SPECIFICATION FOR SUBDIVISION

CONSTRUCTION OF

ROAD WORKS AND DRAINAGE

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P PRELIMINARIES

P1 INSTITUTE OF PUBLIC WORKS ENGINEERING AUSTRALIA (WA DIVISION) LOCAL GOVERNMENT GUIDELINES FOR SUBDIVISIONAL DEVELOPMENT

This specification is an addenda to the above Guidelines and sets out the road and drainage construction requirements peculiar to the City of Karratha.

The specification recognizes local construction materials and local drainage requirements. There is no piped stormwater drainage systems, other than road culverts, used within the City of Karratha.

The following clauses have been amended and differ from the corresponding clauses in the above Guidelines.

Clause 1.21.1 Defects Liability General

Paragraph 1 amended by deleting "12 months' and adding *24 months*.

Clause 2.3.1 Filling

- Insert new paragraph after paragraph 1:

  All areas containing 'gilgai' features indicative of highly reactive clay shall be over excavated by a minimum of 400mm and backfilled with clean local low plasticity clayey or gravelly sand compacted to the same density as the surrounding undisturbed soil. Highly permeable fill shall not be used unless the surrounding subgrade is adequately graded to avoid localized ponding of infiltrated water.

- Paragraph 3 delete and replace with:

  All fill material above the prepared subgrade shall be clean, free draining, suitable materials as determined by an appropriate geotechnical investigation, free from foreign and organic matter.

Clause 3.3.7 Pavement Thickness

Add new paragraph:

Estimates of subgrade Californian Bearing Ratio (CBR) based on regional experience are:

1.5 for gilgai areas

3 for clayey sand areas

provided the subgrade is prepared.

Clause 3.3.9 Urban Base Course Profiles

Clause 3.3.10 Rural Base Course Profiles

These clauses are deleted and replaced with the following:

Pavement materials should conform to Main Roads WA and Australian Geomechanics Society 2002 Guide to the Selection and Use of Naturally Occurring Materials as Base and Sub Base.

Not withstanding the pavement design produced, the minimum standard pavement profile shall be:

- *Sub grade compacted to 95% MMDD to a minimum depth of 150mm below the sub grade surface.*
- *Sub base of a minimum 200mm layer of local crusher dust compacted to 95% MMDD with a minimum 400mm in Gilgai soil.*
- *Base course of 200mm of proprietary crushed rock base compacted to 98% MMDD.*
- *Surface course of 7mm bitumen emulsion or cut back bitumen primer seal and 25mm dense graded asphalt (urban and industrial areas) or 14mm hot bitumen seal (rural areas).*

Clause 4.3.3.1 Drainage Systems

Add further paragraph:

The road network shall be depressed below the adjacent land to provide the primary drainage conveyance system.

The use of small diameter piped collection and disposal systems are to be avoided.

Stormwater shall be conveyed via the road kerb and gutter to multiple side entry pits or formed concrete spillways to the open channel main drains.

It is acceptable for the full road pavement width to act as the drainage channel.

Outlets shall be placed at sufficient intervals to contain the minor storm within the road pavement and the major storm within the road reserve.

All stormwater drainage components shall be reinforced concrete designed in accordance with the relevant Australian standard unless otherwise approved by the Engineer.

Clause 8 Construction Guidelines

This Clause is deleted and replaced by this Specification.

P2 CONDUCT OF THE WORKS

In the construction of the works the parties shall act in a spirit of mutual trust and co-operation.

Any party shall promptly notify the others as soon as it becomes aware of any matter which could increase the total price, delay completion or impair the performance of the works in use.

Any party may call a joint meeting of parties to determine action as to how to manage the effect of the notified matter.

P3 DEFINITIONS

"Contractor" shall mean the party constructing the works.

"Engineer" shall mean the Engineer of the City of Karratha or nominated representative.

"City or Local Authority" shall mean the City of Karratha.

P4 DIMENSION AND EXISTING CONDITIONS

Dimensions are shown on the construction drawings but it shall be the Contractor's responsibility to check all pertinent dimensions and existing conditions on or about the site before commencement of work. Any work component shown on the drawings but not included in this specification, or included in this specification but not shown on the drawings, shall be deemed part of the Contract. If doubt exists in respect of any facet of the work the Tenderer shall clarify the matter with the Engineer prior to lodging the Tender.

P5 SURVEY, SET-OUT AND LEVELS

The Contractor shall check the values and locations of any benchmarks and property pegs to be used for construction and shall notify the Engineer in writing within seven (7) days of possession of the Site of any discrepancies in the values of levels and locations given. The absence of such notification shall be deemed agreement that the values of levels of benchmarks and positions of road truncations and boundary pegs are correct.

The Contractor shall be responsible for all further setting out necessary for the construction of the Works to the levels and positions shown on the Drawings or described in the Specification.

The Contractor shall be responsible for the protection of all benchmarks, cadastral and property pegs and should any disturbance occur that may reasonably be suspected to have been caused by the operations of the Contractor or his Agents, the Contractor shall pay all costs in connection with the re-establishment of any such benchmark, cadastral peg or property peg.

P6 SUPERVISION AND INSPECTION OF WORKS

The Contractor shall provide a Supervisor, experienced in the type of works to be constructed, to be in charge at all times and who is authorised to receive and act upon instructions from the Engineer.

Where the Works are to be inspected by stages, the Contractor shall notify the Engineer or other relevant inspecting authority at least forty eight (48) hours prior to the time the inspection is required.

Inspections will be required by the City at the following stages.

- Completion of set-out and prior to clearing.
- Completion of earthworks prior to respreading of topsoil.
- Completion of sub-grade.
- Completion of laying of drainage and prior to backfill.
- Completion of sub-base.
- Completion of base.
- Completion of box out for paths.
- Completion of works.

The Contractor shall, upon request, provide the City with the location and reduced levels of all temporary benchmarks on or near the Site.

The Contractor shall allow for provision of all facilities reasonably required to conduct such inspections.

The Contractor shall instruct employees to display a co-operative and courteous manner towards the Engineer, inspecting authorities and in all contacts with the Public in respect of works carried out under the Contract. No works subject to inspection or approval shall be backfilled or rendered inaccessible until such inspection has been undertaken or approval has been given.

P7 SAFETY

The contractor shall prepare and implement a Project Safety Management Plan which complies with the Occupational Safety and Health Act and Worksafe WA requirements.

The Contractor shall notify Worksafe Western Australia of all Notifiable Works and make payment of all inspection and other fees in connection with such Works.

The Contractor shall conduct the construction of the Works in accordance with all current statutory requirements, Local Government By-laws and the provisions of Australian Standard AS1470, together with any other Code relating specifically to type of machine, process, handling procedures or materials. The Contractor shall provide employees with all necessary equipment and protective clothing to allow the safe construction of the Works and shall ensure maintenance to all plant and machinery allows for their safe operation.

On notification from the Engineer in respect to any operation, machine or structure being, in the opinion of the Engineer, unsafe, the Contractor shall cease use immediately of such operation, machine or structure and shall conduct remedial work to the satisfaction of the Engineer before continuing to use the operation, machine or structure in the Works. Where no remedial action can ensure continued safe use of an operation, machine or structure, the Contractor shall, in the case of an operation, cease such operation, and, in the case of a machine or structure, shall dismantle and remove such machine or structure from the Site.

Where the general safety of the Public is concerned and time of notification of the Contractor further jeopardises this safety, the Engineer may order immediate remedial works to be conducted at the Contractor's expense.

The Contractor shall report all accidents and near misses to the Engineer within 24 hours in the form of an incident report noting any corrective action undertaken or to be undertaken.

The Contractor shall supply, equip and maintain adequate First Aid facilities and equipment on the site and shall have an experienced First Aid Officer available at all times when work is in progress.

P8 COMPACTION

All fill, backfill, sub-grade or other areas required by the Specification or Drawings to be compacted shall be compacted using mechanical or other approved means to attain a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1 unless otherwise specified for the extent of the fill or 0.6m minimum depth.

P9 FIRE PREVENTION

The Contractor shall provide and maintain adequate, approved fire fighting equipment on site. The Contractor shall observe the provisions of the WA Bushfires Act, Local Authority regulations, WA Fire Brigades Board regulations and any other regulation in respect to fire prevention.

Burning shall not take place.

The Contractor shall ensure that all flammable materials are used and stored in accordance with the Explosives and Dangerous Goods Act and any other statute or regulation governing storage and use of such materials, and shall obtain such permits and licenses and pay all relevant fees and charges.

P10 VANDALISM

The Contractor shall allow for all reasonable measures to protect the Works and the operations therein from acts of vandalism. The Contractor shall allow for any remedial action required as a consequence of such acts. Vandalism shall not be an excluded risk.

P11 HOURS OF WORK

Unless with prior approval in writing from the Engineer, the Contractor shall not conduct works on Sundays, Public Holidays or between the hours of 6 pm on any day and 7 am on the following day except those works required in respect to safety or maintenance of Site conditions, such as dewatering activities.

P12 CODES AND AUSTRALIAN STANDARDS

Where an Australian Standard is specified, the Contractor shall construct and conduct the Works in accordance with the provisions of that standard. Where an Australian Standard has not been specified, the Contractor shall allow for the construction of the Works in compliance with the provisions of the Australian Standard covering the class or type of work being constructed.

In the event that a Standard other than an Australian Standard is specified, the Contractor shall allow for complying with the provisions of the specified Standard. The Standard applying shall be the latest edition at the time of commencement of the Contract.

Copies of Australian Standards may be purchased from the Standards Association of Australia.

The following documents shall apply to this Contract.

