

# Space Matters

## *Planning, designing, building and maintaining for community wellbeing*

During 2008 -09 around 55,000 people saw a doctor (over 350,000 GP visits) for injuries occurring on the road, in the water or as a result of falls in community spaces - community spaces includes road/street, commercial/service location, place of recreation/sports and 'other'. This cost over \$37 million.

Some 8,000 of these injured people took a week or more off work, costing a further \$164 million. Many have since returned to productive working lives. Others have not.

Some of these injuries resulted from what the person was doing. In other cases, the design of community facilities and features influenced both the likelihood of the injury occurring and its severity.

Space Matters is a resource introducing **Injury Prevention through Environmental Design**.(IPTED) Specifically, Space Matters explores how the design of community facilities and features can prevent injuries from occurring.

## How to use this resource

The information has been grouped into three areas of interest; public and play spaces, road spaces and water spaces. There are quicklinks that will take you to areas of interest within the document and also to external websites where you can find further information.

This first section however, is about the concept of Injury Prevention Through Environmental Design. It describes what IPTED is and what the benefits of IPTED are.

## Who is this resource for?

Space Matters is for anyone who has a responsibility for keeping New Zealanders safe in community spaces. This includes roading asset managers, urban designers, district plan and consents planners, parks assets managers, maintenance service providers and policy and strategy decision makers

---

### QUICKLINKS

#### **What is Injury Prevention through Environmental Design?**

Find out what it is, what it does and who needs to know. [More...](#)

#### **How does IPTED apply to councils?**

See how IPTED helps meet your obligations of delivering community wellbeing.

[More...](#)

### **What's wrong with New Zealand's community spaces?**

Far too many New Zealanders are being injured in community spaces. How are these injuries happening? [More...](#)

### **Creating wellbeing in community spaces:**

- IPTED for public and play spaces. [More...](#)
  - IPTED for road spaces. [More...](#)
  - IPTED around water space hazards. [More...](#)
-

## Injury Prevention through Environmental Design

Environmental design shapes the physical environment in which New Zealanders live, work and play. It shapes the activities of children and adults in play and other public spaces. It affects the behaviours of New Zealanders as they enjoy recreational opportunities available in and around the many and varied water environments of this country.

Injury Prevention through Environmental Design (IPTED) uses a step-by-step process to eliminate or minimise the risk of injury in the physical environment.

### Where it all begins

IPTED helps to make it clear that, although we may be planning and designing infrastructure, we are actually planning and designing **for people**.

The IPTED approach focuses on:

- **People**
  - Who the possible users are – both those whom you want to use the community space and those you don't
  - What their needs are
  - What their characteristics are
  - How you expect them to act
- **Purpose**
  - What people will/could be doing
- **Processes**
  - Identifying the hazards – determining what is likely to cause harm
  - Assessing the risk – looking at the frequency of exposure and the probability and seriousness of injury
  - Determining how to manage the hazard – actions to address the hazards
  - Maintenance – proactive planned maintenance and inspection, and reactive, following community reporting of hazards or incidents.
  - Reporting – of incidents and community hazards.

An important feature of IPTED is that it focuses thinking on how to prevent injury and promote wellbeing right at the start of the planning and design stages. This way communities reap the significant benefits the IPTED approach delivers for the minimum cost.

## It's about managing the risks

A systematic risk management process helps you to identify what injury-causing events (hazards) are likely to occur and determine the probability of them occurring.

After assessing the hazards, the next steps are to plan and take action to address them, starting with those that have most impact, ie, that will cause the most harm (see the [three Es of addressing risk](#))

Using a risk matrix like the one below can help in prioritising risk management by calculating a risk score for each hazard. Though it may not fit all circumstances, in most cases using the matrix helps determine:

- If something does happen, how serious the consequences will be
- The likelihood of it happening.

### *Risk score matrix*

Likelihood	Consequence		
		Other than serious	Serious Physical Harm
Low	1	2	3
Medium	2	4	6
High	3	6	9

### Using the matrix

Follow these steps to calculate a risk score:

Step	Action
1	Determine what the main hazards are.
2	<p>For each hazard, decide what the <b>specific consequence</b> would be:</p> <ul style="list-style-type: none"> <li>• Other than serious, or</li> <li>• Serious physical harm, or</li> <li>• Death.</li> </ul> <p><i>Draw a vertical line in the matrix from your chosen 'consequence' downwards through all three numbers in the column</i></p>
3	For each hazard, decide what the likelihood is of the specific consequence occurring: is it...

- Low?
- Medium?
- High?

*Draw a horizontal line in the matrix from your chosen 'likelihood', across through all three numbers.*

4	Where the two lines intersect is the <b>risk score</b>
---	--

You can use this process to assess any number of hazards.

### Example

*Example hazard:* an elderly person falls after tripping on the single step at the entrance to the public library.

*The specific hazard:* single step

*The consequence:* broken hip (serious harm)

*Likelihood of this happening:* medium.

Likelihood	Consequence		
	Other than serious	Serious Physical Harm	Death
Low	1	2	3
Medium	2	4	6
High	3	6	9

The risk score for this hazard is 4.

### Alternatively...

...you could also consider the cost of doing nothing, in terms of:

- The time taken to deal with a number of complaints
- The cost of investigating repeat incidence (staff resource)
- The cost of maintenance
- The cost of negative media attention.

## Everything counts

While it's important to address the hazards attracting the highest scores first, everything identified, as a hazard needs attention over time.

For best practice in risk management see AS/NZ4360:2004 NZ Risk Management Standard.

## The three Es

There are three main approaches for addressing identified injury risks - the 'three Es':

- **Education** - encouraging people to change their behaviours.
- **Enforcement** - introducing rules, laws and regulations that require people to change their behaviour.
- **Engineering** (including design) - changing people's environment to protect them from hazards.

The most effective approach to injury prevention involves a combination of all three Es.

**Education** helps promote injury prevention by addressing unsafe behaviours. It involves informing people about potential hazards and the risks associated with those hazards. It also involves encouraging people to adopt behaviours that will keep them safe around those hazards.

Examples include the 'Down with Speed' and 'Drive to the conditions' road safety campaigns, the 'Swim between the flags' water safety campaign and public information about playground safety.

The effectiveness of education is dependent on people voluntarily acting on the information they receive.

**Enforcement** requires the introduction of laws and regulations that will require people to adopt safer behaviours.

Examples in the road safety area include speed limits and speed cameras. The effectiveness of such laws and regulations is heavily dependent on how actively they are enforced.

**Engineering** involves making changes to environment or product design so that the environment provides protection to the individual without them making any effort.

Safe behaviour becomes less of an issue in environments that are physically and mechanically safe.

Examples include installing impact absorbing playground surfaces or introducing traffic calming measures on busy roads.

Importantly, once these measures are installed they need to be maintained to ensure they themselves don't become a hazard through wear and disrepair.

---

## IPTED in the overall design-scape

In fostering a 'safe design' approach to community spaces, IPTED supports the [New Zealand Urban Design Protocol](#). In particular, IPTED helps you address Custodianship, one of the seven essential design qualities – the seven Cs - promoted by the Protocol.

Custodianships require urban design to be environmentally sustainable, safe and healthy, through:

Creating buildings places and spaces that are safer, with less crime and fear of crime

Avoiding or mitigating the effects of natural and man-made hazards

Considering the impact of design on people's health.

The IPTED material in this document also promotes key activities for the design and support of safe environments, which is a goal of the [New Zealand Injury Prevention Strategy](#). The Strategy sets out the Government's vision for a New Zealand where more people can live free of injury while continuing to lead active and challenging lives.

IPTED is a similar initiative to CPTED – Crime Prevention through Environmental Design. The two are complementary, especially in the area of personal safety, where ensuring community space users 'can see and can be seen' is a common goal.

When creating safer community spaces, both the IPTED guidelines contained in Space Matters and the National Guideline for Crime Prevention through Environmental Design in New Zealand [Parts 1](#) and [2](#) should be viewed together.

### Who needs to know?

Keeping New Zealanders safe in community spaces is a responsibility that impacts a number of local authority roles:

- Roading asset managers
- Urban designers
- District plan and consents planners
- Parks assets managers
- Maintenance
- Policy and Strategy

It also impacts on developers.

Role	Responsibility	Information on this site
Roading Assets Managers	<ul style="list-style-type: none"><li>• Footpath location and design</li><li>• Paving surfaces</li><li>• Kerbs/channels, kerb cuts</li><li>• Gradients</li></ul>	See: <a href="#">Road Spaces</a>

	<ul style="list-style-type: none"> <li>• Vehicle crossings</li> <li>• Intersection design – corner radii,</li> <li>• Visibility</li> <li>• Traffic speeds</li> <li>• Location of pedestrian crossings and traffic signals</li> <li>• Use of pedestrian islands;</li> <li>• Location and design of street furniture,</li> <li>• Litter bins</li> <li>• Visual and physical obstructions – raised kerbs/edging,</li> <li>• Foliage</li> <li>• Sandwich boards and other portable signs;</li> <li>• Bus shelters</li> </ul>	
Urban designers:	<ul style="list-style-type: none"> <li>• Sense of location and direction</li> <li>• Connectivity - 'accessible routes' between places: car parks, shops and services, public toilets, bus stops and transit interchanges</li> <li>• Use of colour and contrast to delineate edges, paths, steps and slopes</li> <li>• Landscaping and the use and effect of lighting, planting, street furniture;</li> <li>• Demarcation and management of the boundaries between public, semi-public and private spaces – entry and exit points, 'collection' and 'congregation' places, transit and movement zones</li> <li>• Legibility – clarity of signage</li> </ul>	See: <a href="#">Road Spaces</a> <a href="#">Public and Play Spaces</a> <a href="#">Water Spaces</a>
District Plan and Consents planners:	<ul style="list-style-type: none"> <li>• Awareness and identification of potential hazards and risks when considering development proposals</li> <li>• Access to examples of 'best practice' in design and construction</li> <li>• Access to specialist advice and resources on safety and accessibility issues</li> </ul>	See: <a href="#">Road Spaces</a> <a href="#">Public and Play Spaces</a> <a href="#">Water Spaces</a>
Parks Assets Managers:	<ul style="list-style-type: none"> <li>• Design, development and maintenance of Council parks and reserves</li> <li>• Safety elements: Use of lighting, landscaping, appropriate signage and legibility.</li> <li>• Design and surfacing of paths, gradients and steps. The location and design of outdoor furniture and fixtures.</li> <li>• Management of boundaries with adjoining properties and road frontages, including access/exit points, visual permeability of fencing, informal surveillance.</li> <li>• Location and design of car parks, public toilets, bus stops.</li> <li>• Design and location of water features, ponds and streams.</li> <li>• Design and construction of playgrounds and skate parks.</li> </ul>	See: <a href="#">Public and Play Spaces</a> <a href="#">Water Spaces</a>

Maintenance	<ul style="list-style-type: none"> <li>• Awareness and identification of potential hazards and risks attributable to maintenance issues</li> <li>• Litter control</li> <li>• Graffiti control</li> <li>• Vegetation control</li> <li>• Lighting maintenance</li> <li>• Street furniture/facilities maintenance</li> <li>• Playground maintenance</li> <li>• Public space maintenance</li> </ul>	See: <a href="#">Road Spaces</a> <a href="#">Public and Play Spaces</a> <a href="#">Water Spaces</a>
Policy and Strategy	<ul style="list-style-type: none"> <li>• Asset Management plans, design guidelines/standards; code of practice</li> </ul>	See: <a href="#">Road Spaces</a> <a href="#">Public and Play Spaces</a> <a href="#">Water Spaces</a>

### Don't forget developers

All development activities impact on the risk of injury from the earliest stages to completion of a development. Developers and their planning consultants have considerable control over the design and therefore the risk profile of their developments.

This influence extends to street layouts, lot sizes, use of terrain (steep, graded, etc), the physical environmental features such as stormwater sediment ponds, retention of natural streams and other water features; provision and location of public open space, playgrounds etc.

During the development phase, developers can:

- Set housing design guidelines that go way beyond the rules and assessment criteria in a resource or building consent. Such guidelines can dictate elements that impact on the likelihood or severity of injury, such as:
  - orientation to the street, parks and reserves
  - landscaping and street frontages
  - location of garaging, fencing
  - minimum/maximum floor area per dwelling
  - density – the number of dwellings per hectare
  - housing style – single dwelling, town house, terrace house, apartment etc.
- Gain prior approval of house plans before they are submitted to the Council for building consent.

During construction, developers can:

- Set controls on building site management for elements that impact on the likelihood or severity of injury, such as:
  - perimeter fencing
  - single point of access
  - kerb and pavement protection
  - silt and run-off control.

Developers and their planning consultants are therefore a target market for IPTED material. They need to be aware of the big picture and see how their development connects and interacts with current and planned adjoining spaces. They need to see that their development isn't a separate project; that it sits within the broader context.

---

## **Gaining the maximum benefits from IPTED**

A two-pronged approach is needed in order to gain the maximum benefits that can be generated through IPTED.

### **IPTED at the strategic level**

There needs to be a high level commitment to IPTED, especially within the policy setting and strategic planning areas.

The critical element at the strategic level is to ensure that policies, strategies, planning tools and mechanisms contain appropriate references to IPTED, CPTED and initiatives such as the Social and Health Impact Assessment.

References should be incorporated into:

- Long Term Council Community Plans
- Community outcomes
- District Plans
- Annual Plan
- Policy development: eg alcohol strategies and sale of liquor policies; housing for older adults; social and affordable housing; sustainable design and development
- Strategy documents: Urban design protocol action plan, community transportation, pedestrian, cycling, positive aging, playground strategy etc.
- Codes of Practice for engineering and infrastructure
- Procurement processes and documentation for new infrastructure and maintenance contracts.

## **IPTED at the operational level**

The practical means of applying IPTED need to be incorporated into day-to-day operations. This document contains a range of practical ideas on how you can do this and also references for more in-depth information. See:

- [Public and play spaces](#)
- [Road spaces](#)
- [Water spaces](#)

## **How IPTED builds community wellbeing**

By using IPTED you will be better able to:

- Control risk
- Meet the needs of your community and your obligations under the local government act
- Predict and manage operational costs across the life cycle of the designed-product
- Predict and reduce the costs associated with injury and environmental damage.

Importantly, the IPTED approach provides for control of risk early on in the design process, which then reduces the need for - and the costs of - redesign and retrofitting.

Under the [Local Government Act 2002](#), local authorities have a responsibility in achieving outcomes for their citizens around the economic, environmental, social and cultural wellbeing of communities.

There's an array of central government policies and strategies that impact on the work of local authorities as they seek to achieve these outcome

- [Urban design Protocol](#)

Using IPTED will help you meet the aims and objectives of these and other strategies and obligations.

---

### **The [New Zealand Health Strategy](#)**

Promoting and achieving an active and healthy population is a current government priority. The [New Zealand Health Strategy](#) is underpinned by seven principles that include "Collaborative health promotion and disease and injury prevention by all sectors". Injury prevention is included in the Strategy's goals, where the objectives are to:

- Reduce the incidence of and impact of road traffic injuries
  - Reduce the incidence and impact of falls in older people
  - Reduce the incidence and impact of injuries (other than traffic) in children and youth
  - Reduce the incidence and impact of workplace injuries.
-

### **[United Nations Convention on the Rights of the Child](#)**

As a signatory of the [United Nations Convention on the Rights of the Child](#) New Zealand has committed to protecting and ensuring the rights of children in this country. Article 31 of the Convention's provisions promotes children's access to leisure, recreation and play activities and participation in the arts and cultural activities.

---

### **[New Zealand Transport Strategy](#)**

The objectives of government's [New Zealand Transport Strategy](#) further promote a safe, healthy and mobile population. The foundation for the country's transport policy, the strategy's objectives include:

- Assisting safety and personal security
  - Improving access and mobility
  - Protecting and promoting public health.
- 

### **[Safer Journeys 2020](#)**

Sitting alongside the New Zealand Transport Strategy is [Safer Journeys 2020](#), which has the goal of *A safe road system increasingly free of death and serious injury* and an associated list of actions to help achieve this.

---

### **[The New Zealand Positive Ageing Strategy](#)**

The [New Zealand Positive Ageing Strategy](#) promotes positive ageing policies that include outcomes such as empowering older people to enable them to live a satisfying life and lead a healthy lifestyle.

