

**DESIGN
SPECIFICATION**

D1

GEOMETRIC ROAD DESIGN

DESIGN SPECIFICATION D1 – ROAD DESIGN

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CITATION

This document is named “Kempsey Shire Council, Design Specification D1 – Road Design”.

ORIGIN OF DOCUMENT, COPYRIGHT

This document was originally based on PMHC AUS-SPEC. Parts of the AUS-SPEC document that remain are still subject to the original copyright.

VERSIONS, D1 - Road Design

VERSION	AMENDMENT DETAILS	CLAUSES AMENDED	DATE ISSUED (The new version takes effect from this date)	Authorised by the Director of Infrastructure
1.0	Version 1 – First Draft Version		March 2025	

DESIGN SPECIFICATION D1 GEOMETRIC ROAD DESIGN (Urban and Rural)

GENERAL

D1.01 SCOPE

1. Road design shall be in accordance with the Austroads Guide to Road Design series. It is acknowledged that Austroads guidelines may not be applicable to lower speed 'street' environments. This specification provides design criteria to supplement Austroads for the detailed geometric design of subdivision roads. Road design is to include provision for all road/street users and stakeholders including vehicles, pedestrians, cycles, people with disabilities, public transport, services, utilities, drainage and where appropriate to support frontage development.

*Road design
criteria,
subdivision
design and
road layout*

Subdivision design will determine the general lot layout, general road and intersection location and horizontal alignment, and is dealt within Council's Development Control Plan.

Prior to submitting a development application for a subdivision, the proposed subdivision design and road layout must be checked to ensure they are physically able to satisfy the geometric requirements of this specification, given the topographical and fixed constraints of the site. This may require 3D CAD design.

2. Urban street design criteria shall be used for urban and small lot rural residential subdivisions.

*Urban or rural
road design*

Small lot rural residential subdivision is defined as:

- Subdivisions where the average lot size, excluding residual and non-residential lots is <5,500m² and is generally undertaken within R5 zoning.

Rural road design criteria shall be used for all rural subdivisions (other than small lot rural residential) and for rural connecting roads to urban subdivisions.

3. Good geometric road design satisfactorily resolves the inherent goal conflict embodied in the "Objectives" below.

*Achieving good
road design*

D1.02 OBJECTIVES

1. **Road design is to:**

- (a) Provide acceptable levels of safety, convenience and amenity for all road users and adjacent residents in accordance with the roads hierarchical status.
- (b) Support frontage development, shops and commerce where appropriate.
- (c) Ensure each road link properly reflects its role based on its status and role in the wider road network and that there is a clear distinction

between functional classes of roads based on status, convenience, traffic volume, vehicle speed, public safety and amenity.

- (d) Provide for public transport to a level consistent with potential future demand, ensuring associated infrastructure confers on all classes of users the dignity to which they are entitled, and which is accessible on foot from most dwellings.
- (e) Provide safe, convenient cycleways.
- (f) Provide a safe, convenient movement network for people with disabilities, including those using wheelchairs and similar aids.
- (g) Provide a safe, convenient movement network for pedestrians between residences and to points of attraction in and outside the subdivision. In particular optimising the walkable access to and into centres, schools, public transport stops, parks and other destinations.
- (h) Provide attractive streetscapes which reinforce the diverse functions of a street and enhance the amenity of residents, leading to a safe, distinct and pleasant environment, with tree planting, landscaping and street furniture that does not adversely impact on the movement of pedestrians and cyclists, street lighting or the integrity of services and drainage systems.
- (i) Provide sufficient width of road and verge to allow streets to perform their designated functions within the street network, and provide a road edge that is appropriate for control of vehicle movements; and is structurally adequate and detailed to reflect pedestrian and cyclist "desire lines".
- (j) Provide street geometry which is safe and appropriate to the street function.
- (k) Provide on street parking where required, including parking for people with disabilities.
- (l) Allow access for special vehicles for waste collection, utility servicing, commercial deliveries, furniture removal, firefighting and other emergency services.
- (m) Minimise the total asset and ownership costs for the life of the road(s).
- (n) Accommodate public utility services and drainage systems.
- (o) Provide adequate levels of street lighting in accordance with AS/NZS 1158.

D1.03 REFERENCE AND SOURCE DOCUMENTS

(a) Council Specifications

List relevant Council Specifications for Design and Construction.

Kempsey Shire Development Control Plan 2013

(b) Australian Standards

AS/NZS 1158	-	Lighting for Roads and Public Spaces
AS 1742.(1-15)	-	Manual of Uniform Traffic Control Devices
AS/NZS 2890.1	-	Parking facilities - Off-street car parking
AS 2890.5	-	Parking facilities - On-street parking
AS/NZS 2890.6	-	Parking facilities - Off-street parking for people with disabilities
AS 4586	-	Slip Resistance Classification of New Pedestrian Surface Materials
AS 1428		

(c) State Authorities

Roads and Maritime Services Supplements to Austroads Guide to Road Design
Department of Housing - Road Manual, 1987.

(d) Other

Austroads

(e) Standard Drawings

D1.04 ABBREVIATIONS

D1.05 DEFINITIONS

Terms used to define the components of the road reserve within this specification have the same meanings as defined in AP-C87-15 Austroads Glossary of Terms.

General

Access	The driveway by which vehicles and/or pedestrians enter and/or leave property adjacent to a road.
Approach sight distance	Relates to the ability of drivers to observe the roadway layout at an anticipated approach speed.
Batter	The uniform side slope of walls, banks, cuttings, etc. Usually expressed as a ratio of horizontal to vertical. The amount of such slope or rake, usually expressed as a ratio of horizontal to vertical, distinct from grade. To form a uniform side slope to a wall, bank, or cutting.

Carriageway	That portion of a road or bridge devoted particularly to the use of vehicles, that is between guide posts, kerbs, or barriers where these are provided, inclusive of shoulders and auxiliary lanes.
Crossfall	The slope of the surface of a carriageway measured normal to the design or road centreline.
Cycleway	Portion of a road or footway for the exclusive use of cyclists.
Design speed	A speed fixed for the design and correlation of those geometric features of a carriageway that influence vehicle operation.
Desired speed/Operating speed	The speed over a section of a road adopted by a driver as influenced by the road geometry and other environmental factors.
Footpath (pathway)	A formed all weather public way reserved for the movement of pedestrians.
Footway area	Whole area between edge of carriageway (back of kerb) and property boundary.
Formation	The surface of the finished earthworks, excluding cut or fill batters.
Horizontal alignment	The bringing together of the straights and curves in the plan view of a carriageway. It is a series of tangents and curves that may or may not be connected by transition curves.
Landform	The type and shape of terrain, usually including topography, geological characteristics, coastlines, rivers and water bodies.
Minor road	All roads which become part of the public road system and are supplementary to arterial and sub-arterial roads. Minor roads may include local sub-arterial roads, collector roads, local roads, and access streets.
Pavement	The portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic.
Plan transition	The length over which widening and shift is developed from the 'tangent-spiral' point to the 'spiral-curve' point; i.e. the length between the tangent and the curve.
Reaction time	The time taken for a driver to perceive and react to a particular stimulus and take appropriate action. It is measured in seconds.
Road	A road is an area that is open to or used by the public and is developed for, or has as one of its uses, the driving or riding of motor vehicles.

Road network	A framework for movement by other modes, including pedestrian, bicycle and bus and plays a vital role in supporting neighbourhoods and town centres.
Road reserve	The strip of public land between abutting property boundaries, specifically gazetted for the provision of public right of way. It includes the road carriageway, as well as footpaths, verges and landscape.
Roundabout	A form of intersection channelization in which traffic circulates clockwise around a central island and all entering traffic is required to give way to traffic on the circulating roadway.
Rural Subdivision	
Safe intersection sight distance (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.
Service road	A roadway parallel to and separated from an arterial road to service adjacent property. They are usually continuous.
Shoulder	The portion of formed carriageway that is adjacent to the traffic lanes and flush with the surface of the pavement.
Shoulder width	The measurement taken from the outer edge of the traffic lane to the edge of usable carriageway and excludes any berm, verge, rounding or extra width provided to accommodate guideposts and guard fencing.
Side friction factor (f)	A measure of the frictional force between the pavement and the vehicle tyre.
Sight distance	The distance, measured along the carriageway, over which the visibility occurs between the driver and an object or between two drivers at specific heights above the carriageway in their lane of travel.
Speed (85th percentile)	The speed at or below which 85% of the vehicles travel.
Stopping Sight Distance	The sum of the braking distance and the distance the vehicle travels at a design speed during a reaction time of 2.5 seconds.
Street	A road that has mainly continuous housing or buildings on one side or both. It provides access to houses, buildings, shops, etc. with frontages onto the street. A street, by definition, is therefore found only in an urban area.

Superelevation	A slope on a curved pavement selected so as to enhance forces assisting a vehicle to maintain a circular path.
Traffic lane	That part of the roadway set aside for one-way movement of a single stream of vehicles.
Traffic lane width	Traffic lanes are measured to the face of the kerb or to the lane line for multi-lane roads or roads with shoulders.
Verge	Defined area of the road formation from outside the shoulder to the batter slope hinge point.
Vertical alignment	The longitudinal profile along the centreline of a road consisting of series of grades and vertical curves.

D1.06 PLANNING CONCEPTS

1. Council's Local Environmental Plan and various locality related Development Control Plans and Development Contribution Plans may already specify network layout, geometric standards and/or access limitations for roads in particular locations. These shall prevail over other considerations unless otherwise approved by Council.

Statutory Planning

2. 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 and type of traffic they are intended to carry, the desirable traffic speed, and other factors.