AS1012	Methods of Testing Concrete
AS1141	Methods for Sampling and Testing Aggregates
AS1160	Bitumen Emulsions for Construction and Maintenance of Pavements
AS1181	Method of Measurement of Civil Engineering Works and Associated Building Works
AS1289	Methods of Testing Soils for Engineering Purposes
AS1348	Glossary of Terms-Road and Traffic Engineering
AS1379	Specification and Supply of Concrete
AS1470	Health and Safety at Work - Principles and Practices
AS1597	Precast Reinforced Concrete Box Culverts
AS1646	Elastomeric Seals for Water Works Purposes
AS1742	Manual of Uniform Traffic Control Devices

AS1743	Road Signs - Specifications
AS1744	Forms of Letters and Numerals for Road Signs
AS2008	Residual Bitumen for Pavements
AS2053	Conduits and Fittings for Electrical Installations
AS2150	Hot Mix Asphalt
AS2157	Cutback Bitumen
AS2341	Methods of Testing Bitumen and Related Road Making Products
AS2648	Underground Marking Tape
AS2700	Colour Standards for General Purposes
AS2701	Methods of Sampling and Testing Mortar for Masonry Construction
AS2758	Aggregates and Rock for Engineering Purposes
AS2876	Concrete Kerb and Channel (Gutters)
AS2891	Methods of Sampling and Testing Asphalt
AS3600	Concrete Structures
AS3679	Structural Steel
AS3700	Masonry Structures
AS3725	Design for Installation of Buried Concrete Pipes
AS3727	Guide to Residential Pavements
AS3798	Guidelines on Earthwork for Commercial and Residential Developments
AS3972	Portland and Blended Cements
AS3996	Access Covers and Grates
AS4058	Precast Concrete Pipes
AS4455	Masonry Units and Segmented Pavers
AS4671	Steel Reinforcing Materials
AS4680	Hot Dip Galvanized Coatings on Fabricated Ferrous Articles
AS4801	Occupational Health and Safety Management Systems
Main Roads WA	Traffic Management for Roadworks Code of Practice 2000
WA Govt.	The Explosives and Dangerous Goods Act
WA Govt.	Construction Safety Act and Regulations
WA Govt.	Noise Abatement Act and Regulations

Institute of Public Works Engineering Australia (WA Division) – Local Government Guidelines for Subdivision Development

Department of Environment - A Guideline for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia (November 1996)

P13 CONTRACTOR TO BE INFORMED

It shall be assumed that the Contractor is fully conversant with the ground conditions within and adjacent to the Site and no extra costs or charges shall be allowed for ground or other Site conditions that may in the opinion of the Engineer be assessed by a full inspection of the site.

P14 DUST AND SMOKE CONTROL

The Contractor shall take all necessary measures to prevent dust and wind born material from being carried onto land outside the Site of the Works.

The Contractor shall comply with the A Guideline for the Prevention of Dust and Smoke Pollution from Land Development Sites in Western Australia (November 1996) published by the Department of Environment.

The Contractor shall be responsible for preventing movement of sand, dust or soil from within the Site of the works and shall indemnify the Principal against any claims which may arise as a result of movement of sand, dust or soil from within the Site of the works however valid those claims may be.

The Contractor shall, if any claims are made, deal fairly with the person making such claims and shall request that person to deal directly with the Contractor and not with the Principal.

The Contractor shall arrange operations so that existing vegetation and topsoil are preserved in all areas except those on which fill is to be placed on or in which excavation is to take place or those areas which are defined in this specification as areas for occupation or access.

All access tracks and other disturbed areas shall be regularly watered to prevent wind erosion.

The Contractor shall on request, within 48 hours, remove from public roads and other land outside the Site, sand or dust where the Engineer considers the sand or dust originated from the Site of the works.

P15 CONTRACTORS FACILITIES AND AMENITIES

The Contractor shall allow for the erection of all sheds, offices, storage compounds, stockpiles and other necessary facilities in areas approved by the Engineer. All sheds, offices, storage compounds, stockpiles and other necessary facilities shall, for the duration of the contract, conform in all respects to the provisions of the Local Government Act, Local Authority By-Laws, Building Code of Australia and all other Acts, By-Laws, Regulations and Codes of Practices relevant to such structures and works.

The Contractor shall provide, for the duration of the Contract, adequate toilet facilities in a clean and sanitary condition to the satisfaction of the Local Authority Health Inspector. On completion of the Contract, the Contractor shall dismantle and remove from the Site all temporary toilet facilities and thoroughly disinfect the area in accordance with the Local Authority Health By-Laws.

P16 ACCESS TO SITE

The Contractor shall at all times maintain access to the Site and the Works therein. The Contractor shall not clear, construct or use any route or way for purposes of access without prior written approval of the Engineer.

The Contractor shall allow for restrictions to the use of the Site to that minimum reasonably necessary for construction of the Works and shall in any case limit activities to those constraints set out in Preliminaries Clause "Limitation of Damage", of this Specification without prior approval of the engineer. The Contractor shall take all reasonable precautions to limit access and entry to the Site to all unauthorised persons and shall allow for the provision of all necessary warning signs, sign posting and any other measures required in this regard.

P17 LIMITATION OF DAMAGE

Generally, the Contractor shall, without prior written approval of the Engineer, conduct the following works within the specified limits

- **Stormwater Drains**

  Works and clearing for stormwater drains within properties and new road reserves shall be limited to an area three (3) metres either side of the centre-line of the proposed stormwater alignment.

- **Roads within New Road Reserves**

  Roads within new road reserves shall be constructed on the alignments shown on the drawings and clearing, stripping and earthworks shall be limited to within the road reserve boundaries except where otherwise stated.

- **Siteworks and Earthworks**

  Earthworks and associated clearing and stripping operations shall only extend to those limits shown on the Drawings together with the batters for such earthworks or as otherwise described in Site Preparation and Earthworks Clause "Clearing".

  Notwithstanding the above, the Contractor shall allow for all restrictions to operations caused as a result of likely damage to existing structures, fences, retaining walls, pavements, services or other improvements either within or outside the Site. Where, in the opinion of the Engineer, the removal of any trench shoring, formwork, falsework or other similar temporary works may cause damage to any existing structure, fence, service, retaining wall, pavement or other improvement, the Engineer may direct that such trench shoring, formwork, falsework or temporary works be left in place.

  Such direction by the Engineer shall in no way relieve the Contractor of responsibility for the repair and reinstatement of any further damage arising from the Contractor's activities.

  Where, in the opinion of the Engineer, the Contractor's activities in clearing, access or stripping have caused unnecessary damage to vegetation, the Contractor shall, replant, seed, or stabilise in a manner approved by the Engineer all such unnecessary damage.

P18 WORK IN EXISTING ROAD RESERVES

The Contractor shall allow to limit operations within existing road reserves to that reasonably necessary to construct the Works. The Contractor shall allow for all costs associated with reinstatement of verges, crossovers, street trees and shrubs and all other improvements within the road reserve and shall conduct such reinstatement to the satisfaction of the Engineer or relevant Controlling Authority.

Excavation within existing road reserves shall be backfilled as soon as is reasonably practicable and any unattended excavation shall be protected by suitable barricades, lights, signs and detours. The Contractor shall allow to maintain at all times access to each property within the road reserve together with free Public thoroughfare of the roadway. The Contractor shall bear all costs and charges related to the provisions of warning signs, barricades, flagmen and lights. The Contractor shall obtain all necessary approvals from Public Utility Authorities, Local Authorities and other involved bodies and shall comply with all provisions and conditions rendered with such approvals.

Road pavements damaged or excavated shall be reinstated to the Local Authority requirements. The Contractor shall allow for all costs associated with such reinstatement.

Certification by the Local Authority that all reinstatement has been undertaken or that arrangements have been made to their satisfaction for such reinstatement, will be required at Practical Completion.

P19 PUBLIC UTILITIES

The Contractor shall be entirely responsible for the location and protection of all Public Utilities and services before any works are commenced regardless of the utility being shown or not shown on the drawings. Repair and reinstatement costs arising from damage to any Public Utility due to the Contractor's activities shall be borne by the Contractor together with all costs arising from delays caused by such damage.

The Contractor shall arrange for any supervision and approval required by any Public Utility in connection with any works on or adjacent to existing services.

P20 NUISANCE

The Contractor shall take all reasonable measures to limit nuisance to the Public arising from operations regardless of the source of such nuisance.

In respect to noise, the Contractor shall ensure the level of noise, when measured in accordance with the Local Authority By-laws and regulations, shall not exceed the maximum permissible level permitted by such By-Laws and Regulations. Where any machine or any operation cannot be conducted within the prescribed limits the Contractor shall cease such operation or remove such machine from site. The cost of all noise attenuation measures shall be borne by the Contractor.

The Contractor shall allow for all reasonable measures, to limit nuisance caused by construction traffic, dust, sand, smoke, vibration, light spill or other intrusion arising from the contract operations.

P21 EXISTING AREA DRAINAGE

The Contractor shall allow for the maintenance and efficient operation of the existing drainage pattern and shall on completion of the Contract clean out and remove from the drainage system, regardless of source, any rubbish, debris or other deleterious matter deposited in the drainage system.

P22 WATER FOR WORKS

The Contractor shall be responsible for provision of a suitable water supply for the construction of the Works and shall comply in all respects to any restrictions in respect to water use in force during the period of the Contract.

With prior written approval of the Engineer and Controlling Authority, the Contractor may draw water for the Works from suitable lakes, streams, bores or other approved source with the exception that water drawn from such sources shall not be used for the purpose of mixing concrete.

P23 DISPOSAL OF RUBBISH

The Contractor shall allow for all costs and charges in relation to rubbish disposal. The Contractor shall provide for the collection, stockpiling and removal of all rubbish, debris, stripped vegetation and other deleterious matter from the Site in a manner approved by the Engineer.

All rubbish, debris and other deleterious matter shall be removed from the Site to an approved tip.

P24 CLEANING UP

The Contractor shall allow for the cleaning of all drains and other structures prior to the completion of the Works regardless of the agent by which the rubbish debris or other deleterious matter was deposited in the Works.

The Contractor shall allow for the sweeping of all pavements with the provision that the paving be swept only once unless further material has been deposited due to the operation of the Contractor or the Contractor's agents.

P25 GROUND VIBRATION

The Contractor shall avoid excessive use of vibratory compaction equipment. The vibrators shall not be started or stopped near a building.

The type of vibratory equipment and the wave velocity generated shall be selected to minimise ground vibrations beyond the Site.

The wave velocity at buildings and structures shall not exceed a maximum velocity of 5mm/s at the foundations.

P26 WA BUILDING AND CONSTRUCTION INDUSTRY TRAINING FUND LEVY

The Contractor shall notify the Building and Construction Industry Training Board of the Work, the construction cost and shall pay the required amount to the Board.

