

TECHNICAL SPECIFICATION

WAROONA COMMUNITY PRECINCT FOURACRE STREET UPGRADES & INTERNAL CIVIL WORKS

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1 SPECIAL CONDITIONS OF CONTRACT

1.1 GENERAL

The works shall consist of earthworks, drainage works and pavement, paths and associated construction and landscape works for construction of the Waroona Community Precinct project at Fouracre Street, Waroona.

The work shall be carried out in strict conformity with the Drawings, the requirements of the Specification and to the approval of the Superintendent.

1.2 EXTENT OF CONTRACT

This is a Contract for the supply and delivery of all materials to site, provision of all labour, materials, implements, tools, machinery and such equipment as will be necessary to construct the works as set out in the specifications and drawings, the carrying out of all necessary incidental works as specified or drawn and the full reinstatement of the site before completion of works.

Pursuant to the General Conditions of Contract and these Special Conditions, the Contract Sum shall be deemed to include allowances for items of works which may neither be shown on the Drawings nor specified but which are nevertheless needed to properly complete the works when having regard to the obvious intent and purpose of the works or any part thereof, and commensurate with good construction practices. Any provision contained or implied in the Contract Documents shall be the Contractor's responsibility and the whole of the resulting costs shall be deemed to have been included in the Contract Sum, unless the item is specifically identified as being a provisional sum or at "the Principal's expense".

The work shall be carried out as described in the Specification and Drawings and to the requirements of the AS 2124-1992 General Conditions of Contract and to the entire and reasonable satisfaction of the Superintendent.

1.2.1 DISCREPANCIES BETWEEN DOCUMENTATION

In the event of any contradiction, discrepancy, or ambiguity between anything contained in the Contract documents, drawings, or other referred specifications, then the following hierarchical precedence shall prevail:

- General Conditions of Contract
- Special Conditions of Contract
- Statement of Requirements
- Drawings
- Civil Works Specification
- Pump Track Specification
- Landscape Works Specification
- Irrigation Specification
- Lighting Strategy

1.3 SCOPE OF CIVIL WORK

The successful Tenderer is required to undertake, supply and install the various goods and materials in accordance with this specification, drawings and relevant Australian Standards and practices.

The works will include, but is not limited to the following:

- Submit an implementation timetable for the works. The contractor is to closely liaise with the contract Superintendent to formulate an implementation timetable to appropriately undertake the works to minimise disruption to school activities and public road access.
- Contractor is to locate and identify all services prior to commencement of works.
- Contractor is to produce a Traffic Management Plan prior to commencement of onsite works for concurrence by the Principal.
- Liaison and coordination with Traffic Control sub-contractor.
- Undertake demolition and vegetation clearing works onsite. Waste spoil and vegetation is to be removed offsite.
- Undertake earthworks to establish new earthworks levels. Box out new pavement areas to design subgrade depth. All subgrade areas are to be proof rolled to determine suitability for pavement construction. Any areas that fail proof rolling will be reprepared or may be treated by method(s) as agreed to by the Superintendent and will be dealt with by variation to the contract.
- Supply materials and construct new piped drainage works to the layout and details on the drawings. Construct new drainage basin and outlet swale including rock scour protection.
- Supply and construct new gravel pavements to design thicknesses as nominated on the drawings. Basecourse layers are to be compacted to a minimum of 98% MMDD.
- Supply and construct bitumen primerseal.
- Supply and construct extruded concrete kerbs and cast insitu concrete paths to levels, widths and surface finishes shown on the drawings.
- Supply and construct Asphalt overlays to new pavement areas to extent shown on drawings.
- Install new signage and linemarking as indicated on the drawings.
- All spoil material, including concrete and other waste products is to be disposed of by the contractor as part of their contract price.
- The whole site is to be left in clean and tidy condition during and upon completion of works.

1.4 PROGRAMMING OF THE WORKS

The commencement of the Contract shall be the date of Contract award and the Practical Completion date/s shall be as scheduled in annexure Part A, to A2124-1992 General Conditions of Contract. Award of this tender is expected in February 2023.

Onsite works for Separable Portion 1 are anticipated to commence in March 2023 with all works to be completed in accordance with the Contract and Separable Portions Practical Completion dates.

Refer to the Statement of Requirements in the Request for Tender document for description of the Separable Portions and their award / direction.

1.4.1 CONSTRUCTION PROGRAM

Refer Request for Tender Document Statement of Requirements, General Conditions of Contract and Special Conditions of Contract

1.4.2 SITE MEETINGS

Refer Request for Tender Document Statement of Requirements, General Conditions of Contract and Special Conditions of Contract

1.4.3 OTHER WORKS ON SITE

During the Contract other works may occur at the site or in the vicinity of the site by other Contractors or Authorities. The Contractor shall allow to liaise with other Contractors or Authorities and act in good faith and cooperate at all times. Works shall be programmed to synergise with other Contractors or Authorities so as to ensure the expeditious completion of the project. No obstruction or interference with other Contractors or Authorities shall occur.

1.5 OTHERS AFFECTED BY THE WORKS

1.5.1 LIAISON

The Contractor shall at least 10 days prior to works commencing give written notice to all Property Owners/Occupiers and/or Authorities affected by the works and shall request that the Owners/Occupiers indicate any special requirements with regards to access or protection of their assets. The Contractor shall abide by any reasonable requests, which the Superintendent shall rule on in the event of disagreement. The Contractor shall abide by the Superintendents decision at no additional cost to the Principal. All work shall be reinstated to equivalent or better condition than prior to construction.

1.5.2 DAMAGE TO ADJACENT BUILDINGS

The contractor is responsible for all measures taken to prevent damage to adjacent property and/or buildings through vibration or other construction activities. Such measures that the contractor may take to mitigate this risk could include dilapidation and/or photographic surveys and/or appropriate selection of compaction plant. The principal will not be liable for any claims for property damage from construction works or other contractor activities.

The contractor shall immediately inform the Superintendent of any claim or complaint made with respect to damage from construction activities and continue to keep the Superintendent informed of progress and settlement of any claims.

1.5.3 EXISTING UTILITY SERVICES

Refer Request for Tender Document Statement of Requirements, General Conditions of Contract and Special Conditions of Contract

1.6 INSPECTIONS

The Contractor shall notify the Superintendent as required within the Specification and at the following stages:

- Setting out of vegetation clearing extents
- Completion of drainage works
- Completion of subgrade, preparation for pavement.
- Completion of gravel basecourse, prior to primerseal.
- Set out of kerbing and paths, prior to construction.
- Prior to asphalt overlay.
- Set out of linemarking & signage.
- Completion of reinstatements.
- Completion of works.

The Superintendent shall have the right to inspect the work prior to the commencement of the next stage. No work shall be covered up until it has been inspected and approved by the Superintendent. The Contractor shall render the Superintendent all necessary assistance including the provision of any labour or materials, which may be required.

1.7 DOCUMENTS GENERALLY, DRAWINGS AND SPECIFICATION

1.7.1 LAYOUT OF SITE

The layout of all features onsite shall be taken as diagrammatic only and all measurements and other information required to carry out the work under the contract shall be obtained by the Contractor on site. No claims arising from failure to obtain measurements and other information on site will be accepted.

The contractor will submit a plan layout prior to commencement of works showing site access, positioning of welfare facilities, site related parking, storage for materials and plant, and to include site security measures.

