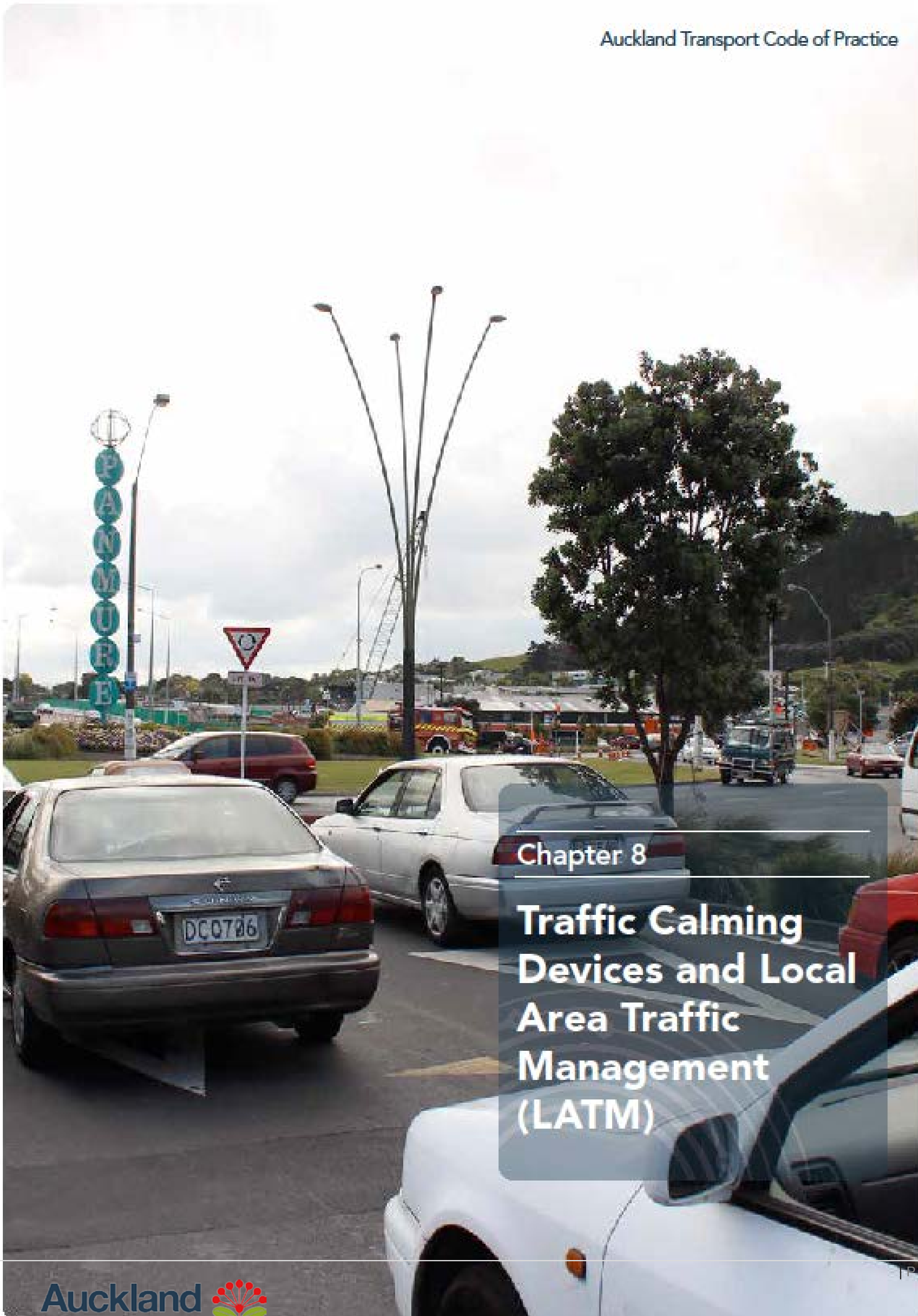

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8 Traffic Calming Devices and Local Area Traffic Management (LATM)

8.1 Local Area Traffic Management Governing Principle

Traffic calming and/or devices are often used as a means to improve the safety and amenity of roads and typically local roads e.g. within a residential area. Their primary purpose is to promote road user safety through speed management and/or traffic diversion i.e. to slow down or make it difficult for vehicles to travel at speed through such locations and therefore make a route less desirable for 'rat runs' or quick travel.

