information BULLETIN

vic roads

Designing Local Roads for Ultra Low Floor Buses

July 1999

Introduction

Victoria's passenger bus fleet is to be progressively replaced with Ultra Low Floor (ULF) buses over the next 20 years to meet the requirements of the Commonwealth Disability Discrimination Act 1992.

The Austroads design vehicles (19m semi trailer and longer vehicles) are to be used for designs on arterial roads. The physical dimensions of the ULF bus means that it has become an important design vehicle for use when developing proposals for local roads serving as bus routes.

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 VicRoads publication "Design for Trucks, Buses & Emergency Vehicles on Local Roads" - November 1998. 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.

Lower bus floor provides improved access for bus patrons, particularly the elderly and people with disabilities.

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.

Vehicle Swept Path

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

Whilst ULF buses have the same length and similar operating characteristics as the standard Austroads design bus, the more modern ULF buses have a greater steering angle, which provides increased manoeuvrability in negotiating local road traffic management treatments.

Rear wheel mounting apron reduces clearance of front overhang of bus

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

These conflicting requirements are demonstrated in Figure 1 where the higher steering angle has been used to allow the ULF bus to turn on a radius of 10.8 m to the outside front wheel, compared with the 12.5 m radius standard adopted for the Austroads single unit truck/bus design vehicle. Nevertheless, in spite of the smaller turning radius, the overall swept path of the ULF bus through the turn is similar to the Austroads vehicle because of the longer front overhang.

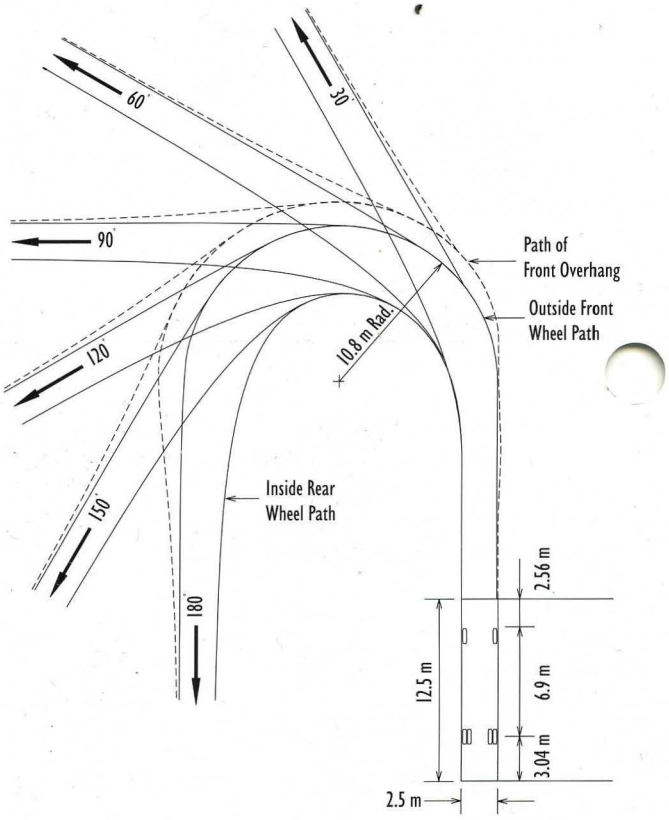

Figure 1 - Design ULF Vehicle for Bus Routes on Local Roads

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

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

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. In particular, improvements should be considered to the design of the following aspects:

- Kerb returns at intersections where buses mount barrier kerbs while turning into or out of local streets.
- Intersections where buses turning left from local roads have to encroach over the centreline of arterial roads to complete the turn.

Bus encroaching over road centreline

- Verges where buses turning right into local streets overhang the verge and impact it because of the surface profile behind the kerb.
- Inappropriate changes in pavement profile across 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 of ULF buses to contact the pavement. Open drainage inverts provided across intersections can cause the same problem.
- Devices such as road humps which may not be constructed strictly in accordance with VicRoads guidelines. These devices may have obstacles or other features which unduly restrict the passage of buses or, if mounted by buses, cause discomfort to passengers.
- Roundabouts which are constructed to make roads safer but which may unreasonably inconvenience large vehicles such as ULF buses.
- Power reticulation and lighting poles which are often located on the corners of intersections and impede the passage of buses.
- Road furniture on the islands of traffic management treatments which should not be located within areas likely to be used by ULF buses.
- Guard fences and barriers which should not be placed where they unduly restrict ULF buses.
- Trees and vegetation which should be located and maintained to ensure that the necessary sight lines are not impeded.