1.8 MATERIALS, LABOUR AND CONSTRUCTIONAL PLANT

1.8.1 SALVAGED MATERIALS

Unless otherwise specified and subject to the General Conditions, materials, plant, equipment or other things salvaged from the works shall become the property of the Contractor and shall be removed by them from the site.

1.8.2 TEMPORARY WATER SUPPLY

The Contractor shall arrange for supply of water for worksite amenities and construction purposes. Any infrastructure installed onsite for supply of water is to be removed on practical completion of the works.

The Contractor shall pay all costs and charges in connection therewith.

1.8.3 CONTRACTOR'S SITE ACCOMMODATION

Refer Request for Tender Document Statement of Requirements, General Conditions of Contract and Special Conditions of Contract

1.8.4 WORKMEN'S AMENITIES

Refer Request for Tender Document Statement of Requirements, General Conditions of Contract and Special Conditions of Contract

1.8.5 PLANT AND EQUIPMENT, QUALITY OF WORKS

If at any time during the progress of the works, plant or equipment appear to the Superintendent to be insufficient, inefficient or inappropriate to secure the quality of work required, or the proper rates of progress, the Superintendent may order the Contractor to increase their efficiency, improve their character, augment their number, or to substitute plant or equipment as the case may be, and the Contractor must conform to such orders.

Failure by the Superintendent to demand such variations or additions shall not relieve the Contractor of his obligations to secure the quality of the work and the rate of progress necessary to complete the work within the time required by the Contract and to the requirements of the Contract.

1.9 WORKING HOURS

Refer Request for Tender Document Statement of Requirements, General Conditions of Contract and Special Conditions of Contract

1.10 SURVEY INFORMATION AND SETTING OUT

The Contractor shall be entirely responsible for setting out and constructing the works to the lines, levels and grades shown on the Drawings and where directed by the Superintendent.

The Principal shall provide the following survey information:

Permanent Control Marks and Temporary Bench Marks located within or near the site.

Digital model of design strings and levels.

All existing Survey Marks and survey information provided by the Principal shall be preserved by the Contractor, and if disturbed shall be replaced by the Contractor at the expense of the Contractor.

It shall be the Contractor's responsibility to liaise with the Principal and the Contractor shall give a minimum of 48 hours notice to the Principal when information or site setout is required.

Any discrepancies between the certified survey and the drawings shall be immediately reported to the Superintendent and work shall not proceed until the Superintendent's instructions have been received.

Should it become apparent that any proposed works may cross a land boundary outside the road reserve, then the Superintendent shall be immediately informed. No works are to be undertaken in the affected area until instructions are received from the Superintendent.

1.10.1 CONTOURS AND LEVELS

Contours and levels provided on the Drawings to show existing levels shall be deemed to be the levels used in preparation of the Tender.

If it can be shown on the date of possession of the site by the Contractor, or within 48 hours of that date, that the existing levels differ from the levels shown on the Drawings by an amount which would change the quantity of any of the works to be executed under the Contract by more than 10% of the quantity calculated from the levels shown on the Drawings, the Contract sum shall be adjusted accordingly.

1.10.2 "AS CONSTRUCTED" DRAWINGS

Refer Request for Tender Document Statement of Requirements, General Conditions of Contract and Special Conditions of Contract

1.11 CONTRACTOR'S REPRESENTATIVE

The Contractor shall maintain at all times full supervision of the works by a competent foreman experienced in this class of works, assisted by a competent surveyor.

The Contractor's representative shall have full authority to receive and to act upon instructions of the Superintendent or his representative.

The Contractor shall, during the period of the Contract, co-operate with all Authorities, property owners or occupiers, or other persons affected by the works, notify them in advance of commencement of any section of work which affects them, and at all times strive to maintain a courteous and helpful manner in any dealings with them.

1.12 CONTROL OF TRAFFIC / WORK ON PUBLIC ROADWAYS

The Contractor shall submit scale drawings of his proposed traffic control layout with sufficient notice to obtain written approvals from the Superintendent, Local Authority and/or MRWA as applicable before any traffic diversion occurs on site. These drawings should contain full detail of sign dimension and type (according to SAA Standards) as well as distances between signs on site. Traffic management plans shall be prepared and endorsed by a suitable person holding a current certificate in a MRWA accredited "Advanced Worksite Traffic Management" training course.

The Contractor shall at all times provide, erect and maintain approved temporary traffic control and warning devices such as signs, lights and barriers at or on the approaches to work on or immediately adjacent to the roadways as per the submitted Traffic management Plan. Such measures shall be to the approval of the Superintendent, Local Authority and/or Main Roads of WA (MRWA) as applicable.

All traffic control signs and devices shall conform to the requirements of both AS1742.3-1985 Part 3 and MRWA standards and shall be selected and positioned to give un-obscured, meaningful and sufficient warning to traffic.

Where required by the Superintendent, Local Authority or MRWA the Contractor shall advertise in the local newspaper the proposed traffic management measures. The Contractor shall notify, liaise with and minimise disruptions to all affected property owners and occupiers.

1.13 PROTECTION FROM WEATHER

The Contractor shall, at his own expense, provide all plant, materials and labour necessary to protect the works from damage by inclement weather. Low points or excavations where water may collect shall be kept thoroughly drained by mechanical or gravitational means. Drains or water courses utilised for this purpose shall be maintained with appropriate erosion & sediment control to the satisfaction of the Superintendent.

The Contractor shall prevent, in so far as is reasonably possible, any materials entering any gully, manhole or pipe, and shall remove from the drainage system any materials from any source which may be deposited in the drainage system by any agency up to the date of Practical Completion.

1.14 VANDALISM AND INTERFERENCE

The Contractor shall allow in his Tender for vandalism and interference or disruption to works which may be caused by any person or persons either employed or not employed by the Contractor during the course of the contract.

1.15 CLEANING UP / DEFECTS LIABILITY PERIOD

1.15.1 GENERAL

Any damage done by the Contractor or his employees to buildings, fences, services etc. shall be immediately made good to the satisfaction of the Superintendent.

During the period of the Contract, the Contractor shall clean up the construction site and remove all surplus construction material and debris from the site. At the completion of the Contract the site shall be clean and tidy, all excavations filled flush with the natural ground level, verges trimmed and graded and all excess material removed to the satisfaction of the Superintendent. Machine wheel tracks and ruts are not acceptable. Practical completion will not be granted till the above requirements are complied with.

1.15.2 DEFECTS LIABILITY PERIOD

The Contractor shall, at its own expense. execute all work of repair, amended, reconstruction, rectification and making good of defects, imperfections, shrinkages or other faults as may be required by the principal during the Defects Liability period or within 14 days after its expiry if required as a result of an inspection made prior to expiration. The defects liability period is 52 weeks from date of practical completion.

1.15.3 SUBSIDENCE AND MOVEMENT OF PIPES, STRUCTURES AND OTHER WORKS

Subsidence of any soil (including fill and backfill) or of any road materials or vertical or lateral movement of any structure, pipe or kerb or any other work completed under this Contract shall constitute a defect for the purpose of the General Conditions of Contract. Normal use of roads, drains or sewers shall not constitute fair wear and tear to relieve the Contractor of his responsibility for repair to defects but the Contractor will not be required to make good subsidence or movement of soil caused solely by weather or by the installation of underground services by others.

The works will be in use during the Defects Liability Period. For the purpose of the General Conditions of Contract a reasonable time for completion of remedial works may be too short, where danger to persons or property exists, to permit notice being given to the contractor. In such cases the Superintendent will arrange for remedial works to be carried out by others at the expense of the Contractor.

