

Engineering Guidelines for Subdivisions and Development Standards

PART 2 DESIGN OF ROADS

FEBRUARY 2021

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1. INTRODUCTION

This section of the Engineering Guidelines for Subdivisions and Developments outlines Council's recommended practice for the design of rural and urban roads. It is in no way a comprehensive 'Design Manual' and it is to be read in conjunction with and as a supplement to referenced standards.

The Subdivision and Development Guidelines comprise the following:

Part 1 General Requirement

Part 2 Design of Roads

Part 3 Stormwater Drainage Design

Part 4 Water Reticulation Design

Part 5 Sewerage Reticulation Design

Part 6 Landscaping, and Measures for Erosion, Sedimentation and Pollution Control

Part 7 Testing

2. REFERENCE DOCUMENTS

The format of the guidelines has been simplified by making reference to both National and State Standards where applicable. Where these standards vary from the referenced standards the variations are highlighted and cross-referenced. The current version of the referenced standard will apply. The references below were current at time of publication of this standard. If any of the references are updated refer to the equivalent clause in the updated versions. These guidelines shall take preference over the referenced standards. In addition to the criteria outlined in this manual, any relevant acts, regulations and Australian Standards will apply.

In New South Wales, Transport for NSW referenced standards will apply.

- Pavement Design for Light Traffic: a supplement to the AUSTROADS pavement design guide'
- A guide to Pavement Technology Part 2: Pavement Structural Design
- Australian Model Code for Residential Development (1995) (AMCORD)
- Australian Rainfall and Runoff (AR&R)
- AUSTROADS Guide to Road Design Part 3: Geometric Design
- AS 1428.2 Design for Access and Mobility.
- Guide to Road Safety Part 9: Road Hazard Management
- AUSTROADS 'Guide to Road Design, Guide to Road Design Part 4: Intersections and crossings', 'Guide to Road Design Part 6A: Paths for Walking and Cycling and 'Guide to Traffic Management'.
- 'Guide to Road Design Part 4: Intersections and crossings', 'Guide to Road Design Part 6A: Paths for Walking and Cycling' and 'Guide to Traffic Management'.
- AUSTROADS publications 'Guide to Road Design Part 4: Intersections and Crossings' and 'Guide to Road Design Part 4A: 'Unsignalised and Signalised Intersections'
- Australian Standard 1742 (Part 13) - Local Area Traffic Management.
- AUSTROADS publication 'Guide to Traffic Management Part 8: Local Area Traffic Management'.
- AS1742 'Manual of Uniform Traffic control Devices' and Transport for NSW road design guidelines.
- Australian Standard AS 1158
- AUSTROADS Guide to Pavement Technology Part 5. Pavement Evaluation and Treatment Design (2011). Refer Also to Section 4.10 Pavement Composition and Material Quality
- Rural Sealed Local Roads Manual
- AUSTROADS publication Guide to Road Design Part 4, 4A & 4B

Abbreviations

| | |
|--------|---|
| AADT | Average Annual Daily Traffic Volumes |
| AC | Asphaltic Concrete |
| AEP | Annual Exceedance Probability |
| AMCORD | Australian Model Code for Residential Development |
| AR&R | Australian Rainfall and Runoff |
| CBR | California Bearing Ratio |
| DCP | Annual Exceedance Probability |
| LEP | Local Environmental Plan |
| NATA | National Association of Testing Authorities |

3. URBAN ROADS

The following section applies to the provision of roads in urban areas, the classification of these roads as urban will be a determination of the Council.

3.1 PLANS

Engineering Plans should include the following:

- Cover sheet with locality plan and drawing list
- Lot boundaries and numbers
- Road centreline chainages, radii, tangent points and deflection angles
- The location and reduced level of the bench marks (at 100m spacing), control points and recovery pegs used in the survey works. Summary table to be included
- Street names and north point
- Bar scales
- Proposed fill areas
- Locality sketch
- Trees
- Public utilities
- Existing surface levels, features services and structures
- Proposed service crossings
- Road reserve and carriage width
- Australian Height Datum
- A legend summarising line types and symbols
- Radii on kerb returns and kerb lines
- Vehicular crossings
- Contours and finished surface levels on lot corners
- Details of abutting roads and streets necessary to ensure matching in of levels and grades
- Existing and proposed drainage structures, overland flood paths (depth and width) plus drainage calculations.

Infrastructure service design is not to be undertaken in isolation rather as an integrated approach that anticipates conflict. For complex intersections where there is potential for service conflict, show service levels in section.

3.2 CENTRELINE LONGITUDINAL SECTIONS

The centreline longitudinal section should be drawn at 1:200 horizontal and 1:20 vertical scales and include the following:

- Reduced levels and linework of existing surface and of design level of road, left and right kerbs (if required), where variations in crossfall occur and building lines.
- Chainages
- Length of vertical curves
- Design grades
- Length of horizontal curves
- Existing and proposed services
- Drainage culvert information
- Cut and fill levels
- Drainage invert levels
- Extent of roadworks

Longitudinal levels at:

- 10 m intervals on straight grades in urban areas
- 20 m intervals on straight grades in rural areas
- At all intermediate changes of grade and horizontal direction

Longitudinal sections and cross sections should be taken along existing intersecting roads (approx. 50 m) to enable kerb returns, dish crossings and stormwater drainage design.

