Supplement

Traffic and Road Use Management
Volume 2 – Guide to Road Safety

Part 5: Road Safety for Rural and Remote Areas (2006)

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4 Road safety countermeasures

4-1 Driver fatigue – guidelines for road-based driver fatigue in rural areas

1 Introduction

This supplement discusses the issues arising from driver fatigue and provides guidance on the use of road-based countermeasures to reduce resulting fatigue-related crashes.

Driver fatigue is one of the leading factors contributing to road crashes on Queensland roads. This supplement summarises the use of road-based countermeasures to reduce the impact of fatigue on road safety outcomes.

Figure 1 – Countermeasures to combat driver fatigue

2 Queensland statistics

In Queensland between 2005 and 2009, five per cent of all crashes were fatigue-related, with 15% of fatal crashes and seven per cent of hospitalisation crashes being fatigue-related.

3 What can be done to combat driver fatigue?

If fatigued drivers are given a warning before their vehicles run off the carriageway, corrective action could be possible. Further, drivers need to be educated to recognise the onset of fatigue and encouraged to take rest breaks before continuing their driving.

The best way to combat driver fatigue is for drivers not to become fatigued or stop driving once fatigued onset occurs.

3.1 Educating drivers

Transport and Main Roads has used fatigue messages and campaigns to educate the motoring public of the dangers of driving while fatigued in order to reduce the incidence of fatigue related crashes.

Despite education campaigns, people continue to drive while fatigued, seriously increasing their risk of being involved in a crash.

4 Queensland-specific fatigue countermeasures

Countermeasures that are specifically targeted at reducing fatigue-related crashes managed by Transport and Main Roads are as follows:

1. driver education signs/billboards
2. driver reviver program  
3. wide centre lines  
4. audio-tactile edge lines, rumble shoulders, strips and sections  
5. rest areas and associated signing.

### 4.1 Driver education signs and billboards

These messages warn of the dangers of driving while fatigued.

*Figure 4.1 – Driver education signs and billboards*

![Driver education signs and billboards](image)

### 4.2 Driver reviver program

The driver reviver program encourages motorists to stop for free tea or coffee. These signs must be closed when the river reviver facility is not operating.

*Figure 4.2 – Driver reviver program signs*

![Driver reviver program signs](image)

### 4.3 Wide centre lines

Refer to the *Guidelines for Road Design on Brownfield Sites* on Transport and Main Roads’ website for further information.

### 4.4 Audio-tactile edge lines, rumble shoulders, strips and sections

Audio-tactile devices can be used in a variety of ways to provide an audible and tactile warning to drivers prior to them leaving the carriageway.
The devices include:

- edge lines
- centre lines
- rumble shoulders
- rumble strips,
- rumble sections.

4.4.1 Audio-tactile edge lines

Audio-tactile edge lines are formed by:

1. a continuous extrusion of thermoplastic material with raised transverse bars, or
2. a discontinuous extrusion of transverse bars.

For audio-tactile edge lines to be effective, the shoulders on that length of road should have a minimum width of 500 mm, desirably one metre, to allow the driver to correct and then re-enter the running lane. Audio-tactile edge lines on inside of a left hand curve may not be as effective, and may wear excessively on winding roads with many tight curves.

The following are specific features or areas along the roadway where audio-tactile edge lines shall not be used:

- where there is an impact of planned re-sealing works. Re-seal works are not programmed for three to four years after audio-tactile line marking implementation
- ten metres prior to structures (such as bridge rail, guard rail and culverts) where it is likely that cyclists might need to enter the traffic lane to pass the structure (this is likely where the structure is within 1 m of the edge line) and is to recommence 10 m beyond the end of the structure
- Transport and Main Roads Specification MRTS45 on pavement marking installation and material requirements for audio-tactile line marking includes provision for cyclists by incorporating a 1.5 m gap spaced every 20 m in the audio-tactile edge line
- where left-turn auxiliary lanes are provided at intersections on a curve due to potentially confusing delineation cues.

4.4.2 Audio-tactile centre lines

Audio-tactile centre lines are formed by:

1. a continuous extrusion of thermoplastic material with raised transverse bars, or
2. a discontinuous extrusion of transverse bars.

The objective of audio-tactile centre lines is to reduce run-off-road to the right (DCA 702 and 704) and head-on not overtaking (DCA 201) crashes on rural undivided two-lane, two-way rural arterial roads where crash severity is high due to high vehicle speeds and high traffic volumes. Audio-tactile centre lines should only be applied in conjunction with audio tactile edge lines, except on roads with sealed shoulder widths less than 500 mm or where audio-tactile edge lines are not used due to noise issues. Audio-tactile centre lines applied in the vicinity of intersections and major accesses may wear excessively and may not be cost effective.
The following are specific features, or areas along the roadway, where audio-tactile centre lines shall not be used:

- where there is an impact of planned re-sealing works. Re-seal works are not programmed until at least three to four years after audio-tactile line marking implementation
- on defined motorcycle routes due to the potential instability causes when riders cross the lines.

4.4.3 Rumble shoulders

Rumble shoulders are road shoulders with a very rough surface achieved by:

1. cutting grooves into the shoulder
2. forming grooves in the shoulder while the asphalt is hot, or
3. laying large stones into the shoulder.

Rumble shoulders provide auditory and tactile feedback to drivers, similar to audio-tactile edge lines, except that the effect is much greater due to the increased rumble area.

For a rumble shoulder to be effective, it needs to be 400 mm wide or greater.

4.4.4 Rumble strips

Rumble strips are transverse strips of rough textured pavement placed across the road. They can be achieved either by:

1. forming grooves in hot asphalt,
2. grinding grooves in the existing pavement or constructing a raised tacked-on strip of rough pavement material using a spray seal.

Transverse rumble strips can be used in identified fatigue areas, especially for attracting drivers' attention to the fatigue signing, high-speed approaches to intersections and narrow structures.

Overuse of any special warning device will tend to dilute its effectiveness.

4.4.5 Rumble sections

Rumble sections are used to break the monotony of the road noise generated by the same type of pavement surface.

This approach should only be used in rural areas after careful consideration of the advantages and disadvantages of this application as follows:

- the life of the chip seal and the ability to remain 'audible' governs the overall effectiveness
- drivers do not have to leave the travel lane to experience the effect (unlike edge rumble strips or audible edge lines)
- possible driver annoyance and discomfort to vehicle occupants if sections are too long
- overuse may lead to driver acclimatisation.

4.4.6 Noise effects

Noise generated by audio-tactile devices can be a problem to nearby residents. If there is increased potential that drivers traverse the ATLM, such as occurs on curvilinear roads, and residences are within 200 m, ATLM should not be installed at these locations.
4.5 Rest areas and associated signing

Rest areas play an important role in fatigue management for both general motorists and heavy vehicle drivers as they provide places for drivers to take rest breaks. However, in order to encourage drivers to use them, it is necessary to ensure that sufficient attractive and suitably equipped stopping places are provided, particularly in areas where fatigue-related crashes are known to be a problem.

