THE DESIGN OF THE PEDESTRIAN NETWORK

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When designing for pedestrians, quite often the 'devil is in the detail'. This section gives detailed guidance on best practice so that those who design, operate and maintain the road network can better provide a quality walkable environment for all.

Higher standards of footpath design are required for two main reasons. Falls on footpaths are a serious problem, and existing designs are difficult to negotiate by people with impairments.

The main obstacle to walking is difficulty crossing roads. Well designed crossing facilities can make a real difference to safety and convenience. Specific attention is given to physical features such as kerb crossings, islands, kerb protrusions and platforms. Attention to intersection details can make quite a difference

Consideration of directional guidance, lighting and maintenance issues completes this part.

14 FOOTPATHS

PROVIDE FOOTPATHS

- Provide footpaths wherever pedestrians will use them
- Use footpath dimensions and geometry that provides access for all
- Choose surface materials for safety, convenience and aesthetics
- Manage design and location of street furniture
- Locate and design driveways appropriately
- Manage conflict on shared paths by good design and operation
- Provide quality connections to public transport

14.1 Where footpaths should be provided

Table 14.1 is a guide to providing footpaths in urban and rural environments [66].

Table 14.1 – When to provide footpaths

Land use	Footpath provision			
	New roads		Existing roads	
	Preferred	Minimum	Preferred	Minimum
Commercial and industrial	**Both sides**		**Both sides**	
Residential (on arterials)				
Residential (on collector roads)				
Residential (on local streets)			**Both sides**	**One side**
Three to 10 dwellings per hectare	**Both sides**	**One side**	**One side**	**Shoulders on both sides**
Fewer than three dwellings per hectare (rural)	**One side**	**Shoulders on both sides**		

Where only the minimum provision is made, the road controlling authority (RCA) should be able to demonstrate clearly why walking is not expected in that area (although for new or improved developments, this is the developer's responsibility). Retrofitting footpaths is more costly than providing them in the first place, so the preferred standard should be installed for any new or improved development [26, 46, 166], unless:

- it is not accessible to the general public
- the cost of suitable measures is excessive (more than 20 percent of the scheme cost)
- it can be shown to benefit very few pedestrians.

For new developments, project timetables can sometimes mean footpaths are not proposed at the initial stages [46]. In these cases, the RCA can reasonably request a written agreement from the developer to provide footpaths in future, potentially with a bond payment.

14.2 Footpath widths

14.2.1 Footpath zones

Most footpaths within the road reserve lie between the edge of the roadway and the frontage of adjacent private property. There are four distinct zones within this area (see table 14.2) and it is important to distinguish between the total width and the width of the zone likely to be used by pedestrians (the through route) [13, 24, 46].

When determining the width of the frontage or street furniture zone, a 'shy distance' of 0.15 m should apply from any object next to the through route. This area should then be excluded from the through route width as it is unlikely to be used by pedestrians. For example, if a lamp post is near the through route, the shy zone would be the area next to it. This area would then be included in the zone where the lamp post is located and the through-route width would be reduced.

In off-road environments the same principles apply, however, one or more of the zones in table 14.2 may be absent or duplicated on the opposite side of the through route. figure 14.1 illustrates some arrangements for these zones.

Table 14.2 – Zones of the footpath

Area	Purpose
Kerb zone	• Defines the limit of the pedestrian environment. • Prevents roadway water run-off entering the footpath. • Deters vehicles from using the footpath. • Is a major tactile cue for vision impaired pedestrians.
Street furniture zone	• Used for placing features such as signal poles, lighting columns, hatch covers, sandwich boards, seats and parking meters. • Can be used for soft landscaping/vegetation. • Creates a psychological buffer between motorised vehicles and pedestrians. • Reduces passing vehicles splashing pedestrians. • Provides space for driveway gradients.
Through route (or clear width)	• The area where pedestrians normally choose to travel (this should be kept free of obstructions at all times).
Frontage zone	• The area that pedestrians naturally tend not to enter, as it may contain retaining walls, fences, pedestrians emerging from buildings, 'window shoppers' or overhanging vegetation.

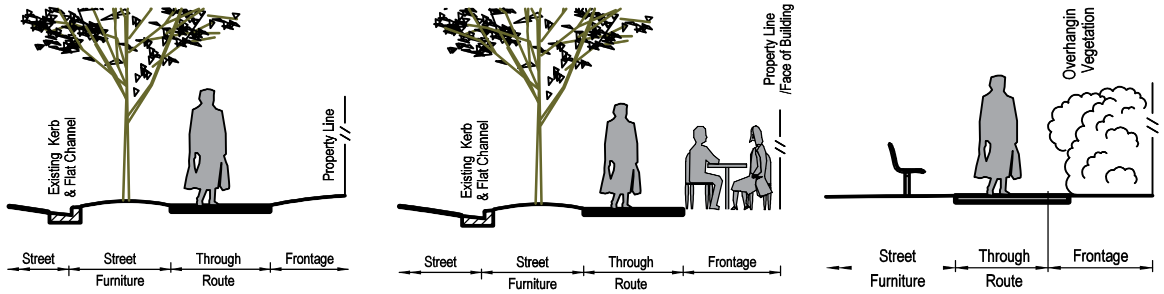


Figure 14.1 – Examples of footpath zones

Photo 14.1 – Kerb zones, Hamilton

Photo 14.2 – Café in street furniture zone, Wellington

14.2.2 Width of zones

The width of the various footpath zones will depend on the environment and those to which the route connects [64, 139]. Table 14.3 has minimum widths that apply to typical pedestrian and vehicle flow conditions [24, 46, 66, 96, 118]. Generally, wider street furniture zones are required in areas with:

- high adjacent vehicle speeds, and/or
- high adjacent vehicle volumes

and wider through-route zones are generally required in areas with:

- high pedestrian volumes, and/or
- a high number of pedestrians stopping on the footpath.

If the flow of pedestrians per minute (p/min) exceeds the maximum in table 14.3, refer to Fruin: *Pedestrian planning and design* [57].

Table 14.3 – Minimum footpath dimensions

Location	Maximum pedestrian flow	Zone				Total
		Kerb	Street furniture #	Through route	Frontage	
Arterial roads in pedestrian districts	80 p/min	0.15 m	1.2m	2.4 m +	0.75 m	4.5 m
CBD						
Alongside parks, schools and other major pedestrian generators						
Local roads in pedestrian districts	60 p/min	0.15 m	1.2 m	1.8 m	0.45 m	3.6 m
Commercial/ industrial areas outside the CBD						
Collector roads	60 p/min	0.15 m	0.9 m	1.8 m	0.15 m	3.0 m
Local roads in residential areas	50 p/min	0.15 m	0.9 m	1.5 m	0.15 m	2.7 m
Absolute minimum*		0.15 m	0.0 m	1.5 m	0.0 m	1.65 m

Consider increasing this distance where vehicle speeds are higher than 55 km/h.

* Only acceptable in existing constrained conditions and where it is not possible to reallocate road space.

All new and improved developments should comply with the above widths. Where footpaths have not been provided to a suitable standard in the past, RCAs should develop works programmes to bring them up to a suitable standard.

When there appears to be not enough space available to install the appropriate footpath width, the step-by-step process in figure 14.2 should be used [139].

