DEVELOPMENT DESIGN SPECIFICATION

D1

GEOMETRIC ROAD DESIGN (Urban and Rural)

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GENERAL

D1.01 SCOPE

1. This section sets out design specifications to be used in the subdivision of land.

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 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

The following reference document list is not exhaustive and it is the responsibility of the designer to maintain awareness of amendments and changes to Australian Standards and other relevant documents.

(a) Council Specifications

All Specifications for Design and Construction, relevant Development Control Plan (DCP) and Local Area Traffic Management Plans (LATM).

(b) Australian Standards

AS/NZS 2890.1 Parking facilities: Off-street car parking.

(c) State Authorities

Roads and Maritime Services NSW - Road Design Guide.

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 Road Design Part 3: Geometric Design.
Guide Policy for the Geometric Design of Major Urban Roads.
Guide to Traffic Management Parts 6 and 8
Guide to Road Design Parts 4, 4A, 4B, 4C and 6A

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: 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 shall in addition to requirements of this Specification ascertain specific requirements of these authorities as they relate to the designs in hand.

2. Where there is inconsistency between the RMS Road Design Guide and AUSTROADS, the RMS Road Design Guide shall have primacy. The Designer should consult with Council for determination.

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, the pattern and width(s) will be determined by Council on their merits.

3. The road network for residential developments shall 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 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.

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

1. All plans for urban design are to be reduced to 1:500. Where detail is is required, plans shall be presented at 1:200.

Longitudinal Sections	1:500 H 1:100 V
Cross Sections	1:100 Natural

(b) Plan Sheets

1. Separate sheets shall be provided for

a. Cover sheets
b. Plan views
c. Longitudinal sections
d. Cross sections
e. Structural details
f. Standard drawings

(c) Plan Presentation

Permanent Record

1. Plans are to be presented on A1 sheets unless otherwise authorised. They are to be clear and legible and prepared in consistent lettering and style. Council has the authority to refuse plans that do not meet these drafting requirements. All plans shall be clearly referenced with notations and tables as appropriate. The designer shall always be mindful that apart from being a permanent record and legal document, plans shall be easily read and understood by the Contractor, and others involved in the construction of the works. Terminology shall be kept in 'plain English' where possible.

(d) Certification

Design Consultant

1. Plans 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).

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 shall convey to motorists the predominant function of the road. For a typical hierarchy refer to Council's DCP.

D1.08 ROAD NETWORK

1. The design features of each type of road convey to the motorist its primary functions and encourage appropriate driver behaviour.

2. Traffic volumes and speeds on any road shall be compatible with the residential functions of that road.

3. The maximum length of lower order roads shall ensure their status as a residential place is retained, where the traffic, in terms of speed and volume will enable the integration of pedestrian, cycle 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 higher order roads within a development shall be minimised.

5. The time required for motorists to travel on all streets within the development shall be minimised.

6. Where lower order roads form part of a pedestrian or cycle network, access links should provide suitable connectivity with adjoining roads or open space systems so as to ensure such pedestrian and cycle network are functionally efficient.

Road Links

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.

D1.09 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. Vehicular speeds are also limited by road intersections as well as changes in horizontal and vertical alignment.

Low Speeds

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 shall 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.

3. Design speeds shall be in accordance with Council's DCP. Where a development is not covered by the provisions of a DCP, the design speed shall be set by Council.

D1.10 LONGITUDINAL GRADIENT

1. Other than at sags and crests, the minimum permissible gradient is 0.5%. Variable crossfall may be necessary to produce the required grade in the gutter. Maximum recommended grades are shown in Table D1.1.

Table D1.1

Road Carriageway Type	Maximum Desirable Grade	Absolute Maximum Grade
Residential	17%	Greater than 17% up to and equal to 20% for distances not exceeding 100 m
Industrial / Commercial	12%	Greater than 12% up to and equal to 15% for distances not exceeding 100 m

2. Design of the road alignment and the grades used are interrelated. A steep grade on a side street is undesirable if vehicles on the side road have to stand waiting for traffic in the priority road.

3. The maximum grade in any direction within a cul-de-sac turning circle or T-Head shall not exceed 8%.

D1.11 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.