The frequency of use of a rest area depends on many factors, including its location along a route, the features and facilities that it provides, and personal safety and comfort. Drivers should normally expect to find the following features at a rest area:

- sheltered tables and seats
- potable water
- rubbish bins, and
- toilets.

4.5.1 Guidance on the provision of rest areas

The following Transport and Main Roads documents provide guidance for the provision of rest areas in Queensland:

- Roadside Amenities Strategy
- Policy on the Provision of Roadside Amenities, and
- Austroads Guide to Road Design.

4.5.2 Signing of rest areas

Signing of rest areas is a positive way to increase their use. However, to be effective, signs need to be conspicuous and placed at locations that give motorists sufficient notice of the facilities ahead.

The signs used for rest areas are shown below and comprise:

1. Advance service signs containing the rest area symbol and the legend, such as ‘300 m ON LEFT’ or ‘300 m ON RIGHT’, e.g., Sign G7-1-1/G7-2-1
2. Position service signs containing the rest area symbol and a left or right arrow pointing to the location of the rest area, e.g., Sign G7-3-1, and
3. Next service sign indicating the distance to the next rest area, e.g. ‘NEXT (rest area) 50 km’ – G7-9-1.
When associated with fatigue, signing for rest areas can include fatigue safety messages. The messages have been designed to alert motorists of the danger of driving while fatigued. Examples of approved fatigue (service) signs and their typical placements are described below.

To minimise their use by motorists and tourist traffic, signs for heavy vehicle rest areas should not show the facilities available. These additional users may restrict the space available for trucks and create unnecessary disturbance to resting truck drivers.

### 4.5.3 Advance signing

The first advance service sign is generally located two to 10 kilometres in advance of the rest area to give drivers sufficient time to decide on a course of action and indicates the type of facility available and the distance ahead. It also contains a fatigue-related safety message, such as to maximise the effectiveness of these signs, rumble strips should be used in advance of these signs to better alert the drivers.

When the first advance service sign is placed 10 kilometres or more in advance of the rest area, it is desirable to place additional advance service signs (using different fatigue messages) in advance of the rest area (e.g., at 20 km, 10 km and 5 km).

A second advance service sign is generally placed 300 metres to two kilometres in advance of the rest area and indicates the type of facility available and its location (e.g., ‘2 km ON RIGHT’). These signs (e.g., G7-1-4) are described in Part 1 and 6 of the MUTCD and the TC Sign Register.

### 4.5.4 Position sign

The position service sign is placed at, and opposite to, the rest area entrance. This sign indicates the type of facility provided as in the advance signings. These signs (e.g., G7-3-1 (L or R)) are also described in the MUTCD.

### 4.5.5 Next service sign

This sign is normally placed on the departure from the rest area to inform motorists of the distance to the next rest area in either direction. This sign may also be placed just before the entrance or turn-off to a rest area to inform motorists of the distance from the next rest area to help them decide whether to stop now or later.
4.5.6 Fasten seat belts sign

The ‘Fasten Seat Belts’ sign (G9-Q09) should be placed adjacent to the exit points of all rest areas. See Figure 4.5.7 for sign design details.

4.5.7 Fatigue signing layout

Figure 4.5.7 shows a typical signing layout for a rest area.
4.5.7 Fatigue signing layout

Figure 4.5.7 – Fatigue signing layout

4.5.8 Fasten seat belts sign

At very high risk driver fatigue zones where there has been a large number of fatigue-related crashes, the ‘DRIVER FATIGUE/CRASH ZONE/NEXT x km’ sign may be used to alert motorists about the seriousness of driver fatigue. This sign should be erected at each approach to the fatigue zone and be
located about 200 m to 300 m before the first advance rest area sign. See TC Sign Register for sign design details.

Ensure that this sign is only used at very high-risk fatigue zones as its overuse could erode its effectiveness.

4-2 Guide for the road safety management of rural school bus routes and bus stops

1 Introduction

This supplement is designed to provide engineering practitioners with a better understanding of rural school bus safety needs in Queensland. It should be read in conjunction with other traffic engineering and road design guidelines. It is intended to demonstrate that best practice and specific attention to the safety needs of school bus traffic can lead to an overall safer road system. Discretion and judgement should be exercised in the light of many factors which may influence the choice of treatment in a given situation.

Issues concerning school bus transport safety include:

a) the selection and the standard of school bus routes
b) the provision of school bus stops
c) signing of school bus routes and stops, and
d) in-vehicle safety, e.g., standees, seat belts and padding.

As this supplement deals with road engineering aspects of school transport safety, issue ‘d)’, above, is outside scope.

Owing to the transient nature of school bus stops in rural areas due to the movement of the school children population, the provision of school bus stops is often considered to be difficult to justify when the costs are high. However, in order to improve the safety performance of the more hazardous bus routes, Transport and Main Roads manages the Safe School Travel (SafeST) package – refer to the department’s website for further information.

To enable school bus routes and stops to be assessed and treated in a consistent manner, guidelines for good practice are necessary to address the first three issues identified above.

2 Purpose of the guidelines

The guidelines provided in this supplement provide guidance to engineering practitioners on the ‘good practice’ principles of road safety on rural school bus routes. They also provide safety principles and criteria in the selection or review of rural school bus routes and school bus stops.

As there are no official warrants or standards applicable for much of the traffic and safety requirements on school bus routes and bus stops, much of the assessment is subjective and relies on engineering judgement and other relevant local knowledge and experience. Where necessary, the practitioner should enlist specialist engineering advice.

This supplement covers the traffic safety aspects of school bus routes and school bus stops, and provides guidance for the provision of appropriate signing to warn motorists of the possible presence of school buses and school children. The treatment and provision of school bus routes and bus stops should ensure safe and convenient travel for children going to and from school.
A Road Safety Checklist (refer to Section 12) has been developed in conjunction with the guide and nominates safety issues to be considered during the assessment of rural school bus routes and bus stops. The checklist is not intended to highlight all of the issues – rather, it is to act as a prompt for practitioners and enables a brief summary of any safety investigation into school bus routes/stops to be made.

This supplement has been divided into the following main parts:

- general information, including the introduction
- definitions of terms used throughout this note
- general road environment safety principles
- guidelines for good practice for school bus routes
- guidelines for good practice for school bus stops.