3.3 CROSS SECTIONS

Cross sections are to be viewed from the direction of increasing chainage at each required interval. Cross sections should be drawn at 1:100 horizontal and 1:100 vertical scales and include the following:

- Chainage label
- Reduced levels and linework of existing surface
- Cut and fill levels
- Design levels and grades

Typical cross section details shall provide information as follows:

- Type of kerb and gutter
- Batters of cuttings and embankments are to be shown beyond the property alignment

- Depth and type of material in each layer of pavement
- Type of surfacing
- Subsoil drainage (where required)
- Pavement and nature strip crossfalls
- Verge offset
- Service corridors
- Landscaping
- Road width between inverts
- Centreline
- Road crown

3.4 KERB RETURNS

Kerb profiles should be shown for all kerb returns, cul-de-sac bulbs and turning tees.

A scale of 1: 200 horizontally and 1:20 vertically is suggested. Levels at $\frac{1}{4}$ points. Kerb return radius shall be 7.5 m in residential streets and 12 m for industrial areas, measurements taken at line of kerb (invert of kerb).

Where bus routes are provided, vehicle-turning paths shall be provided for at intersections. Radius of kerb returns shall accommodate the bus turning path.

Where kerb returns intersect with meet a Local Distributor road, the kerb return radius shall be 9.0m.

3.5 KERB AND GUTTER

All urban streets are to have sealed pavement with kerb and gutter. The kerb profile requirements are stated in table 1. Urban Streets are defined as areas within the land zoning general residential (R1).

Where infill development occurs, the kerb profile must match that of the existing street kerb profile.

The design of kerb and gutter shall comply with drainage requirements of Australian Rainfall and Runoff.

Kerb types are as shown on Council's Standard Drawings. Variations are subject to Council approval. In general, the kerb profile must be capable of storing the major system as described in Council's EDS Part 3 Section 5.1 Major / Minor System Design Approach.

3.6 ROAD SURFACING

All new roads must have a 40mm Asphaltic Concrete (AC) finish. AC to be laid in accordance with good industry practice.

Council will consider the following exceptions:

- Widening of existing roads - Seal to match the existing. Where the existing seal is not AC, the widening seal shall have a two coat 10/7mm with the 10mm to be place over the widening and the 7mm to be placed over the full width of the carriageway.
- Classified roads - to be determined in consultation with the Transport for NSW

3.7 STANDARD ROAD CLASSIFICATIONS AND ASSOCIATED WIDTHS

The road hierarchy comprises; Local distributor; Collector; Local access; Cul-de-sac and minor access.

Table 1: Road Standards, Urban Street Network

| Classification of Road | Local Distributor | Collector | Local Access | Cul-De-Sac & Minor Access |
|---|--|------------------------------|-------------------------------|-------------------------------|
| Number of dwellings | 300 | 150 | 50 | 10 |
| Carriageway Width (m) | 13 | 11 | 8 | 7 |
| Verge Width (m) | 2 x 8.5 | 2 x 6.5 | 2 x 6.0 | 2 x 4.5 |
| Road Reserve (m) | 30 | 24 | 20 | 16 |
| Lane Provision | 2 Moving Parking | 2 Moving Parking | 2 Moving Intermittent Parking | 2 Moving Intermittent Parking |
| Maximum desirable speed (km/h) | 40-60 | 30-50 | 20-30 | 15-25 |
| Maximum design speed (km/h) (for sight distance calculations) | 60 | 60 | 40 | 30 |
| Footpath | 2.5m wide shared path on one side 1.5 on other | 1.5 on both sides | 1.5 on one side | Not required |
| Kerb and Gutter | 150 mm high integral barrier | 150 mm high integral barrier | Semi mountable | Semi mountable |

Verge width: the distance between the property boundary and kerb invert.

Carriageway width: the distance between the kerb invert and kerb invert.

Roads used as bus routes are usually designed to local distributor standards, i.e. 13 m carriageway width or provision for two travel and two parking lanes. Where bus routes are provided in low traffic environments, consideration may be given to a reduction in width and/or the provision of indented bus bays, however such approval will only be considered on a case-by-case basis.

On street parking, at the rate of one car park per lot is to be provided. Where road carriageway is too narrow to provide carpark, carpark to be provided on the verge. Verge carparks are to have a sealed surface. Details are to be incorporated in the Engineering Plans.

Existing unformed road reserves on town plans shall be considered as collector roads unless Council approves otherwise. Proposed developments must favour the use of these road reserves in the subdivision layout. Multiple rear and side fences abutting the existing road reserves will not be permitted.

3.8 INDUSTRIAL ROADS AND ASSOCIATED WIDTHS

Table 2: Road Standards, Industrial Street Network

| ROAD RESERVE | CARRIAGEWAY | VERGE WIDTH | KERB AND GUTTER | PARKING |
|--------------|-------------|-------------|------------------------------|----------------------------|
| 24 | 12 | 6 | 150 mm high integral barrier | Off street parking only |
| 30 | 15 | 7.5 | 150 mm high integral barrier | One design vehicle per lot |

Verge width: the distance between the property boundary and kerb invert.

Carriageway width: the distance between the kerb invert and kerb invert.

All new industrial roads must have a 50mm Asphaltic Concrete (AC) finish

3.9 ACCESS AND VEHICULAR CROSSINGS

Vehicular-crossings are to be provided into each allotment and are to be in accordance with Council Standard Drawings and are to be within the following width ranges.

Table 3: Vehicular Crossings

| | Minimum Width (m) | Maximum Width (m) |
|---------------------------|-------------------|-------------------|
| Residential Crossing | 3 | 6 |
| Industrial and Commercial | 4.5 | 8 |

Note: Widths are at the property boundary and do not include splays.

