Traffic calming

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01 Use of traffic calming devices

ROADS AND STREETS FRAMEWORK (RASF)

This sets out the process for planning a transport network.

It provides guidance on the strategic types of street and the functions and features to be expected in each street, together with modal priorities.

It also describes the process for resolving conflicts for priorities. This should be used to resolve the common issues around general traffic provision with other modes of transport.

URBAN STREETS AND ROADS DESIGN GUIDE (USRDG)

This sets out principles for design of the various urban street types.

Chapter 1 Design Principles These principles must be understood by all designers as the basis for decisions, and the approach to be taken in the design process. In particular, this sets out how safety must be incorporated in all design work.

Chapter 2 Neighbourhood Design focuses on design aspects of planned networks, either as a means of designing the relationship between land use and movement, or for evaluating the local design context for a specific street or place within a neighbourhood. It also includes guidance on environmental design within a neighbourhood.

Chapter 3 Street Users takes each user group in turn, and describes their needs, specific design principles and the features that can be provided for them. Having understood principles and context, this chapter guides the choice of elements for each user to meet the planned function.

Chapter 4 Design Controls deals with the issues of geometric design that need to be considered, to ensure that drivers of vehicles in particular are guided to behave reliably in the way planned for them, safely and efficiently.

Chapter 5 Street Types and

Chapter 6 Intersections can then be used to put the elements together in accordance with the design principles into street and intersection layouts that will effectively deliver the planned outcomes. Typical layouts are shown, not as finished designs, but to illustrate the design considerations required to fit elements together into the design of a whole place.

RURAL ROADS DESIGN GUIDE

This is to be developed later, to set principles for design of the various rural road types.

PURPOSE

Traffic calming devices are means to promote road user safety by limiting speed and diverting traffic. They are usually applied on local roads in residential areas, making a route less attractive for drivers seeking quick shortcuts ("rat runs") between higher-order routes which may be congested. They can also be applied across a residential area to maintain a low-speed environment to improve accessibility, safety and amenity.

Traffic calming can also be used in city, local and neighbourhood centres to improve safety and accessibility. Use on roads with high traffic flows requires special care.

Traffic calming devices include speed humps, road narrowing, signage and other measures. They may also provide additional landscaping opportunities on the road space reclaimed by the devices.

WHERE TO USE THEM

Not all traffic calming devices are suitable for all areas, so it is important to understand the desired outcome as well as the requirements and limitations of the particular street before developing the solution. They should generally only be used on roads with a posted speed limit of 50km/h or less. Roads with operating speeds higher than 60km/h should be redesigned or other speed management techniques should be used if speed reduction is required.

Traffic calming devices can either be constructed as part of new works or retrofitted to existing streets.

Traffic calming devices can be used in conjunction with other road geometry elements that have equivalent speed and volume control effects such as tight radius bends with deflection greater than 60^0.

BUSES

Bus routes have particular requirements, as highlighted throughout this document and specifically in Section 07.

DEPARTURES

Where any deviations from the standards are necessary, they must be clearly documented and must follow the AT Departures from Standard process.

ALL DEVICES HAVE TO BE APPROVED FIRST

All traffic calming devices must be approved by a resolution of Auckland Transports Traffic's Traffic Control Committee before they can be constructed.

STREET LIGHTING

All new traffic calming devices installed in the road corridor must have the correct road lighting treatment as per the requirements of the Engineering Design Code: Street Lighting.

02 Planning the use of traffic calming

ADVANTAGES AND DISADVANTAGES

When deciding whether to use traffic calming devices, it is important to consider the potential advantages and disadvantages.

Potential advantages	Potential disadvantages
• Better safety for road users, including pedestrians and cyclists • Fewer and less serious vehicle crashes • Reduced speed • Less commercial traffic and "rat runs", i.e. commuters taking fast short-cuts • Less heavy vehicle usage • Less noise • Less need for traffic enforcement • Improved street appeal through planting, furniture and reclaiming parts of the carriageway • Increased driver awareness that this is a local street and they should adjust their driving accordingly.	• Longer travel time for local residents • More noise from the acceleration and deceleration of larger vehicles • Increased fuel consumption and exhaust emissions from changing speed • Grounding of vehicles and potential damage, especially if devices are constructed incorrectly • An uncomfortable ride, particularly for bus passengers • Loss of kerbside parking space • Constrained access to nearby properties • Slower emergency service response time (Always consider this if the proposed works are on an emergency route.) • Resistance from residents • Shifting traffic problems to adjacent streets • Longer traffic queues • Difficulty for cyclists • High implementation and maintenance costs.

Careful planning, local public involvement and using the right devices in the right spots should minimise the potential disadvantages.

EFFECT ON THE WIDER NETWORK

Solving one street's problems in isolation may simply move the problems elsewhere, so it is important to consider the effect of traffic calming on the local network as a whole. However, there may be situations where traffic calming devices are required to provide for pedestrians at a specific location.

SPEED ENVIRONMENT AND PURPOSE OF TRAFFIC CALMING

Different planning approaches are required for different purposes.

A Safe Systems approach to making streets attractive for people who live, work or shop there, as well as those who pass through, will guide the choice of design speed.

Where inappropriate traffic use of a route is the issue, the target operating speed may vary. It may be sufficient to reduce operating speed to 50 km/h, with devices causing delay to through traffic or it may be necessary to reduce speed further, to make a route less attractive than the preferred alternative route or to restrict through movement, deterring outside users while still providing routes suitable for residents. Investigation must compare the calmed route with the preferred route, and with other routes that might receive displaced traffic.

For residential areas it is desirable that residents should have not more than 1500 m to travel at up to 30 km/h to reach higher-order roads with 40 or 50 km/h operating speed. Devices must be planned across the whole area to maintain consistency and not used in isolation.

For collector and arterial roads, the target operating speed may be 30, 40 or 50 km/h with preference for low speed in high-pedestrian use areas. This should be determined before commencing selection of appropriate measures to achieve the design speed by the correct application of the Auckland Transport Roads and Streets Framework.

ROAD ALIGNMENT AND BLOCK SIZE

Both horizontal and vertical alignment changes can create the visual impression that the street concerned is not intended as a fast through route, but rather for local traffic access only.

Width of road, forward visibility distance and visibility on approach to intersections all have relationships to operating speed. It is necessary to understand these factors before applying further design of measures.