---

### **[New Zealand Injury Prevention Strategy](#)**

ACC's [New Zealand Injury Prevention Strategy](#) (NZIPS) endeavours to shape a New Zealand where more people can live free of injury while continuing to lead active and challenging lives. The strategy establishes a framework for the injury prevention activities of government agencies, local government, non-government organisations, communities and individuals.

---

### **[Drowning Prevention Strategy](#)**

The [Drowning Prevention Strategy: Towards a Water Safe New Zealand 2005-1015](#), seeks to prevent drowning and water-related injury in New Zealand including around natural waterways and rivers.

---

## **Falls Prevention Strategy**

The [Falls Prevention Strategy](#) seeks to reduce the incidence and severity of injury from falls, thereby reducing the social, psychological and economic impact of fall-related injuries on individuals, families/whanau and communities

---

## **The urban design protocol**

The [Urban Design protocol](#) aims to make our towns and cities more successful by using quality urban design to help them become:

- Competitive places that thrive economically and facilitate creativity and innovation
  - Liveable places that provide a choice of housing, work and lifestyle options
  - A healthy environment that sustains people and nature
  - Inclusive places that offer opportunities for all citizens
  - Distinctive places that have a strong identity and sense of place
  - Well-governed places that have a shared vision and sense of direction
-

## How injuries happen

Wherever it occurs, injury is never caused solely by one factor. Multiple factors will lie behind and contribute to an injury event.

Though a person may suffer injury from a fall after tripping on stairs, there will be a number of factors as to why that person tripped. Who the person is, what the person was doing, how they were doing it and the design and maintenance of the stairs themselves will all have played a part in the cause of injury.

What we know from injury prevention research is that there is no such thing as an 'accident' – a chance or random event that could not have been foreseen. There is actually a clear pattern in the way injuries occur. This means that for the most part, injuries are predictable and preventable. They arise from the interplay of factors such as – cultural, systems and task factors - as shown in this injury causation model:



Each arrow shows the factor that may contribute to an injury. As the number of factors increase so does the likelihood of injury.

## Injury factors in the community environment

The factors of the ACC Worksafe Model also apply to the community environment:

- **Culture** factors include management decisions and organisational processes that influence the way things are done within a local authority. For example:
  - Is health and safety and injury prevention given equal priority to other responsibilities?
  - Are managers, planners, and designers aware of and committed to injury prevention?
  - Is this communicated widely?

Culture factors also relate to the people using community spaces - their characteristics such as their age, how they behave and why.

- **Systems** – or lack of systems – shape the community environment and influence how people may act. This includes:
  - environmental features such as lighting,
  - hazard identification
  - hazard management
  - incident reporting and investigation
  - training within an authority
  - an authority's maintenance programme
  - the way contractors are selected and managed.
  
- **Task** factors are the action and movements used by people to perform an activity.

The key concept behind this model is that it is the presence and combination of factors that determine the risk of injury.

# Public and play spaces

*Planning, designing, building and maintaining for wellbeing in public and play spaces*

Falls are one of the leading causes of serious injury and one of the top three causes of injury-related death in New Zealand<sup>1</sup>

- Between 2000 and 2006 over 2,300 people died from fall-related injuries.<sup>2</sup>
- Between 2000 and 2008 more than 157,000 people were hospitalised for fall-related injuries.<sup>3</sup>
- Playground equipment is associated with nearly one third of falls to children under the age of 15.<sup>4</sup>

Quality planning and design of our communities has a vital role in creating an environment that reduces the likelihood of fall-related injury occurring in public and play spaces in the first place, and one that is more forgiving should incidents occur.

## **What are public spaces?**

When we use the term '**public spaces**' in Space Matters we mean all publicly owned spaces where people have a need to be. It includes footpaths, and pavements, pedestrian precincts, parks, and areas in public buildings with public access – entrances, foyers, stairwells, meeting rooms and halls.

## **What are play spaces?**

When we use the term '**play spaces**' in Space Matters we mean all publicly accessible areas that include any type of play facilities. This covers areas simply providing space for play, and those providing structures, including traditional playground equipment and structures for activities such as skate boarding.

---

## Quick links

### Creating wellbeing in public and play spaces:

- Public and play space users. Who's at risk? [More...](#)
- Public and play space hazards. What you can do about them? [More...](#)
- Design principles for public and play spaces. Check out the references. [More...](#)

### How can IPTED build wellbeing in public and play spaces?

The IPTED approach can help you predict and prevent injury and death occurring in public and play spaces. [More...](#)

### What role do councils play in reducing injuries in community spaces?

Following the IPTED approach helps councils deliver on a range of community obligations. [More...](#)

### What's wrong with New Zealand's public and play spaces?

Find out...

- [The size of the problem](#)
  - [Why public and play space injuries are occurring?](#)
  - [The cost of public and play injuries](#)
-

## **IPTED for public and play spaces**

The IPTED process is a matter of looking at how the community spaces we create shape what people do, and how that affects risk in public and play spaces.

Applying the IPTED process involves asking a series of questions:

- What is the intended **function** of the space and its surrounds?
- **Who** is using the space (both desirable and undesirable)
- What **activity** will they/could they be doing?
- What **hazards** could contribute to the injury of users?
- What **priority** action do we need to assign to the possible adverse event/ accident given its probability, likelihood, and severity?

It's important to ask these questions at the very start of the planning and design processes - whether you're planning a new development or reviewing existing areas.

---

### **Who's at risk?**

The following Public and Play Space User table focuses on the users most at risk of fall injuries – the elderly and children. If we concentrate on measures that protect these most vulnerable users, we make those spaces safer for everyone.

<b>Public spaces</b>					
Function - what is the purpose of the space?	User – who is using the space?	User characteristics	User needs	Hazards - how could users be injured	Design principles
<b>Walking on footpaths</b>					
	Pedestrians – Elderly	<ul style="list-style-type: none"> <li>• Varying co-ordination</li> <li>• May have poor balance</li> <li>• May have poor vision</li> <li>• May be exerted/fatigued</li> <li>• May have impaired spatial awareness</li> </ul>	Stable, firm, slip resistant surfaces	<ul style="list-style-type: none"> <li>• Tripping on uneven/ broken surfaces</li> <li>• Tripping on pavement joints</li> <li>• Tripping on protruding grates, manhole covers</li> <li>• Stumbling into large drains</li> <li>• Tripping over obstructions such as pavement signs, poorly sited street furniture</li> <li>• Slipping on wet pavement</li> <li>• Slipping on litter or other debris on pavement</li> <li>• Losing balance on excessive footpath cross fall</li> </ul>	<ul style="list-style-type: none"> <li>• Proactive maintenance</li> <li>• Slip resistant surfacing</li> <li>• Clear demarcation of footpath from other spaces</li> <li>• Clear zones free of static and moving objects between pedestrian spaces and traffic or other hazards</li> <li>• Good lighting (see <a href="#">Crime Prevention Through Environmental Design</a>)</li> </ul>
	Pedestrians with disabilities	<ul style="list-style-type: none"> <li>• Varying co-ordination</li> <li>• May have poor balance</li> <li>• May have poor vision</li> <li>• May be exerted/fatigued</li> <li>• May have impaired spatial awareness</li> </ul>	<p>Stable, firm, slip resistant surfaces</p> <p>Footpaths with adequate width for wheelchairs, walkers and other aids</p>	<p>As above plus:</p> <ul style="list-style-type: none"> <li>• Difficulty manoeuvring wheelchairs around obstacles</li> <li>• Getting stuck in transition areas, eg, from kerb to road</li> <li>• Getting caught in kerbside drainage</li> </ul>	<p>As above, plus:</p> <ul style="list-style-type: none"> <li>• Wide footpath design</li> <li>• Sloped kerb-road transitions</li> <li>• See also advice provided in <a href="#">Road Spaces</a></li> </ul>
	Young children	<ul style="list-style-type: none"> <li>• Trusting</li> <li>• Unpredictable</li> <li>• Varying physical ability</li> <li>• Variable coordination</li> <li>• Variable physical, cognitive, and social/emotional ability</li> </ul>	Stable, firm, slip resistant surfaces	<ul style="list-style-type: none"> <li>• Tripping on uneven/ broken surfaces</li> <li>• Tripping on pavement joints</li> <li>• Tripping on protruding grates, manhole covers</li> <li>• Stumbling into large</li> </ul>	<ul style="list-style-type: none"> <li>• Proactive maintenance</li> <li>• Slip resistant surfacing</li> <li>• Clear demarcation of footpath from other spaces</li> <li>• Clear zones free of static</li> </ul>

Function - what is the purpose of the space?	User – who is using the space?	User characteristics	User needs	Hazards - how could users be injured	Design principles
		<ul style="list-style-type: none"> <li>Undeveloped ability to make safe judgement</li> </ul>		drains <ul style="list-style-type: none"> <li>Tripping over obstructions such as pavement signs, poorly sited street furniture</li> <li>Slipping on wet pavement</li> <li>Slipping on litter or other debris on pavement</li> </ul>	and moving objects between pedestrian spaces and traffic or other hazards <ul style="list-style-type: none"> <li>Good lighting (see <a href="#">Crime Prevention Through Environmental Design</a>)</li> </ul>
	Pedestrians – Elderly	<ul style="list-style-type: none"> <li>Varying co-ordination</li> <li>May have poor balance</li> <li>May have poor vision</li> <li>May be exerted/fatigued</li> <li>May have impaired spatial awareness</li> </ul>	Visible steps  Appropriately sized steps	<ul style="list-style-type: none"> <li>Tripping over single steps</li> <li>Tripping on steps that are too high</li> <li>Tripping on stairs that are too narrow</li> <li>Falling on stairs without barriers/handrails</li> <li>Exclusion from access</li> </ul>	<ul style="list-style-type: none"> <li>Grouping of stairs to provide greater visual presence</li> <li>Correct stair geometry</li> <li>Handrails and barriers</li> <li>Good lighting</li> </ul>
	Pedestrians with disabilities	<ul style="list-style-type: none"> <li>Varying co-ordination</li> <li>May have poor balance</li> <li>May have poor vision</li> <li>May be exerted/fatigued</li> <li>May have impaired spatial awareness</li> </ul>	Visible steps  Appropriately sized steps  Ramp access	As above plus: <ul style="list-style-type: none"> <li>Exclusion from access</li> </ul>	As above plus: <ul style="list-style-type: none"> <li>Ramp design</li> </ul>
	Young children	<ul style="list-style-type: none"> <li>Trusting</li> <li>Unpredictable</li> <li>Varying physical ability</li> <li>Variable coordination</li> <li>Variable physical, cognitive, and social/emotional ability</li> </ul>	Visible steps  Appropriately sized steps	As above	<ul style="list-style-type: none"> <li>Grouping of stairs to provide greater visual presence</li> <li>Correct stair geometry</li> <li>Handrails and barriers</li> <li>Good lighting</li> </ul>

Function - what is the purpose of the space?	User – who is using the space?	User characteristics	User needs	Hazards - how could users be injured	Design principles
		<ul style="list-style-type: none"> <li>Undeveloped ability to make safe judgement</li> </ul>			
<b>Climbing on raised platform/balcony</b>					
	Young children	<ul style="list-style-type: none"> <li>Trusting</li> <li>Unpredictable</li> <li>Varying physical ability</li> <li>Variable coordination</li> <li>Variable physical, cognitive, and social/emotional ability</li> <li>Undeveloped ability to make safe judgement</li> </ul>	Appropriate barrier/fence to prevent falls from heights	Fall from heights	Appropriate barrier/fence to prevent falls from heights.
<b>Swings - swinging</b>					
Providing play opportunities	Children – under 5	<ul style="list-style-type: none"> <li>Trusting</li> <li>Unpredictable</li> <li>Variable physical ability</li> <li>Variable coordination</li> <li>Variable physical cognitive, and social/emotional abilities</li> <li>Undeveloped ability to make safe judgements</li> </ul>	<ul style="list-style-type: none"> <li>To extend capabilities without exceeding them</li> <li>Explorative non-restrictive play that creates challenges within safe boundaries</li> <li>To provide for proactive supervision</li> <li>To extend the physical, cognitive, social and emotional abilities without exceeding them</li> </ul>	<ul style="list-style-type: none"> <li>Falling from swing</li> <li>Cuts/splinters from wood or metal seats</li> <li>Being hit by swings or swinging into barriers and poles</li> </ul>	<ul style="list-style-type: none"> <li>Fall height of swings</li> <li>Impact absorbing surfacing</li> <li>Clear zones free of static and moving objects around swings</li> <li>Signage re age appropriateness</li> <li>Regular maintenance checks</li> </ul>

	Children over 5	<ul style="list-style-type: none"> <li>• More physically confident</li> <li>• Seeking to test their boundaries</li> <li>• Inclined to risk taking</li> </ul>	As above	As above but severity of injury possibly greater through greater risk taking	As above
	Children with disabilities	As for children under 5 years	The need to provide for greater carer participation in play activities	As above	As above

**Slides – climbing and sliding**

	Children – under 5	<ul style="list-style-type: none"> <li>• Trusting</li> <li>• Unpredictable</li> <li>• Variable physical ability</li> <li>• Variable coordination</li> <li>• Variable physical cognitive, and social/emotional abilities</li> <li>• Undeveloped ability to make safe judgements</li> </ul>	<ul style="list-style-type: none"> <li>• To extend capabilities without exceeding them</li> <li>• Explorative non-restrictive play that creates challenges within safe boundaries</li> <li>• To provide for proactive supervision</li> <li>• To extend the physical, cognitive, social and emotional abilities without exceeding them</li> </ul>	<ul style="list-style-type: none"> <li>• Falling from slide ladder</li> <li>• Falling from slide platform</li> <li>• Falling from slide chute</li> <li>• Falling on exit from slide</li> <li>• Being hit by child exiting slide chute</li> </ul>	<ul style="list-style-type: none"> <li>• Guardrails</li> <li>• Size appropriate tread and rises on ladder</li> <li>• Child sized grips</li> <li>• Fall height</li> <li>• Impact absorbing surfacing</li> <li>• Clear zones free of static and moving objects around slide</li> <li>• Deceleration prior to exit</li> <li>• Signage re age appropriateness</li> <li>• Regular maintenance checks</li> </ul>
	Children over 5	<ul style="list-style-type: none"> <li>• More physically confident</li> <li>• Seeking to test their boundaries</li> <li>• Inclined to risk taking</li> </ul>	As above	As above but severity of injury possibly greater through greater risk taking	As above

	Children with disabilities	As for children under 5 years	The need to provide for greater carer participation in play activities	As above	As above
<b>Roundabouts/Revolving platforms – running and skipping</b>					
	Children – under 5	<ul style="list-style-type: none"> <li>• Trusting</li> <li>• Unpredictable</li> <li>• Variable physical ability</li> <li>• Variable coordination</li> <li>• Variable physical cognitive, and social/emotional abilities</li> <li>• Undeveloped ability to make safe judgements</li> </ul>	<ul style="list-style-type: none"> <li>• To extend capabilities without exceeding them</li> <li>• Explorative non-restrictive play that creates challenges within safe boundaries</li> <li>• To provide for proactive supervision</li> <li>• To extend the physical, cognitive, social and emotional abilities without exceeding them</li> </ul>	<ul style="list-style-type: none"> <li>• Tripping while running</li> <li>• Tripping while attempting to get on</li> <li>• Tripping while attempting to get off</li> <li>• Falling off after losing grip</li> <li>• Being trapped between platform and ground</li> <li>• Stationary person being hit by moving roundabout</li> </ul>	<ul style="list-style-type: none"> <li>• Child sized grips</li> <li>• Fall height</li> <li>• Impact absorbing surfacing</li> <li>• Clear zones free of static and moving objects around roundabout/platform</li> <li>• Regular maintenance checks</li> <li>• Signage re age appropriateness</li> </ul>
	Children over 5	<ul style="list-style-type: none"> <li>• More physically confident</li> <li>• Seeking to test their boundaries</li> <li>• Inclined to risk taking</li> </ul>	As above	As above but severity of injury possibly greater through greater risk taking	As above
	Children with disabilities	As for children under 5 years	The need to provide for greater carer participation in play activities	As above	As above