2 TECHNICAL SPECIFICATION

2.1 GENERAL

The works shall consist of earthworks, drainage works and pavement, paths and associated construction and landscape works for construction of the Waroona Community Precinct project at Fouracre Street, Waroona.

The work shall be carried out in strict conformity with the Drawings, the requirements of the Specification and to the approval of the Superintendent.

2.2 CLEARING

Undertake vegetation clearing works onsite. All vegetation removal extents are to be marked out in the field and approved by the Superintendent prior to any clearing works commencing. Millable timber is to be separated to an agreed stockpile site for Principal use..

If directed, fencing or other protective measures shall be placed around the trunks of trees to prevent damage. Vehicles and equipment shall not be parked or driven over tree roots. Where practical all earthworks are to be suitably adjusted on site in order not to disturb or damage the root systems of remaining trees.

Stumps shall be completely removed. 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 undisturbed soil.

2.2.1 DAMAGE TO REMAINING VEGETATION

Any damage caused by the Contractor to vegetation, landforms, or fauna habitat outside the defined Works areas, shall be rehabilitated at the Contractor's cost.

Rehabilitation work shall be carried out under the direction of an approved professionally qualified environmental consultant engaged by the Contractor. Alternatively, an environmental officer employed by the Principal may be available to direct the work at the Contractor's cost. The work shall involve whatever tasks are required or recommended by the environmental adviser in order that the damaged areas may be restored to pre-existing condition within the shortest possible time. Examples of particular tasks may include deep ripping or hand scarifying and raking of wheel tracks and compacted soil, reinstatement of rocks or stones, planting of seeds or seedlings together with subsequent nurturing, repairs to foliage or root systems of trees and shrubs, reinstatement of fauna habitat, and whatever other works as may be deemed necessary by the environmental adviser.

In the event that an incident involving environmental damage is identified, the Principal shall withhold payment of monies due to the Contractor on the basis of a performance undertaking. The amount of performance undertaking shall be determined as follows:-

- (a) For damaged trees greater than 3m in height, \$1000 each.
- (b) For damaged trees and shrubs up to 3m in height, \$500 each.
- (c) For damaged grassland, open soil areas, rock faces and landforms, and habitat in general, \$10 per square metre. In the case of vehicle wheel track damage, the area shall be calculated as the product of the distance of path travelled and the width of the vehicle.

The minimum undertaking applicable to any particular occurrence of damage shall be \$5000. In the event that the Contractor:

- (a) does not undertake, partially completes, or fails to complete rehabilitation measures within a reasonable time period, or

(b) cannot achieve a sufficient degree of rehabilitation to provide a comparable environment to that which existed immediately prior to the damage occurring,

The Project Manager may arrange for outstanding work to be completed by others at the Contractor's cost.

2.3 EARTHWORKS

Earthworks shall include all excavation, filling, compaction and trimming required to complete road works foundation, drainage structures and protection measures around trees that are to remain undisturbed.

2.3.1 TOPSOIL

Natural topsoil to a minimum depth of 50 millimetres is to be stripped from works disturbance areas. Any topsoil should be stockpiled for re-spreading. The topsoil removal operation shall be managed within the limits of clearing and no additional vegetation shall be cleared to accommodate topsoil without the approval of the Project Manager.

Topsoil stockpiles should be a maximum 1.5 metres in height. Stockpiles should be hydromulched with sterile cereal rye to prevent wind blow and suppress weed growth. Topsoil stockpiles should be fenced off, sign posted and protected from compaction and pollution by waste materials. Stockpiled topsoil should be kept weed-free and mulched to prevent wind erosion and movement.

When earthworks have been completed, the topsoil should be re-spread to a maximum compacted depth of 100 millimetres over all areas of earthworks to match approved finished surface levels.

Where excavated material is classified as unsuitable for use as topsoil by the Geotechnical Report it shall be disposed off-site in an approved manner.

2.3.2 FOUNDATION COMPACTION

After the completion of topsoil removal, the material upon which embankment is to be constructed shall be lightly watered as required to maintain appropriate moisture content and shall be compacted 95 per cent of the modified maximum dry density. Alternately, the Superintendent may approve proof rolling of selected foundation areas to assess suitability for embankment construction.

2.3.3 EXCAVATION

All excavations shall be carried out to the lines, grades, cross-sections and dimensions documented in the drawings provided or as otherwise directed by the Superintendent. Any over-excavation below the foundation level shall be backfilled with gravel material and compacted as specified for foundation compaction. Any backfilled material more than 150 mm below the foundation level shall be compacted as specified for foundation compaction.

2.3.4 UNSUITABLE MATERIAL

In situ material identified by the Contractor as unsuitable shall be notified to the Superintendent for evaluation. Should the Superintendent agree to the material being unsuitable, it shall be excavated, carted, and disposed of in commercial spoil areas. Unsuitable material excavated from below the foundation level shall be replaced with approved foundation quality material.

2.3.5 EMBANKMENT CONSTRUCTION

Embankment construction materials shall be free from boulders and cobbles greater than 100mm and free from clods, stumps, roots, sticks, vegetable matter or other deleterious material.

Embankment material shall be worked in compacted layers not greater than 300mm nor less than 80mm. Where less than 80mm is required to be worked the underlying material shall be grader scarified to such a depth that the resulting thickness of the layer to be worked is greater than 80mm. Each layer worked shall be generally parallel to the finished pavement surface and shall where practicable extend to the full width of the embankment at that particular level. Ponding of water on the embankment shall at all times be prevented. Embankment material shall be placed uniformly without abrupt changes in material type, quality or size.

During the whole of the compaction process the Characteristic Moisture Content of that part of the embankment material being compacted shall be within -2% to +3% of the optimum moisture content. Each embankment fill layer shall be compacted to no less than 95 per cent of the modified maximum dry density.

2.4 SUBGRADE PREPARATION

The formation shall be excavated in conformity with profiles, dimensions, camber and depths shown on the approved drawings.

Tolerance for sub-grade width shall be ± 100 millimetres.

The finished levels of sub-grade shall be within +5 to -30 millimetres of design levels.

The sub-grade shall be compacted to not less than 95 per cent of the maximum dry density when tested in accordance with *AS 1289: Methods of Testing Soils for Engineering Purposes*.

The sub-grade shall be approved by the Superintendent before any sub-base material is placed.

2.5 PAVEMENT MATERIALS & CONSTRUCTION

2.5.1 LIMESTONE SUBBASE MATERIALS

Not Used.

2.5.2 GRAVEL BASECOURSE MATERIALS

A gravel base course shall consist of a combination of soil binder, sand and laterite gravel and shall conform with this specification. It shall be free of vegetable matter and lumps or balls of clay and shall not contain excessive quantities of pyrites or other foreign substances.

2.5.2.1 Properties

Coarse aggregate retained on a 2.36 millimetres sieve shall consist of hard, durable particles or fragments of gravel. Materials that break up when alternatively frozen and thawed or 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 per cent.

Fine aggregate passing a 2.36 millimetres sieve shall consist of natural or crushed sand and fine mineral particles passing the 0.065 millimetres sieve.

The ratio of the portion passing the 0.075 millimetres sieve to the portion passing 0.425 millimetres sieve shall fall within the range 40–60 per cent.