Vehicular crossings for subdivisions are to be provided at the time of house construction. Subdivision engineering plans that are submitted for approval must indicate the potential location for driveway access to each allotment showing conformance to the items below.

Where kerb and gutter exists or is to be provided:

- Access and vehicular crossings are to be a minimum of 1m clear of all drainage structures on the kerb and gutter and are not to interfere with the existing public utility infrastructure, including Council water and sewer structures, street trees and communications and electricity infrastructure.
- Property access is to be provided for forward entry and exit for other than single residential development
- Access to adjacent properties may be fully combined if single (minimum width) only or alternatively separated by a minimum distance of 2m
- Access to residential corner allotments shall be at least 6m from the kerb tangent point (i.e. where the straight and kerb meet).
- The portion of the crossing that passes through the verge is to be designed to AS 1428 'Design for Access and Mobility'
- Where vehicular crossing access slopes are in excess of 1:10 then a design car template should be used to check access
- Bridge type gutter crossings are not permitted
- Multiple vehicular crossings to each lot are discouraged and require specific approval
- The number of crossings to each lot shall be no greater than 2 and will need to be spaced greater than 8.0m.

Where kerb and gutter is not required by Council

- Allotment access, at a minimum, is to incorporate a 300mm RCP RRJ diameter stormwater pipe with concrete headwalls at each end in accordance with Council's standard drawings. Where it is impractical to construct a 300mm RCP RRJ pipe, a concrete dish crossing may be considered subject to approval on a case-by-case basis.

3.10 STAGED ROAD CONSTRUCTION

Where roads are constructed in stages as part of staged subdivision development, a permanent type barricade is to be constructed at the end of each stage to warn motorists of the dead-end, prevent passage beyond and provide temporary turn around at the end of each stage. The barricade is to remain in place until the future stage is completed and approved by Council. The barricade should be made from a D4-2-1 Chevron (refer AS 1743).

Turning Heads shall be constructed at dead ends with a minimum radius of 9.5 m. The extension of the road is to be constructed utilising the appropriate pavement design standard for the road width and is to incorporate a two-coat seal.

3.11 ROAD CROSSINGS

All conduit trenches should be at a grade of not less than 1% and should be clearly located on relevant drawings. Trench backfill is to be 3% cement stabilised sand to subgrade level.

Conduits shall be located perpendicular to the road centreline with conduit location neatly inscribed into the face of kerb. Conduit finished cover shall be 600mm below gutter lip.

Where service crossings are required through existing Council roads, services must be installed by under boring the road.

An approved Works within Road Reserves Permit must be obtained prior to the commencement of works.

3.12 TRAFFIC GENERATION

A local area traffic management plan shall be provided for the subdivision as part of the agreed Master Plan. This plan shall detail average annual daily traffic volumes (AADT) within the subdivision and assess the impacts of traffic on the surrounding street network. Where adverse impacts are identified traffic mitigation measures shall be implemented.

Qualified traffic consultants shall determine projected traffic volumes that account for existing traffic patterns, predicted future development and associated traffic generation.

In the absence of sophisticated traffic modelling, an assessment of trip traffic generation shall be based on 10 vehicle trips per allotment per day.

3.13 PAVEMENT DESIGN

3.13.1 FLEXIBLE PAVEMENTS

Road pavement design shall be based on the provision of flexible road pavements as follows:

- 'Pavement Design for Light Traffic: a supplement to the AUSTRROADS pavement design guide'
- Classified Road and Industrial road pavements are to be designed in accordance with 'a guide to AUSTRROADS Pavement Technology Part 2: Pavement Structural Design'

A minimum design life of 20 years should be used to determine the pavement thickness. Designers are to submit traffic loading calculations based on 'Pavement Design for Light Traffic: a supplement to the AUSTRROADS pavement design guide'.

Design subgrade CBR values should be determined by either Geotechnical Engineering Consultants or a NATA registered laboratory. The investigation will include 'logging' of test holes to a depth not less than 1m below design subgrade levels (unless rock is encountered). Soil samples should be taken at the design depth and CBR tests undertaken after soaking the samples for four days.

The frequency of test holes should be in accordance with 'Pavement Design for Light Traffic: a supplement to the AUSTRROADS pavement design guide'.

A copy of the site investigation report including test results should be submitted with the pavement design and the Engineering Plans.

The minimum pavement thickness shall be 300mm for roads and 150mm for carparks.

3.13.2 RIGID PAVEMENT DESIGN

Concrete pavements will not be considered by Council.

3.14 SUBSOIL DRAINAGE

Subsoil drainage is to be provided and is to be drained to an appropriate stormwater pit. Flushing points are to be provided at all upstream ends. The minimum grade for subsoil drainage is 1:250, council may consider alternative grades where this is not achievable, although, no consideration will be given to solutions that incorporate a grade lower than 1:400.

Subsoil drainage must be provided to drain all boxed out pavement that are not otherwise draining.

Subsoil drainage shall be provided on the topside of the road in the absence of stormwater drainage.

3.15 GEOMETRIC STANDARDS

The design of all other urban roads is to provide smooth, safe and trafficable horizontal and vertical alignments, adequate sight distance with consideration being given to the road classification requirements, pedestrian access to each allotment, provision for utilities and drainage.

The design speed to be used for a particular road is as per Table 1.

