



ENGINEERING DEVELOPMENT GUIDELINES / STANDARDS

SHIRE OF PLANTAGENET

FOREWORD

This document details the Council's requirements for engineering works associated with the subdivision and development of land within the Council.

It is presented in the form of a guideline to Developers/Subdividers rather than a specification, and is performance or results-based, in which the end result is given rather than the means of achieving a desired outcome.

These guidelines were prepared by the Works and Services department, and comments on any matter contained herein are welcome.

.....
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CHIEF EXECUTIVE OFFICER

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SECTION 1 – GENERAL CRITERIA

1. GENERAL

1.1 Development Requirements

- 1.1.1 Local Government (Miscellaneous Provisions) Act 1960, (the Act) Section 295(1) states the following:

‘Where a person who is the owner of land in a district proposes to subdivide the land into lots for disposal, if the proposal is to include in the subdivision a street or streets for use by the public, he shall not commence to put the proposal into effect until he has notified the local government of the proposal in writing and delivered to the local government with the notification a plan of the subdivision, and received the approval prescribed by the *Planning and Development Act 2005* to do so’.

And Section 295(4)(a):

‘Where proposals for the subdivision of land in a district include the provision of streets for use by the public, and the proposals have been approved,the owner of the land shall notdispose of the land, or part of it, or an estate or interest in it,until he has caused those streets to be constructed and drained to the satisfaction of the local government.’

- 1.1.2 Any civil works required to be constructed under the above section of the Act, shall be constructed to Council requirements as detailed in these guidelines, which comprises a guide to the standard of work and design required before the works will be certified by the Council to the Department of Planning as having been constructed to the satisfaction of the Council.
- 1.1.3 The term ‘Engineer’ shall mean an Engineer or firm of Consulting Engineers (or their representatives) appointed by the Council from time to time to act on its behalf.

The term ‘Subdivider’ shall mean the owner of the land being subdivided or their authorised representative.

The term ‘Consulting Engineer’ or ‘Consultant’ shall mean the Engineer appointed by the Subdivider to design, document and superintend construction of the works. They may be required to furnish proof that they are qualified Civil Engineer experienced in engineering work associated with the subdivision of land and must be eligible for membership to the Institution Of Engineers (Aust).

- 1.1.4 Technical provisions included in these Guidelines are intended to provide a guide to the standard of work, materials and design required

before roads and drains will be certified to the Western Australian Planning Commission (WAPC) as having been made to the satisfaction of the Council. They are not necessarily complete and are not intended to be used as a specification or contract for construction. They may be subject to alteration with the approval of the Council's Works and Services department.

1.1.5 Section 295 (6) of the Act states:

- '(a) Where a person who is subdividing land is by the provisions of this Part required to construct and drain streets shown in the plan of subdivision he may:
- (i) carry out or cause to be carried out the construction and drainage at their own cost and expense; or
 - (ii) arrange for the Council to carry out the work on their behalf and at their cost and expense.
- (b) Where the person does not make the arrangements with the Council, he shall pay to it, on demand, an amount to cover the reasonable costs of the Council in supervising the construction and drainage which amount shall be reckoned as follows:
- (i) where the person has not engaged a Consulting Engineer to design and supervise the construction and drainage the amount shall be three percent of the cost of the construction and drainage as estimated by the Council; and
 - (ii) where the person has employed a Consulting Engineer to design and supervise the construction and drainage, the amount shall be one and one-half percent of the cost of the construction and drainage as estimated by the Council.
- (c) The Council may require the person to employ a Consulting Engineer to design and supervise the construction and drainage and that person shall, when required to do so by the Council, carry out the requirement.'

The design, preparation of drawings and specifications, and supervision of construction of subdivision works covered by these requirements shall be undertaken by the Consulting Engineer or his authorised representative. The Consulting Engineer shall carry out a site investigation to determine the geotechnical properties of the soils. Such information shall form the basis of the design of the roads, drainage system and site filling. A copy of this site investigation shall be lodged with the Council prior to or at the same time as drawings are lodged for approval.

- 1.1.6 Where a proposed subdivision abuts an existing road reserve containing a substandard road contained within the road reserve fronting the subdivision, or leading to the subdivision, this road shall be upgraded prior to the clearance of the subdivision to the required standard for that particular road as determined by the Council's Works and Services department.
- 1.1.7 Every attempt shall be made to partially or wholly upgrade substandard roads fronting new subdivisions, but where it is impractical to physically construct the road or part thereof in accordance with this policy, the Subdivider shall lodge a non-refundable cash contribution with the Council prior to the clearance of the subdivision equal to the estimated cost of the proposed roadworks.

The Subdivider shall be responsible for all damage to existing facilities, services and structures in both public and private ownership. Any damage shall be repaired to an acceptable standard without delay.

Where the conditions of approval of the subdivision require works to be carried out in an existing road reserve or on other land under Council's control, a permit to construct works in a street shall be obtained from the Council and a bond in the form of cash or guarantee from a financial institution acceptable to the Council to cover the reinstatement works of value equal to the estimated cost of the works plus 25% with a minimum of \$1,000.00, shall be lodged with the Council prior to the approval of the drawings and the work commencing, the unused portion of the bond to be returned upon the satisfactory completion of the works. The approval of engineering drawings and specifications shall not constitute permission to carry out works in streets within the Council.

After clearance of survey diagrams by the WAPC and the Office of Titles, any land delineated and shown as a new road on such diagrams shall come under the control of the Council.

- 1.1.8 The supervision fee referred to in Clause 1.1.5 above shall be paid to the Council before construction commences.

The amount of the payment shall be based on the estimated cost of all of the works at the time of the commencement of the works. Upon certification of practical completion of the works, the Consultant shall provide the actual construction cost of the works and the amount of the supervision fee shall be adjusted accordingly, if necessary.

- 1.1.9 Drawings and specifications for the construction of roads and drains shall be prepared in accordance with Section 3 of these requirements and must be approved by the Council's Works and Services department before any work will be allowed to commence.

1.1.10 Endorsement of engineering design and drawings by the Council does not imply fulfilment of planning requirements in any manner and the Council of Plantagenet excludes liability for any negligent act or omission in relation to the approval process carried out by the Council involving the works the subject of the engineering design and drawings.

1.2 Control and Supervision of Construction

1.2.1 The construction work shall be carried out in accordance with the approved drawings and specifications, and will be subject to staged inspection and approval by the Council's Works and Services department or his representative during the course of construction. Final approval shall only be given when the whole of the works shown on the approved plans have been executed to the true intent and meaning of the approved drawings and specifications as certified by a qualified Civil Engineer.

1.2.2 An inspection is required for each of the following main stages of construction for roads:

- (a) when the road has been boxed out and the sub grade shaped and compacted;
- (b) after the sub-base has been placed, graded and compacted to shape and level;
- (c) when the base has been placed, graded, compacted and water bound to correct shape and level;
- (d) before the priming operation;
- (e) during the kerbing works; and
- (f) before the placement of asphalt or sprayed surface course.

1.2.3 An inspection is required for each of the following main stages of construction for drainage works:

- (a) when the trenches have been excavated and the pipes laid to true line and level;
- (b) when using sub-soil pipes, after the calibrated metal has been placed; and
- (c) after manholes, gullies and other structures have been built and backfilling of all trenches completed.

1.2.4 A minimum of 48 hours notice is required so that an inspection can be made prior to the next or following stage of construction being commenced.

- 1.2.5 Certification - Upon request, a certificate endorsed by the Consulting Engineer shall be submitted certifying the correctness of work in accordance with approved drawings and specifications for any of the main stages of construction. Documentary evidence to verify quantities and/or quality of work shall be provided when requested.
- 1.2.6 Supervision - When works are in progress, the Consulting Engineer shall ensure that the Contractor has at all times a competent Supervisor stationed and present on the site of the works. The Contractor shall supply that persons name and contact details. A representative of the Consulting Engineer shall be available for the purpose of joint interim inspection where deemed necessary by the Council's Works and Services department.
- 1.2.7 Testing - The Consulting Engineer shall make available to the Council's Works and Services department, all test results related to the subdivisional works. The original copy to be supplied to the Council for verification then returned to the Contractor. Testing shall be carried out by a National Association of Testing Authorities approved testing laboratory. Where testing of a first or preceding stage of construction is requested, then no second or following stage of work shall proceed until approval to proceed is granted by the Engineer.
- 1.2.8 In addition to the normal inspection and testing requirements as detailed elsewhere in these guidelines, the Engineer reserves the right to inspect and require samples of materials being used to be taken and tested to ascertain quantity and/or quality of materials being placed in the construction work. The Consulting Engineer will be informed of any matters requiring remedial action. In the event that such testing reveals the work to be defective, the Subdivider shall reimburse the Council for the cost of the testing.
- 1.2.9 The Manager Works and Services will direct all notices, requests, instructions and approvals to the Consulting Engineer, except in urgent circumstances when they may be given directly to other parties involved in the subdivision.
- 1.2.10 The Council is conscious of the need to preserve natural vegetation wherever possible in rural subdivisions. To this end the Council may impose special conditions on particular subdivisions to minimise the environmental impact of road and drainage construction, particularly in relation to preservation of established trees within road reserves and minimising soil erosion. Subdividers should be conscious of these aims and should take them into consideration in the various stages of planning for a subdivision.

- 1.2.11 Notification of Works – The Council’s Works and Services department shall be advised two days before commencing work, and after cessation of work, one day before recommencing any work.
- 1.2.12 Hours of work - No work outside the hours of 7.00am to 5.00pm Monday to Friday shall be carried out without the written approval of the Manager Works and Services.
- 1.2.13 Indemnity Insurance - The Subdivider shall be responsible for arranging, taking out and keeping in operation all necessary insurance policies to totally indemnify and protect the Council against any and all claims of damages or other claims that may arise during the carrying out of the construction work.

1.3 Practical Completion of Subdivisional Works

- 1.3.1 Upon the satisfactory completion of all subdivisional work including survey, lot pegging and soil stabilisation, the Consulting Engineer shall notify the Council in writing that the works have been inspected and are in accordance with the approved drawings and/or specifications.
- 1.3.2 Upon receipt of this notification, the Engineer shall arrange a Practical Completion inspection of the completed works. Any such inspection shall require the presence of the Manager Works and Services and the Consulting Engineer.
- 1.3.3 At the time of the Practical Completion inspection or as soon as possible thereafter, the Manager Works and Services shall inform the Consulting Engineer of any item/s not in accordance with the drawings and specifications. Any such item/s so indicated shall be rectified without delay and a further inspection of these works shall be carried out upon completion of these remedial works.
- 1.3.4 If at any time after the granting of Practical Completion, the subdivisional work is found to be contrary to the approved drawings, then the Subdivider shall rectify the works at no expense to the Council.

1.4 Survey Release

- 1.4.1 The Consulting Engineer shall satisfy the Council that the Subdivider has complied with all relevant conditions imposed by the WAPC’s Conditions of Approval of Subdivision pertaining to survey release of all or part of the subdivision.
- 1.4.2 The following items refer to the conditions which must be completed by the Subdivider prior to the clearance of relevant conditions for the subdivision:

- (a) Deposited Plan showing full details of all lots, road reserves, easements (temporary and permanent) and reserves;
- (b) Payment of moneys for construction of paths as required by Section 2.4;
- (c) Payment of appropriate supervision fee as required by Clause 1.1.5;
- (d) Receipt of the Consulting Engineer's Certificate as required by Clause 1.3.1;
- (e) Completion of all works associated with the subdivisional construction or the payment of appropriate bond to cover outstanding works as required by Section 1.5;
- (f) Payment of Maintenance Retention Bond as required by Section 1.6; and
- (g) Provision of 'As Constructed' drawings as required by Section 3.5.5.

1.5 Bonding Outstanding Works

- 1.5.1 The Council may accept payment from the Subdivider by way of a bond in the form of cash or unconditional guarantee from a financial institution acceptable to the Council in lieu of completion of part of the subdivisional works. Cash bonds will be placed in an interest bearing trust account.
- 1.5.2 Applications for bonding shall be in writing from the Consulting Engineer to the Council and shall include the following information:
- (a) Concise reference to the extent, nature and location of the work to be bonded;
 - (b) A timetable for proposed future completion of the bonded work;
 - (c) An itemised estimate of the bonded work including contract price and name and address of the Contractors responsible for the bonded works;
 - (d) Reasons for requesting the bonding of the incomplete works; and
 - (e) Any other relevant information, which will assist the Engineer to assess the request.

Compliance with the above requirements does not necessarily imply the Council's acceptance of the bond and each request shall be subject to the Council's Works and Services department approval.

- 1.5.3 In cases where bonding is approved, the Subdivider shall enter into a written bond agreement with the Council which clearly states the following information:
- (a) Name and address of the person or persons responsible for the payment or payments;

- (b) The amount of the payment or payments;
- (c) Name, staging number and location of the associated subdivision;
- (d) The WAPC reference number of the associated subdivision; and
- (e) A concise explanation of the purpose and conditions of payment referring to all items for which the bond payment is to be utilised.

1.5.4 The earliest stage that bonding will be considered is upon completion of all filling, drainage and roads to sub-base stage. In this event, the value of the bond shall be 50% of the total contract value for the roads, drainage and filling works.

1.5.5 Bonding will be considered at any stage later than that specified in the preceding clause in which case the value of the bond shall be twice the estimated cost of the uncompleted works or \$2,000.00 whichever is the greater.

1.5.6 Upon completion of the works described in the Bond Agreement, the Subdivider shall request in writing the release of the bond, following which the works will be inspected and, subject to all outstanding works being completed, the bond moneys will be refunded.

1.6 Maintenance

1.6.1 Maintenance Liability

1.6.1.1 It shall be the responsibility of the Subdivider to maintain all roads and associated works for a period of 12 months from the date of Practical Completion hereinafter referred to as the Maintenance Period. Where defects requiring urgent attention become evident during the Maintenance Period, the Manager Works and Services may request these works to be rectified immediately. Failure to complete the rectification works within the time specified will cause the Council to carry out the works using moneys from the Maintenance Bond.

1.6.1.2 At the expiry of the Maintenance Period the Consulting Engineer shall inform the Council's Works and Services department of their intention to inspect the subdivision, and at a time mutually agreeable to all parties, such an inspection shall be made.

1.6.1.3 The Consulting Engineer shall apply in writing to the Council for Maintenance Release, which will be subject to the satisfactory repair of defective works, cleaning of the drainage system and the sweeping of the roads, and the Council's Works and Services department acceptance of such works.