WIDTH OF ROAD

A decrease in width of road from 8 m to 6 m is likely to reduce operating speed on a local road with some parking from 45 to 35 km/h with a maximum forward visibility of about 100 m. Road width should not exceed 6.0 m for local roads in residential areas, to minimise the additional design measures required.

FORWARD VISIBILITY

It is desirable to limit forward visibility to 100 m or less on local roads where low speed is required. Where this cannot be achieved by alignment or streetscape features, then additional design measures will be required.

The following charts demonstrate the effect forward visibility and seal width to speed:

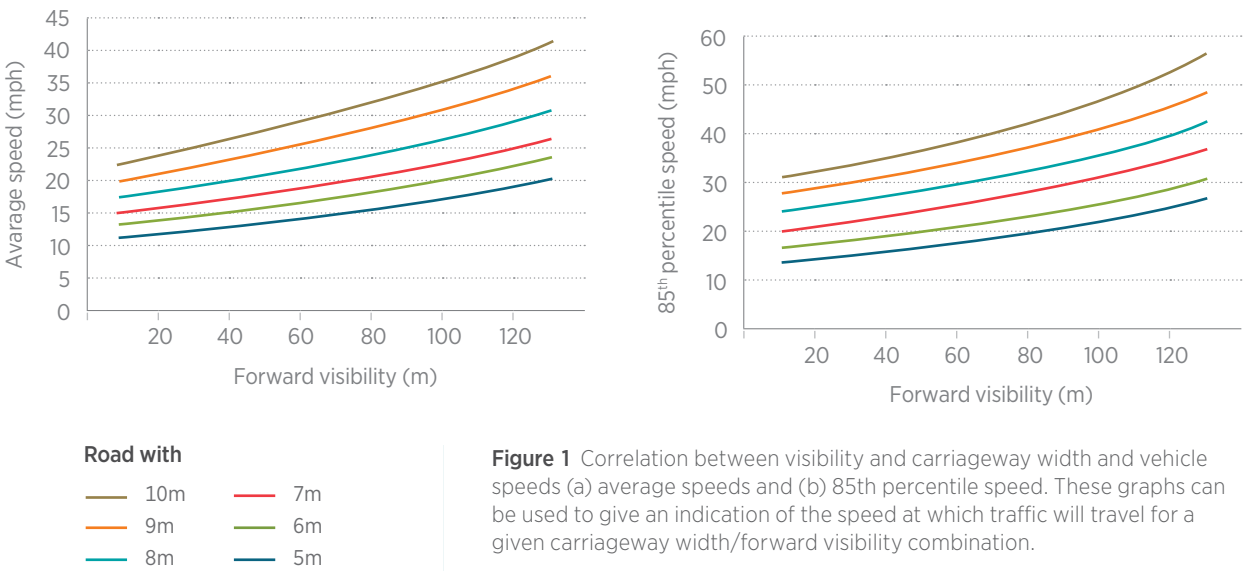


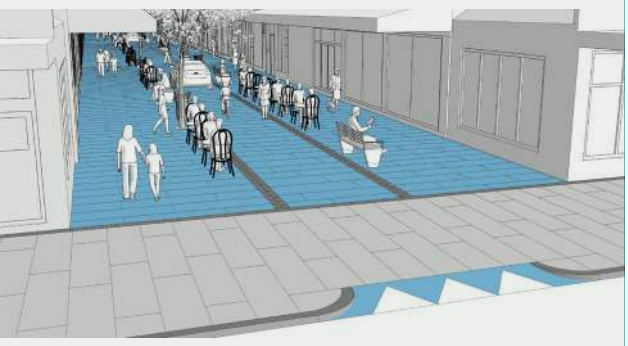
Figure 1 Correlation between visibility and carriageway width and vehicle speeds (a) average speeds and (b) 85th percentile speed. These graphs can be used to give an indication of the speed at which traffic will travel for a given carriageway width/forward visibility combination.

From UK department of Transport 'Manual for Streets' Fig 01 and 'TRL661 – The manual for streets evidence and research'.

SELECTION OF DEVICES

It is only through careful selection, combination and placement of devices that traffic calming is effective. Traffic calming can be implemented using three different types of control:

- vertical deflection (see Section 03)
- horizontal deflection (see Section 04)
- road markings/signage (see Section 05).



is the preferred approach to speed management on local and centre streets and neighbourhood and mixed use collectors as it has the following benefits:

- Vertical side friction
- Amenity planting within the buildouts
- Ability to limit forward visibility
- Reduced asset damage
- Less noise and vibration from larger vehicles
- SUV class vehicles can be controlled.

Vertical devices can be used where the existing network design is such that there is limited opportunities for horizontal deflection to be installed such as at driveways, existing crossings etc., or that the horizontal device would either be excessivly large or too small, e.g. 6 m or less if two way running is required or 8 m+ kerb to kerb.

Visual markings and signs can be used on all roads typologies and be used to further enhance installed devices, act as a gateway threshold treatment and to reinforce a change of place and environment. Often these take the form of coloured surfacings on the roadway, with small vertical gateway features opposite each other in the berm for example.

FACTORS TO CONSIDER

Each control type works differently. To make the correct choice, it is important to consider the potential road users, road function and the required level of service. Individual items such as road markings or signs often do not work in isolation and may require additional control types.

CALMING EFFECT OF INTERSECTIONS

An intersection can be considered as a calming device only if the entry radius is small. Any straight-ahead movement does not provide calming other than an approach to a priority control (Stop or give-way), so devices should be placed either side not more than the maximum effective distance apart.

Width of approach road and visibility along the major road both have a relationship to observed approach operating speeds. Limitation of both width and visibility are required before an intersection can contribute to managing speed.

Alternatively, a raised table intersection may be used as a device.

CALMING EFFECT OF BENDS

A bend which changes direction at least 70^0 with inside kerb radius not exceeding 26 m can be considered as a calming device for all speed environments.

Research in UK by TRL showed the following reductions in speed at bends, where v = approach speed (km/h), R = bend radius (m)

PERCENTAGE SPEED REDUCTION DUE TO BEND

V2/R	From 50%ile speed	From 85%ile speed
20	3.5	5
28	5	7
40	7	10
56	10	14
80	14	20

SPACING OF DEVICES

The spacing of devices should be fit for purpose. Performance is determined by the speed that a driver will pass through a calming feature, and how the distance to the next feature influences the increase and decrease of speed between features. the objective is to induce a reasonably steady speed that does not exceed the Design Speed for the street. Effective spacing usually ranges from 60m to 120m intervals. Spacing greater than these distances can be ineffective at reducing speeds and can increase noise and vibration. Where site constraints affect the spacing that can be achieved, it may be necessary to consider alternative devices that can maintain the calming effect of the total scheme.

