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ATTACHMENT 1 (BROCHURE)
DESIGN FOR TRUCKS, BUSES & EMERGENCY VEHICLES ON LOCAL ROADS (NOVEMBER 1998)

ATTACHMENT 2 (BROCHURE)
DESIGNING LOCAL ROADS FOR ULTRA LOW FLOOR BUSES (JULY 1999)
Local Area Traffic Management (LATM) is a scheme to improve safety and residential amenity in local streets through the discouragement of private and commercial through vehicles and the management of local traffic speed.

This chapter is a guide for implementing or changing local area traffic management (LATM) schemes and should be read in conjunction with the following publications:

- AUSTROADS, Guide to Traffic Engineering Practice
  - Part 10: Local Area Traffic Management (Consultation and implementation procedures) (1988)
  - Part 6: Roundabouts (1993)
  - Part 14: Bicycles (1999)
- Victorian Code for Residential Development, Department of Planning and Housing, 1992
- Trucks on Roads Design Guidelines, VicRoads 1993

Other publications on LATM are:

**Australian**

- Sharing the Main Street, Practitioners’ Guide to Managing the Road Environment of Traffic Routes Through Commercial Centres, Roads and Traffic Authority of New South Wales and the Federal Office of Road Safety, November 1993
- Guidelines for Local Area Traffic Management - 1990, Main Roads Department, Western Australia (A comprehensive manual with emphasis on consultation and implementation).
- Living with Traffic - Ray Brindle, A Report of progress in LATM.

**European**

- Traffic Calming in Practice, a sourcebook with 85 illustrated case studies, County Surveyors’ Society/Landor publishing, 1994. (Good photographs and plans of devices but many treatments have hazardous constructions near traffic lanes.)
- An Improved Traffic Environment, A Catalogue of Ideas, Road Directorate, Denmark Ministry of Transport, 1993. (Well illustrated with emphasis on urban design for traffic management.)
New residential developments should follow the guidelines set out in the ‘Victorian Code for Residential Development’ Department of Planning and Housing, April 1992 to effectively plan for local traffic. Element 6 of the code states:

‘To provide acceptable levels of accessibility, safety and convenience for all street and road users in residential areas, while ensuring acceptable levels of amenity, and minimising the negative impact of through traffic.’

The performance criteria set out in the code should be used to achieve these objectives.

When planning and designing new local streets, the advice in the VicRoads ‘Trucks on Roads Design Guidelines’ also needs to be incorporated in order to accommodate the access needs of trucks, buses (where appropriate) and emergency vehicles. The brochures referred to in Section 8.3 may also be relevant.
The aim of LATM schemes is to improve safety and residential amenity through the management of traffic speed and volume in local streets. Community participation is essential for a LATM scheme to gain community acceptance. LATM schemes have a major impact on residents and the success of a LATM scheme is dependent on the quality of the design and the effectiveness of the consultation process.

The whole of the local government area may need to be broken up into precincts to develop a strategy plan based on a logical priority order for the development of LATM schemes based on the relative need of each area and on Council's budgetary constraints.

The development of a LATM scheme requires a systematic approach as follows:

**Phase 1-The study phase:**

**Surveys and Data collection**
The following is a guide to the surveys and data required:

- Identify an adequate area for considering impacts.
- Traffic speed.
- Volume and vehicle classification counts.
- Traffic, pedestrian and bicycle accident locations and type.
- Origin and destination surveys may be used to identify traffic flow routes.
- A survey of community traffic concerns.
- Bus routes.
- Emergency vehicle access routes.
- Freight generating land uses and commercial vehicles access routes.
- A network of traffic routes (road hierarchy) is selected and agreed to by Council and the local community.

**Investigation and Assessment**

- Establish actual problems and their extent.
- Consult with the community on the problem, and ensure that optional solutions and the trade-offs involved are understood. Proceed no further if the community does not support a scheme.
- Confirm that the problem warrants implementation of a traffic treatment (if no treatment is warranted inform the community and proceed no further).

**Selecting the Treatment**

- Select a solution appropriate to solve the problem.
- Assess the impacts of the treatment throughout the area, including the arterial roads.

**Designing the treatment**

- Consider all likely road users in the design.
- Correct design vehicle (including turning templates) is used.
- The designer complies with the ‘Trucks on Roads Design Guide’, device guidelines, and relevant VicRoads brochures such as:
- Consider the impact on and management of the arterial roads.
Referral and Obtaining approval

- Major Traffic Control Items consent:
  Council may consent to delegated items on certain roads if VicRoads’ guidelines are met (refer Chapter 2 of this manual).
  Obtain VicRoads consent if not delegated to Council.
  Obtain the bus company’s written agreement if device is on a scheduled bus route.

- Comply with the Local Government Act requirements where applicable:
  Notice published.
  Submissions heard.
  VicRoads’ report obtained.

Phase 2 - Implementation

Introduction Strategies
There are three ways of introducing LATM schemes:

- Trial/temporary schemes - Installed to allow evaluation of their effects.
- Staged implementation - Treat problem locations first, or install gateway treatments first, or treat part of an area in its entirety.
- Full implementation - Treat the local traffic area in its entirety (preferable)

Note: Generally it is preferable to install devices in a series of streets to avoid traffic diverting to other untreated streets. Siting and spacing details are shown on page 8-10 of this Chapter.

Publicity
Prior to the implementation of LATM schemes, local residents should be informed by local newspapers and letter box drops of the location of the proposed devices and the objectives and benefits of these devices.

Construction Standard and Practice
The construction materials used and the standard of construction:

- will affect initial costs and the cost of ongoing maintenance.
- need to reflect the image of a local street environment rather than an arterial road environment.
- can affect community acceptance of a LATM scheme.

Phase 3 - Monitoring, consultation and review
Monitoring and review are essential parts of a LATM scheme. Prior to implementation of the LATM scheme, the type of before and after studies to monitor the effects of the scheme should be determined. Monitoring should take place after the initial traffic effects have settled down and meaningful results can be obtained. Before and after studies can be used to determine whether goals are being met.

A review of the LATM scheme should be carried out to confirm the effectiveness of the scheme and to identify and rectify any deficiencies. The review can be used to assist in planning of other schemes.
8.4.1 Forgiving Design

- All physical devices should be designed in such a way as to minimise damage to vehicles which fail to negotiate them in the correct manner.

- Semi-mountable kerbs, fragrable signs, bollards and hazard markers should be used.

- Relocate Electricity Supply Authority poles that are located close to the kerb especially on the departure side of LATM devices.

- The design aim should be that the type of treatment and the required action is clearly apparent to approaching motorists.

8.4.2 Sight Lines

- For roundabouts there should be a good view of the splitter island, the central island and the circulating roadway. At the giveway line a driver should have a clear line of sight to traffic approaching on the right. Section 4.2.7 AUSTROADS, Guide to Traffic Engineering, Part 6, Roundabouts, provides further information.

- On other treatments, landscaping and geometric design may be used to reduce the openness of the local street environment and this will assist in the reduction of vehicle speeds. Sight lines should not, however, be reduced to unsafe levels.

8.4.3 Street Lighting

Where LATM devices are installed, the surrounding intensity of street lighting should be increased to at least AS/NZS 1158.3.1 P standard. This standard is developed for electricity system for local roads and other outdoor public areas primarily to provide visual environment for pedestrian movement at night. Alternatively, or in addition to the above, either the intensity of lighting over the device should be increased or the colour spectrum of lighting changed over the device, i.e. change 40W fluorescent to perhaps a 150W high pressure sodium. LATM devices may be placed at locations which minimise the need for additional street lighting.

8.4.4 Landscaping

Landscaping should create visual continuity, reinforce the local nature of the area and the local function of the street. Good landscaping will foster public acceptance. Landscaping can increase safety by reinforcing vehicle and pedestrian paths, but must not obscure visibility. Select plants appropriate for:

- their shape or form,
- the existing vegetation character,
- existing site characteristics,
- the landscape character of the area,
- the maintenance regime that will apply.

Mulch mass planted areas and use grass where appropriate. Regular maintenance should be arranged.
8.4.5 Signing, Linemarking and Delineation

Advance warning signs are essential on the approaches to all LATM devices when constructed. The signing scheme should use:

- only standard signs where possible. (Refer to AS 1742.13.)
- signs at entry points to treated areas, see note following.
- supplementary advisory speed signs where appropriate.
- signs sparingly.
- signs only for their intended purpose.
- reflective signs to highlight obstructions.
- adequate mounting height near and above footpaths (2.3 m clearance).
- existing furniture for mounting signs where possible.
- raised reflective pavement markers and/or linemarking to delineate vehicle paths.
- frangible bollards with reflectors to highlight the location and shape of a LATM device.
- different kerb materials to highlight the appearance of a LATM device.

Note: Warning signs should be provided at entry points into treated areas as shown in AS 11742.13-1991 ‘LOCAL TRAFFIC ONLY’ (G9-40-1) signs are used at entry points where a local speed limit is not required. The ‘UNSUITABLE FOR LARGE VEHICLE’ (G9-41) sign can be used in conjunction with the ‘TRAFFIC AREA’ sign to warn of the existence of devices or constrictions which may be difficult for large vehicles to negotiate.