Payment shall be made prior to commencement of the Work.

The Contractor shall provide evidence of payment to the Engineer.

P27 DILAPIDATION SURVEY

Where existing buildings are located within 50m of any work area or where buildings may be affected by the works, the Contractor shall have a dilapidation survey of each building undertaken by the Contractor's insurers prior to commencement of work. A copy of the survey report shall be provided to the Engineer within seven (7) days of its completion.

P28 TRAFFIC MANAGEMENT PLAN

The Contractor shall prepare a Traffic Management Plan for all works that abut or are on existing public roads in accordance with Main Roads WA Traffic Management for Roadworks Code of Practice and shall obtain approval of the Traffic Management Plan from the controlling Road Authority.

The Contractor shall follow the approved Traffic Management Plan during the conduct of the work.

P29 SPECIFICATION TO BE TREATED AS A WHOLE

Where the specification is separated into titled sections it is for convenience only and not to dictate or determine the trade or craft involved. Such separations shall not operate to make the City an arbiter for the division of responsibility between the Contractor and Sub-Contractors, and between Sub-Contractors, nor shall separation relieve the Contractor of responsibility for the satisfactory completion of the entire work.

E SITE PREPARATION AND EARTHWORKS

E1 GENERAL

The Contractor shall allow for clearing, excavation, backfilling, compaction and dewatering in any material that may be encountered on site. The Contractor shall deposit all materials that cannot be used in the works at an approved refuse disposal site. The Contractor shall allow for all costs and charges in connection with the removal and disposal of such materials.

E2 TOLERANCES

Item	Tolerance
Clearing and Grubbing (Width of Design Earthworks plus 2.0m)	∀ 0.5m
Earthworks - overall level - top and toe of cut and fill batters - drainage basins	 + 50mm -0mm ∀ 100mm + 0mm -100mm
Verge Level	+ 25mm -0mm
Top Soiling - thickness minimum	 + 50mm - 20mm

E3 CLEARING

The clearing shall consist of removal for the entire width of the formation area and those cut and fill areas designated in the drawings of all trees, stumps and other vegetation, boulders and rubbish. All such material shall be removed to a depth of 600mm from the finished surface.

Any holes left shall be filled and compacted to the same density as that of the surrounding undisturbed soil.

Before any excavation or filling to any part of the Works is commenced, the Contractor shall remove from that part of the Site all vegetation with a diameter of more than 30mm and length of more than 300mm and shall dispose of all such vegetation from the site.

Minor vegetation matter may be re-distributed with the topsoil with the prior approval of the Engineer.

Vegetation shall not be disturbed elsewhere in the Site unless identified on the drawing and where stormwater drains or other works are to be constructed and clearing in these cases shall be limited to the area of work.

No burning shall occur on site.

E4 TOPSOIL

Topsoil shall consist of the upper layer of material which includes vegetation, roots and grass for the purposes of this Contract.

Topsoil shall be removed from all areas on which excavation or fill operations are to be conducted. Topsoil so removed shall be stockpiled in areas so selected as to avoid interference with other construction or causing likely contamination of trench backfill. Clean topsoil free of debris shall be re-distributed to a depth of 100mm to all areas in which cutting, filling and excavation operations have occurred.

After the cutting and filling operations have been approved, the Contractor shall, within 72 hours of such approval, re-distribute topsoil to a maximum depth of 100mm over these areas.

Any surplus topsoil and shall be removed from the site and disposed of at a location approved by the local authority.

E5 EARTHWORKS

Earthworks shall include all cut and fill required within the Site to achieve the required levels and shapes as shown on the drawings and specified herein.

Prior to placement of any fill, the site shall be compacted, proof rolled and inspected by the contractors Geotechnical Engineer. Any areas of unsuitable material exposed shall be excavated, removed and replaced with suitable material. Prior to placement of the fill the contractor=s Geotechnical Engineer shall provide written certification that the site has been prepared in accordance with the Geotechnical Report.

General fill within the Site shall be placed in layers not exceeding 300mm thickness and compacted to achieve a minimum dry density ratio of 95% when tested in accordance with AS 1289 E2.1 unless otherwise specified.

Where the subgrade soils are cohesive materials and poorly draining they shall be shaped to avoid water ponding areas prior to the placement of fill.

All fill shall be clean non plastic material imported to the Site or obtained from general or roadwork excavation and shall not be contaminated with large stones, vegetation, rubbish or other deleterious material.

The Contractor shall allow for any means necessary for adjusting the moisture content of the fill to achieve the required compaction.

Any surplus cut material shall be removed from site and disposed off at a location approved by the local authority.

Earthworks shall be trimmed to a neat finish within the tolerance specified. The surface shall be even and conform to the intent of the drawings.

E6 WATER IN EXCAVATIONS

The Contractor shall at all times maintain excavations free from water regardless of source or method of entry to the excavation. The Contractor shall allow for cut-off drains, well points, bores, drain diversions, pumps and any other means necessary to keep excavations dry and in a safe condition and shall repair or reinstate to the satisfaction of the Engineer any damage caused by failure to keep the excavation free from water.

E7 EXCAVATION IN ROCK

The different kinds of material encountered in excavation shall be classified under the headings "Other than Rock" or "Rock", and shall have the following meanings:

"Other than Rock" shall mean all kinds of materials which can be ripped by a track dozer up to 100kw power and 15t mass with one tyne or broken by a track excavator up to 75kw power and 15t mass with a rock bucket.

"Rock" shall mean hard material which requires ripping or breaking by a larger machine or hydraulic rock breaker and is in fact so ripped or broken.

Where excavation in rock occurs, the Contractor shall be responsible for any overcut beyond that specified and all necessary backfill to allow correct line and level to be maintained.

E8 EXCAVATION IN EXISTING ROAD RESERVES

Excavation shall be kept to a minimum in existing roadways, footpaths, other paved areas and developed verges. Lawn is to be cut in sods or rolls, removed and stacked prior to excavation. Lawn is to be reinstalled and level immediately after backfill of the trenches.

Any irrigation lines which are damaged during the works shall be reinstated immediately upon backfill of the excavations. Pipes shall be cut and capped to allow use of the system during works.

The Contractor shall ensure minimal damage to all vegetation and any damage shall be reinstated to the satisfaction of the Engineer.

E9 STABILISATION

The disturbed soil on the Site other than the road formation shall be stabilised by either dry seeding and covering with shredded vegetation or hydromulch as soon as practicable after the top soil has been satisfactorily replaced and regraded.

E9.1 Dry Seeding

A mixture of endemic local groundcovers and shrubs, as specified by the local authority, shall be sown using an approved seed drill attached to a tractor.

The mixture shall be applied at the rate of not less than 120kg/ha.

The rows of seeds shall, wherever practicable, run parallel to the contours of the ground surface.

The whole area shall, upon completion of the seeding, be lightly raked to remove wheel tracks etc., and present a smooth even surface.

E9.2 Hydromulch

Hydromulch shall consist of mulch and stabiliser applied by mechanical spray.

Stabiliser shall be Ecologel 42, or Curasol AG45, applied at 250 l/ha.

Mulch shall be of a paper mache type.

Prior to hydromulching all areas to be treated shall be graded so as to present an even surface on completion of the hydromulch application.

E9.3 Temporary Stabilisation

Temporary stabilisation shall be undertaken as required by the Engineer by the application of an organic stabiliser, protect coat K61 or similar and water mix. The mix may be sprayed onto the Site by water cart.

E9.4 Spreading Shredded Vegetation

Shredded vegetation shall be evenly spread over disturbed ground, other than building sites, as directed by the Engineer.

E10 SITE PRESENTATION

All verges shall be backbladed and graded so as to present an even surface. This shall be completed prior to stabilization works.

D DRAINAGE

D1 GENERAL

Stormwater drains and subsoil drains shall be constructed in accordance with the drainage layout plans.

Pile and keel or bearers will be required in soft ground and where drains cross existing services.

Drain construction shall take place in dry conditions and where necessary the Contractor shall provide dewatering equipment to ensure such suitable conditions exist.

D2 TOLERANCES

COMPONENT	TOLERANCE		
	ALIGNMENT	GRADE	LEVEL
Pipes, Box Culverts And Lined Channels	∀ 25mm	+ 10mm - 20mm	∀ 10mm
Structures	∀ 20mm	-	∀ 10mm

D3 MATERIALS

D3.1 Cement

Cement shall be of Western Australian manufacture and in accordance with AS3972. Cement shall be contained in bags bearing the stamp of a NATA registered testing Authority. Any bag showing signs of "age caking" shall be rejected.

D3.2 Water

Water used in concrete or mortar shall be of potable quality, free from suspended material, organic matter, alkali, salts and other impurities.

D3.3 Fine Aggregate

The term "Fine Aggregate" is used to designate aggregate in which the maximum nominal size of particles is 4.75mm. Fine aggregate for concrete and mortar shall be natural sand which shall consist of hard, angular, durable grains free from dust, soft particles, alkali, organic matter, loam and other deleterious substances.

Fine aggregate shall be in accordance with AS2758.

D3.4 Coarse Aggregate

The term "Coarse Aggregate" is used to designate aggregate that is in the range of sizes of 4.75mm to 19.0mm. The coarse aggregate shall be free from clay lumps, dust, organic material or other deleterious substances and in accordance with AS2758.

In order to obtain a reasonable grading, the coarse aggregate shall be batched in two size designations or graded as 19.0mm "all in". All grading shall be to the approval of the Engineer.

D3.5 Reinforcing Steel

Reinforcing steel shall be structural grade and shall be in accordance with AS1302 and AS1304.

D3.6 Concrete

All concrete work shall be carried out in accordance with AS3600. No concrete shall be placed before the Engineer has checked the base, formwork and reinforcement. All materials shall be weigh batched and the proportions for each mix shall be approved by the Engineer before concrete is made.

D3.7 Concrete Proportions

Concrete for kerbs and manholes shall contain not less than 213 kg of cement per cubic metre and the water/cement ratio shall not exceed 0.60.

Concrete for other works shall not contain less than 171 kg of cement per cubic metre and the water/cement ratio shall not exceed 0.60.