DESIGN OPTION 1: SPEED BASED DESIGN

It is recommended that all traffic calming, and area traffic calming in particular, should follow the principles of Speed Based Design set out in Austroads Guide to Traffic Management Part 8: Local Area Traffic Management. This is also appropriate for designing new road layouts in residential development areas.

This allows different devices and features to be used in combination to achieve a consistent speed environment.

DESIGN OPTION 2: ACCEPTABLE SOLUTION

For simple road design, it may be sufficient to follow the maximum spacing guidance set out in the table below. Site conditions such as gradient or high traffic volume may require reduction of spacing, for which specialist advice should be sought. This solution only applies to roads not more than 6.0 m wide for 30 or 40 km/h and not more than 7.0 m wide for 50 km/h.

MAXIMUM SPACING OF DEVICES FOR SPEED ENVIRONMENTS

Type	Device	Spacing for 30 km/h (m)	Spacing for 40 km/h (m)	Spacing for 50 km/h (m)	Notes
Vertical	Speed humps (sinusoidal)	60	120	(2)	
	Raised tables	60	120	120 (3)	
	Raised Intersection	60	100	120 (3)	
Horizontal	Build-outs or side islands	(1)	(1)	40	
	Chicane (one lane raised)	100	120	(2)	When device design speed is at least 5 km/h below speed environment
	Chicane (one lane flush)	60	100	120	
	Chicane (two lane)	(1)	80	120	
	Traffic islands	(1)	(1)	120	
	Roundabouts	100 (4)	120 (4)	120 (4)	Distances only apply where roundabout operating speed is at least 10 km/h below speed environment on approach

Notes: Spacing applies to distance from another calming device. Where different devices have different spacing for the same speed environment, spacing should not exceed the average of the two distances.

1. Device not effective for this speed environment unless combined with other devices
2. Device not suitable for higher operating speeds
3. Using 1:20 ramps
4. For roundabouts only, spacing is to any adjoining device, as roundabouts have a greater zone of influence.

03 Vertical traffic calming devices

DESCRIPTION

Vertical calming devices change the height of a part of the carriageway to compel drivers to reduce their speed.

WHERE TO USE THEM

Vertical traffic calming is particularly suited to narrower streets, typically those with carriageways less than 10m in width kerb to kerb, or where the lane configuration reduces the effective width.

They are also well suited to roads used for on-street parking, as vehicles can still park on top of the device.

LOCATION

Vertical traffic calming devices should typically be no closer than 10m to an intersection except as part of an intersection treatment in which case the device must be placed on the user desire line, with the leading ramp at or close to the major road channel line and not be within 1m of a driveway. However, specific site issues, including tracking, should be considered. Suitable forward visibility for the operating speed must be provided on bends. Approach sight distances should be maintained to each oncoming device to meet Austroads standards.

ROAD MARKINGS

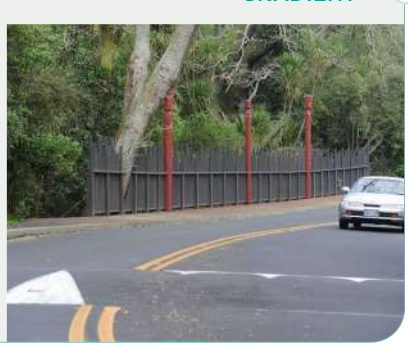
Where road markings coincide with the position of a vertical device, they must be continued on the device. The reflective road marking must have anti-skid properties and be of a suitable hardwearing material.

VERTICAL TRAFFIC CALMING DEVICE DESIGN STANDARDS FOR NON-BUS ROUTES

Route	Device Type	Maximum Ramp Approach Gradient	Maximum Height (mm)	Minimum Length (m)	Notes
No bus service	Speed cushions	1:8 (1:5 side)	75	3.0	Cushion width: 1.9m
	Raised tables	1:15 or 1:10	75 or 100	4.0	Gap between cushions: 0.75m
	Speed humps (sinusoidal)	-	100	3.7	Gap cushion to kerb: 1.0m desirable, 1.1m maximum
	One-way (Swedish) tables	1:10 approach, 1:40 exit	100	2.0	

3.1 Speed humps

GRADIENT



A speed hump with a sharp gradient is useful at slowing vehicles down, but the sudden change in gradient can cause increased noise and vibrations, especially from trucks or buses. A sinusoidal speed hump has a gradual change of gradient and is designed to lead the vehicles to the hump in a smoother motion, but it is not as effective at slowing vehicles down. A sinusoidal profile is more comfortable for people on bikes. It is important to take the longitudinal gradient of the road into account, as this will affect the exit sides of the hump and the wrong choice can lead to the underside of vehicles scraping on the ground.

NOISE

Local noise and vibration may affect nearby residents. Design must achieve the desired result with the minimum adverse effects.

VISIBILITY

Speed humps must be clearly visible to approaching drivers. Use the correct road markings and well-placed street lights. The first hump in each direction, especially, must be easily identifiable, so approaching drivers know they are entering a controlled environment.

POSITION

Speed humps should be installed at right angles to the path travelled by vehicles and should extend as close to the kerb as possible, but with a sufficient opening for drainage.

BUSES

Speed humps are not recommended for bus routes.

TECHNICAL SPECIFICATIONS

Speed humps are generally sinusoidal in shape, 100mm in height and must have a longitudinal length of 3.7m and spaced fit for purpose, typically not more than 80m apart.

SEE PLANS

Speed humps should be constructed as shown in plan TC001.

3.2 Raised tables

DESCRIPTION

Raised tables have a level surface that is easier for larger vehicles to negotiate and for pedestrians to cross at. The devices generally have a flat surface and are generally to sit flush with the kerbs. They are mainly used at intersections or crossing locations. At other locations, the edge may taper to a drainage channel as long as it's clear that this is not a desired crossing location.

INTERSECTION TABLES

At raised intersections, tables generally extend a little beyond the intersection so that ramps can be positioned away from the crossing points and clear of intersection corner radius.

To ensure speed management benefit, the overall length of a raised intersection table should be minimised.

Corner curves should be reduced to their minimum, to enable pedestrian crossing points to be kept close to the intersection. Corners should be clearly defined, with at least 65 mm high kerb except at kerb crossings to guide pedestrians. Traffic lanes flush with footpath should not be used unless pedestrian priority and tactile indication of safe pedestrian routes is provided. Bollards may aid traffic guidance and footpath protection.