Road Hierarchy

D1.07 PLAN REQUIREMENTS

All road plans shall be in accordance shall be submitted to Council for review.

URBAN DESIGN CRITERIA

D1.08 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 in Figure D1.08

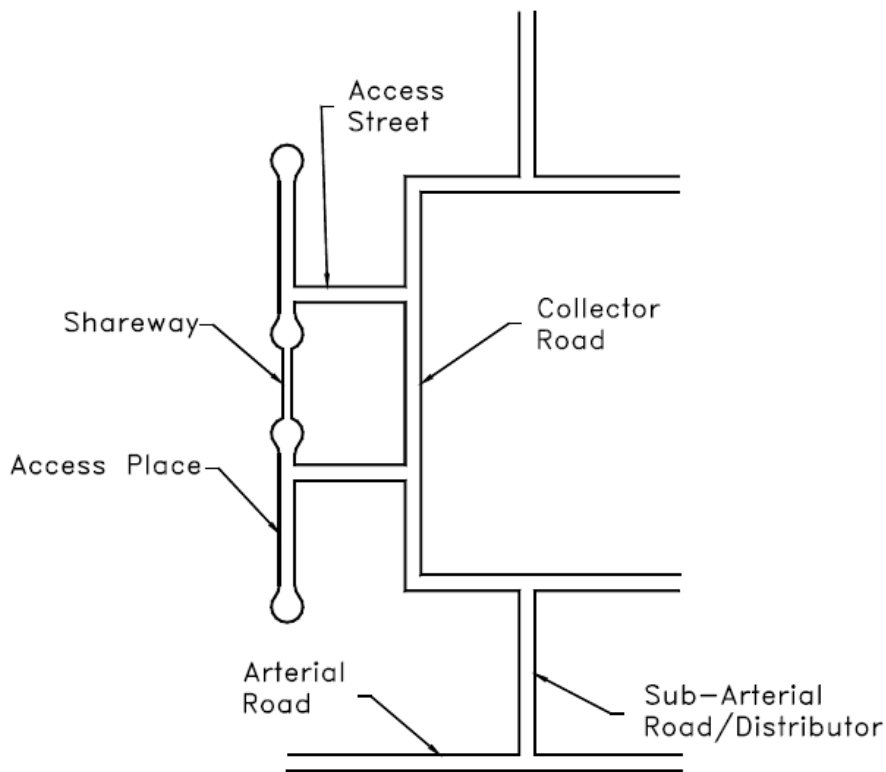


FIGURE D1.08

2. Six distinct levels of roads are:

- (a) Shareway
- (b) Access Place
- (c) Access Street
- (d) Collector Road
- (e) Sub-arterial/Distributor
- (f) Arterial

3. **Shareway:** a minor road which carries the lowest volume of traffic, providing driveway access to no more than 3 lots on each side, having a maximum length of 60m and forming a link between two access places. Vehicles, pedestrian and recreation use is shared, with design to encourage priority for pedestrians. The features of a typical shareway are shown in Figure D1.08. Shareways shall not be a no through road.

Shareway

4. **Access place (no through road / cul-de-sac);** a minor road which carries a low volume of traffic, having a maximum length of 100m and providing direct access to a limited number of allotments. Vehicle, pedestrian and recreation use is shared. The features of a typical access place are shown Figure D1.08.

Access Place

5. **Access street;** a minor road which carries a higher volume of traffic and provides direct access to lots. Vehicles, pedestrian and recreation use is shared, with traffic access having priority. A typical access street is shown in Figure D1.08

Access Street

6. **Collector road:** a road linking access streets to major roads, providing bus routes and giving restricted access to lots. A typical collector road is illustrated in Figure D1.08.

Collector Road

7. **A sub-arterial road** within a development has as its main function as the conveyance of traffic generated by the development. Direct access will not be provided for single dwelling allotments but access can be provided to multi-unit developments and non-residential land uses. The local sub-arterial road typically serves only the development and should not attract through traffic. A typical layout of a sub-arterial road is shown in Figure D1.08.

Sub-Arterial Road

D1.09 ROAD NETWORK

1. The design features of each type of road convey to the motorist its primary functions and encourage appropriate driver behaviour (refer Figure D1.08)

2. Traffic volumes and speeds on any road should be compatible with the residential functions of that road. The design speed and volume should enable the integration of pedestrian, cycle and vehicular movements. The road length should also ensure that residential convenience is not unduly impaired as a result of speed.

4. The length of sub-arterial roads within a development should be minimised.

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

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

Cycleway

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 local street should have access to an access-controlled arterial road.

Road Links

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

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

10. The external road network should be designed and located to provide routes which are more convenient for potential through traffic. Local sub-arterial 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

D1.10 TARGET SPEED

- | | | |
|----|--|---------------------------------|
| 1. | Design speed reflects traffic efficiency. The quality of the road environment for local residents and non-motorised traffic diminishes as speed increases, so that higher design speeds are only contemplated where traffic efficiency is considered of over-riding importance compared to its adverse environmental effects. The priority of vehicles over pedestrians will be progressively reversed as the designer proceeds down the road hierarchy from sub-arterial roads to access places. | <i>Effect of design speed</i> |
| 2. | Where lower traffic speeds are desirable a combination of a low design speed, speed control devices placed in the road, and prioritised intersections should be adopted. Good design assists drivers to interpret perceived hazards, available sight distance, and other visual cues as setting the speed environment, rather than relying on regulatory signage or police enforcement. Any changes in the prevailing speed environment should be signalled, legible and progressive. | <i>Low Speeds</i> |
| 3. | The maximum speed limit on urban local streets is 50kph, which may sometimes be appropriate for design of streets (see 5.), although street type, safety & topography issues will frequently dictate lower values. The RMS will not approve speed zones lower than 50kph without concurrent installation of appropriate physical speed control devices. | <i>Speed Limits</i> |
| 4. | <p>Vehicle speed on local streets can be limited by several design techniques including:</p> <ul style="list-style-type: none"> (a) road width being appropriate to traffic volume and parking demand, so traffic is impeded and slowed by parked and opposing vehicles, but, capacity is not unduly constrained; (b) short leg lengths between street junctions and/or slow points (tight corners, bends or traffic calming devices) to encourage speeds of 30 to 40 km/hr or less; (c) visually and physically tight intersections (small kerb radii); trees near road or in parking lane (by using parking indents) to narrow the road appearance (d) intersection controls including stop signs, narrowed throats and raised pavements, mini roundabouts, or more complex traffic management devices | <i>Control of vehicle speed</i> |
| 5. | The local street network should be designed to normally produce the target maximum speeds shown in Table D1.1, but, lower design speeds are to be adopted approaching intersections, when local conditions, adjacent land use, safety, road geometry or topography indicate that lower design speeds are appropriate. | <i>Maximum speeds</i> |
| 6. | Slow points are to be introduced in accordance with Table D1.1, D1.2 and D1.3. Where bends, slow points or intersections which allow speeds greater than 20 km/h are used, the length of street between two bends or slow points is to be as specified in Table D1.3. | |

7. Slow points including either horizontal or vertical deflection or constrictions are designed to slow traffic to a desired speed. (Vertical deflection devices will not be approved on roads designed for volumes greater than 1,000 vpd due to noise generation issues at night.)

Street type	Target Maximum street speed	Maximum Leg length between 20km/h slow points *	
		If parked cars are likely to be on street	No parked cars likely to help achieve speed control
Access Street (6m road width)	30 km/h	200 m	140m
Access street (7m road width)	40 km/h	250 m	180m
Collector	50 km/h	600 m	220m

Table D1.1: Street Length and Design Speed

* Leg length is distance between intersections or junctions, or points and locations where vehicles must slow to a maximum of 20 km/h. End conditions that reduce vehicle speed to 20 km/h may include; T intersections, roundabouts; and devices in Table D1.2.

Bend type	Road width (m)*	
	5 - 6 m	7 - 7.5 m
Single bend	70°	90°
Chicane - two reverse bends	5° - 45°	60° - 60°

Table D1.2 Minimum road deflection angles for speed control to 20 km/h

* Raised medians must be incorporated in above bends to prevent cutting of corners.

Speed at slow/ point/bend (km/h)	Max leg length of street between slow points/bends (parked cars likely on street) to limit target maximum street speed to:			
	40 km/h		50 km/h	
	Parked cars likely to be on street	Parked cars unlikely to be on street	Parked cars likely to be on street	Parked cars unlikely to be on street
20	200m	140m	250m	180m
25	130 m	80m	210 m	135m
30	110 m	65m	180 m	115m
35	80 m	50m	160m	100m
40	-		125m	80m
45	-		95m	60m

Table D1.3 Maximum length of street between slow points with speed greater than 20km/hr

Note: The installation of speed control devices often restricts on street parking, property access, and the safe passage of bicycles. Device positioning is therefore intimately connected with lot layout.

D1.11 URBAN HORIZONTAL ALIGNMENT

1. Drivers react to restrictive horizontal alignment by slowing to an appropriate speed. The desired maximum speed is maintained by designing a restrictive horizontal alignment
2. Sharp curves. The following requirements allow for safe passing and the occasional heavy vehicle.

Horizontal alignment restricts speed

Curve radii, widening

Minimum curve radius on carriageway centreline:

Access Street	10 m
Collector Road	15 m

Carriageway widening.

(Apply to inside kerb line by using a larger radius for inner kerb)

Radius less than 20 m	1.0 m
Radius 20 m to 30 m	0.5 m

3. The minimum radii applying to various design speeds are shown in Table D1.4

Minimum curve radii

Horizontal Curve Radii	
Target Speed (kph)	Minimum Radius (m)
10	10 (and check turning templates)
20	13
30	20
40	30
50	50
60	90

Table D1.4

For access streets curve radii should preferably range only between the minimum and the next highest ranking in the above table, in order to limit vehicle travel speeds to appropriate levels.