2. The radius of horizontal curves in urban areas shall selected to meet the following objectives:

a. turning movements of a large rigid vehicle to enter and leave each street travelling in a forward direction.

b. sight distance criteria in accordance with AUSTROADS requirements taking account of building set backs and landscape features.

c. desired speed environment to cater for pedestrian, cyclists be the largest attainable.

D1.12 VERTICAL CURVES

1. Vertical curves will be simple parabolas and shall be used on all changes of grade exceeding 1%. The desirable minimum design speed is 40 km/h. The length of the crest vertical curve for stopping sight distance shall conform with AUSTROADS requirements.

2. For adequate riding comfort, lengths of sag vertical curves shall conform with the RMS 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 D1.3. ***Riding Comfort***

Table D1.3

	Local access (m)	Collector (m)	Distributor (m)
Minimum vertical curve	25	35	50
Absolute minimum vertical curve (to be applied at road junctions only)	8	12	20

3. Sight distance requirements at all intersections shall be provided in accordance with AUSTROADS 'Intersections at Grade'. ***Side Road***

4. Drainage poses a practical limit to the length of sag curve. A minimum grade of 0.5 per cent should be maintained in the kerb and gutter. ***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:

- 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 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 and streetscaping. Carriageway width, footway width and road reserve width shall comply with Council's DCP. ***Functions***

2. Where a development is not covered by the provisions of the DCP, carriageway width, footway width and road reserve width shall be determined by Council.

D1.15 CROSSFALLS

1. Desirably, roads should be crowned in the centre. Typical pavement crossfalls on

straight roads are:

Pavement Type	*Crossfall*
Bituminous seal coat	3 %
AC pavement	3 %
Cement concrete pavement	2 %

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

Offset Crown Changes

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 cross falls. Sustained crossfalls should not exceed 4 per cent, although up to 6 per cent may be used where unavoidable.

Rate of Rotation

3. The rate of change of crossfall should not exceed:

a. 6 per cent per 30 m for through traffic;

b. 8 per cent per 30 m for free flowing turning movements; or

c. 12 per cent per 30 m for turning movements for which all vehicles are required to stop.

Priority Road

4. The crossfall on a through road shall take precedence over the grade in side streets. Standard practice is to maintain the crossfall on the priority road and adjust the side road 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.

D1.16 FOOTPATH AREAS

Utility Services

1. A suitable design for the footpath will depend on utility services, the width of pathways, access to adjoining properties, likely pedestrian usage and preservation of trees. Crossfalls in footpath areas shall generally be 4%. Where this is not practical footpath crossfalls shall not be less than 2% nor exceed 6%. The footpath shall be graded to fall toward the kerb other than at locations specifically designed to cater for overland flow of stormwater.

D1.17 INTERSECTIONS

Traffic Volumes

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

Main Roads

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 publication AUSTROADS Guide to Traffic Management Part 6 and Guide to Road Design Parts 4, 4A, 4B and 4C

Tourist Roads State Highways

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 Maritime Services and Council.

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.

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

a. The streets intersect preferably at right-angles and not less than 70°.

b. The landform allows clear sight distance on each of the approach legs of the intersection.

c. The minor street intersects the convex side of the major street.

d. The vertical grade lines at the intersection do not impose undue driving difficulties.

e. The vertical grade lines at the intersection will allow for any direct surface drainage.

f. Two side streets intersecting a major street in a staggered pattern should have a minimum centre-line spacing of 40 m.

6. Stopping and sight distances are to be provided for horizontal and vertical curves at all intersections in accordance with AUSTROADS requirements.

7. In cul-de-sac streets adequate provision should be made at the end of the road for vehicle types which frequently use the streets to turn around. The likelihood of parked vehicles obstructing turns must be catered for.

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

9. Footpath area width shall be in accordance with Council's DCP. ***Verge Widths***

11. All vehicle turning movements are accommodated utilising AUSTROADS Design Vehicles and Turning Templates. ***Turning Movements***

a. For turning movements involving local distributor roads, the "design semi-trailer" with turning path radius 15.0 m.

b. For turning movements involving local streets or collector streets, but not distributor roads, the "design bus/truck" with turning path radius 12.5 m.

c. For turning movements on access streets but not involving distributor roads, collector streets or local streets, the garbage collection vehicle used by the local authority.

d. For turning movements at the head of cul-de-sac streets sufficient area is provided for the "design bus/truck" to make a three-point turn. Where driveway enhances are to be used for turning movements, the required area is constructed and design to withstand the relevant loads.