The ultimate aim of all traffic calming projects is to alter the motorist's perception of a road through self-explaining methods and thereby induce self-enforcement resulting in reduced traffic flows and speeds along it. The safety, amenity and liveability of the residential road concerned are thus enhanced. Traffic calming devices may also provide additional landscaping opportunities by utilising the carriageway space that has been reclaimed by the devices.

The purpose of this chapter is to provide guidance for reducing speeds on roads and more typically local streets, and as such should generally only be used on roads with a posted speed limit of 50kph or less. Traffic calming devices must not be used on roads with operating speeds higher than 60kph. Such roads should be redesigned or other speed management techniques should be used if speed reduction is required.

Auckland Transport Local Area Traffic Management Guidelines

It is essential that the Auckland Transport Local Area Traffic Management Guidelines (PDF 83KB) are read at the embedded hyperlink before reading the rest of this chapter.

8.2 Objectives and Principles

The main objectives of a traffic calming scheme are:

- To improve safety for all road users;
- To reduce vehicle-related crashes and crash severity along the street;
- To reduce the overall speeds of motorists to an acceptable level for the street to function as intended;
- To reduce the incidence of 'rat runs';
- To enhance the environment of the local community and encourage walking and cycling;
- To improve the local amenity of the street through the use of planting;
- To reinforce that the function of a local street is to provide access for properties, not as a through-route; and

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- To discourage larger vehicles and commuter traffic from using residential streets as through routes.

To achieve these objectives, various devices, that can be installed on a street and that perform specific functions, have been developed.

It is a requirement that all new traffic calming devices installed in the road corridor have the correct road lighting treatment applied as described in Section 5.2.5 of AT's Streetlighting Guidelines (PDF 115KB) (refer to ATCOP Chapter 19 Section 19.1).

It is important to note that not all devices are suitable for all areas, and particular care must be taken to understand the requirements of the street and the desired outcome before developing the solution and to ensure that the street lighting is adequate to support the proposed measures.

It is a requirement that all traffic calming devices are approved by a resolution of AT's Traffic Control Committee.

8.3 Advantages and Disadvantages of traffic calming

There are many variables that contribute to the outcome of traffic calming in a street and its success depends entirely on the assumptions used and the devices selected. It is important that when preparing a speed management / traffic diversion scheme the engineers consider the advantages and disadvantages of implementing devices and their effects on the function of the street.

Some advantages / disadvantages are indicated below; although the list contains the most common issues it is not exhaustive:

Advantages

- Increased safety performance for all road users, especially pedestrians and cyclists;
- In combination with other traffic reducing features, noise speed and through-traffic volumes in the vicinity of the traffic calmed area can be reduced;
- Improved local environment and reduced damage to street furniture and property;
- Reduced need for traffic enforcement for certain offences;
- Potential reduction in heavy vehicle usage;
- Ability to increase the amenity of the street through new planting, furniture and reclaiming parts of the carriageway;
- Increased driver perception and awareness that they are driving through a local street and that they should be adjusting their driving behaviour accordingly; and
- Reduced numbers of speed related incidents.

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Disadvantages

- Incorrectly specified devices may cause an increase in noise, pollution or vibration;
- An increase in travel time for local residents;
- Excess noise from the acceleration and deceleration of larger vehicles;
- Increased fuel consumption and exhaust emissions from slowing down to negotiate devices;
- Grounding of vehicles and potential for damage – especially if devices are not constructed appropriately;
- May create an uncomfortable ride – particularly for public transport users;
- Potential for the loss or reduction of available kerbside parking space;
- Constrained access to properties immediately adjacent to certain devices;
- Potential for an increased emergency service response time;
- Residents may want devices installed but don't want them outside their property (NIMBY);
- It may shift the problems to adjacent streets if installed in isolation;
- Potential to increase traffic queues;
- Adjacent roads may require a form of traffic enforcement due to traffic displacement; and
- Some devices may not be fully cycle friendly.

Through careful planning and local public involvement, many of these disadvantages can be minimised by the use of appropriate devices in appropriate locations on the street concerned.

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.

8.4 Traffic Calming on Bus Routes

From a bus service perspective there is a clear preference for horizontal deflection measures, self-explaining measures, speed cameras and vehicle activated signs, rather than vertical deflection measures.

