DEVELOPMENT DESIGN SPECIFICATION

D1

GEOMETRIC ROAD DESIGN

CONTENTS

DEVELOPMENT DESIGN SPECIFICATION D1 - DESIGN

GENERAL

D1.01 SCOPE

1. This section sets out design specifications to be used in the subdivision of land and other developments as relevant.

2. All relevant design principles must be integrated in the development of the road network. A careful balance is required between maximising amenity, safety considerations and those related to legibility and convenience.

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 the 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 Specifications

Wingecarribee Shire Development Control Plan No. 12 and Roadside Management Plan.

(b) Australian Standards

AS 2890.1	Parking facilities: Off-street car parking.
AS/NZS 1158.3.1	Guide to pedestrian and street lighting

(c) State Authorities

Roads and Traffic Authority NSW - Road Design Guide.
Roads and Traffic Authority NSW – 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.

(d) Other

AUSTROADS
Guide to the Geometric Design of Rural Roads.
Guide Policy for the Geometric Design of Major Urban Roads.
Guide to Traffic Engineering Practice:
PART 5, Intersections at Grade
PART 6, Roundabouts
PART 10, Local Area Traffic Management
PART 13, Pedestrians
PART 14, Bicycles

The Institute of Municipal Engineering Australia, Qld Division - 1993: Design Guidelines for Subdivisional Streetworks.

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

Joint Venture for More Affordable Housing - 1989: Australian Model Code for Residential Development.

Stapleton, C 1984: Roads 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: Roads 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.

D1.05 PLANNING CONCEPTS

Road Hierarchy

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.

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

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

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

Legibility

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

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

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

D1.06 PLAN REQUIREMENTS

(a) Reduction Ratios

Drawing Scales

1. All plans for urban design are to be reduced to 1:500. Rural designs may be reduced to 1:1000.

Longitudinal Sections	1:500 H 1:100 V
Cross Sections	1:100 Natural
Intersection Contour Plans	1:200 (Contours generally at 0.1m interval or, where necessary, at closer intervals to adequately reflect the terrain)
Kerb Return Profiles	1:200 H 1:20 V (1:10 for flat terrains)

(b) Plan Sheets

1. Separate sheets should be provided for

a. Cover sheets
b. Plan views
c. Longitudinal sections
d. Cross sections
e. Intersection Contour Plans and Kerb Returns
f. Structural details
g. Standard drawings

(c) Plan Presentation

Permanent Record

1. Plans are to be presented on A1 sheets unless otherwise authorised. They are to be clear, legible and prepared in consistent lettering and style. Council has the authority to refuse plans that do not meet these drafting requirements. Layout plans copied from other works will not be accepted. All plans 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, plans 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.

