

3 ROADS AND PATHWAYS

This section sets out the minimum standards required by Council for the Planning, Design and Construction of roads and pathways in both residential and industrial subdivisions. It defines the road hierarchy and classification of road types for planning the layout of a subdivision, sets the standard road cross sections and details the design requirements for both road geometry and road structure.

Standard drawings

The DPI standard drawings may be acceptable in situations when Council standards are not available. Variations to Standard Drawings and these guidelines will be considered wherever Palmerston City Council standard drawings do not exist, subject to the approval of Council.

Definitions

Residential Catchment. - the residential catchment of a particular road is the residential area that contributes directly or indirectly to the traffic flow on that road.

Carriageway Width. - is the area of road pavement between the face of opposing kerbs.

Verge Width. - is the area between the face of kerb and the road reserve boundary.

Face of Kerb. - is typically the invert of the kerb. In the case of standard kerb or mountable kerb, where there is no gutter, it is the front face of the kerb.

Lot Frontage. - is the side of the lot that has access to the road.

3.1 Urban Road Hierarchy

The classification for all roads as adopted by Council for the purpose of subdivisional layout and road design criteria is as described below and indicated on the typical road hierarchy map included in Appendix C.

3.1.1 Residential

Arterial Road

Arterial roads link with other arterial roads and distributor roads and typically border townships or Municipalities, providing service to a series of suburban areas. Generally arterial roads have a speed limit of 80 - 100 km/hr and provide limited access to residential streets. No lot frontage access is allowed to arterial roads.

Distributor or Sub Arterial Road

Distributor (sub arterial) roads act as feeder or connecting roads, linking the residential areas with the arterial road system. They are typically dual lane and have a speed limit of 60 - 80 km/hr.

A typical distributor road will break up residential areas into catchments of 1800 lots or less, provide access to an arterial road and discourage the through movement of traffic from areas external to that suburb. Typically distributor roads run external to the suburb, forming part of the suburb boundary and do not provide direct frontage to the residential lots. However they can provide access to larger developments such as schools, public facilities and shopping centres.

Collector Roads

Collector roads primary purpose is to connect the residential cells of a suburb to the traffic carrying distributor roads. The roads generally have a number of access roads branching from them and can provide direct access to residential lots. Collector roads will typically be single lane with a speed limit of 50 - 60 km/hr. They can be broken into two types, primary collector roads and secondary collector roads.

- (a) Secondary collectors typically cater for catchments of up to 250 residences and provide access to one or more local access roads. Generally, secondary collector roads servicing more than 125 residences should have more than one access outlet. Typically, no schools, shops or bus routes are allowed on secondary collectors.
- (b) Primary collectors have the same definition and criteria as a secondary collector but have a stronger connectivity between suburbs and the distributor road system. Schools and shops may access the road and the cross section is wide enough to accommodate a bus route. Direct residential lot frontage access is not encouraged on primary collector roads.

Local Access Roads

Local access roads consist of loops and through roads between collector roads. They provide lot frontage and generally give access to up to 60 residences. Local access roads are single lane with a maximum speed limit of 50 km/hr.

Minor Roads

Minor roads include short loops and cul-de-sac's which provide direct access to residential lots. Minor roads typically service no more than 25 residences and should generally not exceed 200 m in length.

3.1.2 Industrial

Collector

Industrial collector roads act as feeder or connecting roads, linking industrial areas with the arterial or distributor road system. Industrial collectors will provide direct frontage to industrial lots and access to industrial access roads.

Local Access

Local access roads connect cells of up to 70 industrial lots to the traffic carrying collector roads. Cul-de-sacs are discouraged but in limited situations cul de sacs may be accepted if the road is no more than 100m long and has a catchment of 10 lots or less.

3.1.3 Matching to Existing Network

The main road and pathway network for Palmerston is generally defined and fixed in relation to any proposed works. Developers must join into this network, forming their development and pattern of land use to be an integral part of the total network.

Master plans for all road and path networks within a development shall be submitted to Council for approval before the commencement of any stage of the subdivision. Refer to section 8.1.6.

3.1.4 Creating Sustainability with Road Network

The road, cycle and pedestrian network should be well connected, shaded and direct in order to provide residents with a choice of transport modes, encouraging alternatives to driving to reach local destinations. Disabled access shall be paramount with the design of all roads and pathways, and steep grades shall be avoided in all instances. CPTED principles (e.g. providing natural surveillance and well lit areas) shall also be adopted in order to encourage the use of pedestrian and cycle paths during both day and night.