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 AT's Public Transport Network Plan. Traffic calming devices and particularly the cumulative effect of these can lead to excessively increased journey times for buses by requiring diversions or slowing them down significantly more than other vehicles. It is therefore important, particularly if buses are the predominant cause of excessive speeds, in the first instance to consider non-engineering interventions such as a review of the relevant bus timetable through consultation with AT's relevant operations unit.

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The above mentioned measures should be considered before resorting to vertical devices because of the following problems associated with raised devices:

- Past claims history related to the sudden jolting when a bus traverses a device;
- Like most other large vehicles carrying heavy loads buses have firmer suspension systems than cars, resulting in greater discomfort to drivers and passengers;
- Bus operators have a duty of care to their passengers, particularly the elderly and disabled, who may be standing or moving around the bus (e.g. to alight);
- Bus operators must take into account the health and safety of bus drivers. In some situations traffic calming devices can cause great discomfort, especially if the bus has driven over numerous vertical devices;
- Traffic calming devices can lead to increased wear and tear, grounding, damage and maintenance costs to buses especially where they are driven along a traffic-calmed road many times a day; and

Due to the vehicle characteristics of buses, speed humps cause a ‘double thump’ effect when buses traverse the hump; one for each set of wheels. Speed humps have a more severe effect on buses than cars, which can result in the reduced attractiveness and commercial viability of bus travel. **Speed humps therefore do not have a suitable profile for use on bus routes and must not be used in this context.**

Vertical Deflection devices should not be installed on the Rapid Transit Network (RTN).

When vertical traffic calming measures are required on Frequent Network bus routes, the first choice should be speed cushions of no higher than 75mm. The exception to this is a bus route that passes through a town centre, a low speed school zone or other areas of recognised high pedestrian frequency where raised tables are acceptable. However, in these instances ramp gradients should not be steeper than 1:20 and table heights should not exceed 75mm.

When installing vertical deflection devices it is important to take into account what is already installed on the relevant bus service routes. Consultation with Auckland Transport’s relevant operational units should be undertaken to establish this. Where a bus route has more than 10 speed cushions or 5 speed tables already, other methods of traffic calming should be used where possible to avoid additional effects to bus service reliability.

As possible increases in exhaust emissions can be caused by the extra acceleration and deceleration associated with vertical deflection devices, this aspect should be considered during the planning phase of a local area traffic management scheme.

8.5 LATM Control Devices

Traffic calming can be implemented using three different types of control; Horizontal deflection, vertical deflection and road markings / signage. These can be either constructed as part of new works or retrofitted to existing streets as necessary.

Each control type has an individual way of operating and the correct choice is paramount to the successful and appropriate operation of the feature. A suitable solution may include one or more of the different control types.

It is important to understand the potential road users, road function and the required level of service when determining the solution, as often individual items such as road markings or signage do not work in isolation and may require additional control types to reinforce the nature of the road.

Both horizontal and vertical alignment changes are largely self-explaining and have the ability to create the visual impression that the street concerned is not intended for fast through-movement of traffic, but rather for the local traffic that needs to use the street. Their main disadvantages are the cost of implementing alignment changes, unless designed in to a new street, and they may have a cost implication on the long term maintenance of a local street. In addition, emergency vehicles may have difficulty in negotiating alignment changes and consideration must be given to whether the proposed works are on a recognised emergency route.

It is only through careful selection and placement that traffic calming is effective and, when used, should generally be part of a wider initiative i.e. as a local area-wide treatment, rather than an individual street treatment. However, there may be situations where traffic calming devices are required to provide for pedestrians at a specific location.

The spacing of devices should be fit for purpose, but typically 80m to 120m intervals as any spacing outside of these ranges tends either to be ineffective at either slowing speeds or has the potential to increase noise and vibration.

When narrowing the carriageway via the use of horizontal displacement devices the treatment of cyclists needs to be considered. Cyclists are particularly vulnerable to 'pinch points' and as such if the device narrows the carriageway suddenly it can often leave a cyclist and another vehicle competing for the same road space. It is important to consider the effect the device will have on the residual carriageway space and ensure particularly on highly trafficked roads that a minimum clearance of 4.2m kerb to kerb remains, should a narrowing of the carriageway need to be incorporated into the design, **or that a safe alternative for cyclists suitable for the location (e.g. bypass) is provided.**

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8.5.1 Vertical Traffic Calming

These devices refer to the vertical realignment of a localised section of the carriageway with the aim of reducing speeds by the introduction of slightly uncomfortable and rapid changes in gradient. This is achieved by the use of raised sections of carriageway, either constructed as part of new works or retrofitted. Vertical displacements may occur jointly with horizontal alignment changes.