For design speeds up to 60 km/hour, the use of transition curves is not considered necessary. The minimum radius of horizontal curves is:

Table 4: Minimum Radius of Horizontal Curves

| Minimum Deflection Angle | Minimum Radius (m) |
|--------------------------|--------------------|
| 75° | 20 |
| 60° | 33 |
| 40° | 65 |
| 30° | 75 |
| 20° | 100 |

Where the deflection angle is 90° and travel speed is not an issue, the size of the horizontal curve is to be related to the turning requirements of vehicles such as single unit trucks (removalist vans and garbage trucks).

3.16 VERTICAL ALIGNMENT

The maximum permissible grade on an arterial road is to be 8%, with a minimum grade of 0.5%. The maximum permissible grade on all other roads is to be 16% for a maximum distance of 50m and 12% where the length of straight grade exceeds 50m. The minimum grade is 0.25%.

A maximum permissible grade of 10% (1 to 10) should be used adjacent to street intersection, locations of poor visibility, horizontal curves of radius 15 m or less and at cul-de-sacs. Turning circles in cul-de-sacs on steep grades should have grades less than 5%.

Council's drainage requirements on steep grades may involve special structures and extensive piping through easements. Refer also to Australian Rainfall and Runoff (AR&R) limitations on velocities.

Kerb and gutter is to have a desirable minimum grade of 0.50% (1 in 200), council may consider alternative grades where this is not achievable, although, no consideration will be given to solutions that incorporate a grade lower than 0.25%. Saw tooth shaped profiles that are reliant upon pipe drainage are discouraged. Special consideration is required for directing of the major flow path of water to designed flow paths.

Roads are to be designed to provide accessibility to the adjacent verge in accordance with AS 1428.2 Design for Access and Mobility.

Grades through intersections are not to exceed 4% to provide for stationary vehicles queued at intersections.

3.17 VERTICAL CURVES

Vertical curves are to be provided at all changes of grade and where practical should coincide with the horizontal curvature. The values given in 'Guide to the AUSTROADS Guide to Road Design Part 3: Geometric Design' are applicable to urban conditions in the relevant ranges.

3.18 PAVEMENT CROSSFALLS

The normal crossfall on bituminous pavements should be 3%.

The maximum crossfall permitted is 6% and will occur in super-elevated curves and road intersections.

Super-elevation of horizontal curves is to be based on the current AUSTROADS design policy for urban roads. The relative change in grade of kerb line and centreline is not to exceed 0.5%.

3.19 OFFSET CROWN

Offset crowns should be avoided where possible. A one way cross fall is the preferred solution. Council may approve an offset crown if it can be demonstrated to have advantages over other solutions.

3.20 SPLIT LEVEL CARRIAGEWAYS

Use of split-level carriageways is not permitted.

3.21 BATTERS

Where road batters are required, the road batters should lie wholly within the adjacent allotments commencing 0.3m beyond road boundaries. Such batters should be 1 vertical to 6 horizontal to allow for safe maintenance. Batters greater than 1 vertical to 4 horizontal are not permitted.

3.22 BATTER ENCROACHMENT

Where any cutting or filling undertaken by a developer, whether shown on the plan or not, encroaches on any private or crown property, is retained by an existing structure, or could possibly undermine or remove the support of any existing structure, the developer must construct an engineer designed retaining wall.

3.23 ROAD EMBANKMENTS

Road embankments should be checked for safety and protection provided in accordance with 'AUSTRROADS Guide to Road Safety Part 9: Road Hazard Management'. Safety barriers should not be used on road boundaries adjacent to residential allotments.

3.24 ROAD RESERVE BOUNDARIES

Road boundaries may be curved, but where they are to be fenced as chords, these should be not less than 6 m. Where a number of such chords occur adjacent to each other, they should, as far as possible, be practically equal.

3.25 CUL-DE-SACS, Y-HEADS AND T-HEADS

The following requirements apply to cul-de-sacs, Y-heads and T-heads:

- Demonstrate compliance with the turning path requirements for service vehicles
- The kerb line radius of a cul-de-sac should not be less than 9.5 m
- Special provision should be made to take drainage from downhill cul-de-sacs through easements or drainage reserves that accommodate extreme flood events via underground drainage or via overland flow paths. The capacity of the major drainage system should be the 1% Annual Exceedance Probability (AEP) event. As there is potential for upstream stormwater pits to block, allow for overland flow paths of water through public owned land and reserves rather than private property
- Safety in design principles require street lighting to be located to improve the safety and the illumination of any pathways or reserves
- Y-heads & T-heads are to be a minimum length of 13 m from the centreline intersection to end

3.26 PATHWAYS, LANES AND VERGE

3.26.1 DEFINITIONS

A Lane is a public road of width greater than 3 m but not greater than 6 m and is to be used primarily for access to the rear of premises.

A Pathway is a public road of width 3 m or less. The maximum width to be adopted for pathways is 3 m and is primarily for the use of pedestrians and/or cyclists.

A Verge Reserve is that part of a public road exclusive of the carriageway and in the case of residential roads may not be less than 4.2 m in width. Residential roads are public roads used primarily for access to residences.

3.26.2 PATHWAYS

Pathways dedicated to the public as access from or between roads, or as access to parks and recreation space should be designed in accordance with 'Safer by Design Principles'. These pathways should be clear and provide uninterrupted lines of site with lighting located at the ends of the pathway. In general, the maximum permissible grade to be used in pathways should be 12%.

The maximum permissible grade to be used in pathways providing access to parks and reserves shall be 8%.

Pedestrian Access and Mobility

Pathways are required as part of all subdivision developments. Pathways are to be consistent with the requirements of Council's Pathway Master Plan which may include reference to a Pedestrian Access and Mobility Plan (PAMP).

