PART 2

TECHNICAL SPECIFICATIONS

SECTION 1 - GENERAL CLAUSES

Revision No.	Date	Affected Clause

PART 2 - TECHNICAL SPECIFICATIONS

SECTION 1 - GENERAL CLAUSES

1.1 GENERAL

Sections 1 to 100 of this specification have been prepared for use in contracts for the construction of road and drains and associated works in new subdivisional estates within the Hume City Council.

1.2 SPECIFIC CONDITIONS

This specification is a technical specification for the Hume City Council and may be amplified by inclusion in the contract documents of specific conditions relating otherwise to the contract.

1.3 DEFINITIONS

- “Engineer” shall mean the Superintendent as defined in the General Conditions.
- “Council shall mean the Mayor and Councillors of the Hume City Council or their authorised representative”.

- "Municipal Engineer" means the Director of Technical Services of Hume appointed by the Municipal Council under the Local Government Act 1988 or his authorised representative.

- "CRB" or "Country Roads Board" or "RCA" or "Road Construction Authority" or "RC" or "Roads Corporation" or "VIC Roads" shall mean one and the same as referred to in these specifications.

- "Relevant Authority" shall mean the Authority or Instrumental Body or its representative in which certain parts of the project shall be vested for future care and maintenance.

In these specifications the Relevant Authorities shall be:

(a) Roads and Drainage Works:
The Council of the City of Hume.
(b) Sewerage Reticulation Works:
Melbourne Water/Western Region Water Authority*.
(c) Water Reticulation Works:
Melbourne Water/Western Region Water Authority*.
(d) Electricity:
Solaris Power.
(e) Gas:
Gas and Fuel Corporation of Victoria.
(f) Telephone:
Telecom Australia/Optus Communciations. *

*** Strike out whichever is not applicabale.**

1.4 DESCRIPTION OF WORKS

This specification covers the supply of all labour and materials for the construction of roads and drains and associated works generally including earthworks, underground drains and pits, footpaths, kerb and channels, road pavements and agricultural drains. street signs, conduits and any other work related to subdivisional construction.

1.5 NOTICE OF COMMENCEMENT

The contractor shall give three days clear notice to the Municipal Engineer of his intention to commence work.

1.6 WORKING HOURS

Before commencing work under the Contract, the Contractor shall submit, for the Superintendent's review, the working hours proposed for the execution of the work under the Contract.
Further to the provisions in General Conditions of Contract;

(a) no work shall be carried out on any Sunday, public holiday, between Good Friday and Easter Monday inclusive, or during the Christmas to New Years periods;
(b) no work shall be carried out on the site outside the period between 7.00 am. or sunrise, whichever is the later, and 6.00 pm. or sunset, whichever is the earlier;

unless otherwise specified or approved by the Superintendent.

1.7 PROGRAMMING

In programming with the Relevant Authorities and other Contractors for the installation of essential services, the Contractor shall arrange for the work to be carried out at such a time as will cause least damage to road construction works.

The order of works shall generally follow:

(a) Stripping and stockpiling of topsoil.
(b) Bulk earthworks
(c) Drainage
(d) Sewerage reticulation
(e) Installation of Gas, Telecom, Water Service
(f) A.G drains and Conduiting
(g) Pavement construction and kerb and channelling
(h) Underground electrical services installation
(i) Concrete and Brick paving
(j) Topsoiling
(k) Wearing Course asphalt

No variation to the order of the works will be permitted without the prior approval of the Council.

1.8 LIVESTOCK

Before entering the site of works to commence work or effect delivery of plant, materials or equipment, the contractor shall make proper provision to ensure that any livestock on or near the site of the works are adequately restrained from straying. The contractor shall give proper advance notice to the occupier (if any) of the site, and the Superintendent.

1.9 CLOSING OF ROADS AND STREETS

During the Contract, the Municipal Engineer by the powers given to him under the Local Government Act, reserves the right to close any road, street or right-of-way.

If such closure is ordered by the Municipal Engineer, the Contractor shall make provision for lighting and barricading, as outlined above.

In all other circumstances, the Contractor shall render every reasonable assistance to provide safe access to those persons and vehicles having the right to use such road, street or right-of-way.

1.10 SURVEY MARKS AND SET OUT OF WORKS

1.10.1 Survey And Levelling Instruments

The Bench marks, for the work shall be shown on Drawings prepared by the Principal's licensed surveyor. Use shall be made of all survey and levelling instruments, templates, straight edges, spirit levels, or other instruments, as are necessary during and for proper execution of the works. These shall be made available at all times to the Engineer for checking purposes.

1.10.2 Setting Out

All title dimension and allotment numbers shall be obtained from the Plan of Subdivision and NOT from the engineering drawings.

In addition to Clause 28 of the General Conditions, the Contractor shall, when setting out the Works and during construction:-

(a) use not less than two previously established bench marks or other reliable level points;
(b) line in the Work both in horizontal and vertical planes over at least three set out points;
(c) check actual depth of excavation in all types of Works against those depths shown on the longitudinal sections.
(d) report to the Superintendent any apparent inconsistency or mistake or error between the set out and data supplied by the Superintendent and not proceed with further construction Works without the authority of the Superintendent.

1.10.3 Contractor To Check Pegs Before Commencing

On commencement of the contract, the Contractor shall check that all survey marks required for setting out of the works are in position and where necessary, survey marks which are missing will be replaced by the Principal's Licensed Surveyor at the cost of the Principal.

1.10.4 Repegging During The Contract

The Contractor shall ensure that sufficient survey pegs or reference marks remain in position to allow the Work to be checked by the Superintendent at any time and to satisfy the Relevant Authorities' requirements.

Checking and replacement of survey marks required by the Superintendent during construction will be arranged by the Contractor with the Principal's Licensed Surveyor and at the Contractor's expense.

Should the Contractor fail to instruct the Principal's Licensed Surveyor to carry out necessary survey Works, the Superintendent may instruct the Principal's Licensed Surveyor to carry out the pegging and the cost of such Work shall be deducted from the Contract price.

1.11 BLASTING

The contractor shall obtain a permit for blasting from the Municipal Engineer prior to commencement of any blasting operations.

Where any blasting works is carried out, roads and frequented paths shall be guarded by traffic controlment and signs "BLASTING STOP-AWAIT SIGNAL", shall be displayed on all roads at a safe distance from the blast area. These signs shall be covered or removed, when traffic flow is resumed after the blast.
In addition, when electric detonators are in use, signs, "BLASTING AREA-SWITCH OFF RADIO TRANSMITTERS' shall be displayed from the time that charges are being made up, until traffic flow is resumed after the blast.

In order to prevent accident, damage or injury to any person, works, services, buildings or property during blasting operations, the Contractor shall:-

(a) use every care, skill and precaution;

(b) use such sizes and arrangement of explosive charges and such method of detonation as will reduce the magnitude of vibration and noise level, resulting from the explosion sufficiently to prevent damage to services, buildings or property in the neighbourhood; and will minimise the nuisance to the nearby residents;

(c) employ all necessary and satisfactory means of protection such as temporary bridges, staging, chains, rope-nets, mats, timber and the like, to prevent effectively all stones and fragments of rock or other materials from being shot or thrown out of any trench, tunnel mouth or shaft excavation;

(d) with respect to the location and design of explosives magazines, to the method of transporting explosives and, in general, to the precautions taken to prevent accident, caused by explosives, conform to:-

(1) The Explosive Act, 1960.

(2) The Sewerage Excavations Safety Regulations, 1941.

(3) The SAA "Specification for Magazines for the Storage of Explosives" AS 2188-1979.

(4) The SAA :"Explosives Code" AS 2187 - Part 1, 1984
Part 2, 1983

(5) All applicable Council regulations regarding the use of explosives.

(6) Such other requirements as the Council may prescribe.

(e) ascertain from the Engineer the blasting signals to be employed and familiarise himself and his employees with such signals and use them when carrying out blasting operations in connection with the Works;

(f) not blast in ground which, in the opinion of the Engineer, is loose, jointed or liable to slips. It is to be distinctly understood that gadding and picking only shall be allowed in such ground;

(g) not blast within 4.5 metres of an existing line of water, gas or sewer pipes or within 15 metres of any completed part of the Works without the consent of the Engineer;

(h) not blast between the hours of 8.00 pm and 7.00 am nor during any Sunday except with the written authority of the Engineer;

(i) not take underground a larger quantity of explosive material than is likely to be used during any current shift;

(j) not, under any circumstances, store explosive material underground;

(k) comply with special directions which may from time to time be issued by the Engineer with regard to the surface storage of explosives and with all local municipal regulation;

(l) 'reinstate any works which are damaged due to blasting operations to the satisfaction of the Engineer at the Contractor's expense.'

1.12 OPENINGS OF ROADS AND FOOTPATHS

The contractor shall be responsible for the safe movement of traffic, within the limits of the contract, and shall so arrange his works to cause minimum amount of inconvenience to traffic and pedestrians. Where it is necessary to excavate trenches across footpaths, the Contractor shall together with all necessary guard rails to give not less than 0.75m clear width of footpath over the excavation. Such crossovers shall be effectively maintained for the full period during which the footpath is opened. Where it is necessary to excavate across a roadway, the Contractor shall maintain a safe, trafficable vehicle lane of not less than 3.60 metre.

No roadway shall be closed to traffic without prior consent of the Municipal engineer, in writing.

Nothing in this section shall be deemed to relieve the Contractor of his responsibility to effectively barricade and light all obstructions, in accordance with this specification.

1.13 PRIVATE RETICULATION SERVICES

The Contractor shall locate all house services, including services for water gas, electricity, sewerage, and telephone, well in advance of the works.

(a) DAMAGE TO SERVICES

Care shall be taken by the Contractor to protect such services from damage. In the event of any damage occurring, the Contractor shall:-

i) notify the Engineer, in writing, of the type of service and the nature and location of the damage;

ii bear the full cost of repairs to such service.

(b) ALTERATIONS TO SERVICES

Should any service require alteration, the Contractor shall:

i) notify the Engineer, in writing of the type of service, along with its location and depth below existing surface level;

ii) have the Engineer present while the work of locating and depthing of such service is carried out;

iii) after the Engineer has approved such alteration, and has notified the requisite Authority, arrange his program of works so that the alteration will not interfere with the progress of the works;

iv) co-operate with the service Authority carrying out the alterations and,

v) bear the full cost of alteration to any service.

In the event of delay occurring, the Contractor shall nave no right of redress against the Council.

1.14 MAIN RETICULATION AND OTHER SERVICES

The Contractor shall verify the position of all mains within the Works, including mains for water, gas, electricity, sewerage and telephone, other that those mentioned in Clause 1.13 above.

(a) DAMAGE TO SERVICES

Care shall be taken by the Contractor to protect such mains from damage. The Contractor will be held responsible for any damage that occurs by any means attributable to him.

(b) ALTERATION TO SERVICES

Should any main require alteration, the Contractor shall:-

i) notify the Engineer, in writing, of the type of service, along with its location and depth below existing surface level.

The Engineer may:-

(a) change the levels, lines, positions or dimensions of that part of the works in conflict, or,
(b) approve such alteration and shall notify the requisite Authority.

ii) arrange his program of works so that alteration of mains will not interfere with progress of the works. In the event of a delay occurring, the Contractor shall have no right of redress against the Council,

iii) co-operate with the service Authority carrying out the alterations, and,

iv) if the authority requests, supply all labour, tools and plant necessary for trenching and backfilling.

Payment Payments to the contractor, under this section, shall be made pursuant to Clauses 40 and 41 of the General conditions of Contract and shall be for labour, plant and tools, other than hand tools employed on the work.

1.15 PROTECTION OF COUNCIL ROADS

The Contractor will be held responsible for any vehicle engaged on the works depositing material or rubbish on road pavements, road reserves or other improvements. The Contractor, at his own expense will ensure that all material or rubbish deposited is promptly and effectively removed and the area cleaned off.

Should the Contractor fail to comply with this requirement, the Council may carry out such work, the cost of which shall be payable by the contractor to the Council.

Any work carried out by the Council pursuant to this clause, shall not relieve the Contractor of his obligation under the Contract.

Damage caused by the contractor to any roads, bridges or other structures shall be thoroughly repaired by the Contractor at his expense and to the approval of the Municipal Engineer.

The Contractor shall only cart along such roads or portions thereof as the Municipal Engineer may direct.

1.16 SAFETY DEVICES

The Contractor shall provide, set up, operate, maintain and remove all necessary warning lights and barriers and temporary devices to protect the public, workmen, plant and equipment and the works. All warning and temporary devices shall be set up and maintained in accordance with AS1742: Manual of Uniform Traffic control Devices Part one and two.

1.17 MAINTENANCE WORKS

Maintenance Work shall include works arising out of normal wear and tear and all requirements of the Municipal Engineer to obtain the Council certification that the works are satisfactory. Maintenance Works are as follows:-

i) Sweeping of road pavements and footpaths.
ii) Removal of all grass, loams, debris, and rubbish from footpaths, roads, drains and drainage pits.
iii) The filling in of any ruts or depressions and the mowing of grass within the road reserves.
iv) Filing in and making good all subsided trenches.
v) Lifting of drainage pit lids as required by the Municipal Engineer for inspection and flushing and cleaning of pipelines and pits.
vi) Making good any subsided or eroded road batters.
vii) Break out and replace all broken concrete works.
viii) Repair or replacement of any portion of the works in a way as deemed fit by the Engineer.

1.18 SUPPRESSION OF DUST

The Contractor shall take measures necessary to keep airborne dust to a minimum.

Payment:

Unless otherwise specified, no separate payment will be made for the suppression of dust.

If the Contactor fails to achieve adequate dust control, particularly where the safety and convenience of the public are affected, the Council may take any action necessary. The cost of such action being payable by the Contractor to the Council.

The Municipal Engineer may direct the suspension of work at any time where that work creates a dust hazard or nuisance to the public, personnel working on the site or property such as crops, stock and houses in the vicinity of the work.

In the event of work being suspended, the Contractor shall have no claim whatsoever for any losses suffered, either against the Council or the Principal.

1.19 LIMITATION OF GROUND VIBRATION DURING CONSTRUCTION

For work near existing buildings, structures and underground service, construction methods shall be adopted which will minimise ground vibrations. These ground particle velocities shall be measured by the Contractor immediately adjacent to the underground service.

The following values of peak ground particle velocity are indicative of velocities which are unlikely to cause damage to the type of building or underground service to which they relate:

brick or masonry sewers	3mm/second
houses, flats and other domestic building, brick and masonry industrial and commercial building (including building clad in these materials)	5mm/second
concrete and steel-framed industrial and commercial buildings, co-axial or optical fibre type cables	10mm/second
other power and telephone cables, gas pipelines and water mains	20/mm second

Irrespective of the values listed, the Contractor shall adopt construction methods that maintain the measured peak particle velocities at a level that will not cause damage to adjacent building or services.

Payment:

The Contractor shall bear all costs associated with any claim from damages resulting from the effects of ground vibration directly caused by the Contractor's construction methods. The cost of such damage shall be in addition to damage caused by other action attributed to the Contractor's work.

1.20 DEFECTS LIABILITY AND MAINTENANCE PERIOD

Clause 37 of the General Conditions of Contract refers to a Defect Liability Period.

The Defect Liability Period shall be concurrent with the Maintenance Period, and shall continue until such time as the Council certifies that all Road and Drainage works have been taken over. The Maintenance Period shall not be less than three (3) months.

1.21 COUNCIL INSPECTIONS

1.21.1 Inspection

The Contractor shall at all times, allow the Municipal Engineer to inspect and measure any part of the works. No part of the works shall have further works placed there or shall be covered up or put out of view without the approval of the Municipal Engineer, or his authorised representative, whose approval shall not be unreasonably withheld or delayed.

Ordinary inspections are required at the various stages of the works and extra ordinary inspections may be required from time to time at the direction of the Municipal Engineer. Table 1.21.1.1.

Table 1.21.1.1.: TABLE OF ORDINARY INSPECTIONS

WORK	STAGE	INSPECTION OF	REMARKS
Earthworks	Prior to placing filling	Stripped Area	
Stormwater Drains	a) Prior to backfilling b) After backfilling	Levels, laying jointing and haunching Material & compactions	
Stormwater Drainage Pits	Prior to pouring	Pit type, wall length thickness, A.G. connections Weep holes	
Agricultural Drains	Prior to backfilling	Levels, line and laying	
Conduits	Prior to backfilling	Laying and jointing, Location and Length	Locations to be verified with Superintendent prior to laying
Kerbs and Channel	a) Prior to placing bedding b) Prior to pouring concrete	Base and Agricultural drains Bedding,lines, level, formwork reinforcement	
Footpath	Prior to pouring	Bedding line & level, formwork	House drains, sewer drains, and electrical conduits to be laid prior to inspection
House Drains	Prior to backfill	i) Laying and jointing ii) Connection to S.W. drains	
Vehicle crossings	Prior to pouring	Bedding, line, level, formwork, reinforcement	
Road pavement	a) Prior to first pavement course b) Prior to placement of each Pavement course c) Prior to priming d) Prior to placing first asphalt course e) Prior to placing wearing course asphalt	(i) Line level and shape (ii) Subgrade material and Compaction (iii) Conduits for depth, marking of location and distance behind kerbs (i) Line, levels & shape (ii) Compaction (iii) Swept surface (iv) Primed surface (v) Kerb and channel (vi) Nature Strips	All road crossings and conduits for water, gas, sewer, drainage and underground electricity are, where applicable to be completed prior to placing of first layer of F.C.R. A "skin" of FCR may be placed on the approved subgrade prior to construction of these crossings. All broken concrete is to be replaced, all nature strips topsoiled and all services laid, prior to laying wearing course asphalt.
Completion	Prior to commencement of Maintenance period	All works	

1.21.2 Notice For Inspection

The Contractor shall give 24 hours notice to the Municipal Engineer when inspection is required.

1.21.3 Inspection After Normal Hours

When construction works are carried on outside normal working hours of 7.30 am to 4.30 pm weekdays, or on week-ends or holidays, it will be necessary for the Contractor to pay Council a fee for any inspection required at the current hourly rates:

Time and one half rates- outside normal working hours on weekdays and 7.30 am-11.30 am Saturdays

Double Time rates- after 11.30 am and on Sundays.

In this regard the Contractor will be required to give Council 24 hours notice of his intention to work so that the necessary arrangements of staff may be carried out.

1.21.4 Suspension Order By The Municipal Engineer

The Municipal Engineer or his representative may order any section of the works to be halted if in his opinion the requirements of this specification are not being complied with.

1.21.5 Final Inspection

The whole of the works are subject to inspection prior to the Council taking on future care and Maintenance of the Works.

1.21.6 Default

Any works covered up or materials place without the required preceding inspection shall be considered a default and where directed by the Municipal Engineer shall be removed and re-executed at the Contractor's expense.

1.22 TIMING OF WEARING COURSE ASPHALT

The wearing course asphalt shall be laid before or during the maintenance period but if building operations, adjacent road works or traffic conditions are such as to make it appropriate for this work to be delayed, the Council reserves the right to defer this work til the time it feels appropriate. In this event, the Principal will lodge a bond with the Council to meet the cost of laying the asphalt at a later date.

1.23 EXAMINATION AND TESTING OF MATERIALS AND WORK

(a) General

The Contractor shall be responsible for carrying out all examination and testing of materials and work under the Contract in accordance with the requirements of the specification.

(b) Allowance for Testing in Construction Program

The Contractor shall make allowance in the construction program for the time necessary to arrange for and to carry out examination and testing of materials and work.

(c) Tests

Unless otherwise specified, all tests shall be undertaken in accordance with the appropriate Australian Standard test method and VIC ROADS codes of practice as current at the time of tender. Where there is no relevant Australian Standard test method then the current appropriate VIC ROADS test method or other specified test method shall be used. Unless otherwise specified, all tests shall be conducted by experienced testing officers in a laboratory accredited by the National Association of Testing Authorities (NATA) for the test methods used under the contract and all tests shall be endorsed in accordance with the NATA registration for that laboratory.

(d) Costs

All costs towards carrying out testing - either as warranted by these specifications or instructed by the Engineer, shall be borne by the Contractor.

1.24 FINAL REPEG

The final repeg of the works at Practical Completion shall be carried out by the Principal's Licensed Surveyor at the cost of the Principal. The Consulting Engineer shall supply to Council a written statement from the Licensed Surveyor stating that the subdivision is pegged in accordance with the Land Surveyors Act.

1.25 PROTECTION OF PROPERTY AND SERVICE

The contractor shall execute and maintain the whole of the works in such a manner that injury and damage shall not be occasioned to any person, or private or public property including all roads used for transport of materials or plant, building, fencing, public utility services or other structures. In the event of any damage to any such structure, service or property, the party controlling it must be immediately informed of the damage. The Contractor shall at his own expense arrange the repair and restoration of any structure, service or property damaged in any way, to the like order and condition in which it was before such damage. The repairs may be made by the party controlling the structure, service or property, and the cost of such repairs shall be at the expense of the Contractor. The Contractor shall also be liable for any loss or damage which may result from such an damage or interference to any structure, service or property, and for any claim arising from delay in repairing and restoring it.

SECTION 5 - PROVISION FOR TRAFFIC

Revision No.	Date	Affected Clause

SECTION 5 - PROVISION FOR TRAFFIC

5.1 DESCRIPTION

This section covers requirements for the provision for traffic and the Contractor is solely responsible for traffic control.

