

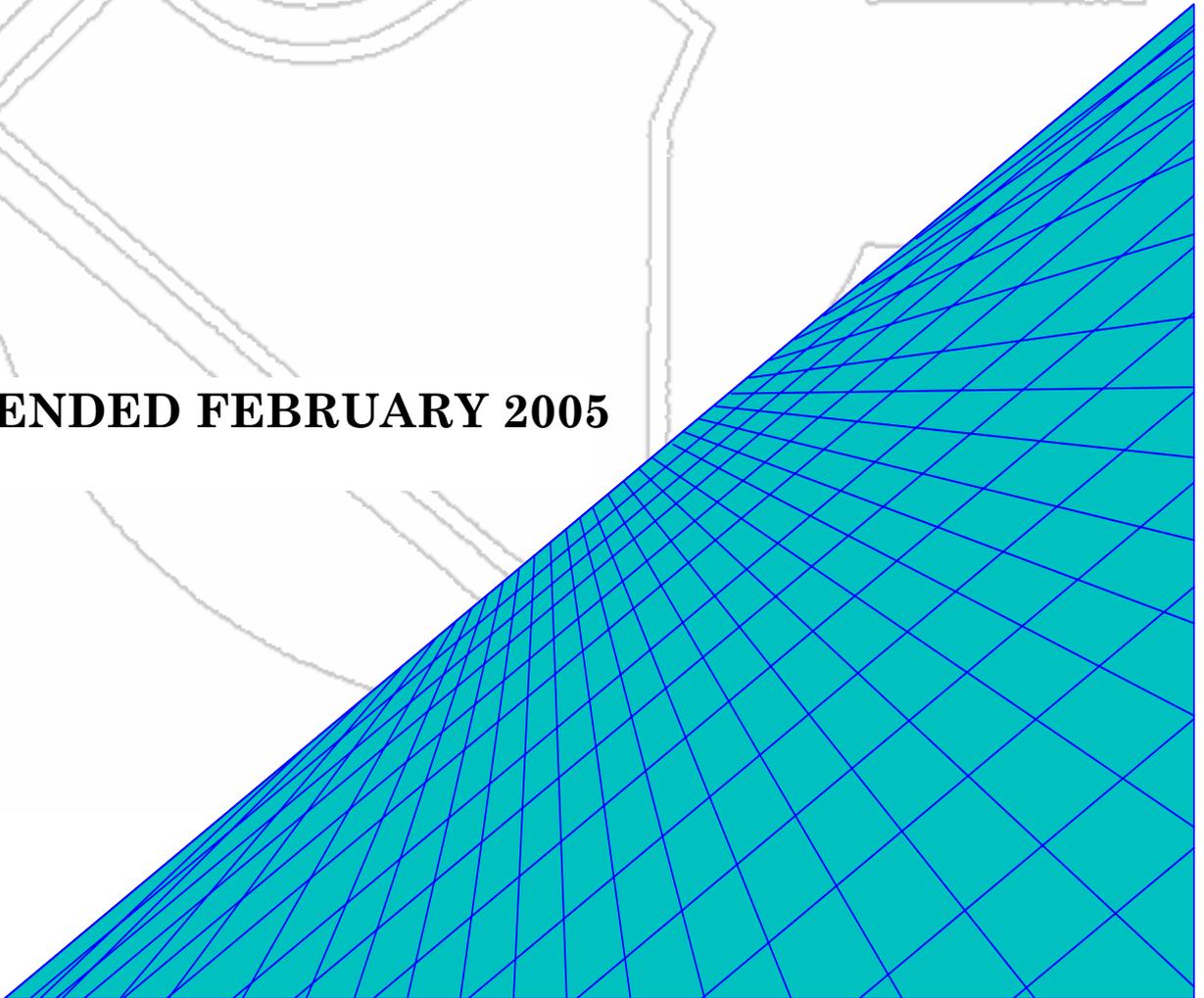


City of Canning

Engineering and Technical Services

STANDARD SPECIFICATIONS
For Subdivisional Development

AMENDED FEBRUARY 2005

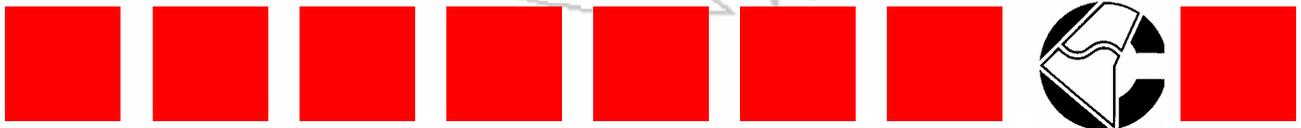


Design Criteria For Subdivisions

AMENDED – DECEMBER 2000

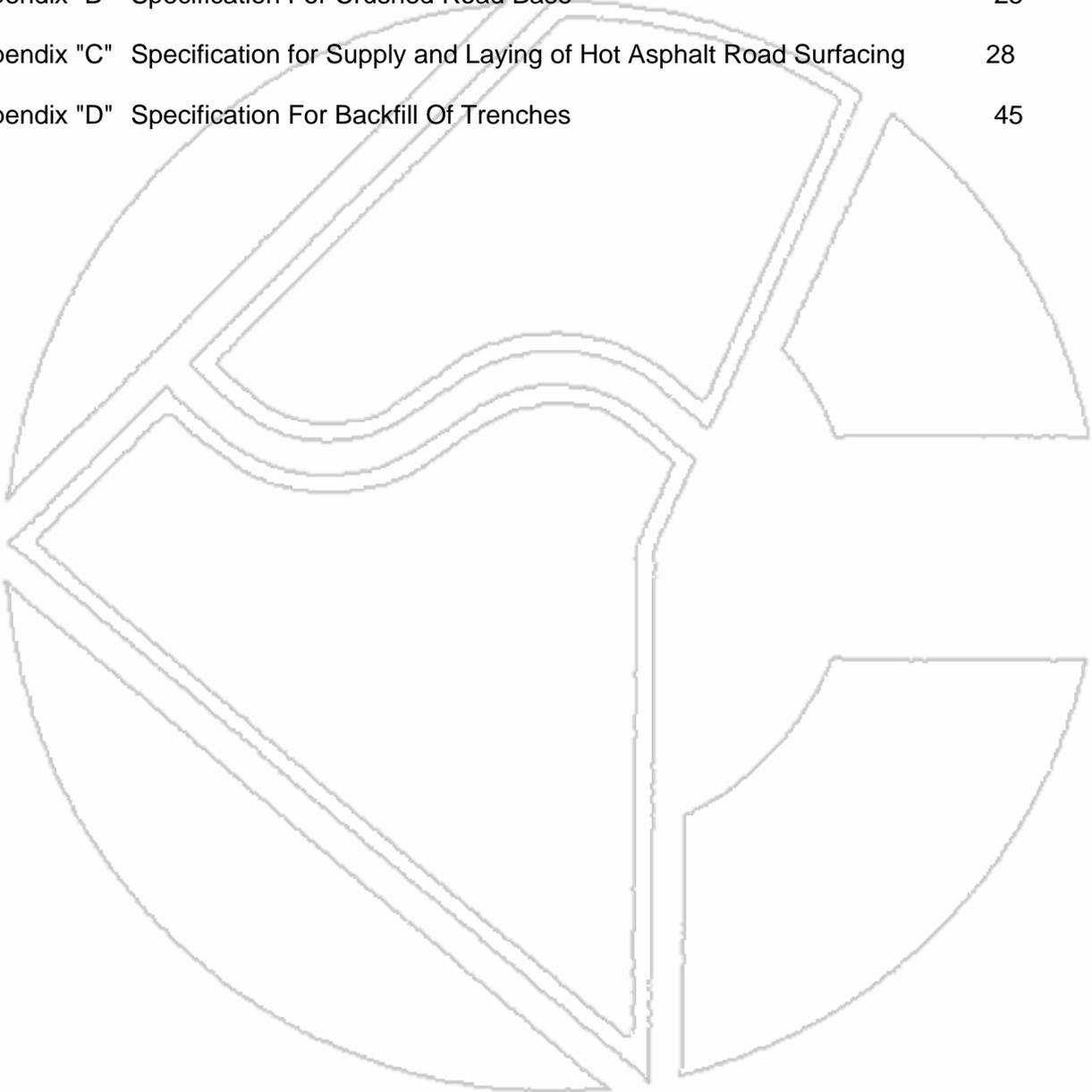
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1. GENERAL

- 1.1. This specification deals principally with materials and methods of construction and, should not be used as a basis for a contract for construction works. The specification shall be read in conjunction with the City of Canning Standard Construction Drawings.
- 1.2. It should be noted that a number of Australian Standards form parts of this document and must be referred to for details of materials, workmanship and construction procedures.
- 1.3. The word "Engineer" in this specification means and refers to the City of Canning's City Engineer or representative.
- 1.4. This document should not be considered a rigid specification, but a minimum standard required. It is expected the Consultant/Contractor shall take into account site conditions before and during construction and advise the Engineer of any variations to the specification that may optimize the final product.

1.5. Insurance

The Contractor shall be entirely responsible to arrange, take out and keep in operation all necessary insurance policies to totally indemnify and protect the Council against any and all claims for damages or other claims that may arise during the carrying out of the work.

1.6. Occupational, Health, Safety and Welfare

The Contractor shall abide by all the conditions of the Occupational, Health, Safety and Welfare Act 1984, the Amendment Act 1987 and the Regulations 1988. Special note should be taken of the noise limitations as outlined in the Noise Abatement Act. The entire responsibility shall remain solely with the Contractor to comply with the regulations and the Council shall not be held liable for any injuries due to noncompliance. However, the Engineer may direct the Contractor to comply with certain regulations and safety measures which he considers are not being met and the Contractor shall comply immediately.

1.7. Notification of Commencement

The Engineer must be advised two (2) working days before commencing any work and, after any cessation, one (1) day before recommencing any work.

1.8. Working Hours

No work outside 7.00 a.m. to 5.00 p.m. Monday to Friday is to be carried out without prior written approval of the Engineer.

1.9. Notice to Residents

Where works within the existing road reserve is to be constructed by a Contractor, or someone other than the City of Canning, approval to carry out such works must be obtained from the Engineer. If approval is granted, a written notice advising of the impending works and a contact person for any queries must be delivered to all adjoining or affected residents a minimum of 7 days prior to works commencing.

