NHVR
National Heavy Vehicle Regulator

NTC AUSTRALIA
National Transport Commission

Performance-Based Standards Scheme – Network Classification Guidelines

July 2007

Prepared by
National Transport Commission

National Transport Commission

PBS Scheme – Network Classification Guidelines

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1. INTRODUCTION

The Performance-Based Standards Scheme for heavy vehicles focuses on what a vehicle must be able to achieve in terms of safety and infrastructure protection, rather than what it looks like, i.e. its prescribed mass and dimensions. With innovative designs, it is possible for vehicles participating in the Scheme to improve productivity and efficiency and be safer than vehicles operating under the current prescriptive regime. For a given freight task, there should be fewer freight vehicles in a Performance-Based Standards regime and subsequently less impact on the road environment.

The National Transport Commission (NTC) has developed 13 safety measures for heavy vehicles and the following seven of these standards have performance levels linked to four different levels of network access:

- startability
- gradeability
- acceleration capability
- tracking ability on a straight path
- low-speed swept path
- tail swing
- high-speed transient offtracking.

Road networks are required to be classified into the four levels of network access so that there is a match between the performance of vehicles participating in the Scheme and the roads on which they operate. The benefits of this match are:

- innovative vehicle designs will emerge for access to each road class. For example, a Level 2 vehicle in the Scheme will need to be designed to match Level 2 road characteristics and therefore can access Level 2, 3 and 4 roads. This avoids excessive designs and the problem of 'one size fits all';
- by classifying all roads in a jurisdiction in a consistent manner, the 'weak' links are identified. Road infrastructure needs such as traffic and load-bearing capacities of such links can be identified, and systematic roadwork priorities can be set;
- a uniform, national road classification system improves connectivity of freight routes within a jurisdiction and across jurisdictions. By using Scheme vehicles, the transport industry will be assured of connectivity for freight route planning;
- an access monitoring system can be implemented such as global positioning system devices to ensure compliance with a uniform and national road classification system; and
- a Performance-Based approach to road classification should encourage better land-use planning.

The road classifications in these guidelines are taken from NTC (2004) and the background information and reference material used to develop the interim guidelines are not reproduced in this document. The overtaking provision in section 2.3 has been incorporated into this document following endorsement by Transport Agency Chief Executives in March 2006.

These guidelines are intended to provide a uniform national method to classify road networks to allow access by the 4 types of Scheme vehicles as shown in Table 1.

Table 1. Four road classes for access by Scheme vehicles

Road class	Scheme vehicle level	Close present vehicle description
Level 1 access (L1)	1	From passenger cars to single articulated
Level 2 access (L2)	2	B-double
Level 3 access (L3)	3	Double road train (Type I)
Level 4 access (L4)	4	Triple road train (Type II)

The Level 1 road class represents general access to the road network and will require vehicles to meet more stringent standards than those seeking access to other parts of the road network, i.e. Level 2, 3 or 4 roads.

Road classification criteria often need to be considered over a reasonable road section length to gain an overall assessment. An indicative length for rural roads is 20–30 km and similarly 5–10 km for urban roads. These lengths are dependent on site and traffic conditions.

This document contains road classification guidelines for the following parameters:

- 2.1 Road width
- 2.2 Bridge widths;
- 2.3.3 Overtaking provision;
- 2.7 Entry length onto main roads and highways;
- 2.8 Approach visibility (stopping sight distance);
- 2.9 Vertical (overhead) clearance;
- 2.10 Off-road truck parking;
- 2.11 Roadside infrastructure; and
- Amenity and environmental factors.

2. ROAD CLASSIFICATION GUIDELINES

2.1 Road width

The purpose of defining minimum lane or road widths is to provide sufficient carriageway for vehicles to operate without a heavy vehicle imposing a risk to other road users by impinging on adjacent lanes or encroaching on limited or no shoulders.

2.1.1 Background

The 'Tracking Ability on a Straight Path' standard is directly relevant to lane width requirements on urban and township roads. It is a primary consideration for lane width requirements for non-kerbside through lanes and for controlled access roads. However, for kerbside lanes or total widths on general purpose roads, the need to accommodate other road users, particularly parked vehicles and provision for cyclists is an important consideration.

Minor width deficiencies alone should not necessarily preclude a route from a road classification level, particularly if the deficiencies only apply to a small proportion of the route length. To provide network continuity and connectivity a relaxation of carriageway width may be considered. In such cases, a risk assessment should be undertaken considering all factors which would contribute to the safe operation of a Scheme vehicle and its interaction with other users.

2.1.2 Requirement

2.1.2.1 Urban and township roads

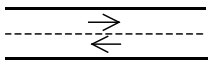
Table 2 lists the minimum lane width requirements for urban and township roads for class L2 to L4. These widths pertain to near straight alignments and the additional widths required on horizontal curves are addressed under curve widening.

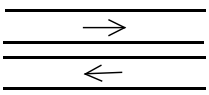
Table 2. Minimum lane widths for urban and township roads

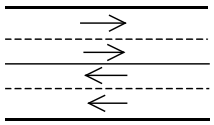
Road class	Road type and operation	Kerbside lanes (m)		Other through lanes (m)	
		60 – 70[1] km/h	80 – 100 km/h	60 – 70 km/h	80 – 100 km/h
L2	2-lane undivided [2]				
	- basic (no separation line)	3.2	3.3	n.a.	n.a.
	- with separation line	3.5	3.6	n.a.	n.a.
	- on-road cyclists	4.7	4.8	n.a.	n.a.
	- regular parallel parking	5.7	5.8	n.a.	n.a.
	- angle parking (45^{o})	9.2	9.3	n.a.	n.a.
	2-lane divided				
	- basic	3.5	3.6	n.a	n.a.
	- on-road cyclists	5.0	5.1	n.a.	n.a.
	- regular parallel parking	6.0	6.1	n.a.	n.a.
	- angle parking (45^{o})	9.5	9.6	n.a.	n.a.
	4-lane undivided and divided				
	- basic	3.2	3.3	3.2	3.3
	- on-road cyclists	4.7	4.8	3.2	3.3
	- regular parallel parking	5.7	5.8	3.2	3.3
	6-lane divided				
	- basic	3.1	3.1	3.2	3.3
	- on-road cyclists	4.6	4.6	3.2	3.3
L3	2-lane undivided				
	- basic (no separation line)	3.3	3.5	n.a.	n.a.
	- with separation line	3.6	3.8	n.a.	n.a.
	- on-road cyclists	4.8	5.0	n.a.	n.a.
	- regular parallel parking	5.8	6.0	n.a.	n.a.
	- angle parking (45^{o})	9.3	9.5	n.a.	n.a.
	2-lane divided				
	- basic	3.6	3.8	n.a	n.a.
	- on-road cyclists	5.1	5.3	n.a.	n.a.
	- regular parallel parking	6.1	6.3	n.a.	n.a.
	- angle parking (45^{o})	9.5	9.6	n.a.	n.a.
	4-lane undivided and divided				
	- basic	3.3	3.5	3.3	3.5
	- on-road cyclists	4.8	5.0	3.3	3.5
	- regular parallel parking	5.8	6.0	3.3	3.5
	6-lane divided				
	- basic	3.2	3.3	3.3	3.5

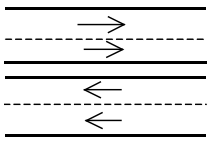
Road class	Road type and operation	Kerbside lanes (m)		Other through lanes (m)	
		60 – 70[1] km/h	**80 – 100 km/h**	**60 – 70 km/h**	**80 – 100 km/h**
	- on-road cyclists	4.6	4.7	3.3	3.5
L4	2-lane undivided				
	- basic (no separation line)	3.6	3.8	n.a.	n.a.
	- with separation line	3.9	4.1	n.a.	n.a.
	- on-road cyclists	5.1	5.3	n.a.	n.a.
	- regular parallel parking	6.1	6.3	n.a.	n.a.
	- angle parking (45^o)	9.6	9.8	n.a.	n.a.
	2-lane divided				
	- basic	3.9	4.1	n.a	n.a.
	- on-road cyclists	5.4	5.6	n.a.	n.a.
	- regular parallel parking	6.4	6.6	n.a.	n.a.
	- angle parking (45^o)	9.8	9.9	n.a.	n.a.
	4-lane undivided and divided				
	- basic	3.5	3.8	3.4	3.6
	- on-road cyclists	5.0	5.3	3.4	3.6
	- regular parallel parking	6.0	6.3	3.4	3.6
	6-lane divided				
	- basic	- 3.3	- 3.5	- 3.4	- 3.6
	- on-road cyclists	- 4.8	- 4.9	- 3.4	- 3.6

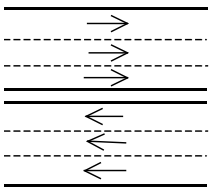
Notes
1. speeds refer to the prevailing speed limit for the road
2. an explanation of road type descriptors follows:

2-lane undivided 

2-lane divided 

4-lane undivided 

4-lane divided 

6-lane divided 

2.1.2.2 Rural roads – sealed

Desirable minimum widths for sealed rural roads for L2 to L4 are in Table 3. These widths pertain to near straight alignments and also consider high speed transient offtracking. The additional widths required on horizontal curves are addressed under curve widening.

Table 3. Minimum widths for sealed rural roads according to Annual Average Daily Traffic (AADT) data

Road class	(AADT) (vehicles)	Minimum Width (m)	
		Lane[1]	Shoulder[2]
L2	< 150	3.4 m seal on 7.2 m formation	
	150 – 500	2.8	1.0
	500 – 1,500	3.1	1.2
	1,500 – 3,000	3.2	1.5
	> 3,000	3.5	1.5
L3	< 150	3.6 m seal on 7.6 m formation	
	150 – 500	2.9	1.2
	500 – 1,500	3.2	1.2
	1,500 – 3,000	3.3	1.5
	> 3,000	3.5	1.3
L4	< 150	4.0 m seal on 8.1 m formation	
	150 – 500	3.0	1.3
	500 – 1,500	3.3	1.5
	1,500 – 3,000	3.6[3]	1.8
	> 3,000	3.9[4]	1.8

Notes:

1. Lane width is the trafficable width divided by the number of lanes.
2. Shoulder width includes both sealed and unsealed portions of the shoulder.
3. For two-lane roads, minimum lane widths can be reduced to 3.5 m where shoulder seals of at least 0.5 m width are provided.
4. For two-lane roads, minimum lane widths can be reduced to 3.5 m where shoulder seals of at least 1.0 m width are provided.

Minimum seal width may be reduced where speeds are controlled to 60 or 70 km/h, for relatively short links, or where other users are familiar with the operation of multi combination vehicles, e.g. farm access roads.

Minimum seal width may be larger for routes or areas where it is expected that a proportion of users will be unfamiliar with the operation of multi combination vehicles (e.g. tourist routes), or where there is shoulder erosion.

For two-lane roads, the presence of a shoulder seal serves to increase the effective lane width allowing greater clearances between vehicles. Where two-lane roads have sealed shoulders which may be used infrequent by others such as cyclists, consideration may be given to reducing minimum lane widths. Lane widths should not be reduced below practical minima, and the reduction should not exceed about 30% of the shoulder seal width.

2.1.2.3 Rural roads – unsealed

The desirable minimum carriageway widths for unsealed roads are in Table 4. The minimum formation width may be reduced where speeds are controlled to 60 or 70 km/h, for relatively short links, or where other users will be familiar with the operation of multi combination vehicles (e.g. farm access roads).