5.2 DEFINITIONS

Works Zone

The length of roadway within the Contract limit of works as specified.

Works Area

The specific area where work is being carried out.

Side Track

A temporary roadway constructed within the road reserve to carry traffic around the works zone or works area.

Traffic Detour

A detour of traffic away from the works zones or works area via alternative roads or streets.

5.3 GENERAL

Unless otherwise specified, the Contractor shall make provision for traffic, including pedestrians, in accordance with this section and the relevant parts of the VIC ROADS Roadworks Signing Code of Practice, hereinafter referred to as the Code, or Australian Standard AS 1742.3 "Manual of Uniform Traffic Control Devices". The Contractor shall make such provision for traffic notwithstanding anything contained in the General Conditions of Contract and without derogating in any way from the Contractor's obligations pursuant to the General Conditions of Contract and in particular from the Contractor's obligations pursuant to Clause 15 of the General conditions of Contract.

When requested in writing by the Superintendent, the Contractor shall submit before commencing any part of the work, details of the proposed provisions for traffic to be provided during the Contract for review by the Superintendent.

The number, type and location of signs and devices shall be not less than the standards set out in the Code as applicable and shall also meet the requirements of this section.

Should circumstances arise which are not adequately covered by the Code or this section, the Contractor shall submit alternative proposals to the Superintendent for review prior to works proceeding.

Work shall not commence or continue at any location until all appropriate signs and devices such as lamps, barricades, traffic control apparatus and the like are in place, side tracks have been constructed where required, line marking completed where required, and have been reviewed by the Superintendent.

At all times when the Contractor's employees are on site, the Contractor shall render immediate assistance without charge to any person whose lawful passage through a work area may be obstructed or made difficult by or as a result of the Contractor's operations.

Unless otherwise approved, when work is not being performed on the site, traffic shall not be carried through that works zone or works area on side tracks, detours or part widths of the existing pavement.

5.4 CONTRACTOR'S REPRESENTATIVES

On commencement of work, the Contractor shall advise the Superintendent in writing of the names, addresses and telephone numbers of employees who can be contacted in any emergency which may require repairs to the work under the Contract or the replacement or maintenance of signs and devices. Any proposed changes of representatives, addresses or telephone numbers shall be notified promptly to the Superintendent and confirmed in writing to the Superintendent.

5.5 SIGNS AND DEVICES

Unless otherwise specified, the Contractor shall supply all signs and devices required to complete the work covered by this section.

Signs and devices shall comply with the relevant requirements of the Code together with the following additional requirements:

(a) Pavement Markers

Pavement markers shall comply with the requirements of AS 1906, Retroreflective Materials and Devices for Road Traffic Control Purposes, Part 3 - Raised Pavement Markers (Retroreflective and Non Retroreflective).

(b) Retroreflective Sheeting

Retroreflective sheeting used on any sign or device shall comply with the requirements of AS 1906, Retroreflective Materials and Devices for Road Traffic Control Purposes, Part 1 - Retroreflective Materials, for Class 2 material, except that the coefficient of luminous intensity shall be not less than 50% of the values given in Table 2.2 of AS 1906, Part 1, for each designated colour when tested in the clean condition.

(c) Signs

Dirty, illegible, damaged or faded signs shall not be used if there is any doubt that the message or intent of the sign is unclear or confusing to road users. The Contractor shall clean, replace or renew all signs as required to ensure legibility.

5.6 STORAGE OF PLANT

When not in use, the Contractor shall be responsible for the safe storage of plant and equipment clear of the travelled path. Wherever possible, plant and equipment shall be stored not less than 3 m from the edge of the traffic path in built up areas and not less than 5 m outside built up areas. If it is not possible to provide such clearance, the plant and equipment shall be moved from the Works area to a suitable storage site or be protected by suitable signs, lights and devices.

5.7 CARE OF AREAS USED BY TRAFFIC

Both during and at the end of each day's work, the Contractor shall be responsible for ensuring that the pavement and shoulders being used by traffic within the Works area and all other areas within the Works zone where the Contractor has undertaken work are in a safe and trafficable condition.

Any material which has fallen on any travelled path as a result of the Contractor's transportation or other operations and any material stored near the travelled path which could constitute a hazard to traffic shall be removed by the Contractor immediately.

5.8 ACCESS TO SIDE ROADS AND ABUTTING PROPERTY

Construction operations shall be conducted in such a manner as to minimise inconvenience to abutting property owners. Unless otherwise specified, access to properties and side roads shall be maintained at all times wherever practicable other than when the works present a traffic hazard or the work would suffer damage as a result of the passage of traffic.
Where the Contractor proposes to restrict access to abutting properties as a result of the Contractor's operations, the Contractor shall provide a minimum of 24 hours notice to the affected property owner/occupier.

Access shall not be denied to any abutting property outside the customary working hours.

5.9 CONSTRUCTION OPERATIONS AFFECTING TRAFFIC

(a) General

The Contractor shall so conduct the operations as to minimise obstruction and inconvenience to the public, and shall not have under construction any greater length or amount of work than can be managed properly with due regard to the convenience of the public.

If the intermingling of construction machinery with traffic is unavoidable the intermingling shall be minimised at all times.

Unless otherwise specified:

(i) provide a minimum safe working width for the Contractor's construction plant plus an absolute minimum clearance to the edge of the traffic path of 1.2 m;

(ii) provide a minimum one way clear travel path width for traffic of not less than 2.8 m for one-way operation and 6 m for two-way operation;

(iii) locate the longitudinal joint(s) for pavement construction and/or cold planning works at either the traffic lane line(s) or at the centre of the traffic lane(s) or as specified in Clause 65 for asphalt paving.

The shoulder (sealed or unsealed) may be used as part of the travelled path subject to the agreement of the Superintendent.

(b) Dust

Immediate action shall be taken by the Contractor to minimise dusty conditions arising from any operations which result in reduced visibility for road users.

(c) Earthworks

Unless otherwise approved by the Superintendent, earthworks shall proceed only in areas clear of travelled paths and footpaths.

Where construction is being carried out over part of the carriageway width, the following conditions shall apply:

Steps or batters within 1.5 m of the travelled path of the carriageway shall be delineated as specified in the Code. Where the step or batter forms a drop in level of more than 200 mm at a slope steeper than 1 in 6, barricades shall be used in addition to delineation.

Where the level difference is in the form of a step or batter of less than 80 mm and is between the travelled paths, such step or batter shall be removed before the close of work each day and the full width of carriageway made available to traffic overnight. The removal of such step or batter shall be effected by shaping to a crossfall not steeper than 1 in 10.

(d) Pavement

Unless otherwise specified, prior to the close of work each day all steps between layers of unbound pavement material being placed shall be tapered to a slope not steeper than 1 in 10.

(e) Footpaths and Pedestrian Walkways

Unless otherwise specified, temporary footpaths or pedestrian walkways within the work zone shall be not less than 1 m wide, shall have a firm, even and free draining surface and shall be free from steps and obstructions.

5.10 DETOURS AND SIDE TRACKS

(a) Side Tracks

Traffic shall not be diverted on to any side track until permission to use such side track has been given by the Superintendent.

(b) Detours

Unless otherwise specified, traffic shall not be detoured on to roads outside the works zone.

Prior to the issue of the Final Certificate, unless otherwise specified, detours and side tracks used or constructed during the Contract shall be restored to the condition existing at the time of commencement of the work under the Contract. Where the Contractor is responsible for the restoration of detours and side tracks to Contractor shall produce from the local authorities or landowners concerned clearances in writing stating that such detours and side tracks have been restored to their satisfaction.

Where COUNCIL as well as the Contractor has some responsibility for the restoration of any detours or sidetracks, the Contractor shall not commence any restoration work until the Contractor has submitted details of the work to be undertaken to the Superintendent for review.

SECTION 10 - CLEARING AND GRUBBING

Revision No.	Date	Affected Clause

SECTION 10 - CLEARING AND GRUBBING

10.1 DESCRIPTION

This section covers the requirements for clearing and grubbing and for the disposal of the materials produced by clearing and grubbing of the site.

10.2 DEFINITION

Clearing and grubbing

Clearing and grubbing is the removal from the site of:

(a) vegetation such as trees, tree stumps, tree roots, logs, brush, noxious weeds and decayed vegetable matter (except as noted in Cl. 10.3) and

(b) refuse such as pole stumps, rubbish dumps and sawdust piles resting on or protruding from the ground surface; and

(c) obstructions such as concrete paving, concrete edgings, drainage pits, foundations, fences and disused structures, but not underground obstructions such as drainage pipes, service conduits and fuel tanks.

10.3 PRESERVATION OF TREES AND SHRUBS ON ALLOTMENTS.

Trees and selected shrubs within allotments/road reservation shall be preserved from clearing or damage except in the following cases:

(i) The area on allotments/road reservation which are to be cut or filled in excess of 200mm shall be cleared as specified.

(ii) Drainage and Sewerage work area within the easements shall be cleared of trees and shrubs as specified, only to the extent necessary to construct the works.

10.4 CLEARING

Unless otherwise specified, the area within the specified limits shall be cleared of all vegetation, refuse and obstructions down to natural surface.

Trees shall be brought down in such manner as to avoid danger to personnel and traffic or damage to other trees, shrubs, structures or property outside the area being cleared or designated to be retained within the area being cleared.

Tree branches extending over the carriageway shall be trimmed to provide a clearance of at least 6m above the carriageway surface. Where whole branches are to be removed cuts shall be made flush with the trunk so as to leave no stubs. Branches or stubs 50mm or more in diameter shall be undercut so that the branches or stubs when falling will not tear the trunk.

10.5 GRUBBING

In areas where excavation will be made, all vegetation, refuse and obstructions shall be grubbed to a depth of not less than 0.3m below the stripped surface or not less than 0.6m below the finished surface of the subgrade, whichever is the lesser treatment. In areas to be covered by embankments exceeding 1m in height, foundations may remain if located or cut off not more than 0.4m above the natural surface but not less than 1m below subgrade.

Pits which are no longer required shall be removed or broken back to a depth not less than 0.3m below the finished surface of the subgrade. Remaining pipe openings shall be sealed with concrete. Any remnants of pits shall be backfilled with material and compacted to a density ratio of not less than 95%. The calculation of density ratio shall be based on Standard compactive effort.

Holes resulting from grubbing shall be backfilled with material similar to the surrounding material and compacted to the same degree as the surrounding material.

10.6 DISPOSAL OF MATERIALS

Unless otherwise specified any salvageable materials from the site shall be stockpiled as directed by the superintendent.

Where burning is proposed, the Contractor shall observe the relevant requirements of the Metropolitan Fire Bridgades Board, the Country Fire Authority, the Department of Conservation and Environment and Council or other authorities concerning stacking and burning of materials and shall hold all necessary permits before any burning off is commenced.

Before commencing any burning operations, the Contractor shall submit all such permits to the Superintendent for review.

All burning shall be carried out in a safe and controlled manner which protects adjoining areas and does not obscure the visibility of motorists. No material shall be stacked or burned on private property. Residue from burning shall be removed from the surface of the site. Tyres or discarded rubber shall not be disposed of by burning.

Where it is not practical or not permitted by the relevant authorities to dispose of material by burning, the material shall be:

(a) removed from the site, or

(b) buried at locations approved by the Superintendent.

10.7 SURVEY MARKS

During clearing and grubbing operations, care shall be taken not to disturb any survey marks, bench marks or level pegs.

10.8 DAMAGE TO FENCES

Any damage to fences shall be repaired immediately by the Contractor to a condition at least equal to that existing before damage and no additional payment will be made for this work.

SECTION 15 - EXAMINATION AND TESTING OF WORK

Revision No.	Date	Affected Clause

SECTION 15 - EXAMINATION AND TESTING OF WORK

15.1 GENERAL

This section covers some of the requirements for examination and testing of materials and work associated with roadwork construction. Particular examination and testing requirements are separately specified in the relevant sections of the specification.

15.2 LOT TESTING

Unless otherwise specified, acceptance of material and work will be based on testing of the material or work in lots. A lot will consist of a single layer, batch or area of like work which has been constructed or produced under essentially uniform conditions and is essentially homogeneous with respect to material and appearance. Unless otherwise specified, the extent of each lot shall not exceed one day's production. Discrete portions of a lot which are non-homogeneous with respect to material and appearance shall be excluded from the lot and shall be either treated as separate lots, or reworked. Where the area excluded from a lot as non-homogeneous exceed 10% of the total lot area or at other specified percentage of the total lot area, the whole of the lot shall be rejected.

15.3 TEST ROLLING

(a) General

The Contractor shall submit to the Superintendent for review a test rolling procedure to be used where specified or directed. The procedure submitted by the Contractor shall include details of when test rolling will be undertaken, the method of preparing an area for testing rolling and the extent of test rolling.

Plant which is nominated for use in test rolling procedures shall comply with the following requirements:

(i) Static smooth steel wheeled rollers shall have a mass of not less than 12 tonnes and a load intensity under either the front or rear wheels of not less than 6 tonnes per metre width of wheel.

(ii) Pneumatic tyred plant shall have a ground contact pressure under either the front or rear wheels of not less than 450 kPa per tyre. The area over which this ground contact pressure shall be applied shall not be less than $0.035m^2$ per tyre.

(iii) Steel wheeled tandum rollers of mass not less than 12 tonnes and a load intensity of not less than 6 tonnes per metre width of the drive wheel.

(b) Testing

Test Rolling shall be undertaken in accordance with the accepted procedure in the presence of the Superintendent.

The layer to be tested shall be test rolled immediately following completion of compaction, but if test rolled at some later date, the surface shall be watered and given not less than eight coverages of testing roller by the Contractor at his expense before the test rolling commences.

(c) Compliance

Compliance with the test rolling requirements shall be when an area withstands test rolling without visible deformation or springing.

15.4 COMPACTION TESTING

(a) General

For the purpose of control of moisture content of material and for determination of compaction procedure the following definitions shall apply:

(i)	material of nominal size 40mm or less:	material which has 15% or less (by mass) retained on a 37.5 mm AS sieve.
(ii)	material of nominal size greater than 40mm:	material which has more than 15% by mass retained on a 37.5mm AS sieve.

(b) Definition of Density Ratio

Density ratio is defined as follows:

(i) Earthworks and pavement materials other than asphalt and concrete

The percentage ratio of the field dry density to the maximum dry density obtained in the compaction test using Modified or Standard compactive effort or the ratio of the field wet density to the peak converted wet density obtained in the Hilf rapid compaction test using Modified or Standard compactive effort as appropriate.

(ii) Asphalt Pavement

The percentage ratio of the field bulk density to the bulk density of the job design mix when compacted in the laboratory.

(iii) Concrete

The percentage ratio of the field bulk density to the mean bulk density of cylinder specimens taken from the same lot.

(c) Characteristic Value of Density Ratio

The characteristic value of density ratio of the lot shall be calculated as X-0.92S for six tests per lot where X and S are respectively the mean and the standard deviation of the individual density ratio test values for the lot.

The mean of density ratio is defined by:

$$\bar{x} = (x_1 + x_2 + \ldots\ldots + x_i + \ldots\ldots x_n) / n$$

The standard deviation of density ratio test values is defined by:

$$s = \sqrt{\{[(\bar{x} - x_1)^2 + (\bar{x} - x_2)^2 + \ldots\ldots + (\bar{x} - x_n)^2] / n - 1\}}$$

where x_i, i=1, 2, 3, ...n, is the individual density ratio test value and n is the number of tests per lot.

(d) Testing Small Areas

For earthworks and pavement construction any lot which has a surface area less than 500 m^2 shall be treated as a small area. When testing a small area as a lot and where test requirements are based on characteristic value of density ratio, acceptance of the lot shall be based on the mean value of 3 individual tests. In this case the lot will be accepted as far as compaction is concerned if the mean value of the individual tests exceeds by 2.0% or more the appropriate compaction scale requirement for the characteristic value of density ratio for six tests per lot. The compaction scale requirements for re-rolling shall also be increased by 2.0% accordingly.

(e) Material of Nominal Size Greater Than 40 mm Found During Density Testing.

When acceptance of a lot is specified to be based upon the results of 6 test values, each from a separate test site within the lot but less than 6 such test values are available due to material from one or more test sites being found during the test process to exceed 40mm in nominal size the acceptance assessment shall be amended as follows, provided that there remain at least 4 test values. The lot will be accepted as far as compaction is concerned if the mean value of the individual tests exceeds the specified characteristic value of density ratio by 2.0% or more. The assessment test values for re-rolling shall also be increased correspondingly by 2.0% density ratio. If there are less than 4 test values acceptance shall be based on test rolling carried out in accordance with the requirement of this Specification.

When acceptance of a lot is specified to be based upon the mean value of density ratio calculated from 3 test values, each from a separate test site within the lot but less than 3 such test values are available due to material from one or more test sites being found during the test process to exceed 40 mm in nominal size, assessment shall be based on test rolling carried out in accordance with the requirement of the Specification.

(f) Refilling Test Holes

The Contractor shall backfill test holes with material of comparable quality to that removed from test holes during testing. The backfill material shall be compacted in the holes in layers with a suitable compaction device.

15.5 SURFACE LEVEL TESTING OF PAVER/TRIMMER CONSTRUCTION

(a) General

The requirements of this Clause apply to roadbeds prepared by automatic level control (ALC) trimmers, granular pavement layers which have been placed using an ALC paver/trimmer or areas which have been placed by other means which are located adjacent to areas constructed with ALC trimmers or an ALC paver/trimmer.

(b) Surface Level Testing

Measurement of level will be made using a level accurate to +3mm per 50 m of reading distance, with levels being recorded to the nearest 1 mm.

Separate lots will be established for areas constructed with a paver/trimmer and areas constructed by other means as well as separate lots for traffic lanes, shoulders and other areas.

Within each lot, level measurements will be compared with the corresponding design levels and individual departures from design, x_i calculated as follows:

x_i = measured level - design level (mm)

The mean of the departures from design level x, of n measurements will be determined to the nearest 0.1 mm as follows:

$$\bar{x} = (x_1 + x_2 + \ldots\ldots + x_i + \ldots\ldots x_n) / n$$

The standard deviation, S, will be determined as follows:

$$s = \sqrt{\{[(\bar{x} - x_1)^2 + (\bar{x} - x_2)^2 + \ldots\ldots + (\bar{x} - x_n)^2] / n - 1\}}$$

15.6 TESTING OF SURFACE LEVEL AND THICKNESS

(a) General

The requirements of this Clause apply to areas of completed earthwork formation and subgrade, pavement layers which have not been constructed using an automatic level control(ALC) trimmer or paver/trimmer and all concrete pavement layers irrespective of the means by which the concrete pavement was constructed.

(b) Surface Level Testing

(i) Earthwork Formation

The surface level of the finished earthwork formation including table drains, verges and prepared subgrades shall be checked longitudinally for conformity with the specified requirements at intervals not exceeding 20 m. Level measurements shall be taken and recorded at all changes in gradient, at the edges of prepared subgrades, designated lane lines and at intervals not exceeding 2m transversely across prepared subgrades.

(ii) Pavement Layers (Excluding Asphalt Resurfacing)

The surface level of each completed pavement layer shall be checked longitudinally and transversely for conformity with the specified requirements at intervals not exceeding 20 m in the longitudinal direction. At each location which is checked for longitudinal level conformity, the surface level shall be checked in the transverse direction at all of the following locations:

1. at the edges of the pavement layer;

2. at all changes of gradient across the pavement;

3. at intervals not exceeding 2 m across the pavement.

(c) Testing Pavement Layer Thickness

The thickness of pavement layers constructed under the Contract shall be determined by taking the difference between the surface level measurements recorded for each layer in accordance with the requirements of Clause 15.6(b).

15.7 TESTING COSTS:

All testing costs are to be borne by the Contractor.

SECTION 20 - EARTHWORKS

Revision No.	Date	Affected Clause

SECTION 20 - EARTHWORKS

20A - EXCAVATIONS

20.1 DESCRIPTION

This section covers the requirements for forming and grading of earthworks including excavation, placement and compaction of filling, disposal of surplus and unsuitable materials, and the trimming of batters, surface drains and formation.

20.2 STANDARDS

AS 1141 : Methods for sampling and testing aggregates.
AS 1289 : Methods of testing soils for engineering purposes.

20.3 DEFINITIONS

Formation:

The finished surface after completion of the earthworks, excluding any cut or fill batters.

Subgrade:

The trimmed or prepared portion of the formation on which pavement and shoulders are constructed.

Boxing:

The space above the subgrade between constructed shoulders or verges, within which the pavement will be constructed.

Batter:

The uniform side slope of a cut or fill.

Batter Point:

The intersection of the batter with the natural surface disregarding any batter rounding.

Table Drains:

A surface drain adjacent to the shoulder, or verge and generally with invert lower than the subgrade.

Catch Drain:

A surface drain above a cut batter or below a fill batter.

Verge:

The portion of the formation between the shoulder and the batter.

20.4 CONFORMITY WITH DRAWINGS

Earthworks shall be finished to conform within the following limits to the levels, lines, grades and cross sections specified or shown on the drawings:

(a) Formation Width and Alignment

The widths measured on each side from the specified centreline or design line to the toes of cut batters and/or the tops of fill batters shall be not less than the widths specified or shown on the drawings.

(b) Boxing Width and Alignment

The boxing width shall not be less than specified or shown on the drawings and the edge of boxing shall not deviate by more than 50 mm from the designed offset from the centreline or design line.