D3.8 Timber

All timber shall be structural grade hardwood treated to be termite resistant.

D3.9 Steel

All steel shall comply with the requirements of AS3679.

All steel shall be new and each member free of any welding or other form of splice.

D3.10 Galvanising

Miscellaneous steel fittings and fixings shall be hot dip galvanising to requirements of AS1214 and ASB193.

Zinc coating shall be not less than 600 gm/m^5 of surface area.

D3.11 Bricks

All bricks to be used for construction shall be solid burnt clay bricks and shall comply with AS1225 and be of quality appropriate to the class of brickwork.

D3.12 Cement Mortar

Cement mortar shall consist of cement and sand gauged by volume in the following proportions : one part by volume of Portland Cement to 3 parts of sand. This shall be employed for all instances unless otherwise directed by the Engineer.

The ingredients shall be mixed in an approved mechanical mixer or shall be mixed together dry on a clean wooden stage until the mix is homogeneous in colour. Water shall then be added in sufficient quantity to give more than stiff workability. The whole shall then be turned until perfectly mixed.

Mortar shall be used within 2 hours of mixing and shall not be remixed or worked up again after it has stiffened. Any mortar that has commenced to set shall be removed from the works.

D4 HEADWALLS AND ENDWALLS

Headwalls, endwalls and aprons shall be constructed using reinforced concrete with a minimum compressive strength of 32MPa as detailed on the drawings. All structures shall have at least a 300mm buried toe.

D5 PIPES AND BOX CULVERTS

Stormwater pipes shall be reinforced concrete, rubber ring jointed, Class 4 drainage pipes manufactured to AS4058 unless otherwise specified on the drawings.

Box culverts and bases shall be precast reinforced concrete culverts manufactured to AS1597 unless otherwise specified on the drawings.

D6 EXCAVATION

The Contractor shall excavate trenches on the alignments and to the widths shown on the Drawings and shall keep to the minimum width reasonably necessary to construct the Works.

No more than 300m of trench shall be open at any particular time and at no time shall excavation lead pipe laying be more than 100m without approval by the Engineer.

The Contractor shall provide all intermediate benches, side-lacings, shorings, frames, timbers and other materials to ensure that the trench sides are maintained at all times in a safe condition.

Care shall be exercised when excavating near existing services, structures or other items likely to be damaged by the Contractor's activities, in particular, machinery causing vibration shall be operated only at a safe distance in such areas and the Contractor shall allow for use of alternative methods of construction where machines of this nature cannot be used.

Where over excavation has occurred, the Contractor shall make good such over excavation with clean well graded sand. Compacted to a minimum dry density ratio of 95% when tested in accordance with AS 1289 E2.1 or other approved remedial actions.

The Contractor shall at all times maintain excavation free from water regardless of source or method of entry to the excavation. The Contractor shall provide cut-off drains, well points, bores, drain diversions, pumps and any other means necessary to keep excavations dry and in a safe condition and shall repair or reinstate any damage caused by failure to keep the excavation free from water.

D7 PIPE AND BOX CULVERT INSTALLATION

Pipes and culverts shall be laid on the prepared bedding to the line level and grade shown on the approved drawings. No pipes or culverts shall be laid on filled ground until such ground has been compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1.

Hip holes shall be dug to ensure the pipe bears uniformly along its barrel and does not bridge between supports at the sockets.

Rubber ring joints shall be installed in accordance with the manufacturer's recommendations. Bitumastic sealant tape 300mm wide shall be applied to the external face of all culvert joints.

Pipes shall be in straight alignment before the joint is closed and after the joint is home any necessary angular adjustment may be made.

Pipes and culverts laid in wet conditions shall be laid on coarse aggregate bedding for the full width of the bottom of the trench.

Culverts shall be laid on a reinforced concrete base.

D8 BACKFILLING

Initial backfill to the top of the pipeline shall be carried out by hand placing approved fill material, free from rock, soil lumps or other unsuitable material.

The fill shall be placed uniformly on both sides of the pipe and compacted as firmly as can be managed by hand tamping.

Care should be taken to avoid damaging the pipe by direct impact.

Final backfill above the pipe shall be placed in uniform layers along the total length of pipeline to prevent overload or displacement and compacted at optimum moisture content by mechanical methods to achieve a compacted density not less than that of the same material in an undisturbed state.

Surplus material from excavations shall be graded out over the Site and any unsuitable materials removed from the site.

No excavation shall be backfilled until the pipeline or structure has been inspected and approved by the Engineer.

Should any section of pipe be disturbed or damaged during backfill it shall be removed and re-laid at the Contractors expense to the satisfaction of the Engineer.

D9 MANHOLES AND GULLY PITS

Manholes and gully pits shall be constructed of reinforced concrete segments, at the locations and to the detail shown on the drawings.

Top of manholes and gully pits shall finish flush with the final level of the surrounding ground, footpath, road or kerb.

All covers shall be aligned to be parallel to the adjacent kerb, road or path.

Step irons shall be installed to the Controlling Authority requirements.

D10 FILL AGAINST STRUCTURES

Filling shall not be placed against structures until the structure has been inspected and approved for filling.

Fill materials shall be placed in horizontal uniform layers not exceeding 150mm thickness and shall be compacted to a minimum dry density ratio of 98% when tested in accordance with AS1289 E2.1 or E3.3.

Backfilling over and around structures shall avoid unbalanced loading or create movement.

The Contractor shall be responsible for any damage to existing structures as a result of filling and compacting operations.

D11 OPEN DRAINS, BASINS AND BERMS

Open drains, basins and berms shall be constructed at the locations and to the details shown on the drawings at the earthwork stage.

All batters shall be trimmed prior to stabilization. Batters steeper than 1 in 8 shall be treated with soil stabilizer, proprietary geotextile or stone revetment.

Open drains having a grade greater than 1 in 1000 shall have stone scour prevention structures constructed at even intervals to achieve the maximum permitted grade.

Inlet and outlet scour protection shall be constructed at the locations shown on the drawings using mortared stone pitching.

Stones shall be hard, durable local stone spalls weighing generally in excess of 5kg each with the greatest dimensions not exceeding 1.5 times the least dimension. Stones shall be set on a prepared soil bed in a close fitting pattern and rammed into position.

Joints shall be raked for their full depth and grouted with cement mortar.

D12 SUBSOIL DRAINS

Subsoil drains shall be installed in the locations shown on the drawings.

Subsoil drains shall consist of slotted pipes or strip drain fitted with a geofabric filter sock and screened by graded aggregate.

The aggregate shall be clean and uniformly graded from 2mm to 10mm.

The aggregate shall have a minimum thickness of 150mm all round pipe or strip drain.

The Contractor shall undertake a particle size distribution analysis of the soil prior to selection of the filter fabric and shall forward the results to the Engineer.

The geofabric filter sock shall be non woven and have the following filtration requirements in relation to the soil being drained;

	$D_{5OS} < 75\Phi m$
	$EOS < D_{85S}$
	$EOS < 2.5 \times D_{50S}$
	$EOS > D_{15S}$
generally	$EOS < 200\ \Phi m$
	$G > 900$

(EOS equivalent open size of fabric)

D13 'AS CONSTRUCTED INFORMATION

The Contractor shall ensure that no part of the work is backfilled or otherwise covered until 'as constructed= information has been obtained.

The drainage >as constructed= information shall include, but need not be limited to the following:

- type of structure;
- pipe invert levels at all structures;
- grade of pipes and open drains;
- distance between structures;
- pipe size and class;
- invert levels of open drains and dimensions of basins;
- cross-section of open drains;
- change of locations e.g. line alignments tied to properties/lot boundaries.

Such information shall be certified by the Contractor's Surveyor and forwarded to the City. Practical Completion will not be issued until a compliant drainage >as constructed= drawing is provided.

R ROADWORKS

R1 TOLERANCES

Pavement construction shall comply with the following tolerances and the surface shape shall be such that water cannot pond at any point.

COMPONENT	TOLERANCE			
	THICKNESS	LEVEL	SHAPE (DEPARTURE FROM 3M STRAIGHT EDGE)	WIDTH
Sub Grade	-	+ 10mm - 30mm	-	+ 200mm - 0mm
Sub Base	+ 15mm - 0mm	+ 10mm - 20mm	-	+ 200mm - 0mm
Base-course	+ 10mm - 0mm	+ 5mm - 10mm	5mm	+ 100mm - 0mm
Seal Surface		+ 5mm -10mm	5mm	+ 100mm - 0mm
			5mm	

Asphalt	+ 5mm	+ 5mm		+ 100mm
Surface	- 0mm	- 10mm		- 0mm

R2 PAVEMENT MATERIALS

R2.1 Modified Pindan

This specification is for red slightly clayey or silty sand for use as a sub base course on well drained sealed roads.

The material shall be extracted from an approved source and shall comply with the following criteria:

PARTICLE SIZE DISTRIBUTION	
NOMINAL SIZE (mm)	**PERCENTAGE PASSING (by mass)**
4.75mm	100
2.36mm	70 – 100
1.13mm	50 – 100
600Φm	36 – 100
425Φm	30 – 84
300Φm	25 – 71
150Φm	18 – 50
75Φm	13 – 35
13Φm	5 – 15
Dust ratio	0.2 – 0.6

Liquid Limit	≤ 25
Plasticity Index	≤ 10
Linear Shrinkage	2-4%
CBR unsoaked	≥ 60

WACCT	
Class No.	≤ 2.5
Cohesion	≥ 85 Kpa
Tensile Strength	≥ 55 Kpa
Horizontal Separation of Class No. Contours %	≥ 1.3
Maximum Dry Density	≥ 2100kg/m³
Optimum Moisture Content	5-7%
$A1_2O_3 + F_{e2}O_3$	> 8%

Notwithstanding this specification, any sample which in the opinion of the Engineer, is composed of unsuitable material, or is composed of material which would break down with aging or weathering to such an extent that it would then fall outside the limits of this Specification, shall be rejected.