(d) Certification

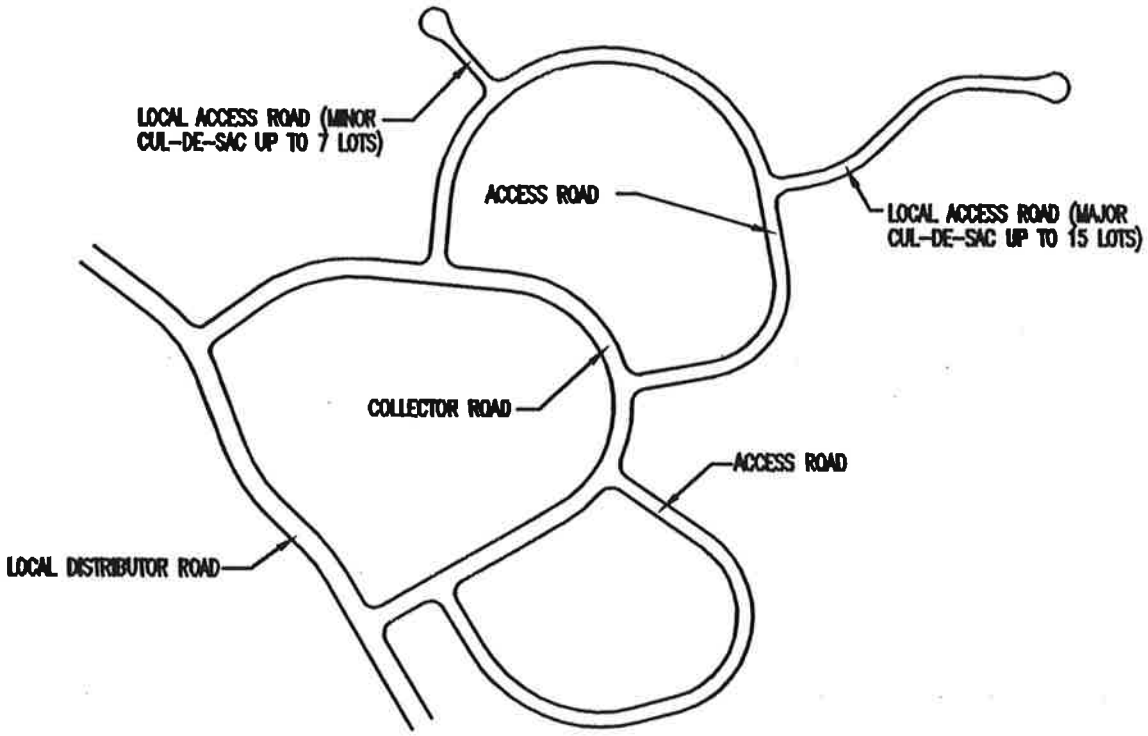
Design Consultant

1. Plans shall identify the designers and shall be certified as complying with the appropriate design specifications (D1 to D12). The certificate shall be in the format detailed by Design Specification DQS.

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.



ROAD HIERARCHY LAYOUT
FIGURE D1.1

2. Six distinct levels of public roads are: ***Road Hierarchy***

- Local Distributor Road
- Collector Road
- Minor Collector Road (access street)
- Local Access Road (major cul-de-sac – up to 15 lots)
- Local Access Road (minor cul-de-sac – up to 7 lots)
- Industrial

3. Local access roads (cul-de-sac's) are provided for access (off the local street system) to up to 15 dwellings. Vehicular traffic is subservient in terms of speed and volume, to those elements of space, amenity, pedestrians and cyclists. Refer Figure D1.1 & Table D1.1. ***Local Access Road (Cul-de-sac)***

4. Access roads have as their primary function access to a discreet residential road network and residential space. The local access road should also incorporate amenity features that facilitate pedestrian and cycle movements. Vehicular traffic is subservient in terms of speed and volume, to those elements of space, amenity, pedestrians and cyclists. Refer Figure D1.1 & Table D1.1. ***Access Road***

5. Collector Roads should provide a direct linkage to the local access road and provide a balance between the status of that street in terms of its access and residential amenity functions. Resident safety and amenity are still factors to have high consideration in the design process. Refer Table D1.1.

6. The Local Distributor Road – the highest order road within a residential development should have as its main function the safe and efficient conveyance of traffic generated by the development. Direct access should not be provided for single dwelling allotments but access may be considered to multi-unit developments and non-residential land uses. The local distributor should serve only the development and should not attract through traffic. Refer Table D1.1. ***Local Distributor Road***

7. Industrial roads are to be provided in areas allowed for such development as shown on the appropriate Development Control Plan and as determined by Council. Refer Table D1.1. ***Industrial Road***

8. Private Roads – these roads are owned by the owners of the land on which the road is located. A private road can serve a maximum of three allotments or one community/strata title development. The standard of construction is the same as a public road see Table D1.1 – combined driveway/accessway. Maintenance of these roads is the responsibility of the landowners and not Council. ***Private Road***

9. Rights of Carriageway – these roads are under the direct ownership of one or more landowners/beneficiaries. A Right of Carriageway can serve a maximum of three lots. The standard of construction is the same as a combined driveway/accessway – see Table D1.1. ***Right of Carriageway***

TABLE D1.1
MINIMUM ACCEPTABLE CHARACTERISTICS OF URBAN ROADS AND DESIGN GUIDELINE PARAMETERS

Classification of Road	Road Reserve Width	Footway Width	Carriageway Width (between nominal face of kerbs)	Kerb Type	AADT
Local Distributor Road	22 m (SD101)	2 x 4.5 m	13 m	Std 150 kerb (SD108)	5000 – 7000
Collector Road	20 m (SD101)	2 x 4.5 m	11 m	Std 150 kerb (SD102)	< 3000
Access Road	18 m (SD101)	2 x 4.5 m	9 m	Roll kerb (SD102)	< 1000
Local Access Road/ Major Cul-de-sac (up to 15 lots)	17 m (SD101)	2 x 4.05 m	8.9 m See Note 8	Roll kerb (SD102)	< 800
Local Access Road/ Minor Cul-de-sac (up to 7 lots)	15 m (SD101)	2 x 4.05 m	6.9 m See Note 8	Roll kerb (SD102)	< 150
Industrial Road	20 m (SD101)	2 x 4.05 m	13 m	Std 150 kerb (SD102)	
Combined Driveway/ Accessway (up to 3 lots)	See Note 3		4.5 m See Note 4	See Note 3	
Internal Driveway for Multi Unit Development	See Note 3		4.5 m	See Note 3	