### 3 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary lane</td>
<td>The portion of carriageway adjoining the through traffic lanes for speed change or for other purposes supplementary to through traffic movement (e.g., overtaking lanes, turning lanes, passing bays, etc.).</td>
</tr>
<tr>
<td>Built-up area</td>
<td>In relation to a length of the road, means an area in which there are buildings on land next to the road, or there is street lighting, at intervals not over 100 m for distance of at least 500 m or if the road is shorter than 500 m for the whole road.</td>
</tr>
<tr>
<td>Carriageway</td>
<td>That portion of the road formation set aside for the use of traffic, either moving or stationary. It includes a number of traffic lanes, plus shoulders, regardless of whether any parts are sealed and regardless of the width of the pavement courses.</td>
</tr>
<tr>
<td>Clear zone</td>
<td>The total roadside border area, starting at the edge of the traffic lanes, available for safe use by errant vehicles. This area may consist of the road shoulder, parking bays, recoverable slopes or clear run out areas.</td>
</tr>
<tr>
<td>Department</td>
<td>Queensland Department of Transport and Main Roads</td>
</tr>
<tr>
<td>Diving line</td>
<td>A road marking formed by a line, or two parallel lines, whether broken or continuous, designed to indicate the parts of the road to be used by vehicles travelling in opposite directions.</td>
</tr>
<tr>
<td>Dividing strip</td>
<td>An area or a structure that divides a road lengthways, but does not include a nature strip, bicycle path, footpath or shared path.</td>
</tr>
<tr>
<td>Pedestrian</td>
<td>Includes any person walking, running, standing, sitting or being otherwise in or upon a road.</td>
</tr>
<tr>
<td>Pedestrian crossing (zebra)</td>
<td>A portion of a carriageway delineated by white stripes, approximately parallel to the centreline of the carriageway and indicated by the display to vehicular traffic of Pedestrian Crossing Signs (R3-1).</td>
</tr>
<tr>
<td>Road shoulder</td>
<td>That part of the roadway from the outer edge of the traffic lane to the edge of usable carriageway and excludes any berm, verge, rounding or</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
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<td>-------------------------------</td>
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</tr>
<tr>
<td>Road user</td>
<td>A driver, rider, passenger or pedestrian.</td>
</tr>
<tr>
<td>School bus</td>
<td>Any omnibus while it is being used exclusively for the carriage of school children to or from a school.</td>
</tr>
<tr>
<td>School bus stop</td>
<td>Any school bus passenger pick up or set down area.</td>
</tr>
<tr>
<td>Sight distance</td>
<td>The distance measured along the carriageway over which visibility occurs between a driver and an object or between two drivers at specific heights above the carriageway in their lane of travel.</td>
</tr>
<tr>
<td>Slow vehicle turnout</td>
<td>A very short section of paved road shoulder or added lane, which is provided to allow slow vehicles to pull aside and be overtaken.</td>
</tr>
<tr>
<td>Stopping sight distance</td>
<td>The distance travelled by a vehicle between the time when the driver receives a stimulus signifying a need to stop and the time the vehicle comes to rest. Usually the minimum distance is implied.</td>
</tr>
<tr>
<td>Traffic</td>
<td>Includes vehicles and pedestrians.</td>
</tr>
<tr>
<td>Traffic control device</td>
<td>A traffic sign, road marking, traffic signals, or other device, to direct or warn traffic on, entering or leaving a road.</td>
</tr>
<tr>
<td>Traffic lane</td>
<td>That part of the roadway set aside for the normal movement of a single stream of vehicles.</td>
</tr>
</tbody>
</table>

### 4 Road environment safety principles

The following sections provide a brief outline of the general principles of a safe road environment and risk assessment.

#### 4.1 A safe road environment

The function of a road is primarily to provide for the movement of people and goods. Other subsidiary functions, such as parking and use of roads for services, are often also permitted. A safe road environment is one which allows road users to perform the primary function of movement without undue risk of injury or damage.

To move about the road system safely, road users must negotiate the physical road environment and avoid or resolve conflicts with other road users. This requires road users to perceive and process information, make decisions, and react within specific time intervals.

Comfortable and safe driving and riding occurs when motorists are operating well below a stressful processing and decision-making rate and above a minimum level of arousal. This aspect is a critical component in the development and maintenance of a safe road environment.

A safe road environment should:

- warn the road user of any substandard or unusual features
- inform the road user of conditions to be encountered
- guide the road user through unusual sections
- control the road user’s passage through conflict points or conflict sections
- forgive the road user’s errant or inappropriate behaviour.

From this it can be seen that:

- Road users expect similar situations to be treated in similar ways. Otherwise there will be a reliance on warning, which may or may not counteract other information and expectations.

Things to be avoided are:
- inadequate treatment (not treating a situation to an appropriate level)
- mistreatment (using the wrong treatment for the situation)
- excessive treatment (using ‘more treatment for more safety’, thereby masking other similar situations which have already been treated to the appropriate level)

Optimum values for design parameters should be applied as often as possible, compatible with terrain or other prevailing constraints.

- Advance information and warning should be used to strengthen the delineation of a road.
- Driver overload, which may cause vital information to be overlooked or discarded, should be avoided. Overload can result from too many signs, conflicting messages or lack of delineation.

Therefore, a safe road environment is one which:

- provides no surprises in road design or traffic control (expectancy factors)
- provides a controlled release of relevant information (not too much at once)
- provides repeated information where pertinent to emphasise danger.

As different road user groups (e.g., car drivers, motorcyclists, truck drivers, cyclists, bus drivers, pedestrians, etc.) and the individuals within each group will have different abilities and needs, a safe road environment will be one which is designed, constructed and managed with these different road user abilities and needs in mind.

4.2 Assessing risk

While all roads have inherent risks, and these risks vary in severity for the different road users, a safe road environment is one where the risk to all road users is at a level which Transport and Main Roads considers suitable based on a risk assessment. Risk in relation to road environment safety is defined by three elements:

1. Probability: the chance of the occurrence of an event.
2. Exposure: the number of vehicles or people travelling past a particular hazard or whom the hazard may affect.
3. Severity: the effect of a range of various factors should a crash occur. Such factors may include:
   - proportion of buses in traffic
   - proportion of trucks in traffic
   - relationship to speed zone or speed environment and actual operating speeds
   - crash severity in terms of fatality, hospitalisation, medical treatment or property damage
   - the proximity of emergency services (in terms of road trauma management), and/or
The following expression can be used to assess risk:

\[
\text{Risk} = \frac{\text{crash frequency} \times \text{severity}}{(\text{Cost})(\text{probability} \times \text{exposure})} \times \text{crash cost}
\]

Where exposure is expressed in terms of traffic volumes, severity is expressed in terms of crash outcome (cost) and probability is expressed in terms of a value.

Thus, a safer road environment can be achieved by reducing exposure and/or probability and/or severity which, in essence, is a Safe System.

Two major road environment safety initiatives for achieving a safe road environment are Road Safety Audit and the Treatment of Crash Locations.

5 Guidelines for good practice – bus routes

The following sections provide an outline of the guidelines for good practice for the safety management of rural bus school routes, considering factors such as road and traffic characteristics and signing.

5.1 General

School bus routes should provide safe and convenient travel for children going to and from school. The route should be safe for the operation of school buses and should be such that school children would be picked up and set down at the same locations.