1.10. Use Of Vibratory Compaction Equipment

Extreme care should be taken in selection of suitable compaction equipment for use in built-up areas. Maximum size rollers will be governed by minimum safety distances which take into account drum module weight and soil conditions in particular. As a guide only, the minimum safety distance should be 2.5 times the drum module weight. The Contractor shall be responsible for any claims for damages resulting from the use of vibratory or other equipment. Further information can be obtained from the following reference:-

- * A.E. Tynan - Ground Vibrations, Damaging Effects to Buildings.
- Special Report No. 11 ARRB

1.11. Provision For Traffic

Throughout the duration of the work, the Contractor shall make provision for the use at all times of all existing streets, and private entrances by vehicular traffic.

1.12. Public Utility Services

All underground public utility services within the road reserve shall be installed prior to asphalt surface. All trenches shall be backfilled in accordance with the City's "Specification for Backfill of Trenches" Appendix E.

1.13. Soil Stabilization And Seeding

Where deemed necessary by the Engineer, the Contractor shall stabilise the disturbed soil on the site by either dry seeding or hydromulch. This will be done as soon as practicable after the topsoil has been satisfactorily replaced and regraded.

1.14. Australian Standards

The main Australian Standards which form part of this specification are:

- AS1289 - 1977 Methods of Testing Soil for Engineering Purposes.
- AS1160 - 1988 Bitumen Emulsions for Construction and Maintenance of Pavements.
- AS2734 - 1984 Asphalt (Hot Mixed) Paving
- Guide to Good Practice.
- AS2150 - 1995 Asphalt (Hot Mixed)
- AS1141 - 1974 Methods for Sampling and Testing of Aggregates

2. ROADWORKS

2.1 Clearing

Unless specifically approved by the Engineer, the complete road reserve shall be cleared of all scrub, trees and boulders and other rubbish. The clearing shall include the grubbing out of all stumps, tree roots and boulders to a depth of 600mm below the natural surface or 400mm below the finished surface of the subgrade, whichever is the greatest. Any holes left after grubbing shall be filled and compacted to the same density of the surrounding undisturbed soil.

Timber growing partly on the road reserve and partly on other property other than public open space, must be included in the clearing operations.

Material from clearing shall be removed from the site, mulched and removed from the site or mulched and stockpiled on the site for use in the landscaping in accordance with the approved landscaping plan. **No burning of cleared material is permitted.**

Prior to any earthworks, the contractor shall strip and stockpile topsoil from the areas of road construction and drainage excavations.

This topsoil shall be re-spread on the road verges on completion of the works.

2.2 Earthworks

Where required, the contractor shall cut or fill the road reserve to its full width in accordance with the levels on the approved plans.

Where filling is required, clean sand free from deleterious material and debris shall be placed in layers which shall be compacted to not less than 90% maximum dry density when tested in accordance with the appropriate test methods of AS.1289 (referred to as M.D.D.- AS.1289 for the remainder of this specification).

2.3 Subgrade

2.3.1 After 'boxing out' for the pavement area either in cut or fill, the subgrade shall be trimmed and compacted to conform to the profiles, grade and dimensions shown on the approved plans. The width of formation 'boxed out' shall be a minimum of 150mm behind the back of the kerb.

2.3.2 The subgrade shall be compacted to not less than 95% M.D.D. AS 1289 (Ref. Sec.2.10)

2.3.3 As-Constructed levels required by independent Licensed Surveyor.

2.3.4 The subgrade shall be approved by the Engineer prior to laying the sub-base material.

2.4 Sub-base

2.4.1 The sub-base shall be constructed of limestone conforming to the specification for crushed limestone in Appendix "A" and shall consist of a minimum compacted depth in accordance with the approved design plans.

2.4.2. The sub-base material shall be placed in one layer and in such a manner to ensure the sub-grade is not disturbed and an even thickness is obtained after compaction.

- 2.4.3. After placement, the sub-base shall be graded, watered and rolled until the correct shape and compaction is obtained. The moisture content during this operation shall be sufficient to attain 95% M.D.D.- AS.1289. The sub-base shall be finished to a smooth even surface to the levels shown on the approved plans.
- 2.4.4. Where limestone is to form a base for direct overlay of asphalt, the limestone shall be compacted to a minimum of 95% M.D.D. - AS.1289 and finished to the tolerances required for base course construction.
- 2.4.5. If subsequent testing (Ref. Sect.2.10) reveals that the above requirements have not been met, the sub-base shall be scarified, further material added where necessary and the above procedure repeated until these requirements are met.
- 2.4.6. The sub-base construction shall be approved by the Engineer prior to commencement of the placing of any base material.

2.5 Base

- 2.5.1. The road base shall be constructed of crushed rock base conforming to the specification for crushed rock base in Appendix "B" and shall consist of a minimum compacted depth in accordance with the approved design plans.
- 2.5.2. The base material shall be placed in one layer and in such a manner to ensure the sub-base material is not disturbed and an even thickness is obtained after compaction.
- 2.5.3. After placing, the base shall be graded, watered and rolled until the correct levels and compaction are obtained. The moisture content during this operation shall be sufficient to attain 97% M.D.D.- AS.1289, 98% M.D.D. for major roadways. The base surface shall be finished to a smooth even surface true to the design levels.

On completion of the base to 2.5.3 above, the surface shall be watered and rolled until a slurry finish has been obtained.

Any surplus slurry shall be broomed off and disposed of as directed.
- 2.5.4. If subsequent testing (Ref. Sect.2.10) reveals that the above requirements have not been met, the base shall be scarified, further material added where necessary and the above procedure repeated until these requirements are met.
- 2.5.5. Cart notes for the supply of the base material may be required for inspection by the Engineer.
- 2.5.6. As-Constructed levels required, by independent Licensed Surveyor, on finished surface.
- 2.5.7. The base construction shall be approved by the Engineer prior to arrangements being made for priming.

2.6 Priming/Primer Seal

The following Australian Standard forms part of this specification - AS.1160-1988 Bitumen Emulsions for Construction and Maintenance of Pavements.

- 2.6.1. Prior to preparation for priming, all utility services crossing beneath roadways are to be installed.
- 2.6.2. The surface of the base course to be primed shall be swept free from loose stones, dust, dirt and foreign matter in order to uncover but not to dislodge the stones in the compacted base course.
- 2.6.3. A mechanically operated rotary broom may be used for sweeping provided it does not disturb the stones in the surface and any additional sweeping necessary to obtain a satisfactory clean surface shall be done by hand using approved brooms.

The sweeping shall be completed as far as practicable immediately before the application of the primer and the surplus material shall be swept completely off the road.

- 2.6.4. Priming shall not be commenced until the surface has been prepared to the satisfaction of the Engineer and the weather conditions are suitable for the work. The Engineer may require that the surface to be primed, be damped with water before the application of the primer.

The primer shall generally be a rapid setting Cationic or Anionic Bitumen Emulsion of Class 170 bitumen manufactured in Western Australia and supplied and sprayed by the manufacturer. The choice of whether to use Cationic or Anionic bitumen will depend upon the type of aggregate to be used and the time of the year and should be discussed with the supplier and the Engineer. (Refer AS.1160-1988). Use of slower setting emulsion must be approved by the Engineer.

- 2.6.5. The primer shall be applied by an approved mechanical sprayer, which is the subject of a current test certificate issued by the Main Roads Department, certifying that it has been listed in accordance with the standards laid down by N.A.A.S.R.A for the "Testing of Mechanical Sprayers of Bituminous Materials". The certificate shall not be considered current if more than 12 months have elapsed since its issue.
- 2.6.6. Areas where, in the opinion of the Engineer, the direct use of the mechanical sprayer is impractical, may be sprayed by using a hand sprayer fed from the mechanical sprayer.
- 2.6.7. The application rate of the primer using bitumen emulsion shall vary according to the condition of the surface to be primed. Generally, the rate shall be around 1.4 litres/m², however, the rate should be decided in consultation with the supplier and the Engineer, following a site inspection. The cover material is to be spread as soon as practicable after application of the primer and all sprayed areas shall be completely covered within a period of 15 minutes.
- 2.6.8. The cover material shall consist of 7mm nominal size diorite or granite aggregate. In Rural Subdivisions, where a second seal coat may be applied, a Larger stone size will be required.
Details should be discussed with the Engineer.
- 2.6.9. The cover material shall have a maximum Los Angeles Abrasion Test percentage of not greater than 35%. The metal shall be clean, free from dust, foreign matter or organic matter and shall not contain an excess of thin or elongated pieces.

The Sieve analysis shall conform to the following for 7mm nominal size aggregate:

100% passing 9.50mm sieve
85 -100% passing 6.7mm sieve
0 - 25 % passing 2.36mm sieve
0 - 0.5 % passing 1.18mm sieve

2.6.10. The cover material shall be spread by means of an approved aggregate spreader attached to the body of the motor vehicle transporting the material. Such equipment shall be capable of spreading a uniform layer of aggregates. Rate of application of the aggregate shall be a maximum of 100 sq.m/tonne but shall provide a uniform cover of at least one stone thickness.

Additional aggregate shall be added by hand spreading to any bare or insufficiently covered areas as necessary to produce the required uniform cover.

2.6.11. Immediately after spreading of the cover material, the surface shall be rolled with a minimum 10 tonne pneumatic tyred roller until the aggregate is firmly embedded in the primer. During this operation, the material is to be constantly broomed to ensure that an even layer of material is equally spread and rolled hard.

2.7 Kerbing

2.7.1. All kerbing shall be cast in-situ concrete kerbing in accordance with the cross section and conforming to the line and levels of the pavement shown on the approved design plans.

2.7.2. All concrete shall be supplied by an approved firm in a ready mixed state and shall have a minimum compressive strength of 32 MPa at 28 days. It shall have the minimum slump to meet the requirements of the relevant kerb extrusion equipment and still provide the desired compressive strength. The maximum aggregate size is 10mm. The quality of all concrete used shall be in accordance with AS.3600-1990. All concrete shall have an approved high early strength additive to give rapid hardening.

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

2.7.4. Kerbing shall be extruded by means of an approved type machine true to line and level to the satisfaction of the Engineer.

The first 150mm of any new pour shall be cut away and removed, the gap between the old and new work shall be filled by hand placing, roding and shaping of the concrete until a satisfactory shape and finish has been obtained. Extruded kerbing shall be joined to existing kerbing in the same way.

2.7.5. Immediately after extrusion a slurry finish may be applied if required. The slurry shall consist of a sand-cement mixture in the ratio 2:1.

2.7.6. After application the surface shall be finished with hand trowels so as to eliminate all trowel marks.

2.7.7 Expansion Joints

Expansion joints shall be cut at 7.5m intervals. Such expansion joints shall be 10mm wide and cut through the kerb with an approved tool. Care must be taken to avoid any disturbance to the edges of the joint and any such disturbance must be made good immediately.