R2.2 Crusher Dust

The material shall be non plastic and from hard rock crushing plant and consist of the portion passing a 4.75mm AS sieve and shall conform to the following and shall be non plastic:

NOMINAL SIZE (mm)	PERCENTAGE PASSING (by mass)
4.75mm	90 - 100
2.36mm	65 - 75
600µm	25 - 40
75µm	3 - 7

R2.3 Road Base

Road base shall be hard crushed aggregate of various gradings, including "fines", derived from naturally occurring igneous rock and free from sand, vegetable matter and any other deleterious material.

Grading:

The portion of the total sample retained on the 19mm AS sieve shall not exceed 5% of the total sample. The grading of the portion passing a 19mm AS sieve shall conform with the following:-

NOMINAL SIZE (mm)	PERCENTAGE PASSING (by mass)
19.0mm	100
9.5mm	70 - 80
4.75mm	40 - 65
2.36mm	30 - 50
425µm	12 - 30
75µm	3 - 12

The ratio of the portion passing the 75µm sieve to the portion passing the 425µm sieve shall fall within the range 40 - 60%.

Soil Constants:

The portion of the sample which passes the 425µm sieve (Soil Mortar) shall conform to the following requirements:-

The plastic limit shall not exceed 20

The liquid limit shall not exceed 25

The Plasticity Index shall not exceed 5

The Linear Shrinkage shall not exceed 1%

The Dry Compressive Strength shall not be less than 1.75 Mpa.

Dust ratio shall not exceed 0.67

Notwithstanding this specification, any sample which in the opinion of the Engineer, is composed of unsuitable material, or is composed of material which would break down with aging or weathering to such an extent that it would then fall outside the limits of this Specification, shall be rejected.

R2.4 Road Sealing Aggregate

Aggregates shall consist of clean hard, durable pieces of crushed stone or crushed gravel, free from deleterious material or excessive amounts of flat or elongated pieces.

Aggregates shall be even graded from coarse to fine and comply with the following limits.

AGGREGATE GRADING SPECIFICATION			
NOMINAL SIZE (mm)	**PERCENTAGE (BY MASS) PASSING FOR THE FOLLOWING NOMINAL SIZE AS SIEVE**		
	14mm	**10mm**	**7mm**
19.0	100		
13.2	80 - 100	100	
9.5	0 - 20	80-100	100
6.7	0 - 2	0-25	80 - 100
4.75	-	0-2	0 - 30
2.36	-	-	-
1.18	0 - 0.5	0-0.5	0 - 0.5
Maximum Flakiness Index	⇑30	⇑30	⇑30
Average least dimension	9-13mm	6-8mm	4-6mm

When tested in accordance with Los Angeles abrasion test, aggregate shall have a percentage of wear not greater than 40% and when tested in accordance with the Aggregate Crushing Strength Test, shall have a loss not greater than 30%.

Notwithstanding this Specification any sample, which in the opinion of the Engineer, is composed of unsuitable material, or is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of this specification, shall be rejected.

R2.5 Bitumen Products

R2.5.1 General

The materials shall comply with the following relevant standards:

AS1160 Bitumen Emulsions for Construction and Maintenance of Pavements

AS2008 Residual Bitumen for Pavements

AS2150 Hot Mix Asphalt

AS2157 Cut Back Bitumen

AS2357 Mineral Filler for Asphalt

AS2734 Asphalt (Hot-mixed) Paving - Guide to Good Practice

R2.5.2 Hot bitumen

Hot bitumen shall be straight run class 170 residual bitumen suitable for road sealing purposes.

Additives for various conditions may be specified by the Engineer.

For spray work the temperature of the bitumen shall be not greater than 180EC and not less than 160EC.

R2.5.3 Bitumen emulsions

The emulsions shall be prepared from class 50 residual bitumen and an approved emulsifier.

The type and grade of emulsion may be specified by the Engineer. The bitumen content shall be a minimum of 60%.

R2.5.4 Cut-back bitumen

The cut-back bitumen shall consist of straight run class 170 residual bitumen mixed with medium curing cutter and slow curing cutter.

The grade and proportions of each cutter may be specified by the Engineer.

For spray work the temperature of the cut-back shall be in accordance with the relevant range recommended in NAASRA, "Bituminous Surfacing - Sprayed Work", 1989.

R2.5.5 Spraying Equipment

The spraying unit shall have a current test certificate issued by Main Roads Western Australia and shall comply with the requirements specified in NAASRA "Bitumen Sprayers", 1989.

Unless otherwise permitted, the sprayer shall have a minimum tank capacity of 2000 litres.

R2.5.6 Adhesion Agents

Adhesion Agents shall be compatible with the Sealing Aggregate being used.

R2.5.7 Precoating

Precoating for aggregates shall be slow curing cutter. The application rate shall be 2l/loose m;.

R2.5.8 Asphalt - (Hotmixed)

Standard Mix	**AC 14**	**AC 10**	**AC 10 Intersections**	**AC 7**
Aggregate Type	Igneous Rock	Igneous Rock	Igneous Rock	Igneous Rock
Nominal Mix Size	14mm	10mm	10mm	7mm
Marshall Blows	50	50	75	50
Minimum Marshall Stability of Compacted Mix	6.5 kN	6.5 kN	8 kN	5.5kN
Marshall Flow Value	2 - 4mm	2 - 4mm	2 - 4mm	2 - 4mm
Range of Voids Content Compacted Mix	4 - 6%	4 - 6%	4 - 6%	3 - 5%
Bitumen Binder	Class 170	Class 170	Class 320	Class 170
Marshall Quotient	1.7 kN/mm	1.7 kN/mm	2.0 kN/mm	1.7 kN/mm
Binder Content	4.5 - 6.5%	5.0 - 7.0%	5.0 - 7.0%	5.0 - 7.0%

Aggregate Grading Limits

Sieve Size	Range Percentage of Mineral Aggregate Passing Sieve (by mass)		
	Size 14	Size 10	Size 7
19.0mm	100		
13.2mm	85 - 100	100	
9.50mm	70 - 85	90 - 100	100
6.70mm	62 - 75	70 - 90	80 - 100
4.75mm	53 - 70	58 - 76	70 - 90
2.36mm	35 - 72	40 - 58	45 - 60
1.18mm	24 - 40	27 - 44	35 - 50
0.600mm	15 - 30	17 - 35	22 - 35
0.300mm	10 - 24	11 - 24	14 - 25
0.150mm	7 - 16	7 - 16	8 - 16
0.075mm	4 - 7	4 - 7	5 - 8

R3 PAVEMENT

R3.1 Sub-Grade

The formation shall be excavated to the required pavement width and to the longitudinal and cross sectional gradings shown on the drawings.

The sub-grade shall be compacted to a minimum dry density ratio of not less than 95% when tested in accordance with AS1289 E2 to a minimum depth of 150m below the sub grade surface.

The completed sub-grade shall be approved by the Engineer prior to placing the sub-base material.

R3.2 Sub-Base

The sub-base shall be constructed of local crusher dust or modified pindan according to the availability of material in the area to the width shown on the drawings.

The material shall be placed within the formed box and spread, without unduly disturbing the sub-grade, to the required profiles working from the centre towards the edges.

The material shall be water bound, spread and compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1.

The final sub-grade shall have a minimum thickness of 200mm but 400mm in Gilgai soils.

The completed sub-base shall be approved by the Engineer prior to the placing of the base course.

R3.3 Base

The base course shall be constructed of crushed rock base to the width shown on the drawings.

The base material shall be spread from an approved tipping truck in an even and continuous layer.

The base material shall be watered to the optimum moisture content, graded to the required profile with a minimum of cut and uniformly compacted to a minimum dry density ratio of 98% when tested in accordance with AS1289 E2.1.

Any part of the base course which is below the required level after consolidation shall be scarified to a depth of 75mm, made up with fresh base material and re-compacted.

The final base course shall have a minimum thickness of 200mm and be free from bony areas and thin layers of finer material.

The completed base course shall be approved by the Engineer prior to the application of the primer seal.

R4 SURFACE COURSE

R4.1 General

The bituminous surfacing of roads shall be a primer seal of bitumen emulsion and 7mm aggregate and a wearing course of a dense graded 10mm size Asphalt (Hotmixed) laid to a minimum thickness of 25mm unless otherwise specified on the drawings.

Intersections shall have a wearing course of dense graded 10mm size asphalt (Hot mixed) intersection mix unless otherwise specified on the drawings.

The Contractor shall notify the Engineer at least 48 hours in advance of the intended sealing or surfacing works and shall submit the proposed seal design for approval.

R4.2 Spray Seals

R4.2.1 Primer Seal

The grade and application rate of the binder shall in accordance with the appropriate seal design and confirmed by the Contractor after the inspection of the completed base course. Generally the binder will be bitumen emulsion but may be cut back hot bitumen.

Generally the application rate will be 1.4 l/m5.

The cover aggregate shall be spread at a rate approved by the Engineer. Generally for 7mm nominal aggregate the application rate will be 110m^2/m^3.

After the completed base course has been approved and any deficiencies corrected it shall be broomed clean of all loose materials and dust without damaging the surface.

Immediately before the application of a bitumen emulsion binder, the base course shall be slightly dampened to ensure proper penetration and coverage.

R4.2.2 Final Seal

The grade and application rate of the binder shall be in accordance with the appropriate seal design and confirmed by the Contractor after inspection of the completed primer seal.

Generally the binder will be hot bitumen fluxed with 1% diesel fuel and contain 0.1% adhesion adent.

Generally the application rate will be 1.50 l/m5.

The cover aggregate shall be spread at a rate approved by the Engineer. Generally for 14mm nominate aggregate the application rate will be 80m5/m;.

Prior to sealing, the primer seal shall be broomed clean of all loose materials and any defects or irregularities corrected to the satisfaction of the Engineer.

R4.2.3 Two Coat Bitumen Emulsion Seal

The grade and application rate of the binder shall be inaccordance with the appropriate seal design and confirmed by the Contractor after the inspection of the completed base course. Generally the binder will be Cationic RS.1

Generally the application rate for the first coat will be 1.1 l/m5 and for the second coat will be 1.9 l/m5.

The cover aggregate shall be spread immediately following application of the binder. Generally the first coat will be 14mm aggregate at an application rate of 80m5/m; and the second coat will be 7mm aggregate at an application rate of 110m5/m;.

After the completed base course has been approved and any deficiencies corrected it shall be broomed clean of all loose materials and dust without damaging the surface.

