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Standard Restricted Access Vehicle Route Assessment Guidelines

D14#493277
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Contents

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Amendments

Revision Number	Revision Date	Description of Key Changes	Section / Page No.
1	May 2016	Removed Appendix G 'Turning Radii' Removed Appendix K 'Assessment Form Template' Updated Appendix H 'Low Volume Condition 7' Updated Appendix D to include the wording 'with dedicated cycle lane'. Updated contact details.	Appendices & 1.5
2	July 2016	Updated to include revised minimum road widths for RAV Categories 2-7 and 9-10 & moved Type B traffic volume / road length table. Added Type B traffic volume / road length table.	Appendix C and 2.4.4
3	October 2016	Amended list of standard turning templates. Updated web location for turning templates. Amended low volume condition 1.	Appendix G & H, 2.92
4	March 2017	Remove section.	2.9.5
5	April 2017	Updated Main Roads website details.	1.4
6	May 2017	Amended low volume condition 6.	Appendix H
7	July 2017	Note added relating to private driveways.	1.2
8	December 2017	Amended stopping sight distances. Amended entering sight distances. Amended wording relating to road parking. Amended wording to include load/vehicle height being 4.6m.	Appendix E, F, D, 2.3
9	August 2018	Amended wording relating to provision for overtaking. Amended wording relating to turning at intersections. Amended wording and requirements for railway level crossing. Amended wording relating to off-road parking. Amended appendices, Appendix E, (Templates) & I removed. Added Figure 1 to 8. Incorporated concessional assessment requirements Amended section 2.4.1 Signage, 2.8.1 Acceleration Lanes, 2.9.1 Signage & 2.9.4 Rail Crossings.	2.6, 2.9, 2.10, 2.11, Appendix A, B, C, D, E 1.1, 2.21

10	September 2018	Amended wording relating to turning at intersections. Amended wording relating to provision of overtaking and removed Figure 1. Amended wording relating to Approach Sight Distance and Entering Sight Distance.	2.6, 2.8, 2.84, 2.85
11	November 2019	Amended introduction to clarify the intent of the guidelines.	Page 6
12	13 May 2022	Reviewed entire document and moved onto current branding (no technical changes).	All

REFERENCES AND RELATED DOCUMENTS

The following documents relate to these Guidelines and are available on the Access Requirements in WA page on the Main Roads website.

Document Number	Description
D16#198414	Guidelines for Approving RAV Access
D16#374056	Tri Drive Route Assessment Guidelines
N/A	RAV Route Assessment Form

DEFINITIONS

The following are definitions for terms used in these Guidelines.

Term	Definition
AADT	Annual Average Daily Traffic (AADT) the daily number of vehicles travelling on a road, averaged over one year. It is determined by the total yearly two-way traffic volume divided by 365, expressed as vehicles per day.
Approach Sight Distance (ASD)	The distance required for a driver of a RAV, travelling at a given speed, to observe the approaching intersection, and react or stop if necessary.
Bridge	A structure (with the exception of gantries) having a clear opening in any span of greater than 3 metres measured between the faces of piers and/or abutments or structures of a lesser span with a deck supported on timber stringers.
Carriageway Width	That portion of a road or structure devoted particularly to the use of vehicles that is between guide posts, kerbs or barriers where these are provided, inclusive of shoulders and auxiliary lanes.
Culvert	A structure under a road having only clear openings of less than or equal to 3 metres measured between the faces of piers and/or abutments or a pipe shaped structure of any diameter.
Entering Sight Distance (ESD)	The required sight distance for a RAV driver to see a sufficient gap in oncoming traffic that will allow a RAV, with greater length and lower acceleration capacity, to clear the intersection safely.
HVS	Main Roads Heavy Vehicle Services.
Main Roads website	www.mainroads.wa.gov.au
Passenger Car Equivalence	Passenger Car Equivalence (PCE) factors are a relative measure of the traffic flow impedance effects of different vehicle types. The PCE factor for a particular vehicle type is the equivalent number of passenger cars (AUSTROADS Vehicle Class 1) that would have the same impedance effect as a single vehicle of that type.
Order	An Order issued under the *Road Traffic (Vehicles) Act 2012*.
RAV	Restricted Access Vehicles (RAV) consists of all combinations of vehicles exceeding 19 metres in length or 42.5 tonnes gross mass including B-Doubles, road trains and truck-and-trailer combinations.

Term	Definition
Remote Road	A general term for a main arterial road carrying mostly long distance traffic.
Rural Road	All roads that provide a secondary network of National, State and local government roads connecting cities and towns.
Seal Width	Width between edges of sealed surface or between edge lines (where installed on undivided carriageways), whichever is less.
Structure	A bridge or culvert.
TPA	Tonnes per annum.
Urban and Town Site Road	All roads within a populated area of established dwellings, a central place of trade and recognised as a distinct place. Generally the area will act as a central hub of activity for the community.
VPD	Vehicles Per Day (VPD) is the number of vehicles observed passing a point on a road in both directions for 24 hours. It is a measure of daily traffic volume, often more relevant to low volume, local government roads, typically rural roads in these guidelines. VPD can differ from AADT in being a better measure of traffic volume during periods of more intensive RAV usage or seasonal tourist traffic.
Vehicle Regulations	The *Road Traffic (Vehicles) Regulations 2014*.

1 INTRODUCTION

1.1 Purpose

These guidelines have been prepared to provide guidance to a person conducting an onsite assessment, on an existing road, for the purpose of assisting Main Roads Heavy Vehicle Services (HVS) in making an informed decision as to whether a road is suitable for use by a particular category of Restricted Access Vehicle (RAV).

These guidelines are to be read in conjunction with the following documents, available on the Access Requirements in WA page on the Main Roads website:

- *Guidelines for Approving RAV Access*; and
- *Tri Drive Route Assessment Guidelines*;

The *RAV Route Assessment Form* is also available on the Main Roads website to further assist in ensuring the required information is captured during the onsite assessment.

These Guidelines form part of the overall RAV access assessment process, as outlined in *Appendix F*, to enable HVS to make an informed decision on behalf of the Commissioner of Main Roads, in accordance with the Commissioner's authority to approve RAV access under provisions of the *Road Traffic (Vehicles) Act 2012*.

These guidelines are not road design standards. However, if a road is constructed to the appropriate road design standards for the particular category of RAV and approved by Main Roads, the road will pass the RAV access assessment process.

1.2 Application

For the purpose of these guidelines, "standard" RAVs are those vehicle combinations specified as Category 1 to 10 Approved Vehicle Combinations under the *Prime Mover, Trailers Combinations Order 2017* and *Truck, Trailer Combinations Order 2017*.

For the purpose of these guidelines, the standard RAV Categories have been grouped into four (4) assessment groups, as follows:

- Group 1 - RAVs Categories 2-4 (e.g., pocket road train, B-Double, and other RAVs with a maximum length of 27.5 m);
- Group 2 - RAVs Categories 5-6 (e.g., RAVs with a maximum length of 36.5 m and a maximum mass of 87.5T);
- Group 3 - RAVs Categories 7-8 (e.g., RAVs with a maximum length of 36.5 m and a maximum mass of 107.5T); and
- Group 4 - RAVs Categories 9-10 (e.g., RAVs with a maximum length of 53.5 m).