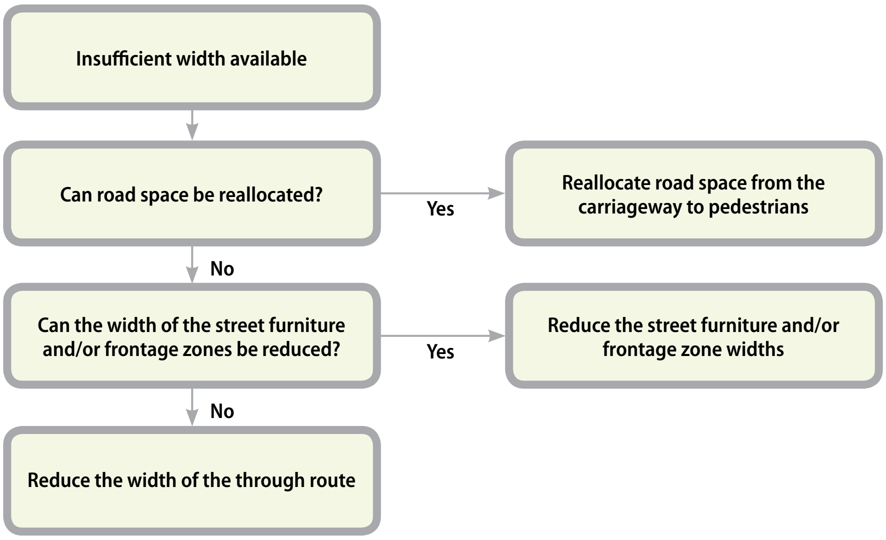


Figure 14.2 – Process for determining footpath provision where width is limited

14.2.3 Passing places

Where through route width is constrained to less than 1.5 metres wide, passing places should be provided – but only where it is not possible to widen the footpath over a longer distance, and never as a low-cost alternative to a full-width footpath. The advantages of passing places are:

- two wheelchairs can pass each other
- walking pedestrians can pass stationary pedestrians, such as those waiting to use a crossing or waiting for public transport.

Table 14.4 outlines passing place dimensions and spacing.

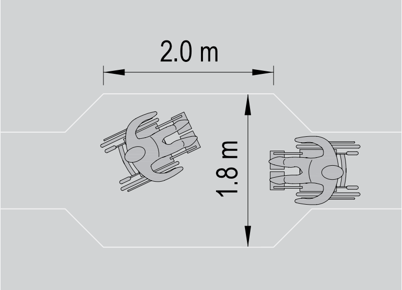


Figure 14.3 – Dimensions of wheelchair passing place

Table 14.4 – Installing passing places

Reason	Passing place dimensions	Location and spacing
Wheelchair users	Minimum through route width 1.8 m. Minimum length 2.0 m (see figure 14.3).	At least every 50 m, and preferably more frequently, where the footpath is less than 1.5 m wide.
Passing pedestrians	Minimum through route width 1.8 m. Minimum length equivalent to the average group of obstructing pedestrians, plus at least 1 m.	As required, according to the RCA's assessment of where pedestrians may wait.
[10, 42]		

14.3 Overhead and protrusion clearances

Overhead clearance

To prevent head injuries to pedestrians, footpaths shall have a vertical (overhead) clearance over their entire width (including the street furniture and frontage zones [10]) that is free of all obstructions, such as vegetation, signs and shop awnings. Table 14.5 shows the minimum overhead clearances.

Table 14.5 – Overhead clearance

Scenario	Clearance
Ideal clearance	2.4 m
Absolute minimum*	2.1 m #

* Only acceptable in constrained existing environments.

The clearance shall never be less than this, even for a short distance.

Photo 14.3 – Overhang, Christchurch

Protrusions

A protrusion is an object projecting into the footpath from the side [13]. Very minor protrusions are acceptable, as long as they are not within the pedestrian through route and comply with the dimensions in table 14.6 [6].

Every item protruding into the footpath shall have an element (which can include any mounting post) within 150 mm of the ground, so that the vision impaired who use canes can detect it [13].

14.4 Gradient

The gradient of a through route is the slope parallel to the direction of travel [13]. Movement becomes more difficult as gradient increases. Table 14.7 shows the three parameters that should be assessed when considering the gradient required [13]. Parameters can be calculated using the procedure outlined at the end of this section.

Through routes in existing developments may have gradients higher than the maximums in table 14.7. Where the mean gradient exceeds the maximum value, the through route should ideally be redesigned as a ramp, which includes rest areas. This allows maximum through-route gradients of up to eight percent while still remaining accessible to wheelchair users [119]. Where this is not possible, and the through route is next to a road, the mean and maximum gradients should be no more than that of the adjacent roadway [46, 166]. Section 14.10 gives advice on designing through routes as ramps.

Generally, through routes in all new developments should be less than the permitted maximums. If they exceed them, the developer should show why this was unavoidable. Section 14.11 advises on situations where footpaths cross driveways.

Table 14.6 – Acceptable protrusions

Mounting	Maximum protrusion into frontage or street furniture ones	Height	Protrusion examples
Attached to walls	100 mm	Between 0.7 m and 2 m	Window sills Business signs Parking meters Public art Benches Post boxes Vegetation Traffic signs Drinking fountains Some litter bins Some sandwich boards
Freestanding or mounted on poles	300 mm		

Table 14.7 – Through-route gradients

Parameter	Definition	Maximum value
Mean gradient	The change in vertical elevation measured between two points.	5%
Maximum gradient	The change in vertical elevation measured at 0.6 m intervals along a route.	8%, over a distance no greater than 9 m. Gradients greater than this are not suitable for wheelchair users.
Rate of change of gradient	The total variation in slope measured at 0.6 m intervals along a route.	13%

The following equations are used to calculate mean and maximum gradient

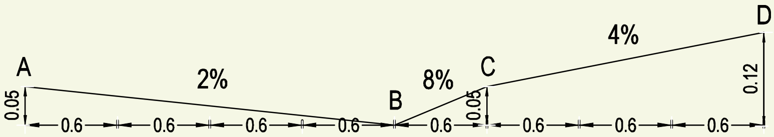
$$\text{Gradient} = \frac{\text{(difference in height)}}{\text{(horizontal distance between points)}} \times 100\%$$

$$\text{Rate of change of gradient}^{*} = \text{(Gradient at point 2)} - \text{(Gradient at point 1)}$$

* Downward slopes are expressed as negative gradients

Example

The following is an example of calculating mean, maximum and rate of change of gradient along the length of the through route:



Parameter	Calculation
Mean gradient (between A and D)	$= \dfrac{\text{(difference in height)}}{\text{(horizontal distance between points)}} \times 100\%$ $= \dfrac{(0.12 - 0.05)}{(4.8)} \times 100\%$ = 1.5%
Maximum gradient (between A and D)	= 8% This is the steepest gradient of the three sections between points A and D (ie. between A and B (2%), B and C (8%) and C and D (4%))
Rate of change of gradient (at point B walking from left to right)	= (gradient to right of B) – (gradient to left of B) = 8% – (-2%) = 10%

Figure 14.4 – Example of gradient calculation

Photo 14.4 – Gradient in footpath between two levels, Christchurch (Photo: Andy Carr)

14.5 Crossfall

Crossfall is the slope of the footpath at right angles to the direction of travel. Some crossfall is required for drainage, but excessive crossfall in the through route requires people using wheelchairs and walking frames to use extra energy to resist the sideways forces [6]. As the crossfall is invariably towards the road where footpaths are in the road reserve, anyone losing their balance is directed towards motorised traffic.

Through route crossfalls should always be between one percent and two percent [6, 13, 24, 42, 46, 134]. Where conditions could lead to greater crossfall, the footpath can be raised or lowered over the whole width. Alternatively, steeper crossfalls can be created in the street furniture and/or frontage (Figure 14.5).

Where land next to the footpath's frontage zone has a significant downwards crossfall (greater than 25 percent) or a vertical drop of more than one metre, pedestrians should be prevented from straying from the through path by, for example [42, 166]:

- a 1.2 m-wide strip of a contrasting coloured and/or textured material between the edge of the footpath and the start of the hazard
- a raised mountable kerb at the edge of the footpath, together with a 0.6 m-wide strip of a contrasting coloured and/or textured material between the kerb and the start of the hazard
- a barrier at the edge of the footpath that is at least 1.1 m high.

