of 50 mm between the outer face of a brick or concrete chimney and the insulation, or a 150 mm gap for metal chimneys and flues.

### 2.10.1.3 Extractor fans

Insulation can get trapped in unducted extractor fans, causing the motor to overheat. Leave a gap of 150 mm between unducted extractor fans and insulation.

### 2.10.2 Polystyrene insulation

Direct contact between electricity cables and polystyrene insulation can cause the sheath on the cables to harden and crack, creating a fire or electrical safety risk. To avoid this, polystyrene insulation must not get into direct contact with any (Polyvinyl Chloride) PVC-sheathed cables. They should be separated using self-adhesive paper, polyethylene or polypropylene tape between the PVC and polystyrene, or by installing the cables through conduits. Because of the fire hazard and other risks associated with poorly installed insulation refer to NZS 4246.

### 2.10.3 Safety gaps for loose-fill insulation

For loose-fill insulation in the ceiling space, install rigid open-ended collars around downlight fittings, chimneys, flues, and unducted extractor fans to maintain the required safety gaps. Contact a loose-fill insulation supply and installation company about sourcing and installing these collars.

### 2.10.4 Underfloor insulation – special care with electrics

There are some important electrical safety considerations when checking or installing underfloor insulation. (Refer to Appendix B of NZS 4246.)

(a) **Avoid stapling insulation near electric cables –**

When stapling underfloor insulation, avoid stapling near or through electrical cables. Doing so could result in a serious or fatal electric shock. An unintentionally stapled cable, even if it went undetected during installation, can also create a fire risk. Foil insulation is a good electrical conductor. Special care must be taken when installing this type of insulation.

(b) **Care when replacing existing underfloor foil insulation –**

Existing foil insulation that is fixed with staples can unknowingly be live (even if it was installed long ago) if an electrical cable was unintentionally stapled during installation. Turning off the mains won't necessarily solve the problem. When replacing underfloor foil, the safest thing to do is get a registered electrician to check whether the foil is live before it is touched.

## HOW INSULATION WORKS

Insulation works by reducing the transfer of heat by means of a barrier. The measure of insulation is expressed as an R-value, which is a product's resistance to heat flow. The higher the R-value the more effective the insulation is in resisting heat transfer.

The most common R-value in new homes for walls and roofs is between R1.9 and 3.3, depending where you live. You can ask for higher R-values in your insulation for more comfort and savings on heating. The extra cost of installing better insulation may be offset by savings in energy costs.

Research shows that older, uninsulated homes typically lose 30 – 35% of heat through the roof, 18 – 25% through walls, 6 – 9% air leakage, 21 – 31% from windows, and 12 – 14% through the floor.

*Source: EECA Energywise and ConsumerBuild*

## 2.11 Moisture control

Moisture builds up quickly and is worse in modern homes which are built to be almost airtight. NZBC Compliance Document E3 Internal Moisture requires safeguards against 'fungal growth or the accumulation of contaminants on linings and other building elements'. Fungi, in the form of moulds or rot can endanger human health. Fungi grow best in damp environments. Having a warm home keeps it drier and gives fungi less opportunity to grow. (See 2.2, 2.9, and 2.15.)

The options for managing moisture are:

- (a) good ventilation
- (b) window joinery with built-in drains – that allow condensation to drain to the outside
- (c) keeping the home warm and dry through heating
- (d) extractor fans in bathrooms and kitchens
- (e) good insulation to keep the home warm and reduce condensation and mould growth.

*Source: ConsumerBuild and BRANZ*

## 2.12 Noise control

Features and materials to minimise the impact of noise from both outside and inside the home are important for healthy living. One way of controlling noise nuisance is by home design, for example, placing the recreation room and utility rooms like the kitchen and laundry away from the quiet rooms such as the study and bedrooms. Buffer zones, such as hallways or cupboards, are another means of noise control. Minimise the impact of noise from outside, such as from traffic and neighbours, by placing rooms which should be quieter farthest from the noise source.

Other methods include:

- (a) using wallboards with noise control properties
- (b) insulation usually also helps control noise transmission
- (c) carpet and underlay on an upper floor help deaden sound
- (d) flooring designed to control noise
- (e) noise control glass
- (f) insulation around plumbing pipes
- (g) seals around doors.

The effectiveness of noise control materials will be reduced if there are gaps, for example, under doorways, or through downlights and power outlets.

AS/NZS 2107 includes recommendations for sound levels and reverberation times inside buildings.

NZBC Compliance Document G6 Airborne and Impact Sound provides for the control of noise transmitted into the habitable spaces of abutting household units. Its objective is to 'safeguard people from illness or loss of amenity as a result of undue noise being transmitted between abutting occupancies'. The approved document provides limits on the noise received from outside the household unit and noise within the home, such as creaking floors and the activities of people, by giving minimum performance levels for walls, floors, and ceilings.

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Source: *ConsumerBuild*

## 2.13 Roof and subfloor space

### 2.13.1 General

When accessing any space which has aluminium foil as part of its insulation, care needs to be taken to ensure that contact with the foil does not lead to electrocution. (See 2.10.)

To reduce the chances of head or body injuries from joists, rafters, building materials, or protruding nails it is wise to wear a soft hat, work overalls, and sturdy shoes or boots when accessing the roof and subfloor.

In case of emergency, someone in the home should always know when someone is working in these areas.

### 2.13.2 Roof

To reduce the need to access the roof of a home, choose roof coverings that are durable. The lifespan of roof coverings will be based on the materials used, the quality of the installation, and weather. Roofs with a pitch of over 20 degrees should have a long-lasting or low-maintenance finish.

When building, ensure that people accessing the roof will not come within 4 m of overhead power lines.

All roof spaces of a pitched roof, other than skillion ceilings, should have an access point from ceiling level. (Refer to NZS 3604.)

Provide secure anchorage for safety lines and harness for areas that are not accessible by roof ladder, for example some parts of a hipped roof and roofs above dormer windows. (Refer to AS/NZS 1891.1.)

### 2.13.3 Subfloor

Easy access to the subfloor can reduce injuries and makes it easier to maintain this important part of a home. For this reason, suspended wooden or wood-based floors should have an access door or be open to provide for subfloor access. Ensure access is secured so that unsupervised children and pets do not enter this space.

#### 2.13.4 Upper floors

Multi-storeyed homes present the following increased hazards which should be addressed in the building design:

- (a) maintenance at greater heights (for example, cleaning and painting)
- (b) safe escape from fires from the upper floors
- (c) falls from balconies and stairs, particularly for children and vulnerable adults (for example, adults under the influence of alcohol).

When steps and stairs are necessary, they should comply with the requirements of the NZBC. (See section 4.)

Window restrictors should be used on all upper-floor windows to minimise the risk of people, particularly children and vulnerable adults, falling out of them. (See 2.8.)

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*Source: ConsumerBuild*

### 2.14 Ventilation

For healthy air quality, the air in a home should ideally be 'renewed' every 2 hours. Some simple options are to fit aluminium windows with passive air vents or to fit security stays that allow the windows to be left ajar. When windows and doors cannot be left open, consider using mechanical ventilation systems and air conditioning systems.

Heat recovery ventilation systems (HRV units) take fresh outdoor air which is then carbon filtered and pumped through a heat exchanger using the heat from the indoor air. As the stale air is removed from the home it passes through a heat exchanger preheating the outdoor clean air. Some heat loss is experienced which needs to be made up.

Forced air ventilation blows dry air into the home from the roof space above the ceiling. It works best where there is a decent amount of space in the roof. It must also be dry and preferably warm on sunny winter days.

Extractor fans are used in places like the kitchen and bathrooms to remove steam. (See sections 5, 6.11, and 8.10.)

### WHY VENTILATION IS IMPORTANT

Good ventilation in a home can help maintain healthy air quality by removing:

- (a) exhaled moisture and CO<sub>2</sub> from occupants
- (b) odour and steam from kitchens and bathrooms
- (c) moisture from unflued combustion heating devices (see 2.9.2.3)
- (d) moisture from other sources including spa baths or water features.

Source: EECA Energywise and ConsumerBuild

## 2.15 Weathertightness

In the NZBC the Acceptable Solution for weathertightness is E2/AS1. This part of NZBC also contains a Verification Method (E2/VM1) for testing claddings to ensure they meet these performance requirements. Under the NZBC, the life of a building is normally considered to be at least 50 years, but we often expect our homes to last much longer. Learn more about weathertightness at [www.dbh.govt.nz](http://www.dbh.govt.nz).

A professional designer should follow weathertight design principles to help ensure a dry and durable home. The designer should consider how the sun, wind, and rain will impact on the building and how the overall design will cope with these forces. (See section 1.1.)

The designer should consider weather effects; joints and junctions; and how different materials, such as windows, doors, and chimneys are combined and detailed. (See 2.2, 2.8, and 2.11.)

Thinking about weathertightness does not stop once a home has been designed and built. A home must be maintained to ensure it continues to perform as it was designed to do. (See 2.16.)

### 2.15.1 Design suggestions

With the correct design, materials, and construction a home will be comfortable and durable.

#### 2.15.1.1 Designing and building

When choosing the site consider how the orientation and exposure will affect a home's ability to resist the weather. One of the main ways to make the most of a site will be to orient the home and certain rooms to take best advantage of the sun and views. (See 1.8.)

#### 2.15.1.2 Consider the style

The style of home is also important for protection from leaking. The home design will have a major influence on the risk score of a home. High-risk scores will require additional consideration and more expensive solutions to the junctions between claddings, windows, doors, roofs, and other features. (Refer to *External moisture – A guide to using the risk matrix* published by the Department of Building and Housing.)

The factors that will influence the weathertightness risk are:

- (a) wind zone
- (b) number of storeys
- (c) roof/wall intersection design
- (d) eaves width
- (e) envelope complexity
- (f) deck design.

### 2.15.2 4Ds approach to weathertightness

The combination of factors that cause leaky buildings led to the development of the '4Ds' approach to weathertightness and these are included in NZBC Compliance Document for E2 External Moisture, Acceptable Solution 1. The four Ds are deflection, drainage, drying, and durability.

### 2.15.2.1 Deflection

Keep water away from entry points. If water cannot impact on or reach a joint or junction, then the likelihood of that joint developing a leak is greatly reduced. The first means of deflection is in the design of roofs, verandahs and overhangs that protect wall surfaces. By using facings, flashings, and overlaps, water is deflected away from a joint to the outside of the building. Cladding can also be used to deflect water, but cladding cannot be relied upon on its own to keep water out.

### 2.15.2.2 Drainage

Allow for water that does get in to drain away. Claddings fixed directly to the framing provide limited drainage if water gets behind the cladding. The cladding underlay provides some drainage for more profiled claddings such as weatherboard. Many claddings hold water against the underlay, and once water has got past the underlay drainage to the outside is unlikely to occur.

By constructing a drainage cavity behind the cladding, water on the back face of the cladding can drain away. Many traditional methods of constructing joints provide for drainage back to the outside, and this greatly increases the building's ability to deal with unwanted moisture.

### 2.15.2.3 Drying

Allow for water that does get in but doesn't drain away, to dry through diffusion and ventilation. The drainage cavity allows diffusion and ventilation behind the cladding. This means water that has not drained away will be able to dry out. This is particularly important for claddings that cannot breathe because of external waterproof coatings, such as texture coated fibre-cement, stucco, and external insulation finishing systems.

#### 2.15.2.4 Durability

Use durable materials. Many leaky buildings developed when minor leaks caused a major failure of the structure of the building. Water which wasn't allowed to dry or drain away rotted the timber which was not treated and therefore was not durable. Fungi established very readily and caused rot that spread beyond the immediate area affected. Timber treatment will prevent, or markedly slow the establishment of rot and isolate the damage to the immediately affected area, greatly reducing repair costs.

It is not only the timber that must be durable, but also the fixings, finishes, and all materials.

The combination of deflection, drainage, drying, and increased durability should ensure future buildings will be much more robust than those that have weathertight problems. For more on leaky buildings visit the Department of Building and Housing website at [www.dbh.govt.nz](http://www.dbh.govt.nz).

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*Source: ConsumerBuild*

## 2.16 Structure maintenance

Routine maintenance can improve home safety, efficiency, and comfort. Below are maintenance tips and a few special areas of concern for renovating homes, such as asbestos and timber-treated wood.

### 2.16.1 Asbestos

Some homes built before 1983 may have been built with materials that contain asbestos (for example, sprayed ceilings, cement sheeting, some types of floor coverings, and some roof materials). Breathing in dust and fibres containing asbestos can cause asbestos-related diseases, such as mesothelioma (a cancer of the chest lining) and pleural diseases (including fluid on the lungs, and asbestosis, which is scarring of the lungs). These diseases are crippling, painful, and usually fatal. There are no known cures for asbestos-related diseases.

If, however, the materials containing asbestos are in good condition and have a good coat of paint there should be no health risk.

If renovations involve removing or sanding materials that are suspected to contain asbestos, or if there is any uncertainty about what the materials are made of, contact a duty health protection officer of the local district health board for advice on identifying and managing this material. For more information on asbestos testing visit the Department of Labour's website at [www.dol.govt.nz](http://www.dol.govt.nz).

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Source: *ConsumerBuild*

The Ministry of Health strongly recommends that homeowners use Department of Labour certified contractors to remove asbestos-containing material, particularly if there is wire, cladding, paint, or plastic covering the asbestos-containing material, as the process of removal is likely to be difficult. Incorrect removal is likely to release asbestos fibres.

Learn more from the Ministry of Health's document *Removing asbestos from the home* which is available at [www.healthed.govt.nz](http://www.healthed.govt.nz). The Ministry of Health has also produced relevant guidelines titled *The management of asbestos in the non-occupational environment*. The publication is available from the Ministry of Health's website at [www.moh.govt.nz](http://www.moh.govt.nz).

### 2.16.2 Gutters

Gutters and downpipes must be clear of leaves and debris to effectively move water away from the roof and home. Clean gutters at least twice a year or more if the roof is directly beneath trees. External surfaces, including paths and decks, should be positioned to promote the safe cleaning of gutters (using ladder access where appropriate). (See Appendix C.)

Wear gloves when cleaning gutters to protect hands since gutters often have sharp metal parts or screw points sticking out into their troughs. Safety glasses or goggles are also recommended.

Properly installed gutter guards can lessen the number of times gutters will need to be cleaned.

### 2.16.3 Painting

It should be possible to reach the eaves of a single-storey home from a secure ladder or scaffold from all points of its perimeter.

Where appropriate, the walls of multi-storeyed homes, or homes on sloping sites should be fitted with anchors for scaffold brackets before the interior of the structure is lined.

Bracket scaffolding will allow repainting to be done more conveniently and safely. Scaffold anchors should be accessible progressively from the lowest level for fitting the scaffolding without exposing the user to the risk of falling. (See Appendix C.)

#### 2.16.3.1 Lead-based paint

If a home was built before 1980, it should be assumed it has some lead-based paint. This is a problem because when paint is removed there is an increased risk of absorbing the lead through skin contact or from the atmosphere through sanding dust or flakes. **Lead contaminates clothing and furnishings and can result in lead poisoning. Symptoms of lead poisoning include stomach pains, loss of appetite, weakness, and difficulty walking. It can eventually lead to death.**

Paint can be tested for lead content by using sodium sulphite solution (5%). Some paint shops and pharmacies sell the solution. Generally the test is carried out by cutting into the paint exposing the back of the suspect layer and dropping some of the solution onto it. If it turns black it contains lead.

Even if a home has been painted more recently, the paint on the lower layers may contain lead, if they were painted over previously.

Lead-based paint is only a danger to health if it has deteriorated or started to flake. If it is in good condition, repainting it is a good option rather than trying to remove it. Removing lead-based paint is likely to increase the risk of exposure from dust and flake.

Get the latest guidelines for the management of lead-based paint from the Department of Labour, Occupational Safety and Health website at [www.osh.dol.govt.nz](http://www.osh.dol.govt.nz).

### 2.16.3.2 Removing lead-based paint

If lead-based paint must be removed, there are specific precautions that must be taken. The best method is by wet sanding – misting painted surfaces with a spray bottle and removing paint using sharp scrapers or wet and dry sandpaper. This keeps the dust to a minimum.

Abrasive blasting is not recommended because of the amount of dust generated. Chemicals can be used for small areas. Dry hand sanding or machine sanding can be done provided the dust is carefully contained. Water blasting for outside is fine provided the flakes are collected and disposed of without contaminating the soil or surrounding area.

It is recommended that the following precautions are taken.

- (a) Take down the curtains and furniture and cover the carpets with protective covering before removing the paint.
- (b) Keep other people and pets away once work has started.
- (c) Use a dust respirator if sanding dust or flakes are present. An activated charcoal filter suitable for removing lead fumes will be needed if fumes are generated by heat removal processes.
- (d) Wear a hair covering and protective clothing, including gloves and suitable footwear.
- (e) Keep windows and doors closed if the work is being done outside, to stop paint dust and flakes getting inside.
- (f) Wipe sanded surfaces and then vacuum. Collect as much of the dust and paint flakes as possible. Contact the local authority for advice on where to dispose of it – don't burn it, as this releases it into the atmosphere.
- (g) Wash hands and face thoroughly before eating or drinking.
- (h) Change out of contaminated clothing before going anywhere else.

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Source: *ConsumerBuild*

#### 2.16.4 Treated timber

When working with treated timber, there is a risk of inhalation of noxious fumes and dust. Guidelines are available for people working with light organic solvent preservatives (LOSP) or copper, chromium, and arsenic (CCA) treated timber. These guidelines can be found at [www.nztif.co.nz](http://www.nztif.co.nz).

The guidelines recommend waiting for the preservatives to dry off before using the treated timber. If this is not an option, protective goggles and a respirator should be used when cutting or sanding treated timber. Dispose of any cut-offs in an authorised landfill.

Clothes used while working with treated timber should be washed separately. Wash hands and face before eating or drinking.

Treated timber should never be burned. Ensure treated timber is disposed of in an authorised landfill. More information is available at [www.mfe.govt.nz](http://www.mfe.govt.nz).

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Source: *ConsumerBuild*

#### 2.16.5 Water damage

Dampness and some mould or fungi can have serious health implications for people living in homes with water damage (often referred to as leaky homes). Damp living conditions affect many people and can worsen the symptoms of illnesses such as asthma, bronchitis, and other breathing disorders. Damp also encourages the spread of dust mites which can further worsen these disorders.