Note 1: *A road approved for one of the standard RAV Categories, is also approved and added to AMMS level one (1) for the equivalent RAV network.*

Note 2: *Where a RAV route assessment is for operations under a concessional loading scheme, such as the Accredited Mass Management Scheme (AMMS), the assessor must take into account the additional mass when requesting a structures assessment as per Section 2.2.*

Where quantitative limits are recommended, they are intended as a guide only and are no substitute for common sense and judgement based on experience. In certain cases, routes which do not meet the requirements outlined in this document can be accepted as RAV routes by imposing conditions, such as speed restrictions. Refer to the *Guidelines for Approving RAV Access*.

1.3 Assessment Requirements

Route assessments will only be accepted from a suitably qualified person. The assessor should have experience and knowledge of the following:

- The principles of heavy vehicle operations, including vehicle configurations, maximum dimensions and axle load limits;
- Heavy vehicle dynamic performance characteristics, including limitations on the ability of heavy vehicles to accelerate, brake, ascend grades and negotiate intersections;
- Heavy transport issues, legal requirements and permit systems; and
- Road safety concepts and principles.

When considering a potential RAV route, the assessor is advised to initially perform a desktop assessment using all available information. In some cases, this initial assessment will identify physical constraints, such as posted bridge load limits and road width deficiencies, which may render the route unacceptable, without the need for further onsite assessment.

If the applicant is willing to pursue upgrades to the road, then a full assessment is required to identify all deficiencies. This is to alleviate any problems with some upgrades being carried out and then the full assessment conducted, only to then identify additional deficiencies. The assessment will only identify the deficiencies and will not provide upgrade design requirements.

RAV use on a particular route may have some negative impacts on the environment, community and traffic. Assessors must first determine if the proposed route is the most appropriate route for the particular operation(s) and recommend variations to the initially proposed route to reduce such impacts. Consideration should also be given to the impact if RAV access is not approved, i.e. will the operation(s) occur regardless and then be carried out with increased heavy vehicle movements.

As part of any route assessment for a RAV, HVS does not assess any access for driveways adjoining a RAV network road. It remains the responsibility of the property owner to ensure safe ingress and egress to the property.

Before making a decision on an application for RAV access, HVS may deem it necessary to do any or all of the following:

- Perform a further assessment of the route;
- Assess the suitability of the road pavement;
- Assess the suitability of all structures on the proposed route to accommodate the specific vehicle;
- Specify conditions of access, such as speed limits restrictions;
- Obtain local government agreement for the proposed RAV access;
- Recommend road improvements as condition of approval;
- Conduct a Performance Based Standards (PBS) Scheme assessment to assess the proposed vehicle’s safety performance.

When assessing a road, all connection points to existing RAV networks must be assessed for suitability and a holistic approach should be taken to ensure overall RAV network connectivity in the area.

1.4 Planning Evaluation

Assessment of a proposed RAV route should be checked against any future planning proposals to evaluate the potential impact of RAVs. The relevant road managers should be consulted as part of the assessment process.

1.5 Further Assistance

Additional information and guidance is available from HVS via telephone 138 486 or hvsrouteassessments@mainroads.wa.gov.au

2 ASSESSMENT CRITERIA

2.1 Traffic Data & Accident Statistics

2.1.1 Traffic Counts

In order to determine the suitability of a road for RAV access, it is essential to obtain current traffic counts for the particular road. The traffic counts must be considered when determining appropriate road widths, potential congestion issues and relevant operating conditions. If traffic data is not available, an estimate from the road manager should be obtained.

2.1.2 Accident Statistics

Consultation with the road manager is necessary to establish if there is an accident history on the particular road that needs to be considered during the assessment process. Consideration should be given to applying conditions to the proposed RAV access to mitigate the risks, such as speed restrictions or curfew conditions, which cannot be applied to general access heavy vehicles.

2.2 Structures

2.2.1 Load Capacity

All bridges and load restrictive culverts on the requested route will be assessed for the proposed RAV access by Main Roads Structures Engineering Branch, via HVS. When carrying out an assessment for Network 2, a separate Structures Engineering assessment must be carried out for the Short B-triple combination.

Any bridge restrictions for the Short B-triple combination must be specified in the access conditions for the relevant road.

Consultation with local governments is required to ensure all culverts on local government roads have been appropriately considered.

2.2.2 Structure Width Requirements

To ensure RAVs can safety pass oncoming vehicles when crossing structures, the minimum width between kerbs on a bridge or over a culvert must not be less than the width specified in Table 1.

Table 1: Minimum Width between Kerbs/Carriageway on a Structure

AADT	Minimum Width Between Kerbs/carriageway (m)	Quality of Approaches
Less than 75	3.5*	Structures with adequate Approach Sight Distance (ASD)**.
75 to 150	5.3	Structures with adequate ASD, clearly signed and road clearly marked.
	7.0	Structures that have inadequate ASD, inadequate signage or no road markings.
150 to 500	5.8	Structures with adequate ASD, clearly signed and road clearly marked.
	7.2	Structures that have inadequate ASD, inadequate signage or no road markings.
More than 500	7.2	All structures at this traffic volume

*Conditions apply; refer to 2.4.2 and *Appendix B*;

**RAV ASD should be measured from a truck driver's eye height of 2.4 metres. Minimum requirements for ASD refer to *Appendix D*.

2.3 Overhead Clearance

Standard RAVs are approved to travel with a height of up to 4.6 metres. RAV route assessments must confirm that adequate vertical clearances are available to safely accommodate a load/vehicle height of 4.6 metres. An adequate vertical clearance is considered to be 4.6 metres, plus the following overhead clearance:

- Overhead structures, such as bridges and gantry signs - 300 millimetres overhead clearance; and
- Power lines - the minimum overhead clearance required by telecommunications and electrical transmission cable providers.

Where telecommunications and/or electrical transmission cables cross the route, approval for a load/vehicle height of 4.6 metres must be obtained from the relevant controller(s) listed in the "Contact Details for Other Agency Approvals" located on the Oversize Over-mass Permits page of the Main Roads website.

Where the required load/vehicle height of 4.6 metres is not approved by the cable provider, the cable provider must specify the maximum approved load/vehicle height and the location of the restricting power line. RAV access may still be considered with appropriate height conditions.

2.4 Rural Road Widths

When the hauling unit of a RAV travels along a straight path over an uneven surface, the trailing units do not follow along the same path as the lead unit. This is defined as "off-tracking" and depends on several factors, including:

- The steering actions of the driver;
- Vehicle configuration and coupling arrangements between units;
- Misalignment of the axles;
- Suspension (geometry, bump and roll steer effects) and tyre characteristics;
- Vehicle length;
- External disturbances that include road roughness, cross-slope and side loading from wind-gusts; and
- Speed of travel.

The maximum deviation in tracking over a straight section of road, when added to the width of the RAV, and then a safety margin applied, determines how much road width is needed to safety accommodate the RAV.

To assess the widths of rural roads, tables of minimum carriageway widths and sealed widths to accommodate the RAV are listed at *Appendix A*.

To be suitable for RAV access, a road should be sealed if AADT is over 150 and annual freight tonnage is over 300,000 tonnes per annum. The requirement for the road to be sealed is partly for safety reasons, but more so for road sustainability.