Immediately before the application of the binder the base course shall be slightly dampened to ensure proper penetration and coverage.

The first coat shall be rolled and lightly drag broomed and the emulsion allowed to >break= before the second coat is applied. Both coats shall be completed in the same establishment.

R4.2.4 Spraying

The binder shall be sprayed directly from a spraying unit having a current test certificate issued by Main Roads Western Australia.

Before and after each spray run the contents of the spraying unit shall be dipped on level ground and the application rate checked. This shall be within ∀ 5% of the specified rate.

The aggregate spreading trucks, rolling and brooming equipment shall be ready to follow the spraying unit prior to the commencement of each spray run.

The width and length of each spray run shall not be greater than that which can be adequately covered by the material and equipment on hand immediately prior to the commencement of the spray run.

The laps of each run shall be free of loose aggregate prior to the commencement of an adjoining run. Stop/start trays or cut-off sheets shall be available for use if required by the Engineer.

Spraying of hot bituminous binders shall not be carried out when the pavement temperature is below 201C and spraying in general shall be not carried out in inclement weather or if the Engineer has advised that conditions are unsuitable.

R4.2.5 Aggregate Spreading

Trucks used for aggregate spreading shall be in good mechanical condition and fitted with bodies and aggregate spreaders from which the material cannot spill.

The aggregate spreader shall be operated only by persons competent and experienced in similar types of work.

At the completion of each spreading run the quantities used shall be recorded and the application rate checked.

The aggregate shall be spread immediately following the commencement of each spray run and continue as close as practicable behind the spraying unit.

R4.2.6 Rolling and Brooming

Prior to rolling, any areas under covered shall be corrected and any spillage heaps shall be removed or uniformly distributed over the work.

If the aggregate is wet the rolling operation shall be delayed until it is almost dry.

Initial rolling shall be effected by a 6/8t smooth steel wheeled roller completing two passes over the total sealed area.

After the initial rolling the seal shall be broomed with a drag broom to ensure uniform distribution of the aggregate and final rolled with a 6/8t smooth steel wheeled roller or 8/10t pneumatic rubber tyred multi-wheeled roller.

The rolling shall continue in conjunction with the brooming to achieve 1 hour of rolling per 500m5 of seal.The wheels of the roller shall be kept clean.

If there is any evidence of aggregate crushing, the steel roller shall be removed from the work and the rolling continued with a rubber tyred roller.

R4.2.7 Finish

The completed seal shall produce a well bonded uniform surface free from over-sprayed, under-sprayed or under-covered areas and an excessive quantity of loose aggregate.

The completed seal may be inspected by the Engineer and no sealing plant shall be removed from the site until the work has been approved.

R4.3 Asphalt (Hot Mix) Surface

R4.3.1 Delivery

All delivery vehicles shall be in good mechanical condition. Vehicle bodies shall be such that the asphalt cannot leak or spill and shall be fitted with covers of such size, thickness and material as to protect the load from the weather.

When directed by the Engineer, or where the lead exceeds 110km, or where the ambient temperature is below 10EC and the lead exceeds 50km, the vehicle body and the cover shall be suitably insulated.

The interior of each vehicle body shall be cleaned of all foreign materials and lightly lubricated as necessary with a slightly detergent solution or other approved material. All foreign material and excess lubrication shall be removed prior to loading the vehicle.

Delivery dockets showing the following written information shall be available to the Engineer.

- Quantity of material.
- The date and time of loading.
- The name of the supplier.
- The identification number of the vehicle.
- The size of the asphalt and the location reference of the plant at which the asphalt was manufactured.

R4.3.2 Construction Plant

Sprayers:

Sprayers shall be capable of spraying the tack coat uniformly through jets in a spray bar at the desired rate of application up to a width of 2.5m. The spray bar shall be fitted with end shields.

Pressure type sprayers issued for spraying bitumen emulsion shall be capable of operating at a continuous pressure of 175kPa.

Pavers:

Pavers shall be self-propelled and shall be equipped with hoppers and distributing screws of the counter rotation type to place the asphalt evenly in front of the screed. Means shall be provided to heat the screed uniformly over its full width.

Pavers shall be equipped with a quick and efficient steering device and shall be capable of forward and reverse travelling speeds of 30m/min. They shall be capable of spreading the asphalt without segregation in a paver compacted thickness between 15mm and 150mm and to widths between 1.8m and 4.3m except in the case of wide or twin pavers which shall be capable of spreading widths up to 8.0m.

Compaction Plant:

The Contractor shall provide at least one steel wheeled tandem roller fitted with a suitable cutting wheel and one pneumatic tyred multi-wheeled roller.

The rollers shall be in good mechanical conditions and capable of reversing without back lash.

All rollers shall be fitted with approved devices to enable the whole of the surface of the wheels to be kept damp with a minimum amount of water. The taps controlling the rate of flow shall be readily accessible to the driver. In no circumstances shall the water be allowed to run directly from taps onto the asphalt being compacted.

For the compaction of asphalt, the Contractor shall provide self-propelled reversible rollers complying with the following requirements:

- Steel wheeled rollers shall have a mass not less than 9 tonne (non vibratory) and 6 tonne vibratory and shall have a static load intensity not less than 4.5 tonne per metre width of drive roll.

- Self-propelled, pneumatic tyred, multi-wheeled rollers shall be equipped with tyres of equal size and diameter, having smooth treads. Tyres on the rear wheel shall be offset relative to the front tyres to give overlapping wheelpaths and complete coverage for the effective width of the roller. The tyres shall be capable of being inflated to 700kPa. The total operating mass and tyre pressures may be varied as directed by the Engineer.

  Rollers used for layers of compacted thickness less than 100mm thickness shall be so constructed that the total mass of the roller can be varied to produce an operating load per tyre up to 1 tonne.

  Rollers used for layers of compacted thickness of 100mm or more shall be so constructed that the total mass of the rollers can be varied to produce an operating load per tyre of between 1.3 tonne and 2.3 tonne.

  Self propelled, pneumatic tyred, multi-wheeled rollers for use in initial rolling on layers of compacted thickness of 100mm or more shall have tyres not less than 220mm wide, on rims not less than 500mm diameter.

- All rollers shall have approved brushes or similar devices so that each roll of tyre is kept clean of foreign material and can be kept uniformly damp.
- For compacting confined areas, the Contractor shall provide a small roller and/or a mechanical impact type or vibrating type hand operated compactor.

R4.3.3 Preliminary Work

Before commencing each days work, the Contractor shall clean the area.

Cleaning shall consist of the removal of all deleterious material and sweeping the area clean.

Surface preparation, which shall include sweeping and hand chipping shall be done before applying the tack coat. When any area contains an excess of binder in such a quantity that there is any possibility of the excess binder coming to the surface of the new work, no asphalt shall be placed upon such area until all such excess binder has been removed to the satisfaction of the Engineer.

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 control devices to control the traffic movement along the street when work is in progress. All such devices shall be selected and placed in accordance with the Main Roads Western Australia Traffic Management for Roadworks Code of Practice, AS 1742.3, Manual of Uniform Traffic Control Devices Part 3 Traffic Control Devices for Works on Roads, and SAA HB81, Field Guide for Traffic Control at Works on Roads.

R4.3.4 Tack Coat

Tack coat shall consist of Class 50 rapid setting bitumen emulsion which may be diluted by the addition of up to 50% of clean water with the consent of the Engineer. It shall be applied only to a clean, dry surface.

Tack coat shall be applied by a sprayer through jets in the spray bar at a rate of 0.5 l/m^2.

Tack coat sprayers shall at all times be in a clean condition internally and externally. The interior of all pipework, spray bars and spraying jets shall be clean and free from any tack coat materials before spraying commences.

Tack coating and spreading of asphalt shall cease if the sprayer does not spray uniformly at the desired rate of application.

The Contractor shall arrange the work so that the minimum length of tack coat is sprayed in any one operation. A sufficient period of time shall be provided in order to allow the tack coat to set up and become tacky before the asphalt is placed.

The use of hand lance or squeegee will be strictly limited to those areas inaccessible to the use of a sprayer or where a variable application rate is required.

When spraying the tack coat shields shall be used and all necessary precautions taken to protect kerbs and adjoining structures from damage.

The Engineer may require the Contractor to dispense with the tack coat when spreading asphalt over clean freshly laid asphalt, or over a clean dry and cured primed surface, or where the depth of the layer equals or exceeds 50mm.

R4.3.5 Spreading

Asphalt shall be laid after the kerbing has achieved adequate strength.

The asphalt shall be laid on a foundation which is essentially dry and free from puddles.

No asphalt shall be placed in layers less than 25mm compacted thickness when the ambient temperature is less than 10^{1}C unless rolling is done immediately after spreading.

No asphalt shall be placed in layers less than 100mm compacted thickness when the ambient temperature is less than 10^{1}C or when cold winds chill the asphalt to an extent that spreading and compacting are adversely affected. In an emergency, approval may be given by the Engineer to spread the asphalt when the ambient temperature is below 10^{1}C but only under such conditions as maybe directed.

Under no circumstances shall asphalt be spread when the ambient temperature is less than 51C.

The asphalt shall be spread in accordance with lines and levels shown on the contract drawings for each pavement course.

The speed of the paver shall be as uniform as possible and the lowest consistent with the rate of delivery of asphalt. The occasions on which the paver needs to be stopped shall be kept to a minimum.

Asphalt paving operations shall not commence until sufficient asphalt is on site to permit continuous spreading operations.

The asphalt shall be spread without tearing, gouging, or displacement to produce an even surface. Where necessary, the surface shall be corrected by methods approved by the Engineer.

The spreading of asphalt by hand behind the paver is not permitted except that, where it is impractical to spread and finish asphalt by machine methods, hand methods may be used with the approval of the Engineer.

Asphalt shall be spread in such a manner as to minimise the number of joints in the carriageway. The layout of joints shall conform to the following requirements.

In any individual layer transverse joints in adjoining paver runs shall be displaced longitudinally by not less than 2m.

All longitudinal joints shall be offset from layer to layer by not less than 150mm. Where proposed lane line positions are provided longitudinal joints in the wearing course shall be made to coincide with these by the use of spreading widths corresponding with the lane widths.