**Jungle gyms/other climbing structures – Climbing, Exploring, Jumping, Leaping, Hanging**

	Children – under 5	<ul style="list-style-type: none"> <li>• Trusting</li> <li>• Unpredictable</li> <li>• Variable physical ability</li> <li>• Variable coordination</li> <li>• Variable physical cognitive, and social/emotional abilities</li> <li>• Undeveloped ability to make safe judgements</li> </ul>	<ul style="list-style-type: none"> <li>• To extend capabilities without exceeding them</li> <li>• Explorative non-restrictive play that creates challenges within safe boundaries</li> <li>• To provide for proactive supervision</li> <li>• To extend the physical, cognitive, social and emotional abilities without exceeding them</li> </ul>	<ul style="list-style-type: none"> <li>• Falling from equipment</li> <li>• Being trapped in openings</li> <li>• Clothing trapped on joints or protrusions</li> </ul>	<ul style="list-style-type: none"> <li>• Child sized grips</li> <li>• Fall height</li> <li>• Impact absorbing surfacing</li> <li>• Clear zones free of static and moving objects around roundabout/platform</li> <li>• Regular maintenance checks</li> <li>• Signage re age appropriateness</li> </ul>
	Children over 5	<ul style="list-style-type: none"> <li>• More physically confident</li> <li>• Seeking to test their boundaries</li> <li>• Inclined to risk taking</li> </ul>	As above	As above but severity of injury possibly greater through greater risk taking	As above
	Children with disabilities	As for children under 5 years	The need to provide for greater carer participation in play activities	As above	As above

**Ropes – swinging and hanging**

	Children – under 5	<ul style="list-style-type: none"> <li>• Trusting</li> <li>• Unpredictable</li> <li>• Variable physical ability</li> <li>• Variable coordination</li> <li>• Variable physical cognitive, and social/emotional abilities</li> <li>• Undeveloped ability to make safe judgements</li> </ul>	<ul style="list-style-type: none"> <li>• To extend capabilities without exceeding them</li> <li>• Explorative non-restrictive play that creates challenges within safe boundaries</li> <li>• To provide for proactive supervision</li> <li>• To extend the physical, cognitive, social and emotional abilities without exceeding them</li> </ul>	<ul style="list-style-type: none"> <li>• Fall from ropes</li> <li>• Trapping from frayed fibres</li> </ul>	<ul style="list-style-type: none"> <li>• Fall height</li> <li>• Impact absorbing surfacing</li> <li>• Clear zones free of static and moving objects around roundabout/platform</li> <li>• Regular maintenance checks</li> <li>• Signage re age appropriateness</li> </ul>
	Children over 5	<ul style="list-style-type: none"> <li>• More physically confident</li> <li>• Seeking to test their boundaries</li> <li>• Inclined to risk taking</li> </ul>	As above	As above but severity of injury possibly greater through greater risk taking	As above
	Children with disabilities	As for children under 5 years	The need to provide for greater carer participation in play activities	As above	As above

**Open spaces – Running, Jumping, Leaping, Galloping, Skipping**

	Children – under 5	<ul style="list-style-type: none"> <li>• Trusting</li> <li>• Unpredictable</li> <li>• Variable physical ability</li> <li>• Variable coordination</li> <li>• Variable physical cognitive, and social/emotional abilities</li> <li>• Undeveloped ability to make safe judgements</li> </ul>	<ul style="list-style-type: none"> <li>• To extend capabilities without exceeding them</li> <li>• Explorative non-restrictive play that creates challenges within safe boundaries</li> <li>• To provide for proactive supervision</li> <li>• To extend the physical, cognitive, social and emotional abilities without exceeding them</li> </ul>	<p>Falls on uneven paving Falls on uneven grounds, holes Cuts from broken glass or other litter Hit by vehicles Exposure to water hazards Exposure to crime (offenders)</p>	<p>Regular maintenance checks Bollards, fences, other physical barriers to separate people from vehicles See <a href="#">Water spaces</a> See <a href="#">Crime prevention through environmental design</a></p>
	Children over 5	<ul style="list-style-type: none"> <li>• More physically confident</li> <li>• Seeking to test their boundaries</li> <li>• Inclined to risk taking</li> </ul>	As above	As above but severity of injury possibly greater through greater risk taking	As above
	Children with disabilities	As for children under 5 years	The need to provide for greater carer participation in play activities	As above	As above

<b>Parks - skate boarding and opportunity for congregating</b>					
	Teens	Highly physically confident More inclined to at-risk behaviour	More challenging play spaces	Injuring themselves or others through inappropriate use of space, eg, boarding on pathways	Physical barriers to separate spaces for activities such as skateboarding from other users Also design for safe environment to deter congregation - – see <a href="#">Crime prevention through environmental design</a>
<b>All areas</b>					
	Supervisors	<ul style="list-style-type: none"> <li>Actively supervising children's activities</li> <li>May be involved in some activities, eg, pushing swings</li> </ul>	<ul style="list-style-type: none"> <li>Open, unobstructed sightlines to children's activity areas</li> <li>Seating facilities located near playing areas</li> </ul>		See water safety section re strategies for active supervision Design for safe environments – see <a href="#">Crime prevention through environmental design</a>
	Undesirable Users: vandals	Interfering with/destroying equipment Tagging, etc	Opportunity for corrupt activity <ul style="list-style-type: none"> <li>seclusion</li> <li>darkness</li> <li>isolation</li> </ul>		Design for safe environments – see <a href="#">Crime prevention through environmental design</a>
	Child offenders	Abduction Interference	Opportunity for corrupt activity <ul style="list-style-type: none"> <li>seclusion</li> <li>darkness</li> <li>isolation</li> </ul>		Design for safe environments – see <a href="#">Crime prevention through environmental design</a>
	Drug dealing	Opportunity for other crime activities eg drug dealing	Opportunity for corrupt activity <ul style="list-style-type: none"> <li>seclusion</li> <li>darkness</li> <li>isolation</li> </ul>		Design for safe environments – see <a href="#">Crime prevention through environmental design</a>

## Addressing public and play space hazards

IPTED requires a reorientation in planning for designing, building, operating and maintaining public and play spaces. It's all about applying a new perspective.

As a starting point, we need to ask...

- How can spaces be arranged to support activities, people's needs and the relationships between the different users and their activities?
- Will the spaces provide for the efficient circulation of people, vehicles activities and support and maintenance functions?
- Will the spaces provide sustainability of financial investment and cost to maintain?
- Will the spaces meet the environmental and cultural needs?
- Will the spaces respond to the users' physical needs in terms of comfort, safety, security and convenience?
- Will the spaces respond to the users' social needs in terms of health, interaction, sense of community?
- How realistic are space and activity requirements in terms of demographic projections, people's needs and space efficiencies?

### What does this look like:

- in our [public spaces?](#)
- in our [play spaces?](#)

## Addressing public space hazards

There are three groupings of hazards:

- Structures
  - [Think pedestrians first](#)
  - [Think stair design and layout](#)
  - [Think standards](#)
- Surfaces
  - [Think safe surface](#)
  - [Think standards](#)
  - [Think long term](#)
- Surroundings
  - [Think clear spaces](#)
  - [Think protection](#)

**In all cases you need to consider the suggested solutions within the bigger planning picture and your local circumstance. Some solutions will readily apply. Others may not. The real point of the exercise is to include a focus on injury prevention in your planning, design operational and maintenance processes. And not just for new facilities but for existing facilities also.**

---

## Structure hazards

### Think pedestrians first

Building more pedestrian friendly community spaces creates a safer environment for everyone. The benefits include improved health from walking; lower air pollution through reduced vehicle emissions; increased business for shops because of foot traffic in the area; lower crime rates from increased social connections; and an increased sense of community due to greater interactions between people meeting on the street.

According to The New Zealand Institute of Research on Aging it is estimated that by 2050 there will be a 500 percent increase in the number of those over 85 years. And, as New Zealand's population ages, more and more of us are likely to walk and cycle both for recreation and as our primary means of getting around.

- Create walk able communities with features – quality pavements, protection from vehicles, regular and safe crossing opportunities - that encourage people to walk rather than use vehicles for travel. See recommendations for pedestrian facilities in the [Road spaces section](#). See section four of New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [Community Walkability](#). See also [Standards New Zealand Handbook for Tracks and Outdoor Visitor Structures](#) (SNZ HB 8630:2004).
  - Ensure street furniture is sited safely. While street furniture can encourage greater use of public spaces it can present a tripping hazard. Ensure furniture can be detected and avoided by the visually impaired. See section 14.9 of the New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [street furniture](#)
  - Make sure grates and covers are flush with surrounding surfaces. Openings in grates should be perpendicular with the main direction of pedestrian flow and be no greater than 13mm wide and 150 mm long. See section 17 of the New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [grates and covers](#)
  - Think head heights of adults and children when considering obstacles, protrusions and visibility (see and be seen).
- 

### **Think stair design and layout**

- Eliminate short, sharp level changes. Get rid of one or two stair/step combinations. Consider replacing with a sloping surface or grouping stairs/steps into sets of three or more, which are more visible to people. See section 14.4 of the New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [gradients](#) and [ramps and steps](#). See also [Standards New Zealand Handbook for Tracks and Outdoor Visitor Structures](#) (SNZ HB 8630:2004).
- Ensure stairs/steps are designed properly with recommended stair/step height and adequate room for placement of feet. Where there are more than 10 stairs/steps in a flight, incorporate landings to allow less able climbers to rest. Avoid open-back designs.
- Make stairs/steps more visible by using contrasting colours to mark the edges of stairs particularly where there are fewer stairs.
- Lighting - install adequate lighting so pedestrians can see and be seen. See lighting standards. See also section 17 the [New Zealand Transport Agency's Pedestrian Planning and Design Guide](#) for guidance on lighting the pedestrian network

---

## Think standards

Ensure you are using the most up to date standards and guidelines:

- [NZS 4102:1996 New Zealand Standard. Safer House design](#) (Guidelines to reduce injury at home)
  - [New Zealand Transport Agency Pedestrian Planning and Design Guide](#)
  - [Preventing home falls injuries: structural and design issues and solutions](#) (Gunatilaka A, Clapperton. A, and Cassell. Hazard (edition no 59) summer 2005 Victorian Injury Surveillance and Applied Research System (Viaar) Monash University Accident Research Centre.
  - [New Zealand Transport Agency. \(1999\). RSS12: Floodlighting Pedestrian Crossings.](#)
  - [AS/NZS 1158.1.1:2005 Road lighting - Vehicular traffic \(Category V\) lighting - Performance and design requirements](#)
  - [AS/NZS 1158.6:2010 Road lighting - Lighting for roads and public spaces - Luminaires](#)
  - [AS/NZS 1158.2:2005 Road lighting - Computer procedures for the calculation of light technical parameters for Category V and Category P lighting](#)
  - [AS/NZS 1158.0:2005 Road lighting - Introduction](#)
  - [AS/NZS 1158.1.3:1997 Road lighting - Vehicular traffic \(Category V\) lighting - Guide to design, installation, operation and maintenance](#)
  - [AS/NZS 1158.1.3:1997 Road lighting - Vehicular traffic \(Category V\) lighting - Guide to design, installation, operation and maintenance](#)
  - [AS/NZS 1158.3.1:2005 Road lighting - Pedestrian area \(Category P\) lighting - Performance and design requirements](#)
  - [SNZ HB 8630:2004 New Zealand Handbook Tracks and Outdoor Visitor Structures](#)
-

## Surface hazards

### Think safe surfaces

To reduce the possibility of pedestrian falls, all footpaths should be firm, stable and slip resistant, especially when wet.

- As a first step choose slip-resistant paving materials.
- Ensure footpaths and communal spaces are well maintained – keep up a regular inspection programme for cracks and other surfacing damage or covering.
- Regularly monitor drainage systems to ensure they are removing water from pedestrian areas.
- Keep footpaths and communal spaces clear of litter and dog droppings.
- Make sure any resurfacing work retains the original safety-promoting features, eg, pedestrian crossings that sit proud of the road, clear kerb distinction.

As a back up, check how well surfaces meet the recommendations of the non motorised user audit.

See section 14.6 of New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [surfaces](#).

See also [Standards New Zealand Handbook for Tracks and Outdoor Visitor Structures](#) (SNZ HB 8630:2004).

---

### Think standards

Making sure all footpaths and pedestrian areas comply with surfacing standards is another step in reducing the likelihood of pedestrian falls. Make sure you are using the most current versions:

- [AS/NZS 3661.2:1994 Australia/New Zealand standard. Slip resistance of pedestrian surfaces. Part 2: Guide to the reduction of slip hazards.](#)
  - [AS/NZS 4663:2004. Australia/New Zealand standard. Slip resistance measurement of existing pedestrian surfaces.](#)
  - [Standards Australia, 1999. HB 197:1999 An introductory guide to the slip resistance of pedestrian surface materials. Standards Australia.](#)
  - [New Zealand Transport Agency Pedestrian Planning and Design Guide.](#)
  - [SNZ HB 8630:2004 New Zealand Handbook for Tracks and Outdoor Visitor Structures](#)
-

## Think long term

All pedestrian facilities – whether roadside or recreational – need regular ongoing maintenance. Without it, facilities designed to encourage walking may themselves end up becoming hazards or deterrents to walking trips.

- Choose quality surfacing that remains in usable condition longer. Though sometimes requiring greater upfront investment, using long-life surfacing treatments can reduce monitoring and maintenance costs over the life of the surface.
- Avoid planting trees, shrubs and other plants that will cause heave on walking spaces or drop excessive foliage.
- Ensure adequate drainage to prevent rainwater and groundwater washing away pavement base.
- Discourage behaviours that potentially reduce the life of the surfaces. For example, cars parking on footpaths subject them to added weight that they may not be built to take.
- Establish a pro-active preventive maintenance schedule.
  - Regularly check performance of surfacing against its expected life.
  - Determine the threshold for remedial action – at what point you'll take action, and what that action will be.
  - Programme a works schedule accordingly, including adequate funding.
  - Process for community reporting of hazards/maintenance issues with a system to prioritise and action reports.
- Consider encapsulating the above points into a footpath policy. Such a policy can help establish and maintain consistent standards.

Also see section 18 of New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [maintaining the pedestrian network](#)

---

## Surroundings hazards

### Think clear spaces

Keeping pedestrian spaces clear of slip and trip hazards will lessen the chances of people falling.

- Keep footpaths clear of obstructions such as shop advertising signs and parked vehicles.
- Consider carefully the location of street furniture – choose sites that are convenient but don't obstruct pedestrians and cyclists.
- Ensure litter bins are cleared before they overflow and do not provide obstruction to foot traffic.

- Keep vegetation in check so that it does not overhang paths, restrict access or create a tripping or slip hazard. Ensure that leaves do not obscure vision of footpath hazards ie cracks, heaves, holes.
- Watch for pavement heave caused by tree roots and settlement.
- Use distinctive paving to clearly mark the different functions of paved areas, eg, using contrasting paving to distinguish the footpath from the road.

See section 14 of the New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [footpaths](#).

The other part of the equation in reducing fall injuries is to create a more forgiving environment should a person have a fall.

- Separate pedestrians from vehicles. Consider using:
  - Clear definitions of footpaths from road spaces.
  - Clear zones free of both static and moving objects.
  - Barriers such as bollards, fencing, dense planting.

---

### **Think protection from surrounding hazards.**

See the [Road Spaces](#) section for more information

- Encourage on street parking to provide a buffer between pedestrians and traffic. See the [Road Spaces](#) section for more information.
- Discourage off-street parking that puts vehicles between pedestrians and building frontages. See the [Road Spaces](#) section for more information.
- Employ traffic calming measures to slow traffic in high pedestrian areas. See the [Road Spaces](#) section for more information.
- Ensure the slope of footpath is not so extreme that a slip or trip on the footpath would result in the pedestrian falling into moving traffic.
- Provide protection, such as fences barriers or dense planting around water spaces to reduce the chance of a pedestrian or young child on a bike, trike, scooter or pushchair falling and ending up in the water. See the [Water Spaces](#) section for more information.
- Ensure adequate lighting levels in pedestrian designated areas. This provides for [personal safety](#) while helping pedestrians to clearly see their walking environment and any obstacles or hazards that may be present. Good lighting also allows motorists to clearly see pedestrians and reduces the likelihood of pedestrians being hit by vehicles.

See section 6.4 of the New Zealand Transport Agency's Pedestrian Planning and Design Guide for guidance on [pedestrian network components](#) and section 14 of the same publication for guidance on [footpaths](#).

See also [Standards New Zealand Handbook for Tracks and Outdoor Visitor Structures](#) (SNZ HB 8630:2004).