4. The minimum horizontal sight distance is measured along the vehicle path and shall be in accordance with Table D1.5.

Sight Distance

Horizontal target speed (km/h)	Sight distance required (m)
20	20
25	30
30	40
35	50
40	60
50	80
60	110

Table D1.5 Minimum Horizontal Sight Distance (1.15m to 1.15m)

5. An Access Place Cul-de-sac maximum length is 100 m, servicing no more than 12 dwellings or lots, and with no more than 15% of lots in a neighbourhood on cul-de-sacs. Where constrained by landforming limits, the maximum length may be increased to 200m, subject to Council approval and

Cul de sacs

serving no more than 24 lots, if it can be demonstrated that this leads to better urban design outcomes.

Cul-de-sacs shall be located so that they do not impede the overall interconnectivity of the system. The cul-de-sac head should be visible from the cross street and consideration given to pedestrian links within the subdivision layout extending from the cul-de-sac. If the cul-de-sac head is onto a foreshore or other reserve where no future road is contemplated, the public road reserve shall be continued full width until meeting the reserve in order to preserve street vistas and a sense of public ownership.

6. The minimum radius of kerb and gutter, both within the turning circle and in the approaches to the turning circle shall be 9.0m in residential/rural residential subdivisions and 12.5m in industrial subdivisions. Verge width shall not be less than 3.5m at any point in or approaching the turning circle.

Any Access Place Cul-de-sac over 150m in length shall have a turning radius of 12m.

Cul-de-sacs in bushfire prone areas and that have an entry line of travel being parallel through to perpendicular towards the hazard area shall have a minimum turning circle of 12m.

7. A minimum lot frontage of 12.5m, or 9.0m of kerb frontage (whichever is the greater) is required for each lot in a cul-de-sac.
8. Broken back curves shall not be used within a subdivision.

***Broken back
curves***

D1.12 URBAN LONGITUDINAL GRADIENT

1. The minimum centreline gradient may be 0% however the minimum kerb and gutter gradient at any point shall not be less than 0.5% except at crests. Roads with flat longitudinal gradients may require variable cross falls to maintain minimum kerb and gutter gradient. Maximum gradients are shown in Table D1.6.

***Flat and Steep
Terrain***

2. For grades greater than 12% the requirements for pedestrians, cyclists, waste collection vehicles and transverse access are to be addressed explicitly in the design. Grades on the inside of curves and the grade for turning vehicles at T-intersections require special design consideration.

3. Longitudinal grade through intersections should not exceed 4 per cent, the actual gradient being dependent on the type of terrain. Generally grades will be maintained on the priority road, with the side roads adopting the priority road cross-fall where they join the priority road carriageways. (Adjusting with 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 acceptable.)

Intersections

Road type	Desirable maximum grade %	Absolute maximum grade %
Sub-Arterial	6	10
Collector Road	8	12
Industrial	6	10
Commercial	5	5
Access street	10	15
Access place	8	15
Shareway	10	20 [#]
Cul-de-sac head	5	5

[#]Subject to meeting emergency service requirements for access

Table D1.6

D1.13 URBAN VERTICAL CURVES

1. A vertical curve, of parabolic form, shall be provided at every crest and at other changes of grade of more than 1%. Vertical curves should generally be as long as possible for improved appearance; but surface drainage must be maintained in proximity to summit and sag points. Irrespective of road centreline grading at sag vertical curves, the kerb and gutter grade shall not fall below 0.5% at any point. For crest grade changes of <1%, the length of vertical curve in the gutter shall be 15m only; accommodating the road grade variance in the parking lane crossfall.
2. **Minimum Length of Vertical Curves**
 - (a) **Crest Curves:**
The minimum length of a crest curve is governed by sight distance requirements for the adopted design speed.

Vertical Curve placement, drainage must be maintained

Minimum length of vertical curves

- (b) **Sag Curves:**
- (i) desirable minimum to be based on providing minimum headlight sight distance
 - (ii) absolute minimum to be such that vertical acceleration does not exceed 0.10G.
- (c) Minimum Length for Appearance
Except for crest changes of grade of <1% the minimum length of a vertical curve shall not be less than:

	Access Street (m)	Collector (m)	Sub-Arterial (m)
Minimum vertical curve (Except intersections)	25	30	50
Absolute minimum vertical curve at intersections only	10	12	20

3. (a) Vertical curve length in side roads at T intersections can be reduced

Vertical curves at intersections

- (b) The minimum length of such vertical curves shall be not less than 10m or

on a local Access Streets $L = 0.7A$

on a Collector Road $L = 1.25A$

L = minimum length of vertical curve

A = the change of grade between the side road and the crossfall of the through road

- (c) The tangent point of the vertical curve in the side road shall be located at, or behind the kerb line of the through road.

D1.14 URBAN VERTICAL SIGHT DISTANCE

- The absolute minimum sight distance is that required for a driver to perceive an object 0.15m high on the road ahead, and stop before reaching that object. This distance shall be available at every point on every road, using the approved design speed.
- The desirable minimum sight distance for two-way roads is that required for the drivers of two opposing vehicles to perceive the other, and to stop both

Vertical sight distance

Two way roads

vehicles before meeting. This sight distance shall be provided at intersections and wherever possible.

3. The minimum sight distance at intersections shall be

**Safe
Intersection
sight distance
(SISD)**

- (a) Sufficient distance for an approaching vehicle to stop before an obstruction in the road at an intersection (see table D1.5)
- (b) Sufficient distance for a vehicle stopped in a side road, at the alignment of the through road, to start and turn safely onto the through road (see Table D1.5)

D1.15 URBAN SUPERELEVATION

1. Superelevation will not be required in the majority of urban streets, which have design speeds less than 60 km/h. Access streets which 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. Adverse cross-fall should be limited to 3%.

**When to use
superelevation**

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. While it is desirable to superelevate all curves on high-speed roads, negative crossfall should be limited to 3 per cent.

**Negative
Crossfall**

3. 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 depends on the maximum coefficient of side friction. Table D1.4 incorporates a maximum coefficient of side friction of 0.15 where there is assisting cross fall. This should be recalculated for a coefficient of 0.12 where there is adverse crossfall.

**Coefficient of
Side Friction**

4. Recommendations for minimum curve radii (in metres) on major urban roads under varying superelevation / crossfall are found in AUSTROADS

AUSTROADS

5. Superelevation of urban roads reduces high side gutter hydraulic capacity to zero, and can lead to dangerous sheet flow across the pavement during storm events. In these locations special drainage interception provisions are required to eliminate the risk of such sheet flow.

Sheet flow

D1.16 COORDINATION OF HORIZONTAL AND VERTICAL CURVES

1. The 3 dimensional coordination of the horizontal and the vertical alignment on the road aims to increase efficiency, safety, encourage uniform speed, improve aesthetics, and provide harmony with the landform and drainage.
2. Horizontal and vertical alignment coordination is to comply with the following requirements:
 - (a) Avoid the use of minimum radius horizontal curves with crest vertical curves.

**3 dimensional
coordination**

- (b) Contain the crest vertical curves within horizontal curves to enhance the appearance of the crest by reducing the three dimensional rate of change of direction and to improve safety.
- (c) Provide the same design speed of the road in both horizontal and vertical planes.
- (d) Avoid sharp horizontal curves at or near the top of a crest vertical curve.
- (e) Consider three dimensional combined horizontal and vertical stopping sight distance and minimum sight distance.
- (f) Provide a horizontal curve to indicate the change in direction before introduction of vertical curve in both directions of travel.
- (g) Be aware that 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.

3. The following aesthetic considerations are to be addressed:

Aesthetic considerations

- (a) Provide horizontal curves slightly longer than the vertical curve, such that the curves fits with the terrain and are coincident.
- (b) Provide long horizontal curves to short curves such that:
 - (i) The overtaking opportunities are not reduced.
 - (ii) Small deflection angles avoid the appearance of a kink.
 - (iii) Best appearance is provided for deviations around obstructions.
- (iv) The far tangent point is beyond the driver's point of concentrated vision for curves located at the end of long straights.

4. To ensure pavement drainage and to reduce the risk of aquaplaning, avoid very long crest and sag curves that result in long sections of flat grades at the top and the bottom of the curves.

Drainage considerations

D1.17 URBAN CROSS SECTION ELEMENTS

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, streetscaping and tree planting. Table D1.7 details carriageways and footway widths and road reserve widths.

Functions

2. Cross-section element specifications in Table D1.7 are strongly influenced by Council's statutory obligation to pursue Ecologically Sustainable Development (ESD), with particular relevance to ecologically sustainable transport – this presently being confined to self powered walking and cycling. It is also widely held that public transport is more sustainable than use of the private

Ecologically Sustainable Development

automobile. In addition, the elements are framed on the presumption of compliance with Council's ESD expectation of designs embodying neighbourhood self-containment to the highest degree possible. An identified small local neighbourhood commercial centre and/or transport node should be within 400 metres walk of 90% of dwellings. For this concept to gain effective community acceptance, all pedestrian and cycle paths must have high levels of safety, efficiency, security and amenity.

3. All urban and small lot rural residential roads shall have kerb and gutter on both sides (type as outlined in Table D1.7). Where Water Sensitive Urban Design (WSUD) is adopted, kerb and gutter may be substituted with flush kerbs and associated bollards or castellated kerbs to prevent vehicle egress onto the verge. WSUD will generally involve conveying street drainage (formerly conveyed in kerb and gutter) in grass swale drains located on the road verge, with the verge being widened to accommodate the swale. Pram ramps shall be provided at all footpath/road crossings. The use of WSUD within a subdivision is subject to a detailed Stormwater Management Plan and approval by Council.