Where possible, road and lot orientation shall be designed to encourage houses facing due north or south with neighbouring houses shading each others' eastern and western facades (e.g. through predominant east-west road layout). Subdivision master planning and design shall note the prevailing breeze directions and aim to maximise building access to prevailing breezes (particularly during the wet season).

Water Sensitive Urban Design (WSUD) shall be adopted within new road networks, particularly along distributor roads where central medians can incorporate drainage swales and bioretention systems. The Darwin WSUD Strategy prepared by the NT Government shall be used to develop WSUD design standards on new developments. The current version of the strategy shall be used whether it be in draft, interim or final form.

3.2 Speed Environment

An urban speed environment uses road structure to make motorists feel that it is unsafe to drive at high speed. Generally the design speed of roads is not reduced, instead restrictions are used to form a picture in the driver's mind of a low speed/safe-driving environment.

To achieve an urban speed controlled regime use is made of road geometry, pavement surface and ancillary structures such that drivers are induced to reduce their speed from 80 km/h in arterials and distributors to 60 km/h along collectors, to lower speed in local access and minor roads. A 50 km/hr default speed limit applies to all areas within the Northern Territory.

A master plan shall be provided showing the proposed speed limits on all new roads. Refer to section 8.1.6.

The design of roads within the subdivision development shall conform to the following design speed requirements:

Road Classification	Speed (km/hr)
Residential minor and local access roads	50
Residential Collector Roads	50 - 60
Residential Distributor roads (general)	60 - 80
Residential Distributor roads (special*)	50
Industrial Roads	60

*adjacent to schools and parks and any special zones where dense pedestrian movement requires special treatment.

Developers are encouraged to make use of the following restrictions, features and measures to create an urban speed environment within their subdivision:

- (a) Variable alignment (meandering carriageway within the road reserve);
- (b) Isolated width restrictions (generally used in conjunction with other restrictions);
- (c) Selected variations to pavement surface texture;
- (d) Variations to pavement surface colour (at boundaries to low speed areas, etc);
- (e) Street furniture placement;
- (f) Verge planting (to create wall effects and modify sight lines);
- (g) Local Area Traffic Management (LATM) or Traffic Calming devices and;
- (h) Other appropriate measures.

Care should be exercised in the use of the above measures to ensure there are no unacceptable traffic hazards created or a loss of amenity to residents. All measures will be subject to the approval of Council.

3.3 Cycle Paths and Footpath Networks

Subdivision Design is to incorporate a system of footpaths, shared pedestrian/cycle paths and on road bicycle routes connecting residential areas, and open space to provide access through the

subdivision and connecting with other pathway systems in adjoining suburbs and eventually to the City Centre.

Developers shall provide a master plan prior to commencement of any stage of a new development which indicates proposed on road and off road routes for cyclists and pedestrians which shall be submitted to Council for approval (refer to section 8.1.6). The plan shall show connections to the neighbouring suburb pathway systems, proposed schools, shops, unit/ flat developments, open space and playing fields. Generally, pedestrian facilities shall comply with Austroads, Guide to Traffic Engineering Practice, Part 13 - Pedestrians.

Bicycle facilities shall comply with Austroads, Guide to Traffic Engineering Practice, Part 14 - Bicycles.

3.4 Geometric Design Standards for Roadways

3.4.1 Relevant National Standards and Guidelines

Generally, the road network shall be designed in accordance with all relevant standards and guidelines including, but not limited to, the following;

- (a) Guide to Traffic Engineering Practice - All Parts (AUSTROADS)
- (b) Pavement Design - A Guide to the Structural Design of Road Pavements (AUSTROADS 1995)
- (c) AP-T36/06 Pavement Design for Light Traffic (A supplement to the Austroads Pavement Design Guide)
- (d) AUSTROADS, Urban Road Design - Guide to the Geometric Design of Major Urban Roads

3.4.2 Geometry

Gradients

The maximum and minimum longitudinal grades on roads (in particular along the kerb line) should meet the following criteria for various road classifications:

	Residential Distributor	Residential Other	Industrial All
Desirable Max %	8	10	6
Absolute Max %	10	12	8
Desirable Min %	1.0	1.0	1.0
Absolute Min %	0.5	0.5	0.5

The absolute maximum grades may be approved in special cases. An attempt should be made to redesign sections where these grades are contemplated, and only after complete examination of all alternatives will they be considered acceptable.