---

**Want more information?**

See our [best practice references](#)

## Addressing play space hazards

There are three groupings of hazards

- Structures
  - [Think kids first](#)
  - [Think standards](#)
  - [Think safe equipment](#)
  - [Think lifecycle](#)
- Surfaces
  - [Think standards](#)
- Surroundings
  - [Think protection](#)
  - [Think sightlines](#)
  - [Think beyond maintenance](#)

**In all cases you need to consider the suggested solutions within the bigger planning picture and your local circumstance. Some solutions will readily apply. Others may not. The real point of the exercise is to include a focus on injury prevention in your planning, design operational and maintenance processes.**

---

### Structure hazards

#### Think kids first

Children are the main - and the most vulnerable - users of play spaces. First and foremost the design of a play space must recognise the physical size, physical capabilities and interests of children and at the same time provide a variety of challenges within fun environments.

- Provide separate play areas for different age groups, with appropriate equipment and opportunities for both active and passive play for those ages. Injuries are caused by the environment, and how a child plays, a safe play structure for an 8-year old is not necessarily a safe play structure for a 3-year old.
- Aim for explorative, unrestricted play that creates fun challenges but within safe boundaries.

- Link activity areas with paths that allow easy travel between areas, with unobstructed vision from a child's height. See the [Road spaces section. For advice on footpaths](#). See also the [New Zealand Transport Agency's Pedestrian Planning and Design Guide](#).
- Create inclusive play spaces that provide access and play opportunities for children of all abilities.

[Grounds for sharing: a guide to developing special school sites / Stoneham, Jane. - Winchester, Hampshire: Learning Through Landscapes, 1996.](#)

[Outdoor access for all: a guide to designing accessible outdoor recreation facilities / Kidd, Brian J.; Clark, Ross. - Melbourne : Dept. of Youth, Sport and Recreation, 1982.](#)

### **Think standards**

It is important that the planning and designing of playgrounds take into account the specifications and requirements of the most current standards. Ensure you keep up with any changes or revisions.

- Choose a playground design that meets all recommended standards
  - the [New Zealand Playground Safety Standards \(NZS 5828: 2004 Playground Equipment and Surfacing\)](#).
  - [SNZ HB 5828: General playground equipment and Surfacing handbook](#).
  - [SNZ HB 5828:2 2006 supervised early childhood facilities – playground equipment and surfacing handbook](#).
  - [Accessibility Standards \(NZS 4121:2001\)](#) and
  - national/local Building Standards and Codes.
- Check that the equipment you install meets the requirements of NZS 5828 – don't assume!
- Install equipment to the Standard and local codes.
- Ensure surfaces under and around playground equipment meet the Standard and continue to do so while playground is in use.

## Think safe equipment

Equipment design has a big influence on safety. It's important that you select equipment that – at the least - meets current safety standards (see [NZS 5828](#)).

- For climbing equipment:
  - Though safety standards allow a fall height of up to 2.5m, consider installing equipment where the fall distance is no greater than 1.5 metres. Research has shown there is a significant increase in the risk of injury beyond this height.

For platforms:

  - Provide barriers, and staggered platforms at heights to prevent falls, or reduce the fall height

- For swings:
  - Soft rubber or canvas seats are safer than wooden or steel.
  - Allow generous clear zones free of both static and moving objects around swings to avoid other children being hit by swinging children.
- For slides, they must have:
  - Platforms that allow children to sit before getting onto the slide.
  - a gradual slope at the bottom to slow children down.

And:

- Avoid any equipment or other park furniture made with angles or openings that could trap a child's head or any part of a child's body.
- Make sure hand grips are sized and shaped so that children can grasp them easily.

The recommendations above are by no means exhaustive. Follow the direction of [NZS 5828](#) when the planning, designing and maintaining playgrounds.

---

## Think lifecycle

Playgrounds have a hard life. Equipment has to withstand the rigors of the physical environment such as weather, and the social environment eg, vandalism, as well as many and varied activities of the children using it.

- Anticipate potential safety problems associated with the design, site and user/play/use characteristics.
  - Buy quality equipment - any upfront price difference is likely to be offset by a lower maintenance burden and replacement costs.
  - Install to local codes and requirements.
-

## Surface hazards

### Think standards

Ensuring play spaces are compliant with safety standards will ensure the risk of injury is eliminated, isolated, or minimised provided fall heights are not excessive.

- Consider establishing a playground policy to ensure consistent standards are achieved and maintained. Such a policy would be based on or refer to current playground standards:
    - [NZS 5828:2004](#) Playground equipment and surfacing sets out the recommended surfacing for playgrounds. Complying with these standards will reduce the number of fall injuries in playgrounds.
    - [SNZ HB 5828.1:2006 General Playground Equipment and Surfacing Handbook](#).
    - [AS/NZS 3661.2:1994](#) Australia/New Zealand standard. [Slip resistance of pedestrian surfaces. Part 2: Guide to the reduction of slip hazards](#).
    - [AS/NZS 4663:2004](#). Australia/New Zealand standard. [Slip resistance measurement of existing pedestrian surfaces](#).
    - [Standards Australia, 1999. HB 197:1999](#) [An introductory guide to the slip resistance of pedestrian surface materials. Standards Australia](#).
    - [AS/NZS 4586:2004](#) [Slip resistance classification of new pedestrian surface materials](#)
    - [AS/NZS 4586:2004A1](#) [Slip resistance classification of new pedestrian surface materials: Amendment 1](#).
- 

## Surroundings hazards

### Think protection

There may be nearby hazards such as roads, streams, trees and holes – even other play or recreation areas.

- Protect play space users from vehicles:
  - Clearly define areas including play space, road and parking areas.
  - Use signage.
  - Use physical barriers such as bollards, fences, planting, however ensure that barriers do not reduce sightlines or act as areas for entrapment (refer to [crime prevention through environmental design](#))
- Separate the playground from surrounding streets and parking areas with full boundary length fences or other barriers. Ensure such barriers/fences do not obstruct visibility, or create entrapment areas.
- Protect observers/others from children using play equipment:

- Provide adequate clear zones free of both static and moving objects around activity areas, such as swings.
- Recognise that children of different ages play in different ways. Have separate areas for younger and older children with different equipment for each age group.
- Protect children from [water hazards](#) such as ponds, streams, either within the play space or nearby.

Hazards needing attention can also include:

- Uneven ground and holes
- Exposed sprinkler heads, broken glass, rubbish or stones
- Sharp edges on equipment and furniture.

---

### **Think sightlines**

Supervision by parents or caregivers is an important factor in reducing children's injury in play spaces, and in reducing the incidence of crime-related incidents.

- Set out equipment so that supervising adults can clearly see the children at play at all times.
- Provide seats, tables and shade areas that encourage active supervision of children at play but don't interfere with their play unless invited. Ensure that the type of seating provided is appropriate for the activity thereby promoting supervision rather than another activity (picnic tables promote eating and reading)
- Ensure vegetation and landscaping is kept in check and doesn't obscure the view of play areas.

---

### **Think beyond maintenance**

Regular ongoing maintenance is vital to the safety of play spaces. It's important to move beyond a 'fix-it-if-it-is-broken' mentality.

- Carry out a hazard assessment of any new spaces and its surrounds before opening to the public. Then establish a proactive preventative maintenance schedule based on a recognised standard of care. Useful maintenance resources include:
  - [NZS 5828:2004 Playground equipment and surfacing.](#)
  - [SNZ HB 5828.1:2006 General Playground Equipment and Surfacing Handbook.](#)

Provide facilities for community reporting of hazards or maintenance issues and develop systems for reports to be prioritised and managed.

When hazards are identified:

- If repairs cannot be made immediately, remove the equipment from service until repaired.
  - When repairing equipment:
    1. fix or eliminate those hazards that might kill
    2. fix or eliminate hazards that might cause serious injury
    3. fix hazards that might cause minor injuries.
  - Keep records of safety audits.
  - Keep records of injuries related to facility/equipment use for future analysis and identification of problem areas or hazards.
- 

### **Want more information?**

See our [best practice references](#).

## **Best practice for public and play spaces**

See best practice guidelines:

- [for public spaces](#)
  - [for play spaces](#)
- 

### **For Public Spaces**

#### **General**

- The Ministry for the Environment [Urban Design Tool Kit](#).
- Design for safe and healthy communities: the [Matrix of Like Design Considerations](#), p 24. Healthy by Design: a planners' guide to environments for active living,. National Heart Foundation of Australia. June 2004.

#### **General pedestrian**

- New Zealand Transport Agency: [Pedestrian Planning and Design Guide](#).

#### **Stairs/steps**

- [NZS 4102:1996 New Zealand Standard. Safer House design \(Guidelines to reduce injury at home\)](#).
  - New Zealand Transport Agency: [Pedestrian Planning and Design Guide](#)

## **Surfacing**

- [AS/NZS 3661.2:1994 Australia/New Zealand standard. Slip resistance of pedestrian surfaces. Part 2: Guide to the reduction of slip hazards.](#)
- [AS/NZS 4663:2004. Australia/New Zealand standard. Slip resistance measurement of existing pedestrian surfaces.](#)
- [Standards Australia, 1999. HB 197:1999 An introductory guide to the slip resistance of pedestrian surface materials. Standards Australia.](#)
- [AS/NZS 4586:2004 Slip resistance classification of new pedestrian surface materials.](#)
- [AS/NZS 4586:2004A1 Slip resistance classification of new pedestrian surface materials: Amendment 1.](#)
- [SNZ HB 8630:2004 Standards New Zealand Handbook for Tracks and Outdoor Visitor Structures.](#)

## **Personal Safety**

- See [Crime prevention through environmental design](#)

## **Lighting**

- [New Zealand Transport Agency. \(1999\). RSS12: Floodlighting Pedestrian Crossings.](#)
- [AS/NZS 1158.1.1:2005 Road lighting - Vehicular traffic \(Category V\) lighting - Performance and design requirements.](#)
- [AS/NZS 1158.2:2005 Road lighting - Computer procedures for the calculation of light technical parameters for Category V and Category P lighting.](#)
- [AS/NZS 1158.6:2010 Road lighting - Lighting for roads and public spaces - Luminaires.](#)
- [AS/NZS 1158.0:2005 Road lighting - Introduction.](#)
- [AS/NZS 1158.3.1:2005 Road lighting - Pedestrian area \(Category P\) lighting - Performance and design requirements.](#)
- [AS/NZS 1158.1.3:1997 Road lighting - Vehicular traffic \(Category V\) lighting - Guide to design, installation, operation and maintenance.](#)

## **Accessibility**

- [NZS 4121:2001 Accessibility Standards.](#)
  - [Grounds for sharing: a guide to developing special school sites / Stoneham, Jane. - Winchester, Hampshire: Learning Through Landscapes, 1996.](#)
  - [Outdoor access for all: a guide to designing accessible outdoor recreation facilities / Kidd, Brian J.; Clark, Ross. - Melbourne: Dept. of Youth, Sport and Recreation, 1982.](#)
-

## For Play spaces

### General

- [NZS 5828:2004 Playground Equipment and Surfacing.](#)
- [NZS HB5828.1:2006 General Playground Equipment and Surfacing Handbook.](#)
- [SNZ HB 5828:2 2006 supervised early childhood facilities – playground equipment and surfacing handbook.](#)
- [NZS 4121:2001 Accessibility Standards.](#)
- [Building Act 1991.](#)

### Accessibility

- [NZS 4121:2001 Accessibility Standards.](#)
- [Grounds for sharing: a guide to developing special school sites / Stoneham, Jane. - Winchester, Hampshire: Learning Through Landscapes, 1996.](#)
- Outdoor access for all: a guide to designing accessible outdoor recreation facilities / Kidd, Brian J.; Clark, Ross. - Melbourne: Dept. of Youth, Sport and Recreation, 1982.

### Personal Safety

- See [Crime prevention through environmental design.](#)

### Maintenance

- [NZS 5828: 2004 Playground Equipment and Surfacing.](#)
- [NZS HB5828.1:2006 General Playground Equipment and Surfacing Handbook.](#)
- New Zealand Transport Agency: [Pedestrian network planning and facilities design guide.](#)

## Benefits of safe community spaces

Public spaces such as parks, playgrounds, and recreation facilities – even footpaths – all provide the opportunities and encouragement to participate in activities that contribute to a good quality of life. In *Physical Activity and Health - The benefits of physical activity*, Dr Harriette Carr promotes physical activity as particularly important in reducing the risks of developing:

- obesity
- coronary heart disease
- non-insulin dependent diabetes mellitus
- colon cancer
- depression.

Dr Carr reports that recent studies suggest that moderate physical activity can reduce the risk or improve symptoms of:

- Alzheimer's disease
- duodenal ulcers
- immunity
- incontinence.

Physical activity also reduces the impact of aging and improves quality of life, and life expectancy.

The challenge for planners, designers, operators and maintainers of public spaces, is to create environments that help people participate in increased levels of physical activity - safely.

<b>Benefit Design Principle</b>	<b>Fewer injuries</b>	<b>Improved physical activity</b>	<b>Improved health</b>	<b>Improved social cohesion</b>	<b>Improved security and reduced crime</b>
<b>Creating Walk/cycle –friendly public spaces</b>	✓	✓	✓	✓	✓
<b>Creating attractive, challenging and safe play spaces</b>	✓	✓	✓	✓	✓

### **The injury problem in public and play spaces**

Being active and getting outdoors are simple pleasures that can build healthy, long-lived New Zealanders.

Parks, playgrounds, and recreation facilities – even footpaths - all provide the opportunities and encouragement to participate in activities that contribute to a good quality of life. However, falls – including those happening outside the home - are a leading cause of serious injury. They are one of the top three causes of injury-related death in New Zealand.<sup>5</sup>

Between 2000 and 2006 over 2,300 people died from fall-related injuries.<sup>6</sup>

Between 2000 and 2008 more than 157,000 people were hospitalised for fall-related injuries.<sup>7</sup>

Playground equipment is associated with nearly one third of falls to children under the age of 15.<sup>8</sup>

Australian studies show that, outside the home, older people suffer nearly half their falls as a pedestrian. Falls for the elderly can have especially far reaching results on their quality of life. An American study of over 1,000 people aged over 71 living in the community showed that falls to be a strong predictor of placement in a skilled nursing facility.

For children aged five to nine, the risk of a fall is typically greatest when they're in a play space. Around half of five-to nine-year-olds admitted to hospital with a fall-related injury experience those falls in playgrounds.<sup>9</sup>

### **Why are injuries occurring?**

People are suffering injuries in public spaces because:

- [They're falling on footpaths and pavements](#)
- [They're falling on steps and stairs](#)

And injuries are occurring in play spaces because:

- [The fall height of play equipment is too high](#)
- [Surfaces aren't breaking kids' falls](#)
- [Kids are getting caught on equipment.](#)

Looking for solutions? [See addressing public space hazards](#)  
[See addressing play space hazards](#)

---

## **Injuries in public spaces**

### **People are falling on footpaths and pavements**

A study by Australia's Monash University Accident Research Centre (1994) showed that falls are a major feature of fatal and non fatal injuries in people aged 65 years and older. Some 47 percent of pedestrian injuries of older people involved falls. The majority (60%) of these falls occurred on footpaths.

What we know about footpath hazards:

- Uneven/broken surfaces are a main cause of falls. In the Monash study (1994) 38 percent of pedestrian falls were caused by people tripping on uneven surfaces; three percent tripped on footpath joints.
- Slippery surfaces increase the possibility of falls. Slips happen where there is not enough friction between the foot and pavement. In the Monash study (1994) slips accounted for 10 percent of falls on footpaths, nearly a third of these falls were on wet footpaths.
- The steepness of the footpath can create issues of balance for older pedestrians. Pavements that are sloped towards the kerb to allow water to drain also 'push' pedestrians towards traffic.<sup>10</sup>
- Unexpected changes in surface level create a stumbling hazard. A study by Murray (1967) found that the average toe to ground clearance was 14 mm. This indicates that a rise in surface of 14mm increases the chances of pedestrians stumbling. Older people are at greater risk as they lift their feet the least.
- Obstructions such as pavement signs, poorly sited street furniture, protruding grates or manhole covers, and litter and other debris, create tripping hazards.<sup>11</sup>

Footpath hazards are not solely restricted to the urban or built environment.

Pedestrians enjoying New Zealand's natural environment must also contend with slip trip and fall hazards when using tracks and visitor structures.