Damp insulation within the wall framing dramatically reduces the insulation value, making rooms harder to heat. The combination of cold damp rooms and the presence of some fungi will worsen respiratory problems for the very young and very old.

In addition to these problems, some fungi which grow within wet wall cavities are toxic. In particular the *Stachybotrys* mould (a type of fungi) produces spores which carry chemical toxins known as mycotoxins. These may cause flu-like symptoms. They particularly affect the young, the old, and those with weakened immune systems.

*Stachybotrys* can be present within a damp wall cavity with no obvious signs or ill effects, but once exposed it will produce airborne spores which can be inhaled by those in close proximity.

If *Stachybotrys* is found, residents will probably need to leave the home while repairs are made. People working on the removal of affected timber have to wear protective gear.

For more information see the Department of Labour publication *Risks to health from moulds and other fungi*.

If a home could have issues with weathertightness, it is especially important to carry out maintenance checks – particularly potentially unsafe balconies, balustrades, decks, and car decks.

#### 2.16.5.1 Checking for moisture

Make regular inspections part of a normal maintenance routine. In particular look for:

- (a) any cracks in the finish to the monolithic cladding
- (b) separation within any sealant joints
- (c) any signs of dampness, mould, or musty smells
- (d) swelling of particleboard flooring, skirtings, or window surrounds.

Watch these problem areas:

- (a) fascias and gutter penetrating the exterior cladding
- (b) where roofs finish within a wall
- (c) sill flashings under windows
- (d) where balustrades on decks and balconies connect to walls
- (e) meter boards (without flashings or sealant)
- (f) electrical, plumbing, and other penetrations. ➤

There is growing concern at the damage that water blasters can cause when used to clean the outsides of homes. If there is concern that a water blaster has been improperly used on a home, have a weathertightness consultant check with moisture meters to detect the presence of moisture in walls or the roof.

If cracking, staining, or discolouration is observed engage a weathertightness consultant to assess the problem before doing any repairs. The New Zealand Institute of Building Surveyors, New Zealand Institute of Architects, and Institution of Professional Engineers New Zealand websites list consultants in each region who specialise in addressing weathertightness problems. These consultants have non-destructive moisture meters which can help find moisture without removing claddings. This is particularly important for monolithic cladding and untreated timber framing. The consultant should also be able to give advice on what repairs are needed.

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Source: *ConsumerBuild*

#### **2.16.5.2 Mould**

Be careful when dealing with any timber in a home that appears to be infected with mould. There could be a health risk.

Take care when removing wall lining, particularly if there is a history of dampness. At the very least face masks should be used when removing lining and rooms should be well ventilated.

For advice about dealing with mould, read the Department of Labour publication *Risks to health from moulds and other fungi*.

## 2.16.6 Decks and balconies

### 2.16.6.1 Car deck check

Car decks are normally constructed with durable treated timbers or from steel and timber. All structures require some maintenance. Check the following things regularly.

- (a) Check whether there is any sign of timber beginning to decay. For example, is there any sign of excessive cracking or 'softness'? Timber may appear sound from the outside but, if unsure, poke it with a screwdriver to see if it is soft underneath (to do this may require looking underneath the deck and at where timber meets or runs across other timber).
- (b) Check the tightness of bolted connections on the safety barrier, and ensure they are securely connected to the deck structure. The barrier should not wobble.
- (c) Check the tightness of all other bolted connections to ensure nuts are secure. These will be between diagonal braces and timber poles or posts, where timber posts and beams are bolted together, or where timber beams are bolted to a concrete anchor point.
- (d) Check that galvanised steel bolts and other metal connections are not corroding.
- (e) Where the deck is constructed with a steel frame, the framework needs to be protected from corrosion. Spots of rust should be thoroughly cleaned and a protective coating applied. If the rust is extensive, there may be a need to obtain professional advice from someone like a chartered structural engineer.
- (f) Where movement of a car deck is noticeable or seems excessive, or if there is noticeable rotting or corrosion of structural timbers or steelwork, close off the deck and do not allow it to be used. Immediately get professional advice about what action needs to be taken.

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Source: *ConsumerBuild*

### 2.16.6.2 Open-timber deck check

Open-timber decks constructed with durable treated timbers are less likely to be of concern than enclosed balconies. Check the following.

- (a) Look at where the deck meets the wall of the home. Is there anywhere that water can sit or leak into the home?
- (b) Do the flashings take water away from the home wall and allow it to drain away?
- (c) If the cladding relies on paint to keep the water out, is that coating continuous or is there any point where water might penetrate?
- (d) Check whether there is any sign of timber beginning to decay. For example, is there any sign of excessive cracking or 'softness'?
- (e) Is there proper waterproofing around the cantilevered joists or around other joists that penetrate the home wall?
- (f) Are the balustrades or posts correctly connected to the deck or balcony structure? They should not wobble.
- (g) Check the tightness of bolted connections to ensure nuts are secure, especially on balustrades and handrails. Also check where posts are bolted to beams, or where beams are bolted to the home.
- (h) Check that galvanised steel connectors are not corroding.

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Source: *ConsumerBuild*

### 2.16.6.3 Balconies

Look out for risk factors and warning signs that show potentially dangerous rotting around balconies. If these structures collapse from water damage and rot, they could cause serious injury.

During the course of maintenance, check:

- (a) deck clearances will allow water to drain away. There should be at least a 6 mm gap between the decking boards and a bigger gap, up to about 12 mm, between the home and the deck structure
- (b) bolts and flashings for signs of rust which may appear as a blackish staining around the bolt hole
- (c) the deck surface for slime or mould. This should be cleaned off to reduce the chance of people slipping
- (d) the step down from the doorsill. It should ideally be about 100 mm deep but can be less if the sill is well sheltered
- (e) for a slope on the balcony floor. Check this by running water onto it and making sure that it runs away to the drain outlet. If it ponds, especially against the building, the balcony should be rebuilt
- (f) for a clear gap (minimum of 35 mm or more) between wall claddings and the floor of the balcony to stop water being drawn up into the wall cladding material and wall framing. Clear this gap of any dirt and leaves
- (g) for cracks in balcony junctions which will allow water in and cause timber to rot. If the balustrade is covered with a proprietary cladding, it is a good idea to seek recommendations for any remedial work from the cladding manufacturer, as it may still be under warranty
- (h) if there are solid balustrades there should be outlets for the water to drain. Clear the outlets and overflows of debris, dirt, and leaves.

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Source: *ConsumerBuild*

**NOTES**

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## 3 Floor planning

### 3.1 Floor planning

A home's floor plans need to accommodate the physical abilities of not only the immediate owners or residents, but also of visitors to the home. During the lifetime of a home, people of all ages and with a variety of mobility and sensory impairments may live in or visit it.

It is important to identify activity areas at the design stage so that incompatible activities (such as cooking and circulation) can be avoided. This includes determining potential children's play areas that are separate from the kitchen, but which can be supervised from the principal work areas.

To reduce hazards in the home, avoid:

- (a) unnecessary external corners in interior walls
- (b) projecting walls and fittings.

Below are some floor planning tips. For more information see other sections on specific rooms in this guide.

### 3.2 Architectural features

Ideally, architectural features (for example, skirtings, cover strips, exterior corners in interior walls, projecting fittings and walls, and architraves) should have rounded edges to minimise the risk of injury.

### 3.3 Circulation

Allow for adequate space and circulation for all household activities.

The optimum width for corridor circulation space is 1200 mm. This will allow a person using a wheelchair, or a person carrying a large object, to pass someone walking in the opposite direction.

## 3.4 Doors

Doors are a significant cause of injuries.

To remove hazards caused by doors, designers should:

- (a) minimise the use of doors
- (b) ensure hinged doors do not swing open into hallways, stairways, or circulation channels
- (c) avoid creating wind corridors, particularly at entries and in stairs and hallways
- (d) use safety glass in doors.

Easy access should be considered when installing doors. (Refer to NZS 4121.)

### 3.4.1 Door hardware

Lever action handles fixed at 1000 mm above the finished floor level are recommended. Lever action handles can be operated by those with restricted hand and arm strength and activated more easily by those with their arms full carrying babies, shopping bags, and household items.

The 1000 mm height enables the widest range of use by everyone, including older people and people with disabilities. It is also important for young children to be able to reach and operate door handles in an emergency. (Refer to NZS 4121.)

It is also recommended that door hardware and light switches are horizontally aligned throughout the home. (See 5.9.) Consistent height of door handles and light switches ensures familiarity and speed of use particularly in the dark.

### 3.4.2 Entry doors

The potential for slips and falls can be greatly reduced if entries don't have steps and are sheltered from the prevailing wind. Sheltered entries also reduce severe draughts in the home.

### 3.4.3 Hinged doors

The slamming of hinged doors is a potential cause of finger and head injuries and is particularly hazardous for young children. This danger can be reduced by fitting hardware on doors that controls the speed of closing.

Injuries at the hinge pin side can include lacerations and crushing. Door hinge guards cover the space between the door and the door jamb at the hinge side, and can help prevent injuries. When fitting door hinge guards, make sure they allow the door to open to its full extent.

### 3.4.4 Security

To improve security and safety, locate entries so that they can be observed by neighbours or from the street. Design main entry doors so it is possible for a person inside to view outside visitors without being seen.

Aluminium sliding entry doors should be fitted with an anti-lift device, so that the door cannot be lifted from its track from the outside.

Deadlocks should be able to be operated without a key so that occupants are easily able to exit the home in an emergency, such as a fire.

Safety and security glass can deter break-ins.

### 3.4.5 Sliding doors

Sliding doors have some safety advantages over hinged doors.

- (a) They do not project towards a user when half open.
- (b) They cannot be opened into the face of another person approaching the door.
- (c) They do not encroach into corridor thoroughfares.

Locate finger grips and handles on sliding doors to avoid pinching of fingers.

#### ACCESS TO POOLS

Ranchslider type doors giving access to pools should be fitted with an adjustable self-closing device so that children cannot accidentally enter the pool area. (See section 10 and refer to the Fencing of Swimming Pools Act on the protection of young children from pools, spas, and tubs.)

## 3.5 Flooring

### 3.5.1 Levels

Falls on stairs are a major cause of severe injuries. The recommendations made in this section and in section 4 are meant to reduce the likelihood of a fall on a set of stairs, or reduce the likelihood of serious injury should a fall occur. Even well-built stairs pose a potential hazard, so changes in floor level should be minimised.

Where a change in level is unavoidable, the layout of the home should:

- (a) allow adequate width and headroom for a comfortable stairway
- (b) be arranged in such a way that stair travel is kept to a minimum
- (c) allow for the installation of handrails on either side beyond the start and finish of the change in level (the space allowance and structural studwork will allow for future inclusion even if the current occupants do not require them).

### 3.5.2 Materials

Use slip-resistant flooring in all areas, particularly areas that are likely to get wet (see Appendix A).

## 3.6 Glazing

While all glass can be dangerous, safety glass can greatly reduce unintentional injuries. Use safety glass if people can bang into it, fall on it (such as glass furniture) or if it can fall on them when it is broken. Refer to NZS 4223.3 for the requirements for glazing in specific locations such as stairways, balustrades, doors, showers, and bathrooms.

Follow these safety tips for areas in the home with glazing.

- (a) Make the presence of glass visible by adding appropriate graphic designs to the surface of the glass at heights which are appropriate to the age group in danger.
- (b) Remove any tripping hazards, such as loose rugs or mats, from areas where there is glass (including windows and glass doors).

- (c) Screen low-level glass areas with plants or furniture to reduce the chance of people falling into the glass.
- (d) Use safety glass.

### 3.7 Stairs and corridors

Do not place windows and mirrors at the end of circulation routes such as stairs and corridors. If windows already exist in these areas, ensure they are made of safety glass in accordance with NZS 4223. Place windows in locations where they do not cause a distraction for stair users. (See 4.10.)

If glazing is required in corridors for natural light or other reasons, it should be glare reducing, laminated, or toughened safety glass in accordance with NZS 4223.

### 3.8 Windows

Windows provide natural light, ventilation, and even emergency exits in a home. There are, however, a number of safety hazards associated with windows, ranging from falling out of open windows, to pinched fingers when windows are being opened or closed, to cuts if window glass is broken. (See 7.7.)

Consider the placement of windows, particularly for upper levels or internal void areas (empty areas), at the planning stage to reduce the risk of falls.

#### 3.8.1 Bathroom

To avoid slips and falls, windows that can be opened should be positioned so that it is not necessary to step into, or lean over, a bath to operate them. (See 6.11.)

#### 3.8.2 Emergency exit

Ensure windows are designed so they can be used as an emergency exit in the event of a fire.

### 3.8.3 Placement

Windows, shutters, or awnings should not open across paths or other access ways unless allowing for a head height clearance of 2.1 m.

### 3.8.4 Security

Security stays on windows should be able to be released when the window is closed so that people may easily escape the home in an emergency.

Windows required to be open for continuous ventilation, such as bathroom, toilet, or laundry windows, should be fitted with security stays.

### 3.8.5 Upper-storey windows

Upper-storey windows should not have clear openings of more than 100 mm or a sill under 1200 mm from the floor. Consider fitting removable security stays or modifications so a young child cannot open a window more than 100 mm.

## 3.9 Storage

A useful guideline is that 10% of the floor area of a home should be devoted to storage. Adequate storage that is easily accessible can help prevent tripping hazards in work areas and stairs and hallways.

Incorporate enough accessible storage for tools, utensils, and appliances (such as vacuum cleaners, irons, and toasters), as well as for seasonal storage items such as clothing, blankets, and recreational equipment.

Secure televisions, wall units, and bookshelves to the wall or ensure they are stable enough to prevent them from falling in the event of an earthquake or unintended use (for example, a young child climbing on them).

## 4 Steps and stairs

### 4.1 General

Steps and stairs can be a particularly dangerous part of any home. As a general rule, keep stairs easy to navigate, easy to see, and clear of any clutter or distracting items. Avoid the use of spiral stairs or winders in stairs.

There are a number of design, building, and general maintenance solutions to reduce unintended injuries on steps and stairs. (Refer to NZBC Compliance Documents D1 Access Routes and F4 Safety from Falling. Also refer to AS/NZS 1428.4.1.) If possible, the entry level should be stepless and toilet and living accommodation available at the entry level. (Refer to NZS 4121 and AS 4299.)

#### STAIRS AND UNINTENTIONAL FALLS

In June 2010 a report on unintentional falls in the home (Kool et al) looked at 344 cases of domestic falls among people aged 25 to 59. Stairs were a factor in over a third of the cases studied. By gender, stairs were involved in 43% of domestic falls for women and 28% of domestic falls for men.

*Source: New Zealand Medical Journal*

#### 4.1.1 Older people and people with disabilities

Homes designed for use by older people and people with disabilities should be built on one level with no entry steps.

### 4.1.2 General tips

A few general tips are listed below.

- (a) Don't mix uses on stairs and landings.
- (b) Ensure activity areas of the home do not intrude onto stairs or landings. Ensure that doors do not open directly onto stairways or outward onto landings (see Figure 4). Avoid woodburners, windows, and other potential dangers at the foot of stairways.
- (c) Landings that have a secondary use (such as, a sitting area or home office) should be large enough for that purpose without intruding on the circulation space. Use built-in furniture and storage in the space to reduce trip hazards.

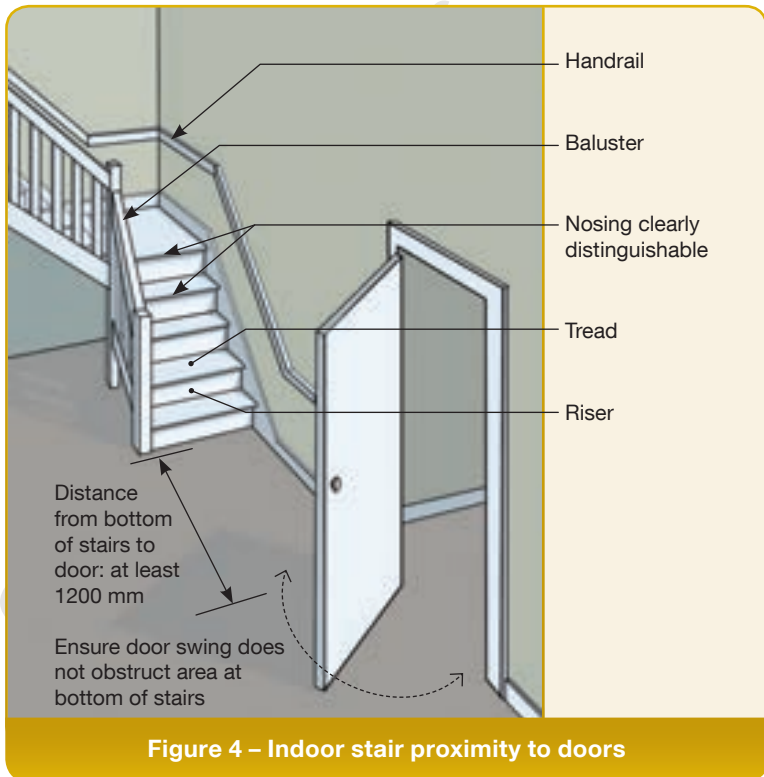


Figure 4 – Indoor stair proximity to doors

### 4.1.3 Number of steps

Single steps, including steps at entries, can create a trip hazard. Ideally, steps should be in groupings of three.

Where possible, keep flights of stairs short by using landings. The total rise between landings should be no higher than 1500 mm.

## 4.2 Balustrades (barriers)

To stop people from falling provide balustrades if staircase, landing, balcony, and raised decking are not enclosed by walls. Where required, balustrades should be at least 900 mm high for staircase and landings, and at least 1000 mm high for balconies and decks (refer to NZBC Compliance Document F4 Safety from Falling, Acceptable Solution 1). **Where the hazard is extreme the balustrade should be at least 1100 mm high. Balustrades for external stairways should be 1200 mm high to serve as both a visual and physical barrier.**

To reduce dangerous climbing, design staircase, landing, balcony, and raised decking balustrades that do not provide footholds.

Balusters should be vertical. One good test for child safety for balustrades is that a ball of 80 mm diameter cannot be passed through the balustrade at any point. Balusters should have a maximum spacing of 100 mm between them to prevent the possibility of children squeezing through them (refer to NZBC Compliance Document F4 Safety from Falling, Acceptable Solution 1).

### 4.3 Handrails

Handrails are critical in the design of stairs because they offer support and can be used to break a fall. It should be possible to grasp a handrail for its entire length. (See 4.2.)