Vertical traffic calming is more suited to the narrower street typology (such as those with carriageways less than 10m in width, either kerb to kerb or with lane configurations that reduce the effective width to 10m or less). They are also more suited to those roads which have a large quantity of on-street parking - as vehicles can still park on top of the device.

All road markings must be continued in accordance with the TCD Rule and as such they may coincide with the position of a vertical device. If this occurs, the reflective road marking must be specified as having anti-skid properties and be of a suitable long wearing material.

Vertical traffic calming devices should typically be located no closer than 6m to an intersection and should not be within 1m of any driveway. However, specific site issues including tracking need to be considered. Suitable forward visibility for the operating speed must be provided on bends. Approach sight distances should be maintained to each oncoming device in accordance with the latest Austroads standards.

Table 20: Summary of Vertical Traffic Calming Device Design Standards related to Bus Routes

Route / Road Element Type	Vertical Traffic Calming Device Type	Maximum Ramp Approach Gradient	Maximum Height (mm)	Minimum Length (m)	Additional Information
Rapid Transit Network	none (speed cushions only in exceptional situations)	-	-	-	typically not permitted (see speed cushion design standards below)
Frequent Transit Network	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 maximum
Bus Routes through Low Speed Zones	raised tables	1:20	75	6.0	town centres outside schools high pedestrian frequency areas (intersections, mid-block & pedestrian crossings)

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Table 21: Summary of vertical Traffic Calming Device Design Standards Related to Non-Bus Routes

Route / Road Element Type	Vertical Traffic Calming Device Type	Maximum Ramp Approach Gradient	Maximum Height (mm)	Minimum Length (m)	Additional Information
No Bus Service	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 maximum
No Bus Service	raised tables	1:15 or 1:10	75 or 100	6.0	Typical longitudinal spacing between devices = 80m – 120m
No Bus Service	Speed humps (sinusoidal)	-	100	3.7	Typical longitudinal spacing between devices = 80m – 120m
No Bus Service	Speed humps (modified Watts profile)	-	100	5.0	Typical longitudinal spacing between devices = 80m – 120m

While Table 21 above is relevant to non-bus routes - as a safeguard - designers should consult with the relevant AT operational units to check if the route concerned is planned as a future bus route.

8.5.2 Speed Humps

A speed hump with a sharp gradient is useful at slowing vehicles down, but the sudden change in gradient can sometimes be detrimental to the surrounding area due to the increased noise and vibrations generated by this, especially from larger vehicles such as trucks or buses.

A sinusoidal speed hump on the other hand has a gentler gradient and is designed to lead the vehicles in to the hump in a smoother motion but is not as effective at slowing vehicles down. It is important to understand the existing longitudinal gradient of the road as this will affect the exit sides of the hump and the wrong choice can lead to 'grounding' of the underside of vehicles.

Local noise and vibration may impact nearby residents and design decisions must be made early-on as to the desired effect from the device.

Speed humps are not acceptable for bus operations and should not be used on Auckland's bus network.

Speed humps must be clearly visible to approaching motorists by the use of the correct pavement markings and must be illuminated by street lights. It is important that the first hump in either direction is correctly placed and is easily identifiable by approaching drivers so they know they are entering a controlled environment.

Speed humps are generally sinusoidal in shape following either the standard or modified Watts profile (see standard detail TC001), 100mm in height and must have a longitudinal

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length of 3700mm (5000mm for the modified Watts profile) spaced fit for purpose, but typically 80m to 120m apart.

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 remaining for drainage.

It is also permissible to design the speed hump to be narrower in width than standard and provide cycle bypasses. This allows the speed hump to be slightly harsher in ride and discomfort to drivers without sacrificing the usability for the cyclists (Standard Plan No. TC002).

8.5.2.1 Speed Cushions

Speed cushions are an alternative option to the conventional speed hump and are used in areas where larger vehicles need to be accommodated. Speed cushions take the form of a speed hump that occupies only part of the road width and allows vehicles with a larger wheel track to bypass the device by straddling the cushion while vehicles with a smaller wheel track must drive over the cushion, thus reducing the speed accordingly.