Photo 14.5 – Footpath with acceptable crossfall, Wellington (Photo: Lesley Regan)

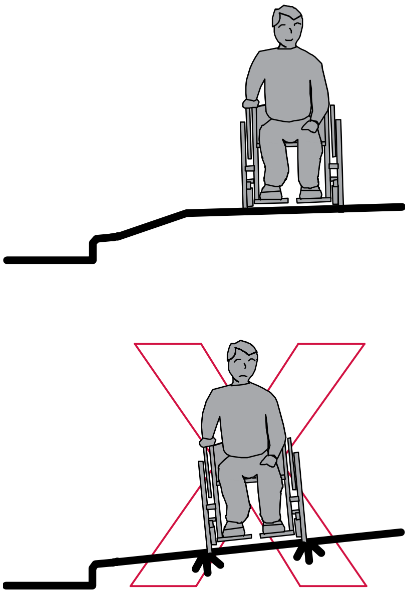


Figure 14.5 – Correct and incorrect provision of crossfall

14.6 Surfaces

General design

All surfaces on which pedestrians walk should be firm, stable and slip resistant even when wet [46, 66, 118, 139]. Slip resistance requirements are discussed in section 3.11. Sudden changes in height on otherwise even surfaces should be less than five mm [18]. To minimise stumbling hazards, undulations in otherwise even surfaces should be less than 12 mm [18]. Both the above are achieved where the maximum deviation of the surface under a 500mm straight edge is less than five mm [10] (figure 14.6). This also prevents puddles from forming. Dished channels for drainage should not be incorporated within the through route [42].

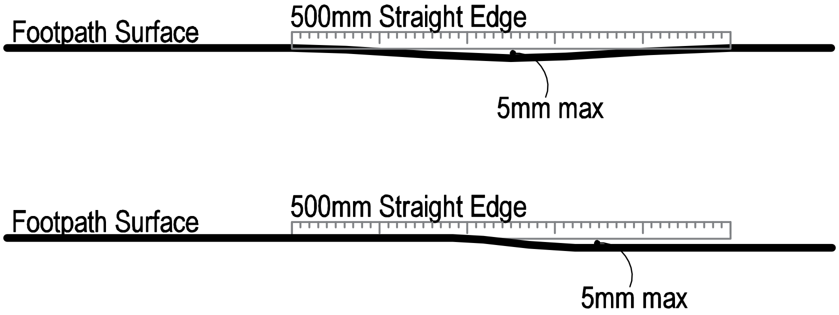


Figure 14.6 – Measuring the maximum deviation of the surface

Short, sudden changes in the surface, such as single steps, should be avoided [134] as they are unexpected and can cause pedestrians to trip or catch the front wheels of wheelchairs and baby carriages.

Where footpaths incorporate structures such as footbridges, refer to the *New Zealand building code handbook* for design and surfacing advice [119].

Decorative surfacing

RCAs are increasingly promoting high-quality and distinctive environments by installing different footpath surfaces, particularly in areas such as the CBD, commercial areas and at tourist attractions. A wide range of material can be used as long as it is firm, stable, even, slip resistant when wet, and does not give misleading signals to the vision impaired. As well as the initial costs, the costs and ease of maintenance, repair, reinstatement and replacement should be considered, along with the drainage properties of different footpath materials.

Vision impaired pedestrians often use differences in texture, contrast and colour as a way-finding cue, so material standardisation and consistency are important [6]. At all times there should be a clear visual and textural contrast between the footpath and the roadway to ensure the vision impaired can define the boundary between the two [92]. For more information on designing for vision impaired pedestrians and providing tactile paving, see the appropriate section of this guide or *Guidelines for facilities for blind and vision-impaired pedestrians* [92]. To avoid excessive changes within an area and promote

Photo 14.6 – Brick-lined asphalt path, Nelson (Photo: Tim Hughes)

Photo 14.7 – Traffic calmed area with contrasting surfaces, Wellington (Photo: Shane Turner)

consistency, RCAs should develop guidelines on when particular surface types should be used.

Materials

Concrete and asphalt are generally considered the most appropriate footpath surfaces, although stone pavers and unglazed brick can also be used [6, 10, 13, 24, 46]. Material combinations are possible, such as a concrete through route edged with unglazed brick to provide visual contrast for vision impaired pedestrians. Table 14.8 gives examples of different materials used for footpaths and their advantages and disadvantages.

Table 14.8 – Footpath surfaces

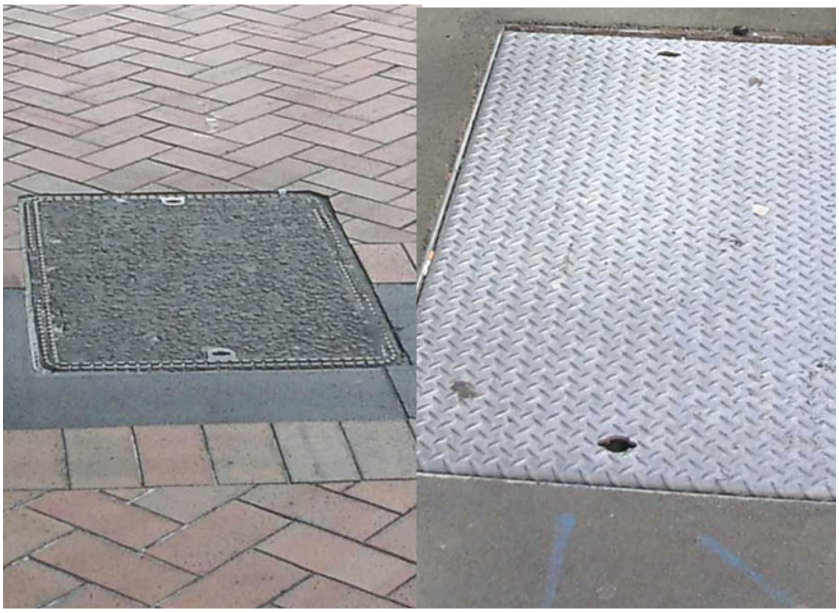
Surface	Advantages	Disadvantages	Design issues
Concrete and asphalt	Require minimum ongoing maintenance. Any maintenance is inexpensive. Surface can easily be reinstated if removed. Provide longest service life.	Can be aesthetically displeasing. Asphalt can be confusing for pedestrians as it is associated with a 'road' surface. Asphalt can 'sink' and produce protrusions, especially at kerbs.	Texture with a broom finish (perpendicular to the direction of travel) to enhance friction and improve drainage. Concrete shall not be painted. Joints between units shall be less than 13 mm.
Stone pavers and unglazed brick	Highly decorative. Easy to replace if damaged. Easy to reset if displaced.	Small units can move independently and create a trip hazard. Can be difficult to maintain crossfalls. Can cause vibration to users. Some pavers or joints are susceptible to moss.	Consider stamped or stained concrete instead. Joints between units shall be less than 13 mm. Needs a firm base (preferably concrete). Ensure good installation and regular maintenance to prevent moss growth and minimise/reset displaced pavers.
Split-face stone, cobblestones	Highly decorative.	Not easily crossed by the mobility impaired or walking pedestrians wearing some fashion shoes. Prone to moss and weed growth.	Avoid use in the through route. Can be used to delineate places to walk, and within other areas of the footpath.
Loose surfacing, such as exposed aggregate, gravel and bark	Inexpensive to install. Can be aesthetically pleasing. Can fit well in 'rural' environments.	Can cause severe problems for the mobility impaired if not well compacted. Requires significant maintenance commitment. Very prone to weeds.	Avoid use in the through route unless there is an extremely high aesthetic justification (such as in a botanical park). Use to manage vegetation and street trees only (and take measures to prevent materials spilling into the through route)
Tactile paving	Provides a positive tactile way-finding cue for the vision impaired.	Can be aesthetically displeasing.	Should be used in a consistent way and only in specified locations.

14.7 Grates and covers

Whenever possible, covers and grates should be sited within the street furniture zone [24, 42]. If this is not possible, they can be placed at the edge of the through route [10].

To minimise pedestrian hazards, grate openings should be less than 13 mm wide and 150 mm long [10, 42]. Any elongated openings should be placed perpendicular to the main direction of pedestrian movement [10, 42].