Table 4. Minimum carriageway widths for unsealed roads

Road class	AADT (vehicles)	Carriageway (m)
L2	<100	7.2
	>100	7.7
L3	<100	7.6
	>100	8.1
L4	<100	8.1
	>100	8.6

2.1.2.4 Curve widening

For a combination vehicle traversing a curve at low speed, the trailing units will track inwards in response to curve superelevation and the kinematics of the vehicle configuration. For high speeds, the trailing units may track outwards. The additional lane width required to accommodate the greater tracked width on curves is in Table 5. Turning templates for the smallest radii as noted in Table 5 are in Appendix B.

Table 5. Additions to minimum lane width for horizontal curves

Road class	Radius (m)	Additional width (m)
L2	≤ 60	Use turning template
	70	1.30
	80	1.15
	90	1.05
	100	0.90
	120	0.80
	140	0.70
	160	0.60
	180	0.50
	200	0.45
	250	0.35
	300	0.30
	350	0.25
	400	0.2
	≥ 450	0
L3	≤ 70	Use turning template
	80	1.60
	90	1.45
	100	1.25
	120	1.15
	140	1.00
	160	0.85
	180	0.75
	200	0.60
	250	0.50
	300	0.40
	350	0.35
	400	0.30
	450	0.25

Road class	Radius (m)	Additional width (m)
	500	0.25
	600	0.20
	≥ 700	0
L4	≤ 90	Use turning template
	100	1.80
	120	1.60
	140	1.45
	160	1.25
	180	1.05
	200	0.90
	250	0.75
	300	0.60
	350	0.50
	400	0.45
	450	0.40
	500	0.35
	600	0.30
	700	0.25
	800	0.20
	≥ 900	0

2.2 Bridge widths

2.2.1 Background

Bridges are normally the narrowest points on a road and few rural bridges provide the lane widths as shown in Table 3 to Table 5. Therefore, defining the minimum width of bridges provides guidance when classifying roads with bridges.

2.2.2 Requirement

Table 6 provides the minimum bridge width requirements for L2 to L4 roads. A visual inspection and risk assessment should be undertaken for bridges not providing the minimum recommended widths considering:

- bridge approach sight distance;
- ability of drivers on a bridge approach to see vehicles on the opposing approach; and
- willingness of drivers to adjust trajectory or entry onto a bridge to accommodate the width needs of large vehicles.

Table 6. Minimum bridge width requirements on rural roads

Road class	AADT	Minimum width[1] (m)	Comment
L2 to L4	< 150	4	Meeting requirements for single-lane bridges
	< 500	7.2	Two-lane bridges
	> 500	8.4	

Note 1. The lesser of between bridge rails or between kerbs.

2.3 Overtaking

2.3.1 Background

The purpose of the overtaking provision is to provide a specified level of service for all vehicles using Performance-Based Standards routes. The level of service defines a quality of traffic flow as related to a number of road and traffic attributes which affect flow performance.

When Scheme vehicles are operating on appropriately classified routes they should not impede or delay other traffic beyond the expected level of service.

2.3.2 Requirement

Six levels of service are designated, from A to F, with A corresponding to free flow conditions and F corresponding to full capacity. Level of service C expresses user expectations for flow conditions on the intermediate to high volume two-lane roads and this level of service is used as the performance level for L1 and L2 class roads see Table 7. Similarly, level of service B is recommended for L3 and L4 class roads as it denotes user expectations for flow conditions on low to intermediate volume two-lane roads.

Table 7. Recommended level of service for each road class

Performance standard	Performance measure	Performance level (Road Class)				Test specification
		L 1	L 2	L 3	L 4	
Overtaking provision	The time taken for another vehicle to safely overtake the subject heavy vehicle related to the available overtaking opportunities and a target traffic flow level of service.	Level of service C	Level of service C	Level of service B	Level of service B	Specific to road and traffic conditions.

2.3.3 Overtaking provision

2.3.3.1 Background

The overtaking provision combines the following effects to determine, in relative terms, the difficulty of overtaking a vehicle of specified length:

- the probability that the sight distance profile will provide a sight distance opportunity (this is approximately quantified in terms of the proportion of road with overtaking barrier line);
- the probability that a sight distance opportunity is blocked by opposing traffic; and
- the extent of overtaking lanes.

2.3.4 Overtaking sight distance

2.3.4.1 Background

The time taken to overtake a long vehicle is of concern for traffic operations on single-carriageway, essentially two-lane, rural roads. The manoeuvre commonly requires that the overtaking vehicle uses the opposing traffic lane, and opportunities for this to be undertaken safely are limited by the sight distance profile of the road and the availability of gaps in the opposing traffic. The time required for an overtaking manoeuvre increases with increasing length of the overtaken vehicle. As overtaking time increases, the frequency with which the road and the opposing traffic provide safe overtaking opportunities decreases. Drivers wishing to overtake the vehicle will, on average, have to wait longer for a safe opportunity. Queues may form behind long vehicles, and frustration can lead to overtaking being attempted in situations that are less safe than normal.

A road of given classification should provide sufficient overtaking opportunity relative to the length of the vehicles which will be using it and the traffic volume.

The Austroads (2003) guide on *Rural Road Design* specifies overtaking road design requirements in terms of two sight distances:

- Establishment Sight Distance: A minimum sight distance that is adequate to encourage a given proportion of drivers to commence an overtaking manoeuvre.
- Continuation Sight Distance: A critical sight distance, which if maintained for some length of road after the Establishment Sight Distance has become available, will enable an overtaking driver to either complete or abandon a manoeuvre already commenced with safety.

2.3.4.2 Requirement

A section of road for which the available sight distance exceeds the Establishment Sight Distance is a sight distance overtaking opportunity. The length of the opportunity is the length of the section providing Establishment Sight Distance plus the length of the following section providing Continuation Sight Distance. Table 8 gives establishment and continuation sight distances for cars overtaking heavy vehicles appropriate to the road class and the prevailing operating speeds.

Table 8. Establishment sight distances for overtaking Scheme vehicles

Road class	Establishment Sight Distance (m)		Continuation Sight Distance (m)	
	80 km/h	100 km/h	80 km/h	100 km/h
L1	700	1,000	320	450
L2	750	1,100	340	490
L3	840	1,200	380	550
L4	900	1,300	430	650

The calculation of design values for Establishment Sight Distance and Continuation Sight Distance uses a number of assumptions regarding the proportion of drivers who will accept an overtaking opportunity and vehicle speeds. In practice, there is considerable variation in the

distances required for overtaking manoeuvres and in driver preparedness to initiate the manoeuvre. Hence, the information in Table 8 is a general indication of requirements for an overtaking opportunity and provides estimates of available sight distance for most route assessment purposes.

2.3.5 Overtaking opportunity

2.3.5.1 Background

For roads carrying less than an Annual Average Daily Traffic (AADT) of about 500 vehicles, other users will catch-up to slow vehicles infrequently and the overtaking opportunities provided by the sight distance profile will seldom be blocked by an opposing vehicle. As traffic volumes increase, the frequency with which other users catch-up to slow vehicles increases, as does the probability that a sight distance opportunity will be blocked by an opposing vehicle. Hence, more frequent sight distance opportunities are required for increasing traffic volume. Table 9 gives desirable maximum distances between overtaking opportunities as related to AADT.

Table 9. Desirable maximum distances between sight distance overtaking opportunities, including overtaking lanes

Road class	AADT (vehicles)	Average distance between opportunities (km)	Maximum distance between opportunities (km)
L1 to L4	< 100	n.a.	n.a.
	100 – 500	30	50
	500 – 1000	15	30
	1,000 – 2,000	8	10
	> 2,000	5	10

Note:

1) The distance requirements can be relaxed when Scheme vehicles represent less than 5% of total traffic and where other users can be expected to be familiar with the operation of multi combination vehicles. A shift of one AADT range in the table is considered appropriate.

2.3.5.2 Requirement

Relationships between the overtaking lanes, sight distance profile and sight distance opportunity for overtaking difficulty for specific traffic flow level of service are in Appendix A. These plots pertain to sections of road of relatively uniform alignment character and preferably at least 40 km long. They are applied in addition to the sight distance opportunity considerations (Table 8) when traffic volumes exceed the values at zero percentage directional overtaking lane.

As an example of the application of these plots, consider the case of an L3 road with each direction having 40% barrier (no-overtaking) line and 1.25 km overtaking lanes spaced at about 25 km, giving 5% directional overtaking lane. As illustrated in Figure 1, this road would provide the target level of service for 40 m Scheme vehicles for AADT values up to about 1,800 vehicles per day.

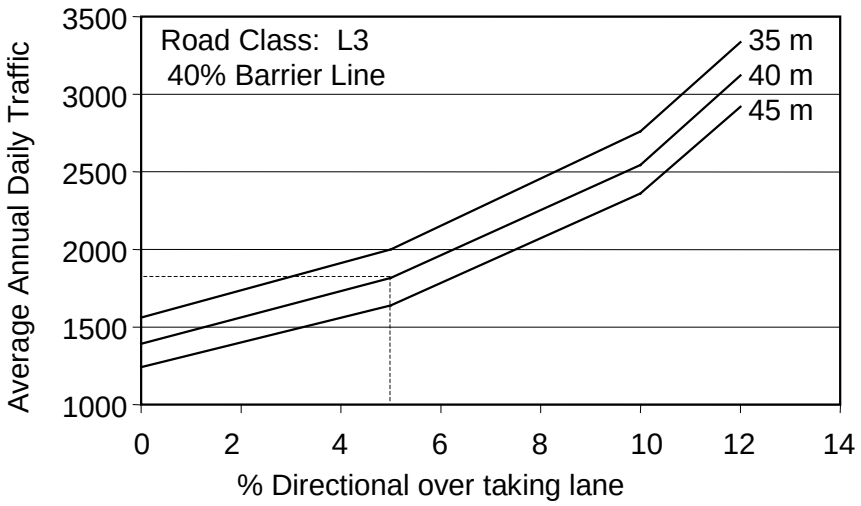


Figure 1. An example of determining AADT for a target level of service for a given percentage directional overtaking lane

The following should be noted when determining the AADT value from the plots in Appendix A:

- The percentage overtaking lane measure is applied directionally and is the percentage of road length for containing an overtaking lane intended for that direction. Under normal practices for the provision of overtaking lanes, the percentage directional overtaking lane will be similar in each direction.
- The percentage directional overtaking lane indicated by the plots pertains specifically to the difficulty of overtaking a vehicle of nominated length. This is not necessarily the proportion of overtaking lane required to maintain the specified traffic flow level of service for the total traffic stream.
- For L1 and L2 class roads, the overtaking difficulty criterion is satisfied for directional overtaking lane greater than about 7%, regardless of traffic volume or overtaken vehicle length.
- For L3 and L4 class roads, the overtaking difficulty criterion is satisfied for directional overtaking lane greater than about 15%, regardless of traffic volume or overtaken vehicle length.

2.3.6. Overtaking lanes

2.3.6.1 Background

Directional overtaking lanes provide overtaking opportunity additional to that provided by the sight distance profile.

2.3.6.2 Requirement

Directional overtaking lanes are particularly advantageous at higher traffic volumes as the opportunities they provide are unaffected by opposing traffic. For a 100 km/h or greater road operating speed and near flat grades, the desirable length of overtaking lanes including tapers is 1 km for L1 and L2 class roads and 1.25 km for L3 and L4 class roads. Shorter lengths are acceptable where prevailing operating speeds are 80 km/h or less or when the overtaking lane is on a grade sufficient to reduce the speed of heavy vehicles.