Because of the weight that may be put on handrails in breaking falls, handrails should be able to resist the loads detailed in Table 3.3 in AS/NZS 1170.0.

So that handrails are easy to reach, set them between 900 mm and 1000 mm above the pitch line as measured from the tread nosing.

Handrails should extend the full length of the stair and at least 300 mm beyond the end of the stairs, with a downward sloping end to indicate to the visually impaired that there are no more steps.

Ideally, handrails should be continuous on both sides of the stair and around landings.

### 4.4 Lighting of stairs

Good lighting on stairs is essential for their safe use. Lighting should allow people to clearly see the tread of each step.

#### 4.4.1 Lighting levels

Illumination on a stair tread should be at least 100 lux (illuminance design value – see Table 5) and should be consistent for the entire length of the stairway. For a person with impaired vision illumination may need to be increased up to 350 lux. (See 5.9 and refer to AS/NZS 1680.1 and 1680.2.1.)

Illumination levels have the following requirements.

- (a) Avoid concentrated light sources which can cause disability glare. These light sources may include skylights, windows, luminaires, or the reflection from polished wood or stone treads.
- (b) Light sources below handrail level will light the stairs without the risk of temporarily blinding the stair user.
- (c) Ensure that such lighting does not produce shadows on the stair treads.

Below are other important tips for safe lighting of stairs.

- (a) Use at least two lighting sources (such as, lamps or overhead lights) for stairs, so that lighting will be available if one light fails.
- (b) Ensure lamps and other light fixtures are easy to reach so bulbs may be safely replaced.
- (c) Light sources should not throw any shadows on stair treads and other parts of the stair if possible.
- (d) Provide control switches at the top and bottom of the stairway (such as, two-way switching). Mount stairway light switches at least 1 m horizontally from a top or bottom stair tread, or from an internal wall.

The use of motion detector lighting on stairs can provide for a hands-free way to turn on lights.

#### 4.4.2 Light switches

It's important to have easy and immediate access to lighting for stairs. This can be accomplished by having light switches:

- (a) with control switches at the top and bottom of the stairway (such as, two-way switching), so that it is not necessary to use the stairs in the dark
- (b) that are fitted with neon indicators which operate either continuously or when the stair lights are off
- (c) with face plates for switches that have a high-colour contrast with their surroundings.

Consider motion detector lighting that automatically illuminates stairways when movement is detected.

## 4.5 Pitch

To be safely used, the pitch or slope of stairs must allow a person to use them with a comfortable gait. Dangerous falls occur when rhythm of movement is broken (refer to NZBC Compliance Document D1 Access Routes, Acceptable Solution 1). A pitch of 30° is comfortable for most users and will minimise the chance of falling.

Stairs steeper than 42° are hazardous to descend. Stairs less than 23° do not allow people to use their normal gait. To avoid head injuries, the headroom on stairs should be at least 2 m above the pitch line through the tread nosings. (See 4.9.)

## 4.6 Risers

Risers are the vertical part of a step that separates it from the next step (see Figure 5). For safe use, it is recommended that riser heights should be in the range of 180 mm to 220 mm maximum, dependent on stair use and angle of pitch line. Riser height for all steps in one flight shall be uniform within the tolerance of  $\pm 5$  mm.

Avoid the use of open risers for the following safety reasons.

- A small child can climb between the treads.
- The visual clutter of the view through open risers, when climbing the stair, can cause confusion and make it difficult to identify the stair nosing. (See 4.10.)

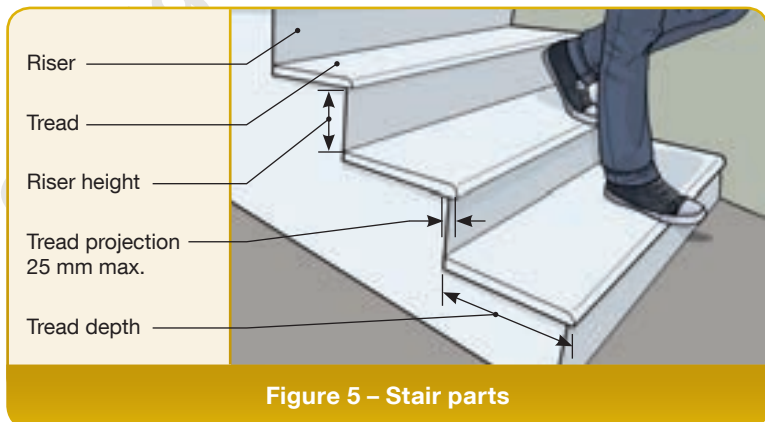


Figure 5 – Stair parts

## 4.7 Stair gates

Stair gates are used to stop children from using stairs without adult supervision. At the design stage, it's important to ensure stairs will be able to fit a standard stair gate at the top and bottom.

While stair gates are meant to stop the unintended use of stairs they can also be a serious trip hazard if there is a temptation to step over them. To reduce this risk, stair gates should be easy to operate and at the same height as the handrail or balustrade. Stair gates that can be opened and closed are preferable to stair barriers.

## 4.8 Stair width

The distance between stringers (the actual tread length) should be a minimum of 900 mm.

Design and locate stairways to ensure that a stair lift can be fitted in the future (a minimum of 1200 mm is required).

A straight flight design, with a middle landing for respite is ideal for both ease of use and for retrofitting of a stair lift.

## 4.9 Treads

Falls down stairs are often caused because there is not enough room on the tread to easily accommodate a person's foot or because the surface is slippery.

### 4.9.1 Tread depth

The depth of each stair and step tread should be in the range of at least 220 mm, to 310 mm dependent on stair use and angle of pitch line, to take the full length of most feet. **Tread depth for all steps in one flight, shall be uniform within the tolerance of  $\pm 5$  mm.** (See Figure 5.)



Below are tips to make treads safer to use.

- (a) Tread depth should be consistent for the full extent of the stairs or steps.
- (b) Stair treads should be level.
- (c) Forward slopes for drainage on exterior steps should not exceed 1 in 100.

#### 4.9.2 Nosing

A nosing is the edge of the tread that projects over the riser of a stair. To reduce falls, nosings should be rounded and project no more than 25 mm from the vertical plane of the riser.

#### 4.9.3 Tread surface

Treads should have secure, non-slip surfaces. (See Appendix A and refer to ISO 13746.)

Following are a few specific things to consider for treads on both interior and exterior stairs.

- (a) Exterior concrete steps should have a U5 (soft broom) finish and any painted nosing should have coarse sand sprinkled in the last coat of paint before it dries.
- (b) Tiled treads and nosings should be textured or have carborundum inlay strips.
- (c) Carpet or vinyl stair coverings should be securely fixed at each step.
- (d) Nosings should be mechanically fixed (by nails or screws) rather than glued to ensure that they do not come loose.
- (e) Nosings should be slip resistant and contrast in colour and texture from the tread.
- (f) Avoid heavily patterned carpeting on stairs as it can make nosings difficult to see.
- (g) Deep pile carpet or deep underlays should not be used.

## 4.10 Visual and physical cues

When building or renovating look for ways to keep stairs away from traffic corridors both inside and outside the home.

Where this is not possible, use cues to reduce trips and falls. (Refer to AS/NZS 1428.4.1.) These cues may include:

- (a) changes in colour or lighting intensity
- (b) changes in wall or floor finishes
- (c) a high-colour contrast handrail.

Contrasting colours between the riser, tread, and nosing can provide visual cues for people with visual impairments. (Refer to NZS 4121.)

Mirrors, televisions, even a good view can momentarily distract stair users and increase the likelihood of trips and falls. To reduce potential distractions consider where decorations and household items are placed.

## NOTES

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## 5 Electricity

When designing or modifying a home, consider current and future electrical requirements. This can be done by the provision of adequate wiring circuits and outlet points (such as socket-outlets, lights, switches, or permanent connections for fixed appliances), and by providing facilities and space to add or replace circuits.

Ensure that there are enough circuits and socket-outlets to avoid unsafe practices, such as running extension cords across floors.

Consider the use of smart wiring to enable the control of all or parts of a home's electrical installation. Smart wiring allows various devices around the home to be controlled from central locations. This allows for remote control of lighting, socket-outlets, and other electrically operated devices.

### ELECTRICAL WORK

Any person, other than a homeowner, who carries out prescribed electrical work, is required to be registered by the Electrical Workers Registration Board. All electrical workers who carry out electrical work in return for payment or reward must hold an annual practising licence. When contracting an electrical worker, always ask to see their practising licence and check the expiry date.

Electricians must issue a Certificate of Compliance to customers when constructing an electrical installation or adding to an electrical installation. This includes fitting new power points. Certificates of Compliance are not issued for maintenance work, such as replacing sockets and light fittings or repairing appliances. Keep all Certificates of Compliance in a safe place as a record of the work done on the property. It is an important document and may be required for insurance claims or when selling a home.

The law also requires some electrical work to be inspected, particularly work on the main switchboard, the main cable, and the main earth. The licensed worker employed should be able to assist in arranging for a licensed electrical inspector to carry out the inspection. Keep the inspection report with the Certificate of Compliance.

### ELECTRICAL WORK *(continued)*

New Zealand law allows homeowners (who own and reside in the home being worked on) to carry out some electrical work. Energy Safety does not recommend homeowners do their own electrical work unless they have the necessary skills and knowledge.

**Homeowners must get the finished job checked and tested by a licensed electrical inspector. The homeowner cannot connect the work to the electricity supply. The inspector must connect it, test it, and issue you with a Certificate of Compliance if it complies with safety requirements. (Refer to Energy (Safety) Regulations and *New Zealand electrical code of practice for homeowner/occupier's electrical wiring in domestic installations.*)**

Visit the Energy Safety website at [www.energysafety.govt.nz](http://www.energysafety.govt.nz) to learn about the rules governing electrical work in New Zealand.

*Source: Energy Safety*

## 5.1 Electrical fittings and equipment

Users of electrical equipment need to ensure safety, especially with maintenance of flexible cords. Exposed primary insulation (which is the coloured insulation around each conductor) and damaged cords are electrical hazards.

Electrical fittings such as light switches and socket-outlets should be checked on a regular basis for breakage and signs of burning. Any switch or outlet that sparks or gives a shock when touched in the normal course of operation should be repaired or replaced immediately (and not used meanwhile).

Minimum separation distances are required when installing any electrical or gas equipment. (Refer to AS/NZS 3000 for electrical installation and AS/NZS 5601.1 for gas installation.)

## 5.2 Circuits

### 5.2.1 Mains and installation wiring cables

Statistics show that overhead power lines are a significant source of electrocution. Problems occur with extended loads on vehicles, kites or flying toys, trees falling, or unsupervised children retrieving toys near lines. Avoid overhead lines within a property and where possible install outside installation wiring underground. This applies to the incoming mains, as well as circuits to other buildings on a property.

### 5.2.2 Power circuits

Plan to group general power outlets on circuits so that no circuit is likely to exceed its load capacity. In high-load areas, such as the kitchen, two or more circuits should be provided.

Make provision for sufficient permanently connected heaters to ensure that the use of plug-in portable heaters is minimised. Circuits of high electrical demand and permanently connected appliances, such as heaters, should be independent of lighting and socket-outlet circuits.

Heating circuits and others with a high electrical loading are safer when permanently connected to the supply and fixed in position.

### 5.2.3 Lighting circuits

The design of the electrical installation should have a minimum of two separate circuits for lighting. It is recommended that each circuit has no more than 12 light fittings.

Since 1 January 2003, the lighting circuits in all domestic electrical installations have been protected by a residual current device (RCD).

It is important that sufficient capacity be provided to allow for future modifications and for the increase in lighting which is often required as a person gets older.



Consider the effect of the loss of any one lighting circuit, and arrange for crucial areas to receive illumination from light fittings connected to a different circuit. This may be achieved by installing 'night lights' which operate all night. Especially consider the lighting of switchboards, hallways, and stairways.

Provide a permanently installed light fitting with battery back-up, proximity sensor controlled in key (hallway) locations. Consideration could also be given to the provision of a rechargeable torch and outlet, along with a locating LED (light-emitting diode) on the battery, mounted in an easily accessed position. In the case of a multi-level building, there should be at least one at each level.

#### 5.2.4 Meter board

Where the meter board is separate from the switchboard, it should be located outside the home, in a position where the meter(s) are easily accessible and at a height between 1500 mm and 2000 mm. They should not be located in direct sunlight. For easy access, it is recommended that the meter board be located beyond any area likely to be fenced in order to secure dogs or other animals.

NOTE – Automatic meter reading technology is reducing the need for meters to be read on site.

Protect the metering enclosure from the weather. An earth pole should have adequate mechanical protection at all times. If not adequately protected the earth pole could cause a trip hazard.

## 5.3 Socket-outlets

### 5.3.1 Quantity

Provide sufficient outlets to accommodate every appliance anticipated to be in use at any one time. A guide is to have a socket-outlet located at least every 3 m of wall.

Table 1 shows the number of socket-outlets that should be provided in the various locations. Plan the installation to reduce the need for extension leads, double adaptors and 'piggy backing', and electrical portable outlet devices (EPOD). One location may require more than one outlet, for example, at an appliance garage or feeding a sound system comprising multiple components.

**Table 1 – Recommended number of socket-outlets for different areas**

Area	Desirable	Minimum
Work area of kitchen	8	6
Dining area	4	2
Living area	8	5
Double bedrooms	6	4
Single bedrooms	4	2
Hallways and landings (each)	2	1
Laundry	4	2
Store/workshop/garage	4	3

Allow for the use of many of the portable appliances listed in Table 2.

### 5.3.2 Location of socket-outlets

Cords across walkways and through doors present both a physical and an electrical hazard. Ensure socket-outlets are located where appliances are to be used and in a way that cords are unlikely to cross walk areas or pass between rooms.

Install a suitable outlet, sheltered from the weather and in a well-ventilated location, for battery chargers and mobility equipment.

Always install socket-outlets in the wall rather than in the floor, where there is a greater chance they could get wet and then short circuit.

Socket-outlets should not be installed in a bathroom. Permanently mount and wire appliances, such as heaters, lights, and fans. Appliances such as hair dryers and shavers are safer when used outside the bathroom or away from other damp areas.

### 5.3.3 Access to socket-outlets

Position socket-outlets so they can be easily and safely reached. Avoid locating them behind door swings, over door openings, or above fireplaces, cookers, or fixed heaters.

Installing outlets more than 500 mm from an internal corner of a room is desirable.

Where the socket-outlet is not readily accessible (as is often the case with refrigerator outlets), install a prominently labelled, separate isolation switch in a convenient nearby position. This way the appliance can be turned off without being moved. Consider a neon indicator when the power is required to be maintained, such as alarms and freezers.

Separate isolation switches (for example, for electric ranges) can look like light switches or appear to have no purpose. For this reason, clear identification is important.

The preferred fixing height for fixed socket-outlets should be between 500 mm and 1000 mm from the floor. Socket-outlets at 1000 mm height will eliminate the need for excessive bending and will be out of reach of very young children (crawling or toddling) but may be unacceptable on aesthetic grounds. A height lower than 1000 mm is

recommended in places where people can walk, since the cord from this height can introduce a trip hazard. Be aware that babies and toddlers, however, can pull themselves up on cords at this height.

Locate socket-outlets at the backs of benches or on a return wall if one is fitted, at a height of approximately 150 mm above the level of workbenches.

### 5.3.4 Child-proofing

Socket-outlets mounted near the floor are liable to have children stick items into them. Consider alternative locations and also the use of safety-shuttered socket-outlets which require the right-hand (neutral) pin to be inserted in order to open the shutter over the left-hand (live) aperture. These are recommended throughout a property where children are likely to spend time. Fit safety shutters or blank plugs to all socket-outlets.

Children might insert a metal object, such as a knife, behind partially withdrawn plugs. All 3-pin plugs sold since 2009 have insulated sleeves over the angled (live) pins as an added safety feature. Some older plugs will not have this feature and will require extra care.

### 5.3.5 Home entertainment

Provide for socket-outlets for home entertainment and for the home office, (for example, computer, printer, and fax). Each location should include at least four outlets. Access should be available to the outlets without the need to crawl under a table or move equipment. Consider the use of a movable trolley unit for the equipment. The unit should have multiple socket-outlets fitted in an accessible position.

Smart wiring systems allow for data cabling between units to be built into the walls of the home. This eliminates tripping hazards by removing the need to run data cords and cables across floors and between rooms.

### 5.3.6 Outlet configuration

Where several outlets are required at one location, the installation of several single-outlet units will usually provide the most convenient access for inserting and withdrawing the plugs. The use of multi socket-outlets (a single wall fitting having two or more outlets) is less costly and is preferable to stacking plugs.

### 5.3.7 Outdoor situations

Charge batteries for mobility scooters in a well ventilated and sheltered area outside the home.

Provide suitable socket-outlets for gardening equipment. Socket-outlets for appliances used outdoors should be protected by RCDs as described in 5.4.

## 5.4 RCD-protected outlets

**Since January 2003 all new domestic installations must include an RCD consisting of an RCCB (residual current circuit breaker) or an RCBO (residual current breaker with overload).** The RCD provides safety by rapidly switching off the electrical supply if a person touches a live part.

Domestic installations which have been installed prior to 1 January 2003 will have varying amounts of RCD protection. If no installation of additional socket or sockets has occurred there will be no RCD installed. If additional socket-outlets have been installed, only these additions will be RCD protected.

It is recommended as an additional safety measure, that all domestic electrical installations be upgraded by the fitting of RCD protection to AS/NZS 3000 requirements on all socket-outlets rated at 20 amps and below and to all lighting final subcircuits. **RCD protection is crucial for the safety of children in areas accessible to them.**

RCD-protected outlets are particularly desirable where earthed material is readily accessible, such as in a garage, workshop, kitchen, or laundry, and where portable appliances used outside are likely to be plugged in.

The assurance that an RCD will provide protection requires the operation of the built-in test push-button at regular intervals. As this testing will disconnect all appliances connected, and this will require the resetting of the clocks, it is recommended that this testing be carried out at change to and from daylight time saving as this also requires the resetting of all clocks. For testing and resetting each RCD unit must be in a readily accessible location, usually on the switchboard.

RCDs may be installed as:

- (a) a circuit breaker in the switchboard
- (b) wall-mounted devices which protect outlets connected to them
- (c) a combined outlet and RCD unit (which may also protect downstream outlets)
- (d) a plug-in unit or mid-cord device.

An RCD fitted as a main switch has the drawback that in the event of its operation all lights are turned off which may create a new hazard.