8.4.6 Local Traffic Precinct Speed Zones

It may be appropriate to introduce a 40 km/h or a 50 km/h local traffic area speed-limit. As speed limit signs are Major Traffic Control Items under the Road Safety (Road Rules) Regulations 1999 and as their approval is not delegated to Councils the creation of any speed limit requires the approval of VicRoads. A 40 km/h speed zone is appropriate for roads on which local area traffic management works have been undertaken to limit speeds to about 40 km/h. The 50 km/h speed limit is appropriate for streets whose primary function is to provide access to property and are undivided carriageway local streets along which there is substantial or full abutting urban development having direct access. The speed limit is signed by the ‘AREA SPEED LIMIT’ (R4-6) sign which includes the speed limit and the ‘END AREA SPEED LIMIT’ (R4-7) sign at the perimeter streets.

8.4.7 Temporary LATM Devices

Temporary LATM devices are generally inferior to permanent treatments as their visual appearance can create adverse public reaction. Trial treatments do not inspire the confidence of residents in the skills of the traffic planners. Wherever possible the use of temporary LATM devices should be avoided.

8.4.8 Siting, Spacing and Combination of LATM Devices

The location of existing services, drainage pits, poles, driveways and street lighting must be considered when selecting sites for LATM devices. LATM devices should be located to maximise landscape potential. Residents will often accept LATM devices in principle, provided that the devices are not located outside their own homes because the devices increase noise due to braking, can affect access and reduce on street parking.
The spacing between devices in a street will determine the maximum speed reached along the street. Generally devices should be spaced at a maximum of 100 to 150 m intervals. Where gateway treatments are used, the next device in the street should compliment and, in general, be about 100 m from the gateway treatment.

LATM devices may be used in combination for increased effectiveness or to reinforce their function eg. combination of a slow point and a road hump.

Slow points may be located at intervals along a street so that on street parking or landscaping may be provided between devices. A non linear street alignment may be created by locating offset slow points at intervals along alternate sides of a wide street.

8.4.9 Design for Large Vehicles

LATM devices which are severe enough to significantly slow small cars, must still allow access to larger vehicles such as a furniture van or a car towing a caravan. Medium size trucks, eg. an 8.1 m long compactor garbage truck should be able to negotiate all LATM devices. Designers should refer to VicRoad’s ‘Trucks on Roads Design Guidelines’ and the brochures referred to in Section 8.3.

Emergency and service vehicles must be able to reach every residence, but it is acceptable to construct LATM devices which require larger vehicles to run one set of wheels over a mountable kerb. Councils should liaise with emergency service authorities when considering schemes.

Restrictive devices should not be installed on streets with high emergency vehicle volumes such as an access road to a fire station.

Buses must be able to negotiate all LATM devices situated on bus routes and on access routes to schools. Operators should be consulted prior to the design phase and their written agreement obtained to the proposed devices. Advance warning signs should be provided in order to discourage large vehicles from entering areas where devices are difficult to negotiate.

Where a dispute exists between Council and another party regarding issues of trucks, buses or emergency vehicles the matter should be referred to the VicRoads’ Regional Manager for resolution. See Section 4.6 of the ‘Trucks on Roads Design Guidelines’.

8.4.10 Consideration of Pedestrians and Cyclists

It is a primary consideration of any LATM scheme to provide safe access through treated areas for pedestrians and cyclists. Consideration should be given to allowing cyclists to bypass LATM devices and thus avoid conflict with vehicular traffic where this is possible. Lane widths should either be wide enough to allow the safe passage of a cyclist and a vehicle side by side or narrow enough to permit the passage of a vehicle or a bicycle only. Widths in between these two extremes create squeeze points and result in conflict points between bicycles and motor vehicles.

Pedestrian facilities should be incorporated in LATM devices where there is pedestrian activity.
Users should consult these guidelines when they have reached the stage in a LATM scheme where it is necessary to select LATM devices that will satisfy adopted strategies. Table 8.1 - “Key Selection Criteria” will assist in the selection of a LATM device to satisfy a particular objective. The table is a subjective guide as to the likelihood of each device achieving a particular objective.

For ease of selection, the LATM devices have been divided into four categories which are based on the primary function of each device. However, in some instances it may be valid to select a device on the basis of its secondary function, eg. selection of a roundabout for the purpose of speed reduction. See also the Austroads ‘Guide to Traffic Engineering Practice’, Part 10, Local Area Traffic Management, Appendix B, Figure C3.

The suitability, effectiveness and impact of proposed LATM devices must always be assessed before implementation. There are no hard and fast rules for the selection of LATM devices as the effects of any particular device may vary depending on the site specific characteristics. Wherever possible, LATM devices should be self enforcing. The design vehicle adopted throughout these guidelines is an 8.1 m compactor garbage truck. (Typical dimensions: length 8.1 m, width 2.5 m.)

Roundabouts have not been included in this chapter under Section 8.6, Device Selection Guidelines as roundabouts are covered in the AUSTROADS, Guide to Traffic Engineering Practice, Part 6, Roundabouts.

Impellor devices are not recommended. These devices are similar to roundabouts but have a right turn movement in advance of the central island. The side roads face a give way or stop sign. As the device looks similar to a roundabout there is concern that traffic entering from a side road will fail to give way, especially to bicycles.
### OBJECTIVES

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<th>Reduce Mid-Block Traffic Speed</th>
<th>Reduce Accidents/Severity</th>
<th>Increase Drivers Awareness of the Local Environment</th>
<th>Self Enforcement</th>
<th>Minimise Change to Local Access</th>
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Ability to meet objectives:  
M = Most potential  
A = Average potential  
L = Least potential

# Effective at Intersection  
* Excludes Device Related Accidents  
✓ Guidelines in Section 8.6  
♦ Chapter 3 Traffic Engineering Manual Vol 1  
○ Guide to Traffic Engineering Practice, Part 5  
● Guide to Traffic Engineering Practice, Part 6

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**Table 8.1**  
**Key Selection Criteria**
The following are guidelines for the use of local area traffic management devices, however, each location should be treated on its merits.

### 8.6.1 Full Road Closures

A full road closure is a means of eliminating through motor vehicle traffic from a street by a self-enforcing physical treatment. A full road closure can be located either mid-block or at an intersection. Pedestrian and cyclist access should be maintained at a road closure.

![Figure 8.1: Full Road Closure](image)

#### APPROPRIATE LOCATIONS
- As part of a LATM scheme to discourage traffic bypassing busy arterials via local streets.
- To improve the safety of an arterial road where the carriageway is of insufficient width to provide a right turn storage lane at the local street intersection. Left turn only into the local street could be considered in this situation.
- At intersections where poor horizontal or vertical geometry places vehicles turning either into or out of the side road, at risk.
- Where accident numbers at an intersection are high.
- To convert a cross intersection to a T-intersection to reduce potential vehicle conflicts.

#### INAPPROPRIATE LOCATIONS
- Where there is no reasonable alternative route for the traffic affected by the road closure.
- On bus routes that cannot be easily diverted.
- On an access road to an emergency service institution.
### ADVANTAGES
- Elimination of through traffic from the closed street.
- Reduction in potential vehicle conflicts at the closed intersections. (Mid-block closures reduce potential vehicle conflicts at either end of the closed street by discouraging turning movements into the treated street.)
- Increased pedestrian safety.
- Improved residential environment.
- Creation of new open space for landscaping.
- Can retain access for pedestrians and cyclists.

### DISADVANTAGES
- May increase traffic volumes on adjacent local streets.
- Reduced accessibility for local residents.
- Increased trip lengths and travel times for some local users.
- Reduced accessibility for service and emergency vehicles.
- Reduction of on-street parking space.
- Increased driver confusion if poorly signed.

### DESIGN PRINCIPLES
- The location of full road closures should be carefully selected so that unacceptable volumes of traffic are not redirected onto unsuitable routes.
- Provide turning circle for vehicles at the end of the closed section of street.
- Rename segments of streets created by road closures and advise the appropriate authorities.
- Provide advance signing where appropriate.
- Maintain acceptable access for emergency vehicles or provide pathways of frangible bollards for emergency vehicle access.
- Construct pathways through closures for pedestrians and cyclists.
- Generally a cul-de-sac created by road closures should not be longer than 200 metres or shorter than 50 metres in length.
- "No Through Road" signs should be installed.
- Proposed full and partial road closures must be referred to VicRoads for a report before consideration by Council. Further information on the process of seeking approval for a road closure is contained in Chapter 13 of this manual.
Partial road closures are a means of traffic control without full restriction on vehicular traffic. There are several types of partial road closures including: half road closure, diagonal closure, and various other configurations of channelisation to enforce turning bans.

**Figure 8.2: Diagonal Closure**

### APPROPRIATE LOCATIONS
- Where a restriction on through traffic is required but a full road closure is considered inappropriate.
- Where turn or entry bans into the street have been installed and observance of these bans by motorists is low.