Width should be not more than one traffic lane in each direction.

SIZE – MID-BLOCK

At any other location, the flat area of the raised table is generally 4m, or 6m to allow larger vehicles to negotiate the device more easily and create less discomfort for those on board.

GRADIENTS

Ramp gradient (and table spacing) can be varied to achieve differing speed reduction effects. The design must be based on the context of the surrounding environment and the gradients can be changed to suit. The maximum ramp gradient allowed on any road is 1:10.

ALIGNMENT

Ramps must be aligned at right angles to vehicle paths as far as practicable.

ONE-WAY TABLES

One-way (Swedish) tables can be used on one-way traffic lanes, usually divided by a median, traffic island or splitter island. This type of ramp is suitable for roundabout entries and exits.

The height is normally 100 mm.

The approach ramp is 1.0 m long (1:10 grade), or 2.0 m (1:20 grade) for bus routes.

The table top can be reduced to 2.0 m minimum, but usually not less than 3.0 m where pedestrians cross.

The departure ramp is normally 4.0 m long, or the road surface may continue flush with the table top on the departure side.

BUSES

The appropriate dimensions of any raised table are dictated by whether the road is or is likely to be on a bus route. Raised tables are not generally preferred by bus operators. Consult with Auckland Transport's Chief Engineer if the proposed location of a raised table is on a bus route. Raised tables should ideally not be located close to bus stops, since passengers may be standing up on the vehicle before getting off the bus. If the raised table is to be on a bus route, the top of the device should be at least the length of the wheelbase of the longest bus likely to use the road. The length of the flat section should be a minimum of 6m. Ramp Gradient should be 1:20, which will affect the speed reduction achieved by the device, and height of table should be 75 mm. Where practicable, consider use of One-way (Swedish) tables, where the gentle exit grade change does not require an extended table top. See Section 8.

EMERGENCY VEHICLES

If the road is not a bus route or likely to become one, then the top of a road table can be reduced to a minimum of 4m, to accommodate the wheelbase of the largest emergency vehicle.

HEAVY VEHICLES

If the raised table is to be installed on a route that takes a larger number of heavy vehicles or on a four-lane route (e.g. arterials through town centres), its design needs to address aspects such as cracking, rebar content, joint spacing and shear connections, as these will impact on the constructability of the table and the overall cost to the project.

CONSTRUCTION

Speed tables should be constructed as shown in Plans TC003, TC004 or TC013. 25 MPa concrete with mesh reinforcement requires time to harden before traffic is introduced. 50 MPa concrete with fibre reinforcement can harden sufficiently for traffic in a much shorter time.

CYCLES

If a raised table is constructed on a cycle route and is not intended as an informal crossing facility, the table could be constructed with cycle bypasses.

ONE-WAY TABLES

One-way (Swedish) tables can be used on one-way traffic lanes, usually divided by a median, traffic island or splitter island. This type of ramp is suitable for roundabout entries and exits.

- The height is normally 100 mm.
- The approach ramp is 1.0 m long (1:10 grade).
- The table top can be reduced to 2.0 m minimum, but usually not less than 3.0 m where pedestrians cross.
- The departure ramp is normally 4.0 m long (1:40 grade), or the road surface may continue flush with the table top on the departure side, with a grade difference not more than 1:40 from the approach grade.

PEDESTRIANS

Raised tables may be interpreted by pedestrians as formal pedestrian crossings. This can lead to unsafe use of the crossing point, as pedestrians assume they have right of way. To avoid this, such uncontrolled crossing points should be constructed from a material of an appearance and colour clearly distinguishable from the footpath.

Features such as berm planting alongside a raised table may be used to avoid inappropriate crossing.

If a raised table is meant to be used as a pedestrian crossing, tactile paving should be used to differentiate the crossing point from the carriageway. Tactile paving represents a physical warning to the visually impaired that there is a dropped or flush kerb. Therefore yellow pigmented concrete tactile paving slabs should be provided on the footway at the kerbside of all raised tables that are designed for pedestrian use. Directional indicators may be needed to guide users along a flush edge of footpath to warning indicators at crossing points. The table top should have a grade of 2% or less at right angles to the path of pedestrians where possible.

A pedestrian crossing, or combined pedestrian and cycle crossing, may be installed on a raised table with all approriate signs and markings.

Do not use signs indicating pedestrians should give way to traffic, or motorists have right of way.

RTS14

All tactile ground surface indicators should be laid out as outlined in NZTA RTS14.

DRAINAGE

If a raised table spans the entire width of the carriageway, the drainage channel will be blocked. Full-width tables should only be installed where little or no road catchment drains towards them unless adequate road drainage is installed at the ramp. Where there is a catchment, primary and secondary drainage should be considered and documented in the design report. Take care to avoid the risk of flooding to adjoining habitable floors and pedestrian routes.

Drainage can be:

- Upstream catch pits must be used for large catchments if within 50m of a surface water system
- Drainage by-pass channels can be constructed as a replacement to the road channel for small catchments.

* Combined kerb and channel blocks can be used to collect surface water on the upstream approach, and continue past to discharge either to the road channel, or to a CP or other device beyond the table.

Catch pits are preferred, as a channel can be blocked by detritus and other materials.

ROAD DRAINAGE CHAPTER

The Road Drainage document of the Engineering Design Code has further details on road drainage catchment and the methods used to control the catchment.

3.3 Speed cushions

DESCRIPTION

Speed cushions take the form of a rectangular table with tapered edges that occupies only part of the road width and allows vehicles with a larger wheel track to straddle the cushion, while vehicles with a smaller wheel track must drive over the edges of the cushion.

WHERE TO USE THEM

They are not effective in reliably slowing vehicles, especially SUVs, on their own. They should be used only to influence the direction of vehicle movement in conjuntion with horizontal calming features, such as chicanes, narrowings and approaches to roundabouts.

LATERAL SPACING

The cushion's lateral spacing must be considered carefully. If the gap is too wide, vehicles might pass through without being affected by the cushion. If it is too narrow, it will force the larger vehicles onto the cushion, increasing the potential for noise and vibration and potential damage to the road surface on the exit side of the cushion.

Clear distance to kerbside parking or other obstructions is also critical to ensure vehicles can follow preferred path straddling cushions.