The portion of the sample which passes the 0.425 millimetres sieve (soil mortar) shall conform to the requirements shown in below, when tested in accordance with *AS 1289*:

Gravel Material Properties

| Property | Value |
|---|---------|
| 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 |

2.5.2.2 Grading

The grading of the gravel shall conform to the requirements shown below.

Gravel Grading

| Sieve Size (Square Opening AS Sieve) | Percentage by weight passing |
|---|------------------------------|
| 19 mm | 100% |
| 4.75 mm | 45-65 % |
| 2.36 mm | 30-50 % |
| 0.425 mm | 12-30 % |
| 0.075 mm | 0-12% |

2.5.3 CONSTRUCTION

2.5.3.1 Spreading

Prior to laying of base materials, all drainage and utility service crossings beneath roadways shall be installed. All road crossings shall be backfilled and compacted according to requirements for sub-grade and sub-base construction.

Materials shall be placed so that the underlying material layer is not disturbed or broken up and an even thickness as specified is obtained.

Base material shall be spread to the required compacted thickness by means of an approved mechanical spreader or by grading from continuous stacks deposited on the sub-base.

2.5.3.2 Compaction

All material layers shall be watered, compacted and cut to grades and crossfalls specified in the approved drawings. Each course shall be watered to optimum moisture content and rolled until it is compacted to a firm, even surface.

The sub-base shall be watered to optimum moisture content and compacted by rolling to a density not less than 95 per cent of the maximum dry density when tested in accordance with *AS 1289: Methods of Testing Soils for Engineering Purposes*.

The depth of sub-base after compaction shall be as specified on the approved drawings with a tolerance of +5 to -10 millimetres.

Base course material shall be rolled until it is compacted to a firm, even surface by appropriate self-propelled steel-wheel and pneumatic tyred rollers. The use of the pneumatic tyred roller is essential for the final passes to achieve compaction of immediate surface material. Where damage to adjoining properties results, use of vibrating rollers are not permitted.

Grading of loose material over a hard surface and/or compaction in a thin layer is not permitted. The base course shall be compacted to not less than 98 per cent of the maximum dry density when tested in accordance with *AS 1289: Method of Testing Soils for Engineering Purposes*.

Thickness of the base course after compaction shall be as specified on the approved drawings with a tolerance of +10 to 0 millimetres.

2.5.3.3 Acceptance

The surface course shall be tested for shape and level, and any irregularities greater than 10 millimetres, when tested with a straight edge three metres long, shall be made good by addition or removal of material and further rolling and cutting to grade until the specified cross-section is obtained.

Any imperfections or failures detected in the surface of the base course shall be corrected in an approved manner. Unsatisfactory material shall be removed from site and replaced with material as specified.

Base course construction shall be approved by the Superintendent prior to the application of bituminous sealing.

2.6 BITUMINOUS SEALING OF PAVEMENTS

2.6.1 PREPARATION

The surface of the base course shall be swept free from loose stones, dust, dirt and foreign matter so as not to damage the finished surface of the base course prior to application of the binder.

Sweeping shall be completed immediately before the application of the primer. All sweepings shall be completely removed from the road and disposed of in an approved manner.

2.6.2 BINDER

Bitumen emulsion

Bitumen emulsion shall be rapid setting cationic Grade CRS 170-60 conforming to *AS1160: Bituminous Emulsions for Construction and Maintenance of Pavements*, and shall be uniformly and evenly sprayed onto the existing surface at a rate determined by design, but shall not be less than 1.3 litres/m² measured at 15.0°C.

Hot cut-back bitumen

A medium curing cut-back bitumen in accordance with *AS2157: Cutback Bitumen*, shall be applied at a rate determined by the design but shall not be less than 1.2 litres/m² measured at 15°C and at a temperature of 70°–120°C. The proportion of medium curing cutting oil and application rate shall depend on the condition of the base surface and traffic density.

2.6.3 AGGREGATE

2.6.3.1 Material Specification

The aggregate shall be crushed diorite, granite or basalt, unless otherwise approved. It should consist of clean, tough, durable fragments free from an excess of thin or elongated pieces; soft or disintegrated pieces; and dirt or other foreign matter.

Particle shape

The proportion of flat or elongated particles in any grading of course aggregate shall not exceed 20 per cent. A flat particle is one having a ratio of width to thickness of greater than three and an elongated particle is one having a ratio of length to width greater than three.

There shall not be more than 2.5 per cent of particles of greater length in any direction than twice the gauge and there shall not be more than 20 per cent of particles of greater dimensions in any direction than 25 per cent in excess of the gauge.

Hardness

The aggregate shall have a Los Angeles Test abrasion value not exceeding 20 per cent of wear for diorite and basalt and 40 per cent for granite.

Specific gravity

The bulk specific gravity of the particles shall be not less than 2.9 for diorite, 2.8 for basalt and 2.6 for granite.

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.

Method of sampling and testing

The method of testing the aggregate shall be in accordance with *AS1141: Methods for Sampling and Testing Aggregates*.

Flakiness index

The flakiness index of granite shall not exceed 30.

Grading Requirements

The Contractor shall supply crushed aggregate cover material for bituminous sealing to the grading requirements as shown in table below.

Aggregate Grading Requirements

| Nominal Size | 14 mm | 10 mm | 7 mm | 5 mm |
|---------------------|--------------|--------------|-------------|-------------|
| Passing AS mm seive | | | | |
| 37.5 | | | | |
| 26.5 | | | | |
| 19 | | | | |
| 16 | 100 | | | |
| 13.2 | 80-100 | 100 | | |
| 9.5 | 0-20 | 80-100 | 100 | |
| 6.7 | 0-2 | 0-25 | 80-100 | 100 |
| 4.75 | | 0-2 | 0-30 | 80-100 |
| 2.36 | | | | 0-30 |
| 1.18 | | | | 0-0.5 |
| 0.6 | | | | |

2.6.4 BITUMEN SEALING APPLICATION

The bitumen seal shall be applied by an approved mechanical sprayer which has been tested in accordance with *Testing of Mechanical Sprayers of Bituminous Material* (Austroads).

Where direct use of a mechanical spray is impracticable, the binder may be sprayed using a hand lance supplied from the mechanical sprayer.

Kerbs shall be protected from bitumen overspray at all times by adequately covering the kerbs with polythene sheeting or similar approved material. Any kerbing marked by bitumen overspray shall be made good by the contractor at the contractor's expense

Aggregates shall be dry and free from dust and other foreign material at the time of application (pre-coated where necessary) and shall be uniformly spread over the sprayed area by means of an approved mechanical spreader.

All sprayed areas, with the exception of approved lapping strips, shall be covered with aggregate within 10 minutes of spraying the binder.

Rate of application shall be determined by design but shall not exceed 150 m² per cubic metre of stone, controlled so that only a sufficient amount is applied to give a uniform dense mat one stone thick. Additional aggregate may be added by hand spreading to any bare or insufficiently covered areas to produce the required uniform cover.

The spread aggregate shall immediately be rolled into the binder using approved equipment and continued until the aggregate is well embedded in the binder and a uniform surface is obtained.

Any loose aggregate not incorporated in the seal after the completion of rolling shall be lightly swept from the surface in a manner that will not disturb the embedded aggregate and disposed of in an approved manner.

2.6.5 MEASUREMENT AND RECORDING OF APPLICATION RATES

Binder

All loads of bitumen shall be sampled in accordance with the following Australian Standards:

- AS 1160: Bitumen Emulsions for Construction and Maintenance of Pavements;
- AS 2008: Residual Bitumen for Pavements; and
- AS 2157: Cutback Bitumen.