Notes:

1. A trip generation factor of 10 is assumed for each dwelling.
2. The minimum footway width on any one side of the road reserve is 2.5m. Council must approve any reduction in the normal footway width in writing.
3. The provision of combined driveways/accessways, battleaxe handles and internal driveways will be considered on a case-by-case basis. The road reserve width in access handles serving single battle-axe allotments may be reduced to not less than 6.0m wide.
4. The carriageway in access handles serving single battle-axe allotments may be reduced to not less than 3.0m wide where it can be shown that there is adequate sight distance and safe passing opportunities for vehicles. However, in no circumstances will a width of less than 3.0 m be approved. Where pavements <4.5 m in width are provided, they shall meander within the access way except within the first six metres from the public road boundary. These driveways shall generally be surfaced with either reinforced concrete or asphaltic concrete and designed in accordance with the requirements contained within D2. The width of the driveway shall include the concrete edge strips for asphaltic pavement. The width of the of pavement shall generally be defined by WSC SD 101 & WSC SD 102.

5. Asphaltic Concrete pavement shall have concrete edge restraints such as concrete edge strips. The width of pavement shall include the concrete edge strips, otherwise the pavement width is as defined by the nominal kerb line in WSC SD 101 & WSC SD 102.
6. Typical cross section details are shown on WSC SD 101 and SD 147, as amended from time to time.
7. The road reserve width is a minimum requirement. Additional width may be required to cater for cut and fill batters, catch drains, intersection layout requirements, adequate sight distance, safe intersection sight distance, special landscape requirements and provision for public utilities.
8. The construction of swale drains within the road reserve will in most cases require an increase in the road reservation width to at least 20m to accommodate the swale drain clear of public utilities and footways.
9. These are absolute minimum widths and must be increased to the satisfaction of Council's Development Engineer where either horizontal or vertical alignments dictate.
10. Urban subdivisions with a zoning requiring a minimum lot size of 2000 sq. metres will require grass swales.
11. Other Council policies and the Local Environmental Plan need to be checked for specific design criteria that may exist within the Shire.

D1.08 PROVISION FOR FLEXIBLE SUBDIVISIONAL DESIGN

1. All proposals departing from this specification need to be discussed with and receive written concept approval from Wingecarribee Shire Council (i.e. prior to commencement of design).

D1.09 ROAD NETWORK

1. The length of local distributor road(s) within a development should be minimised.

2. Where access roads form part of a pedestrian or cycle network, access links should provide suitable connectivity with adjoining access roads or open space systems so as to ensure such pedestrian and cycle network are functionally efficiently. ***Minimise travel times***

3. 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 road or local road should have access to an access-controlled arterial road. ***Road Links***

4. Connections between internal roads should be T-junctions or controlled by roundabouts.

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

6. The external road network should be designed and located to provide routes that are more convenient for through traffic than to utilise the local road 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 projected movements. The internal road system should not provide through routes that are more convenient than the external road network. ***External Road Network***

D1.10 DESIGN SPEED

1. Design speed is generally used as the basic parameter in the specification of design standards, determining the minimum design value for other elements. The NSW Roads and Traffic Authority 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, however the design travel speed of 60 km/h is be used in calculating design values which depend on speed, (eg collector and distributor roads). Vehicular speeds are also limited by road intersections as well as changes in horizontal and vertical alignment. ***RTA Guidelines***

2. Adoption of a low design speed discourages speeding; however, where vertical or ***Low Speeds***

horizontal curves of low design speed are located in otherwise high-speed sections (tangents) 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 that will help a driver avoid errors of judgement. Designers should incorporate hazard free escape paths for both drivers and pedestrians within their design should a road user make an error in judgement.