Kerb and gutter. For Water Sensitive Urban Design, adopt castellated kerb.

4. In industrial subdivisions all road junctions and cul-de-sac bulbs shall be concrete paved as far as the tangent points of kerb returns.

Industrial areas

5. Standard Cross-section elements, for use in any special cases where standard road types are inapplicable, shall be:

Lane widths

Travel Lane	absolute minimum	3.0 m
	slow speed	3.4 m
	standard	3.7 m
	one-way	4.0 m
Parking	access street	2.6 m
	Major road	3.0 m
Turn Lane	minimum	3.0 m
	Standard	3.4 m

6. Where infill development requires upgrades to existing road cross-sectional elements (including pavement, and road surface) due to increased traffic generation, these upgrades shall extend to the nearest external intersection with a higher order road.

In Fill Development

7. 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 including trucks, emergency vehicles and, on some roads, buses. (Refer to Clause D1.21 for bus routes.)

Vehicles

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

9. The carriageway width should also provide for unobstructed access to individual allotments. Motorists 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.

Reversing

10. 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.

Road Reserve

11. Appropriate road reserve width should be provided to enable the safe location, construction and maintenance of required paths and public utility services (above or below ground) and to accommodate the desired level of streetscaping.

Footway Area

12. The footway area 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.

Category/ Characteristics	1 Shareway	2 Access Place	3 Access Street	4 Collector Road	5 Commercial	6 Industrial Access	7 Industrial Collector	8 Sub-Arterial
Maximum No of potential equivalent tenements (ET) / Indicative traffic volume vehicles/day (vpd) ⁽¹⁾	6 ET 100 vpd	30 ET 400 vpd	100 ET 2000 vpd	300 ET 10000 vpd	6000 vpd	6000 vpd	15000 vpd	20000 vpd
Maximum length (m)	60 ⁽²⁾	100 ⁽³⁾						
Carriageway width (m)	5.5	6 ⁽⁴⁾ 7	7 8 ⁽⁵⁾	9 ⁽⁶⁾ 11	12 22 ⁽⁷⁾	13	15	13
Footway Area width (m)	3.5 ⁽⁸⁾	4 ⁽⁹⁾	4.5 4	5.5 4.5	4	4.5	5	4.5
Road Reserve width (m)	12.5 ⁽¹⁰⁾	15 ⁽¹⁰⁾	16	20	20 (min) 30	22	25	22
Kerb Type ⁽¹¹⁾	Flush/SE	SE	SE	SE SA	SA	SA	SA	SA
Target Speed (km/h)	15	25	40	50	40	50	50	60 ⁽¹²⁾
Minimum Distance between Intersection (m)	N/A	N/A	60	80	60	60	60	80
Longitudinal Grading								
Maximum	20%	15%	15%	12%	5%	10%	10%	10%
Minimum ⁽¹³⁾	1%	1%	1%	1%	1%	1%	1%	1%

Two way Crossfall	3% ⁽¹⁴⁾	3%(15)	3%	3%	3%	3%	3%	3%
Pavement Surface	Reinf. Conc	30 mm AC	30 mm AC	AC Design req'd	AC Design req'd	Reinf. Conc. Or AC Design req'd	Reinf. Conc. Or AC Design req'd	AC Design req'd
Footpaths	Nil	One side – as required ⁽¹⁵⁾	One side ⁽¹⁶⁾	Both sides ⁽¹⁷⁾	Both sides ⁽¹⁸⁾	Both sides	Both sides	As Specified on DA consent
Cycleways	Nil	Nil	Nil	1.5m lane mixed with parking lane	1.5m mixed with parking lane	Nil		1.5m separate lane

Notes:

- 1 Traffic Volumes to be estimated using RMS Guide to Traffic Generating Developments. VPD includes total catchment of vehicles ie all lower road categories to be included
- 2 Shall connect two Access Places, “no through road” not permitted.
- 3 See Clause D1.11 (5.)
- 4 6m width carriageway shall only be used for Access Places less than 80m in length.
- 5 8m require on perimeter roads for fire protection
- 6 If 9m then must have indented bus bays @ 400 m (±50 m) c/c complying with Austroads
- 7 Allows for angle and parallel parking, landscaping should be incorporated into carriageway width.
- 8 May be reduced to minimum of 2.5m subject to Council approval if all services and footway area requirements can be met.

- 9 May be reduced to a minimum of 3.5m for 6m wide carriageways subject to Council approval if all services and footway area requirements can be met.
- 10 May be reduced to match reduce footway area width, see notes 8 and 9.
- 11 Kerb Type - SE or SA – refer to Council Standard Drawing ASD 200, 207,208,209,210, and 211.
- 12 Subject to RMS speed zoning – may require reducing to 50km/h.
- 13 See clause D1.12.
- 14 May be one-way cross-fall
- 15 Only required if connects through end of Access Place to wider pedestrian network.
- 16 Shall be a 2.5m shared path if specified in DA consent, particularly with perimeter roads
- 17 2.5m shared path required on one side, located on non-frontage side of perimeter roads
- 18 Foot paving shall be for the full footway area width of commercial shop-front frontages, paving surface shall be exposed aggregate finish in specified colour.

Table D1.7 Characteristics of Roads in Urban Subdivision Road Networks

D1.18 CROSSFALLS

1. Desirably, roads should be crowned in the centre. Typical pavement crossfalls on straight roads are show in Table D1.5.
2. There are many factors affecting levels in urban areas which may force departures from these crossfalls. Differences in level between kerb alignments can be taken up by offsetting crown lines or adopting one-way crossfalls. The rate of change of crossfall shall not exceed: 6 per cent per 30 m for through traffic; 8 per cent per 30 m for free flowing turning movements; or 12 per cent per 30 m for turning movements for which all vehicles are required to stop.
3. The crossfall on a collector or sub-arterial 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. A difference 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.
4. Crossfalls on roundabouts should generally be in the range of $\pm 3\%$ to ensure rider comfort.

*Crossfall
Changes*

Priority Road

D1.19 FOOTWAY AREAS

1. A suitable design for the footway will depend on utility services, the width of footpaths, access to adjoining properties, likely pedestrian usage and preservation of trees. Low level paths are undesirable but may be used if normal crossfalls are impracticable. The footway area behind the kerb must fall towards the kerb for at least 3 metres in accordance with Council Standard Drawings ASD 207, and ASD 208. Crossfalls in footway paving should not exceed 2.5 per cent. Longitudinal grade usually parallels that of the road and this may be steeper than 5 per cent. Refer to Austroads. For standard cross-sections and utility service allocations refer to standard drawings.
2. Cut and fill batter slopes shall be an absolute maximum of 1 in 4. Any variation to this to avoid excessive batter width in private property or excess excavation in road shall be site specific and approved by Council, retaining structures shall not be used within the road reserve unless otherwise approved by Council. Council may consider low maintenance retaining structures (eg. in median of a divided road) to accommodate level differences across a road reserve or where upgrading an existing road.
3. Differences in level across the road between property boundaries should be accommodated by cutting and filling at the property boundaries to provide the standard footway batters.
4. Concrete paths 1.5 m minimum width shall be provided as specified in Table D1.5. Paving at intersections is to extend to kerb line and is to be provided with a standard kerb ramp (ASD100). A standard kerb ramp is also to be provided on the

Utility Services

Batter Slopes

Options

Path Width

other side of the road to allow exit from the carriageway. Where there is no connecting footpath a 1.5m wide landing is to be connected to the kerb ramp. For location and detail refer to standard drawings. Conduits for property stormwater drainage are to be installed prior to the construction of concrete paths.

5. Location of the footpaving shall be generally no closer than 1m from the face of kerb line.

Location

6. Designs specified herein shall not be in conflict to Aus-Spec D9 - Cycleway and Pathway Design.

***Other Relevant
Aus-Spec
Specifications***

D1.20 PATHWAYS

Council has specific requirements for cycleways and pathways in Council's Bicycle Plan and Pedestrian Access & Mobility Plan. The Designer will need to enquire about such requirements and provide for any nominated paths within the development proposal.

The Designer should familiarise himself with cycleway geometric design requirements in terms of:

- (a) width
- (b) grade
- (c) stopping sight distance
- (d) change in grade
- (e) horizontal curvature
- (f) crossfall and drainage
- (g) superelevation
- (h) sight distance on horizontal curves

These requirements are discussed in the AUSTRROADS Guide.

Cycleways can be provided on road and off road. The Austroads Guide provides detailed descriptions, warrants, widths, pavement marking etc for the majority of these cycleways.

The Designer shall provide adequate signposting design for cycleways and pathways.

Signs and pavement marking will provide for the safe and convenient use of the facility. The signs and pavement marking will comply with AS 1742.9 and AS 1742.10.

Cycleways and pathways shall be designed to comply with AUSTRROADS and KSC requirements as referenced below:

- Path width - refer S.D.013
- Crossfall - refer S.D.013
- Horizontal Clearances - refer AUSTROADS Guide to Road Design Part 6A
- Grade - refer AUSTROADS Guide to Road Design Part 6A
- Integration with other cross sectional elements and services - refer D1, Tables D1.7 and D1.8

	Footpath	Shared Path
Path Width	1.5m	2.5m
Crossfall min.	2%	2%
max.	2%	2%
Horizontal Clearance	1.2m	2.5m
Grade min.	0.5%	0.5%
absolute max	16%	16%

Table D1.8 Minimum Off-Road Design Standards

Concrete is the preferred material for cycleway and pathway pavement construction. For details on concrete cycleway/pathway pavement design requirements see Standard Drawing S.D.013 Footpath and Cycleway Details.