1.6.1.4 Where a Subdivider chooses to delay seeking subdivisional clearance after the date of Practical Completion, the Council may redefine the date of commencement of the Maintenance Period as being the date of subdivisional clearance.

1.6.2 Maintenance Bond

A bond to the value of 7.5% of the total cost of the work shall be paid to the Council to cover any defects which may arise in the first 12 months after clearance of the relevant WAPC condition(s) relating to roads and/or drainage, landscaping or any other details included within the Council or Manager Works and Services approved plans or specifications. The bond may take the form of a payment to the Council or alternatively a binding Bank Guarantee. Unused portions of the bond are refundable with any incurred interest.



SECTION 2 – DESIGN PRINCIPLES

2. DESIGN CRITERIA

2.1 General

Criteria provided here are minimum criteria only and are necessarily broad based to cover general subdivision situations. In particular situations amendments may be required and the Council may impose special conditions not covered by the criteria.

2.2 Roads

2.2.1 General

Roads should generally be designed in accordance with relevant Austroads (NAASRA) and ARRB guidelines and publications, which include:

- (a) Guide to Traffic Engineering Practice
- (b) Guide for the Design of Typical Urban Intersections;
- (c) Guide Policy for Geometric Design of Major Urban Roads;
- (d) Policy for Geometric Design of Rural Roads;
- (e) Policy for Installation by Public Utility Authorities within the Road Reserve;
- (f) A Structural Design Guide for Flexible Residential Street Pavements;
- (g) Pavement Design – A guide to the Structural Design of Road Pavements;
- (h) Australian Model Code for Residential Development;
- (i) Bicycle Facilities Design Guidelines; and
- (j) Where there is any conflict between the requirements of these guidelines and the above publications, the details specified in these guidelines

Generally all road pavement widths shall conform to the Shire of Plantagenet's road hierarchy. For residential subdivisions, this has been based upon the Liveable Neighbourhoods Community Design Code which is the operational policy for the WAPC. This road hierarchy enables the safe and orderly movement of vehicles, cyclists and pedestrians within and throughout the municipality. Consideration however must be given to the final aesthetic and functional aspects of

the area, particularly in rural areas. Aspects to be considered include minimising the environmental impact (particularly regarding existing trees and vegetation), fitting road grades as close to existing contours as practicable and provision of lot access.

2.2.2 Pavement Design

Pavements shall generally be designed for a 40 year design life in accordance with the publication ‘Pavement Design’ NAASRA 1987 (or its latest issue).

In all cases pavement design shall be based on the in situ sub grade California Bearing Ratio (CBR), which shall be determined for each different sub grade type expected to be encountered in the works. Determination of sub grade CBR shall be by one of the methods nominated in the publication ‘Pavement Design’, i.e. by laboratory testing, or by field testing backed up by limited laboratory tests. The Consultant shall adopt whatever test procedures are necessary to provide an accurate assessment of sub grade CBR for design purposes. The Council’s Works and Services department may request further field or laboratory testing at their discretion.

In any case the absolute minimum pavement profile shall be as follows:

	Alternative 1	Alternative 2
Access Roads & Collector Roads	<ul style="list-style-type: none"> • 125 ‘B’ grade sub-basecourse • 100 ‘A’ grade basecourse • 25mm asphalt on urban roads • Two coat sprayed seal on rural roads 	<ul style="list-style-type: none"> • 200 ‘A’ grade basecourse • 25mm asphalt on Urban roads • Two coat sprayed seal on rural roads
Other Roads (except industrial)	<ul style="list-style-type: none"> • 150 ‘B’ grade sub-basecourse • 100 ‘A’ grade basecourse • 25mm asphalt on urban roads • Two coat sprayed seal on rural roads. 	<ul style="list-style-type: none"> • 225 ‘A’ grade basecourse • 25mm asphalt on urban roads • Two coat sprayed seal on rural roads
Industrial roads	<ul style="list-style-type: none"> • 175 ‘B’ grade sub-basecourse • 100 ‘A’ grade basecourse • 25mm asphalt 	<ul style="list-style-type: none"> • 250 ‘A’ grade basecourse • 25mm asphalt

Alternative pavement profiles giving equivalent load bearing capacities will be considered. The Council may, at its discretion, allow sprayed seal surfacing in lieu of asphalt surfacing on urban roads.

2.2.3 Materials

2.2.3.1 'A' Grade Basecourse

'A' grade basecourse shall consist of graded crushed rock or laterite gravel. When tested in accordance with AS 1289 the material shall have the following properties:

As Sieve Aperture (mm)	Percentage Passing
26.5	100
19.0	95-100
9.5	70-88
4.75	48-71
2.36	34-57
1.18	24-46
0.425	14-33
0.075	6-20

Liquid Limit:	not to exceed 25%
Plasticity Index:	not to exceed 6%
Linear Shrinkage:	not to exceed 2%
Los Angeles Abrasion Value:	not to exceed 40%
Maximum Dry Comp. Strength:	not less than 1700 kPa

The material shall be free from organic matter and other deleterious substances.

2.2.3.2 'B' Grade Sub-Basecourse

'B' grade sub-basecourse shall consist of limestone or laterite type gravel.

Limestone and laterite type gravel shall be in accordance with Council's Specification for such materials, which in summary includes:

Limestone shall conform to the following requirements:

- (a) all materials shall contain a maximum of 70% calcium carbonate;
- (b) all material shall pass through a 100mm square sieve;
- (c) not more than 80% of the material shall pass through a 2.36 AS sieve;

- (d) not more than 15% of the material shall pass through a 75 micron AS Sieve; and
- (e) all material shall be free from capstone, roots and other deleterious substances.

Gravel shall be selected natural laterite gravel which exhibits an even grading curve throughout the full range. When tested to AS 1289 the material shall have the following properties:

- | | |
|--|---------------|
| (a) Percentage passing 40mm sieve: | 100% |
| (b) Percentage passing 1.18mm sieve: | 10% to 50% |
| (c) Percentage passing 0.075mm sieve: | less than 20% |
| (d) Plasticity Index: | 3% to 10% |
| (e) Linear Shrinkage: | less than 8% |
| (f) Minimum CBR at the placed
in situ moisture density condition: | 35 |

The material shall be free from organic matter and other deleterious substances.

It is preferable for crushed gravel (Ferricrete or similar) to be used for the base course.

2.2.3.3 Asphalt

Asphalt shall be a nominal 10mm size asphaltic concrete mix in accordance with an AC10 mix designation to AS 2734.

2.2.3.4 Sprayed seals

Sprayed seals shall consist of a minimum two coat seal. The first or primer seal shall be a hot sprayed bitumen primer seal, unless, with the approval of the Engineer, a bitumen emulsion primer seal may be used.

In rural residential areas, the cover aggregates shall be 10mm, followed by the second coat of 10mm diorite metal.

In areas zoned other than rural residential where a spray seal is applicable, the cover aggregate shall be 5mm and 14mm diorite metal respectively.

2.2.4 Basecourse Widths

On kerbed roads the width of basecourse shall equal the width of seal plus 900mm. On unkerbed roads the width of basecourse shall equal the width of seal plus 1.3 metre shoulders.

2.2.5 Shoulders

Shoulders shall be constructed with the same materials and to the same depth as the adjacent basecourse.

2.2.6 Road Reserve Width

Non – Residential:

Local roads shall have a minimum road reserve width of 20m, however, Council reserves the right to make a wider road reserve should the site or engineering requirements dictate.

Residential:

The width of all road reserves shall comply with Liveable Neighbourhoods Community Design Code.

The designation of which road types shall apply to a particular subdivision (i.e. town centre residential, rural, rural living or mixed business) shall be in accordance with the Shire of Plantagenet's Zoning Scheme.

The Subdivider shall comply with the requirements for those designations.

2.2.7 Town Centre and Residential Streets

Road design guidelines are generally in accordance with Liveable Neighbourhoods Community Design Code.

Local Distributors 7.2m wide, concrete kerbed with 25mm asphalt surface on a primer seal. There shall be a shared path on at least one side of the street and may be required on both sides of a street where the likelihood of pedestrian traffic is high.

Access Road: 5.5m to 6m wide, depending on anticipated traffic volumes and functionality. The pavement shall be concrete kerbed with 25mm asphalt surface on a primer seal.

The maximum longitudinal grade of a road shall be 10% (1 in 10) unless otherwise approved.

The minimum longitudinal grade shall be 0.50% or 1 in 200 however, because of water shedding problems, this grade should only be used in extreme circumstances.

All changes of grade of more than 1% shall be joined by a vertical curve. The length of all vertical curves shall be in accordance with the relevant Austroads publications, and shall take into account overtaking and stopping sight distances and comfort factors.

The cross fall on the cross section of the road pavement shall be generally 3% each way from the crown but through horizontal curves, one way cross fall or superelevation shall be applied in accordance with the appropriate Austroads guidelines. In minor residential streets and cul-de-sacs the road pavement may have a one-way cross fall where the natural surface across the road reserve lends itself to this type of construction. This condition does not apply on horizontal curves where the normal requirement of superelevation to match design speeds and radii shall apply.

Verges shall have sufficient width for the provision of public utility services, and shall be a minimum of 3.5m. Verges shall normally be graded at +2% from the top of the kerb to the property boundary. In areas of steep cross fall or where earthworks should desirably be reduced to minimise environmental impact, the verge grading may be increased as agreed with the Manager Works and Services.

Culs-de-sac shall have a minimum head radius of 9m with 15m radius tapers.

Kerb type shall be semi mountable to residential frontages and semi-barrier elsewhere.

In the Shire of Plantagenet the standard kerb shall be flush mounted type.

The Consulting Engineer shall prepare detailed designs of the pavement thicknesses in accordance with Australian Road Research Board (A.R.R.B.) and/or Austroads Design Guidelines as follows:

- (a) 'Pavement Design – A Guide to the Structural Design of Road Pavements', Austroads, 1987; and
- (b) 'A Structural Design Guide for Flexible Residential Street Pavements', P.J. Mulholland, ARRB Special Report No 41;

Notwithstanding the design thicknesses obtained, the sub-base course shall be a minimum compacted thickness of 150mm, the base course shall be a minimum compacted thickness of 75mm and the asphalt compacted thickness shall be a minimum of 25mm.

The designer shall provide pavement drainage where necessary to maintain a moisture-free sub grade and base course as determined by the site conditions.

The road base shall extend 500mm beyond the face of kerb.

2.2.8 Rural Living Streets

The minimum standard for rural living streets within a subdivision shall be as follows:

Straight Pavements: 7.4 metre wide, two coat seal (1x10mm stone plus 1x5mm stone) with 1.2 metre gravel shoulders.

Intersections:

- (a) All intersections shall be provided with concrete kerbing to at least 10m beyond the tangent point of the sweep. This kerbing shall repeat on the opposite side of the intersection on the straight section of road. At the terminating end, the kerbing shall be flared towards the verge; and
- (b) All intersections shall be provided with a 25mm asphalt surface on a primer seal, to the full extent of the concrete kerbing.

Geometric design shall be according to 'Rural Road Design', Austroads 1989. The maximum design speed for access roads shall be 60km/h, collector roads 70km/h and arterial roads 90km/h. These design speeds shall be verified by Main Roads Western Australia.

The maximum longitudinal grade of a road shall be 12.5% unless otherwise approved. The minimum longitudinal grade shall be 0.5% unless table drains are graded independently of the road to provide satisfactory drainage.

All changes of grade of more than 1% shall be joined by a vertical curve. The length of all vertical curves shall be in accordance with the relevant Austroads publications, and shall take into account overtaking and stopping sight distances and comfort factors.

One-way cross fall to a maximum of 3% may be approved for access roads when excessive cross fall exists in the natural surface. Roads shall normally have two-way cross-falls of 3% except where geometric design requirements dictate that superelevation is required.

Table drains shall be provided for all roads for a minimum width of 1.2m, flat bottomed, with side slopes of a minimum 1:3 grade (33%).

Cut batters shall generally be no steeper than 1 in 3 (33%) except in hilly terrain, where depth of cut is considerable, or where ground conditions are such that it is not practical to comply with this requirement without excessive cost or environmental disturbance. Subject to the approval of the Council's Works and Services department, cut batters may be increased to a maximum of 1 in 1 (100%). Fill batters shall generally be no steeper than 1 in 4 (25%) except in hilly terrain or where fill heights are considerable, in which case a maximum slope of 1 in 2 (50%) may be used subject to the approval of the Council's Works and Services department.

Verges shall have sufficient width to install public utility services. In particular, sufficient width must be provided to install overhead power lines with poles located at least 2.5m from the invert of the table drain.

Roads shall be designed to enable access to lots at an absolute maximum grade of 16%.

Cul-de-sac heads shall have a minimum head radius of 9m to edge of seal, with 15m radius tapers.

2.2.9 Rural Roads

Rural roads shall comply with the standards prescribed in the Roads 2020 Strategy, and will be dependent on estimated AADT counts.

The Council has identified minimum road standards, given known and/or estimated Annual Average Daily Traffic (AADT) counts.

Type 1	Formed road constructed from surrounding local material: 10-20 AADT – 6m seal with 1.3m shoulders.
Type 2	Formed road paved with imported gravel material: 20-75 AADT – 6m seal with 1.3m shoulders.
Type 3	Sealed road (6m seal width): 75-500 AADT.
Type 4	Sealed road (7m seal width): 500-1000 AADT.
Type 5	Sealed road (8-9m seal width): 1000-4000 AADT.
Type 6	Sealed roads with overtaking lanes: 2000+ AADT but lower volumes may be considered depending on the percentage of heavy vehicles and terrain conditions.
Type 7	Dual carriageway – divided rural road: 4500 +AADT.

For the purposes of determining the impact a subdivision will have on AADT counts for any particular road, the Council will utilise eight vehicle movements per lot per day.

All rural roads shall be sealed with a two coat seal (1x10mm stone, 1x5mm stone) with 1.3 metre gravel shoulders, except at intersections which shall be kerbed with 25mm asphalt over a primer seal. The extent of the kerbing shall be as stipulated for 'Rural Living Streets'.

Where existing rural roads are considered by the Council to warrant sealing, the width of such sealing shall be a minimum of 6m, the maximum width being determined on the basis of AADT counts.

The maximum longitudinal grade of a road shall be 8% unless otherwise approved. The minimum longitudinal grade shall be 0.5%.