In general, the route used and/or proposed to be used by school buses should satisfy the design criteria contained in relevant Austroads guides and the Manual of Uniform Traffic Control Devices in relation to issues such as:

- sight and stopping distances
- road geometry
- pavement and drainage
- auxiliary lane and intersection
- traffic control, and/or
- roadside object, etc.

Further considerations for good practice in relation to school bus routes and safety should include issues such as:

- school bus performance/operations along the route, and
- signing specifically for school bus routes.

These issues are further discussed in the following clauses.
5.2 **School bus performance issues**

5.2.1 **Traffic delay and queuing**

Momentary bunching of the traffic may result because of the performance of the school bus (e.g., up/down roadway grades due to the stopping of the bus fully or partially within a traffic lane, etc.). Bunching causes delays to the vehicles in the bunches. If these delays are continued over a perceived long period of time, they may cause unnecessary risk taking by the motorists. This may have an adverse effect on the safety of school children.

Thus, the following traffic criterion should be considered when assessing school bus routes: *The school bus performance and frequency of stops should not create excessive traffic delays and queues for other vehicles.*

Where excessive delays are experienced by other road users, consideration should be given to the provision of overtaking facilities, such as auxiliary lanes, bus stopping areas fully clear of the traffic lanes, slow vehicle turnouts, etc.

Queue lengths following school buses may create a safety hazard to other road users. For example, the end of a queue may be just over the crest of hill due to school bus performance/stopping. Where this situation is unavoidable and frequently occurs, consideration should be given to warning motorists of the situation through other measures such as signing.

5.2.2 **Speed disparities**

Speed disparities between vehicle types (e.g., passenger car, school bus, etc.) may occur as a result of the performance of the school bus (e.g., up/down roadway grades due to the stopping of the bus, etc.). This may lead to increased queuing, delay and overtaking manoeuvres. The increased overtaking requirements and reduced service volumes can give rise to operational and safety problems at higher traffic flow.

Moreover, high speed disparities between vehicles may cause unsafe situations and increase the possibility of multiple vehicle crashes (e.g., rear-end, etc.). For example, where the driver of a high speed vehicle comes unexpectedly onto a slow moving vehicle (e.g., around curve, over crest, etc.).

Thus, the following roadway criterion should be considered when assessing school bus routes: *The school bus performance and frequency of stops should not create excessive speed disparities between vehicles.*

Where excessive speed disparities are expected, consideration should be given to overtaking provisions, maximising sight and stopping distances, improving warning of the situation, using an alternate route, using a more appropriate vehicle, etc.

Where long, steep grades are likely to cause the school bus to slow down to speeds of 40 km/h or less, auxiliary lanes should be considered in accordance relevant Austroads guides and the *Manual of Uniform Traffic Control Devices.*

5.2.3 **Traffic lane discipline**

Poor traffic lane discipline (e.g., not travelling within the designated traffic lane) may result from the performance of the school bus (e.g., around curves, etc.). Poor traffic lane discipline in conjunction with poor visibility increases the potential for multiple vehicle crashes (e.g., side swipe, head-on, etc.).

Wide traffic lanes and shoulders provide drivers with increased opportunity for safe recovery when their vehicles run off the road and also provide increased lateral separation between overtaking and
passing vehicles. Additional safety benefits include reduced interruption from school bus stopping, emergency stopping and road maintenance activities, less wear at the lane's edge, improved sight distance at critical horizontal curves and the possibility of improved pavement structural support/pavement drainage.

Thus, the following carriageway criterion should be considered when assessing school bus routes: *The school bus should be able to remain within its correct traffic lane around horizontal curves.*

Where this is not possible, and depending on the degree of the hazard created, consideration should be given to carriageway widening, improving the sight distance to or warning of the situation, using an alternative route, using a smaller sized vehicle, providing additional warning to road users, etc. The degree of the hazard can be subjectively assessed on the basis of traffic volume and visibility (e.g., probability of conflict and ability to see it, etc.).

Refer to the Austroads *Guide to Road Design* for information pertaining to desirable lane widths and curve widening in relation to bus routes.

### 5.2.4 Road surface condition

Irregularities or defects in the roadway surface could adversely affect the controllability of the school bus and, thus, could increase the chance of driver error which, in turn, could increase the likelihood of a crash. It has been reported that surface roughness may be a much larger factor in truck crashes than car crashes.

Pavement/road surface type and condition (e.g., skid resistance, etc.) can influence operating speed, rolling resistance, the vehicle's performance and aquaplaning characteristics. For example, consider the scenario of a fully loaded school bus climbing up a curvilinear steep grade under moist road conditions, e.g., fog.

Thus, the following pavement criterion should be considered when assessing school bus routes: *The road surface material along the school bus route should be suitable for bus performance under all weather conditions.*

In the instance of unsatisfactory roughness and skid resistance, consideration should be given to rectifying the problems.

*Figure 5.2.4-A – Unsealed pavement along school bus routes*
Pavement appears to be soft with pavement edges deeply scoured. The poor condition of the pavement may be hazardous to the school bus operator and school children as there is a risk of reduced controllability of the school bus.

*Figure 5.2.4-B – Unsealed pavement along school bus route*

5.2.5 Structures

A number of structures, such as bridges, culverts, floodways, causeways and stock grids, may be present along the school bus route. It is extremely important to investigate and confirm the structural integrity of these structures, keeping in mind the mass and dimensions of the school bus using the route. In addition to this, any property access that is traversed by the school bus should be structurally sound.

Thus, the following structural criterion should be considered when assessing school bus routes: *The structural integrity of all bridges, culverts, floodways, causeways, stock grids, property accesses, etc., along the school bus route should be adequate.*

5.3 School bus route signing

Traffic signs are provided to aid in the safe and orderly movement of traffic. It is therefore essential to ensure uniformity in the application of signs. Similar conditions should always be treated with the same type of sign, so that road users can readily anticipate the course of action required. The use of a sign which is at variance with its use elsewhere is confusing and, consequently, creates a potentially hazardous situation.

Furthermore, the *Manual of Uniform Traffic Control Devices* also stresses the significance of the loss in effectiveness of warning signs if used unnecessarily or too frequently. Their use should be restricted to the minimum and consistent with safety requirements. A warning sign should not be used if, under normal conditions, the motorist can be expected to see and appreciate the potential hazard ahead.
Thus, the following signing criteria should be considered when assessing school bus routes: *A road should only be signed as a school bus route where, for safety reasons, it is necessary to warn motorists of the possible presence of the school bus or school children on the road.*

Should it be necessary to sign a road as a school bus route, the ‘SCHOOL BUS ROUTE’ sign (TC9945), with supplementary plate ‘NEXT ...km’ (W8-17), should be used at the beginning of the route, and repeated as necessary, where the school bus route exists for a distance greater than 1 km along a particular road and has one or more of the following deficiencies/conditions:

- narrow carriageway
- unsealed surface
- winding alignment
- poor longitudinal profile
- steep grades
- the route is used by more than two school bus services, in either the same direction or opposing directions, at the same time of the day
- the route is highly used by heavy vehicles, tourist vehicles, etc., and the safety operations of the school bus are of high concern (e.g., proportion of heavy vehicles is greater than 10%, etc.), and/or
- the school children activities adjacent to the roadway pose safety concerns.

