Road Planning and Design Manual
Edition 2: Volume 3

Supplement to Austroads Guide to Road Design Part 4: Intersections and Crossings - General

November 2021

Queensland Government

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Relationship with Austroads Guide to Road Design – Part 4 (2021)

The Department of Transport and Main Roads has, in principle, agreed to adopt the standards published in the *Austroads Guide to Road Design* (2021) *Part 4: Intersections and Crossings: General.*

When reference is made to other parts of the *Austroads Guide to Road Design*, *Austroads Guide to Traffic Management* or the *Austroads Guide to Road Safety*, the reader should also refer to Transport and Main Roads related manuals:

- *Road Planning and Design Manual* (RPDM)
- *Traffic and Road Use Management Manual* (TRUM).

Where a section does not appear in the body of this supplement, the *Austroads Guide to Road Design – Part 4* criteria is accepted unamended.

This supplement:

1. has precedence over the *Austroads Guide to Road Design – Part 4* when applied in Queensland
2. details additional requirements, including *accepted with amendments* (additions or differences), *new* or *not accepted*.
3. has the same structure (section numbering, headings and contents) as *Austroads Guide to Road Design – Part 4*.

The following table summarises the relationship between the *Austroads Guide to Road Design – Part 4* and this supplement using the following criteria:

Accepted	Where a section does not appear in the body of this supplement, the *Austroads Guide to Road Design – Part 4* is accepted.
Accepted with amendments	Part or all of the section has been accepted with additions and/or differences.
New	There is no equivalent section in the Austroads Guide.
Not accepted	The section of the Austroads Guide is not accepted.

Austroads Guide to Road Design – Part 4		RPDM relationship
1 Introduction		
1.1	Purpose	Accepted
1.2	Scope of this Part	Accepted with amendments
1.3	Road Safety	Accepted
1.4	Design Criteria in Part 4	Accepted with amendments
2 Types of Intersection		
2	Types of Intersection	Accepted
3 Road Design Considerations for Intersections		
3.1	Road Users	Accepted
3.2	Provision for Large / Special Vehicles	Accepted
3.3	Topography and Land Availability	Accepted
3.4	Environment and Heritage	Accepted

Austroads Guide to Road Design – Part 4		RPDM relationship
3.5	Physical Constraints	Accepted
3.6	Work Health and Safety	Accepted
3.7	Other Considerations	Accepted with amendments
3.8	Consistency Considerations	New
3.9	On-road Parking	New
4 Design Process		
4.1	General	Accepted
4.2	Basic Data for Design	Accepted
4.3	Location of Intersections	Accepted
4.4	Design Speed	Accepted
4.5	Road Cross-section	Accepted with amendments
5 Design Vehicle		
5.1	General	Accepted
5.2	Design Vehicles	Accepted with amendments
5.3	Checking Vehicles	Accepted with amendments
5.4	Restricted Access Vehicles	Accepted with amendments
5.5	Visibility from Vehicles	Accepted
5.6	Design Vehicle Swept Path	Accepted with amendments
6 Public Transport at Intersections		
6.1	General	Accepted
6.2	Design Vehicle	Accepted
6.3	Bus Facilities	Accepted with amendments
7 Property Access and Median Openings		
7.1	General	Accepted
7.2	Property Access	Accepted with amendments
7.3	Median Openings	Accepted with amendments
8 Pedestrian Crossings		
8.1	Introduction	Accepted with amendments
8.2	Mid-block Crossings on Roads	Accepted with amendments
9 Cyclist Crossings		
9.1	Introduction	Accepted with amendments
9.2	Kerb Ramps for Cycling	Accepted
9.3	Path Crossings of Intersecting Local Access Roads	Accepted
9.4	Path Terminals	Accepted
9.5	Intersections between Off-road Paths	Accepted
10 Rail Crossings		
10.1	General	Accepted with amendments
10.2	Sight Distance	Accepted with amendments
10.3	Horizontal Alignment	Accepted
10.4	Vertical Alignment	Accepted
10.5	Cross-section	Accepted

Austroads Guide to Road Design – Part 4		RPDM relationship
10.6	Pedestrians and Cyclists	Accepted
References		
References		Accepted with amendments
Appendices		
Appendix A	Intersections - General	Accepted with amendments
Appendix B	Signalised Intersections	Accepted with amendments
Appendix C	Cyclist Crossings	Accepted
Appendix D	Crash Types at Unsignalised Intersections	Accepted
Appendix E	Access Spacing	Accepted
Appendix F	Derivation of Sight Distance Requirements at Railway Level Crossings	Accepted
Appendix G	Extended Design Domain for Two Stage Mid-Block Crossing	New
Commentaries		
Commentary 1		Accepted
Commentary 2		Accepted
Commentary 3		Accepted
Commentary 4		Accepted
Commentary 5		Accepted
Commentary 6		Accepted
Commentary 7		Accepted
Commentary 8		Accepted
Commentary 9		Accepted
Commentary 10		Accepted
Commentary 11		Accepted
Commentary 12		Accepted
Commentary 13		Accepted

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1 Introduction

1.2 Scope of this part

Addition

In undertaking intersection design, practitioners are reminded that the full intersection design process spans the *Austroads Guide to Traffic Management – Part 6: Intersections, Interchanges and Crossings Management* and the *Austroads Guide to Road Design – Part 4 series.* For application in Queensland, the intersection design process also spans the related Transport and Main Roads *Traffic and Road Use Management* (TRUM) *Manual* and this *Road Planning and Design Manual* (RPDM). The design of intersections in accordance with this RPDM must consider all of the planning and operational issues outlined within the TRUM Manual and *Austroads Guide to Traffic Management* (AGTM).

1.4 Design criteria in Part 4

Addition

Guidance on the use of values outside of the design domain (Normal and Extended) should be undertaken in accordance with Volume 3, Part 1 of the RPDM and Appendix A of the relevant part.

3 Road design considerations for intersections

3.7 Other considerations

3.7.1 Road lighting

Addition

Volume 6 of this RPDM describes Queensland specific requirements and information on lighting at intersections. This information will be transferred in the near future to the Transport and Main Roads TRUM Manual.

