

Armidale

Regional Council

ENGINEERING DESIGN CODE SPECIFICATION D1

GEOMETRIC ROAD DESIGN (Urban and Rural)

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DESIGN SPECIFICATION D1 GEOMETRIC ROAD DESIGN (Urban and Rural)

GENERAL

D1.01 SCOPE

1. This section sets out the specifications developed specifically for the design of subdivision, public and private (driveway) roadworks using principles of street design to ensure safety and improved amenity and to reduce pedestrian/vehicular conflicts.

*Subdivision
Roadworks*

2. A fundamental requirement of the design process is for designers to determine the vehicle speed which is deemed acceptable for a particular subdivision or section of road. The concept of designing to regulatory street speeds is contrary to the current principles of subdivision road design.

*Acceptable
Vehicle Speed*

3. All relevant design principles must be integrated in the development of the road network. A careful balance is required between maximising amenity, safety and convenience considerations and those related to the drivers' perception of driving practice.

*Integrated
Design
Principles*

4. The words "street" and "road" are interchangeable throughout all parts of this Specification.

5. For the purpose of this Specification the definition of terms used to define the components of the road reserve shall be in accordance with AS 1348.1 and AMCORD.

*Road Reserve
Component
Definitions*

AS 1348.1 terms:

- | | |
|-------------|---|
| Carriageway | - That portion of the road or bridge devoted particularly to the use of vehicles, inclusive of shoulders and auxiliary lanes. |
| Footpath | - The paved section of a pathway (verge). |
| Pathway | - A public way reserved for the movement of pedestrians and of manually propelled vehicles (AMCORD verge). |
| Pavement | - That portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic. |
| Shoulder | - The portion of the carriageway beyond the traffic lanes and contiguous and flush with the surface of the pavement. |

AMCORD term:

- | | |
|--------|---|
| Verge: | - That part of the road reserve between the carriageway and the road reserve boundary. It may accommodate public utilities, footpaths, stormwater flows, street lighting poles and plantings. |
|--------|---|

D1.02 AIMS

1. The provision of a road system within a subdivision is to be designed so as to achieve the following aims:

- Provide convenient and safe access to all allotments for pedestrians, vehicles and cyclists.

- Provide safe, logical and hierarchical transport linkages with existing street system.
- Provide appropriate access for buses, emergency and service vehicles.
- Provide for a quality product that minimises maintenance costs.
- Provide a convenient way for public utilities.
- Provide an opportunity for street landscaping.
- Provide convenient parking for visitors.
- Have appropriate regard for the climate, geology and topography of the area.

D1.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Documents

Local Environmental Plan (LEP) - current
 Development Control Plan - current
 All Specifications for Design and Construction..

(b) Australian Standards

AS 1348.1	-	Road and traffic engineering – Glossary of terms, Road design and construction.
AS 1428	-	Design For Access and Mobility.
AS 2890	-	Parking facilities - all parts.
AS 1158	-	Road Lighting - all parts.
AS 3845	-	Road Safety Barrier Systems.
SAA HB69.14	-	Guide to traffic engineering practice - Bicycles.
AS/NZS 3845	-	Road safety barrier systems.
AS1100.401	-	Technical Drawing Engineering Survey and Engineering Survey Design

(c) State Authorities

Roads and Maritime Services (RMS) NSW - Road Design Guide (formerly RTA).
 - Guide to Traffic Generating Developments
 Department of Housing - Road Manual, 1987.
 Department of Urban Affairs (formerly Environment) and Planning - Technical Bulletin 12
 (1981), Residential Road Widths.
 NSW Police – Safer By Design

(d) Other

AUSTROADS	Guide to Road Design (AGRD) - all parts Guide to Road Safety (AGRS) - all parts Guide to Road Transport Planning (AGRTP) Cycling Aspects Of Austroads Guides Guide to Traffic Management (AGTM) - all parts RMS amendments to Austroads Guidelines - RMS website
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The Institute of Municipal Engineering Australia, Qld Division - 1993: Design Guidelines for Subdivisional Street works.

ARRB Special Report No. 33, L E Comerford: A Review of Subdivision Road Design Criteria.

Commonwealth Department of Housing and Regional Development – 1995: Australian Model Code for Residential Development. (AMCORD). A National Resource Document for Residential Development.

Stapleton, C 1984: Streets Where We Live – A Manual for the Design of Safer Residential Estates.

Stapleton, C 1988, Dept of Transport South Australia: Planning & Road Design for New Residential Subdivisions.

Brindle, R 1988, ARRB: Planning & Design of the Local Distributor.

Colman, J 1978, ARRB: Streets for Living.

Pak-Poy Kneebone – 1989: Research Study into Road Characteristics for Residential Development.

D1.04 CONSULTATION

1. Designers are encouraged to consult with the Council and other relevant authorities prior to or during the preparation of design. Designers should, in addition to requirements of this Specification, ascertain specific requirements of these authorities as they relate to the designs in hand.

Council, Other Authorities

2. Public consultation on designs shall be provided where such action is required by Council's current policy.

Public Consultation

3. The Designer shall obtain service plans from all relevant public utility authorities and organisations whose services may exist within the area of the proposed development. These services are to be plotted on the relevant drawings including the plan and cross-sectional views.

Public Utilities

D1.05 PLANNING CONCEPTS

1. In new areas (as distinct from established areas with a pre-existing road pattern) each class of route should reflect its role in the road hierarchy by its visual appearance and related physical design standards. Routes should differ in alignment and design standard according to the volume of traffic they are intended to carry, the desirable traffic speed, and other factors.

Road Hierarchy

2. The road pattern and width must be in conformity with that shown on any relevant Development Control Plan. In areas not covered by these plans, the pattern and width(s) will be determined by Council on their merits.

Conformance with DCP

3. The road network for residential developments should have clear legibility.

Legibility

4. The road network should reinforce legibility by providing sufficient differentiation between the road functions.

Differentiation

5. Distinct landmark features such as watercourses, mature vegetation or ridge lines should be emphasised within the structural layout so as to enhance the legibility.

Landmark Features

6. Whilst legibility can be enhanced by introduced physical features such as pavement and lighting details, the road network should by its inherent design and functional distinction provide the necessary legibility.

Introduced Features

7. The maximum number of turning movements at intersections or junctions that a driver should be required to undertake to reach a particular address within the development should be minimised.

Intersection Turning Movements

8. There will be special constraints and costs associated with the design of roads through or adjacent to land known to be salt affected. Early planning shall consider avoiding detrimental interference with land known to be salt affected. Adjustments in horizontal and vertical line shall be considered to avoid recharge of subsurface water within or adjacent to the road reserve. Consultation with the relevant land and water resource authority shall be mandatory under the above circumstances.

Salinity Prevention, Early Planning, Mandatory Consultation

9. Appropriate native deep-rooted species should be selected for plantings in association with road reserve works. Plantations should be of sufficient size and density, multiple row belts and relatively close spacings are recommended, to be effective in their desired role of lowering the groundwater table.

Landscaping, Salinity Prevention

D1.06 DRAWING REQUIREMENTS

(a) Preferred Reduction Ratios

1. In general, all plans for urban design are to be reduced to 1:500. Rural designs may be reduced to 1:1000. In circumstances where very short sections of road are encountered in design, plans may be reduced to a scale of 1:200.

	Urban	Rural
Longitudinal Sections	1:500 H	1:1000 H
	1:50V	1:100V
Cross Sections	1:100 Natural	1: 100 Natural
	1:200 Natural where large	1:200 Natural where large
Intersections	1:200 and Contoured	1: 200 and Contoured
Cross section intervals	Every 10 to 20m	Every 20 to 50m

(b) Drawing Sheets

1. Separate sheets should be provided for but are not limited to:
 - a. Cover sheets
 - b. Plan views
 - c. Longitudinal sections
 - d. Cross sections
 - e. Structural details where applicable
 - f. Standard drawings (referenced but not necessary to reproduce as hard copy)
 - g. Erosion and sediment control plan

(c) Drawing Presentation

1. Drawings are to be presented on A3 sheets unless otherwise authorised. They are to be clear and legible and prepared in consistent lettering and style and shall be in accordance with AS1100.401. Council has the authority to refuse drawings that do not meet these drafting requirements. Drawings copied from other works will not be accepted. All drawings shall be clearly referenced with notations and tables as appropriate. The Designer should always be mindful that apart from being a permanent record and legal document, drawings should be easily read and understood by the Contractor, and others involved in the construction of the Works. Terminology should be kept in 'plain English' where possible.

Clear and Legible, Permanent Record, Legal Document

2. The scope and sequence of drawing sheets shall comply with the example provided in Annexure [DQS-B](#) of the Specification for [QUALITY ASSURANCE REQUIREMENTS FOR DESIGN](#).

Compliance

(d) Certification

1. Drawings shall bear the signature of the design consultant and shall, where required by the Council, be certified as complying with the appropriate design specifications (D1 to D12). The certificate shall be in the format detailed in Annexure DQS-A of the Specification for QUALITY ASSURANCE REQUIREMENTS FOR DESIGN.

Design Consultant

(e) Certification

1. All design drawings shall reflect the road chainages used by Council on designs for existing roads.

Council Road Chainages

URBAN DESIGN CRITERIA

D1.07 ROAD HIERARCHY

1. A hierarchical road network is essential to maximise road safety, residential amenity and legibility. Each class of road in the network serves a distinct set of functions and is designed accordingly. The design should convey to motorists the predominant function of the road. A typical hierarchy is shown on Figure D1.1.

Functionality

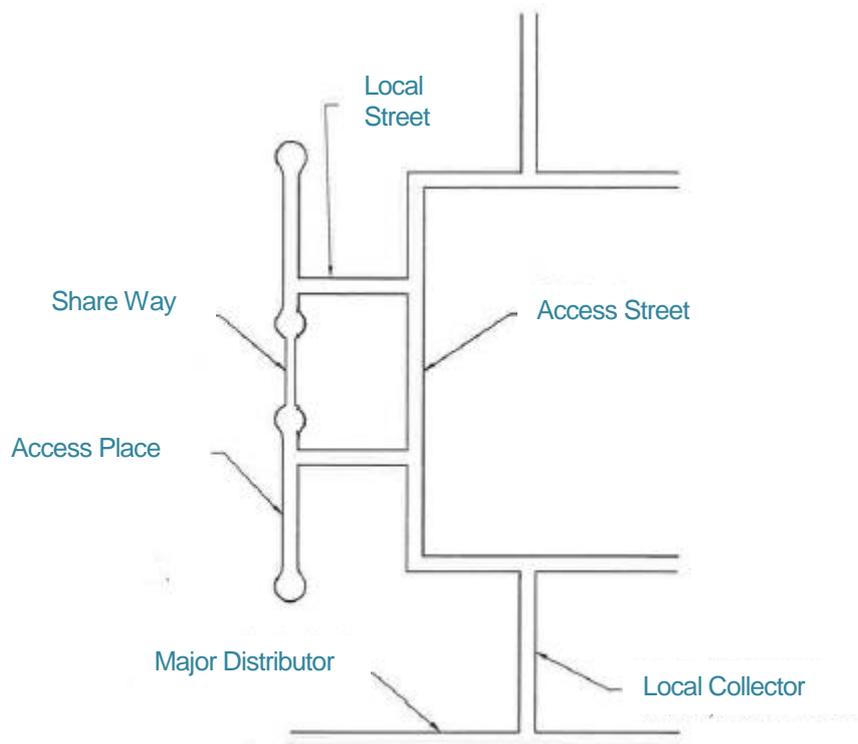


Figure D1.1 - Typical Road Hierarchy

2. The levels of roads are (Refer DCP 2012 S3, Ch3.1, Table 2) :

Road Hierarchy

- Share way – As approved by Council, refer NSW Police Safer By Design
- Access Place / Cul-de-sac
- Minor Access or Local Street
- Access Street
- Local Collector
- Minor or Major Distributor

Emergency Access

Provide at least two emergency access routes for each street type in all subdivisions.

Emergency Access

Traffic calming

Provide calming geometry to conform with Austroads Design Guides.