Tactile Ground Surface Indicators (TGSIs) should be used in accordance with AS 1428.4.

D1.21 URBAN INTERSECTIONS

1. See also section on design speed.

Warrants

Note: Warrants in this section refer to those in AUSTROADS, Guide to Road Design Part 4: Intersections and Crossings - General.

2. Normally intersections will be at-grade uncontrolled, channelised, or a roundabout (see D1.18). Traffic signals will very rarely be required. The design of intersections or junctions should allow all movements of vehicles, cyclists and pedestrians to occur safely without undue delay. Projected traffic volumes shall be used in designing all intersections or junctions on local arterial/sub-arterial roads.

Traffic Volumes

- | | | |
|----|---|---------------------------------------|
| 3. | 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 Road Design Part 4. In urban areas this will require raised concrete medians. | Main Roads |
| 4. | Intersections with main roads, regional roads or state highways are to be designed and constructed in accordance with the requirements of the Roads and Maritime Services and Council. | Regional Roads, State Highways |
| 5. | Where intersections on existing roads are required to serve a development, complete reconstruction of the existing road pavement for the full width to the limit of intersection tangent points, shall be undertaken in accordance with the relevant standards to match the road classification. | Remediation/ Reconstruction |
| 6. | The safety of pedestrian and cyclist users will be a paramount consideration in the selection of intersection type. | Pedestrians and cyclists |
| 7. | Intersections should be generally located in such a way that: <ul style="list-style-type: none"> (a) The streets intersect at right angles (minimum angle 70 degrees). (b) The landform and parking controls allow clear sight distance on each of the approach leg of the intersection. (c) The minor street intersects the convex side of the major street, if on a curve. (d) Two side streets intersecting another street in a staggered pattern should have a minimum centre-line spacing of the design speed in metres (e.g. 40kph = 40m). <p style="margin-left: 40px;">Other criteria are in the AUSTROADS <i>Guide to Road Design Part 4</i>.</p> | Intersection location criteria |
| 8. | All vehicle turning movements are to be accommodated utilising AUSTROADS Design Vehicles and Turning Path Templates, as follows: <ul style="list-style-type: none"> (a) For turning movements involving Sub-Arterial roads, the "design semi-trailer" with turning path radius 15.0 m. (b) For turning movements involving Collector Roads or bus routes, but not Arterial/Sub-Arterial roads, design for the AUSTROADS 14.5 metre long rigid bus with a minimum turning path radius of 15.0 m. (c) For turning movements on access streets but not involving Arterial/Sub-Arterial roads or Collector roads, design for the AUSTROADS 12.5 metre long single unit truck/bus with an absolute minimum turning radius of 12.5 metres. | Turning Movements |

- (d) For turning movements at the head of cul-de-sac streets a minimum 9m radius is required

- 9. 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

- 10. Channelisation is required (unless grade separation or roundabouts provided) at:

Channelisation

- (a) Arterial/Sub-Arterial with Arterial/Sub-Arterial intersections
- (b) Arterial/Sub-Arterial with Collector intersections
- (c) Collector with Collector connections (if warranted)

Channelisation should:

- (a) provide separate and clearly defined paths for each traffic movement, and provide passage for cyclists and pedestrians
- (b) minimise the general area of conflict by causing opposing traffic streams to intersect at (or near) right angles
- (c) maximise separation of conflict points
- (d) merge traffic at small angles
- (e) control approach and crossing speed by funnelling or bending traffic paths
- (f) provide refuge for turning or crossing vehicles at signalised intersections as required
- (g) prohibit certain turns
- (h) provide pedestrian protection and pram ramps where appropriate
- (i) improve the efficiency and layout of signalised intersections
- (j) provide sites for signs and traffic signals
- (k) be lit at night (mandatory if kerbs or other rigid obstructions are introduced to the carriageway) to AS/NZS 1158 requirements
- (l) improve and define alignment of major movements
- (m) not obstruct pavement drainage

Channelisation is to accommodate a design semi-trailer of 19m in length, providing a minimum clearance of 0.6m between the wheel track and kerbs at all points.

Medians and traffic islands shall be constructed with concrete mountable type kerb. Minimum median 600mm, standard medium 1.2m.

11. Traffic Control at 4 - Way Intersections shall be in accordance with the following:

***4 way
intersections***

- (a) Arterial/Arterial 4-way intersections to be signal (where warranted) or high capacity roundabout controlled (roundabouts may be inappropriate in high pedestrian/cyclist activity areas).
- (b) Arterial/Collector 4-way intersections to be signal (where warranted) or roundabout controlled (roundabouts may be inappropriate in high pedestrian/cyclist activity areas).
- (c) Collector/Collector 4-way intersections to, be roundabout controlled (10-12 m inner island diameter) with adequate vehicle path deflection (refer to *AUSTROADS* Guide to Road Design Part 4B: Roundabouts) to keep speeds low.
- (d) Collector/Access Street 4-way intersections should be minimised by altering street block layout. Roundabouts are to be used for speed control and intersection safety.
- (e) Access Street/Access Street 4-way intersections (should also be minimised as above) to be controlled by small roundabouts (mountable are acceptable).

12. Traffic Control at T-Junctions shall be:

T junctions

- (a) Arterial/Arterial T-Junctions to be signal (where warranted) or high capacity roundabout controlled (roundabouts may be inappropriate in high pedestrian/cyclist activity areas).
- (b) Arterial/Collector T-Junctions to be signal (only where warranted) or roundabout controlled (roundabouts may be inappropriate in high pedestrian/cyclist activity areas). Side road may be controlled by stop/give way/median permitting left turn only depending on volumes and nearby signals as alternative access.
- (c) Collector/Collector T-Junctions to be provided with roundabouts (10-12 m inner island diameter, refer to *AUSTROADS* Guide to Road Design Part 4B: Roundabouts) for speed control benefits even if volumes are acceptable.
- (d) Collector/Access Street T-Junctions may require roundabouts for speed control and intersection safety. Normal control by T Junction rule favouring the Collector.

- (e) Access Street/Access Street T-Junctions, control by T-junction rule.

13. The access street network is to be configured to manage traffic volumes, traffic speeds and run up length at Access Street/Access Street 4-way intersections to enable safe application of a priority (give way) controls.

**Managing
speed, volume**

14. Corner 3 x 3 metre truncations are to be provided as a default in the local street network, provided a minimum of 3.5m verge is available between kerb face and property boundary. The truncation must be increased above 3m to ensure there is a minimum of 3.5m between kerb face and property boundary where the geometry of the corner or demands for road widening would otherwise encroach on the verge,

**Corner
truncations**

Exceptions to the default:

- (a) Intersection treatments that require more space
- (b) Acute angle intersections and intersections on the inside of a small radius curve
- (c) Narrow frontage lots may warrant reduction of truncation provided adequate accommodation is provided for 3.5m footway at corner, services, and sight distance from stop/giveway lines.

15. Default minimum kerb return radius requirements

**Kerb return
radius**

Access Street/Access Street	10m
Access Street/Collector	10m, increase if median on Collector
Collector/Collector	Will depend on roundabout design requirements, but minimum 10m
Industrial areas and to any higher order road	12m

Arterial/Sub-Arterial routes must be designed to cater for articulated vehicles, and have minimum kerb return radius 15m

D1.22 ROUNDABOUTS

1. Roundabouts design shall be approved by Council and the Roads and Maritime Services (if on classified road).

Approval

2. Roundabouts shall be designed in accordance with the requirements of the publication AUSTRoads Guide to Road Design Part 4B: Roundabouts. Roundabout design should always provide for safe passage of pedestrians and cyclists.

AUSTRoads

3. Landscaping requirements for the centre island will be determined in accordance with D13.

Landscaping

4. Roundabouts are required at:
 - (a) Collector Roads and Access Street intersections where this option is needed to reduce street lengths to those nominated in Table D1.1
 - (b) 4-way intersections identified in D1.17.11
 - (c) T-intersections identified in D1.17.12
5. AUSTROADS Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings identifies appropriate and inappropriate sites for roundabouts (Table 2.3 and 2.4).

D1.23 TRAFFIC CALMING

1. Calming devices such as thresholds, slowpoints, speed humps, chicanes and splitter islands should be designed in accordance with AUSTROADS Guide to Traffic Management - Part 8: Local Area Traffic Management, and "Sharing the Main Street" (RMS 2000). These will require Local Traffic Committee approval. Device designs should generally comply with AS 1742 - Manual of Uniform Traffic Control Devices

AUSTROADS
2. **Streetscape**

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.
3. **Location of Devices/Changes**

Location

 - (i) devices other than at intersections should be located to be generally consistent with streetscape requirements
 - (ii) existing and future street lighting, drainage pits, driveways, parking needs, and utility services will control the exact location of devices
 - (iii) slowing devices are generally located in accordance with D1.07 Design Speed.
4. **Design Vehicles**

Design Vehicles

 - (i) emergency vehicles must be able to reach all residences and properties

- (ii) bicycles should not have to move into the path of motor vehicles to negotiate devices.
- (iii) streets with a 'feeding' function between arterial roads and access streets should be designed for an AUSTROADS 14.5 metre long rigid truck/bus.
- (iv) raised platforms are not permitted unless otherwise approved by Council and shall not be used where they are likely to be used as pedestrian crossings by pedestrians. (see RMS Technical Direction), and vertical deflection devices are generally discouraged in suburban and retail areas, due to impacts and problems with emergency vehicles and public transport.