3. Generally the following design speeds should be adopted:

Access Street	25 km/h
Local Street	50 km/h
Collector Road	60 km/h
Distributor Road	80 km/h

D1.11 LONGITUDINAL GRADIENT

Flat Terrain

1. The minimum gradient is 1.0%. Maximum recommended grades are shown in Table D1.2.

Table D1.2
Maximum Longitudinal Road Gradients

	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 (and maximum cross grade) through intersections, roundabouts and cul-de-sac heads should not exceed 4 per cent (and be no less than 2%). However in difficult terrain 5% maximum will be considered, dependent on other site conditions. Design of the road alignment and the grades used are interrelated. A steep grade on a side street is undesirable if vehicles have to stand waiting for traffic in the priority road.

D1.12 HORIZONTAL CURVES AND TURNING MOVEMENTS

Transition Curves

1. The Horizontal Alignment of a road is normally a series of tangents and curves, which may be connected by transition curves. For design speeds up to 60 km/h the use of transition curves is not considered necessary. In practice, curve radii on urban roads range from right-angled bends to large radius curves. The radius of horizontal curves should be the largest attainable. The minimum deflecting angle for which a curve is necessary is 1 degree. The minimum radius of horizontal curves is shown in Table D1.3.

Table D1.3
Minimum Horizontal Curve Radii

Minimum Deflection Angle	Minimum Radius (m)
75°	20
60°	33

40°	65
30°	75
20°	100

2. Sight distance on curves is determined by formula, values of which are tabulated in RTA Road Design Guide.

D1.13 VERTICAL CURVES

1. Vertical curves will be simple parabolas and should be used on all changes of grade exceeding 1 per cent. Generally, the desirable minimum design speed in urban conditions is 60 km/h, and designed to suit the 85th percentile speed in rural conditions. All vertical curves shall be designed in accordance with the RTA Road Design Guide.

Riding Comfort

2. For adequate riding comfort, lengths of sag vertical curves should conform to the RTA Road Design Guide. As residential roads are usually lit at night, the criterion for designing sag vertical curves is a vertical acceleration of 0.05 g for desirable riding comfort, and 0.10 g for minimum riding comfort. The minimum lengths for vertical curves are shown in Table D1.4.

Table D1.4
Minimum Length of Vertical Curves

	Local access (m)	Collector (m)	Distributor (m)
Minimum vertical curve	25	35	50
Absolute minimum vertical curve (to be applied at road junctions only)	6	12	20

Side Road

3. Junctions of roads should be located at a safe distance from a sight obstruction (vertical or horizontal), determined by visibility from the side road, in accordance with the Safe Intersection Sight Distance as determined using the RTA Road Design Guide. Location of a side road at or near a crest shall be avoided.

Sag Curves

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 localised minimum grade of 0.5 per cent should be maintained in the kerb and gutter. This may require some localised warping of road cross sections at sag points (maximum cross fall in these situations of 5%).

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:

- 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 gradeline between sag curves may adversely affect the road's symmetry and appearance.

D1.14 SUPERELEVATION

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 that are designed for speeds of 40 km/h or less, and with curves of 60 m 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.

Negative Crossfall

2. The maximum superelevation for urban roads of higher design speeds should be 6 per cent. Any increase in the longitudinal grade leading to excessive crossfall at intersections should be considered with caution. Superelevation shall be applied as determined by the RTA Road Design Guide.

Coefficient of Side Friction

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 and the pavement, and on speed.

4. Recommendations for minimum curve radii (in metres) on major urban roads under varying superelevation/crossfall are shown in Table D1.5.

Table D1.5
Superelevation and Crossfall

	Design Speed km/h	60	70	80
		Curve Radii (m)	Curve Radii (m)	Curve Radii (m)
Minimum Superelevation (%)	5 4 3 2 1	145 150 160 170 180	195 205 215 230 245	255 265 280 300 315
Maximum Crossfall (%)	0 1 2 3	190 260 285 315	260 355 390 430	340 460 505 560

(Source: AUSTROADS, Guide policy for the geometric design of major urban roads.)

5. 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.