Share way (As approved by Council)

A minor street which carries the lowest volume of traffic, providing driveway access to no more than 3 lots on each side and forming a link between two access places. Vehicles, pedestrians and recreation uses are shared, with design to encourage priority for pedestrians.

3. The Access Place / Cul-de-sac has as its primary function, residential space - amenity features which facilitates pedestrian and cycle movements, and where vehicular traffic is subservient in terms of speed and volume, to those elements of space, amenity, pedestrians and cyclists. The features of a typical access place are shown in Figure D1.2.

Access Place / Cul-de-sac

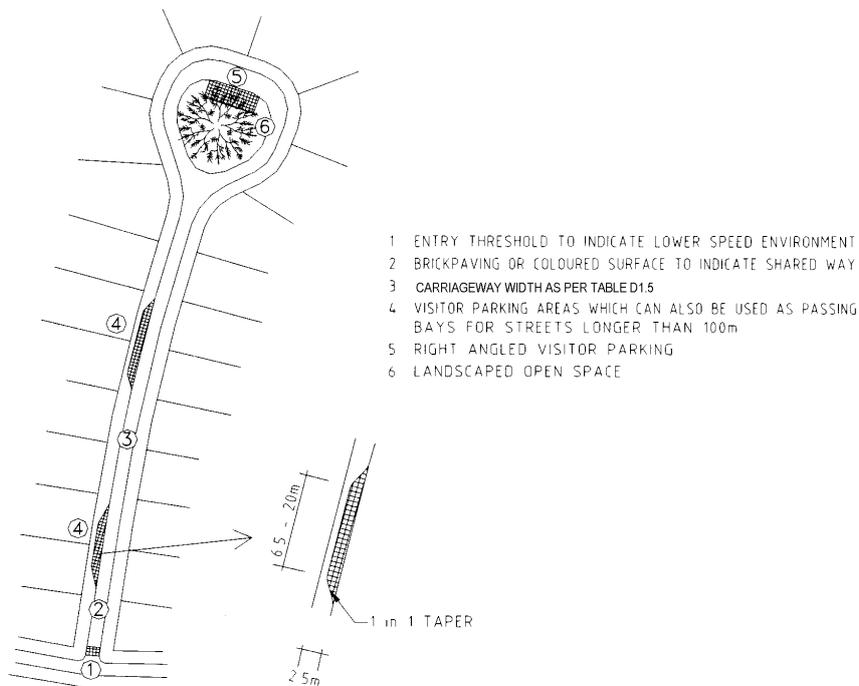
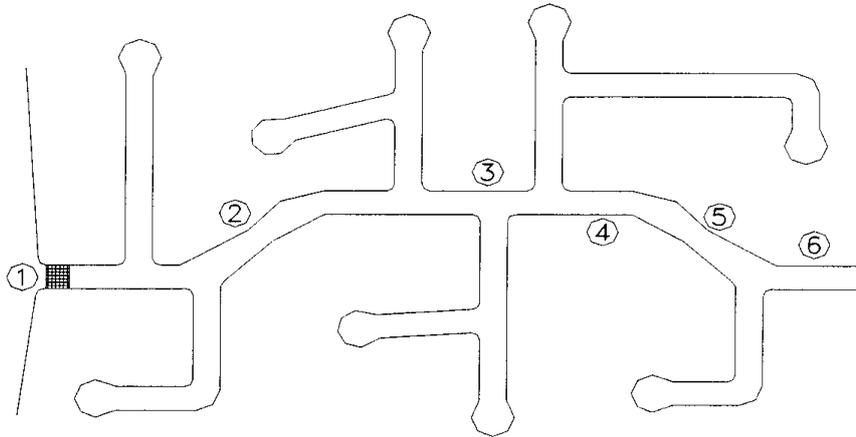


Figure D1.2 - Access Place / Cul-de-sac

4. The Minor Access or Local street should provide a balance between the status of that street in terms of its access and residential amenity functions. Resident safety and amenity are dominant but to a lesser degree than access streets. Refer Figure D1.3.

Minor Access or Local Street



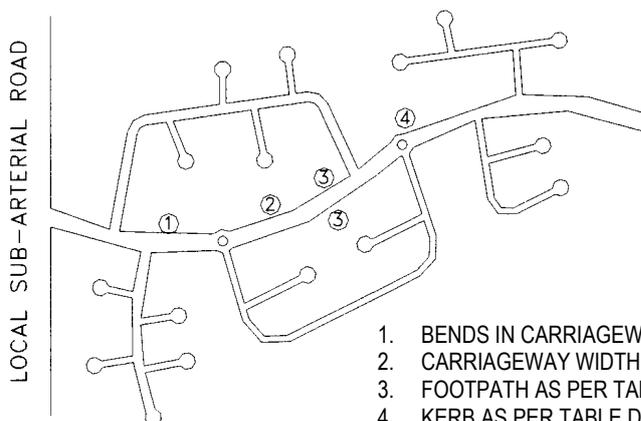
- 1 Entry threshold (as approved by Council) signifies entry to lower speed environment
- 2 Bends in carriageway control speed
- 3 Short sections of straight carriageway control speed
- 4 Carriageway width as per table d1.5
- 5 Footpath on one side as per table d1.5
- 6 Kerb as per table d1.5

Figure D1.3 - Minor Access or Local Street

5. The Access Street has a residential function but also carries higher volumes of traffic collected from lower order streets. A reasonable level of residential amenity and safety is maintained by restricting traffic volumes and speeds, however, amenity and resident safety do not have the same priority as access or local streets. A typical collector street is shown in Figure D1.4.

Access Street

- * MAXIMUM VOLUME 3000 VPD
- * MAXIMUM SPEED 50 km/h
- * CARRIAGEWAY SHARED BY VEHICLES AND CYCLISTS
- * AS A CUL-DE-SAC ARRANGEMENT SERVES APPROXIMATELY 16 Ho



- 1. BENDS IN CARRIAGEWAY CONTROL SPEED
- 2. CARRIAGEWAY WIDTH AS TABLE D1.5
- 3. FOOTPATH AS PER TABLE D1.5
- 4. KERB AS PER TABLE D1.5

Figure D1.4 - Access Street

6. The Local Collector within a residential development should have as its main function the convenient and safe distribution of traffic generated by the development. Direct access should not be provided for single dwelling allotments but access can be provided to multi-unit developments and non-residential land uses. The Minor Distributor should serve only the development and should not attract through traffic. Figure D1.5 shows the layout of a Local Collector and Minor Distributor road in an urban area.
7. Table D1.6 on page D1-32 provides the standards to be adopted for a variety of road types and LEP zones and Fig D1.7a, Fig D1.7b and Fig D1.7c illustrate several road cross sections for typical road design situations.

Local Collector

Road Design Standards

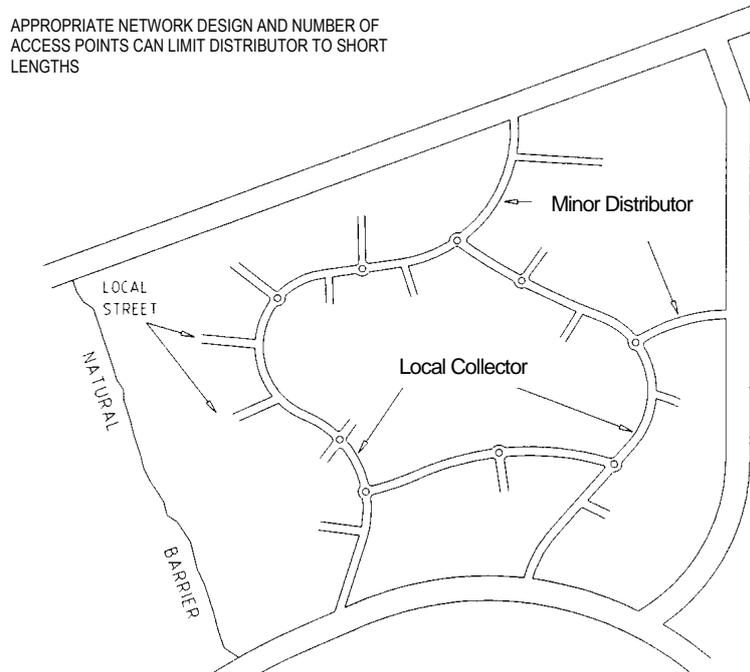


Figure D1.5 - Local Collector and Minor Distributor

D1.08 ROAD NETWORK

1. The design features of each type of road convey to the driver its primary functions and encourage appropriate driver behaviour (refer Figure D1.2 to D1.5). Fig
2. Traffic volumes and speeds on any road should be compatible with the residential functions of that road.
3. The maximum length of an access place should ensure its status as a residential place is retained, where the traffic, in terms of speed and volume will enable the integration of pedestrian, bicycle and vehicular movements. This length will also ensure that residential convenience is not unduly impaired as a result of speed restraints.
4. The length of Minor Distributor within a development should be minimised.
5. The time required for drivers to travel on all streets within the development should be minimised.
6. Where access places form part of a pedestrian or bicycle network, access links should provide suitable connectivity with adjoining access places or open space systems so as to ensure such pedestrian and bicycle network are functionally efficient.

Compatibility

Access Place / Cul-de-sac

Minor Distributor

Travel Time

Pedestrian or Bicycle Network

7. The road network should ensure that no road links with another road which is more than two levels higher or lower in the hierarchy. In exceptional circumstances roads may link with others that are more than two levels apart, however, no access place or local street should have access to an access-controlled Major Distributor road.

Road Links

8. Connections between internal roads should be T-junctions or controlled by roundabouts. The spacing of T- junctions shall be in accordance with Chapter 7 of Austroads Guide to Road Design Part 4A: Unsignalised Intersections.

Internal Road Connections

9. The road layout should conform to the requirements of the external road network and satisfy the transport provisions of an outline development plan.

Transport Provisions

10. The external road network should be designed and located to provide routes which are more convenient for potential through traffic within the network. Major roads should be provided at intervals of no more than 1.5 km and should be complete and of adequate capacity to accommodate through network movements. The internal road system should not provide through routes that are more convenient than the external road network.

External Road Network

11. Subdivision and development proposals are to show the proposed hierarchy on the design drawings as well as in the Traffic Impact Study. When preparing a road hierarchy plan for a proposed subdivision or development, consideration shall be given to the function of the road network within the entire road network, the expected traffic volume and the connection with the adjacent road network.

Hierarchy & Traffic Impact Study

12. The road category to be adopted and formation widths to be used for design purposes will be approved by Council following submission of a detailed analysis of the proposed site, the design traffic and the nature and function of the subdivision or development. The adopted road category and width shall apply to the entire length of the road, and progressive widening or narrowing of a road through intersections or development stages will not be permitted.

Adopted Road Category

13. When calculating the proposed category or function of a road, designers must consider the ultimate number of lots serviced by the road when all potential stages of development and subdivision are complete. Consultation with Council regarding the ultimate function of the road may be necessary.

Consultation

14. It is the designers' responsibility to ensure that road reserve widths are sufficient to accommodate all road and ancillary services and utilities that are required to be located within the reserve. The road reserve may need to be wider than the minimum width required. Consultation with relevant service authorities, such as telecommunications (including NBN Co.) and electricity distribution authorities, to determine their requirements for the subdivision will be necessary. Refer standard drawing No 030-063 for guidance in the location of utility services.

Utility Location Within Road Reserve

D1.09 DESIGN SPEED

1. Design speed is generally used as the basic parameter in the specification of design standards and in determining the minimum design value for other elements. NSW Roads and Maritime Services bases its current design standards on a travel speed rather than a design speed. Travel speed identifies a speed/horizontal radius relationship. This approach is intended for roads of a minimum travel speed of 60 km/h. The maximum speed limit in NSW for built-up areas is 50 km/h as the default speed limit and this should be used in calculating design values which depend on speed, (e.g. local collector and distributor roads) however, in difficult topography, the design speed may be reduced. Vehicular speeds are also limited by road intersections as well as changes in horizontal and vertical alignment.