ALIGNMENT

The long axis of speed cushions must be aligned parallel to vehicle track. Care is needed to ensure that space is provided for horizontal deflections to align vehicles with cushions.

BUSES

Speed cushions may be used in conjunction with horizontal measures to avoid vertical feature discomfort for buses, but the tracking path of front and rear axles must be checked. This is significant on entries to turns, and where on-street parking may affect vehicle paths.

TECHNICAL SPECIFICATIONS

The maximum height of a speed cushion is 75mm with an optimum width of 1.9m - 2.0m and a gradient of 1:8 at the leading and trailing ramps. Side ramps should be 1:5 ramp. The gap between cushion and kerb and between adjacent cushions should ideally be 1.0m, and no less than 750mm.

If a single cushion is used in a single lane section of road, the gap between kerb and cushion must be 750 – 1000 mm on each side.

SEE PLANS

Speed cushions should be constructed using:

- Pre-made rubber cushions bolted into the road surface (see Plan TC006) or
- Asphaltic concrete or concrete. (See Plan TC007.)

CONCRETE PREFERRED

Asphaltic concrete or concrete cushions are harder to construct than rubber cushions and care must be taken when designing the ramp gradients. However, they are the preferred choice of cushion, because the costs to install and maintain the device are lower.

AUTHORISATION

Rubber or polymer cushions require a road surface with sufficient depth and strength to anchor the bolts. Authorisation from Auckland Transport Chief Engineer is needed before installing rubber speed cushions.

04 Horizontal traffic calming devices

DESCRIPTION

These devices refer to the horizontal realignment of the kerb line over a short length of road. This is generally achieved by kerbside islands and/or central islands. Horizontal changes may incorporate vertical deflection devices described in Section 03 above. Traffic flows can be restricted to one-way flows at the device.

CYCLES

When narrowing the carriageway with horizontal displacement devices, cyclists need to be considered, as they are particularly vulnerable at pinch points. If the device narrows the carriageway suddenly, it can often leave a cyclist and another vehicle competing for the same road space. Should a narrowing of the carriageway be required, particularly on high-traffic roads and roads with design speed greater than 30 km/h, a minimum clearance of 4.2m kerb to kerb should remain. Otherwise, a bypass or other safe alternative should be provided for cyclists.

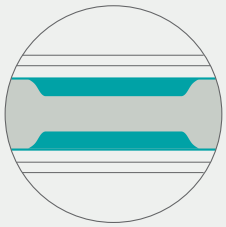
When horizontal devices are used in low-traffic residential local roads in 30 km/h speed environment, 3.0 m kerb to kerb width may be appropriate as cyclists will be able to proceed without risk of cars passing them.

4.1 Road-narrowings (including build-outs and chicanes)

DESCRIPTION

A road-narrowing is a device that narrows the road between two kerb lines. These often take the form of two build-outs constructed on opposite sides of the road, with the minimum allowable carriageway width maintained through the narrowing.

WHERE TO USE THEM



These controls are difficult to place without adversely affecting drainage, street frontages or on-street parking. Road narrowings are good for locations where speed is a problem, but the noise and vibrations associated with vertical deflection measures would be unacceptable. They may be used with speed cushions to manage vehicle paths, either in the narrow section, or in the traffic lanes either side.

TWO-DIRECTION OR SINGLE-DIRECTION TRAFFIC

Road narrowings can be designed for two-direction or single-direction traffic flow, with alternating give-ways if used in series along the road. Such give-ways tend to deter through-traffic. Road narrowings work best where the flows in each direction are relatively balanced. If the traffic volume in one direction is too low, there could be little opposing flow to force drivers to give way. If this is the case, the horizontal deflection is required to provide the desired speed reduction without relying on the effect of opposing flow.

TECHNICAL SPECIFICATIONS

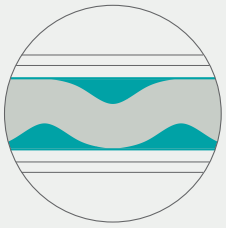
Road narrowings should be designed so that the traffic is channelled safely into the remaining carriageway space. The angle by which the vehicle should deviate is generally between

15 and 45 degrees from the original path, producing speeds below 50km/h. The length of the build-out should not exceed 10m. The remaining width should be suitable for the types of vehicles expected along the road.

Tracking for a vehicle of suitable design should be undertaken to ensure that the vehicle movements into and out of adjacent driveways are practical. Where appropriate, allowance should also be made for trailers. The design and check vehicles should be those approriate for the site.

4.1.1 Build-outs or side islands

DESCRIPTION



Build-outs or side islands are usually placed opposite each other, with give-way signage on the approach that does not have priority. The gap left by the extensions to the kerbs protruding into the road can either be angled or parallel to the centreline of the road. If two-way flow is permitted, a central median island may also be included to separate opposing traffic. This will also provide greater visual restriction, as well as providing a pedestrian refuge.

Side islands allowing two-way traffic should only be used in conjunction with other horizontal or vertical deflection devices for traffic calming, as they will not reduce operating speeds on their own. They may be used with speed cushions to manage vehicle paths, either in the narrow section, or in the traffic lanes either side.

CYCLES

If the remaining lane width cannot be at least 4.2m wide, it is advisable to provide a gap along the original kerb line to allow cyclists to bypass the build-outs on high-traffic roads. This is discretionary on local streets or roads with a low number of vehicles per day and low speed (<30km/h).

PEDESTRIANS

Narrowing the carriageway has the added benefit of bringing crossing points closer together for pedestrians, especially those that have difficulty in walking, as they can cross more quickly. For this reason, they often make good sites for pedestrian crossings.

PLANTING

Planting depends on safety and visibility. See Pedestrian and Public Realm Chapter.

SEE PLANS

Plan TC009 and Plan TC010 show typical planted side islands and details.

4.1.2 Chicanes

DESCRIPTION

Chicanes follow a similar principle to build-outs, but they differ by being staggered on opposite sides of the road, rather than being directly opposite each other.

USING PARKING AS CHICANES

Chicanes can also be created by alternating on-street parking, either diagonal or parallel, between one side of the road and the other. To protect the parked vehicles, each set of parking bays can be created by installing raised, landscaped islands at their ends.

OVER-RUN AREAS

It is possible to use over-run areas to allow larger vehicles to negotiate tighter chicanes than would normally be allowed.

BUSES

If school or service buses are expected to use a road, care should be taken to provide buffering between kerb and footpath where front overhang may track.