(c) Formation Level and Shape (Outside Subgrade Width)

Prior to topsoiling, the level at any point on the finished surface outside those areas to be paved shall not differ by more than 50 mm from the specified level and the surface shall be free from depressions capable of retaining water. No point on the surface shall lie more than 25 mm below a 3 m straightedge laid on the surface.

(d) Subgrade Level and Shape (overstrike inapplicable alternative)

(i) For Concrete Pavement Construction

The level at any point on the subgrade shall not be above the design level for that point by more than 10 mm or below the design level for that point by more than 30 mm and no point shall lie more than 20 mm below a 3 m straight edge laid in any direction, except across a crown.

(ii) For Other Pavements

The level at any point on the subgrade shall not differ by more than 25 mm from the specified level and no point shall lie more than 20 mm below a 3 m straightedge laid in any direction, except across a crown.

(e) Batter Slope and Shape

At any cross section the batter slope shall be not steeper than the slope specified. The batter face shall be finished to reasonably uniform shape. No point on the completed batter shall vary from the average plan more than 150mm in the case of cut batters in earth or 300mm in the case of cut batters in rock or in the case of fill batters.

(f) Batter Line

Cut batters shall be so constructed that the batter point is not more than 10% of the batter height outside the calculated batter line.

Fill batters shall be so constructed that the toe of the batter is not more than 10% of the batter height outside the calculated batter line.

Notwithstanding the above, on all sections beneath bridges, and on other sections where it becomes necessary to confine the lateral spread of the earthworks to closer limits due to site constraints, the tops of cut batters and the toes of fill batters shall be not more than 300 mm outside the calculated batter lines.

(g) Drain Level

Surface drain invert and side slopes shall be finished to within 50 mm of the specified level at any point and shall be free from depressions capable of retaining water.

20.5 CONSTRUCTION

The area to be prepared shall be cleared of any vegetation, other perishable material and topsoil and shall be brought to the specified width, alignment, level, shape and compaction. Unless otherwise specified or agreed to by the Superintendent, surplus excavated material shall be disposed of by removing from the site. All holes, ruts and other depressions shall be scarified and filled with materials similar to those existing in the roadbed.

Unsuitable materials which exist or develop during construction immediately below roadbead level, or immediately below the existing surface level before placement of any filling necessary, shall be rectified by the Contractor.

Payment

Where material:

(a) is unsuitable, it shall be treated insitu or excavated and replaced and payment will be made for the full volume of material below subgrade level so treated or excavated and replaced;

(b) has become unsuitable to any depth due to the Contactor's negligence or use of inappropriate methods it shall be treated insitu or excavated and replaced and no additional payment will be made for this work.

The Contractor shall notify the Superintendent of any requirement to treat unsuitable materials and any action to be taken shall, unless otherwise specified, be submitted to the Superintendent for review.

Where the roadbed is subgrade, the upper 75 mm shall, unless otherwise specified, be scarified and trimmed and shall be compacted to satisfy test rolling requirements specified in Section 15.

Where the roadbed is existing pavement, the upper 100 mm shall, unless otherwise specified, be scarified, reshaped and compacted as specified before additional material is spread.

Any damage to the roadbed resulting from traffic or any other cause shall be made good by the Contractor. No additional payment will be made for this work.

20.6 TREATMENT OF ROCKY SUBGRADE

Unless otherwise specified, where the excavation at subgrade level is rocky material, the subgrade shall be loosened and rocks or boulders removed to a depth of at least 150 mm below subgrade level in areas on which pavement is to be placed. Any resulting depressions shall be backfilled with suitable material similar to the surrounding insitu material and such backfilling together with the loosened material shall be reworked and compacted as specified.

Payment

If the contract is a schedule of rates contract or the work is covered by a provisional item in a lump sum contract, payment for this work will be made at the relevant scheduled rate or, where there is no relevant rate, the Superintendent will value the work in accordance with the provisions of Clause 40 of the General Conditions of Contract.

When removal of material below subgrade level is not required the surface shall be loosened to a depth of 150 mm and recompacted to specified requirements. During compaction of these areas, subgrade material shall have a moisture content within the range 85% to 115% of the optimum moisture content as determined by test using Standard compactive effort for the fraction of material that passes the 19.0 mm AS Sieve.

20.7 REMOVAL OF SOFT AREAS OR UNSUITABLE MATERIAL

In cuttings, where directed and authorised in writing by the Engineer, soft, wet or unstable areas of depths exceeding 150mm below the designed levels of the subgrade which exist or develop during construction, shall be excavated and replaced with approved stable materials in layers not exceeding 150mm loose thickness and compacted as specified in Clause 20.32

After completion of clearing and grubbing of areas, upon which filling is to be placed, the Engineer may direct in writing, that unsuitable material shall be excavated to the depths directed, and replaced with approved stable material, placed and compacted in layers as hereinafter specified.

The price for authorised excavation and replacement of unsuitable material below the designed levels of the subgrade shall be included in the relevant item of the schedule, but irrespective of the quantity shown in the schedule, payment will be made only for the actual authorised excavation and backfilling.

Soft, wet or unstable areas of depths less than 150mm below the designed levels of the subgrade and all soft, wet or unstable areas of depths greater than 150mm which, in the opinion of the Engineer, have been caused by the Contractor's negligence or improper methods, shall be excavated and replaced with approved stable material, spread and compacted by the Contractor at his own expense and as specified in Clause 20.32.

20.8 REQUIREMENTS FOR ACCEPTANCE OF COMPACTION

Unless otherwise specified, acceptance of work as far as compaction is concerned will be based on test rolling the roadbed carried out in accordance with Section 15.

20.9 PROTECTION OF ROADBED

The surface of the roadbed shall be kept moist, in good order and condition free from contamination, and shall continue to satisfy the requirements of Clause 20.7 until any subsequent pavement works under the Contract are commenced or the Superintendent accepts and takes responsibility for that part of the work.

20.10 DISPOSAL OF SURPLUS UNUSABLE EXCAVATED MATERIAL.

Surplus or unusable excavated material is material which is surplus to the total quantity of excavated material required for the work under the Contract or material not suitable for use as filling. All such material shall become the property of the Contractor and shall be disposed of off site by the Contractor unless directed otherwise by the Superintendent.

20.B EXCAVATIONS - SHORING REQUIREMENTS

20.11 GENERAL

The contractor shall properly timber and shore all excavations so as to ensure the safe working of the excavation and to prevent any building or other structures, road or road surfaces over and adjacent to the line of works from settling, cracking, being shaken, slipping or from falling in, and to prevent any portion of the floors, sides, roofs and end faces of excavations beyond the exact cross-sections and dimensions determined from slipping, falling, running in or being forced through joints and open spaces in the timbering, and maintain the said timbering and shoring until the completion of the work to the satisfaction of the superintendent. The contractor shall be held entirely responsible for the strength and safety of all timbering. The contractor shall have sufficient quantity of timber and planks constantly on hand for bracing, sheeting and shoring in order to be available for use immediately in case of accident or emergency.

20.12 STANDARDS

Timbering of excavations and safety precautions shall comply with all applicable Victorian State Acts of Parliament and the Code of Practice for Safety Precautions in Trenching operations, and in accordance with this specification. In all underground workings the contractor shall take precautions and procedures as required by the Mines Act 1958 and Mines (Trenches) Regulations 1982.

20.13 NOTIFICATIONS

The contractor is required to notify the Chief Mining Inspector of the Department of Labour in accordance with the Mines (Trenches) Regulations, 1982 on Form No. 372. The contractor is also required to provide a copy of this document to the Superintendent to enable him to similarly notify the Department of Labour.

20.14 COST OF SECURING EXCAVATIONS

The rate shown against any item in the Schedules of Prices which includes excavation in open trench or shallow shafts shall include all the costs of materials and labour for securing excavations in accordance with this specification.

20.15 MATERIALS FOR SHORING

On all excavation Work an adequate supply of timber of suitable quality and dimensions or other suitable material for use as shoring shall be provided and used where necessary to prevent injury to any persons employed from a fall or dislodgment of earth, rock or other material forming the side of or adjacent to any excavation or earthwork.

20.16 USE OF SHORING

The timber or material provided as required above shall be used to adequately support against collapse the sides of every excavation or other opening in the ground 1.5m or more in depth in which workers are required to work unless the sides of the excavation are self supporting by virtue of an angle of the slope of the sides or the stability of material under all conditions of operation.

20.17 STRENGTH OF SHORING MATERIALS

All shoring, bracing and sheet piling, shall be of sound material and of adequate strength having regard to the magnitude of the Work and the character of the soil or material in which the excavation is made.

20.18 ERECTION OF SHORING

The erection of shoring, bracing and sheet piling shall be carried out under the direct supervision of a competent person and such shoring, bracing and sheet piling shall at all times be maintained in good and safer order and condition.

The Engineer may require the Contractor to submit for examination such information as he may require of such shoring, bracing or sheet piling written in the English language.

20.19 PROTECTION OF STRUCTURES FROM COLLAPSE

No excavation or earthwork which is likely to reduce, so as to endanger any person employed, the security or stability of any part of any structure whether temporary or permanent, shall be commenced or continued unless adequate precautions are taken before and during the progress of the Work to prevent danger to any person employed from collapse of the structure or the fall of any part thereof.

20.20 PROTECTION OF EXCAVATIONS & OTHER OPENINGS

Every accessible part of an excavation or other opening in the ground on or in connection with construction Work shall be securely and adequately protected so as to safeguard any person from falling or sustaining injury.

20.21 PLACING OF MATERIALS

Material shall not be placed or stacked nearer than 600 millimetres from the edge of any excavation or other opening in the ground so as to endanger persons working therein.

20.22 USE & POSITIONING OF MACHINERY AND EQUIPMENT

Except as otherwise provided by this Specification, no hoisting appliance, power-driven equipment or other heavy object shall be placed or moved near the edge of any excavation where a collapse of the side of the excavation or other opening may occur unless the side of such excavation or opening has been adequately supported to resist the extra pressure due to such superimposed loads.

20.23 SAFE ACCESS AND EGRESS

In every excavation or other opening in the ground wherein persons are working or will be required to Work, safe access and egress shall be provided.

Where such excavation or other opening is in the form of a trench or pit safe means of access and egress shall be provided at least every 30 metres along the trench or pit.

20.24 PLACING OR WITHDRAWING SHEET PILING OR SHORING

A hoisting appliance or other equipment shall not be used for placing or withdrawing sheet piling or shoring unless such hoisting appliance or other equipment has been designed for that purpose or measures have been taken to ensure that such appliance or other equipment is not subjected to loads greater than those for which it was intended.

All timbering and shoring shall be withdrawn as the Work of backfilling proceeds except in the following cases.

i) Any permanent timbering planking etc., forming part of the permanent Works in any excavation shall be left in place;

ii) Where the Engineer orders the timbering to remain in position because, in his opinion, the withdrawing of same is impracticable or would endanger the safety of the Works, building, structures, street, and other surfaces over and adjacent to the line of the Works; and

iii) Where the Engineer permits the Contractor to allow the timbering or shoring to remain in position.

Where the contactor is ordered or permitted to leave timbering in position in open excavations such timber shall be cut off at a depth of at least 600 mm below finished surface level.

PAYMENT

The contractor shall allow in his Tender Price and shall bear the cost of any of the timber left in place in accordance with the above cases.

20.25 SHORING FOR EXCAVATION WITH SLOPING SIDE

When the sloping side of an excavation, at an angle not exceeding the angle of repose of the soil, does not extend to the bottom of the excavation, shoring shall be provided in conformity with this section of the Specification. Such shoring shall extend not less than 300 mm above the bottom of the slope. Boards shall be placed behind the shoring, where necessary, to prevent material sliding into the excavation.

20.26 ADDITIONAL LOADS

Shoring, bracing or sheet piling shall not be used to support scaffolding or any other superimposed loads unless such shoring, bracing or sheet piling has been designed or reinforced to withstand the additional loads.

20.27 MOVEMENT OR ALTERATION TO BE AUTHORISED

No person shall interfere with, move or alter in any way, any shoring, bracing, sheet piling, barricade, guard rail or thing which has been provided in connection with construction Work unless the person carrying out or in charge of the Work authorises such moving or altering.

20.28 SHAFTS, WELLS AND TUNNELS

i) Every shaft and well shall be securely cased, lined or otherwise made safe.

ii) Every drive and tunnel shall be securely protected and made safe for persons employed therein.

iii) All entrances between the bottom of every shaft and the poppet head pulley wheel shall be securely fenced, including any entrances from an elevated platform.

iv) Any fence or cover may be temporarily removed, in order to facilitate the Work which is in progress, if proper precautions are taken.

20.C FILL CONSTRUCTION

20.29 GENERAL

Fill construction includes the preparation of areas upon which fills are to be constructed and the selection, placement, and compaction of filling.

20.30 AREAS UPON WHICH FILLS ARE TO BE CONSTRUCTED

Areas upon which fills are to be constructed shall be prepared for test rolling by the Contractor. The surface of the prepared area shall be test rolled in accordance with the Contractor's approved test rolling method and any unstable areas detected by test rolling shall be rectified in accordance with the requirements of Clause 20.5.

Except where the height of fill to be compacted over the stripped surface is less than 1.0 m, material immediately below the surface exposed after stripping of topsoil or removal of existing pavements shall be scarified to a depth of not less than 150 mm and compacted to a dry density of not less than 95% Australian Standard Maximum Dry density. During compaction of these areas the moisture ratio of the material shall be maintained at not less than 85% as determined by test using Standard compactive effort. If optimum moisture content has not been determined by compaction testing, it shall be determined on that fraction of material which passes the 19.0 mm AS sieve.

Existing pavements which are not required to be salvaged shall be scarified to a depth of not less than 150mm and compacted as specified.

Where groundwater or seepage is encountered, or is likely to be encountered, the Contractor shall notify the Superintendent and any action to be taken shall, unless otherwise specified, be submitted to the Superintendent for review.

The Contractor shall not commence placing any filling on the prepared areas until the Superintendent has inspected these areas and has given consent to proceed.

20.31 BENCHING

Where a fill is to be constructed on sidelong ground or against an existing fill, surfaces on or against which the fill is to be constructed which have a slope steeper than 4 horizontally to 1 vertically shall, unless otherwise specified be cut progressively in the form of benches over the full area to be covered by new filling. The width of each bench shall be such as to permit safe and effective operation of plant but shall be not less than 1 m.

Material excavation during benching may be used in the fill if it is of satisfactory quality.

No additional payment will be made for any work required to comply with this sub-clause.

20.32 MOISTURE CONTENT OF FILLING

Unless otherwise specified filling shall have during compaction a moisture ratio not less than 85% as determined by test using the Standard compactive effort. If optimum moisture content has not been determined by compaction testing, it shall be determined on that fraction of material which passes the 19.0 mm AS sieve. After completion of compaction of a layer the moisture content of the material in the layer shall be maintained within the range specified until test rolling in accordance with Clause 15 has been completed.

20.33 PLACING OF FILLING

A. EMBANKMENTS AND ALLOTMENTS:

Filling to embankments and allotments shall be approved material from the excavations spread in successive layers not exceeding 150 mm (loose measurement) and compacted throughout to a dry density of not less than 95% Australian Standard Maximum Dry Density.

The top 150 mm of filling to allotments shall consist of topsoil obtained from stripping; graded and shaped to the finished levels shown on drawings and as specified.

B. ROAD PAVEMENTS AND FOOTPATHS

Filling under road pavements and footpaths shall be approved granular material spread in successive layers not exceeding 150mm (loose measurement) and placed by a method acceptable to the Superintendent and compacted throughout to a dry density of not less than 95% Australian Standard Maximum dry density. The top 450mm of such fill shall be compacted to a dry density of not less than 100% Australian Standard Maximum dry density.

20.34 TEST ROLLING

Areas upon which filling is to be placed, all layers of filling, and material within 150mm. of subgrade level in cuts, shall be compacted so as to be capable of withstanding test rolling. Test rolling shall be undertaken in accordance with Section 15 of the specification.

20.35 BORROW EXCAVATION FROM SOURCES NOMINATED BY THE CONTRACTOR

Borrow excavation shall be limited to the quantity of material necessary to complete the work under the contract and will not be permitted where sufficient suitable material from within the limits of site excavation is available.

Where borrow material is required to complete the work under the contract it may be obtained from one or more sources.

Prior to commencing delivery, the contractor shall submit to the superintendent for review test results of proposed borrow materials. No material shall be borrowed from within the road reserve unless agreed to by the superintendent. Where borrow excavation is necessary because of the contractor's negligence or use of inappropriate methods, the borrow excavation shall be carried out by the contractor and no additional payment will be made for this week.

SECTION 25 - SHAPING, GRADING & TOPSOILING

Revision No.	Date	Affected Clause

SECTION 25 - SHAPING, GRADING & TOPSOILING

25.1 REGRADING

The allotments, including the uneven surfaces from the previous use of the property shall be smoothed, graded and shaped to an even surface free from depressions in which water may pond and shall be graded such that a minimum fall of 1 in 150 towards the drainage outlet is achieved. The surface of excavations and fillings shall be finished parallel to the finished surface level to allow for the depth of topsoil surfacing as specified.

Where shown on the drawings, allotment areas shall be formed by cutting and filling as required, to bring them to the levels and/or grades shown on the drawings.

25.2 FILLING AND TOPSOILING

The topsoiling of allotments and batters shall be carried out as described below for the different cases:

i)	Top 150mm finished surface is inferior material to the stockpiled topsoil.	excavate an additional 150mm and replace with topsoil. Surplus spoil to be disposed of as specified.
ii)	Top 150mm finished surface is similar or superior to stockpiled top soil.	No further action.
iii)	Filling required is less than 200mm depth.	Regulate surface to design levels with stockpiled topsoil.
iv)	Filling required is greater than 200mm depth.	Strip and fill with approved material as specified and top with 150mm depth stockpile topsoil.

Filling on allotments is to be clean filling approved by the Superintendent and is to be compacted to a dry density of not less than 95% Australian Standard Maximum Dry Density in layers not exceeding 150mm in thickness.

25.3 PROTECTION OF TREES

The Contractor shall take the necessary precautions to ensure the protection of trees and shrubs on allotments during the above operations.

25.4 HAND FINISHING

The allotments and batters shall be finished as above by hand if the weather will not permit the use of plant and under no circumstances will extension of the contract be granted for shaping, grading and topsoiling of allotments.

25.5 DEWATERING, DESLUDING & FILLING DAMS & WATERHOLES

The contractor shall inspect the site prior to tendering and determine whether any dams or waterholes exist on the site.

The contractor shall be responsible for the effective removal and conveying of all water and sludge from such storage areas in such a manner as not to cause any nuisance or injury to property or persons.

The contractor shall fill any dams and waterholes with approved material from the excavations, spread and compacted in layers not exceeding 150mm as specified for filling.

Before filling is commenced, the whole of the area to be filled shall be stripped as specified. The contractor shall notify the superintendent to determine if the exposed subgrade is suitable to commence filling upon.

The contractor shall at all times during the progress of the work, construct and maintain such temporary drains, pumps and other equipment necessary to protect the filling.

25.6 RECORDING OF FILLING IN ALLOTMENT AREAS

The profile of the excavated areas of dams and other areas to be filled in allotment areas is to be recorded prior to the placement of filling. The contractor to notify the superintendent 48 hours in advance of commencement of filling operations so that a licensed surveyor can record levels.

PAYMENT

The cost of survey work relating to this filling will be borne by the Principal. Any filling done during construction shall be shown on the transparencies.

25.7 COMPACTION TESTING OF FILLING IN ALLOTMENT AREAS

Filling on allotments is to be compacted to a dry density of not less than 95% Australian Standard Maximum Dry Density in layers not exceeding 150mm in thickness.

Compaction testing of filling in allotment areas are to be undertaken at the discretion of the supervising engineer.

The actual soil testing shall be carried out under the direct supervision of a member of the National Association of Testing Authorities and a copy of the results shall be submitted to the Superintendent as soon as practicable.

All testing shall be undertaken during the progress of the works.

PAYMENT

The cost of this work shall be borne by the Principal.

Guideline for tests in allotments are generally on a 30 metre square grid provided that a minimum of 1 test per allotment is carried out. Testing will be required on each additional 1.25 metres of fill compacted, and will be required as set out above in every circumstance where the total depth of fill to final level exceeds 1.25 metres.

Where the depth of filling does not exceed 1.25 metres or the area of filling does not exceed 900 sq. metres the number of tests carried out will be at the discretion of the Supervising Engineer.

25.8 DRAINAGE OF THE EARTHWORKS

Earthworks shall be kept clear of water at all times. The work shall be arranged so that all water will flow to one or more points, from which it shall be drained away by gravity or removed by pumping.

25.9 DISPOSAL OF SPOIL

Excavated material which is not required for filling replacement and topsoil surfacing, shall be disposed off site by the contractor in a manner as directed by the superintendent.

SECTION 30 - CONCRETE

Revision No.	Date	Affected Clause

SECTION 30 - CONCRETE

30.1 GENERAL

This section specifies the materials and workmanship for concrete and cement products used in drainage Works, kerbing, kerbs and channels, footpath paving, pram and vehicular crossings, and elsewhere in the Contract.

All Work shall be constructed to the lines, levels and details shown on the Drawings and shall be straight between changes of direction and shall be done evenly between changes of grade.

Where shown on the Drawings or directed by the Superintendent, horizontal and vertical curves shall be built at all changes of direction or grade; also the kerb height, cross section or slope and direction of the Work shall be varied to provide proper approaches to pram crossings, vehicular crossings, pit inlets and the like.