RMS Guidelines

2. Adoption of a low design speed discourages speeding, however, where vertical or horizontal curves of low design speed are located in otherwise high speed sections the result is a potentially dangerous section of road. It should be recognised that in low standard roads, operating speeds will tend to be in excess of arbitrary speed standards. Attention should be given to ensuring that potentially hazardous features are visible to the driver and adopting traffic engineering measures which will help a driver avoid errors of judgement.

Low Speeds

Hazardous Features

3. Generally the following target speeds in urban streets should be adopted:

Target Speeds

Access Place / Cul-de-sac	25 km/h
Minor Access or Local Street	40 km/h
Access Street	40 km/h
Local Collector	50 km/h
Minor or Major Distributor	60/80 km/h

Urban Streets

Generally the following target speeds in rural residential roads should be adopted:

Rural Residential Roads

Minor Access or Local Street	40 to 60 km/h
Access Street	40 to 60 km/h
Local Collector	60 to 80 km/h
Minor or Major Distributor	80 to 100 km/h

4. The need for road safety barriers shall be assessed and designed in accordance with AS/NZS 3845.

Road Safety Barriers

D1.10 LONGITUDINAL GRADIENT (Refer Austroads Design Guides)

1. A desirable minimum gradient of 1% is to be adopted in road design. Where this cannot be achieved a general minimum gradient of 0.5 per cent should be adopted. In very flat conditions it may be reduced to 0.3 per cent subject to specific Council approval. Where underground drainage with gully pits or other special works are used it is preferable to allow near level grades rather than reverting to the unsatisfactory device of introducing artificial undulations. Variable crossfall may be necessary to produce the required grade in the gutter. Maximum recommended grades are shown in Table D1.1.

Flat Terrain

Table D1.1

	Local Access	Collector	Distributor	Rural
Desirable maximum percentage*	12	10	8	10
Absolute maximum percentage*	16	12	10	12

*maximum length 150 m on straight alignment.

2. Longitudinal grade of the minor street on the approach to an intersection should not exceed 4 per cent, the actual gradient being dependent on the type of terrain. Design of the road alignment and the grades used are interrelated. A steep grade on a minor side street is undesirable if vehicles have to stand waiting for traffic in the major road.

Intersections

3. Turning circles in cul-de-sacs on steep grades should have grades less than 5 per cent.

Cul-de-Sacs

D1.11 HORIZONTAL CURVES AND TANGENT LENGTHS (Refer Austroads Design Guides)

1. The horizontal alignment of a road is normally in a series of tangents (straights) and curves which may be connected by transition curves. The choice of the horizontal alignment is normally determined from the design speeds for a particular street within the road hierarchy as described in Clause D1.09. Designers should ensure that, for a given design speed, the minimum radius of curvature utilised is such that drivers can safely negotiate the curve. Curves which progressively tighten produce an uncomfortable sense of disorientation and alarm. Sudden reverse curves which drivers cannot anticipate also have a potential to cause similar conditions.

Speed/Radius Relation

2. Where speed restriction is provided by curves in the street alignment the relationship between the radius of the curve and the desired vehicle speed is given in Table D1.2(a). Table D1.2(a) is derived from AMCORD.

Speed Restriction

Table D1.2 (a) - Speed/Radius Relationship

Design Vehicle Speed (km/h)	Curve Radii (m) on Road Centreline	
	Curvilinear Alignment (no tangents)	Isolated Curve Alignment (with tangent sections)
20	15	10
25	20	15
30	30	20
35	50	30
40	90	40
45	105	50
50	120	60
55	140	70
60	160	80

3. To determine appropriate lengths for tangents between speed restrictions, which may be curves, narrow sections or other obstructions, Table D1.2 (b) is recommended. Table D1.2(b) is derived from AMCORD.

Tangent Length

Table D1.2 (b) - Speed/Tangent Length Relationship

Desired Vehicle Speed in Curve (km/h)	Maximum Advisable Tangent Length (m) between Curves or Restrictions Appropriate to a Selected Design Speed.						
	DESIGN SPEED						
	25	30	35	40	45	50	60
20 or less	40	75	100	120	140	155	180
25	-	45	75	100	120	140	165
30	-	-	45	80	100	120	150
35	-	-	-	50	80	100	135
40	-	-	-	-	55	80	120
45	-	-	-	-	-	60	105

4. Sight distance on curves is determined by formula, refer Austroads Design Guides.

D1.12 VERTICAL CURVES (Refer Austroads Design Guides)

1. Vertical curves will be simple parabolas and should be used on all changes of grade exceeding 0.8 per cent at the desirable minimum design speed of 60 km/h. Table 8.6 of the Austroads document Guide to Road Design Part 3 Geometric Design provides additional information on vertical curve lengths for different design speeds. The length of the crest vertical curve for stopping sight distance should conform with Austroads Design Guides. These standards are based on 1.5 second's reaction time which provides a reasonable safety margin for urban conditions, where drivers' reaction time is usually considered to be lower than in rural conditions.

Criteria

2. For adequate riding comfort, lengths of sag vertical curves should conform with the Austroads Design Guides. As residential roads are usually lit at night, the criterion for designing sag vertical curves is a vertical acceleration of 0.05g for desirable riding comfort, and 0.10g for minimum riding comfort.

Riding Comfort

3. Junctions of roads should be located at a safe distance from a crest, determined by visibility from the side road. Location of a side road at a crest should only occur if there is no suitable alternative.

Side Road Junctions

4. Drainage poses a practical limit to the length of sag curves and a maximum length (in metres) of 15 times the algebraic sum of the intersecting vertical grades (expressed as a percentage) has been suggested. This is to avoid water ponding in excessively flat sections of kerb and gutter. A minimum grade of 0.5 per cent should be maintained in the kerb and gutter. This may require some warping of road cross sections at sag points.

Sag Curves

5. The three dimensional coordination of the horizontal and vertical alignment of a road should be aimed at improved traffic safety and aesthetics. Economic considerations often require a compromise with aesthetic considerations. The following principles should be applied:

Horizontal and Vertical Alignment Coordination

- The design speed of the road in both horizontal and vertical planes should be of the same order.
- Combined horizontal and vertical stopping sight distance and minimum sight distance should be considered three dimensionally.
- Sharp horizontal curves should not be introduced at or near the crest of a vertical curve. A horizontal curve should leave the vertical curve and be longer than the vertical curve.
- A short vertical curve on a long horizontal curve or a short tangent in the grade line between sag curves may adversely affect the road's symmetry and appearance.

D1.13 SUPERELEVATION (Refer Austroads Design Guides)

1. The use of superelevation in association with horizontal curves is an essential aspect of geometric design of roads with design speeds in excess of 60 km/h. Local access roads, which are designed for speeds of 40 km/h or less and with curves of 60m radius or less generally have the pavement crowned on a curve instead of superelevation. Design standards for such curves have little meaning as drivers usually cut the corners and rely on friction to hold them on a curved path. As the radius of the curve falls, friction becomes more important than superelevation.

Low Design Speed, Crowned Pavement

2. The maximum superelevation for urban roads of higher design speeds should be six per cent (6%). Any increase in the longitudinal grade leading to excessive crossfall at intersections should be considered with caution. While it is desirable to super elevate all curves, negative crossfall should be limited to three per cent (3%).

High Design Speed

3. In general, curve radii larger than the minimum and superelevation rates less than the maximum should be used where possible. The minimum radius of curves is determined by the design speed, the minimum superelevation (or maximum adverse crossfall) at any point on the circular portion of the curve, and the maximum coefficient of side friction which allows safe lane changing. This is 0.15 where there is positive superelevation and 0.12 where there is adverse crossfall. The coefficient of side friction depends upon the type and condition of tyres, the pavement, and on speed.

Criteria

4. Plan transitions are desirable on superelevated curves for appearance and to provide a convenient length in which to apply the superelevation. On urban roads, superelevation may be conveniently applied to the road cross section by shifting the crown to 2m from the outer kerb. The axis of rotation of the cross section for urban roads will normally be the kerb grading on either side which best enables access to adjacent properties and intersections. On the outside of superelevation, or where the longitudinal grade of the gutter is less than 0.5 per cent, a crossfall of 63mm in a 450mm wide gutter may be adopted.

Transitions, Offset Crowns

5. Also refer Austroads Design Guides

D1.14 ROAD RESERVE CHARACTERISTICS

1. The cross section of the road reserve must provide for all functions that the road is expected to fulfil, including the safe and efficient movement of all users, provision for parked vehicles, acting as a buffer from traffic nuisance for residents, the provision of public utilities and street scaping.

Cross Section Provisions

2. The carriageway width must allow vehicles to proceed safely at the operating speed intended for that level of road in the network and with only minor delays in the peak period. This must take into consideration the restrictions caused by parked vehicles where it is intended or likely that this will occur on the carriageway. Vehicles include trucks, emergency vehicles and, on some roads, buses. (Refer to Clause D1.21 for bus routes.)

Operational Aspects

3. The safety of pedestrians and cyclists where it is intended they use the carriageway must also be assured by providing sufficient width.

Pedestrians, Cyclists

4. The carriageway width should also provide for unobstructed access to individual allotments. Drivers should be able to comfortably enter or reverse from an allotment in a single movement, taking into consideration the possibility of a vehicle being parked on the carriageway opposite the driveway.

Access to Allotments

5. The design of the carriageway should discourage drivers from travelling above the intended speed by reflecting the functions of the road in the network. In particular, the width and horizontal and vertical alignment should not be conducive to excessive speeds.

Discourage Speeding

6. Appropriate verge width should be provided to enable the safe location, construction and maintenance of required footpaths and public utility services (above or below ground) and to accommodate the desired level of street-scaping. Wherever possible services should be located in common trenches.

Verge Width

7. The verge when considered in conjunction with the horizontal alignment and permitted fence and property frontage treatments should provide appropriate sight distances, taking into account expected speeds and pedestrian and cyclist movements.

Sight Distance Across Verge

8. Stopping sight distances and junction or intersection sight distances, provided by the verge, should be based on the intended speeds for each road type.
9. Also refer to Austroads design guides.

D1.15 CROSSFALL

1. Desirably, roads should be crowned in the centre. The recommended minimum crossfall on any pavement shall be 2%. Typical pavement crossfalls on straight roads are:

<i>Pavement Type</i>	<i>Crossfall</i>
Earth / Loam	5 per cent
Gravel	4 per cent
Bituminous seal coat	3 per cent
Bituminous / Asphaltic concrete pavement	2.5 – 3 per cent
Cement concrete pavement	2 - 3 per cent

(Source: NAASRA (Now AUSTRROADS), Guide policy for geometric design of major urban roads.)

Where two-way crossfall cannot be achieved due to site terrain, Council approval is required for any design solution using one-way crossfall. Offset Crowns, kerb types, drainage and driveway access and any other site specific impacts must be considered. Offset crowns, where required, shall be developed on the edge of the parking lane.

2. There are many factors affecting levels in urban areas which force departures from these crossfalls. Differences in level between road alignments can be taken up by offsetting crown lines or adopting one way crossfalls. Sustained crossfalls should not exceed 4 per cent, although up to 6 per cent may be used where unavoidable. The rate of change of crossfall should not exceed: 6 per cent per 30m for through traffic; 8 per cent per 30m for free flowing turning movements; or 12 per cent per 30m for turning movements for which all vehicles are required to stop.

Offset Crown Lines

Rate of Change

3. The crossfall on a collector or Distributor road should take precedence over the grade in minor side streets. Standard practice is to maintain the crossfall on the major road and adjust the minor side street levels to suit. The crossfall in side streets should be warped quickly either to a crown or a uniform crossfall depending on the configuration of the side street. A rate of change of grade of two per cent in the kerb line of the side street relative to the centre line grading is a reasonable level.

Precedence

D1.16 VERGES AND PROPERTY ACCESS (Refer Driveway Policy – POL 035)

1. A suitable design for the verge will depend on utility services, the width of footpath, access to adjoining properties, likely pedestrian usage and preservation of trees. Low level footpaths are undesirable but may be used if normal crossfalls are impracticable. Crossfalls in footpath paving should not exceed 2.5 per cent, in accordance with Austroads Design Guides, AS1428 and Council’s Driveway Policy POL 035. Longitudinal grade usually parallels that of the road and this may be steeper than 5%. Where Possible, footpath grades shall comply with the requirements for disabled access (AS1428) with respect to longitudinal grade i.e. 7% maximum and regular flat rest areas.