---

### **People are falling on steps and stairs**

How people use stairs/steps accounts for a significant number of falls. For example, carrying items and running up or down stairs/steps increases the likelihood of tripping. But the design of stairs/steps can also be a major contributor to injuries.

What we know about stair/step hazards:<sup>12</sup>

- Too few stairs/steps makes it more likely a person will trip. Short, sudden changes in surface can be hard to see. Sixty percent of falls happen where there is only one or two stairs/steps. Grouping stairs/steps make them easier to see. The risk of falling is lower when there is more than six stairs/steps.
- Poor stair/step dimensions increase the likelihood of tripping:
  - Where individual stair/step height is too high a person can become fatigued and lose the energy to lift their feet. A tripping hazard also occurs where the depth is too low, especially where there is a single stair/step that might not be easily noticed.
  - Where individual stairs/steps are not deep enough – from the front to the back - for a person's foot. Older people are at higher risk of falling on narrow stairs/steps.
  - Open backed stairs/steps can increase the visual clutter and make the stair/step edge less visible. This depends on what the climber sees through

the gaps. Again, this is particularly a problem for older people and people using walking aids.

- A lack of lighting or shadows created by poor lighting can make stair/step edges harder to see.
- Low hanging lights and the underside of another flight of stairs/steps can create overhead hazards, especially for people with visual impairment.
- The lack of a handrail increases the tripping hazard. One study (Roys) shows the risk of fall doubles if there are just walls on both sides of stairs/steps as opposed to handrails or barriers on both sides. The risk increases four-fold where there is nothing to hold on to on at least one side. The risk is especially great for the elderly.<sup>13</sup>

---

## Injuries in play spaces

### **The fall height of play equipment is too high**

Research shows that children were at increased risk of injury if they fell from playground equipment not complying with the height and surfacing requirements of the then New Zealand playground standard (NZS5828:2004) (Chalmers et al 1996).<sup>14</sup>

What we know about playground falls:

- **The height from which children fall is a significant contributor to the problem.**

A Dunedin case-control study, Chalmers et al (1996) followed up on 300 children who had falls in playground that resulted in injury. Chalmers findings included:

1. The risk of injury from a fall above 2.5m is triple that of falls from below 2.5m
2. A child who falls from above 1.5m is at quadruple the risk of having an injury than a child who falls from below 1.5m
3. The incidence of injuries requiring hospital treatment would reduce by an estimated 45 percent if the maximum height from which children could fall was 1.5m.

---

### **Surfaces aren't breaking their falls**

Although it will not stop the fall from happening, the right surfacing under playground equipment can reduce the severity of a fall. The odds of a child being injured in a fall from playground equipment more than doubles if they fall onto a non-impact absorbing surface (such as asphalt or concrete).

Again, NZS 5828:2004 sets specifications for the installation of impact-absorbing surfaces in playgrounds. But follow up research as outlined below shows that problems with surfacing are still exposing children to injury risks.

### **What we know about surfacing problems:**

- **The quality and maintenance of the surfacing onto which children fall is a significant contributor.**

In *Height and surfacing as risk factors for injury in falls from playground equipment: a case control study*, David Chalmers et al found that the Standard's surfacing requirements were effective in reducing fall-related injuries. But in *Playground Injury – the Kids are Still Falling for it*,<sup>15</sup> Chalmers noted that for surface material to be effective, they must be correctly installed and properly maintained.

- The absence of suitable impact absorbing surface material doubles the risk of injury.

An Australian study (Guanatilaka, 2004)<sup>16</sup> in Victoria identified that shallow or compacted bark surfacing under playground equipment poses a severe risk for head injury.

---

### **They're getting caught on equipment**

Though rare, deaths in playgrounds are most likely to be from strangulation<sup>17</sup>.

What we know about trapping or choking hazards:

- **Sharp angles, hooks or protrusions on equipment can trap children.** Children have died when clothing or drawstrings have become caught and have tightened around their neck.
- **Openings on equipment can trap children**, for example, where a play equipment opening lets a child squeeze in their head or neck, but not their whole body. The danger of strangulation or choking arises where they're unable to support their weight if they become stuck or lose their footing.

## The cost of falls

Between 2000 and 2008 almost 347,000 people were hospitalised for unintentional injury; of these 157,400 – around 45 percent – were fall related<sup>18</sup>.

In these years:

- Almost 9,700 children aged 0 to 4 years were hospitalised for fall-related injuries – nearly 40 percent of pre-schoolers hospitalised for injuries<sup>19</sup>.
- 29,000 children aged 5 to 14 years were hospitalised for fall-related injuries<sup>20</sup>.
- falls accounted for
  - o 56 percent of all hospitalised injuries for 65-69 year olds, 65 percent for 70-74 year olds and 82 percent for people over 75 years.

In just one year, from July 2008 to June 2009, over 30,000 people visited a registered medical practitioner for a fall that happened in the community (over 166,000 GP visits). This carried an ACC price tag of \$15 million. Of those who fell, over 2,300 had to take more than one week off work, at a further cost of \$22 million.

On top of this are the costs associated with those who had fallen in previous years who continued to receive rehabilitation or earnings related compensation.

In a recent study completed by Des O’Dea and Dr John Wren, the social and economic cost of falls was reported to be \$1.735 billion per annum.<sup>21</sup>

Falls in all age groups can result in disability. Injuries to the spinal cord and brain can lead to a lifetime disability or require long-term rehabilitation to regain physical and mental function. Serious fractures require a long time in hospital and restriction on activities. Time away from work, study and play affect not only the injured person but their carers, family and whanau.

Most falls in community spaces happen in two distinct age groups – children and older adults.

While 5- to 14-year-olds have a high number of hospitalisations from falls in play spaces, death as a result of a fall injury is uncommon.

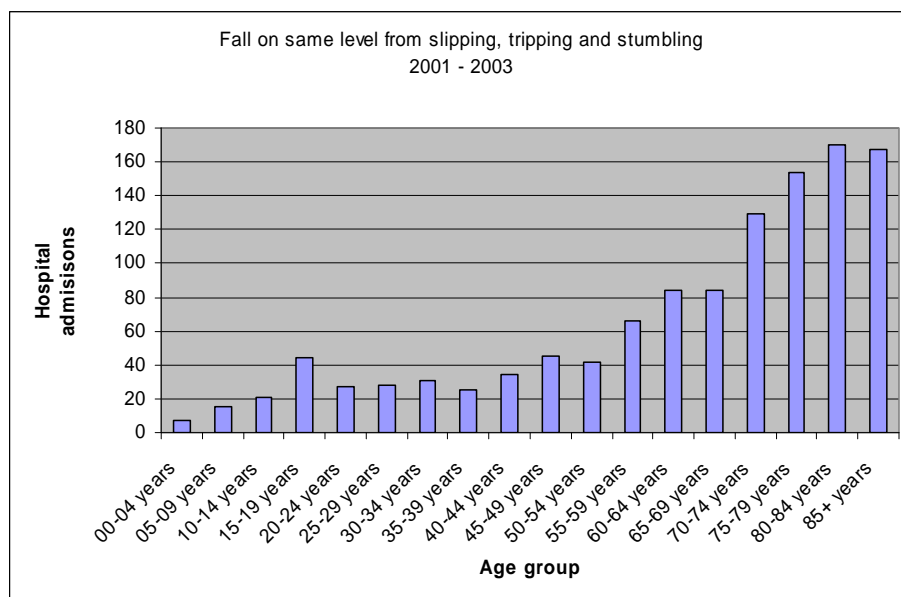
Conversely, older people’s vulnerability and longer recovery periods make falls a particularly serious threat to their health and functioning.

Even when no physical injury has happened, a fall can result in a loss of independence and confidence, a reluctance to undertake certain activities and a fear of falls happening again. Falls can also have financial and social impacts on an individual’s family/whanau and community – for example, if an older person needs to go into residential care as a result of a fall, or a child requires alternative care because their caregiver has been injured in a fall.

Research conducted in New Haven, Connecticut on 1103 people over 71 years living in the community found falls to be a strong predictor of placement in a skilled nursing facility.<sup>22</sup>

A study by Australia's Monash University Accident Research Centre (1994) noted that, at 46 percent, fractures were the most common injury to result from pedestrian falls. Around 20 percent of these fractures involved the hip, 16 percent were wrist and 16 percent the humerus. In a hospital setting the average stay for a hip fracture is 11 days at a cost of \$ 1,323 per day (total of \$14,557).<sup>23</sup>

**Hospital admissions from falls in the road environment (2001 – 2003).**



Source: Pedestrian Planning and Design Guide, Land Transport New Zealand

# Road spaces

*Planning, designing, building and maintaining for wellbeing on and around roads*

In 2009, 385 people died on New Zealand road and since 2004 the number of serious injuries has risen by six percent, although there has recently been a decrease from the high of 3,095 reached in 2008<sup>24</sup>. Every year around 13,000 people suffer minor injuries.

In 2007 45 pedestrians are killed and 868 were injured in vehicle-related incidents.<sup>25</sup>

Quality environmental planning and design of our communities has a vital role in creating an environment that reduces the likelihood of injury occurring on and around roads in the first place, and one that is more forgiving should incidents occur.

Road engineering is a highly technical, specialist field with a well established range of guidelines and strategies. Space Matters is not replacing any of these and is not a practice resource for road engineers. Space Matters seeks to encourage broader thinking within the wider council planning function on how features of community spaces impacts on injuries occurring.

## What are road spaces?

When we use the term '**road spaces**' in Space Matters we mean the areas on and around all road ways – roads, accessways, lanes, streets and highways. It includes the surrounding areas of roads, including road shoulders, cycleways and especially, footpaths.

---

## QUICK LINKS

### Creating wellbeing on and around road spaces:

- Road space users. Who's at risk. [More...](#)
- Road space hazards. What you can do about them. [More...](#)
- Design principles for road spaces. Check out the references. [More...](#)

### How can IPTED build wellbeing on and around road spaces?

The IPTED approach can help you predict and prevent injury and death occurring on and around road spaces. [More...](#)

## **What role do councils play in reducing road-related injuries?**

Following the IPTED approach helps councils deliver on a range of community obligations. [More...](#)

## **What's wrong with New Zealand's road spaces?**

Find out...

- [The size of the problem](#)
  - [Why road space injuries are occurring](#)
  - [The cost of road-related injuries](#)
-

## IPTED on and around roads

The IPTED process is a matter of looking at how the community spaces we create shape what people do, and how that affects risk on and around our road spaces. In essence, this thinking forms the basis of the IPTED approach

Applying the IPTED approach to road spaces involves asking a series of questions:

- What is the intended **function** of the road space?
- **Who** is using the road/roadside, (both desirable and undesirable)?
- What **activity** will they/could they be doing?
- What **hazards** could contribute to the injury of road users?
- What **priority** action do we need to assign to the possible adverse event/accident given its probability, likelihood, and severity?

It's important to ask these questions at the very start of the planning and design processes - whether you're planning a new development or reviewing existing areas.

## Who's at risk?

The [World Health Organisation \(WHO\)](#) proposes that road crash injury is an issue of social equity. WHO promotes the equal protection for **all** road users since non-motor vehicle users bear a greater share of road injury and risk.

Space Matters extends this view to a concentration on the most vulnerable road spaces users – pedestrians - on that basis that where pedestrians are safer, so are all road space users.

The following *Road Space At-Risk User* table provides an overview of the needs of pedestrians and summarises some of the potential hazards and controls.

Road space	Function – what is the purpose of the road space?	User – who is using the road space?	Activity – what is the user doing?	User needs	Hazards - how could users be injured	Design principles
Footpaths	Providing for non-motorised travel	Pedestrians – able bodied	Walking: <ul style="list-style-type: none"> <li>• To/from work</li> <li>• To/from home</li> <li>• To from/others' homes</li> <li>• To/from school</li> <li>• To/from shops</li> <li>• To/from local facilities</li> <li>• To/from public transport</li> </ul>	<ul style="list-style-type: none"> <li>• Pleasant and safe walking environment</li> <li>• Protection from traffic</li> <li>• Well maintained footpaths</li> <li>• Convenient and direct routes</li> <li>• Footpaths free from obstruction, including parked vehicles</li> <li>• Adequate lighting so they can see and be seen</li> <li>• Safe, convenient and responsive crossing options</li> <li>• Appropriate street furniture placed in logical places</li> <li>• Opportunity to shelter from weather conditions</li> <li>• Easy and convenient access to public transport options</li> <li>• Streets free from</li> </ul>	<ul style="list-style-type: none"> <li>• Collision with car while crossing road (not on pedestrian crossing)</li> <li>• Collision with car while on pedestrian crossing</li> <li>• Collision with car mounting pavement</li> <li>• Collision with vehicle using right of way/ driveway</li> <li>• Collision with vehicle at physical works sites</li> <li>• Collision with cyclist on shared footpath/ cycleway</li> <li>• Adverse effects from vehicle emissions, eg, in congestion prone areas</li> <li>• Slipping falling due to footpath debris</li> <li>• Falling or tripping on uneven pavement, uneven surfaces etc.</li> </ul>	<ul style="list-style-type: none"> <li>• Actively managing speed</li> <li>• Traffic calming</li> <li>• Promoting walking and cycling</li> <li>• Reducing traffic demand</li> <li>• Streetscaping to encourage pedestrians</li> </ul>

Road space	Function – what is the purpose of the road space?	User – who is using the road space?	Activity – what is the user doing?	User needs	Hazards - how could users be injured	Design principles
				hiding places that may encourage crime. (learn more about <a href="#">Crime Prevention Through Environmental Design</a> )	<ul style="list-style-type: none"> <li>• Tripping over street furniture, shop pavement signage, slippery surfaces.</li> </ul> Find out more about <a href="#">pedestrian hazards</a> that need to be addressed [go to: Public and play spaces>]	
		Pedestrians - elderly and disabled	<i>As for able-bodied</i>	<i>As for able-bodied, plus:</i> Wide footpaths that cater for use of mobility equipment Slip-resistant surfaces Consistent use of streetscape elements – no surprises Handrails for steeper gradients Visibly distinct separation of footpath and roadside, eg, tactile paving Smooth kerb transitions at crossing points Sufficient time on signal-controlled	<i>As for able-bodied, plus:</i> Fall caused by physical fatigue Falls from street furniture Falls/trips on unseen kerbing/change in level, slippery surfaces  Find out more about <a href="#">pedestrian hazards</a> that need to be addressed [go to: Public and play spaces>]	<i>As above</i>

Road space	Function – what is the purpose of the road space?	User – who is using the road space?	Activity – what is the user doing?	User needs	Hazards - how could users be injured	Design principles
				<p>crossings to allow enough time to cross</p> <p>Need clear visual reinforcement for signals, signs, eg, large letters</p> <p>Need clear aural reinforcement for signals</p> <p>Gentle cross fall.</p>		
		Young children	<i>As for able-bodied</i>	<p>As for able bodied pedestrians plus</p> <p>Locating signal controls within reach</p> <p>Visibly distinct separation of footpath and roadside</p> <p>Use of symbols on signs to reinforce words</p> <p>Places to rest</p>	<p><i>As for able-bodied</i></p> <p>Find out more about <a href="#">pedestrian hazards</a> that need to be addressed [go to: Public and play spaces&gt;]</p>	Streetscaping that allows small children to be seen
	Providing for health and recreation	Exercisers	<p>Power walking</p> <p>Running</p> <p>Jogging</p>	<p><i>As for able-bodied, plus:</i></p> <p>Routes that are accessible and obvious</p> <p>Pathways that are comfortable to use with even well drained surfaces</p> <p>Generous, level and</p>	<p>Find out more about <a href="#">pedestrian hazards</a> that need to be addressed [go to: Public and play spaces&gt;]</p>	<i>As above</i>

Road space	Function – what is the purpose of the road space?	User – who is using the road space?	Activity – what is the user doing?	User needs	Hazards - how could users be injured	Design principles
				well-maintained road run-offs Places to rest		

## Addressing road space hazards

IPTED requires a reorientation in planning for designing, building, operating and maintaining of road spaces.

### It's all about applying a new perspective

Starting by asking...

- How can road spaces be arranged to support activities, people's needs and the relationships between the different users and their activities?
- Will the spaces provide for the efficient circulation of people, vehicles activities and support maintenance functions?
- Will the spaces respond to the users' physical needs in terms of comfort, safety, security and convenience?
- Will the spaces respond to the users' social needs in terms of health, interaction, sense of community?
- How realistic are space and activity requirements in terms of demographic projections, people's needs and space efficiencies?