The consultant shall provide a design report to Council (refer to section 8.2.1) which highlights any areas where road grades are above or below the desirable figures listed above along with explanations for why the desirable figures were not achieved.

Horizontal and Vertical Curves

Horizontal and vertical curves should be applied and calculated in accordance with the design criteria and formulae in AUSTRROADS, Urban Road Design - Guide to the Geometric Design of Major Urban Roads.

Intersections

Staggered T intersections will be separated as far as practicable but desirable minimum distances are:

Classification	Access	Collector	Distributor
Distance (m)	50*	80	200

*Where site distances are appropriate and subdivision layout warrants it, separation distances for staggered T intersections on access streets may be reduced to 30 metres at the discretion of Council.

At all intersections the through road shall maintain its cross section. The terminating road shall match its longitudinal gradient to the pavement cross fall of the through road.

In the instance when the through road of an intersection is constructed by one developer and the terminating road is constructed by another developer, the former developer shall fully construct the intersection to the tangent points of the terminating road. This may require work to be carried out outside the boundaries of the lease.

At all intersections, adequate stopping sight distance shall be provided.

Crossroads will not be approved without the installation of a roundabout as a minimum treatment. Other controls (e.g. signalised intersections) may be considered by Council where considered appropriate based on road hierarchy and traffic.

Y-junctions are not acceptable.

3.4.3 Cross Sectional Elements

Residential Road Width

The minimum cross section dimensions for road verge width, carriageway width and overall road reserve width will be:

Road Configuration	Verge Width (m)	Carriageway Width (m)*	Road Reserve Width (m)
<i>Residential</i>			
Minor	4.5	6.0**	15.0
Local access	4.5	6.0**	15.0
Secondary Collector	5.0	8.0	18.0
Primary Collector	5.0	8.0	18.0
Primary Collector (bus route or high density housing)	5.0	11.0***	21.0
Distributor (single lane)	5.0	11.0	21.0
Distributor (dual lane)	5.0	17.0	27.0
<i>Industrial</i>			
Local Access	5.0	11.0	21.0
Collectors	5.0	13.0	23.0

*No allowance has been made for central medians which may be approved in Collector and Distributor roads.

**Must have a tapered access strip. Refer Appendix D for details.

***Width may be reduced to 7.0 m when combined with a wider verge width and indented parking. Refer to Appendix E for details.

Refer to Appendix E for typical cross section drawings. Note that there is no standard cross section provided for Distributor Roads as these roads can be single or dual lane, may include on road bicycle lanes and will often include a central median with width to be determined to suit WSUD, landscaping, drainage and other requirements. Proposed cross sections for Distributor Roads shall be agreed with Council prior to submission of a new Development for Planning Approval. The minimum dimensions applicable to Distributor Roads (excluding central medians) are as per the above table.

Adopted road widths shall take into consideration requirements for public transport (buses). The Developer shall provide a master plan (refer to section 8.1.6) showing the location of all proposed bus routes and bus stop locations which shall be developed in liaison with Public Transport and submitted to Council for review and consideration. Where desired road widths do not adequately cater for on street parking and bus stops, indentations shall be provided at bus stops to the satisfaction of Council. The master plan shall also indicate where sheltered bus stops are to be provided and/or where bus stops include other types of street furniture (e.g seats, bins etc).

Road widths shall also take into consideration the need for on road bicycle lanes as agreed with Council.

For rural subdivisions, carriageway widths shall be the same as those listed above. Verge widths will depend on necessary space required for open drains as discussed in section 4.8.7.

Cul-de-sac Turning Area - Residential

Cul-de-sac turning areas shall be circular in shape. Council will not accept t-shape or any other geometry for turning areas.

For circular turning areas at the head of cul-de-sacs, the acceptable kerb radius is 9.0 metres. The space reserved for special services shall not be reduced because of the increased width of road pavement at the head of a cul-de-sac.