Criteria

Disabled Access

2. Differences in level across the road between road reserve boundaries may be accommodated by:

Options

- Cutting at the boundary on the high side and providing the verge at normal level and crossfall.

- Battering at the boundary over half the verge width with the half against the kerb constructed at standard crossfall in rural subdivisions and on rural roads only.
- A uniform crossfall across the carriageway.

3. The above measures can be used singularly or combined. The verge formation should extend with a 0.5m berm beyond the road reserve boundary.

4. The Designer shall design a vehicular driveway centreline profile for the property access and check this design using critical car templates to ensure that vehicles can use the driveway satisfactorily. Refer Standard Drawings 030-070 to 030-073/2 inclusive and AS2890.

Driveway Profile

5. If the floor height of the garage exceeds 1m above or below the road centreline, a driveway profile must be submitted prior to the release of any Construction Certificate.

D1.17 INTERSECTIONS

1. The design of intersections or junctions should allow all movements to occur safely without undue delay. Projected traffic volumes should be used in designing all intersections or junctions on Distributor roads.

Traffic Volumes

2. Intersection design for the junction of subdivision roads with existing state rural or urban roads and national highways should be in accordance with Austroads Design Guides.

State Roads, National Highways

3. Intersections with state roads, regional roads and national highways are to be designed, approved and constructed in accordance with RMS and Austroads Design Guides.

Approval of State Road Authority

4. Where major intersections are required to serve a development complete reconstruction of the existing road pavements will be necessary where the speed environment and irregularity of the existing road pavement may endanger the safety of traffic in the locality.

Existing Road Pavement

5. Intersections should be generally designed in such a way that:

Criteria

- The streets intersect preferably at right-angles and not less than 70°.
- The landform allows clear sight distance on each of the approach legs of the intersection.
- The minor street intersects the convex side of the major street.
- The vertical grade lines at the intersection do not impose undue driving difficulties.
- The vertical grade lines at the intersection will allow for any direct surface drainage.
- Two minor side streets intersecting a major street in a left-right staggered pattern should have a minimum centreline spacing of 50m to provide for a possible right-turn auxiliary lane on the major street..
- A right-left manoeuvre between the staggered streets is preferable, avoiding the possibility of queuing in the major street.
- Existing public utilities, existing services, parking and property access are considered

6. Adequate stopping and sight distances are to be provided for horizontal and vertical curves at all intersections. *Sight Distance*
7. Where required, appropriate provision should be made for vehicles to park safely. *Parking*
8. The drainage function of the carriageway and/or road reserve must be satisfied by the road reserve cross-section profile. *Drainage*
9. All vehicle turning movements are accommodated utilising AUSTRROADS Design Vehicles and Turning Templates, as follows: *Turning Movements*
- For intersection turning movements involving Distributor roads, the "design semi-trailer" with turning path radius 15.0m.
 - For intersection turning movements involving local streets or collector streets, but not Distributor roads, the "design single unit" bus with turning path radius 13m.
 - For intersection turning movements on access streets but not involving Distributor roads, collector streets or local streets, the garbage collection vehicle used by the local authority.
 - For turning movements at the head of cul-de-sac access streets sufficient area is provided for the "design single unit" truck to make a three-point turn or, where the length of the cul-de-sac is less than 60m for the "design car" to make a three-point turn. Where driveway entrances are to be used for turning movements, the required area is to be designed and constructed to withstand the relevant loads.
10. Turning radii at intersections or driveways on Distributor road accommodate the intended movements without allowing desired speeds to be exceeded. *Turning Radii*
11. On bus routes 3-centred curves with radii 7.0m, 10.0m and 7.0m are used at junctions and intersections. *Bus Routes*

D1.18 ROUNDABOUTS

1. Roundabouts are to be designed, approved and constructed in accordance with RMS and Austroads Design Guides. *Approval*
2. Roundabouts should generally be designed in accordance with the requirements of Austroads Design Guides. Designs adopting alternative criteria will be considered on their merits. Roundabout design should generally comply with the following: *Criteria*
- entry width to provide adequate capacity
 - adequate circulation width, compatible with the entry widths and design vehicles eg. buses, trucks, cars.
 - central islands of diameter sufficient only to give drivers guidance on the manoeuvres expected
 - deflection of the traffic to the left on entry to promote gyratory movement
 - adequate deflection of crossing movements to ensure low traffic speeds

- a simple, clear and conspicuous layout
 - design to ensure that the speed of all vehicles approaching and passing through the intersection will be less than 50 km/h.
 - Lighting, landscaping, and design vehicle (pavement type and design) considerations
 - May include a street light on the centre island
 - Landscaping plan of the centre island with suitable drainage to protect the road pavement
3. Pavement design shall be in accordance with Specification D2.

D1.19 TRAFFIC CALMING

1. Traffic calming devices are to be designed, approved and constructed in accordance with RMS and Austroads Design Guides. *Approval*

2. Calming devices such as thresholds, slow points, speed humps, chicanes and splitter islands should be designed in accordance with the requirements of Austroads Design Guides. Device designs should generally comply with the following: *Criteria*

(a) Streetscape

- reduce the linearity of the street by segmentation
- avoid continuous long straight lines (eg. kerb lines)
- enhance existing landscape character
- maximise continuity between existing and new landscape areas

(b) Location of Devices/Changes

- devices other than at intersections should be located to be consistent with streetscape requirements
- existing street lighting, drainage pits, driveways, and services may decide the exact location of devices
- slowing devices are optimally located at spacings of 100-150m. *Device Spacing*

(c) Design Vehicles

- emergency vehicles must be able to reach all residences and properties *Emergency Vehicles*
- local streets with a 'feeding' function between arterial roads and minor local streets might be designed for a AUSTROADS Design Single Unit Truck/Bus *SU Truck*
- where bus routes are involved, buses should be able to pass without mounting kerbs and with minimised discomfort to passengers *Buses*

- in newly developing areas where street systems are being developed in line with LATM principles, building construction traffic must be provided for

Construction Traffic

(d) Control of Vehicle Speeds

- maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowings have only minor effects on average speeds, and usually little or no effect on maximum speeds
- speed reduction can be achieved using devices which shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (humps, platform intersections, platform pedestrian/school/bicycle crossings)
- speed reduction can be helped by creating a visual environment conducive to lower speeds. This can be achieved by 'segmenting' streets into relatively short lengths (less than 300m), using appropriate devices, streetscapes, or street alignment to create short sight lines

Speed Reduction

(e) Visibility Requirements (sight distance)

- adequate critical sight distances should be provided such that evasive action may be taken by either party in a potential conflict situation. Sight distances should relate to likely operating speeds
- sight distance to be considered include those of and for pedestrians and cyclists, as well as for drivers
- night time visibility of street features must be adequate. Speed control devices particularly should be located near existing street lighting if practicable, and all street features/furniture should be delineated for night time operation. Additional street lighting shall be provided by the Developer at proposed new speed control devices located away from existing street lighting.

Night Visibility

(f) Critical Dimensions

Many devices will be designed for their normal use by cars, but with provision (such as mountable kerbs) for larger vehicles. Some typical dimensions include:

- pavement narrowings
 - single lane 3.50m between kerbs
 - 3.75m between obstructions
 - two lane 5.50m minimum between kerbs
- bicycle lanes (including adjacent to pavement narrowings) - 1.2m absolute minimum (1.0m in special circumstances in accordance with the AUSTROADS 'Guide to Road Design Part 6A: Pedestrian and Cyclist Paths' (AGRD06A-09).
- plateau or platform areas
 - 75 mm to 150 mm height maximum, with 1 in 15 ramp slope
- width of clear sight path through slowing devices
 - 1.0m maximum

(i.e. the width of the portion of carriageway which does not have its line of sight through the device blocked by streetscape materials, usually vegetation)

Bicycle Lanes

Clear Sight Path

- dimensions of mountable areas required for the passage of large vehicles to be determined by appropriate turning templates.

(g) Stormwater Flows

The placement of ant traffic calming device may have an impact on stormwater flows with respect to local flooding of the pavement, pooling of trapped water and localised higher velocities in the vicinity of the device. The impact of the device must be assessed and any problems associated with its location resolved.

Flooding and Flow Velocities

D1.20 PARKING

1. The parking requirements for normal levels of activity associated with any land use should be accommodated on-site. *On-Site*
2. All on-site parking should be located and of dimensions that allow convenient and safe access and usage. Refer AS2890. *AS2890*
3. Adequate parking should be provided within the road reserve for visitors, service vehicles and any excess resident parking since a particular dwelling may generate a high demand for parking. Such parking is to be convenient to dwellings. The guide document for provision of parking is the Armidale Dumaresq Council DCP 2012, Section 2.9 Parking. *Road Reserve Parking*
DCP 2012 Section 2.9
4. The availability of parking should be adequate to minimise the possibility of driveway access being obstructed by cars parked on the opposite side of the street. *Obstruction*
5. On single lane access streets parking spaces should be provided within the verge. Such parking should be well defined and an all-weather surface provided. Such parking shall not restrict the safe passage of vehicular and pedestrian traffic. *Verge Parking*
6. Parking spaces provided on the verge or carriageway should be of adequate dimensions, convenient and safe to access.
7. For non-residential land uses the opportunity for joint use of parking should be maximised by being shared by a number of complementing uses. *Joint Use*
8. All verge spaces and indented parking areas are constructed of concrete, interlocking pavers, bitumen with crushed rock or other suitable base material and are designed to withstand the loads and manoeuvring stresses of vehicles expected to use those spaces. *Verge Spaces*

D1.21 BUS ROUTES

1. Bus routes will normally be identified by Council. It is important that the road hierarchy adequately caters for buses. The main criteria in determining the location of bus routes is that no more than 5% of residents should have to walk in excess of 400 metres to catch a bus. Normally roads above the local street in the hierarchy are designed as bus routes. Conformance with the Disability Discrimination Act and consultation with local bus service operators is required. Table D1.3 details minimum criteria for bus route design. *Criteria for Location*
2. For rural bus stops, standard drawing 030-074 provides the recommended layout and standard drawings 030-078, 030-079 and 030-080 provide the arrangement of the approved bus shelter signage and structure design. Sight stopping distance must be considered in determining the location of any bus stop.

Road	Stops (Spacing)	Bays
Collector	400 metre *	Single + Shelter
Distributor	400 metre	Shelters**
Arterial	400 metre	Shelters and Bays

Table D1.3 Bus Route Criteria

* Loop roads with single entry/exit only require stops and bays on one side road.

** Shelters are subject to Council's requirements.

RURAL DESIGN CRITERIA (Refer Austroads Design Guides)

D1.22 GENERAL

1. In addition to the foregoing sections this section specifically applies to all those sites identified as being suited to rural subdivisions inclusive of rural home sites and hobby farms types of developments.

2. Design speed is to be generally used as the basic parameter of design standards and the determination of the minimum design value for other elements in rural subdivisions is to be based on the concept of a "speed environment" as outlined in Austroads Design Guides.

Design Speed

3. Where appropriate superelevation, widening and centreline shift and their associated transitions are to comply with the Austroads Design Guides.

4. Where the table drain is likely to scour a RMS Type SH dish drain, or similar structure is to be constructed along the invert. Also for grades of less than 0.8%, the inverts of the drain are to be lined to prevent siltation.

Table Drain

5. All rural subdivisions should be designed to restrict access to major roads.

6. Rural residential subdivisions may be required to provide kerb and gutter on both sides of roads, and piped drainage will generally be required. Refer to Council's DCP on subdivision code for guidance.

Kerb and Gutter

7. Access should be limited to one point on to local, collector, Distributor or arterial road networks.

Access

D1.23 SIGHT DISTANCES

1. Stopping and minimum sight distances. Stopping sight distance should be provided at all points on the road. The stopping distance is measured from an eye height of 1.15m to an object height of 0.20m, using a reaction time of 1.5 seconds. A minimum sight distance measured from a height of 1.15m to a height of 1.15m is preferable for speeds of 60 km/h and over.