Then...

[Think pedestrians first](#)

[Think active people](#)

[Think equal access](#)

[Think calm traffic](#)

[Think safer footpaths](#)

[Think long term](#)

[Think standards/Best practice](#)

**In all cases you need to consider the suggested solutions within the bigger planning picture and your local circumstance. Some solutions will readily apply. Others may not. The real point of the exercise is to include a focus on injury prevention in your planning, design operational and maintenance processes.**

## Think pedestrians first

Without the protection enjoyed by vehicle users, pedestrians primarily require a road environment that protects them from traffic. The adoption of 'smart growth' policies and practices help create walk-able communities that reduce the risk for road users. These policies promote:

- Compact, integrated local communities that include a mix of use – housing, shops, schools, employment, parks and community facilities.
- Locating community elements within easy walking distance of one another.
- Using a mix of housing types so that the community is accessible to a wide range of citizens.
- Establishing a central core that combines commercial, civic, cultural and recreational activity.
- Providing ample open space - squares, greens and parks - which by its handy location encourages regular use.
- Ensuring public spaces are convenient and are populated at all hours of the day and night.
- Creating a connected network of streets, paths and cycleways that offer interesting routes to all destinations.
- Keeping streetscapes small and defined by buildings, trees, and with lighting levels that encourage walking and cycling.
- Incorporating features that encourage lower vehicle traffic speed.
- Differentiating clearly footpaths, cycleways, and shared pedestrian/cycle spaces with signs and surface markings. This includes ensuring by-laws provide the legal back up signage and allow enforcement action to be taken against persistent offenders.
- Reduce the need for vehicular transport
  - close streets to create pedestrian zones.
  - don't allow certain vehicle types to use particular roads, eg, ban heavy vehicles from inner city routes.
  - don't allow certain road users to use particular roads.

See more IPTED ideas on addressing [pedestrian fall hazards](#).

See also New Zealand Transport Agency's [Pedestrian Planning and Design Guide](#) for guidance on pedestrian network planning

---

## Think active people

Good streetscaping can improve the options for non-motorised travel, create more attractive environments, enhance security, encourage greater use of alternative transport modes, including walking and cycling and revitalise activity in urban centres.

Aspects to consider include:

- **Street widths** - decrease the width of wide traffic lanes by:
    - extending the footpath, building pedestrian islands in the middle of the street, marking in cycle lanes. This reduces the distance pedestrians have to negotiate to cross streets.
  - **Crossing opportunities**
    - locating pedestrian crossing points at regular intervals – put them where people want them, ie, near schools, kindergartens, shopping areas, parks.
    - providing pedestrian priority at traffic lights to discourage pedestrians from crossing against the light.
    - creating street corner environments that encourage drivers to slow their speed.
    - ensuring crossing points are provided at key destinations.
    - extending kerbing to physically prohibit parking in front of pedestrian crossings.
    - using distinctive pavement treatments to clearly mark transitions from streets to curbs and other public spaces to help visually impaired pedestrians.
  - **Providing access** - to facilities and public transport:
    - ensuring pedestrian routes provide direct and ready access to community facilities.
    - providing regular opportunities to access public transport.
    - enhancing street aesthetics with artwork and sculpture, fountains, green spaces and playgrounds.
    - creating opportunities for employment closer to people's homes.
  - **Street furnishings:**
    - ensuring plenty of pedestrian shelter.
    - providing street seating and resting points frequently along popular routes.
    - ensuring street furniture is scaled for people.
  - **Vegetation and landscaping**
    - planting trees to enhance the environment and provide shade while still ensuring pedestrian can be seen by vehicles and other pedestrians.
  - **Maintenance**
    - keeping up maintenance [go to: Maintaining the benefits]of pavements.
-

## Think equal access

Incorporating features that provide for people of limited physical abilities - the elderly, people using wheelchairs and other mobility aides and people with hearing or visual impairment - will often improve road space for all users. Features include:

- mobility equipment-friendly footpaths – wide, slip-resistant footpaths with gentle cross fall and smooth kerb transitions at crossing points.
- ‘no surprises’ streetscapes – consistent use of street furniture and other elements.
- handrails for steeper gradients.
- visibly distinct separation of footpath and roadside, eg, tactile paving.
- clear visual and aural reinforcement for signals.

---

## Think calm traffic

Traffic calming focuses on altering the road space environment to encourage driver behaviours that will save lives and reduce injury to both pedestrians and drivers.

Besides improving the safety of road users, traffic calming makes the urban environment more attractive, makes the street environment more hospitable – and therefore more likely to be used, and can improve property values as homebuyers pay a premium for properties in quieter areas.

- **Apply appropriate speed** (*note: the rule for setting speed limits has changed*):
  - applying reduced speed limits to high risk areas, eg, areas with a history of crashes, particularly in urban environments.
  - reducing speed limits near institutions such as schools and hospitals.
  - applying [rural speed zoning](#) – this zoning is designed to encourage motorists to drive at speeds that match the characteristics and use of roads
- **Encourage slower driving:**
  - providing pedestrian platforms.
  - adding speed humps on high risk roads.
  - narrowing road lanes by extending the footpath and curb, adding chicanes, adding bollards or planters; building median islands (this also provides a safe zone for pedestrians); marking bicycle lanes.
  - creating more acute angles on street corners, which encourages vehicles to reduce speed when turning.
  - changing through roads into two cul de sacs with connecting walkways to encourage walking and discourage urban rat-runs (drivers speeding through back roads to avoid arterial traffic controls such as traffic lights).
- **Increase awareness of lower speeds:**
  - installing warning or gateway signs to inform road users they are entering residential zones, etc.

- installing speed feedback signs and ‘Slow down’ warning signs to alert drivers that are exceeding the speed limit.
- laying distinctive pavement treatments to demarcate different areas/uses.

### **Be aware!**

- Some traffic calming measures such as speed bumps and raised pedestrian crossings can cause problems for emergency services vehicles. It’s important to weigh up the delay caused by calming measures against the overall benefits they deliver in reduction in road-related death and injury.
- When you use traffic calming measures on one road, it may increase vehicle use on other roads. You need to weigh up whether the roads you may be shifting traffic to are as equally sensitive to the road you are shifting it from.

See section 6 of New Zealand Transport Agency’s [Pedestrian Planning and Design Guide](#) for guidance on traffic engineering and calming measures.

---

### **Think safer footpaths**

- **Protect pedestrians from vehicles**
  - encourage on-street parking to provide a buffer between pedestrians and traffic. However, you need to consider that this may reduce drivers’ view of children intending to cross. This can be rectified by the provision of pedestrian platforms strategically placed between parked cars.
- **Improve the walking environment**
  - widen footpaths to ease the flow of pedestrians.
  - enhance street aesthetics with artwork and sculpture, fountains, green spaces and playgrounds.
  - encourage recreational activities such as concerts, fairs, markets.
  - build structures to provide shade and rain shelters. Use attractive street furniture scaled to meet pedestrian needs.
  - encourage building owners to provide overhead shelter, eg, awnings.

See also section 4 of New Zealand Transport Agency’s [Pedestrian Planning and Design Guide](#) for guidance on Community Walkability.

- **Create a safer environment**
    - maintain high security, cleanliness and physical maintenance standards.
    - install adequate lighting so pedestrians can see and be seen.(learn more about [Crime Prevention Through Environmental Design](#))
-

## Think long term

How well communities are maintained influences people's travel choices and ultimately affects people's risk exposure to road-related injury.

Overgrown trees and shrubs that reduce visibility, malfunctioning street lighting, excessive graffiti and litter will deter people from public spaces. Even broken or uneven paving stones, or small areas of ponding following rain can encourage travellers to retreat from the footpaths back into cars.

- **Safe surfaces**

- ensure footpaths and cycleways are well maintained – keep up a regular inspection programme for cracks and other surfacing damage.
- regularly monitor drainage systems to ensure they are removing water from pedestrian areas.
- keep footpaths and cycleways clear of litter and dog droppings.
- make sure any resurfacing work retains the original safety-promoting features, eg, clear curb distinction.

See also section 14.6 of New Zealand Transport Agency's [Pedestrian Planning and Design Guide](#) for guidance on surfaces.

- **Safe environment**

- install adequate lighting and regularly monitor for broken or malfunctioning lights.
- ensure safe diversion of pedestrians where either infrastructure or utility maintenance works have to be carried out on footpaths. Where works are extensive consider using the footpath on the opposite side of the street for the diversion.

See also section 17 of New Zealand Transport Agency's [Pedestrian Planning and Design Guide](#) for guidance on lighting pedestrian networks.

- **Clear walking spaces**

- keep footpaths clear of obstructions such as shop advertising signs and parked vehicles.
- consider carefully the location of street furniture – choose sites that are convenient but that don't obstruct pedestrians and cyclists.
- regularly monitor street furniture to ensure it remains in a usable condition, especially seating.
- ensure litter bins are cleared before they overflow.
- regularly inspect and clean up graffiti prone areas.

See also section 18 of New Zealand Transport Agency's [Pedestrian Planning and Design Guide](#) for guidance on maintaining the pedestrian network.



## Best practice for road spaces

### General

- [New Zealand Transport Agency Safety Management Systems](#)
- [New Zealand Transport Agency Road and Traffic Standards Series](#)
- New Zealand Transport Agency [Road Safety survey series](#)
  - RSS 2 Street lighting
  - RSS 5 Advisory speed signs
  - RSS 6 pedestrian crossings
  - RSS 11 Floodlighting pedestrian crossings
  - RSS 16 Road hierarchies
  - RSS 17 School crossing facilities
  - RSS 21 Traffic calming devices
  - RSS 22 Road Markings.
- [New Zealand Transport Agency's Code of Practice for Temporary Traffic Management \(CoPTTM\)](#)
- [Safer Journeys Road Safety to 2020](#)
- [New Zealand Transport Strategy](#)

### Setting the right speed

- Down with Speed: A Review of the Literature, and the Impact of Speed on New Zealanders. Accident Compensation Corporation and Land Transport Safety Authority, 2000.
- Charlton, S.G.1, 2, Baas, P.H.1 2006. Speed change management for New Zealand roads. [New Zealand Transport Agency Research Report 300](#).
- [New Zealand Transport Agency Speed Limits](#)
- [New Zealand Transport Agency Road Safety survey series](#)
- [Rural speed zoning](#)

### Calming traffic

- [Traffic Calming Benefits, Cost and Equity Impacts, Todd Litman, Victoria Transport Policy Institute.](#)
- Influence of Traffic Calming on Emergency Response Times, ITE journal
- Charlton, S.G.1,2, Baas, P.H.1 2006. Speed change management for New Zealand roads. [New Zealand Transport Agency Research Report 300](#).
- [New Zealand Transport Agency Road Safety survey series](#)
- [New Zealand Transport Agency Pedestrian Planning and Design Guide](#)

### Encouraging walking/reducing travel demand

- [New Zealand Transport Agency Pedestrian Planning and Design Guide](#)
- Burden, D. and Lagerwey, P, 1999, Road Diets: Fixing the Big Roads. Walkable communities, High Springs, FL.

## Streetscaping

- Peter Swift, Residential street typology and injury accident frequency, swift and associates (Longmont, 31 march 1998).
- Farouki, O.T. and Nixon, W.J., 1976. "the effect of width of suburban roads on the mean free speed of cars," Traffic Engineering and Control, vol 17 pages 518-519.
- Uttermann, R.K., 1990, "Street Design – reassessing the function, safety and comfort of streets for pedestrians: in The road less travelled: Getting there by other means, 11<sup>th</sup> International Pedestrian Conference, City of Boulder, CO, pages 19-26.
- [New Zealand Transport Agency's Road Safety survey series](#)
- [Land Transport New Zealand Pedestrian planning and design guide](#)
- [AS/NZS 1158.1.1:2005 Road lighting - Vehicular traffic \(Category V\) lighting - Performance and design requirements](#)
- [AS/NZS 1158.6:2010 Road lighting - Lighting for roads and public spaces - Luminaires](#)
- [AS/NZS 1158.2:2005 Road lighting - Computer procedures for the calculation of light technical parameters for Category V and Category P lighting](#)
- [Roads and Traffic Authority, New South Wales, Beyond the Pavement: TRA Urban and Regional Design Practice notes. Practice note 12](#)
- [AS/NZS 1158.0:2005 Road lighting - Introduction](#)
- [AS/NZS 1158.1.3:1997 Road lighting - Vehicular traffic \(Category V\) lighting - Guide to design, installation, operation and maintenance](#)
- [AS/NZS 1158.3.1:2005 Road lighting - Pedestrian area \(Category P\) lighting - Performance and design requirements](#)

## Maintenance

- [New Zealand Transport Agency Safety Management Systems](#)
- [New Zealand Transport Agency: Code of Practice for Temporary Traffic Management](#)

## Benefits of safe road spaces

As well as fewer New Zealanders suffering injury or death, good urban design applied to road spaces offers a wide range of other benefits:

- Greater mobility and travel choices for everyone, including children, older people, and people with disabilities.
- More sustainable development - as cars are used less, the environment becomes quieter, cleaner.
- A healthier population through increased walking opportunities and reduced vehicle emissions.
- Better security – more people populating public spaces provides ‘natural surveillance’.
- Greater community connection as dynamic communities encourage more infill and less urban sprawl development.
- Improved quality of life gained from living in more attractive areas.
- Greater social interaction is promoted as people feel safer and more street activities are made possible.
- Economic improvement as communities become more active.
- Improving property values as traffic speeds and volumes decrease.

### *Benefits of design injury free community spaces*

<b>Benefit Design Principle</b>	<b>Fewer crashes</b>	<b>Reduced air pollution</b>	<b>Improved property Values</b>	<b>Improved physical activity</b>	<b>Improved security and reduced crime</b>	<b>Improved social cohesion</b>
<a href="#"><u>Limiting speed</u></a>	✓	✓	✓	✓	✓	✓
<a href="#"><u>Calming traffic</u></a>	✓	✓	✓	✓		✓
<a href="#"><u>Promoting walking and cycling</u></a>	✓	✓		✓	✓	✓
<a href="#"><u>Streetscaping to encourage pedestrians</u></a>	✓	✓		✓	✓	✓
<a href="#"><u>Reducing traffic demand</u></a>	✓	✓	✓	✓		✓

## The road-related injury problem

Too many New Zealanders are dying or suffering injuries on our roads.

In 2009, 385 people died on New Zealand road and since 2004 the number of serious injuries has risen by six percent, although there has recently been a decrease from the high of 3,095 reached in 2008 <sup>26</sup>. Every year around 13,000 people suffer minor injuries.

In 2007 45 pedestrians are killed and 868 were injured in vehicle-related incidents. <sup>27</sup>

For New Zealanders aged 65 years and over, falls account for a large proportion of fatal and non fatal injuries on the road. Data collected by Australia's Monash University Accident Research Centre shows that 47 percent of injuries of older pedestrians are due to falls. Most of these falls (60 percent) occurred on footpaths, with uneven surfaces and trips on joints being the main causes. Slips accounted for 10 percent of the falls on footpaths, often because of water (30 percent of falls were on wet pavement). Fractures are the most common injury to result from such falls (46 percent), of which hips accounted for (20 percent), wrists (16 percent) and humerus (16 percent).

Such injuries can have significant impacts, not only on the life of the person injured, but also on the lives of family and whanau, friends and care givers.

## Why are road space injuries occurring?

People are suffering injuries on and around road spaces because:

- [We're going too fast](#)
- [There are more vehicles](#)
- [Some streetscape features create greater risks.](#)

---

### We're going too fast...

Speed is the single biggest problem on New Zealand roads. What we know about the impact of speed is:

- **It increases the chance of being involved in a crash.**
  - a 1.6 kph increase in speed leads to a 5 percent increase in crashes. For example there will be twice as many fatal crashes at 120 kph than at 100 kph.<sup>28</sup>
- **It increases the severity of a crash.**
  - 'The greater the speed, the bigger the mess' - while a crashing vehicle rapidly changes speed, its occupants do not: occupants keep travelling at the pre-crash speed... until they hit something - an airbag, seat belt, car interior, a tree, a pole.
  - 'Speeding is as dangerous as drink driving' - at 5 kph over the speed limit in a 60-kph zone, a driver faces the same crash risk as if they have an increase in blood alcohol concentration from 0 to 50 mg/100 ml.<sup>29</sup>
  - The probability of death for a pedestrian is 5 percent if hit by a vehicle travelling at 32 kph, 45 percent if hit by a vehicle travelling at 48 kph, and 85 percent if hit by a vehicle travelling at 64 kph.<sup>30</sup>
  - Elderly, and young pedestrians are particularly vulnerable in a pedestrian-car collision. For children, their small stature makes it more likely that their heads are hit directly by the car's rigid front. The elderly are generally frailer, which increases the challenge of recovery.