3.7.2 Streetscaping

Addition

Practitioners should refer to the Transport and Main Roads *Road Landscape Manual* for information on landscaping around intersections.

3.7.5 Pavement markings and signs

There is no equivalent Section 3.7.5 in *Austroads Guide to Road Design – Part 4*.

New

Practitioners should refer to the Transport and Main Roads *Manual of Uniform Traffic Control Devices* (MUTCD) as the Queensland jurisdictional guide on pavement markings and signage.

3.8 Consistency considerations

There is no equivalent Section 3.8 in *Austroads Guide to Road Design – Part 4*.

New

The uniform application of intersection control devices is an essential factor in the safe and efficient operation of the road system as drivers tend to establish expectancy with regard to the type of devices being used.

To achieve consistency, the following guidelines are important:

- Through lane(s), especially the rightmost lane(s) next to the median, should preferably not become exclusive turn lane(s). Where this situation cannot be avoided clear diagrammatic signposting, sited well before the intersection, should be provided.
- Right to left merges should generally not be used. They must not be used on motorways. Where such a merge cannot be avoided, appropriate signage is to be provided and the location of the merge must not be at the same location as a merge on the opposite side of the same carriageway. In undertaking such a right to left merge, truck drivers rely solely on mirrors to view vehicles in the adjacent lane. Preferred practice at intersection is to provide a dedicated lane for a right-turn movement which is required to run simultaneously with a through movement. Where this requires a lane drop, consideration should be given to merging the kerb side lane(s) depending on traffic volumes.
- Short merge lanes and merge lanes without adequate run-out areas should be avoided.
- The appearance of intersection types and forms of traffic control should be consistently applied.
- The forms of traffic control are to be appropriate to the site and not disobeyed with impunity.
- Advertising signage should be in accordance with Transport and Main Roads *Roadside Advertising Manual*. Advertising signage which imitates traffic control devices, give direction to traffic or distracts drivers should not be permitted.
- Adequate recovery areas should be provided for drivers who ‘get it wrong’ in accordance with the 'Safe Systems' principle.
- Intersections should be monitored to identify unusual movements, or where ‘decision overload’ situations are occurring.
- The priority of each intersecting stream should be obvious to drivers and other users.

3.9 On-road parking

There is no equivalent Section 3.9 in *Austroads Guide to Road Design – Part 4*.

New

On-road parking in close proximity to an intersection can cause the following:

- reduction in the numbers of effective lanes on an approach or departure
- misleading activations of the traffic detectors
- obstruction of signal displays and other control devices
- reduced sight distances for vehicle, cyclist or pedestrian traffic, and
- delays as vehicles manoeuvre into parking spaces.

Statutory parking restrictions near intersections are outlined in the Queensland Government *Transport Operations (Road Use Management—Road Rules) Regulation* 2009. These restrictions identify where parking is prohibited in the absence of any signed or lined parking restrictions.

Parking should be designed so as not to interfere with sight distance or impede the flow of traffic turning at an intersection. This may require signed restrictions in excess of the statutory restrictions. In

addition to these requirements, parking on major roads should preferably be prohibited within 100 m of signalised intersections.

For sight distance requirements at property entrances, refer to Volume 3, Part 4A, Section 3.4 of the RPDM.

4 Design process

4.5 Road cross-section

4.5.2 Traffic lanes

Difference

In Queensland, the design lane width shall exclude any channel component, and shall not be measured to the line of the kerb as shown in Figure 4.1 of *Austroads Guide to Road Design – Part 4*.

5 Design vehicle

5.2 Design vehicles

Addition

Maps and guidelines designating approved routes for multi-combination vehicles are available from the Transport and Main Roads website (search for 'multi-combination vehicles'). Where a specific class of vehicle is permitted to use roads on both the approach and departure legs of an intersection, that vehicle shall be the design vehicle for the relevant intersection movements.

Difference

Notes 1 to 3 of Table 5.1 in *Austroads Guide to Road Design – Part 4* are replaced with the following:

Notes:

1. The restricted access vehicle to be used in the design of these intersections in Queensland is determined from the approved multi-combination vehicle maps. Where the route is not approved for multi-combination vehicles, the single articulated (19 m) design vehicle applies.
2. The maximum permissible length for a B-double in Queensland is 26 m.
3. Road Train dimensions applicable in Queensland are outlined in the Transport and Main Roads *Route Assessment for Multi-Combination Vehicles (MCV) and Performance Based Standards (PBS) Vehicles in Queensland Guideline*.

5.3 Checking vehicles

Addition

The appropriate checking vehicle should be determined from one of the following criteria typically determined by the road asset owner:

1. None – In certain instances, it will not be necessary to design for check vehicles. For example, in urban areas where the design vehicle is a B-double and it is unlikely that a vehicle larger than a B-double will ever use the road / intersection, the swept path of larger vehicles do not need to be provided for. The design vehicle should still be provided for with appropriate clearances.

2. Checking vehicle at least the next larger vehicle to the design vehicle. This checking vehicle is in accordance with Section 5.3 of *Austroads Guide to Road Design – Part 4*.
3. Restricted Access and Permit vehicles. These vehicles are considered in accordance with Section 5.4 of *Austroads Guide to Road Design – Part 4*.

5.4 Restricted access vehicles

Difference

Replace the last sentence of the first paragraph in *Austroads Guide to Road Design – Part 4* with the following:

In this case, the largest type (e.g. a Conventional Type 2 Road Train) is likely to be the design vehicle for that route.