2.4 Maximum vehicle lengths

The provision of upper bounds for vehicle lengths for each Scheme vehicle provides jurisdictions with a tool for classifying and mapping a national road network and a performance envelope within which to classify vehicles. For Scheme vehicles that wish to gain access to a specific network level but exceed the upper bound length for that level, an individual route assessment will need to be carried out.

Table 10. Equivalent maximum vehicle length

Vehicle Performance Level	Network Access by Vehicle Length, L (m)	
	Access Class 'A'	Access Class 'B'
Level 1	L ≤ 20 (General Access*)	
Level 2	L ≤ 26	26 < L ≤ 30
Level 3	L ≤ 36.5	36.5 < L ≤ 42
Level 4	L ≤ 53.5	53.5 < L ≤ 60

* General Access is subject to a 50 tonne gross mass limit, posted local restrictions and restrictions or limitations specified by the jurisdiction.

When classifying routes that feature rest areas with marked truck parking bays, consideration should be given to the lengths of the parking bays.

2.5 Signalised intersections

2.5.1 Purpose

To ensure sufficient clearance time and distances are available in the direction of travel for different Scheme vehicle classes at signalised intersections.

2.5.2 Requirement

The minimum stopping sight distances should be in accordance with the values in Table 15. The minimum green time and intergreen time in a green phase should be sufficient for vehicles in each road class to clear an intersection from a stationary position at the stopline. Average acceleration capability requirements for Scheme vehicles during straight line acceleration on roads without grade are shown in Table 11. Allowance should be made for grades and/or turning movements as required.

The requirements for the minimum green, intergreen times are calculated using the data Table 11 and the lengths of current representative vehicle types as shown in Table 10. These results together with the stacking distances on the approach and departure side are shown in Table 12.

There should also be sufficient road length (stacking distances) between adjacent intersections to allow a multi combination vehicle to clear the first intersection before stopping at the second intersection as indicated in Table 12.

Clearance times and distances in Table 12 are for flat roads and allowances should be made for the effect of longitudinal grade on clearance times at intersections.

Table 11. Acceleration capability of Scheme vehicles

Performance-Based Standards Road Class	Time To Travel 100m Free Rest (secs)
1	20
2	23
3	26
4	29

Table 12. Clearance times and distances at signalised intersections at flat grades

Road class	Signalised intersection clearance			#Stacking distances at intersection (m)	
	Intersection width in the direction of travel (m)	*Minimum green plus intergreen (s)			
		Access Class 'A'	Access Class 'B'	Access Class 'A'	Access Class 'B'
L1	20	12.0		23.5	
	25	13.0			
	30	14.0			
L2	20	15.0	15.5	29.5	33
	25	16.0	16.5		
	30	16.5	17.5		
L3	20	18.0	19.0	40.0	45
	25	19.0	20.0		
	30	19.5	20.5		
L4	20	25.0	26.5	57.0	63
	25	26.0	27.5		
	30	27.5	28.5		

*assumes a driver reaction time of 0.5 s

assumes a margin of 3.5 m for stacking distances.

The clearance times, warning times and stacking distances calculated in Table 12 and Table 13 are for Scheme vehicles complying with Class A access. For longer vehicles, assessments should be made against the appropriate access class.

2.6 Railway level crossings

2.6.1 Purpose

To ensure sufficient warning and clearance time is available for different Scheme vehicle classes at railway crossings.

2.6.2 Requirement

The warning time of a warning device at a railway crossing should be adequate. The warning time in Table 13 refers to the time period when flashing lights at a railway level crossing commence operation and the boom gate begins to descend. The warning times are estimated using the data in Table 11 and the lengths of current representative vehicle types as shown in Table 10. This period is sufficient to allow a multi combination vehicle to pass over the railway level crossing without striking the boom gate. The flashing light period is followed typically by 10 seconds for boom gate lowering and another 10 seconds until the train arrives.

Sufficient stacking distances should be provided at railway level crossing sites (see 0). At railway level crossing sites where the stacking distances are insufficient, consideration should be given to the level of train movements and main road traffic. The requirements on stacking distances may be waived if the number of train movements is less than or equal to 10 per day and the AADT is less than 500 vehicles. Individual site inspections are also recommended.

Clearance times and distances in Table 13 are for flat roads and allowances should be made for the effect of longitudinal grade on clearance times at rail level crossings.

An alternative approach in the assessment of railway level crossings is the use of the Australian Level Crossing Assessment Model (ALCAM 2007). This is a safety assessment tool used to assist in the prioritisation of railway level crossings according to their comparative safety risk. It provides a rigorous process for decision making for road level crossings.

The Australian Level Crossing Assessment Model is a complex scoring algorithm which considers each site's physical properties, including consideration of the related common human behaviours, to provide each level crossing with a 'Risk Score'. This score is linked with the 'Exposure Rating' enabling the compilation of a 'Total Risk Exposure Score'. This total score is used to assess the safety risk of the level crossing and determine the appropriate measures for the operation of the crossing. The use of this model should be undertaken in conjunction with site assessments, standards and other risk mitigation strategies.

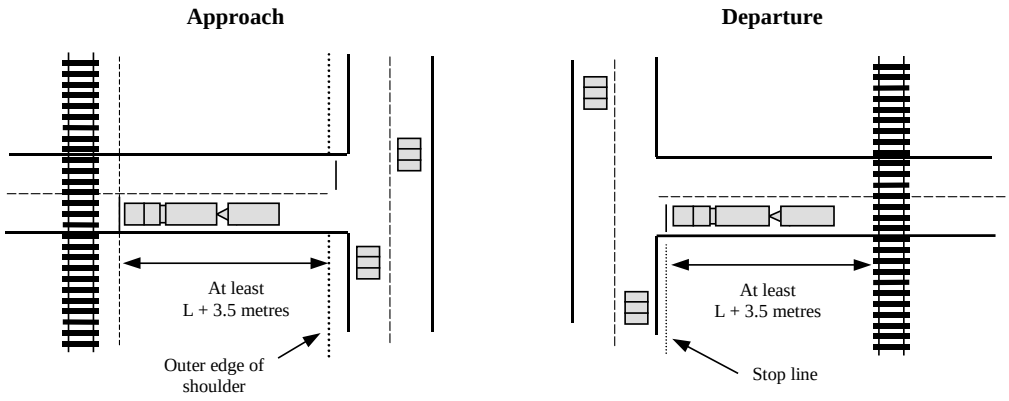


Figure 2. Stacking distances at railway level crossings (Main Roads WA 2003)

Table 13. Railway level crossing warning time at flat grades

Road Class	*Warning time at railway level crossing (s)		#Stacking distances at railway level crossing (m)	
	Access Class 'A'	Access Class 'B'	Access Class 'A'	Access Class 'B'
L1	8		23.5	
L2	11	12	29.5	33
L3	14	16	40	45
L4	21	22	57	63

*assumes a driver reaction time of 0.5 s

assumes a margin of 3.5 m for stacking distances.

2.7 Entry length onto main roads and highways

2.7.1 Background

Heavy vehicles should maintain appropriate speeds when they merge into main stream traffic from an entry lane to avoid undue hazard or obstruction.

The length of an entry lane should be sufficient to allow a vehicle, when fully loaded, to accelerate to an acceptable level of the normal traffic speed at the point where the lane joins with the through road.

2.7.2 Requirement

Table 14 shows the minimum length of an entry lane for different vehicles and conditions. This table refers only to situations where the through road is a main road or a highway with moderate to high traffic volume. In other cases, traffic volumes and traffic composition should be considered when assessing the route if the minimum acceleration lengths required to achieve 70% of the operating speed are not met.

Table 14. Minimum length of an entry lane onto a main road or highway

Road class	Operating speed on through road (km/h)	Minimum length of entry lane (m)					
		Down grade			Level	Up grade	
		-4%	-2%	-1%	0%	1%	2%
L1	80	150	210	280	400	860	1,840
	110	320	500	720	1,270	1,090	*
L2	80	190	270	350	510	1,090	*
	110	410	630	910	1,620	*	*
L3	80	200	280	370	570	1,500	*
	110	420	670	970	1,870	*	*
L4	80	220	330	460	790	*	*
	110	470	760	1,180	*	*	*

* not possible to accelerate from rest up to the required speed within a distance of 2,000 m.

2.8 Approach visibility (stopping sight distance)

2.8.1 Background

The driver of a vehicle approaching any intersection on a priority road (or railway level crossing) must have sufficient visibility to observe another vehicle at or within the intersection, and stop if necessary.

Approach sight distance is proposed as the approach visibility requirement for road classification. It is measured from an average (heavy vehicle) driver eye height of 2.4 m above the road surface.

2.8.2 Requirement

Table 15 shows stopping sight distances for heavy vehicle drivers for a range of speeds and gradients for each road class. These values are conservative but do provide a safety margin for road operations.

Heavy vehicles on L2, 3 and 4 roads should descend in low gear on the grades noted in Table 15 to prevent overrun. 'TRUCKS USE LOW GEAR' signs should be installed on these grades approximately 100 m before the start of the descent.

Table 15. Stopping sight distances

<table>
<tr><th rowspan="3">Road class</th><th rowspan="3">Operating speed (km/h)</th><th colspan="9">Stopping sight distance (m)</th></tr>
<tr><th colspan="4">Down grade</th><th>Level</th><th colspan="4">Up grade</th></tr>
<tr><th>-8%</th><th>-6%</th><th>-4%</th><th>-2%</th><th>0%</th><th>2%</th><th>4%</th><th>6%</th><th>8%</th></tr>
<tr><td rowspan="8">L1</td><td>40</td><td>65</td><td>62</td><td>60</td><td>58</td><td>57</td><td>55</td><td>54</td><td>53</td><td>52</td></tr>
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<tr><td>80</td><td>191</td><td>180</td><td>172</td><td>164</td><td>158</td><td>152</td><td>147</td><td>143</td><td>139</td></tr>
<tr><td>90</td><td>232</td><td>219</td><td>208</td><td>199</td><td>190</td><td>183</td><td>177</td><td>172</td><td>167</td></tr>
<tr><td>100</td><td>281</td><td>263</td><td>248</td><td>236</td><td>225</td><td>215</td><td>207</td><td>200</td><td>194</td></tr>
<tr><td>110</td><td>344</td><td>317</td><td>295</td><td>277</td><td>262</td><td>249</td><td>238</td><td>228</td><td>219</td></tr>
<tr><td rowspan="8">L2</td><td>40</td><td>69</td><td>66</td><td>64</td><td>62</td><td>61</td><td>59</td><td>58</td><td>57</td><td>56</td></tr>
<tr><td>50</td><td colspan="2" rowspan="7">N/A (Descent at slow speed and in low gear required)</td><td>88</td><td>85</td><td>83</td><td>80</td><td>78</td><td>77</td><td>75</td></tr>
<tr><td>60</td><td>115</td><td>111</td><td>107</td><td>104</td><td>101</td><td>99</td><td>97</td></tr>
<tr><td>70</td><td>145</td><td>140</td><td>135</td><td>130</td><td>127</td><td>123</td><td>120</td></tr>
<tr><td>80</td><td>179</td><td>171</td><td>165</td><td>159</td><td>154</td><td>150</td><td>146</td></tr>
<tr><td>90</td><td>215</td><td>206</td><td>197</td><td>190</td><td>184</td><td>179</td><td>174</td></tr>
<tr><td>100</td><td>261</td><td>249</td><td>238</td><td>228</td><td>220</td><td>213</td><td>207</td></tr>
<tr><td>110</td><td colspan="9">Not applicable</td></tr>
<tr><td rowspan="8">L3</td><td>40</td><td>74</td><td>72</td><td>70</td><td>68</td><td>66</td><td>65</td><td>64</td><td>62</td><td>61</td></tr>
<tr><td>50</td><td colspan="2" rowspan="7">N/A (Descent at slow speed and in low gear required)</td><td>95</td><td>92</td><td>89</td><td>87</td><td>85</td><td>84</td><td>82</td></tr>
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<tr><td>80</td><td>190</td><td>182</td><td>176</td><td>170</td><td>165</td><td>161</td><td>157</td></tr>
<tr><td>90</td><td>228</td><td>218</td><td>210</td><td>203</td><td>197</td><td>191</td><td>186</td></tr>
<tr><td>100</td><td>275</td><td>263</td><td>252</td><td>242</td><td>234</td><td>227</td><td>220</td></tr>
<tr><td>110</td><td colspan="9">Not applicable</td></tr>
<tr><td rowspan="8">L4</td><td>40</td><td colspan="3" rowspan="4">N/A</td><td>75</td><td>73</td><td>72</td><td>70</td><td>69</td><td>68</td><td>67</td></tr>
<tr><td>50</td><td>102</td><td>99</td><td>96</td><td>94</td><td>92</td><td>91</td><td>89</td></tr>
<tr><td>60</td><td>132</td><td>127</td><td>124</td><td>121</td><td>118</td><td>115</td><td>113</td></tr>
<tr><td>70</td><td>165</td><td>159</td><td>154</td><td>150</td><td>146</td><td>143</td><td>140</td></tr>
<tr><td>80</td><td colspan="4" rowspan="3">(Descent at slow speed and in low gear required)</td><td>187</td><td>181</td><td>176</td><td>172</td><td>168</td></tr>
<tr><td>90</td><td>222</td><td>215</td><td>209</td><td>204</td><td>199</td></tr>
<tr><td>100</td><td>266</td><td>256</td><td>248</td><td>241</td><td>234</td></tr>
<tr><td>110</td><td colspan="9">Not applicable</td></tr>
</table>