In the absence of any traffic data, the following parameters may enable a judgement as to whether a road needs to be sealed:

- If the road is unlikely to be used by more than 10 RAVs per day; or
- If the road is unlikely to be used by more than 60 RAVs per day over a seasonal two month period.

When considering whether a road has adequate width, an assessment should also be made in relation to any potential risks posed by:

- Crests;
- Pronounced cambers;
- Poor shoulder condition;
- Surface roughness; and
- Reduced sight distances.

Despite a road's width being above the specified minimum in *Appendix A*, these factors may require additional width, application of specific RAV operating conditions, or in extreme cases, mean the route is unsuitable for RAV access.

Minor width deficiencies are acceptable, particularly if it is only for a small portion of the road. If width requirements are relaxed, consideration should be given to applying conditions to mitigate risk and to ensure safe operation.

Off-tracking of a vehicle combination is more severe at high speeds; therefore minimum seal width may be reduced where speeds are reduced to 60 km/h or less.

Minimum seal widths may also be reduced on roads where all other road users are familiar with the operation of heavy vehicles e.g., farm access roads, industrial areas and mine access roads.

2.4.1 Sight Distance Considerations at Curves and Tight Bends

When the hauling unit of a RAV travels around a curve or tight bend, the trailing units pull across the curve or tight bend and as such, require additional road with. This is defined as "swept width" and depends on several factors, including:

- Radius of the curve or tight bend;
- Length of vehicle combination;
- Number and type of articulation points; and
- Road surface and geometry.

In instances where it is identified the RAV would be required to utilise additional road width when travelling around a curve or tight bend, potentially encroaching into oncoming traffic, the assessor must ensure there is sufficient visibility on the approach to the curve or tight bend to observe oncoming vehicles, and react or stop if necessary. The table in *Appendix D* shows the required sight distance for RAVs, given the speed and the gradient of the road.

It will be necessary for the assessor to conduct swept path assessments on curves to determine if the RAV is likely to encroach into oncoming traffic.

Note: *Access should be declined if the RAV crosses a solid white line when traversing a curve or tight bend, unless there is sufficient sight distance.*

2.4.2 Low Volume Road Width

When assessing road width, where traffic volumes are less than 75 vehicles per day and the road width does not meet the requirements in *Appendix A*, the width of the road may be assessed in accordance with the requirements in *Appendix B* and the relevant conditions in *Appendix E* should be applied.

A Type B low volume road should not exceed the maximum road length stipulated in Table 2.

Table 2: Maximum allowable road length for Type B suitability

Daily Traffic Volume	0 to15 VPD	16 to 30 VPD	31 to 50 VPD	51 to 75 VPD
Max Road Length	5.0 km	2.0 km	1.5 km	1.0 km

2.4.3 Traffic Volume Consideration

It is important to use the most appropriate measure of traffic volume when determining if *Appendix A* or *Appendix B* should be applied.

AADT is an average daily traffic count for the year, while VPD is an actual measure of the daily traffic count, which is more appropriate for recording seasonal traffic.

Appendix A road widths should always be used, unless both the AADT and any increased seasonal traffic volumes (measured in VPD) are less than 75, in which case it is appropriate to use *Appendix B.*

2.4.4 Assessing a Road in Sections

The road may be composed of a number of sections that vary in their standard and that would fall into different categories of RAV suitability, or require different operating conditions (e.g., for low volume roads). Width variation is a typical example of this principle. Where differing sections are reasonably long, it can be beneficial to separately assess each section as to its category of RAV access and any applicable operating conditions. Assessors should only consider applying this method of assessment where there is a likely benefit and a practical start and finish point, otherwise it is extremely difficult for drivers to comply with the changing conditions.

2.4.5 Short Sections of Reduced Width

There may be short narrow sections along the road due to narrow structures, roadside vegetation or short narrow sections of pavement. The entire length of the road does not need to meet the minimum road width requirements, provided the narrow sections comply with paragraphs (a) and (b) below.

(a) Traffic Volume Less than 75 Vehicles per Day

This paragraph only applies to low volume rural roads that do not meet the width requirement in *Appendix A*, the road width has been assessed in accordance with *Appendix B* and the relevant conditions in *Appendix E* have been applied.

Where all narrow sections of the low volume rural road meet the following criteria, the narrow sections can be excluded from the overall road width assessment:

- Narrow sections must not be less than 3.5 metres wide;
- Each narrow section must not be more than 100 metres long;
- A combination of narrow points that are all within a single 100 metres length of road can be considered to be one single narrow section;
- Two adjacent narrow sections must not be within 150 metres of each other;
- The approach sight distance from both ends of the narrow section must comply with *Appendix D*; and

If any narrow section fails to meet the 3.5 metres minimum width criteria, the route shall be considered unsuitable for RAV access.

Where all narrow sections meet the 3.5 metres minimum width criteria, but do not meet all the remaining criteria, the road shall be considered unsuitable for two-way RAV access. However, the

road may still be suitable for one-way RAV access only, provided relevant conditions as per *Appendix B* for a Type B road are applied. Type B roads suitability is also subject to traffic volume and road length requirements outlined in Table 2.

(b) Traffic Volume from 75 to 500 Vehicles per Day

This paragraph only applies to medium volume roads that is having the road width assessed in accordance with *Appendix A*.

Where all narrow sections of a medium volume road meet the following criteria, the narrow sections can be excluded from the overall road width assessment: :

- Narrow sections should not have a carriageway width more than 1.3 metres below the requirements in *Appendix A*;
- For a sealed road, narrow sections should not have a sealed width more than 0.2 metres below the requirements in *Appendix A*;
- Each narrow section should not be more than 2 kilometres long; and
- The combined length of narrow sections should not be more than 15% of total road length.

2.5 Urban and Town Site Road Widths

There are a number of width requirements to be considered for RAVs travelling in urban and town site areas. As well as accommodating the additional swept width of RAVs, the width requirements for activities such as cycling and kerbside parking also need to be taken into account. The minimum road width requirements for town site areas are listed in *Appendix C*.

2.6 Provision for Overtaking

RAVs tend to operate at lower average speeds than light vehicles. If the road does not have sufficient overtaking opportunities, drivers of light vehicles may experience delays behind slower moving RAVs and in some cases may form queues of vehicles waiting to overtake. This may cause driver frustration and thereby increase the risk of drivers attempting to overtake when it is not safe. Therefore, it is essential, from a road safety perspective, to have adequate overtaking opportunities on a RAV route.

It is recommended that AADT figures are used to assess overtaking opportunities, however the assessor should consider the impact of seasonal traffic during the assessment, as the AADT could be less than seasonal peak traffic volumes.

The volume of traffic and percentage of RAVs on the route affects the requirement for overtaking opportunities. To assess the suitability of overtaking opportunities, an AADT derived using the Passenger Car Equivalence (PCE) factors (refer to Table 3) shall be used. The derived AADT is calculated by multiplying the AADT for each of the Austroads vehicle classes by the PCE factor based on the road's terrain. This derived ADDT is the figure to use to determine the maximum distance between overtaking opportunities in Table 4.