5.6 Design vehicle swept path

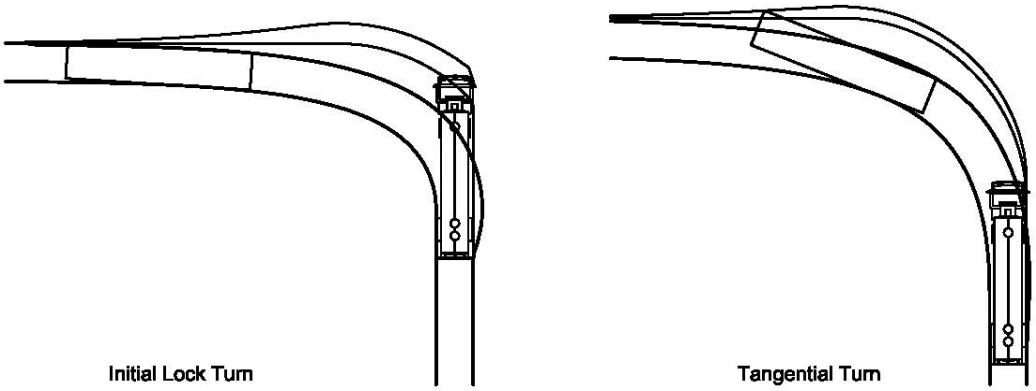
5.6.1 General

Addition

In addition, tangential turns should always be used for the design of intersection turns and turns from the roadway into a property access. In practice, drivers may sometimes execute turns after applying some initial lock while the vehicle is stopped. This is due to factors such as driver error or constraints imposed by low standard geometry, disabled vehicles or obstacles on the road.

Initial lock turns require shorter arcs of turn but involve maximum off-tracking for more of the turn and greater out swing of the rear of the vehicle at the start of the turn (Figure 4-1). Initial lock turns are relevant for off-street manoeuvres (including roadside parking manoeuvres) and, in constrained situations, for entering and leaving parking spaces. Initial lock turns are not to be used for circulating roadways within a parking facility, on roads or at intersections.

Figure 4-1 – Swept path comparison between initial lock and tangential turns



5.6.2 Radius of turn

Addition

Representative steering path

When any turning movement is assessed in VPATH, it is first necessary to determine a representative steering path for the turn. Variations in steering radius are accommodated by the clearances that must be provided when a swept path is used to check a vehicle movement.

In the case of complex turning manoeuvres, the scope for variations in steering path is greater than for simple circular turns.

To accommodate the transition from one segment of the steering path to the next, either transition curves are to be used, or a sufficient length of straight should be introduced between the curves. A minimum length of straight of about 3 m should be provided, if both of the curves are less than about 40 m in radius. If both of the curves are less than about 20 m in radius, it is desirable that the minimum length of straight be increased to about 5 m (Cox 1987).

VPATH calculates and plots swept path details for turning vehicles. It may be used for the production of standard templates or the design or checking of the turning requirements for vehicles in operation on specific road segments, (e.g. turning paths at intersections, roundabouts and so on).

VPATH is the preferred program for use in Queensland. AutoTurn and AutoTrack are acceptable but are not as accurate for large MCVs.

5.6.3 Clearances to swept paths of turning vehicles

Addition

Edge of pavement / kerb / centreline

In addition to the minimum offset to a kerb, pavement edge or centreline, the swept path for design vehicles should also have a minimum offset of 0.5 m to an edge line or safety barrier (median or kerbside).

Check vehicles may intrude into the 0.5 m clearance and in other areas specifically designed for the occasional vehicle to mount.

Between swept paths – turns in the same direction

At ports and major industrial areas, double turns must allow for 1 m clearance between heavy vehicles turning two abreast.

6 Public transport at intersections

6.3 Bus facilities

Addition

For Transport and Main Roads' specific requirements relating to bus facilities refer to the *Public Transport Infrastructure Manual* (Translink) via https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Public-transport-infrastructure-manuals.

7 Property access and median openings

7.2 Property access

7.2.2 Urban roads

Addition

In commercial zones, access points should be consolidated to minimise crashes.

The following additional items are to be considered for urban divided arterial roads in Table 7.2 of *Austroads Guide to Road Design – Part 4.*

On arterial routes, accesses should be consolidated where possible. Depending on the circumstances, consideration should be given to providing access to property through some of the following methods:

- Grade separation: Major commercial developments, such as shopping centres with mid-block access, may require grade separated right-turn movements, deceleration and acceleration lanes or signalised intersections. Intersection analysis will dictate the treatment.
- In conjunction with left in, left out access facilities, typical sheltered U-turn facilities for passenger vehicles and articulated vehicles are shown in Figure A 22 of *Austroads Guide to Road Design – Part 4.*
- Direct access: Right-turn direct access should be limited to situations where the road network layout precludes those measures mentioned above. A separate right-turn bay for such an access should be located so that the right-turn is a minimum five seconds travel distance from the nearest street intersection. An ideal site for this is preceding a signalised intersection where the turning vehicle can take advantage of the gap caused by the inter-green.

7.3 Median openings

7.3.2 Location

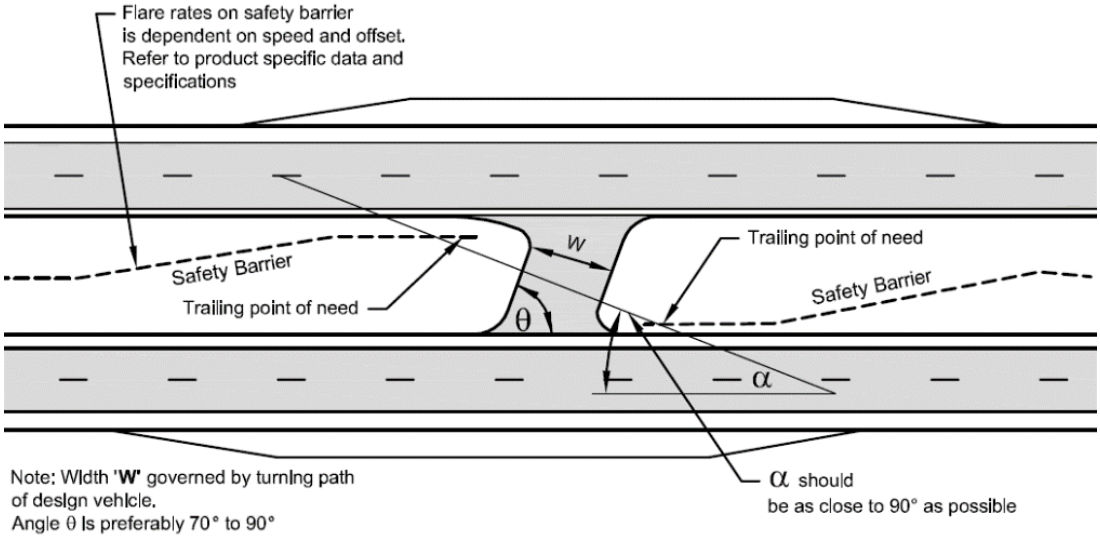
Differences

Practice in Queensland requires that a driver wishing to use a crossover should be able to recognise that the crossover exists from at least 10 seconds of travel in either direction. This replaces the requirement in the last paragraph of Section 7.3.2 of *Austroads Guide to Road Design – Part 4* which requires at least 300 m.