30.2 STANDARDS

The current editions of the following Australian Standards shall form part of this Specification for supply of all labour and materials:

AS 3600	Concrete structures
AS 1315	Portland cement
AS 1316	Masonry cement (Metric units)
AS 2758	(Part 1) Aggregates and rock for engineering purposes
AS 1141	Methods for sampling and testing aggregates
AS 1379	Ready mixed concrete
AS 1012	Methods of testing concrete
AS 1509	Rules for design and construction of formwork
AS 1510	Code of practice for control of concrete surfaces
AS 1302	Steel reinforcing bars for concrete
AS 1303	Hard-drawn steel reinforcing wire for concrete
AS 1304	Welded wire reinforcing fabric for concrete
AS 2701	Methods of sampling and testing mortar for masonry constructions

30.3 PRODUCTION AND DELIVERY OF READY MIXED CONCRETE

All concrete used in this Contract shall be ready-mixed concrete ordered, produced and delivered in accordance with AS 1379-Ready mixed concrete.

Ready mixed concrete shall only be supplied from a source approved by the Superintendent.

Mixed-on-site concrete shall not be used without specific approval of the Superintendent.

In accordance with AS1379 Clause 2.2.1 Method A - "Performance Ordering" the Contractor shall be responsible for the design of the concrete mix, and the following performance specifications shall be achieved.

i) The slump of the concrete at the time and place of delivery shall be appropriate to the method of handling and placing but shall not be greater than 80mm nor less than 40mm without the approval of the Superintendent.

ii) The nominal maximum size of the aggregate shall be 20mm.

iii) The characteristic compressive strength F'c at 28 days shall be 25Mpa when tested in accordance with Australian Standard Specification AS1012 Part 7 and Part 9.

iv) No further water shall be added to the mix after it leaves the mixing plant.

For the purpose of this Specification where referred to in AS1379 the "Manufacturer" shall be regarded as a "Subcontractor" of the Contractor and the Contractor's responsibility under the General Conditions shall apply.

30.4 STRENGTH

All concrete shall have a compressive strength 17.0 MPa minimum at 7 days, with a minimum of 25MPa at 28 days unless otherwise stated on the drawings.

30.5 ADMIXTURES

Chemical admixtures shall not be used in the concrete mix without the approval of the Superintendent.

30.6 INSPECTION SAMPLING & TESTING READY MIXED CONCRETE

In accordance with AS 1379 the inspection sampling and testing shall be carried out by the Contractor.

The specified Manufacturer's certificate shall be furnished for each truckload.

Tests shall be carried out on a standard 200mm high x 100mm dia cylinder samples, cured and tested in accordance with AS 1012 - Methods of Testing Concrete.

Capping and testing shall be cast for each test. If the specified seven day strength is not attained, the second cylinder shall be tested at 28 days and if the specified strength is still not attained, the contractor shall remove the whole of the concrete of that batch from the job and replace same at his own expense.

The result of the compressive strength tests as specified for 28 days shall be supplied to the Superintendent within 7 days of testing. The cost of the testing shall be at the expense of the Contractor.

30.7 CEMENT MORTAR

Cement mortar shall be supplied, stored, measured and mixed in accordance with AS 2701.

Unless otherwise specified for use in this Contract the mix proportions by volume shall be 1 part cement to 2 parts sand.

30.8 INSPECTION BY THE SUPERINTENDENT

The Contractor shall give reasonable notice to the Superintendent and the Municipal Engineer when inspections are specified.

No Works shall proceed or be covered up under this section until the following items have been inspected and approval to proceed has been granted.

i) Compacted foundation.

ii) Formwork fixed in place braced and coated with form oil or other approved release agent.

iii) Reinforcement fixed in position.

iv) Work prior to pouring concrete.

30.9 FORMWORK GENERAL

The design, fabrication, erection and stripping of formwork shall be carried out in accordance with AS 1509 and AS 1510 Part 1 Formwork, and shall be the responsibility of the Contractor. For the purpose of this Specification the "Engineer" referred to in AS 1509 and AS 1410 shall be the Superintendent.

All forms and levels must be checked by the Superintendent before concrete is placed. Notwithstanding this the Contractor shall be solely responsible for the sufficiency and accuracy of the forms.

The forms shall be to the shapes, lines and dimensions required to construct the Works to the Drawings. Forms shall be properly supported and braced to maintain position during and after the placing of concrete.

Approved release agents shall be used on the forms to obtain easy stripping and desired finish.

The forms shall not be stripped until the concrete has hardened and obtained sufficient strength to support its own weight and any construction loads without injury to the concrete. Except for slip formed concrete in no case shall the forms be removed before 12 hours after placing of the concrete and due consideration shall be given to the decrease in the rate of hardening in cold weather.

30.10 FOUNDATION BEDDING UNDER CONCRETE

Bedding under concrete Works shall consist of Class 2 fine crushed rock of 20mm nominal size or other material as may be approved by the Superintendent, to be spread and compacted to the thickness as shown on the Drawings, by hand ramming, rolling with a vibrating roller or as directed. Any soft patches shall be removed and made good with bedding material as above. Immediately prior to placing of concrete the bedding shall be thoroughly wetted with a hose having a spray nozzle, until it will not absorb further moisture. There shall be no pools of water on the base.

30.11 TRANSPORTATION AND PLACING OF CONCRETE

Concrete shall be transported and placed generally in accordance with AS 3600.

Concrete shall be placed as near as practicable to its final position and at such a rate as will avoid segregation.

30.12 CONCRETE COMPACTION

After placement the concrete shall be thoroughly compacted as appropriate using an immersion vibrator or vibrating screed under the direction of the Superintendent or by other approved means. The concrete shall be thoroughly worked around embedded fixtures and into the corners of forms. Compaction by internal vibration shall be so controlled that segregation of materials will not occur. If, in an inaccessible portion of Work, spading, rodding, or internal vibration is impractical, the concrete shall be compacted by lightly hammering or vibrating of forms.

30.13 JOINTS IN CONCRETE

Joints shall be provided where shown on the Drawings or where specified or directed by the Superintendent. Concrete placing shall be carried on continuously from joint to joint. Wherever the work of placing concrete is likely to be delayed until the concrete has taken its initial set, a construction joint shall be formed. The location of construction joints shall be planned in advance and shall be made only where approved by the Superintendent. These joints shall be perpendicular to the principal lines of stress and in general shall be located at points of minimum shear.

30.14 NEW CONCRETE AGAINST OLD

Before placing new concrete on or against concrete which has set, the forms shall be retightened and the surface of the set concrete shall be roughened as required by the Superintendent, thoroughly cleaned of foreign matter, laitance, and loose or porous material and saturated with water. The surface shall then be covered with a thin coat of stiff neat cement to bond and concreting shall then proceed immediately. No work shall be stopped or temporarily discontinued within 300 mm of the top on any finished surface, or during pouring the base of pits or cover slabs.

30.15 TEMPERATURE CONSTRAINTS ON CONCRETE POUR

No concrete shall be poured without special precautions and the Superintendent's approval if the air temperature is below 5 degrees Celsius or above 30 degrees Celsius.

30.16 CURING

Concrete and rendering shall be cured generally in accordance with AS 3600 so as to prevent excessive loss of moisture from the surface for at least 7 days continuously following the time of placing; or in hot weather for longer periods as the Superintendent may direct.

Curing shall be accomplished by one or more of the following methods:

i) Covering with hessian or similar material maintained in a wet condition.

ii) Covering with an impermeable membrane after spraying the concrete with water.

iii) Coating with an approved curing compound.

The occurrence of shrinkage cracking unacceptable to the Superintendent shall be regarded as defective Work.

No traffic shall be permitted on the new works for at least seven days.

30.17 DEFECTIVE MATERIALS OR WORK NOT COMPLYING

The Contractor is responsible for the supply and construction of the concrete Works as specified.

Failure of the Work to comply with the specified supply, placing, accuracy, compaction, finish and curing of concrete or adequacy of the forms shall be dealt with as defective work under the General Conditions of Contract.

Approvals by the Superintendent to various stages of the Work shall not relieve the Contractor of his responsibility for the Work to comply with the Specification.

30.18 KERB AND CHANNEL CONSTRUCTION

30.18.1 Foundation

The kerb and channel shall be constructed upon the approved sub-base pavement course prepared as specified and as detailed on the Drawings.

Where thinner pavements are proposed and the sub-base does not project under the kerb and channel, a separate bedding shall be constructed consisting of 75 mm compacted thickness of 20 mm nominal size Class 2 F.C.R. and laid on a compacted subgrade prepared as specified for road pavement.

The foundation shall extend 150 mm outside the limit of the kerb and channel unless otherwise shown on the drawings.

The foundation shall be sprayed with clean water to a damp but not wet state prior to placing the concrete.

30.18.2 Formwork

Forms shall be designed to suit the section of channel and kerb and shall be capable of being removed without injury to the concrete. Lagging used in formwork shall be perfectly straight, sound, dressed softwood, free from twists and warps, or suitable steel sections. Damaged or unsuitable formwork, may be rejected by the Superintendent and all rejected materials shall be removed from the Site of the Works.

Before use and as may be necessary to ensure non-adhesion of mortar, all forms shall be cleaned and greased, oiled or soaped.

The forms are to be set in position, true to line and grade, held rigidly in position by a sufficient number of pins and braced so as to prevent movement under the pressure of the concrete. There shall be sufficient forms to provide for them to be set for the full length of the section or for 75 metres, whichever is the lesser in advance of concrete placing, and to provide for the concrete to remain at least 12 hours in the forms before they are removed.

Face boards of kerbing only may be removed to permit surfacing as specified. All curves must be timbered in full, together with at least 8 metres of the tangential straight at each end of the curve, before any concrete is placed.

30.18.3 Templates (Dummy or Contraction Joints)

The contractor shall provide 5 mm thick steel templates cut to the specified section, hung by lugs to the forms, for the purposes of checking the channel bed to ensure the specified thickness of concrete and to create contraction joints at their location.

Templates shall be spaced to form bays of three (3) metres except at changes of grade where length of bays shall be 1.5 metres. As each bay is poured and completed, the templates shall be moved on to successive bays. The shape of these templates shall simulate the profile of the kerb and channel as shown on the standard Drawings, and shall also be such as not to completely cut through the kerb and channel.

30.18.4 Placing

Concrete shall be placed in forms immediately after arriving on Site. Concrete is to be well spread against forms, rammed with approved tampers into forms and screeded on steel templates cut to profile and finished to a smooth surface.

On grades exceeding 3% the work is to proceed up the gradient so as to prevent creeping of concrete.

30.18.5 Rendering

Exposed faces of the work shall be rendered to produce a neat appearance of uniform colour.

Rendering shall be applied immediately after the body of the concrete is laid, but under no circumstance must the time between laying the concrete and applying the rendering exceed 45 minutes. The thickness of the rendering shall not exceed 7 millimetres.

The mortar mix shall be 1 part Portland Cement: 2 parts washed concrete sand: 1 part screened bluestone dust.

Moulding and chamfering of angles as shown in Drawings, is to be done with proper trowels made for the purpose. Dummy or contraction joints in kerbing and channelling shall be made by withdrawing templates and by facing and trowelling so as to form an unbroken surface. The joint is then to be accurately marked by a small jointing tool.

All concrete kerb and channel shall be trowelled to a smooth glass like impervious finish with a steel float and to be free from all imperfections. Excessive trowelling of the surface is to be avoided.

30.18.6 Machine Extrusion or Slip Form Construction

Where an extrusion or slip form machine is used the grade and alignment of the section to be extruded shall be established by an offset guide line set by the Contractor. The forming portion of the machine shall be readily adjustable vertically during the forward motion of the machine to maintain the specified grade regardless of surface irregularities in the bedding. A gauge or pointer shall be attached to the machine in such a manner that a continuous comparison can be made between the section being placed and the grade and alignment set by the guide line.

As an alternative to the use of an offset guide line, the machine may be operated on rails or forms parallel to the grade specified for the section.

Concrete slump shall be such that the extruded section does not deform from the specified shape as the machine progresses.

Concrete shall be fed to the machine at a uniform rate. The machine shall be so operated as to produce a satisfactorily compacted mass of concrete.

Extruded kerb and channel shall be rendered as for normal formed kerb and channel.

30.18.7 Layback for Vehicle & Pram Crossings

Where vehicle crossings and pram crossings are shown on the Drawings to be provided, layback sections shall be constructed in accordance with the Drawings concurrently with kerb and channel construction.

30.18.8 Expansion Joints

Expansion joints shall also be provided on each side of the bays in the kerbs and channel adjoining side entry pits and at the tangent points of curved kerbs and channels at intersections. Such joints shall be formed by providing a layer of "Spandex" or other approved material between the vehicular crossing and the adjoining bay. Three 20mm dia. M.S. dowels each 0.5 metre long shall be set 0.25 metre into the concrete on each side of the joint. Care shall be taken to ensure that one half of each of the dowels is greased and wrapped so that no bond exists between the steel and concrete. At least 24 hours shall elapse between the placing of the bays on either side of the joint. The Engineer may delete any expansion joints he considers unnecessary. In no case shall the distance between the expansion joints exceed 24 metres.

30.18.9 House Drain Connections

Openings through the barrier type kerbs will be made opposite existing house drains on and in the low side of all allotments and/or in such positions as the Engineer may direct. Such openings will be made with Galvanised or P.V.C. rectangular cross section kerb entry adaptors with suitable section for connection to 100 mm dia. house drain. The opening shall be neatly rounded off to facilitate stormwater discharge into the channel.

The invert of holes shall be level and at the same level as the invert of the channel.

30.18.10 Backing Up

As the work proceeds and the forms are removed, the work shall be backed up with approved filling to the satisfaction of the Superintendent. Backing up shall be completed within 24 hours of stripping of the formwork, to prevent scouring and damage to the concrete.

Special care shall be taken to compact the backfill behind any opening in the kerbing to prevent water passing from the channel into the backfill prior to the house drains being laid. When delay is expected in connecting the house drains, the opening in the kerb shall be securely plugged with clay.

30.18.11 Pavement Construction

Kerbs and channels shall be properly backed up and the concrete cured at least 7 days in warm weather prior to construction of any abutting pavement courses.

30.18.12 Tidying Up

All rubbish and waste material shall be removed day by day as the work proceeds and the Works shall be kept clean and tidy. When the pavement has been constructed, the channels shall be swept clean and all rubbish, surplus or waste materials shall be removed from the job.

30.19 FOOTPATH, PRAM CROSSINGS AND VEHICULAR CROSSINGS

30.19.1 Subgrade Preparation

Cutting, Filling and compaction of subgrade shall be carried out to the profile specified under Earthworks. The subgrade for the footpath, pram crossing and vehicle crossings shall be accurately trimmed to template and level. The Contractor is to ensure that the specified thicknesses for bedding and concreting are achieved.

30.19.2 Crushed Rock Foundation Bedding

After subgrade preparation a foundation bedding of 20 mm nom. size Class 2 approved crushed rock shall be provided as follows for the full width of the work.

i) Footpath and Pram Crossings - 75 mm nominal thickness
ii) Vehicle crossings - 75 mm nominal thickness

It shall be evenly spread, watered and rolled with an approved roller and shall have a minimum of 75 mm compacted thickness. This bedding shall be approved by the Superintendent before any concrete is placed. Soft sections in the formation shall be excavated and filled with crushed rock or other filling approved by the Superintendent. The superintendent reserves the right to order 2% cement stabilised crushed rock under footpaths and driveways in soft ground.

30.19.3 Formwork

The edge forms shall be set true to line and level with the transverse forms set at right angles to the longitudinal forms.

The practices in relation to formwork shall be observed as specified under Formwork General.

30.19.4 Placing of Concrete

The concrete shall be placed in the forms immediately it arrives on Site and shall be well spaded and rammed with approved tampers or an approved vibrating screed and shall be screeded off on the templates or adjacent finished slabs until a true surface is obtained.

30.19.5 Pavement Thickness

Footpath and pram crossings shall be 75 mm thick and at vehicular crossings the pavement shall be thickened to 150 mm. Vehicular crossings shall be constructed as shown on the Drawings in 150mm thick concrete. Industrial and right of way crossovers shall be constructed as shown on the drawings in 175mm thick concrete reinforced with F82 mesh.

30.19.6 Surface Finish

The surface shall be rendered with a coat of rendering 7mm thick consisting of one part of clean sand, one part of stone dust and one part of cement or the use of driers as directed. The driers shall consist of 2 parts clean stone dust and one part cement. The surface of the render or driers shall be steel trowelled to produce a smooth, matt, non-skid hard surface, free from stone pockets, depressions or projections. Excessive trowelling of the surface is to be avoided. The whole shall be lightly broomed within a fine hair broom.

The footpath margins shall be neatly tooled off to a radius of 6 mm and both sides of all joints shall be edged with a special tool for a width of 40 mm.

The finish of the footpath shall be to the approval of the Superintendent.

30.19.7 Weakened Plane Joints

Weakened plane joints 5mm wide and 40 mm deep shall be constructed at 1.5 metre intervals, or where directed. Except as otherwise required by the Engineer, they shall be constructed at right angles to the side forms. These joints shall be formed perfectly straight using the following tools:-

1. **Cutter:** Made from two pieces M.S. flat 40 x 5 mm x 1.35 metre welded together to form a "T" section. Alternatively an equivalent M.S. rolled "T" may be used. Handles shall be provided for removal from concrete. This cutter shall be placed in position immediately after striking off, and removed immediately prior to final finishing.

2. **Grooving**
   Tool: To be similar in construction to the normal 75 mm wide grooving tool, but with a grooving blade 40 mm deep. This tool shall be used in the final finishing of the joint.

Alternatively 5 mm wide x 40 mm deep joints may be cut using a diamond blade or similar approximately 24 hours after the footpath has been poured.

At vehicular crossings bays shall be made equal in length and at locations where house drains or other services pass under the footpath, bays shall be a minimum of 300 mm in length.

30.19.8 Expansion Joints

Expansion joints consisting of an approved composite cork pad in one piece with the top edge taped, shall be inserted for the full depth of the concrete. Concrete shall be finished flush with top of the pad and tape removed after 24 hours curing. No jointing tool shall be used along the edge of the pad. Expansion joints shall be provided:

a. On the outside of the transitioning of the thickened sections at vehicular crossings.

b. So as to cut the footpath into lengths of not more than 24 metres between expansion joints.

c. At each intersection as shown on the concrete footpath jointing intersection details.

d. At each break in concreting for more than half an hour and at the close of a days Work except at private crossings, or where directed by the Engineer.

e. Longitudinal joints in full width footpath midway between kerb and building line.

f. Around manholes, drainage pits, S.E.C. poles, telephone boxes, fire hydrants and the like where directed by the Engineer.

30.19.9 Tongue and Groove Joint

A tongue and groove joint in accordance with the drawings shall be constructed on the nature strip side of all driveway laybacks. Such a joint shall be full length or as directed by the Engineer.

30.19.10 Reinforcing

F82 reinforcement or as otherwise specified shall be placed in all right of way crossings and 50 mm cover to reinforcement from top surface shall be provided. All reinforcement shall be supported on bar chairs with a maximum spacing of 1m centres or a grid of 1m centres in each direction for Reinforcement fabric. Fabric shall lap at least 225mm.

30.20 BUFFER STRIPS

Where bituminous sealing terminates against an existing unsealed section of road, a line of bluestone pitchers or a 200mm wide 300mm deep concrete buffer strip shall be laid as indicated on the Drawings.

If bluestone pitchers are used they shall be grouted in position using a grout mixture of 1 part cement to 3 parts sand mixed with water to a stiff consistency.

After grouting of the pitchers, or curing of the concrete, excavation adjacent to the unsealed section of pavement shall be backfilled with Class 2 fine crushed rock and compacted to the Engineer's satisfaction.

30.21 PATTERN PAVING

Pattern paving shall be used where shown on the drawings. Concrete shall conform with the relevant clauses of this specification and the manufacturers recommendation. The minimum thicknesses shall be that shown on the drawings. 30MPa strength concrete shall be used for all pattern paved concrete.

30.21.1 Pattern Type and Depth

Unless otherwise shown on the drawings, pattern shall be imprinted to a maximum depth of 10mm. A header course imprint shall be applied to all free edges and at construction joints. The pattern shall be imprinted after finishing the concrete surface as specified in Section 30.19.6

30.21.2 Colouring

Colouring shall be mixed at the concrete batch plant and applied through the concrete for a minimum depth of 75mm from the surface. The dosage rate shall be as recommended by the manufacturer to achieve a deep rich coloured concrete.

The contractors shall control the placing of coloured concrete to ensure that adjoining areas of plain concrete are not stained with the coloured concrete.

30.21.3 Sealing

As soon as the finishing operation is completed, a suitable correctly formulated liquid curing compound sealer shall be applied to the surface of concrete to ensure adequate curing.

SECTION 35 - -UNDERGROUND STORMWATER DRAINS AND CONDUITS

Revision No.	Date	Affected Clause

SECTION 35 - UNDERGROUND STORMWATER DRAINS AND CONDUITS

35.A. UNDERGROUND STORMWATER DRAINS

35.1 GENERAL

This section specifies the supply of labour plant and materials for the construction of all stormwater drains (including culverts) and associated Works, subsoil drains and service conduits.

35.2 STANDARDS

The current editions of the following Australian Standards shall form part of this Specification for supply of all labour and materials.