D1.15 CARRIAGEWAY WIDTH

1. The cross section of the road reserve must cater 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, drainage swales and roadscaping. Table D1.1 details carriageway and footway widths and road reserve widths. ***Functions***

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. Carriageway widths need to be increased in accordance with the appropriate standards to accommodate buses, parking bays, service vehicles etc. ***Accommodate Design Vehicles***

3. The safety of pedestrians and cyclists where it is intended they use the carriageway must be assured by providing sufficient width. If necessary, the road reserve width is to be increased to safely cater for expected pedestrian and/or bicycle movements. ***Pedestrian & Cyclist Safety***

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

5. The design of the carriageway should discourage motorists 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.

6. Appropriate road reserve width should be provided to enable the safe location, construction and maintenance of required paths, public utility services (above or below ground) and swale drains and to accommodate the desired level of roadscaping. Wherever possible services should be located in common trenches and not within drainage swales. ***Road Reserve***

7. The footway widths should be considered in conjunction with the horizontal alignment, table drains and permitted fence and property frontage treatments and should provide appropriate sight distances, taking into account expected speeds and pedestrian and cyclist movements. The proposed footway width should be discussed with Council's Development Engineer prior to undertaking detailed design. ***Footway***

8. Stopping sight distances and junction or intersection sight distances should be based on the intended speeds for each road type.

D1.16 CROSSFALLS

1. Roads should be crowned in the centre. Typical pavement crossfalls on straight roads are:

Pavement Type	*Crossfall*
Flexible	3 per cent
Rigid	2 per cent

2. There are many factors affecting levels in urban areas. In some circumstances this may force departures from these crossfalls. Departures from the standard will be considered on a case-by-case basis. ***Offset Crown Changes***

3. The crossfall on a collector or distributor road should take precedence over the grade in side roads. Standard practice is to maintain the crossfall on the priority road and adjust the side road levels to suit. The crossfall in side roads should be smoothly transitioned to a crown or a uniform crossfall depending on the configuration of the side street. ***Priority Road***

D1.17 FOOTWAY AREAS

1. A suitable design for the footway will depend on utility services, the width of pathways, access to adjoining properties, likely pedestrian usage and preservation of trees. Low-level paths are undesirable but may be considered if normal crossfalls are impracticable. Crossfalls in footway paving should not exceed 4 per cent, as above this paving can be slippery. Longitudinal grade usually parallels that of the road ***Utility Services***

2. Batters outside of the road reserve (unless stable rock is encountered) shall not exceed 1 (vertical) to 4 (horizontal) in cut or filled embankment situations. ***Batters***

3. Where batters cannot be constructed in accordance with D1.17.2, approved retaining walls shall be provided, for the full frontage of the affected allotment, to a height that allows batter slopes to be constructed in accordance with the requirements of D1.17.2. Retaining walls with an overall height exceeding 0.9m shall be designed and structurally certified by a qualified Civil or Structural Engineer and will also require the provision of a 0.9m high approved pedestrian safety railing. Pedestrian safety should also be considered on walls of lesser height. ***Retaining Walls***

4. Where vehicular access is to be provided through retaining walls on allotment frontages, the retaining wall shall be returned along each side of the access. The return shall be for a minimum distance of 1.0 metre beyond a 3.0m x 3.0m splay corner on each side of the access, or extended as required to enable a minimum 1 (Vertical) to 4 (Horizontal) batter inside the allotment. The 3.0m x 3.0m splay may need to be increased should sight distance be inadequate. ***Access through retaining walls***

5. Where driveway crossings are provided vertical clearance of vehicles shall be ensured. Vehicle profiles of low clearance vehicles shall be used using a scale of 1:20 horizontal and vertical. Typical grading profiles are shown in the current issue of SD 123. ***Vehicle profile clearance***

6. All footway areas shall be topsoiled and seeded in accordance with Development Construction Specification C273. A minimum 900mm wide continuous strip of turf shall be provided behind all kerb and gutter in accordance with Development Construction Specification C273. ***Topsoil, seeding and turf***

D1.18 INTERSECTIONS

1. The design of intersections or junctions should allow all movements to occur safely and without undue delay. Projected traffic volumes should be used in designing all intersections or junctions on local distributor roads. T- junctions are preferred over 4 way intersections and may necessitate the provision of a roundabout. ***Traffic Volumes***

2. Intersection design for the junction of subdivision roads with existing main rural, main urban and state highways should generally be designed in accordance with the RTA Road Design Guide. ***Main Roads***

3. Intersections with main roads, tourist roads or state highways are to be designed and constructed in accordance with the requirements of the Roads and Traffic Authority. ***Tourist Roads State Highways***

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

in the locality.