2.9 Vertical (overhead) clearance

2.9.1 Background

Vehicles with high loads are particularly vulnerable to striking low overhead obstructions.

Overhead clearances should be at least 200 mm above the height of a vehicle for rigid overhead obstructions (e.g. bridges, overpasses and signs) and non-rigid overhead obstructions (e.g. wires and trees).

2.9.2 Requirement

Where power lines cross the route, the minimum overhead clearance requirements must be within the local electricity authority requirements. Similarly, where electric overhead wiring exists at level crossings, height clearance requirements must be checked with the relevant rail authority.

Table 16 shows the subsequent requirements on maximum vehicle heights for different road classes.

Table 16. Vertical clearance

Road class	Maximum vehicle height (m)	Comments
L1	4.3	Structures with less than 5 m clearance should be signed to show the clearance level to the nearest 0.1 m
L2	4.6	
L3	4.6	
L4	4.6	

2.10 Off-road truck parking

2.10.1 Background

All road classes should have adequate off-road truck parking facilities at sufficient spacing, especially in remote areas.

An adequate off-road parking facility is defined as any:

- service station, roadhouse or other commercial establishment with provision for public truck parking;
- signed parking bay, truck bay, rest area; and
- designated road train assembly area.

2.10.2 Requirement

The minimum stopping sight distances to the entry/exit points for traffic travelling on the through road are in accordance with the values in Table 15, and the full length of the vehicle must be able to be parked without encroachment onto the carriageway.

A guide for the maximum spacing for off-road parking facilities in any one direction of travel is shown in Table 17.

Table 17. Spacing for off-road parking

Road class	Maximum spacing (km)
L1	80
L2	80
L3	80
L4	120

The minimum clearance distances from the pavement edge of the parked vehicle at different speed limits are shown in Table 18.

Table 18. Clearance of parked vehicles from pavement edge

Road Class	Speed limit (km/h)	Minimum clearance from edge of pavement* (m)
L1 to L4	60	5.0
	70	5.7
	80	6.2
	90	7.6
	100	8.8
	110	11.0

* for parking facilities located on the outside of a curve, add a further 1.6 m to the nominal minimum clearance

2.11 Roadside infrastructure

2.11.1 Background

Heavy vehicles may adversely impact roadside infrastructure such as drainage pits, kerb and channel, roadside poles, signs, vegetation, footpaths, and pram/bicycle crossings due to their increased length and larger turning requirements. These facilities need to be checked against the swept path to ensure that there is adequate separation with the likely pathways of various vehicle classes.

2.11.2 Requirement

Under the Scheme, this consideration is not necessary because the swept path is controlled by vehicle performance standards to match existing vehicle types.

3. AMENITY AND ENVIRONMENTAL CONSIDERATIONS

3.1 Consultation

Community consultation should be undertaken during road classification, except in the most straightforward of cases. The nature of the consultation will be determined by the authority responsible for the road or as agreed to by the affected parties.

A model for assessing whether community consultation is required and what level of consultation should be undertaken is shown in Figure 3 (adapted from Transport South Australia 2002). Note that consultation should be undertaken for Performance-Based Standards road classes L2 to L4 because L1 is for general access.

If a road or route is already in use by larger vehicle combinations (i.e. the prescriptive equivalent of a Scheme vehicle class) and there are no unacceptable amenity impacts resulting from the use of the road by that prescriptive equivalent, then there may not be a need for community consultation.

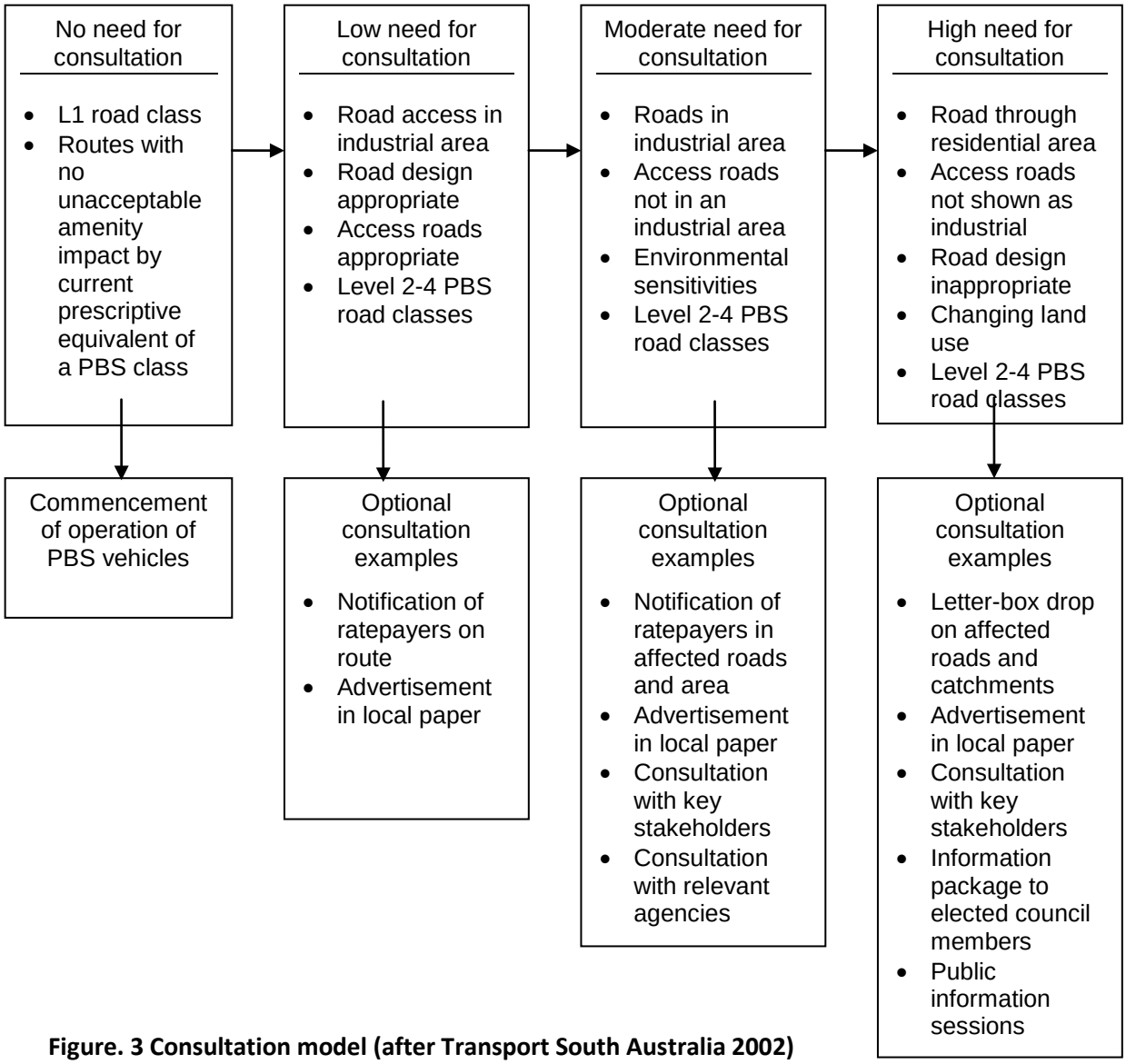


Figure. 3 Consultation model (after Transport South Australia 2002)

3.2 Land use

The key issue with land use is the level of access to abutting development. The proximity to sensitive land uses needs to be considered when determining the appropriate level of network classification. In this context a sensitive land use is one that has a high level of access. Land uses may be sensitive to other aspects that may change as a result of network classification, such as noise, and these are addressed separately.

Sensitive land uses include:

- residential areas;
- commercial areas;
- industrial areas;
- schools;
- hospitals;
- aged care facilities;
- religious facilities;
- aboriginal land;
- areas with significant movements of pedestrians and cyclists; and
- recreational areas.

L3 and L4 road classes should avoid such land uses as much as possible, with the aim of minimising undesirable amenity impacts and potential traffic conflicts as shown in Table 19.

Table 19. Land use

Road class	Expectations
L1	This road class is expected to be in areas where a wide range of land uses has developed over time including sensitive land uses
L2	This road class is expected to pass through areas where some sensitive land uses may have developed in the past
L3	This road class is expected to pass through areas with limited existing sensitive land uses; future sensitive land use development adjacent to this road class should be avoided
L4	Sensitive land uses are not expected to be developed in areas adjacent to this road class

3.3 Noise

Noise assessment is a critical component when determining a road access class. Noise is particularly an issue at night where noise peaks are likely to cause sleep disturbance. However, if the road is on an existing heavy vehicle route, Scheme vehicles reduce the trips required for a given freight task and there may be a better noise outcome.

It is recommended that noise modelling and noise monitoring be undertaken to assist in determining specific noise impacts on noise sensitive receptors, which include:

- residential dwellings;

- schools;
- hospitals;
- libraries;
- aged care facilities;
- religious facilities; and
- recreational areas.

If necessary, noise amelioration measures and/or works may be necessary to reduce noise to acceptable levels before adopting a particular road class.

Noise amelioration measures and works may include:

- signs such as 'REDUCE NOISE - PLEASE LIMIT COMPRESSION BRAKING' or 'URBAN AREA – PLEASE REDUCE NOISE';
- restricted operating hours of operation for Scheme vehicles;
- noise barriers along the sides of the road;
- building noise attenuation treatments; and
- a requirement for Scheme vehicles to comply with the latest noise emission standards.

In cases where the proximity of the road to noise sensitive receptors is 1,500 m or greater along all parts of the road segment, a noise problem is very unlikely and noise monitoring and modelling may not be necessary (Main Roads WA 2003).