An example of calculating the derived AADT is listed below:

	Sum of AVG AADT	PCE Flat Terrain	AADT Flat Terrain
Austroads 1 & 2	3,180	1	3,180
Austroads 3, 4 & 5	1,893	2	3,786
Austroads 6, 7 8 & 9	285	2.5	713
Austroads 10 (RAV 2 - 4)	120	4	480
Austroads 11 (RAV 5 - 8)	117	4	468
Austroads 12 (RAV 9 -10)	2	9	14
		AADT derived	**8,640**

PCE factors represent the equivalent number of light vehicles for a particular type of RAV or general access heavy vehicle. The use of PCE factors provides a derived AADT value that can then be used to better assess overtaking opportunities.

Table 3: Passenger Car Equivalence Factors for RAVs

Vehicle Types	PCE Factors on Flat Terrain	PCE Factors on Rolling Terrain
Austroads Class 1	1	1.3
Austroads Class 2	1	1.3
Austroads Class 3 to 5	2	3.5
Austroads Class 6 to 9	2.5	5
Austroads Class 10 - RAVs Categories 2-4	4	10
Austroads Class 11 - RAVs Categories 5-8	4	10
Austroads Class 12 - RAVs Categories 9-10	9	22

The maximum distances between overtaking opportunities are shown in Table 4.

Table 4: Maximum Distances between Overtaking Opportunities

AADT (Derived using PCE Factors)	Maximum average distance between overtaking opportunities	Maximum distance between any two overtaking opportunities	Notes
500 or below	N/A	N/A	Provision of additional opportunities is usually not justified.
501 to 1000	15 km	30 km	
1001 to 1800	8 km	15 km	
1801 and above	5 km	10 km	At AADT > 2700, additional opportunities that exceed the criteria may be necessary.

For each overtaking opportunity, the portion of road available to complete the overtaking opportunity should meet the minimum length shown in Table 5.

Table 5: Minimum Length for Overtaking Opportunities

Road Section Operating Speed (km/h)	Assumed Truck Speed (km/h)	Length (m)		
		RAVs Categories 2-4	RAVs Categories 5-8	RAVs Categories 9-10
70	60	600	640	690
80	69	740	790	860
90	77	890	950	1040
100	86	1070	1130	1240
110	94	1290	1310	1440

Note: *The above lengths are generally determined by measuring the length of the divided line where overtaking is permitted.*

2.7 Steep Grades

2.7.1 RAVs Losing Speed on Grades

The speed of RAVs ascending long and steep grades can be reduced to the extent that the speed differential is hazardous for vehicles approaching from behind. If possible, steep ascending grades should have overtaking lanes.

In some cases where an overtaking lane is not provided, the drivers of faster following vehicles may become frustrated and attempt an overtaking manoeuvre when unsafe to do so. A RAV speed reduction to 40 km/h is considered the threshold point at which drivers will seek to overtake a slower vehicle, regardless of whether or not adequate sight distance is available.

Table 6 outlines the maximum distance required for a laden RAV travelling up a grade to slow down to 40 km/h. For roads with grades, or consecutive varying grades, exceeding these distances, it is recommended that the road should have an additional climbing lane for RAVs.

Table 6: Maximum distances (m) of uphill travel before RAV speeds are reduced to 40 km/h

Grade %	RAVs Categories 2-6		RAVs Categories 7-8		RAVs Categories 9-10	
	80 km/h Approach Speed	100 km/h Approach Speed	80 km/h Approach Speed	100 km/h Approach Speed	80 km/h Approach Speed	100 km/h Approach Speed
3	*	*	*	*	1080	1650
4	950	1410	900	1350	690	1110
5	640	980	610	960	520	840
6	480	760	470	750	410	680
7	390	630	380	620	340	570
8	330	530	320	530	290	490

* RAV can maintain a higher speed than 40 km/h on these grades.

2.7.2 Maximum Grade Requirements for RAVs

For a route to be suitable for RAV access there must be no steep grades that are in excess of the limits in Table 7.

Table 7: Grades Limits for RAVs

	Sealed Roads	Gravel Roads
RAVs Categories 2-6	8%	5%
RAVs Categories 7-8	6%	4%
RAVs Categories 9-10	5%	3%

2.8 Turning at Intersections

It is essential that intersections can be safely negotiated, with minimal or no interference to other traffic and minimal risk of damage to property.

2.8.1 Vehicle Speed While Negotiating the Turn

The vehicle turning radius is directly related to the maximum turning speed of the vehicle:

- For intersections where the vehicle must always stop before turning (e.g., at a Stop sign), a turning speed of 5-15 km/h is generally sufficient;
- For intersections where the vehicle rarely or never needs to stop before turning, a speed of 20 km/h to 30 km/h can be assumed; and
- A turning speed of 30 km/h or more can be used on roads with high posted speed limits with high traffic volumes, where the RAV is likely to turn at a higher speed.

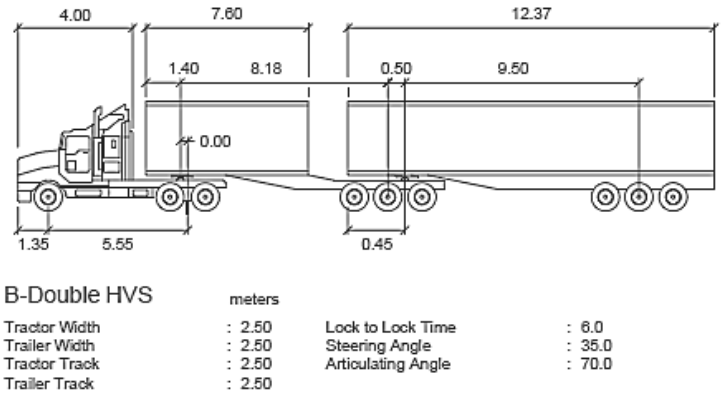
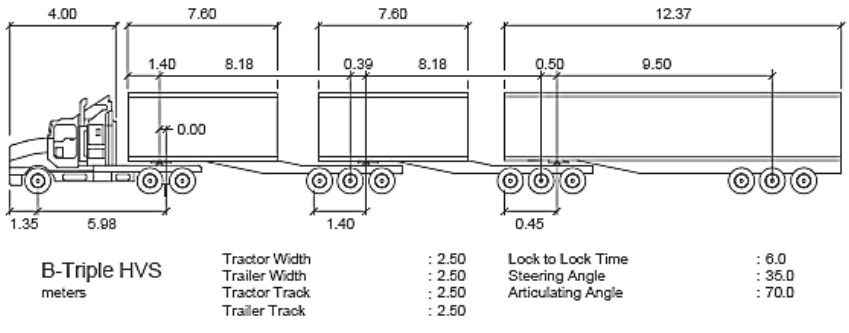
2.8.2 Turning Clearances

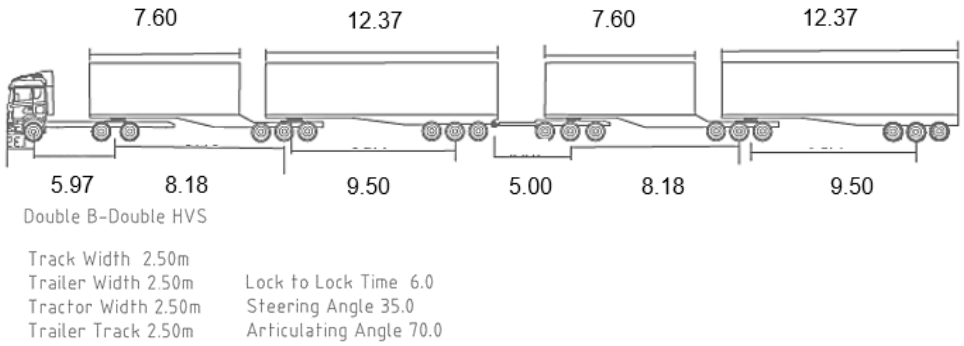
Where there is any possibility that the RAV may have insufficient clearance from kerbs or other nearby objects, standard turning templates shall be used to accurately check the swept path of the RAV.