*Figure 5.3-A – ‘SCHOOL BUS ROUTE’ sign with ‘NEXT ... km’ plate (TC9945 and W8-17)*

It should be noted that where the safety standard of the road environment is considered to be deficient and compromises the safety of school bus operations, school children's activities, or other general road users, the use of the road/route for school bus operations should be reviewed. This may mean upgrading the road environment to improve safety if no other school bus route choices are available.

It is not intended that school bus warning signs be used to justify unsafe school bus routes and school bus stopping areas. Every attempt should be made to ensure school bus routes and school bus stops are safe and convenient.

To maintain credibility of school bus warning signs, it is important that they be removed as soon as the road ceases to be used as a school bus route or the road is upgraded such that the school bus route may not need signing.
A non-standard school bus route sign is shown in Figure 5.3-B. The sign has a white background with red text, which drivers may mistakenly perceive as a regulatory sign.

If the school bus route requires signing, TC9945 with W8-17 would be more suitable.

The school bus turn around area along a school bus route should be signed where, for safety reasons, it is necessary to warn motorists of the possible presence/operations of the school bus on the road.

The ‘SCHOOL BUS TURNING’ sign (TC9306) should be used in advance of where the school bus performs a turnaround manoeuvre, which may impede traffic flows and/or compromise the safety of other road users.

The school bus turn around areas should be located at places where the safety of the bus occupants and other road users is not compromised. The road in the vicinity of the turnaround area should provide sufficient visibility to approaching drivers and should be in good condition (e.g., roughness, skid resistance, etc.).

The ‘SCHOOL BUS TURNING’ sign should not be used to justify unsafe school bus turnaround areas. Every attempt should be made to ensure school bus turnaround areas is safe and convenient.

The school bus entry from an adjoining land access onto a road system should be signed where, for safety reasons, it is necessary to warn motorists of the possible presence/operations of the school bus on the road.
The ‘SCHOOL BUS ENTERING’ sign (TC9611) should be used in advance of where the school bus enters a road from an adjoining land access and this may impede traffic flows on such a road and/or compromise the safety of other road users.

*Figure 5.3-D – ‘SCHOOL BUS ENTERING’ sign (TC9611)*

It should be noted that where the safety of the road environment is considered to be deficient (e.g., lack of visibility, etc.) and compromises the safety of school bus operations, school children's activities, or other road users, the use of the access for school bus entering operations should be reviewed. This may mean upgrading the road environment/access to improve safety if no other school bus entering choices are available. This sign should not be used to justify unsafe school bus entering operations.

### 6 Guidelines for good practice – bus stops

The following clauses outline the guidelines for good practice for the safety management of rural school bus stops, considering factors such as crash history, visibility, roadway characteristics, traffic characteristics, school bus stop locations, signing, passenger waiting facilities and pedestrian facilities.

#### 6.1 General

The location of school bus stops should be carefully evaluated to enhance the safety and convenience for school children using the facilities and/or for other road users.

Generally, school bus stops should be located and designed to:

- maximise the safety of school children and other road users, and
- minimise the interference to traffic flow on the road system.

In general, the location and/or design of school bus stopping places should satisfy the design criteria contained in the traffic engineering and road design guidelines/manuals (e.g., Austroads *Guide to Traffic Management*, Transport and Main Roads’ *Manual of Uniform Traffic Control Devices*, Transport and Main Roads’ *Road Planning and Design Manual*, etc.).

Further considerations for good practice in relation to school bus stopping locations, design and safety should include issues such as:

- crash history in the vicinity of the school bus stop
- visibility to/from the school bus stop activities
- provisions for passing zones at the school bus stop
- roadway characteristics in the vicinity of the school bus stop
- traffic characteristics in the vicinity of the school bus stop
• provisions for bus stop facilities at intersections and mid-blocks
• signing specifically for school bus stops and crossing areas
• provisions for passenger waiting facilities, and
• provisions for pedestrian facilities.

These issues are further discussed in the following clauses.

6.2 Crash history

Crashes in most instances have multiple causal factors. In general, the three contributing factors in motor vehicle crashes (and their involvement) are:

1. human factors (which are involved in around 95% of crashes)
2. road environment factors (which are involved in some 28% of crashes), and
3. vehicle factors (which are involved in around 8% of crashes).

Analysis of crash data at a particular site or road section may identify the causal factors and subsequently remedial treatments may be recommended. All crash data should be considered when assessing school bus stop locations.

Thus, the following crash criterion should be considered when assessing school bus stops: School bus stops should not be located in areas with a history of crashes.

6.3 Visibility issues

6.3.1 Visibility

Drivers need sufficient visibility along a road to avoid collision, especially with respect to events such as stopped school buses, children crossing, etc.

The optimum locations for school bus stops are locations on sections of a road with a straight alignment and uniform gradient. School bus stops should not be located in unexpected situations and/or at locations with limited visibility, such as just around sharp horizontal curves or just over crests, etc.

The visibility of the school bus stop should be adequate so that:

• following vehicles can stop or slow down safely behind the school bus while the bus is entering or leaving the bus stop, and/or
• vehicles can safely pass the school bus while it is engaged in pick up/set down activities.

Thus, the following visibility criteria should be considered when assessing school bus stops: The school bus stopping location and its activities should be conspicuous to all road users and in accordance with the Manual of Uniform Traffic Control Devices.

Where sight distance is restricted, school bus stops should be avoided in the vicinity of sharp curves or severe changes in vertical alignment. Ideally, in relation to visibility issues, school bus stops should be located on sections of relatively straight and flat roadway.

Where school bus stops need to be located in less than ideal locations, other measures (e.g., signing, providing full pull-off areas for the bus, etc.) should be considered for increasing the conspicuity of the hazard and improving safety. Where children are required to cross the roadway at such locations,
serious consideration should be given to relocating the bus stop to a safer location and ensuring a safe travel path is provided for the children.

School bus stops and their associated activities should not be obstructed by vegetation, road side objects, bridge abutments, etc. Where necessary, measures such as removing or selective clearing of vegetation, benching of embankments, etc., should be considered for increasing the conspicuity of the site and improving safety.

The school bus stop and its activities should be adequately visible in all relevant lighting and weather conditions.

Where visibility is deficient under one or more of such conditions and safety may be compromised, other measures, such as signing, delineation, lighting, etc., should be considered to warn motorists of the potential hazards associated with the school bus stop activities during adverse weather conditions.

*Figure 6.3.1 – Example of advance warning sign on approach to a school bus stop*

Visibility to/from the school bus stopping area is restricted by the horizontal curve.