### ADVANTAGES
- Elimination of selected turning movements.
- Reduction of potential vehicle conflicts.
- Increased pedestrian safety.
- Reduced local street connectivity.

### DISADVANTAGES
- Reduced accessibility for local residents.
- Increased trip lengths and travel times for some local users.
- May increase traffic volumes on adjacent local streets.
- Reduced accessibility for service and emergency vehicles.
- Reduction of on-street parking space.

### INAPPROPRIATE LOCATIONS
- On bus routes.
- On an access road to an emergency service institution.
- Where driver compliance may be a problem resulting in wrong way movements.
DESIGN PRINCIPLES

- Construct so that physical difficulty is presented to drivers of vehicles attempting the prohibited manoeuvres.
- ’No Entry’ or turn ban signs must be installed to make the prohibitions legal.
- Construct pathways through closures for pedestrians and cyclists.
- Provide advance signing where appropriate.
- Proposed full and partial road closures must be referred to VicRoads for a report before consideration by Council. For further information on the process of seeking approval for a road closure refer to Chapter 13 of this manual.
8.6.3 Driveway Links

A driveway link discourages through traffic and reduces through vehicle speeds by creating the appearance of two culs-de-sac. Local residents may drive between the culs-de-sac on a narrow driveway link.

### APPROPRIATE LOCATIONS
- Short streets with excessive through traffic but where a full road closure is inappropriate.
- In relatively new subdivisions where traffic patterns are not well established.
- Where the continuity of a local street system is to be made less attractive to through traffic.

### INAPPROPRIATE LOCATIONS
- Streets with a high connective role in the local street network.
- Two driveway links should not be located in the same section of street as access to properties may only be by the driveway link.
- On bus routes.
- On an access road to an emergency service institution.

### ADVANTAGES
- Discourages through traffic.
- Creates a visual and physical obstruction.
- Increases pedestrian safety.
- Provides an opportunity for landscaping.

### DISADVANTAGES
- Restrictive for emergency and service vehicles.
- Loss of some on-street parking, but this may be compensated for in the design.
- Give way rule is unclear.
DESIGN PRINCIPLES

- Disguise the vehicle path by constructing a narrow one-lane meandering section.
- Construct a crossover at either end similar to a private driveway but with a smooth invert for cyclists.
- Paving materials should contrast with the street surface.
- Use planting to conceal the connective nature of the road, but do not restrict sight lines to unsafe levels.
- Design for a maximum speed through the device of 10-20 km/h.
8.6.4 Regulatory Signs - Turn, Entry and Specific Vehicle Bans

No entry and turn ban signs can be used to:
- restrict entry of through and short cutting traffic into a local traffic area.
- prevent turning traffic from causing excessive delays to through traffic.

Bans can be used to prohibit the entry of certain types of vehicles, (eg. trucks), into a local traffic area.

**APPROPRIATE LOCATIONS**
- Where vehicles are using local streets as a bypass of arterial roads and other measures such as road closures are inappropriate.
- On an arterial road where the carriageway is of insufficient width to provide a right turn storage lane at a local street intersection.
- Where turn bans are required for selected times, rather than all times.

**INAPPROPRIATE LOCATIONS**
- Where a high proportion of drivers wish to make the particular manoeuvre and no alternative route is readily available.
- On an access road to an emergency service institution.
- Where enforcement is likely to be low.

**ADVANTAGES**
- Discourages bypass movements which involve the use of local streets by through traffic.
- Increases capacity and reduces delay on the major road at intersections where bans apply.
- Can selectively discourage certain types of vehicles.
- Can be applied as a time of day ban (ie. No right turn 7.00 am - 9.00 am Monday - Friday).
- Full time bans can be made self-enforcing by restrictive channelisation.
- Low cost.

**DISADVANTAGES**
- May increase traffic volumes on adjacent local streets.
- Indiscriminate installation can result in low compliance.
- Increased trip lengths and travel times for some local users.
- Turn and entry prohibitions are difficult to enforce. (Particularly left turn bans.)
- No exemption for residents.
DESIGN PRINCIPLES

- The signs should conform to AS1742.13, and should be placed in conspicuous positions.
- Satisfactory alternative routes should be investigated.
- Exemptions for buses, taxis and cyclists should be provided where appropriate.
- Turn and entry bans for specific classes of persons or vehicles are MTCI's under Schedule 2, Road Safety (Road Rules) Regulations 1999 and require VicRoads consent. See Chapter 2 of this manual for further details.
- Turn and Entry bans at traffic signals are MTCI's under Schedule 2, Road Safety (Road Rules) Regulations 1999 and require VicRoads consent. See Chapter 2 of this manual for further details.
### 8.6.5 One-way Streets

One-way operation can be implemented in narrow streets where stationary or manoeuvring vehicles often restrict the available carriageway width. One-way streets can be introduced in residential areas to discourage through traffic or to assist with the consolidation of on-street parking.

On a one way street a contra-flow bicycle lane can be considered to provide a bicycle link.

#### APPROPRIATE LOCATIONS
- As part of a LATM scheme where it is desirable to introduce a one-way movement on a particular street to achieve the desired distribution of traffic throughout that area.
- Where a narrow two-way street is frequently blocked by vehicles manoeuvring into on/off street parking.
- On lightly trafficked streets where it is possible to increase the availability of parking by introducing one-way operation and converting kerbside parking from parallel to angle.
- On lightly trafficked streets where it is desirable to improve the visual amenity of the street by streetscaping and narrowing is acceptable.
- In areas of high pedestrian activity to reduce vehicular congestion and to improve safety for pedestrians.

#### INAPPROPRIATE LOCATIONS
- Where there is no suitable alternative route for the traffic in the prohibited direction.

#### APPROPRIATE LOCATIONS
- Reduced vehicular congestion.
- Reduction in potential vehicle conflicts.
- Parking manoeuvres tend to be less hazardous and cause less obstruction.
- Increased space for on-street parking or landscaping.
- Improved pedestrian safety and amenity.

#### INAPPROPRIATE LOCATIONS
- Possible non-observance in low volume streets.
- Increased traffic volumes on adjacent local streets.
- Buses may be obliged to follow unpatronised routes.
- Higher operating speeds if not carefully designed.
- Increased trip lengths and travel times for some local users.
- Emergency and service vehicles may have difficulty in reaching their desired destinations.
- Prohibits use of the carriageway by cyclists in the prohibited direction unless a contra-flow bicycle lane is provided. (Specific signing required.)
DESIGN PRINCIPLES

- The signs must conform to AS1742.2.

- One way signs are MTCL's if erected at or near traffic signals or have inscriptions limiting their operation to classes of persons or vehicles and VicRoads consent is required in these cases.

- Conversion of a street to one way operation in cases other than the above only involves signs which are minor traffic-control items and a report from VicRoads under section 10 schedule 11 of the Local Government Act is not required.

- Contra-flow bicycle lanes should follow the guidelines given in Section 4.3.4 of the Austroads Guide to Traffic Engineering Practice, Part 14, Bicycles.
8.6.6 Road Humps

A road hump is a speed reduction device in the form of a longitudinal section of carriageway raised in an approved profile and extending across the carriageway.

There are two approved hump profiles for on road use, ‘Type 1’, a curved hump commonly called the Watts hump and the flat top hump. The use and installation of road humps is to be in accordance with the following guidelines.

For off road use, such as car parks or camping grounds a smaller ‘Type 2’ hump may be used as described on page 8-28 and shown in Figure 8.7.

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**APPROPRIATE LOCATIONS**

- Where vehicle speeds on a local street are excessive.
- In residential streets with a local or limited collector function.
- Where a speed limit of 60 km/h or less applies.
- Where the traffic volumes are less than 4000 between 7.00 am - 7.00 pm.
- Where truck (> 4.5 tonne GVM) volumes are less than 50 between 7.00 am - 7.00 pm.
- Where the longitudinal gradient of the road is less than 10%.
- In rights-of-way or access roads to parks, reserves, where speeds are already low, but walking speeds are required, Type 2 humps may be used.

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**INAPPROPRIATE LOCATIONS**

- On bends and crests.
- Where access to private properties would be impeded.
- Streets in which emergency service institutions are located, ie. hospitals, or where that part of the road is used extensively for access to emergency service institutions.
- On streets with high commercial vehicle content.
- Where the road forms part of an essential access to commercial development.

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**ADVANTAGES**

- Reduction of vehicle speeds in the vicinity of the road hump.
- When used in series, reduces vehicle speeds over the entire length of the street.
- May discourage through traffic.

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**DISADVANTAGES**

- May adversely affect commercial vehicles.
- May only be used on relatively straight and flat streets away from intersections.
- Increased noise often due to vertical displacement of goods in the trays of utilities.
DESIGN PRINCIPLES

Based on AS1742.13-1991, Appendix D

- The first hump should be within 80-100 m of the start of the street where the approach speed of vehicles is naturally low, but it should be clear of arterial road intersections so that turning movements from the arterial are not impeded.