5. Control of Vehicle Speeds

Vehicle Speeds

- (i) maximum vehicle speeds can only be reduced by deviation of the travelled path. Pavement narrowings may have only minor impact on average speeds, and usually little or no effect on maximum speeds in circumstances where there is good forward visibility, unless the carriageway is reduced to a single path (even then, only if a vehicle is approaching from the opposite direction).
- (ii) speed reduction can be achieved using devices which shift vehicle paths laterally (slow points, roundabouts, corners). Vertical devices (humps, platform intersections, platform pedestrian/school/bicycle crossings) are not permitted unless otherwise approved by Council for specific locations.
- (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 350m), using appropriate devices, streetscapes, or street alignment to create short sight lines. Increasing access activity by (say) provision of angle parking is also effective.

6. 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 and if not existing then lighting is to be installed as per AS/NZS 1158, and all street features/furniture shall be delineated for night time operation.

7. Critical Dimensions

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 width shall be a minimum 1.5 m. Adjacent to pavement narrowings width may be reduced to 1.35 m 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.

D1.24 PARKING

1. All on-site parking shall be in accordance with Kempsey Shire Development Control Plan 2013 Chapter 2.5, AS/NZS 2890.1 - Parking facilities - Off-street car parking and AS/NZS 2890.2 - Parking facilities - Off-street commercial vehicle facilities and as otherwise modified by DA consent conditions.

Off-Street Parking

2. All on-site parking shall be so located to allow convenient and safe access from the road.

Access

3. On-street parking shall be provided in accordance with the DA consent, AS 2890.5, AGRD03 clause 4.10 and AGTM11.

On-Street Parking

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.

5. On single lane access streets parking bays shall be provided within the footway area. Such parking shall be well defined and an all-weather surface provided.

6. Parking spaces provided on the verge or carriageway are to be of adequate dimensions and provide safe access.

Verge Spaces

7. All verge spaces and indented parking areas are constructed of suitable material and are designed to withstand the loads and manoeuvring stresses of vehicles expected to use those spaces, including garbage trucks.

Right-angled Parking

8. Right-angled parking is allowed only up to access street level in the road hierarchy. A commensurate increase in the road reserve width shall be required to maintain the service corridor. Road width shall be sufficient to allow turning path movements into the parking bays.

D1.25 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 10% of residents should have to walk in excess of 400 metres to catch a bus. Normally roads above the access street in the hierarchy are designed as bus routes.

Road	Carriageway Width (min)	Stops (Spacing)	Bays Indented (in accordance with AUSTROADS Part 11 and Council Standard Drawing ASD 205)	Shelters
Collector	9m	400 metre	Yes	No
	11m		No	
Sub-Arterial	13m	400 metre	No	Yes
Arterial	13m	400 metre	Yes	Yes*

* Shelters are subject to Council's requirements.

Table D1.9 Bus Route Criteria

D1.26 URBAN DRIVEWAYS AND ACCESS

Access to every lot

1. Every lot must have feasible access from the street. Care is to be taken with short frontages and battle axe lots that an access corridor is available after allowing for kerb lintels, poles, structures and trees etc.

2. Right of Way Access

Right of way access

Where access is on a right of way over another property, the following minimum standards apply:

Benefited Properties

Standard of Access

- | | |
|------------------------|---|
| 1 | 100mm roadbase, 3m wide, 2 coat seal, drainage |
| 2 (or reciprocal bays) | 150 reinforce concrete, 3m wide, drainage, passing bays |
| 3 to 5 | as for above but 4.5m wide |

Note: Easement/right of way shall be 1 m wider than the pavement and any associated batters, catch drains or service corridors.

The maximum number of allotments that may share in the above access arrangements is 5.

3. Battle Axe (Hatchet Shaped) Blocks - Minimum Standard of Access

Battle axe, hatchet shaped lots

Width shall be a minimum 4m, plus width required for earthworks, batters, retaining walls, longitudinal drainage and services.

For multiple leg accesses with reciprocal rights of way the provisions of 2 above shall also apply.

4. Where street grades in excess of 12% are approved, the designer will limit the number of property access frontages to that section. Where frontage is provided, the feasibility of gaining safe property access shall be demonstrated, paying regard to driveway grade (including edge line grades) footpath continuity and combined crossfall.

Street grades

D1.27 URBAN ROAD DRAINAGE

1. See Development Design Specification, "D5 Stormwater Drainage Design".

D5

2. Bridges/Culverts

Bridges

Bridges and Culverts are to be designed in accordance with Development Design Specification D3 – Civil Structures and Bridges. Bridges are to have low maintenance finishes (timber and steel are not permitted unless otherwise approved by Council). Provision for pedestrians and on-road cyclists is required and is to be consistent with the footway/cycleway provision in approach streets. Bridges must accommodate current and future utility service in concealed conduits. Urban bridges must be provided with lighting, handrails, road edge kerb and railings.

RURAL DESIGN CRITERIA

D1.28 GENERAL

1. Rural subdivision (excluding small lot rural subdivision) roads shall be designed in accordance with this section inclusive of rural homesites and hobby farms types of developments. Small lot rural subdivisions shall be designed in accordance with the “urban” road design section of this specification.

Small lot rural residential subdivision is defined as:

- Subdivisions where the average lot size, excluding residual and non-residential lots is <5,500m².

2. All rural subdivisions shall be designed to deny direct property access to Sub-Arterial / Arterial roads.

Access

3. The development shall provide a sealed road connection, of an appropriate standard base on traffic volumes, between the proposed subdivision internal road network and nearest existing sealed public road. Within an upgraded intersection in accordance with D1.34.

D1.29 RURAL PROPERTY ACCESS

1. Each rural lot shall have a driveway delivered as part of the development according to the following specification (refer to Standard Drawing ASD 214):

**Property Access
Rural Lots**

- (a) 3 metres wide at the property boundary;
- (b) 5 metres wide at the edge of the bitumen;
- (c) 150 mm thick roadbase with a 2 coat bitumen seal extend 3m inside property boundary;
- (d) minimum 375 mm diameter RCP and headwalls through the table drain;
- (e) The driveway location shall be such that an internal 2-wheel drive access road can be constructed from the driveway to the nominated building site;
- (f) The driveway must be located on the subdivision road at a location where there is sight distance from both driveway and road of:

Design Speed (of road)	Sight Distance required
30	30
40	35
50	50
60	70
70	95
80	115
90	145
100	180
110	215
120	260

2. Road design shall provide for practical access to all rural lots, the maximum desirable longitudinal grade for access roads is 12%. Private access roads with longitudinal grade greater than 15% are to be sealed. The maximum permissible grade is 25%.

**Private Access
Roads on Rural
Lots**

3. “Battle-axe handle” access. The minimum width of the handle shall be demonstrably in accordance with D1.22.3 above. Multiple separate, but contiguous battle-axe handles are not permitted and must be amalgamated into a reciprocal right of way.

**Battle axe
access**

4. Right of Way Access. Where access is gained by right-of-way through another lot, the access road shall be constructed in accordance with road standards except that the pavement and formation width may be reduced to:

Right of way

3.6m full width seal Access to 1 or 2 properties

4.5m full width seal Access from 3 to 5 properties

Note: Easement/right of way shall be 1 m wider than the pavement and any associated batters, catch drains or service corridors.

The maximum number of properties that may use a common right of way access is 5.

5. Designers shall demonstrate that sufficient room exists at the road end of rights-of-way or battle axe handles for erection of the requisite number of private letterboxes and standing of garbage bins that are accessible but clear of traffic. If not, road widening shall be provided to accommodate them.

**Room for
letterboxes and
garbage pickup**

6. Internal accesses shall be designed and shaped (or transverse drainage structures constructed) to ensure longitudinal access runoff is not discharged

**Access
drainage not to**

to the public road surface. Except for natural streams and gullies, only un-concentrated runoff from catchments that naturally drain to the road reserve will be permitted to discharge to the road reserve.

discharge onto public road formation

D1.30 RURAL STANDARD CROSS SECTIONS

1. Road Class and width is to be determined by estimated ultimate traffic volume, see Table D1.10.
2. Traffic volumes are to be derived from an appropriate traffic impact assessment for the development. The estimates are to account for ultimate development of the land and adjacent areas taking into account all future stages of development and desirable connections to other land.
3. For single dwelling allotments a traffic generation rate of 6.5 vehicles per day (vpd)/allotment (equivalent to approximately 0.65 vehicles per hour (vph) in the peak hour) is to be used unless a lower rate can be demonstrated. For multiple occupancies adopt half the above rate per dwelling.

Rural road class

4. Formation width is to be increased by 1.5m where road safety barrier is to be installed. Road safety barrier is to be installed at approaches to structures and on fill batters over 2.1m high. Where road safety barrier is installed the road shoulder is to be sealed and a 100mm high AC berm is to be constructed to intercept road runoff and prevent it flowing down batter slopes. Runoff so collected is to be conveyed by flume drains to natural surface.

Widening for road safety barrier, earthworks and drainage

Catch drains are to be located on the high side of cuttings prevent runoff flowing down cutting batters. Catch drains are to be concrete lined where longitudinal grades are less than 0.5% or more than 5%.

5. Road reserves are to be of sufficient width to accommodate all roadworks, earthworks (including all cutting and fill batters), drainage structures (including catch drains) and utilities with a minimum clearance of 1m.
6. Where road drainage (both longitudinal and cross drainage) discharges concentrated flows to locations other than natural watercourses, easements are to be provided to convey such runoff to a natural watercourse or legal point of discharge.