Speed cushions are generally the most acceptable type of vertical traffic calming device to bus operators, but only if parking can be prevented in the bus tracking zones.

The cushion's lateral spacing must be considered carefully as if the gap between the cushions is too wide this will allow vehicles to navigate over the cushion with only one wheel on the device, negating much of the benefit of the speed cushion. Conversely, a gap that is too narrow will force the larger vehicles on to the cushion, increasing the potential for noise and vibration and potential damage to the road surface on the exit side of the cushion.

The maximum height of a speed cushion is 75mm with an optimum width of 1.9m and a gradient formed at the ramp of 1:8. The gap between cushion and kerb and between adjacent cushions should ideally be 1.0m, and no less than 750mm. Gaps which are too wide encourage drivers to drive through the gap at speed without the risk of grounding.

Speed cushions should be constructed using pre-made rubber cushions, bolted in to the road surface (Standard Plan No. TC007) or from asphaltic concrete or concrete (Standard Plan No. TC008). 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

Rubber cushions require a road surface with sufficient depth and strength the anchor the bolts. Authorisation from Auckland Transport Design Review Committee must be sought before the implementation of rubber speed cushions.

If prevention of parking is required, physical prevention by means of build-outs and pinch points is preferred rather than enforcement through the provision of yellow lines. It is advisable for

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parking to be restricted to enable the appropriate tracking for buses, intervisibility and the safety of other road users.

Speed cushions should typically not be located near to bus stops or intersections, again to ensure that buses can approach them at the correct angle. This is particularly important to note as a significant number of passengers leave their seats to alight before the bus stops. So, if a bus transverses a vertical deflection device incorrectly near a stop there is a much higher risk of passenger injury.

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

8.5.2.2 Raised tables

Raised tables are devices which are predominately used at intersections or crossing locations, and allow a level surface for both larger vehicles to negotiate and for pedestrians to cross at. The devices generally have a flat surface and are designed to sit flush with the kerbs. At intersections, raised tables are generally the same size as the intersection but extend a little beyond the intersection to allow the ramps to be positioned away from the crossing points. At any other location, the flat area of the raised table is generally 6m - 9m in length as this allows larger vehicles to negotiate the device more easily and creates less discomfort and noise for those on board. However, the vehicles might create more external noise and vibration as a result.

Raised tables are not generally preferred by bus operators. Consultation with AT's relevant operational units must be undertaken if the proposed location is on a bus route.

The appropriate dimensions of any raised table in the road reserve are dictated by whether the road is or is likely to be on a bus route. In such cases the top of the device should be at least the length of the wheelbase of the longest bus likely to use the road. Following the advances in bus design, it is likely that the length of the flat section should be a minimum of 6m. Typical raised table design parameters are shown in Standard Plan No. TC003.

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

Ramp gradient (and table spacing) can be varied to achieve differing speed reduction effects. In respect of the comfort of vehicle occupants the ramp gradients of raised tables should not be steeper than 1:10.

It is important to note that the design must be based on the context of the surrounding environment and that the gradients indicated above can be changed to suit, e.g. a highly

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trafficked local road used as a shortcut may need steeper gradients, even if it is on a bus route to deter vehicle rat running. Therefore the maximum ramp gradient allowed on any road is 1:10.

Raised tables should typically not be located close to bus stops, since passengers may be standing up on the vehicle prior to alighting from the bus.

If a raised table is constructed on an existing cycle route and is not intended as an informal crossing facility then the table could be constructed with cycle bypasses (see Standard Plan No. TC004).

If a raised table is to be used as a pedestrian crossing point, tactile paving should be used to delineate the crossing point from the carriageway. Tactile paving represents a physical warning to the visually impaired that there is a dropped or flush kerb, and without this warning a visually impaired person could walk into the carriageway. Therefore yellow pigmented concrete tactile paving slabs should be provided on the footway at the kerbside of all raised tables that are designed for yse by pedestrians and accessible from the footpath. All tactile ground surface indicators should be laid out in accordance with NZTA's RTS14 (formerly LTNZ).

Raised tables that are constructed for use as uncontrolled crossing points are often interpreted by pedestrians as formal pedestrian crossings. This can lead to unsafe use of the crossing point by pedestrians as they assume they have right of way. To avoid this situation it is recommended that raised tables used as uncontrolled crossing points are constructed from a material of similar appearance and colour to the surrounding road surface and that they are clearly distinguishable from the footpath.