The ‘CHILDREN’ sign installed is suitable, though a ‘BUS STOP’ plate could be added or, alternatively, a ‘SCHOOL BUS TURNING’ sign could replace this sign.

### 6.3.2 Stopping sight distances

Approach sight distance appropriate to the approach speed should be provided on each approach to the bus stop. This is the minimum distance that is required by the driver of a vehicle to observe the school bus at the bus stop, children crossing at the bus stop, etc., in sufficient time to react and stop, if necessary, before entering the conflict area.

Generally, the same stopping sight distance criterion is applied to all passenger vehicles and buses/trucks where the driver’s eye height is 1.15 m and 1.80 m, respectively. This is based on the assumption that even though buses and trucks generally require longer braking distances, the bus/truck drivers are generally able to see the vertical features of obstructions substantially farther ahead due to their higher position. The only exception is where vertical obstructions are on the inside of curves, where the greater eye height of the driver is of no value in compensating for the longer stopping distances. In such situations, longer stopping distances should be provided for buses/trucks. Refer to Austroads *Guide to Road Design.*
Thus, the following visibility criterion should be considered when assessing school bus stops:

*Adequate stopping sight distances to the school bus stop and its activities should be made available to approaching drivers, especially if children are required to cross the roadway.*

Where the minimum stopping sight distance is not attainable, other measures, such as signing, providing a high friction surface, etc., should be considered for increasing the conspicuity of hazards (i.e., stopped bus and children) and reducing crash risk. Refer to the Austroads *Guide to Road Design* for minimum stopping sight distances.

It should be noted that stopped buses within the traffic lane, on, or near, a crest or curve, may also be in breach of traffic legislation. That is, a driver must not stop on, or near, a crest or curve on a length of road that is not in a built-up area unless the driver’s vehicle is visible for 100 m to drivers approaching the vehicle and travelling in the direction of travel of traffic on the same side of the road as the vehicle.

### 6.3.3 Passing zones (overtaking zones)

Safe and effective passing zones at bus stops on two-lane roads require both adequate sight distance to opposing vehicles and adequate passing zone length. Passing sight distance is needed to ensure that passing drivers have a sufficiently clear view ahead to minimise the possibility of collision with an opposing vehicle. The length of the passing zone needs also to take account of the length of the bus being overtaken. This is also dependent on the speed.

Thus, the following visibility criterion should be considered when assessing school bus stops:

*Adequate passing opportunities should be provided at school bus stops for following vehicles.*

To allow for safe passing of vehicles at bus stops, it may be necessary to provide pick-up/set-down areas for buses to stop. It should be noted that, in accordance with traffic legislation, where there is no continuous dividing line or dividing strip, there must be at least three metres of the road alongside the vehicle that is clear for other vehicles to pass and where there is a continuous dividing line or dividing strip, the driver must position the vehicle at least three metres from any such dividing line or dividing strip.

*Figure 6.3.3 – School bus stop established on narrow carriageway*

A school bus stop is located where the sedan is parked. There is restricted width between the barrier lines and the kerb (i.e., three metres between parked school bus and barrier lines would not available as stipulated by legislation). As a result, motorists are forced to cross the barrier lines to pass the parked vehicle. This is illegal and extremely unsafe.
A bus pick-up/set-down area should be constructed or, alternatively, the bus stop should be relocated.

6.4 Road characteristics

6.4.1 Roadway grades

Grades in the road cause speed disparities between vehicle types, leading to increased queuing and overtaking requirements. The increased overtaking requirements and reduced level of service can give rise to operational and safety problems at higher traffic flows.

The safety aspect of uphill operation also relates to speed disparities. Rear-end crashes can occur where the driver of a vehicle comes unexpectedly onto a slow moving vehicle.

Thus, the following roadway criterion should be considered when assessing school bus stops: The school bus stop should be appropriately located in relation to the roadway grade and auxiliary lane facilities.

School bus stops should be located in relation to grades, such that adequate sight distance is achieved (refer Clause 6.3.1) and school bus performance is not excessively degraded so as to become a hazard and/or impede general traffic flows. For example, where visibility is not an issue and where grades are very steep school bus stops should be avoided in sag curves or on the grade incline due to the difficulty and hazard of braking and/or accelerating amid general traffic.

School bus stops should not be located within the tapering sections of auxiliary lanes (e.g., overtaking lanes, climbing lanes, descending lanes, turning lanes, passing bays, etc.) or runaway vehicle facilities.

6.4.2 Lanes and shoulders

Wide traffic lanes and shoulders provide drivers with increased opportunity for safe recovery when their vehicles run off the road and also provide increased lateral separation between overtaking and passing vehicles. Additional safety benefits include reduced interruption from school bus stopping, emergency stopping and road maintenance activities, less wear at the bitumen edge, improved sight distance at critical horizontal curves and possibility of improved pavement structural support/pavement drainage.

Thus, the following carriageway criterion should be considered when assessing school bus stops: Adequate road shoulders should be provided to improve safety at school bus stops.

Wider road shoulder widths (e.g., 3.0 metres or wider, etc.) allow commercial vehicles to stop clear of the traffic lanes. Where the route carries a high volume of commercial vehicles (e.g., greater than 10%) and/or the incidence of bus stopping is high, wider shoulders are desirable.

Traffic legislation states that the driver of a heavy vehicle, or long vehicle, must not stop on a length of road that is not in a built-up area, except on the shoulder of the road. Therefore, where the stopped school bus either partially or fully obstructs the traffic lanes, widening of road shoulders should be carried out to provide full clearance to traffic lanes.
Figure 6.4.2 – Location of school bus stop

![Location of school bus stop](image)

There is inadequate width for the school bus to be positioned completely clear of the travel lane. The uneven surface is unsuitable for school children to embark/disembark from the bus. This would be considerably worse during wet weather when water would be flowing down the table drain.

6.4.3 Road surface condition

Irregularities or defects in the roadway surface could adversely affect the controllability of the vehicle and, thus, could increase the chance of driver error and the likelihood of a crash. It has been reported that surface roughness may be a much larger factor in truck crashes than car crashes.

Pavement/road surface type and condition can influence operating speed, rolling resistance, the vehicle’s performance and aquaplaning characteristics.

Thus, the following criterion should be considered when assessing school bus stops: The road surface material at the school bus stop should be suitable for bus performance under all weather conditions.

Where the road surface performance at the bus stop is deficient under wet weather conditions (e.g., low skid resistance, etc.) and safety of the bus and passengers may be compromised, consideration should be given to a more appropriate surface material (e.g., gravel, bitumen, etc.).

If resealing work is being carried out in the vicinity of a bus stop, consideration should be given to sealing the bus stop if the amount of usage of the bus stop is significant.
Figure 6.4.3 – Bus stopping area located at property access

Bus stopping area is unsatisfactory due to poor skid resistance during wet weather conditions.