All changes of grade of more than 1% shall be joined by a vertical curve. The length of all vertical curves shall be in accordance with the relevant Austroads publications, and shall take into account overtaking and stopping sight distances and comfort factors.

Intersections of arterial roads shall be widened as follows:

- (a) Terminating road (collector or access) shall be widened to at least 7.4m seal width for a straight length of 10m from the tangent point of the turn-out radius, and then tapering to the normal seal width over an additional 10m length;
- (b) Through road (arterial) shall be widened on the approach near side by a 2.5m deceleration lane, with a minimum 1.3m wide shoulder, for a distance of at least 30m from the tangent point of the turn out radius, and then tapered back to the normal seal width over an additional 10m length;
- (c) On the departure near side, it shall be widened by at least 1m from the tangent point of the turn out radius for a length of at least 10m (which shall be kerbed); and
- (d) On the opposite side of the road, it shall be widened by a 2.5m passing lane for a distance of 45m either side of the centre line of the intersecting road, or then tapered back to the normal seal width over an additional 100m at each end.

Verges shall have sufficient width for the provision of public utility services, and shall be a minimum of 3.5m. In areas of steep cross fall or where earthworks should desirably be reduced to minimise environmental impact, the verge grading may be increased as agreed with Manager Works and Services.

The maximum longitudinal grade of a road shall be 12.5% unless otherwise approved. The minimum longitudinal grade shall be 0.5% unless table drains are graded independently of the road to provide satisfactory drainage, where necessary. A vertical curve shall be provided when the grade change is 1% or greater.

Geometric design shall be according to 'Rural Road Design', Austroads 1989. The design speed for any rural road shall be determined by Main Roads Western Australia.

One-way cross fall to a maximum of 3% may be approved for access roads when excessive cross fall exists in the natural surface. Roads shall normally have two-way cross-falls of 3% except where geometric design requirements dictate that superelevation is required.

Table drains shall be provided for all roads for a minimum width of 1.2m, flat bottomed, with side slopes of a minimum 1:3 grade (33%).

Cut batters shall generally be no steeper than 1 in 3 (33%) except in hilly terrain, or where depth of cut is considerable, or where ground conditions are such that it is not practical to comply with this requirement without excessive cost or environmental disturbance. Then, subject to the approval of the Manager Works and Services, cut batters may be increased to a maximum of 1 in 1 (100%). Fill batters shall generally be no steeper than 1 in 4 (25%) except in hilly terrain or where fill heights are considerable, in which case a maximum slope of 1 in 2 (50%) may be used subject to the approval of the Manager Works and Services.

Traffic control devices, sign posts, guide posts, street nameplates, guide signs and warning signs shall be provided in accordance with AS1742 to the satisfaction of the Council's Works and Services department.

2.2.10 Industrial Roads

In light industrial areas, roads shall be kerbed and sealed (25mm asphalt) to a minimum width of 7.4m. All other design criteria shall be in accordance with the requirements for Urban Residential Streets with the following exceptions:

- (a) Verge width to be a minimum 4.5m;
- (b) Culs-de-sac shall be avoided wherever possible;
- (c) Kerbs shall be semi-mountable; and
- (d) All intersections are to be constructed to enable the application of extra mass vehicles to be permitted to enter the Industrial area.

In heavy industrial areas, road construction requirements will be subject to specific engineering design.

Where culs-de-sac cannot be avoided, they shall have a minimum head radius of 15m with 25m radius tapers.

2.2.11 Public Utility Conduits

The Consultant shall ascertain the need for conduits under roads for all public utility services for both present and future services. If the public utility authority concerned will not install conduits at the time of construction of the roads, then the conduits shall be installed by the Subdivider (prior to surfacing of roads) whether or not the conduits are immediately required. Backfill trenches for conduits with compacted cement stabilised sand as detailed for storm water pipeline systems in Section 2.8.6.

2.3 Stormwater Drainage

2.3.1 General

- (a) Stormwater drainage systems are required to provide for effective disposal of stormwater and all drainage designs shall comply with appropriate industry design standards such as;
- (b) 'Australian Rainfall and Runoff' Institution of Engineers, Australia;
- (c) 'Stormwater Drainage Design in Small Urban Catchments' J Argue, ARRB Special Report No 34; and
- (d) 'Subsurface Drainage of Road Structures' R J Gerke, ARRB Special Report No 35. All piped drainage lines shall be designed in accordance with the pipe manufacturer's recommendations and appropriate Australian Standards.

2.3.2 All drainage systems shall be piped in urban and residential areas. In areas of porous ground, every effort must be made to disperse water into the ground via sub-soil drainage or similar. In rural areas, open drains and swales may be utilised where the grade is fairly flat and erosion will not occur. Where erosion is likely to occur in steeper gradients, a piped drainage system will be required. The designer shall design the drainage network using a recurrence interval of 5 years except in the case of arterial drains and compensating basins where a recurrence interval of 10 years shall be used. Additionally, the designer shall provide for the adequate discharge of flood flows between the intervals mentioned above and a 100 year recurrence interval in order that the floor level of all buildings shall be 500mm above the 100-year flood level.

2.3.3 It is possible that some existing drainage systems in the municipality may not be able to carry the design storms applicable to the recurrence intervals detailed in the preceding Clause. It is the responsibility of the Consulting Engineer to examine the complete downstream network to evaluate the maximum quantity of water, which may be discharged into the existing network. If, using the recurrence intervals mentioned above, the capacity of the existing drainage network is exceeded, the Council's Works and Services department may direct that the surplus water either be retained within the subdivision in an approved manner or the existing drainage system upgraded to accommodate the design run-off.

2.3.4 It shall be the responsibility of the Manager Works and Services to examine the total catchment area of which a particular subdivision may form a part, and to ensure that any arterial drainage that may pass through the particular subdivision is capable of carrying the ultimate design flow from the upstream catchment. Subdividers are responsible for arranging their own cost sharing arrangements, however, in some

instanced the Council may administer such arrangements at the Subdivider's request.

2.3.5 In cases where stormwater is discharged onto private land downstream of a subdivision or development, arrangements shall be made by the Subdivider with the owner of the downstream land to provide an easement in favour of the Council over the route of the drain and to construct and/or improve the drainage outlet to the requirements of the Council's Works and Services department.

2.3.6 The subdivisional drainage system shall be connected to an approved outlet in the district drainage system by a suitable outfall drain as approved.

2.3.7 Types of Pipe Work

The following pipe types shall be permitted:

Residential areas: Reinforced concrete pipes (and boxes) in classes appropriate to loadings and cover heights;
Rib lock (plastic) for non trafficable areas; and
PVC pipes in classes appropriate to loadings and cover heights.

Rural Areas: Reinforced concrete pipes (and boxes) in classes appropriate to loadings and cover heights.

Other types of pipes may be approved by the Council's Works and Services department.

The minimum pipe size in the verge or within private property shall be 225mm diameter and the minimum pipe size under roads shall be 300mm diameter.

Pipelines shall be designed to ensure that hydraulic grade lines do not reach a level of less than 150mm from finished surface levels for the design recurrence interval.

The velocity in pipes shall be limited to the range 1.0m/sec - 6.0m/sec. The possibility of scour at outfalls shall be considered and steps taken to eliminate it where it may occur.

Manholes shall be provided at each change in direction and at a maximum spacing of 90m.

Inlet pits shall be placed at low points and at the upstream side of intersections if warranted by flow considerations. Inlet pits shall also be placed at intervals to limit the width of gutter flow to 1.5m (or 2.0m in the case of one-way cross fall), in kerbed roads, and at intervals to prevent the top water level in the table

drain from rising to within 200mm of the edge of the shoulder in the case of un-kerbed roads, or to limit the inflow to the entry pit to its inlet capacity, whichever is the least, for the design recurrence interval flows.

On kerbed roads side entry pits shall be used wherever possible, although combined side entry/grated pits may also be used.

On un-kerbed roads, any concrete catchpits situated in table drains shall have grated tops at least 150mm above entry lips to prevent access to the pit by the public.

All outlets to pipe drainage systems (and inlets in the case of open ended culverts) shall have concrete headwalls with concrete aprons, and shall have anti-scour rock protection for a minimum distance of 2m beyond the edge of aprons.

All trenches for pipes laid under road pavements shall be backfilled to the pavement sub grade surface with compacted cement stabilised sand or cement stabilised road base course material. Sand and cement shall be thoroughly mixed in the proportions of a 10 to 1 ratio. Sufficient water shall be added and mixed such that the moisture content is just sufficient to enable mixing and placement of the material. The material shall be placed in even layers not exceeding 225mm in thickness and each layer shall be compacted with a minimum of four passes of a vibratory plate compactor having a minimum static mass of 50kg.

Care shall be taken to ensure that the material fills all voids under the haunches and that no damage will occur to the pipe whilst compacting material next to and immediately over the pipe.

The cement stabilised sand shall preferably be supplied from a central concrete mixing plant, or manually machine mixed on site at a rate of 8 to 1 ratio.

2.3.8 Open Drains

Where drainage is by means of open drains, allowances must be made for access culverts to properties which must be provided at the development stage by the Subdivider.

All culverts shall have adequate concrete headwalls and drain scour protection, where pre-cast headwalls are used, the finished level of the headwall shall not project more than 100mm above the adjacent pavement level.

Table drains to un-kerbed roads shall be sized so that the top water level in a drain does not rise to within 200mm of the edge of the shoulder for the design recurrence interval flow. Installation of catchpits is at the discretion of the Council's Works and Services department. Culverts may be utilised to contain flows in table drains within permissible limits where practicable.

Where there is a risk of scouring in open drains (including table drains), the drains shall be piped to prevent erosion. In some instances it may be permissible for the open drain to be fully lined with rock, concrete or other method approved by the Council's Works and Services department.

2.3.9 Sub-Soil Drains

Where sub-soil water is present, or is likely to become present at any time, and is likely to interfere with the stability of any buildings, the road pavement (or footpath or access way, etc) a system of sub-soil drainage shall be designed and installed to the approval of the Council's Works and Services department.

Sub-soil drains shall be installed to cut off flows at least 600mm clear of any building or surface of the pavement and shall discharge to piped drainage systems or open drains downstream of the affected area, as appropriate for each situation.

As stipulated in Clause 2.3.2, sub-soil drainage may also be used to recharge stormwater into the ground aquifer where the ground conditions permit.

2.3.10 Drainage Easements

Where drains are laid within, or discharge stormwater onto private property the drain and stormwater discharge shall be protected by registered easements which shall show on all plans. The easement shall be centrally located over and about the drainage line and it shall have a width of at least twice the depth of the drain with an absolute minimum width of 3m.

2.4 Miscellaneous Facilities

2.4.1 Footpaths and Dual-Use Paths

Footpaths and dual-use paths in road reserves shall be provided in urban residential subdivisions unless special circumstances prevail in which case they may be omitted at the Council's discretion. If such paths are required they shall be provided at the Subdivider's cost. The Council may wish to defer construction of such paths until the majority of houses fronting the street are constructed to enable driveway crossings to be located and constructed. In this case the Subdivider shall pay to the Council the estimated cost of deferred path construction (as estimated by the Council) in lieu of constructing the paths at the time of subdivision.

Where paths are to be provided by the Subdivider they shall normally be 1.5m footpath and/or 2m dual-use x 100mm thick concrete paths with a 2% slope towards kerbs (or edge of roadways). Tooled lock-joint contraction joints shall be provided at 2m intervals and 12mm wide full depth expansion joints shall be provided at 6m intervals. The surfaces of concrete paths shall have a non-

slip broomed finish. Other types of path e.g. brick may be accepted at Council's discretion.

Paths shall generally be provided on one side of a road only however a path may be required on both sides of a street if so determined by the Liveable Neighbourhoods document. The paths shall normally be laid parallel to the kerb line (or edge of roadway). The longitudinal profile shall follow the longitudinal profile of the kerb line (or edge of roadway).

2.4.2 Signs and Guide Posts

All direction or warning signs and guide posts shall be erected in accordance with AS 1742.5 - 1986. Requirements for such signs shall be clearly shown on the drawings.

2.4.3 Street Nameplates

Street nameplates shall be erected at all newly created intersections and shall indicate the names of both streets. Nameplates shall generally be in accordance with AS 1742.5 - 1986 and shall be purchased by the Council and invoiced to the Subdivider.

Depth of sign shall be 150mm with 100mm lettering except on major roads where a depth of 200mm with 150mm lettering shall be used.

Signs shall be mounted at a height of 3m above finished ground level. If two or more signs are to be erected on the same pole they shall be erected at differing levels.

Nameplates shall be mounted on a 50mm nom. bore galvanised steel pole concreted a minimum of 600mm into the ground. The pole shall be erected where possible on the 2.7m alignment.

2.4.4 Battle-Axe Block Access Roads

Access road pavement to battle-axe blocks shall not be less than 4m wide and centrally located for the full length of the access way. Special consideration shall be given to 'reciprocal rights' access ways which will require greater road pavement width.

All battle-axes shall be constructed to an asphalt, concrete or brick paved finish in residential areas and shall also be adequately drained to shed water to an appropriate drainage system. Where required the battle-axe may need to be kerbed.

The design, shape, width and drainage of these access ways shall be to the approval of the Council's Works and Services department.

2.4.5 Standard Crossovers

Crossovers shall be constructed to all new lots created in a subdivision. The construction and location of such crossovers shall be to the Council's satisfaction.

Crossovers shall be constructed to a minimum width of 3m, with the pavement being 100mm concrete, a 150mm thickness of gravel, or 100mm of limestone and 50mm of gravel. The surface of the crossover shall be asphalt, bitumen chip seal, concrete or brick paved, or other improved surfaces as approved by the Manager Works and services.

Where required, culvert pipes beneath crossovers shall be a minimum 250mm diameter RCP and 4.8m in length. Headwalls to culverts shall be of concrete construction.

Table 1 Crossover Widths

Low Vehicle Volume Developments are those that can be serviced by one driveway and generate weekday vehicle movements of less than 10 vehicles per hour on a typical weekday and less than 20 vehicles per hour on a typical weekend day.

Where a wide verge area exists the crossover width may be reduced once the vehicle turning movement has been accommodated. Refer to Figure 3.