Table 5: Pathway requirements specific to Federation Council

| | |
|-----------------------------|--------------------------------------|
| Pathway Width | 1.5m |
| Shared verge and cycle ways | 2.5m |
| Materials | Reinforced concrete SL72 100mm thick |
| Location of the verge | 600mm from the property boundary |

Design is to be in accordance with AUSTROADS 'Guide to Road Design, Guide to Road Design Part 4: Intersections and crossings', 'Guide to Road Design Part 6A: Paths for Walking and Cycling' and 'Guide to Traffic Management'.

Perambulator ramps should be provided at all kerb crossings and comply with pedestrian access and mobility requirements.

Design is to be in accordance with Australian Standard AS 1428 – 'Design for Access and Mobility'.

3.26.3 VERGES

In areas where the verge reservation is to be totally paved from the top of the kerb to the adjacent boundary, the crossfall is to be 1 in 50 towards the kerb (2%).

In areas where the verge is unpaved or partially paved, crossfall from kerb to the adjacent boundaries is to be 1 in 33 towards the kerb (3%). Alternative treatments that achieve water sensitive urban design outcomes are encouraged subject to prior approval as part of the concept design development. The design of verge crossfalls shall comply with the drainage requirements in Australian Rainfall and Runoff. 1% AEP flows shall be contained within the road reserve, public reserves or piped.

Vehicular crossings which cross the verge are to be checked using standard vehicle templates.

3.27 CYCLEWAYS

Where cycleways are to be required by a development consent they shall be designed in accordance with AUSTROADS 'Guide to Road Design, Guide to Road Design Part 4: Intersections and crossings', 'Guide to Road Design Part 6A: Paths for Walking and Cycling' and 'Guide to Traffic Management'.

3.28 STREET SIGNS

Street signs are to be erected at all street intersections and are to be in accordance with Councils Standard Drawings and requirements.

3.29 HALF WIDTH CONSTRUCTION

Where proposed subdivisions or developments front an existing sealed road and the existing pavement is of adequate strength and the vertical alignment is satisfactory, the existing pavement may be retained.

Where existing roads are to be widened, the existing pavement shall be saw cut 500mm in from the existing seal edge. Full depth pavement is to be provided to the required road widening.

Should Council determine the existing pavement to be unsatisfactory, then the pavement construction is to be extended to the existing road centreline.

In all cases, the new seal should extend to the road centreline to avoid irregularities.

Any unsealed road must be sealed for the full width as per this manual for the entire length of the development.

In any development where its frontage is adjacent to an undeveloped site, a minimum carriageway width of 8m shall be provided with kerb and gutter on the development side only. Where Council determines the road to be a collector or local distributor road, the design road crown shall be designed to allow for future road widening.

3.30 INTERSECTIONS

- Intersection design should be based on the AUSTRROADS publications 'Guide to Road Design Part 4: Intersections and Crossings' and 'Guide to Road Design Part 4A: 'Unsignalised and Signalised Intersections'
- 'T' junctions should be adopted in preference to four-way intersections. Where staggered 'T' junctions are to be provided, the intersecting roads should be located a minimum distance of two times stopping distance for the travel speed along the through-road (1.5 second reaction time)
- Roads should intersect at not less than 70°
- The minimum centreline spacing between intersections is 50 m in urban areas
- Four-way intersections or cross intersections shall be designed with roundabouts
- Where intersections are in a configuration likely to cause traffic problems, the construction of traffic islands, or such traffic facilities is required to provide traffic control and safety

3.31 TURNING MOVEMENTS FOR DESIGN VEHICLES

Turning movements shall be provided for the design vehicle. Prior to commencement of design process, consultation is required with Council to determine the design vehicles for the different street classifications. The fire emergency services vehicle is frequently used as the design vehicle. Vehicle turning movements must allow for left turn from the left lane without crossing lanes for design vehicles. Where requested, traffic movement paths shall be presented using such packages as 'Autoturn' or similar. Clearance of 500 mm shall be provided to the total swept path.

3.32 LOCAL AREA TRAFFIC MANAGEMENT

Traffic Management devices are to be designed in accordance with AUSTRROADS publication 'Guide to Traffic Management Part 8: Local Area Traffic Management'. Local Area Traffic Management Devices may be required as a condition of Development Consent. Alternatively, developers may elect to install these devices where appropriate. The use and installation of the devices should be in accordance with Australian Standard 1742 (Part 13) – 'Local Area Traffic Management'.

3.33 GUIDE POSTS

Guideposts and protection fencing are to be provided where required in accordance AS 1742, AUSTRROADS and Transport for NSW guidelines.

3.34 SIGNPOSTING AND PAVEMENT MARKINGS

Signposting and pavement markings are to be provided where required in accordance with AS1742 'Manual of Uniform Traffic control Devices' and Transport for NSW road design guidelines.

3.35 CAR PARKING

Car parking is to be provided in accordance with:

- Development Control Plan and Local Environmental Plan (DCP and LEP)
- AUSTRROADS 'Guide to Traffic Management Part 11 – Parking'
- AS 2890 Parking Facilities

Indented parking will only be considered as part of an integrated solution that enhances environmental and aesthetic outcomes such as for water sensitive urban design and entry features.

The developer is responsible for providing parking associated with the development onsite. Parking on the street is regarded as being additional to development generated parking and is for general public parking.

All car parking and manoeuvring surfaces are to be bitumen sealed or equivalent.