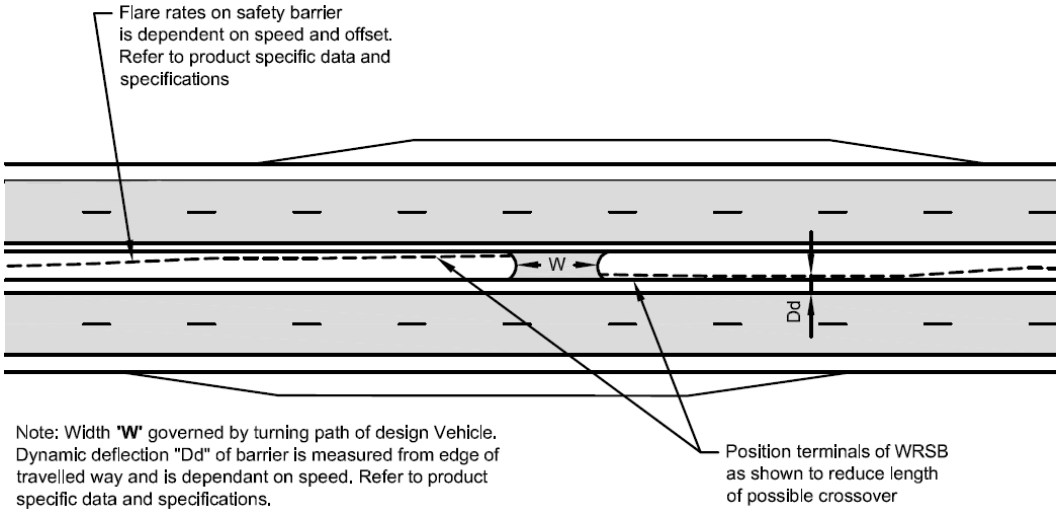
Addition

Emergency services access requires a median crossover facility between all interchanges on motorways. Details of the treatment of medians with safety barrier to allow for emergency crossover are shown in Figure 4-2.

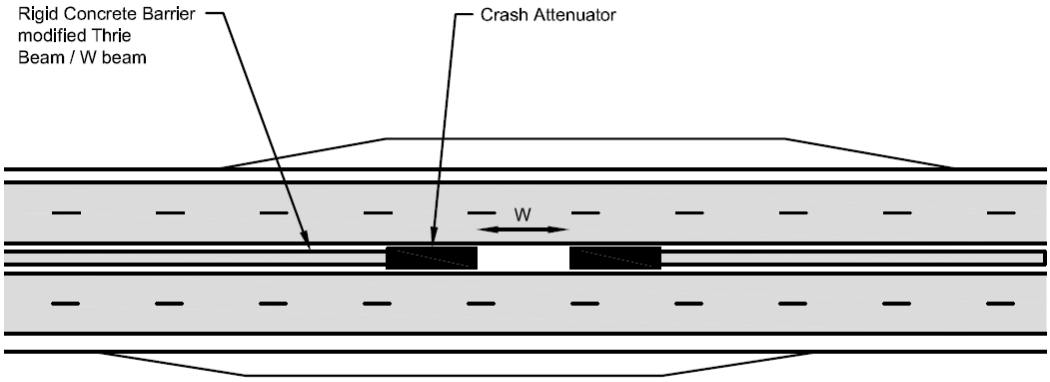
Figure 4-2 – Narrow medians with safety barrier – median crossovers for emergency purposes



6-10m WIDE MEDIAN WITH WIRE ROPE SAFETY BARRIER



NARROW MEDIAN WITH WIRE ROPE SAFETY BARRIER



NARROW MEDIAN REQUIRING RIGID / SEMI RIGID BARRIER

Notes:

The widened areas should be denoted as “No Stopping” to prevent the widened pavement being used as a breakdown area.

8 Pedestrian crossings

8.1 Introduction

8.1.2 Types of crossings

Addition

In Queensland, the selection of traffic control devices to be used in the control and protection of pedestrian traffic on roads is described in the Transport and Main Roads TRUM Manual. Further information can also be found via https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Cycling-guidelines.

8.2 Mid-block crossings on roads

8.2.1 General considerations for design

Addition

The following is to be added to Table 8.1 of *Austroads Guide to Road Design – Part 4.*

Feature	Considerations
Mid-block pedestrian crossings location	Signalised mid-block pedestrian crossing must be located a minimum of 30 m from any side streets. This is to avoid side street traffic misinterpreting the traffic signals as controlling their movement. It also prevents the situation where a vehicle enters the main roads just as the signals change to the pedestrian phase and the driver of the entering vehicle is unaware of the change or unable to react in time.
Mid-block pedestrian crossings – Two stage crossings	At sites where long pedestrian crossings occur, a two stage crossing assists traffic signal coordination under STREAMS and reduces traffic delays. Where two stage crossings are 2.4 m wide or less, the crossing point must be flush with the adjacent pavement surfaces. The kerbside pedestrian lanterns must be aimed so that they are not visible to pedestrians on the opposite side of the road. A physical barrier of suitable fencing should be provided on the median to prevent pedestrians from 'short cutting' between the crossings (refer to *Austroads Guide to Road Design – Part 4A and Austroads Guide to Road Design – Part 6*). Fences should be aligned so pedestrians face oncoming traffic as they leave the median. The fences should commence at the signal post and not encroach past the push button position. Parking for motorcycles does not inhibit crossing sight distance as much as general parking and may be appropriate for the first parking bays abutting a pedestrian crossing or refuge.

8.2.2 General crossing treatments

Addition

An EDD design for a staged crossing of a median is detailed in Appendix G.

Where a crossing is staggered, checks must be undertaken to ensure it is accessible for people with a disability i.e. it can be readily negotiated using a wheelchair or mobility scooter.