---

### There are more vehicles...

When there is more traffic on the road, there is a greater chance that a driver's error will result in them hitting another vehicle or pedestrians. Though we have a population of only four million, we travel some 37 billion-vehicle kilometres every year (Transit New Zealand Annual Report 2005-2006). And it's increasing.

### What we know about the impact of traffic volume is, it:

- **Contributes to crashes and fatalities**, when combined with higher speeds and certain streetscape characteristics.

- **Presents a hazard to pedestrians crossing busy streets.** A [study of the effects of environmental factors and child pedestrians injured by vehicles](#) showed that the risk of injury at high traffic volume sites was 13 times more likely than at the least busy sites.

Falls can be a major contributor to pedestrian injury statistics. Australian studies show that, outside the home, older people suffer nearly half their falls as a pedestrian, most of which (60%) are on footpaths.<sup>31</sup> Want to find out more about [fall hazards](#)?

- **Can contribute to health risks through increased levels of vehicle emissions.**
  - Of the 970 deaths per year attributed to air pollution, it is estimated that approximately 40 percent (399 deaths) reflect vehicle emissions (Fisher et al 2002 as cited in [Looking Upstream. Causes of death cross-classified by risk and condition New Zealand](#))
  - [In Health Effects of Fine Particulate from Motor Vehicles in New Zealand](#) a report commissioned by the Ministry of Transport it was estimated that the total mortality for over 30 year olds in New Zealand due to traffic related air pollution is 399 people per year.
- **May change the way we can use land** - through the effects of increased vehicle emissions on climate change.

---

### Some streetscapes features create greater risk...

Streetscaping plays a direct role in the interaction between vehicles and pedestrians.

#### What we know about streetscaping:

- **Wide, straight streets encourage drivers to speed.** Where the road environment presents some uncertainty drivers are more cautious; they travel more slowly, reducing the likelihood of crashes or their severity should they occur.<sup>32</sup>
- **Highly pedestrianised roads promote lower speeds** than lowly pedestrianised roads.
- **Road designs that give priority (not right of way) to motorists present greater risks to pedestrians.** By including features than make it easier for vehicle travel, the street environment becomes hostile for pedestrians and cyclists.
- **Poor lighting makes pedestrians less visible** to oncoming vehicles. It also increases the risk of pedestrians slipping, tripping, or poor lighting also increases the potential for crime.

- **Poorly located footpaths or footpaths that lack clear distinction from the road** put people at greater risk of
- Landscaping or vegetation providing clear sightlines along routes encourages the use of footpaths. The desire for visual attractiveness must be carefully balanced with the need for safety both from injury and [crime](#).
- **The condition and/or characteristics of some rural roads makes it unsafe** for drivers to travel at the default open road speed limit of 100km/h.

### **Cost of road-related injuries**

When a person dies or suffers an injury on and around our roads, it affects not only the life of the injured person, but also the lives of the people around them. The 'cost' of the loss of participation in life, and productivity both in the home and work environment can be considerable.

Then there's the financial costs, firstly of responding to road crashes, including rescue services (air and land based). Secondly, there's the cost of medical assessment whether at an emergency department or local registered medical practitioner, and ongoing rehabilitation (medical, vocational or social). For some this will be temporary, for others, it will mean a lifetime of rehabilitation.

Finally there are other costs such as damage to personal or community property, insurance, and in some cases, legal costs.

At June 2009, the average cost per fatality was estimated by the Ministry of Transport at \$3,528,400. For non-fatal injuries, the average cost is estimated at \$372,000 per reported serious injury and \$19,600 per reported minor injury. <sup>33</sup>

The total social cost of motor vehicle injury crashes in 2008 was estimated to be \$3.7 billion at June 2009 prices. <sup>34</sup>

### **Want to know more?**

For more information on the social costs of road crashes and injuries see [The Social Cost of Road Crashes and Injuries](#), produced annually by the Ministry of Transport.

# Water spaces

*Planning, designing, building and maintaining for wellbeing on and around water*

For the decade of 2000-2009, an average of 116 people have drowned every year in New Zealand.<sup>35</sup> With 2.6 drownings per hundred thousand people, based on the five year rolling average to 2008, New Zealand has double the drowning rate found in Australia, the United States and the United Kingdom.<sup>36</sup>

Quality environmental planning and design of our communities has a vital role in creating an environment that reduces the likelihood of water-related injury occurring in the first place, and one that is more forgiving should incidents occur.

---

## What are water spaces?

When we use the term '**water spaces**' in Space Matters we mean all natural waterways such as rivers, streams, estuaries, lakes, the sea, and also all man-made waterways such as pools, ponds, water features, water races. But the term water spaces also includes the areas surrounding these waterways. The content of this site focuses on water spaces in community areas, ie, it does not address home owners' pools.

## QUICK LINKS

### Creating wellbeing in and around water spaces:

- Water space users. Who's at risk. [More...](#)
- Water space hazards. What you can do about them. [More...](#)
- Design principles for water spaces. Check out best practice references. [More...](#)

### How can IPTED build wellbeing in water spaces?

The IPTED approach can help you predict and prevent injury and death occurring in water spaces. [More...](#)

### What role do councils play in reducing water-related injuries?

Following the IPTED approach helps councils deliver on a range of community obligations. [More...](#)

### What's wrong with New Zealand's water spaces?

Find out...

- [The size of the problem](#)
  - [Why water space injuries are occurring](#)
  - [The cost of water-related injuries](#)
-

## **IPTED for around water spaces**

The IPTED process is a matter of looking at how the community spaces we create shape what people do, and how that affects risk on and around water.

Applying the IPTED process to water spaces involves asking a series of questions:

- What is the intended **function** of the water space and surrounding area?
- **Who** is using the water space and the surrounding area?
- What **activity** will they/could they be doing?
- What **hazards** could contribute to the injury of those using the water spaces and surrounding areas?
- What **priority** action do we need to assign to the possible adverse event/ accident given its probability, likelihood, and severity?

It's important to ask these questions at the very start of the planning and design processes - whether you're planning a new development or reviewing existing areas.

---

## **Who's at risk?**

The Water Space At-Risk User table provides an overview of the needs of 'at risk' users and summarises some of the potential hazards and controls.

<b>Water space</b>	<b>User- who is using the space?</b>	<b>At risk user Characteristics</b>	<b>Activity – what is the user doing?</b>	<b>Hazards – how could users be injured?</b>	<b>Design principles</b>
Coastal land and water	Swimmers/surfers	Males: 15 – 44 years <ul style="list-style-type: none"> <li>Over-confident</li> <li>Inclined to risk taking</li> <li>Likely to mix alcohol with activity</li> </ul>	<ul style="list-style-type: none"> <li>Swimming</li> <li>Surfing</li> <li>Body boarding</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>unsafe conditions (too rough, shallow water, poor visibility, night time)</li> <li>risky behaviours</li> <li>use of alcohol</li> <li>collisions with water craft</li> </ul>	<ul style="list-style-type: none"> <li>Discourage access to hazardous areas through provision of gates, fences or dense planting.</li> <li>Separation of social areas from water areas</li> <li>Hazard signage</li> <li>Safety information signage</li> <li>Emergency services information signage</li> <li>Surveillance facilities</li> <li>Emergency services support</li> <li>Maintenance of pathways to avoid falling hazards</li> </ul>
		Tourists <ul style="list-style-type: none"> <li>Unfamiliar with surroundings/ hazards</li> <li>English skills may be poor</li> </ul>	As above	As above, but increased risk due to: <ul style="list-style-type: none"> <li>lack of familiarity with area</li> <li>unaware of hazards</li> <li>unable to read signs in English</li> </ul>	As above, plus: <ul style="list-style-type: none"> <li>Signage needs to incorporate international symbols</li> </ul>
	Boaties/ jet skiers/ Water skiers	Males: 15 – 44 years As above	<ul style="list-style-type: none"> <li>Recreational boating</li> <li>Fishing off boat</li> <li>Jet skiing</li> <li>Water skiing</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>Falling overboard</li> <li>Crashes with other craft</li> <li>Crashes with other water space users, eg, swimmers</li> </ul>	As above
	Picnic-ers, party goers	General population	<ul style="list-style-type: none"> <li>Eating</li> <li>Drinking</li> <li>Playing ball games etc</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>Intoxication</li> <li>Unintentional immersion</li> </ul>	As above, plus: <ul style="list-style-type: none"> <li>Lighting of hazard areas</li> <li>A careful balance needs to be struck between IPTED and CPTED lighting recommendations, as increasing lighting to help prevent injury could encourage inappropriate night time congregation.</li> </ul>

Water space	User- who is using the space?	At risk user Characteristics	Activity – what is the user doing?	Hazards – how could users be injured?	Design principles
	Fishers	Males: 15 – 44 years As above <ul style="list-style-type: none"> <li>New Settlers</li> </ul>	<ul style="list-style-type: none"> <li>Surf casting</li> <li>Rock fishing</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>Falling onto rocks</li> <li>Pulled into surf by waves</li> <li>Falling down river/stream banks</li> <li>Falling into water</li> </ul>	As above
Rivers	Swimmers/ Kayakers/rafters	Males: 15 – 44 years As above	<ul style="list-style-type: none"> <li>Swimming</li> <li>Kayaking</li> <li>Rafting</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>unsafe conditions (too rough, shallow water, poor visibility, night time)</li> <li>risky behaviours</li> <li>use of alcohol</li> <li>collisions with water craft</li> </ul>	<ul style="list-style-type: none"> <li>Discourage access to hazardous areas through provision of gates, fences or dense planting.</li> <li>Separation of social areas</li> <li>Hazard signage</li> <li>Safety information signage</li> <li>Emergency services information signage</li> </ul>
	Fishers	Males: 15 – 44 years	Fly fishing	Drowning/injury due to: <ul style="list-style-type: none"> <li>Falling down river/stream banks</li> <li>Falling into water</li> </ul>	As above, plus: <ul style="list-style-type: none"> <li>Discouraging access to hazards by perimeter planting</li> <li>Levelling steep inclines on surrounding banks</li> <li>Pathways that avoid hazards</li> <li>Maintenance of pathways to avoid falling hazards</li> </ul>
	Walkers/trampers	General population Tourists: <ul style="list-style-type: none"> <li>Unfamiliar with surroundings/hazards</li> <li>English skills may be poor</li> </ul>	<ul style="list-style-type: none"> <li>Walking</li> <li>Tramping</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>Being swept away while crossing waterway</li> <li>Falling into water</li> </ul>	As above, plus <ul style="list-style-type: none"> <li>Maintenance of pathways to avoid falling hazards</li> </ul>
	Picnic-ers/ party goers	General population	<ul style="list-style-type: none"> <li>Eating</li> <li>Drinking</li> <li>Playing ball games etc</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>Intoxication</li> <li>Unintentional</li> </ul>	As above , plus: <ul style="list-style-type: none"> <li>Lighting of hazard areas</li> </ul>

<b>Water space</b>	<b>User- who is using the space?</b>	<b>At risk user Characteristics</b>	<b>Activity – what is the user doing?</b>	<b>Hazards – how could users be injured?</b>	<b>Design principles</b>
Urban waterways (streams, embankments, storm water, grey water)	Children	<ul style="list-style-type: none"> <li>• 3-5 years old</li> <li>• Unpredictable</li> <li>• Exploratory</li> <li>• Limited water survival skills</li> <li>• Limited physical skills</li> <li>• Limited mental reasoning and awareness of hazards</li> </ul>	<ul style="list-style-type: none"> <li>• Walking</li> <li>• Playing</li> <li>• Exploring</li> </ul>	Drowning/injury due to: <ul style="list-style-type: none"> <li>• Falling into water features</li> </ul>	As above, plus <ul style="list-style-type: none"> <li>• Surveillance facilities (ie, seating, unimpeded view of water where children will play).</li> <li>• Dense planting to discourage access.</li> </ul>
Man-made water features	As above	As above	As above	As above	As above, plus <ul style="list-style-type: none"> <li>• Surveillance facilities</li> </ul>

## Addressing water space hazards

IPTED requires a reorientation in planning for designing, building, operating and maintaining water spaces. It's all about applying a new perspective.

### Start by asking...

- How can spaces be arranged to support activities, people's needs and the relationships between the different users and their activities?
- Will the spaces provide for the efficient circulation of people, vehicles activities and support and maintenance functions?
- Will the spaces respond to the users' physical needs in terms of comfort, safety, security and convenience?
- Will the spaces respond to the users' social needs in terms of health, interaction, sense of community?
- How realistic are space and activity requirements in terms of demographic projections, people's needs and space efficiencies?

### Then...

[Think awareness](#)

[Think appropriate access](#)

[Think surveillance](#)

[Think safer roads](#)

[Think emergency support](#)

[Think maintenance](#)

**In all cases you need to consider the suggested solutions within the bigger planning picture and your local circumstance. Some solutions will readily apply. Others may not. The real point of the exercise is to include a focus on injury prevention in your planning, design operational and maintenance processes. And not just for new facilities but for existing facilities also. And not just for new facilities but for existing facilities also.**

## Think awareness

The use of signage is an important part of making people more aware of what the hazards are in and around water spaces. Providing information gives people the resources they need to make good decisions about safe activities.

- Ensure signage meets the requirements of [Water Safety Signs Standard NZS 8690:2003](#)
- Think about:
  - Vehicle access signs – in areas where vehicles are likely to collect around recreational water spaces such as car parks and vehicle access points to provide information hazards generally before people undertake water activities.
  - Pedestrian access signs – located near pedestrian access points to water spaces so they are clearly visible.
  - Individual hazard signs – specifically placed to warn of particular hazards and high risk areas.
  - Emergency services information signs – who to call and how.
  - Warning signs on road curves bounding water spaces or on areas with high vehicle run-off risk.
- Consider how you can use outdoor recreation symbols to ensure visitors to New Zealand can clearly understand hazard warning signage.
- Consider using lighting to ensure hazards can be clearly seen at night. Be aware, though, that too much lighting may encourage people to congregate in the area and as a result expose more people to the hazard.
- Consider creating information campaigns to raise awareness among home pool owners of the new best practice-based [standards](#) (NZS 8500:2006) surrounding the fencing of pools. Consider also supporting initiatives such as pool audits to check home pools are meeting the new standards.

---

## Think appropriate access

Restricting access to particularly high risk water spaces reduces the likelihood of water-related injuries.

- Create effective physical and geographical barriers around any water spaces that may be used by unsupervised children.

- Avoid creating paths that lead directly to a significant hazard. For example, avoid creating a path that sees people brought out directly in front of a rip or other river hazard. Erect warning signs where you can't avoid this.
- Try to create separate areas for different recreational and other functions. It is particularly important to keep areas where alcohol might be consumed – such as picnic or barbecue areas and car parks and drinking establishments - away from significant water hazards.
- Use dense perimeter planting around bodies of water and on river sides to discourage children and others from accessing water spaces. Choose plants that are low growing (up to one metre) - tall enough to deter a young child from getting through while ensuring they stay within adult sight).
- Create flatter, wider slopes for drains and waterways to reduce the likelihood of people falling.
- Consider the provision of grates on the ends of drains and culverts to act as a physical barrier to the space.

Where the risk of injury in a given water space is low, ways of ensuring there is access for water space users of all abilities need to be considered. This includes the incorporation of features that provide for:

- people of limited physical abilities, including the elderly
- people using wheelchairs and other mobility aides
- people with hearing or visual impairment.

See ideas on [accessible pavements](#) in the road spaces section

---

## Think surveillance

Providing an environment that makes it easy for people to oversee, or actively supervise people in and around water both prevents people getting into difficulty and ensures prompt responses if they should do so.

- Provide and maintain seating for parents and observers that enables a good view of water hazards. This encourages adults to supervise young children around water.
  - Provide adequate lighting so that water space users can see and be seen. Again, you need to be aware that too much lighting may encourage people to the area and as a result expose more people to the hazard.
  - Keep vegetation under control to ensure the observers' view of water space users is not obscured. (This vegetation control is separate from vegetation used to discourage access to hazards.)
-

## Think safer roads

Curves in roads that bound water spaces present a greater risk of drowning where vehicles run off the road.