3.36 FLOODING

The design of the road system must account for the major flow paths associated with flood events as the piped stormwater drainage networks typically account for flow paths of water during minor events, the flow path of water during major events frequently involves the road network. In particular intersections shall be designed to direct the major flow path of water in accordance with an approved subdivision master plan.

Road longitudinal section sag points must direct flows to major open channels or intersections. Sag points mid-block are discouraged and will only be approved if consistent with an agreed drainage master plan. Direction of water to cul-de-sacs, Y-heads and T-heads is discouraged.

3.37 EARTHWORKS

In all new development areas lot filling is to ensure that finished surface levels are 500 mm above the 1% AEP flood levels. Where infill development occurs, consultation with Council regarding local requirements and Council flood policies is required.

Fire trails are to be graded to divert stormwater away from residential properties to either drainage reserves or road reserves.

Filling of depressions requires consent, as there is potential to redirect the major flow path of water and for subsequent land settlement. Earthworks are to be in accordance with AS 3798 'Guidelines on Earthworks for Commercial and Residential Development'.

3.38 TESTING OF ROADS

All pavement courses, surfacing and subgrade are to be tested in accordance with an approved testing regime and are to demonstrate that the pavement meets the requirement of the specification. Refer to part 7 'Guidelines for Testing'.

3.39 STREET LIGHTING

Street lighting is to comply with the current Australian Standard AS 1158 to provide for pedestrian and vehicular movements.

Lighting designs are to be prepared by consultants approved for lighting design by the energy authority and Council.

3.40 ROAD SAFETY AUDITS

A road safety audit is to be undertaken of the road design to provide documentary evidence that the road design has taken risks and safety issues into account.

4. RURAL AND RURAL RESIDENTIAL ROADS

In addition to the preceding section relating to urban road design, this section applies to the provision of roads and access to rural and rural residential areas. Council is responsible for making the determination of areas where rural residential design standards apply.

4.1 DEFINITIONS, QUALIFICATIONS AND EXPERIENCE

New road widths require discussion with Council and should generally be in accordance with the following:

Table 6: Rural/Rural Residential

| AADT | ROAD RESERVE | CARRIAGEWAY | SHOULDER | FORMATION |
|---|--------------|-------------|-------------------|-----------|
| <50 | 20 | 6.0 | 0.0 | 6.0 |
| 50-250 | 24 | 6.0 | 1.0 | 8.0 |
| 250-500 | 30 | 7.0 | 1.0 | 9.0 |
| 500+ (including Regional and State Roads) | 30+ | 8.0 | 1.0 (0.5m sealed) | 10.0 |

Note:

- In all cases AADT is that predicted at the end of the design period (20 years)
- The designed pavement thickness is to extend for the full formation
- The road reserve width is nominal only and consideration is to be given to the extent of cut and fill batters, catch drains, intersection layout requirements, and provision for public utilities adjacent to the road reserve boundary. A minimum allowance of 3m from the batter point to the boundary is to be provided
- All roads which form part of a new development must be sealed.

4.2 PLANS

A3 Engineering Plans should be drawn at a 1:500 scale and include the following:

- Cover sheet with locality plan and drawing list
- Overall site plan
- Lot boundaries and numbers
- Road centreline chainages, radii, tangent points and deflection angles
- The location and reduced level of the bench marks (at 100m spacing), control points and recovery pegs used in the survey works. Summary table to be included
- Street names and north point

- Bar scales
- Trees
- Public utilities
- Existing surface levels, features services and structures
- Proposed service crossings
- Road reserve and carriage width
- Australian Height Datum
- A legend summarising line types and symbols
- Radii on kerb returns and kerb lines
- Vehicular crossings and entrances
- Contours and finished surface levels on lot corners
- Cut and fill levels on all sections
- Details of abutting roads and streets necessary to ensure matching in of levels and grades
- Existing and proposed drainage structures, overland floor paths (depth and width) plus drainage calculations

Infrastructure service design is not to be undertaken in isolation rather as an integrated approach that anticipates conflict.

4.3 CENTRELINE LONGITUDINAL SECTIONS

The centreline longitudinal section should be drawn at 1:500 horizontal and 1:100 vertical scales and include the following:

- Reduced levels and line work of existing surface and of design level of road, left and right kerbs (if required), where variations in cross fall occur and building lines
- Chainages
- Length of vertical curves
- Design grades
- Length of vertical curves
- Existing and proposed services
- Drainage culvert drainage information
- Extent of roadworks

Longitudinal levels at:

- 50m intervals on straight grades and horizontal curves exceeding R1000m
- 20m intervals for horizontal curves between R150m and R1000m
- 10m intervals for horizontal curves less than R150m
- At all intermediate changes of grade

Longitudinal sections and cross sections should be taken along existing intersecting roads for a sufficient distance to enable design requirements to be satisfied.

4.4 CROSS SECTIONS

Cross sections are to be viewed from the direction of increasing chainage, should be drawn at 1:100 horizontal and 1:100 vertical scales and to be at:

- 50m intervals along straight alignments and horizontal curves exceeding R1000m
- 20m intervals for horizontal curves R1000m and less
- All culvert sites
- The SS, TS, TP and SC of each horizontal curve. The scale should be 1:100 natural

Cross sections should not be terminated at the property alignment but should be levelled sufficiently beyond the road boundaries to enable batters of cut and fill to be shown.