4.2 Traffic islands

DESCRIPTION

Mid-block traffic islands can be used as part of a physical narrowing of the road by reducing the available carriageway. They can also serve as pedestrian refuges. Used on their own, their traffic calming effect is limited, but they can be effective as part of an overall traffic calming scheme.

CYCLES

The design of pedestrian refuge or traffic islands must take the width of the remaining carriageway into account. If the distance between the kerb and the traffic island is between 3.2m and 4.1m, this can be detrimental to cyclists, as it is too narrow for a vehicle to safely overtake cyclists. The context will determine the importance of providing the appropriate width, e.g. whether it is a high-traffic road or a quiet local street.

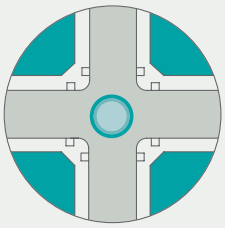
Where the lane width is less than 3.2m, a cycle bypass should be considered on highly trafficked routes. A lane width of 4.2m or greater provides sufficient space to allow vehicles to overtake cyclists.

PEDESTRIAN REFUGE ISLANDS

For more information on the design of pedestrian refuge islands, see Footpath and Public Realm document in the Engineering Design Code.

4.3 Roundabouts

DESCRIPTION



While roundabouts are general traffic management tools at intersections, they can also be a useful traffic calming tool when used with single-lane entries and exits to and from the circulatory path. They can reduce vehicle speeds, reduce the number of conflict points, and the central roundabout island increases the visibility of the intersection. Roundabouts used in traffic calming schemes may require over-run aprons for larger vehicles to achieve a speed reduction for cars.

They can be effective when used in conjunction with other devices at appropriate spacing.

CYCLES AND PEDESTRIANS

It is important to consider transport modes other than cars when planning roundabouts, as traditionally designed roundabouts tended to be poor pedestrian and cyclist routes. With careful design, roundabouts can accommodate all road users safely.

SPEED

The ideal design for a traffic calming roundabout is one that requires vehicles to slow down to 25km/h or below to cross safely. They should be designed with small enough entry radius to force the vehicle onto the circulatory path, preventing a direct path across the roundabout. One-way speed tables may be used at entries or exits where vehicle paths do not reduce speed sufficiently. Speed cushions may assist in guiding the approach path of vehicles.

SEE ALSO

For further details on the design of roundabouts, see Urban and Rural Roadway Design document in the Engineering Design Code.

4.4 Intersection modifications

DESCRIPTION

Sometimes an intersection is too complex to change its nature by the use of new signs and road markings. Alternative treatments such as roundabouts may also not be appropriate. In such situations, consider modifying the intersection by relocating kerbs or constructing kerbs, median or channelling islands, or a combination, so that the path of the major road through the intersection is clearly defined. Alternatively, a raised platform could be constructed to maintain slow vehicle speeds and improve safety and crossing locations for pedestrians.

KERBLINE AT CORNERS

Reducing speeds at an intersection can be achieved by changing the kerb corners to a tighter layout. This will have the effect of forcing vehicles to slow down, as they will not be able to make the turn at a higher speed.

SPLITTER ISLAND

The installation of a splitter island on the approach arms can also narrow the intersection, forcing the vehicles into a narrowing at the point where the arms of the intersection meet, again slowing vehicles down, as well as providing a pedestrian refuge. However, entry and exit lanes may need to be wider for large vehicles to turn, so splitter islands are rarely preferable to tight corner kerblines.

ENTRY THRESHOLD

Where there is significant pedestrian activity, a raised table entry threshold may be used. This may be with or without a refuge splitter island. Attention needs to be given to the traffic conditions on the major road to ensure that speed reduction to make a turn is not sudden, leading to crashes. A speed environment of 50 km/h or less is likely to be necessary for a busy pedestrian street.

The toe of the ramp may maintain the line of the major road kerbline, or be set back so that the top of the ramp is 2 – 6 m from the major road kerbline.

Where pedestrian activity is low, a flush entry threshold with colour or paving difference may be more appropriate, with a calming feature between 6 and 40 m from the intersection continuity line.

SEE PLANS

See Plan TC011 for an example layout.

05 Volume reduction devices

DESCRIPTION

A series of horizontal or vertical calming devices may encourage drivers to choose other streets, thus reducing volume of traffic on streets with traffic calming. This may not be sufficient to reduce undesirable traffic volume, especially where a low speed local street still offers a quicker route than a congested arterial road, for example.

Volume reduction devices prevent certain vehicle movements, so that streets only carry vehicles requiring access to properties within the local neighbourhood. Other speed reduction devices may also be needed on these streets.

They generally include kerbing, and vertical street furniture to limit vehicle movements, with regulatory signs as needed.

Not all movements or all users need to be controlled, for the exclusion of sufficient vehicles to reduce traffic to the desired maximum.

ALTERNATIVE ROUTES

The local street network must be analysed and planned, to ensure that accessibility to land uses is achieved, while limiting undesirable through traffic. It is also necessary to ensure that traffic is not displaced onto other local streets more than is desirable for those streets.

PEOPLE ON BIKES

It is generally desirable to provide safe means for people on bikes to make the turns that are prohibited for other vehicles. Volume reduction is often useful to reduce traffic on cycle routes, to make them safe.

BUSES

In some cases, bus priority gates may be used to prohibit other traffic from making a turn while permitting buses to pass.

EMERGENCY VEHICLES

The local network must allow ready access to emergency vehicles. Mountable kerbs for emergency access routes may be incorporated. Demountable bollards are not desirable on emergency response routes, so means of avoiding unauthorised movements must be considered.

5.1 Diagonal diverter

DESCRIPTION

A diagonal diverter breaks a standard four-way intersection into two opposing left or right-turn corners. The diagonal diverter can be accomplished with full kerbing and paving, though small islands are also possible. On-street cycle access is enabled via a gap in the centre of the intersection or via widened ramps at the formed corners. Footpaths remain the same as a conventional crossroads.

DESIGN CONSIDERATIONS

- Tracking for Design and Check vehicles must be used to design diverter layout.
- In greenfield development, it is easier to achieve this layout with a slight stagger of two streets, to allow space for the diverter tracking paths.

- Visibility must be checked for tight bend conditions, especially on existing intersection approaches that were formerly give-way.
- Parking should be controlled on the approaches, to ensure safe vehicle paths are protected.
- Provides good opportunity for landscaping. Native and low maintenance plants are recommended.
- Consider the pedestrian desire for a diagonal crossing and provide for it.