AS3725	Loads on buried concrete pipes.
AS1342	Precast concrete drainage pipes.
AS1597	Precast reinforced concrete box culverts.
AS1646	Rubber joint rings for water supply, sewerage and drainage purposes.
AS1741	Vitrified clay pipes.
CA33	Code of recommended practice for concrete pipe laying design.
AS4139	Fibre reinforced concrete pipes and fittings.
AS3500	National Plumbing and Drainage Code.
AS2566	Plastics Pipelaying Design.

35.3 CONCRETE

All concrete used in the Works shall comply with Section - Concrete of this Specification.

35.4 PIPES

35.4.1 Types

All underground drains shall be supplied by the Contractor in Class 2 reinforced concrete pipes (R.C.P.) unless otherwise specified. The use of FRC pipes or UPVC pipes will only be permitted under conditions specifically authorized by the Municipal Engineer.

35.4.2 Joints

All concrete pipes unless otherwise stated on the drawings shall be spigot and socket type with rubber ring joints. Deviation at the joints used in such pipes shall not exceed the manufacture's specification. All other pipes may be interlocking flush joints type, unless otherwise specified.

35.5 EXCAVATION

35.5.1 Requirements

The excavation for drains, junction pits and side entry pits shall be taken out to the exact lines, levels, gradings and cross-sections shown on the Drawings or as may be directed by the Superintendent. All trenches for pipe drains shall not be less than the pipe internal diameter plus 225 mm. All trenches for drains shall be located centrally about the centreline of the drain. The bottom of the trench shall be trimmed accurately to line and grade.

35.5.2 Rock

All rock encountered in excavation works shall be removed to a depth of not less than 75 mm from the bottom of the pipe. Any resulting depressions shall be backfilled with 20 mm Class 2 compacted crushed rock.

Payment

No claim will be considered on account of any rock or any other materials met within the excavation unless specifically noted in the schedule.

35.5.3 Shoring

The Contractor shall provide all materials and labour for shoring up trenches in accordance with the Section 30 Excavations of this Specification.

35.5.4 Excess Excavation

The Contractor shall be fully responsible for any damage caused through the sides of excavation and trenches collapsing.

Any excess in width of the excavation, that is outside the limits of easements, shall be made good with approved materials, if in the opinion of the Superintendent this is necessary.

Payment

Any excess in the excavation below the required depth shall be made good with approved compacted bedding material at the Contractor's expense.

Any excess in width of excavation that requires a superior pipe Class or improved bedding type or concrete bedding shall be at the expense of the Contractor.

35.5.5 Soft Base

Any soft or yielding material encountered at the bottom of the trenches shall be, where directed in writing by the Superintendent, excavated to a sound bottom and replaced with approved material.

Payment will be made only for the actual, authorised excavation and backfill. Any soft areas caused by Contractor's negligence or unproper methods shall be rectified at the Contractor's expense.

35.6 BEDDING, LAYING AND JOINTING OF PIPES

35.6.1 Bedding

All pipes shall be laid on an evenly graded bed of 20 mm nominal size Class 2 F.C.R. compacted by hand ramming or as directed to 75 mm compacted thickness or other approved bedding.

35.6.2 Inspection

No pipes shall be laid in the trenches until the foundation bed has been inspected and approved by the Superintendent.

35.6.3 Laying

The Contractor shall lay and join accurately all pipe lines shown on the Drawings, true to line, level and gradient and shall be particularly careful to lay all pipes with the top as indicated by the manufacturer in its correct position. Unless otherwise specified or approved by the Superintendent, laying of all pipes shall commence at the downstream end.

The socket shall face upstream and the barrel shall bear evenly for its full length on the bedding material, care being taken that no lips or projecting surfaces occur at the interior surface at the joint. Unless otherwise directed by the Superintendent the Contractor shall complete the laying of pipes between adjacent pits before placing any backfill.

35.6.4 Conformity with the Drawings and Tolerances

All pipes shall be laid true to line and level as shown on the drawings within the following tolerances:-

(i) Alignment
The drain pipeline shall be laid so that the departure at any point from its indicated position in plan shall not exceed 50mm.

(ii) Level
The drain invert at any structure shall not depart from its level as determined from the information given on the Drawings by more than 10 mm.

The invert of each pipe length shall not deviate from the design gradient of the drain by more than 5 mm for 1200 mm lengths or 10 mm for 2400 mm lengths.

(iii) Location
a. Pipeline laid within easement.
All easement drains shall be laid at a centreline offset of 1.0 metre from the property line, unless otherwise shown on the drawings.

b. Pipeline laid behind kerb:
All drains laid behind kerb within the road reserve shall be laid at an offset as shown in the Table below, unless otherwise shown on the drawings:

PIPE LOCATION DETAILS

PIPE DIAMETER mm	LOCATION OF PIPE LINE from back of kerb
225	610
300	610
375	610
450	610
625	610
600	610
675	860
750	860
825	860
900	860
975	1,020
1,050	1,020
1,125	1,020
1,200	1,020
1,275	1,170
1,350	1,170
1,425	1,170
1,500	1,170

35.6.5 Spigot & Socket Joints

Rubber Ring R.C.P. shall be jointed by pushing the spigot with the ring in place into the socket for its full depth.

35.7 BACKFILLING PIPE TRENCHES

35.7.1 Inspection

No backfilling of trenches shall be carried out until the pipe laying has been inspected and approved by the Superintendent. Backfilling shall be done in three stages, each one of which shall be inspected and approved before proceeding to the next stage.

35.7.2 Within Road Reserve (not under pavement or kerb)

Material to be used for backfilling shall be class 2 FCR and the best excavated material available on site. The layers of backfilling in each backfilling stage shall not exceed 150mm loose in Stage 1 and 2 and 225mm loose in Stage 3.

Stage 1. To springing Line of Pipe. The material shall be carefully placed round the pipe and thoroughly compacted by mechanical means with a piston type rammer or other approved method. Water shall be added as necessary and as directed to bring the material to its optimum moisture content before compacting. The material used shall be 20mm class 2 FCR.

Stage 2. To 225mm above top of pipe or to the underside of Ag. trench or within 45^{o} influence lines (whichever is greater). The material used shall be similar to that used in Stage 1, but it may be somewhat drier. If the material to be used is very dry it shall be watered to assist compaction. This layer shall also be thoroughly compacted by mechanical means such as vibrating roller or piston type rammer. The material in this layer shall be laid either up to 225mm above the top of the pipe or to the underside of Ag. trench or to a height where 45^{o} influence line intersects the wall of the trench, whichever is greater.

Stage 3. To finished surface level. The material used on these layers may contain small quantities of hard lumps and small pieces of stone but not within 150 mm of the finished surface. This 150 mm shall be top soil stripped from areas to be excavated. For trenches in road reserves, these layers shall be compacted with vibrating rollers or piston type rammers to the approval of the Engineer.

35.7.3 Within Pavement or Kerbing Area.

Where any stormwater drain is laid in such a position as it will be underneath any proposed or existing kerbing and/or channelling or where the line of drain crosses any roadway the whole of the pipe trench shall be backfilled with approved 20 mm nominal size Class 2 fine crushed rock.

35.7.4 Around Pits

The kerbing side of any pit shall be backfilled as in 35.7.3 above. The remaining three sides shall be backfilled as in 35.7.2.

35.7.5 Within Easements

Stage 1. To springing line of pipe. The material to be used shall be 20mm class 2 FCR or other granular material approved by the engineer. The material shall be carefully placed around the pipe in 75 mm layers and thoroughly rammed with an approved hand rammer (flat end of crowbar).

Stage 2. To 225 mm above top of pipe. The material used shall be the best available from the excavation trench. No stones of any kind over 18mm shall be placed within this layer. Layers shall be 150mm loose maximum. Compaction shall be by approved hand rammers (75mm x 75mm timber).

Stage 3. To top of trench. The material shall be that excavated from the trench, placed in 150mm layers and well rammed into place. Construction machinery shall be used for compaction when 375mm of cover has been placed over the top of pipe.

35.7.6 Topsoiling Trenches

Where the line of drainage is to be within naturestrip, reserves or allotment areas, 150mm of topsoil shall be used to complete the backfilling to finished surface level.

In easement and reserve areas, along the line of backfilled trench topsoil shall be neatly mounded above the level of the finished surface level to a height equivalent to one twelfth of the depth of the trench.

If the contractor has not set aside topsoil for this purpose approved topsoil shall be provided by the contractor at his own expense.

35.7.7 Drainage Line Maintenance

Drainage lines shall be continuously maintained during the works to the end of the maintenance period. Any settlement, washouts, blockages, debris etc. shall be immediately made good.

35.8 BOX CULVERTS

Box culvert laying and backfilling shall be carried out as for pipes. The tops of the box culvert sections shall be set on cement mortar (1 part cement to 2 parts sand) and joints between sections grouted with cement mortar of the same composition.

35.9 PROVISION FOR DRAIN EXTENSION

Where shown on the Drawings, or as directed by the Superintendent, the Contractor shall provide a circular penetration in a pit where future drains are to be connected. The penetration shall be formed to permit the future drain of size specified to be inserted with the correct invert level. The penetration shall be plugged with redgum planks or by an approved method.

In certain circumstances, the Superintendent may direct the Contractor to provide one (1) 1.20 length of pipe for future drain extensions.

35.10 PROPERTY INLETS (TO EASEMENTS DRAINS)

Property inlets to easement drains for each allotment shall be supplied and constructed where shown on the Drawings and as detailed in Council's standard drawing. The level of the end pipe shall be not greater than that shown on the drawing or the minimum cover requirement of 200mm clear.

35.11 HOUSE DRAINS (PROPERTY CONNECTION IN ROADS)

The Contractor shall provide and lay house drains across the nature strip to each allotment as shown on the Drawings. The position of each house drain shall be marked on to face of the kerb with metal stump having a 50mm high inverted letter "D". All pipes to be used shall comply with the relevant Australian Standard as specified below:

PIPE MATERIAL	CLASS	DIAMETER	JOINT TYPE	ABSOLUTE MIN. GRADE
R.C.P. A.S. 1342	Class 2	100 mm	Spigot & Socket	1 in 100
P.V.C. A.S. 1477	Heavy Duty Sewer	100mm	Spigot & Socket	1 in 100

The Contractor shall provide and lay one 100 mm diameter drain pipe to each vacant allotment draining to the kerb and channel or underground drain as shown on the drawings. Pipes shall be laid a straight line at uniform grades as set out above at approximately right angles to the kerb and shall extend at least 300 mm into the property. The invert level of the end pipe where shown on the drawings shall be not greater than that specified or the minimum cover requirement of 200 mm clear.

All joints shall be filled with cement mortar made up of three (3) parts of sand to one (1) part of cement.

The connections to the underground drainage shall be as shown on Council Standard Drawings No. SD24.

Where connection to the kerb is specified an opening shall be cast in the kerb to accommodate a rectangular entry adaptor from the house drain as shown on standard Drawing No. SD30.

35.12 DRAINAGE DURING PROGRESS OF THE WORKS

The Contractor shall make proper provision and take all necessary precautions for the diversion of flood and drainage waters and the proper discharging of same during the progress of the Works.

The Contractor shall not obstruct the gutter or channel of any street, but may divert the flow where necessary using all proper measures to provide for the free passage of surface water along the gutters or channels.

35.13 PITS

Pits shall be constructed in concrete to dimensions and thickness, and covers and lintels provided all as shown on the pit details on the Drawings, and as detailed in the Pit Schedule drawing. Pits shall be poured with properly constructed internal and external forms.

Pit floors shall be constructed on a 75mm consolidated thickness of 20 mm Class 2 crushed rock as specified.

The bottom of the pit shall be constructed in the manner shown on the Drawings such that the pit will be self cleansing and the top of the pit shall be constructed to take the specified pit covers.

The ends of pipes at pits shall be rounded off to avoid obstruction to the flow of water. The invert of any pit shall be flush with the pipe invert and shaped to conform with it for at least 1/3 of the pipe diameter above the invert, unless otherwise shown on the Drawings. Rendering or topping of pit bottoms shall not be used without the Superintendent's approval.

All pits shall be provided with two (2) agricultural pipe inlets where shown on standard drawings to drain ground water from outside the pipe drains.

The Contractor shall supply and place in position all concrete pit covers and grates, as specified or detailed on the Drawings.

During construction the concrete in pits shall be compacted to the satisfaction of the Superintendent by the use of immersion vibrators.

35.14 GALVANISED STEPIRONS

Stepirons shall be built into all pits over 900 mm deep. These shall be made from 20 mm diameter mild steel rods bent to form a 225 mm tread and galvanised. The first step shall be 450 mm from the bottom of the pit, with 300 mm spacing between subsequent stepirons to the top.

Approved prefabricated hardened plastic type step irons may be used with the approval of the Municipal Engineer.

35.15 ANCHOR BLOCKS

Where pipes are to be laid at grades steeper than 1 to 7 the Contractor shall provide anchor blocks every 10.0 metres or at lesser intervals if specified. Anchor blocks shall be constructed as shown on the standard details drawings as applicable.

35.16 CONNECTIONS TO MELBOURNE WATER MAIN DRAIN

Where connections to the Melbourne Water main drain are specified on the drawings the Road Contractor shall arrange with the Melbourne Water's District Engineer for the Board to provide the connection.

35.17 AGRICULTURAL DRAINS

Agricultural pipe drains shall be laid true to the lines, levels and grades shown on the drawings behind all kerb and channel; concrete edge strips; and where else specified.

Unless otherwise specified agricultural pipes shall be 100mm diameter corrugated PVC pipe of approved type laid 250mm behind all kerb and channel.

The pipes shall be laid on a 50 mm depth of 20 mm screening as specified and shall be backfilled with 20 mm screenings, carefully placed to avoid any displacement of the pipes.

Backfilling shall not commence until approval of the bedding and laying of the pipes is given by the Engineer.

The pipe trench shall be backfilled to within 300 mm of the top of the kerb with 20 mm nominal size screenings free from dust and excessive fine materials.

The remaining 300mm layer (between top of screenings and top of kerb) shall be of selected topsoil compacted to the approval of the Engineer.

Unless shown otherwise on plans or directed by the Engineer, agricultural pipes shall have a minimum depth of 760mm to invert below the top of kerb. Notwithstanding the above A.G. Drain must be at least 300mm below subgrade level.

All agricultural drains are to be connected to drainage pits and neatly mortared in.

At the upstream end the A.G. pipe is to be connected into the upstream pit at a point above the top of the stormwater drain or sealed by means of a concrete plug or other suitable material to prevent ingress of soil.

35.B SERVICE TRENCHES AND CONDUITS

35.18 GAS, WATER AND TELECOM CONDUITS

35.18.1 Road Conduits

The Contractor shall supply and lay conduits for gas, water and Telecom services under the roadway at locations and depths shown on the Drawings.

Service conduits for residential allotments shall be 50 mm diameter Class 12 PVC unless otherwise shown. Conduits for use by Telecom shall be supplied by Telecom.

Service conduits in industrial/commercial subdivisions shall be as follows:

Water supply/fire service	-	225mm
Gas Service	-	100mm
Telecom Service	-	50mm
Electricity Service	-	125mm

All these conduits shall be Class 12 PVC, unless otherwise shown.

Conduits shall be laid at right angles to the road centreline unless otherwise shown and shall be graded evenly from end to end in lengths with a grade of at least 1 in 100 uniform fall to an existing or proposed water main or gas main unless otherwise directed. Spacing of conduits shall be 50 mm apart.

The ends of service conduits shall be plugged with a screwed cap, wooden discs or other approved material to prevent entry of soil and other material. The conduit shall be perfectly water tight throughout.

The minimum cover above a conduit laid below the subgrade shall be 50mm but not less than 450mm from finished surface and conduits shall extend for a minimum of 450mm behind Backs of Kerb.

Backfilling of trenches shall not commence until approval of the laying of the conduit is given by the Superintendent. Backfill material shall be 20mm Class 3, 3% cement treated fine crushed rock compacted to 95% Australian Modified dry density in layers of 150 mm maximum loose thickness.

The position of conduits shall be clearly marked on the face of the kerb using the symbols detailed on the Drawings. The markings shall be as follows:-

Conduit for water service	-	W, 50 mm high
Conduit for gas service	-	G, 50 mm high
Conduit for Telecom service	-	T, 50 mm high

It is the responsibility of the Contractor to ensure that the kerbs are marked accurately and neatly. The ends of conduits shall be left exposed for inspection by the Superintendent after the kerbs have been marked. If a kerb marking is inaccurate or otherwise unsatisfactory, the section of kerb and channel containing the marking shall be removed and replaced at the Contractor's expense.

35.18.2 Footpath Conduits

The Contractor shall supply and lay conduits as specified for road conduits at a depth of 450 mm below finished level of the footpath. These conduits shall generally be constructed opposite the roadway service conduits or offset 1.0 m on the side of the street which the Gas and water services occupy ie. the minimum distance between tappings is 1 metre.

The conduits shall extend a minimum distance of 300 mm beyond the edges of the path.

The conduit positions shall be accurately and neatly marked on the front of the footpath in the manner outlined for the road conduits.

Where conduits or services pass under footpath two(2) contraction joints shall be made in the footpath approximately 450 mm apart.

SECTION 40 - CRUSHED ROCK AND PLANT MIXED WET-MIX CRUSHED ROCK FOR BASE AND SUBBASE PAVEMENT

Revision No.	Date	Affected Clause

SECTION 40 - CRUSHED ROCK AND PLANT MIXED WET-MIX CRUSHED ROCK FOR BASE AND SUBBASE PAVEMENT

40.1 DESCRIPTION

This section covers the requirements of crushed rock and plant mixed wet-mix crushed rock for Classes 1 and 2 base of 20 mm and 40 mm nominal size produced from igneous or metamorphic source rock, Class 3 subbase of 20 mm, 40 mm and 75mm nominal size.

The requirements relate to quality of source rock and properties of the product.

The classes and nominal sizes shall be as specified in the special clauses and/or the drawings and/or the schedule.

40.2 DEFINITIONS

Crushed Rock

Crushed rock is composed of crushed rock fragments with or without sands and with or without filler, produced in a controlled manner to close tolerances of grading.

Plant Mixed Wet-Mix Crushed Rock (PMWMCR)

Plant mixed wet-mix crushed rock is a mixture of crushed rock and water, produced at a controlled mixing plant to close tolerances of grading and moisture content based on the modified optimum moisture content of the material.

Unsound Rock

Unsound rock is that material, whether in the source or as spalls or as crushed particles, which:

(a) is soft, friable, or composed of clay or weathered rock, or which contains matter which breaks up when alternately wetted and dried; or

(b) in the case of igneous and metamorphic source rock, has a Degradation Factor - Source Rock less than the minimum value for marginal rock specified in Clause or

(c) in addition in the case of basic igneous rock, has a Secondary Mineral Content greater than the maximum value for marginal rock specified in Clause or

(d) in the case of sedimentary rock, has a Texas Ball Mill value greater than the maximum value for marginal rock specified in Clause.

Assigned Los Angeles Abrasion Loss

The assigned Los Angeles Abrasion Loss is a hardness rating derived from Los Angeles Abrasion Loss test results and is assigned to each source by VIC ROADS on the basis of past test data.

40.3 SOURCE ROCK

Prior to the commencement of work, the Contractor shall confirm the source from which the material will be obtained.

Sedimentary source rock shall not be used for the production of crushed rock base.

Source rock shall be considered sound or marginal in accordance with the provisions of Table.

TABLE 40.3.1

Rock Type	Test Value					
	Sound Rock			Marginal Rock		
	Degradation Factor Source Rock (min)	Secondary Mineral Content % (max)	Texas Ball Mill Value (max)	Degradation Factor Source Rock (range)	Secondary Mineral Content % (range)	Texas Ball Mill Value (range)
ACID IGNEOUS						
Granitic Rocks (includes Granite, Adamellite, Granodiorite)	50	-	-	35-49	-	-
Granophyre	45	-	-	35-44	-	-
Rhyolite	45	-	-	35-44	-	-
Rhyodacite	45	-	-	35-44	-	-
INTERMEDIATE IGNEOUS						
Diorite	45	-	-	35-44	-	-
Porphyry	45	-	-	35-44	-	-
Trachyte	50	-	-	30-49	-	-
BASIC IGNEOUS						
Basaltic Rocks (includes Basalt, Dolerite, Limburgite)	50	25	-	30-49	26-30	-
METAMORPHIC						
Hornfels	40	-	-	20-39	-	-
Quartzite	45	-	-	30-44	-	-
Schist	45	-	-	30-44	-	-
Phyllite	45	-	-	30-44	-	-
Gneiss	45	-	-	30-44	-	-
Greenstone	45	-	-	30-44	-	-
SEDIMENTARY						
Argillaceous (includes Mudstone, Calcareous Mudstone, Shale, Siltstone, Claystone, Tillite)	-	-	30	-	-	31-35
Arenaceous (includes Sandstone, Arkose, Greywacke, Quartzite, Calcarenite)	-	-	45	-	-	46-55

The hardness of the source rock shall be measured by a Los Angeles Abrasion Loss test on the product and shall comply with the test values shown in Table 40.3.2.