Using a suitable vehicle swept path simulation software, the appropriate vehicle combination must be used to check all turning movements at all required intersections and any clearance problems should be noted on the *RAV Route Assessment Form*. As a rule:

- The wheel paths of the rear trailer of the RAV must not come any closer than 200 millimetres from the face of any kerb, unless the kerb is designed to be mounted, in which case the 200 millimetres clearance is not applied.
- If there is no kerb (such as a gravel road), the edge of the road formation can be taken as the kerb.
- The swept path must not come any closer than 200 millimetres to a nearby object.
- For a left or right turn, the wheel paths must not cross over the centreline of the road, unless the sight distances in all directions of the intersection are adequate according to *Appendix D*.

Table 8: Vehicle combinations for completing swept path assessments

RAV Categories	Assessment Vehicle	Maximum Length (m)
2-4	**B-double**  	27.5
5-7	**B-triple**  	36.5

9-10	**Double B Double**  	**53.5**

2.8.3 Intersection Layout

To assist in ensuring network performance levels are maintained, the assessor needs to identify if acceleration lanes and turn pockets are present at intersections and the length of these treatments.

Capturing this information in the assessment will assist in determining if network improvements are necessary, in consultation with the road manager.

2.8.4 Approach Sight Distance

The route shall be rejected if the driver of a RAV approaching the intersection has insufficient visibility to observe the intersection, or advance intersection warning, and react or stop if necessary. The table in *Appendix D* shows the required sight distances for RAVs, given the vehicle type, speed and the gradient of the road. When measuring the available approach sight distance, the measurement must be taken from a truck driver's eye height of 2.4 metres.

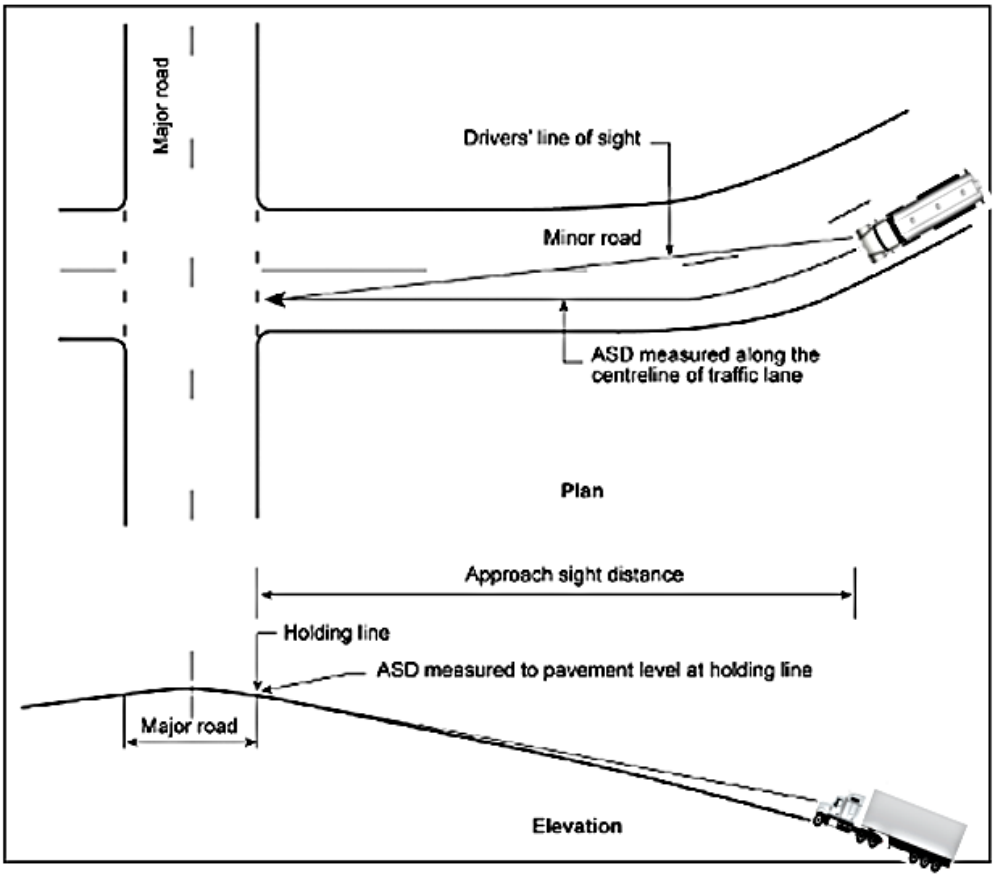


Figure 1: Example of Approach Sight Distance

2.8.5 Entering Sight Distance

The road shall be rejected if the driver of a RAV, entering a through road, does not have appropriate sight distance to see a sufficient gap in oncoming traffic that will allow a RAV, with greater length and lower acceleration capacity, to clear the intersection safely. The table in *Appendix D* shows the required sight distances for RAVs, given the vehicle type, speed and the gradient of the road. When measuring the available entering sight distance, the measurement must be taken from a truck driver's eye height of 2.4 metres to a height that considers all traffic.

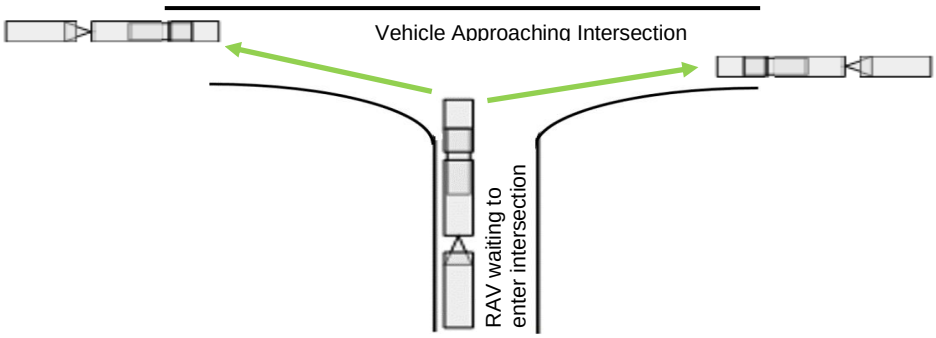


Figure 2: Example of Entering Sight Distance

The angle and gradient of the intersection should also be considered to determine if additional time is required for a RAV to manoeuvre the intersection, for instance a steep upgrade in the direction of travel will adversely affect the RAV's start up and acceleration when entering the through road.

Note: *The entering sight distance requirement is only required for intersections that are not controlled by traffic signals, with the exception of a right turning movement with no right turn arrow.*

2.9 Railway Level Crossings

The various operational requirements at railway crossings are described in the *Railway Crossing Control in Western Australia Policy and Guidelines* found on the Main Roads website.