Stopping Distance

Sight Distance

2. Stopping distance is the sum of the braking distance and the distance the vehicle travels during a reaction time of 1.5 seconds and is calculated in accordance with Austroads Design Guides.

Braking Distance

D1.24 HORIZONTAL AND VERTICAL ALIGNMENT

1. Horizontal and vertical curves are to be designed generally to the requirements of Austroads Design Guides. These requirements are essential to satisfy the safety and performance of proper road design. Roads having both horizontal and vertical curvature should be designed to conform with the terrain to achieve desirable aesthetic quality and being in harmony with the landform.

Criteria

D1.25 INTERSECTIONS

1. Intersections should generally be designed in accordance with the Austroads Design Guides. The type of intersection required will depend on existing and planned connecting roads.

Criteria

2. Adequate sight distance should be provided at intersections both horizontally and vertically. Each intersection location shall be examined for conformance with the criteria for Approach Sight Distance (ASD), Entering Sight Distance (ESD) and Safe Intersection Sight Distance (SISD).

Sight Distance

ASD relates to the ability of drivers to observe the roadway layout at an anticipated approach speed.

ESD relates to the driver entering the intersection from a minor road and ability to observe the roadway layout and assess traffic gaps.

SISD relates to an overall check that vehicles utilising the intersection have sufficient visibility to allow reaction and deceleration so as to provide adequate stopping distance in potential collision situations.

Tabulated speed/sight distance requirements together with detailed explanations for each of the sight distance criteria are given in Austroads Design Guides. Repositioning of an intersection may be required to obtain conformance with the sight distance criteria.

Intersection Treatments

3. The following diagrams of intersection treatments presented in Figs D1.6a, D1.6b, D1.6c and D1.6d are sourced from superceded versions of Austroads Design Guides and are included **for information only**. Designers must refer to the current versions of the Austroads Design Guides to determine intersection layout and operation.

Staggered-T Intersections

4. Staggered-T arrangements proposed for rural cross-intersections should preferably be of the "right to left" type. This arrangement eliminates traffic queuing in the major road, the need for additional pavement for right turn lanes and greater stagger length associated with "left to right" T-intersections refer Austroads Design Guides.

D1.26 PLAN TRANSITIONS

1. A plan transition is the length over which widening and shift is developed from the "tangent-spiral" point to the "spiral-curve" point; ie, the length between the tangent and the curve. In urban road design it is often impracticable to use plan transitions as kerb lines are fixed in plan and any shift requires carriageway widening. Widening on horizontal curves compensates for differential tracking of front and rear wheels of vehicles; overhang of vehicles; and transition paths. Where proposed roads are curved, the adequacy of carriageway width should be considered.

Widening and Shift on Curves

2. Abrupt changes in crossfall, can cause discomfort in travel and create a visible kink in the kerb line. A rate of change of kerb line of no more than 0.5 per cent relative to the centre line should ensure against this. The wider the pavement the longer the transition. Superelevation transitions should be used at all changes in crossfall, not just for curves. Drainage problems can arise with superelevation transitions which may require extra gully pits and steeper gutter crossfalls. Where crossfalls change at intersections, profiles of the kerb line should be drawn. Calculated points can be adjusted to present a smooth curve.

Crossfall Changes

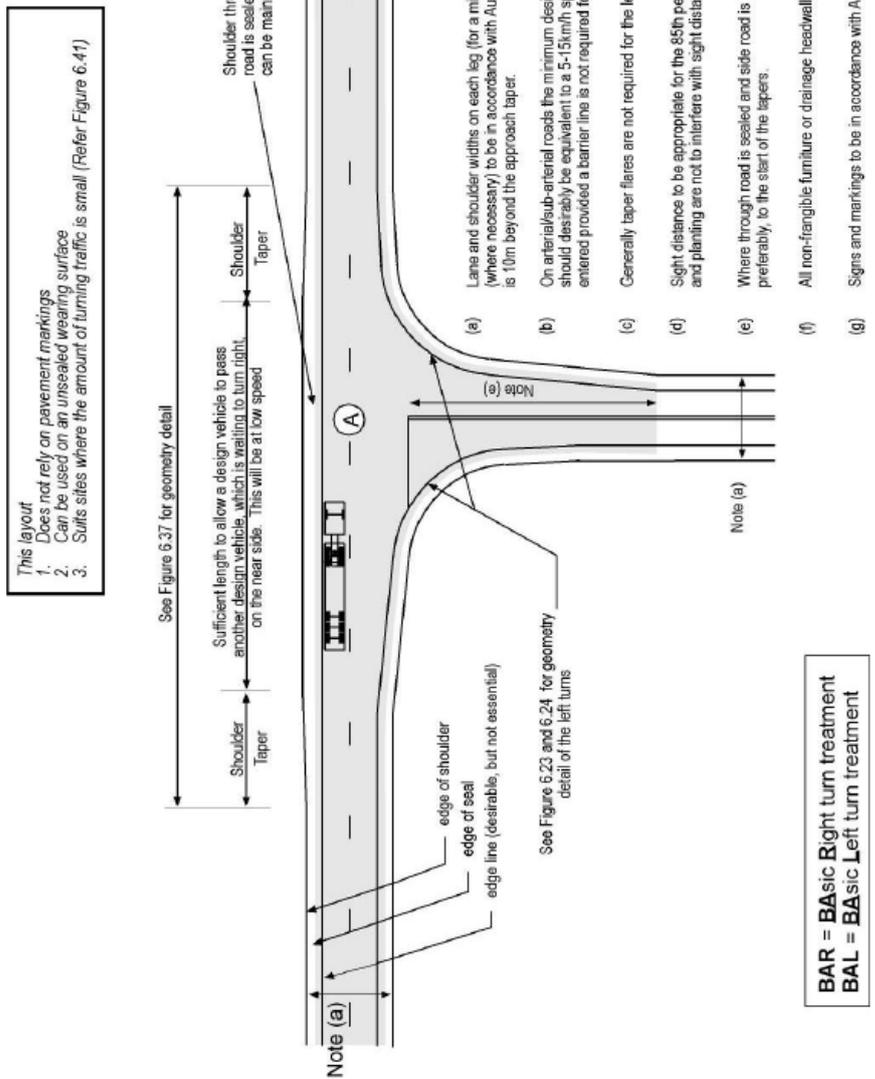


Figure 2.3 — Type BAR and BAL Layout Combined to Show a Basic Rural Intersection Treatment on Both a Through and a Terminating Leg

Source: AUSTRROADS Guide to Traffic Engineering Practice PART 5, Intersections at Grade.

Figure D1.6a - Typical Rural Intersection Treatments Type BAR and BAL

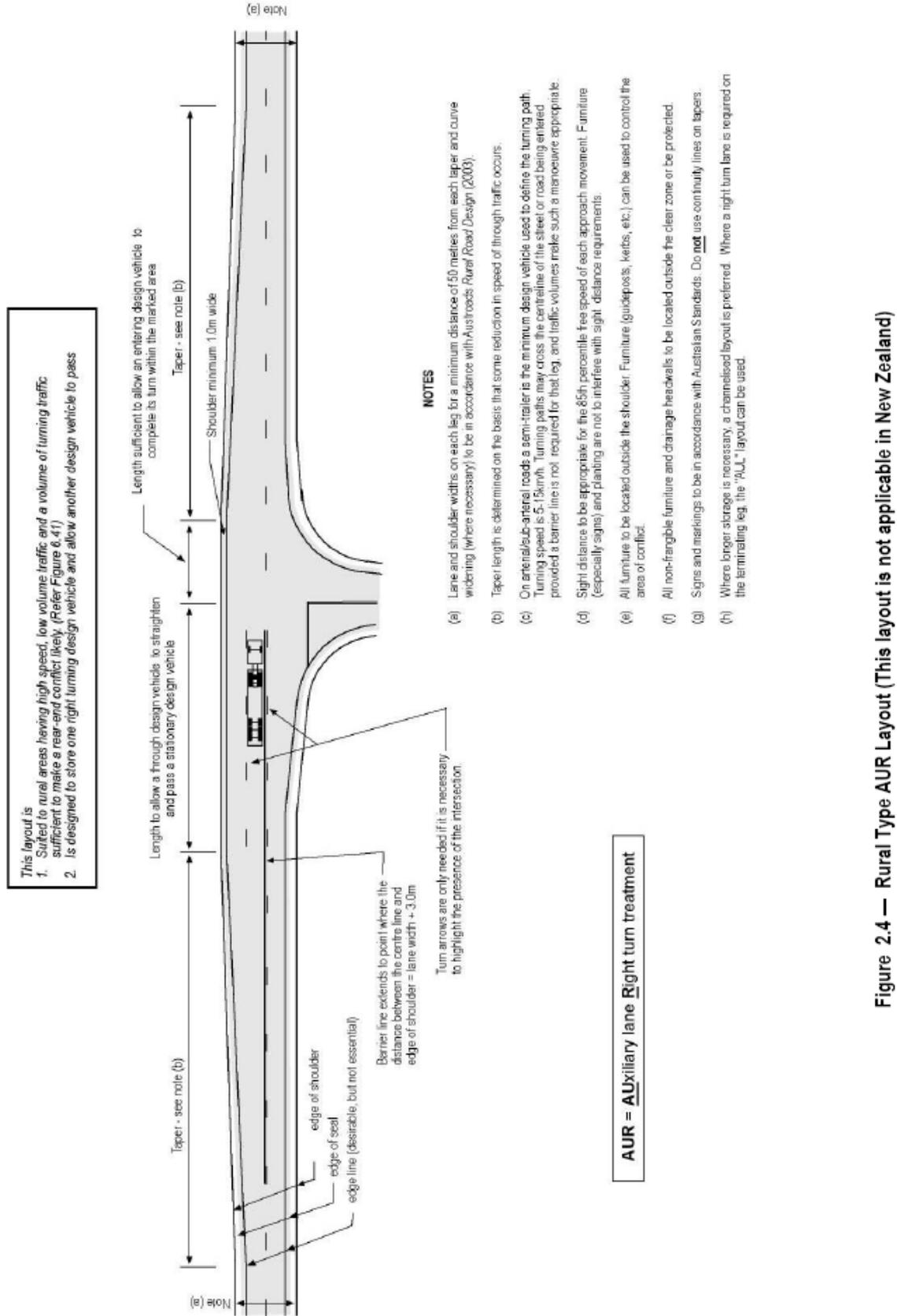
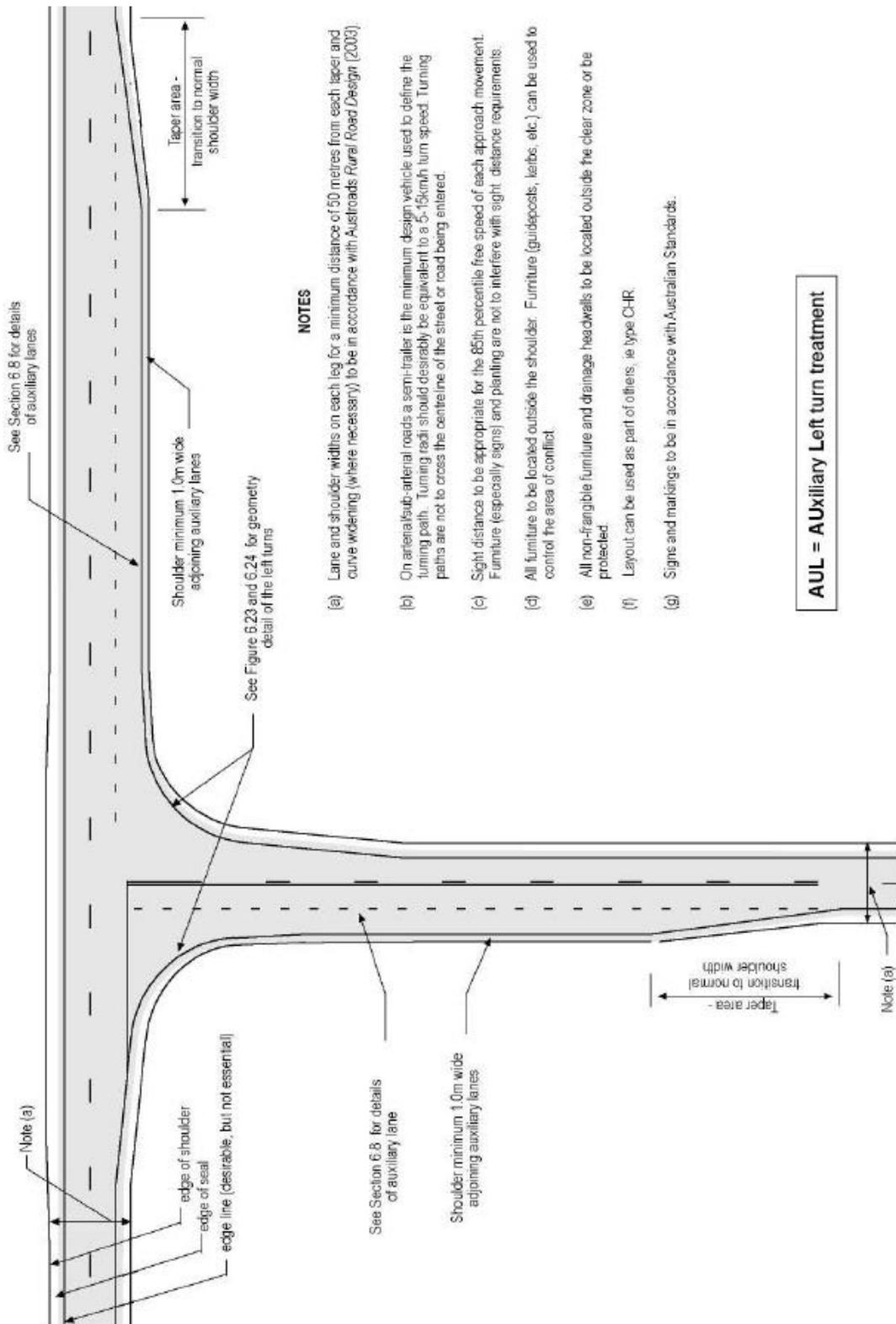