5. Intersections should be generally located in such a way that: ***Criteria***

- The roads should intersect at right angles. Intersections up to 70 degrees may be satisfactory in difficult circumstances.
- The landform allows clear sight distance on each of the approach legs of the intersection in accordance with the Safe Intersection Distance requirements of the RTA Road Design Guide.
- The minor street intersects the convex side of the major street.
- The vertical grade lines at the intersection will allow for any direct surface drainage.
- Two side roads intersecting a major street in a staggered pattern should have a minimum centre-line spacing of 40 m.

6. Adequate stopping and sight distances are to be provided for horizontal and vertical curves at all intersections in accordance with the RTA Road Design Guide.

7. Appropriate provision should be made for vehicles to access properties and park safely.

8. In cul-de-sac roads adequate provision should be made at the end of the road for vehicle types which frequently use the roads to turn around (provision for turning of garbage service vehicles, as a minimum, should be provided at all cul-de-sac heads – see D.1.18.10 and SD 106).

9. The drainage function of the carriageway and/or road reserve must be satisfied by the road reserve cross-section profile.

10. All vehicle turning movements are accommodated utilising AUSTROADS Design Vehicles and Turning Templates, as follows: ***Turning Movements***

- For turning movements involving local distributor roads, the "design semi-trailer" with turning path radius 15.0 m.
- For turning movements involving access roads or collector roads, but not distributor roads, the "design single unit" bus with turning path radius 13.0 m.
- For turning movements on local access roads but not involving distributor roads, collector roads or access roads, the "design single unit" truck with turning path radius of 12.5 m.
- For turning movements at the head of cul-de-sac roads sufficient area is provided for the "design single unit" truck to make a three-point turn.

11. Turning radii at intersections or driveways on local distributor roads shall accommodate the intended movements without allowing desired speeds to be exceeded. ***Turning Radii***

12. On bus routes 3-centred curves with radii 7.0 m, 10.0 m, 7.0 m are used at junctions and intersections. ***Bus Routes***

13. Combined entry and exit driveways on local distributor roads are 6.0 m wide and separate entry and exit driveways are each 3.0 m wide. For all other cases, the combined driveway minimum width is 4.5m or 3.0m each for separate entry and exit driveways ***Minimum Driveway Widths***

14. Kerb returns shall be designed at all road junctions to ensure a smooth trafficable carriageway around the return and to locate low points in the gutter for drainage purposes. ***Kerb Returns & Splays***

A typical design layout is shown on SD 105. The standard radius of a kerb return is 8.5m based on a 4 m by 4 m splay corner and a standard 4.5 m footpath width. Variation of the radius may occur if the dimensions of a splay corner and/or width of footway change. A minimum splay of 4m by 4m will always be required on both sides of any intersection.

D1.19 ROUNDABOUTS

Provision of Roundabouts

1. Roundabouts shall be provided at locations determined following discussions with Council (and if necessary the Roads and Traffic Authority and the local Traffic Committee) in the early planning stages. In certain circumstances, Council and/or the Roads and Traffic Authority may determine the requirement of additional roundabouts at locations that are likely to be dangerous (due to the nature of the geometry or terrain) or potentially highly trafficked intersections.

Roundabout Geometry

2. Roundabout geometry and gradings are to be approved by Council. All roundabout layout and grading plans are to be submitted to the Roads and Traffic Authority. The Roads and Traffic Authority reserve the right to accept or reject any roundabout design.

3. Roundabouts should be designed in accordance with the requirements of the RTA "Roundabouts – Geometric Design Method" and pavement marking in accordance with the RTA "Pavement Markings of Roundabouts." Traffic control devices should be in accordance with Australian Standard AS1742.2 – "Manual of uniform traffic control devices."

4. All roundabouts should be constructed with an asphaltic concrete and thermoplastic line marking:

D1.20 TRAFFIC CALMING

Local Area Traffic Management

1. Calming devices such as thresholds, slow points, chicanes and splitter islands shall only be provided following prior consultation with Council. Such devices are often required to offset deficiencies in the overall layout, and where possible should be avoided by reviewing the overall road layout in "greenfield" situations. Where such devices are deemed to be required they shall be designed in accordance with the requirements of the publication AUSTROADS Guide to Traffic Engineering Practice - PART 10, Local Area Traffic Management and are to be approved by Council and, in some circumstances, the Local Traffic Committee. Devices designs should generally comply with the following:

(a) Roadscape

- reduce the linearity of the street by segmentation
- avoid continuous long straight lines (e.g. 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 generally consistent with roadscape requirements
- existing street lighting, drainage pits, driveways, and services may decide the exact location of devices
- slowing devices are optionally located at spacings of 100-150m.