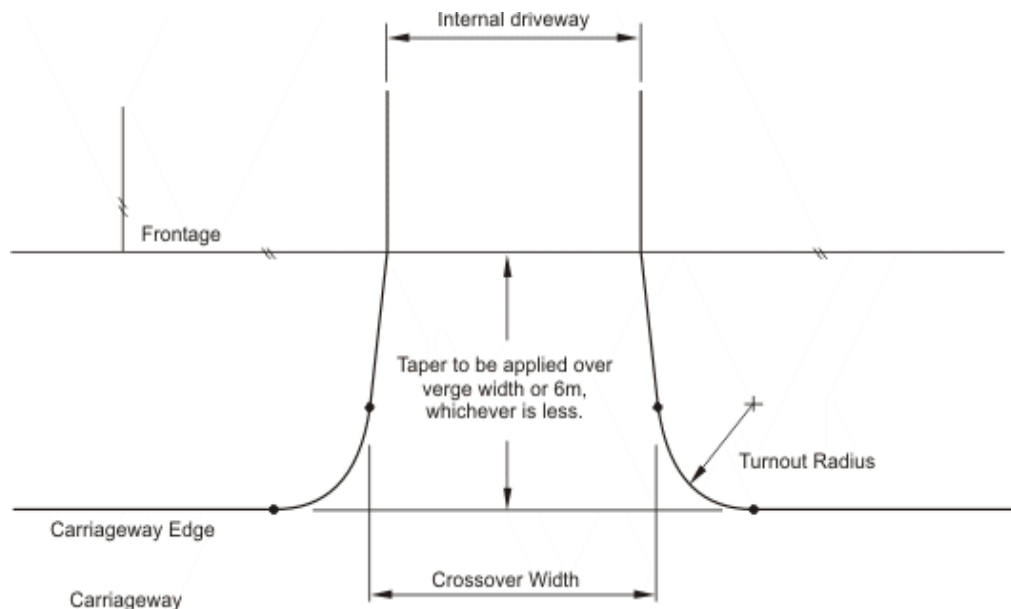
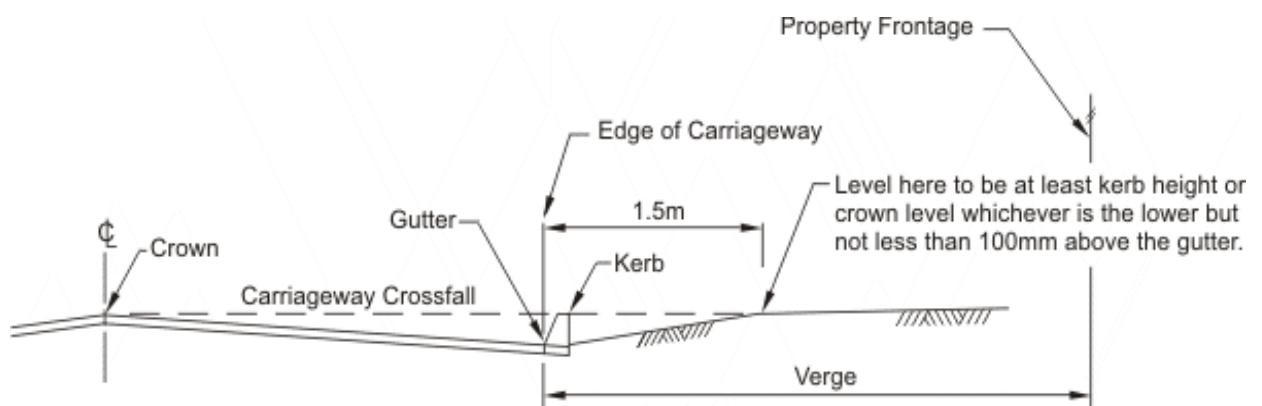


Figure 3 Crossover Width

Sufficient storage length must be provided for a vehicle to stand clear of the carriageway when stopped. Where the entrance has a gate, the set back from the edge of the carriageway to the gate shall vary with the type of vehicle likely to use the driveway in accordance with Table 2. Also refer to Figure 5.

Type of Vehicle	Minimum Length
Light vehicles	6m
Single unit trucks	15m
Semi-trailers and wide farm machinery	21m
Long Vehicles & Road Trains	Length of Vehicle + 3m

Table 2 Storage Lengths



Cross-section of Kerbed Road

Figure 4



SECTION 3 – DRAWINGS

3. REQUIREMENTS FOR DRAWINGS

3.1 General

- 3.1.1 Two copies of the initial design drawings, specifications and drainage and pavement calculations shall be submitted for approval by the Council.
- 3.1.2 Any amendments will be marked up on one copy which shall be returned to the Consultant. Three copies of amended drawings and specifications shall then be re-submitted by the Consultant. One copy of approved drawings and specifications shall be signed by the Manager Works and Services and marked 'Approved for Construction' and shall be returned to the Consultant together with any conditions imposed on the approval.
- 3.1.3 No construction shall commence until 'approved for construction' drawings are certified by the Manager Works and Services.

3.2 Drainage Calculations

The Consultant shall submit drainage calculations for approval for every underground drain and all open drains (except table drains) including bridges, pipe drains, box culvert drains, etc. Calculations shall show catchment areas, run-off coefficients, recurrence intervals, rainfall intensities, and times of concentration and method of sizing of drains. Calculations shall be set out in a standard tabular format or approved format to facilitate checking.

3.3 Pavement Calculations

Submit pavement calculations for approval. Calculations shall show the method adopted for calculation of sub grade CBR including test results, design pavement life, design traffic loadings, determination of basecourse thicknesses and need for sub grade stabilisation/improvement where necessary. Provide copies of all sub grade tests.

3.4 Required Drawing Scales

Scales of plans where possible should conform to the following:

- | | | |
|-----|---|--|
| (a) | Overall Layout Plan | 1/500 or 1/1000 |
| (b) | Plan | 1/500 |
| (c) | Longitudinal Section | 1/500 horizontally
1/50 vertically |
| (d) | Cross Sections | 1/200 horizontally
1/100 vertically |
| (e) | Particular Details
(Intersections, cul- de-sac, turn circles, traffic devices) | 1/200 or 1/250 |

These scales are minimal and may be increased on jobs of small extent.

The datum used shall be an established Landgate Bench Mark to Australian Height Datum. The location of such datum points shall be clearly indicated on the plan.

3.5 Drawing Information

3.5.1 Layout Plan

Layout Plan shall show:

- (a) All existing and new streets and roads with the allocated street names;
- (b) All lots fronting such streets with each lot numbered and fully dimensioned;
- (c) All existing and proposed street drainage, allotment drains with necessary easements and outfall drains;
- (d) All survey and bench marks;
- (e) All existing and proposed contours;
- (f) The north point; and
- (g) All proposed traffic management devices.

3.5.2 Road Plans

Each street shall be drawn in plan and profile.

The plan of the street shall show:

- (a) Width of all pavements, verges and medians;
- (b) Design speed of the road;
- (c) Distances on the centre line of the road (SKL);
- (d) All horizontal curve data;
- (e) All existing and proposed contours;
- (f) All existing and proposed street drainage including manholes and gullies;
- (g) All lots facing onto the street;
- (h) All traffic management devices;
- (i) All existing and proposed services in the road reserve; and
- (j) North point.

The longitudinal profile of the road shall show:

- (a) A running distance along the centre line of the road (SKL);
- (b) The natural surface levels along the centre line and both property lines;
- (c) Design levels at the centre line and both channels. These levels shall be at 20m intervals on straight grades and alignments and at 10m intervals on vertical and horizontal curves;
- (d) Lengths of grade lines with grades expressed as a percentage;

- (e) Intersection and tangent points at change of grades;
- (f) Length of vertical curves;
- (g) Transition and superelevation details; and
- (h) Finished surface levels along both property lines.

Cross section details shall be provided in all cases to show the thicknesses and other relevant details.

Intersections, cul-de-sac heads, roundabouts and any other traffic device or feature – details of these devices shall include:

- (a) All lot boundaries;
- (b) Geometric details;
- (c) Design levels at appropriate points;
- (d) All services, including drainage; and
- (e) North point.

3.5.3 Drainage Plans

All drainage lines will be drawn in plan and profile on the same drawing at the scales as previously specified.

The plan shall show:

- (a) All existing and proposed drainage lines showing pipe sizes, grades, lengths, manholes, gullies, other drainage structures and whether the pipes are solid or slotted;
- (b) Upstream and downstream levels on all existing drainage outfalls to which connections are being made;
- (c) All existing and proposed sewer lines and any other services which may effect;
- (d) All existing and proposed contours and spot levels;
- (e) Where appropriate and especially on industrial subdivisions, the stormwater connection location and the designed discharge from each lot;
- (f) The north point;
- (g) All drainage easements including their description and width; and
- (h) All streets with their allocated names and all lots facing onto such streets with the appropriate lot number.

The longitudinal section shall show:

- (a) A small plan (scale 1:2000) in the bottom right hand corner of the drawing, showing the location of the specific drains as detailed on the same drawing;
- (b) All pipe sizes and grades, the class of pipe and whether the pipe is solid or slotted;
- (c) The existing natural and finished surface levels;

- (d) The invert levels of the pipes and the depth to invert from the finished surface level;
- (e) The distances between gullies, manholes and other drainage structures;
- (f) The location and levels of all other services, especially sewer line crossings; and
- (g) Details of all manholes, gullies and other structures.

Separate details shall be included on the drawings showing pipe laying and bedding details and other appropriate details as required.

3.5.4 Earthworks Plans

In all subdivisions involving earthworks, plans showing existing and proposed contours and appropriate cross sections are required.

3.5.5 'As Constructed' Drawings

The Subdivider shall submit to the Council prior to the release of the subdivision, a full set of engineering drawings for the subdivisional works in reproducible form and in digital format, and certified by a licensed surveyor or other non-biased surveyor as approved as follows:

- (a) Road Drawings – amended to show details of any alterations made during construction; and
- (b) Drainage Drawings – amended to show actual lines, levels and grades against the design lines, levels and grades and stamped 'As Constructed'.



SECTION 4 – CONSTRUCTION OF ROADS

4. CONSTRUCTION OF ROADS AND ASSOCIATED WORKS

4.1 General

4.1.1 All works shall be carried out in accordance with the Occupational Health, Safety and Welfare Act, 1984.

4.1.2 Temporary Road Closure

Where it is necessary to close an existing road to carry out any part of the subdivisional works, approval for such closure shall be obtained from the Council's Works and Services department at least 28 days prior to the work commencing.

The following conditions shall apply to such closures:

- (a) A suitable detour shall be determined and clearly signposted with approved signs for the duration of the works and if no such detour is available, suitable and passable side tracks shall be provided;
- (b) In the case of arterial roads and on other roads where a suitable and convenient detour is unavailable, the road closure shall be advertised by double column display advertisements in local newspapers advising the reason, location and duration of the closure and the route of the proposed detour, such advertisements being placed 21 days prior to the date of the proposed closure;
- (c) In the case of arterial roads and on other roads where a suitable and convenient detour is unavailable, advisory signs shall be erected at appropriate locations on the site 21 days prior to the closure, such signs to comprise a minimum 100mm letter height and to advise the reason, location and duration of the road closure;
- (d) The works and road closure shall be adequately lit at night and other appropriate precautions shall be taken to ensure public safety;
- (e) Emergency services, schools, other large institutions and large businesses that may be affected by the closure shall be advised in writing of the reason, location and duration of the road closure and the route of the proposed detour at least 21 days prior to the closure;
- (f) The works shall be carried out in an expeditious manner to minimise the impact of the road closure on the general public; and
- (g) Where the road closure is required by a private contractor to carry out works in the road reserve then the contractor must obtain approval from the Council's Works and Services department prior to commencing the works.

4.2 Survey Set Out

- 4.2.1 All works shall be set out and constructed in accordance with the alignments, levels, grades and cross sections as shown in the approved drawings.
- 4.2.2 Care shall be taken when working in the vicinity of survey pegs and bench marks to ensure the accuracy thereof.
- 4.2.3 The Subdivider shall be responsible for the accuracy of the setting out of works.

4.3 Construction Tolerances

The tolerances to levels permitted for the various stages of road construction shall be as follows:

Sub-grade	-50mm to + 0mm
Sub-base	-25mm to +10mm
Base	-10mm to +10mm
Bitumen primer	+/- 0.5 litres/m ²
Concrete kerbing	Refer to Section 4 Clause 4.12
Asphalt surfacing	+/- 5mm

4.4 Clearing Works

- 4.4.1 Clearing of all shrubs and trees shall be completed to an extent sufficient to facilitate the construction work. Natural vegetation should be retained where possible.
- 4.4.2 All tree roots, boulders and other deleterious material shall, where possible, be totally removed to a depth of 600mm below the natural surface or finished surface levels of the street, whichever is the greater. Stumps shall be completely removed.
- 4.4.3 All holes and depressions resulting from clearing and grubbing shall be backfilled with approved material and compacted to at least the compaction of the surrounding in-situ material.
- 4.4.4 No material from the clearing shall be pushed beyond the limits of the site.
- 4.4.5 Material cleared shall be either removed from the site and disposed of at an approved waste disposal site or disposed of by burning. All burning off shall be strictly to the requirements of the Bush Fires Act and Environmental Protection Act.

4.5 Earthworks

- 4.5.1 Earthworks shall be completed to this specification and tolerances as set out herein and as detailed in the drawings.
- 4.5.2 The road shall be cut to the grades and batters indicated on the approved drawings.
- 4.5.3 All fill shall be clean free-draining medium to coarse sand and shall be compacted to the full depth of 95% of the modified maximum dry density when tested in accordance with AS 1289 E2.1 – 1977 unless otherwise approved.
- 4.5.4 All cut through rock shall be excavated to a depth of 100mm below sub-grade level and 200mm below the finished level of verges.
- 4.5.5 Blasting
 - 4.5.5.1 Excavation in rock or hard soil may be carried out by blasting only if a blasting permit has been obtained from the Council's Chief Executive Officer in accordance with Explosives Regulations 1963 Regulation 115(6).
 - 4.5.5.2 All explosives shall be stored and handled in accordance with AS2187-1983-4¹ under the personal supervision of the holder of a Current Shotfirer Permit. The Shotfirer shall be held responsible for the repair, replacement, legal liability claims or anything that may arise from the blasting operations. All such screens, shields, matting and the like as is necessary to prevent rock, stones, earth, debris or other material from scattering or blowing from the immediate site of blasting shall be provided.

All road verges shall be graded evenly and smoothly, free from rubble and other deleterious material, to meet the level of the road kerb.