- Sight distance, commensurate with an operating speed of 60 km/h, is to be available to approaching motorists.

- Humps should be installed at right angles to the direction of travel.

- Hump spacing is recommended to be between 80 metres and 120 metres but spacing up to 200 m has been successfully used.

- Humps should extend laterally across the full road pavement which is available to traffic (except for an allowance for drainage). A bypass of the hump should be provided for bicycles, where possible.

- Sinusoidal Profile road humps may be used on roads used by a significant number of cyclists and where hump bypasses are not practical.

- Humps should be illuminated to the standard as specified in the Australian Standard Lighting Code, AS/NZS 1158.1 B1 category.

- A threshold treatment may be used in a street containing road humps to lower the approach speed to the humps.

- A road hump may be used in conjunction with a parallel slow point for increased effectiveness.

- Flat top road humps may be used at local road intersections provided the ramp to the hump is not within the intersection. Turning traffic may have ground clearance problems if the ramp is within the intersection.

- Humps should be clear of driveway entrances to avoid ground clearance problems when vehicles are accessing driveways.

- The hump pavement markings are given in Figure 2.7 (AS1742.13-1991 Section 4.3.6). The marking may be omitted where the humps are made from pavement material which contrasts with the road and the hump is clearly visible under all conditions. Flat top humps should have a contrasting top surface and ramps of linemarked asphalt or a contrasting material. If using a contrasting material for the ramps the ramps must be a light colour if asphalt road pavement is used so the ramp is visible in poor light conditions.

Note: Any profile with ramps flatter than 1:20 will not be considered a Road Hump as defined under these guidelines.

- To install a road hump on a scheduled bus route the written agreement of the Public Transport Corporation or bus company operating the route is required.

- Road humps are a Major Traffic Control Item and consent to install is delegated to Councils on certain roads and subject to the conditions shown in this Chapter.

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1 AS1742.13 specifies 50 m but experience has shown that 100 m is satisfactory.
(a) Flat top hump
Provide bypass for cyclists where possible

Dimensions are in millimetres.

(b) Watts profile hump

Note:
1. At ramps at entry points to shared zones the ramps grade is increased to between 1:2 and 1:4.

(c) Sinusoidal profile hump
(Bicycle facility)
**8.6.7 Road Hump Signing**

The standard road hump warning sign (W5-10) at each hump may be waived in streets where adequate advisory signing has been installed at the entries to the street.

Bollards with delineators are used in parks to highlight the location of the hump where there is inadequate public lighting.

At the beginning of any road in which a series of humps are constructed the symbolic advance warning sign, “Road humps ahead” (W3-4) and the “Next... (distance)... m” (W17-2) should be erected on one side of the carriageway facing entering traffic. A general arrangement for signing is shown below. Generally it is not necessary to use both ‘Road humps ahead’ signs and ‘Hump Warning’ signs where the humps are spaced 80 to 120 metres apart and are clearly visible.

**Figure 8.6: Type 1 Road Hump Scheme**

Humps Ahead Warning Sign (W3-4) and ‘Next ....m’ (W17.2) to be used in advance of an isolated hump or at the start of a series of humps.

Road Hump Sign (W5-10) and Advisory speed sign (W8-2) to be used at an isolated hump or at the leading hump in a series.

Not normally required where the humps are part of an area wide LATM scheme.
### 8.6.8 Off Road Hump - Type 2

The Type 2 road hump is considered appropriate only for off-road locations such as carparks, private access roads and caravan parks where vehicle speeds are very low (≤10 km/h). The road hump shape should conform generally to the cross-section detailed in Figure 8.7. The standard hump warning sign (W5-10) may be used at each hump with an advisory speed sign (W8-2) although their use may be waived if a sign is provided at the entry. Pavement markings should be used on the hump as illustrated in Figure 8.7 unless different light coloured paving material is used to distinguish the hump.

Care should be exercised when proposing use of Type 2 humps in areas where prams and shopping trolleys travel or where low clearance ground equipment operates (ie. fork lifts). Road humps should be located such that they will not inhibit drainage and should not be within vehicle manoeuvring areas.

![Figure 8.7: Type 2 Road Hump (Off Road)](image)

### 8.6.9 Road Humps For Buses

ARRB Transport Research Ltd, report ARR222, outlined the results of an investigation of road humps for use on bus routes. The report concluded that 100 mm high and 8 m long raised pavements with ramps 2000 to 2500 mm long resulted in acceptable bus comfort at speeds up to 24 km/h. These flat topped road humps, however resulted in mean vehicle speeds for light traffic of 47 km/h which made the road humps less effective for controlling vehicle speeds.

If road humps are being considered on scheduled bus routes the bus company must be consulted in the design process. If the ramp of the road hump is greater than 2 m long for a 100 mm high hump then under the design principles for road humps Section 8.6.6 the hump is not considered a Major Traffic Control Item and consent to install is not required.
8.6.10 Road Cushions

Road cushions have been used in other countries as an alternative to road humps where it is desirable to minimise inconvenience to buses and emergency vehicles. Under Section 105 of the Road Safety (Road Rules) Regulations 1999 a road hump is defined as a section of raised pavement constructed or placed in or on and across or partly across a road to restrict the speed of vehicles along that road.

Road cushions would therefore be administered as road humps which are Major Traffic Control Items for which consent is delegated to Councils on certain roads. Road cushions have not been used in Victoria to date but could be trialed.

The City of York, England, trialed road cushions and has recommended three cushion profiles shown in Figure 8.8. The road cushions are located in the centre of the traffic lane. Average car speeds over the cushions was in the 25 km/h to 30 km/h range. Refer report dated 19 October 1992 by Geoff Lewis and John Rigby, City of York, available from ARRB Transport Research.

![Figure 8.8: Road Cushions](image-url)
8.6.11 Slow Points

A slow point is a device intended to reduce vehicle speeds on a local street by the creation of a short narrowed section which must be negotiated at low speed. Depending on the geometry adopted and the spacing between slow points, a range of speed reductions can be achieved.

In general horizontal displacement treatments (slow points) have a higher accident rate than vertical displacement treatments (road humps) and are less favoured. There is a trade off between designing a narrow lane to reduce the speed of cars while providing a lane wide enough to allow garbage, recycling, and delivery vehicles into the area. The resultant design can be a challenge to some drivers.

APPROPRIATE LOCATIONS
- Where vehicle speeds on a local street are excessive.
- Where there is substantial vehicular/pedestrian conflict. (ie. parks, playgrounds, school crossings and elderly persons’ villages).
- Where it is desirable to reduce vehicle speeds and to increase landscaped area.

INAPPROPRIATE LOCATIONS
- On streets where sight distance is inadequate.
- Streets where on-street parking is in short supply.
- On narrow carriageways
- Streets with high commercial vehicle volumes.
- One-lane two-way slow points are not appropriate on bus routes.
- Where traffic volumes are greater than 5,000 between 7 am - 7 pm.
### ADVANTAGES
- Reduction of vehicle speeds in the vicinity of the slow point.
- When used in series, reduces vehicle speeds over the entire length of a street.
- May discourage through traffic.

### DISADVANTAGES
- Contrary to driver expectation if used in isolation.
- Restrictive for service and emergency vehicles.
- Reduction of on-street parking space.
- Increased traffic noise due to braking and acceleration at the device.
- Can be hazardous for cyclists at squeeze points.
- Two lane parallel slow points are ineffective for reducing traffic speed.

### DESIGN PRINCIPLES
- The first slow point in a street should be within 100 metres of a gateway treatment, sharp corner or end of the street so that the approach speed may not exceed 50 km/h.
- A 2.8 to 3.5 m lane width should be maintained through the device.
- Deflection angles may be varied in the range 10 - 30 degrees and return deflection kerbs should be provided to redirect vehicles away from parked cars or bicycle paths. (Too shallow an angle will be ineffective.)
- The two “leading edges” are critical to the geometry of the slow point. These should be constructed so that large vehicles can mount them and smaller vehicles can mount them without danger, although it may be uncomfortable.
- Provide frangible bollards with reflectors to delineate the shape of the device and to protect landscaping where appropriate.
- Consideration should be given to allowing cyclists to bypass slow points and thus avoid conflict with vehicular traffic. Raised kerbs should be used to prevent vehicles straying onto the bicycle path at the ends of angled slow points.
Figure 8.10: Types of Slow Points

- Single-Lane Parallel Slow Point
- Two-Lane Parallel Slow Point
- Single Lane Angled Slow Point
- Two Lane Angled Slow Point
- Double Offset Slow Point
Design Principles (cont)

- Consider the visibility of the device at night.
- Approaches should be delineated by linemarking/diagonal marking and raised reflective pavement markers.
- May be used with road humps for increased effectiveness.
- Should a one way slow point create confusion over priority the erection of a ‘Give Way’ sign at one approach may be considered. The likelihood of two cars meeting head on and one having to give-way in a one-lane two-way slow point is no higher than the likelihood of the same thing happening in a narrow street opposite parked cars. Refer AS1742.2 Section 3.6.6.1.
- A succession of one lane slow points are irritating to drivers and at night where eye contact is lost, priority is difficult to determine.
- Need to be able to manoeuvre a car and a caravan through the slow point.
- Avoid locations with driveways on the exit side of the device.
- Offset slow points, when used in series, should be installed on alternate sides of the carriageway with the first protuberance on the left side of the carriageway facing the driver, and at least 8.0 m from the intersection.
### 8.6.12 Mid Block Islands

A series of mid-block islands can reduce vehicle speeds along the length of a street by narrowing the road pavement available to traffic. Mid block islands provide increased safety for pedestrians crossing the road.