(c) Design Vehicles ***Design***

Vehicles

- emergency vehicles must be able to reach all residences and properties
- local roads with a 'feeding' function between arterial roads and minor local roads shall be designed for a AUSTROADS Design Single Unit Truck/Bus
- where bus routes are involved, buses should be able to pass without mounting kerbs and with minimised discomfort to passengers.
- in newly developing areas where street systems are being developed in line with Local Area Traffic Management (LATM) principles, building construction traffic must be catered for.

(d) Control of Vehicle Speeds

Vehicle Speeds

- maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowing has only minor effects on average speeds, and usually little or no effect on maximum speeds
- speed reduction can be achieved using devices that shift vehicle paths laterally (slow points, roundabouts, corners) or vertically (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' roads into relatively short lengths (less than 300m), using appropriate devices, roadscapes, or street alignment to create short sight lines

(e) Visibility Requirements (sight distance)

Visibility

- adequate critical sight distances should be provided such that either party in a potential conflict situation may take evasive action. 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.

(f) Critical Dimensions

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

- pavement narrowing
  - single lane 3.50 m between lips of kerbs
  - 4.0 m between obstructions
  - two lane 5.50 m minimum between lips of kerbs
- bicycle lanes (including adjacent to pavement narrowing) – 2.00 m minimum

Bicycle Lanes

- plateau or platform areas

  - 75 mm to 150 mm height maximum, with 1 in 15 ramp slope and a minimum platform length of 4.0m

- width of clear sight path through slowing devices

  - 1.0 m maximum

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

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

D1.21 PARKING

1. The parking requirements for normal levels of activity associated with any land use should be accommodated on-site in accordance with Wingecarribee Shire Council's Development Control Plan No. 12 and development conditions.

2. All off-street parking should be designed in accordance with Development Control Plan No. 12.

D1.22 BUS ROUTES

1. Council will normally identify bus routes. Roads identified as bus routes shall be designed to local distributor standards. ***Design for bus routes***

Table D1.6
Bus Bay and Bus Shelter Requirements

Road	Carriageway Width (min)	Stops (Spacing)	Bays
Access	9 m	400 metre *	Single
Collector	11 m	400 metre	Shelters** and Bays
Local Distributor	13 m	400 metre	Shelters** and Bays

* 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

D1.23 GENERAL

1. In addition to the foregoing sections this section specifically applies to all sites

greater than one hectare and where permissible for rural developments excluding rural homes and ancillary structures. Where subdivision is being undertaken, existing unsealed roads fronting the subdivision shall be sealed in accordance with D2 Pavement Design and Standard Drawing 101 for Rural Roads.

2. Rural Subdivision Roads are to be constructed according to the following criteria:

Minimum Lot size	Road Type	Pavement Type
1 Ha to 10 Ha	Public Road	2 coat seal
1 Ha to 10 Ha	Private Road (up to 3 lots)	2 coat seal
Greater than 10 Ha	Public Road	2 coat seal
Greater than 10 Ha	Private Road (up to 3 lots)	unsealed

Design Speed

3. 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 Guide to the Geometric Design of Rural Roads.

4. Where appropriate, superelevation, widening, centreline shift, and their associated transitions are to comply with the RTA Road Design Guide or AUSTROADS Guide.

Table Drain

5. Where the table drain is likely to scour, an RTA Type SH dish drain, or similar structure is to be constructed along the invert. Also for grades of less than 1.0%, the inverts of the drain are to be lined to prevent siltation.

6. All rural subdivisions creating lots sizes ≤ 2 Ha should be designed to deny property access to major roads.

Kerb and Gutter

7. In some circumstances (as determined by Council) rural residential subdivisions may be required to provide kerb and gutter on both sides of roads and if so, piped drainage may also be required.

Access

8. Access should be limited to one point on to local, arterial or main road networks.

Gates

9. Gates are to recessed a minimum of 6 metres from the road frontage within the property

D1.24 SIGHT DISTANCES

Stopping Distance

Sight Distance

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 1.2 m to an object height of 0.25 m, using a reaction time of 1.5 to 2.5 seconds depending on anticipated driver alertness. A minimum sight distance measured from a height of 1.2 m to a height of 1.2 m is preferable for speeds of 60 km/h and over – Tables are provided in the RTA Road Design Guide.