Figure 2.4 — Rural Type AUR Layout (This layout is not applicable in New Zealand)

Source: AUSTRROADS Guide to Traffic Engineering Practice PART 5, Intersections at Grade

Figure D1.6b - Typical Rural Intersection Treatment Type AUR



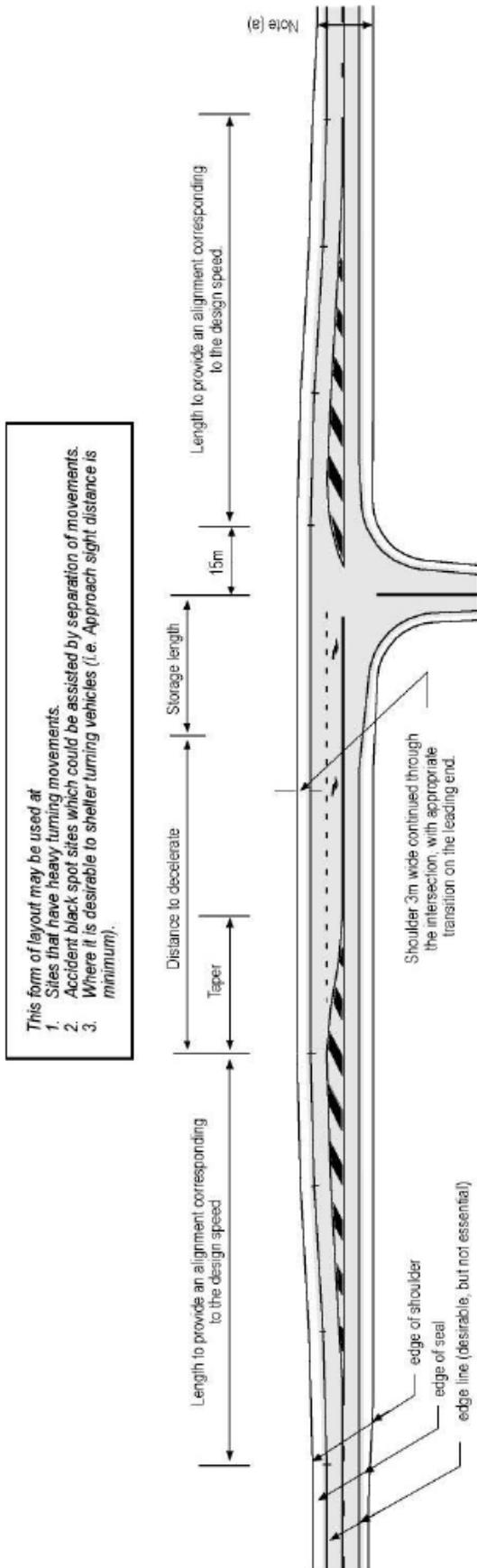
NOTES

- (e) Lane and shoulder widths on each leg for a minimum distance of 50 metres from each taper and curve widening (where necessary) to be in accordance with *Austrroads Rural Road Design (2003)*.
- (b) On arterial/sub-arterial roads a semi-trailer is the minimum design vehicle used to define the turning path. Turning radii should desirably be equivalent to a 5-15km/h turn speed. Turning paths are not to cross the centreline of the street or road being entered.
- (c) Sight distance to be appropriate for the 85th percentile free speed of each approach movement. Furniture (especially signs) and planting are not to interfere with sight distance requirements.
- (d) All furniture to be located outside the shoulder. Furniture (guideposts, kerbs, etc.) can be used to control the area of conflict.
- (e) All non-frangible furniture and drainage headwalls to be located outside the clear zone or be protected.
- (f) Layout can be used as part of others, i.e. type CHR.
- (g) Signs and markings to be in accordance with Australian Standards.

Figure 2.5 — Rural Type AUL Layout Showing the General Arrangement for Both a Through and a Terminating Leg
 (Note: The need for auxiliary lanes is assessed independently for each leg.)

Source: AUSTRROADS Guide to Traffic Engineering Practice PART 5, Intersections at Grade.

Figure D1.6c - Typical Rural Intersection Treatments Type AUL



NOTES

- (a) Lane and shoulder widths on each leg for a minimum distance of 100 metres from the start of each median and curve widening (where necessary) to be in accordance with Austroads Rural Road Design (2003).
- (b) The longest expected vehicle to be used to define the turning path assuming a turning speed of 5-15km/h. Turning paths are NOT to cross the centreline of the street or road being entered.
- (c) Sight distance to be appropriate for the 85th percentile free speed of each approach movement. Furniture (especially signs) and planting are not to interfere with sight distance requirements.
- (d) On a curved alignment the alignment is still to have geometry appropriate to the design speed. A system of offsets, as shown in Figure 6.39, may be used to determine initial geometry.
- (e) All non-fragible furniture and drainage headwalls to be located outside the clear zone or protected.
- (f) Signs and markings to be in accordance with Australian Standards, including the need for advance warning signs and direction signs.

Figure 2.7 — Type CHR Rural Intersection Layout General Details

Source: AUSTRROADS Guide to Traffic Engineering Practice PART 5, Intersections at Grade.

Figure D1.6d - Typical Rural Intersection Treatments Type CHR

D1.27 CHARACTERISTICS OF RURAL ROADS

1. This section specifically applies to all those sites identified as being suited to rural subdivisions inclusive of rural home sites and hobby farm types of development. Table D1.4 and Table D1.5 provide the standards to be adopted for a variety of road types and LEP zones and Armidale Regional Council Standard Drawings 030-062 and 030-064 illustrate several road cross sections for typical road design situations.

*Reference
Tables*

(a) Sealing shall be required for longitudinal grades in excess of 10% for the Rural Village RU5 zone and in excess of 16% for the RU1 and RU4 Rural zones and E3 and E4 Environmental zones. Where it is possible for the road to be extended to service additional lots, the road shall be constructed to a 6.0m seal standard.

Sealing

(b) Sealing may be required at sites where existing adjacent roads are sealed. In this instance the seal width shall match the adjoining seal with a minimum of 6.0m.

(c) In undulating terrain this width shall be increased to enable services to be constructed on accessible flatter land on top and below batters.

(d) Where the road is a designated on-road bicycle route (signposted and pavement marked) the shoulder provision needs to conform to the AUSTRROADS 'Guide to Road Design Part 6A: Pedestrian and Cyclist Paths' (AGRD06A-09).

Bicycle Route

(e) Culverts shall be designed to accommodate flood immunity flows with a maximum headwater level 150mm below the shoulder level. Reference should be made to the supplement to Specification D5 – 'Stormwater Drainage Design'.

(f) The vertical alignment shall be designed such that the maximum overtopping depth is 200mm to achieve trafficable immunity.

(g) For existing road reserves – if there is potential for further properties to access, then classification will be local minor.

D1.28 SUPERELEVATION

1. Use of maximum superelevation will be considered where the radius of the curve in approaching the minimum speed environment. Reference should be made to Austroads Design Guides and superelevation calculation. At low and intermediate ranges of design speed (i.e. below 80 km/h) it is desirable to superelevate all curves at least to a value equal the normal crossfall of straights.

Design Speed

D1.29 SCOUR PROTECTION

1. Scour protection of roadside drainage and table drains is required. The level of protection will depend on the nature of the soils, road gradients and volume of stormwater runoff. Protection works may involve concrete lined channels, turfing, rock pitching, grass seeding, individually or any combination of these. Geotechnical investigations should be carried out to determine the level and extent of any protection works prior to proceeding to final design stage.

*Roadside
Drainage and
Table Drains*

GEOMETRIC ROAD DESIGN

	1 Right of Carriageway (Private property Access)	2 Access place	3 Local Street	4 Access Street	5 Local Collector	6 Major Distributor	7 Rural Residential
LEP 2012 Zone	R1, R2	R1, R2	R1, R2	R1, R2	R1, R2	R1, R2	R2, R5
Maximum no. of potential tenements	2 ET	4 ET	50 ET	150 ET	150 to 500 ET	N/A	100 ET
Vehicles/day	0 to 20	0 to 20	20 to 200	>200	>2000		400
Carriageway width (m) and Seal type	4 (gravel)	4 (gravel) (A)	6 (sealed)	6 (sealed) (C)	7 (Sealed) (C)	9 (Sealed) (C) (7m carriageway edge line marked)	6 (sealed) (C)
Shoulder width (m)	0.5 (unsealed)	1	1 (0.5m seal)	1 (0.5m seal) (D)	1 (0.5m sealed)	1.2 (1m sealed)	1 (0.5m sealed) (D)
Road Reserve width (m)	10	Existing	20	20	20	30	20
Design Speed (km/h) Minimum	N/A	20	40	60	80 (E)	80	40
Design Speed(km/h) Desirable	NA	40	60	80	80	100	60
Longitudinal grading Max/Min	20%	16%/1%	16%/1%	12%/1%	12%/1%	12%/1%	16%/1%
Crossfalls - normal	3%	3%	3%	3%	3%	3%	3%
Superelevation (%) (max)	N/A	N/A	Up to 3%	Up to 3%	Up to 3%	Up to 7%	Up to 7%
Minimum Pavement Design Traffic ESAs	N/A	3 x 10 ⁵	3 x 10 ⁵	1 x 10 ⁶	1 x 10 ⁶	2 x 10 ⁶	3 x 10 ⁵
Atypical road in ARC LGA	Access driveway within handle of axe handle lot	Coakes Street	Roseneath Rd	Hook Subdivision, Old Gostwyck Road?	Dangarsleigh Rd (to Old Gostwyck Rd), Rockvale Rd,	Waterfall Way	Lakeview Drive

Table D1.4 - Characteristics of Roads in Rural Residential Subdivisions

- (A) These roads to be widened locally at blind crests and curves and provide passing bays (6m wide) within sight distance of each point and not greater than 300m apart.
- (B) Passing and auxiliary lanes and all other criteria as per Austroads Design Guides.
- (C) Minimum requirements for sealing of rural road pavements shall be: 14mm/10mm two coat flush seal.
- (D) Scour protection in table drains – see Spec Drainage in Roadways.
- (E) Extenuating circumstances may be considered for reducing design speed

GEOMETRIC ROAD DESIGN

Traffic Volume / Road Class	<10 VPD Rural Access Lane	10 – 99 VPD Rural Access Minor/Primary production, small lots	100 – 149 Rural Access Major/Primary production, small lots	150 – 999 Rural Collector, Minor	1000 - 7999 Rural Collector, Major	>8000 Major Distributor	Rural Village	Primary Production
LEP Zoning	RU4	RU4, RU1, E3, E4	RU1	Any zoning	Any zoning	Any zoning	RU5	RU1
Road reserve flat terrain ≤ 5%	15m	20m	25m	25m	30m	30m	15m	20m
Road reserve undulating ≥ 5%	20m	20m	30m	30m	30m	30m	20m	20m
Carriageway width	6.5m	7.5m	7.5m	8.0m	9.0m	11.0m	6.0m	7.5m
Seal width	5.5m	6.0m	7.5m	8.0m	9.0m	11.0m	7.0m	6.0m
Shoulder width	-	0.75m	0.75m	0.5m	1.0m	2.0m	1.0m	0.75m
Desirable Speed environment (km/h)	60	80	100	100	100	100	50	100
Design speed for individual elements (Min) (km/h)	60	80	80	80	80	100	40	80
Flood immunity (ARI years)	2	2	2	5	20	20	10	2
Trafficable Immunity (ARI years)	20	20	20	20	50	50	20	20

Table D1.5 - Characteristics of Roads in Rural Areas

ET - Equivalent Tenements – See latest RMS Traffic Generating Developments and Supplements 2013.
 VPD - Vehicles per Day.
 ESA - Equivalent Standard Axles.