The cost of installing individual RCD-protected outlets is usually prohibitive.

Socket-outlets located in a bedroom or lounge have a low priority of protection since the hazard risk is normally low. Also, since appliances with clock displays are often used in these rooms, the need to frequently reset these appliances is likely to deter people living in the home from carrying out the safety push-button tests.

The use of a shaver unit in bathrooms is intended to supply an electric shaver only. For hair dryers and the like, an RCD-protected socket-outlet that meets AS/NZS 3000 requirements for damp locations should be installed. Users and installers must be aware that the critical factor is the location where the appliance is used, rather than the location of the socket-outlet.

## 5.5 Switchboards

### 5.5.1 Location

For immediate access, locate switchboards inside the home. Mount switchboards on an unobstructed wall to ensure easy access.

A switchboard located over a bench, or recessed within a cupboard enclosure, can be difficult to reach, especially by a person in a wheelchair. Access is made difficult if a large appliance or item of furniture is positioned nearby. Avoid using the switchboard location as a storage area.

### 5.5.2 Construction and equipment

Switchboards are now required to be fully enclosed, providing user access only to the operating levers of main switches and circuit breakers.

Locate main switches and circuit breakers at a height of 1200 mm to 1500 mm for ease of reach and position so they can be found easily and operated in the dark. Avoid locations which are difficult to access in the dark. A clear hall wall is usually an ideal location.

It is recommended that permanently mounted, flush circuit breakers (with only the toggle showing) in a flush or surface mounted enclosure should be used for all protection devices.

## 5.6 Specific uses of electricity

### 5.6.1 Alarms and communication

#### 5.6.1.1 Fire

Install smoke alarms in bedrooms, kitchens, lounges, central hallways, and sleep-outs, located according to the manufacturer's recommendations. Detectors are available which may be set up so that the operation of one initiates the sounding of all detectors. (See 2.5.1.)

Install mains-operated systems to avoid the need for regular battery changes. If battery-operated models are used, check battery life twice a year at the beginning and end of daylight saving.

Should a fire be caused by an electrical fault, a back-up battery-powered unit should be installed in living areas. Battery-operated smoke detectors should have a built-in battery condition indicator (light).

A mixture of heat detectors as well as smoke alarms is recommended. A smoke alarm insensitive to cooking smoke is recommended for use in a kitchen. A smoke detector near a toaster should have a way to temporarily turn off the audible alarm.

#### **5.6.1.2 Door bells and other visitor alerts**

Install permanent door push-buttons with an alerting device suitable for the user. Suggestions include a loud bell, chime or buzzer, a floor-mounted vibrating device, or a visual indicator (flashing light).

If security is a concern, consider installing a two-way speaker that allows the resident to initiate communication from within the home with the outside visitor. Further features could include a viewing monitor and a remote door-opening controller.

#### **5.6.1.3 Monitoring devices**

For patients or people with disabilities, a viewing monitor could be installed to monitor areas where the person may collapse. Consider the privacy of all people in the home, especially in places such as toilets, bedrooms, and bathrooms.

Baby monitors can be helpful in 'observing' a baby's activities while in a different part of the home. Ensure that the monitor is safely out of reach of the baby and other children.

### 5.6.2 Telephones

Cordless or portable phones allow for ease of use and can readily be used in an emergency other than in a loss of power. Follow manufacturer's instructions for setting up, using, and maintaining. For emergencies, phones should be accessible in areas such as the living or dining area and beside the main bed. Telephones that operate from a mains power supply do not operate during power failure conditions. A traditional line-powered or corded telephone should be available to provide telephone service during power failure conditions.

In many homes, mobile or cell phones are now used in place of 'landline' phones. In case of emergencies, however, it is still preferable to have a dedicated corded phone for the home so that it is always available and accessible to everyone in the home.

So that people are able to get through to the home in an emergency, install 'call waiting' or have two lines. This is particularly important in homes where computers require dial-up.

Consider the use of a home wiring system that supports a range of applications, depending on the appliance plugged into it and the service required. The outlets in this type of system are part of a common wiring network providing telephone and wireless services, along with local area networks for computers. This eliminates tripping hazards by removing the need to run wiring across floors and between rooms.

### 5.6.3 Security alarms and call systems

There are numerous forms of paging or call systems on the market, ranging from a button-operated bell within the home, to radio and telephone systems that are linked to particular caregivers or organisations.

Security or intruder alarms are recommended, but consult a licensed security firm for details. Locate control panels at a height similar to light switches and consider the needs of the main user. (Refer to NZS 4301.3.)

## 5.7 Appliances

### 5.7.1 Typical portable appliances

The initial installation should allow for the use of many of the appliances set out in Table 2, whether the first person living in the home owns them or not. This list is not definitive.

**Table 2 – Appliances for which socket-outlets should be provided**

Food preparation	Craft tools	Comfort/security/communication
Benchtop oven	Bench saw	Air-conditioning unit
Blender	Drill	Clock
Bread maker	Inspection lamp	Computer equipment
Can opener	Overlocker	Cordless telephone
Coffee grinder	Planer	Dehumidifier
Coffee maker	Sander	Desk/floor lamp (strong)
Crock pot	Sewing machine	Door bell (on mains)
Dishwasher	Skill-saw	Electric blanket
Electric frying pan		Electric heater
Electric knife	<b>Utility</b>	Fan
Exhaust fan	Battery charger	Foot warmer
Food processor	Clothes dryer	Garage door opener
Freezer	Dust buster	Heath pumps
Hob and oven	Electric lawn mower	Heated towel rail
Hot water boiler	Floor polisher	Intercom
Juice extractor	Inspection lamp	Intruder alarm
Kettle/jug	Iron	Lamp dimmer
Microwave oven	Vacuum cleaner	Telephone/fax
Mixer	Washing machine	Security alarm system
Range cooker	Weed eater	Security lights
Rangehood extractor		Strong reading lights
Refrigerator	<b>Entertainment</b>	Time switches
Slow cooker	Home entertainment systems	
Toasted sandwich maker	Musical instruments	<b>Personal care</b>
Toaster	Radio	Curling tongs
Waste disposal unit	Sound system	Hair clippers
	Television	Hair dryer
		Shaver
		Electric toothbrush

## 5.7.2 Appliance hazards and concerns

### 5.7.2.1 General safety tips

Consider the use of appliances in the building design phase to ensure selected appliances meet the safety needs of the household and can be placed in a safe and appropriate location.

Always refer to manufacturer's instructions for installation, use, and maintenance of appliances.

When appliances are not in use turn them off and unplug them or switch off the socket-outlet they are plugged into.

The condition of an appliance reflects directly on its safety. Immediately attend to an appliance that is cracked, worn, dirty, or corroded.

### 5.7.2.2 Electric shock

Electric shocks can happen as a consequence of heat, humidity, and moisture. Different environments can change how current travels through and over the surfaces of appliances. In warmer climates many cases of electrocution are due to fans that are badly earthed. People also get electrocuted because there are insufficient distances between live parts and touchable surfaces.

### 5.7.2.3 Fire and heat hazards

Many electrical fires are caused by dirty appliances. While breadcrumbs in a toaster do not transfer current, they can be a fire hazard. The same is true of a bathroom fan that has not been cleaned for many years.

Pollution can seep into insulated surfaces and ignite when exposed to electrical sparks.

Careless use of appliances is another source of fires. Leaving a pot unattended on a switched-on stove may have dramatic consequences. Frequent sources of fire include electric blankets that are incorrectly used or electric room heaters that have been covered.

Always plug appliances such as a dishwasher, dryer, or washing machine directly into a socket-outlet. An overload in a dryer for instance can produce enough heat to melt or set fire to a lightweight extension cord.

#### 5.7.2.4 Burn hazards

The surface of many appliances can constitute serious burn hazards due to ineffective thermal insulation.

Low-quality appliances normally have less insulation material. Their surfaces can give serious burns, especially to babies, children, and older people. Hot oven doors are an example of a burn hazard.

The burn effects of different materials can vary widely. At a similar surface temperature, wood will produce a different burn effect to that of glass, metal, or ceramics. This is related to the thermal conductivity and conductive capacity of a given material.

Source: IEC E-tech January/February 2010

#### 5.7.3 Appliance guide

Table 3 illustrates some of the hazards associated with appliances and actions that can be taken to reduce hazards.

Table 3 – Appliance guide for hazard reduction		
Appliance	Potential hazards	Actions that can be taken to reduce hazards
Room of home: <b>General</b>		
Vacuum cleaners	Vacuum cleaners are heavy and difficult to manoeuvre which can lead to back strain or discourage people from using or properly putting away. Cord gets in the way.	Vacuum cleaners with an internal cord extraction are recommended. Store vacuum cleaners in a cool and dry place.
Room of home: <b>Bedrooms</b>		
Bedside lamps	On/off switch difficult to reach or operate.	A touch-pad switch is recommended, particularly for individuals who are less dexterous.
	Fire hazard increases when the lamp is hot and close to flammable materials (such as, bedding and reading materials)	Lights with compact fluorescent tubes are recommended as they provide good light while also being low heat (as well as low-energy use).

Table 3 – Appliance guide for hazard reduction (continued) 

Appliance	Potential hazards	Actions that can be taken to reduce hazards
Room of home: <b>Bedrooms</b> (continued)		
Electric blankets	Fires, burns, overheating, and electrocution are all potential hazards in the use of electric blankets.	<p>Each autumn, carefully inspect electric blankets to ensure they are still safe to use. This includes inspecting the cord, control switch, and plug for any damage. Also look for any kinks, worn or exposed wires, scorch marks, or breaks in the heating element. Finally, turn the blanket on for 15 minutes at the highest setting (don't leave the room) and then turn it off. Run your hand over the blanket and feel for hot spots. A hot spot indicates that the heating coil has been kinked or damaged, which could lead to fire or electric shock so the blanket should be replaced with a new one.</p> <p>Use an electric blanket only to warm the bed. To avoid overheating, switch it off before you get in. Overheating can be life threatening, especially for the very young, ill, or older people.</p> <p>Creasing can damage the heating elements, so when fitting the blanket, ensure it is flat on the bed. Secure the blanket firmly, using the attached ties. Pins or sharp objects should not be used. Keep the cord and control switch clear of the bed so they don't get damaged.</p> <p>Never leave an electric blanket unattended for long periods of time when it is switched on.</p>

Table 3 – Appliance guide for hazard reduction (continued) 

Appliance	Potential hazards	Actions that can be taken to reduce hazards
Room of home: <b>Bedrooms</b> (continued)		
Electric blankets	Fires, burns, overheating, and electrocution are all potential hazards in the use of electric blankets.	<p>In summer, store your blanket rolled (in corrugated cardboard, if possible) or leave it flat on your bed or in a dry area where no objects will be placed on it. Never fold your blanket, as this is likely to damage the heating elements.</p> <p>Never use an electric blanket that is wet. Dry it thoroughly according to the manufacturer's instructions. Never drink in bed or place a hot water bottle in a bed when an electric blanket is in use.</p> <p>Never buy second-hand or used electric blankets.</p> <p>Some people are more sensitive to electricity than others and can feel a sensation from an electric blanket, even with the electric blanket controller in the off position. Any such sensation from an electric blanket or any other electrical appliance should be checked out by an electrician or other competent person, prior to further use. Should the blanket be found to be safe by the electrician or other competent person, any sensation felt from the blanket can be stopped by switching the blanket off at the wall socket-outlet or by removing the plug from the socket-outlet.</p> <p><i>Source: Energy Safety</i></p>

Table 3 – Appliance guide for hazard reduction (continued) 

Appliance	Potential hazards	Actions that can be taken to reduce hazards
Room of home: <b>Kitchen</b>		
Cookers and free-standing electric ranges  (More information on electric ranges can be found under 5.10.)	Smooth top cooktops have particular safety concerns, as they are easily mistaken for a counter surface and will be hot even after a pot is removed from their surface.	Look for cooktops which not only have a bright light while they're on, but don't turn off that light until the surface has cooled to a touchable level.
	Danger of getting burned when attempting to shut off the cooker.	Ensure switches for cooking appliances are isolated and can be readily identified from other switches. Locate cooking appliance switches on the wall beside the appliance not behind or above it so that it is not necessary to reach over the appliance to shut it off.
	Danger of being burned if the appliance falls (either by being unintentionally pulled over or during an earthquake).	Ensure cookers and free-standing electric ranges are secured to the wall behind them.
Dishwashers	Dishwashers that are poorly positioned in the kitchen can make loading and unloading difficult which can lead to back strain or other injuries.	Consider installation at time of design and locate in a spot that is easy to access.
	Dishwashers with bottom-hinged doors are often used to rest items on, or as a means of support. Children may climb on hinged doors that are open.	Dishwashers with bottom-hinged doors should be securely fixed to prevent tipping.

Table 3 – Appliance guide for hazard reduction (continued) ➤

Appliance	Potential hazards	Actions that can be taken to reduce hazards
Room of home: <b>Kitchen</b> (continued)		
Kettles and jugs	Cords fray or get burned on elements. A jug cord left hanging over the edge of a bench presents a hazard to children who may pull the jug onto themselves.	A 'cordless' jug or fixed hot water dispenser is recommended. Emptying the jug of hot water after use can also reduce injury-causing spills.
	Steam can cause severe burns.	Reduce the need to reach over steam by selecting a kettle or jug with an automatic on/off switch.
Microwaves	Burns from hot food or liquids as they are being pulled from the microwave.	Ideally, microwaves should be at benchtop height: too low (such as under benchtops) and they are a potential danger to children, too high (for example, on top of a refrigerator) and the chance of spilling hot food or drink increases.
	Food that is heated too long can catch fire.	Space and heat resistant set-down requirements for a microwave are the same as for a conventional oven.  As a microwave oven's cavity is enclosed and metal, fires are usually well contained. Switch off the oven and allow the fire to consume the available oxygen with the door closed.
Refrigerators and freezers	Falling during events such as earthquakes or unintentionally being pulled over.	Like other major appliances in the kitchen (such as, dishwashers and stoves), refrigerators and freezers should be secured to the wall immediately behind them to reduce the chance of them falling over or being pulled on top of someone.
	Back strain from reaching for items within them.	Locate so that the appliance is not hard to access. Food most used in a refrigerator or freezer should be stored at arm height.

Table 3 – Appliance guide for hazard reduction (continued)

Appliance	Potential hazards	Actions that can be taken to reduce hazards
Room of home: <b>Kitchen</b> (continued)		
Toasters	Toasters are probably the most dangerous appliance in the kitchen for the following reasons: stuck toast can easily catch fire; the top is usually excessively hot when in use which can cause burns of varying degrees; and the exposed live elements in toasters are extremely dangerous if metal objects come into contact with them while the toaster is plugged in (usually in an attempt to retrieve a stuck piece of toast).	Use toasters with a switch that detects faults in the toaster and automatically cuts off the power supply. Toasters should also be cool to the touch on the outside even when in use. Always unplug a toaster to clean it or when trying to retrieve a stuck piece of toast.
Room of home: <b>Laundry area</b>		
Iron and accessories	Hanging cords can be tripping hazards. Irons can cause burns (either by falling on someone or being touched when hot).	Have a safe place designated for ironing that is out of the way of foot traffic (especially children and pets). Consider a cordless iron or one that shuts off if not moved when in the horizontal position. Do not leave irons that are switched on unattended.
	Fires can be caused if hot irons are placed in poorly ventilated areas, such as storage cabinets.	After use, allow the iron to cool in a well-ventilated place before returning it to a storage cabinet.
	Muscle strain or repetitive strain injury can be caused by overuse or poor posture.	Adjust ironing boards to a comfortable height for the user.


Look for safety certification on appliances, electrical tools, and other household products. Safety certification is not limited to electrical appliances. It extends to a wide range of the products and materials that are used to manufacture them.

#### 5.7.4 Appliance protection

Portable appliances are used in a variety of situations with varying degrees of hazard. The better contact a person makes with earth, the greater the hazard.

Various forms of safeguard are available for appliances as listed in Table 4.

**Table 4 – Portable appliance safeguards (listed in decreasing levels of safety)**

Condition of use	Form of appliance safeguard
Dry, indoor, non-earthed situations	<p>Battery-operated equipment</p> <p>All insulated (for example, plastic covered clocks)</p> <p>Direct earthing (for example, metal toaster, space heater, iron)</p>
Indoor and damp, or outdoor, or building under construction	<p>Battery-operated tools (in-built or detachable battery packs)</p> <p>Double insulation (marked on the appliance as )</p> <p>Supplied from a 230-volt isolating transformer</p> <p>RCD</p>
Where person is partly or wholly immersed in conducting substance or in a substantially conductive location	<p>Battery-operated tools (in-built or detachable battery pack)</p> <p>Supplied at extra low voltage</p> <p>Permanently connected through a continuous flexible cord to an isolated supply with no more than 230 volts between conductors</p> <p>A double insulated appliance with the connecting cord monitored by RCD</p>

## 5.8 Automatic controls

### 5.8.1 Garage door control

Garage-door openers are often the heaviest piece of moving machinery in the home. Injuries (particularly to children) can be caused by the garage door coming down and hands, fingers, hair, or clothing being caught between the rolling mechanism and its track or a tensioned spring breaking suddenly. Where springs are used in the door mechanism, make sure that each spring is equipped with a device capable of restraining the spring assembly in the event of failure, to prevent it flying towards anyone. (Refer to AS/NZS 4505.)

To reduce potential hazards garage door openers should be motorised and controlled by a remote device. The device should include a reversing feature so that when resistance or an obstruction is detected in its path the device reverses itself.

A manual-release mechanism should be included in the device and be easy to access.

The garage unit should have an automatic light fitting incorporated, so that when the door is opened, the light turns on and stays on for a suitable time after the door closes.

Fit a pressure-sensitive skirt or similar to the leading edge(s) of the door. This sensor should react in both the opening and the closing action.

The installer should ensure that the door-operating and protection mechanisms work as intended and that the user understands the system.

### 5.8.2 Remote controllers

Limit the range of remote controllers to a few metres.

Remote controllers can operate many electrical devices including curtains, heaters, doors, alarms, and lights. These remote controllers are also known as environmental controls and can be used to greatly increase the independence of people with limited mobility.

## 5.9 Lighting

### 5.9.1 Planning

Provide adequate lighting for the activities carried out in each space. (See Table 5.)

In all home areas, attention should be given to the lighting of room surfaces. The selection and positioning of light fittings should provide a compromise between attractive 'sparkle' and unwanted glare. Dimming is useful for changing background lighting. Refer to NZS 6703 and AS 4299 for additional guidance on lighting levels.