4.6 Soil Stabilisation

- 4.6.1 The subdivider shall be responsible for the satisfactory control of dust and sand drift from the construction site.
- 4.6.2 Stabilisation of topsoil, sand or other material or matter subject to movement over or near the subdivision shall generally be carried out in accordance with the Environmental Protection Authority's Dust Control Guidelines and to the satisfaction of the Council's Works and Services department, both during the construction stages and upon completion of the subdivisional works.

- 4.6.3 Where initial stabilisation is carried out and subsequent works associated with the subdivisional works causes deterioration of effective stabilisation of the area, the area so affected shall be re-stabilised in an appropriate manner. The Subdivider shall effect a varying method of re-stabilisation should initial stabilisations be found to be unsuitable.
- 4.6.4 Stabilisation disturbed by works other than the subdivisional works shall be the responsibility of the person responsible for the disturbance of the stabilised areas (for example, builders, private lot owners and Service Authorities).
- 4.6.5 To avoid dust nuisance to adjacent owners the Works and Services department may direct that **no earthworks**, including stripping, filling or placing of topsoil, be carried out when a wind is blowing towards surrounding properties which is likely to cause sand drift or dust to reach those properties.

4.7 Sub-Grade

- 4.7.1 The formation shall be excavated in conformity with the profiles, dimensions, cambers and depths as shown on approved drawings.
- 4.7.2 Unless otherwise specified the width of the formation 'boxed out' shall be at least 600mm greater on each side than the finished sealed width of the road pavement for urban roads.
- 4.7.3 Unless otherwise specified the width of the formation 'boxed out' shall be at least 1m greater on each side than the finished running surface for rural roads.
- 4.7.4 The sub-grade shall be compacted to not less than 95% of its modified maximum dry density when tested in accordance with AS 1289 E2.1 – 1977 Methods of Testing Soil for Engineering Purposes.
- 4.7.5 This work shall be checked and approved prior to the placement of any foundation material.

4.8 Sub-Base Course

- 4.8.1 The sub-base shall be constructed of limestone complying with the requirements of Section 9.1 'Specification for Crushed Limestone' unless otherwise approved.
- 4.8.2 The sub-base shall be placed so that the compacted sub-grade is not disturbed and broken up and that the even thickness specified is

achieved. Sub-base material shall not be spread upon a waterlogged sub-grade.

- 4.8.3 The sub-base course must be installed full depth (ie. no separate base course layers) to suit the overall pavement design.
- 4.8.4 The sub-base course shall be compacted to not less than 95% of its modified maximum dry density when tested in accordance with AS 1289 E2.1 – 1977.
- 4.8.5 Where damage to adjoining properties may result, the use of vibrating rollers will not be permitted.
- 4.8.6 All irregularities in the longitudinal grade and cross section shall be corrected in an approved manner until the road sub-base is brought to a uniformly compacted smooth and even surface.
- 4.8.7 If, during the construction period, the surface of the sub-base shows any imperfections or failures, such shall be corrected in an approved manner.
- 4.8.8 Unsatisfactory sub-base material shall be removed from the site and replaced with material as specified.
- 4.8.9 The sub-base construction shall be approved prior to the commencement of the placing of the base material.
- 4.8.10 No work is to continue with the installation of the Base Course until all testing is done and original test results are supplied to Council and approved.

4.9 Base Course

- 4.9.1 The pavement base material shall consist of fine crushed rock (road base) complying with the requirements of Section 9.2 ‘Specifications for Road Base’ unless otherwise approved.
- 4.9.2 The base material shall be placed so that the limestone sub-base material is not disturbed or broken up during the placement of the base material and an even thickness as specified is obtained.
- 4.9.3 The base course must be installed full-depth (i.e. no separate sub-base course layers) to suit the overall pavement design as approved.
- 4.9.4 Grading of loose material over a hard surface and/or compaction in a thin layer is not permitted.

- 4.9.5 The base course shall be compacted to not less than 98% of its modified dry density when tested in accordance with AS 1289-E2.1 1977.
- 4.9.6 The base shall be water bound by the surface being sprayed with water and rolled until a slurry finish has been obtained. When this has dried, any surplus slurry material shall be broomed off the surface and disposed of as directed.
- 4.9.7 The base construction shall be approved prior to priming.
- 4.9.8 Prior to surfacing all underground public utilities service crossings shall be installed. All road crossings shall be backfilled and compacted in accordance with the requirements for sub-grade and sub-base construction.

4.10 Primer Sealing Of Pavement

- 4.10.1 The surface of the base course shall be primer sealed in accordance with Austroads publication 'Bituminous Surfacing Volume 1, Sprayed Work 1989' prior to the application of the wearing course.
- 4.10.2 Sweeping -The surface of the base course shall be swept free from any loose material and dust in such a manner that will not damage the finished surface of the base course prior to the application of the binder.
- 4.10.3 Application of Binder

In cases where a hot sprayed bitumen surface is specified, the primer seal shall be hot cut-back bitumen; for asphalt surfaces, either bitumen emulsion or hot cut-back bitumen as specified below may be used.

Primer sealing shall not be carried out for a period of at least 24 hours after completion of the water binding of the base course.

4.10.3.1 Bitumen Emulsion

Bitumen emulsion in accordance with AS 1160-1988 shall be uniformly and evenly sprayed onto the existing surface at a rate determined by the design but shall not be less than 1.4 litres per square metre measured at 15 degrees Celsius.

4.10.3.2 Hot Cut-Back Bitumen

Hot cut-back bitumen in accordance with AS2157-1980 'Cutback Bitumen' shall be applied at the rate determined by the design but shall not be less than 1.2 litres per square

metre measured at 15 degrees Celsius, with the temperature of the bitumen being between 70 and 120 degrees Celsius.

4.10.3.3 The Binder Application

The primer seal shall be applied by an approved mechanical sprayer. Where the direct use of a mechanical spray is impracticable, the binder may be sprayed using a hand lance fed from the mechanical sprayer.

4.10.4 Application for Aggregate

4.10.4.1 The primer seal shall immediately after spraying be covered with approved 14mm nominal size aggregate as detailed in Section 9.3 'Specification for Sealing Aggregate' so that all sprayed areas shall be completely covered within a period of 15 minutes.

4.10.4.2 The aggregate shall be dry and free from dust and other deleterious material, and be spread by means of an approved aggregate spreader capable of spreading a uniform layer of aggregate.

4.10.4.3 Rate of application shall be determined by design but shall not exceed 150m² per cubic metre of metal, controlled so that only sufficient is applied to give a uniform dense mat of one stone thickness.

4.10.4.4 Within five minutes of the application of the aggregate, rolling shall commence using appropriate equipment and continue until the aggregate is well embedded in the binder and a uniform surface obtained.

4.11 Hot Sprayed Bitumen Surfacing

4.11.1 The application of a single coat aggregate wearing course to a surface which has been primer sealed in accordance with Section 4.9 shall be designed and carried out in accordance with Austroads publication 'Bituminous Surfacing, Volume 1, Sprayed Work 1989'. The wearing course shall be applied to those areas as shown on the approved drawings and shall consist of a hot bitumen binder with appropriate aggregate.

The Subdivider shall submit his proposed application rates for binder and aggregate for approval.

4.11.2 Before the binder is applied, the surface shall be swept free of all loose stones, dust, dirt and foreign material. Any sections of pavement that are loose or damaged shall be repaired and finished to the correct level.

4.11.3 Materials

The binder and medium curing cutting oil shall comply with AS 2008-1980 and AS2157-1980.

The proportion of medium curing cutting oil to be added to the binder shall be determined by the design and shall not to exceed 8%.

The aggregate shall consist of crushed stone as specified in Section 9.3 'Specification for Sealing Aggregate' and shall be of 14mm nominal size.

4.11.4 Application of Binder

4.11.4.1 The Subdivider shall give the Manager Works and Services at least 48 hours notice of his intention to apply the binder and the approval shall be obtained before any spraying commences. The surface to be sealed shall be dry and no binder shall be applied whilst the pavement temperature is less than 25 degrees Celsius or during wet conditions, or when adverse weather conditions may prevail at any time during such work.

4.11.4.2 The binder shall be applied by an approved mechanical sprayer. Where the direct use of the mechanical sprayer is impracticable, the binder may be applied by using a hand lance fed from the mechanical sprayer.

4.11.4.3 The binder edge shall not deviate from the desired edge lines by more than 50mm. The rate of deviation of the binder edge from the desired edge lines shall not exceed one in four hundred (1:400).

4.11.4.4 All necessary precautions shall be taken to prevent over spray of binder. Any damage or defacement shall be made good immediately the sealing in that section has been completed, with all cleaning work being carried out to an acceptable standard.

4.11.5 Application of Aggregate

4.11.5.1 The aggregate shall be dry and free from dust and other deleterious material at the time of application and shall be uniformly spread over the sprayed area by means of an approved type of mechanical spreader.

4.11.5.2 The time lag between spraying and spreading shall be kept to a minimum and all sprayed areas, with the exception of approved lapping strips, shall be covered with 14mm nominal size aggregate within 10 minutes of spraying the binder.

4.11.5.3 If there are surplus loose particles on any portion of the sealed area such portion shall be swept lightly so as to move the loose particles but not disturb the aggregate embedded in the binder.

4.11.5.4 Rate of application shall be determined by design but shall not exceed 150 m² per cubic metre of metal, controlled so that only sufficient is applied to give a uniform dense mat of one stone thickness.

4.11.5.5 Within five minutes of the application of the aggregate, rolling shall commence using appropriate equipment and continue until the aggregate is well embedded in the binder and a uniform surface obtained.

4.11.5.6 Any loose cover material not incorporated in the seal after the completion of rolling shall be removed from the seal surface as directed and disposed of in an approved manner.

4.11.6 Two-Coat Surfacing

The application of a consecutive two coat aggregate wearing course seal will be approved on submission of a fully detailed specification.

4.11.7 Measurement and Recording of Application Rates

4.11.7.1 Binder

All loads of bitumen shall be sampled in accordance with AS 1160-1988, AS 2008-1980 or AS2157 –1980 as appropriate.

The following records shall be kept of all spray runs by a competent person and supplied to the Council's Works and Services department:

- (a) Spray width;
- (b) Start chainage – finish chainage;
- (c) Side of road (left or right);
- (d) Road temperature;
- (e) Bitumen temperature;
- (f) Volume of bitumen used; and
- (g) Average bitumen application rate.

4.11.7.2 Aggregate

Aggregate volume shall be measured in truck at the point of spreading. Each load shall be levelled to facilitate calculation of volumes with the volume of the aggregate being recorded for each truck.

The actual application rate of cover aggregate shall be calculated from the measured volumes spread and the actual area measured on the site by the Consulting Engineer and supplied to the Council's Works and Services department.

4.12 Concrete Kerbing

4.12.1 All concrete kerbing shall be cast in-situ Semi-Mountable type using an extrusion machine to a cross sectional profile as shown on the approved drawings.

4.12.2 Appropriate measures shall be taken to ensure that kerbing is securely held in position. The laying of kerbing on the primed base course the same thickness as main road base course, with asphalt placed against the front face and fill against the rear face is deemed to comply with this requirement.

4.12.3 All concrete work shall be carried out in accordance with AS3600-1988.

4.12.4 All concrete used shall be supplied in a ready mixed state and shall comply with the requirements of AS1379-1973. All concrete used in the works shall develop a minimum compressive strength of 20 MPa at 28 days with a maximum slump of 90mm.

4.12.5 The surface of the road shall be thoroughly swept clean of all loose material prior to the kerb being cast to ensure the maximum bond between the kerb and the pavement material.

4.12.6 Tolerances

The line, level and radius of all kerbing shall be in accordance with the following tolerances:

- (a) The top surface of the kerb shall be parallel to the ruling grade of the pavement and shall be free from irregularities exceeding 5mm when measured with a 3m long straight edge.
- (b) Level +/- 5mm
- (c) Line +/- 10mm
- (d) Cross section dimensions +/- 5mm.

4.12.7 The finished kerb shall be true to the cross-section dimensions specified and shall have a smooth finish.

4.12.8 Contraction Joints

Contraction joints shall be constructed every 2.5m run of kerbing. The contraction joints shall be 6mm wide and shall be cut through the kerb above the road surface level immediately after extrusion. Care must be taken to avoid any disturbance to the edges of the joint and any such disturbance shall be made good immediately.

4.12.9 Expansion Joints

Not less than 24 hours after placement of the kerb, expansion joints shall be formed by cutting completely through the kerb at 5m intervals, at sides of drainage gullies and at tangent points of all small radius horizontal curves. The expansion joints shall be 13mm wide. Each expansion joint will be filled with a foam packer which shall be covered with an approved compound.

4.12.10 Curing

All concrete shall be cured as specified in AS3600-1988.

4.12.11 Protection

All kerbing shall be protected from damage and any damage repaired immediately so that no visible cracks remain.

Kerbing with any cracking will not be approved and must be replaced prior to final inspection taking place. There will be no minimum amount of cracking allowable.

4.12.12 Backfilling

The backfill material shall be free draining sand and/or topsoil, free from debris and deleterious matter and levelled and compacted to not less than 90% of the modified maximum dry density when tested in accordance with AS1289 E2.1-1977.

4.12.13 All surplus materials including materials removed due to non-compliance with the specifications shall be removed from the site and the area left in a neat and tidy condition.

4.13 Asphalt Surfacing

4.13.1 General

Asphalt used for the wearing course on any road pavement shall consist of a combination of coarse aggregate, fine aggregate and mineral filler, uniformly

coated and mixed with a bitumen binder in accordance with that detailed in Section 9.4 'Specification for Asphalt'.

All work and material shall be in accordance with the requirements of AS 2734-1984 and shall provide a surface with level and roughness tolerances complying with the standard and having a compaction of at least 98% of the 50 blow, 35 blow or 25 blow Marshall density as approved.

4.13.2 Commencement of Works

The Contractor shall give at least 48 hours notice to the Works and Services department before commencing or recommencing any asphalt surfacing works.

4.13.3 Delivery Records

A weighbridge ticket showing the empty and loaded masses of the vehicle shall be made available to the Works and Services department at the point of delivery by the driver of the vehicle together with written confirmation of the following if requested:

- (a) The date and time of loading;
- (b) The name of the supplier and the plant location;
- (c) The identification number of the vehicle; and
- (d) The nominal size of the asphalt aggregate.