#### APPROPRIATE LOCATIONS
- Where vehicle speeds on a local road are excessive.
- Where local street width is sufficient and traffic volumes are low.
- Where centre of the road tree planting is desirable.
- Where pedestrians cross at several points along the street.

#### INAPPROPRIATE LOCATIONS
- On narrow streets where a substantial mid block island cannot be fitted.

#### ADVANTAGES
- Well spaced mid-block islands reduce speeds along the length of a street.
- They provide a refuge for pedestrians and cyclists crossing the street.
- When landscaped, mid-block islands may visually enhance the residential streetscape.

#### DISADVANTAGES
- Reduction of on-street parking space. This may be compensated for by the provision of centre of the road parking bays between islands on wide streets.
- May create a squeeze point for cyclists.

#### DESIGN PRINCIPLES
- Variable width of island depending on the carriageway width. (2 m is desirable, 1.2 m minimum.) The path through the island may be angled to increase the holding length for bicycles.
- Variable length of island depending on parking demand and the location of driveways.
- Desirable minimum lane width of 3.0 m.
- Kerbs of mid-block islands are preferred to be semi mountable.
- Pedestrian paths should be incorporated into the islands in areas of high pedestrian activity.
- Landscaping and beautification of the islands should not reduce sight distances to unsafe levels.
A variation on the mid block island is the **centre blister island** which has angled approaches and are installed in locations where a slow point is required in a mid block location but the restricted cross section makes angled slow points unacceptable. Centre blister islands may be more acceptable on bus routes.

*Figure 8.11: Centre Blister Island*
### 8.6.13 Modified T-intersections

This device generally provides speed and through traffic reduction by altering the geometry and hence the priority at a T-intersection. The priority of the intersection changes so that the continuing road turns through the intersection.

Rule 73(7) of Road Rules - Victoria describes how the Give Way requirements at a 'T'-intersection are applied at a modified 'T'-intersection.

<table>
<thead>
<tr>
<th>APPROPRIATE LOCATIONS</th>
<th>INAPPROPRIATE LOCATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>❑ Where there is a series of T-intersections and vehicle speeds on the top of the “T” are excessive.</td>
<td>❑ On crests where the sight distance is limited.</td>
</tr>
<tr>
<td>❑ Where the volume of turning traffic is high.</td>
<td>❑ On streets with carriageway widths less than 7.0 m.</td>
</tr>
<tr>
<td>❑ At T-intersections where accident numbers are high.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>❑ Reduction of vehicle speeds in the vicinity of the device.</td>
<td>❑ May be restrictive for emergency and service vehicles unless carefully designed and constructed.</td>
</tr>
<tr>
<td>❑ When placed in series, can lower vehicle speeds along the length of a street.</td>
<td>❑ May reduce on-street parking spaces.</td>
</tr>
<tr>
<td>❑ May discourage through traffic from the top of the “T”.</td>
<td>❑ May cause confusion over which vehicle has the right of way.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DESIGN PRINCIPLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>❑ Lane widths should allow furniture vans and garbage trucks to negotiate the intersection.</td>
</tr>
<tr>
<td>❑ A modified intersection requires a change to a Major Traffic Control Item (stop or give way signs) for which approval is delegated to Councils on certain roads.</td>
</tr>
<tr>
<td>❑ Splitter islands should be used and should have semi mountable kerbs.</td>
</tr>
<tr>
<td>❑ Visibility at night should be carefully considered.</td>
</tr>
<tr>
<td>❑ Use hazard markers to highlight the device and RRPM’s to delineate the approaches.</td>
</tr>
<tr>
<td>❑ Drainage considerations may limit the geometry of the device.</td>
</tr>
</tbody>
</table>
Another form of T-intersection modification is a deviation at the top of the T to achieve a speed reduction (Figure 8.12). There is no change of priority at the intersection. Care must be taken in the design to separate opposing traffic lanes by splitter islands to avoid head on conflicts. A give way line at the leg of the T should be marked to emphasise priority. See also Section 3.2.4, terminating intersections.
## 8.6.14 Entry thresholds

An entry threshold is a device intended to change the image of a street so that drivers are made aware that they are entering a residential environment with driving conditions that are different to the arterial network.

<table>
<thead>
<tr>
<th>APPROPRIATE LOCATIONS</th>
<th>INAPPROPRIATE LOCATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>❑ At streets entering a local traffic area or at a mid-block location.</td>
<td>❑ Roads with more than 4000 vpd.</td>
</tr>
<tr>
<td>❑ Streets with traffic volumes less than 4000 vpd.</td>
<td>❑ On wide carriageways unless road narrowing is provided.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>❑ Alerts drivers that they are entering a local traffic area and that LATM devices may be expected in the area.</td>
<td>❑ Effectiveness is limited unless complemented by other devices in the street.</td>
</tr>
<tr>
<td>❑ Reduces entry speed to an intersection.</td>
<td>❑ May increase traffic volumes on other nearby streets.</td>
</tr>
<tr>
<td>❑ Separates residential areas from areas of non-residential land use.</td>
<td></td>
</tr>
<tr>
<td>❑ Can be built to reduce the carriageway width to be crossed by pedestrians.</td>
<td></td>
</tr>
<tr>
<td>❑ Highlights the presence of an intersection.</td>
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<thead>
<tr>
<th>DESIGN PRINCIPLES</th>
</tr>
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<tbody>
<tr>
<td>❑ Minimum length of the threshold should be 5.0 m for adequate visual effect.</td>
</tr>
<tr>
<td>❑ Visual effect may be enhanced by the use of contrasting pavement materials at the threshold.</td>
</tr>
<tr>
<td>❑ Should not be so restrictive or have ramps so as to cause entering vehicles (particularly right turning vehicles) to turn too slowly and cause hazards for traffic on the major road.</td>
</tr>
<tr>
<td>❑ Tactile paving should be used if there is no level difference where the footpath meets the road to warn partially sighted people of the start of the road way.</td>
</tr>
</tbody>
</table>
8.6.15 Splitter islands

Splitter islands can be used as a means of improving safety by channelising traffic, improving intersection conspicuity and providing pedestrian refuges at an intersection. They are used to reduce the volume of through traffic by limiting the capacity of traffic to leave the local street and to provide motorists with a clear indication they are entering a local street.

**APPROPRIATE LOCATIONS**

- Where there is a need to reduce the capacity of an intersection as part of a LATM scheme.
- At all points of transition between boundary roads and local streets, ie. at gateways to residential areas.
- Residential streets with high volumes of through traffic.
- Where there is a need to reduce entry speed of vehicles to a short residential street, (ie. less than 500 m long).
- Where there is a need to provide a pedestrian refuge at an intersection.
- To control turning traffic and prevent corner cutting.
- At the entrances to a local traffic area.

**ADVANTAGES**

- May discourage through traffic by reducing intersection capacity, for instance, reducing a two lane exit of a local street to one lane may divert drivers to other routes.
- Reduces entry speeds at the intersection.
- Reduces the carriageway width to be crossed by pedestrians.
- Increases vehicular and pedestrian safety at an intersection.
- Provides physical separation of traffic.
- Can improve intersection definition.

**DISADVANTAGES**

- Splitter islands have little effect on mid-block vehicle speeds in long streets.
- May be restrictive for emergency and service vehicles.
- May increase traffic volumes in other nearby streets.
- Effectiveness limited unless complimented by other devices in the street.
- Can create a squeeze point for cyclists.
DESIGN PRINCIPLES

- Lane widths and the set back of the island at the intersecting street should be adequate to provide for the turning requirements of service vehicles.

- The overhang of a turning truck should be checked to ensure the safety of a pedestrian sheltering in the splitter island.

- The width of a splitter island should not be less than 1.2 m for sheltering a sign. If the island is intended to be used as a pedestrian refuge, a desirable minimum island width of 2 m should be provided. If fully mountable kerbs are used and the splitter island is free of signs the width may be reduced below 1.2 m.

- Requires good illumination.

- Install a centre line over the last 30 m of the street and take it past the island on the left hand side and install white raised reflective pavement markers at 6 m spacing.

- A “Keep Left” sign is desirable to provide conspicuity of the island.

- An opening in the island should be provided for pedestrians and perambulators, preferably at road pavement level.

- Pram crossings should be provided on both sides of the intersection.

- Minimum length of splitter island should be 8.0 m for adequate visual effect. (May be reduced to cater for driveways.)

- Visual effect may be enhanced by the use of contrasting pavement materials with adequate skid resistance at the threshold.