Covers should have a rough surface texture, but without regular, large protrusions that could result in the vision impaired mistaking them for a tactile surface [42]. However, they can incorporate attractive designs that can lead to a more interesting streetscape. They should always be flush with the surrounding surface [10, 24, 42] and be slip resistant, even when wet.



Photos 14.8 & 14.9 – Covers in through route, Wellington (Photo: Shane Turner)

14.8 Landscaping

Landscaping can create an attractive visual environment and a 'buffer' between the footpath and the roadway [24]. It creates the appearance of a narrower road and can encourage drivers to travel more slowly [145], as well as possibly providing shade and shelter from wind for pedestrians.

Permanent planting

Permanent planting should be sited within the street furniture zone and consist of trees, flowers, shrubs or grass [24]. Species should be selected with care to ensure they fit in the surrounding area and are appropriate for the environment. It is particularly important that [24, 46, 145]:

- root systems do not damage buried utilities or buckle the footpath surface
- canopies do not interfere with overhead lighting
- plants do not obscure pedestrian or driver visibility when installed or when mature, at any time of the year. This generally requires new trees to be five metres tall at installation
- vegetation and tree limbs do not protrude into the through route or block sight lines when installed or when mature, at any time of the year
- plants are capable of surviving with minimal maintenance and (in drier areas) preferably do not need irrigation
- the landscaping does not create cover for criminal or antisocial activities.

Photo 14.10 – Young trees set back in street furniture zone, Christchurch (Photo: Aaron Roozenburg)

Landscaping also should not create a hazard to vehicles that unintentionally leave the roadway. Outside of traffic-calmed areas (where speeds are greater than 40 km/h), but within urban areas, only collapsible or frangible landscaping should be placed within four metres of the edge of the nearest traffic lane. This distance should be increased on the outside of curves where there is a higher chance of vehicles leaving the roadway. Trees within this area should [87]:

- have a trunk diameter less than 100 mm when mature, measured 400 mm above the ground
- not be hardwood species
- be frangible.

Moveable planters

Moveable planters can be placed in the frontage zone (or street furniture zone in a traffic calmed area) as long as they do not protrude into the through route. For design purposes planters should be considered to be street furniture (see section 14.9).

14.9 Street furniture

The footpath is the main location for street furniture. Some furniture is designed to benefit pedestrians and enhance the walking environment, while other furniture is provided mainly for other road users.

Placement

Furniture can create a visually interesting environment for pedestrians and encourage greater use of the street as a public space. However, it can also create obstructions and trip hazards, obscure visibility and intimidate pedestrians [7, 42, 66, 92, 121, 134, 145].

Every piece and type of street furniture should be easily detectable (and avoidable) by the vision impaired. This means each should [42, 134]:

- be at least one metre high where possible/practical
- have an element within 150 mm of the ground for its entire length parallel to the ground, so that it is detectable by the vision impaired who use a cane
- be placed outside the through route
- be placed in a consistent way within the same environment.

For more advice on catering for the vision impaired, see *Guidelines for facilities for the blind and vision-impaired pedestrians* [92].

Photo 14.11 – Planters in street furniture zone, Christchurch (Photo: Susan Cambridge)

Photo 14.12 – Rubbish bin in street furniture zone, Hamilton (Photo: Shane Turner)

Photo 14.13 – Bollards, Wellington (Photo: Shane Turner)

Photo 14.14 – Public telephones, Hamilton (Photo: Shane Turner)

Outside of traffic calmed areas (where speeds are greater than 40 km/h), but within urban areas only collapsible or frangible street furniture should be placed within four metres of the edge of the nearest traffic lane, so as not to create a hazard for vehicles that leave the roadway. This distance should be increased on the outside of curves where there are higher chances of vehicles leaving the roadway.

Typical characteristics

Street furniture design should be sympathetic to the surrounding environment and, where it is intended for use by pedestrians, should be accessible to all types [42]. There should be a good colour contrast between street furniture and background surfaces to ensure it is conspicuous to the vision impaired [42, 134]. Generally, grey colours should be avoided as they blend into the general background [42].

Table 14.9 shows the typical characteristics and conventional locations of common street furniture for new or improved streets [24, 42, 134].

Photo 14.15 – Bench in frontage zone, Christchurch (Photo: Susan Cambridge)

Table 14.9 – Typical characteristics of street furniture

Furniture	Typical footprint	Typical height	Locations and frequency	Ideally sited	If ideal is not possible, consider
Bench	2.4 m by 0.75 m	0.4-1.0 m	Provide every 50 m in commonly used pedestrian areas, or more frequently on sloping footpaths. Provide also at bus stops and shelters.	Within street furniture zone if zone is more than 0.9 m wide. Within frontage zone if zone is more than 0.9 m wide. At least 0.5 m from the edge of the through route. At right angles to the through route.	Facing the through route.
Bollard	0.3 m diameter	0.6 m to 1.2 m	As required, but no more than 1.4 m apart.	At most 0.3 m from kerb and wholly within street furniture zone.	As per ideal.
Bus stop shelter (see section 14.13)	2.6 m by 1.4 m	2.5 m	As required by bus services.	Where there are large numbers of passengers, within the street furniture zone. The through route width should be maintained which may involve using kerb extensions.	Mostly within street furniture zone but can protrude into the through route as long as the minimum width is maintained.
Cycle locker	2 m by 1.9 m	2.1 m	As determined in consultation with cycle user groups. Provide also at transport interchanges/major stops.	Where there is a manoeuvring depth of 2.7 m at the locker door.	Where there is a manoeuvring depth of 1.8 m at the locker door. This distance may include the through route.
Cycle rack and stand	0.75 m by 50 mm	0.75 m	As determined in consultation with cycle user groups. Provide also at transport interchanges/major stops.	Parallel to the kerb, 0.9 m from it. Retain at least 0.75 m between the rack and the through route. Footpath should be at least 3.6 m wide. At right angles to any severe gradients.	Parallel to the kerb, 0.6 m from it. Retain at least 0.75 m between the rack and the through route. Footpath should be at least 3m wide. At right angles to any severe gradients.
Drinking fountain	0.3 m diameter	0.6 m	As required.	Wholly within street furniture zone.	As per ideal.
Litter bin	0.8 m diameter	1.3 m	As required. Consider for areas where litter may be generated, such as bus stops, transport interchanges and fast-food outlets.	Centred within street furniture zone if zone is more than 0.9 m wide.	Consider using a litter bin with narrower footprint and site wholly within street furniture zone.
Parking meter	0.3 m by 0.15 m	1.5 m	As required by on-street parking.	Centre of supporting post should be 0.8 m from kerb.	Centre of supporting post should be 0.6 m from kerb. If footpath is under 2.7 m wide, install within frontage zone.
Planter	Varies	Varies	As required. More effective if looked down upon.	Within street furniture zone if zone is more than 0.9 m wide. Removable planters are permitted within the frontage zone as long as they do not intrude into the through route.	As per ideal.
Pole – lighting	Up to 0.6 m by 0.6 m	Varies	As required to provide a suitable lighting level.	Centre of supporting post should be 0.75 m from kerb or centred in street furniture zone if it is greater than 1.5 m. Poles should be aligned along the road corridor.	Centre of supporting post should be at least 0.45 m from kerb. Poles should be aligned along the road corridor.
Pole – signal	0.55 m by 0.55 m	Varies	As required under standards for traffic signal installations.	Centre of supporting post should be 0.75 m from kerb or centred in street furniture zone if it is greater than 1.5 m.	Set pole closer to kerb. Place pole within frontage zone.
Pole – utility	0.45 m by 0.45 m	Varies	As required.	Centre of pole should be 0.6 m from kerb.	Centre of pole should be 0.45 m from kerb.
Public art	Varies	Varies	As required.	Centred within street furniture zone.	As per ideal.
Public telephone	Varies	Varies	Not within 1.5 m of a building entrance. Not within 1.2 m of street light or traffic signals pole. No more than one public telephone within 30 m of an intersection. Single telephone or clusters should be at least 60 m apart.	Edge of unit should be 0.6 m from kerb. Minimum footpath width is 3.65 m.	As per ideal.