Intersections

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

This can be achieved by designers checking the design using the turning template in Figure 1 and checking the vertical profile along the length of the bus at points where vertical clearance is likely to be critical.

The principles described below for the design of a typical urban local road roundabout should be applied to other types of existing and proposed intersections and traffic management treatments along bus routes.

A tight turn at a signalised intersection

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 also be applied to other types of intersections along bus routes where this is applicable.

As a general rule, all kerbing used at roundabouts and other local traffic management treatments should desirably have a semi-mountable profile so that vehicles, particularly trucks and buses, are not unduly affected should they mount the kerb. Wherever possible, barrier kerb and bluestone kerbs should be avoided.

Power and street lighting poles should not be located or retained within the area likely to be traversed by buses.

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 this is the easiest movement for buses, a design that provides the appropriate entry and exit widths for buses could compromise the vehicle path deflection required to ensure the safety of smaller vehicles (Figure 2). A fully mountable paved annulus should be provided to reduce the speeds of smaller vehicles, its outer edge being bounded by a suitably profiled mountable kerb such as VicRoads M1 profile. This profile should not cause undue inconvenience or tyre damage to larger vehicles because they approach it at an acute angle and the kerb is not very high (50 mm).

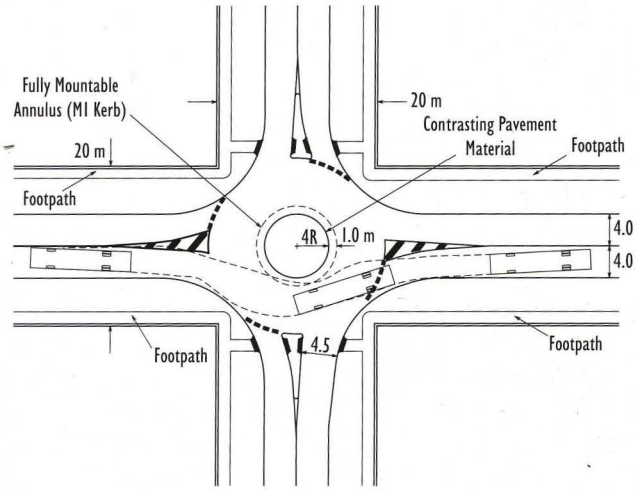

Figure 2 - Swept Path for Through Movement

The apron behind the annulus should not be superelevated to the extent that the front of a ULF bus would strike it or the kerb of the central island. If raised islands are located on the roundabout approach and departures, areas overswept by the front and rear overhangs should be kept clear of road furniture and landscaping. The finished paved surface of traffic islands should not be higher than the surrounding kerb.

Bus front overhangs nature strip

Left Turn Movement

In order to undertake this manoeuvre, the approaching bus may need to either encroach on the splitter island (painted or kerbed) or mount the inside kerb return (Figure 3). This can be eased by providing a fully

Left turning bus impeded by raised island and signs

mountable apron on the inside of the turn. However, drainage lines, pit lids and services (overhead service poles are frequently encountered in these locations) need to be considered. Further, pedestrian standing areas need to be defined and located so that they are not overswept by buses.

On the departure, the vehicle could also be required to encroach upon splitter islands or into the opposing direction traffic lanes for a short distance. Road furniture should not be located in areas which are likely to be traversed by buses, such as the splitter islands and the kerb on the inside of the left turn.