Cul-de-sac Turning Area - Industrial

Cul-de-sacs are considered undesirable in an industrial subdivision and will generally not be approved by Council. Where a cul-de-sac can not reasonably be avoided, and at the discretion of the Director of Technical Services, approval may be given for its use. Lots should generally be of a smaller size so as not to encourage industry which would attract heavy transport.

As with residential areas, turning areas in industrial cul-de-sacs shall be circular.

For circular turning areas at the head of cul-de-sac, the minimum acceptable kerb radius is 13.5 metres which will preclude the turning around of road trains. The space reserved for services shall not be reduced because of the increased width of road pavement at the head of a cul-de-sac.

Cross fall and Configuration

Pavement cross fall shall generally be 3% from the centreline for crowned roads and from kerb to kerb on one way cross fall roads.

One way cross fall shall be avoided on all undivided roads and will not be approved on arterial, distributor and collector roads and for all undivided roads in industrial subdivisions. On divided carriageways with central medians (e.g. on distributor roads) one way cross fall can be adopted, particularly where it is being used to achieve WSUD.

On minor and local access roads, where one way cross fall is impossible to avoid, drainage connections shall be provided to each allotment on the high side and all internal lot drainage shall be directed to the collection point. The collection point shall be designed to take the 'initial storm' as specified in section 4, Stormwater Drainage. Where one way cross fall is proposed, reasons for the requirement shall be included in the design report (refer to section 8.2.1) and will only be approved at the discretion of the Director of Technical Services.

Verge cross fall shall be 2% minimum to 5% maximum fall towards the kerb.

3.4.4 Kerb and Gutter

The type of kerb and gutter to be provided is as indicated in clause 3.6.5.

Minimum Return Radii - Residential

Classification	Access	Collector	Distributor
Kerb radius at junction (m)	8	10	15

Minimum Return Radii - Industrial

Minimum kerb radii at junctions to be 20m and minimum gradient around quadrants at junctions to be 0.7%.

3.4.5 Vehicle Crossover and Access Strip

Vehicle cross overs and access strips shall be constructed to each lot. Refer Appendix D for details.

Vehicle Crossover and Access Strip Width

Allotment Type	Access Strip Width
Residential Lot - single dwelling	3.5 metres wide*
Multi Unit Residential Lot	6 metres wide**
Industrial/Commercial lots	6 metres wide

*Access strips on Minor and Local Access Roads require flanged access strips. Refer to Appendix D for details.

**Driveway width to be 6 metres wide for the first 6 metres inside the property boundary.

Where roadways contain upright kerb and gutter rather than the standard layback kerb, a driveway crossover shall be provided in accordance with the details shown in Appendix D.

Access strips in residential areas shall be a minimum 100 mm thick concrete pavement with SL 72 reinforcement mesh placed centrally. In industrial and commercial areas, access strips shall be a minimum of 150 mm thick with SL 82 reinforcement mesh placed centrally.

3.4.6 Traffic Islands

Traffic island surrounds shall be constructed of mountable type kerbing with landscaped or 100 mm thick concrete slab in filling. In areas where trucks are permitted to mount the kerb, such as roundabouts, concrete slabs and kerbs shall be 150mm minimum thickness with SL82 reinforcement mesh placed centrally.

When the traffic island is landscaped, subsoil drainage behind the kerb is required and provision for irrigation shall be included.

Traffic islands shall have a minimum width of 1200mm and shall be geometrically designed in accordance with Austroads guidelines for

Intersections at Grade and Roundabouts. Where traffic islands are required to provide refuge for pedestrians at crossing points, the minimum width of refuge shall be 2500 mm.

3.4.7 Special Treatments – Entry Statements

Where the developer proposes to construct an alternative surface treatment such as a form of subdivision entry statement or as a special feature throughout the subdivision, plans and specifications for the alternative treatment are to be submitted for Council approval.

Preferred options include exposed aggregate and/or coloured concrete pavements and coloured asphalt.

3.4.8 Access to Open Space Areas

Generally, public vehicular access shall be prevented. However, emergency vehicle access shall be provided as well as service access for plant and equipment for landscape and stormwater maintenance to open space areas. The location and number of accesses required shall depend upon size, shape and location of the open spaces. The following gives an indication of the requirement in each open space area:

- (a) A minimum of one service access shall be provided.
- (b) Access should be spaced at a maximum of 300m between access ways in elongated areas.
- (c) It is preferred that access is from a distributor or collector road rather than an access road.
- (d) Access points shall contain barriers that are removable and lockable.