Cross sections should show:

- Chainage Label
- Reduced levels and line work of existing surface
- Design levels on the road centreline
- Cross falls
- Centreline offsets
- Lateral dimensions if pavement and formation widths vary
- Batter slopes that vary from those shown on the typical cross section

Typical cross sections shall show:

- Pavement details
- Typical dimensions
- Subsoil drainage
- Road surfacing
- Kerb detail

4.5 PAVEMENT DESIGN

Road pavements are to be designed in accordance with the following publications:

- AUSTRROADS Guide to Pavement Technology Part 5. Pavement Evaluation and Treatment Design (2011). Refer Also to Section 4.10 Pavement Composition and Material Quality
- Rural Sealed Local Roads Manual
- Federation Council Standard Drawings

Prior to commencing pavement design meet with Council and undertake road design in accordance with a broad precinct based strategy that optimises pavement design and pavement life based on available quarry materials, subgrade conditions ground water moisture and economic considerations. A minimum design life of 20 years should be used to determine the pavement thickness. Designers are to submit traffic loading calculations.

Design subgrade CBR values should be determined by either Geotechnical Engineering Consultants and/or agents of a NATA registered laboratory. The investigation will include 'logging' of test holes to a depth not less than 1m below design subgrade levels (unless rock is encountered). Soil samples should be taken at the design depth and CBR tests shall be undertaken after soaking the samples for four days.

The frequency of test holes should be in accordance with 'Pavement Design for Light Traffic: a supplement to the AUSTRROADS Pavement Design Guide'. The testing frequency of pavement material is to be specific and determined on a case by case basis depending on the condition of the road.

A copy of the site investigation report including test results should be submitted with the pavement design and the Engineering Plans.

4.6 GEOMETRIC STANDARDS

The Geometric design and design speed of rural roads is to be based on AUSTRROADS Guide to Road Design Part 3: Geometric Design.

4.7 SIGHT DISTANCE

Adequate horizontal and vertical sight distance should be provided for the design speed in accordance with AUSTRROADS Guide to Road Design Part 3: Geometric Design.

Vehicular access to properties is not permitted where the stopping sight distance is inadequate. Where practical, the horizontal and vertical curves should coincide.

4.8 VERTICAL ALIGNMENT

The maximum permissible grade on an arterial road is to be 8% with a minimum grade of 0.5%.

The maximum permissible grade on all other roads is to be 16% for a maximum distance of 150 m on straight alignment with a minimum grade of 0.5%.

The maximum permissible grade of 10% (1 in 10) should be used adjacent to street intersections, locations of poor visibility, horizontal curves of radius 15 m or less and at cul-de-sacs. Turning circles in cul-de-sacs on steep grades should have grades less than 5%.

4.9 PAVEMENT CROSSFALLS

The normal crossfall on bituminous pavements and shoulders should be 3%.

The maximum crossfall permitted is 6% and will occur on super-elevation curves and road intersections depending on geometric road design.

4.10 CLEARING AND GRUBBING

All road reserves should be cleared approximately 0.5 m beyond the extent of roadworks. All trees to be removed must be clearly marked on the plan with a diameter of the canopy and the trunk represented diagrammatically on the plan. Native and threatened species impacts are to be identified and are subject to approval.

4.11 VEHICULAR ACCESS

Roads should be located and designed so that vehicular access can be readily obtained at every lot of a subdivision. Where the natural surface slopes steeply to or from the road, the access to each lot should be given special consideration. Preference for limitation of the number of access points to the road network.

Access to rural properties shall provide safe access and egress, having regard to fire risk.

The vehicular crossing is to be all weather sealed construction from the edge of the existing road boundary.

All vehicle access is to be 4.88 m minimum wide culverts.

End walls to be trafficable when located within a clear zone (refer to Transport for NSW standard drawings).

Hydraulic capacity shall be a minimum of 1 in 5 years.

Install a 375 mm RCP RRJ minimum diameter pipe culvert in the table drain.

Calculate pipe flows in the drain and provide capacity for 1 in 100 year overland design flows. For flows in excess of the pipe capacity, check flow path to ensure that risk to the public and physical assets is minimised or eliminated. Major flow path of water is to be clear of the edge of gravel and sealed roads.

4.12 BUS ROUTES

Where there is potential for future access by school bus services turning provision is required.

4.13 GUIDE POSTS

Guideposts and protection fencing are to be provided in accordance AS 1742, AUSTRROADS and Transport for NSW guidelines.

4.14 ROAD NAME SIGNS

Road name signs are to be manufactured to accord with Council's Standard and should be erected at all intersections. The road name and colour of signs are to be in accordance with an approved sign location drawing.

4.15 INTERSECTIONS

'T' junctions should be adopted in preference to four-way intersections. Where staggered 'T' junctions are to be provided intersection design should be based on AUSTRROADS publication Guide to Road Design Part 4, 4A & 4B.

Roads should intersect at no less than 70°.

Where intersections are in a configuration likely to cause traffic problems, the construction of traffic islands, or such traffic facilities are required to provide traffic control and safety.

4.16 PUBLIC UTILITIES

All public utilities in subdivisions should be provided underground. An early approach is to be made to those authorities for their requirements regarding conduits, contributions, layout plans and other relevant details.

The location of proposed conduits beneath the road carriageway is to be shown on the plans. Service location markers are to be attached to the kerb during construction.

4.17 STEEP GRADES

Where grades exceed 6%, a one-coat bitumen seal is to be provided on the road shoulders. Where shoulders are sealed, edge line marking is to be provided.

Where the grade of the table drain exceeds 6% and scouring is likely, a concrete lined drain is required.

Where the terrain permits, batters in the region of 4 horizontal to 1 vertical are desirable. Proposed batters of greater slope than 4 horizontal to 1 vertical require separate approval.