A 10mm thick foam packer shall be positioned in each expansion joint and a butyl mastic placed between the foam packer and all faces of the kerbing.

2.7.8 Contraction Joints

In conjunction with the expansion joints, contraction joints shall be made at intervals of 2.5m apart. Such contraction joints shall be 10mm wide and shall be formed by depressing an approved tool or device into the plastic concrete. Care must be taken to avoid any disturbance to the edges of the joint and any such disturbance must be made good immediately.

2.7.9 Curing

All exposed faces of the completed kerb shall be protected from moisture loss for a period of not less than 72 hours by covering with plastic sheeting or by spraying of an approved curing compound.

2.7.10 Keyed Kerbing

The kerbing shall be keyed or pinned in accordance with the approved plans for all kerbing in bends of radius 40 metres or less, or where directed by the Engineer.

Where keyed kerbing is required, excavation for the base key is to be by an approved method. Care is to be taken not to disturb the primed road surface beyond the line of the face of kerb.

Provision shall be made in the base key for extension of the expansion joint through the complete kerb section. Such provision may be made by installing a sand joint or other approved method.

The excavation for the base key shall be approved by the Engineer prior to placing of the concrete.

2.7.11 Backfilling

Backfill to kerbing shall be placed after the curing of the concrete and acceptance of the kerbing by the Engineer. The backfill material shall be a similar material to the locally occurring topsoil free from debris or clean filling sand and where kerbing is not keyed shall be compacted and levelled to the satisfaction of the Engineer.

2.7.12 Protection

The contractor shall take every care to protect the laid kerb from damage or defacing of any kind during subsequent works. This is particularly important during bitumen spraying and asphalt laying. In the event of damage or defacing occurring, the section or sections shall be removed and replaced at the Contractors expense.

2.7.13 Non Compliance

Any work not complying with the above specifications shall be removed and replaced at the Contractor's expense. 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.

2.8 Asphalt Surfacing

Asphalt surfacing shall conform with the City of Canning’s Specification for Supply and Laying of Hot Asphalt Road Surfacing attached as Appendix C.

2.9 Tolerances

2.9.1 Tolerances for pavement layer thickness, level and shape shall be in accordance with the table below:-

Table 1 - Pavement Tolerances

Component	Thickness	Tolerance (mm)	
		Level	Shape
Sub-Grade	-	+10	-
		-30	
Sub-Base	+15	+10	-
	-10	-20	
Base	+10	+10	10
	- 0	-10	
Asphalt Surface	+5	+10	5
	-0	-10	

2.9.2 Remedy For Thin Layers

Any road or measured area where the measured thickness falls below the specified tolerance shall where directed by the Engineer be overlaid at the expense of the Contractor with a wearing course of AC5 asphalt spread at a maximum thickness of 15mm.

2.9.3 Water Test

Where requested by the Engineer, the Contractor shall at his own expense undertake a "water test" to determine the pavement will adequately drain. The Contractor shall be responsible to undertake necessary works to remove any ponding which may be evident.

2.10 Testing

2.10.1 Density Testing

In situ density testing shall be carried out at random in locations determined by the Engineer. **ALL TESTS MUST PASS.** The Contractor shall be responsible for the following density tests under the contract:

- (a) Sub-grade 1 test per 100 m of road formation (Min 3 tests)
In sandy soils standard Perth Penetrometer Tests to be undertaken as directed by the Engineer.
- (b) Sub-base 1 test per 100 m of road formation (Min. 3 tests)
- (c) Base 1 test per 100 m of road formation.(Min. 3 tests)
- (d) Asphalt A laboratory compacted density shall be determined from a sample of the mix taken prior to laying.

(Min. 3 core tests per nominated quantity of work) Where the results indicate non-compliance with the specification, a further 3 core tests will be required.

Testing shall be carried out and certified by an approved NATA registered testing laboratory. Certified test results shall be submitted to the Engineer prior to the next stage of works.

In respect to the sub-grade, the in-situ density test should also provide the basis for a direct calibration between relative density and the number of blows per 300 mm of the standard Perth Penetrometer to achieve a **95% confidence level**. This shall then be used by the Contractor for the entire compaction of the sub-grade.

2.10.2 Material Testing

Where directed by the Engineer, the Contractor shall allow for the testing of all material used in the construction of the road to determine if the material conforms with the specifications of Appendix "A" and "B" of this document. Certified test results from an approved NATA registered testing laboratory shall be submitted to the Engineer prior to priming. For this reason sufficient limestone and rockbase material shall be kept by the contractor in suitably labelled soil bags for testing.

2.10.3 Test Results

Priming shall not commence until the test results have shown that the tested portion of the work has been constructed in accordance with all requirements.

2.10.4 Re-Testing Of Unsatisfactory Portions

Unsatisfactory portions revealed by testing shall be remedied to the Engineer's approval followed by re-testing until the work is fully satisfactory to the Engineer.

2.11 Street Name Plates

- 2.11.1 The Contractor shall erect all street name plates, which in the opinion of the Engineer are necessary due to the subdivision of the land, where designated by the Engineer.
- 2.11.2 Name plates shall be fully reflectorized with lettering to match British standard - Claret - R55 on white background with City of Canning logo placed after the road abbreviation, mounted on extruded aluminium of an approved manufacture and design. Nameplates shall be a minimum 150mm high on all streets except those intersecting with a major road where the nameplates shall be a minimum 200mm high.
- 2.11.3 The sign or signs shall be mounted at a height of 2.6m clear of the ground and fixed to a 50mm diameter galvanised post. Posts shall be concreted in position to a minimum depth of 0.5m.



3. STORMWATER DRAINAGE

3.1 General

The drainage shall be constructed in accordance with the approved design plans and profiles and any variation from these must be approved by the Engineer. The completed drainage network shall be surveyed by a Licensed Surveyor and "as constructed" drawings supplied to the Engineer.

3.2 Pipes

Pipes shall be precast concrete conforming to AS.1342-1973, and be of a spigot and socket Rubber Ring Joint type Class 2, unless otherwise approved by the Engineer.

Subsoil pipes shall be PVC, stormwater class HD manufactured in accordance with AS.1254 unless otherwise approved by the Engineer.

3.3 Excavation

The trenches shall be excavated to the line and levels as shown on the drawings or such other lines and levels as the Engineer may direct. Where no invert levels have been determined, the minimum depth to overt of 225mm diameter pipes at road crossings shall be 600mm below the channel level of the road. No pipes shall be laid on filled ground until such ground has been compacted to a minimum of 95% M.D.D. - AS.1289.

3.4 Dewatering

Irrespective of the sources of water all excavations shall be kept dry during the entire excavation process by approved dewatering methods, and in accordance with good engineering practices and proper construction procedures. The dry condition shall be maintained continuously under all conditions including the following:-

- (a) Until all testing of any section has been successfully completed and approval is given.
- (b) The items of work placed in the trench are able to withstand the effects of water.
- (c) Backfilling and compaction to a minimum of 600mm above the normal water table level has been completed.
- (d) Sufficient backfill has been placed to prevent flotation of the pipeline.

Application of the conditions and cessation of dewatering shall be subject to the Engineer's approval. In the context of this clause the term "dry" shall not preclude the presence of dampness contained in the earth as distinct from "free water" being present. Disposal water shall not be discharged on any land without the land owner's permission, nor shall any water be discharged into stormwater drains without the permission of the relevant authority. Any water discharged to a stormwater drain shall pass through a settling tank prior to discharge. Any damage caused by the disposal of water shall be rectified at the Contractor's expense.

3.5 Blasting - Use Of Explosives

No blasting shall be carried out without the Engineer's written approval. When approved all blasting operations shall be carried out in accordance with the following:-

- (a) W.A. Mines Regulation Act
- (b) W.A. Explosives and Dangerous Goods Act
- (c) AS 2188 "Magazines for Storage of Explosives"
- (d) AS 2187 "SAA Explosives Code"

All blasting and handling of explosives shall be at the Contractor's sole risk in every respect.

3.6 Unsuitable Soil

If suitable bearing soil is not reached at the depths shown on the drawings, the Contractor shall advise the Engineer without delay. The Engineer shall direct the action to be taken according to the conditions and no material shall be placed on the exposed sub-grade or any work be commenced without the Engineer's approval. Suitable bearing soil is a sandy material conforming to the specification for Sand Fill Material. (Refer 3.11.1).

3.7 Unauthorised Excavations

Excavations taken to a greater depth or width than reasonably necessary with regard to the requirements shown on the drawings or authorised by the Engineer, shall be backfilled and compacted to the correct profile as specified with sand fill material. In critical areas and where so directed by the Engineer, over-excavated parts shall be filled with 25mm "all in" crushed metal to the correct profile.

3.8 Maintaining Excavations

Excavations shall be kept free of all loose material and water until concrete has attained its initial set and/or all other work within the relevant excavations is properly completed. Unless otherwise specified, all excavations shall be secured by necessary means including timbering, planking and strutting, shoring and bracing, sheet piling, battering the sides to safe slopes or any other methods needed to maintain the excavation safe.

3.9 Planking And Strutting, Definition And Requirements

Unless specified otherwise the term "planking and strutting" shall be deemed to cover whatever methods and systems the Contractor adopts to support the sides of the excavations and prevent the ingress of groundwater, run-off water or any other water and to prevent foreign materials from falling into freshly placed concrete. Where applicable, the methods adopted by the Contractor shall also be designed to effectively and adequately support adjacent buildings, structures, paving, other excavations and/or any other items which are likely to be affected by the works. All planking and strutting shall be removed when no longer required unless directions are given to the contrary by the Engineer.

3.10 Trench Dimensions

The bottom levels of the trench shall be to the maximum possible reduced level and minimum width to allow for Type 'U' bedding as specified in AS3725-1989 and AS3725 Supplement 1-1989. The width of the trench at the top of the pipe shall be the minimum to allow safe pipe laying operations.

3.11 Bedding Of Pipes

3.11.1 Bedding In Dry Conditions

Pipes laid in dry conditions shall be bedded on a minimum thickness of 200mm of sand bedding material extending 100mm either side of the pipe diameter (D) and 0.25 D up each side of the pipe.

Material shall be naturally occurring or borrowed sandy material having hard uncoated grains and shall be free from stones larger than 8mm in size and free from any clay or organic or other deleterious matter. Not less than 35 per cent by weight shall pass a 4.75mm sieve. Not more than 15 per cent by weight shall pass a 75 micron sieve. The plasticity index of the material passing a 435 micron sieve shall not exceed 8.