The following points highlight the main considerations for RAVs at railway crossings for the various levels of protection.

2.9.1 Inadequate Approach Stacking Distance

Inadequate approach stacking distance occurs where the distance between the railway and a nearby intersection is insufficient to enable a vehicle to stop at the crossing without impeding the traffic flow at the intersection.

Approach stacking distance is measured from the vehicle stopping line at the railway crossing to the nearest shoulder edge of the crossroad. The vehicle stopping line at a railway crossing is normally indicated by a painted line or, in the absence of a marked line, it is assumed to be 3.5 metres back from the nearest rail.

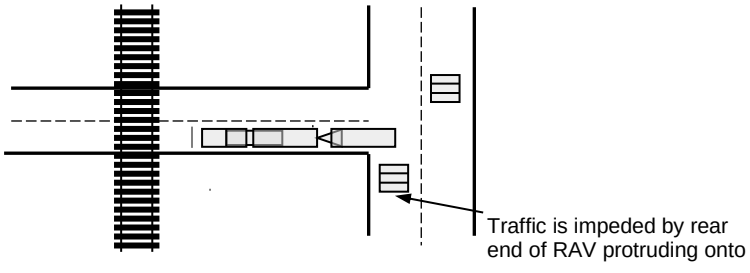


Figure 3: Examples of Inadequate Approach Stacking Distance

2.9.2 Inadequate Departure Stacking Distance

Inadequate departure stacking distance occurs when part of a vehicle would encroach within 3.5 metres of the railway track, while stopped to give way to traffic on the priority road of an adjacent intersection. An exception is in cases where the intersection is controlled by traffic signals that are coordinated with the railway crossing signals.

Departure Stacking Distance is measured from the vehicle stopping line at the intersection to within 3.5 metres of the nearest railway track. In the absence of marked lines, the measurement is to be taken from the edge of the through lane (if there are edge lines) or the edge of the seal.

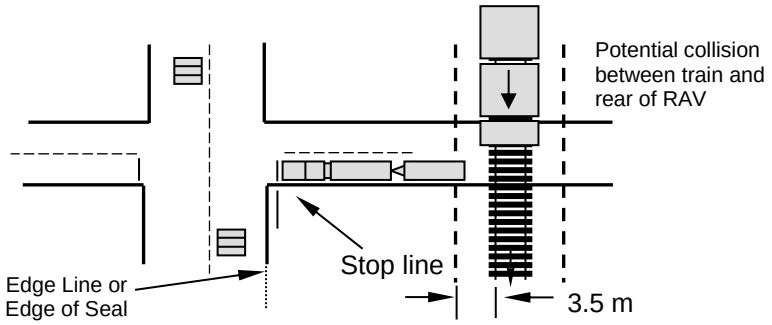


Figure 4: Examples of Inadequate Departure Stacking Distance

2.9.3 Adequate Stacking Distance

Figure 5 shows the methodology for measuring approach and departure stacking distances. Ideally, a clearance of 3.5 metres should be applied when assessing the available approach stacking distance. However, if the approach stacking distance is at least the length of the RAV and there is sufficient ESD for other vehicles departing the intersection, while there is a RAV stopped at the rail, a lesser clearance is acceptable.

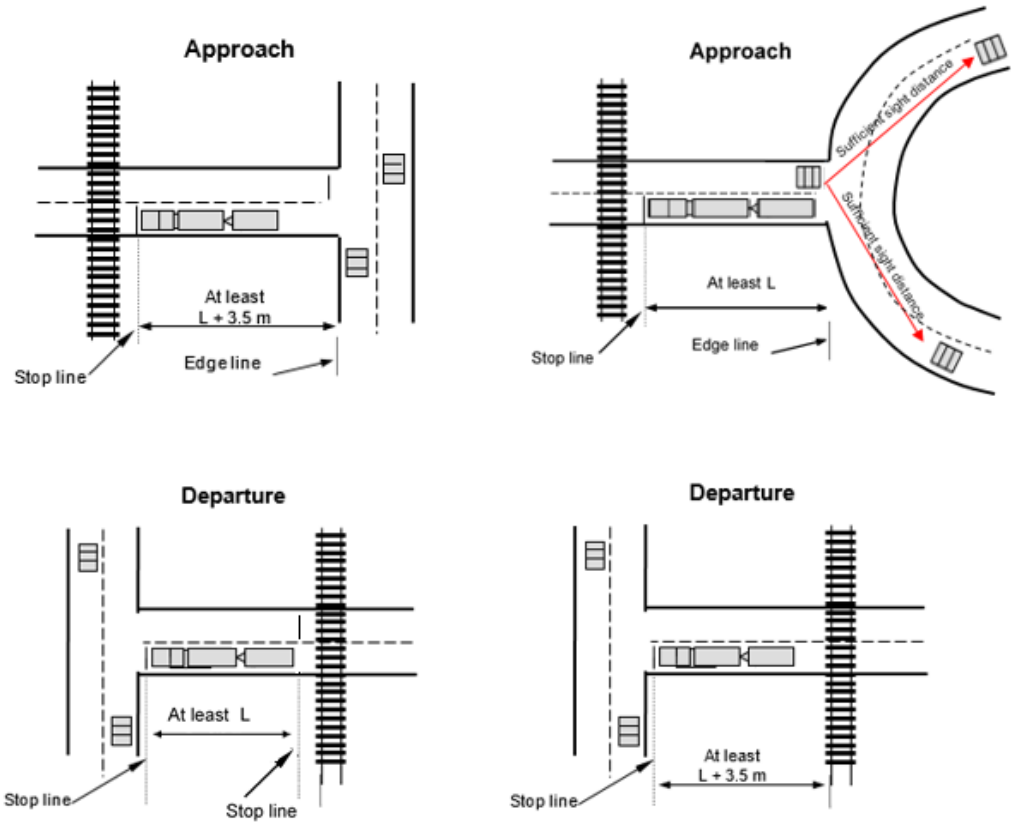


Figure 5: Examples of Adequate Stacking Distances

2.9.4 RAVs at Crossings Protected by Give Way or Stop Signs

The driver of a RAV approaching a railway crossing protected by a GIVE WAY or a STOP sign needs to be able to see the crossing from a sufficient distance to allow enough time to stop the RAV if required. The ASD to a railway crossing must meet *Appendix D*.

There also needs to be sufficient sight distance for the driver of a RAV, after having stopped at a railway crossing with a GIVE WAY or STOP sign, to see an oncoming train and allow adequate time to safely cross. The required sight distances for RAVs at railway crossings must meet:

- The S3 formula for STOP signs of the Australian Standards AS1742.7-2016 – Manual of Uniform Traffic Control Devices – part 7: Railway Crossings.

The S3 formula determines the minimum distance required for the driver of a vehicle stopped at the railway crossing to be able to see an oncoming train in order to safely cross.

When measuring the available sight distance to all directions at rail crossings, a truck driver's eye height of 2.4 metres is recommended.
Where railway crossings with STOP signs are located along the proposed route, the assessor must record the information shown below in Figure 6 on the *RAV Route Assessment Form*. This information is then used to calculate the S3 formula.