8.2.3 Kerb ramps for pedestrians

Addition

Requirements of compliant kerb ramps and TGSI installation are set out in the drawings within the Transport and Main Roads *Standard Drawings Roads*.

9 Cyclist crossings

9.1 Introduction

Addition

For more information in relation to cyclist crossings refer to the Transport and Main Roads website via https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Cycling-guidelines.

10 Rail crossings

10.1 General

Addition

In addition, special precautions are required to ensure that green traffic signal aspects are not visible across the level crossing at the same time as the flashing red rail signals, commonly referred to as the 'see-through' effect. Similarly, the positioning, screening and aiming of the vehicle lanterns must be arranged to ensure that traffic signals do not cause confusion to train drivers.

ALCAM is not mandated for application at rail level crossings in Queensland but is used almost exclusively by the major rail operators. It is used to prioritise upgrades to existing level crossings and to determine the crossing treatments to be applied at new crossings. It is therefore generally the rail authority who is responsible for determining whether passive or active control is used or if the crossing is grade separated.

10.2 Sight distance

Addition

Where a crossing is located on a side road only a short distance from the through road, the vehicle speeds at the crossing location will be relatively low and therefore the sight distance requirements will be reduced. In this case the operating speed at the crossing location should be determined by applying the vehicle acceleration/deceleration models respectively on the two approaches to the crossing.

Motorists who drive slower than the 85th percentile speed will be closer to the railway line at the time they need to detect an approaching train. It follows that the visibility angle for slower drivers will therefore be increased. It is therefore necessary to check that for the 15th percentile (taken as 0.75 times the 85th percentile speed) road speed, visibility angles are within the prescribed limits.

References

Transport and Main Roads publication references refer to the latest published document on the departmental website (www.tmr.qld.gov.au).

Addition

Arndt O.K and Troutbeck R.J. (2001). *Relationship between Unsignalised Intersection Geometry and accident rates – a literature review*, Road and Transport Research, Volume 10, No. 3, ARRB Transport Research Ltd, Victoria.

Austroads *Guide to Road Design – Part 3 – Geometric Design*, Sydney, NSW

Austroads *Guide to Road Design - Part 4, Intersections and Crossings - General*, Austroads, Sydney, NSW

Austroads *Guide to Road Design – Part 4A – Unsignalised and Signalised Intersections*, Sydney, NSW

Austroads *Guide to Road Design – Part 6 – Roadside Design, Safety and Barriers*, Sydney, NSW

Austroads *Guide to Traffic Management - Part 6, Intersections, Interchanges and Crossings*, Austroads, Sydney, NSW

Cox, R.L. (1987). *Swept Paths of Vehicles for Complex Turns*, 20th Divisional Draftman's Conference Minutes, Main Roads Department, Brisbane

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Transport and Main Roads Guideline *Selection and Design of Cycle Tracks*, Brisbane, QLD

Transport and Main Roads *Guidelines for Cyclists and Pedestrians* https://www.tmr.qld.gov.au/business-industry/Technical-standards-publications/Cycling-guidelines

Transport and Main Roads *Manual of Uniform Traffic Control Devices* (MUTCD), Brisbane, QLD

Transport and Main Roads *Queensland Road Rules*, Brisbane, QLD

Transport and Main Roads *Road Landscape Manual*, Brisbane, QLD

Transport and Main Roads *Road Planning and Design Manual* (RPDM), Brisbane, QLD

Transport and Main Roads *Roadside Advertising Manual*, Brisbane, QLD

Transport and Main Roads *Route Assessment for Multi-Combination Vehicles (MCV) and Performance Based Standards (PBS) Vehicles in Queensland Guideline*, Brisbane, QLD

Transport and Main Roads *Standard Drawings Roads*, Brisbane, QLD

Transport and Main Roads *Traffic and Road Use Management Manual* (TRUM), Brisbane, QLD

Appendix A – Intersections – General

A.5 Auxiliary lanes

A.5.3 Rural auxiliary lane (AU) turn treatments

There is no equivalent Section A.5.3 in *Austroads Guide to Road Design – Part 4*.

New

Auxiliary Right Turn Lane (AUR) treatments are not to be constructed at new intersections and existing AURs are to be replaced with at least a CHR(s).

A.5.4 Channelised turn treatments (Type CH)

There is no equivalent Section A.5.4 in *Austroads Guide to Road Design – Part 4*.

New

Channelisation has particular application in the following areas:

- Intersections at odd angles (Y-junctions, skewed cross roads), or multi-leg intersections (generally only appropriate if the intersection is realigned and/or if traffic signal control is used).
- Sites where turning traffic movements are particularly heavy.
- Locations where the safety record of an intersection is shown to be susceptible to particular accident types, such as opposing side swipe and head on crashes, right-turn opposing, and high-speed rear end collisions.
- Sites where a refuge area for pedestrians is desirable, and
- Sites where unusual manoeuvres are occurring, or where unwanted movements are to be eliminated. A channelised layout may be the only solution appropriate at some sites. These include some multi-lane divided roads, and sites where it is necessary to provide positive protection of the furniture (signs, traffic signal posts, etc.) associated with the form of traffic control adopted.

The associated furniture (particularly raised medians) can be regarded as a hazard, which means that the increased risk must be clearly outweighed by other advantages.

All channelised intersections with raised medians and kerbed islands must be lit in accordance with the standards set out in Volume 6 of the RPDM.

Channelised intersections always require good sight distance to the starting point of the median (especially raised). The median or island may have to be extended to meet this requirement. A few large islands are always preferable to a large number of small islands.

Drainage of raised medians and islands can be expensive. Regular sweeping may be necessary.

Where traffic volumes are high, the number of approach lanes, including auxiliary lanes, will increase and channelisation (in some form) becomes inevitable. Preliminary, approach lane requirements may be assessed using the techniques outlined in *Austroads Guide to Traffic Management - Part 3*. Detailed design requirements for medians and islands are given in Section 6 of the RPDM and of *Austroads Guide to Road Design – Part 4A*. As urban channelised intersections are often controlled by traffic signals, the possibility of this form of control should be established early in the process so that appropriate provision can be made.