In cases where the proximity of the road to noise sensitive receptors is 300 m or greater along all part of the road segment, and there are no intersections or significant grades, a noise problem is very unlikely and noise monitoring and modelling may not be necessary (Main Roads WA 2003).

Scheme network classification should be undertaken within the context of the road traffic noise policy of the relevant state or territory, as there is some variation of requirements and objectives among the states and territories. The noise limit objectives in Table 20 are not intended to replace any existing policy or regulations, but are a guide only.

Table 20 provides some guidance on the appropriate noise limit objectives at noise sensitive receptors for each of the Scheme road classes. Noise monitoring and/or modelling should be adopted to determine if the movement of Scheme vehicle traffic along a section of road is likely to raise the noise level above the noise limit objectives indicated. The noise criteria used is L10. This is the sound level which is exceeded for 10% of the nominated averaging period. The L10 (15 hour) is the arithmetic average of the 15 L10 (1 hour) values from 0700 to 2200 h. The L10 (9 hour) is the arithmetic average of the 9 L10 (1 hour) values from 2200 h to 0700 h.

Table 20. Noise limit objectives

Road class	Time	Noise limit objective at Noise Service Receptor's (L_{10})	Averaging period (h)
L1	0700 to 2200 h	63 dB (A)	15
L2			
L3	2200 to 0700 h	55 dB (A)	9
L4			

3.4 Vibration

If a route passes close to abutting development, there may be an adverse impact upon people and property along the roadside due to vibration. Due to the complex nature of determining vibration effects, where factors such as the frequency of vibration and the natural frequency of the roadside structure need to be considered for each case, it is recommended that vibration not be used as a basis for classification of the road system for Scheme vehicles. As noise and vibration are closely related, the vibration issues will be largely addressed by ensuring the noise limit objectives discussed above are not exceeded.

3.5 Dangerous goods and potential load spillage

The regulatory requirements for the road transport of dangerous goods in Australia are covered in The Road Transport Reform (Dangerous Goods) Act 1995 (Commonwealth) and The Road Transport Reform (Dangerous Goods) Regulations 1997 (Commonwealth). The Australian Code for the Transport of Dangerous Goods by Road and Rail – 6th Edition provides further technical information.

Due to the extensive coverage of the issue and requirements for compliance with the above regulations it is not intended to use transport of dangerous goods as a performance measure for the classification of a road.

3.6 Dust, splash and spray

The effect of dust, and of splash and spray of rainwater from the pavement by Scheme vehicles on other road users should be considered. These factors can adversely impact on other vehicles, pedestrians, cyclists and nearby property.

Dust is a much greater issue on unsealed roads, and to some extent the nature of the road shoulder will also affect the dust generated.

Table 21 provides guidance on the classification of roads based on the posted speed zone, AADT and whether the road pavement and shoulder is sealed or unsealed. Some L1, L2 and L3 roads may not be sealed in rural, remote areas and individual route assessment is necessary.

Table 21. Dust, splash and spray objectives

Road class	Posted speed zone (km/h)	AADT (vehicles)	Pavement
L1	<80 >80	No limit No limit	The road should be sealed with a sealed shoulder
L2	<80 >80	No limit <10,000	The road should be sealed, preferably with a sealed shoulder but a grassed or unsealed shoulder is acceptable
L3	<80 >80	No limit <1,000	The road should be sealed; unsealed shoulders are acceptable
L4	<80 >80	No limit _	Unsealed roads are acceptable, with speeds above 80 km/h not recommended

3.7 Air quality (odours and fumes)

Some types of heavy vehicles, such as stock trucks, produce undesirable odours. The effect of this is greatest when these vehicles remain in communities whilst on route, such as when held up in traffic and at intersections. A possible measure for road classification could be the number of access points (e.g. intersections and driveways) and the extent of congestion along a road segment.

The US Highway Capacity Manual (Transportation Research Board) suggested that the free-flow speed on two-lane two-way roads or multi-lane highways is influenced by the density of access points. This speed decreases by 16 km/h if the access point density exceeds 24 per km on a two-way road. This is equivalent to changing from a Level of service A at an average speed of, say, 90 km/h to a Level of service D at an average speed of 74 km/h. The level of service can be used to set requirements on each road class. It is proposed that vehicles carrying goods that affect air quality should operate in restricted hours or routes with traffic conditions specified in Table 22.

Table 22. Road classification with consideration to odours and fumes

Road class	Minimum (Level of service)	*Indicative two-way volumes on a two-way two-lane road (passenger-car units pcu /h)
L1	C	1,200
L2	C	1,200
L3	D	1,790
L4	D	1,790

* on a level terrain with good sight distances and lane widths, and 50% directional splits (*Guide to Traffic Engineering Part 2*, Austroads 1988)

3.8 Vegetation and wildlife

If the route in question is in close proximity to areas of known habitat of vulnerable or endangered species of fauna then the impact of the addition of Scheme vehicles on these species should be considered.

If the road is an existing heavy vehicle route, the introduction of Scheme vehicles will reduce the number of trips required for a given freight task and reduced exposure of wildlife to the risk of collision.

In areas with a history of fauna mortality, fauna sensitive road design treatments should be considered. These may include:

- fauna underpasses and culverts;
- exclusion or guide fencing;
- wildlife reflectors; and
- warning signs.

The effect of network classification of existing roads on roadside vegetation is likely to be negligible. If road works are to be undertaken, e.g. carriageway widening to allow for a higher level of network classification to be obtained, then the clearing of roadside vegetation needs to be taken into account. Areas containing significant roadside vegetation should be avoided in such instances.

4. OTHER CONSIDERATIONS

4.1 Pavement loading

Three infrastructure protection standards address the potential impact of Scheme vehicles on the structural performance of the pavement: pavement vertical loading, pavement horizontal loading and tyre contact pressure distribution. These are addressed in the *Performance-Based Standards Scheme: The Standards and Vehicle Assessment Rules*.

4.2 Bridge loading

A bridge loading infrastructure standard is included in the *Performance-Based Standards Scheme: The Standards and Vehicle Assessment Rules*.

4.3 Intermodal transport

In classifying roads, consideration should be given to the level of access to rail, sea and air terminals. Good access to these terminals enables the choice of the best multi-modal transport arrangement with due regard to economics, safety and community benefits. The proposed road access classification is shown in Table 23.

Table 23. Road classification and intermodal transport

Road class	Level of access to other transport modes
L1	Access to all rail, sea and air terminals, and also to a transport hub such as a road/rail centre
L2	Access to most rail, sea and air terminals, and also to a transport hub such as a road/rail centre
L3	Access to some rail, sea and air terminals
L4	Access to specific transport terminals

4.4 Freight route planning

Assessment of a Scheme road classification should be checked against any planning proposals to evaluate the potential effect the classification may have. The appropriate local government and the transport planning section of the relevant road authority should be consulted as part of this process.

The level of network connectivity can be used as a measure for classification of a road (as set out in Table 24). It should be noted that a L1 Scheme vehicle can use L1 to L4 road classes. Similarly, L2 vehicles can go on Levels 2 to 4 roads. L3 Scheme vehicles can use L3 and L4 roads, and L4 Scheme vehicles can only use L4 roads.

A high level of connectivity and continuity should be a characteristic of a L1 road class, with a correspondingly lesser degree of continuity for the other classes.

Table 24. Freight route planning objectives

Road class	Network connectivity
L1	Highest level of network connectivity and continuity with access to all road classes
L2	Good network connectivity and continuity with access to L2, L3 and L4 roads
L3	Moderate network connectivity and continuity with access to L3 and L4 roads
L4	Connectivity and continuity is limited to L4 roads

5. AMENDMENT OF THESE GUIDELINES

These Guidelines may only be amended by the National Transport Commission –

(a) with the consent of the Australian Transport Council; or

(b) in the case of an amendment that is of an administrative or non-controversial nature, with the unanimous consent of the Transport Agency Chief Executives.

A reference in any document to these Guidelines as approved by the Australian Transport Council from time to time is to be read as including any amendments consented to by the Transport Agency Chief Executives under subrule (1)(b).

6. REFERENCES

Austroads 1988. Guide to Traffic Engineering Practice: Part 2 – roadway capacity. Pub. No. AP-11.3/88. Austroads, Sydney.

Austroads 2003. Rural road design: guide to the geometric design of rural roads. Pub. No. AP-G1/03. Austroads, Sydney.

Main Roads Western Australia 2003. Guidelines for assessing the suitability of routes for multi-combination vehicles. Main Roads Document No. 37/2-07, Draft Version 3. Main Roads, East Perth.

NTC 2004. Interim Performance-Based Standards road classification guidelines. National Transport Commission, Melbourne.

Transport South Australia 2002. Route access assessment for restricted access vehicles. Operational Instruction Manual HPF 701. TSA, Walkerville.

Transportation Research Board 2000. Highway Capacity Manual HCM 2000. TRB, Washington, DC.

ALCAM Crossing Assessment Handbook V1.01 2007

Appendix A – Overtaking Requirements

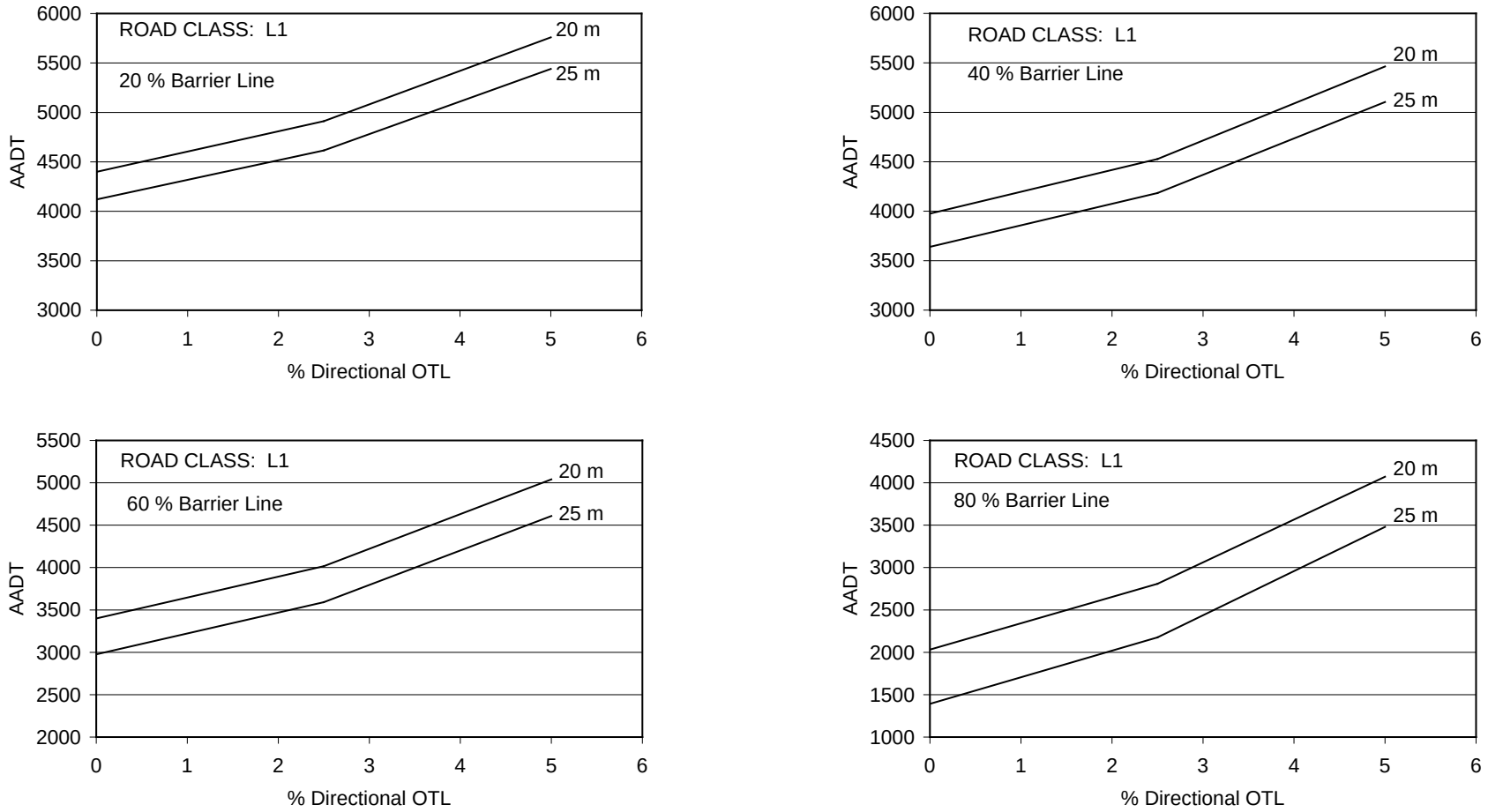


Figure 4. Maximum Annual Average Daily Traffic for which overtaking difficulty criterion is satisfied - L1 class roads