An even degree of light, particularly along paths of travel, should be available throughout the home (for example, more than one single lamp may be required in each room).

Lighting design should be sufficiently flexible to allow the illuminance to be increased up to twice the standard illuminance design values (lux) given in column 2 of Table 5.

The requirement for additional light for fine work begins at 21 years of age for adults with average sight, and increases throughout life. The need for extra light should be able to be met without installing an extra light fitting, and without exceeding the rating of existing fittings.

## 5.9.2 Lighting levels

Table 5 – Recommended standard service illuminances (lux)<sup>(1)</sup> ➤

Area	Standard service	Level for people with vision impairment	Position of measurement of lamps
<b>Bathrooms</b> <sup>(2)</sup>	100 lux (150 W)	500 lux (675 W)	Working surface
<b>Bedrooms:</b>			
General	50 lux (75 W)	300 lux (400 W)	Floor
Bedhead	150 lux (200 W)	500 lux (675 W)	Bed
<b>Halls and landings</b>	150 lux (200 W)	350 lux (475 W)	Floor
<b>Stairs</b> <sup>(3)</sup>	100 lux (150 W)	350 lux (475 W)	Treads
<b>Home offices</b>	300 lux (400 W)	600 lux (800 W)	Task <sup>(4)</sup>
<b>Kitchens</b> <sup>(5)</sup>	300 (400 W)	600 lux (800 W)	Working surface

## NOTE –

- (1) Lux (illuminance design value) is expressed in watts representing approximate incandescent lamp watts for 3 m x 3 m x 2.4 m high room. Incandescent lights give a light which is classed as intermediate or warm.
- (2) Additional lighting is desirable for mirrors. Enclosed fittings should be used.
- (3) High luminance areas should be screened from the view of a person ascending or descending stairs. Lights mounted at a low level and illuminating stair treads or outside steps are recommended.  
  
The low-intensity recessed lights should be located to illuminate the floor in corridors and toilet areas. These should be wall-mounted about 200 mm off the floor and be provided with louvres or similar to prevent direct illumination into the eyes. The use of long-life lamps is encouraged. Standard fluorescent tubes and compact fluorescent lamps meet this requirement. Fittings must be rugged.
- (4) Allow for adjustable light fittings for task lighting. Install a suitably located socket-outlet as an alternative.
- (5) Cupboards, recesses, appliance garages, and shelving often require additional local lighting. Automatic control by opening and shutting of the door should be considered.

**Table 5 – Recommended standard service illuminances (lux)<sup>(1)</sup>**  
(continued)

Area	Standard service	Level for people with vision impairment	Position of measurement of lamps
<b>Living rooms and lounges:</b> <sup>(6)</sup>	General	50 lux (75 W)	300 lux (400 W)
	Casual reading	150 lux (200 W)	300 lux (400 W)
	Sewing and handcrafts	300 lux (400 W)	600 lux (800 W)
<b>Garages and workshops:</b> <sup>(7)</sup>	50 lux (75 W)	300 lux (400 W)	Floor
	300 lux (400 W)	600 lux (800 W)	Bench

NOTE –

- (6) The installation of dimmers or the fitting of lamps of lower wattage should be considered to suit people with normal sight.
- (7) Low-intensity recessed night lighting should be installed in utility areas. These should be controlled by a photoelectric cell to switch on during the night hours. Manual override switching, both on and off, should be provided in a convenient location, but where the switches are not likely to be operated casually.

Adapted from AS 4299.

### 5.9.3 Light switch location

For light switch layout follow the main night-time circulation routes, such as from the entrance ways to the living areas and from the bedrooms to the bathrooms and toilet.

‘Walk through’ the plan and choose light switch positions so that it is not necessary to cross any major space in the dark. When possible, involve the users in this exercise.

Use two-way switching at each entrance to a major space and at each end of passageways and hallways (to avoid the need to pass through these spaces in darkness). Multi-way switches (intermediate switches) are recommended where there are more than two likely switch positions. Two-way switching can also be implemented by the use of strategically located push buttons which between them toggle the lights on and off via a relay and timer or similar.

Consider fitting luminous indicators (neons or LEDs) to light switches, which operate either continuously or when the lights are off, so as to enable users to locate the switches in the dark.

Stair lighting should have control switches at the top and bottom of the stairway (such as, two-way switching). Stairway light switches should be mounted at least 1 m horizontally from a top or bottom stair tread, or from an internal wall.

A person should be able to reach a switch while well clear of any stairs or steps.

Switches should be within the safe reach of children, and the convenient reach of adults. It is desirable that light switches be horizontally aligned with door handles. A height of 1000 mm height enables the widest range of use by everyone, including older people and people with disabilities. It is also important for young children to be able to reach and operate door handles in an emergency.

Light switches (or other light sources such as lamps) should be within easy reach of each bedhead to avoid falls that often occur at night when people get up to use the bathroom or to attend to young children. (See section 7.)

It is also recommended that door hardware and light switches are horizontally aligned throughout the home. Consistent height of door handles and light switches ensures familiarity and speed of use particularly in the dark.

#### 5.9.4 Switching and control

Switching of lighting should be made accessible, simple, and automated where possible.

This can be achieved by the toggle, rocker, push pad, or push button projecting clear of the switch plate, or if the width of any pad, toggle or button is no less than 20 mm. Touch type switch plates are easy to use and are a good feature as a ramp up and ramp down switch.

Install photoelectric cells and proximity switches where the operation of switches incurs some difficulty. Infra-red detectors responsive to a portable transmitter may be located at each light location.

Use sensor lighting where possible. Sensor lighting is suitable for stairways and dark passages, or for outside lighting, where it has the added advantage of providing security.

Where finance allows, it is also worth considering the use of remote devices, including voice activated systems for control of electrical switching mechanisms. Remote devices are now very reliable and reasonably priced.

Provide a light switch within easy reach of each bedside. At least one of the main room lights should have a bedside switch. If the wall immediately behind a bedhead is not easily reached or seen by a person in the bed, a side console is suggested.

### 5.9.5 Outside lights

Light switch layouts should include provision of circuits and switches for exterior lighting, whether or not such lighting is installed at the time when the home is constructed. Switches used outdoors will have an IP rating marked on the switch.

NOTE – The marking would be in the form of IPxx where the first x designates the degree of protection of people against access to hazardous parts. The second x indicates protection against water entering the switch and ranges from 0 (unprotected) to 8 (protection against continuous submersion). External switches must be at least IP23.

Besides illuminating the path, lighting at entrance ways should illuminate visitors so that they can be readily identified.

Outside lights should be controlled by movement sensors which turn the lights on at night only.

### 5.9.6 Lamp replacement

For safety reasons, lamp replacement should be carried out while the lights are off. Where two-way switches are used for control, the installation of at least two lamp holders (or the fitting of a neon indicator at each switch) can enable the state of the circuit to be identified.

Light fittings, with the possible exception of security lighting, should be located so that they are reasonably easy to access for changing lamps. Access to light fittings on stairways, sloping ceilings, and outdoors is often particularly difficult.

Ideas to consider include the following.

- (a) Install 'pull-down' fittings.
- (b) Where lamps cannot be reached, lamp changing may be implemented by providing easily manipulated clips or tools.
- (c) Unless there is good reason for a light fitting to be much lower than the ceiling, pendant suspended light fittings (as a feature) should not be used since two hands are usually required to change a lamp.
- (d) Consideration should be given to positioning light fittings in low, accessible (wall-mounted) locations.
- (e) The use of fluorescent tubes and compact fluorescent lamps is encouraged because they have the following advantages:
  - (i) they last about five times as long
  - (ii) they run considerably cooler
  - (iii) they use considerably less energy
  - (iv) they usually give warning of impending failure (they flicker or dim).
- (f) It is recommended that standard light fittings have bayonet lamp connections, and that reflector lamp fittings have Edison screw lamp connections. This helps to ensure that the correct replacement lamp is fitted and is generally the way they are available in stores. Both types are equally subject to seizure if overheated, or if left in a damp or corrosive atmosphere.

## 5.10 Permanently connected services

### 5.10.1 Electric ranges

Where a range incorporates socket-outlets which may be used for supplementary appliances, these outlets should be located on the side of the range to reduce the chance of the cord being burnt on an element. Putting the range in this position does make the plug difficult to remove, so this outlet should be considered an 'extra'. It is better if sufficient outlets are provided in convenient locations to avoid the need to use range-mounted outlets. Some ranges imported into New Zealand do not have socket-outlets mounted on the stove; in such cases sufficient sockets-outlets should be mounted adjacent to the range to compensate. (See 8.2.)

The use of an induction hob is suggested because the energy source is usually cool to touch.

Isolating switches for electric ranges should be readily identifiable and located on the wall beside the range. In the event of a fire, access to the range isolator must be easy and safe. Mount the isolating switch so it is not necessary to reach over the cooking surfaces.

The preferred cooking appliances for kitchens should be a separate wall oven and cooktop.

Oven and hob controls should be located on the side or front of the appliance, so that the need to reach over hot pots is avoided.

Ranges that have a bottom-hinged door should be securely fixed to prevent tipping. The doors of such appliances are often used to rest items on, or as a means of support. Children are also likely to climb on open bottom-hinged doors.

Ensure any free-standing range is secured to the wall behind it to minimise the chance of it being unintentionally pulled over on a person or falling during an earthquake.

### 5.10.2 Heated towel rails

AS/NZS 3000 provides information on the permitted location for heated towel rails in damp locations. So that falling wet towels will not become lodged on the supply cable, install towel rails that have bottom entry. Locate the permanent connection unit to ensure only a short length of flexible cable is fitted.

Avoid locating a towel rail where it is likely to be used as a grab rail. Provide alternative rails if this is likely to occur. The heater is too hot to hang on to safely for long. Older people often have slow reactions and can suffer severe burns. (See 6.7.)

### 5.10.3 Pools

It is preferable that electrical equipment installed for aerating, filtering, heating, and lighting the water of swimming or spa pools be permanently connected to the fixed wiring.

The use of plug-in appliances around a pool is often the most practical approach but fixed-wired appliances are likely to be safer.

There are a number of additional requirements in AS/NZS 3000 for electrical equipment near pools and spa pools. (See 10.3.)

### 5.10.4 Space heating and cooling

The World Health Organization recommends that homes are heated to a minimum of 18°C to provide a healthy and comfortable environment. Indoor temperatures below 16°C increase the risk of respiratory disease.

See 5.10.4.1 through 5.10.4.5 to learn about some of the electrical options for heating and cooling a home along with potential hazards and steps that can be taken to reduce those hazards. Other heating and cooling systems that should be considered at the design stage include central heating, ventilation systems, insulation, and use of renewable energy. (See sections 1 and 2.9.)

#### 5.10.4.1 Air-conditioning unit (heat pump)

The installation of an air conditioning unit (heat pump) can provide both heating and cooling options.

Air conditioners have fans associated with them which may be noisy and can cause draughts. Ensure air conditioners are located so that blown air is deflected away from people.

#### 5.10.4.2 Ceiling fans

Install ceiling fans with exposed blades only where the ceiling permits a distance of at least 2.2 m from the floor to the fan blades. Install variable speed controllers so the draught can be matched to the ambient temperature conditions.

#### 5.10.4.3 Electric heaters

Portable heaters have caused injuries and deaths due to tripping over them, burns, fires, and electric shock. Minimise the use of portable heaters by placing permanently mounted heaters in all locations where a heater may be required.

Ideally, bedrooms should be wired for permanently connected electric heating or central heating should be installed.

Table 6 lists types of electric heating options and their typical applications for the designer to consider.

**Table 6 – Electrical heating type and application**

Heater type	Applications
Infra-red radiant heaters	Instant personal heating, such as bathrooms, kitchens, and workshops
Convection heaters	Space heating, such as lounges, bedrooms, and hallways
Panel and oil column heaters	Unobtrusive space heating, such as lounges and living rooms
Embedded ceiling heating	Unobtrusive space heating, such as lounges and living rooms
Fan-assisted heaters	Personal and space heating, such as bathrooms, kitchens. Heaters should be wall-mounted for nurseries and children's bedrooms
Storage heaters	Space heating, such as lounges, bedrooms, and hallways
Air conditioning (heat pump)	Space heating and cooling
Underfloor and undercarpet heating	Unobtrusive space heating, such as lounges and living rooms

Table 7 provides guidance on heater capacity for different areas.

**Table 7 – A guide to heater capacity application types for a typical 2.4 m high room with wall and ceiling insulation**

Heater	Room/ Application	Minimum rating
Convection storage heater	Living rooms	0.6 kW/m <sup>2</sup> floor area
Convection storage heater	Sleeping areas	0.4 kW/m <sup>2</sup> floor area
Fan-assisted storage heater	Living rooms	0.6 kW/m <sup>2</sup> floor area
Panel heaters and radiators	Living rooms	80 kW/m <sup>2</sup> floor area
Panel heaters and radiators	Sleeping areas	60 kW/m <sup>2</sup> floor area

NOTE – Consider the influence of the lighting installation in heating calculations. Enhanced lighting levels can provide an apparent 'instant' heating effect.

#### 5.10.4.4 Heater location and protection

Position high-level radiant heating away from curtains, blankets, soft furnishings, and doors.

Bathroom heaters mounted at a high level are less likely to be affected by splashing of water.

Prevent direct access to heaters by fitting barriers or ensuring they are out of reach.

#### 5.10.4.5 Control

Provide suitable automatic heater control. Thermostat control, wall-mounted at a level of 1300 mm from the floor, is preferable to a thermostat mounted on the heater.

Install thermostats and time switches at a height suitable for the user. Ensure displays are clearly legible, and the controls suitable for operation by the user. The height should be similar to that recommended for door handles and light switches.

## NOTES

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## 6 Bathroom, toilet, and laundry

The bathroom may be one of the smallest rooms in a home, but it also can be one of the most hazardous. There are many ways to make a bathroom safer.

### 6.1 Baths

Grab rails are recommended to minimise falls that may occur when climbing into or out of a bath.

Bath bottoms should be near level and textured for slip resistance. A slip-resistant surface for baths can be provided by means of adhesive strips of slip-resistant materials or a slip-resistant mat.

Avoid showers over baths. When a bath is also used as a shower, the slipperiness of the bath surface and the action of stepping over the edge of the bath significantly increases the risk of slipping or tripping.

Minimise the risk of injuries by positioning rigid soap holders so they do not protrude over the bath.

### 6.2 Cabinets and storage areas

#### 6.2.1 Child-resistant catches on cabinets

Many bathroom and laundry cabinets contain substances that are very hazardous to people, such as prescription medicines or cleaning chemicals. Place any of these items that could be accessed by children in storage areas that are fitted with child-resistant catches. Child-resistant catches are preferable to locks as their operation is automatic. These catches can be purchased from most supermarkets. Ideally, dangerous substances should be stored in high cupboards that are out of reach of children. Even high cupboards should be fitted with child-resistant catches as some children will climb.

To ensure that access to the bathroom and laundry cabinets can be restricted without denying access to the toilet, at least one toilet should be in a separate room.

Arrange fittings so that they do not create a climbing path for children to other potential hazards, such as basins or windows.

### 6.2.2 Rounded fittings and fixtures

Sharp edges on cupboards, doors, and benches can cause bruising, scrapes, and cuts. The edges of bathroom, toilet, and laundry fittings and fixtures should be rounded to minimise this occurring.

## 6.3 Cleaning

Poor cleaning can increase slip hazards in the bathroom. A moist environment can also lead to germs (viruses, bacteria, and other microorganisms) or mould build-up which could cause illness.

## 6.4 Design

Design bathrooms for ease of cleaning and accessibility to encourage safe practices and reduce the likelihood of possible injury.

Smooth surfaces are easier to clean. It's important to consider this when choosing materials for walls, benches, and other surfaces. Select flooring that is easy to clean and slip resistant.

## 6.5 Doors and windows

### 6.5.1 Doors

It is important to design any bathroom, toilet, or laundry space for easy access in the event of an emergency. Where a lock is fitted to an internal door, it must be able to be unlocked from the other side.

To assist someone who has fallen or collapsed it is often necessary to be able to gain access through the door. In a bathroom, toilet, or laundry this can be achieved in several ways.

- (a) Fit removable hinges.
- (b) Use a sliding door. Generally a sliding door can be opened without injuring someone who has fallen against it.
- (c) Use an outward opening door where possible.

### 6.5.2 Windows

Reaching over a bath to open or close a window is a potential cause of slips and falls. Locate windows that can be opened so that it is not necessary to step into, or lean over the bath to operate them.

To reduce injury, all bathroom glazing should comply with the human-impact requirements for glazed panels and windows in bathrooms. (Refer to NZS 4223.3 and the modifications made in NZBC Compliance Document F2 Hazardous Building Materials, Acceptable Solution 1.) **All glazing around showers shall be safety glass or plastic and comply with NZS 4223.**

The requirements set out in NZS 4223 specify various types of safety (or toughened) glass depending on combinations of:

- (a) the size of the glazed panel or window
- (b) the height of the glazing above floor level
- (c) the clearances between the glazed panels or windows and other bathroom elements and fittings.

### 6.5.3 Mirrors

Mirrors must be securely attached to walls. In all instances safety mirror glass is recommended.

### 6.5.4 Electricity

Put simply, water and electricity do not mix. Extra care must be taken when using electricity in bathrooms, toilets, or laundries. Guidelines are given in 6.5.4.1 to 6.5.4.4. (Also see section 5.)

#### 6.5.4.1 Electrical installation

**Permanently fitted electrical equipment in bathrooms shall be installed in accordance with the Electricity (Safety) Regulations, and refer to AS/NZS 3000 if installing electrical outlets in a bathroom, toilet, or laundry.**

#### 6.5.4.2 Electrical appliances

To reduce the chance of electrical shock, use appliances such as hair dryers and shavers outside the bathroom or away from other damp areas. It is recommended that general purpose socket-outlets not be installed in a bathroom. (See 5.3.)

The use of a shaver unit in bathrooms is intended to supply an electric shaver only. For hair dryers and similar appliances, a RCD-protected socket-outlet that meets the requirements of AS/NZS 3000 for damp locations should be installed.

Permanently mount and wire other appliances, such as heaters, lights, and fans to avoid the need to have portable appliances taken into the room.