CHR turn treatments record much lower crash rates than BAR and AUR turn treatments but are not significantly different than CHR(s) treatments. CHL treatments record a slightly higher crash rate than BAL treatments but the increase is not significant.

Therefore, warrants for CHL turn treatments should not be selected on the basis of safety. Instead, they may be justified by circumstances such as:

- Improving capacity and delays at the intersection.
- Improving safety for other conflict types. CHL treatments on the major road may provide greater visibility for drivers on the minor road as per the example at Section 8.6 of this supplement.
- Providing a bypass facility (slip lane) for left-turning vehicles at traffic signals. In areas where there is a pedestrian demand, unsignalised left turn slip lanes should be avoided at signalised intersections. A slip lane should either be signalised or have a wombat crossing (raised zebra crossing) provided in these instances, or an alternative treatment to the slip lane considered – refer to Transport and Main Roads Guideline *Selection and Design of Cycle Tracks*.
- Changing the give way rule in favour of other manoeuvres at the intersection.
- Defining more appropriately the driving path by reducing the area of bitumen surfacing, especially at skewed intersections catering for large and over dimensional vehicles.

A.5.5 Urban channelised (CH) turn treatments

There is no equivalent Section A.5.5 in *Austroads Guide to Road Design – Part 4*.

New

Unsignalised left turn slip lanes should generally be avoided at signalised intersections. If a slip lane is deemed necessary, it should be signalised with pedestrian protection. For existing situations an acceptable alternative may be to install a wombat crossing on the slip lane.

A.5.6 Warrants for BA, AU and CH turn treatments

There is no equivalent Section A.5.6 in *Austroads Guide to Road Design – Part 4*.

New

Warrants for turn treatments are described in Section 3.3.6 of *Austroads Guide to Traffic Management – Part 6* subject with the following additions.

Many lower-order existing intersections on two-lane, two-way roads have historically been constructed without any widening and do not meet the minimum design layout for a BAR/BAL. These intersections are referred to as Simple Right (SR) and Simple Left (SL) intersections.

The warrants shown in *Austroads Guide to Traffic Management – Part 6* are for greenfield sites (i.e. new intersections on new roads). These warrants are to be applied as Normal Design Domain (NDD) for the selection of the preferred intersection type at any intersection. The warrants provide guidance on where a full-length deceleration lane must be used, and where a shorter lane, AUL(s) and CHR(s), may be acceptable based on traffic volume.

At intersections on Two-Lane Two-Way roads (2L2W) the minimum turn treatment shall be a BAR/BAL. SR/SL intersections types are not to be constructed at new intersections on new roads. The preferred minimum intersection turn treatment on major roads and highways is a CHR(s)/AUL(s) due to the combination of operational and safety issues.

Where a high volume of left turning traffic is present on high speed rural roads, sight lines must not be obscured for traffic entering from the minor road. Depending on sight lines and traffic volumes, left turn lanes may need to be repositioned or channelised – see Section 8.2.6.

Auxiliary Right Turn Lane (AUR) treatments are not to be constructed at new intersections and existing AURs are to be replaced with at least a CHR(s).

On 4-Lane 2 Way (4L2W) and 6-Lane 2-Way (6L2W) roads the minimum turn treatment shall be a CHR(s)/BAL. At new four and six lane roads, it is preferred practice that a median of sufficient width would be included to accommodate a CHR(s) or CHR treatment at every intersection allowing a right turn from the major road.

An EDD version of these warrants for potential application at constrained and brownfields sites is provided at Appendix A.10 of the RPDM*, Supplement to Austroads Guide to Road Design – Part 4A*. Further commentary on the methodology behind these warrants is provided at Commentary 6 of that document.

A.7 Right-turn treatments – layout design details

A.7.1 Introduction

Addition

Motorcycle and cyclist risks should also be considered in determining the preferred layout for right turns at a site. These road users are more difficult to see and when stopped waiting to turn right from the major road are at increased risk of rear end crashes. There is also likely to be an increased risk of motorcyclists and cyclists accepting smaller gaps in traffic due to the perceived risk of rear end crashes.

Locations with a crash history involving motorcyclists / cyclists or in areas with higher proportion of motorcycle / cyclist traffic should consider the CHR treatment to provide additional protection to vehicles making the right turn movement.

A.7.4 Right-turn lanes for cyclists

Addition

Right-turn lanes for cyclists are generally not provided where a cyclist would need to cross two or more lanes to access the facility. In this case a hook turn storage box may be provided to accommodate the right turn for cyclists (refer to *Austroads Guide to Road Design – Part 4*, Appendix B, Section B.6.2 for further details on hook turns).

A.8 Left-turn treatments

A.8.1 General

Provision for cyclists at rural free flow left-turn lanes on bicycle routes

Addition

Slip resistant chevrons without RRPM's would help to advise cyclists that a potential hazard is approaching (the added lane in this case) whilst minimising the hazard from the surface if a cyclist does not use the detour for some reason.

A.8.2 Urban left turn treatments

Urban basic left-turn treatment (BAL)

Addition

Unsignalised left turn slip lanes should generally be avoided at signalised intersections. If a slip lane is deemed necessary, it should be signalised with pedestrian protection. For existing situations an acceptable alternative may be to install a wombat crossing on the slip lane.

Where a left turn is not permitted, a minimum kerb return radius of at least 0.5 m is to be designed. A right-angle in the kerb line is generally unacceptable, even in these circumstances as the arris is so prone to damage.

Where a left-turn is permitted, the minimum kerb return radius without a corner cut-off (which interferes with the adjoining property) is equal to the footway width provided. Such an arrangement is appropriate for cars and the occasional Single Unit truck (such as the garbage truck) provided that there is sufficient pavement width available for the turning path.

This arrangement can be used for the left-turn out of a local street into local and collector roads, especially if one-way conditions apply.

However, this layout is generally not acceptable at sub-arterial and arterial intersections. At such sites there may be a need to accommodate heavy vehicle turning movements. Appropriate arrangements are shown in Figures A 15 and A 16 of *Austroads Guide to Road Design – Part 4*.

For left turn movements from the major road to the minor road it is preferable to provide a widened area using part of a parking lane and providing a parking limit.