7. Table drains shall be constructed on cutting sides of roads. Table drains shall commence at formation (shoulder) edge and develop a depth of 400mm, 1.6m from the edge of formation. If pavement depth is greater than 350mm, the table drain shall be deepened and widened to ensure it is 50mm deeper than underside of pavement. Table drains are to be concrete lined where longitudinal grades are less than 0.8% or more than 5%. If longitudinal grades are over 8%, (or lesser grades, where soils are such that there is risk of erosion), kerb and gutter and full shoulder seal is to be provided.

Table drains

8. In rural subdivisions suitable measures must be placed to ensure no scouring occurs. Such measures may include concrete dish drains, kerb and gutter and

Rural Residential Table Drains

turfing. The measures required will be determined on the basis of geotechnical assessment. Reference is made to Council Standard Drawing ASD 200-202, and ASD 307-308. Sealed shoulders are required adjacent to concrete dish drains.

Category Characteristics	1 Right of Carriageway (Private Property)	2 Rural Laneway	3 Rural Minor	4 Rural Major	5 Rural Collector	6 Arterial
Maximum No of potential Tenements	2ET	4ET	50 ET	150 ET	150 to 500 ET	NA
Indicative traffic volume vehicles/day (vpd)	30	100	500	1000	2000	10000
Carriageway width (m)	5	7 ⁽¹⁾	9	9	11	11
Shoulder width (m) and surface type	0.5 unsealed	1.5 unsealed	1.5 unsealed	1 sealed 0.5 unsealed	1 sealed 1 unsealed	2 sealed
Road Reserve width (m)	10	20	20	20	20	30
<i>Design Speed (km/h).</i>						
Min	20	20	40	60	60	80
Desirable		40	60	80	80	100
Longitudinal Max	25% ⁽³⁾	15%	15%	12%	12%	12%
Grading Min	1%	1%	1%	1%	1%	1%
Crossfalls	5%	4%	4%	4%	4%	4%
Travel lane Surface ⁽²⁾	Unsealed	Two coat seal	Two coat seal	Two coat seal	Two coat seal	Two coat seal

Table D1.10 Characteristics of Roads in Rural Subdivision Roads

Table D1.10 Notes:

- 1 These roads to be widened locally at blind crests and curves and provide passing bays (6 metres wide) within sight distance of each point and not greater than 300 m apart.
- 2 Minimum requirements for sealing of rural road pavements shall be:
14 mm/10 mm two coat flush seal
- 3 >20% to be sealed

The width of the road carriageway includes shoulders.

RFS planning for bushfire requirements shall be adhered to and may supersede the requirements listed in this table

Cut batters

9. Rural road cutting batter slopes shall not be steeper than shown on Table D1.11. If there is evidence of geotechnical instability, batter slope and design is to be in accordance with a geotechnical engineers certified recommendation. A geotechnical expert investigation and report is required for all cuttings deeper than 5m.

Material	Weathering	Maximum Slope H:V
Massive, unjointed, hard rock	Fresh	0.25:1
As above	Fresh - slight	0.5:1
Strong igneous or metamorphic rock with some jointing or discolouration, but, exposed rock not noticeably weaker than fresh rock.	Fresh - slight	0.75:1
Shale, siltstone, sandstone with not more than two joint sets, unaltered joint walls, surface staining only	Fresh - slight	1:1
Moderately weathered rock with no obvious seepage	Slight - moderate	1.5:1
Sandy soil or gravel with minor seepage		3:1
Cohesive soil or completely weathered rock with minor seepage	Extreme	3:1
Weathered rock where joint fillings have eroded out	Moderate - high	3:1
Cohesive soil or highly weathered rock with obvious seepage problems		4:1
Weathered rock or soil with boulders		4:1

Table D1.11 Cutting Batter Slopes

Fill batters

10. Rural road fill batter slopes shall not be steeper than shown on Table D1.12.
11. Notwithstanding 6 and 7 above, batter slope length, berm drain locations and gradient relationships are not to exceed those in Chapter 4, *Landcom – Managing Urban Stormwater - Soils and Construction, 4th edition March 2004*

Batter berm drains

Material	Maximum Slope H:V
Shale, soft limestone, foliated metamorphic rock	2:1
Other rock	1.5:1
Gravel, gravel with silt or sand, well graded sand	1.5:1
Clayey gravel, silty sand, clayey sand, silty soils	2:1
Fatty clays, elastic silty clays	3:1

Table D1.12 Fill Batter Slopes

D1.31 RURAL DESIGN SPEED

1. Design speed shall generally be in accordance with the following table, subject to topographical restraints.

*Design
speed*

Road Class	Design Speeds (kph)
Rural Laneway (Dead End)	30 – 50
Rural Laneway	40 – 60
Rural Minor	50 – 80
Rural Major	50 – 100
Rural Collector	70 – 100
Rural Sub-Arterial/Arterial	80 – 110

2. Lower design speeds with increased pavement width will only be considered where the above standards are demonstrably inappropriate or environmentally unacceptable.

D1.32 RURAL HORIZONTAL ALIGNMENT

1. Horizontal alignment on Class A rural roads is to be designed to suit the topography rather than achieve maximum design speeds. Adverse crossfall is only permitted on class A rural dead end roads of length not exceeding 250m.

*Horizontal
alignment to
suit topography*

Minimum Curve Radii								
	Minimum Horizontal Curve radii (m)							
Design Speed (kph)	Superelevation				Transition Lengths (m)		Centre Line Shift (m)	Widening (m) for 2 lane road
	-3% Adverse	+3%	+6%	+7%	Plan	Super		
30	30	25		20	25	45	1.3	1.7
40	70	50		45	30	50	1.3	1.6
50		90		80	35	55	1.3	1.5
60		140		90	40	60	1.3	1.4
70		200		160	40	60	0.8	1.2
80		300		250	60	80	0.9	1.0
100			460		80	60	0.5	0.8
Note: Radius 301 - 440m not permitted)								

2. Dead Ends

Dead ends

Dead end roads shall be provided with a sealed turning area, diameter 18 metres. Where topography does not permit circular turning areas cross head type turning areas will be considered and will be subject to Council approval.

“No through road” signs are to be placed at start of dead end roads and chevron sight boards are to be provided at dead ends to warn oncoming traffic.

D1.33 RURAL VERTICAL ALIGNMENT

1. Minimum grade 0.5%, maximum desirable 10%, absolute maximum 15% (specific permission of Council is required for exceeding desirable grades and permission will generally only be considered for lesser class roads). Parabolic vertical curves to be provided where grade change greater than 1%.

Vertical grade and curves

Minimum Length of Vertical curves

Crest Curves			
Length for each 1% change of grade			
Design Speed	Normal	At Intersections	Min VC Length
30	0.8	1.2	10
40	2.2	2.9	25
50	4.4	8.8	30
60	7.8	15.7	35
70	13.9	27.8	40
80	22	43.5	50
100	49	98	60

Sag Curves	
Design Speed	Length for each 1% change of grade
30	1
40	2.5
50	6.6
60	10
70	14.9
80	20
100	33.4

Where absolute maximum gradients are approached, designs should demonstrate these are not exceeded on the inside edge of horizontal curves.	
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D1.34 RURAL INTERSECTIONS

Intersections

- Intersections are to be designed in accordance with AUSTROADS Guide to Road Design Part 4 on the basis of ultimate rather than current volumes. On all roads directly linking villages, the safe movement of cyclists and pedestrians through the intersections shall be demonstrated. On other roads its need shall be addressed. Signage, linemarking and lighting in accordance with relevant standards is required.

D1.35 RURAL ROAD DRAINAGE

1. Rural road drainage is to be designed in accordance with Development Design Specification, “D5 Stormwater Drainage Design” except as varied by this specification.
2. In rural subdivisions the existing natural drainage pattern will be maintained. Drainage works will be confined to that required to drain subdivision roads. The road formation shall be kept free of all stormwater by provision of crossfall on straights and superelevation on curves, and the construction of table drains of adequate capacity.
3. Transverse drainage facilities will be provided across roads to enable runoff to pass from upstream to downstream side in a manner that avoids damage to the road and adjacent upstream or downstream property. Transverse drainage will normally be accommodated by installation of culverts. For larger waterways bridges (or in restricted circumstances causeways) will be required.
4. Longitudinal drainage systems will be provided along roads where this is necessary to safeguard the integrity of the road and to convey sheet drainage to transverse drains.

Rural road drainage

5. In rural residential subdivisions where road drainage (both transverse and longitudinal) would discharge onto land other than a defined natural watercourse an easement shall be provided. Such easements will generally be 5 metres wide (minimum) and extend to the defined natural watercourse. Pipes should extend a minimum of 30 metres into the lots and the remainder of the open drain suitably formed to ensure flow to the natural watercourse. Treatments to prevent scouring and erosion of the open drain shall also be undertaken.

Drainage Easements

6. Subsoil drainage will be provided where necessary to preserve the structural strength of the road. It shall be provided in all rural road cuttings.
7. Design shall be based on “Australian Rainfall and Runoff, A Guide to Flood Estimation” 2016.
8. ARI for design of rural road drains and drainage structures shall be in accordance with Table D1.13. Notwithstanding the design selection, the impact of ARI 100 year events must be examined to assess the safety and structural risks to: persons and vehicles; property; stream channel; the road and associated structures. If damage or danger is likely to occur in the ARI 100 year event then the drainage structure must be enlarged or other measures taken (eg embankment/channel scour protection, signage, depth indicators etc) to eliminate risk to the public, vehicles, road, structures, stream channel or adjacent property. Details of such measures, sufficient to withstand design velocities in the ARI 100 year event, must be included with designs.