- Ensure parking restrictions are adequate to allow safe approach to and departure from the device.
Design for Trucks, Buses & Emergency Vehicles on Local Roads

November 1998
Design for Trucks, Buses & Emergency Vehicles on Local Roads

Introduction

Trucks have a legitimate reason to travel on local roads, including roads in residential areas. Access is also necessary for emergency vehicles, cars towing caravans, and trucks used to provide various services to properties within the area.

In addition, some local roads perform important traffic functions and need to be designed and managed accordingly.

This brochure is a summary of information available for the design of traffic management devices to ensure safe and convenient passage of the above vehicles on local roads. For full information on the guidelines applying to traffic facilities, the VicRoads’ manuals, listed in this brochure, must be consulted.

Legal Requirements

Chapter 2 of the VicRoads’ Trucks on Roads Design Guide sets out the legal requirements for designing and implementing traffic treatments. The designer needs to determine whether the highway authority has the power to install the treatment, where is the source of the power (in what act or regulation), and what are the obligations and limitations to that power.

The law of negligence attaches liability for a failure to take reasonable care in circumstances where the law has imposed a duty of care. An authority which designs and installs traffic treatments has a duty of care towards road users. Also a road is considered to be a workplace for the transport industry under OH&S legislation. Therefore a highway authority must be able to demonstrate that all traffic facilities are appropriate and have been designed and installed by suitably qualified and competent personnel.

Obstructions on roads

The Local Government Act gives a Council power to block or restrict the passage or access of vehicles on local roads. However, a Council must consider a report from VicRoads, before exercising this power.

Approval to install major traffic control items

The Traffic Regulations allow a highway authority to erect minor traffic control items and, with VicRoads’ consent, erect major traffic control items.

VicRoads authorises a designated officer at each Municipal Council to approve the installation of the following major traffic control items on local roads:-

- a stop sign
- a give way sign
- a roundabout sign
- a road hump
- signs directing angle parking or parking near the centre of a carriageway
- parking signs near traffic islands, intersections and school crossings
- parking signs on the right hand side of service roads

(Only the major traffic control items affecting larger vehicles are shown above)
In approving these major traffic control items the designated officer must follow the guidelines in the Traffic Engineering Manual Volume 1, Traffic Management, and in the Trucks on Roads Design Guide.

The installation of major traffic control items on declared highways and main roads and the installation of major traffic control items, not delegated to Council, on any road, requires the consent of VicRoads.

Local Area Traffic Management Planning

Local area traffic management schemes must be planned taking account of:

- Identification of routes for larger vehicles in local areas
- Emergency vehicle routes and access
- Service vehicle access
- Location of fire stations and hospitals
- Schools/School Bus routes
- Scheduled bus routes
- Commercial areas, corner shop, small neighbourhood shopping strips
- Industrial areas, small factories and garages

A traffic treatment check list is shown in Figure 4.1 and Appendix E of the Trucks on Roads Design Guide.

Community consultation is important to develop an agreed strategy for managing traffic in local areas and design criteria suitable for the role each road is to perform. Traffic management treatments are selected to suit the function of each road.

Emergency and service vehicles must be able to reach all residences and properties

An access strategy for larger vehicles should be developed for an area. Devices which are not negotiable by larger vehicles should be used sparingly so that the length of travel to each residence is not significantly increased. Signs should be used to provide adequate warning of restrictions on larger vehicles.

Streets with a lesser traffic function may be designed with mountable kerbs or paved areas to enable large vehicles to turn. Devices should preferably be designed and constructed so as not to trap the occasional larger vehicle. The design should take into account the likelihood of this vehicle entering the area and, where practical, provide for escape paths, eg alternative routes and the ability to mount kerbs without hitting obstructions.

Road safety audits should be carried out, by an independent qualified examiner, at various stages during the design and installation of traffic management devices.

The statutory approval process must be followed before any traffic control treatments are installed. If a scheduled bus route is affected the written approval of the Public Transport Corporation or the bus company is required.

When using major traffic control items delegated to a Council, VicRoads’ guidelines must be followed. VicRoads consent must be obtained for the installation of any major traffic control items not delegated to Council or which do not follow VicRoads design guidelines. The requirements of the Local Government Act on the placement of barriers and obstructions must be followed.
If a proposal requires the banning of classes of vehicles by weight, height and length the agreement of VicRoads is required.

If there is a dispute between a Council and another party on an issue relating to trucks, buses and emergency vehicles, that matter should be referred to the VicRoads’ Regional Manager who can refer it to the Truck Operations Committee prior to deciding on the proposal.

**Geometric Design**

It is essential to ensure that roads are both safe and functional by the use of consistent design standards which meet the expectations of drivers. The VicRoads Road Design Guidelines, Part 2, Vertical and Horizontal Geometry includes provisions for trucks in the design of road alignments and intersections.

**Turning path templates**

It is important to provide for the swept path of trucks by using the standard templates for turning vehicles contained in the AUSTROADS, Design Vehicle and Turning Path Templates, 1995, available from the VicRoads’ Bookshop.

The design principle for layouts is that a design vehicle template is used initially and the next larger vehicle template is used to check the layout to ensure occasional access is available.

The size of vehicles used in the design of local roads are:

- Car: 5.0m x 1.9m
- Service truck: 8.8m x 2.5m
- Single unit truck/bus: 12.5m x 2.5m

In local road areas the following design vehicles should be used:

- For collector type local roads the single unit truck/bus should be used.
- For other local roads the service truck should be used.

Roads designed to accommodate the service truck should also be checked to ensure that a single unit vehicle has an escape route. This may be accomplished by allowing the single unit vehicle to travel over specially designed parts of traffic islands or to encroach into the opposing direction traffic lane for a short distance as permitted by traffic regulations.

For the design of local roads the 8.8m long design service vehicle should be used. This length vehicle caters for fire trucks and garbage compactors.
**Cross fall**

The rate of cross fall and super-elevation on curves and at intersections can be a serious problem for trucks and buses due to their high centre of gravity. Especially critical locations are intersections on a down grade steeper than 3% - 4%. It is preferable to limit the longitudinal grade across significant intersections to 3%.

Where trucks have to operate close to a kerb the effect of the pavement camber has to be taken into account in the positioning of fixtures such as service poles, lighting poles, signs, shop verandahs and landscaping (trees) to prevent collision with these objects.

**Kerb types**

The kerb profiles used are:
- mountable M1 to M6 profiles
- semi mountable SM1, SM2 and SM3 profiles
- barrier B1, B2 and B3 profiles

Refer to VicRoads standard drawing SD2001.

Current practice is to use a channel or tray, regardless of the need to collect drainage, as roadway delineation is improved.

These kerb types are used in the following ways:
- Mountable no bullnose (M1, M2, M3) - use where vehicles are expected to regularly cross over a kerbline ie. between a parking bay and a traffic lane or a break in a median opposite a driveway.
- Mountable 30 - 40 mm bullnose (M4, M5, M6) - use where it is desirable to keep traffic off an island, for example the mountable apron of a roundabout central island. Do not use where pedestrians or cyclists have to cross the kerb.

Semi mountable (SM1, SM2, SM3) - generally used where a vehicle is expected to mount the kerb at an angle of less than 20 degrees.

Barrier kerb (B1, B2, B3) - use only adjacent to areas of pedestrian activity where there is adequate roadway width for larger vehicles and traffic speed is 60km/h or less.

Bluestone may be used on semi mountable or barrier kerb profiles if care is taken to avoid sharp protrusions which may damage tyres. The use of unusually high barrier kerbs or rough bluestone kerbs should be avoided.

**Placement of traffic signs and delineation**

When locating signs on local streets, realistic consideration should be given to the swept path of larger vehicles to minimise damage to signs by the front overhang of vehicles. The location of signs is particularly relevant at driveways, intersections and traffic management devices.

Ensure that high mounted signs or landscaping (trees) do not obstruct the vision of truck and bus drivers from side roads and driveways.

Also do not place “KEEP LEFT” signs or hazard markers on the nose of narrow or small islands as they are prone to damage. Instead use pavement markings to provide control and guidance.
Some Traffic Control Devices

Roundabouts

In most cases the design should be based on a single unit truck/bus. In some cases, however a service vehicle or a design car may be used as the 'design vehicle'. In this case, provision should be made for the occasional single unit vehicle to negotiate the roundabout by encroaching onto specially constructed areas of the central island, splitter island or behind the outside corner kerbs.

Where scheduled bus services operate on a local road, in the interests of passenger comfort the bus should not be required to mount kerbed or raised islands.

Splitter islands should be kept relatively free of furniture and landscaping to allow an occasional large vehicle to traverse over them if required. An alternative to kerbed splitter islands are painted islands with raised reflective pavement markers.

T Intersections

T intersections need to be carefully designed to enable passage by the design vehicle. Lane widths on the through roadway need to allow the design vehicle to turn within the kerbs. As for roundabouts, kerbed median islands need to be constructed so they can be driven over by the occasional vehicle larger than the design vehicle.