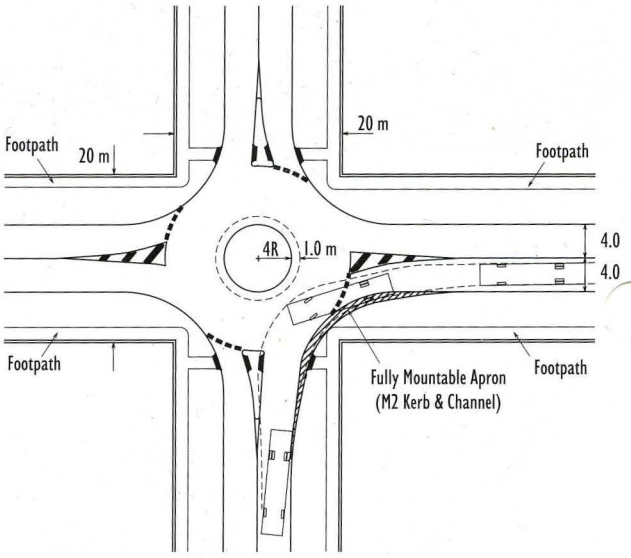

Figure 3 - Swept Path for Left Turn Movement

Right Turn Movement

The swept path of the vehicle throughout this movement is the controlling factor in determining the overall size of the roundabout. Similar to other movements, a mountable annulus and encroachment upon splitter islands must be considered (Figure 4). The position of holding lines on approaches should also be checked to ensure that they are located clear of the front overhang of a circulating bus.

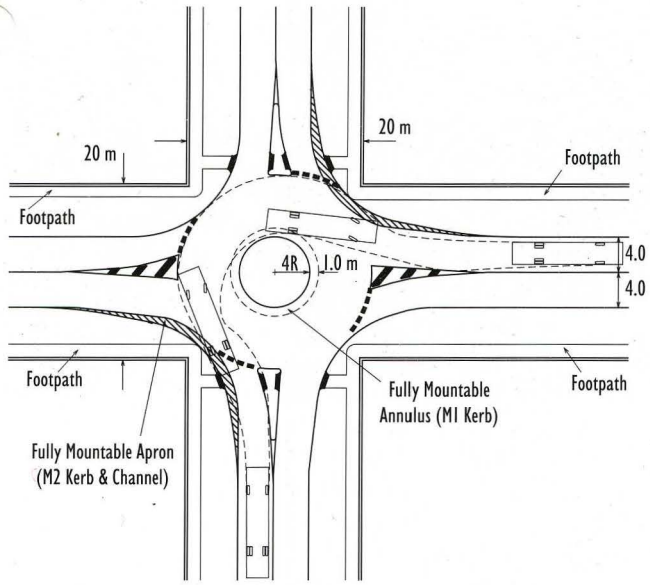

Figure 4 - Swept Path for Right Turn Movement

Design should not allow bus overhang to encroach over footpaths

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 150 mm above the projected pavement level or have any road furniture, utility poles or landscaping on it (Figure 5).

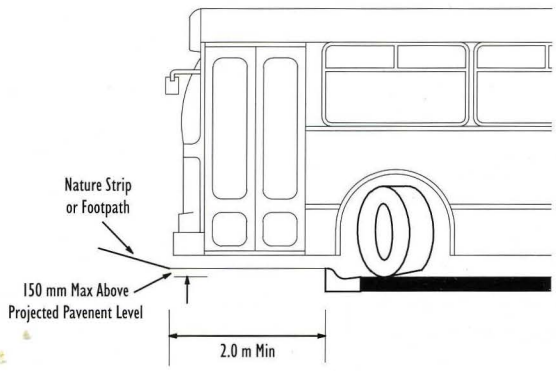

Figure 5 - Front Overhang Requirements for Turning ULF Bus

Front bus overhang over traffic island at roundabout

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 flat top humps be used, in order to minimise twisting of the chassis of the bus. The flat top hump should be long enough 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 dividing 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 route.

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
- 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 5: Intersections at Grade
  - Part 6: Roundabouts
  - Part 10: Local Area Traffic Management
- Design Vehicles and Turning Templates
- Road Safety Audit

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

Traffic Management - An Introduction
Chapter 13 - Local Area Traffic Management,
RT Underwood

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

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North Eastern	5761 1888	50-52 Clarke Street **BENALLA VIC 3672**
Northern	5434 5000	57 Lansell Street **BENDIGO VIC 3550**
Western	5333 8759	1315 Sturt Street **BALLARAT VIC 3350**
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