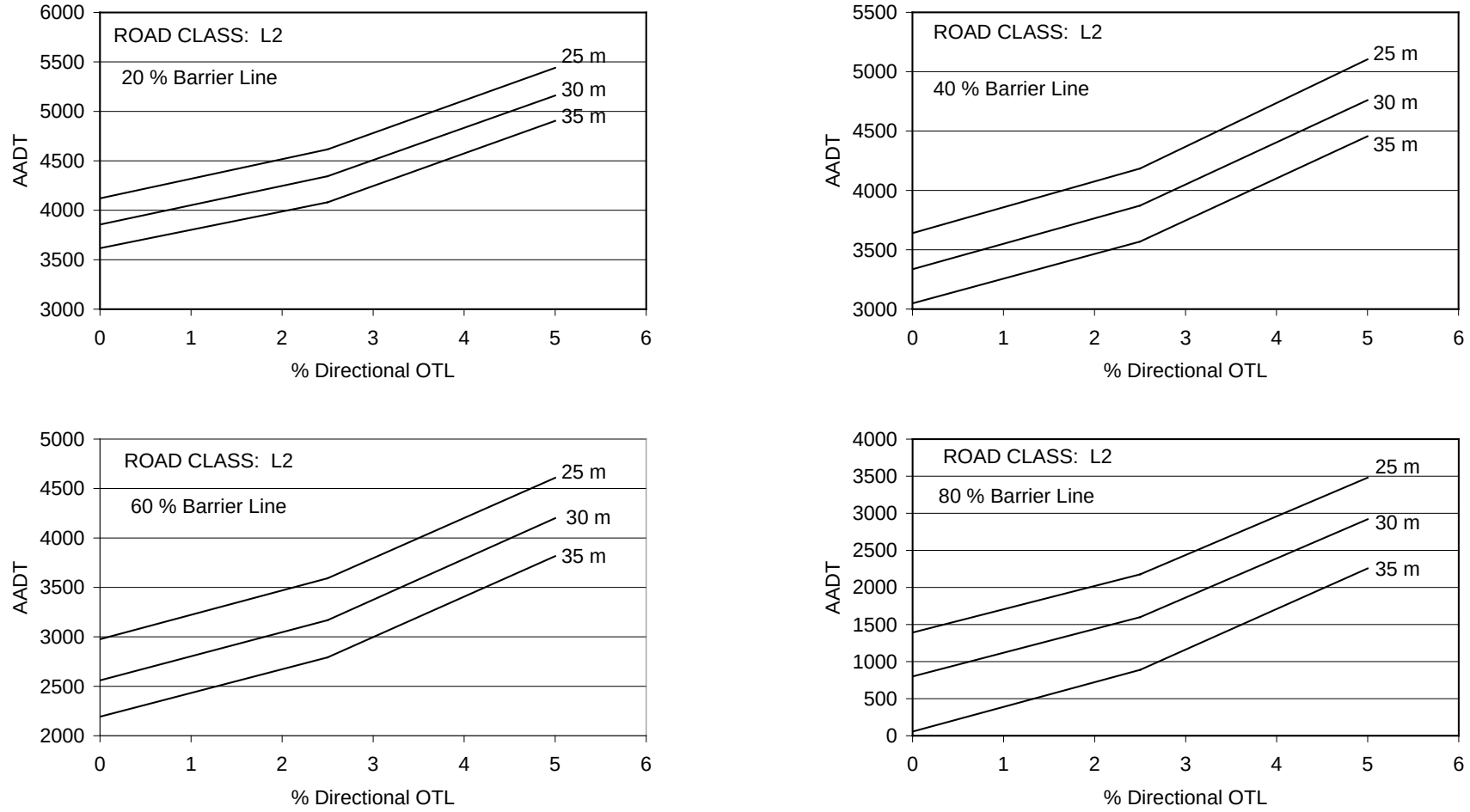
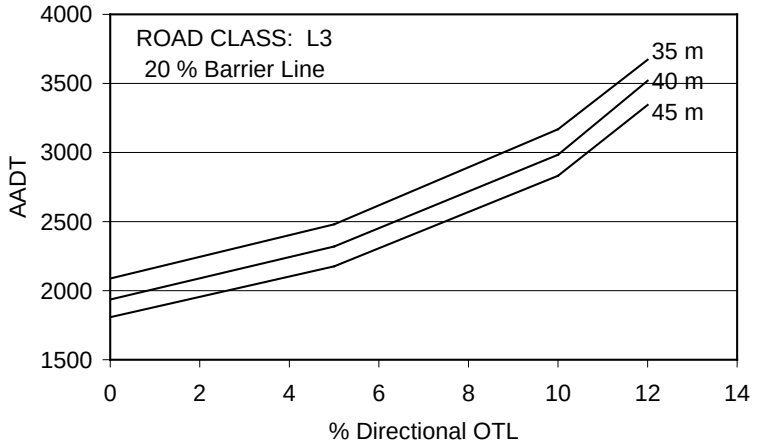
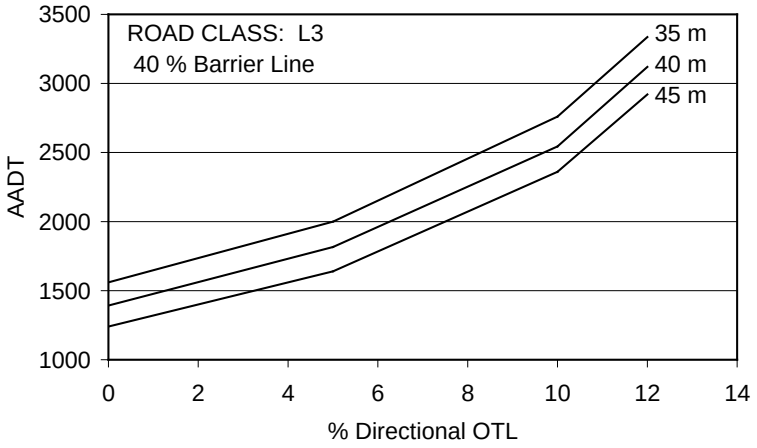
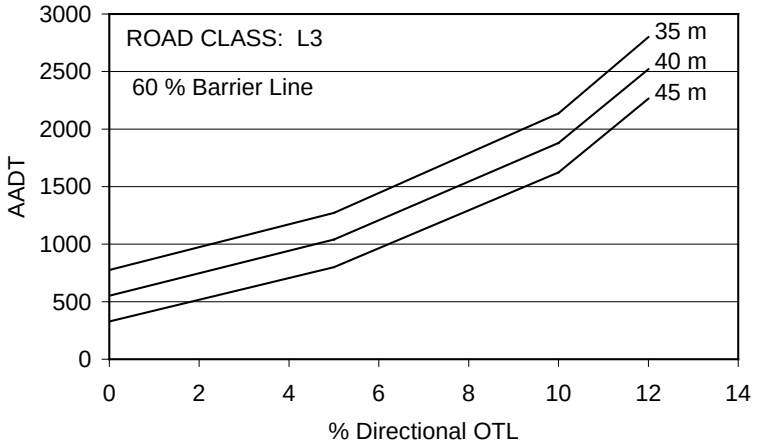


Figure 5. Maximum Annual Average Daily Traffic for which overtaking difficulty criterion is satisfied - L2 class roads



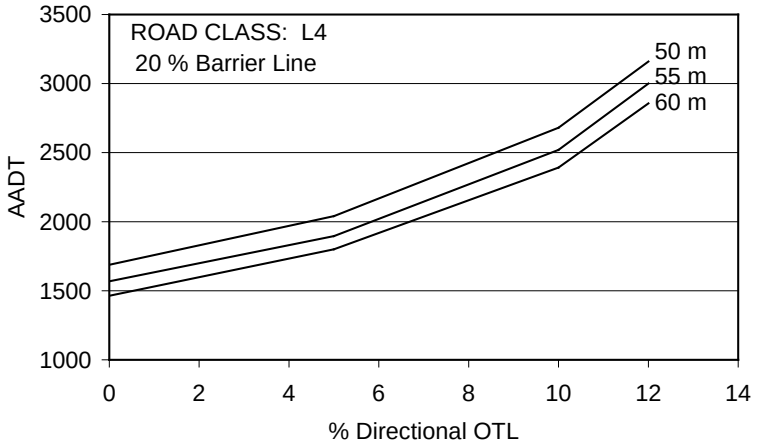


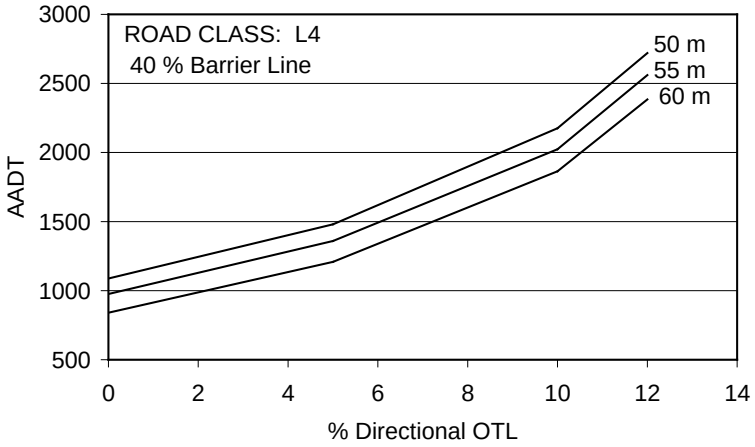


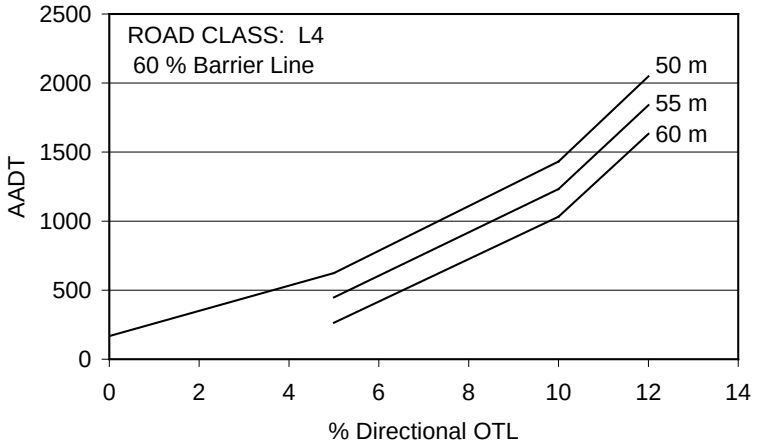
80% Barrier Line

Overtaking difficulty criterion can only be achieved with 15% directional overtaking lane