3.5 Design Standards for Pathways

3.5.1 General

All pathways and associated facilities shall be designed to comply with all relevant disabled access requirements and standards.

Footpaths in all new roads shall be constructed prior to the establishment of structures on any new allotment. Footpaths may be constructed by either Council or the Developer but shall be at the Developers expense.

3.5.2 Footpaths

Footpath Widths and Construction

Footpaths shall be a minimum 1.5 metres wide in all roads and open space areas.

Footpaths shall widen to 2.5 metres minimum width in the vicinity of meeting points, schools, shops and other activity centres - the length

of 2.5 m wide sections are to be agreed with Council in the concept development/preliminary design phase.

Footpaths in residential areas shall be a minimum 100 mm thick concrete pavement with SL 72 reinforcement mesh placed centrally. In industrial and commercial areas, footpaths shall be a minimum of 150 mm thick with SL 82 reinforcement mesh placed centrally.

Footpaths Location

Footpaths shall be located where possible to satisfy a majority of the following criteria:

- (a) Be the shortest route
- (b) Require the least road crossings
- (c) On the bus stop side of bus routes
- (d) Achieve appropriate grades (cross fall and longitudinal)
- (e) Be appropriately lit
- (f) Achieve linkage to open space and other facilities.

It is noted that where a footpath is only required on one side of a road, it is likely to be located on the side with the most allotments fronting the road, which is also likely to be the side with the services and street lighting.

Footpaths shall be located to be compatible with service corridors in the road verge. Cross section details are to be approved by all service authorities.

The offset of the footpath from the property boundary will be typically 500mm.

In addition to the above, footpaths shall be placed adjacent to unit and/or flat developments, adjacent schools, shops, major areas of open space (as determined by Council) and playing fields.

Generally, the following minimum requirements shall apply for footpaths in different road classifications:

Road Classification	Footpath Requirement
Minor Roads	Required on one side of the road
Local Access	Required on a minimum of one side of the road
Collector Roads	Footpaths required on both sides of the road
Distributor Roads	Footpaths required on one side of road with a shared pedestrian/cycle path on the other

A Master Plan showing all footpaths shall be submitted to Council for approval prior to the commencement of any stage of a Development (refer to section 8.1.6). The Master Plan shall show all paths and links throughout the entire development, not just an individual stage.

3.5.3 Pedestrian Linkages

Landscaped open space shall be provided wherever pedestrian linkages are required and shall have a minimum width of 15 metres. Narrow laneways will not be approved by Council at any location within a development.

Pedestrian linkages shall have removable and lockable vehicle barriers at both ends.

Pedestrian linkage reserves shall, where possible, serve as cut off drains and flood surcharge routes. The design stormwater flow along linkages must be restricted to a width that leaves a minimum 1.0 m of pavement and 1.0 m width adjacent each boundary free from inundation by collected storm water flow in the initial storm. The runoff must be collected by the underground drainage system before it reaches the road reserve.

WSUD principles shall be adopted within pedestrian linkages in accordance with the Darwin WSUD Strategy. The current version of the Strategy shall be consulted whether it be in draft, interim or final form.

3.5.4 Disabled Access Ramps

Disabled access ramps are to be provided at all kerbs where footpaths and shared pedestrian/cycle paths cross roadways. These shall be constructed in accordance with AS 1428.

Typically crossing points will be at intersections or where designated paths change from one side of a road to the other. Developers shall provide other appropriate crossing points in consultation with and at the direction of Council.

3.5.5 Cycle paths

Cycle paths shall be provided in accordance with AUSTRROADS Part 14 - Bicycles and the Australian Standard AS 1742.9, Manual of Uniform traffic control Devices - Part 9 - Bicycle Facilities.

Shared use paths are shared between pedestrians and cyclists, and are the most common type of facility due to the cost to construct separated path facilities, as well as limitations of space.

However, shared use paths are not desirable within public road reserves where there is direct vehicular access to multiple abutting allotments. This is due to safety concerns of vehicles reversing out and having to cross the shared use path before gaining access to the roadway. These paths should therefore be used along roads where there is no or limited vehicle crossovers or on the public reserve side of a roadway adjacent to parkland.