Furniture	Typical footprint	Typical height	Locations and frequency	Ideally Sited	If ideal is not possible, consider
Sign – public transport	65 mm diameter pole	2.1 m	As required by bus-operating companies.	Use existing signpost or utility pole to place sign. For new posts, centre of pole should be 0.45 m from kerb with the closest edge of the sign 0.3 m from the kerb.	Attached to building face. Place poles within frontage zone.
Sign – parking	65 mm diameter pole	1.5 m	As required by on-street parking.	Use existing posts to place sign where practice and legislation allows. For new posts, centre of pole should be 0.45 m from kerb.	Attach sign to building face. Place poles within frontage zone.
Sign – street name	65 mm diameter pole	2.1 m	As required (see *Guidelines for street name signs* [75]).	Within street furniture zone if zone is more than 0.9 m wide.	Some signs may be attached to building face. Place poles within frontage zone.
Sign – traffic	65 mm diameter pole	2.1 m	As required by traffic control devices rule [111].	Within street furniture zone if zone is more than 0.9 m wide, with the closest edge of the sign 0.3 m from the kerb.	Locate pole closer to the kerb. Place poles within frontage zone. Some signs may be attached to building face.
Signal controller box	0.75 m by 0.6 m	Up to 1.75 m	At traffic signal installations.	Centred within street furniture zone if zone is more than 0.9 m wide. Parallel to kerb.	Mostly within street furniture zone but can protrude into the through route as long as the maximum width possible is maintained (at least 1.5 m). Perpendicular to kerb.
Street tree	As per tree grates	5 m tall when installed	Varies	Centred within street furniture zone. Minimum footpath width is 2.75 m. Leaves should be above pedestrian eye-line.	As per ideal.
Tree grate	1.2 m by 1.2 m	Flush	See 'Street tree'.	See 'Street tree'.	See 'Street tree'.
Utility vault	Varies	Flush	As required by utility companies.	Centred within street furniture zone if zone is more than 0.9 m wide.	Locate within private property.

Café furniture/advertising signs

There are currently no New Zealand guidelines for placing café furniture (tables and chairs). However, whatever placement is adopted (either frontage zone or street furniture zone), it is important to keep it consistent within the RCA – noting that there are advantages to placing café furniture in the street furniture zone as some vision impaired people use shop frontages as a cue to follow. It is important that café furniture placement should not reduce the through-route width below the appropriate minimum (see section 14.2).

Some RCAs allow footpaths to be used for displaying shop stock or displaying advertising signs and boards. In this case, there should be no interference, obstruction or hazard for pedestrians. Any items should only be placed in the frontage or street furniture zone and no part should be sited on, or extend into, the through route. Placement of hazardous items should be banned, and rules on these items enforced.

Photo 14.6 – Brass plate on footpath delineates permitted trading area, Perth (Photo: Tim Hughes)

Constrained environments

In very constrained environments, there may not be enough space in the street furniture or frontage zones for even street furniture or equipment that is necessary for the street to be safe and function efficiently. Figure 14.7 shows the approach for determining the location of such items [24, 42].

The last option should be chosen rarely; if it is used, it is important to:

- maintain the maximum possible clear through route at all times
- keep the length over which the through route is restricted to less than six metres [42]
- ensure that the through route width is at least 1.5 m and preferably 1.8 m [10]
- ensure that the colour of the obstruction contrasts with its surrounding environment [42].

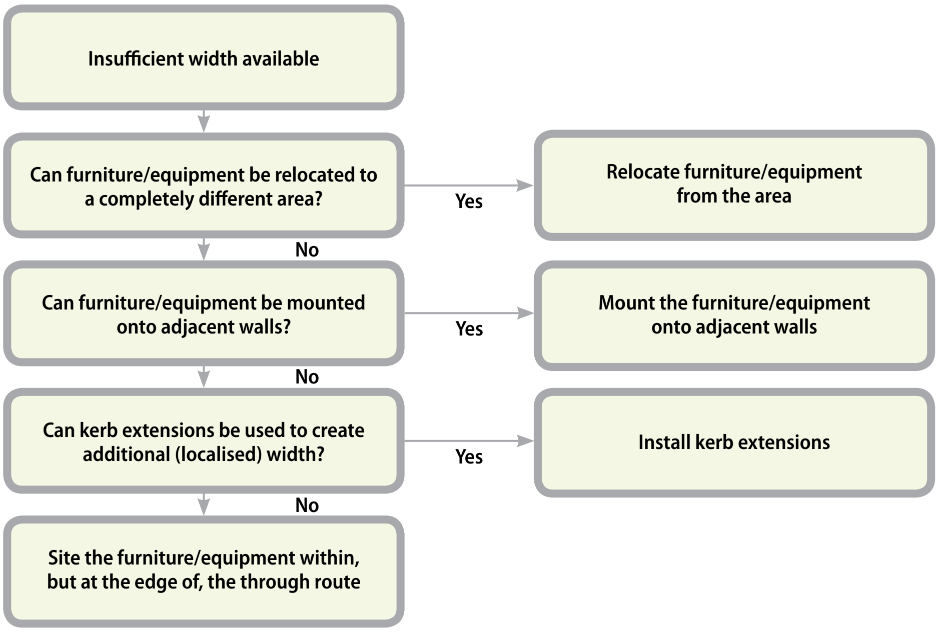


Figure 14.7 – Approach to determining location of necessary equipment

14.10 Ramps and steps

A through route should be treated as a ramp if the mean gradient is greater than five percent. Note rest areas are required where the mean gradient exceeds three percent (see figure 14.8) [134].

Table 14.10 has key design features common to both ramps and steps [10, 24, 42, 134].

Photo 14.17 – Choice of ramps or steps, Queenstown (Photo: Tim Hughes)

Photo 14.18 – Steps, Wellington (Photo: Shane Turner)

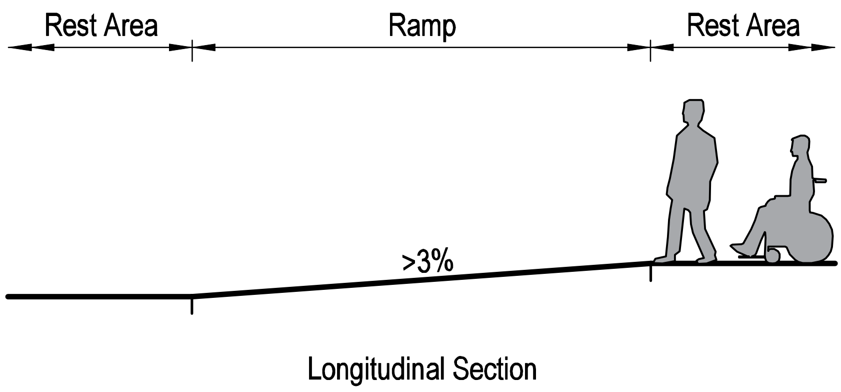


Figure 14.8 – Rest areas in ramp (for ramp lengths see Table 14.10)