GEOMETRIC ROAD DESIGN

	1 Shareway	2 Access place	3 Local Street & Access Street	4 Local Collector	5 Major Distributor	6 Arterial	7 Commercial	8 Industrial
LEP 2012 Zone	R1	R1	R1	R1	R1	R1		
Maximum no. of potential tenements	6 ET	30 ET	75 ET	300 ET	-	-	-	-
Vehicles/day	Less than 60	61 - 300	300 - 750	751 - 3000	3001 to 10000	More than 10000	-	-
Carriageway width (m) kerb face to kerb face	5	6	8	11.2/11.6 (4)	11.6/13 (5)	13	13	13
Verge width (m)								
Road Reserve width (m)	13	14	16	20	20	22	20	20
Kerb type	One side only	RT Rollover	RT Rollover	SA Barrier	SA Barrier	SA Barrier	SA Barrier	SA Barrier
Design Speed(km/h) Desirable	15	25	40	50	50	80	40	50
Minimum distance between intersections (m)	-	30	60	80	80	500	60	60
Longitudinal grading Max/Min	20%	18%	16%	12%	10%	10%	5%	10%
Pavement surface	25mm AC	25mm AC	25mm AC	40mm AC	40mm AC	40mm AC	40mm AC	40mm AC or Reinforced Concrete
Concrete footpath (m)	No	No	No	Yes ⁽²⁾ 1.2m	Yes ⁽²⁾	No ⁽²⁾	Yes ⁽²⁾	No
Cycleway	No	No	No	Refer (2)	Refer (3)	Refer (2)	No	No
Minimum Pavement Design Traffic ESAs	5 x 10 ⁴	7 x 10 ⁴	5 x 10 ⁵	1 x 10 ⁶	2 x 10 ⁶	1 x 10 ⁷	5 x 10 ⁶	5 x 10 ⁶ (light) 1 x 10 ⁷ (heavy)
Atypical road in ARC LGA	-	-	Dalton Drive	Link Road	Marsh Street	Grafton Road	Rusden Street	Mann Street

Table D1.6 - Characteristics of Roads in Urban Residential Subdivision Road Networks

- (1) Footpath may need to be widened to 4.5m to accommodate a 2.0m wide shared path or 5.0m for a 2.5m wide shared path.
- (2) If required by Council or if included in Council's Footpath Strategic Plan or Bike Strategy.
- (3) 2.5m wide shared path one side or two 1.5m marked lanes on carriageway plus 1.2m wide footpath.
- (4) Adopt 11.6m for through roads and bus routes.
- (5) Adopt 13m for higher trafficked roads and commercial routes.

SPECIAL REQUIREMENTS

D1.30 TURNING AREAS

Turning areas shall be provided at the termination of all roadways and shall generally have the dimensions given in Table D1.7

Turning Area Radii

D1.31 INDUSTRIAL ROAD WIDTHS

1. The minimum carriageway widths and verge widths to be provided in industrial areas shall be as presented in Table D1.6.
2. All industrial development shall require the provision of parking on site in accordance with the DCP 2012 but parallel parking on the road may also be permitted in accordance with Table D1.6.

Minimum Road Widths

Parallel Parking

Minimum carriageway width	Minimum Verge	Parallel parking permitted on road
13	3.5	Yes

Table D1.6 – Minimum carriageway and road reserve widths for roads servicing industrial areas

D1.32 CUL-DE-SAC DIMENSIONS

1. The minimum dimensions for cul-de-sac bowls shall be as presented in Table D1.7

Minimum Radii

Table D1.7 – Cul-de-sac Radii

Road Type	Minimum Radius (m)
Urban Residential	10
Rural Residential	10
Industrial	15

2. Cul-de-sac surface treatment shall be in accordance with D2.16(3)

D1.33 BATTLE AXE HANDLES

1. Lots which require access to a street through a narrow access way are commonly termed battle axe lots. Provision must be made to allow for access to the lot for a range of vehicles and allowance must be made for the provision of landscaping and the provision of services. Table D1.8 sets out the minimum standards required to provide an acceptable level of service to residents of battle axe lots. A maximum of two lots only shall be permitted from the handle of battle axe lots whether through a shared ROW easement or through a reciprocal ROW easement.
2. The carriageway and corridor width presented in Table D1.13 are Council's minimum standard. Where NSW Rural Fire Service 'Planning for Bushfire Protection Guidelines' apply, the higher standard for carriageway and corridor widths shall apply.

Minimum Widths

Maximum lot numbers for access

Planning for Bushfire Standards

Table D1.8 – Axe handle access widths (serving no more than 1 lots or 1 dwelling)

Rural residential		Urban residential	
Carriageway width	Corridor width	Carriageway width	Corridor width
4m	7m	3m	6m

3. Requirements for access ways serving more than 2 lots or more than 2 dwellings shall be in accordance with AS 2890.1

AS 2890.1

4. For access driveways which access multi dwelling developments the corridor width shall be a minimum of 3m wider than the carriageway and shall be of sufficient width to accommodate services (drainage, water supply, sewerage, power, telecommunications), fencing and landscaping as required. Refer AS2890 and D1.16.

D1.34 KERB RETURN DESIGN RADII

1. Kerb return design radii shall be provided in accordance with Austroads Design Guides. Table D1.9 provides a guide to the minimum requirements for kerb return radii for rural and urban situations.

Kerb Return Radii

2. The design of rural intersections must take account of the swept path for semi trailers and will require the provision of flares and shoulder widening in addition to the minimum radii given in Table D1.9. Figure D1.9 provides examples of typical treatments for turning lanes at rural intersections.

Shoulder Widening and Flares

Design Turning Speed (kph)	Rural Intersection (m)	Industrial Intersection (m)	Urban Intersection			
			Access way (m)	Local Road (m)	Collector Road (m)	Distributor Road (m)
0	15	15	6	6	8	8
10	15	15	6	6	8	8
20	15	15	6	8	10	10
30	15	15	6	8	10	10

Table D1.9 – Minimum kerb returns for intersections

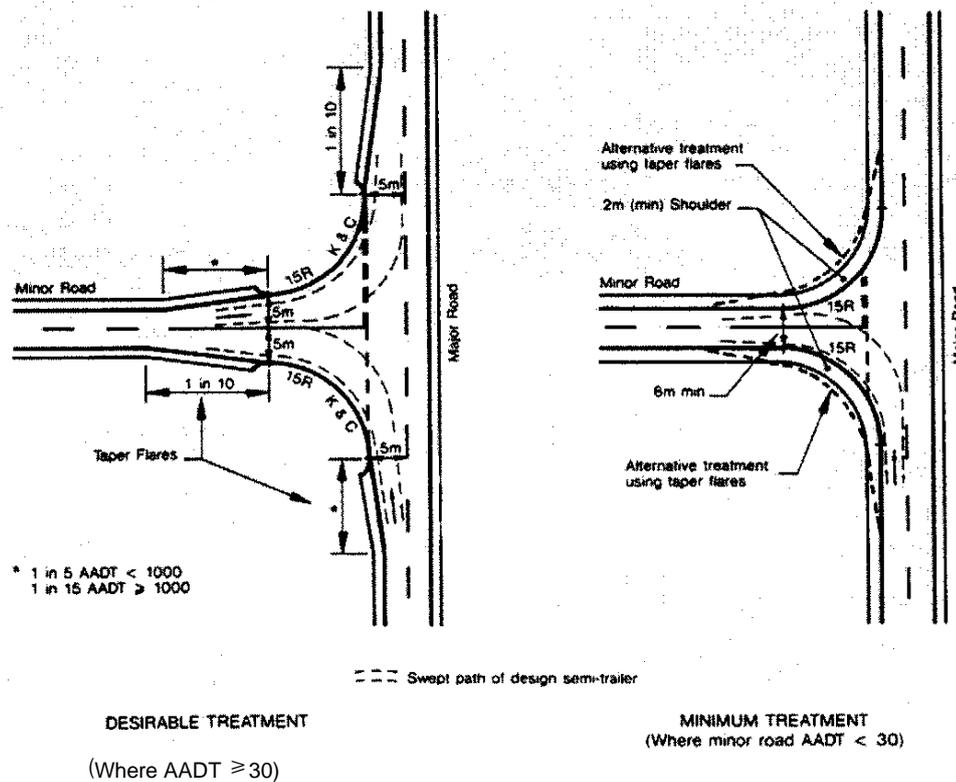


Figure D1.9 - Simple Left Turn Treatments for Rural Intersections

D1.35 GUIDE POSTS

- The design for the setting out of guide posts is contained in Construction Specification C263 Guide Posts.
- Guide posts shall be set out in accordance with the RMS document Delineation Section 16 – Guide posts and delineation of safety barriers

Guide Post Set Out

Alternative RMS Design

D1.36 BATTER SLOPES

- Batter slopes on all road works shall generally accord with the requirements Austroads Design Guides.

Desirable Batter Slopes

	Cut		Fill	
	Desirable	Maximum	Desirable	Maximum
Earth batter	3:1	2:1	6:1	4:1 ⁽²⁾
Rock batter	0.5:1	0.25:1 ⁽¹⁾	–	–
Median	10:1	6:1 ⁽²⁾	10:1	6:1 ⁽²⁾

- May be steeper if geotechnical conditions permit.
- Steeper slopes may be considered in combination with safety barriers to protect errant vehicles; however consideration should be given to safe maintenance practices and the surfacing treatment adopted.

Source: Austroads Guide to Road Design Part 3: Geometric Design – Table 4:12

Table 1.10 – Desirable Batter Slopes

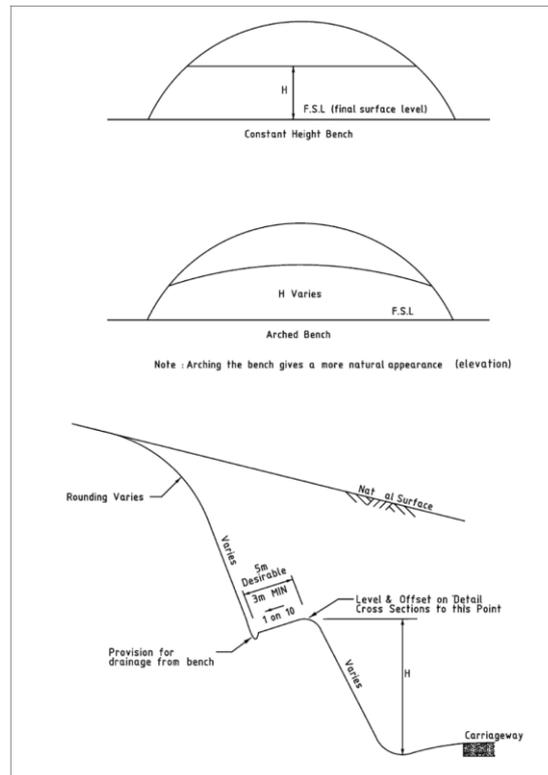
2. Batter slopes steeper than those presented in Table 1.10 shall require geotechnical design or certification as being stable, from a professional engineer qualified and/or experienced in geotechnical engineering.