D1.18 ROUNDABOUTS

1. Roundabouts are to be approved by the Council.

2. Roundabouts shall be designed in accordance with the requirements of the publication AUSTROADS Guide to Traffic Management - Part 6 and Guide to Road Design - Part 4B and current RMS Guidelines. Roundabout design should generally comply with the following:

a. entry width to provide adequate capacity.

b. adequate circulation width, compatible with the entry widths and design

vehicles e.g. buses, trucks, cars.

c. central islands of diameter sufficient only to give drivers guidance on the manoeuvres expected.

d. deflection of the traffic to the left on entry to promote gyratory movement.

e. adequate deflection of crossing movements to ensure low traffic speeds.

f. a simple, clear and conspicuous layout.

Approach Speed

g. design to ensure that the speed of all vehicles approaching the intersection will be less than 50 km/h.

D1.19 TRAFFIC CALMING

1. Calming devices such as thresholds, slow points, speed humps, chicanes and splitter islands should be designed in accordance with the requirements of the publication AUSTROADS Guide to Traffic Management - PART 8, and are to be approved by Council. Designs should generally comply with the Council LATM plans and the following:

(a) Streetscape

i. reduce the linearity of the street by segmentation

ii. avoid continuous long straight lines (e.g. kerb lines)

iii. enhance existing landscape character

iv. maximise continuity between existing and new landscape areas

(b) Location of Devices/Changes

i. devices other than at intersections should be located to be generally consistent with streetscape requirements

ii. existing street lighting, drainage pits, driveways, and services may decide the exact location of devices

iii. slowing devices are located at spacings of 100-150m

(c) Design Vehicles

i. emergency vehicles must be able to reach all residences and properties

Design Vehicles

ii. where bus routes are involved, buses should be able to pass without mounting kerbs

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

(d) Control of Vehicle Speeds

i. 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

Vehicle Speeds

ii. 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)

iii. 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

(e) Visibility Requirements (sight distance)

Visibility

i. 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

ii. sight distance to be considered include those of and for pedestrians and cyclists, as well as for drivers

iii. 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:

i. pavement narrowings

- single lane 3.50 m between kerbs
  3.75 m between obstructions
- two lane 5.50 m minimum between kerbs

ii. bicycle lanes (including adjacent to pavement narrowings) ***Bicycle Lanes***

- 1.35m minimum

iii. plateau or platform areas

- 75 mm to 150 mm height maximum, with 1 in 15 ramp slope

iv. 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 streetscape materials, usually vegetation)

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

D1.20 PARKING

1. The parking requirements are outlined in Council' DCP.

D1.21 BUS ROUTES

Buses

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.

RURAL DESIGN CRITERIA

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 homesites 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 Guide to Road Design – Parts 2, 3, 4, 6 and 7. ***Design Speed***

3. Reserved.

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. For grades of less than 0.5%, the inverts of the drain are to be lined to prevent siltation. ***Table Drain***

D1.23 SIGHT DISTANCES

1. Sight distances shall be in accordance with AUSTROADS requirements ***Sight Distance***

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

D1.24 HORIZONTAL AND VERTICAL ALIGNMENT

1. Horizontal and vertical curves are to be designed generally to the requirements of AUSTROADS - Guide to Road Design: Part 3 Geometric Design. 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.

D1.25 INTERSECTIONS

1. Intersections shall be designed in accordance with the publication AUSTROADS Guide to Traffic Management - Part 6 and Guide to Road Design – Parts 4, 4A, 4B and 4C. The type of intersection required will depend on existing and planned connecting roads.

2. Adequate sight distance in accordance with AUSTROADS requirements shall be provided at intersections and junctions.

3. An absolute minimum spacing of 40 m shall be adopted for staggered junctions. The intersection angle between two roads shall not be less than 70 degrees. ***Staggered Junctions***

D1.27 CARRIAGEWAYS

1. Carriageway width shall be in accordance with Council's DCP. Where a development is not covered by the provisions of the DCP, carriageway width shall be determined by Council.

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.

2. Protection works may involve concrete lined channels, turfing, rock pitching, grass seeding, individually or any combination of these. Geotechnical investigations should be carried out of determine the level and extent of any protection works prior to proceeding to final design stage.

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