**The use of portable heaters and extension cords in bathrooms is extremely dangerous and shall be avoided.**

#### 6.5.4.3 Heaters

Although some heaters are designed for use in the bathroom, extra precaution should be taken when installing or using a bathroom heater. Always comply with AS/NZS 3000 and the manufacturer's recommendations when installing and using a bathroom heater.

Follow these safety tips for the use of heaters.

- (a) Reduce the chance of carbon monoxide poisoning by not using an unflued gas heater in an enclosed space such as a bathroom. (Refer to AS/NZS 5601.1 for more information on suitable gas-fired heaters in bathrooms.)
- (b) Place the heater at safe distance from the bathtub or water basin.
- (c) Ensure a wall or ceiling heater is securely mounted.
- (d) Turn off the heater when the room is not in use.
- (e) Unless specifically designed, heaters should not be used to dry towels or clothes.

#### 6.5.4.4 Heated towel rails

AS/NZS 3000 details the permitted location for heated towel rails in damp locations. (See 5.10.2.)

Avoid locating a towel rail where it is likely to be used as a grab rail. Older people often have slow reactions or may be insensitive to the heat and can suffer severe burns.

## 6.6 Floors

### 6.6.1 Slip resistance

To reduce slips, trips, and falls flooring should be slip resistant. (See Appendix A.)

### 6.6.2 Level floors

To reduce trips, no steps or abrupt change of level should occur in a bathroom or toilet floor.

### 6.6.3 Flooring colours

Dust, dirt, and mould build up on a floor surface make it more slippery when wet. For this reason, in bathrooms and laundry areas choose flooring surface colours that show dust, dirt, or mould. Green or beige are less suitable than contrasting colours.

### 6.6.4 Slope of wet-area shower floors

Design wet-area shower floors to be continuous with the rest of the bathroom floor and allow water to run naturally to the floor drain. A slope of 1:50, provided it is consistent over the whole surface, is sufficient to ensure that water will drain away.

## 6.7 Grab rails

### 6.7.1 Grab rail locations

Properly installed grab rails are an important safety feature in a bathroom. Grab rails can break falls, provide stability, and assist people in pulling themselves up. Even if grab rails will not be installed immediately, when building or renovating, structural stud work in the bathroom walls should allow for the addition of grab rails at a later date as required.

Fit grab rails beside baths (this reduces the chance of taps being used for leverage).

For people with mobility or health issues, a grab rail is also suggested in showers and near toilets.

### 6.7.2 Grab rail installation

Grab rails should be able to withstand a downward force of 225 kg. (Refer to NZS 4121.) If a grab rail is not fitted initially, the builder should reinforce the framing area around the bath and shower with a 300 mm wide band of 25 mm thick timber or 12.5 mm thick construction plywood so that support is available for fixing rails at a later date.

Provide a visual cue by using grab rails that contrast in colour and texture with their surroundings. Where the intended use of a building qualifies as a home, toilet layout and fittings must comply with the requirements of NZS 4121.

## 6.8 Showers

There are two types of showers in general use – wet-area and cubicle or stall showers. Wet-area showers are preferable.

A wet-area shower has a shower floor that is continuous with the rest of the floor in the shower or bathroom area. A gentle, consistent fall of the floor to the shower drain is required to prevent pooling of water. Wet-area showers have the following safety advantages.

- (a) The number of projections in the bathroom is reduced, removing potential causes of injuries in the event of a fall.
- (b) The absence of obstructions makes it easier to assist children, older people, or infirm people in the shower.
- (c) A seat is easily fitted.
- (d) Should an emergency occur it is easier to escape from an open shower area than a cubicle.
- (e) The other recommendations made in this guide for the safer design of showers are easily incorporated into wet-area showers.

### 6.8.1 Shower floors

A slip-resistant surface for showers can be provided by means of adhesive strips of slip-resistant materials or a slip-resistant mat.

### 6.8.2 Shower doors

Place glass shower doors so they do not bang into objects in the bathroom area, as they may break under impact and cause injury. (See 2.8 and refer to section 308 in NZS 4223.3.)

Follow the care instructions for safety glass. If toughened shower glass becomes damaged, it should be immediately replaced. Damaged glass may spontaneously shatter.

### 6.8.3 Shower fixtures

To reduce injuries in the shower, space for soap, shampoo, and other personal hygiene products should be easy to reach. Do not store products on the shower floor, on windowsills, or other locations where people will need to bend down or stretch to reach. Recessed holders are best as they do not project into the shower area.

Fit showers with grab rails.

Shower seats can be helpful for people with disabilities or if a person becomes ill while using a shower. Even if a shower seat will not be installed immediately, when building or renovating, structural stud work in the bathroom walls should be done to allow for the addition of a shower seat at a later date as required.

#### 6.8.4 Showerheads

To avoid the risk of burns, it is important that the shower mixer be positioned so that the water temperature can be adjusted without the user getting wet before entering the shower.

Hot water stored at a minimum of 60°C at the cylinder prevents the growth of *Legionella*. Fit showers with shower mixers that have pre-set, anti-burn devices. (See 6.9.) Thermostatic or thermoscopic mixers are preferable because of their consistent and precise temperature control.

Hand-held shower roses are preferred to fixed roses. A hand-held rose enables immediate control over the direction of flow of the water, particularly an unrelieved flow of hot water.

### 6.9 Taps

#### 6.9.1 Water temperature

The hot water stored in the cylinder must be stored at 60°C to prevent the growth of *Legionella*. To reduce the risk of burns, however, the hot water coming out of a tap should be no hotter than 55°C.

If the water at taps is too hot and you have difficulty altering the temperature, ask a registered plumber or local energy supplier to discuss installing an automatic tempering valve. A thermostatic mixing valve includes a temperature sensing mechanism that automatically adjusts the amount of cold mixed in with outgoing hot water to maintain the desired output water temperature. (See Appendix B.)

There is usually just one tempering valve fitted to the water supply system that regulates all taps and other water fixtures. The tempering valve is usually fitted near the hot-water cylinder on the outlet side. (Refer to NZS 4617 and NZBC Compliance Document G12 Water Supplies.)

### 6.9.2 Tap hardware

Many homes now have single-lever mixer taps that allow individual users to find the right temperature for their needs. These taps can reduce unintentional burns by bringing hot and cold water together. Where single-lever mixer taps are used the hot selection should always be to the left.

In homes with hot and cold water taps, the location of hot and cold water taps should be consistent throughout the home to avoid confusion and the risk of burns. This is particularly important in homes where children or people with impaired vision live. To avoid confusion for users, follow standard practice and place cold taps on the right and the hot taps on the left.

The exception to this practice is that the location of hot tap in a bathtub should be farthest away from the edge of the bath so that it is harder for young children to reach.

For all taps, clear marking by the use of red (for hot) and blue (for cold) symbols should be used to identify the tap temperature. (Refer to NZS 4121.)

## 6.10 Toilets

Toilets should be located away from the door. This will allow for easier access to the bathroom in case of an urgent situation, for example if an ill person falls from the toilet and emergency services are required. (See 6.5.1.)

## 6.11 Ventilation

Good ventilation in bathrooms, toilets, and laundries will reduce slip hazards, improve visibility, and reduce germ build-up. **Natural ventilation for kitchens, bathrooms, toilets, and laundries is required, even where there is no external wall in accordance with NZBC Compliance Document G4 Ventilation.**

It is also recommended that a mechanical means (such as an extractor fan) be installed to provide additional ventilation.

## 6.12 Washbasins

Position washbasins with safety and access in mind. Ensure that the washbasin:

- (a) does not overhang the end of the bath
- (b) is placed so that the bathroom door does not strike someone standing in front of the basin
- (c) does not affect access in or out of the room.

Similar to grab rails, washbasins should be able to withstand a downward force of 225 kg in case they are used for stability or to arrest a fall. (Refer to NZS 4121.)

## 6.13 Laundry

With the damp conditions that can exist in laundry areas, this part of the home has many of the same electrical, flooring, and ventilation design requirements as the bathroom. Additional safety issues that should also be considered are discussed below.

### 6.13.1 Appliances

To minimise movement and the chance of tipping over, secure floor-mounted washing machines or dryers to the wall behind, or as recommended by the manufacturer.

Dryers present a fire risk in many homes. To reduce this risk, ensure that the flue off the dryer is vented to the outside of the home.

### 6.13.2 Storage areas

Design laundry layout to allow storage of dangerous items, such as household cleaners, out of reach of children or in cabinets that are fitted with child-resistant catches.

To reduce strain and other injuries, laundry facilities should accommodate a shelf at 910 mm high. The shelf should be large enough and strong enough to hold a full laundry basket. If space is at a premium, this could be a fold-down shelf over a laundry tub.

### 6.13.3 Laundry tubs

The NZBC requires laundry tubs to have a capacity of no less than 35 litres and be capable of fully containing a solid cylinder of 400 mm diameter and 200 mm depth to allow for filling and washing out of buckets and other containers.

For older people, people with disabilities, or people with back injuries a tub with a depth of 210 mm with space under for seating is recommended to minimise the risk of musculoskeletal injuries associated with bending and lifting. (Refer to AS 4299.)

#### THE DANGER OF BUCKETS

Buckets with even a small amount of liquid can be a drowning hazard to young children. Children may fall head first into a bucket and not be able to get out by themselves.

### 6.13.4 Laundry cupboard

If laundry facilities are located in a small space such as a laundry cupboard, ensure that there is proper ventilation when washing machines and dryers are in use. (See 6.13.1.) This may include leaving cupboard doors open while laundry appliances are in use.

## NOTES

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## 7 Bedrooms

As bedrooms are where people sleep, special consideration needs to be given to safety – from location, to room layout, to electrical needs.

### 7.1 Doors

Wherever possible, use side-hung doors for bedrooms. These doors usually provide a better air seal which can reduce noise and smoke from seeping in. (See 7.3.)

### 7.2 Electrical

See section 5 in this guide for more safety information on electricity and electrical appliances. Below is specific electrical information for bedrooms. (See also 7.3.)

When wiring the home consider permanently wiring power and phone outlets for computers and entertainment systems in bedrooms to avoid tripping hazards like trailing cables.

#### 7.2.1 Lighting

To reduce trips and falls, place light switches at the entry door, the en suite door, and within easy reach of the bed. Also consider permanent night lighting.

#### 7.2.2 Socket-outlets

During design and construction ensure there are enough outlets to anticipate the types of appliances that will be used in each bedroom (see Table 8). This will reduce the use of double adaptors and extension cords.

For safety and ease of use, place socket-outlets in convenient positions. Ensure that:

- (a) appliance supply cords do not need to cross doorways or circulation routes
- (b) socket-outlets are not behind door swings.

**Table 8 – Recommended number of bedroom socket-outlets**

Area	Desirable	Minimum
Double bedrooms	6	4
Single bedrooms	4	2

Locate socket-outlets at each side of a bedhead. A socket-outlet supplying an electric blanket may be supplied through a time switch, or time delay switch, to ensure that the blanket is turned off after a pre-selected time. (See 5.7.3.)

## 7.3 Fire safety

Smoke alarms, sprinkler systems, fire-resistant materials, and designing for evacuation are some of the ways to make the home safer in the event of fire. Seek advice from an architect or builder to determine what warning system would be best for a specific home. (See 2.5.)

### 7.3.1 Fire exits

Fires often originate within the kitchen and living room. Ensure at least one of the fire exits from each bedroom does not pass through these areas.

Windows used for emergency fire exits should have:

- a minimum dimension of 560 mm clear opening in one direction and a minimum unimpeded clear opening of 0.6 m<sup>2</sup>
- the top of the windowsill at no more than 900 mm from the floor, and no more than 900 mm from exterior decking or 1800 mm from the ground.

Ensure that security stays fitted to windows designated as fire exits can be removed when the sash is closed without the use of key or tool.

Secondary exit routes for older people or people with disabilities should be through exterior doors to bedrooms, such as ranchsliders that have a level entry.

### 7.3.2 Furnishings

Position desks, bed tables, and other furniture to allow clear access from the bed to bedroom entry points (doors and windows) to ensure a safe exit in the case of fire or other danger.

To prevent being crushed or injured by falling items during an earthquake, secure heavy furniture to walls.

Do not hang heavy objects above bedheads.

Select soft furnishings, including carpet and drapes with fire safety in mind. Often soft furnishings are made of plastics, foams, and other synthetic materials that can burn faster and hotter than wood or natural fibres. (Refer to BS EN 1021-1 and BS EN 1021-2.)

### 7.3.3 Smoke alarms

Install smoke alarms on the escape routes on all levels within the home, and in areas where people sleep, either in every sleeping area or within 3 m of every bedroom door. The alarms must be audible to sleeping occupants on the other side of the closed door. Install smoke alarms on or near the ceiling, in accordance with the manufacturer's instructions. (See 2.5.1.)

## 7.4 Heating

Install fixed heaters in accordance with the manufacturer's requirements. It's important that heaters are a safe distance from joinery, doors, windows, drapes, and furnishings. (See 2.9.)

Wire bedrooms for electric heating unless a home has central heating, forced ventilation systems, or another full-home heating system.

Heating for a bedroom for a young child should be electric heating with thermostat control.

### 7.4.1 Gas heaters

Special requirements apply to flued gas appliances in bedrooms – they must be either room sealed or be fitted with a flame safeguard and the room must have permanent ventilation.

It is recommended that unflued gas heaters are not used in bedrooms. (See 2.9.2.3.)

#### **7.4.2 Electric heaters**

When using electric heaters make sure they are a safe distance from combustible items like bedding, clothes, and drapes.

#### **7.4.3 Radiant heaters**

Do not use radiant heaters in bedrooms because of the risk of fire and burns.

#### **7.4.4 Electric blankets**

Although not part of home design, electric blankets are a common item in many homes. While electric blankets can provide warmth on cold nights, they can also be a fire risk. (See 5.7.3 and 7.2.2.)

### **7.5 Floors**

Tips for reducing trips and falls in bedrooms include:

- (a) avoid steps and stairs between a bedroom and the toilet closest to it
- (b) use non-slip floor finishes (see Appendix A)
- (c) mats and unsecured rugs are a trip hazard – avoid their use between the bed and bedroom exits.

### **7.6 Noise**

To reduce the effects of noise, during the design phase, consider placing living areas, the kitchen, and the laundry area away from bedrooms. Hallways and storage areas can also serve as noise buffers for bedrooms.

Noise-resistant wall linings should be used where separation is not feasible.

## 7.7 Children

### 7.7.1 Electricity

Reduce the risk of electrocution by fitting safety shutters or blank plugs to all socket-outlets.

### 7.7.2 Heating

If possible, heating a bedroom for a young child should be electric heating with thermostat control. Any heat sources should have guards around them to keep children from touching or falling into them.

### 7.7.3 Storage

Consider building toy storage areas into the home to reduce safety hazards. Install child-resistant catches on all drawers and cabinets that a young child should not have access to and store dangerous items (such as cleaning products and medications) in a different part of the home.

### 7.7.4 Windows

Install restrictors at the bottom of all windows to limit how far the window can open. (See 3.8.)

Make sure that cots and beds are not placed near any windows.

Blinds and curtain cords can strangle infants sleeping or playing in cots placed near windows where the cords are within reach or hanging into the cot.

## FURNITURE FOR CHILDREN'S ROOMS

### General furniture suggestions

Use furnishings that have rounded edges and do not have parts that a child could swallow (for example, small dresser knobs.)

Use toy boxes and storage units without lids to reduce head, arm, and finger injuries.

Visit the Ministry of Consumer Affairs website at [www.consumeraffairs.org.nz](http://www.consumeraffairs.org.nz) for more tips, including information on cots and beds. (Refer to AS/NZS 4220 and AS/NZS 2172.)

### Placement of furniture

Place furniture in positions that will allow clear access from the bed to bedroom exits.

Place furniture in ways that do not create climbing routes for children.

Place children's cots and beds away from opening windows.

See 7.3.2 for more tips.

## NOTES

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## 8 Kitchen design

The kitchen is one of the most used rooms in a home. It is also the most dangerous room – with around 130 injuries occurring in home kitchens every day.

Fortunately, there are ways to make the kitchen safer through design, building, and maintenance.

### 8.1 Benches and work surfaces

#### 8.1.1 Heights

Variations in bench heights increase the risk of a kitchen user misjudging the bench height when placing items down which increases the risk of spills. Benchtop heights should be uniform. If work surfaces of variable heights are required (for example, if one of the kitchen users needs to sit while preparing food) they should be provided through pull-out work surfaces and mobile trolleys.

The general rule is that the ergonomic requirements of the primary user of the kitchen are met. To do this, the height of benchtops should be about 50 mm below the height of the elbow joint, measured from the floor, when the user is wearing typical footwear. For more detailed information see Table 9.

Benchtop cooktops enable the height of the worktop to be set to suit the ergonomic requirements of the user: if a conventional floor mounted range is fitted, this fixes the worktop height at 910 mm.

#### 8.1.2 Surfaces

Bench surfaces should be smooth, non-porous, and easy to clean to reduce the chance of germ build-up. Connections between benches, backsplashes, and walls should be seamless for easy cleaning.

To reduce injuries, ensure benchtops have rounded corners and no sharp edges.

Table 9 – Space requirements for benchtops

Work centre	Minimum	Target	Comment
Beside oven or microwave	300 mm	450 mm	Heat resistant surface on one side at least.
Beside cooktop	300 mm one side 600 mm the other	450 mm one side 600 mm the other	Should be at the same level as the cooktop and have heat-resistant surfaces on both sides, smooth enough to slide a pot.
Food processor	450 mm each side	525 mm each side	–
Sink	900 mm one side, drainer the other	900 mm one side 750 mm the other	–
Refrigerator	300 mm one side	450 mm one side	–
Under bench storage (two shelves)	1800 mm	3000 mm	Dimension does not include dishwasher or cupboard with waste disposal, but does include underbench cupboard.
Wall hung cupboards (two shelves)	1800 mm	3000 mm	Maximum height of top shelf 1650 mm from floor.

NOTE – Work centres may overlap to reduce the total length of worktop required.

## 8.2 Cooking appliances

There are many fire and safety hazards associated with cooking appliances. When installing or using a cooking appliance follow the manufacturer's instructions.

A fire blanket provides a means of effectively dealing with cooktop and oven fires. Keep the fire blanket in an easily accessible and conspicuous location not immediately adjacent to the cooking appliances.