Shared use paths should have a minimum width of 3.0 metres. Construction of shared use paths shall be concrete as detailed for footpaths.

Where provided, shared use paths within the road reserve shall be placed on the side of the road that best suits the suburbs overall cycle and pedestrian network. Shared use paths shall be provided adjacent major public facilities (i.e. on the same side of the road) such as shopping centres, schools and recreational facilities.

Cycle paths (either shared or separate in high demand situations) are required in parklands and reserves to provide links within the development to the cycle and pedestrian network.

3.6 Requirements for Road Pavements

3.6.1 General

Design and construction of road pavements shall generally comply with the Department of Planning and Infrastructure (DPI) standard "Technical Specification for Roadworks".

Road pavements shall not be designed without a detailed Geotechnical Investigation outlining the nature of the subsoil conditions including, but not limited to, sub grade CBR, logging of soil profile, classification of soil types and groundwater conditions (refer to section 8.1.14).

3.6.2 Roads and Earthworks

Road reserves shall be excavated or formed to conform to the relevant standard cross section or other approved cross section. Where the nature of the terrain is such that the standard cross section cannot be used without excessive earthworks, cut and fill areas may be extended into the adjacent lots. In these cases, batter slopes shall not exceed 1:6.

All road service crossings shall be backfilled using a pre mixed concrete slurry (7 MPa) for the full width of the trench to sub grade level.

3.6.3 Pavement

Road pavement design shall be undertaken in accordance with the relevant standards and guidelines in the AUSTRROADS 'Pavement Technology' series of publications. In particular, the latest editions of the following publications shall be used:

AP-G17/04 - Pavement Design - A Guide to the Structural Design of Road Pavements.

AP-T36/06 - Pavement Design for Light Traffic - A Supplement to Austroads Pavement Design Guide.

The minimum design life for pavement design shall be 30 years.

The design consultant shall undertake an analysis of design traffic taking full consideration of in service commercial traffic as well as

construction traffic. Assessment of construction traffic shall include consideration of subdivision staging and associated access for construction vehicles through completed stages. Construction vehicles will include traffic associated with construction of infrastructure for new stages of development as well as construction traffic associated with building development on new allotments.

The engineering consultant is responsible for determining design traffic loadings and appropriate pavement structure but the minimum requirements for design loading and wearing course are tabulated below for various road classifications.

Road Classification	Minimum depth of asphalt seal*	Residential design loading (E.S.A)	Industrial design loading (E.S.A)
Distributor	40 mm	1.0×10^6	5.0×10^6
Collector	40 mm	5.0×10^5	2.0×10^6
Local Access	30 mm	5.0×10^4	8.0×10^5
Minor	30 mm	8.0×10^3	6.0×10^4

*Two coat spray seal surfaces in lieu of asphalt may be used in rural subdivisions.

The design loadings provided in the above table are a minimum requirement for design. The Design Consultant shall calculate the actual design traffic based on the proposed road classification as defined in section 3.1 and, in particular, shall make suitable allowance for bus traffic where applicable, garbage truck traffic on all roads and construction traffic as discussed above.

The design consultant should confirm the likely garbage truck traffic with Council prior to design of any pavements. As a guide, the following traffic movements would be anticipated:

- Twice weekly pick up for domestic rubbish bins.
- Once a fortnight pick up for domestic recycling bins
- Four times a week pick up for domestic rubbish bins in high density residential areas.
- Once a week pick up of domestic recycling bins in high density residential areas.

The regularity of pick ups may be higher in commercial areas.

The road classifications defined in section 3.1 are further defined in terms of the anticipated Average Annual Daily Traffic (AADT) as follows.

Road Classification	AADT Limits
Distributor	>3000
Collector	1000-3000
Local Access	150-1000
Minor	<150

The Design Consultant shall submit their pavement design including proposed Design ESA's to Council for review and approval. Pavement thicknesses should take into account construction tolerances and be increased accordingly to ensure as constructed thicknesses are no less than the minimum design requirement.

Alternative surface treatments may be considered.

The preferred road pavement material is a manufactured crushed rock in accordance with DPI standard specification. Natural gravel or a blended material consisting of quarry products and naturally occurring gravels which conforms to grading and material properties as described in the DPI standard roadworks specification for "Pavements and shoulders" may be approved at the discretion of Council. All pavement materials must be tested insitu after compaction to comply with all DPI materials requirements for grading, Plasticity Index (PI), Linear Shrinkage (LS), soaked CBR, compaction etc. As constructed thicknesses shall also be measured during pavement testing.