- Anticipate and address run-off hazards when designing new road ways around water spaces.
  - Install barriers on high risk curves on existing roads around water spaces.
- 

## Think emergency support

So that they can respond quickly to incidents and reduce the severity of injuries in and around water spaces, emergency response service requires quick notification, sufficient access to those spaces and adequate facilities in which they can operate.

- Where you are providing new public access or increasing the existing public access to water spaces you need to think about the impact the increased access will have on supervision and rescue services. Ask:
    - Is there sufficient access to the site for ambulance and other emergency services.
    - Is there provision for air rescue facilities.
    - Is there provision for rescue service needs, eg operating facilities.
- 

## Think maintenance

Regular ongoing maintenance is vital to ensuring water spaces are as safe as possible.

Pay particular attention to the condition and hazard risk of:

- Barriers – that they continue to be affective in preventing access.
  - Signs – replace any missing, broken or faded signs.
  - Roads – ensure adequate crash barriers on high risk curves bounding waterways.
  - vegetation
- 

## Best practice for water spaces

### Signage

- [Water Safety Signs Standard NZS 8690:2003](#)
- Signage for Beaches Best Practice Manual 2003.

## **Barriers**

- Fencing of Swimming Pools Act 1987.
- [NZS 8500:2006](#) Safety Barriers for Young Children around Swimming Pools, Spas and Hot Tubs.
- The New Zealand Building Code.
- The Building Code Handbook.

## **Walkways**

- [SNZ HB 8630:2004 Tracks and outdoor visitor structures. Handbook for DOC Walkways](#), a document managed by Standards New Zealand providing a complete guide to the service standard for tracks and the engineering design standard for outdoor visitor structures on tracks.

## **Lighting**

- [Lighting Standards AS/NZS 1158.6:2010](#).

## **Audits**

- Aquatic Risk and Safety Assessment Audit . Surf Life Saving New Zealand.

## **General.**

- [NZS 8500:2006 Safety barriers and fences around swimming pools, spas and hot tubs](#).

## **Also see:**

[Water Safety New Zealand](#) – this link works

[RiverSafe](#) – this link works

[PoolSafe](#) – this link works

[Drowning Prevention Strategy](#)

## Benefits of safe water spaces

By allowing us to participate in activities such as swimming, surfing, diving and even walking, water spaces and their surrounds provide the opportunity and encouragement to be active, thereby supporting the New Zealand Health Strategy.

The challenge for planners, designers, operators and maintainers of community water spaces, is to create environments that help people participate in increased levels of physical activity - safely.

<b>Benefit Design Principle</b>	<b>Fewer injuries</b>	<b>Improved physical activity</b>	<b>Improved health</b>	<b>Improved social cohesion</b>	<b>Improved security and reduced crime</b>
<a href="#"><u>Creating safer water spaces</u></a>	✓	✓	✓	✓	✓

## The water-related injury problem

Studies by Sport and Recreation New Zealand (SPARC) show that over a third of New Zealand's population identify swimming as an activity they participated in 2008; whilst a quarter identified fishing. Add to this over 3 million domestic visitors going to beaches and 1.5 million fishing in our waters (Ministry of Tourism, 2008) it is apparent that the aquatic environment is an important site for leisure and recreation for New Zealanders.<sup>37</sup>

Swimming, surfing, fishing, boating or simply relaxing at the beach or walking by the river and waterways are some of the many activities enjoyed by New Zealanders. But for some people, these activities will result in them being injured or drowning.

Water Safety New Zealand's Drowning Report 2009 shows that on average (a rolling 5 year period from 2004-2008) 14 people die every year swimming and 15 people die in boating related activities (including sailing, and both powered and non-powered boats).

Rivers and beaches were the most dangerous environments with 2009 seeing 19 fatalities in each. The toll in rivers however is half what it was in 2008.<sup>38</sup>

## Why are injuries occurring?

People are suffering injuries in water spaces because:

- [They aren't heeding the hazards](#)
- [New Zealanders are driving into water spaces](#)
- [Environments are failing to provide protection](#)

Looking for [solutions](#)?

---

## People aren't heeding the hazards

A main cause of drowning and water-related injury is people not taking sufficient care in, on and around water.

What we know about people's habits:

- **Young males are taking risks**, while:

- **Swimming.** Males are more likely to suffer drowning than females – according to DrownBase™ statistics 85% of those who drowned in 2009 were male. And in the same year those aged 45-54 years had the highest death rate, followed closely by 55-64 year-olds.<sup>39</sup>

Research conducted in 2001 suggests the greater number of males in drowning statistics is due to the tendency for males swim more often.<sup>40</sup> The same research revealed they also have greater confidence in their swimming ability, are more likely to swim in hazardous situations, and more likely to consume alcohol while swimming. Other potential risk factors include the type of body of water, river currents, season, swimming alone, swimming at night, swimming at beaches not served by lifeguards.<sup>41</sup>

- **Surfing.** Choosing to surf in low surf, shallow water or when there is poor visibility were factors reported in a review of surf-related spinal injuries in a US study of a Californian surf beach.<sup>42</sup>

- **Alcohol is fuelling risky behaviour.** Evidence suggests that the combination of swimming and alcohol is behind a substantial proportion of drowning incidents. Alcohol is also a risk factor in recreational diving<sup>43</sup>, along with a lack of familiarity with the body of water or the conditions at the time.

Both alcohol and lack of experience are confirmed risk factors for injury associated with boating.<sup>44</sup> The risk of death in recreational boating increases as blood alcohol concentration increases and with operators who have less than 100 hours of boating experience. Alcohol increases the risk of a person crashing or of falling over board, and reduces their chances of survival when in the water.

- **Warning signs aren't providing protection.** New Zealand's natural beauty attracts many visitors to this country. However their knowledge of the dangers of our water ways is often limited. There are not always signs warning of possible hazards. In other cases, where there are signs, they are not appropriate for people with limited English language skills.

## **New Zealanders are driving into water spaces**

Many roads run beside and over rivers and other water spaces. Motor vehicle crashes on these roads can result in people ending up unexpectedly in water. In some instances vehicles have crashed off the road into the water. In others, waterways have risen during floods, plucking vehicles from the road itself.

What we know about water related crashes:

- Alcohol increases both the chance of a vehicle crashing into water and of more serious injury resulting from the crash.
- The greater the curve of a road bounding water spaces the greater the chance a vehicle will end up in the water in a crash.
- Driver inexperience of flood conditions contributes to the chance of vehicles becoming submerged on flooded roadways.<sup>45</sup>

---

## **Environments are failing to provide protection**

A common cause of non-recreational water-related injuries (particularly where rivers are concerned) involve immersion – either where the person didn't intend to end up in water or they are submerged unintentionally. Such incidences include where people:

- Fall or slip from a river bank into the water.
- Fall into a backyard pool when they did not intend to go swimming.

Hazards that may contribute to accidental immersions include:

- Inadequate information, eg, warning signs.
- Steep river banks, which present a fall hazard.
- Lack of fencing or other barriers, allowing free access to natural and man-made waterways.
- Lack of supervision of small children around waterways.

## **Cost of water-related injuries**

Drowning and water-related injury cost all New Zealanders on a number of levels.

From 2008 - 2009 ACC data, \$21.1 million in entitlement claims were made for water-related sport and recreational injuries. This includes new and ongoing claims for boating, fishing, surfing swimming underwater diving, waterskiing and windsurfing injury claims.

Responding to these incidents incurs not only a financial cost but also costs in time, resources and effort by emergency response services.

In 2008 - 2009 the Royal New Zealand Coastguard Federation:

- Conducted 3,410 search and rescue operations
- assisted 5,493 people

In 2008 - 2009 Surf Life Saving New Zealand:

- made 1,303 rescues
- conducted 285 searches
- administered 2,011 first aid treatments

More important though, are the social costs of people who die or are injured in, on, under and around water. When a person dies or suffers an injury, it affects not only the life of the injured person, but also the lives of the people around them. The 'cost' of the loss of participation in life, and productivity both in the home and work environment can be considerable. Research conducted in 2010 indicates that the social and economic cost of injury is \$295.5 million per annum.<sup>46</sup>

---

<sup>1</sup> Statistics drawn from A Chartbook of the New Zealand Injury Prevention Strategy Serious Injury Outcome Indicators: 1994-2008- P.Gulliver, C.Cryer, G.Davie – Injury Prevention Research Unit 2010

<sup>2</sup> Statistics drawn from the National Injury Query System, Injury Prevention Research Unit, Otago University

<sup>3</sup> Statistics drawn from the National Injury Query System, Injury Prevention Research Unit, Otago University

<sup>4</sup> Cited in Safekids Factsheet July 2006 Childhood Fall Injury, based on Injury Prevention Research Unit, University of Otago, unpublished NZHIS Hospitalisation Discharge Data. 2004.

<sup>5</sup> Statistics drawn from A Chartbook of the New Zealand Injury Prevention Strategy Serious Injury Outcome Indicators: 1994-2008- P.Gulliver, C.Cryer, G.Davie – Injury Prevention Research Unit 2010

<sup>6</sup> Statistics drawn from the National Injury Query System, Injury Prevention Research Unit, Otago University

<sup>7</sup> Statistics drawn from the National Injury Query System, Injury Prevention Research Unit, Otago University

<sup>8</sup> Cited in Safekids Factsheet July 2006 Childhood Fall Injury, based on Injury Prevention Research Unit, University of Otago, unpublished NZHIS Hospitalisation Discharge Data. 2004.

<sup>9</sup> Cited in Childhood Fall Injury, SafeKids Factsheet July 2005. Original sources: Coggan, C. Lee, M. Bennett, S. Falls in New Zealand: A study of mortality and morbidity data for all age groups. Injury Research Centre, Te Pūhaki Aukati Whāra Report Series No 78, 2003; Injury Prevention Research Unit, University of Otago, unpublished NZHIS Hospitalisation Discharge Data. 2004; Starship Health Trauma Service Data, Unpublished Database. 2004. Auckland District Health Board.

<sup>10</sup> Hazard (edition no 19) June 1994 Victorian Injury Surveillance System. Monash University Accident Research Centre. Injuries among older people. Lesley Day, Sally Kent, Brian Fildes

<sup>11</sup> Murray M P. 1967, Gait as a total pattern of movement. American Journal of Physical Medicine.

<sup>12</sup> Templer, J. 1994. The staircase: studies of hazards, falls and safer design. The MIT Press Massachusetts Institute of Technology, Cambridge: Massachusetts.

<sup>13</sup> Roys, MS. The risk associated with various stair parameters. In: Proceedings of 6th World Conference on Injury Prevention and Control; Montreal; 2002.

<sup>14</sup> Chalmers, D.J., Marshall, S.W, Langley, J.D., Evans, M.J., Brunton, C.R., Kelly, A-M., & Pickering, AE 1996. Height and surfacing as risk factors for injury falls from playground equipment: a case control study. Injury Prevention, 2, 98-104.

<sup>15</sup> Chalmers D.J. (1999) Playground Injury – the Kids are Still Falling for it, Childrenz Issues, vol 3, No.2, 29-32.

<sup>16</sup> Gunatilaka A.H., Sherker S., Ozanne-Smith J. [Comparative performance of playground surfacing materials including conditions of extreme non-compliance](#), Inj Prev 2004; 10:174-179.

<sup>17</sup> Safe Kids Canada Child and Youth Unintentional Injury:10 Years in Review 1994-2003. ACC, Safe at Play: Making Playgrounds safer for children, Feb 2005.

<sup>18</sup> Statistics drawn from the National Injury Query System, Injury Prevention Research Unit, Otago University

<sup>19</sup> Statistics drawn from the National Injury Query System, Injury Prevention Research Unit, Otago University

<sup>20</sup> Statistics drawn from the National Injury Query System, Injury Prevention Research Unit, Otago University

<sup>21</sup> **Source:** O’Dea, D. and Wren, J. (2010). New Zealand Estimates of the Total Social and Economic Cost of “All Injuries” and the Six Priority Areas Respectively, at June 2008 Prices: Technical report prepared for NZIPS. Accident Compensation Corporation, Wellington, New Zealand. 16 February 2010

<sup>22</sup> Tinetti ME, Williams CS. Falls, injuries due to falls, and the risk of admission to a nursing home. New England Journal of Medicine 1997; 337: 1279-1284.

- 
- <sup>23</sup> Hazard (edition no19) June 1994 Victorian Injury Surveillance System. Monash University Accident Research Centre. Injuries among older people. Lesley Day, Sally Kent and Brian Fildes
- <sup>24</sup> *Safer Journeys, New Zealand's Road Safety Strategy 2010-2020*, Ministry of Transport. Serious injury is measured by hospitalisation over one day.
- <sup>25</sup> Ministry of Transport *Risk on the road: Ongoing New Zealand Household Travel Survey 2003 – 2007*
- <sup>26</sup> *Safer Journeys, New Zealand's Road Safety Strategy 2010-2020*, Ministry of Transport. Serious injury is measured by hospitalisation over one day.
- <sup>27</sup> Ministry of Transport *Risk on the road: Ongoing New Zealand Household Travel Survey 2003 – 2007*
- <sup>28</sup> *Down with Speed: A Review of the Literature, and the Impact of Speed on New Zealanders*. Accident Compensation Corporation and Land Transport New Zealand, 2000.
- <sup>29</sup> *Down with Speed: A Review of the Literature, and the Impact of Speed on New Zealanders*. Accident Compensation Corporation and Land Transport New Zealand, 2000.
- <sup>30</sup> *Down with Speed: A Review of the Literature, and the Impact of Speed on New Zealanders*. Accident Compensation Corporation and Land Transport New Zealand, 2000.
- <sup>31</sup> Hazard (edition no 19) June 1994 Victorian Injury Surveillance System. Monash University Accident Research Centre. Injuries among older people. Lesley Day, Sally Kent, Brian Fildes
- <sup>32</sup> Peter Swift, Residential street typology and injury accident frequency, swift and associates (Longmont, 31 march 1998).
- <sup>33</sup> Social costs of crashes and road injuries 2009 - Overview. Ministry of Transport, 2009.
- <sup>34</sup> Social costs of crashes and road injuries 2009 - Overview. Ministry of Transport, 2009
- <sup>35</sup> Water Safety New Zealand, 2009 Drowning Report
- <sup>36</sup> Cited in Price WaterhouseCoopers, Review of the Economic and Social Costs of Drowning Fatalities and Water-related Injuries Compared to Prevention: October 2009.
- <sup>37</sup> Price WaterhouseCoopers, Review of the Economic and Social Costs of Drowning Fatalities and Water-related Injuries Compared to Prevention: October 2009.
- <sup>38</sup> Water Safety New Zealand, 2009 Drowning Report
- <sup>39</sup> Water Safety New Zealand, 2009 Drowning Report
- <sup>40</sup> Langley, J.D., et al., Drowning-related deaths in New Zealand, 1980-94. *Australian & New Zealand Journal of Public Health*, 2001. 25(5): 451-457.
- <sup>41</sup> Bell, Amoroso, Yore, Williams, Smith and Theriault, 2001; The Canadian Red Cross Society, 2001; Driscoll, Steenkamp and Harrison, 2003).
- <sup>42</sup> DeMers, G. and W. Richardson, Cervical spine injuries in a surf environment: an etiology of 258 injuries. *CAHPERD journal/times-(Sacramento,-Calif.)*, 1998. 61(2): 16-19.
- <sup>43</sup> Blanksby, B.A., et al., Aetiology and occurrence of diving injuries. A review of diving safety. *Sports Medicine.*, 1997. 23(4): 228-46.
- <sup>44</sup> Chalmers et al. 2004. Drowning, near-drowning and other water-related injury: literature review and analysis of national injury data. Report to the Accident Compensation Corporation
- <sup>45</sup> Yale, J.D., et al., Motor Vehicle-Related Drowning Deaths Associated with Inland Flooding after Hurricane Floyd: A Field Investigation. *Traffic Injury Prevention.*, 2003. 44(4): 279-284.
- <sup>46</sup> **Source:** O'Dea, D. and Wren, J. (2010). New Zealand Estimates of the Total Social and Economic Cost of "All Injuries" and the Six Priority Areas Respectively, at June 2008 Prices: Technical report prepared for NZIPS. Accident Compensation Corporation, Wellington, New Zealand. 16 February 2010