Slow Points

If bluestone kerbs are used, care should be taken to avoid sharp protrusions which may damage tyres.

Two-lane angled slow point from Australian Standard 1742.13 - 1991 Local area traffic management.
Slow points may be angled, parallel, one lane or two lane and are usually restrictive for larger vehicles. To allow the passage of larger vehicles, the leading edges of islands are critical in the design of slow points. These should be constructed so that large vehicles and small vehicles can mount them without danger, although it may be uncomfortable for car occupants.

**Driveway links**

A driveway link is a short length of single width carriageway only able to be used in one direction at a time.

On driveway links, consideration should be given to two vehicles meeting on the link. Preferably drivers should be able to see whether the link is clear of vehicles before proceeding. Alternatively passing opportunities should be provided at appropriate locations.

Two driveway links should not be used in the same street as access to some properties will only be via driveway links, thereby restricting large vehicles.

**Splitter Island, Centre Blister Islands and Pedestrian Refuges**

These devices require careful design to ensure that lane widths will cater for larger vehicles.

**Road Humps**

Road humps are major traffic control items and approval to install them is delegated to Councils on local roads. The design of road humps must follow VicRoads' guidelines which include profiles for rounded top (Watts type), sinusoidal and flat topped road humps. Road humps should be spaced at 80 - 120m but spacing up to 200m has been successful. The first hump should be located 50 - 100m from the start of a street.

Road humps may sometimes cause noise problems in residential areas. Also road humps can be a problem for some vehicles and should therefore be used with caution.
**Bridge Load Limit Sign**

A ‘bridge load limit’ sign is a major traffic control item which requires VicRoads’ approval to erect. Vehicles which are heavier than the mass posted on the sign, must not pass the sign.

**No Trucks Sign**

A ‘no trucks’ sign is a major traffic control item which requires VicRoads’ approval to erect. Vehicles (other than commercial passenger vehicles) over 4.5 t, gross vehicle mass, or a specified mass or length, must not pass the sign, except for access for delivery or pickup in close proximity, where not alternative route is available.

**Road Load Limits**

Under Schedule 11 of the Local Government Act, a Council may prohibit or restrict vehicles of a certain size or weight from using a road. The Road Safety (Vehicles) Regulations also allows a Council to prohibit vehicles of more than 5 tonnes mass from using a road under its care or management if it believes the highway construction or condition warrants such a prohibition. As the ‘No Trucks’ sign is easily understood, it is recommended that for future load limit prohibitions, Councils use the ‘No Trucks’ sign. This sign requires VicRoads’ consent before installation.

**REFERENCES**

Victorian Road Safety (Traffic) Regulations 1988

VicRoads

Trucks on Roads Design Guide, 1994
Traffic Engineering Manual Volume 1, Traffic Management
Road Design Guidelines

Australian Standard 1742, Manual of Uniform Traffic Control Devices

Part 2: Traffic control devices for general use
Part 10: Pedestrian control and protection
Part 13: Local area traffic management

AUSTROADS,
Guide to Traffic Engineering Practice,
Part 6: Roundabouts
Part 10: Local Area Traffic Management
Design Vehicles and turning templates
Road Safety Audit

Traffic Engineering and Management,
KW Ogden and SY Taylor Chapter 4.8
Planning and Design for Trucks, Monash University 1996
Traffic Management - an Introduction

*This brochure has been prepared to provide general information on the design of local roads for larger vehicles. While it directs attention to and comments upon, aspect of law, it is not intended to provide legal advice in the area. Further professional advice should be sought if needed.*

*For more information contact VicRoads’ Regional Manager for your area.*
Road Humps

Road humps should be designed in accordance with the principles set out in VicRoads Traffic Engineering Manual, Volume 1: Traffic Management. However, in areas where ULF buses are used, it is desirable that the front overhang of the bus is not allowed to extend beyond the kerb. This is to ensure that the front and rear axles of the bus are raised at the same time, and the ramps should have the most gentle slope permitted by the guidelines. It is noted that humps should be no higher than 100 mm above the surrounding road surface. It is important that the clearance of the vehicle is not reduced due to irregularities in the road surface adjacent to the hump, or the hump height is not increased by potential obstacles such as narrow raised concrete driving strips.

Bus Stops

Bus stops should be easily accessed by persons with disabilities and elderly pedestrians, by the provision of smooth, well-designed and well-maintained footpaths. Consultation

It is essential that councils or consultants initiate discussions with bus operators at an early stage in the development of intersection or traffic management treatments along local roads so that they are designed to accommodate the buses which are intended to use the roads. Bus operators or ULF bus manufacturers will make available to councils or consultants precise details of the bus characteristics, such as under body clearances, so that inconvenient and costly changes to designs and/or traffic management treatments are avoided.

References

- Victorian Road Safety (Traffic) Regulations 1998
- VicRoads Design For Trucks, Buses and Emergency Vehicles on Local Roads - 1998
- Traffic on Roads Design Guide 1994
- Road Design Guidelines
- Part 2: Traffic Control Devices for General Use
- Part 10: Pedestrian Control and Protection
- Part 13: Local Area Traffic Management
- Austroads Guide to Traffic Engineering Practice
- Part 4: Roundabouts
- Part 10: Local Area Traffic Management
- Road Safety Audit
- VicRoads Traffic Engineering and Management, Chapter 4.8: Planning and Design for Trucks
- Monash University 1996
- KW Ogden and SY Taylor Traffic Management - An Introduction
- RT Underwood Design Vehicles and Turning Templates
- Road Safety Audits
- Traffic Engineering and Management, Chapter 10: Local Area Traffic Management, BT Underwood

For more information contact the VicRoads' Regional Manager for your area.
Introduction

Victoria’s passenger buses have been in the process of being replaced with ULF (Ultra Low Floor) buses over the past 20 years to meet the requirements of the Commonwealth’s Disability Discrimination Act 1992.

The Austroads design vehicles (18m semi trailer and 10m long bus) are used to be designed on arterial roads. The physical dimensions of the ULF bus mean that it has become an important design vehicle for use when developing proposals for local road projects.

This brochure presents information to assist in the design of traffic management treatments on local roads to ensure safe and convenient passage for ULF buses. It supplements, and must be read in conjunction with, the Austroads design vehicles. Nevertheless, in spite of the smaller turning radius, the overall swept path of the ULF bus remains critical since bus operation can be affected by obstacles close to the front of the bus.

The principles described below for the design of typical urban local road roundabouts in Victoria are to be considered (Figure 8). The principles outlined in this guide. The principles described should be applied to other types of intersections along bus routes where this is applicable.

Important Factors to Consider

A number of features on existing roads are known to cause operational and potential safety problems for ULF buses. Urban roads need to be considered in the development of ULF bus designs.

The following additional information describes aspects of design which must be taken into account to adequately provide for ULF buses at local road roundabouts.

Through Movement

Whilst the urban local road roundabout is the most common intersection type, situations have been considered (Figure 4). The position of holding lines on approaches should also be checked to ensure that they are located clear of the front of turning ULF buses.

Roundabouts

Austroads Guide to Traffic Engineering Practice, Part 6 – Urban Local Road Roundabouts is the primary reference for the design of roundabouts in Victoria. All roundabouts, including those on local roads, should be designed in accordance with the principles outlined in this guide. The principles described should be applied to other types of intersections along bus routes where this is applicable.

A tight turn at a signalised intersection

Through Movement

Roundabouts

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Introduction
Victoria’s passenger bus fleet has been in the process of progressively replaced with Ultra Low Floor (ULF) buses over the past 20 years to meet the requirements of the Commonwealth’s Disability Discrimination Act 1992.

The Australian design guidelines (ULF buses) are modelled on the local roads and at their intersections with arterial roads. In particular, improvements should be considered to the design of the following aspects:

- Setting of a turn on the inside of a roundabout where vehicles mount barrier kerbs while turning into or out of local streets.
- Intersections where vehicles have kers instead of local roads to control the overall swept path of the ULF bus through to the turn in a similar way to the Australian vehicle because of the larger front overhang.
- Roads that have no barriers provide greater access for bus patrons, particularly the elderly and people with disabilities.

Important Factors to Consider

- Lower bus floor provides improved access for bus patrons, particularly for the elderly and people with disabilities.
- The principles described below for the design of a typical roundabout should be applied to other types of roundabouts in Victoria. All roundabouts, including those on local roads, should be designed in accordance with the principles outlined in this guide. The principles described should be applied to other types of intersections and roundabouts on local roads to complete the turn.
- Ultra Low Floor (ULF) bus characteristics differ from the traditional bus in that they are lower to the ground, have a longer front overhang and a shorter turning radius and swept path.
- The other references listed at the end of this brochure should also be consulted by designers to gain a comprehensive understanding of the guidelines applying to the design of traffic facilities.

Vehicle Sweep Path

Traffic management treatments on bus routes along local roads should be designed to accommodate the design vehicle, as shown in Figure 1.

While ULF buses have the same length and similar steering angle, which provides increased manoeuvrability, they have a greater front overhang, which provides increased maneuverability in negotiating local road traffic management treatments.