4.13.4 Testing of Asphalt

Test results indicating the following shall be supplied on request:

- (a) Marshall Stability
- (b) Marshall Flow
- (c) Bitumen content
- (d) % air voids
- (e) % compaction

4.14 Street Name Plates

4.14.1 The subdivider shall liaise with the Works and Services department regarding the supply and erection of all street nameplates in accordance with AS1742.5 –1986 Part 5.

Nameplates shall be of approved type, be fully reflective on extruded aluminium and shall be erected at all newly created intersections and shall indicate the names of both streets. Nameplates shall incorporate any special feature which may be required by the Council (eg Council logo, colours of legend and background, etc).

4.14.2 Depth of sign shall be 150mm with 100mm lettering except on major roads where a depth of 200mm with 150mm lettering shall be used.

4.14.3 Signs shall be mounted on 50mm diameter galvanised steel posts so that the bottom of the sign is 2.7m clear of the ground. Posts shall be concreted into the ground to a depth of at least 0.6m. The pole shall be erected on the 2.7m alignment.

Temporary 'No Through Road' signs shall be erected on roads that have been temporarily terminated.

4.15 Path and Island Paving

4.15.1 The paving material used in the construction of off-road paths and islands shall be 100mm thick cast 'in situ' concrete. The finished surface shall be smooth and free from defects with a 'broomed' non-skid finish. Contraction joints shall be provided every 2m. These shall be cut with an approved grooving tool and be 6mm wide. Expansion joints fitted with 'Lock-Joint' shall be provided every 6m. Every 48m, a non 'Lock-Joint' expansion joint shall be provided. These shall be 13mm wide and filled flush with an approved jointing material. Alternative equivalent paving materials may be used as approved.

4.15.2 All concrete work shall be carried out in accordance with AS3600-1988.

4.15.3 All concrete used shall be supplied in a ready mixed state and shall comply with the requirements of AS1379-1973. All concrete used in the works shall develop a minimum compressive strength of 20 MPa at 28 days with a maximum slump of 90mm.

4.15.4 All paving to median islands shall be to the colour as specified by the Manager Works and Services.

4.15.5 The sub-grade under all paths shall be clean, well compacted sand fill. All concrete to median islands shall be placed on a compacted sand bed.

4.15.6 All public utility services shall be installed under paths and other paved areas prior to the paving work commencing.

4.15.7 The level of the finished concrete path shall suit the surrounding ground levels provided that the paved surface is free draining, with all path levels to be approved. Generally, all paths will have a 2% cross fall towards the road pavement.

- 4.15.8 The Subdivider shall give landowners whose verges will be affected by the path construction at least two weeks notice of the commencement of the construction work.
- 4.15.9 All work shall be carried out in accordance with the Council's requirements as appropriate and as detailed in its 'Path Construction Specification.'
- 4.15.10 Appropriate alterations to existing verge reticulation systems shall be carried out as part of the work at no extra cost.

4.16 Lot Filling

- 4.16.1 Where lot filling is required in accordance with these guidelines, the fill area shall be cleared and stripped of all organic material rubbish and any other deleterious material and the filling placed and compacted to the approved design levels.

The tolerances on lot filling shall be +/- 50mm.

- 4.16.2 The fill material shall be clean, free draining, medium to coarse sand, free from foreign and organic matter.
- 4.16.3 Topsoil shall be stockpiled for later re-spreading on batters and other disturbed surfaces where appropriate.
- 4.16.4 Material from clearing shall be disposed of away from the site of the works in a place and manner approved by the Council. No material from clearing shall be deposited within the road reserve or on property beyond the boundaries of the subdivision without the owner's permission.
- 4.16.5 Adequate precautions must be taken to ensure no damage occurs to trees, vegetation, fences, services and other improvements outside the designated areas of the works. Survey pegs or marks which are disturbed shall be reinstated by a licensed surveyor at the Subdivider's expense.
- 4.16.6 All fill shall be compacted to the full depth with a density of 95% over the building envelope and 90% over the remainder of the fill area, of the modified maximum dry density when tested in accordance with AS 1289 E2.1-1977.
- 4.16.7 Where open drains across lots have been backfilled, the compaction of the backfill shall be in accordance with the preceding Clause and such areas shall be subject to special testing as determined by the Council's Works and Services department.

- 4.16.8 The requirements for stabilisation, dust control and sand drift as detailed in Section 4.6 shall also apply to lot filling.
- 4.16.9 For urban subdivisions on a clay sub grade, the clay surface shall be sloped at a minimum grade of 1:100 towards a subsoil drainage line and covered with a minimum fill of 300mm of clean sand over the entire site. Clay being used as fill to achieve a uniform graded surface shall be compacted to 90% of the modified maximum dry density when tested in accordance with AS1289 E2.1-1977.



SECTION 5 – CONSTRUCTION OF DRAINS

5. CONSTRUCTION OF DRAINAGE WORKS

5.1 General

5.1.1 All works shall be carried out in accordance with the Occupational Health, Safety and Welfare Act, 1984.

5.1.2 Temporary Road Closure

Where it is necessary to close an existing road to carry out any part of the subdivisional works, approval for such closure shall be obtained from the Council's Works and Services department at least 28 days prior to the work commencing.

The following conditions shall apply to such closures:

- (a) A suitable detour shall be determined and clearly signposted with approved signs for the duration of the works and if no such detour is available, suitable and passable side tracks shall be provided.
- (b) In the case of arterial roads and on other roads where a suitable and convenient detour is unavailable, the road closure shall be advertised by double column display advertisements in local newspapers advising the reason, location and duration of the closure and the route of the proposed detour, such advertisements being placed 21 days prior to the date of the proposed closure.
- (c) In the case of arterial roads and on other roads where a suitable and convenient detour is unavailable, advisory signs shall be erected at appropriate locations on the site 21 days prior to the closure, such signs to comprise a minimum 100mm letter height and to advise the reason, location and duration of the road closure.
- (d) The works and road closure shall be adequately lit at night and other appropriate precautions shall be taken to ensure public safety.
- (e) Emergency services, schools, other large institutions and large businesses that may be affected by the closure shall be advised in writing of the reason, location and duration of the road closure and the route of the proposed detour at least 21 days prior to the closure.
- (f) The works shall be carried out in an expeditious manner to minimise the impact of the road closure on the general public.
- (g) Where the road closure is required by a private contractor to carry out works in the road reserve then the contractor must obtain approval from the Council's Works and Services department prior to commencing the works.

5.2 Survey Set Out

- 5.2.1 All drainage works shall be set out and constructed in accordance with the alignments, levels and grades as shown in the approved drawings.
- 5.2.2 Care shall be taken when working in the vicinity of survey pegs and bench marks to ensure the accuracy thereof.
- 5.2.3 The Subdivider shall be responsible for the accuracy of the setting out of works.

5.3 Construction Tolerances

The tolerance for piped drainage lines shall generally be +/-10mm for level and +/-50mm for line, but in all instances each section of drain shall be capable of carrying the design flow.

5.4 Materials

5.4.1 Pipes

5.4.1.1 Drainage pipes may be reinforced concrete, fibre reinforced cement, corrugated aluminium or plastic. Other types may be used on the approval of the Council's Works and Services department.

5.4.1.2 All pipes shall conform to the appropriate Australian Standard, such as the following:

AS 1342-1973	Precast Concrete Pipes
AS1712 – 1976	Fibre Cement Pipes
AS1761 – 1985	Helical Corrugated
AS1762 – 1984	Steel Pipes
AS2566 - 1982	Plastic Pipelaying Design

5.4.1.3 Subsoil drainage pipes shall conform to the above but, except in the case of reinforced concrete pipes, shall have 250mm by 5mm slots cut through the pipe on alternate sides at 100 degrees so that the total length of slots is approximately half that of the pipe.

5.4.1.4 Reinforced concrete pipes shall be spigot and socket type unless otherwise approved.

5.4.2 Concrete

5.4.2.1 Concrete used for in-situ work shall conform to AS3600-1988 and be provided by a pre-mix concrete supplier conforming to AS1379-1973 or mixed on site, using materials as specified and plant to the approval of the Manager Works and Services.

5.4.2.2 Concrete for manholes, headwalls, end walls and keels shall have a minimum compressive strength of 20 MPA after 28 days. The slump shall not exceed 70mm or be less than 30mm. Maximum size of aggregate shall be 20mm.

5.4.3 Cement

5.4.3.1 All cement used shall be Portland cement in accordance with AS1315-1982 and obtained from an approved manufacturer.

5.4.3.2 Cement shall be delivered to the site fresh and in sealed bags and there stored in a weatherproof shed until such time that it is to be used. Any bag showing signs of deterioration or setting shall be rejected.

5.4.4 Concrete Aggregate

5.4.4.1 Fine aggregate shall be well graded, clean, sharp and free from clay and organic impurities in accordance with AS2758.1-1985.

5.4.4.2 Coarse aggregate shall be crushed granite or diorite clear and free from all impurities in accordance with AS2758.1-1985.

5.4.5 Water

5.4.5.1 Water for use in concrete and mortar shall be of potable quality, free from any impurities harmful to concrete mortar or steel.

5.4.6 Sand

5.4.6.1 Sand for mortar will be crushed stone or natural sand free from all deleterious substances and have a uniform grading.

5.4.6.2 Sand for bedding or backfilling shall be clean sand free from roots, clay or any deleterious matter.

5.4.7 Steel

- 5.4.7.1 Steel reinforcing fabric and steel reinforcing bars for concrete shall comply with the requirements of AS1302-1977, AS1303-1973 and AS1304-1973 and be free from loose rust or matter likely to impair the bond with concrete.
- 5.4.7.2 Structural steel shall comply with the requirements of AS1205-1980.

5.4.8 Bricks

- 5.4.8.1 Bricks shall be hard, well burnt, pressed or wire cut clay bricks in accordance with AS1225-1984 having a minimum ultimate strength of 30 MPA and absorbing when saturated, not more than 10% of their own weight in water.
- 5.4.8.2 Bricks shall be of uniform shape and size, carefully conveyed and unloaded at the site. No chipped or broken bricks shall be used, and no pieces of brick to be used except where necessary as closures.

5.4.9 Calibrated Metal

- 5.4.9.1 Calibrated metal (granite or diorite) shall conform to the following sieve grading:

<u>Sieve Size</u>	<u>%Passing</u>
19.0	100
13.2	98-100
9.5	80-90
6.7	53-70
2.4	5-14
0.6	0-3

And be free from roots, clay and any deleterious material.

5.4.10 Manhole Liners

- 5.4.10.1 Manhole liners shall be circular precast concrete liners from approved manufacturers capable of withstanding anticipated design loadings.

5.4.11 Manhole Covers

- 5.4.11.1 Manhole covers located in the carriageway shall be equipped with purpose built reinforced concrete surrounds a minimum of 150mm thick and fitted with a 'Gatic' or similar type cast iron frame and lid.
- 5.4.11.2 Manhole covers located elsewhere in the road reserve shall be equipped with a purpose built reinforced concrete surround 150mm thick.
- 5.4.11.3 All manhole covers shall be equipped with 600mm square or circular access point with tapered inserts. Both cover and insert shall have suitable lifting points installed.
- 5.4.11.4 Manhole covers located in easements on private allotments shall be of suitable thickness as determined by design loading but not less than 100mm.

5.4.12 Grated Covers

- 5.4.12.1 Grated cover surrounds shall be 150mm thick reinforced concrete, 20 MPA at 28 days compressive strength concrete with sufficient reinforcement to withstand the design loading.
- 5.4.12.2 The steel insert shall be contained within a steel surround firmly embedded in the concrete and hinged on one side to permit opening with the steel surround protruding above the concrete surround by 25mm.
- 5.4.12.3 All grated gully covers shall be of a heavy duty construction and shall be load tested to full Austroads Highway Loading Conditions (90kN Wheel Load applied as per AS1597 Part 1-1974).
- 5.4.12.4 Grated covers shall have clear minimum internal dimension of 650mm x 490mm measured between and excluding the supporting angle frame.
- 5.4.12.5 Where there is any likelihood of cycle traffic crossing the road at right angles to the centreline of the road in the vicinity of gullies, 25mm x 3mm mild steel straps shall be welded to the bars at 100mm centres across the full length of the grate or other method as approved.

5.4.13 Side Entry Kerb

Side entry kerb sections shall be reinforced concrete to a design submitted and approved by the Council's Works and Services department.

5.5 Installation of Manholes and Road Gullies

- 5.5.1 Manholes shall be constructed from either circular precast concrete sections or square/rectangular brickwork as determined by detailed design. Minimum thickness of brickwork shall be 230mm.
- 5.5.2 The minimum internal size of all manholes shall be either 900mm circular or square but in all cases the manhole shall be at least 600mm larger than the largest pipe connected to the manhole. The minimum manhole diameter in private property shall be 750mm.
- 5.5.3 All manhole covers shall overhang the liner or walls by 100mm minimum. The tops of all manholes shall be flush with either the pavement level or the finished ground level and set at appropriate cross falls where necessary.
- 5.5.4 Manholes shall be embedded on sand compacted not less than 95% of the maximum dry density when tested in accordance with AS1289.E2.1-1977.
- 5.5.5 Steel step irons shall be installed in the walls of all manholes over 1.2m deep at approximately 400mm spacing or at every fifth course of brickwork. Step irons shall be of an approved design with a minimum diameter of 12mm. The surface of these steps is adequately protected against rust by galvanising or similar treatment.
- 5.5.6 Road gullies shall be a side entry pit design, a steel grate design or a combination of both.
- 5.5.7 All manholes located in the road reserve shall have bases of 150mm thick reinforced concrete, 20MPA at 28 days compressive strength concrete with sufficient reinforcement to withstand the design loading.
- 5.5.8 The grated cover shall be installed with the bars at right angles to the road centreline.
- 5.5.9 Side entry pits shall be created by installing a precast kerb section fitted with an opening into the kerb line. The minimum depth of the opening shall be 100mm.
- 5.5.10 The side entry kerb shall be located directly above the manhole wall such that the water flows directly from the water channel into the manhole.

- 5.5.11 The road pavement in the vicinity of the side entry pit shall be shaped to facilitate the ingress of water by forming an evenly graded depression, the maximum depth of which shall be 50mm at the face of kerb in the centre of the opening in the kerb section, constructed in such a manner that does not reduce the serviceability of the road pavement.
- 5.5.12 Manholes installed on the drainage lines 600mm diameters and over shall not be fitted with side entry inlets.
- 5.5.13 The road-wearing surface shall extend over grated gully surrounds. Gully grates shall be installed 25mm proud of the primed road surface in order to be flush with wearing surface.