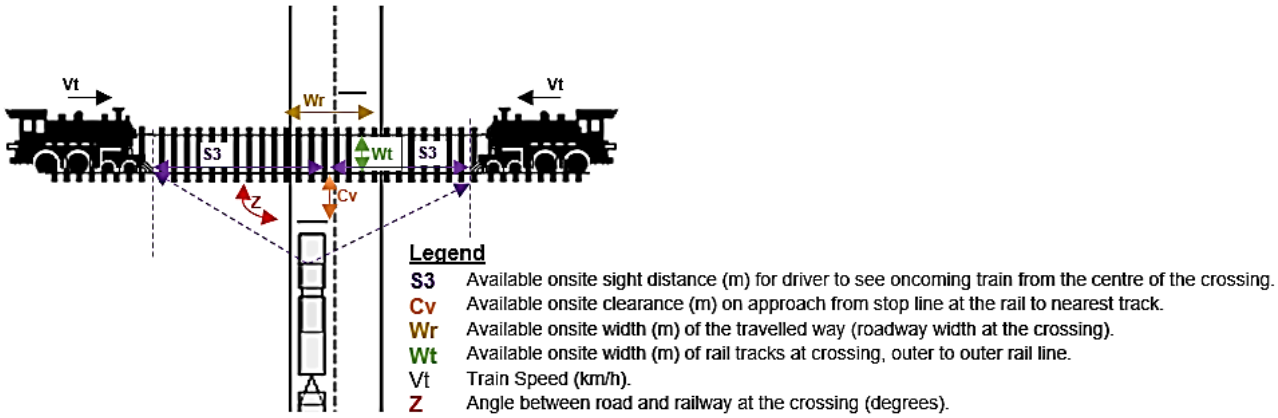


Figure 6: Required Information from Onsite Assessment for S3 Calculation

2.9.5 RAVs at Railway Crossings Protected by Flashing Lights

The visibility of the primary flashing lights and advance flashing yellow warning signs displayed on the approach to crossings, must be assessed so that the driver can safely stop if required. The sight distance to the flashing lights, or alternatively the advance flashing yellow warning signs must meet the minimum requirements in *Appendix D*.

When measuring the available sight distance to all directions at rail crossings, a truck driver's eye height of 2.4 metres is recommended.

2.10 Off-road Parking

In rural and remote areas, the route should have adequate off-road truck parking facilities at sufficient spacing along the route.

In any one direction of travel, the maximum spacing for off-road parking facilities should be:

- Rural Area roads - 80 kilometres
- Remote Area roads - 120 kilometres

Adequate off-road parking facility is defined as any:

- Service station or roadhouse, (or other commercial establishment), with provision for public truck parking;
- Signed parking bay, truck bay, rest area; or
- Designated road train assembly area.

Which meets the following criteria:

- Minimum approach sight distance (measured from a truck driver's eye height of 2.4 metres) to the entry/exit point are in accordance with *Appendix D*; and
- Minimum entering sight distance (measure from a truck driver's eye height of 2.4 metres to a height that considers all traffic.) from the entry/exit point in accordance with *Appendix D*; and
- The full length of the RAV can be parked within the parking area, without encroachment onto the carriageway. The ideal minimum clearance between the parked RAV and the adjacent road is shown in Table 9 (as per the example in Figure 7).

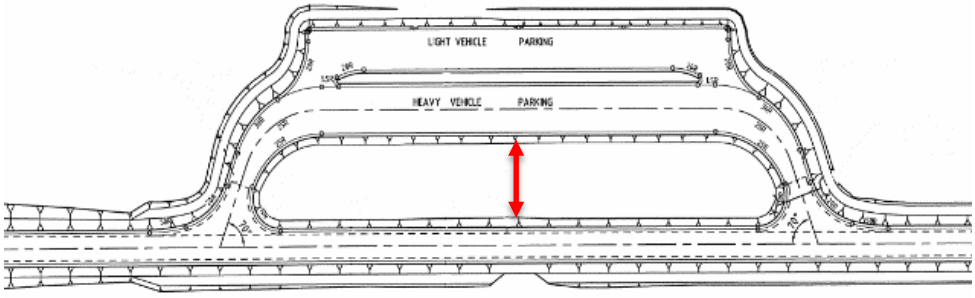


Figure 7: Minimum clearance between road pavement and parking bay

Table 9: Minimum safe clearance distance of parked RAV from road

Speed Limit (km/h)	Minimum Clearance from edge of pavement* (m)
60	5
70	5.7
80	6.2
90	7.6
100	8.8
110	11

2.11 Other Road Users

Consideration must be given to the risks a RAV may pose to more vulnerable road users, such as the following:

- Pedestrians;
- Cyclists;
- Tourists and recreational users (who may be unfamiliar with the conditions);
- School buses, where the buses are dropping children adjacent to the road in a non-dedicated bus stop.

3 COMMUNITY CONSIDERATIONS

HVS will consult with the relevant Local Government and/or Main Roads Region for input in relation to potential adverse impacts on the local community that may result from approving RAV access.

4 RAIL CONTESTABILITY

HVS will consult with the Department of Transport if they consider the proposed RAV access may be contestable with rail.

5 APPENDICES

Appendix	Title
Appendix A	Rural Road Minimum Widths
Appendix B	Low Volume Rural Road Minimum Widths
Appendix C	Townsite Road Minimum Widths
Appendix D	Required Sight Distance
Appendix F	Operating Conditions
Appendix F	RAV Access Assessment Process

Appendix A: Rural Road Minimum Width

	60 to 70 km/h		80 to 100 km/h	
	Carriageway Width (m)	**Sealed Width (m)**	**Carriageway Width (m)**	**Sealed Width (m)**
0 to 150 AADT / VPD* **				
RAVs Categories 2-4	7.6	3.3	7.9	3.4
RAVs Categories 5-7	7.7	3.4	8.0	3.5
RAVs Categories 8-10	8.2	3.8	8.6	3.9
150 to 500 AADT / VPD				
RAVs Categories 2-4	7.6	5.6	7.9	5.9
RAVs Categories 5-7	7.7	5.7	8.0	6.0
RAVs Categories 8-10	8.2	6.1	8.6	6.4
500 to 1 000 AADT				
RAVs Categories 2-4	7.9	6.1	8.2	6.4
RAVs Categories 5-7	8.0	6.2	8.3	6.5
RAVs Categories 8-10	8.6	6.6	9.0	6.9
More than 1 000 AADT				
RAVs Categories 2-4	9.6	6.8	9.9	7.1
RAVs Categories 5-7	9.7	6.9	10.0	7.2
RAVs Categories 8-10	10.6	7.6	11.0	8.0

Notes:

- *The carriageway widths given in the above table should be used for assessing usable width on gravel roads.*

- *A road should be sealed if the AADT is over 150 and the annual freight tonnage is over 300,000 TPA. In the absence of any traffic data, the following parameters may be a guide: the uniform annual loaded RAV traffic volume exceed 10 vehicles per day; or the loaded RAV traffic volume exceed 60 vehicles per day over a seasonal two month period.*

Appendix B Low Volume Rural Road Minimum Widths

Type A Road (suitable for two-way RAV traffic)