The following records shall be kept of all spray runs:

- spray width;
- start distance – finish distance;
- side of road (left or right);
- road temperature;
- bitumen temperature;
- volume of bitumen used; and
- average bitumen application rate.

Aggregate

The actual application rate of cover aggregate shall be calculated from the measured volumes spread and the actual area measured on site, and expressed as the number of square metres per cubic metre of aggregate.

2.7 ASPHALT WORKS

2.7.1 GENERAL

This specification is to be read in conjunction with the following documents:

- AS 2150: Hot Mix Asphalt;
- AS 2008: Residual Bitumen for Pavements;
- AS 2734: Asphalt (Hot Mixed) Paving – Guide to Good Practice;
- MRWA, Methods for Sampling and Testing of Asphalt;
- Technical Specification, Tender Form and Schedule for Supply and Laying of Hot Asphalt Road Surfacing (IPWEA/AAPA).

Specification

All asphalt pavements and wearing courses shall be laid in accordance with the IPWEA/AAPA specification. Any deviations to the listed mixes shall be at the discretion of the Principal.

2.7.2 CHARACTERISTICS OF THE ASPHALT DESIGN

The design for the asphalt surface course shall meet the requirements shown in the tables below (drawn from the IPWEA/AAPA specification), by weight, when determined by Australian Standard (AS) sieves.

The residual binder (residual asphaltic bitumen), shall be determined as a percentage by weight of the total mixture.

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 |
| 0.6mm | 17-35 | 15-30 | 14-27 |
| 0.3mm | 11-24 | 10-24 | 9-21 |
| 0.15mm | 7-16 | 7-17 | 6-15 |
| 0.075mm | 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 |

| | | | | |
|--|--------------------|----------------|----------------|----------------|
| Voids in Mineral Aggregates (Min.) | | 15 | 14 | 14 |
| Refusal voids (350 cycles gyropac) 75 blow Marshall mixes only | | 2.5 | 2.5 | 2.5 |
| Minimum Marshall Stability | 50 blow 75 blow | 6.5kN 8.0kN | 6.5kN 8.0kN | 6.5kN 8.0kN |
| Marshall Flow (mm) | | 2.0-4.0 | 2.0-4.0 | 2.0-4.0 |
| Marshall Quotient (min.) (kN/mm) | 50 blow 75 blow | 1.7 2.0 | 1.7 2.0 | 1.7 2.0 |

ASPHALT MIXES – RESIDENTIAL STREETS, CARPARKS & RECREATIONAL AREAS

| Property | | Mix Designation | | |
|--------------------------------------|---------|-----------------|---------|------------|
| | | AC5 | AC7 | AC10 (Res) |
| Grading Limits % passing AS Sieve | | | | |
| 19.0mm | | | | |
| 13.2mm | | | | 100 |
| 9.5mm | | | 100 | 95-100 |
| 6.7mm | | 100 | 80-100 | 80-95 |
| 4.75mm | | 85-100 | 70-90 | 65-80 |
| 2.36mm | | 55-75 | 45-60 | 45-60 |
| 1.18mm | | 38-57 | 35-50 | 35-50 |
| 0.6mm | | 26-43 | 22-35 | 25-40 |
| 0.3mm | | 15-28 | 14-25 | 15-25 |
| 0.15mm | | 8-18 | 8-16 | 7-15 |
| 0.075mm | | 4-11 | 5-8 | 4-7 |
| Bitumen Content | | 5.0-7.0 | 5.0-7.0 | 5.0-7.0 |
| Marshall Voids (%) | 35 blow | 2.5-4.5 | 2.5-4.5 | 2.5-4.5 |
| | 50 blow | 3.0-5.0 | 3.0-5.0 | 3.0-5.0 |
| Voids in Mineral Aggregate (VMA) (%) | 35 blow | - | 17 | 16 |
| Minimum Marshall Stability | 35 blow | 4.0kN | 4.0kN | 4.0kN |
| | 50 blow | 5.0kN | 5.5kN | 6.5kN |
| Marshall Flow | 35 blow | 2.0-5.0 | 2.0-5.0 | 2.0-5.0 |
| | 50 blow | 2.0-4.0 | 2.0-4.0 | 2.0-4.0 |
| Marshall Quotient (min.) (kN/mm) | 50 blow | 1.0 | 1.0 | 1.0 |
| | 75 blow | 1.7 | 1.7 | 1.7 |

2.7.3 PREPARATION OF SURFACE

Surface preparation, which includes sweeping, chipping and burning off rich fat areas, shall be carried out immediately before applying the tack coat. No asphalt shall be placed upon any area which contains an excess of binder in such quantity that there is any possibility of the binder coming to the surface of the new work.

2.7.4 TACK COAT

The tack coat shall be laid in accordance with AS 2734: Asphalt (Hot-mixed) Paving – Guide to Good Practice. The bituminous emulsion shall comply with requirements of AS 1160: Bituminous Emulsions for Construction and Maintenance of Pavements. Anionic or cationic bitumen may be used depending on the site conditions and the time of the year. The application rate shall generally be sufficient to fully coat the surface with a residual binder content of 0.1 litres per square metre. The application rate may be varied or even omitted to satisfy particular conditions.

No asphalt shall be laid on the tack coat until the emulsion has broken and the water has substantially evaporated.

Any pools of tack coat which may have formed in surface depressions shall be brushed out. No traffic other than trucks delivering the asphalt shall be permitted to travel over the tack coat.

2.7.5 PLACING OF ASPHALT

Asphalt shall be laid upon a base which is clean and dry and in dry weather conditions with the atmospheric temperature above 10°C.

Prior to the delivery of asphalt to the construction site, the prepared base shall be cleaned of all loose or foreign material. The mixture shall be delivered on site in accordance with requirements of *AS 2150 – Hot Mix Asphalt* and *AS 2734 – Asphalt (Hot-mixed) Paving – Guide to Good Practice*, unless otherwise approved.

The mixture shall be spread to such line, level and camber detailed in the approved drawings in a single layer and compacted to give the average compacted thickness specified.

Thickness tolerance shall be +5 to –2 millimetres.

Spreading shall be by an approved self-propelled paver unless otherwise approved.

Mixing and placing asphalt will not be permitted when the surface of the road is wet, or cold winds chill the mix to the extent that spreading and compaction are adversely affected. The surface on which the asphalt is to be laid shall be free from ponding water.

The temperature of the mix when it is tipped into the spreader shall not be less than 135°C. Spreading shall proceed without undue delay and initial rolling of the mix shall commence at a temperature of not less than 120°C.

Uniform compaction to the required density shall be achieved before the temperature of the mix falls to 80°C.

The contractor shall ensure that the complete operation from mixing to final compaction is maintained within the specified temperature ranges.

Joints

Asphalt shall be spread in such a manner as to minimise the number of joints in the surface, and unless otherwise specified, the layout of joints shall conform to the following requirements.

Transverse joints

In any individual layer, transverse joints in adjoining paver runs shall be displaced longitudinally by not less than two metres.

Transverse joints in any layer shall be longitudinally displaced from any transverse joints in the underlying layer by not less than two metres.

Transverse joints shall be at right angles to the direction of spreading and cut to a straight vertical face for the full depth of the layer.