6.5 Traffic characteristics
6.5.1 Traffic volume, speed and composition

High traffic volumes on a two-lane road may result in a higher level of bunching of vehicles and/or lower operating speeds which may in turn cause unnecessary risk taking by motorists due to such factors as frustration, impatience, etc. This risk taking may affect or compromise the safety of other road users.

Roads with high traffic speed and a large proportion of heavy vehicles present a higher risk situation to road users.

Thus, the following traffic criterion should be considered when assessing school bus stops: Provision should be made for the school bus to stop clear of the traffic lanes especially where traffic volumes, speed environments and/or the percentage of heavy vehicles, towing vehicles, etc. are high.

The factors influencing the traffic efficiency and road safety on roads due to school bus operations are typically:

- traffic volumes during school bus operation times
- speed environment
- traffic composition (e.g., high proportion of heavy vehicles, towing vehicles, etc.)
- frequency of school bus stopping
- lengths of time school bus stopped
- probability of passing vehicles (i.e., gaps)
- terrain, and/or
- road conditions.

Where the traffic efficiency and/or road safety are compromised by one or more of these factors, due to the school bus operations, consideration should be given to the provision of pick-up/set-down facilities (or similar) for the school bus.

School bus stops should be avoided (or limited) in high-speed environments (e.g., greater than 80 km/h), particularly on major roads (e.g., arterial roads, etc.) and/or where the proportion of heavy
vehicles, towing vehicles, or similar, using the route during school bus operations, are considered to be high (e.g., greater than 10%). Heavy vehicles, towing vehicles, etc., present a higher risk situation, especially to children waiting at the road side or crossing the road (e.g., eye heights, stopping distances, clearances, etc.).

Where school bus stops are located in such environments, other measures, such as appropriate bus stopping facilities, children's waiting facilities/areas and children's travel paths/crossing locations should be provided considering the traffic composition and speed. For example, these initiatives include the provision of a facility for bus re-entry into the traffic stream at bus stopping areas, ensuring that the location of waiting children is conspicuous to all motorists, the provision of a waiting area that is appropriately distanced from the traffic lanes and the provision of a safe crossing of the carriageway for children.

6.6 School bus stop locations

6.6.1 At intersections

As stopped/stopping buses cause conflicts in traffic, locating bus stops at intersections minimises the conflict area. However, the effect of bus stops on intersection sight distance requirements and the visibility and location of pedestrian crossings should always be considered.

From the bus passenger and pedestrian safety viewpoint, a bus stop located on the departure side of the intersection is safer than one located on the approach side as children cross behind the bus where they can be seen. In this position, the bus does not block the view of traffic controls and other intersection traffic.

Other advantages of the departure side bus stop include:

- reduced bus conflicts with left turning vehicles
- increased intersection capacity by freeing the kerb lane for through movement
- improved sight distances at intersections
- shorter kerb length requirements for bus stop approaches, and
- easier bus re-entry into traffic after passenger loading/unloading.

Buses stopped on the approach side of intersections may severely block the children's view of approaching traffic, and the approaching driver's view of the children. Approaching motorists are often unable to stop when a child steps out into the traffic from behind the front end of a bus. Relocation of a school bus stop to the departure side of an intersection can improve pedestrian safety because it eliminates the sight restriction posed by the bus.

Thus, the following intersection criteria should be considered when assessing school bus stops: The school bus stop should be located on the departure side of intersections, children's crossing locations, and property accesses, where possible.

To avoid misinterpretation of a bus driver's intention to stop at the departure side of the intersection as turning left, the bus stop should be located approximately 50 metres beyond the intersection.

School bus stops should not be located opposite the terminating leg of a T-junction for safety and efficiency reasons. Refer to the Austroads Guide to Road Design for typical intersection bus stop layouts and details on set out.
6.6.2 At mid-blocks

As mentioned previously, full pick-up/set-down areas are preferred and should be provided where sufficient width exists as buses can load and unload passengers clear of traffic.

Mid-block school bus stops should be located either across property accesses or downstream of property accesses to minimise conflicts. Refer to the Austroads Guide to Road Design for typical bus stop pick-up/set-down area layouts.

Where there is a possibility of buses from opposite directions arriving concurrently at a school bus stopping location on an undivided road, the school bus stops should be staggered or full pick-up/set-down areas provided to avoid the creation of a bottleneck. In the former situation, the bus stops should be staggered with the rear of the buses opposite each other, so as to encourage children to always cross the road behind the school bus where sight distance between children and other traffic is best.

When buses are not fully clear of the traffic lanes, an appropriate stagger distance (i.e. between the rears of the stopped buses) should be provided to ensure other vehicles can safely pass.

6.7 School bus stop signing

Traffic signs are provided to aid in the safe and orderly movement of traffic. It is therefore essential to ensure uniformity of applications of signs. Similar conditions should always be treated with the same type of sign, so that road users can readily anticipate the course of action required. The use of a sign which is at variance with its use elsewhere is confusing and, consequently, creates a potentially hazardous situation.

Furthermore, the Manual of Uniform Traffic Control Devices also stresses the significance of loss in effectiveness of warning signs if used unnecessarily or too frequently. Their use should be restricted to the minimum and consistent with safety requirements. A warning sign should not be used if, under normal conditions, the motorist can be expected to see and appreciate the potential hazard ahead.

Thus, the following signing criteria should be considered when assessing school bus stops: A school bus stopping location should only be signed as a school bus stop where sight distance is restricted and cannot be sufficiently improved.

In accordance with the Manual of Uniform Traffic Control Devices, the ‘Children’ sign (W6-3) with supplementary plate ‘BUS STOP’ (W8-Q03) or bus and student sign (TC9944) should only be used in advance of school bus stops in rural areas where visibility for approaching drivers of any children waiting at the stop is less than 200 metres. It is not intended that these signs should be generally used at school bus stops. To improve safety, consideration should be given to relocating the bus stop to a location with adequate visibility.

Where sight distance is adequate to the school bus stopping location (i.e., greater than 200 metres), these signs should generally not be used. In such situations, it is considered that the signing on the school bus and the operation of the bus flashing lights during stops is more effective in alerting other road users of the likely presence of children than the use of permanent warning signs.
**Figure 6.7-A – School bus stop signing**

Children’s sign with ‘BUS STOP’ plate  OR  Bus and Student sign (W6-3 and W8-Q03)  OR  Bus and Student sign (TC9944).

Children’s crossing areas should only be signed where, for safety reasons, it is necessary to warn motorists of the possible presence of school children on the road.

The children sign (W6-3) alone should only be used where:

- pedestrian volumes are significant, but insufficient to justify a pedestrian crossing (zebra) or traffic signals
- the presence of pedestrians may not be expected, or
- the pedestrian demand extends over a length of road.

To maintain credibility of these signs, it is important that they be removed as soon as the situation ceases to warrant such signing.