3.11.2 Bedding In Wet Conditions

Pipes laid in wet conditions shall be laid on a 25 mm "all in" crushed metal bedding of sufficient thickness to stabilise the conditions. Bedding shall be for the full width of the bottom of the trench.

3.11.3 Bedding - General

In either case the bedding material shall be shaped to suit the barrel of the pipe to give full support to the length of the pipe. Bedding shall be tamped into position up the sides of the pipe to give full support to the diameter of the pipe. At collars, the bedding material shall be scooped out to allow jointing to be carried out and the pipe shall not rest on the pipe collars.

3.11.4 Plates And Wedges

Plates and Wedges may be used as an aid to pipe laying but shall not be used in sections of pipe under the road carriageway.

3.12 Pipe Jointing

Pipes shall be jointed by means of the rubber ring supplied by the pipe manufacturer. The joints shall be made with the rubber ring evenly distributed around the circumference of the pipe and be firmly and securely positioned between the spigot and socket of adjoining pipes. No pipe with damaged ends shall be used without the prior approval of the Engineer and any remedial action directed because of such damage shall be carried out as required.

3.13 Sub-Soil Drains

- 3.13.1 Sub-soil drains shall consist of slotted pipes screened by metal placed within a geotextile wrapping as described hereafter.
- 3.13.2 Sub soil pipes shall have 300 mm long by 5 mm slots cut through the pipe on alternate sides, separated by one third the circumference, with a combined length of approximately half that of the pipe.
- 3.13.3 Pipes shall be laid with the slots on either side of the centre line of the pipe and evenly placed about the centre line. Pipes shall always be laid with the slots in the lower half.
- 3.13.4 Pipes shall be screened, by calibrated metal, to the following composition:
- | | |
|------------|---------|
| 14mm metal | 33-1/3% |
| 10mm metal | 33-1/3% |
| 5mm metal | 33-1/3% |
- 3.13.5 Screening shall be a minimum thickness of 50mm under the pipe, 150mm on each side of the pipe and 50mm over the top of the pipe.
- 3.13.6 The geotextile membrane shall be a non woven, thematically bonded wrapping with a minimum flow rate of 50 l/ m²/ sec and a minimum 200 mm overlap at all joints.

3.14 Backfilling Of Trenches

- 3.14.1 The first section of trench to a height of 300mm above the top of the pipe shall be backfilled with naturally occurring or borrowed sandy material having hard, uncoated grains and shall be free from stones larger than 25mm in size and free from any clay or organic or other deleterious matter. Not less than 35 per cent by weight, shall pass a 75 micron sieve. The plasticity index of the material passing a 425 micron sieve shall not exceed 8. Backfilling shall be undertaken in a minimum of 2 layers, the first being to a maximum level of the centre of the pipe and the second to a maximum of 300mm above the pipe. Back-fill and sand bedding shall be compacted to conform to a Standard Perth Penetrometer reading of not less than 11 blows per 300mm penetration.
- 3.14.2 The remainder of the trench may be backfilled with general fill material excavated from the trench previously, provided that it is free from stone over 50mm diameter and/or clay, organic or other deleterious matter. In trenches under road carriageway fill material shall conform to that specified in 3.14.1. The trench shall be compacted in layers suitable to the compaction equipment available to a density at least equal to the density of the adjacent undisturbed soil or to no less than the following minimum Standard Perth Penetrometer reading.

Under road carriageway and trafficable areas: 11 blows per 300mm penetration.

Road reserve verge: 8 blows per 300mm penetration.

Elsewhere : 5 blows per 300mm penetration

3.15 Manholes And Gullies

- 3.15.1 Manholes and Gullies shall be constructed in accordance with the Standard Drawings.
- 3.15.2 Manholes may be constructed of brick, precast concrete manhole liners or a combination of bricks and precast concrete manhole liners constructed to the requirements of AS.1342. Manhole liners shall be sized in accordance with City of Canning Standard Drawing C1631.
- 3.15.3 Manholes of a depth greater than 1.0 m from underside of cover to the lowest invert shall be fitted with approved step irons.
- 3.15.4 Manholes in areas subject to traffic shall be fitted with a 600mm square medium duty gatic cover and those in non traffic areas to a 600mm square reinforced concrete cover in accordance with the standard drawings.
- 3.15.3. Gullies may be constructed of brick, precast concrete liners or precast concrete sections of approved manufacture. Unless otherwise agreed, gullies shall be side entry type with a 900 x 450 cover as per the Standard Drawings.
- 3.15.4. All downstream gullies to be trapped prior to connection to manhole.
- 3.15.5. Manholes constructed within the road carriageway shall be constructed with a minimum of four courses of brickwork immediately under the frame of the cover.
- 3.15.6. The bedding of manhole bases shall be subject to the same general conditions as the adjacent pipes, except in the case of manholes in areas of clay or peat. The Engineer may direct that manhole bases be piled. Piling details are as shown on standard drawings.
- 3.15.7. No manhole is to be constructed around another service without prior approval of the Engineer and the approval in writing of the authority responsible for the service in question.

3.15.10 Concrete

- (a) Concrete used for in-situ work shall conform to AS 3600-1988 and be provided by a pre-mix concrete supplier conforming with AS 1379 - 1973 or mixed on site, using materials as specified and plant to the approval of the Engineer.
- (b) Concrete for manholes, headwalls, endwalls and keels shall have a minimum compressive strength of 20 MPa.
- (c) The slump shall not exceed 70mm or be less than 30mm.
- (d) Maximum size of aggregate shall be 20mm.

3.15.11 Cement

- (a) All cement used shall be Portland Cement or Type "A" in accordance with AS 1315-1982 and obtained from an approved manufacturer.
- (b) Cement shall be delivered to the site fresh and in sealed bags and stored in a weatherproof shed until it is used. Any bag showing sign of deterioration or setting is to be rejected.

3.15.12 Aggregate

- (a) Fine aggregate shall be well graded, clean, sharp and free from clay and organic impurities in accordance with AS1141 - 1974.
- (b) Coarse aggregate shall be crushed granite or diorite clean and free from all impurities and dust in accordance with AS 1141 - 1974.
- (c) The maximum particle size shall not exceed 20mm.

3.15.13 Water

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

3.15.14 Sand

- (a) Sand for mortar will be crushed stone or natural and free from all deleterious substances and have a uniform grading.
- (b) Sand for bedding or back filling shall be clean sand free from roots, clay or any deleterious matter.

3.15.15 Bricks

Bricks shall be approved manufacture and of standard size complying with AS 1225. All bricks shall be smooth face, best quality, sound, hard, well burned, matched for sizes, true to shape and dimensions with sharp arises.

3.15.16 Mortar

Mortar shall be mixed from 1 part cement and 3 parts sand.

3.15.17 Steel

- (a) Steel reinforcing fabric and steel reinforcing bars for concrete shall comply with the requirements of AS 1302-1973, AS1303 - 1973 and AS 1304 - 1973 and be free from loose rust or matter likely to impair the bond with concrete.
- (b) Structural steel shall comply with the requirements of AS 1250 1984.

- 3.15.18 Metal Covers, Frames and Miscellaneous Steel Items Manhole and gully grates and frames shall be manufactured of mild steel plates and sections conforming with the requirements for Grade 250 of AS 3678 and AS 1131.

Gatic manhole covers to be used in carriageways shall be SC cast iron in accordance with AS 1830 - 1976.

Miscellaneous steel details for manholes and gullies including step irons, keyholes and hoods as shown in the drawings, shall be manufactured from mild steel conforming to AS3678, AS3679 and AS1302 and hot dipped galvanised conforming to the requirements of AS 1214 except that the zinc coating shall weigh not less than 600 grams per square metre of actual surface area.

3.16 Inspection

- 3.16.1 The following stages of works shall be inspected by the Engineer prior to works on the next stage proceeding. Should any section be covered before inspection the Engineer may instruct the Contractor to expose the section so covered for inspection.

- (1) Bedding of all pipes to 0.25 D.
- (2) Placement of metal screening around sub-soil drain.
- (3) Back fill to 300mm above pipes.
- (4) Where trench depth exceeds 3 metres at 1.5m above top of pipe.

3.17 Testing Of Compaction

The Engineer shall test the various stages of backfill to determine if it conforms with the standards set in Section 3.14.2. Should the results of the Engineer's tests show substandard compaction, then further testing may be directed by the Engineer to determine the extent of substandard compaction. Once defined the Engineer may direct the Contractor to take any steps necessary including re-excavation to achieve the required standards.

All such testing and remedial works will be at the Contractor's expense.

3.18 Backfill Of Road Crossings

Where a trench crosses an existing road, the trench shall be back filled and compacted in accordance with the City's "Specification for Backfill of Trenches" Appendix D.

3.19 Reinstatement Of Verges And Parklands

Where a trench is excavated in an existing verge or parklands, the Contractor shall be responsible to reinstate the verge or parkland to levels existing prior to the excavation and to replant with grass, trees and shrubs where applicable to return the area to as near as possible the original condition.

3.20 Reinstatement Of Crossovers/Footpaths

Any existing crossovers/footpaths damaged as a result of any works shall be reinstated by the City to the satisfaction of the Engineer at the Contractor's expense.

3.21 Connection To Existing Council Drain

Where a drain is to be connected to an existing Council drain, the connection will be made by the Council at the Developer's cost.

3.22 Connection To WAWA Drain

Prior to commencement of work to connect any drain to any existing drain under the control of the Water Authority of Western Australia, the Contractor shall make application for, pay any fees required and receive the approval of that Authority for such work.

3.23 Piling And Keeling

Where piling and keeling is shown on the approved plans, it shall be in accordance with the Standard Drawings.

4. **PATHS**

4.1 General

Where dual use paths are to be constructed through Public Open Space the works shall be constructed in accordance with the Drawings and this Specification and will be subject to inspection and the approval of the Engineer.

Any instructions from the Engineer pertaining to the Works shall be issued by that Engineer to the Superintendent. The extent of paths to be constructed is shown on the Drawings.

Paths shall not be constructed until after all drainage and earthworks have been completed.

4.2 Clearing

The path alignment shall be cleared for the width of the path reserve. Only trees specifically nominated by the Principal or the Superintendent shall be retained. The clearing shall consist of removal of all trees standing or fallen, and other vegetation, boulders and rubbish, and shall include the grubbing out of all stumps, tree roots and boulders to a depth of 600mm below the natural surface or 400mm below finished surface of the subgrade, whichever is the lower and disposing of all spoils resulting from the clearing and grubbing. Any holes left after grubbing shall be filled and compacted to the same density as that of the surrounding undisturbed soil.