Longitudinal joints

Longitudinal joints shall be continuous, parallel and coincident within 150 millimetres of line of change of crossfall.

Longitudinal joints shall be offset by at least 150 millimetres from joints in underlying layers and located away from traffic wheel paths. Where feasible, longitudinal joints should be located beneath proposed traffic line markings.

Special care shall be taken in the forming of longitudinal joints at all intersections to avoid joint layouts and an appearance that would tend to misdirect traffic from the design travel paths.

Longitudinal and transverse joints shall be made in a careful manner, be well-bonded and sealed. Joints between old and new pavements, or between successive paver runs, shall be carefully made to ensure a thorough and continuous bond between old and new surfaces. The edge of the previously laid course shall be cut back to its full depth so as to expose a fresh surface, after which the hot mixture shall be placed in contact with it and raked to the specified depth and grade. Hot smoothers or tampers shall be employed to heat up the old pavement sufficiently without burning to ensure an effective bond.

Before placing the mixture against surfaces of longitudinal joints, kerbs, gutters, headers, junction pits or other surfaces, the contact surfaces shall be painted with a thin uniform coating of hot or cutback bitumen.

Where asphalt is required to match an existing surface, road or other fixture, the contractor shall place the material in such a manner as to provide a smooth riding surface across the junction.

2.7.6 COMPACTION OF ASPHALT

The density of the asphalt shall be achieved using approved equipment and techniques and in accordance with *AS 2734: Asphalt (Hot-mixed) paving – Guide to Good Practice*.

The surface of the finished course shall be free from depressions exceeding five millimetres as measured with a three-metre straight edge.

2.7.7 ACCEPTANCE OF ASPHALT SEAL

Testing

Asphalt testing shall be undertaken by a laboratory approved by the National Association of Testing Authorities. All tests shall be made on a single test lot which consists of one sample of loose asphalt extracted on site and six random core samples taken from the compacted asphaltic mat. A test lot may be a day's paving on the subdivision, the entire subdivisional stage or a selection of suspect pavement surfaces. All tests shall be carried out in accordance with the current Australian Standard and/or MRWA standards.

Grading and bitumen content

Where the in situ job mix (aggregate grading, bitumen content and film thickness) fails to meet specification requirements, the work may be rejected; alternatively, with the agreement of the Local Government, the contractor shall provide to the Local Government, a five-year guarantee of asphalt performance from the date of paving. The contractor shall remove and replace or overlay the entire area should the surface show signs of distress during the guarantee period.

When the results of an individual audit test or field testing shows that the mix does not meet requirements of the specification, the contractor's process control records shall be considered before a decision is made on an appropriate course of action.

Marshall characteristics

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

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.

If stability and flow are both within or equal to specification parameters, the asphalt is deemed conforming to specification and is acceptable.

If the stability or flow is less than the minimum specified value, the mix shall be deemed nonconforming.

Where flow exceeds the maximum value and the stability of the mix is high, 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 one millimetre.

Where the mix is 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 underlying layers or any road fixtures, such as gully ratings. Any such damage shall be repaired at the contractor's expense.

Density

When tested in accordance with Clause 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 of six Marshall Density tests shall be deemed to be conforming if they attain the minimum value required for the mix type as shown in the Table below.

DENSITY REQUIREMENTS

| Marshall Blows | Characteristic Marshall Density (Rc percentage) |
|----------------|---|
| 35 | 95.0 |
| 50 | 94.5 |
| 75 | 94.0 |

Asphaltic mat voids

Asphaltic mat voids is the relationship between maximum density and the mean core density of a sample test lot. It is calculated as follows:

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

Where:

AMV = Asphaltic mat voids

MD = Maximum density of a test lot

CD = Mean core density of a test lot

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.

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.

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 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.

Thickness

When tested for thickness, any test lot of a minimum six core samples shall be deemed to be conforming if the mean core thickness is greater than the minimum specified thickness less 15 per cent.

Should any one of the six core samples be less than the minimum thickness specified by more than 20 per cent, 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 contractor shall arrange, at the contractor's expense, to have the area of thin pavement overlaid or removed and replaced with fresh asphalt, and retested. Where it is necessary to overlay or remove and replace asphalt, the absolute minimum overlay or layer thickness shall not be less than 2.5 times the aggregate Average Least Dimension (ALD). 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.

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 (Hotmixed) Paving – Guide to Good Practice*.

2.8 STORMWATER DRAINAGE

2.8.1 GENERAL

Drainage shall be set out and constructed in accordance with alignments, levels and grades shown on the approved drawings.

2.8.2 MATERIALS

Pipes

Drainage pipes within the road area shall be reinforced concrete pipes unless otherwise approved by the Principal.

All pipes shall conform to the appropriate Australian Standards:

- AS 4058 Precast Concrete Pipes (Pressure and Non-Pressure);
- AS 1712 Fibre Cement Pipes;
- AS 1761 Helical Lock-seam Corrugated Steel Pipes;
- AS 1762 Helical Lock-seam Corrugated Steel Pipes – Design & Installation;
- AS 2566 Plastic Pipe laying Design;
- AS 2439.1 – 2007 Perforated plastics drainage and effluent pipe and fittings - Perforated drainage pipe and associated fittings.

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

Strength class for reinforced concrete and fibre-reinforced cement pipes shall be Class 2 unless otherwise specified.

Concrete

Concrete used for in situ work shall conform to *AS 3600: Concrete Structures*, and be provided either by a pre-mix concrete supplier conforming with *AS 1379: Specification and Supply of Concrete*, or mixed on-site, using materials and equipment as approved.

Concrete for pits, headwalls, end walls and keels shall have a minimum compressive strength of 20 MPa at 28 days.

The slump shall not exceed 70 millimetres or be less than 30 millimetres.

Maximum size of aggregate shall be 20 millimetres.

Cement

All cement used shall be Portland cement in accordance with *AS 3972: Portland and Blended Cement*, and obtained from an approved manufacturer.

Cement shall be delivered to the site fresh and in sealed bags and 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.

Concrete aggregate

Fine aggregate shall be well-graded, clean, sharp and free from clay and organic impurities in accordance with *AS 2758.1: Concrete Aggregates*.

Coarse aggregate shall be crushed granite, diorite or basalt clear and free from all impurities and dust in accordance with *AS 2758.1: Concrete Aggregates*.

Water

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

Sand

Sand for mortar shall be crushed stone or natural sand – free from all deleterious substances with a uniform grading.

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

Steel

Steel-reinforcing fabric and bars for concrete shall comply with the requirements of the following Australian Standards:

- AS 1302 Steel Reinforcing Bars for Concrete;
- AS 1303 Steel Reinforcing Wire for Concrete; and
- AS 1304 Welded Wire Reinforcing Fabric for Concrete.

Bricks

Bricks shall be hard, well-burnt, pressed or wire-cut clay brick in accordance with *AS/NZS 4455: Masonry Units and Segmental Pavers* and *AS 3700: Masonry in Buildings*. The bricks shall have a minimum ultimate strength of 30 MPa, and absorb not more than 10 per cent of their own weight of water when saturated.

Bricks shall be of uniform shape and size, carefully conveyed and unloaded at the site. No chipped or broken bricks shall be used, and pieces of brick may only be used where necessary as closures.

Junction pit liners

Junction pit liners shall be circular precast concrete liners from approved manufacturers capable of withstanding anticipated design loadings.