The screed of the paver shall overlap the previously spread lane by 25mm to 50mm. At cold joints the overlapped asphalt shall be removed to waste or crowded back at the joint. No asphalt shall be thrown on to the mat being spread.

Unless otherwise directed by the Engineer, the day's work shall be organised so that each layer spread covers the full width of the carriageway.

Immediately after any layer is spread and before compaction is started, the surface shall be checked, any unevenness adjusted, and all sandy, segregated, hungry, or dusty areas removed and replaced with fresh hot asphalt. Irregularities in alignment and grade along the outside edge shall be corrected by the addition or removal of asphalt before the edge is rolled.

Competent workmen capable of correcting all pavement irregularities shall be employed. The correction of irregularities shall be checked for shape and level with a straight edge immediately following the initial rolling.

Permission to proceed with paving operations may be withdrawn by the Engineer until remedial work is complete.

When laying of asphalt by hand is approved it shall be distributed into place without segregation in a loose layer of uniform density and to the correct level. It shall be spread without tearing, gouging or displacement to produce a smooth even surface true to line, level and camber. Raking shall be done in a careful and skilful manner. Asphalt shall not be deposited any faster than can be properly handled.

Workmen shall not stand or walk on the hot spread asphalt except for the purposes referred to in above.

R4.3.6 Joints and Junctions

All longitudinal and transverse joints shall be well bonded and sealed. Hot longitudinal joints are preferred.

Junctions between old and new pavements and joints between successive days' work shall be carefully made in such a manner as to ensure a thorough and continuous bond between the old and new surfaces and to provide a smooth riding connection across the junction or joint.

The exposed edges of each paver run shall be formed while hot with a dense face which may be between vertical and 451 to the vertical for the full depth of the layer. Rollers shall not be permitted to damage this face. Any segregated or open textured asphalt in such face shall be removed by cutting back the edge in a straight line to expose fresh, dense asphalt. The cut edge shall be between vertical and 451 to the vertical.

All longitudinal joints shall be parallel to the centre line of the carriageway. Special care shall be taken in the forming of longitudinal joints at ramp terminals and at all intersections to avoid joint layouts and an appearance that would tend to misdirect traffic from the designed travel paths. The plan of jointing in critical traffic path areas shall be approved by the Engineer prior to placing of the wearing course.

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.

When necessary, after asphalt has been placed by the paver along any abutting edge such as kerb, manhole or an adjoining pavement, just enough hot asphalt shall be carried back to fill any space left unfilled. This joint shall be properly 'set up' at the proper height and level to receive the specified compaction under rolling.

Any longitudinal edge which is damaged by traffic or rolling shall be treated as set out before additional asphalt is laid alongside it.

Where asphalt is required to match an existing surface, or other fixture, the Contractor shall place the asphalt in such a manner as to provide a smooth riding surface across the junction. Where required the Contractor shall remove sufficient of the existing pavement to enable a smooth riding surface to be constructed across the junction.

Where it is necessary to re-sheet an existing asphalt surface in order to provide a smooth riding surface across the junction the section of tapering thickness asphalt shall end at a chase cut into the existing asphalt. This chase shall be approximately 25mm deep and 150mm wide, unless otherwise directed by the Engineer. When necessary, removal of coarse particles from tapering thickness asphalt will be allowed using hand raking.

Where the depth of asphalt being placed in tapers is less than twice the size of the asphalt the area upon which such reduced thickness is to be placed shall be uniformly covered with tack coat at an application rate of 0.50 l/m5 as directed by the Engineer.

R4.3.7 Compaction Procedures

After spreading, the asphalt shall be thoroughly and uniformly compacted as soon as it will support the roller without undue displacement, other delays in rolling freshly spread asphalt will not be permitted.

Where asphalt is being placed in layers of less than 100mm and greater than 25mm compacted thickness the following procedure shall be adopted for compaction unless otherwise directed or approved by the Engineer.

- Initial rolling shall be performed with a steel wheeled tandem roller with the driving roll nearer the paver except on steep grades or on sharp curves where the steering roll shall be nearer

the paver. Any transverse and/or longitudinal joints shall be rolled first. Rolling shall then continue and be in longitudinal straight runs, commencing on the lower side and proceeding to the higher side of the spread asphalt. The roller shall overhang the unsupported edges of the paver run approximately 0.1m.

- Each longitudinal run shall overlap the previous run by approximately 0.1m and adjacent passes of the roller shall be of differing lengths.

- Secondary rolling shall be performed as soon as possible after initial rolling, and shall be performed with a self-propelled pneumatic tyred roller or vibratory of gross mass not exceeding 12 tonne, with the driving wheels nearer the paver. Rolling shall be in longitudinal straight runs commencing on the lower side and proceeding to the higher side of the spread asphalt, each run substantially overlapping the previous.

- Final rolling, if necessary and directed by the Engineer, shall be performed with a steel wheeled tandem roller whilst the asphalt is sufficiently warm to permit all roller marks to be eliminated. Rolling shall be limited to a maximum of two coverages in a similar manner and pattern as for initial roller except that the prior rolling of joints shall not be necessary.

The speed of rollers shall not exceed 5km/h for steel wheeled roller or 25km/h for self-propelled pneumatic tyred or vibratory rollers, or shall be as directed by the Engineer, and at all times shall be slow enough to avoid displacement of the asphalt. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected immediately. Rollers shall be operated by competent and experienced drivers and shall be kept in continuous operation so that all parts of the pavement shall receive substantially equal compaction.

Rollers shall not remain stationary on recently compacted work. All roller wheels shall be kept clean of any build up including tack coat material.

Around manholes and similar structures and at all places not accessible to the roller, thorough compaction shall be obtained by means of approved tampers. The joints between these structures and the asphalt shall be effectively sealed.

Each layer shall have a characteristic Marshall density of 94.5%.

R4.3.8 Clean Up

During the progress of the work the Contractor shall keep all channels and pits free of debris at all times. The Contractor shall remove all sweepings, spoil and excess or rejected material from the site and shall leave the area clean to the satisfaction of the Engineer. The disposal of such material shall be in accordance with any requirements of the Local Authority.

R4.3.9 Testing

All tests shall be conducted in accordance with Marshall design parameters by a NATA registered testing laboratory to current Australian Standard or Main Road WA standard.

The acceptance of the asphalt surface will be determined in accordance with the requirements of the Institute of Public Works Engineering Australia (WA Division) and Australian Asphalt Pavement Association (WA Branch) Technical Specification for Supply and Laying of Hot Asphalt Road Surfacing.

R5 KERBING

R5.1 General

Cast in-situ kerbing shall be constructed using extruded concrete and finished as required in AS2876 concrete kerb and channel (gutters).

Cross section of kerbing shall be in accordance with detail drawings show on the drawings.

R5.2 Placement

Construction shall be carried out in approved method and shall be extruded and vibrated to give maximum density. Concrete strength shall develop a minimum twenty eight (28) day strength of 32 MPa.

The extruded kerb shall be laid on the freshly swept surface of the primer sealed bitumen pavement, the surface is to be cleaned of all foreign or loose and broken pavement material.

Finish to top and road face of kerb shall be uniformly smooth and free from voids and air pockets.

The line of the kerbing shall be parallel to the centre line of the road and the kerbing on both sides of the road shall be exactly parallel to each other, unless shown otherwise on the drawings.

All kerbing shall be laid to correct grades corresponding to the design grade of the road and radius sweeps and intersections.

All kerbing on radii less than 30m shall be fully keyed into the pavement.

All kerbing shall be protected by the Contractor from marking and from bitumen overspray.

R5.3 Curing

Kerbs shall be sprayed with Calcure "D" or equivalent curing membrane within two hours of surface finishing of the concrete.

R5.4 Joints

Kerbs shall be cut completely through to give 10mm expansion joint every 4.5 metres of kerb length. Immediately after extrusion, contraction joints shall be formed by a grooving tool at every 1.5 metres.

A 10mm expansion joint shall be left either side of all road drainage gullies and tangent points of all curves.

Expansion joints shall be cut by a suitable cutting wheel and filled with an approved Butylmastic compound filler and foam or polyurethane backing.

All failed and surplus material shall be removed from the Site. On no account are these materials to be disposed of within the Contract area.

R5.5 Backfilling

Backfill material shall be of a suitable earth free from stones greater than 100mm as approved by the Engineer. Backfill shall be compacted to a minimum dry density ratio of 92% when tested in accordance with AS1289 E2.1. The road verge shall be graded from top of kerb to the profile shown on drawings.

R6 BRICKPAVING

R6.1 General

Brick paving shall be constructed to the details shown on the drawings. The preparation and construction of the sub-grade and base courses shall be as specified in the Pavement Section of this Specification.

R6.2 Bedding Sand

The sand shall be siliceous, non-plastic type, free from deleterious materials and organic matter.

The sand shall all pass a 4.75mm sieve and have a maximum of 5% passing a 0.075mm sieve. The moisture content of sand in place shall be in the range 4% to 8% by weight.

The sand shall be spread loosely and screeded to the profile and depth shown on the drawing and protected from pre-compaction.

R6.3 Laying Patterns

The laying patterns shall be herringbone at 451 to the main traffic flow, unless otherwise specified on the Drawings.

R6.4 Laying of Bricks

Bricks shall be placed on the screeded bedding sand by hand with 2mm to 3mm gaps between adjacent faces and the edge restraints. Bricks should be laid so that they do not come into contact with adjoining bricks. All full bricks shall be laid first. Closure bricks shall be cut with saw and fitted into the spaces as required.

Cutting of bricks to less than 25% of whole paver size should be avoided. Alternative cutting-in methods should be adopted using half or three quarter bricks.

R6.5 Compaction of Bricks

A high frequency, low amplitude plate compactor, with a plate area sufficient to cover a minimum of 12 paving bricks shall be used. The metal base should be covered to prevent it coming into direct contact

with the bricks. A plywood sheet of minimum thickness of 12mm, or a thick rubber based carpet square, attached to the base of the compactor, can be used to protect the bricks.

Compaction shall be sufficient to achieve a firm even surface. A minimum of 3 passes is required.

Compaction shall precede all other traffic.

Any bricks damaged during compaction shall be immediately replaced.