TABLE 40.3.2

Rock Type	Los Angeles Abrasion Loss (max)			
	Base		Subbase	
	Class 1	Class 2	Class 3	Class 4
ACID IGNEOUS				
Granitic Rocks (includes Granite, Adamellite, Granodiorite)	40	40	45	-
Granophyre	25	25	30	-
Rhyolite	25	25	30	-
Rhyodacite	25	25	30	-
INTERMEDIATE IGNEOUS				
Diorite	25	25	30	-
Porphyry	25	25	30	-
Trachyte	30	30	35	-
BASIC IGNEOUS				
Basaltic Rocks (includes Basalt, Dolerite, Limburgite)	30	30	35	-
METAMORPHIC				
Hornfels	25	25	25	-
Quartzite	30	30	35	-
Schist	30	30	35	-
Phyllite	30	30	35	-
Gneiss	30	30	35	-
Greenstone	30	30	35	-
SEDIMENTARY				
Argillaceous (includes Mudstone, Calcareous Mudstone, Shale, Siltstone, Claystone, Tillite)	-	-	25	-
Arenaceous (includes Sandstone, Arkose, Greywacke, Quartzite, Calcarenite)	-	-	45	-

If at any time the Contractor proposes to obtain material from a source other than the confirmed source, the Superintendent shall be notified in sufficient time to allow such investigation as may be required.

The Superintendent's approval shall be obtained prior to changing the source of material.

If the Contractor proposes to use a source rock type other than those listed in Tables 40.3.1 & 40.3.2 the Superintendent will determine whether the rock type is acceptable and will set appropriate test values.

Source rock which does not comply with specified requirements but from which crushed rock of proven satisfactory performance has been produced may be accepted for use subject to the written approval of the Superintendent.

40.4 COMPONENTS

(a) Crushed rock fragments shall consist of clean, hard, durable, angular fragments of rock.

The use of crusher fines produced from a quarry, or a location within a quarry, different from that used for production of that fraction of the crushed rock retained on a 4.75 mm AS sieve shall be subject to approval in writing by the Superintendent to the proposed source and nature of these materials and the proposed amounts to be added.

Crusher fines produced from any igneous or metamorphic rock shall have a Degradation Factor - Crusher Fines not less than 60.

(b) The use of sands and/or filler shall be subject to approval in writing by the Superintendent to the proposed source and nature of such materials, the proposed amounts to be added and the proposed method of incorporating such materials in the product.

40.5 PRODUCT

(a) The crushed rock shall be free from vegetable matter and lumps or balls of clay and shall comply with the relevant requirements of Table 40.5.1.

TABLE 40.5.1

Test	Test Value		
	Base		Subbase
	Class 1	Class 2	Class 3
Liquid Limit % (max)	25	30	35
Plasticity Index (max)	3	6	10
California Bearing Ratio (5)(min)*	-	-	-
PI x % passing 0.425 mm AS Sieve (max)	-	-	-
Sand Equivalent **(min)	55	50	-

* Value applicable to material passing 19.0 mm sieve: initially at optimum moisture content and 95% of maximum dry density as determined by test using Modified compactive effort, but then soaked for 4 days prior to the CBR test.

** The Superintendent may specify other values of sand equivalent on the basis of tests carried out on crushed rock which complies with the specified requirements for grading and plasticity

(b) Unsound and marginal rock in that fraction of the product retained on a 4.75 mm AS sieve shall not exceed the percentages specified in Table 40.5.2. Where two or more aggregates are combined to produce the crushed rock and no facilities exist in the mixing plant to sample the mixture, unsound and marginal rock in that fraction of each aggregate retained on a 4.75 mm AS sieve shall not exceed the percentages specified in Table 40.5.2..

Table 40.5.2

Class	Total of Marginal and Unsound Rock % (max)	Unsound Rock % (max)
1	10	5
2	10	5
3	20	10
4	-	-

(c) For PMWMCR, the aggregates and water shall be mixed at a mixing plant by continuous or batch mixing.

40.6 WATER

Where it is specified that water shall be added to the crushed rock prior to delivery, such water shall be clear and substantially free from detrimental impurities such as oils, salts, acids, alkalis and vegetable substances.

40.7 GRADING OF UNCOMPACTED CRUSHED ROCK AND PMWMCR BASE

After completion of production, but before compaction, crushed rock and PMWMCR base shall comply with the relevant grading requirements of Tables 40.7.1 to 40.7.6 corresponding to the assigned Los Angeles Abrasion Loss and the nominal size of the material.

The Contractor shall aim to produce the crushed rock and PMWMCR in such a way that the grading coincides with the relevant target grading specified in Tables 40.7.1 to 40.7.6. The permitted ranges of grading in these tables provide for random fluctuations in the production process.

Grading Requirements for 20 mm Base (by mass)

TABLE 40.7.1

Assigned Los Angeles Abrasion Loss: 25 or less. Igneous (other than granitic) and metamorphic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction	
		Limits of Grading (% Passing)	% Retained between Sieves
26.5	100	100	
			0 - 5
19.0	100	95 - 100	
			7 - 18
13.2	85	78 - 92	
			10 - 16
9.5	73	63 - 83	
			14 - 24
4.75	54	44 - 64	
			10 - 20
2.36	39	30 - 48	
			14 - 28
0.425	18	14 - 22	
			6 - 13
0.075	8	6 - 10	

TABLE 40.7.2

Assigned Los Angeles Abrasion Loss: 26 or greater. Igneous (other than granitic) and metamorphic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction	
		Limits of Grading (% Passing)	% Retained between Sieves
26.5	100	100	
			0 - 5
19.0	100	95 - 100	
			7 - 18
13.2	85	78 - 92	
			10 - 16
9.5	73	63 - 83	
			14 - 24
4.75	54	44 - 64	
			10 - 21
2.36	38	29 - 47	
			15 - 29
0.425	16	12 - 20	
			9 - 15
0.075	4	2 - 6	

TABLE 40.7.3

Granitic Source Rock

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction	
		Limits of Grading (% Passing)	% Retained between Sieves
26.5	100	100	
			0 - 5
19.0	100	95 - 100	
			7 - 18
13.2	85	78 - 92	
			10 - 16
9.5	73	63 - 83	
			14 - 24
4.75	54	44 - 64	
			10 - 20
2.36	39	30 - 48	
			15 - 29
0.425	17	13 - 21	
			7 - 14
0.075	7	5 - 9	

Grading Requirements for 40 mm Base (by mass).

TABLE 40.7.4

Assigned Los Angeles Abrasion Loss: 25 or less. Igneous (other than granitic) and metamorphic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction	
		Limits of Grading (% Passing)	% Retained between Sieves
53.0	100	100	
			0 - 5
37.5	100	95 - 100	
			9 - 15
26.5	85	80 - 90	
			7 - 15
19.0	74	66 - 82	
			17 - 23
9.5	54	44 - 64	
			10 - 20
4.75	39	29 - 49	
			4 - 16
2.36	29	21 - 37	
			10 - 22
0.425	13	10 - 17	
			3 - 10
0.075	6	5 - 8	

TABLE 40.7.5

Assigned Los Angeles Abrasion Loss: 26 or greater. Igneous (other than granitic) and metamorphic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction	
		Limits of Grading (% Passing)	% Retained between Sieves
53.0	100	100	
			0 - 5
37.5	100	95 - 100	
			9 - 16
26.5	85	80 - 90	
			7 - 15
19.0	74	66 - 82	
			17 - 23
9.5	54	44 - 64	
			10 - 20
4.75	39	29 - 49	
			5 - 17
2.36	29	22 - 35	
			13 - 22
0.425	11	8 - 13	
			5 - 10
0.075	3	2 - 5	

TABLE 40.7.6

Granitic Source Rock

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction	
		Limits of Grading (% Passing)	% Retained between Sieves
53.0	100	100	
			0 - 5
37.5	100	95 - 100	
			9 - 15
26.5	85	80 - 90	
			7 - 15
19.0	74	66 - 82	
			17 - 23
9.5	54	44 - 64	
			10 - 20
4.75	39	29 - 49	
			4 - 16
2.36	29	21 - 37	
			11 - 22
0.425	12	9 - 15	
			4 - 10
0.075	5	4 - 7	

The Superintendent may change the target grading requirements pertaining to the 2.36 mm, 0.425 mm and 0.075 mm sieves specified in Tables. Notwithstanding any change made to the target grading, the magnitude of the range of the limits of grading will remain unchanged and the range will remain centred on the target grading. No additional payment will be made unless the change from the specified requirements exceeds two percentage units for the 2.36 mm and 0.425 mm sieves or one percentage unit for the 0.075 mm sieve.

40.8 GRADING OF UNCOMPACTED CRUSHED ROCK AND PMWMCR SUBBASE

(a) Class 3 Subbase

After completion of production, but before compaction, Class 3 crushed rock and PMWMCR subbase shall comply with the relevant grading requirements of Tables 40.8.1 to 40.8.4 corresponding to the assigned Los Angeles Abrasion Loss and the nominal size of the material.

The Contractor shall aim to produce the crushed rock in such a way that the grading coincides with the relevant target grading specified in Tables 40.8.1 to 40.8.4. The permitted ranges of grading in these tables provide for random fluctuations in the production process.

The crushed rock shall not be graded from near the coarse limit on one sieve to near the fine limit on the following sieve or vice versa.

Grading Requirements for Class 3, 20 mm Subbase (by mass)

TABLE 40.8.1

Assigned Los Angeles Abrasion Loss 25 or less, igneous (other than granite) and metamorphic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction - Limits of Grading (% Passing)
26.5	100	100
19.0	100	95 - 100
13.2	85	75 - 95
9.5	75	60 - 90
4.75	59	42 - 76
2.36	44	28 - 60
0.425	21	14 - 28
0.075	10	6 - 13

TABLE 40.8.2

Assigned Los Angeles Abrasion Loss 26 or greater, igneous and metamorphic source rock and all sedimentary and granitic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction - Limits of Grading (% Passing)
26.5	100	100
19.0	100	95 - 100
13.2	85	75 - 95
9.5	75	60 - 90
4.75	59	42 - 76
2.36	44	28 - 60
0.425	19	10 - 28
0.075	6	2 - 10

Grading Requirements for Class 3, 40 mm Subbase (by mass)

TABLE 40.8.3

Assigned Los Angeles Abrasion Loss 25 or less, igneous (other than granite) and metamorphic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction - Limits of Grading (% Passing)
53.0	100	100
37.5	100	95 - 100
26.5	85	75 - 95
19.0	77	64 - 90
9.5	60	42 - 78
4.75	46	27 - 64
2.36	35	20 - 50
0.425	17	10 - 23
0.075	9	6 - 12

TABLE 40.8.4

Assigned Los Angeles Abrasion Loss 26 or greater, igneous and metamorphic source rock and all sedimentary and granitic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction - Limits of Grading (% Passing)
53.0	100	100
37.5	100	95 - 100
26.5	85	75 - 95
19.0	77	64 - 90
9.5	60	42 - 78
4.75	46	28 - 64
2.36	35	20 - 50
0.425	15	7 - 23
0.075	6	2 - 9

The Superintendent may change the target grading requirements pertaining to the 2.36 mm, 0.425 mm and 0.075 mm sieves specified in Tables 40.8.1 to 40.8.4. Notwithstanding any change made to the target grading, the magnitude of the range of the limits of grading will remain unchanged and the range will remain centred on the target grading. No additional payment will be made unless the change from the specified requirements exceeds two percentage units for the 2.36 mm and 0.425 mm sieves or one percentage unit for the 0.075 mm sieve.

40.9 STOCKPILING PRIOR TO DELIVERY

Material may be stockpiled prior to delivery provided the following requirements are fulfilled:

(a) the product, after recovery from the stockpile, complies with this specification;

(b) the stockpile site is clean, adequately paved, and well drained;

(c) if a stockpile is constructed in more than one layer, each layer is fully contained within the area occupied by the upper surface of the preceding layer;

(d) no cementitious filler is used.

40.10 HANDLING OF MATERIALS

Handling of materials, including the loading of trucks and stockpiling, shall be effected in such a manner as to minimise segregation.

40.11 MINIMUM TESTING REQUIREMENTS

Unless otherwise directed by the Engineer, the Contractor shall carry out the following checks on the crushed rock in accordance with current test methods and procedures used by the Road Construction Authority.

Test	Minimum Frequency of Testing
Sand Equivalent[+]	One per 300 tonnes or part thereof
Grading	One per 300 tonnes or part thereof
Unsound Rock	One per 300 tonnes or part thereof
Moisture Content - Crushed Rock - PMWMCR	 One each day One each day - one per 200 tonnes or part thereof
Plasticity Index	One per 20,000 tonnes or part thereof
California Bearing Ratio	Prior to the commencement of work and when in the opinion of the Superintendent the nature of the material has changed significantly.
Degradation Factor - Crusher Fines (imported)	One per day
[+] Not applicable to Class 3 subbase.	

SECTION 45 - CEMENT TREATED CRUSHED ROCK FOR BASE AND SUBBASE PAVEMENT

Revision No.	Date	Affected Clause

SECTION 45 - CEMENT TREATED CRUSHED ROCK FOR BASE AND SUBBASE PAVEMENT

45.1 DESCRIPTION

This section covers the requirements for cement treated Class 3 crushed rock subbase of 20 mm and 40 mm nominal size produced from source rock of any type. The requirements relate to quality of source rock, and properties of the product.

The nominal sizes shall be as specified in the special clauses and/or the drawings and/or the schedule.

45.2 DEFINITIONS

Cement Treated Crushed Rock

Cement treated crushed rock is a mixture of crushed rock fragments, cement and water or crushed rock fragments, sand, cement and water produced at a controlled mixing plant to close tolerances of grading, moisture content and cement content.

Unsound Rock

Unsound rock is that material, whether in the source or as spalls or as crushed particles, which:

(a) is soft, friable, or composed of clay or weathered rock, or which contains matter which breaks up when alternately wetted and dried; or

(b) in the case of igneous and metamorphic source rock, has a Degradation Factor - Source Rock less than the minimum value for marginal rock specified in Clause 45.3; or

(c) in addition in the case of basic igneous rock, has a Secondary Mineral Content greater than the maximum value for marginal rock specified in Clause 45.3; or

(d) in the case of sedimentary rock has a Texas Ball Mill value greater than the maximum value for marginal rock specified in Clause 45.3.

Assigned Los Angeles Abrasion Loss

The assigned Los Angeles Abrasion Loss is a hardness rating derived from Los Angeles Abrasion Loss test results and is assigned to each source by VIC ROADS on the basis of past test data.

45.3 SOURCE ROCK

Prior to the commencement of work, the Contractor shall confirm the source from which the material will be obtained.

Source rock shall be considered sound or marginal in accordance with the provisions of Table 40.3.1.

TABLE 45.3.1

Rock Type	Test Value					
	Sound Rock			Marginal Rock		
	Degradation Factor Source Rock (min)	Secondary Mineral Content % (max)	Texas Ball Mill Value (max)	Degradation Factor Source Rock (range)	Secondary Mineral Content % (range)	Texas Ball Mill Value (range)
ACID IGNEOUS						
Granitic Rocks (includes Granite, Adamellite, Granodiorite)	50	-	-	35-49	-	-
Granophyre	45	-	-	35-44	-	-
Rhyolite	45	-	-	35-44	-	-
Rhyodacite	45	-	-	35-44	-	-
INTERMEDIATE IGNEOUS						
Diorite	45	-	-	35-44	-	-
Porphyry	45	-	-	35-44	-	-
Trachyte	50	-	-	30-49	-	-
BASIC IGNEOUS						
Basaltic Rocks (includes Basalt, Dolerite, Limburgite)	50	25	-	30-49	26-30	-
METAMORPHIC						
Hornfels	40	-	-	20-39	-	-
Quartzite	45	-	-	30-44	-	-
Schist	45	-	-	30-44	-	-
Phyllite	45	-	-	30-44	-	-
Gneiss	45	-	-	30-44	-	-
Greenstone	45	-	-	30-44	-	-
SEDIMENTARY						
Argillaceous (includes Mudstone, Calcareous Mudstone, Shale, Siltstone, Claystone, Tillite)	-	-	30	-	-	31-35
Arenaceous (includes Sandstone, Arkose, Greywacke, Quartzite, Calcarenite)	-	-	45	-	-	46-55

The hardness of the source rock shall be measured by a Los Angeles Abrasion Loss test on the product and shall comply with the test values in Table 45.3.2.

TABLE 45.3.2

Rock Type	Los Angeles Abrasion Loss (max)			
	Base		Subbase	
	Class 1	Class 2	Class 3	Class 4
ACID IGNEOUS				
Granitic Rocks (includes Granite, Adamellite, Granodiorite)	40	40	45	-
Granophyre	25	25	30	-
Rhyolite	25	25	30	-
Rhyodacite	25	25	30	-
INTERMEDIATE IGNEOUS				
Diorite	25	25	30	-
Porphyry	25	25	30	-
Trachyte	30	30	35	-
BASIC IGNEOUS				
Basaltic Rocks (includes Basalt, Dolerite, Limburgite)	30	30	35	-
METAMORPHIC				
Hornfels	25	25	25	-
Quartzite	30	30	35	-
Schist	30	30	35	-
Phyllite	30	30	35	-
Gneiss	30	30	35	-
Greenstone	30	30	35	-
SEDIMENTARY				
Argillaceous (includes Mudstone, Calcareous Mudstone, Shale, Siltstone, Claystone, Tillite)	-	-	25	-
Arenaceous (includes Sandstone, Arkose, Greywacke, Quartzite, Calcarenite)	-	-	45	-

If at any time the Contractor proposes to obtain material from a source other than the confirmed source, the Superintendent shall be notified in sufficient time to allow such investigation as may be required.

The Superintendent's approval shall be obtained prior to changing the source of material.

If the Contractor proposes to use a source rock type other than those listed in Table 45.3.1 the Superintendent will determine whether the rock type is acceptable and will set appropriate test values.

Source rock which does not comply with specified requirements but from which cement treated crushed rock of proven satisfactory performance has been produced may be accepted for use subject to the written approval of the Superintendent.

45.4 COMPONENTS

(a) Crushed rock fragments shall consist of clean, hard, durable, angular fragments of rock.

The use of crusher fines produced from a quarry, or a location within a quarry, different from that used for production of that fraction of the crushed rock retained on a 4.75 mm AS sieve shall be subject to approval in writing by the Superintendent to the proposed source and nature of these materials and the proposed amounts to be added.

Crusher fines produced from any igneous or metamorphic rock shall have a Degradation Factor - Crusher Fines not less than 60.

(b) The use of sands and/or filler shall be subject to approval in writing by the Superintendent to the proposed source and nature of such materials, the proposed amounts to be added and the proposed method of incorporating such materials in the product.

45.5 PRODUCT

(a) The cement treated crushed rock shall be free from vegetable matter and lumps or balls of clay and shall comply with the relevant requirements of Table 45.4.1.

Table 45.4.1

Total of Marginal and Unsound Rock % (max)	Unsound Rock % (max)
20	10

The Superintendent will supply the reference specimens necessary for use with Test Method RC 372.01.

(b) The mixture before the addition of cement shall comply with the requirements of Table 45.5.2.

Table 45.5.2

Test	Test Value
Liquid Limit % (max)	35
Plasticity Index (max)	10

45.6 CEMENT

Cement shall comply with the requirements of AS 3972-1991 - Portland and Blended Cements. It shall be stored in weatherproof structures, and any cement which is damaged by moisture shall not be used.

45.7 WATER

Water shall be clear and substantially free from detrimental impurities such as oils, salts, acids, alkalis and vegetable substances.

45.8 MIXING

The crushed rock, sand (if any), cement and water shall be mixed by continuous or batch mixing.

The mixing period and the time of addition of water shall be such as to produce a uniform mixture of the components.

45.9 GRADING OF CRUSHED ROCK WITHOUT CEMENT

The crushed rock, just prior to the addition of cement, shall comply with the relevant grading requirements of Tables 45.9.1 to 45.9.4 corresponding to the Los Angeles Abrasion Loss and the nominal size of the material.

The mixture shall not be graded from near the coarse limit in one sieve to near the fine limit on the following sieve or vice versa.

Grading Requirements for Class 3, 20 mm Crushed Rock Prior to the Addition of Cement (by mass)

TABLE 45.9.1

Assigned Los Angeles Abrasion Loss 25 or less, igneous and metamorphic source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction Limits of Grading (% Passing)
26.5	100	100
19.0	100	95 - 100
13.2	85	75 - 95
9.5	75	60 - 90
4.75	59	42 - 76
2.36	44	28 - 60
0.425	21	14 - 28
0.075	10	6 - 13

TABLE 45.9.2

Assigned Los Angeles Abrasion Loss 26 or greater, igneous and metamorphic source rock - all sedimentary source rock

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction Limits of Grading (% Passing)
26.5	100	100
19.0	100	95 - 100
13.2	85	75 - 95
9.5	75	60 - 90
4.75	59	42 - 76
2.36	44	28 - 60
0.425	19	10 - 28
0.075	6	2 - 10

Grading Requirements for Class 3, 40 mm Crushed Rock Prior to the Addition of Cement (by mass)

TABLE 45.9.3

Assigned Los Angeles Abrasion Loss 25 or less, igneous and metamorphic source rock

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction Limits of Grading (% Passing)
53.0	100	100
37.5	100	95 - 100
26.5	85	75 - 95
19.0	77	64 - 90
9.5	60	42 - 78
4.75	46	27 - 64
2.36	35	20 - 50
0.425	17	10 - 23
0.075	9	6 - 12

TABLE 45.9.4

Assigned Los Angeles Loss 26 or greater, igneous and metamorphic source rock and all sedimentary source rock.