Figure 6. Maximum Annual Average Daily Traffic for which overtaking difficulty criterion is satisfied - L3 class roads







80% Barrier Line

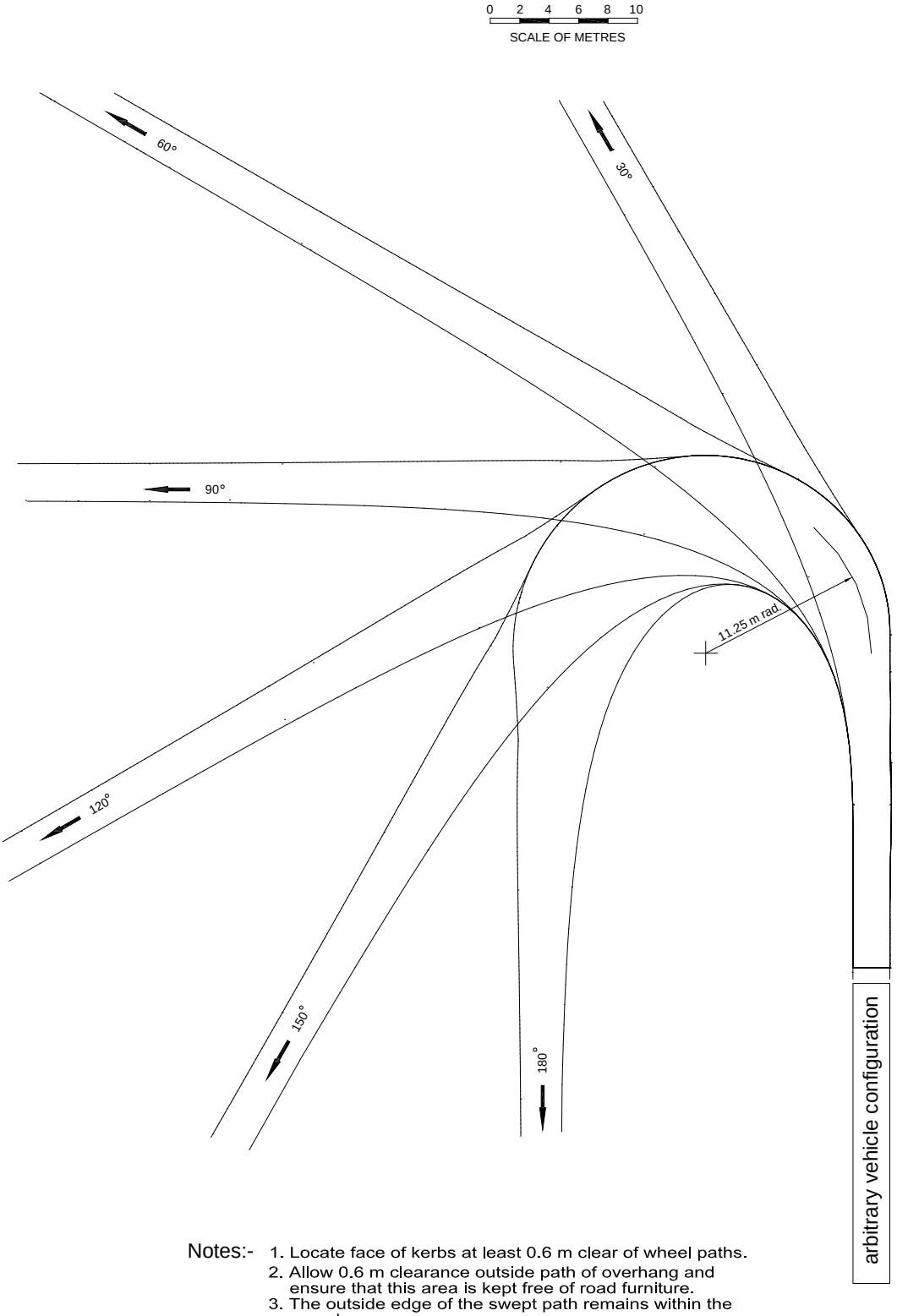
Overtaking difficulty criterion can only be achieved with 15% directional overtaking lane

Figure 7. Maximum Annual Average Daily Traffic for which overtaking difficulty criterion is satisfied - L4 class roads

Appendix B – Turning templates

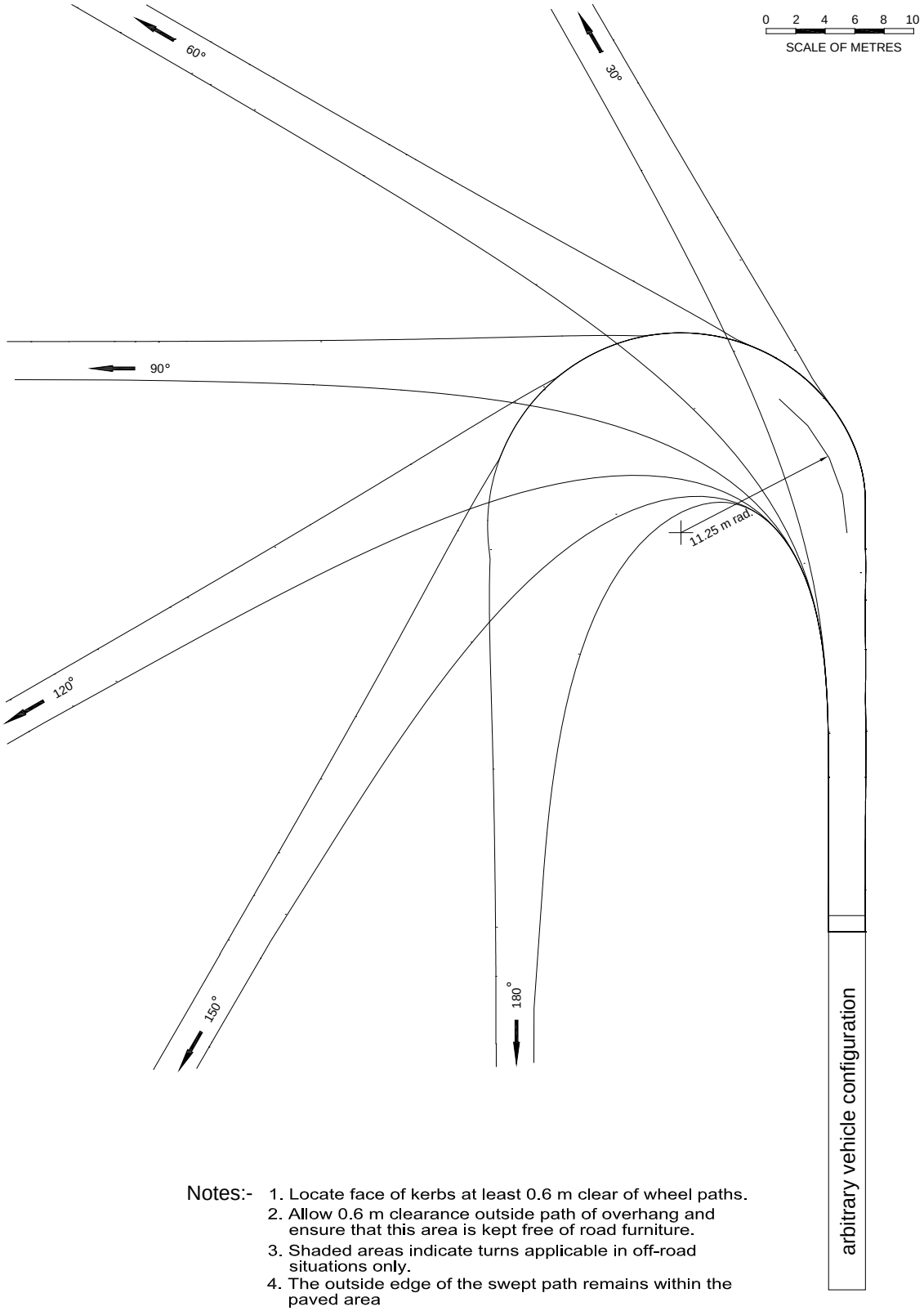
(not to scale – electronic templates are available)

AUSTROADS
DESIGN LEVEL 1 PBS VEHICLE
Radius 12.5 m
Turning speed 0 - 5 km/h



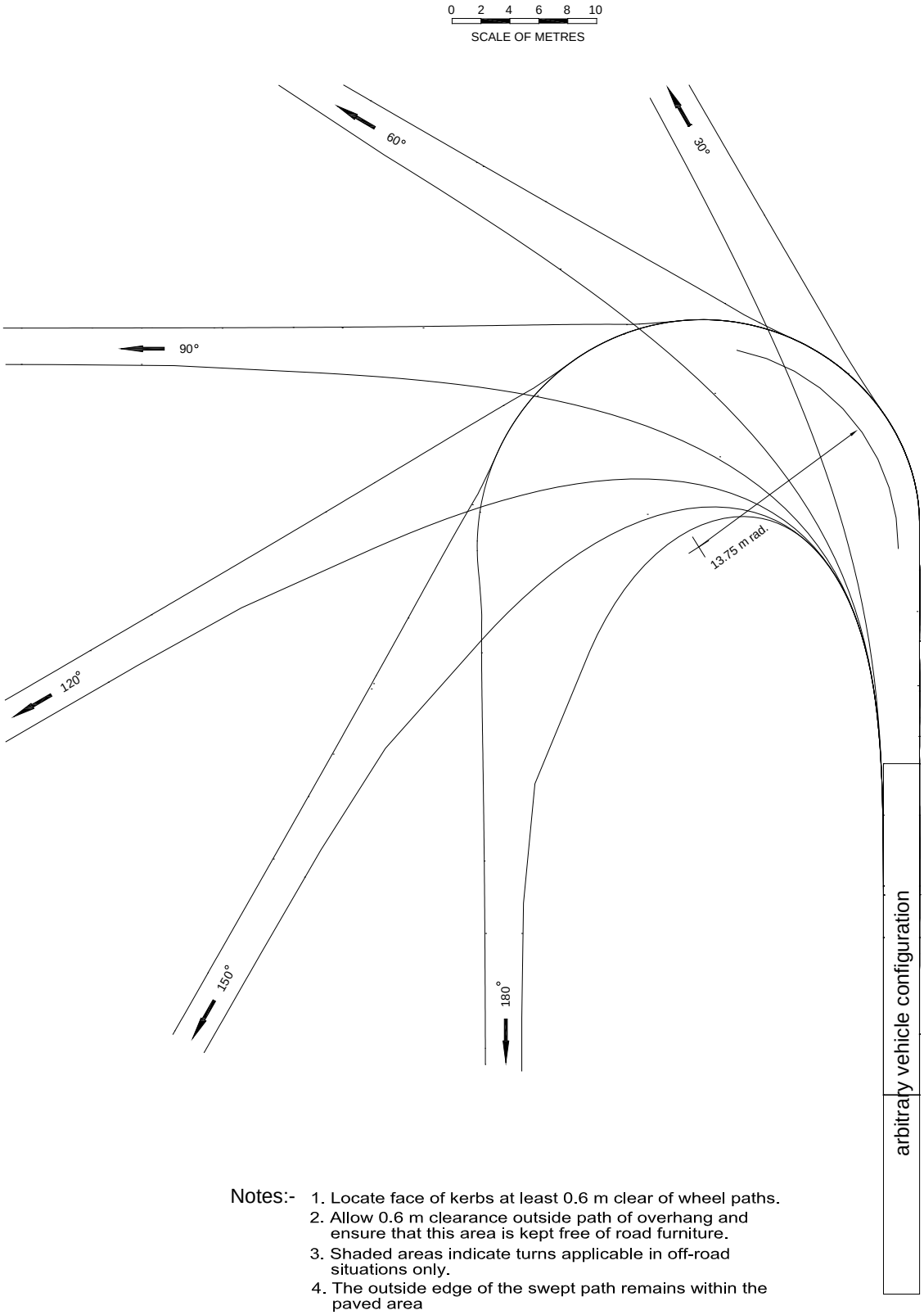
Notes:-
1. Locate face of kerbs at least 0.6 m clear of wheel paths.
2. Allow 0.6 m clearance outside path of overhang and ensure that this area is kept free of road furniture.
3. The outside edge of the swept path remains within the paved area