Sub grade materials and compaction shall comply with DPI standards. Subsoil drainage is essential within all new road reserves to protect pavements from the effects of groundwater seepage. Refer to section 4.7 of these Guidelines for requirements of the subsoil drainage system.

Laboratory tested soaked CBR values shall be used for pavement design. However, where the CBR value of tested sub grade materials is greater than 10, a maximum CBR value of 10 shall be used for all new pavement design calculations.

3.6.4 Compaction

The following compaction factors shall be achieved:

Pavement Layer	Required Compaction M.M.D.D
<i>Carriageways</i>	
- Base course	100 %
- Sub base	98 %
- Sub grade (top 150 mm)	95 %
- Earthworks	90 %
<i>Access Strips</i>	
- Sub grade	95 %
<i>Footpaths</i>	
- Sub grade	90 %
<i>Walkways and Bicycleways</i>	
- Pavement	95 %
- Sub grade	90 %

At least one compaction test shall be carried out per 200 m³ or one test per layer per 1000 m² whichever ever requires the more tests.

3.6.5 Kerb and Gutter

Layback kerb shall be used on all minor, local access and secondary collector roads.

Standard barrier kerb and gutter shall be used on primary collectors and distributor roads as well as adjacent to all reserves and general open space.

Kerbs shall generally not be constructed on roads in rural subdivisions except at all intersections where kerbs shall be required to at least the tangent points on all intersection radii.

All kerbs shall be constructed on sub base compacted to 98% M.M.D.D.

12mm expansion joints are required to be installed in the kerb and gutter at the turning point of kerb returns. The joints are to be filled with an appropriate flexible-jointing compound.

3.6.6 Conduits

Conduits shall be provided for the conveyance of telephone, cable television, irrigation lines and electrical cables under roadways, footpaths, access strips and elsewhere as required, with consultation with the appropriate authority or as directed by the Director of Technical services. In particular, conduits for irrigation purposes shall be provided to all landscaped traffic islands and roundabouts.

Where conduits cross roads, trench backfill shall be in accordance with section 3.6.2.

3.6.7 Building Lots

All lots shall have a minimum grade of 0.5%, be self-draining and shall be graded so as to drain to the adjacent road reserve which services the lot.

Drainage shall not be directed from one lot to another unless the natural terrain is too steep to make lot regrading practicable. In such situations, rear or side of lot drainage shall be provided in accordance with section 4.8.6 and easements granted to Council (at no cost to Council) shall be provided over all necessary drainage infrastructure included within lots. Lots required to be regraded to achieve these requirements shall be indicated on the plans.

Ponding of water on allotments is not acceptable.

Generally clearing of lots shall be avoided where not required for lot regrading purposes. Sediment and erosion control measures shall be put in place on all lots until they are fully developed and landscaped. Refer to section 6 of these Guidelines.

3.7 Road Signs and Markings

3.7.1 Australian Standards

Unless otherwise required by council, all warning signs, regulatory signs, direction signs and road marking shall be provided in accordance with the current Australian Road Rules as well as AS 1742.1 and 1742.2 Manual of Uniform Traffic Control devices.

3.7.2 Signs and Linemarking Required

Use highly reflective "diamond Grade" VIP for all signs.

As a minimum the following signage and marking shall be provided:

- (a) street name signs at each intersection (the colours shall be white background with black lettering and in accordance with Councils standards which are shown in Appendix F),
- (b) warning signs at the approach to all hazards,
- (c) "keep left" signs at the approach end of the first island at all channelled intersections and at all median openings,
- (d) separation lines on distributors and collectors,
- (e) double unbroken lines on road centreline at locations on two-way roads where the sight distance available is less than the desirable minimum,
- (f) at a temporary termination of road construction, such as a subdivision or stage boundary, a diagonal striped sight board shall be erected,
- (g) holding lines at T intersections and
- (h) other traffic control devices necessary for effective traffic control and any traffic control devices required by council.

A Traffic Management Plan is required indicating the location and type of street name signs and all regulatory signs including speed signs where the default speed limit does not apply. The plan shall also show all required linemarking and pavement markers and shall be supplied to Council for approval.