### 8.2.1 Safety concerns with gas and electric cooking appliances

#### 8.2.1.1 Gas cooking appliances

Safety concerns with gas ranges and cooktops centre on concerns of working with gas appliances. Unlit gas can accumulate and cause explosions. **Installation by a registered tradesperson is recommended and all installations must be signed off by a certified gasfitter.**

There is a possible relationship between gas products and some respiratory conditions in well-sealed buildings. (See 8.10.) For this reason, as well as to reduce the risk of fire, gas appliances should be adequately ventilated and installed in accordance with the local authority's requirements and the manufacturer's recommendations. (Refer to AS/NZS 5601.1.)

#### 8.2.1.2 Electric cooking appliances

Smooth top cooktops have particular safety concerns, as they are easily mistaken for a counter surface and can remain hot even after a pot is removed from their surface. Look for cooktops which not only have a bright light while they're on, but don't turn off that light until the surface has cooled to a touchable level.

Ensure switches for cooking appliances are isolated and can be readily identified from other switches. Locate cooking appliance switches on the wall beside the appliance not behind or above it so that it is not necessary to reach over the appliance to shut it off. (See section 5 and refer to AS/NZS 3000.)

### 8.2.1.3 Cooktops

Place cooktops and ranges away from foot traffic. Avoid installing cooktops adjacent to doorways or in peninsular or island units which open to living areas.

To avoid cooktops being unintentionally turned on, controls for cooktops should be mounted in the work surface and away from the front of the bench.

Bench-mounted cooktops with staggered burners or elements are preferable, unless the extra length that these fittings require will reduce bench spaces to below the minimums shown in Table 9.

### 8.2.1.4 Floor-mounted stoves

To prevent the stove tipping over if a child climbs onto an open oven door, fix floor-mounted cooking appliances to the wall behind them.

### 8.2.1.5 Microwaves

At the kitchen design stage identify a safe and appropriate place to put the microwave.

Ideally, microwaves should be at benchtop height: too low (such as under benchtops) and they are a potential danger to children, too high (for example, on top of a refrigerator) and the chance of spilling hot food or drink increases.

Space and heat resistant set-down requirements for a microwave are the same as for a conventional oven. See Table 9 for information, and the manufacturer's instructions for ventilation of the microwave unit.

### 8.2.1.6 Wall ovens

To reduce bending and the risk of back injury, install wall ovens and cooktops instead of floor-mounted cooking appliances.

Set wall ovens with the middle shelf at benchtop height to reduce the likelihood of back injury or burns.

### 8.2.1.7 Food-waste disposals

Food-waste disposals are sometimes used in houses and apartments to dispose of food scraps and reduce the amount of rubbish that goes into the bin. If considering a food-waste disposal consider one that does not rely on blades and automatically shuts down when the motor jams. Follow manufacturer's instructions for the installation, use, and maintenance of a food-waste disposal.

Consider options such as composting to remove the need for mechanical disposal units.

## 8.3 Electrical

The recommended number of socket-outlet locations in the work area of the kitchen is eight with a minimum of six. Place socket-outlets as far as possible from the edge of the bench so cords from electrical appliances are out of reach of children. (See section 5.)

## 8.4 Flooring

There are a number of ways to reduce slips, falls, and dangerous spills in the kitchen.

- (a) Ensure kitchen flooring is slip resistant (See Appendix A.)
- (b) Keep the distance that hot food must be carried between the serving area in the kitchen and the dining area to a minimum.
- (c) Make sure the floor is level between the kitchen and the dining area.

## 8.5 Layout and space planning

### 8.5.1 Foot traffic

No matter the size of the kitchen, keep work areas away from foot traffic. Consider where entrances into the kitchen are and place sinks, stoves, and refrigerators away from circulation routes.

If possible, avoid kitchen designs which facilitate traffic routes through them. This layout can lead to injuries, especially when people with hearing impairments are working in the kitchen.

### 8.5.2 Floor and bench dimensions

To allow for more than one person to work safely within the kitchen, allow for a minimum floor dimension of 1500 mm between benches, or between benches and fittings. This dimension will also allow for wheelchair turning space.

### 8.5.3 Layout for households with children

Consider kitchen designs that allow the opportunity to temporarily fence off the kitchen from young children. Ideally, a stair gate will fit across the kitchen entrance to block young children's access as necessary.

Avoid kitchen designs which facilitate traffic routes through them; this layout can lead to injuries especially when people with hearing impairments are working in the kitchen.

Position the kitchen so that it's possible for adults working in the kitchen to see indoor and outdoor play areas.

## 8.6 Lighting

To reduce injuries such as cutting, kitchens provide adequate lighting over the sinks, ovens, and other work areas.

## 8.7 Sinks

To reduce back strain, shallow sinks are preferable to deep sinks. Often the bottom of a kitchen sink is placed lower than optimum for most kitchen users so that benchtops can be kept at a comfortable height. Shallow sinks help remedy this and allow benchtops to be set at a more convenient height.

To accommodate seated users and people with disabilities, provide open space under the sink with flooring material laid all the way to the wall under the sink. A sink with the drain placed toward the back, rather than the middle is preferable so that pipes below the sink are less in the way for storage or for a seated user.

## 8.8 Storage

### 8.8.1 Height

To avoid dangerous falls and strains, avoid storing frequently used and heavy items up high. It should be possible to reach a cupboard comfortably without having to stand on a chair or steps.

Ideally, the highest shelf should be no higher than 1650 mm from the floor. For older people and wheelchair users the maximum height should be 1350 mm. If items are stored at heights that are above a person's reach, have a suitable stepladder easily accessible so that the stepladder is used instead of chairs, stools, or less safe devices.

Where practical, low storage should also be avoided as many back injuries are aggravated by having to bend down and reach into low-level storage. Consider raising the height of the toe space under low-level cupboards to at least 150 mm.

### 8.8.2 Rubbish and compost bins

To reduce falls, place rubbish and compost bins under the bench where they are away from foot traffic. Remove as many tripping hazards as possible, such as pet bowls, from the kitchen to allow easy and safe movement.

### 8.8.3 Pulls and handles

Pulls and handles should be rounded and well secured to avoid injury.

### 8.8.4 Type of storage

Pull-out, sliding drawers and cupboards, hinged corner baskets, and specialised appliance garages at worktop level minimise bending and straining when reaching for cooking appliances and tools.

To reduce dangerous obstacles, avoid side-hung doors at head height.

Keep kitchen cleaners and other dangerous substances out of reach of children by putting them in cupboards with a child-resistant catch. On average, each kitchen should have two cupboards fitted with a child-resistant catch. Locked cupboards are not suitable as users may forget to lock them when children are only occasionally in the home. High cupboards that are not secure still pose a danger, as children will climb to reach them. Where child-restraint catches are fitted it is important to ensure that adults with manipulative, mobility, and visual disabilities are still able to access the cupboard when necessary.

## 8.9 Taps

### 8.9.1 Tap location

Taps should not project permanently over the sink as this restricts the space required to wash bulky items like electric frying pans.

Single-lever controlled, anti-burn faucet taps are preferable as they are easier for those with disabilities to use. Quarter turn, lever action taps, with a high contrast in colour from their background work well. (Refer to NZS 4121.)

In homes with hot and cold water taps, the location of hot and cold water taps should be consistent throughout the home to avoid confusion and the risk of burns. This is particularly important in homes where children or people with impaired vision live. To avoid confusion for users, follow standard practice and place cold taps on the right and hot taps on the left. (The bathtub is the one exception to this practice, see 6.9.2.)

### 8.9.2 Water temperature

The hot water stored in the cylinder must be stored at 60°C to prevent the growth of *Legionella*. To reduce the risk of burns, however, the hot water coming out of a tap should be no hotter than 55°C.

If the water at taps is too hot and you have difficulty altering the temperature, ask a registered plumber or local energy supplier to discuss installing an automatic tempering valve. A thermostatic mixing valve includes a temperature sensing mechanism that automatically adjusts the amount of cold mixed in with outgoing hot water to maintain the desired output water temperature. (See Appendix B.)

## 8.10 Ventilation

It is important for the kitchen to have a permanent means of ventilation at the cooking source to remove the heat, smoke, and steam that occur during cooking. This is even more crucial when gas appliances are used, since gas produces carbon monoxide which is toxic.

**Natural ventilation for kitchens, bathrooms, toilets, and laundries is required, even where there is no external wall in accordance with NZBC Compliance Document G4 Ventilation.**

Additionally, it is recommended that all kitchens have a mechanical means of ventilation, such as an extractor fan.

## 9 Living rooms and lounges

Living rooms and lounges are where groups of people gather for entertainment, casual eating, watching television, and more. These varied uses by many different people in the home should be considered in the design and building of a home. To reduce injuries, areas for low activity (for example, reading or studying) and high activity (for example, exercising) should be separated.

Below are a few safety tips specific to living rooms.

### 9.1 Electrical

See section 5 for information on electricity and the use of electrical appliances in the home. Specific information for living rooms and lounges is included 9.1.1 to 9.1.3.

#### 9.1.1 Lighting

To provide safe exiting and entering, a switch by the front door that lights all the living areas should be installed. (See 5.9.)

Light switches should be located at all living room entrance points so people do not have to cross the room in the dark when coming in or out.

Recommended standard service illuminances (lux) vary based on the activity and the needs of the individual. See Table 5 for suggested lighting levels. (Refer to AS 4299.)

#### 9.1.2 Socket-outlets

There should be a sufficient number of socket-outlets to plug in electric equipment to reduce the tripping hazards of cables running across the floor. In the living area the minimum recommended number of socket-outlet locations is five and the desirable number of socket-outlet locations is eight. (See Table 1.)

### 9.1.3 Home entertainment

Where appropriate, provision should be made for electrical and network outlets for home entertainment. Each location should include at least four outlets. Access should be available to the outlets without the need to crawl under a table or move equipment. Consider the use of a movable trolley unit for the equipment. This should have multiple socket-outlets fitted in an accessible position on the unit.

## 9.2 Fire safety

Smoke alarms, sprinkler systems, fire-resistant materials, and designing for evacuation are some of the ways to make the home safer in the event of fire. Consider getting advice from an architect or builder to determine what warning system would be best for a specific home. (See 2.5.)

As fires often originate in the kitchen and living room, at least one of the fire exits from each bedroom should not pass through these areas.

## 9.3 Heating

See sections 2 and 5 for home heating suggestions and safety tips for using heating devices such as wood-burning stoves and space heaters.

## 9.4 Placement

The location of the living room and lounge in a home is important for a number of reasons that are described 9.4.1 to 9.4.3.

### 9.4.1 Noise

To reduce the effects of noise, during the design stage consider placing living areas, the kitchen, and the laundry area away from bedrooms. Hallways and storage areas can also serve as noise buffers for bedrooms.

### 9.4.2 View to outdoor areas

So that adults are able to respond to accidents quickly, children's outdoor play areas and the swimming pool, spa, or hot tub should be visible from the main living areas of the home.

### 9.4.3 Passive design

To make the most of the sun for warmth and natural light, a home's main living areas and glazing (such as windows, skylights, and glass doors) should face north. (See 2.9.1.)

## FURNISHINGS

Consideration should be given to what types of activities will be carried out in living rooms and lounges. Furnishings can then be selected for these areas that will be both safe and attractive.

Where possible, use furniture with rounded corners and no protrusions. This is particularly important in homes with children, people with disabilities, and older people.

If using furniture which is made of glass, or has glass parts, make sure that it is safety glass which can meet all human impact safety requirements (refer to NZS 4223.3 and *Glass in furniture and similar applications: GANZ code of practice*). Safety glass will break apart in a way that is less likely to cause serious injury. Coffee tables are most likely to be fallen against or have things dropped on them, so these are especially dangerous if children are around. Bent glass coffee tables without frames should be avoided where children may have access to them.

Heavy furniture (such as pianos and bookcases) should be secured to the wall behind them, so that they will not fall during an earthquake.

To reduce trips and falls, ensure there are clear circulation routes through living spaces. All rugs and carpets should be secured. Because of the potential for tripping, rugs should not be placed near heaters.

Soft furnishings, including carpet and drapes should be selected with fire safety in mind. Often soft furnishings are made of plastics, foams, and other synthetic materials that can burn faster and hotter. (Refer to BS EN 1021-1 and BS EN 1021-2.)

## NOTES

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## 10 Pools, spas, and hot tubs

### 10.1 General

The home pool is the highest drowning risk area for children aged 1 to 4. For this age group, the main safety risk identified is access directly from the home to the pool. To reduce this risk, there are a number of steps that can be taken at the site layout and design stages.

**All private outdoor swimming and spa pools, or pools deeper than 400 mm which can be used for swimming or paddling must be fenced on all four sides. Even pools less than 400 mm deep must be fenced on all four sides to prevent people from drowning.**

### 10.2 Design

Safety should be built into pool design. The safest and most efficient use of a pool is made when diving is prohibited and the depth of water does not exceed 1.5 m. (Refer to NZS 4441.)

**The structure of a swimming pool must be designed in accordance with NZBC Compliance Documents B1 Structure Verification Method 1 and B2 Durability.**

**All pool surrounds must have anti-slip surfaces to minimise the risk of slips and falls.**

### 10.3 Electrical

The technical requirements for electrical wiring in damp areas, based on the classification of zones surrounding the pool in AS/NZS 3000 should be followed. **All installations should be done by an appropriately skilled and registered electrician.**

## 10.4 Fencing and safety barriers

Fencing and other safety barriers must effectively restrict unsupervised children less than 6 years of age from accessing the pool, spa, or hot tub. (Refer to the Fencing of Swimming Pools Act.)

Fences must not have any toeholds or climbable rails and must have self-closing and latching gates.

To prevent climbing, fence framing must be on the side of the fence facing the pool and the fence line should also be kept clear of all objects (such as furniture or toys) that could help a child climb over the fence and enter the pool area.

Child safety around swimming pools is covered by the Fencing of Swimming Pools Act, and NZBC Compliance Document F4 Safety from Falling. (Refer also to NZS 8500.)

### 10.4.1 Fencing and safety barriers specifications

A pool fence must be at least 1200 mm higher than the surrounding ground level or any permanent fixture adjacent to the fence. For fences 1.2 m high (the minimum height of any pool fence) with netting the openings in the netting must not exceed 10 mm.

While mesh fences for pools are not recommended, if they are used the openings in the mesh should not be any larger than 50 mm (including diagonal measurements). **The netting or mesh fence must extend at least 1.8 m above the ground or any permanent projection from, or object placed on, the ground outside within 1.2 m of the fence.**

The fence should be durable, and designed to prevent children from climbing over or crawling under from outside. All glass in fencing and safety barriers should be safety glass.

One good test for child safety for fences and balustrades is that a ball of 80 mm diameter cannot be passed through the balustrade at any point. A maximum of 100 mm diameter is required by NZBC Compliance Document F4 Safety from Falling, Approved Solution 1. Clearance between palings and between the bottom of the fence and the ground should be between 80 mm and 100 mm.

#### 10.4.2 Gates

**Gates must be of at least the same height as the pool fence and must not open inward towards the pool area.**

Gates should be self-closing and self-latching with latches on either the inside of the gate facing the pool area or, if mounted on the outside of the gate, at a height of at least 1500 mm from the ground.

**Exterior doors of a home opening into the pool area shall open away from the pool, be self-closing and self-latching, and have control heights no lower than 1500 mm from the finished floor level. In buildings which have an intended use defined by section 1.2.3 of the NZBC Compliance Document F4 Safety from Falling, the latches are to be no higher than 1200 mm from the ground.**

Ideally the exterior wall of the home or doors within the home should not be part of the pool fence.

### 10.5 Indoor pools

Indoor pools, including spa pools, must have self-closing, self-latching doors with the latch set at 1200 mm from finished floor level.

**Sliding doors that provide access to a pool must be fitted with safety glass that complies with NZS 4223.3.** These doors should also have an adjustable self-closing device at 1500 mm above floor level to 'restrict the access of children under 6 years of age to the pool or the immediate pool area' (as stated in NZBC Compliance Document F4 Safety from Falling, Performance Requirement F4.3.4 (f)). Check with your local authority for modifications to requirements.

## 10.6 Line of sight

If possible, the swimming pool, spa, or hot tub should be visible from the kitchen and other living areas of a home.

## 10.7 Other safety concerns

Keep all pool chemicals locked away from young children. Ensure chemicals are used, stored, and disposed of in accordance with the manufacturer's instructions. For sanitary reasons and to reduce risk of illness ensure good water quality. (Refer to NZS 5826.)

Provide adequate storage for items such as hoses, brooms, and other pool cleaning accessories.

### POOL SUPERVISION

While all of the steps taken here will reduce the chance of drowning, it is vital to supervise children in and around a pool, spa, or hot tub. Young children should be no more than an arm's length away from a caregiver when swimming.

## Appendix A – Slip-resistance characteristics of exterior and interior surfaces

Table A1 and Table A2 provide general information on slip-resistant characteristics for exterior and interior surfaces. These tables give guidelines only.

For more information on slip resistance refer to NZBC Compliance Document D1 Access Routes, Acceptable Solution 1, Section 2. (Refer also to AS/NZS 3661.2.)

Adequate slip resistance of walking surfaces depends on proper maintenance. Most materials become less slip resistant with wear. Applying waxes and polishes can also reduce slip resistance. Follow manufacturer's instructions for cleaning and maintenance of surfaces.

**Table A1 – General slip-resistance characteristics of exterior paving and tread finishes** ➤

Material	Slip resistance		Remarks
	Dry and unpolished	Wet	
Clay tiles (carbonium finish)	Very good	Very good	May be suitable for external stairs
Clay tiles (textured)	Very good	Very good	May be suitable for external stairs
Clay tiles	Good	Poor to fair	Slip resistance when wet and polished is very poor
Mastic asphalt	Good	Good	–

### KEY

Very good	=	Surface suitable for areas where special care is needed.
Good	=	Surface satisfactory for normal use.
Poor to fair	=	Surface below acceptable safety limits.
Very poor	=	Surface unsafe.

**Table A1 – General slip-resistance characteristics of exterior paving and tread finishes** *(continued)*

Material	Slip resistance		Remarks
	Dry and unpolished	Wet	
Mastic asphalt	Good	Good	–
Concrete	Good	Poor to fair	If a textured finish or a non-slip aggregate is used, slip resistance when wet may be increased to good
Terrazo concrete stone and marble	Fair	Poor	Non-slip nosing (the rounded projecting edge of a stair tread) necessary on stairs and very poor slip resistance when polished or when polish is transferred by shoes from adjacent surfaces
Rough sawn or band sawn timber	Not rated	Not rated	Not a durable slip-resistant surface

**KEY**

- Very good = Surface suitable for areas where special care is needed.  
 Good = Surface satisfactory for normal use.  
 Poor to fair = Surface below acceptable safety limits.  
 Very poor = Surface unsafe.