It is important to consider how drainage is to be accommodated when designing a new raised table. If a raised table spans the entire width of the carriageway the drainage channel will be blocked. To accommodate the drainage requirements in this situation, upstream catchpits (see Standard Plan No. TC003) must be used if within 50m of a surface water system, or a drainage channel can be constructed as a replacement to the road channel (see Standard Plan No TC005.).

It is preferable that full-width tables are only installed where little or no road catchment drains towards them. Where there is a catchment, primary and secondary drainage is required to be considered and should be documented in the Design Report. Care must be taken to ensure that the risk of flooding to adjoining habitable floors and reduced serviceability of pedestrian routes is avoided. *ATCOP Chapter 17 Road Drainage* has further details on road drainage catchment and the methods used to control the catchment.

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These methods allow the water to be removed before it can form ponds at the upstream side of the table. The provision of catchpits is preferred for water removal as a channel can be blocked by detritus and other materials.

Raised tables should be designed in accordance with the construction details on Standard Plan Nos TC003 – TC006. If the raised table is expected to be installed on a route that takes a larger number of heavy vehicles or on 4 lane routes (i.e. arterials through town centres) then the design of the raised table needs to address items such as cracking, rebar content, joint spacing and shear connections as these early details will impact on the constructability of the table and the overall cost to the project.

8.5.3 Table Horizontal Traffic Calming

These devices refer to the horizontal realignment of the kerb line over a short length of road with an aim to eliminate long, wide straight sections of road. This is generally achieved by kerbside islands and/or central islands. Vertical deflections may coincide with changes to the horizontal alignment. Traffic flows can be restricted to one-way flows in the proximity of the device, with priority given to one direction and alternated by successive controls.

8.5.3.1 Build-outs / Side Islands

Extensions to the kerbs protruding into the road leave a gap that can either be angled or parallel to the centreline of the road. If two-way flows are 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 form of pedestrian refuge.

In order to accommodate cyclists passed these narrow sections, it is advisable to provide a gap between the existing kerb line and the proposed kerb extension to allow cyclists to bypass the build-outs (if the remaining lane width cannot be 4.2m wide). This is recommended on highly trafficked routes such as busy local or collector roads, but it is discretionary whether it is used on local streets or roads with a low number of vehicles per day and low speed (<30km/h).

These controls are the most difficult to locate without adversely affecting drainage, street frontages or existing on-street parking and careful planning must be undertaken to balance the needs of the road. They can also encourage high speed manoeuvres and swerving as well as risk taking.

However, kerb build-outs can serve a dual purpose in that they act as a speed deterrent and also they tend to deter through-traffic by constantly changing the priority along the street by the use of alternating give ways. They are an ideal location for pedestrian crossing points due to the narrowed nature of the street.

Kerb build-outs should be designed so that the traffic is funnelled safely into the remaining carriageway space. The angle by which the vehicle should deviate is generally between 15 and

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45 degrees from the original path, producing speeds that are less than 50kph. 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 and cycle by-passes should be considered where visibility is low or the road is part of the cycle network.

Tracking for a suitable design vehicle should be undertaken to ensure that the vehicle movements in to and out of adjacent driveways can be made satisfactorily. Where appropriate, allowance shall also be made for trailers. The selection of the suitable design vehicle shall be made on a case by case basis but as a minimum the 99 percentile car should be used.

Standard Plan Nos TC009 & TC010 show typical planted side islands and details.

8.5.3.2 Chicanes

Chicanes follow a similar principle to build-outs but they differ by combining two build-outs that are staggered by a short distance on opposite sides of the road to form a chicane. They can either be designed for single direction in which case the oncoming traffic must give way or designed for two-way traffic flows.

Chicanes are similar to kerb build-outs in that they are kerb extensions that alternate from one side of the road to the other, forming S-shaped curves. 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 the ends of each parking bay.

Chicanes are good for locations where speeds are a problem but the noise and vibrations associated with vertical deflection measures would be unacceptable. However, in areas of excessive speed they can encourage high speed swerving manoeuvres and other aspects of dangerous driving.

Chicanes are designed by the use of two build-outs staggered to create an 'S' curve between them. Each build-out is a conventional design, with the spacing and the path angle defined as detailed in Standard Plan No. TC011.