4.18 SIGNPOSTING AND PAVEMENT MARKINGS

Signposting and pavement markings in accordance with Australian Standard AS 1742 – 'Manual of Uniform Traffic Control Devices', are to be provided where required.

4.19 FIRE TRAILS

Fire trails are to be provided as part of an integrated network that improves community safety from the risk of fire.

Fire trails are to have a desirable maximum grade of 1 in 200. In localised sections steeper grades will be permitted with these sections requiring erosion treatment of gutters and drains.

4.20 ROAD SURFACING

The carriageway of Rural/Rural Residential roads should be sealed to a minimum standard of two coat spray bitumen seal.

The carriageway is to be marked with a 150mm wide edge line for roads with AADT greater than 500 vehicles per day.

The shoulder adjacent to a barrier centreline is to be widened to 3m. A prime coat will be required prior to application of two coat seal.

Application rates of aggregates and binder, and the Average Least Dimension of aggregates, shall be submitted for approval prior to commencement of sealing on-site.

4.21 DUST SUPPRESSION

Consideration is on a case-by-case basis having regard to

- Existing impacts on buildings within 100m
- Potential future impacts
- Provide sealed surface 75m each side of access to building
- Where less than 30 vehicles per day provide 4.5m seal
- Where greater than 30 vehicles per day provide 6.2m seal

4.22 CAUSEWAYS AND FLOODING

Rural roads that include causeway crossings require calculation of flows and recurrence interval of events. Direction from Council will be required on the design criteria and risk assessment approach required.

4.23 EROSION PROTECTION

Erosion protection is required to minimise erosion potential where water concentrates, such as at piped culvert inlet and outlet systems.

4.24 SPLAYS AT INTERSECTIONS

Splays are to be provided at intersections.

4.25 RURAL ROAD DESIGN PHILOSOPHY

Rural road pavements are typically elevated in comparison to urban pavements, which are depressed to provide for the major flow path of surface water. Elevated rural road design is to include table drains that prevent water from ponding against and saturating into the subgrade. Table drains are to be designed to effectively transfer water away from the pavements gravel base and subgrade materials. Gravel base and subgrade materials are not to be boxed and should extend to a free draining surface.

4.26 GUARDRAILS

Provide in accordance with AUSTRROADS standards.

4.27 BATTER AND DRAIN MAINTENANCE

The road reserve area shall be constructed with batter and drain slopes that permit routine access for mowing. This requires desirable minimum batter slopes of 4 horizontal to 1 vertical.

5. STANDARD DRAWINGS

| No. | Description | Drawing No. |
|-----|--|-------------|
| 1 | Street Services Offsets | SD 000 |
| 2 | Rural & Distributor Roads – Typical Geometric Cross Sections | SD 001 |
| 3 | Residential Streets Urban Zones – Typical Geometric Cross Sections for Collector, Local Access and Minor Cul-De-Sacs | SD 002 |
| 2 | Residential Streets Urban Zones – Typical Geometric Cross Sections for Service Roads and Industrial Roads | SD 003 |
| 3 | Pavement Details – Cul-De-Sacs, Local Access Streets and Collector Streets | SD 100 |
| 4 | Pavement Details – Distributor, Industrial & Rural Roads | SD 101 |
| 5 | Standard Pram Crossing | SD 300 |
| 6 | Concrete Footpaths | SD 301 |
| 7 | Asphalt Footpaths | SD 302 |
| 8 | Private Access Installation | SD 400 |
| 9 | Headwall – Major Roads – High Speed, High Volume (≥ 80 km/hr) | SD 401 |
| 10 | Headwall – Urban & Rural – Within 6.0m Offset | SD 402 |
| 11 | Headwall (Precast High Profile) – Urban & Rural – Greater Than 6.0m Offset | SD 403 |
| 12 | Vehicular Crossing at Culvert – Major Roads – High Speed, High Volume (≥ 80 km/hr) | SD 404 |
| 13 | Vehicular Crossing at Culvert – Urban & Rural – Within 6.0m Offset | SD 405 |
| 14 | Vehicular Crossing at Culvert – Urban & Rural – Greater Than 6.0m Offset | SD 406 |
| 15 | Concrete Vehicle Crossing – Residential Elevation Limits | SD 407 |
| 16 | Concrete Layback Driveway – Residential Barrier Kerb | SD 408 |
| 17 | Concrete Layback Driveway – Industrial and Commercial | SD 409 |
| 18 | Standard Kerb Profiles – Mountable Kerbs | SD 500 |
| 19 | Standard Kerb Profiles – Barrier Kerbs & Edge Strips | SD 501 |
| 20 | K&G Construction Setout – For Surveying Purposes | SD 502 |
| 21 | Trench Backfilling Requirements – Roads Without Kerb & Gutter | SD 600 |
| 22 | Trench Backfilling Requirements – Boring Under K&G and Concrete Paving | SD 601 |
| 23 | Trench Backfilling Requirements – Under Sealed Roads & Concrete Paving | SD 602 |

| No. | Description | Drawing No. |
|-----|---|-------------|
| 24 | Advanced Tree Planting – for use in Grassed and Mulched Areas | SD 900 |
| 25 | Speed Hump Profile – Local Area Traffic Management | SD 901 |
| 26 | Lock Socket Spike & Wedge – for Sign Posts | SD 902 |
| 27 | Street Name Sign Post | SD 903 |

| Version | Date | Changes/Amendments |
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| 1 | November 2018 | Approved issue |
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