5.2 Median barrier

DESCRIPTION

This limits vehicle entry to a street by eliminating right turns from the through street – usually a major cross street–by installing a raised traffic island. The island also eliminates right turns from the side street, making it operate as "left in, left out" only.

It prevents vehicle movements straight across the major road.

Gaps are retained for pedestrian and bike crossings. This allows users on foot or bike to cross while focusing on one direction of traffic at a time (two-stage crossing).

May be used where a cycle route crosses a collector or minor arterial street; on wide roadways with multiple lanes of traffic or few gaps in traffic to allow two-stage crossings; where vehicle movements across the major road are undesirable; where right turns to or from the side roads would result in unwanted traffic volume.

DESIGN CONSIDERATIONS

- Effective when located between signalised intersections, as the signals create gaps between waves of motor vehicles.
- Opportunities for U-turns, or right turns rom the major road at nearby intersections may be needed for local network accessibility in some cases.
- Opportunities for landscaping

5.3 Vehicle road closure (Cul-de-sac)

DESCRIPTION

Closure of the minor leg of an intersection to motor vehicles. Where space is available and the street network is sufficient, forming a cul-de-sac is the most effective solution at reducing motor vehicle traffic volumes along the street.

Paths for people on foot or bike provide access for them.

Additionally, a cul-de-sac can be planted to improve the amenity of the street.

Typically placed on minor streets at an intersection with a major street, to manage motor vehicle volumes on the minor street.

This treatment may also be used to reduce the number of intersections on an arterial road for safety and efficiency.

A closure may enable a pedestrian or cycle crossing to be installed on the major road to serve a significant desire line, or a bus stop.

DESIGN CONSIDERATIONS

- Special consideration should be given to service vehicles to allow them to turn around in the turning head provided.
- Where the street block is very short, and property access allows waste collection from other street frontages, a turning head may not be necessary.
- Provides good opportunity for landscaping. Native and low maintenance plants are recommended.

5.4 Half road closure

DESCRIPTION

Remove through traffic in one direction from a street by closing off either the inbound or the outbound lane at an intersection. A traffic island is placed near the centreline with a gap between the island and kerb extension to permit bicycle access.

DESIGN CONSIDERATIONS

- Not suitable for streets that have bi-directional bus routes.
- Can be combined with a pedestrian crossing or threshold treatment to provide additional traffic calming
- Consider pedestrian desire lines

5.5 Driveway link

DESCRIPTION

Driveway links take the form of a single-lane two-way meandering road extending over the length of two or more property frontages. They are an extended form of a slow point that generally provides a greater visual and physical impact on the street and the amount of traffic using it. Passing points may be required along the link if it is either very long or it is curved such that approaching drivers cannot see to the far end. Driveway links are particularly effective in reducing through traffic.

DESIGN CONSIDERATIONS

Driveway links should be located either close to intersections or where vehicles accessing properties can easily turn.

Consideration needs to be given to maintaining drainage paths and providing bypasses for bicycles where possible.

Driveway links often incorporate extensive landscaping and care needs to be taken that sufficient sight distance is retained.

Paving materials should contrast with the adjacent street surface.

Vehicle crossings to properties within the link must be specifically designed to be safe, and to give desirable access to and from the adjoining streets.

It is appropriate to use driveway links where:

- there is a high proportion of through traffic
- full or partial road closures are not appropriate
- vehicle speeds on a street are less than 50 km/h
- the resulting traffic volume will be low (not more than 1000 vehicles per day) otherwise congestion and crash risk may increase
- there is a need to break long, straight lines of sight.

It is inappropriate to use driveway links on:

- bus routes
- routes leading to emergency facilities, e.g. a hospital.

06 Signs and visual effects

ADVANTAGES AND DISADVANTAGES

Signs and markings are cheaper to install and maintain than the vertical or horizontal deflection devices described above, but are often not as effective or self-enforcing. Some road users may ignore them.

6.1 Signs

6.1.1 Prohibited movement signs

PURPOSE

If a local street is between two or more collector or arterial routes, it may often be used as a "rat run" to avoid congestion further in the network. Prohibited movement signs can be used to ban certain movements to reduce the effect of peak traffic movements and speed. They include:

- No Right Turn
- No Left Turn
- Turn Left
- Turn Right
- No U Turns
- No Turns
- No Entry (e.g. one-way street).

PART OF WIDER SCHEME

Like most sign-based schemes, prohibited movement signs should only be installed as part of a wider traffic calming scheme. The acceptance of these signs depends on the driver, and enforcement can be an issue should drivers flaunt the ban. Any bans need to be considered holistically, as bans may increase traffic in other places that could be less safe.

CYCLES

It is also important to consider the routes that cyclists use when prohibited turn bans are implemented. While a turn ban or entry restriction might not have a detrimental effect on a motor vehicle, it could significantly increase the distance for a cyclist to negotiate the intersection. In such situations, it might be wise to consider the use of contra-flow cycle lanes, as these would allow the cyclist to use the intersection as intended, while restricting motor vehicle access.

6.1.2 Speed hump and raised table signs

VISIBILITY

Any vertical deflection device needs to be easily identifiable by the reflective marking on the device and with preceding signs that are visible to oncoming drivers.

SIGN REGULATIONS

The NZTA Traffic Control Devices Manual states that the sign PW-39 (hump sign) should be used on the approach to each device and placed approximately 60m from the device for driver visibility. When the PW-39 sign is used, it must also be used with the PW-25 (advisory speed) sign to indicate the recommended speed limit for negotiating the device. No other signs may be placed on the sign pole with the PW-39 and PW-25 signs.

6.1.3 Give-way signs and markings at single-lane narrowings

SIGN REGULATIONS

Give-way signs and markings should always be installed at single-lane two-way features where peak traffic flow is significant or where speed environment exceeds 30 km/h. Absence of defined priority direction can be a beneficial feature in speed environments of 30 km/h or less, encouraging greater driver attention.

6.1.4 Signs at roundabouts

SIGN REGULATIONS

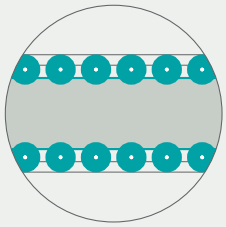
Clause 10.4(2) of the TCD Rule states that "If a single lane roundabout has safe and appropriate engineering measures installed to slow vehicles and the measured mean operating speeds on the approaches to and through the roundabout are 30 km/h or less, the roundabout may operate without signs, signals and road markings described in Clause 10.4(1).