Structure	Dwellings served or Road Function	Approach Road Flood Status	ARI for Trafficable Flood
Bridges	100+ or inter village connector	Flood free	100
	21 – 100	Flood free	50
	6 – 20	Flood free	10
	1 – 5	Flood free	5
	100+	Flood liable	Commensurate with approach road immunity but minimum 20
	20 – 100	Flood liable	Commensurate with approach road immunity but minimum 10
	6 – 20	Flood liable	Commensurate with approach road immunity but minimum 5
	1 – 5	Flood liable	ARI not specified, low level bridge may be used
Causeways	1 – 5	Flood liable	ARI unspecified
Culverts	100+ or inter village connector	Flood free	50
	Flood bypass road		20
	Other roads		10
Catch, table and other open drains			5

Table D1.13 ARI Values for Rural Road Drainage

9. Longitudinal drainage will normally consist of table drains and subsoil drains in cuttings and catch drains on the high side of cuttings. Table drains are to be concrete lined where grades are less than 0.5% or more than 5%; If grades are over 8% Kerb and gutter and full shoulder seal is to be provided. Catch drains are to be concrete lined where grades are less than 0.5% or more than 5%.

Longitudinal drainage

10. Transverse Drainage

Transverse drainage

Culverts will normally discharge onto natural surface. If culvert outlets or other drainage outlets discharge down embankments, corrugated galvanised half round flumes are required to convey runoff to natural surface. Energy dissipaters are required at flume exits. All headwalls are to be marked with reflectorised guideposts.

Where transverse drainage discharges onto adjacent land that is not a natural watercourse or waterway, the Developer must obtain an appropriate drainage easement or reserve over that land, see D1.35.5

Table drains and embankment berm drains are to be relieved with mitre drains, transverse culverts, flumes or discharged into an underground pipe system at intervals not exceeding:

Gradient of Road (%)	Maximum Relief Interval (m)
1	250
2	250
3	250
4	200
5	150
6	120
8	100
10	90
12	80
14	70
16	60

11. Bridges and Causeways

Bridges and causeways

High-level bridges designed to the ARI specified in Table D1.14 are to be used where conventional culverts are unable to provide sufficient waterway area or site topography is unsuitable for culvert installation. Note that bridges and causeways over declared streams require the separate consent of relevant crown authorities and may require acquisition and extinguishment of native title if foundations are obtained in the streambed.

Causeways or low-level bridges may be considered by Council as an alternative to high-level bridges, where roads leading to the subdivision are liable to flooding and the causeway/low level bridge will serve a maximum 5 dwellings. Causeways will not be permitted at sites where there is evidence of an unstable streambed and risk of excessive scouring to the streambed or banks or excessive deposition.

Bridges must be constructed of low maintenance materials such as reinforced and prestressed concrete, all external steelwork (handrails etc) is to be hot dipped galvanised after fabrication. Timber bridges or bridges with steel girders will not be permitted. Causeways will be constructed of reinforced concrete.

12. Bridge Design

Bridges will be designed in accordance with Development Design Specification D3 – Civil Structures and Bridges.

Designs must be prepared by consulting engineers who have a record of competency in this field. The Principal Consultant shall submit the name and qualifications and experience of the proposed consulting engineer and obtain the approval of Council prior to commencement of bridge design.

Bridges must provide 2 traffic lanes where serving 10 or more dwellings. Council may permit one-lane bridges where up to 9 dwellings only are to be served.

Council will require provision of a footway in areas where 20 or more dwellings will be served and significant pedestrian traffic is likely.

High-level bridges are to be designed for 300mm freeboard in the specified ARI flood and to withstand floodwater and debris impacts from larger events.

Low-level bridges will generally be designed as low as practical to minimise the structural and overturning risk from floodwater and debris.

Bridge abutments and approaches are to be suitably protected from scour and erosion during high water flow.

Where appropriate bridges are to be designed to accommodate other services (water, telephone, sewer, etc).

13. Causeway Design

Causeways should be constructed as low as possible to minimise impacts on flood flows and minimise risk of erosion and overturning. Central deck level is generally streambed level plus height of low flow pipe(s) plus deck thickness. There will be a central deck section and two approach sections. The central section will extend across the entire streambed and beyond the stream bank projection for a distance of 2m on either side. At each end of the central deck section there will be approach deck sections 3m long. The long section of the central section shall be level or slope a maximum of 3% upstream, the approach sections shall slope at a maximum grade of 8% towards the central section. Causeways shall be straight and cross-streams at right angles.

Low flow pipe(s) or box culvert(s) shall be provided under the causeway. The pipe/BC shall be sized to carry average dry weather flow only. Pipe/BC dimensions shall be minimised to keep deck level as low as possible, but, minimum dimension shall be 375mm; or larger if required to reduce likely build up of upstream debris, boulders or silt.

The deck sections shall consist of 150mm thick reinforced concrete with one central layer of F82 mesh constructed on compacted creek gravel or similar material. There shall be 150mm thick, vertical cut off walls constructed at the upstream and downstream edges of the deck for the full length of the central and approach decks. The cut off walls shall be reinforced with a central layer of F82 mesh which shall extend 600mm above the wall and be bent over and cast into the deck pour.

The cut off walls for the central deck shall extend from the deck to a level 1.2m below the deepest point of the streambed. If rock is encountered above this level the cut off walls may be bonded to the rock by dowels drilled 600mm into the rock. Cut off walls for approach decks shall extend 450mm below ground level.

A spillway shall be constructed downstream from the central deck. The spillway shall be sloped at 45° and extend from the downstream edge of the central deck to the streambed. At the streambed it shall be terminated in a cut off wall 450mm deep. The spillway shall be bonded to the deck by reinforcing and shall be poured on compacted creek gravel or similar. The spillway shall be 100mm thick concrete with centrally placed F62 mesh.

Concrete lined table drains are to be used on both sides of the causeway and approach roads where the road /causeway cuts through the stream bank profile. Mitre drains are to be used to remove excess stormwater from the road, prior to the causeway approach.

Causeways are better suited to rock or sound creek-crossing areas. For sandy, soft clay and similar locations, bridges are preferred. If there is active erosion on the stream below the proposed site, then a bridge may be required by Council, or if a causeway is approved by Council, then the cut off walls must be 1.2m below the potential erosion level. Maccaferri gabions or Reno mattresses may also be required to protect causeways against erosion.

If there is active deposition in the streambed in the vicinity of the proposed site, a bridge may be required by Council.

D1.36 RURAL ROAD FENCING

1. All new roads in rural subdivisions shall be fenced on the road reserve boundary. Unless required otherwise by Council, the minimum standard fence shall be a four strand barb wire fence strung through drilled split hardwood posts every 3m, strainers at each change of direction and at intervals of not less than 300m.

Fencing

TRAFFIC CONTROL DEVICES, SIGNS, PAVEMENT MARKING, ROADSIDE FURNITURE, LIGHTING, FENCING

D1.37 TRAFFIC CONTROL DEVICES, SIGNS AND PAVEMENT MARKING

1. Signs, traffic control devices, guideposts and pavement markings are to be provided to roads, intersections, pathways, cycleways and carparks in accordance with *AS1742 Manual of uniform traffic control devices Parts 1 to 15* and the *RMS Delineation Manual*.
2. Street name and community facility name signs are to be provided in accordance with AS1742.5 and Standard Drawing ASD 203 and 204.

D1.38 STREET FURNITURE

1. Guideposts shall be installed on all rural roads in accordance with AS1742.2 and on urban roads where there is limited street lighting as required by Council.
2. Safety barriers shall be required on all rural and urban roads where warrant are established according to Austroads Guide to Road Design – Part 6: Roadside Design, Safety and Barriers. Safety barrier system selection shall be in accordance with C264 – Safety Barrier Systems

Guide Posts

Guard Rail

D1.39 LIGHTING

1. Street lighting shall be provided for all urban roads (excluding small lot rural residential roads designed to urban standard), all traffic calming devices, all intersections and pedestrian refuges and crossings on rural and urban roads and other outdoor public areas in accordance with AS/NZS 1158 *Lighting for Roads and Public Spaces*.
2. The lighting design for the following road elements shall be illuminated to the minimum lighting category specified below or as otherwise specified by Council on the Essential Energy Public Lighting Consent Form:

Lighting standards

Road Element	Lighting Category
Access Places/Shareways	P4
Access Streets	P4
Access Streets in Shopping Areas	P3
Collector < 2,000 vpd#	P4
Collector > 2,000 vpd#	P3
Public Pathways & Paths through Parks & Cycleways not in Road Reserves	P4
Sub-Arterial/Arterial Roads	V3
Car Parks	P11
Traffic Management Devices (including roundabouts)	Horizontal Illuminance min. of 3.5 lx *
Pedestrian Refuge	Horizontal Illuminance min. of 3.5 lx *
Pedestrian Crossing	See AS1158.4-1987
Cluster Housing - Private Roads	P4

TABLE D1.15 Road Element Lighting Category

Category of illumination is defined in AS/NZS 1158.1.1 and AS/NZS 1158.3.1. All lighting designs are to be prepared in accordance with AS/NZS 1158 for the above specified categories.

* Figures 3.1, 3.2 and 3.3 in AS/NZS 1158.3.1 define the roadway area that must be illuminated to the standard specified above.

Total predicted traffic for development and future stages/connections to road.

D1.40 FENCING

1. All street side and median fencing located within traffic clear zones as defined by AUSTRROADS Guide to Road Design Part 6: Roadside Design, Safety and Barriers, shall be RMS Type 1 Pedestrian Fencing unless otherwise authorised by Council.
2. All other fencing and balustrades in Council road reserves shall be of tubular galvanised steel design in accordance with Standard Drawing ASD806. Aluminium and/or timber fencing is not permitted unless otherwise approved by Council.

D1.41 LANDSCAPING

1. All subdivisions shall provide landscaping in accordance with Development Design Specification D13 Landscaping

Landscaping