AUSTROADS
LEVEL 2 PBS VEHICLE
Radius 12.5 m
For use at mandatory stop only
Turning speed 0 - 5 km/h



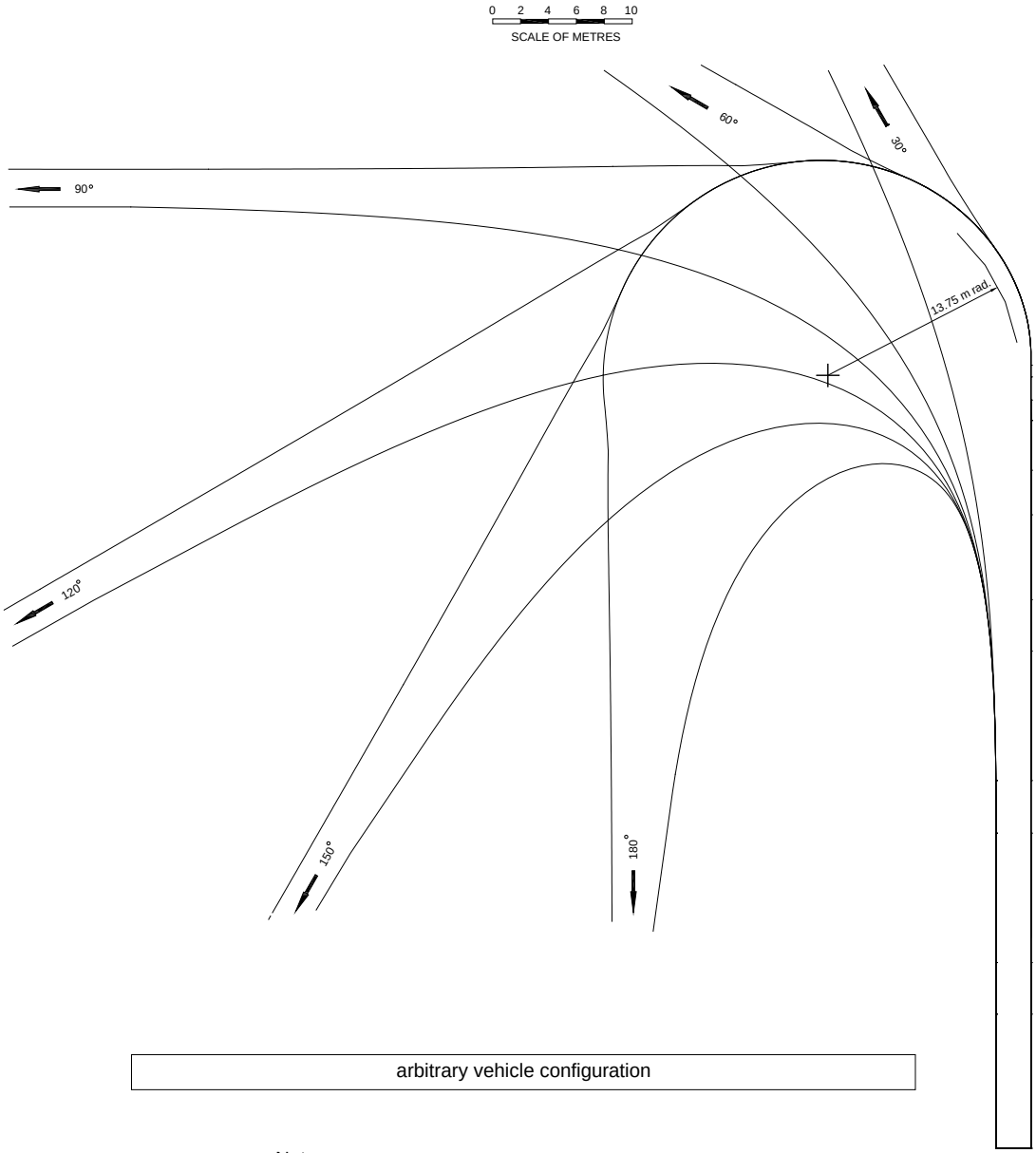
Notes:-
1. Locate face of kerbs at least 0.6 m clear of wheel paths.
2. Allow 0.6 m clearance outside path of overhang and ensure that this area is kept free of road furniture.
3. Shaded areas indicate turns applicable in off-road situations only.
4. The outside edge of the swept path remains within the paved area

AUSTROADS
LEVEL 3 PBS VEHICLE
Radius 15 m
Turning speed 5 - 15 km/h



Notes:-
1. Locate face of kerbs at least 0.6 m clear of wheel paths.
2. Allow 0.6 m clearance outside path of overhang and ensure that this area is kept free of road furniture.
3. Shaded areas indicate turns applicable in off-road situations only.
4. The outside edge of the swept path remains within the paved area

AUSTROADS
LEVEL 4 PBS VEHICLE
Radius 15 m
Turning speed 5 - 15 km/h



arbitrary vehicle configuration

Notes:-
1. Locate face of kerbs at least 0.6 m clear of wheel paths.
2. Allow 0.6 m clearance outside path of overhang and ensure that this area is kept free of road furniture.
3. Shaded areas indicate turns applicable in off-road situations only.
4. The outside edge of the swept path remains within the paved area

APPENDIX C – GLOSSARY OF TERMS

AADT:	Annual Average Daily Traffic - the total volume of traffic passing a roadside observation point over the period of a year, divided by the number of days in the year.
B-double:	An articulated vehicle hauling two trailers with the rear trailer superimposed on to the front trailer of the articulated vehicle, and achieved by the use of a fifth wheel permanently located towards the rear of the front trailer.
Carriageway width:	The width between the outer shoulder edges or between the kerb faces, of undivided carriageways.
Crossfall:	The slope, measured at right angles to the alignment, of the surface of any part of a carriageway.
Freight roads:	These are roads specifically designated for the movement of long or heavy freight vehicles as they should have appropriate geometric and structural standards and meet community expectations in respect to environmental and amenity effects. In urban areas these routes will typically be undivided or dual carriageway roads having two, three or more lanes in each direction, with critical intersections flared or channelled to provide for heavy turning movements for large vehicles. In rural areas they may include two-lane two-way roads constructed to meet standards for different levels of road access.
Gradeability:	A measure on the ability of a vehicle to maintain forward motion on specified grade.
Heavy vehicle:	A vehicle with a gross mass exceeding 4.5 tonnes.
High speed transient offtracking:	The lateral distance that the last axle on the rear trailer tracks outside the path of the steer axle in a sudden evasive manoeuvre.
Multi combination vehicle:	Comprising all articulated combinations of vehicles exceeding 19 metres long or 42.5 tonnes gross mass including B-doubles, road trains and truck-and-trailer combinations.
Offtracking:	The lateral distance that the last-axle on the rear trailer tracks outside the path of the steer axle, usually used for low-speed movements (see also swept path).
	An auxiliary lane provided to allow for slower vehicles to

Overtaking lane:	be overtaken. It is line-marked so that all traffic is initially directed into the left-hand lane, with the inner lane being used to overtake.
Pavement width:	The width between the outer shoulder edges or between the kerb faces.
Roadside infrastructure:	A general term covering all road furniture that includes signs, street lights and protective devices for the control, guidance and safety of traffic, and the convenience of road users.
Scheme	The Performance-Based Standards Scheme
Seal width:	Width between edges of sealed surface or between edge lines (where installed on undivided carriageways), whichever is less.
Shoulder:	The portion of formed carriageway that is adjacent to the traffic lane and flush with the surface of the pavement.
Startability:	A measure of the ability of a vehicle to commence forward motion on specified grade.
Stopping sight distance:	The distance required for a driver, travelling at a given speed, to perceive an object on the road and to stop before striking it.
Superelevation:	A slope on a curved pavement selected so as to enhance forces assisting a vehicle to maintain a circular path.
Swept path:	Low-speed swept path is defined for the purposes of the Scheme as the maximum distance that a vehicle or combination tracks inside the path taken by the steering axle in a low speed turn, plus the vehicle width.
Tracking ability on a straight path:	The amount of variation in the lateral position of the trailing unit (last trailer) measured relative to the path or track followed by the hauling unit (rigid track or prime mover).

APPENDIX D – SAMPLE FORM FOR ROAD CLASSIFICATION

Road name: _____

References: _____

Ref. item no.	Road performance measures		Assign road access class				Comments
	Description	**Performance levels**					
	Physical and operational considerations		**L1**	**L2**	**L3**	**L4**	
0	Road widths - Minimum lane and shoulder width for sealed rural roads - Minimum carriageway width for unsealed roads - Minimum bridge width on rural roads - Minimum lane width for urban/township roads - Minimum lane width for horizontal curves	 Table 3 Table 4 Table 6 Table 2 Table5					
2.3	Overtaking provision - Minimum establishment sight distance - Maximum distance between overtaking opportunities - Overtaking lanes - Relationship between overtaking difficulty at specified Level of Service and effects due to extent of overtaking lane, sight distance profile and opposing traffic.	 Table 8 Table 9 L1, L2 -1 km L3, L4 -1.25 km L1 - Fig. 4 L2 - Fig. 5 L3 - Fig. 6 L4 - Fig. 7					

Ref. item no.	Road performance measures		Assign road access class				Comments
	Description	**Performance levels**					
Physical and operational considerations			**L1**	**L2**	**L3**	**L4**	
0	Low speed offtracking and intersection requirement	Intersection geometric requirements to be determined by each representative Scheme vehicle class and swept path software					
2.5 2.6	Signalised intersection and railway crossings - Minimum green plus intergreen time - Stacking distances at intersections and railway level crossings - Warning time at railway level crossings	Table 12 Tables 12 & 13 Table 13					
2.7	Entry length onto highways - Entry lengths a function of grade and main road operating speed	Table 14					
2.8	Approach visibility - Minimum sight distance as a function of grade and operating speed	Table 15					
2.9	Vertical clearance - Minimum overhead clearance	L1 - 4.5 m L2 - 4.8 m L3 - 4.8 m L4 - 4.8 m					

Ref. item no.	Road performance measures		Assign road access class				Comments
	Description	**Performance levels**					
	Physical and operational considerations		**L1**	**L2**	**L3**	**L4**	
2.10	Off-road parking - Maximum spacing - Clearance from edge of pavement as a function of speed	 L1 – 80 km L2 – 80 km L3 – 80 km L4 – 120 km Table 18					
2.11	Roadside infrastructure - Widths of entry and exit lanes and radius of curvature to minimise damages to roadside furniture	(same requirements as low speed offtracking)					

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