Table 14.10 – Design features common to both ramps and steps

Feature	Purpose	Location	Design issues
Landing	Accommodates changes of direction after the ascent/ descent is completed. Ensures that pedestrians emerging from the ramp/steps are clearly visible to others.	Top and bottom of every ramp or flight of steps.	At least 1.2 m long, 1.8 m preferred. Extends over the full width of the ramp/steps. Kept clear of all obstructions. Gradient should be less than 2%.
High contrast material	To enable people to detect the top and bottom of the ramp/ steps.	Edge of the landings, adjacent to the ramp/steps. On the edge of each step.	Should cover the full width of the steps/ramp. On steps, it should be 55 mm deep.
Tactile paving	To help vision impaired people to detect the top and bottom of the steps or steep ramps.	Edge of the landings, adjacent to the ramp/steps.	Install tactile ground surface indicators coloured 'safety yellow', as described in *Guidelines for facilities for blind and vision-impaired pedestrians* [92].
Signing	To inform pedestrians of the impending change in levels. To provide directions to an alternative route where available.	Top and bottom of every ramp or flight of steps.	No additional requirements to normal pedestrian signage.
Handrails	To provide a means of support, balance and guidance. To provide a means of propulsion for some types of pedestrian.	Continuous over the whole route. Provided on both sides.	Handrails should be 30 mm to 45 mm in diameter. Sited at least 50 mm from any surface. They should extend by at least 0.3 m into the top and bottom landings, and return to the ground or a wall, or be turned down by 0.1 m. Sited 0.8 m to 1.1 m above the step pitch line or ramp surface. Secondary handrails may be considered at a height of 0.55 m to 0.65 m. Colour should contrast with the background.
Rest areas	To allow pedestrians to recover from their exertions. To make changing direction much easier.	Frequency depends on the height gained (or lost). A rest area is required every 0.75 m change in height for the ramp to remain accessible to wheelchair users. For ramps, rest areas are required: **Gradient**: 4% – 19 m; 5% – 15 m; 6% – 13 m; 7% – 11 m; 8% – 9 m (Rest area frequency)	At least 1.2 m long, 1.5 m preferred. Covers the full width of the ramp/steps. Gradient should be less than 2%.

Rest area frequencies within the Location cell:

Gradient	**4%**	**5%**	**6%**	**7%**	**8%**
Rest area frequency	19 m	15 m	13 m	11 m	9 m

Flights of steps and ramps should be straight, with corners where necessary [42 134]. Curved ramps and flights of steps are not recommended because [6]:

- they are harder for the mobility impaired to negotiate
- for ramps, the gradients between the inner and outer edges are different
- for steps, the tread length on the inner edge is always smaller than that on the outer
- it is much harder to provide rest areas of a suitable size.

It is important to minimise the risk of pedestrians colliding with the underside of freestanding stairs or ramps by ensuring they are positively directed around the obstacle [42].

Table 14.11 details design parameters for ramps [10, 42, 134].

Table 14.11 – Design features specific to ramps

Parameter	Range/value
Surface	Should comply with the same best practice as other footpath surfaces.
Width	1.2 m absolute minimum, preferably 1.8 m (between handrails). If more than 2 m, a central handrail should be provided.
Maximum length	Preferably less than 50 m. Absolute maximum length of 130 m.
Maximum crossfall	2% (but no crossfall normally required).
Mean gradient	No greater than 8%.
Maximum gradient	Generally no greater than 8%. In highly constrained conditions, greater gradients are tolerated but only over short distances: • a gradient of 10% is permitted over a length of 1.5 m • a gradient of 12% is permitted over a length of 0.75 m • a gradient of 16% is permitted over a length of 0.6 m.
Rate of change of gradient	No greater than 13%.

Table 14.12 details design parameters for steps [10, 24, 42, 134].

Table 14.12 – Design features specific to steps

Parameter	Range/value
Surface	Should comply with the same best practice as other footpath surfaces.
Width	0.9 m absolute minimum, preferably 1.2 m (between handrails). If more than 2.1 m, an additional handrail may be provided. This can be located to create a route on which the mobility impaired can hold a rail on either side.
Maximum crossfall	2%.
Tread	Depth no less than 0.31 m and consistent for the entire flight. No overhang at the edge of the tread. Nose of the step should be slightly rounded.
Riser	Height of between 0.1 m and 0.18 m and consistent for the entire flight. Solid risers are required.
Flight	A maximum rise of 2.5 m is permitted before a rest area should be provided. A minimum of three steps is required to avoid a tripping hazard. Long-tread, low-riser steps can be very helpful for the mobility impaired.

14.11 Driveways

Location

The following principles apply when locating driveways [10, 46]:

- Driveways should be located where the expected pedestrian activity is low.
- High-volume driveways and pedestrian accesses should be separated.
- The number of driveways should be reduced through pairing/combining accesses to several properties, and not having separate low volume entrances and exits.
- Driveways should be located as far from street intersections as possible to avoid confusion and conflict.

General design

When designing driveways the following principles apply [24, 46]:

- Turning radii should be minimised to ensure slow vehicle speeds.
- The driveway width at both edges of the through route should not be significantly greater than at the property boundary.
- The driveway width should be minimised to slow vehicle speeds.
- The give way obligations of drivers and pedestrian should be clear.
- The road user rule states 'a driver entering or exiting a driveway must give way to a road user on a footpath'.
- If it is desired that pedestrians give way at a high-volume access way to a development, the entrance should be designed as an intersection.

Photo 14.19 – Driveway with normal pedestrian path crossfall maintained, Queenstown (Photo: Tim Hughes)

When deciding whether to design a high volume entrance as an intersection consider:

- Is the driveway busy enough? – at least above 500 vehicles per day?
- Is the driveway traffic volume substantially greater than pedestrian path volume?
- Is the strategic function of the pedestrian path less important than the traffic access function?

Drivers and pedestrians should be provided with clear cues that they are at either a driveway or an intersection.

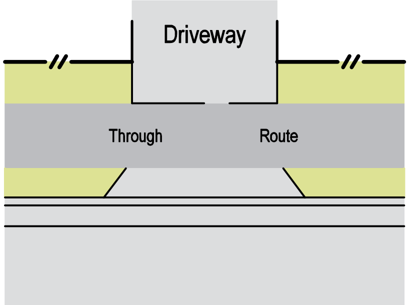
Driveway cues include:

- The pedestrian path is continuous in grade, crossfall, colour and texture across the driveway, with no tactile warning tiles.
- The driveway changes grade to cross the kerb at a kerb ramp, and preferably changes in colour and texture to cross the pedestrian through path.
- The roadway kerb is continuous and cuts down to a concrete gutter crossing running straight across the driveway ramp – it does not return into the driveway.

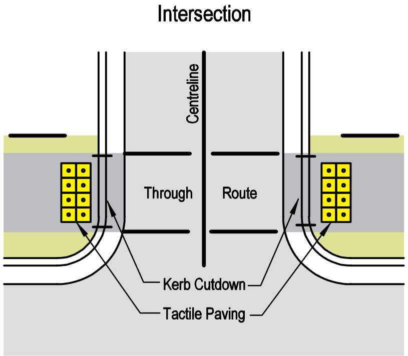
Intersection cues include:

- Between the footpath and the side road there is a change in colour and texture, tactile paving, and preferably a kerb ramp at a kerb crossing.
- The vehicle path is kerbed and continuous with the road surface with no change in colour and texture.
- There is no kerb crossing or ramp to enter the roadway.
- The road kerb does not continue across but returns to follow the side road.

These design differences are shown in figure 14.9



Driveway



Low-volume intersection (high-volume access way)

Figure 14.9 – Comparison between driveway and higher-volume access way

Driveways should have a level landing at the top (similar to a kerb ramp), and be at least 1.2 m wide across the through path. The crossfall should be less than two percent, with the gradient differing from the adjacent through path by less than two percent [6, 24]. To achieve this, the sloped part of the driveway should be within the street furniture zone and/or the adjacent private property. It may be necessary to lower the footpath (see figure 14.10) [24].