R6.6 Joint Filling

After initial compaction and prior to traffic clean, dry siliceous sand which has 5% to 15% particles passing 0.075mm sieve shall be spread over the pavement and swept into the joints.

A further two passes with the plate compactor shall be applied after joint filling. Further sand shall be swept into any joints as required and the compaction process shall be repeated until all joints are completely full.

The final surface shall be true to grade and free from loose sand.

R7 CONCRETE FOOTPATHS

R7.1 General

Cast in situ concrete footpaths shall be laid on the alignments and at the locations shown on the drawings.

The road verge shall be constructed to grade to the top of the kerb.

All Service Authorities (including power, water, sewer, gas, telecommunications, etc) and the Local Authority are to be advised 48 hours prior to commencement of construction.

R7.2 Placement

The foundation material shall be compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1 to a depth of at least 450mm. Special attention shall be given to Service Authority trenches. The Engineer shall be given 24 hours prior notice of the concrete pour.

The path shall be constructed from concrete with at least a 28 day cylinder compressive strength of 32MPa. The ground shall be thoroughly wetted immediately prior to laying the concrete. The concrete shall be compacted by a vibrating screed board of sufficient capacity to effectively vibrate and compact the full thickness of the path.

The paths generally shall be constructed with a crossfall of 2% towards the kerb.The surface finish shall be brushed with a smooth edge to all outside edges and joints. All work shall be of high quality, uniform appearance and executed in a tradesman-like manner.

All paths shall be protected by the Contractor from marking by children, animals or other causes.

R7.3 Joints

Grooved crack control joints to a minimum depth of 20mm shall be at 2m centres with a 12mm wide expansion joint for the full depth of the path at 8m centres (every fourth joint). Expansion joints shall be filled to full depth with 12mm thick bitumen impregnated material of approved type. An expansion joint shall be installed where the pathway butts to service manholes and existing crossovers.

The joint filler material shall be such that when it is subjected to compression in hot weather, no bitumen is extruded. The following materials are approved:

Nonporite	-	Bitumen impregnated canite by the cold solvent process.
Expandite	-	Flexcell.

R8 CLEAN UP

At the completion of all paving works, the Contractor shall clean away all debris.

Kerbs shall be left clean and true to line and verges graded off to ensure full drainage of the pavement.

Verges shall be compacted to a density not less than that of the surrounding undisturbed soil and be free from unsightly winrows and wheel marks.

R9 ROADSIDE STRUCTURES

R9.1 Guide Posts and Delineators

Guide posts in accordance with the drawings shall be placed along the roadway at horizontal and vertical curves, straight sections where embankments exceed 2m in height, each side of culvert headworks and cul-de-sac turn rounds, in accordance with spacings as defined in AS1742.2.

The posts shall be placed not less than 1.5m from the seal edge with the broad face towards the oncoming traffic.

The colour shall be white.

The height should generally be 1.0m

The height of the posts shall be adjusted so that the tops are on a uniform grade taking into account shoulder contours and the effects of superelevation.

Retroflective delineaters shall be attached to the guide posts with white on the right side of the carriageway and red on the left side of the carriageway as seen by approaching drivers, as per Class 1A Material in AS 1906.1 AReflective Materials and Devices for Road Traffic Control Purposes - Reflective Materials@.

The spacing of guide posts shall be in accordance with Austroads AGuide to Traffic Engineering Practice Part 8, Traffic Control Devices@ and Australian Standard AS 1742.2 AManual of Uniform Traffic Control Devices, Part 2: Traffic Control Devices for General Use@.

R9.2 Guardrail

R9.2.1 General

Guardrails shall not be erected prior to the application of the bituminous surfacing for the section concerned.

Guardrails shall be galvanised steel Flexbeam type or similar approved with galvanised steel posts and separators. All rail sections and fittings shall be supplied and erected by the Contractor to the details shown in the drawings.

All steelwork shall be treated as indicated in the drawings. All metalwork shall be shop fabricated, and no punching, cutting or welding will be permitted in the field.

The installation of guardrail shall be in accordance with AS 3845 and Main Roads WA standard drawings.

R9.2.2 Posts

All posts and separators or packers shall be fabricated from 178 x 76 x 6 pressed steel channel sections conforming to AS 1204, and shall be hot dip galvanised as indicated in the drawings.

The first and last two posts at each end of the guardrail assembly shall be anchored in unreinforced 32 mpa concrete to the dimensions and other details as shown on the drawings. Holes to receive these posts shall be excavated to the required depth, and the bottom of the holes adequately rammed. The posts shall be supported in their proper position to true line and level until the concrete has gained sufficient strength.

Unless otherwise directed by the Engineer, all other posts shall be driven vertically in their correct locations, generally at 2 metre spacings. The front faces of the posts shall be positioned to their true line and level. The surrounding ground surface shall be levelled and made good to the satisfaction of the Engineer.

R9.2.3 Tolerances

All posts shall be set within 20mm of their true plan position on the ground and all elevated dimensions shall be withing 10mm of those specified.

Bolts shall be sufficiently long to extend at least 6mm beyond the nuts but not more than 12mm beyond the nuts except where required for adjustments. All drilled holes shall be within 5mm of their true position.

R10 UNDERGROUND DUCTS (POWER, GAS AND TELECOMMUNICATIONS)

The Contractor will be provided with duct layout plans showing proposed duct crossings under the road system. The Contractor shall supply and install the ducts under the road and in strict conformity with the requirements of the relevant Authority prior to base course construction.

R10.1 Materials

Road crossing ducts shall be conduits of pipes complying with AS2053.

R10.2 Size of Ducts

40mm - UPVC, light orange colour, heavy duty.

80mm and 150mm - UPVC, light orange colour, heavy duty or fibre cement, heavy duty.

R10.3 Installation of Ducts

All ducts shall have a minimum cover of 750mm to the top of the duct and bedded in sand for a minimum distance of 150mm below the lowest duct, and 150mm above the highest duct. No ducts shall be installed with more than 1100mm cover. Ducts are to be laid in horizontal formation up to four in number, and thereafter in tier formation. The length of the ducts is to be the road width plus 1000mm minimum either side of kerb. All ducts shall be plugged with suitable end caps. Draw wires shall be provided in all ducts. Marker tape shall be installed 300m below ground level and above the duct, and brought out to ground level at each end, with a marker peg at one end.

R10.4 Supervision and Installation

The Contractor shall contact the relevant Authority Liaison Officer concerned, prior to any road ducts being installed to enable Authority staff to supervise the installation and to provide the special marker tape.

R11 SIGNS AND LINEMARKING

R11.1 General

All regulatory and warning signs and pavement linemarking shall be provided to the requirements of Main Roads Western Australia.

R11.2 Temporary Signing and Linemarking

The Contractor shall ensure that the site is maintained in a safe condition for all traffic during the construction works and until permanent signing and marking is installed. Temporary signing and pavement markings shall be provided to Main Roads Western Australia requirements, pending installation of permanent markings.

R11.3 Permanent Roadway Signing and Linemarking

Permanent road signs and linemarking shall be installed by Main Roads Western Australia .

The Contractor shall insert 150mm PVC diameter sleeves at the location of all new signs.

The Contractor shall spot the approved pavement marking in accordance with Main Roads Western Australia=s **Specification for spotting in preparation for longitudinal line marking on roads**. The Contractor shall remove any unnecessary pavement marking with 5-7mm aggregate seal or by grinding off, depending on the condition of the existing surface. The Contractor shall then notify Main Roads WA through the completion of the AAdvice of Completion of Conditions Required Prior to the Provision of Services by Main Rods Western Australia@ form. The Contractor shall maintain temporary signs and linemarking until permanent linemarking is installed.

R11.4 Permanent Parking Area Signing and Linemarking

The pavements shall be marked by one of the following materials to AS 4049:

- Paint - with or without glass beads;
- Thermoplastic or other applied insitu plastic materials - with or without reflective properties.

Paint shall be resistant to bleeding when applied to a bitumen surface.

Colour of line markings shall be white excepting that yellow may be used for parking lines to indicate where parking is restricted and blue may be used to indicate areas for disabled persons parking.

White	off white Y35 in AS 2700
Yellow	golden yellow Y14 in AS 2700
Black	charcoal B65 in AS 2700
Blue	to ACROD requirements

The width of longitudinal or broken lane lines shall be 80mm minimum with 100mm preferred.

The width of parking bay lines shall be 80mm minimum with 100mm preferred.

Parking bays shall be marked with an unbroken line between spaces except those indicated by kerbing or other contrasting paving and a 1200mm T at the line of the carriageway.

The surface shall be dry and swept clean before paint is applied.

Paint application shall produce a wet film thickness of 375 ∀ 25Φm and have a no pick up time of not more than 4 minutes.

Signs shall be consistent with those used in the street network in accordance with AS 1742.

Direction signs for vehicles and pedestrians shall comply with AS 2890.1.

The Contractor shall install 150mm diameter PVC sleeves at the location of all new signs.

In pedestrian areas the clearance to the underside of the sign shall be 2500mm. Signs shall not obstruct driver or pedestrian visibility.

R12 ROAD CROSSINGS

Where services or ducts are placed across the road after sub grade preparation, the backfill shall be mixed dry with 1% by weight with cement and then water bound, placed and compacted.

R13 TESTING

Testing of materials, compaction, thickness and shape is required at each stage of the roadworks.

All tests shall be arranged and paid for by the Contractor with a NATA registered testing authority. All test results shall be forwarded to the Engineer at each stage of the roadworks.

The testing schedule shall be as follows for each pavement course:

1. Compaction Testing - 1 test for each 200m5 of pavement with a minimum of two tests for each road.

2. Quality Testing - 1 test for each 2000m5 of pavement with a minimum of one test for each road.

R14 'AS CONSTRUCTED' INFORMATION

The Contractor shall ensure that no part of the work is backfilled or otherwise covered up until 'as constructed' information has been obtained to the satisfaction of the controlling authority.

Roadwork 'as constructed' information shall include, but not be limited to the following:-

- Pavement and surface width.
- Pavement centre line, right and left hand side levels at 20m intervals.
- Pavement position within the road reserve.

Such information shall be certified by the Contractor's Surveyor.