Sieve Size AS (mm)	Target Grading (% Passing)	Test Value before Compaction Limits of Grading (% Passing)
53.0	100	100
37.5	100	95 - 100
26.5	85	75 - 95
19.0	77	64 - 90
9.5	60	42 - 78
4.75	46	28 - 64
2.36	35	20 - 50
0.425	15	7 - 23
0.075	6	2 - 9

The Superintendent may change the target grading requirements pertaining to the 2.36 mm, 0.425 mm and 0.075 mm sieves specified in Tables 45.9.1 to 45.9.4. Notwithstanding any change made to the target grading, the magnitude of the range of the limits of grading will remain unchanged and the range will remain centred on the target grading.

45.10 CEMENT CONTENT

Cement shall be added and mixed into the crushed rock in such a manner as to produce a uniform cement content. After mixing, the cement content of the mixture, expressed as a percentage by mass of the dry crushed rock, shall be within 0.3 of the value specified below:

*******The cement content shall be:

(a) 20 mm nominal size crushed rock - 3%

(b) 40 mm nominal size crushed rock - 3%

45.11 MOISTURE CONTENT

Where the work of the Contract includes supply and delivery only, the moisture content of the mixture at the point of delivery, expressed as a percentage by mass, shall be within plus 0.5 to minus 1.0 of the target nominated from time to time by the Superintendent.

45.12 STOCKPILING OF MIXTURE

Cement treated crushed rock shall not be stockpiled.

45.13 HANDLING OF MIXTURE

Handling of the mixture, including discharging from mixing plant and loading of trucks shall be effected in such a manner as to minimise segregation.

45.14 MINIMUM TESTING REQUIREMENTS

The Contractor shall test the cement treated crushed rock at a frequency which is sufficient to ensure that all material supplied under the Contract complies woith the specified requirements. The frequency shall not be less than that shown in Table 45.14.1, except that the Superintendent may agree to a lower frequency where the Contractor has implemented a system of statistical process control and can demonstrate that such lower frequency is adequate to assure the quality of the product.

Table 45.14.1 - Minimum Frequency of Testing

Test	Minimum Frequency of Testing
Grading	One per 300 tonne or part thereof
Unsound Rock	One per 300 tonne or part thereof
Cement Content	One per 100 tonne or part thereof
Moisture Content	One per 100 tonne or part thereof
Plasticity Index	One per 20,000 tonne or part thereof
Degradation Factor - Crushed Fines (imported)	One per day

SECTION 50 - GRAVEL, SAND AND SOFT OR RIPPED ROCK FOR BASE AND SUBBASE PAVEMENT

Revision No.	Date	Affected Clause

SECTION 50 -GRAVEL, SAND AND SOFT OR RIPPED ROCK FOR BASE AND SUBBASE PAVEMENT

50.1 DESCRIPTION

This section covers the requirements for gravel, sand and soft or ripped rock, including mixtures thereof and materials to be broken to size on the roadbed.

50.2 DEFINITIONS

Gravel
Gravel is a naturally occurring mixture of angular or rounded rock fragments substantially retained on a 4.75mm AS sieve, with or without some finer material, and all passing a 75 mm AS sieve.

Sand
Sand is a product of rock weathering substantially passing a 4.75 mm AS sieve, and is generally siliceous and free from appreciable quantities of clay and silt.

Soft or Ripped Rock
Soft or ripped rock is rock extracted from a deposit without blasting and not requiring processing through a crushing plant for reduction of size.

50.3 MATERIAL SOURCE

Prior to the commencement of work, the Contractor shall confirm the source from which the material will be obtained.

50.4 PHYSICAL PROPERTIES AND GRADINGS

The material shall meet the relevant requirements of Tables 50.4.1 & 50.4.3 and shall be free from vegetable matter and lumps of balls of clay or other deleterious matter.

When specified by means of a cross (+) in Table 50.4.2 the Contractor shall supply to the Superintendent for approval, grading figures to indicate the average grading of the material proposed for supply.

The approved average grading shall become the target grading for material to be supplied. The permitted range of grading about the target is specified in Table 50.4.3.

All material supplied shall comply with the grading limits.

TABLE 50.4.1

Type of Material and Use (Base or Subbase)	All Passing Sieve Size AS (mm)	Liquid Limit (%/max)	Plasticity Index		Texas Ball Mill (max)	Plasticity Index x% passing 0.425 mm (max)	California Bearing Ratio * (%/min)
			(min)	(max)			
Base - sealed		25	4	6			
Base - unsealed		35	4	10			
Subbase - top 150mm		40	4	10			
Subbase - below 150mm		40	4	20			

* Value applicable to material passing 19.0 mm sieve: initially at optimum moisture content and 95% of maximum dry density as determined by test using Modified compactive effort, but then soaked for 4 days prior to the CBR test.

TABLE 50.4.2 - Grading Requirements (percentage passing by mass).

Type of Material and Use (Base or Subbase)	Sieve Size - AS Sieve (mm)										
	150	75	37.5	26.5	19.0	13.2	9.50	4.75	2.36	0.425	0.075
20mm nom size gravel	-	-	-	100	95-100	-	70-90	48-72	34-60	14-32	6-20
10mm nom size gravel					-	100	95-100	70-90	50-70	20-40	9-25

\+ Contractor shall supply to the Superintendent for approval, grading figures to indicate the average grading of material proposed for supply.

TABLE 50.40.3 - Permitted Range of Grading

Sieve Size AS (mm)	Permitted Range of Grading ± (%, by mass)
150,75,37.5	20
26.5, 19.0, 13.2, 9.50, 4.75, 2.36	15
0.425	10
0.075	5

50.5 WATER

Where it is specified that water shall be added to the material prior to delivery, such water shall be clear and substantially free from detrimental impurities such as oils, salts, acids, alkalis and vegetable substances.

50.6 MINIMUM TESTING REQUIREMENTS

The Contractor shall test the material at a frequency which is sufficient to ensure that all material supplied under the contract complies with the specified requirements. The frequency shall not be less than that shown in Table 811.061, except that the Superintendent may agree to a lower frequency where the Contractor has implemented a system of statistical process control and can demonstrate that such lower frequency is adequate to assure the quality of the product.

***** Table 811.061 - Minimum Frequency of Testing**

Test	Minimum Frequency of Testing
Grading	One every 300 tonnes
Plasticity Index	One per 20,000 tonnes or part thereof
Texas Ball Mill	Prior to the commencement of work

SECTION 55 - FLEXIBLE PAVEMENT CONSTRUCTION

Revision No.	Date	Affected Clause

SECTION 55 -FLEXIBLE PAVEMENT CONSTRUCTION

55.1 DESCRIPTION

This section covers the requirements for the use of gravel, sand, soft or ripped rock, crushed rock or crushed concrete pavement materials, for the construction of pavement courses (including shoulders).

55.2 CONFORMITY WITH DRAWINGS

Pavement courses, each consisting of one or more layers, shall after compaction be finished to smooth and uniform surfaces conforming to the limits for level, line, grade, thickness and cross section shown on the drawings or as specified.

(a) Level

(i) Gravel, sand and soft or ripped rock material

The top of each pavement course shall not differ from the specified level by more than 25 mm.

(ii) Crushed material

The top of each pavement course shall not differ from the specified level by more than 15 mm.

Where pavement is to be constructed to the lip level of kerb and channel, it shall be constructed flush with the lip of the channel or not more than 5 mm above.

(b) Thickness

The subbase course at any point shall be not less than the specified thickness by more than 15 mm and where the subbase consists of two or more layers the thickness of the top layer at any point shall be not less than that specified by more than 10 mm.

The base course at any point shall be not less than the specified thickness by more than 10 mm and where the base consists of two or more layers the thickness of the top layer at any point shall be not less than that specified by more than 5 mm. The average thickness of base over every 100 m section, for the full carriageway width shall be not less than the specified thickness, as determined from measurements taken in accordance with the requirements of Section 15.

The combined thickness of subbase and base courses at any point shall be not less than the specified thickness by more than 15 mm.

(c) Width and Alignment

The widths measured on each side from the specified centreline or design line shall not deviate by more than 50 mm from the designed offset.

(d) Shape

No point on the surface of each layer of base or subbase shall lie more than 10 mm below a 3 m straightedge laid parallel to the centreline of the pavement or below a template placed at right angles to the centreline.

55.3 MATERIALS

The Contractor shall be responsible for the procurement of sufficient specified material to complete the work.

55.4 ADDITION OF WATER

Water added to the pavement material, shall be clean and substantially free from detrimental impurities such as oils, salts, and, alkalis and vegetable substances.

55.5 DELIVERY DOCKETS

Where material is scheduled for measurement by loose volume in delivery vehicles or by mass, a delivery docket for each load shall be issued to the Superintendent at the point of delivery.

Where material is measured by other means and for Lump Sum Contracts, the Contractor shall make delivery dockets available for inspection on request by the Superintendent.

Delivery dockets shall show:

(a) name of the supplier, and location of plant;

(b) docket number;

(c) name of user;

(d) project name and location (or contract number);

(e) registered number or fleet number of the vehicle;

(f) date and time of loading;

(g) nature and source of material;

(h) empty and loaded masses of the vehicle (where material is scheduled for measurement by mass);

(i) loose volume in delivery vehicle.

55.6 JOINTING

Unless otherwise specified, the layout of joints shall conform to the following requirements:

(a) Material shall be spread in such a manner as to minimize the number of joints.

(b) In any layer, transverse joints in adjoining paver runs shall be offset by not less than 2 m.

(c) Transverse joints shall be offset from one layer to the next by not less than 2 m.

(d) Longitudinal joints shall be offset from one layer to the next by not less than 150 mm.

(e) Longitudinal joints shall be located within 300 mm of the planned position of traffic lanes lines or within 300 mm of the centre of a traffic lane.

The edge of any paver run shall be kept moist until spreading and compaction has been completed in adjacent paver runs.

55.7 COMPACTION PROCEDURE FOR CEMENT TREATED CRUSHED ROCK PAVEMENT LAYERS:

Each layer of material shall be compacted separately. Not more than two hours shall elapse between the time of completion of mixing and the time of completion of initial rolling, nor more than three hours between the time of completion of mixing and the time of completion of final rolling.

55.8 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

(a) Material of nominal size 40 mm or less

On completion of compaction any segregated areas shall be rectified.

Material which will have a nominal size after compaction of 40 mm or less shall be compacted to comply with the following requirements.

The calculation of density ratio shall be based on tests performed using Modified compactive effort. The work shall be assessed for compliance with requirements for testing and acceptance of compaction as specified in Table 55.8.1.

A lot shall consist of a single layer of work and its size shall be determined by the Council's supervising engineer.

For work to be tested for compliance with Scale A or Scale B requirements, the number of tests per lot shall be six.

For work to be tested for compliance with Scale C requirements, the number of tests per lot shall be three.

All pavement layers shall be compacted to withstand test rolling and shall be test rolled in accordance with Section 15 prior to acceptance of the layer.

Table 55.8.1 - Requirements for Lot Acceptance of Compaction

(i) Scale of Requirements for Testing and Acceptance of Compaction in 27m wide Road Reserves or more.
Scale A Requirements for Testing and Acceptance of Compaction.
The No. of tests per lot will be six (6).

Characteristic Value of Relative Compaction %		Action to be taken by Contractor
Base	**Subbase**	
> 99.9	> 97.9	Nil - Lot will be accepted
99.0 to 99.9	97.0 to 97.9	Re-roll as directed by the Superintending Officer
98.0 to 98.9	96.0. to 96.9	Re-roll and re-present for testing
98.0	< 96.0	Rip, re-work and re-present for testing

(ii)_ Scale of Requirements for Testing and Acceptance of Compaction in Road Reserves, 15m to 16.5m wide.

The following are the Scale B Compaction requirements.
The number of tests per lot will be six (6).

Characteristic Value of Relative Compaction %		Action to be taken by Contractor
Base	**Sub-base**	
> or = 98.0	> or = 97.0	Nil-lot will be accepted.
97.0 to 97.9	96.0 to 96.9	Re-roll as directed by the Superintending Officer
96.0 to 96.9	95.0 to 95.0	Re-roll and re-present for testing
< 96.0	< 95.0	Rip, re-Work and re-present for testing.

(iii) Scale of Requirements for Road reserves 14.5m wide and less.

The following are the Scale C Compaction Requirements.
The number of tests per lot shall be three(3)

Characteristic Value of Relative Compaction %		Action to be taken by Contractor
Base	**Sub-base**	
> or = 100	> or = 98.0	Nil-lot will be accepted.
98.0 to 99.9	96.0 to 97.9	Reroll as directed by Superintending Officer.
< 98.0	< 96.0	Rip, re-Work and re-present for testing.

(b) Material of nominal size greater than 40 mm.

Unless otherwise specified, material shall have during compaction a moisture ratio not less than 85% and not more than 115% as determined by test using Modified compactive effort. If optimum moisture content has not been determined by compaction testing it shall be determined on that fraction of material which passes the 19.0 mm AS sieve. After completion of compaction of a layer the moisture content of the material in the layer shall be maintained within the range specified until test rolling has been completed.

On completion of compaction, any segregated areas shall be rectified.

Unless otherwise specified, material which will have a nominal size after compaction greater than 40 mm shall be compacted using a grading, mixing, watering and rolling procedure proposed by the Contractor and reviewed by the Superintendent.

The Superintendent may require that trial sections be constructed to verify that the proposed compaction routine is acceptable. No additional payment will be made for any such request.

Acceptance of work as far as compaction is concerned will be based on compliance with the accepted compaction routine and test rolling carried out in accordance with Section 15.

Any unstable areas detected by test rolling shall be rectified by the Contractor.

If required by the Superintendent, further test rolling shall be carried out by the Contractor on the pavement layer prior to being covered by a successive layer. No additional payment will be made for any requirement to carry out such further test rolling.

(c) Testing Small Areas

A small area for the purpose of pavement construction shall be defined as one having surface, area less than 500 square metres. The requirements for testing and acceptance of small area shall be as outlined in Clause 15.4(d). The scale of requirements for Characteristic Value of Relative Compaction are set out under Scale C in Table 55.8.1.

55.9 MINIMUM TESTING REQUIREMENTS

The Contractor shall carry out testing at a frequency which is sufficient to ensure that work performed under the Contract complies with the specified requirements but which is not less than that shown in Table 55.9.1.

*****Table 55.9.1 - Minimum Frequency of Testing for Compaction**

Material	Acceptable lot size	Percentage of lots to be tested (minimum)		
		Scale A	Scale B	Scale C
Base	*	70	50	30
Sub Base	*	50	50	30
Lower Sub Base	*	30	30	*

* On discretion of the Council's Supervising Engineer.

The Contractor shall initially test every lot for acceptance in accordance with the requirements of the Specification. Testing of every lot shall continue until three consecutive lots of like material or work have achieved the specified standard when tested for the first time. The Contractor may reduce the frequency of testing to the minimum testing requirements specified after satisfying the above requirement.

For the purposes of this sub-clause, acceptance of compaction for small areas as defined in Section 15 will not be regarded as satisfying the initial testing requirements stated above.

55.10 PROTECTION OF COMPACTED LAYERS

The surface of any compacted layer shall be kept moist, in good order and condition and free from contamination until any subsequent pavement work under the Contract is commenced or the Council accepts and takes responsibility for that part of the Works.

55.11 GRADING OF PAVEMENT MATERIAL AFTER COMPACTION

Material shall comply with the relevant grading requirements of Tables 55.11.1 & 55.11.2 respectively following completion of compaction.

Table 55.11.1 - Grading Requirements for Base Crushed Rock After Compaction

Sieve Size (mm)	Permitted Grading After Compaction (% Passing)	
	Nominal Size (mm)	
	20	40
53.0		100
37.5		95 - 100
26.5	100	80 - 90
19.0	95 - 100	66 - 82
13.2	78 - 92	
9.5	63 - 83	44 - 64
4.75	44 - 64	29 - 49
2.36	30 - 49	21 - 38
0.425	14 - 23	10 - 18
0.075	6 - 11	5 - 9

TABLE 55.11.2 - Grading Requirements for Class 3 Crushed Subbase After Compaction

Sieve Size (mm)	Permitted Grading After Compaction (% Passing)	
	Nominal Size (mm)	
	20	40
53.0		100
37.5		95 - 100
26.5	100	75 - 95
19.0	95 - 100	64 - 90
13.2	75 - 95	
9.5	60 - 90	42 - 78
4.75	42 - 76	27 - 64
2.36	28 - 61	20 - 51
0.425	14 - 29	10 - 24
0.075	6 - 14	6 - 13

SECTION 60 - PRIMING, PRIMER SEALING AND SEALING.

Revision No.	Date	Affected Clause

SECTION 60 - PRIMING, PRIMERSEALING AND SEALING

60.1 GENERAL

This section covers the requirements for priming, primersealing and sealing. The requirements relate to supply of bituminous materials, preliminary work, cleaning of the surface to be treated, and supply, delivery and application of bituminous materials and aggregates. Types of work and materials and nominal rates of application shall be as specified in Clause 60.15.

60.2 DEFINITIONS

Priming:

The application of primer to a pavement.

Primersealing:

The application of primerbinder to a pavement and the covering of the primerbinder with aggregate.

Sealing:

The application of binder to a pavement and the covering of the binder with aggregate.

Cutting back:

The addition of cutter to bitumen.

Fluxing:

The addition of flux oil to bitumen.

Binder:

Bitumen, bitumen emulsion or bitumen fluxed and/or cutback.

Residual binder:

Binder which includes bitumen proprietary grades of modified bitumen, and flux oil but not cutter granulated rubber or other additives. In the case of bitumen emulsion, it is binder which remains after water has separated.

Bituminous Materials:

Primer, Primerbinder, Binder or a mixture of binder with cutter, flux oil, adhesion agent binder modifiers such as rubber and polymer or special additives.

Aggregate:

One sized crushed rock particles used to cover the hot film of primerbinder or binder.

Adhesion Agent:

A wetting agent which promotes adhesion of binder or primerbinder to stone.

60.3 BITUMINOUS MATERIALS

(a) Supply

Unless otherwise specified, bituminous materials shall be supplied by the Contractor.

Any offer to supply a material which is subject to approval by the Superintendent or which does not comply with the requirements of Clause 60.3(b) to Clause 60.3(e) inclusive shall be accompanied by a statement setting out the properties of the material.

(b) Primer

The primer to be used shall be one of the following:

(i) Medium curing cutback bitumen complying with the requirements of Australian Standard 2157 - Cutback Bitumen. The grade of cutback bitumen shall be in accordance with Table 60.3.1.

TABLE 60.3.1

Primer Classification	Grade of Cutback Bitumen	Viscosity at 60°C (Pa.s.)
Very Light	AMC 00	0.008 - 0.016
Light/Medium	AMC0	0.025.0.050
Heavy	AMC1	0.060-0.120

(ii) **Proprietary grades of special cutback bitumen, provided that the proprietary product is approved by the Superintendent.** The viscosity shall be in accordance with Table 60.3.2.

TABLE 60.3.2

Primer Classification	Viscosity at 60°C (Pa.s.)
Very Light	0.010 - 0.015
Light	0.015 - 0.025
Light/Medium	0.030 - 0.050
Medium	0.055 - 0.075
Heavy	0.085 - 0.115

(iii) Field produced medium curing cutback bitumen primers manufactured by blending Class 170 bitumen and cutter in accordance with Table 60.3.3.

TABLE 60.3.3

Classification	Parts by volume at 15°C		Equivalent % of Cutter in Mixture
	Class 170 bitumen	Cutter	
Very Light	100	130	56
Light/Medium	100	80	44
Heavy	100	50	34

(iv) Field produced slow curing cutback bitumen primer manufactured by blending Class 170 bitumen, flux oil and cutter in accordance with Table 60.3.4

TABLE 60.3.4

Primer Classification	Approximate Viscosity Range Pa.s. @ 60°C	Field Produced Cutback Bitumen Parts by Volume at 15°C		
		Class 170 Bitumen	Flux Oil	Cutter
Very Light	0.012 - 0.018	100	60	80
Light	0.2 - 0.06	100	60	50
Medium	0.06 - 0.10	100	45	35
Heavy	0.20 - 0.40	100	30	25

(c) Primerbinder

The primerbinder to be used shall be one of the following:

(i) Medium curing cutback bitumen complying with the requirements of Australian Standard 2157 - Cutback Bitumen. The grade of cutback bitumen shall be in accordance with Table 60.3.5.

TABLE 60.3.5

Primerbinder Classification	Grade of cutback bitumen	Viscosity at 60°C (Pa.s)	Parts of adhesion agent to added
Medium	AMC4	2.0 - 4.0	1.0
Very Heavy	AMC5	5.5 - 11.0	1.0

(ii) **Proprietary grades of special cutback bitumen provided that the proprietary product is approved by the Superintendent.** The viscosity and residue shall be in accordance with Table 60.3.6.

TABLE 60.3.6

Primerbinder Classification	Viscosity at 60°C (Pa.s)	Residue from Distillation to 360°C % (by volume/min)
Light/medium	1.5 - 3.0	80
Heavy	4.0 - 7.0	88

(iii) Field produced cutback bitumen manufactured by blending Class 170 bitumen and cutter in accordance with Table 60.3.7.