Signs and markings should only be omitted:

- if a roundabout is within a 30 km/h speed environment
- peak traffic flows are low
- the roundabout is clearly visible, and
- there is low risk of abuse by right-turning vehicles.

6.2 Visual narrowings

DESCRIPTION



Traffic calming a road can be combined with other techniques to create a visual perception of a narrow, multi-use carriageway in an effort to reduce speeds and increase driver attentiveness. Treatments such as additional street trees, lamp posts, street furniture, special paving treatments or roadway markings and even cycle lanes may create a perception of a narrow carriageway without physically narrowing the road.

The effectiveness of these treatments in lower speed environments has still not been fully tested, but completed works around Auckland seem to be producing positive results.

Street trees may be used within traffic islands to produce this effect, but only in combination with other traffic calming devices close by for design speed of 30 km/h or less.

VISIBILITY

It is important that visibility for pedestrians and cyclists is still maintained after any treatment. The use of low-level planting or setbacks can help achieve this.

PAVING MATERIALS

The use of contrasting paving materials might also enhance the functional separation of different portions of the roadway. For example, different paving treatment from that used for other lanes might emphasize a cycle lane and increase drivers' perception that cyclists should be expected.

LANDSCAPING

See Footpath and Public Realm document in the Engineering Design Code for planting for use in local area traffic management.

07 Entry/gateway treatments

PURPOSE

At the beginning of all traffic calmed or slow-speed zones, an entry or gateway treatment should be applied to indicate that the area is calmed and that drivers must proceed with more caution and at a slower speed.

ELEMENTS

These treatments can consist of many different features, e.g. a narrowing, a raised table or signage. Entry features must be highly visible to clearly identify the area as a slower speed environment.

In areas where driver compliance is a concern, multiple treatments could be applied to accentuate the slow-speed environment.

ACCOMMODATE OTHER ROADS

Where a vertical deflection device is utilised as the gateway treatment, this should be designed to accommodate the function of the major road. For instance, if the treatment is on a side road, it should be designed so that a vehicle can turn off the major road without disrupting traffic flow.

08 Traffic calming on bus routes

SPECIAL CONSIDERATION FOR BUSES

Bus services operate to a timetable, making reliability and frequency important if customer confidence is to be maintained. This is particularly important in the context of Auckland Transport's Public Transport Network Plan. An accumulation of traffic calming devices can lead to excessively increased journey times for buses.

OTHER MEASURES

If buses are the predominant cause of excessive speeds, non-engineering interventions such as a review of the bus timetable in consultation with Auckland Transport's relevant Service Planning Team should be considered first.

HORIZONTAL DEFLECTION PREFERRED

Should traffic calming devices be needed, please bear in mind that bus operators prefer horizontal deflection measures (e.g. directional changes and road narrowing), self-explaining measures, speed cameras and vehicle activated signs, rather than vertical deflection measures (e.g. speed humps).

PROBLEMS WITH RAISED DEVICES

Problems associated with raised devices include:

- Discomfort to drivers and passengers due to jolting when a bus traverses a device. Buses typically have stiff suspension. Speed humps cause a double thump effect when buses traverse the hump, one for each set of wheels
- Safety issues, as passengers may be standing or moving around the bus, e.g. to get off
- Increased wear and tear, grounding, damage and maintenance costs to buses

- Speed humps have a more severe effect on buses than on cars, which can result in the reduced attractiveness and commercial viability of bus travel
- The extra acceleration and deceleration associated with vertical deflection devices can lead to increased exhaust emissions.

SPEED TABLES

Where horizontal measures cannot be used to provide the required speed management, then raised tables may be required. Likely uses may be at pedestrian crossings, intersections with a straight approach and through path, and low-speed streets with high pedestrian activity.

One-way (Swedish) tables are preferred on bus routes, as the speed management is achieved by an approach ramp only, with minimal effect from the exit ramp.

NO SPEED HUMPS

Speed humps therefore do not have a suitable profile for use on bus routes. Speed humps should not be installed on bus routes.

Speed cushions may be used in conjunction with other horizontal features to influence vehicle path approaching or at the feature. When used on a bus route, the tracking path of the Design bus must be checked to ensure that a bus can pass with front and rear axles centred over the cushion.

Speed cushions should ideally not be located near bus stops or intersections, mainly to ensure that buses can approach them at the correct angle. This is particularly important, as many passengers leave their seats to get off before the bus stops. If a bus transverses a hump near a stop, there is a much higher risk of passenger injury.

In most cases, parking near the device has to be restricted to allow the right tracking for buses, as well as visibility and the safety of other road users. To prevent parking, it is best to use build-outs rather than yellow lines.

Adequate warning of speed cushions is also needed if buses are to straddle them properly.

CONSIDER ENTIRE BUS ROUTE

When installing vertical deflection devices, it is important to take into account what is already installed on these bus routes. Consult Auckland Transport's Public Transport Planning and Operations Departments about this. Where a bus route has more than ten speed cushions or five speed tables already, other methods of traffic calming should be used where possible to avoid additional effects to bus service reliability.

TECHNICAL SPECIFICATIONS

Speed cushions should be no higher than 75mm. However, raised tables are acceptable on a bus route that passes through a town centre, a low-speed school zone or other areas of recognised high pedestrian frequency. In these instances ramp gradients should not be steeper than 1:20 and table heights should not exceed 75mm.

VERTICAL TRAFFIC CALMING DEVICE DESIGN STANDARDS FOR BUS ROUTES

Route	Device Type	Max Ramp Approach Gradient	Max Height (mm)	Min Length (m)	Notes
Rapid Transit Network	None (speed cushions only in exceptional situations)	-	-	-	Typically not permitted (see speed cushion design standards below)
Frequent Transit Network	One Way (Swedish) tables	1:10 (1:40 departure)	100	3.0(1)	
	Raised Table	1:10	100	6	
	Raised Table	1:15	75	6	Can only be used if a departure from standard has been approved.
	Speed cushions	1:8 (1:5 side)	75	3.0	Cushion width = 1.9m Gap between cushions = 0.75m Kerb to cushion gap = 1.0m desirable Kerb to cushion gap = 1.1m max
Bus routes through low-speed zones	Raised tables[1]	1:10	75	6.0	Town centres Outside schools High pedestrian frequency areas (intersections, mid-block & pedestrian crossings)

[1] See section 03 for One-way speed table dimensions suitable for buses.