5.6 Headwalls and End walls

- 5.6.1 Where a piped drain interfaces with an open drain, a suitable end wall structure shall be provided to prevent the entry of loose material into the pipe and the erosion of surrounding ground. In the case of pipes exceeding 600mm diameter, suitable structures shall be fitted to the inlet to the pipe drainage system to prevent access.
- 5.6.2 All headwalls and end walls shall be constructed using either concrete with 20 MPA compressive strength, mortared stonework or brickwork.
- 5.6.3 For mortared stonework each stone shall weigh in excess of 10kg and the greatest dimension of any stone shall not exceed 1.5 times its least dimension.
- 5.6.4 End walls located on outlet pipes exceeding 300mm diameter shall include suitable erosion protection in the form of aprons and edge beams.

5.7 Pipe Laying

- 5.7.1 Pipes shall not be laid on filled ground until such ground has been compacted to a minimum of 95% of its modified maximum dry density when tested in accordance with AS 1289.E2.1-1977.
- 5.7.2 Trenches shall be excavated to the dimensions shown on the approved drawings to the minimum consistent with bed width requirements.
- 5.7.3 In the case of rock occurring in the bottom of the trench, the trench shall be excavated to a depth of at least 200mm below the design levels, backfilled with clean sand fill and compacted as specified in Clause 5.7.1.
- 5.7.4 All blasting shall be carried out in accordance with Clause 4.5.5.

- 5.7.5 Free water in excavations shall be controlled to a level sufficiently low so as not to interfere with the construction work.
- 5.7.6 The trenches shall be cut to the line, depth and gradient required. If any pipe trench is excavated deeper than required, the extra depth shall be filled with sand and compacted to a density comparable to that of the natural surrounding material.
- 5.7.7 Any excavation which is carried out in public or private roads shall be arranged so that pedestrian and vehicle access is maintained at all times unless this is considered highly impractical, in which case work shall be arranged to cause the minimum disruption possible.
- 5.7.8 Pipes shall be laid true to the design lines and levels as shown on the approved drawings and shall be laid so that the pipes will be bearing uniformly on the foundation for their entire length.
- 5.7.9 All pipes shall be jointed in accordance with the manufacturer's recommendations unless specified otherwise.
- 5.7.10 No damaged pipe shall be used in the works.
- 5.7.11 All pipe laying and jointing shall be inspected and approval given before backfilling or metalling commences. Any work that is covered before being so approved shall be uncovered if so directed.
- 5.7.12 Slotted pipes shall be laid with the slots in the down position symmetrical about the vertical centre line.
- 5.7.13 Calibrated metal as previously specified shall be placed along the full length of all subsoil pipes and inspected prior to backfilling.
- 5.7.14 The trenches shall be backfilled using clean coarse sand filling free from clods or stones and effectively free draining. This backfilling material shall be compacted evenly around manholes and gullies and over and around pipes. Compaction shall be 95% under paved areas and within the building envelope, and 90% elsewhere of the modified dry density when tested in accordance with AS1289-1977 E2.1.
- 5.7.15 Any surplus excavated material shall be disposed of in an approved manner.
- 5.7.16 All pipes protruding into gullies and manholes shall be trimmed to be flush with the internal face of the structure and any irregularities and depressions filled with an approved grouting material.

- 5.7.17 Where a drain is to be laid on unsound ground, or if the drain crosses over a sewer line or other essential services, the pipe shall be laid on a suitable independent support structure.
- 5.7.18 All backfilling shall be placed with great care in such a way that no pipes or joints or other works are displaced or damaged.
- 5.7.19 During construction no sand or other material shall find its way into the drainage system. Unfinished manholes shall be covered to prevent this occurring.
- 5.7.20 The backfilling and interim restoration of the trenches in existing road pavements shall be completed immediately after acceptance of piping work.

The material used for backfilling pipe trenches and the pits in roadways shall be a cement stabilised sand at a cement rate of 10 to 1 ratio, if supplied by a concrete batch plant. If mixed by machine the ratio is to be an 8 to 1 ratio.

Clean granular material shall be compacted to a density not less than 95% of the maximum dry density as tested in accordance with AS1289 E2.1 1977. The top 300mm of trench shall be filled with limestone to surface level and compacted as specified herein. The surface of the trenches shall be kept in safe and reasonable condition for traffic until permanent road reinstatement is carried out. All subsidence shall be made good with fresh approved material. Unless otherwise stated interim restoration and maintenance of private roads or right of ways shall be carried out in the same manner as if they were public roads. The remainder of the reinstatement shall be carried out by the Council unless otherwise approved.

- 5.7.21 The surface of verges and all other similar land shall be restored to the condition in which it was found and shall be left with the surrounding ground level after all consolidation has been completed. The surface soil and sub-soils shall be stored separately and afterwards reinstated in their natural order. All areas disturbed by drainage works shall be stabilised in accordance with Section 4.6 of this guideline.

5.8 Open Drains

- 5.8.1 Open drains shall be installed to the lines and levels shown on the approved drawings.
- 5.8.2 Excavated material from open drains shall be disposed of in an approved manner.

- 5.8.3 Where over excavation occurs, this shall be corrected by filling with in-situ material and compacting to a density comparable to that of the natural surrounding material.
- 5.8.4 A corridor 3m wide shall be provided for future maintenance access along one side of the drain.



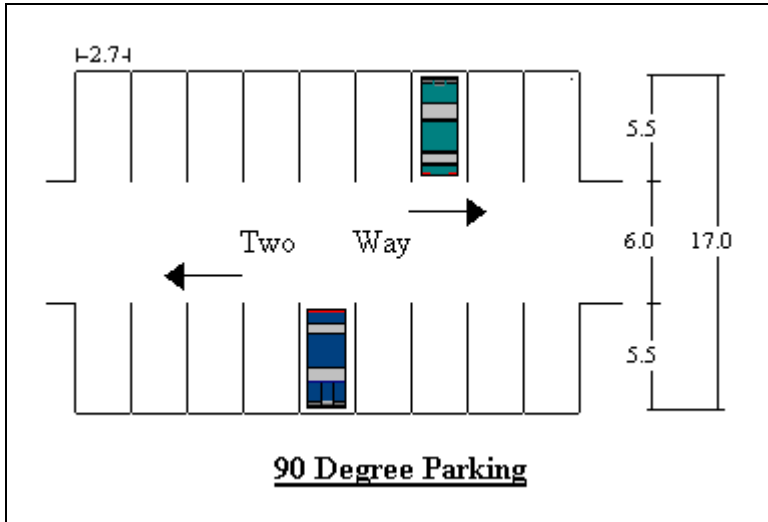
SECTION 6 – CAR PARKING AREA DIMENSIONS

6. CAR PARKING AREA DIMENSIONS

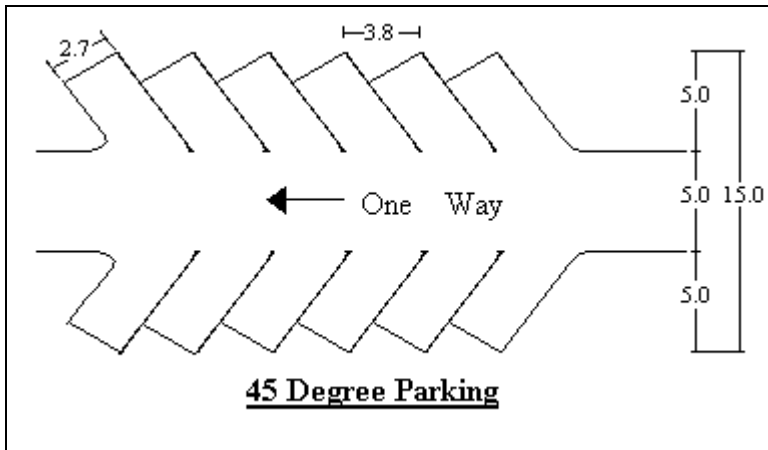
6.1 General

All car parking works shall be designed and constructed in accordance with sound engineering principles and in compliance with the approved drawings and specifications.

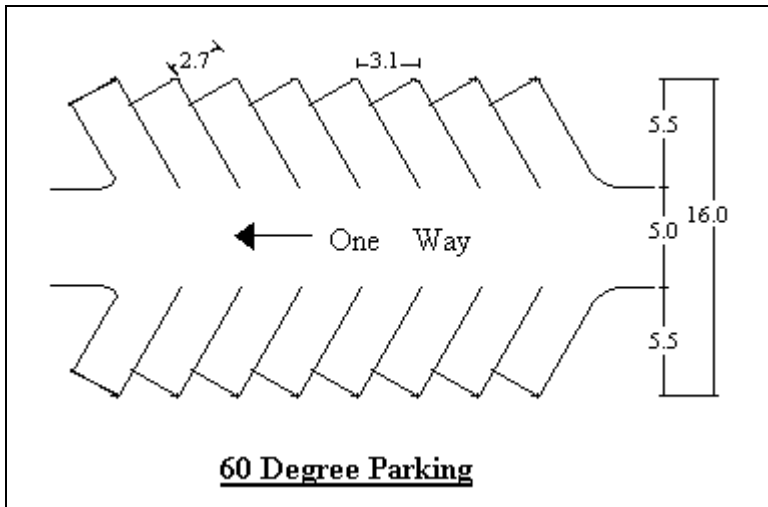
6.2 90 Degree Parking



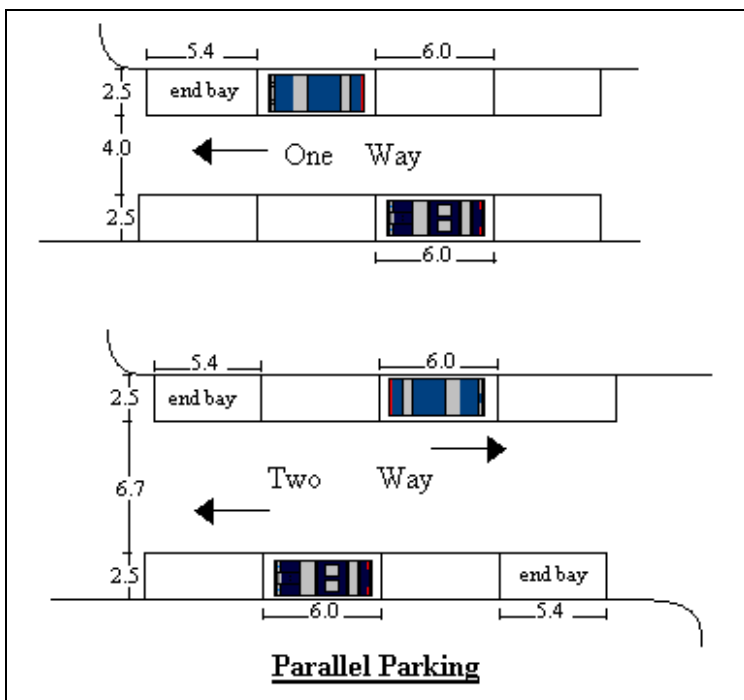
6.3 45 Degree Parking



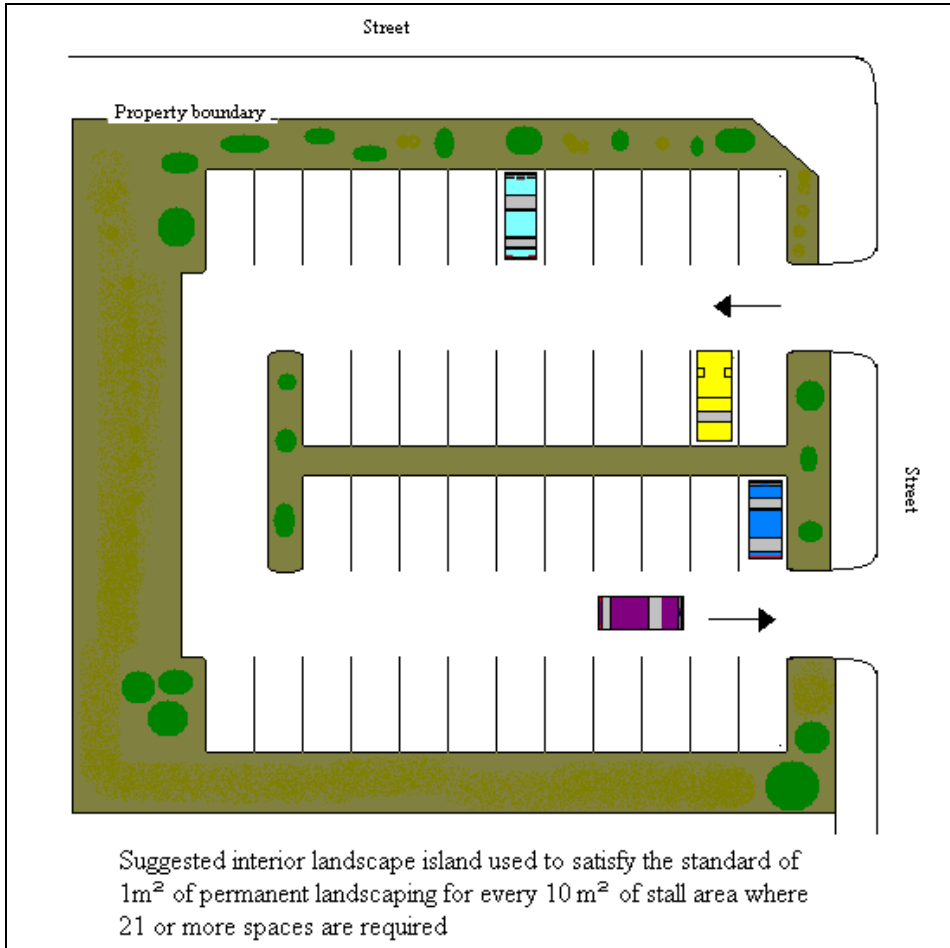
6.4 60 Degree Parking



6.5 Parallel Parking



6.6 Parking Landscaping





SECTION 7 – SUPERVISION

7. CONTROL & SUPERVISION OF CONSTRUCTION

7.1 Site Supervision

All subdivision works shall be designed and constructed in accordance with sound engineering principles and in compliance with the approved drawings and specifications.