Braking Distance

2. Stopping distance is the sum of the braking distance and the distance the vehicle travels during a reaction time of say 1.5 seconds, and may be calculated using the following formula:

$$d = 0.42v + \frac{v^2}{254f}$$

Where d = stopping distance (m)
v = speed of vehicle (km/h)

f = coefficient of longitudinal friction

(Source: Policy for geometric design of rural roads, AUSTROADS)

3. Recommended sight distances (based on the RTA Road Design Guide and adjusted to include lower speeds and minimum site distances using the above formula) are shown in Table D1.7.

Table D1.7
Minimum Longitudinal Sight Distance

Travel Speed Km/h	Coefficient of * longitudinal friction	Stopping sight distance (m)	Minimum sight distances (m)
40	0.52	33	**
50	0.50	46	**
60	0.47	60	180
70	0.45	80	220
80	0.43	100	260

* bituminous or concrete surfaces
** not applicable at lower speeds

4. These figures may apply on crest vertical curves only where there are straight alignments. Adjustments should be calculated for steep grades.

D1.25 HORIZONTAL AND VERTICAL ALIGNMENT

1. Horizontal and vertical curves are to be designed generally to the requirements of the RTA Road Design Guide. 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 to the terrain to achieve desirable aesthetic quality and be in harmony with the landform.

D1.26 INTERSECTIONS

1. Intersections should generally be designed in accordance with the RTA Road Design Guide and the publication AUSTROADS Guide to Traffic Engineering Practice - Part 5, Intersections at Grade. ***Intersection design***

2. Adequate sight distance should be provided at intersections and junctions. The intersection sight distances required by stopped vehicles are to be in accordance with the RTA Road Design Guide.

3. An absolute minimum spacing of 40 m should be adopted for staggered junctions. The intersection angle between two roads should preferably be 90°, and variations to this should be within +/- 20° band**. ***Staggered Junctions***

D1.27 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 ***Widening of Curves***

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.

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 0.1% per linear metre 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

D1.28 CARRIAGEWAYS

1. Carriageway widths for rural roads should generally be as follows:

7 metre seal (edge linemarked to 6.0 m) plus 2 x 1.2 metre shoulders (measured from the edge line)

D1.29 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 Guide to Geometric Design of Rural Roads for superelevation calculation. At low and intermediate ranges of design speed (ie below 80 km/h) it is desirable to superelevate all curves at least to a value equal to the normal crossfall of straights.

Design Speed

D1.30 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 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.

2. For rural roads with longitudinal gradients greater than 5%, the roadside drainage (including table drains) will be suitably stabilised in accordance with the RTA Road Design Guide.

SPECIAL REQUIREMENTS

D1.31 PUBLIC PATHWAYS

1 The pathway shall be cleared and formed with a 2.0m wide concrete pathway (specifications as per SD 118).

Concrete Pathway

2. Pathway barriers (SD 130) to be installed at each end to prevent vehicular entrance.

Barriers

3. The area between the concrete path and pathway boundaries shall be either topsoiled and turfed in accordance with DCP41 Construction Specification C273 or otherwise suitably landscaped (design details to be approved by Council).

Pathway Landscaping

D1.32 STREET NAME SIGNS

1. Street name blades and brackets shall be provided at all street junctions, intersections and roundabouts in accordance with WSC SD 119

Street Name Blades

D1.33 VEHICULAR CROSSINGS

1. Kerb crossings in accordance with SD 107 and SD 109 (for residential areas, SD 108 (for commercial and industrial areas) and SD 110 (for rural areas) shall be provided in accordance with Table D1.8 where roll kerb is not provided or as directed by Council.

Provision of Vehicular Crossings

Table D1.8
Provision of Vehicular Crossings

	Residential	Industrial	Commercial	Rural
Number of crossings per street frontage	1	1	1	1
Minimum width per crossing	3.0m	6.0m	4.0m	4.0m
Minimum distance to closest side of crossing from kerb tangent point at intersections	6.0m	6.0m	6.0m	To be assessed on its merits

Notes:

Rural crossings are to be provided in accordance with SD 110. If crossing is adjacent to sealed road entrance, it is to be sealed from existing edge of bitumen to boundary line.