As little as possible of the surface soil shall be removed during clearing operations and precautions shall be taken to avoid damage to growing trees and shrubs, fences and other improvements outside the designated areas.

The spoils of all clearing and grubbing operations shall be removed from the site. Combustible spoils may be burnt on site in strict conformity with the Bush Fires Act. No spoils of clearing and grubbing shall be pushed beyond the limits of the site.

4.3 Subgrade

The entire width of the path reserve shall be cut or filled as necessary. After excavation or filling, compaction, trimming and boxing out, the finished surface of the footpath subgrade shall conform to the shape and dimensions shown on the Drawings.

Subgrade is to be compacted to not less than 95% of the maximum dry density obtained in modified maximum dry density compaction tests (AS 1289.E2.1-1977) to a minimum depth below the surface of 300mm.

All filling shall be placed in generally horizontal layers not exceeding 250mm and compacted prior to the placing of further material.

The subgrade is to be thoroughly moistened, made smooth and be to the given line required. Compaction to level will be generally taken as 100mm below the designated finished level of the land or natural surface if undisturbed by the works unless otherwise specified by the Local Authority or Superintendent. The work is to be inspected by the Engineer prior to any concrete being placed.

4.4 Cast Insitu Concrete Paths

4.4.1 Dimensions

The dual use paths shall be constructed with a crossfall of 2% towards the centre of the POS area. The finished thickness of the slab to be a minimum of 100mm. The width of the path shall be 2.0m unless otherwise noted in the Contract Drawings or instructed formally by the Engineer.

4.4.2 Construction

The path shall be placed on the prepared subgrade that shall be screeded to profile and crossfall to provide the finished slab thickness.

The path longitudinal profile will be such as to achieve a uniform grading and generally conform to the surrounding finished ground or as shown on the drawings.

No concrete shall be poured until the Engineer has approved the sand bedding.

4.4.3 Forming

Forms shall be of such cross section and strength and so secured as to resist the pressure of the concrete when placed and the impact and vibration of any equipment which they support, without springing or settlement. The method of connection between sections shall be such that the joints shall not move in any direction. The maximum deviation of the top surface in cross section shall not exceed 4mm in 3m or the inside face not more than 6mm in 3m longitudinally.

The form, when set, will be uniformly supported for its entire length at the specified elevation. The supply of forms shall be sufficient to permit their remaining in place for at least 12 hours after the concrete has been placed. All forms shall be cleaned and oiled each time they are used.

The contractor shall check and correct alignment and grade elevations of the forms immediately before placing the concrete. When the form has been disturbed or any grade has become unstable the form shall be reset and rechecked.

- 4.4.4 The concrete used in this construction shall conform to AS 3600-1988 and be provided by an approved pre-mixed concrete supplier, conforming with AS 1379. Each batch provided shall be supported with evidence of strength slump, aggregate size, etc.

Concrete compressive strength at 28 days shall be 20 MPa (residential) and 32 MPa (commercial/industrial).

The maximum aggregate size shall be 14mm.

The slump shall not be less than 80mm or exceed 100mm.

No admixtures shall be used in the concrete unless specifically approved by the Engineer. The concrete, when placed, must be well tamped to remove all voids and to work fines to the surface for trowelling.

4.4.5 Placing And Finishing

4.4.5.1 General

The concrete shall be deposited on the subgrade in such a manner as to require as little additional handling as possible.

The subgrade shall be thoroughly moistened but not saturated immediately before concrete placement begins.

Any necessary hand spreading shall be done with shovels not rakes.

Concrete shall be thoroughly compacted against the faces of forms and along the full length of the footpath by vibration or hand tampering where approved by the Engineer.

4.4.5.2 Strike Off, Consolidation And Finishing

The pavement shall be struck off and consolidated with a mechanical finishing machine, vibrating screed or by hand finishing methods when approved by the Engineer. A slipform paver may be used.

Compaction of concrete shall be achieved by mechanical means unless the Engineer approves the use of hand-finishing methods. Mechanical means of compaction must have the capacity to effectively vibrate and compact the full thickness of the path.

The addition of water to the surface of the concrete to assist in finishing operations may be allowed in hot weather conditions. If permitted such water shall be applied as a fog spray.

After the pavement has been struck off and consolidated, it shall be scraped with a screed board to sufficient length to span between side forms. The screed board shall be operated perpendicular to the centre line of the footpath and shall be moved forward one half its length after each pass. Surface Irregularities shall be corrected by adding or removing concrete. All disturbed places shall again be straightened.

Final finishing shall not be commenced until bleed water has disappeared from the surface.

A dry cement shake shall not be used to absorb bleed water.

The final finish shall be deep broom finish (approximately 2mm deep). Edges to be polished smooth for 80mm width and carefully finished with an edger of radius 10mm or that approved by the Engineer.

The path shall be protected with polythene film for 24 hours after completion if rainfall during this period is apparent.

4.4.6 Joints

4.4.6.1 Contraction Joints

Contraction "joints" shall be provided every 5m. These shall be 10mm in depth and placed at right angles to the centre line of the path or as directed by the Superintendent. Formed grooves shall be made by depressing an approved tool or device into the plastic concrete. The edges of the joints shall be neatly defined with a joining tool and smooth trowel finished for 50mm either side of the joint. Lock Joint or similar product is to be used in place of formed grooves when requested.

4.4.6.2 Transverse Expansion Joints

Expansion joints - 10mm wide shall be constructed at 15m intervals or as shown on the Drawings for the full depth of the slab. The expansion joint filler shall be continuous from form to form and extend the full depth of the slab. The jointing material shall be approved closed cell polythene foam or similar approved material. The filler shall at no point protrude above the surface of the path. An expansion joint shall be installed where the pathway butts each edge of driveways and, public utility service manholes.

The expansion joints shall be marked out with an edging tool to match the appearance of the contraction joints.

4.4.6.3 Construction Joints

Construction joints shall coincide with contracting joints or expansion joints. Construction joints in mid-slab will NOT be accepted.

4.4.7 Curing

After initial set, concrete surfaces shall be protected against loss of moisture and allowed to cure for a minimum period of two (2) days by one of the following methods:-

- a) Treat with a sprayed application of approved membrane (i.e. Calcrete "CR" or equivalent), applied at the rate and by the method specified by the manufacturer, within two hours of surface finishing of the concrete.
- b) Covering the works with approved polythene membrane, carefully placed to preserve the concrete finish and securely fastened in position.

or as directed by the Superintending Officer.

4.4.8 Protection

Barricade, warning signs and lights shall be erected to prevent damage of the footpath from vehicles and pedestrians for not less than 24 hours after completion.

4.4.9 Clean Up And Backfilling

All cement droppings, slurry, etc. and surplus materials to be removed from site.

All formwork, pegs, stakes, etc. shall be removed after the curing of the path has been completed and approved by the Engineer.

After removal of the formwork, and acceptance of the path by the Engineer, the path shall be backfilled with clean sand. Backfilling shall be compacted to not less than 90% of the maximum dry density obtained in modified maximum dry density compaction tests (AS. 1289.E2.1-1977) and shaped level with the top of path.

5. PRACTICAL COMPLETION

Prior to the "Practical Completion Inspection" the Contractor shall ensure that:

- i) The road and drainage works are completed in accordance with the approved design plans.
- ii) The verge is levelled.
- iii) Where requested the stabilisation of disturbed soil has been completed.
- iv) All gullies and drainage lines are free of debris and construction material.
- v) The road has been swept clean.
- vi) The subdivision has been left in a clean and tidy condition.



APPENDIX "A"

SPECIFICATION FOR CRUSHED LIMESTONE

1. MATERIALS

- 1.1 The limestone shall be obtained from an approved source and crushed to conform with the following requirements.
- 1.2 The crushed limestone shall be free of sand, capstone, roots, and other deleterious material.
- 1.3 Methods of sampling and testing of crushed limestone shall be in accordance with the following Australian Standards:

AS 1141 - 1974 Methods of sampling and testing Aggregates
AS 1289 - 1977 Methods of testing soils for Engineering purposes.
- 1.4 The crushed limestone shall have a LOS ANGELES abrasion value of not more than 60 or less than 20 per cent.
- 1.5 The calcium carbonate content shall be not less than 60% by weight.
- 1.6 The crushed limestone shall conform to the following grading requirements.

<u>AS Sieve</u>	<u>% By Weight Passing</u>
76 mm	100
19 mm	60 - 80
2.36 mm	20 - 40

2. CONDITIONS

- 2.1 All limestone shall be subject to inspection by the Engineer or his representative who reserve the right to reject the whole or any part of a consignment, which, in the opinion of the Engineer, does not comply with the specifications. Any material rejected shall immediately be removed and no liability for payment in any manner whatsoever will be accepted by the Council for such rejected consignment.
- 2.2 Measurement of quantities shall be by Registered Public Weighbridge dockets and one copy of such dockets shall be supplied with each load to the Council Officer receiving the material.

APPENDIX "B"

SPECIFICATION FOR CRUSHED ROCK BASE

1. MATERIALS

1.1 All crushed rock base shall be suitable granite quarried from an approved source only. The crushed rock base shall consist of a uniformly blended mixture of coarse and fine aggregate complying with the following requirements.

1.1.1 Coarse Aggregate (retained 4.75 mm sieve)

Shall consist of clean, hard, durable, angular fragments of rock produced by crushing sound unweathered rock and shall not include materials which break up when alternately wetted and dried.

1.1.2 Fine Aggregate (passing 4.75 mm sieve)

Shall consist of crushed rock fragments or a mixture of crushed rock fragments with natural sand. Crushed rock fine aggregate from each source shall, except as to size, comply with all the provisions specified for coarse aggregate.

1.1.3 Mixture Of Fine And Coarse Aggregate

The mixture of fine and coarse aggregate shall be free from vegetable matter, lumps of clay, overburden, or any other deleterious matter.

1.2 Methods of sampling and testing of crushed rock base shall be in accordance with the following Australian Standards:

AS 1141 - 1974 Methods of sampling and testing Aggregates

AS 1289 - 1977 Methods of testing soils for Engineering purposes.

1.3 The mixture of base course materials shall meet the following requirements. The grading of material passing the 19.0 sieve shall vary from coarse to fine in a uniform and consistent manner. It shall not be subject to extreme or near extreme percentages of gradation represented by the maximum and minimum limited for the various sieve sizes, and shall conform as closely as possible to the required target grading.