**Table A2 – General slip-resistance characteristics of interior flooring surfaces** 

Material	Dry	Wet
Carpet	Very good	Very good for specialist carpets (nylon, polypropylene) designed for wet area use
Ceramic tile – glazed	Fair	Very poor
Ceramic tile – unglazed	Fair	Poor
Textured <sup>(1)</sup>	Good – fair	Good – poor
Concrete – steel-trowelled	Fair	Very poor
Wood-floated	Good	Poor
Ground	Good	Fair – poor
Broomed	Good	Fair – poor
Cork tile (clear sealed)	Fair	Poor
Linoleum	Fair	Poor
Paint	Fair	Very poor
Textured <sup>(1)</sup>	Good	Good
Particle board (clear sealed)	Fair	Poor
PVC tiles and sheet	Fair	Poor
Smooth, plain, or patterned	Fair	Poor
Emery or carborundum impregnated	Good	Fair
Textured <sup>(1)</sup>	Very good	Good – fair
Textured <sup>(1)</sup> and impregnated	Very good	Good – fair

**KEY**

- Very good = Surface suitable for areas where special care is needed.  
 Good = Surface satisfactory for normal use.  
 Poor to fair = Surface below acceptable safety limits.  
 Very poor = Surface unsafe.

(1) The effect of texture in providing slip resistance is dependent on the size and spacing of the texturing. Generally a granulated effect of raised areas 1 mm – 2 mm in diameter and a similar distance apart is the most effective. Larger diameters and spacings become progressively less effective.

**Table A2 – General slip-resistance characteristics of interior flooring surfaces** *(continued)*

Material	Dry	Wet
Rubber tiles and sheet	Fair	Poor
Smooth, plain, or patterned	Fair	Poor
Emery or carborundum impregnated	Good	Fair
Textured <sup>(1)</sup>	Very good	Good – fair
Textured <sup>(1)</sup> and impregnated	Very good	Good – fair
Stone and marble	Fair	Very poor
Terrazzo concrete	Fair	Very poor
Synthetic – resin	Fair	Very poor
Timber	Fair	Poor
Parquet	Fair	Poor
Strip	Fair	Poor
Vinyl tile	Fair	Poor

**KEY**

- Very good = Surface suitable for areas where special care is needed.  
 Good = Surface satisfactory for normal use.  
 Poor to fair = Surface below acceptable safety limits.  
 Very poor = Surface unsafe.

- (1) The effect of texture in providing slip resistance is dependent on the size and spacing of the texturing. Generally a granulated effect of raised areas 1 mm – 2 mm in diameter and a similar distance apart is the most effective. Larger diameters and spacings become progressively less effective.

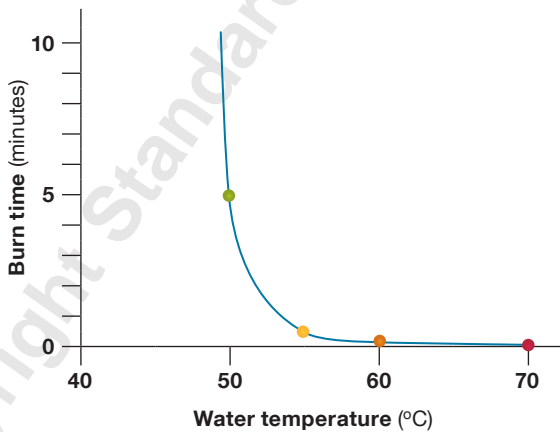
## Appendix B – Water heating

### Water temperature

A home hot-water cylinder should be set to at least 60°C to prevent the growth of *Legionella*.

**In retirement homes, hospitals, early childhood centres, and primary and secondary schools, the temperature of hot water delivered to sanitary fixtures (basins, baths, and showers) shall not exceed 45°C, and 55°C for other buildings including residential dwellings. See Figure B1.**

These delivery temperatures can be achieved even when holding the stored water at 60°C by fitting thermostatic mixing valves immediately adjacent to each hot water outlet.



- At 50°C, 5 minutes for an adult or child
- At 55°C, 30 seconds for an adult and 7 seconds for a child
- At 60°C, 5 seconds for an adult and 1 second for a child
- At 70°C, 1 second for an adult and 0.5 seconds for a child

**Figure B1 – Full thickness burns – contact times with water**

Source: Henriques F C, Moritz A R. *Studies of thermal injury V: the predictability and the significance of thermally induced rate processes leading to irreversible epidermal injury.* Arch Pathol 1947; 43: 489–502.

There is no evidence that hot water burns occur in buildings with 55°C hot water. There is evidence, however, that hot water burns occur in buildings that do not have water tempered to either 55°C or 45°C.

The NZBC requires only that safe hot water temperatures (as discussed above to not exceed 55°C in residential dwellings) are delivered from water outlets used for personal hygiene, such as baths, showers, and basins. Water outlet temperatures can be higher if required in locations such as the kitchen or laundry facilities, but it is important that a registered plumber be consulted.

If a homeowner chooses to have only one hot water temperature at all water outlets, 55°C is a temperature that allows a degree of safety and is sufficiently hot for kitchen and laundry uses.

Electrically operated solenoid valves may be installed to control water flow. This could include the control of gardening water or the bath water by push-button, timer, or a remote controller. (Refer to AS/NZS 3500.4.)

## Appendix C – Scaffolding and ladders

Whether the job is painting, cleaning out gutters, or doing other maintenance, properly installed scaffolding is much safer and easier to work on than ladders on a multi-storey home or on a home built on a sloping site.

Wherever temporary access (such as ladders, scaffolding, and safety lines or harnesses) has been provided for in the design of the home, adequate information on its use and maintenance should be available to the current residents.

Below are tips from ConsumerBuild on staying safe at heights.

### Staying safe at heights

Fit outside walls with anchors for holding scaffold brackets. Position anchors so a scaffolder can move up the wall without risking a fall. Bracket anchors must be securely fixed into the wall.

### Using scaffolding

If the scaffold is fixed to the wall, check scaffold brackets are firmly attached to the studs and not corroded. (Refer to AS/NZS 1576.1 and AS/NZS 4576.)

For free-standing scaffolding:

- (a) fix the scaffolding squarely onto solid footings or support
- (b) tie the scaffolding for extra safety
- (c) only use scaffolding with handrails and toe boards
- (d) tie boards to scaffolding.

**Scaffolding over 5 m high requires a certified scaffolder to erect the scaffolding. Certified scaffolders must also notify the Department of Labour at least 24 hours prior to commencement of work.**

### Basic safety guidelines for using a ladder

Make sure the ladder is in good condition before use. Look for loose or damaged rungs, damaged styles, and missing or worn non-slip feet. If the ladder is damaged, get it repaired or replaced. Don't use it!

### New metal ladders must have a label that says they meet the requirements of AS/NZS 1892.1.

Guidelines for using a ladder include the following.

- (a) Make sure the ladder is sitting on a level base; putting a ladder on uneven ground can cause it to topple under your weight.
- (b) Put blocks behind the slip-resistant feet of the ladder.
- (c) If the ground is soft use a baseboard or sheet of plywood under the ladder footing.
- (d) Prop the ladder at the correct angle – 1 m out for every 4 m up.
- (e) Use a long enough ladder for the task – ladders should extend 1 m past the structure being climbed.
- (f) Wear shoes with a low heel.
- (g) Place the ladder at a point where the roof line or other structure is closest to the ground.
- (h) Make sure there is nothing dangerous on the ground if you do fall, such as protruding objects.
- (i) Check there is somewhere to tie the top of the ladder near where it is resting (if there isn't, reposition the ladder before going up).
- (j) Have the ladder steadied by another person until the top can be anchored or tied. This person should secure the base of the ladder with their feet and hold the ladder with both hands. If a person is not available to hold the bottom of the ladder, properly placed sandbags can be used to anchor the ladder.
- (k) It's a good idea to have a piece of strong cord permanently looped around the top rung to tie it off (synthetic cord between 4 and 8 mm is ideal).

- (l) Don't carry tools in hands up the ladder – use a tool belt or backpack for larger items and heavy items should be pulled up with a rope.
- (m) Always have three points of contact between your body and the ladder – two hands, one foot as you go up or down the ladder, two feet one hand as you work.
- (n) If you are working on the roof, don't tie a rope around your waist – it is likely to cause you internal injuries if you fall. As an alternative, use a safety harness.
- (o) Make sure there are no electrical wires that could pose a threat of electrocution.
- (p) Always face the ladder; never come down the ladder with your back to it.
- (q) Don't over-reach sideways – as a rule your belt buckle should stay between the ladder uprights, if this puts you out of reach of your task, climb down and reposition the ladder.
- (r) Don't lean the ladder against anything breakable, such as glass and plastic guttering – if you lean the ladder against guttering, place a block of wood in the gutter to prevent damage.
- (s) Don't work from the top three rungs of a ladder.
- (t) Don't place the ladder where it is likely to be hit by passing vehicles or people.

### Stepladders

Guidelines for using a stepladder include the following.

- (a) Use a firm level, non-slip footing for the ladder.
- (b) Make sure the ladder has two working stays and that these are locked when in use.
- (c) Don't place a stepladder on boxes or scaffolding for extra height.
- (d) Don't use a stepladder to support a work platform.
- (e) Don't work from the top two steps of a stepladder.

## Appendix D – Referenced documents

Reference is made in this guide to the following:

### New Zealand Standards

NZS 3114:1987	Specification for concrete surface finishes
NZS 3604:2011	Timber-framed buildings
NZS 4121:2001	Design for access and mobility: Buildings and associated facilities
NZS 4218:2009	Thermal insulation – Housing and small buildings
NZS 4223:---	Glazing Standards Set
AS/NZS 4666:2000	Insulating glass units
Part 1:2008	Glass selection and glazing
Part 3:1999	Human impact safety requirements
Part 4:2008	Wind, dead, snow, and live actions
Supplement 1:2008	Code of practice for glazing in buildings – Supplement 1 to NZS 4223.1:2008 and NZS 4223.4:2008
NZS 4232.2:1988	Performance criteria for fire resisting enclosures Part 2: Fire resisting glazing systems
NZS 4246:2006	Energy efficiency – Installing insulation in residential buildings
NZS 4301.3:1993 (AS 2201.3-1991)	Intruder alarm systems – Detection devices for internal use
NZS 4441:2008	Swimming pool design Standard
NZS 4514:2009	Interconnected smoke alarms for houses
NZS 4517:2010	Fire sprinkler systems for houses
NZS 4617:1989	Tempering (3-port mixing) valves

NZS 5826:2010	Pool water quality
NZS 6703:1984	Code of practice for interior lighting design
NZS 8500:2006	Safety barriers and fences around swimming pools, spas and hot tubs

## Joint Australian/New Zealand Standards

AS/NZS 1170.0:2002	Structural design actions Part 0: General principles
AS/NZS 1428.4.1:2009	Design for access and mobility Part 4.1: Means to assist the orientation of people with vision impairment – Tactile ground surface indicators
AS/NZS 1576.1:2010	Scaffolding Part 1: General requirements
AS/NZS 1680.1:2006	Interior and workplace lighting – Part 1: General principles and recommendations
AS/NZS 1680.2.1:2008	Interior and workplace lighting – Part 2.1: Specific applications – Circulation spaces and other general areas
AS/NZS 1891.1:2007	Industrial fall-arrest systems and devices – Part 1: Harnesses and ancillary equipment
AS/NZS 1892.1:1996	Portable ladders – Part 1: Metal
AS/NZS 2107:2000	Acoustics – Recommended design sound levels and reverberation times for building interiors
AS/NZS 2172:2010	Cots for household use – Safety requirements
AS/NZS 2918:2001	Domestic solid fuel burning appliances – Installation
AS/NZS 3000:2007	Electrical installations (known as the Australian/New Zealand Wiring Rules)



AS/NZS 3500.4:2003	Plumbing and drainage – Part 4: Heated water services
AS/NZS 3661.2:1994	Slip resistance of pedestrian surfaces – Part 2: Guide to the reduction of slip hazards
AS/NZS 4220:2010	Bunk beds and other elevated beds
AS/NZS 4505:1998	Domestic garage doors
AS/NZS 4576:1995	Guidelines for scaffolding
AS/NZS 5601.1:2010	Gas installations – Part 1: General installations
SAA/SNZ HB 114:1998	Guidelines for design of eaves and box gutters

### International Standard

ISO 13746:2000	Textile floor coverings – Guidelines for installation and use on stairs
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### Australian Standards

AS 4299-1995	Adaptable housing
AS 1530.4-2005	Methods for fire tests on building materials, components and structures – Fire-resistance test of elements of construction

## British Standards

- BS EN 1021-1:2006 Furniture. Assessment of the ignitability of upholstered furniture. Ignition source smouldering cigarette
- BS EN 1021-2:2006 Furniture. Assessment of the ignitability of upholstered furniture. Ignition source match flame equivalent

## Other publications

BRANZ. *Homes without barriers: A guide to accessible houses*. 2010.

Department of Building and Housing. *External moisture – A guide to using the risk matrix*. Wellington: Department of Building and Housing, June 2005.

Department of Labour. 'Risks to health from moulds and other fungi' *Workplace Health Bulletin*, No. 17, November 2002.

Energy Safety. *New Zealand electrical code of practice for homeowner/occupier's electrical wiring work in domestic installations* (NZECP 51:2004). Wellington: Energy Safety, 2004.

Glass Association of New Zealand. *Glass in furniture and similar applications: GANZ code of practice – GF1*. 2008.

Henriques F C, Moritz A R. Studies of thermal injury V: the predictability and the significance of thermally induced rate processes leading to irreversible epidermal injury. *Arch Pathol* 1947; 43: 489–502.

IEC E-tech. 'Electrical hazards in household appliances' January/February 2010. Retrieved from [www.iec.ch/etech/2010/pdf/etech\\_2010-01\\_LR.pdf#page=12](http://www.iec.ch/etech/2010/pdf/etech_2010-01_LR.pdf#page=12).

Kool et al. 'Unintentional falls at home among young and middle-aged New Zealanders resulting in hospital admission or death: Context and characteristics'. *New Zealand Medical Journal*, June 2010. Retrieved from [www.nzma.org.nz/journal/123-1316/4158/content.pdf](http://www.nzma.org.nz/journal/123-1316/4158/content.pdf).



Ministry of Health. *Removing asbestos from the home*. HE7022. 9 July 2008. Retrieved from: <https://www.healthed.govt.nz/resource/removing-asbestos-home>.

Ministry of Health. *The management of asbestos in the non-occupational environment*. August 2007. Retrieved from: [www.moh.govt.nz/moh.nsf/indexmh/management-asbestos-non-occupational-environment](http://www.moh.govt.nz/moh.nsf/indexmh/management-asbestos-non-occupational-environment).

Shepherd, M. et al. 'Driveway run over, the influence of the built environment: a case control study'. *Journal of Paediatrics and Child Health*. December 2010.

University of Otago, Wellington. Injuries and deaths in the home a major hidden cost. 2011. Retrieved from: [www.otago.ac.nz/news/news/otago016171.html](http://www.otago.ac.nz/news/news/otago016171.html).

## New Zealand legislation

Building Act 2004, New Zealand Building Code (NZBC) Handbook and Compliance Documents

Electricity (Safety) Regulations 2010

Fencing of Swimming Pools Act 1987

Resource Management (National Environmental Standards Relating to Certain Air Pollutants, Dioxins, and Other Toxics) Regulations 2004

## Websites

Accident Compensation Corporation	<a href="http://www.acc.co.nz">www.acc.co.nz</a>
BRANZ	<a href="http://www.branz.co.nz">www.branz.co.nz</a>
ConsumerBuild	<a href="http://www.consumerbuild.org.nz">www.consumerbuild.org.nz</a>
Deaf Aotearoa – New Zealand	<a href="http://www.deaf.co.nz">www.deaf.co.nz</a>
Department of Building and Housing	<a href="http://www.dbh.govt.nz">www.dbh.govt.nz</a>
Department of Labour	<a href="http://www.dol.govt.nz">www.dol.govt.nz</a>
Department of Labour, Occupational Safety and Health	<a href="http://www.osh.dol.govt.nz">www.osh.dol.govt.nz</a>

Energy Efficiency and Conservation Authority	<a href="http://www.eeca.govt.nz">www.eeca.govt.nz</a>
EECA Energywise	<a href="http://www.energywise.govt.nz">www.energywise.govt.nz</a>
Energy Safety	<a href="http://www.energysafety.govt.nz">www.energysafety.govt.nz</a>
Hearing Association of New Zealand Inc.	<a href="http://www.hearing.org.nz">www.hearing.org.nz</a>
Institution of Professional Engineers New Zealand	<a href="http://www.ipenz.org.nz">www.ipenz.org.nz</a>
Ministry for the Environment	<a href="http://www.mfe.govt.nz">www.mfe.govt.nz</a>
Ministry of Consumer Affairs	<a href="http://www.consumeraffairs.govt.nz">www.consumeraffairs.govt.nz</a>
Ministry of Health	<a href="http://www.moh.govt.nz">www.moh.govt.nz</a> and <a href="http://www.healthed.govt.nz">www.healthed.govt.nz</a>
New Zealand Fire Service	<a href="http://www.fire.org.nz">www.fire.org.nz</a>
New Zealand Institute of Architects	<a href="http://www.nzia.co.nz">www.nzia.co.nz</a>
New Zealand Institute of Building Surveyors	<a href="http://www.buildingsurveyors.co.nz">www.buildingsurveyors.co.nz</a>
New Zealand Legislation	<a href="http://www.legislation.govt.nz">www.legislation.govt.nz</a>
New Zealand Timber Industry Federation	<a href="http://www.nztif.co.nz">www.nztif.co.nz</a>
Standards New Zealand	<a href="http://www.standards.co.nz">www.standards.co.nz</a>
Window Association of New Zealand	<a href="http://www.wanz.co.nz">www.wanz.co.nz</a>

## Latest revisions

The users of this Handbook should ensure that their copies of the above-mentioned New Zealand Standards are the latest revisions. Amendments to referenced New Zealand and Joint Australian/New Zealand Standards can be found on: [www.standards.co.nz](http://www.standards.co.nz).

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**AMENDMENTS**

<i>No.</i>	<i>Date of issue</i>	<i>Description</i>	<i>Entered by, and date</i>



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