However, ULF buses also have a longer and longer front overhang which must be taken into account in designing traffic management treatments.

The conflicting requirements are demonstrated in Figure 2, where the highest steering angle has been used to allow the ULF bus to turn on a radius of 10.8 m in the outside bus turn, compared with the 12.5 m radius standard adopted for the Australian single unit bus design vehicle. Nevertheless, in spite of the smaller turning radius, the overall swept path of the ULF bus through to the turn in a similar way to the Australian vehicle because of the larger front overhang.

Roundabouts

A number of features on existing roads are found to cause operational and potential safety problems for ULF buses using local roads and at their intersections with arterial roads. In particular, improvements should be considered to the design of the following aspects:

- Settling of the overhanging road superstructure due to unequal loads on the two sides of the bus.
- Power reticulation and lighting poles which are often located on the corners of intersections and impede the movement of ULF buses or, if mounted by buses, cause discomfort to passengers.
- Road furniture on the islands of traffic management treatments which should not be located where they unduly restrict ULF buses.
- Pedestrian standing areas which need to be defined and located so that they are not impeded.
- Power and street lighting poles should not be located on the corners of intersections and impede the movement of ULF buses.
- Road furniture on the islands of traffic management treatments which should not be located where they unduly restrict ULF buses.
- Pedestrian standing areas which need to be defined and located so that they are not impeded.

The principles described below for the design of a typical roundabout should be applied to other types of roundabouts in Victoria. All roundabouts, including those on local roads, should be designed in accordance with the principles outlined in this guide. The principles described should be applied to other types of roundabouts on local roads to complete the turn.

All intersection movements forming part of a bus route must be designed to safely accommodate the movement of ULF buses.

Verges where buses turning right into local streets everting the very exact location of the surface profile behind the kerb.

In the process of this manoeuvre, the approaching bus may encounter difficulties in terms of the relative turn in the turn so that they should be designed to allow the ULF bus to turn on a radius of 10.8 m in the outside bus turn, compared with the 12.5 m radius standard adopted for the Australian single unit bus design vehicle. Nevertheless, in spite of the smaller turning radius, the overall swept path of the ULF bus through to the turn in a similar way to the Australian vehicle because of the larger front overhang.

The swept path of the vehicle throughout the movement is the area that must be defined in terms of the relative positions with respect to the roundabout. Similar to other movements, a mountable apron on the inside of the turn. However, drainage, signage, kerbs and service (overhead service poles are frequently encountered in these locations) need to be considered. Further, pedestrian areas should be permitted and located so that they are not impeded by buses.

The other references listed at the end of this brochure should also be consulted by designers to gain a comprehensive understanding of the guidelines applying to the design of traffic facilities.

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**Introduction**

Victoria’s passenger bus fleet has been in the process of being replaced with Ultra Low Floor (ULF) buses over the past 20 years to meet the requirements of the Commonwealth Disability Discrimination Act 1992.

The Australian design vehicles (ULF semi trailer and longer vehicles) are to be used for designs on arterial roads. The physical dimensions of the ULF has means that it has become an important design vehicle for use when developing proposals for local road design guidelines and road space management.

This brochure presents information in assistance to the design of traffic treatments on local roads to ensure safe and convenient passage for ULF buses and supplements, and may be used in conjunction with, the VicRoads publication “Design for Buses, Trams & Emergency Vehicles on Local Roads”. November 1996. The other references listed at the rear of this brochure should also be consulted by designers to gain an understanding of other guidelines applicable to the design of traffic facilities.

**Important Factors to Consider**

A number of features on existing roads are known to cause operational and potential safety problems for ULF buses using local roads and at their intersections with arterial roads. Particular improvements should be considered to the design of the following aspects:

1. Road geometry at intersections where buses mount barriers while turning into or out of local streets.
2. Inappropriate changes in pavement profile across intersections, at the crown of a road, at median openings, within intersections, at the crown of a road pavement, or at entrances (to schools, shopping centres, bus terminals) may cause the front or rear ULF bus to contact the pavement.
3. Devices such as road humps which may be constructed strictly in accordance with VicRoads guidelines.
4. Trees and vegetation which should be located and maintained to ensure that the necessary sight lines are not impeded.
5. Roundabouts

Austroads Guide to Traffic Engineering Practice, Part 6 - Roundabouts is the primary reference for the design of roundabouts in Victoria. All roundabouts, including those on local roads, should be designed in accordance with the principles outlined in this guide. The principles described should be applied to other types of intersections and traffic management treatments along bus routes.

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**Vehicle Swept Path**

Traffic management treatments on bus routes along local roads should be designed to accommodate the design vehicle shown in Figure 1.

While ULF buses have the same length and similar operating characteristics as the standard Australian design buses, the semi-trailer ULF buses have a greater steering angle, which provides increased maneuverability in negotiating local road traffic management treatments.

A scaled drawing of the above turning template has been distributed to councils and road authorities.

Designers should also be checked to ensure that they can accommodate other design vehicles that are likely to use the route, such as service vehicles.

**Through Movement**

While this is the common movement for buses, a design that provides the appropriate entry and exit widths for buses may also be required to reduce the speeds of smaller vehicles. (Figure 26). Viewing radius should be provided to reduce the speeds of smaller vehicles, its inner edge being positioned by a radius of 12.0 m to the kerb. On VicRoads A81 profiles this path should not cause uncomfortable lane changes where large vehicles approach it as a slight curve and the kerb not very high (Figure 24).

**Vehicle Swept Path**

The swept path of the vehicle throughout the movement is illustrated in Figures 25 to 27, and is determined by the turning radius of the roundabout. Similar to other movements, a smooth and safe transition to and from the swept path should be considered (Figure 4). The position of box lines on approaches should also be checked to ensure that they are located clear of the front edge of turning circles.
Designing Local Roads for Ultra Low Floor Buses
July 1999

References
Victoria Road Safety (Traffic) Regulations 1998
VicRoads
Design For Trucks, Buses and Emergency Vehicles on Local Roads - 1998
Traffic on Roads Design Guide 1994
Road Design Guidelines
Part 2: Traffic Control Devices for General Use
Part 10: Pedestrian Control and Protection
Part 13: Local Area Traffic Management

For more information contact the VicRoads’ Regional Manager for your area.

Road Humps

Road humps along local roads must be designed in accordance with the principles set out in VicRoads Traffic Engineering Manual, Volume 1: Traffic Management. However, on routes used by ULF buses it is desirable that the front overhang be kept to a minimum in order to maximise the safety of pedestrians. It is important that the design of the road surface should not exceed 150 mm above the surrounding road surface. It is important that the clearance of the vehicle is not reduced due to irregularities in the road surface adjacent to the hump, or the hump height is not increased by potential obstacles such as narrow raised concrete driving strips.

Bus Stops

Bus stops should be easily accessed by persons with disabilities and elderly pedestrians, by the provision of smooth, well-designed and well-maintained footpaths.

Consultation

It is essential that councils or consultants initiate discussions with bus operators at an early stage in the development of intersection or traffic management treatments along local roads so that they are designed to accommodate the buses which are intended to use the roads.

Bus operators or ULF bus manufacturers will make available to councils for consultation precise details of the bus characteristics, such as under body clearances, so that inconvenient and costly changes to designs and/or traffic management treatments are avoided.

For more information contact the VicRoads’ Regional Manager for your area.

Front Overhang

Where the front overhang of an ULF bus sweeps beyond the pavement, designers should make provision for the front overhang to clear the area beyond the kerb. An area for a distance of 2.0 m behind the back of kerb should not exceed 50 mm above the projected pavement level or have any road furniture, utility poles or landscaping on it (Figure 5).

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Front bus overhang on traffic island at roundabout

Front bus overhang over traffic island at roundabout

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Front Overhang

Where the front overhang of an ULF bus sweeps beyond the pavement, designers should make provision for the front overhang to clear the area beyond the kerb. An area for a distance of 2.0 m behind the back of kerb should not exceed 50 mm above the projected pavement level or have any road furniture, utility poles or landscaping on it (Figure 5).

Bus stops should be easily accessed by persons with disabilities and elderly pedestrians, by the provision of smooth, well-designed and well-maintained footpaths.

Consultation

It is essential that councils or consultants initiate discussions with bus operators at an early stage in the development of intersection or traffic management treatments along local roads so that they are designed to accommodate the buses which are intended to use the roads.

Bus operators or ULF bus manufacturers will make available to councils for consultation precise details of the bus characteristics, such as under body clearances, so that inconvenient and costly changes to designs and/or traffic management treatments are avoided.

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Road Humps

Road humps along local roads must be designed in accordance with the principles set out in VicRoads Traffic Engineering Manual, Volume 1 - Traffic Management. However, on routes used by ULF buses it is desirable that the humps be no higher than 100 mm above the surrounding road surface. It is important that the clearance of the vehicle is not reduced due to irregularities in the road surface adjacent to the hump, or the hump height is not increased by potential obstacles such as narrow raised concrete dividing strips.

Bus Stops

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Designing Local Roads for Ultra Low Floor Buses

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