Provision for cyclists at urban channelised treatments

Addition

Treatment options for left-turn lanes include:

- a crossing treatment close to the island gore, or
- a weave right transition.

A multi-lane left-turn roadway requires a signalised pedestrian crossing. In this case the associated provision of a bicycle crossing lantern with the pedestrian signals would be preferred over the weave right transition.

A.10 Wide median treatment

There is no equivalent Section A.10 in *Austroads Guide to Road Design – Part 4*.

New

Wide Median Treatments, even in isolated locations, can be confusing with drivers mistaking the intersection for a roundabout. This can potentially lead to hazardous situations where traffic travelling across the median (right turning traffic from the major road and through / right traffic from the minor road) may fail to give way to through traffic on the opposing major road. In these cases, designers should consider additional measures to further alert drivers that the wide median treatment is not a roundabout. These measures may include additional and larger signage, particularly at the give way lines within the median treatment.

Appendix B – Signalised intersections

Addition

See also Transport and Main Roads RPDM supplement to *Austroads Guide to Road Design – Part 4A*, Section 9.

B.2 Signal operation considerations

B.2.1 Traffic operation at an intersection

Addition

Complex intersections, such as fast diamonds, require additional consideration to ensure safe operation is maintained. Additional signal aspect redundancy ensures that drivers can see multiple operational traffic signals. The safety consequences may be high at these types of intersections when individual traffic signal aspects fail.

B.3 Intersection layouts

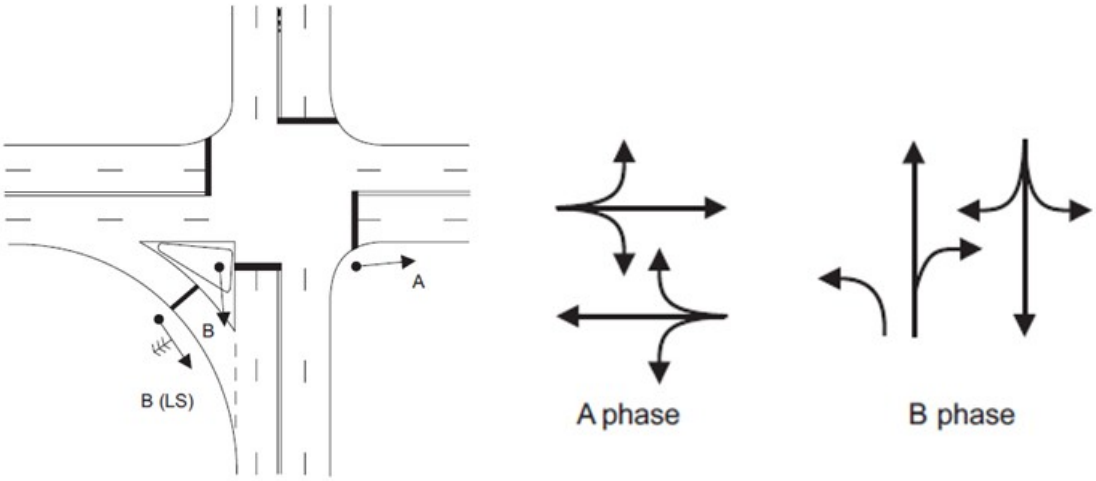
B.3.1 General

Addition

The following guidance applies to signalised intersections:

- The layout of the intersection should provide for the optimum location of traffic signal hardware and appropriate clearance to this hardware. Median widths must be large enough to store traffic signal equipment.
- While appropriately balancing the needs of other geometric parameters, the distance that vehicle and pedestrian movements need to travel from the stop line to clear the intersection should be minimised. Longer distances require longer inter-green times to safely allow these movements to clear the intersection and thereby reduce the intersection capacity.
- Where it is desirable to use diamond phasing, appropriate clearance should be provided between right-turning movements (Refer to *Austroads Guide to Traffic Management – Part 6*).
- A late start interval may be used to delay the introduction of a green signal group at a controlled left-turn slip lane where there is a large corner island (instead of increasing the clearance interval for the entire signal group). This allows vehicles to clear the conflict area before the left-turn is introduced. Refer to Figure 4-B 1 below.

Figure 4-B 1 – Late start for large corner islands



- Medians and islands
  - Refer to Table 4-B 1 below. The absolute minimum width of raised medians for two stage pedestrian mid-block crossings of 2.5 m is needed to store pedestrians; refer to Volume 3, Part 4, Section 8.2.2 of the RPDM.
  - The use of wide medians reduces intersection capability because of increased clearance times for vehicle and pedestrian movements. For intersections with wide medians, consider staging pedestrian movements. Also, wide medians may cause the problem of interlocking opposing right-turn vehicles and therefore should be avoided.

Table 4-B 1 – Minimum widths of raised medians

Situation	Desirable (m)	Absolute (m)
No posts	1.2	0.9
Post with single 200 mm lanterns	2.4	1.2
Post with dual 200 mm lanterns	2.4	1.5
Two stage mid-block pedestrian crossing	4.0	2.5

B.3.2 Service road treatments

Addition

As an alternative to the treatments shown in Figure B.3 of the *Austroads Guide to Road Design – Part 4*, if space is available, the service road can be 'bulbed' to intersect the cross road at a distance from the intersection sufficient to form a separate intersection. This distance should be longer than the expected queue at the intersection or a minimum of 20 m (allows a semi-trailer to do a U-turn between inside lanes).