% By Weight Passing

<u>AS 1152 Sieve</u>	<u>Target Grading</u>	<u>Specified Grading Limits</u>
26.5 mm	100	100
19.0 mm	100	95 - 100
13.2 mm	82	70 - 90
9.5 mm	70	60 - 80
4.75 mm	50	40 - 60
2.36 mm	38	30 - 45
1.18 mm	25	20 - 35
600 um	19	13 - 27
425 um	17	11 - 23
300 um	13	8 - 20
150 um	10	5 - 14
75 um	8	5 - 11

- 1.4 The material retained on 6.70 mm sieve shall not include more than twenty per cent (20%) by weight of flat or elongated particles. One (1) flat particle has a ratio of width to thickness greater than three (3) and an elongated particle has a ratio of length to width greater than three (3).
- 1.5 The Dust Ratio herein defined as the ratio of the percentage by weight passing the 75 mm sieve to the percentage by weight passing the 425 um sieve, shall be within the range of 0.35 to 0.6.
- 1.6 The portion of material retained on the 2.36 mm sieve shall have a Los Angeles Abrasion Test value not exceeding forty percent (40%).
- 1.7 The material passing the 425 um sieve shall be used for the determination of the soil consistency and shall conform with the following requirements.

<u>Item</u>	<u>Value</u>
Liquid Limit (Cone Penetrometer)	25% maximum - MRD Test Method WA 120.2
Linear Shrinkage (Cone Penetrometer)	2.0% maximum - MRD Test Method WA 123.1

1.8 Blended rock base material shall have a California Bearing Ratio (CBR) value when tested in accordance with MRD Test Method WA 141.1 of not less than 100%. The specimen shall be surcharged and soaked for a minimum of 72 hours.

2. **CONDITIONS**

2.1 All material shall be subject to inspection by the Engineer or his representative who reserve the right to reject the whole or any part of any consignment which in the opinion of the Engineer does not comply with the specifications. Any material thus rejected shall immediately be removed and no liability for payment in any manner whatsoever will be accepted by the Council for such rejected consignment.

APPENDIX "C"

TECHNICAL SPECIFICATION FOR SUPPLY AND LAYING OF HOT ASPHALT ROAD SURFACING

1.1 SCOPE OF SPECIFICATION

1.1.1 Specification Documents

This Specification is to be read in conjunction with Australian Standards AS 2150 - Hot Mix Asphalt, AS 2008 - Residual Bitumen for Pavements, AS 2734 - Asphalt (Hot-Mixed) Paving - Guide to Good Practice, and Main Roads Western Australia, methods for Sampling and Testing of Asphalt. Where conflict exists, the requirements of this specification will be decisive.

1.1.2 Interpretation Of Terms

"Australian Standard (AS)" refers to the latest revision of the quoted standard document.

"Pay factor" means the calculated proportion of the whole payment to be paid to the Contractor subject to conformance with this document.

"Payment penalty" means the actual reduction in payment resulting from the pay factor.

"Contractor" - shall mean the person or persons, corporation or corporations whose tender is accepted by the Principal or his agent, and shall include the executors or administrators, successors and assigns of such person or persons, corporation or corporations.

"Council" - shall mean the Mayor and Councillors of the City of Canning.

"Superintending Officer" - shall mean any person who from time to time shall be entrusted to superintend the works on behalf of the Council.

"Contract" - shall mean and include the Tender, Contract, General Conditions, Schedule of Quantities, Schedule of Rates, Specifications and all plans, drawings and other schedules.

"Works" or "Work" - shall mean the work to be done by the Contractor under the Contract.

1.2 MATERIALS

1.2.1 Aggregate

All aggregates used will meet the requirements of AS 2758.5 – Asphalt Aggregates. The aggregate shall be produced from a source rock designated in the table of special requirements (Table 2).

1.2.2 Bitumen

Bitumen will be Class 170 or 320 (see Table 3) unless otherwise directed by the Superintending Officer and will meet the requirements of AS 2008 – Residual Bitumen for Pavements.

1.3 **MIX DESIGNS**

1.3.1 General

All mix supplied for this contract will be on a performance basis and will generally be a nominal AC10 or AC14, though other mix types may be used at the direction of the Superintending Officer.

1.3.2 Job Mixes

The Contractor will submit 'Job Mixes' for each mix type, using 75, 50 and 35 blow Marshall compactive efforts and conforming to the properties listed in Table 3.

On acceptance of a 'Job Mix', the permissible variation of aggregate grading and bitumen content shall not exceed Table 7 of AS 2150 – Hot Mix Asphalt. The minimum calculated bitumen film thickness shall be 7.5 micron using the Hveem method of calculation.

1.3.3 Alternative Mixes

Should tenderers wish to submit alternative mix designs; e.g. gap graded asphalt which are outside of the specifications, details of the mix designs shall be submitted to the City for consideration.

Mixes with properties other than those listed in Table 3 may be called and these shall be listed in the table of special requirements (Table 2).

The Council does on occasions allow the use of modified binders such as Multigrade Bitumen, EVA Modified Bitumen and SBS Modified Bitumen as shown in Table 2.

Multigrade Bitumen is used in lieu of conventional straight run Class 170 or Class 320 bitumen.

EVA polymer is added to the bitumen at a rate of 3-5% by weight of the bitumen in the mix.

SBS polymer is added to the bitumen at a rate of 3-6% by weight of the bitumen in the mix.

1.4 **TESTING**

1.4.1 General

The testing of the asphaltic pavement shall be carried out by a NATA endorsed laboratory. All tests shall be made on a single sample test lot which consists of one (1) sample of loose asphalt extracted on site and six (6) random core samples taken from the compacted asphaltic mat. A test lot may be a days paving on a single project, the entire project or a section of suspect pavement surface. All tests shall be carried out in accordance with the current Australian and/or Main Roads WA standard.

1.4.2 Laboratory

The selected laboratory responsible for testing shall be noted in the Table of Special Requirements (Table 2), and shall be approved by the City.

1.4.3 Quality Assurance

If the Contractor must have Quality Assurance accreditation and shall supply copies of all relevant testing and paving procedures to the Superintending Officer.

The Contractor's Quality Assurance System may include a Process Control System conforming to the requirements of ISO 9002 - Quality Systems for Production and Installation and the AAPA publication Asphalt Plant Process Control Guide.

The Contractor's process control records may be made available to the City and in all cases the control intervention levels should be within the limits of the specification.

The Contractor's Quality Assurance System shall be used to identify areas/lots of suspect mix where audit testing shows that the mix does not meet the specification.

1.4.4 Dispute Resolution

If a payment penalty or rejection of work is in dispute, the Contractor may apply to have a retest carried out at the Contractor's cost. The retest shall consist of removal of a random sample of the compacted asphaltic mat (1m x 1m). This shall be divided into two samples, one sample to be tested by a laboratory of the Contractor's choice, and the other sample tested by a laboratory of Council's choice. These tests are to be carried out in accordance with the current Australian and/or Main Roads WA standard. The mean result of the two tests shall be the definitive result.

The Superintending Officer reserves the right to witness any testing that is part of dispute procedures.

The costs of retesting shall remain the responsibility of the Contractor.

Where the Contractor considers that failure to achieve the specified quality of the asphaltic mat is due to deficiencies in the base preparation, the Contractor may arrange independent testing of the base compaction by a NATA registered laboratory or level survey by a licensed land surveyor.

1.5 MANUFACTURE

All mix shall be manufactured according to the requirements of AS 2150 – Hot Mix Asphalt and AS 2734 – Asphalt (Hot-mixed) Paving – Guide to Good Practice, unless otherwise directed by the Superintending Officer.

1.6 PREPARATION

1.6.1 Programming

Programming of works shall be discussed with the Superintending Officer prior to commencement.

The works within the contract need not be continuous and the Contractor must have the approval of the Superintending Officer prior to stopping work. The point of cessation shall be approved and in no circumstances shall it be in a location considered to be detrimental to the completed job.

1.6.2 Responsibility

The Superintending Officer accepts full responsibility for the quality of the base preparation. Where the Superintending Officer is aware of any deficiencies in the base preparation, these will be brought to the attention of the Contractor and confirmed in writing. The Superintending Officer will provide compaction and field moisture content test results when requested, should these be available.

This acceptance of responsibility for the quality of the base preparation must be supported by a minimum amount of testing for level, density, and deflection, to define adequately the smoothness and stiffness of the pavement.

1.6.3 Site Inspection

The Contractor will inspect every paving job with the Superintending Officer or his representative prior to paving commencing. Should the Contractor be concerned with any aspect of the surface preparation, base construction or irregularities in the base prior to or during paving operations, such concerns shall be brought to the attention of the Superintending Officer. This shall be confirmed in writing.

1.6.4 Keying In

The Contractor will be responsible for keying in work at each end of the job. This may be done by burning or 'chasing', and removing the existing asphalt. The method used will be that agreed with the Superintending Officer. Alternative methods may be negotiated between the Contractor and the Superintending Officer.

1.6.5 Tack Coat

Tack Coat shall be laid in accordance with AS 2734 - Asphalt (Hot-mixed) Paving – Guide to Good Practice, Section 5.

Material shall be a bitumen emulsion and shall be in accordance with AS 1160 – Bituminous Emulsions for the Construction and Maintenance of Pavements. Anionic and Cationic bitumen may be used depending on site conditions and the time of year and should be discussed with the Superintending Officer.

The application rate shall generally be sufficient to fully coat the surface with a residual binder content of 0.10 litres per square metre. However, the application rate may be varied or even omitted to suit particular conditions when approved or instructed by the Superintending Officer.

1.6.6 Corrector Course

When directed by the Superintending Officer, preparatory to resurfacing those areas in which there are departures of more than 20mm from a 3m straight edge, a separate regulating course shall be placed for correction of both longitudinal and transverse pavement shape. Unless directed otherwise, the maximum compacted thickness of any one layer of corrector course shall not exceed five times the size of the largest aggregate in the asphalt used.

1.7 **LAYING OF MIX**

1.7.1 Delivery

All mix shall be delivered according to the requirements of AS 2150 - Hot Mix Asphalt and AS 2734 - Asphalt (Hot-mixed) Paving – Guide to Good Practice, unless otherwise directed by the Superintending Officer.

Delivery shall be made during the hours approved by the Superintending Officer.

1.7.2 Weather Conditions

The surface on which asphalt is to be laid shall be free from ponding water. The Superintending Officer reserves the right to stop paving operations under adverse weather conditions.

1.7.3 Removal Of Debris

During the progress of the work the Contractor shall :-

- i) keep all channels and pits free of debris at all times,
- ii) remove all sweepings, spoil and excess or rejected material from the site to the satisfaction of the Superintending Officer.