**Figure 6.7-B – Example of using children sign (horizontal curve restricts visibility to/from school bus stopping area)**

In Figure 6.7-B Children sign is used to advise motorists of unexpected presence of pedestrians.
6.8 Passenger waiting facilities

6.8.1 Waiting areas

Waiting areas for children are typically adjacent to the school bus stop and provide children with a safe area to wait for the school bus. The areas should be level, well drained and free from tripping hazards, and may be gravelled, sealed, etc. Shade provisions may also need to be a consideration in some locations.

Waiting areas are not provided at set down stops where children would normally just step off a school bus to walk (without waiting) to their destination.

Thus, the following passenger waiting criterion should be considered when assessing school bus stops: Where needed, waiting areas should be provided at school bus stops for school children to assemble and disperse.

Children’s waiting areas should be located as far as possible from the traffic lanes for their safety. Waiting areas should desirably be located beyond the clear zone with easy access to the bus door.

6.8.2 Passenger infrastructure

Bus shelters provide the children with weather protection. Shelter location is an important consideration because the shelter may restrict sight distances of drivers leaving side roads or property accesses, be within the clear zone for the speed environment, etc. If the shelter is located too close to the traffic lanes, the restricted space between the fixed shelter and the moving school bus can become hazardous to children.

Thus, the following passenger facility criterion should be considered when assessing school bus routes and school bus stops: Where needed, provisions for passenger bus shelters should be considered.

Passenger shelters should be provided where there is a demonstrated need. The need should be determined from factors such as passenger demand, stop permanency, passenger waiting duration, passenger convenience (e.g., from heat, rain, etc.).

The shelter should be located such that the bus driver is able to see the waiting children in time to stop the school bus. Speed environment and physical features should be considered in the location of the shelter in relation to the traffic lanes. Desirably, shelters should be located beyond the clear zone so as not to become a hazard to road users. Refer to Transport and Main’s Road Planning and Design Manual for further details on clear zones.

6.8.3 Parking facilities

Safe parking facilities (i.e., roadside parking, separate parking area, etc.) should be available at school bus stops where parents assemble with vehicles to drop-off/collect children. Parked/stopping vehicles should not create hazardous situations for any road users.

Adequate area should be available to permit parents to park their vehicle, drop-off children and collect them safely with minimal disruption to traffic. Where needed, a separate parking facility should be considered.

Thus, the following parking criterion should be considered when assessing school bus stops: Provisions for safe parking facilities should be considered at school bus stops where parents assemble with vehicles to drop-off/collect children.
Parking availability in all appropriate weather conditions (i.e., dry, wet, etc.) and access of parking facilities (where applicable) needs to be considered.

6.9 Pedestrian facilities

Pedestrian facilities, such as crossings and refuges, should only be provided where warranted. The warrants for these facilities are outlined in the *Manual of Uniform Traffic Control Devices*.

Generally, young children lack the skills and road sense that are typically acquired at a later age, which enable people to behave safely on the road.

Thus, the following pedestrian facility criteria should be considered when assessing school bus stops:  
*Where necessary, safe pedestrian crossing opportunities should be provided at the school bus stop.*

Safe crossing opportunities should be provided for children considering:

- conspicuity of children at the side of the road
- visibility from both the drivers and children’s view points
- crossing distance.

Where applicable, school bus stops should be located as close as practical to existing pedestrian crossing facilities. In such cases, the school bus stop should be located on the departure side of the crossing, at a minimum distance of 10 metres from the crossing. If there is a need to locate the bus stop on the approach side of the crossing, the bus stop should be a minimum of 20 metres from the crossing.

Safe travel paths should be available for children to travel from/to the school bus stop for children.

The need for children to walk along the edge of a vehicle carriageway should be avoided where possible, especially on roads where the traffic speed, volume and proportion of heavy vehicles are high. In such situations, travel paths at the maximum distance from the traffic lanes should be cleared/provided for children to access.

7 Road safety checklist

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<td>School bus performance and bus route issues</td>
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<td>Is the performance of the school bus acceptable to other motorists (i.e., no significant delays)?</td>
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<td>2</td>
<td>Is adequate infrastructure provided to prevent excessive speed disparities between school bus and other vehicles?</td>
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<td>3</td>
<td>Does the school bus remain within the designated traffic lane, particularly around horizontal curves?</td>
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<td>4</td>
<td>Is the pavement surface along the school bus route in good condition and is it satisfactory under adverse weather?</td>
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<td><strong>School bus route signing</strong></td>
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<td>school bus or school children ahead?</td>
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<td>2 Are the correct signs used for advance warning of school bus operations and is each sign necessary?</td>
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<td>3 Have all redundant signs been removed?</td>
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<td>4 Are all school bus turning movements free from impeding traffic flow and/or reducing safety of other road users (e.g., within road, near properties, etc.)?</td>
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</tbody>
</table>

### School bus stops

#### Crash history

1 Does crash history indicate that a bus stop at the location will not compromise school bus stop activities?

#### Visibility issues

1 Is the location of the school bus stop conspicuous to all road users?

2 Are school students crossing the road visible to motorists?

3 Is the school bus stop free from obstructions, such as vegetation, roadside objects, bridge abutments, etc.?

#### Stopping sight distances

1 Is the minimum stopping sight distance provided on each approach to the bus stop?

2 Are adequate passing opportunities for following vehicles provided at the school bus stop?

#### Roadway grades

1 Is the school bus stop appropriately located in relation to the roadway grade?

2 Is the school bus stop located away from the tapering section of an auxiliary lane or from a runaway vehicle facility?

#### Lanes and shoulders

1 Are adequate road shoulders provided for safe school bus operators?

#### Road surface condition

1 Is the road surface material at the school bus stop adequate, particularly during wet weather conditions?

#### Traffic characteristics
<table>
<thead>
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<th>No</th>
<th>Comments</th>
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<tbody>
<tr>
<td>1</td>
<td>Have investigations into factors such as speed, traffic composition and school peak traffic volumes been carried out in an effort to assess whether bus pull-off areas are needed?</td>
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</table>

**School bus stop locations**

| 1 | Is the bus stop appropriately located on the departure side of the intersection/crossing location/property access? | | | |
| 2 | Is the mid-block bus stop located opposite the property access (opposite side of road) and downstream of, or across, property access (same side of road)? | | | |
| 3 | Are school bus stops that are located on opposite sides of an undivided road staggered to avoid bottleneck? | | | |

**School bus stop signing**

| 1 | Does school bus stop signing comply with MUTCD? | | | |

**Passenger waiting facilities**

| 1 | Are passenger waiting facilities level, well-drained and free from tripping hazards? | | | |
| 2 | Are passenger waiting areas outside the clear zone? | | | |
| 3 | Is the bus shelter located outside the clear zone? | | | |
| 4 | Are safe parking facilities provided near the school bus stop? | | | |

**Pedestrian facilities**

| 1 | Do pedestrian crossings and refuges comply with MUTCD? | | | |
| 2 | Are safe travel paths provided for children travelling to/from the bus stop? | | | |