Junction pit covers

Junction pit covers located in the carriageway shall be equipped with purpose-built reinforced concrete surrounds a minimum of 150 millimetres thick and fitted with an approved cast iron frame and lid.

Junction pit covers located elsewhere in the road reserve shall be equipped with a purposebuilt reinforced concrete surround 150 millimetres thick.

All junction covers shall be equipped with a 600-millimetre square or circular access point with tapered inserts. Both cover and insert shall have approved lifting points installed.

Junction pit covers located in easements shall be of a thickness as determined by design loading but be not less than 100 millimetres.

Grated covers

Grated cover surrounds shall be 150 millimetres thick reinforced concrete with a minimum compressive strength of 20 MPa at 28 days.

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 25 millimetres.

Grated covers with parallel bars shall be installed with the bars at 90° to the kerbline.

All grated gully covers shall be of heavy duty construction and shall be load tested to full Austroads Highway Loading Conditions 90kN Wheel Load applied as per *AS 1597.1: Small Culverts*. Where there is any likelihood of cycle traffic crossing the road perpendicular to the centreline of the road in the vicinity of gullies, 25 x 3 millimetres mild steel straps shall be welded to the bars at 100-millimetre centres across the full length of the grate or other approved method.

2.8.3 INSTALLATION OF JUNCTION PITS AND GULLIES

Junction pits shall be constructed from either circular precast concrete sections with a minimum internal diameter of 1050 millimetres or the square or rectangular equivalent.

All junction pit covers shall overhang the external edge of the liner or walls by a minimum of 100 millimetres. Covers of all junction pits shall be flush with either the pavement level or the finished ground level and set at appropriate crossfalls where necessary.

Junction pits shall be embedded on sand compacted to not less than 95 per cent of the maximum dry density when tested in accordance with *AS1289: Methods of Testing Soils for Engineering Purposes*.

Gullies shall be of either a side entry pit design, a steel grate design or other approved design.

2.8.4 HEADWALLS

Where a piped drain interfaces with an open drain, a suitable headwall structure shall be provided to prevent entry of loose material into the pipe and erosion of surrounding ground.

All headwalls shall be constructed using either concrete with 20 MPa compressive strength, mortared stonework or brickwork. The headwall should be designed to aesthetically fit with the surrounding environment.

For mortared stonework, each stone shall weigh in excess of 10 kilograms and the largest dimension of any stone shall not exceed 1.5 times its least dimension.

Headwalls located on outlet pipes exceeding 300 millimetres diameter shall include suitable erosion protection in the form of aprons and edge beams.

2.8.5 EXCAVATION

The ground shall be excavated to the dimensions and depth required for safe construction and installation of pipe work. 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 an approved material and compacted to a density exceeding that of the natural surrounding material.

Width of the trench shall be kept to the minimum, consistent with bed width requirements and the need for adequate working space and shoring.

Any excavation carried out on public or private roads shall be arranged so that pedestrian and vehicle access are maintained at all times cause minimum disruption. If work requires road closure, approval of the local government shall be obtained.

Excavation for junction pits and gullies shall be completed to the approved depth and to dimensions allowing the use of adequate shoring or battered sides.

Free water in excavations shall be controlled to a level sufficiently low so as not to interfere with construction works. Such control shall be exercised by pumps or a well point dewatering system. Pumps shall be operated in such a manner to cause a minimum of noise disturbance to the local surroundings.

2.8.6 SHORING

Excavation of trenches with irregular shaped sides shall be avoided. Where this occurs or if there is any danger of sides collapsing, approved shoring shall be placed. Approved shoring shall be used where the drain is within two metres, plus drain depth to a building or load bearing structure.

2.8.7 PIPE LAYING AND BACKFILLING

No pipes shall be laid on filled ground until such ground has been compacted to a minimum of 95 per cent of its maximum dry density when tested in accordance with *AS 1289: Methods of Testing Soils for Engineering Purposes*.

Extra excavation shall be taken out at the bottom of the trench at all joints, so that pipes will be bearing uniformly on the foundation for their entire length.

Bedding of pipes shall be carried out evenly and thoroughly. Piling, keeling or importation of bedding material may be required. In the case of rock occurring in the bottom of the trench, the trench shall be excavated to a depth of 75 millimetres below the depth required for the pipe. The trench shall be backfilled to grade with approved material and compacted to specification.

During construction, no sand or other material shall be allowed to enter the drainage system. Junction pits shall be covered to prevent this occurring.

No part of the works or any length of pipes or fittings shall be covered until they have been inspected, tested and approved by the Superintendent.

All backfilling shall be placed in such a way that no pipes or joints or other works are displaced or damaged.

Backfilling up to 300 millimetres above the top of pipes shall be of approved readily compactable material such as sand or fine gravel, and shall be free from stones retained on a 25-millimetre sieve, clay lumps, building rubbish, tree roots and other vegetable matter.

Backfilling of trenches and excavations shall be carried out as far as possible with excavated material, except that no organic and other materials, articles or substances which might cause uneven settlement or voids shall be used. Former topsoil shall be used as the top layer of backfilling.

Backfilled material in the pipe trench shall be thoroughly rammed and compacted in 150-millimetre layers using appropriate equipment. Required compaction shall be at least the density of the adjoining soil in situ.

Immediately after a trench has been filled, the surface shall be restored and all surplus earth and other materials removed and disposed of in an approved manner.

The surface of fields, grassland and all other similar land shall be restored to the condition in which it was found.

2.8.8 EXCAVATION IN ROADWAYS

Backfilling and interim restoration of trenches in roadways shall be completed immediately after acceptance of drainage work. Material used for backfilling pipe trenches and pits in roadways shall be a clean granular material and compacted to a maximum of 300-millimetre layers to a density not less than 98 per cent of the maximum dry density when tested in accordance with *AS 1289: Methods of Testing Soils for Engineering Purposes*.

2.8.9 OPEN DRAINS

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

Over-excavation is corrected by filling with material in situ and compacting to a density exceeding that of the natural surrounding material.

2.8.10 STONE PITCHING

Surfaces shall be protected by hand-placed pitching stones. Stones shall be hard, sound and durable and generally weigh in excess of 10 kilograms each. The largest size of any stone shall not exceed 1.5 times its least dimension. Geofabric may be used to prevent subsidence or wash-outs.

Stones shall be set on a sand bed in a close fitting pattern, watered and rammed into position.

Where specified as mortared stone pitching, joints between stones shall be raked for their full depth and grouted with three parts sand to one part Portland cement mortar.

2.9 EXTRUDED CONCRETE KERBING

2.9.1 GENERAL

The developer shall be responsible for the provision of extended concrete kerbing in accordance with the approved drawings.

2.9.2 MATERIALS

The kerbing shall be constructed using pre-mixed concrete complying with *AS 1379: Specification and Supply of Concrete and the following requirements:*

| Item | Value |
|----------------------|---------------------------|
| Compressive Strength | Minimum 32 MPa at 28 days |
| Aggregate Size | Maximum 10 mm |
| Slump | Maximum 90 mm at delivery |

Where flush kerbing is to be used which could carry loadings on a regular basis from traffic, the strength should be to 32 MPa at 28 days with steel reinforcing.

2.9.3 PREPARATION AND PLACEMENT

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

Road kerbing shall be constructed of extruded concrete kerbing using an approved extrusion machine equipped with an automatic levelling device. Kerbing to small radii that cannot be placed with the extrusion machine shall be cast in situ to the same cross-section as the extruded kerbing.