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

8.5.3.3 Road-Narrowing's

A road-narrowing is the installation of a device which narrows the road physically between two existing kerb lines. These often take the form of two build-outs constructed opposite each other, with the minimum allowable carriageway width maintained through the narrowing. They can be

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designed for traffic as either single-direction or bi-direction with alternate give-ways if used in series along the road.

Narrowing the road can be considered to be a supportive measure to other traffic calming on the street as it can reinforce the slow speed nature of the road. By itself, the narrowing achieves very little speed reduction unless there is oncoming traffic and the narrowing is single direction.

Narrowing the carriageway has the added benefit of bringing crossing points closer together for the benefit of pedestrians, especially those that have difficulty in walking - as the time to cross is reduced.

A road-narrowing is designed by placing two build-outs opposite each other, with a give-way and appropriate signing on the approach that does not have priority. The carriageway width retained in the narrowed section should be suitable for the types of vehicles expected along the street.

Road narrowing's work best where the flows in each direction are relatively balanced, however should imbalanced flows exist then give ways can be used to alternate flows through the devices.

It is important to note that a low traffic volume can cause the devices to not work as there could be little opposing flow to force motorists to give way.

Standard Plan No. TC009 indicates the position of the side islands that form the road-narrowing, but planting may not be required depending on the safety and visibility requirements.

8.5.3.4 Entry/Gateway Treatments

At the beginning of all traffic calmed or slow speed zones, an Entry or Gateway Treatment should be applied at or near to the entrance to the zone to emphasise that the road is local and to enhance the residential nature of the area.

The treatments can consist of many different features; some might consist of a narrowing, a raised table or perhaps some simple signage. In areas where driver compliance is a concern, multiple treatments could be applied to the entrance to enhance the slow speed environment.

An entry/gateway treatment must always be used for TC/LATM zones. The reason being that it indicates that the area is calmed and that drivers must proceed with more caution and at a slower speed. It is important to note that the entry features must be highly visible as this will clearly identify the area as a slower speed environment.

Where a vertical deflection device is utilised as the gateway treatment this should be designed to accommodate the function of the major road, i.e. if the treatment is a minor side road off a

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major road then the treatment should be designed to enable a vehicle to turning to the side road without detrimentally affecting the major road.

8.5.3.5 Roundabouts

While roundabouts are general traffic tool to help deal with intersections, they can also be a useful traffic calming tool when used with single lane entries/exits to/from the circulatory carriageway as they have the ability to reduce vehicle speeds, reduce the number of conflict points and the central roundabout island increases the visibility of the intersection.

It is important to understand other transport modes when proposing the use of roundabouts. Traditionally-designed roundabouts tended to be poor pedestrian and cyclist routes. Often in the past, the consideration of pedestrians and cyclists in roundabout design was an afterthought. With careful planning and clever use of kerbs and road markings - roundabouts can be designed to accommodate all users of the road.

Roundabouts used in traffic calming schemes tend to be designed in a manner that limits the circulatory speed and prevents the straight through movement.

The ideal design for a traffic calming roundabout is one that would cause a vehicle at speeds greater than 30kph to spiral out of the circulatory path towards the kerb. They should be designed with enough entry flare and roundabout deflection to force the vehicle on to the circulatory path so that a direct path across the roundabout is avoided.

For further details on the design of roundabouts refer to *ATCOP Chapter 7 Road Layout and Geometric Design, Section 7.11.3.*

8.5.3.6 Traffic Islands (mid-block islands)

Mid-block islands are a useful device for horizontal displacement of traffic lanes. They can be used as part of a physical narrowing of the road, by reducing the available carriageway width to be driven on and can also serve as pedestrian refuges on pedestrian desire lines. Due to the fairly short nature of these islands their traffic calming effect is limited, but they are often used as part of an overall traffic calming scheme.

It is important that the design of pedestrian refuge or traffic islands takes into account the available width of the carriageway that will remain. If the distance between the kerb and the traffic island is between 3.2m and 4.1m this can be detrimental to cyclists due to the available width being slightly too narrow for a vehicle to safely overtake cyclists. The context will determine the importance of providing the appropriate width e.g. a highly trafficked local road versus a quiet local street.