Perpendicular

Combination

Parallel (To be used only in existing constrained circumstances)

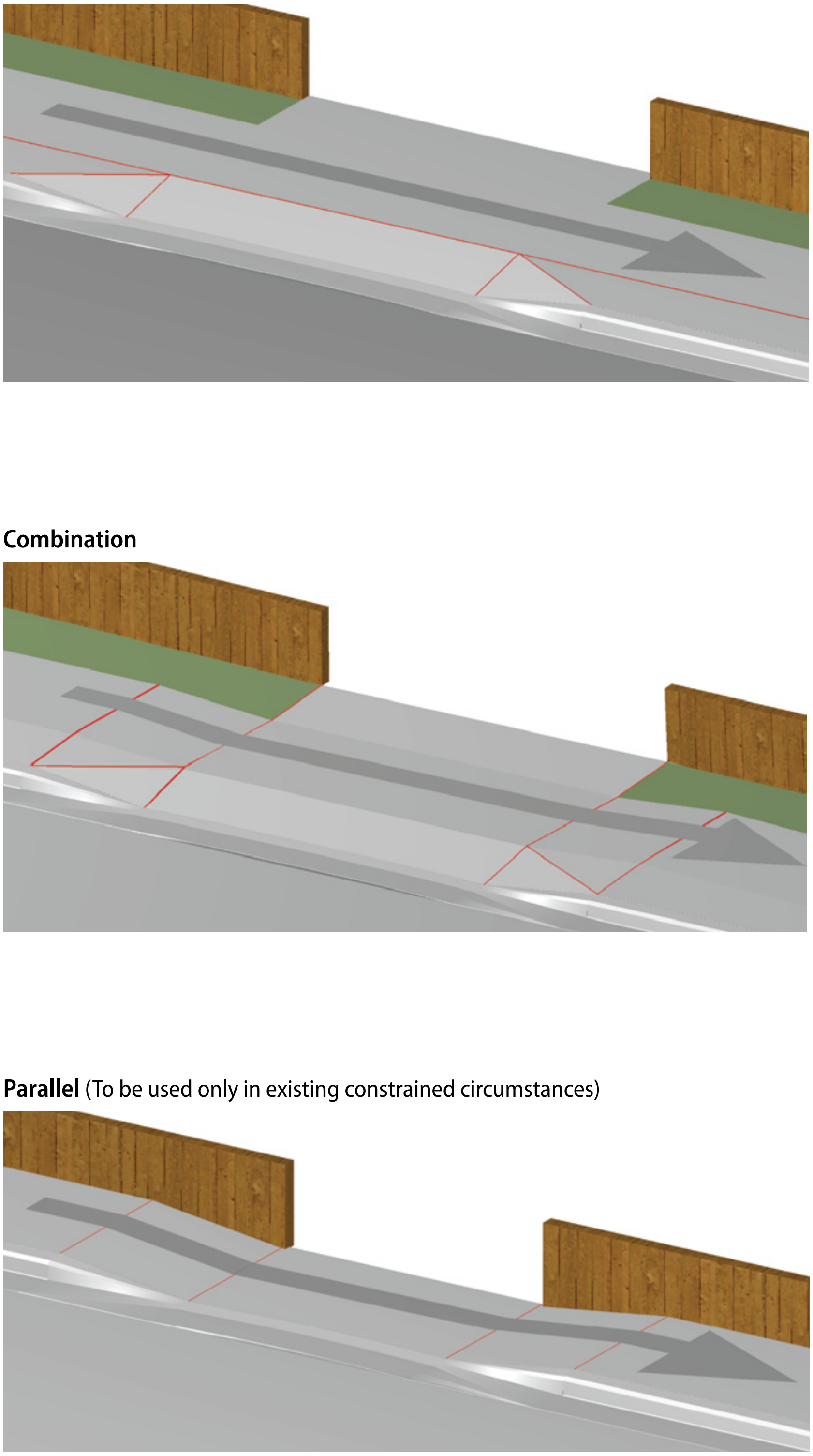


Figure 14.10 – Interface between driveways and footpaths

Visibility

Footpaths on either side of the driveway should be kept clear of all obstructions [10, 84]. A five metre by two metre 'visibility splay' (see figure 14.11) should be installed in areas with high pedestrian flows and more than 200 expected daily vehicle access manoeuvres [84].

Boundary treatments next to driveways should not obscure pedestrians – avoid tall, close-boarded fencing, solid structures and dense vegetation. They should also not adversely affect any formal visibility splay. If visibility splays cannot be provided in very constrained situations, install convex mirrors at the access way and/or visual and audio warnings to pedestrians.

Vertical visibility is also an issue for driveways that descend quickly from the footpath – ascending drivers may not be able to see pedestrians clearly on the through route, especially children. To prevent this a near level platform at the top of the driveway next to the through route can be provided (see figure 14.12). At higher-volume access ways (200 vehicle access manoeuvres per day) where constrained circumstances do not allow such a platform, provide convex mirrors.

Driveways (especially residential driveways) should be carefully designed to minimise the risk to young children, especially those less than four years old. Where possible, physical barriers should be installed between homes and driveways, using features such as fences and self-closing gates [15]. Internal driveway layout should also encourage drivers to enter and exit the site in a forward direction if possible.

Signage for drivers should be provided at more heavily used driveways, such as those for servicing retail and industrial developments. This warns drivers of the presence of pedestrians and encourages a low vehicle speed [10].

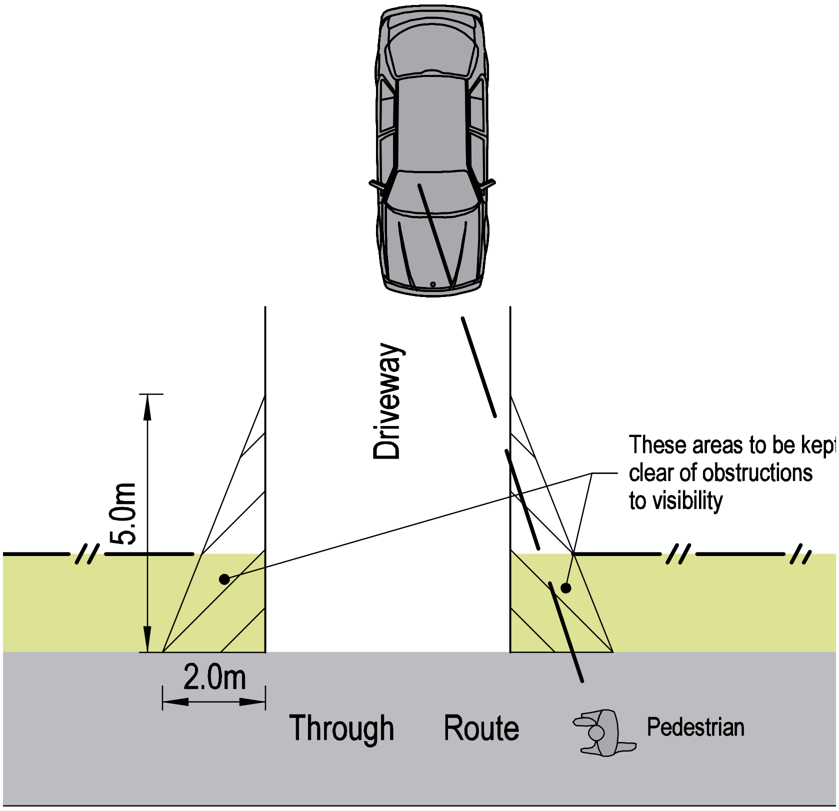


Figure 14.11 – Driveway visibility splays for high-volume driveways

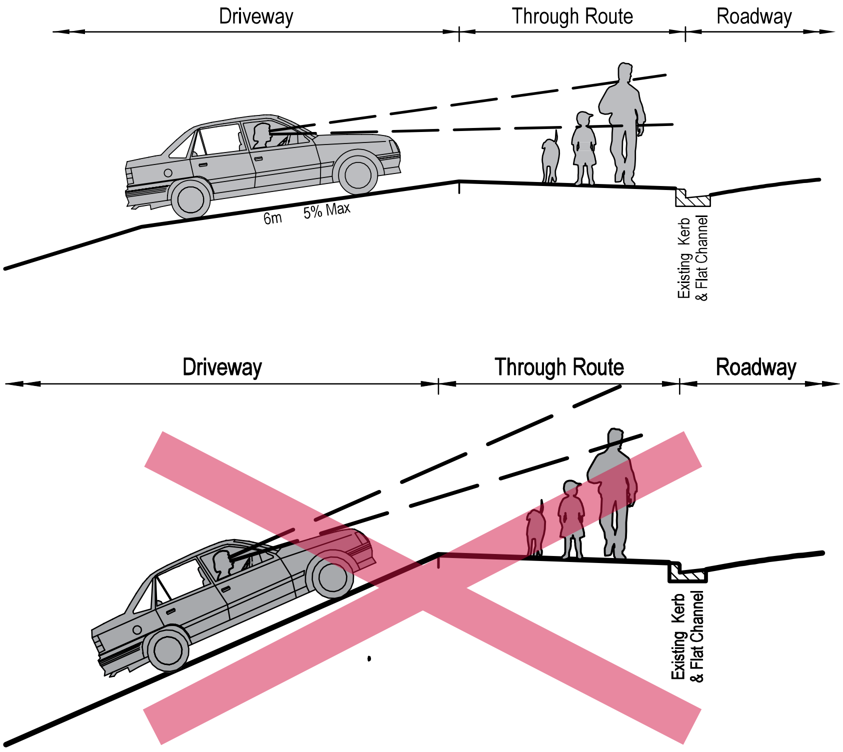


Figure 14.12 – Steep driveway with a vertical visibility problem and one where the approach is closer to level