B.5 Pedestrian treatments

B.5.1 Pedestrian crossings

Addition

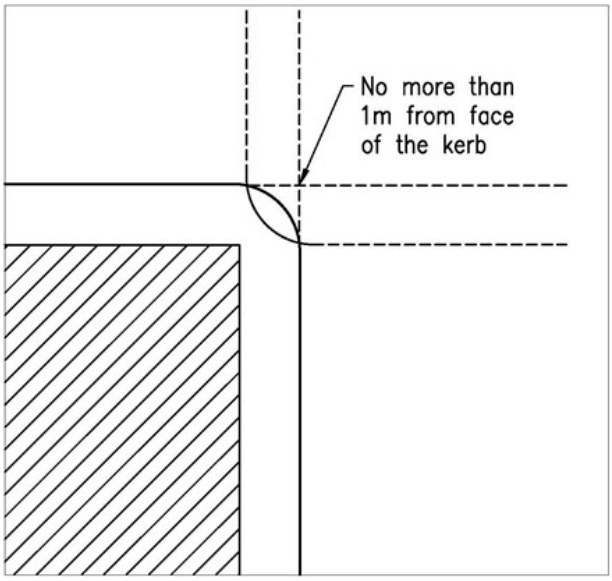
Pedestrian crossings on all intersection legs

The department's default position is that pedestrian crossings are to be provided on all approaches at signalised intersections. Where turning vehicles can conflict with a pedestrian movement, pedestrian protection shall be provided by delaying the start of the vehicle movements. The length of the delayed start will depend on the type of pedestrians using the crossing, the flow of pedestrians and the flow of the conflicting vehicles. However, a minimum of four seconds is required to allow pedestrians to establish themselves on the crossing before vehicle movements begin.

Intersection of pedestrian crossings

Where two pedestrian crossings meet, the intersection point of the outside edges should be no more than 1 m from the face of the kerb. This is to minimise conflicts by pedestrians in separate phases and to deter pedestrians from waiting on the road pavement. Refer to Figure 4-B 2.

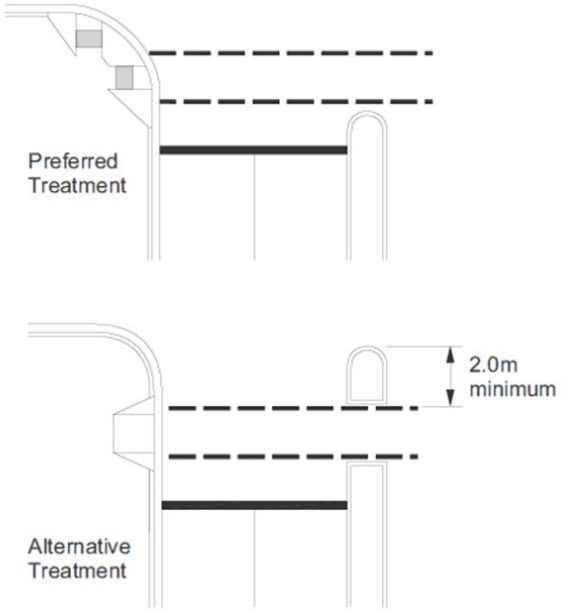
Figure 4-B 2 – Intersection of pedestrian crossings



Median islands

When a pedestrian crossing is provided, the median should preferably terminate at the crossing unless a gap in the median as wide as the crossing is provided and the median continued for at least 2 m beyond the crossing. Refer to Figure 4-B 3 below.

Figure 4-B 3 – Treatment of pedestrian crossings



Pedestrian crossing of a left-turn slip lane

Guidance regarding the selection of treatments to minimise the consequences of a possible pedestrian / vehicle conflict with turning vehicles can be found in the *Queensland Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management*.

B.6 Cyclist facilities at signalised intersections

Addition

Detector loops

Where a bicycle lane is to be retrofitted through an existing signalised intersection the position of existing detector loops is to be established. Reinstallation of the loops may be required depending on the proposed lateral shift of traffic lanes induced by the bicycle lane.

Bicycle lane widths

The width of stand up lanes at signalised intersections are to be as required by the speed environment, in accordance with Table 4.17 of *Austroads Guide to Road Design – Part 3*.

Head start and bicycle storage areas

Use of head start and bicycle storage areas should to be considered when upgrading or retrofitting signalised intersections. Bicycle storage areas should be considered where there is a signal controlled left-turn lane, coupled with high volumes of left-turning vehicles, buses or heavy vehicles.

Head start areas across multiple lanes as shown in Figure B 12(d) of *Austroads Guide to Road Design – Part 4* are not to be used in Queensland on state controlled roads.

Right-turn bicycle lanes

Where right-turn bicycle lanes are provided, it is assumed that alternative paths through the intersection will be provided for younger and less experienced cyclists. It is considered that bicycle hook turns and/or bicycle crossing signals would cater for less experienced cyclists.

Bicycle paths

Where a bicycle path forms one of the arms of a signalised junction, loop detectors, provided sufficiently in advance, can trigger the appropriate phase at the signals with minimal delay to a cyclist using the path.

Inter-green times

On particularly long intersections (e.g. single point diamond) a check of inter-green time should be made to ensure an on-road cyclist can clear the intersection.

Notes to Figure B 12 of *Austroads Guide to Road Design – Part 4:*

- LHS = 3 m minimum, 4 m to 5 m desirable.
- Treatment (b): The left-turn phase must occur at the same times at the through traffic phase to avoid conflicts between left turning vehicles and cyclists stopped in the storage box.
- Treatment (d): Hook turns can be completed by cyclists at any intersection unless otherwise signed. The painted hook turn storage box is intended to make cyclists aware of the alternative right-turn method available and indicate the appropriate location to wait. Installation of a painted hook turn storage box is recommended where cyclists would need to cross two or more through traffic lanes to access a right-turn lane. Installation of a bicycle detection loop under the painted hook turn storage area should be considered if the side street signal phase is only activated on demand and it is estimated that a cyclist could have a lengthy wait before a vehicle would arrive to activate the side street the phase. For hook turns to work effectively the traffic signal phase should progress clockwise around the intersection.
- Treatment (d): Head start/bicycle storage areas across multiple traffic lanes are not recommended. The provision of head start/bicycle storage box areas with multiple traffic lanes may result in some cyclists crossing in front of lanes at the commencement of the green phase, causing potential safety problems (particularly when it is possible for visibility of cyclists to be obscured by large vehicles). Head start/bicycle storage areas may also allow for an early release bicycle phase if required (only to be used as defined in *Austroads Guide to Road Design - Part 4*, in low speed areas).

Appendix G – Extended design domain for two stage mid-block crossing

There is no equivalent Appendix G in *Austroads Guide to Road Design – Part 4*.

New

Staged pedestrian crossings of a road can be accommodated with medians as narrow as 2.0 m. In these circumstances the sight distance parameters, road design and nearby intersections shall all meet NDD design criteria.

Figure 4-G 1 – Two stage mid-block crossing (LH Offset)