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

Tracking for a suitable design vehicle should be undertaken to ensure that the vehicle movements in to and out of adjacent driveways can be made satisfactorily. Where appropriate, allowance shall also be made for trailers. The selection of the suitable design vehicle shall be made on a case by case basis but as a minimum the 99 percentile car should be used.

For additional information on the design of traffic islands refer to ATCOP Chapter 12: Footpaths and Pedestrian Facilities.

8.5.3.7 Intersection modifications / 'Dead-Ending'

Sometimes an intersection is too complex to change its nature by the use of new signs and road markings, or where alternative treatments such as roundabouts are not appropriate. In such situations consideration should be given to modifying the intersection by way of relocating kerbs or constructing kerbs, median or channelling islands, widening, 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.

It is also possible to reduce the number of intersection arms by 'dead-ending' roads. This allows other modes (e.g. pedestrians, cyclists) to use the redundant arms but reduces the traffic through the area. A consequence of this is the potential redistribution of traffic to other local roads, and as such this should only be considered as part of an overall traffic calming scheme.

Reducing speeds at an intersection can be achieved by changing the kerb radii 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.

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 such as the illustrated example in Plan No. TC012.

A dead-end could be created by the use of physical installations such as bollards or street furniture or with more permanent construction such as kerbs and concrete. With either type, a pass-through could be created to allow for cyclists and pedestrians to navigate past the dead-end while cars would have to use different, more appropriate streets. It is important, when designing a dead-end, that suitable signage is placed on the entry to the street to indicate that

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the road is a dead-end. It is also important to prevent or minimise the possibility of traffic being displaced onto other unsuitable roads.

The legal way of 'Dead-Ending' is through 'Road Stopping' or the creation of a Pedestrian Mall.

There are a number of other types of intersection modifications that are not described here that could be developed, but in principle the key objective is the reduction in traffic speed and traffic volume through the intersection.

It is important to note the effect that a horizontal traffic calming scheme can have on cycle routes and that cycle bypasses are not always the possible or preferred solution. It is in the interest of the designer to seek input from Auckland Transport's Walking and Cycling Specialist before incorporating any bypasses.

8.6 Signs and Visual Effects

Signs and markings are lower in cost to install and maintain, but are often not as effective or self-enforcing and there is the potential for them to be ignored by a proportion of road users.

8.6.1 Signs

8.6.1.1 Prohibited Movement Signs

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, such as No Right Turn / No Left Turn / Turn Left / Turn Right / No U Turns / No Turns and No Entry (e.g. one way street), can be used to ban certain movements to reduce the effect of peak traffic movements and speed due to a re-configured intersection. This has the benefit of increasing safety at the intersection as there will be a reduction in traffic volume and a consequential reduction in the potential for conflicting movements.

Like most sign based schemes, prohibited movement signs should only be installed as part of a wider traffic calming scheme as the acceptance of these signs depends on the motorist and enforcement can be an issue should motorists decide to flaunt the ban - as prohibited movement bans are no self-enforcing. Any bans need to be considered holistically - as bans are likely to increase movements or turns in other places that could be less safe.

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, a cyclist could incur a significant increase in distance to negotiate the intersection change. 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 but restrict motor vehicle access.

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8.6.1.2 Speed Hump / Raised Table Signs

Any vertical deflection device needs to be easily identifiable by the reflective line marking on the device and with preceding signs that are visible to oncoming drivers. 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 advisory speed for negotiating the device or through a series of devices.

No other signs may be placed on the sign pole when the PW-39 and PW-25 signs are present and there is no requirement for a sign plate that indicates the length of road covered by vertical devices.

8.6.2 Visual Narrowings

Traffic calming a road can be combined with other techniques using treatments designed to create a visual perception of a narrow, multi-use carriageway in an effort to slow speeds and increase motorist attentiveness, alertness and overall safety. Treatments such as additional street trees, vertical lighting elements, street furniture, special paving treatments or roadway markings and even bike lanes may create a perception of a narrow carriageway without physically narrowing the road. It is important that visibility for pedestrians and cyclists is still maintained after any treatment as this can often be overlooked and leave these users vulnerable. The use of low level planting or setbacks can help achieve this. Refer to *ATCOP Chapter 14 Landscaping Appendix D Table 49* for the list of suitable plants for LATM use. Refer also to Plan Nos. TC008 andTC009.

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.

In addition, 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 bike lane and increase motorists’ perception that cyclists should be expected.

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