Geotechnical Certification

3. Benches shall be provided for high batters of 10m or more in vertical height or for batters on unstable ground. The following criteria shall be followed in bench construction:

Benches

- Minimum width of bench 3m;
- Maximum crossfall 10%; and
- Preferred bench width for road safety, maintenance and drainage 5m.



Source: Austroads Guide to Road Design Part 3: Geometric Design – Fig 4.7

Figure D1.10 – Elevation and cross section of benches

D1.37 INTERNAL DRIVEWAYS

The design of private internal driveways must comply with the requirements of the Driveway Policy POL 035 and the ‘Supplement to D1 Handbook for Driveway Access to Property’.

Private Driveway Design

D1.38 PRIVATE ACCESSWAYS

The design of private access ways must comply with the requirements for access ways provided in AS 2890 and the Driveway Policy POL 035.

Private Access Way Design

D1.39 PUBLIC ROAD LIGHTING

1. The objective of road lighting is to provide an illuminated environment which is conducive to the safe and comfortable movement of vehicular and pedestrian traffic at night and discourages illegal activity. To accomplish this, the lighting should reveal necessary visual information. This consists of the road surface, the course of the road ahead, kerbs, footpaths, property lines, road furniture and surface imperfections, together with road users including pedestrians, cyclists and vehicles and their movements, and other animate and inanimate objects.
2. All roads in urban areas are required to be effectively lit, generally in accordance with the criteria of the Australian/New Zealand standard AS/NZS 1158 series. Lighting standards in park residential areas shall be determined by a delegated officer of Council.
3. All public lighting on road reserves and in new subdivisions shall be Type B LED lights in accordance with the design requirements of the electricity supply vendor, currently Essential Energy.

Road Hierarchy and Categories

Type B LED Lighting

Road Hierarchy	Usual Minimum Applicable Lighting Sub-Category
Access Place	P4
Access/Local Street	P4
Local Collector Street	P3
Minor Distributor Road	P3
Major Distributor Road	P3
Sub Arterial	To be determined by Armidale Regional Council
Arterial	To be determined by Armidale Regional Council
Park Residential	To be determined by Armidale Regional Council
Rural & Rural Residential	To be determined by Armidale Regional Council
Industrial Access	P4
Industrial Collector	P3

Additional Information Regarding Categories

Table 1.11 - Lighting categories for road reserves in local areas (Refer Table 2.1 from AS1158.3.1)

4. The exception to the use of LED lighting is on main roads where sodium vapour lighting is still required.
5. The sub-categories used in this specification do not apply to lighting intended specifically as security lighting for building exteriors and lighting for video surveillance.
6. Calculation procedures for specific site requirements need to be completed using AS1158.2 before acceptance of a Lighting Category.

Sodium Vapour

7. Alternative categories may be considered under direction of Council

Category P Lighting – Lighting that is applicable to roads and other outdoor public spaces on which the visual requirements of pedestrians are dominant, e.g. local roads, outdoor shopping precincts and outdoor car parks.

Public Road Lighting

- a) Calculation procedures for specific site requirements need to be completed using AS1158.2 before acceptance of a Lighting Category.
- b) Category P Lighting is provided for pedestrians, not motorists, with the exception of the lighting of LATMS, which are intended to reveal sufficient details of the device to allow approaching vehicles to navigate through the devices appropriately. This is a lower standard (Category V) than the standard for pedestrian lighting so the higher standard Category P will be used in preference. Alternative categories may be considered under direction of Council.

Category P Lighting – Lighting that is applicable to roads and other outdoor public spaces on which the visual requirements of pedestrians are dominant, e.g. local roads, outdoor shopping precincts and outdoor car parks.

D1.40 LINEMARKING

1. Line marking shall be undertaken to comply with RMS Specifications R141, R145 and the Delineation Manual, and the requirements of the RMCC Contract. Thermo-plastic markings shall be used in areas of high traffic volumes i.e. Roundabout Holding lines and Pedestrian Crossings. Generally, the use of thermo-plastic markings is considered on a case by case basis.

Thermo-plastic Markings

D1.41 SIGNS

- 1. Street signs shall be provided in accordance with the following requirements:
 - The street sign naming process shall be undertaken through council. The Planning Department of Council manage the process through the Geographical Names Board
 - Signs shall be provided and installed by Council at the developers cost
 - Installation shall be in accordance with the standard drawing
- 2. Road signs shall be provided in accordance with the following requirements:
 - Sign faces and installation shall be in accordance with AS1742
 - Signs shall be provided and installed by Council at the developers cost
 - Installation shall be in accordance with the standard drawing

Street Signs

Road signs

D1.42 SHOULDERS

- 1. Road shoulders shall be designed to carry out the following functions:
 - Provide lateral support to the road pavement layers.
 - Provide an initial recovery for an errant vehicle, emergency use, a refuge for stopped vehicles and space for cyclists.
- 2. Shoulder width shall be:
 - Generally: 1.5m to 2.0m.
 - For higher volume roads: 2.5m to 3.0 m.

Function

Width

3. Shoulders may be sealed partially or wholly to reduce maintenance costs, to improve road user safety and to improve moisture conditions under pavements. Sealed shoulders shall conform to the following sealed widths:

*Sealed
Shoulders*

- a) Minimum width of shoulder seal for AADT < 1000 shall be 0.5m.
- b) For wet areas where moisture control is required:
 - Desirable shoulder seal width shall be 0.5m.
 - Preferred shoulder seal width shall be 1.0m.
- c) For discretionary stopping of cars shoulder width shall be 2.5 m.
- d) For bicycles, minimum sealed shoulder width shall be 2.0m to 3.0m.

4. The following shoulder crossfalls shall be provided:

- For earth and loam: 5% to 6%.
- For gravel or crushed rock: 4% to 5%.
- For concrete and for full depth pavement with bitumen seal or asphalt wearing course, match with the traffic lane.

Crossfall

D1.43 ROADSIDE DRAINAGE

1. Roadside drainage shall be provided to remove water from the road and its surroundings and to maintain road safety and pavement strength. Drainage infrastructure shall include where appropriate table drains, catch drains, median drains and kerbs and channels.

General

2. Table drains shall be formed as a dish drain adjacent to the road shoulder with the invert of table drains to typically match subgrade level and be of minimum depth 500mm below shoulder level. Where scour is likely to occur, the outer edges of the pavement and the shoulder verges shall be sealed and the invert of the drain shall be lined. The following batter slopes shall be provided on formed table drains:

Table drains

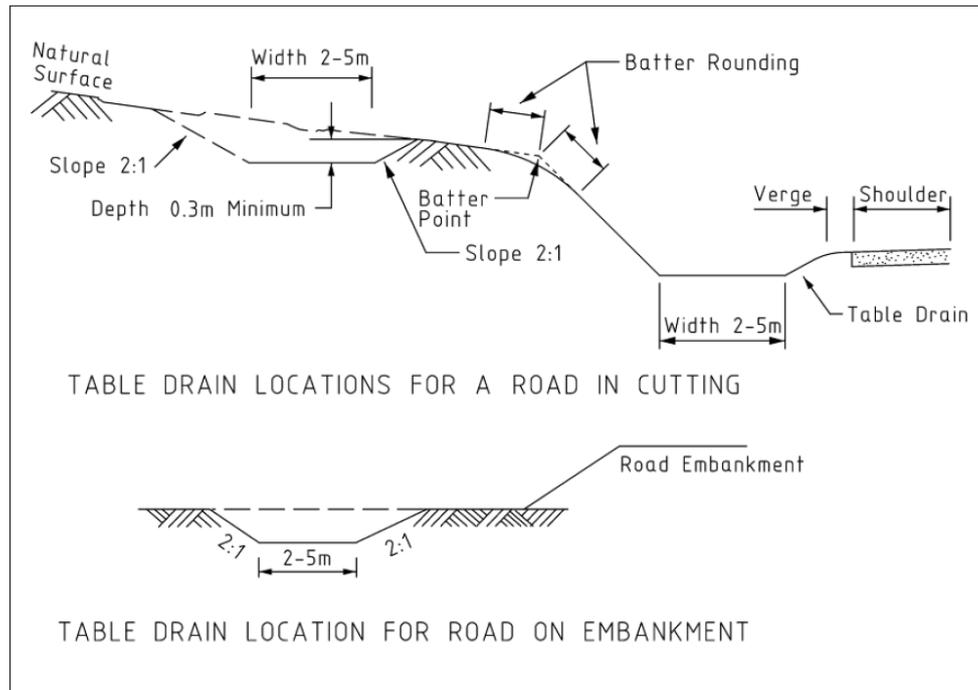
- Side slopes minimum requirement: < 4H:1V.
- Desirable slope: 6H:1V.

3. Catch drains shall be provided to prevent overloading of the table drain and to minimise scour of the batter face. They shall be placed at least 2 m from the edge of cuttings to minimise possible undercutting of the top of the batter.

Catch Drains

4. Median drains shall be constructed with side slopes of 10H: 1V to reduce the chance of an errant vehicle from overturning. A depressed median of minimum width 10 m shall be provided with the invert of the median drain below subgrade level to facilitate drainage of pavement layers.

Median Drains



Source: Austroads Guide to Road Design Part 3: Geometric Design – Fig 4.8

Figure D1.11 – Typical table drain shape and location

D1.44 KERB AND GUTTER

1. Kerb and gutter shall be designed to address drainage requirements and to adequately and safely provide both vehicular and pedestrian access to each allotment.
2. Where it is considered impractical to construct an isolated section of kerb and gutter and road pavement, Council may require the developer to pay a Contribution in lieu of construction, based on the estimated full cost of the works calculated by Council.
3. Kerb and gutter is to extend the full length of the proposed lot or lots and not just to the point of access of the property/lot.
4. Kerb and gutter shall be of the type SA (Barrier) for all Arterial, Distributor and Collector roads as detailed in Table D1.6 and type RT (Mountable) for Local and Access roads. All Commercial and Industrial areas (as shown in Table B) shall have type SA kerbing.
5. Notwithstanding the requirements above where a road carriageway is to be utilised as an overland flow path for stormwater drainage, the kerb and gutter shall be of type SA in accordance with Council Standard Drawings. Roads with roll over kerb are also utilised as overland flow paths.

Kerb Type

6. Kerb and gutter shall be provided to perform the following:
 - Collect and convey surface drainage to a discharge point.
 - Delineate the edges of the carriageway.
 - Separate carriageways from areas dedicated to footpath users.
 - Support the edge of the base course of the pavement.
 - Reduce the width of cut by substituting an underground drainage system in place of table drains.

Performance Requirements

7. Kerb type and placement shall be in accordance with Austroads Guide to Road Design Part 3: Geometric Design – Section 4.6.4 and the following:

- Provide barrier kerb for lightly trafficked local roads, adjacent to parking lanes and parking areas and bus bays to reduce the risk to pedestrians.
- Provide layback kerb on minor roads to allow for off-road parking and for continuous access to property.

8. Kerb and channel shall be placed with the clearance between the face of the kerb and the edge of the traffic lane in accordance with Table D1.12.

Traffic Lane Clearance

Speed (km/h) (operating speed)	Kerb type	Minimum clearance (m) Edge of traffic lane to line of kerb
0 – 60	High profile barrier kerb	0.3
0 – 79	Barrier or semi-mountable	0
80 – 99	Semi-mountable dished channel	0 1.3
100+	Semi-mountable dished channel	0.8 1.3
Freeways	Semi- mountable	0.8

Source: Austroads Guide to Road Design Part 3: Geometric Design – Table 4.13

Table D1.12 – Clearances from line of kerb to traffic lane

D1.45 RESERVED

D1.46 RESERVED