The finished alignment shall conform to requirements of the approved drawings.

The first 150 millimetres of any new pour shall be cut away and removed. Any gap between the old and new work shall be filled by hand-placing, rodding and shaping of the concrete until a uniform shape and finish has been obtained.

2.9.4 TOLERANCES

The finished product shall be true to the dimensions specified and shall be to a smooth finish. Tolerances for kerbing shall be in accordance with the following requirements:

- the top surface of the kerb shall be parallel to the ruling grade of the pavement and free from depressions exceeding five millimetres when measured with a three metre straight edge;
- level ± 5 millimetres;
- line ± 10 millimetres to face of kerb or gutter line; and
- cross-section dimensions ± 5 millimetres.

2.9.5 CONTRACTION JOINTS

Contraction joints shall be constructed at 2.5-metre intervals along the new kerblines. Contraction joints shall be five millimetres wide and shall be cut through the kerb above the road surface level with an approved tool immediately after extrusion. Care shall be taken to avoid disturbing joint edges, with any disturbance made good immediately.

Where the kerb adjoins a footpath the contraction joints are to coincide with the footpath joints where possible.

2.9.6 EXPANSION JOINTS

Not less than 24 hours after kerb placement, expansion joints shall be formed by completely cutting through the kerb with a suitable cutting wheel at five-metre intervals along the new kerblines, at sides of drainage gullies, at tangent points of all small radius horizontal curves and at junctions with existing kerbing. Expansion joints shall be a minimum of 10 millimetres wide.

Each expansion joint shall be filled with an approved butyl mastic compound filler and foam or polyurethane backing.

All joints should be cut prior to the laying of asphalt unless the Local Government has approved designs where the kerbing is laid on the asphalt running surface.

Where the kerb adjoins a footpath the expansion joints are to coincide with the footpath joints where possible.

2.9.7 CURING

Within two hours of surface finishing, all exposed faces of the completed kerb shall be protected from moisture loss for a period of not less than four days after extrusion by covering with plastic sheeting or spraying with an approved curing compound.

In the event of defacing or damage to the kerb, from the time of its construction until the practical completion stage, the kerb shall be removed and replaced at the Contractor's expense where in the opinion of the Local Government repairs would detract from the finished product.

2.9.8 BACKFILLING

Backfilling to the kerbing shall be placed after curing the concrete and acceptance of the kerbing. Backfill material shall be free draining sand or a similar material to the local topsoil, free from debris and compacted to a thickness not less than that of the surrounding natural surface.

2.9.9 KEYED KERBING

Where keyed kerbing is specified on approved drawings, excavation of the base shall be by an approved method. The primed road surface beyond the line of the face of kerb shall not be disturbed.

Provision shall be made in the base key for extension of the expansion joint through the complete kerb section.

2.10 CONCRETE FOOTPATHS AND SHARED PATHS

2.10.1 GENERAL

The developer shall be responsible for the construction of footpaths or shared paths in accordance with the approved drawings.

2.10.2 MATERIALS

The pavement shall be constructed using pre-mixed concrete complying with *AS 1379: Specification and Supply of Concrete*, and the following requirements:

| Item | Value |
|----------------------|---------------------------|
| Compressive Strength | Minimum 25 MPa at 28 days |
| Aggregate Size | Maximum 20 mm |
| Slump | Maximum 75 mm at delivery |

High early strength additive in accordance with *AS 1478: Chemical Admixtures for Concrete*, may be used. No other additives or admixtures of any kind shall be used without written approval.

2.10.3 PREPARATION AND PLACEMENT

The excavation, fill, backfill and trimming shall be carried out to required levels and grades and surplus materials resulting from the works shall be removed and disposed of in an approved manner.

Earthworks shall be carried out in accordance with approved design alignments, grades and levels.

The sub-grade shall be evenly graded and free of rocks, organic matter and any other deleterious material. The sub-grade shall be compacted so as to provide even compaction to a depth of 450 millimetres. Compaction shall be not less than 95 per cent of maximum dry density when measured in accordance with *AS 1289: Methods of Testing Soils for Engineering Purposes*. Alternatively, it should be 7 blows per 300mm with a calibrated Perth Sand Penetrometer.

Before placement of concrete, the boxed-out alignment shall be watered to provide a thoroughly moistened, but not flooded, sub-grade.

The concrete pavement shall be consolidated using a mechanical vibrating screed spanning the width of the path and supported by rigid side forms.

After consolidation, the concrete shall be screeded perpendicular to the side forms to provide a straight surface between forms and a smooth, even surface profile along the path alignment.

To prevent premature drying of the surface of screeded concrete in hot weather conditions, addition of water to the surface of the screeded concrete using a fog spray may be permitted. Approval of the addition of water in this manner is conditional upon the integrity of the mix being maintained in accordance with its specification.

The finished concrete pavement shall have a non-slip, broomed surface. The broomed grooving (approximately two millimetres deep) shall be aligned at 90° to the edge of the pavement.

For dual use paths, transverse lips or ridges of concrete, such as may be formed during jointing works, are not permitted and the broomed finish surface shall be maintained at joints.

Dry cement shall not be added to the surface of the pavement.

2.10.4 EXPANSION JOINTS

Transverse expansion joints shall be installed in accordance with the Principal's standard drawing. The joints shall be 10 millimetres wide and extend the full depth and width of the pavement, and be filled with approved expansion joint filler. The joint filler shall not exude bituminous material when compressed in hot weather. The following materials are approved:

- Non-Porite – Bitumen impregnated by cold solvent process
- Expandite – Flexicell
- Meljoint – Melcann.

Other expansion joint fillers may be approved such as lock joints. Expansion joints shall be installed where the pathway abuts kerbing, utility service structures, drainage pits and/or existing crossovers.

Expansion joints are to coincide with kerb joints and vice versa where possible.

Expansion joints to be at changes in direction or width or where adjacent to a solid object, otherwise at maximum spacing of 40m.

Joints to be Lock Joint or other similar type, as approved by the Principal.

2.10.5 CONTRACTION JOINTS

Transverse contraction joints shall be installed in accordance with the Principal's standard drawing and equally spaced between expansion joints. The contraction joint shall be aligned at 90° to the pavement alignment and be a minimum of five millimetres deep, and provide a vertical plane of weakness through the pavement. The joint shall be made in plastic concrete by depressing an approved grooving tool into the surface of the pavement.

Contraction joints are to coincide with kerb joints and vice versa where possible.

2.10.6 EDGE TREATMENT

Edges of the footpath shall be polished smooth and rounded using an edge of radius 10 millimetres. Edges shall be free from irregularities of alignment and/or level. Edges of dual use paths shall retain the non-slip broom finish surface and shall not be rounded.

2.10.7 PROTECTION

The contractor shall provide and maintain protection of pavement against damage of every kind during the period of setting and curing of the concrete.

The contractor shall be responsible for appropriate signage and public safety.

Responsibility for the repairs shall be by negotiation between the Contractor and the Principal.

2.10.8 BACKFILLING AND REINSTATEMENT OF THE VERGE

The verge shall be backfilled to the established grading from the top of kerb to the road reserve boundary and flush with the edges of the pavement using material excavated from the boxed out alignment of the pathway which is free of foreign material. Residual and unwanted material shall be removed off site in an approved manner.

The contractor shall reinstate all existing verge features and treatments to their original condition.

Backfill to be compacted to the satisfaction of the Principal.