The disposal of such materials shall be in accordance with any requirements of Council.

1.7.4 Traffic

The Contractor shall take all necessary action and precautions to prevent and divert traffic from damaging the works. The Contractor shall at all times supply, use and place all necessary traffic signs to control the traffic movement around or through the site when work is in progress. All signs shall be selected and placed in accordance with AS 1742.3, Manual of Uniform Traffic Control Devices, and SAA HB81, Field Guide for Traffic Control at Works on Roads.

Where determined by the Superintending Officer, the Contractor shall provide flag persons to control traffic. No roads are to be totally closed to traffic without the approval of the Superintending Officer.

The Contractor shall prepare a detailed traffic management plan, and works shall not proceed until the Superintending Officer has approved the plan, and all signs are in place.

Where the Superintending Officer instructs that flag control is to be used, or detours are to be set in place, the Contractor shall employ the services of an authorised specialist Traffic Management Contractor, employing a minimum of 2 licensed flag persons to control the traffic. Alternatively, the Superintending Officer may arrange for traffic controls at the contractors cost.

1.7.5 Joints

The compaction and surface finish at joints shall be similar to those of the remainder of the layer.

Unless otherwise directed by the Superintending Officer, longitudinal joints shall be :-

- continuous and parallel
- coincident within 150mm of line of change in crossfall
- offset by at least 150mm from joints in underlying layers
- located away from traffic wheel paths
- located beneath proposed traffic line markings where feasible, in the case of a wearing course

Where practical, adjacent paving runs will be completed to within 20 metres of each other daily.

The contractor will be responsible for the preparation of longitudinal joints where new work abuts old work such as that encountered in road widening.

1.7.6 Level Control

The Contractor shall take all necessary level control measures to meet the finished surface shape as set out in Clause 1.8.6.

These measures may involve string lines, levelling beams, joint matching shoes or automated level setting devices as specified by the Superintending Officer.

1.7.7 Survey Control

It shall be the Contractor's responsibility to ensure that the levels are maintained to within ± 10 mm over a 3m straight edge. Inability to maintain the required level may result in rejection of the section.

1.7.8 Spreading And Compaction

Spreading and compaction of the asphalt shall be carried out in a manner such that the finished pavement meets the specification.

1.7.9 Delivery Dockets

A delivery docket showing the empty and loaded masses of the vehicle shall be handed to the Superintending Officer at the point of delivery by the Contractor's representative. In addition, the following written information shall be supplied:

- the date and time of loading
- the name of the supplier
- the identification number of the vehicle
- the size and Marshall blows of the asphalt and the location reference of the plant at which the asphalt was manufactured
- the temperature of the asphalt

1.8 ACCEPTANCE OF ASPHALT PAVEMENT

1.8.1 Grading And Bitumen Content

Where the onsite job mix (aggregate grading, bitumen content, and film thickness) fails to meet the specification, the Superintending Officer may reject the work in accordance with Clause 1.9.1 or alternatively with the agreement of the Superintending Officer, the Contractor shall provide a 5 year guarantee of the asphalt performance from the date of paving and the Contractor shall remove and replace or overlay the entire area should the surface show signs of distress. The method of repair shall be at the discretion of the Superintending Officer.

When the results of an individual audit test undertaken by the City or the Contractor's field testing show that the mix does not meet the specification, the Superintending Officer shall take into consideration the Process Control Records before deciding on a course of action, where the Contractor has in place a Process Control System as part of an accredited Quality Assurance System in accordance with Clause 1.4.3.

1.8.2 Marshall Characteristics

The Marshall characteristics (stability, flow and quotient) of a test lot when tested in accordance with the current Australian and/or Main Roads WA standard, shall form part of the determination for quality level of the asphalt.

The Marshall quotient is the calculated ratio of stability to flow which represents an approximation of the ratio of load to deformation and may be used as a measure of the asphalt's resistance to permanent deformation under load.

The Marshall characteristics of a test lot shall be judged on one of the three quality levels:

- Conformance
- Conditional Conformance
- Non-Conformance

If the stability and flow are both within or equal to the specification parameters (see Table 3), the asphalt is deemed conforming to specification and the payment shall be made at the scheduled rate.

If the stability or flow is less than the minimum specified value, the mix shall be deemed non-conforming and no payment shall be made.

Where the mix is non-conforming, at the direction of the Superintending Officer, the Contractor shall arrange, at the Contractor's expense, for the test lot to be removed and replaced with fresh asphalt and retested. Removal shall be carried out so as not to damage the underlying layers

or any road fixtures, such as gully gratings. Any such damage shall be repaired at the Contractor's expense.

Where the flow exceeds the maximum value, and the stability of the mix is high, then the mix shall be considered conforming providing the minimum Marshall quotient value is met, and the flow does not exceed the maximum specified value by more than 1.0mm.

1.8.3 Density

Density (compaction) shall be judged at one of three quality levels:

- Conformance
- Conditional Conformance
- Non-Conformance

When tested in accordance with 9.4 of AS 2734 - Asphalt (Hot-mixed) Paving – Guide to Good Practice, the Characteristic Percent Marshall Density (Compaction) for any test lot of a minimum 6 (six) Marshall Density tests shall be deemed to be conforming if it attains the minimum value required for the mix type as shown in Table 1.1. Payment for conforming work shall be at the scheduled rate.

Where a Characteristic Percent Marshall Density is less than the specified density the quality level shall be deemed to be either non-conforming or conditionally conforming depending on the difference between the Characteristic Percent Marshall Density and the specified density. The tolerances applicable to conditional conformance are given in Table 1.2. A Pay Factor, as shown in Table 1.2 shall be applied for work at the appropriate conformance level in accordance with these tolerances. The pay factor shall reflect the lower level of serviceability of conditionally conforming asphalt.

Where any test lot of asphalt work is deemed non-conforming, the Contractor shall arrange, at the Contractor's expense, for the test lot to be removed and replaced with fresh asphalt and retested. Removal shall be carried out so as not to damage the underlying layers or any road fixtures, such as gully gratings. Any such damage shall be repaired at the Contractor's expense. Alternatively, the pay factor shall apply.

TABLE 1.1 - DENSITY REQUIREMENTS

Marshall Blows	Characteristic Marshall Density (Rc %)
35	95.0
50	94.5
75 & SMA	94.0

The Characteristic Percent Marshall Density, R_{ct} , of a test lot shall be calculated thus:

$$R_{ct} = R - 0.91s$$

where:

R is the mean of the results of the percentage of Marshall Density tests on the lot being assessed, reported to the nearest 0.1 percent.

s is the standard deviation of the results of the percentage of Marshall Density tests on the lot being assessed, calculated in accordance with the standard deviation calculation below and reported to the nearest 0.1 percent.

TABLE 1.2

Characteristic Percent Marshall Density	Quality Level	Payment Factor
R_{ct} equal to or greater than R_c	Conformance	1.0
R_{ct} less than R_c and greater or equal to $R_c - 3\%$	Conditional Conformance	$1 - 0.1(R_c - R_{ct})$
R_{ct} less than $R_c - 3\%$	Non-conformance	0.0

Rounding of all calculations should be in accordance with AS 2706 - Numerical Values - Rounding the Interpretation of Limiting Values.

Standard Deviation

Where specified the standard deviation (s) of the distribution of the values shall be calculated as:

$$S = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{(n - 1)}}$$

Where :

x_i is an individual result

\bar{x} is the mean of n results

n is the number of results from one lot

1.8.4 Asphaltic Mat Voids

The asphaltic mat voids are the relationship between the maximum density and the mean core density of a sample test lot. It is calculated thus:

$$AMV = \left(\frac{MD - CD}{MD} \right) \times 100$$

where:

AMV = Asphaltic mat voids

MD = The maximum density of a test lot

CD = The mean core density of a test lot

It shall be judged on one of three quality levels:

- Conformance
- Conditional Conformance
- Non-Conformance

In the case of 35 blow mixes:

Where the asphaltic mat voids is greater than or equal to 2.5 and less than or equal to 10.0, it shall be deemed as conforming.

Where the asphaltic mat voids is greater than 10.0 but less than or equal to 12.0, it shall be deemed as conditional conformance and a pay factor shall apply (see Table 1.3).

Where the asphaltic mat voids is less than 2.5 or greater than 12.0 it shall be deemed as non-conforming.

In the case of 50 blow mixes:

Where the asphaltic mat voids is greater than or equal to 3.5 and less than or equal to 10.0, it shall be deemed as conforming.

Where the asphaltic mat voids is greater than 10.0 but less than or equal to 12.0, it shall be deemed as conditional conformance and a pay factor shall apply (see Table 1.3).

Where the asphaltic mat voids is less than 3.5 or greater than 12.0 it shall be deemed as non-conforming.

In the case of 75 blow mixes:

Where the asphaltic mat voids is greater than or equal to 3.5 and less than or equal to 11.0, it shall be deemed as conforming.

Where the asphaltic mat voids is greater than 11.0 but less than or equal to 12.0, it shall be deemed as conditional conformance and a pay factor shall apply (see Table 1.3).

Where the asphaltic mat voids is less than 3.5 or greater than 12.0, it shall be deemed as non-conforming.

Where any test lot of asphalt work is deemed non-conforming, the Contractor shall arrange, at the Contractor's expense, for the test lot to be removed and replaced with fresh asphalt and

retested. Removal shall be carried out so as not to damage the underlying layers or any road fixtures, such as gully gratings. Any such damage shall be repaired at the Contractor's expense. Alternatively, the pay factor shall apply.

Where for any individual core the asphaltic mat voids is less than 3.0 for 75 blow mix or 2.5 for 50 blow or 2.0 for 35 blow mixes, additional testing shall be carried out to determine the extent of unstable asphalt. This asphalt shall be removed and replaced at the Contractor's expense.

TABLE 1.3

Total Voids	Quality Level	Pay Factor
10.0 > AMV > 2.5 (35 blow) 10.0 > AMV > 3.5 (50 blow) 11.0 > AMV > 3.5 (75 blow)	Conformance	1.000
12.0 > AMV > 10.0 (35 & 50 blow)	Conditional Conformance	35 & 50 blow AMV(-0.15) + 2.5
12.0 > AMV > 11.0 (75 blow)	Conditional Conformance	75 blow AMV(-0.30) +4.3
AMV > 12.0	Non-Conformance	0.000
2.5 > AMV (35 blow) 3.5 > AMV (50 & 75 blow)	Non-Conformance	0.000

Where: AMV is the asphaltic mat voids in the asphalt pavement.