	40 km/h	60 km/h
	Carriageway Width (m)	**Carriageway Width (m)**
RAVs Categories 2-7	5.8	6.1
RAVs Categories 9-10	5.9	6.3

Notes:

- *This section is not to be used for assessing routes for RAV Category 8.*
- *For Type A low volume roads, Appendix E operating conditions 1, 2, 3, 4, 5, 7 and 8 may be applied as a condition;*
- *If a road is at least 1.0 metre wider than the widths specified for 60km/h, an 80km/h speed restriction should be considered. A speed restriction above 80km/h should only be considered if the road is sealed, has good sight distance and presents no significant safety concern.*

Type B Road (unsuitable for two-way RAV traffic)

	40 km/h
	Carriageway Width (m)
RAVs Categories 2-7	3.5*
RAVs Categories 9-10	3.5*

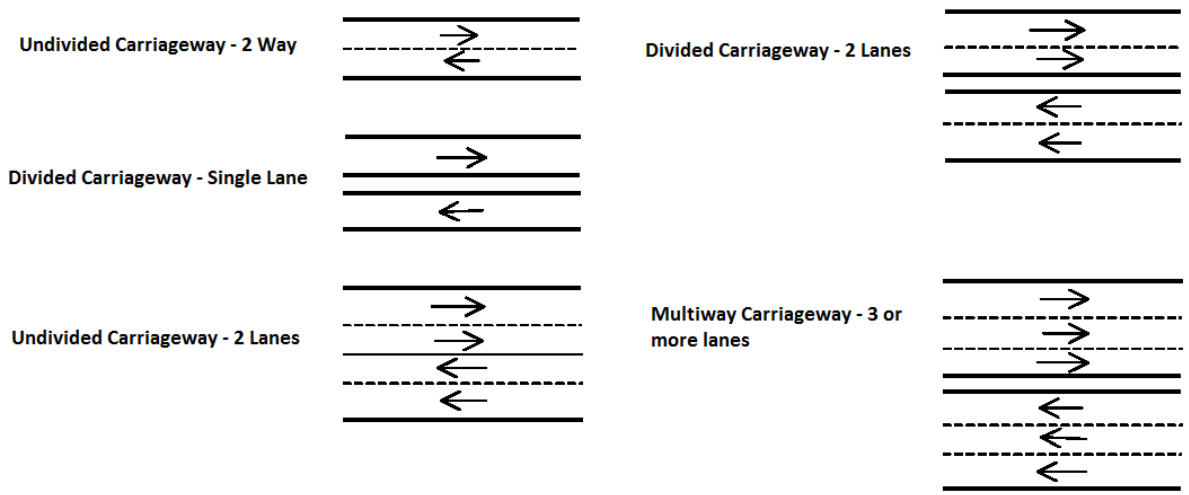
Note:

- *For type B low volume roads, Appendix E operating conditions 1, 2, 3, 4, 5, 6, 7 and 8 may be applied as a condition.*

Appendix C: Town Site Road Minimum Widths

Feature	RAVs Categories 2-4		RAVs Categories 5-8		RAVs Categories 9-10	
	60 - 70 km/h	80-100 km/h	60 - 70 km/h	80-100 km/h	60 - 70 km/h	80-100 km/h
(Undivided carriageway – 2 Way) Width between sealed edge and road centre (m)						
Basic / unmarked	**3.2**	**3.5**	**3.3**	**3.7**	**3.6**	**4.1**
with marked separation line	**3.5**	**3.8**	**3.6**	**4.0**	**3.9**	**4.4**
with dedicated cycle lane	**4.7**	**5.5**	**4.8**	**5.7**	**5.1**	**6.1**
with dedicated or regular parallel parking	**5.7**	**NA**	**5.8**	**NA**	**6.1**	**NA**
with dedicated angle (45º) parking	**9.2**	**NA**	**9.3**	**NA**	**9.6**	**NA**
(Divided carriageway – single lane) Width between sealed edge and edge of median or traffic island (m)						
Basic / unmarked	**3.5**	**3.8**	**3.6**	**4.0**	**3.9**	**4.4**
with dedicated cycle lane	**5.0**	**5.8**	**5.1**	**6.0**	**5.4**	**6.4**
with dedicated or regular parallel parking	**6.0**	**NA**	**6.1**	**NA**	**6.4**	**NA**
with dedicated angle (45º) parking	**9.5**	**NA**	**9.6**	**NA**	**9.9**	**NA**
(Undivided carriageway – 2 lanes) Width between sealed edge and road centre (m)						
Basic / unmarked	**6.6**	**7.0**	**6.7**	**7.1**	**7.0**	**7.5**
with dedicated cycle lane	**8.1**	**9.0**	**8.2**	**9.1**	**8.5**	**9.5**
with dedicated or regular parallel parking	**9.1**	**NA**	**9.2**	**NA**	**9.5**	**NA**
(Divided carriageway – 2 lanes) Width between sealed edge and edge of median or traffic island (m)						
Basic / unmarked	**6.6**	**7.0**	**6.7**	**7.1**	**7.0**	**7.5**
with dedicated cycle lane	**8.1**	**9.0**	**8.2**	**9.1**	**8.5**	**9.5**
with dedicated or regular parallel parking	**9.1**	**NA**	**9.2**	**NA**	**9.5**	**NA**
(Multiple Lane Carriageways – 3 or more lanes) Width of additional through lane (m)						
basic	**3.2**	**3.4**	**3.3**	**3.5**	**3.4**	**3.6**

Note: *An explanation of road type descriptors is as follows:*



Appendix D: Required Sight Distances

Posted Speed km/h	Downhill				Level	Uphill			
	-8%	***-6%***	***-4%***	***-2%***		***2%***	***4%***	***6%***	***8%***
40	74	72	70	68	66	65	64	62	61
50	102	98	95	92	89	87	85	84	82
60	134	128	123	119	116	112	110	107	105
70	170	162	155	149	144	140	136	133	130
80	209	198	190	182	176	170	165	161	157
90	252	239	228	218	210	203	197	191	186
100	308	290	275	263	252	242	234	227	220

The above values have been derived using the formula given in Austroads Guidelines with following factors:

Reaction Time	4.0 s

(Deceleration rate of 0.29g up to 90 km/h, 0.28g at 100 km/h.)

Appendix E: Operating Conditions

These and other similar operating conditions may be applied to the assessment of low volume roads.

1. When travelling at night, the RAV must travel at a maximum speed of 40km/h and display an amber flashing warning light on the prime mover.
2. No operation on unsealed road segment when visibly wet, without road owner's approval.
3. Headlights must be switched on at all times.
4. Speed restrictions of 40 km/h or 60 km/h as determined from *Appendix B*.
5. Direct radio contact must be maintained with other RAVs to establish their position on or near the road (suggested UHF Ch 40).
6. For a single lane road, the road must not be entered until the driver has established via radio contact that there is no other RAV on the road travelling in the oncoming direction.
7. Operation is not permitted while the school bus is operating on the road. Operators must contact the relevant schools directly and obtain school bus timetables; or where direct contact can be made with the school bus driver, operation is permitted once the school bus driver confirms all school drop-offs/ pick-ups have been completed on the road.
8. Current written support from the road asset owner, endorsing use of the road, must be obtained, carried in the vehicle and produced upon request.

Appendix F: RAV Access Assessment Process