14.12 Shared-use paths

For both unsegregated and segregated paths, particular care needs to be taken:

- where cyclists join the shared route to ensure they can do so safely and without conflict with pedestrians
- where the shared routes ends, to ensure that cyclists do not continue to use a route intended for pedestrians only
- where one route crosses another pedestrian, cyclist or shared-use route
- to ensure adequate forward visibility for cyclists, who are generally moving more quickly than pedestrians
- to provide adequate signing to indicate the presence of pedestrians and cyclists.

In both cases [121] it is important to:

- leave a lateral clearance distance of one metre on both sides of the path to allow for recovery by cyclists after a loss of control or swerving
- maintain an overhead clearance of 2.4 m over the path and the lateral clearance distance
- ideally, keep a 1.5 m separation between the path and any adjacent roadway
- ensure the gradient and crossfall comply with the most stringent best practice for pedestrians and cyclists.

Table 14.13 shows the typical widths of the through route for unsegregated shared paths [11].

Segregated paths require pedestrians and cyclists to use separate areas of the path, delineated by contrasting surfaces or markings. To ensure the vision impaired do not stray into cyclists' paths, the pedestrian and cyclist areas should be separated by:

- a raised mountable kerb
- a white thermoplastic line
- a median strip of a different surface, at least one metre wide
- a landscape barrier
- raising the pedestrian area by at least 75 mm.

Table 14.14 shows typical through-route widths for segregated paths [11].

Austroads [11] and the New Zealand supplement to Austroads: Part 14: Bicycles [153] have more design details for shared routes. Comprehensive guidance on all the issues for shared paths is found in the toolbox developed for the Australian Bicycle Council: *Pedestrian-cyclist conflict minimisation on shared paths and footpaths* [69].

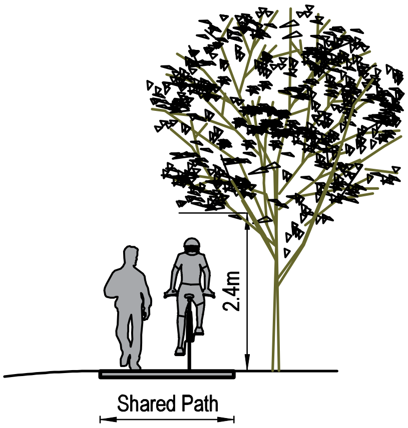


Figure 14.13 – Minimum overhead clearance for shared-use path

Photo 14.20 – Shared bridge markings, Brisbane (Photo: Tim Hughes)

Photo 14.21 – Shared bridge signs, Brisbane (Photo: Tim Hughes)

Photo 14.22 – Landscape barrier separates pedestrians and cyclists, Subiaco, Perth (Photo: Tim Hughes)

Table 14.13 – Widths of unsegregated shared-use paths

	Likely main use of path *		
	Local access only	Commuters	Recreational or mixed use
Desirable path width	2.5 m	3 m	3.5 m
Path width range	2 m to 2.5 m	2 m to 3.5 m	3 m to 4 m

* Where the use is uncertain, provide a width of 3 m [121].

Table 14.14 – Widths of segregated shared-use paths

	Area for cycles	Area for pedestrians	Total
Desirable path width	2.5 m	2 m	4.5 m
Path width range	2 m to 3 m	At least 1.5 m	At least 3.5 m

Shared areas

Cyclists are often excluded from pedestrian-only areas, such as malls. There can be little justification for this, as collisions between pedestrians and cyclists are comparatively rare [32]. Nevertheless, some pedestrians do perceive a danger from cyclists due to their speed and quietness [32], and may feel intimidated by them. The elderly feel especially vulnerable when encountering cyclists in their walking space. As a result, a physically segregated route might be appropriate for cyclists in pedestrian-only areas [143]. Signs outlining cyclists' obligations in pedestrian-only areas should be provided if cycling is allowed. Such examples of signs may be 'Cyclists: Walking Speed Only' or 'Cyclists: Give Way to Pedestrians'.

Photo 14.23 – Unsegregated shared-use path, Nelson (Photo: Susan Cambridge)

14.13 Public transport interface

Well designed public transport stops and their interface with the pedestrian network are essential to a usable system. In designing public transport interfaces, other sections of this guide are relevant, such as those covering crossfall, footpath width and materials. Good practice for designing stops includes [10, 151]:

- making bus stops clearly visible, to avoid passengers missing their stop
- naming stops and shelters with locally recognisable names, to reduce confusion between passenger and driver, and to promote a sense in which the service is part of the local community
- ensuring that the stop or shelter is well lit, or located in an area that is generally well lit
- ensuring that stops and shelters remain unobscured by overgrown trees and foliage, or by other traffic signage
- ensuring the boarding point is laid at right angles to the through route for clarity, with clear details of its location provided by signage and tactile cues
- ensuring that boarding points are kept clear of street furniture and signage
- minimising changes in level between the waiting and boarding areas
- displaying a route map, timetable and real-time bus information at the stop
- minimising changes in level from footpaths to buses (kerb ramps should not be provided at the boarding point and the stop should be oriented so that buses can extend their entrance ramp (if fitted) to the footpath).

Photo 14.24 – Tactile paving at a boarding point, Christchurch (Photo: Paul Durdin)

Photo 14.25 – Bus stop, with tactile pavment arrangement, Subiaco, Perth, Western Australia (Photo: Tim Hughes)

Vision impaired pedestrians need to identify public transport access areas. This can be done by environmental cues, but tactile paving can also be provided. Tactile paving should comprise directional indicators that intercept the through route and lead to warning indicators close to the entry door. Tactile warning indicators should also be provided 600 mm from the edges of train platforms and ferry wharfs. For more guidance, see *Guidelines for facilities for blind and vision-impaired pedestrians* [92].

Footpath width needs to be considered carefully at public transport stops where a large number of pedestrians are expected to board or exit, such as at railway stations. Table 14.3 covers the maximum pedestrian volumes for different through-route widths that result in a level of service B. Where expected pedestrian volumes at public transport stops exceed those in the table for a given through-route width, refer to Fruin: *Pedestrian planning and design* [57].

Shelters

To maintain an unobstructed through route the likely number of passengers using a bus stop needs to be considered. At very busy bus stops and interchanges, shelters should be provided in a widened street furniture zone. To achieve this, kerb extensions may be required. Alternatively, shelters should be in the frontage zone.

Bus shelters should be designed so that:

- approaching traffic can see them clearly
- there is adequate lighting for security
- they have adequate seating
- they are protected from the weather
- they are resistant to vandalism
- there is adequate security (such as with multiple exits at enclosed shelters, and transparent walls)
- they are located near existing land uses that provide passive security.
- they are visually distinct from surroundings to aid visually impaired pedestrians [134].

Photo 14.26 – Bus shelter in street furniture zone (through route behind shelter), Christchurch (Photo: Aaron Roozenburg)

Photo 14.27 – Train station, Papakura (Photo: Megan Fowler)

Photo 14.28 – Tactile paving treatment at railway station, Fremantle, Western Australia (Photo: Tim Hughes)