1.8.5 Thickness

The minimum thickness of asphalt to be laid shall be specified by the Superintending Officer. Thickness of the asphalt shall be judged on one of three quality levels:

- Conformance
- Conditional Conformance
- Non-Conformance

When tested for thickness any test lot of a minimum six (6) core samples shall be deemed to be conforming if the mean core thickness is greater than the minimum specified thickness less 15% or less than the minimum specified thickness plus 20%, net of corrective courses.

Should the mean core thickness be less than the minimum thickness specified by greater than 15% the conditional conformance payment factor shall apply as detailed in Table 1.4

Should any 1 of the 6 core samples be less than the minimum thickness specified by greater than 20% then additional cores may be taken at the Contractor's expense to establish that an area of thin pavement exists.

Cores shall be taken at locations halfway between existing random cores and/or additional thickness determining cores to determine the extent of the thin pavement. The non-conformance payment factor for that area may apply as detailed in Table 1.4. Alternatively, the Contractor may arrange, at the Contractor's expense, to have the area of thin pavement overlaid or removed and replaced with fresh asphalt and retested. Removal shall be carried out so as not do damage the underlying layers or any road fixtures, such as gully gratings. Any such damage shall be repaired at the Contractor's expense.

The mean core thickness of asphalt laid shall not exceed the minimum specified thickness by greater than 20% net of corrective courses. The contractor shall only be paid for the proportion of mix necessary to achieve minimum thickness plus 20%.

Where it is necessary to overlay or remove and replace asphalt, the minimum overlay or layer thickness shall not be less than 20mm. The contractor shall only be paid for the proportion of asphalt necessary to achieve the specified minimum thickness.

TABLE 1.4 - THICKNESS REQUIREMENTS

Average Thickness Range	Quality Level	Pay Factor
1.2 NMT > AT > 0.85 NMT	Conformance	1.000
0.85 > AT > 0.8 NMT	Conditional Conformance	$\frac{AT}{0.85 \text{ NMT}}$
AT > 1.2 NMT	Conditional Conformance	$\frac{1.2 \text{ NMT}}{AT}$
0.8 NMT > AT	Non-Conformance	0.000

Where:

AT: The average thickness of the results of a six (6) core test lot reported to the nearest millimetre.

NMT: The nominal minimum thickness specified by the Superintending Officer.

1.8.6 Shape

Where the base pavement conforms with the appropriate standard, the shape shall conform to the values for freeways and highways as detailed in Table 9.1 of AS 2734 – Asphalt (Hot-mixed) Paving – Guide to Good Practice.

1.9 PAYMENT

1.9.1 Rejection Of Work

The Superintending Officer reserves the right to reject any asphalt laid that does not conform to the requirements of this specification. As an alternative to a payment penalty, the Superintending Officer reserves the right to have the asphalt removed and replaced at the Contractor’s cost.

1.9.2 Payment Penalty

Should any of the asphalt laid fall into a conditional conformance criterion, then the payment penalty shall be lodged with the City of Canning to compensate for the reduction of pavement life.

TABLE 2 - TABLE OF SPECIAL REQUIREMENTS

Clause	(i)Description	(ii)Requirement
1.2.1	Aggregate Type	Granite
1.3.3	Alternative Mixes	Alternative mixes used may include: Multigrade binder EVA modified binder SBS modified binder
1.4.2	Laboratory	The City of Canning will arrange for all testing of mix delivered to site, and coring of the pavement to test for conformance using its own selected NATA registered laboratory. The City will meet the cost of this testing.

TABLE 3 - ASPHALT MIXES

2.1 ASPHALT MIXES: Highways, Arterial, Industrial and Distributor Roads

Property	Mix Designation		
	AC10	AC14	AC20
Grading Limits % passing AS Sieve			
26.5mm			100
19.0mm		100	90-100
13.2mm	100	85-100	75-90
9.5mm	90-100	70-85	60-80
6.7mm	70-90	62-75	50-70
4.75mm	58-76	53-70	40-60
2.36mm	40-58	35-52	25-43
1.18mm	27-44	24-40	18-35
600µm	17-35	15-30	14-27
300µm	11-24	10-24	9-21
150µm	7-16	7-16	6-15
75µm	4-7	4-7	3-7
Bitumen Content	5.0-7.0	4.5-6.5	4.0-6.0
Marshall Voids (%)	4.0-6.0	4.0-6.0	4.0-6.0
Minimum Marshall Stability 50 blow	6.5kN	6.5kN	6.5kN
75 blow	8.0kN	8.0kN	8.0kN
Marshall Flow (mm)	2.0-4.0	2.0-4.0	2.0-4.0
Marshall Quotient (min) 50 blow	1.7	1.7	1.7
(kN/mm) 75 blow	2.0	2.0	2.0
Refusal Voids (%) at 350 Cycles of Gyratory Compactor 75 blow	2.5	2.5	2.5

Traffic Recommendations: - over 20 years design traffic

Range/Type	Mix	Bitumen Type
Heavy truck traffic	75 blow	Class 320
Less than 2,000,000 ESA	50 blow	Class 170
Greater than 2,000,000 ESA	75 blow	Class 320
Maintenance	50 blow	Class 170
Intersections	75 blow	Class 320

2.2 ASPHALT MIXES: Residential Streets/Cul-de-sacs

Property	Mix Designation		
	AC7	RAC10	RAC14
Grading Limits % passing AS Sieve			
19.0mm			100
13.2mm		100	90-100
9.5mm	100	95-100	70-90
6.7mm	80-100	80-95	62-75
4.75mm	70-90	65-80	47-67
2.36mm	45-60	45-60	34-52
1.18mm	35-50	35-50	25-41
600µm	22-35	25-40	16-32
300µm	14-25	15-25	9-21
150µm	8-16	7-15	5-13
75µm	5-8	3-10	2-8
Bitumen Content	5.0-7.0	4.5-6.5	4.5-6.5
Marshall Voids (%)	3.0-5.0	3.0-5.0	3.0-5.0
Minimum Marshall Stability	35 blow 50 blow	4.0Kn 5.5kN	4.0kN 6.5kN
Marshall Flow (mm)	35 blow 50 blow	2.0-5.0 2.0-4.0	2.0-5.0 2.0-4.0
Marshall Quotient(min) (kN/mm)	35 blow 50 blow	1.0 1.7	1.0 1.7

Traffic Recommendations: - over 20 years design traffic

Range/Type	Mix	Bitumen Type
Greater than 500,000 ESA	Use distributor road mix	
Greater than 50,000 ESA	50 blow	Class 170
Less than 50,000 ESA	35 blow	Class 170
Maintenance	50 blow	Class 170

2.3 ASPHALT MIXES: Recreational Areas

Property	Mix Designation	
	AC5	AC7
Grading Limits % passing AS Sieve		
9.5mm		100
6.7mm	100	80-100
4.75mm	85-100	70-90
2.36mm	55-75	45-60
1.18mm	38-57	35-50
600µm	26-43	22-35
300µm	15-28	14-25
150µm	8-18	8-16
75µm	4-11	5-8
Bitumen Content	5.0-7.0	5.0-7.0
Marshall Voids (%)	3.0-5.0	3.0-5.0
Minimum Marshall blow	35	4.0kN 5.0kN
Stability blow	50	4.0kN 5.5kN
Marshall Flow (mm)		2.0-5.0
Marshall Quotient (min) blow	35	1.0 1.7
(kN/mm) blow	50	1.0 1.7

Note: Bitumen shall be Class 170 unless otherwise requested by the Superintending Officer.

Traffic Recommendations:

Range/Type	Mix
Cycle Paths, Basketball Courts etc	35 blow
Maintenance	50 blow

2.4 STONE MASTIC ASPHALT MIXES: SPECIAL APPLICATIONS

Property	Mix Designation	
	SMA 10	SMA 14
Grading Limits % passing AS Sieve		
26.5mm		
19.0mm		100
13.2mm	100	85-100
9.5mm	90-100	70-85
6.7mm	70-90	62-75
4.75mm	58-76	53-70
2.36mm	40-58	35-52
1.18mm	27-44	24-40
600µm	17-35	15-30
300µm	11-24	10-24
150µm	7-16	7-16
75µm	4-7	4-7
Bitumen Content	5.0-7.0	4.5-6.5
Voids at 120 Cycles of the Gyratory Compactor (%)	3.5-4.5	3.5-4.5
Refusal Voids (%) at 360 Cycles of the Gyratory Compactor	2.5	2.5
VMA (min) (%)	18	17
Binder Draindown (max) (%)	0.3	0.3
Cantabro Abrasion Unconditioned	25	25
Loss (Max) (%) Conditioned	35	35

Traffic Recommendations:

Range/Type	Mix	Bitumen Type
Special applications requiring good skid resistance, rut resistance and fatigue performance	120 Cycles Gyropac	Class 320

APPENDIX "D"

SPECIFICATION FOR BACKFILL OF TRENCHES

1 ROAD CROSSINGS

1.1 MATERIALS

Backfill material for road crossing shall be entirely of sand to within 300mm of the road surface or to the depth of existing road pavement whichever is greater. The sand shall be free of clay material, vegetable matter, building debris and disused road paving material.

The upper 300mm shall consist of crushed limestone, evenly graded, with a maximum spall size of 75mm.

1.2 COMPACTION

Before the general backfill of the trench is commenced, all manholes, and spaces around the utility installed shall be carefully compacted with hand rammers. The minimum depth of initial hand compaction above the top of the utility will generally be specified by each Public Utility Authority concerned, but should in no case be less than 150mm.

Compaction of the remaining backfill shall be in layers suitable to the compaction equipment available. Compaction shall be achieved by mechanical means to a density at least equal to that of the surrounding undisturbed road material. This compaction shall conform to a Standard Perth Penetrometer reading of not less than 11 blows per 300mm penetration.

2. DRIVEWAY CROSSINGS

Materials for backfilling trenches across driveways shall be as for road crossings.

The penetrometer standard for driveways shall be a minimum of 9 blows per 300mm penetration.

3. FOOTPATH CROSSINGS

Materials for backfilling trenches across footpaths shall be as for road crossings except that the sand material shall be brought up to the full depth of the trench. No limestone need be used.

The penetrometer standard for footpaths shall be equivalent to surrounding virgin ground but not less than a minimum penetrometer standard of 7 blows per 300mm penetration.

4. VERGES

Verges shall be backfilled and compacted to a minimum penetrometer standard of 5 blows per 300mm penetration.

5. REINSTATEMENT OF SURFACE

The City will generally carry this out, unless approved by the Engineer or his representative. The surface reinstatement will generally consist of 50mm minimum compacted depth of 14mm aggregate asphalt.