If day to day site supervision is to be provided by the Consulting Engineer or Site Supervisor, the subdivider must pay to the Council an amount of 1.5% of the total cost of construction as estimated by the Council, to cover the costs incurred by the Council through activities such as officer attendance at site meetings/inspections etc. If day to day site supervision is not provided by the Consulting Engineer or Site Supervisor then the amount required is 3%.

Final approval for the works shall only be given when the whole of the works shown on the drawings of subdivision have been executed to the true intent and meaning of the approved drawings and specifications and to the satisfaction of the Council's Works and Services department.

7.2 Responsibility for Quality of Construction

Irrespective of any approvals given by the Council's Works and Services department, the Subdivider and his responsible agents (including where applicable the Consulting Engineer and/or the Contractor) shall remain fully responsible for the quality of the works. The inspections, checks and tests to be carried out by the Council's Works and Services department are not intended to be comprehensive or detailed and do not take the place of comprehensive superintendence of the works by the Subdivider's Consulting Engineer.

All subdivision works shall be subject to the provisions of AS 2990 'Quality Systems for Engineering and Construction Projects' and AS 3900 to 3904 'Quality Systems'. The quality assurance category to be adopted should be Category C generally with only critical aspects to be subject to Category B requirements. The Consultant shall ensure that all contract work complies with these provisions.

7.3 Schedule of Inspections

Inspections by the Council's Works and Services department shall be required at the following stages of construction. A minimum of 48 hours notice shall be given to by the Subdivider's Consultant:

Roads

- (a) When the road has been boxed out and the sub grade shaped and compacted;
- (b) After the sub-base has been placed, graded and compacted to shape and level;
- (c) When the base has been placed, graded, compacted and water bound to correct shape and level;

- (d) Before and during the priming operation;
- (e) During laying of concrete kerbing; and
- (f) Before and during the placement of asphalt or sprayed surface course.

Drains

- (a) When the trenches have been excavated and the pipes laid to true line and level;
- (b) When using sub-soil pipes, after the calibrated metal has been placed; and
- (c) After manholes, gullies and other structures have been built and backfilling of all trenches completed.

No second or follow up stage of construction shall proceed until approval has been given for the preceding stage.

Representatives of the Consultant and the Contractor shall be present at stage inspections if requested by the Council's Works and Services department.

7.4 Testing and as Constructed Surveys

All test results and as constructed surveys taken during the works, whether required under this part or not, shall be made available to the Council's Works and Services department. All materials and compaction tests shall be carried out by a NATA approved testing laboratory. All as constructed surveys shall be carried out by an independent licensed surveyor. Works which fail to meet specified criteria shall be corrected and re-tested or re-surveyed, as the case may be.

The following minimum tests shall be required:

- (a) Grading and testing of properties of representative samples of sub-base and basecourse materials prior to commencement of supply of those materials;
- (b) In situ density testing -
 - Embankment filling: 4 tests per 1 000m³
 - Sub-base & basecourse: 4 tests per 500m³

Additional density tests of foundation and sub grade to road pavements shall be taken at the Subdivider's cost when requested by the Council's Works and Services department.

The following minimum as constructed surveys shall be required:

- (a) After completion of sub grade preparation and prior to cartage of base courses, take levels at no greater than 20m intervals on the centreline and on both edges of pavement boxing. The as constructed information shall be presented in plan or tabular form showing the chainage, the design sub grade levels for each point, the as constructed levels and the difference between the two;
- (b) After completion of sub-basecourse construction and basecourse construction, and prior to surfacing (sealing), take levels at no greater than 20m intervals on

the centreline (at chainages to match sub grade levels) and on both edges of basecourse. The as constructed information shall be presented in plan or tabular form showing the chainage, the design basecourse levels for each point, the as constructed levels and the difference between the two; and

- (c) Pipe drain systems and open drains (not including table drains). Details shall include location and size of pipes and drains, length between ends (or centreline distances to pits etc), lid or cover levels where appropriate, and invert levels at ends. For open drains bottom widths, invert levels at no greater than 20m intervals and side slopes shall additionally be required.

7.5 Practical Completion

Any items of work found to require rectification at the time of the practical completion inspection, or at any time thereafter, shall be rectified before practical completion will be certified by the Council's Works and Services department.

When all subdivisional works are completed to the satisfaction of the Council's Works and Services department, the Consultant shall be notified of the practical completion date.

If at any time after the granting of practical completion the subdivisional work is found to be contrary to the Council's requirements, or is found to have been constructed in error to the approved drawings, specifications and any instructions which may have been issued by the Council's Works and Services department during the course of construction, then the works shall be rectified at no cost to the Council. Minor rectification items may be undertaken at the completion of the maintenance period.



SECTION 8 – MAINTENANCE AND SURVEY RELEASE

8. MAINTENANCE AND RELEASE

8.1 Survey Release

The Consultant shall satisfy the Council that the Subdivider has complied with all relevant conditions imposed by the WAPC pertaining to survey release of all or part of a constructed subdivision.

The conditions which the Subdivider must be comply with, prior to the Council's approval of survey release of a subdivision shall include, but shall not necessarily be limited to, the following:

- (a) Creation and location of all stormwater drainage easements;
- (b) Creation of any other easements (temporary or permanent) which are relevant to the subdivision;
- (c) Creation of all reserves (including drainage and recreation reserves) pertaining to the subdivisional works;
- (d) Payment of all moneys required to be paid to the Council in consideration of construction of footpaths, footways or any other works associated with the subdivision and which are to be carried out by the Council;
- (e) Payment of any maintenance retention money (or lodgement of bank guarantees) and payment of supervision fees required by the Council;
- (f) Stabilisation of topsoil, sand or other material or matter subject to movement over or near the subdivision shall be completed to the satisfaction of the Council's Works and Services department;
- (g) Completion of all roadworks and other works associated with the subdivision construction to the stage of practical completion; and
- (h) Such drawings shall be on a reproducible material, and show the location of all drains and services.

8.2 Maintenance

A 12 months defects liability period shall apply from the date of practical completion of the subdivisional works.

During the period the Subdivider and/or their responsible agents shall be responsible for rectification of any defects, whether they are construction or design defects, which may become apparent. The Subdivider or their responsible agents shall carry out rectification work within the time requested by the Council when notified of such defects.

If defects are not rectified within the time required by the Council then the Council may have the defects rectified at the Subdivider's expense. In this case the cost of the work shall become a debt due to the Council and the Council may draw on any retention money or bank guarantee being held, without reference to or approval from the Subdivider and without limiting its right to recover any balance of money due should the security be insufficient to cover the costs of the works.

Clearance of the subdivision by the Manager Works and Services shall be granted at such time as the subdivisional civil works are fully completed, all other relevant conditions set by the WAPC are satisfied, supervision fee (1.5% or 3%) paid, and the 7.5% retention bond is in place.

Clearance may also be granted to an uncompleted subdivision whereby bonds will be negotiated to cover the cost of the incomplete works or relevant conditions. This will be decided, at the discretion of the Manager Works and Services, on a case by case basis however generally bonds will only be permitted where the majority of the work or the majority of the relevant conditions set by the Planning Commission has been satisfied.

Bonds will be held until such time as the outstanding issues are completed to the satisfaction of the Manager Works and Services.

The amount of the bond will be determined based on the value of the work subject to the bond plus 20%.

Any defects rectified during the defects liability period shall be subject to a further 12 months defects liability period. During this further period the Council may, at its discretion, withhold the release of all or part of any security.

Retention money or bank guarantee shall only be released at the expiration of the defects liability period (or any further period) after satisfactory rectification of all defects.



SECTION 9 – MATERIAL SPECIFICATIONS

9. MATERIAL SPECIFICATIONS

9.1 Specification for Crushed Limestone

9.1.1 General

Crushed limestone shall be limestone obtained from an approved source and be crushed to comply with the grading in this specification.

The crushed limestone shall be free from:

- (a) Roots and other organic matter; and
- (b) sand, capstone and other deleterious material

9.1.2 Testing

Methods of sampling and testing of crushed limestone shall in accordance with the following Australian Standards:

AS1141-1974

AS1289-1977

9.1.3 Properties

The crushed limestone shall have a resistance to abrasion, when determined in accordance with the Los Angeles Test to show a weight loss not exceeding 60% by weight.

The Calcium Carbonate content of the crushed limestone shall not be less than 80% by weight.

9.1.4 Grading

The crushed limestone for sub-base shall comply with the following grading requirements.

<u>Sieve Size</u> <u>(Square Openings As Sieve)</u>	<u>Percentage Passing By Weight</u>
75 mm	100%
19mm	50-75%
2.36mm and less	30-50%

9.2 Specifications for Road Base

9.2.1 General

The road base material shall consist of a combination of soil binder, sand and gravel and shall conform to this specification. It shall be free of vegetable matter and lumps or balls of clay and shall not contain objectionable quantities of pyrites or other deleterious substances.

Coarse aggregate retained on a 2.36mm sieve shall consist of hard, durable particles or fragments of gravel; materials that break up when alternatively wetted and dried shall not be used.

Coarse aggregate shall have a percentage wear by the Los Angeles Abrasion Test of not more than 45.

Fine aggregate passing a 2.36mm sieve shall consist of natural or crushed sand and fine mineral particles passing the 0.075mm sieve.

The ratio of the portion passing the 0.075mm sieve to the portion passing 0.425mm sieve shall fall within the range 40-60%.

9.2.2 Properties

The portion of the sample which passes the 0.425mm sieve (Soil Mortar) shall conform to the following requirements when tested in accordance with AS1289-1977:

Plastic limit shall not exceed	20
Liquid limit shall not exceed	25
Plasticity Index shall not exceed	5
Linear Shrinkage shall not exceed	1%
Dry Compressive Strength shall not be less than	1.75MPa
Dust ratio shall not exceed	0.67

9.2.3 Grading

When tested in accordance with AS1289-1977, the grading of the gravel shall conform to the following requirements:

Sieve Size (Square Opening AS Sieve)	Percent by Weight Passing
19mm	95 – 100%
13mm	75 – 85%
9.5mm	65 – 75%
4.75mm	40 – 60%
2.36mm	30 – 50%
1.18mm	20 – 40%
0.425mm	10 – 30%
0.150mm	5 – 15%
0.075mm	2 – 10%

9.3 Specification for Sealing Aggregate

9.3.1 Aggregate

The aggregate shall be crushed diorite or granite consisting of clean, washed, tough, durable fragments free from an excess of thin or elongated pieces, free from soft or disintegrated pieces, stone coated with dirt, dust or other deleterious matter.

9.3.2 Particle Shape

The proportion of flat or elongated particles in any grading of coarse aggregate shall not exceed 20%. A flat particle is one having a ratio of width to thickness of greater than three and an elongated particle is one having a ration of length to width greater than three. There shall not be more than 2.5% of particles of greater length in any direction than twice the gauge, and there shall not be more than 20% of particles of greater dimensions in any direction than 25% in excess of the gauge.

9.3.3 Hardness

Wear – the aggregate shall have a Los Angeles abrasion value not exceeding 20% of wear for diorite and not exceeding 40% for granite.

9.3.4 Specific Gravity

The bulk specific gravity of the particles of diorite shall be not less than 2.90 (2.60 for granite).

9.3.5 Elongation Factor

The elongation factor which shall be defined as the ratio of the average long dimension to the average least dimension shall not exceed 2.75 for the sample.

9.3.6 Method of Sampling and Testing

The method of testing the road metal shall be in accordance with AS1141-1974.

9.3.7 Grading Requirements – (Percentage by Weight)

Size No.	1	2	3	4	5	6
NORMAL SIZE	25mm	20mm	14mm	10mm	5mm	3mm
Passing						
A.S.mm Sieve						
37.5	100					
26.5	80 -100					
19	0 – 20	100				
16	0 – 2	80 -100	100			
13.2		0 – 20	80 -100	100		
9.5		0 – 2	0 – 20	80 -100		
6.7			0 – 2	0 – 25	100	
4.75				0 – 2	80 -100	100
2.36					0 – 30	80 -100
1.18	0 – 0.5	0 – 0.5	0 – 0.5	0 – 0.5	0 – 0.5	0 – 30
600 micron						0 – 5

8.3.8 Average Least Dimension Requirements

SIZE NO.	1	2	3	4	5
Average Least Dimension	15 – 25	10 – 18	9 – 13	6 – 8	4 – 6

9.4 Specification for Asphalt (Bituminous Concrete)

9.4.1 General

All asphalt used in paving works shall comply with AS2734-1984.

9.4.2 Binder

The binder shall be Class 170 residual asphaltic bitumen complying with AS2008-1980.

9.4.3 Aggregate

The aggregate shall be granite and be in accordance with Appendix 'K' of AS2150-1978.

9.4.4 Characteristics of the Paving Mixture

The paving mixture for the surface course shall meet the following requirements by weight when determined by A.S. sieves. The residual binder, that is the residual asphaltic bitumen, shall be determined as a percentage by weight of the total mixture.

SIEVE SIZE	PERCENTAGE OF MINERAL AGGREGATE PASSING SIEVE (by weight)			
	AC5	AC7	AC10	AC14
19.0 mm	-	-	-	100
13.2 mm	-	-	100	85 – 100
9.50 mm	-	100	90 – 100	70 – 85
6.70 mm	100	80 – 100	70 – 90	62 – 75
4.75 mm	85 – 100	70 – 90	58 – 76	53 – 70
2.36 mm	55 – 75	45 – 60	40 – 58	35 – 52
1.18 mm	38 – 57	35 – 60	27 – 44	24 – 40
600 um	26 – 43	22 – 35	17 – 35	15 – 30
300 um	15 – 28	14 – 25	11 – 24	10 – 24
150 un	8 – 18	8 – 16	7 – 16	7 – 16
75 un	4 – 11	5 – 8	4 – 7	4 – 7
General limits of bitumen content	5.5 – 7.0	5.3 – 7.0	5.3 – 7.0	4.8 – 6.5

9.4.5 Marshall Properties

PROPERTY	MIX			
	AC5	AC7	AC10	AC14
Minimum Marshall Stability (50 blow)	5.0 kN	5.5 kN	6.5kN	6.5kN
Marshall flow (50 blow)	2 – 4 mm	2 – 4 mm	2 – 4 mm	2 – 4 mm
Voids Content	3 – 5%	3 – 5%	3 – 5%	3 – 5%
Bitumen Content	5.5 – 7.0%	5.3 – 7.0%	5.3 – 7.0%	4.8 – 6.5%