TABLE 60.3.7

Primerbinder Classification	Field Produced Primerbinder (Parts by Volume at 15°C)			Approximate Viscosity Range Pa.s @ 60°C
	Class 170 Bitumen	Cutter	Adhesion Agent	
Medium	100	20	1.0*	2.1 - 3.1
Heavy	100	15	1.0*	4.5 - 7.0

* The added parts of adhesion agent is based on normal concentration. The Superintendent shall determine the quantity of more concentrated forms of adhesion agent to be added as specified in Clause 60.3(g)

(iv) Bitumen emulsion as specified in Clause 60.3(l)

(d) Bitumen

Bitumen shall be Class 170 complying with the requirements of Australian Standard 2008 - Residual Bitumen for Pavements, with the additional requirement that the minimum time to reach the specified apparent viscosity level shall be 9 days when tested in accordance with Australian Standard 2341.13 - Determination of Durability of Bitumen.

(e) Flux Oil

Flux oil shall be diesel fuel oil, automotive distillate or other similar product approved by the Superintendent and supplied in accordance with Australian Standard 3568 as applicable.

(f) Cutter

Cutter shall comply with Australian Standard 3568 - Oils for Reducing the Viscosity of Residual Bitumen for Pavements.

(g) Adhesion Agent

The type of adhesion agent and the percentage to be added to the binder, primerbinder and/or aggregate precoating material shall be subject to approval by the Superintendent and shall be based on the volume of binder primerbinder or aggregate precoating material at 15°C, and the concentration of the adhesion agent to be added.

(h) Aggregate Precoating Material

Aggregate precoating material shall be distillate or distillate based product, cutback bitumen, or proprietary product as approved by the Superintendent.

(j) Polymer Modified Binder

If the use of polymer modified binder is specified or used in lieu of granulated scrap rubber, the polymer modified binder or polymer additive shall be subject to the approval of the Superintendent. Polymer modifier binder shall be handled and used in accordance with the manufacturer's specifications and a certificate of quality shall be submitted for each load of polymer modified binder received.

(k) Scrap Rubber

Scrap rubber to be used as a binder additive shall be supplied in accordance with VIC ROADS standard specification Section 425Q - Bitumen/Scrap Rubber Seals.

(l) Bitumen Emulsion

Bitumen emulsion of Grade ARS or CRS manufactured from Class 170 bitumen shall be supplied at specified grade in accordance with Australian Standard 1160 - Bitumen Emulsion for Construction and Maintenance of Pavements. The type of bitumen emulsion to be used including any proprietary grades shall be subject to the approval of the Superintendent.

60.4 AGGREGATE

Aggregate shall be supplied by the Contractor. Aggregate supplied by the Contractor shall comply with VIC ROADS standard specification Section 831Q - Aggregate for Sprayed Bituminous Surfacing.

60.5 PREPARATION OF BITUMINOUS MATERIALS

(a) Temperatures and Heating

Except as otherwise provided below, the temperatures of bituminous materials shall not exceed the upper limits specified in Table 60.5.1 and, at the time of spraying, shall be within the range specified in that table. Higher temperatures will be permitted for freshly blended field produced cutback bitumen primers and primerbinders provided that the temperature of Class 170 bitumen prior to blending does not exceed 185 °C and that the primer or primerbinder is not reheated to a temperature higher than that specified in Table 60.5.1.

Materials shall be heated at a rate not exceeding 40 °C per hour and mixing shall continue until the load of material is at a uniform temperature.

Bituminous material containing adhesion agent which has been reheated or stored for more than 6 hours shall not be used without the addition of fresh adhesion agent.

TABLE 60.5.1 - Spraying Temperatures of Bituminous Materials

Material		Temperature °C	
		Minimum	Maximum
Very light primer		-	30
Light primer		-	35
Medium primer		35	55
Heavy primer		60	80
Light/Medium cutback bitumen primerbinder		120	135
Heavy cutback bitumen primerbinder		140	155
Bitumen emulsion:	60% bitumen content	40	60
	70% bitumen content	70	90
Class 170 bitumen		178	185
Fluxed and/or cutback bitumen binder		See Table	See Table

For fluxed and/or cutback bitumen binder, the spraying temperature shall be determined from Table 60.5.2.

TABLE 60.5.2 - Spraying Temperatures of Fluxed and/or Cutback Bitumen Binder

Cutter, Parts by Volume per 100 parts of Class 170 Bitumen at 15°C	Flux Oil, Parts by Volume per 100 parts of Class 170 Bitumen at 15°C					
	0		2		4	
	Min °C	Max °C	Min °C	Max °C	Min °C	Max °C
0	178	185	170	184	166	180
2	170	184	166	180	162	178
4	166	180	162	178	160	174
6	162	178	160	174	158	172
8	160	174	158	172	154	170
10	158	172	154	170	152	168
12	154	170	152	168	150	164
14	152	168	150	164	148	162
16	150	164	148	162	144	160
18	148	162	144	160	142	158
20	144	160	142	158	140	156
22	142	158	140	156	138	154
24	140	156	138	154	136	152
26	138	154	136	152	134	150
28	136	152	134	150	132	148
30	134	150	132	148	130	146

(b) Fluxing and/or Cutting Back of Binder and Addition of Adhesion Agent

Unless otherwise specified or directed, the proportions of flux oil and/or cutter shall be as specified in Table 60.5.3. These rates may be varied for very light rates of application and for delayed opening to traffic.

Adhesion agent shall be added to the binder in accordance with Clause 60.3(g) at a rate of one part of adhesion agent at normal concentration for every 200 parts of bitumen for all damp or wet aggregate and for aggregate containing quartz or for other types of aggregate as specified or directed.

The fluxing, cutting back and addition of adhesion agent and the binder and added materials shall be continuously mixed until the whole load of material is homogenous with additional heating as required to meet the spraying temperature range as specified in Table 60.5.2.

TABLE 60.5.3 - Parts by volume of Flux Oil and Cutter per 100 Parts of Bitumen at 15°C

(i) Size 7 Aggregate and Smaller

Air Temp. in °C	Under 150 vehicles per day		150-500 vehicles per day		500-1000 vehicles per day		Over 1000 vehicles per day	
	Flux Oil	Cutter	Flux Oil	Cutter	Flux Oil	Cutter	Flux Oil	Cutter
15-20	4	12	2	12	-	12	-	10
20-25	4	8	2	8	-	8	-	6
25-30	4	6	2	6	-	6	-	4
30-35	4	4	2	4	-	4	-	2
35+	4	2	2	2	-	2	-	-

(ii) Size 10 Aggregate and Larger

Air Temp. in °C	Under 150 vehicles per day		150-500 vehicles per day		500-1000 vehicles per day		Over 1000 vehicles per day	
	Flux Oil	Cutter	Flux Oil	Cutter	Flux Oil	Cutter	Flux Oil	Cutter
15-20	4	10	2	10	-	10	-	8
20-25	4	6	2	6	-	6	-	4
25-30	4	4	2	4	-	4	-	2
30-35	4	2	2	2	-	2	-	-
35+	4	-	2	-	-	-	-	-

(c) Blending of Primer and Primerbinder

Where primer or primerbinder is blended in a sprayer, road tanker or storage tanker, the mixture shall be circulated until a homogenous mixture is achieved.

60.6 PRECOATING OF AGGREGATE

For sealing, aggregate which has not been previously precoated with cutback bitumen, shall be precoated with material as specified in Clause 60.3(h). Adhesion agent shall be added to the aggregate precoating material if specified or directed by the Superintendent.

Such precoating shall be carried out during the loading operation so that each aggregate particle is uniformly coated.

60.7 RATES OF APPLICATION

(a) General

Unless otherwise specified, all rates of application of bituminous material will be expressed in terms of volume at 15°C per unit area (l/m²). In the case of binder, rates of application refer to residual binder. Where it is necessary to apply correction factors for temperatures other than 15°C, the appropriate multiplier from Tables 60.7.1 or 60.7.2 shall be used.

(b) COUNCIL Design **

The nominal rates of application for bituminous material and aggregate are given in Clause 60.15(a). These rates may be varied depending on road surface conditions.

The Superintendent will advise the Contractor of the design application rates prior to the commencement of surfacing work.

If the application rates are varied, payment will be adjusted up or down in accordance with the rate submitted in Schedule 1 for Schedule of Rates contracts, or for Lump Sum contracts, Schedule 2 - Rates for Variation Purposes.

If no rate is provided the adjustment will be valued in accordance with sub-clause 40.2 of the General Conditions of Contract.

(c) Contractor Design **

Where rates of application are to be determined by the Contractor, rates so determined shall be in accordance with the procedures set out in the VIC ROADS Bituminous Surfacing Manual or the AUSTROADS pamphlet - Design of Sprayed Seals - July 1990 used in conjunction with the NAASRA Technical Report - Bituminous Surfacing - Sprayed Work 1990. The traffic data provided in Clause 60.15(f), the aggregate type and size, and the road surface condition as determined by the Contractor shall also be used by the Contractor to design the final rates of application.

Prior to the commencement of work, the Contractor shall submit the rates of application for review by the Superintendent.

**** Strikeout whichever is not applicable.**

TABLE 60.7.2 - Volume Correction Tables - Bitumen Emulsion

Bitumen Content - 60%

A		B	
Table for calculating the volume of bitumen emulsion at a temperature above 15°C TO its volume at 15°C		Table for calculating the volume of bitumen emulsion at a temperature above 15°C FROM its volume at 15°C	
Temperature °C	Multiplier	Temperature °C	Multiplier
15	1.0000	15	1.0000
20	0.9975	20	1.0025
25	0.9951	25	1.0049
30	0.9926	30	1.0075
35	0.9901	35	1.0100
40	0.9877	40	1.0125
45	0.9852	45	1.0150
50	0.9827	50	1.0176
55	0.9802	55	1.0202
60	0.9778	60	1.0227
65	0.9753	65	1.0253
70	0.9728	70	1.0279

Bitumen Content - 70%

A		B	
Table for calculating the volume of bitumen emulsion at a temperature above 15°C TO its volume at 15°C		Table for calculating the volume of bitumen emulsion at a temperature above 15°C FROM its volume at 15°C	
Temperature °C	Multiplier	Temperature °C	Multiplier
15	1.0000	15	1.0000
20	0.9973	20	1.0027
25	0.9946	25	1.0054
30	0.9919	30	1.0082
35	0.9892	35	1.0109
40	0.9866	40	1.0136
45	0.9839	45	1.0164
50	0.9812	50	1.0192
55	0.9784	55	1.0221
60	0.9758	60	1.0248
65	0.9731	65	1.0276
70	0.9704	70	1.0305
75	0.9677	75	1.0334
80	0.9650	80	1.0363
85	0.9624	85	1.0391
90	0.9597	90	1.0420

TABLE 60.7.1 - Volume Correction - Bitumen

Multiplier for Converting Volume at Temperature above 15°C to Volume at 15°C						Multiplier for Converting Volume at 15°C to Volume at Temperature above 15°C					
Temp 0°C	Multi-plier	Temp 0°C	Multi-plier	Temp 0°C	Multi-plier	Temp 0°C	Multi-plier	Temp 0°C	Multi-plier	Temp 0°C	Multi-plier
15	1.0000	90	0.9536	170	0.9060	15	1.0000	90	1.0487	170	1.1038
		92	0.9524	172	0.9048			92	1.0500	172	1.1052
		94	0.9512	174	0.9037			94	1.0513	174	1.1066
16	0.9994	96	0.9500	176	0.9025	16	1.0006	96	1.0526	176	1.1080
18	0.9981	98	0.9488	178	0.9014	18	1.0019	98	1.0540	178	1.1094
20	0.9969	100	0.9476	180	0.9002	20	1.0031	100	1.0553	180	1.1109
22	0.9956	102	0.9464	182	0.8990	22	1.0044	102	1.0566	182	1.1123
24	0.9943	104	0.9452	184	0.8979	24	1.0057	104	1.0580	184	1.1137
26	0.9931	106	0.9440			26	1.0069	106	1.0593		
28	0.9918	108	0.9428			28	1.0083	108	1.0607		
30	0.9906	110	0.9416	185	0.8973	30	1.0095	110	1.0620	185	1.1144
32	0.9894	112	0.9404			32	1.0107	112	1.0634		
34	0.9881	114	0.9391			34	1.0120	114	1.0648		
36	0.9869	116	0.9379	186	0.8967	36	1.0133	116	1.0662	186	1.1152
38	0.9856	118	0.9368	188	0.8956	38	1.0146	118	1.0675	188	1.1166
40	0.9844	120	0.9356	190	0.8944	40	1.0158	120	1.0688	190	1.1181
42	0.9832	122	0.9344	192	0.8932	42	1.0171	122	1.0702	192	1.1196
44	0.9819	124	0.9332	194	0.8921	44	1.0184	124	1.0716	194	1.1210
46	0.9807	126	0.9302	196	0.8909	46	1.0197	126	1.0730	196	1.1225
48	0.9794	128	0.9308	198	0.8898	48	1.0210	128	1.0743	198	1.1238
50	0.9782	130	0.9296	200	0.8886	50	1.0223	130	1.0757	200	1.1254
52	0.9770	132	0.9284	202	0.8874	52	1.0235	132	1.0771	202	1.1269
54	0.9757	134	0.9272	204	0.8863	54	1.0249	134	1.0785	204	1.1283
56	0.9745	136	0.9260	206	0.8851	56	1.0262	136	1.0799	206	1.1298
58	0.9732	138	0.9248	208	0.8840	58	1.0275	138	1.0813	208	1.1312
60	0.9720	140	0.9236	210	0.8829	60	1.0288	140	1.0827	210	1.1326
62	0.9708	142	0.9224	212	0.8817	62	1.0301	142	1.0841	212	1.1342
64	0.9695	144	0.9213	214	0.8806	64	1.0315	144	1.0854	214	1.1356
66	0.9683	146	0.9201	216	0.8794	66	1.0327	146	1.0868	216	1.1371
68	0.9670	148	0.9189	218	0.8783	68	1.0341	148	1.0883	218	1.1386
70	0.9658	150	0.9177	220	0.8772	70	1.0354	150	1.0897	220	1.1400
72	0.9646	152	0.9165	222	0.8760	72	1.0367	152	1.0911	222	1.1416
74	0.9634	154	0.9154	224	0.8749	74	1.0380	154	1.0924	224	1.1430
76	0.9622	156	0.9142	226	0.8737	76	1.0393	156	1.0939	226	1.1446
78	0.9609	158	0.9130	228	0.8726	78	1.0407	158	1.0953	228	1.1460
80	0.9597	160	0.9118	230	0.8715	80	1.0420	160	1.0967	230	1.1474
82	0.9585	162	0.9106	232	0.8704	82	1.0433	162	1.0982	232	1.1489
84	0.9573	164	0.9095	234	0.8693	84	1.0446	164	1.0995	234	1.1504
86	0.9561	166	0.9083	236	0.8681	86	1.0459	166	1.1010	236	1.1519
88	0.9548	168	0.9072	238	0.8670	88	1.0473	168	1.1023	238	1.1534

60.8 COMMENCEMENT OF WORK

The Contractor shall submit details of the proposed sequence of bituminous surfacing work to the Superintendent for review, prior to the commencement of work.

Work shall not commence until the Contractor and the Superintendent have agreed that the road surface is ready and fit for surfacing.

60.9 SWEEPING AND CLEANING

The surface to be sprayed shall be swept clean and be free of dust, dirt, clay and deleterious materials.

60.10 CONDITIONS FOR SPRAYING

(a) Pavement

The surface on which primer or binder is to be applied shall be dry. The surface on which primerbinder is to be applied shall be damp.

(b) Ambient Temperature

Unless otherwise approved by the Superintendent, spraying shall not be carried out when the air temperature is less than that specified in Table 60.10.1, except that:

(i) primersealing may be carried out when the air temperature is between 5°C and 15°C if the work is so arranged that the aggregate is applied to the primer binder within ten minutes of spraying;

(ii) sealing with high binder content CRS emulsions may be carried out when the air temperature is not less than 8°C.

TABLE 60.10.1

Type of Work	Air Temperature °C (min)
Priming	10
Primersealing	15
Sealing	15

60.11 SPRAYING AND COVERING

(a) General

Work shall not proceed until there is sufficient material, suitable plant and personnel on site to carry out the works as specified.

(b) Spraying of Bituminous Material

Bituminous material shall be sprayed uniformly to the specified areas using a sprayer to produce a film of material of consistent application over the road surface at the design rate of application.

The work shall be so planned as to minimise spraying by hand and hand spraying in the wheel paths shall be avoided.

Each sprayer run shall overlap any adjacent run by 50 mm to 100 mm.

Except where the surface to be primed abuts an existing edging, structure or bituminous surface, the primer shall be applied at least 100 mm wider than the width of the proposed seal.

Spraying of any load of primerbinder or binder shall not commence unless sufficient aggregates to cover the area to be sprayed is at the work site in trucks.

The work shall be carried out in such a manner as to minimise the number of cold joints in the work. Unless otherwise specified, all joints shall be located at the traffic lane lines or the centre of a traffic lane.

Traffic shall be stopped while spraying is in progress. Unless otherwise specified, traffic shall not be stopped for more than 15 minutes while material is being sprayed and covered.

(c) Papering and Other Protection

The Contractor shall lay paper at the start and finish of each sprayer run to ensure a clean cut-on and cut-off. The paper shall be Kraft 215 g/m² or an equivalent.

Edgings, raised pavement markers, adjoining structures and drainage pit covers and sections of roadway not required to be treated shall be protected from splash and all necessary precautions shall be taken to protect traffic and parked vehicles from airborne bituminous material.

For primersealing and sealing, paper used for cut-ons, cut-offs and protection of edgings and structures shall be held in place by weighting down with small quantities of aggregate from the same stockpile as used for the work.

At the cessation of work each day, the Contractor shall remove from the site all paper and other protective materials.

(d) Loading of Aggregates

Aggregates shall be screened to remove undersize material as part of the loading operation. The size of wire screens to be used to remove undersize material are:

(i) Size 16 aggregate or larger - 9.0 mm

(ii) Size 10 and Size 14 aggregate - 6.3 mm

(iii) Size 5 and size 7 aggregate - 3.15 mm

(iv) Sand - No screen required.

The Contractor shall be responsible for replacing or cleaning aggregate contaminated as a result of the Contractor's operations, and if conditions of the stacksite permit, for windrowing and winning any excess material left on stacksite floors.

Aggregate shall be precoated in accordance with Clause 60.6.

(e) Spreading of Aggregates

Spreading of aggregates shall be carried out using aggregate spreaders. All binder or primerbinder shall be fully covered with aggregate within 20 minutes of spraying.

Aggregates shall be spread at the design application rate to evenly cover the film of bituminous material in a uniform mat. Any aggregate spilt on areas to be treated, shall be removed prior to further spraying over such areas.

(f) Gritting of Primed Surfaces

In locations requiring the passage of traffic or where directed by the Superintendent, primed surfaces shall be gritted. At least two hours shall elapse between application of primer and grit unless otherwise directed.

(g) Rolling

Rolling shall be carried out with self propelled pneumatic tyred multi-wheeled rollers weighing not less than 6.5 tonnes with the rear wheels offset relative to the front wheels to give overlapping tyre paths.

Rolling shall commence immediately after the aggregates have been spread and shall continue uniformly over the whole area until at least 95% of aggregate particles are bedded down into the binder or primerbinder to the satisfaction of the Superintendent. Any areas of binder not adequately covered after initial spreading shall be covered during the rolling process by additional spreading or drag brooming as specified in Clause 60.11(h) to the satisfaction of the Superintendent.

Rolling shall be carried out such that every 4000 m² of seal/primerseal receives a minimum continuous rolling of four roller hours within two hours of the binder being sprayed.

(h) Drag Brooming

When size 10 or smaller aggregates are used, drag brooming shall be done in conjunction with rolling to ensure that a uniform distribution of aggregates is achieved.

60.12 REMOVAL OF EXCESS AGGREGATE

The Contractor shall remove the excess aggregate from the pavement, pits, kerb and channel and concrete paving by brooming it off on to the unsealed shoulder or by use of a suction . Excess aggregate shall not be removed until the aggregate has properly bedded down into the binder by either trafficking or additional rolling, and shall be removed from 6 hours to 48 hours of being sealed or primersealed unless otherwise specified. If a suction cleaner is used, it shall remove aggregate by suction only. No more than 40 loose stones in any square metre of pavement shall remain after the removal of excess aggregate.

Any damage done to the seal due to the removal of excess aggregate shall be repaired by the Contractor at no cost to Principal.

60.13 SUPERVISION

The Contractor shall afford the Superintendent every facility to check rates of application, temperatures and quantities and to take samples.

60.14 TESTING AND ACCEPTANCE

(a) Samples

When requested by the Superintendent at any time during the Contract, the Contractor shall provide up to three one litre samples of each bituminous material required under the Contract.

(b) Tests

The Contractor shall provide certification of specification compliance for each delivery of primer, primerbinder or binder supplied to the work site.

All tests shall be conducted in accordance with VIC ROADS relevant test method and Codes of Practice.

(c) Inspection

Prior to the Contractor leaving the site, the work shall be jointly inspected by the Superintendent and the Contractors representative to identify any defects in the work requiring immediate rectification to avoid rapid deterioration of the road surface or danger to road users.

(d) Acceptance of Work

Further to the provisions of Clause 408.14(c) and Clause 30 of the General Conditions of Contract, work shall be assessed in accordance with Tables 60.14.1 and 60.14.2.

TABLE 60.14.1 - Application of Bituminous Material

Variation from the design rates of application *	Assessment
Not more than 0.05 l/m² below or 0.1 l/m² above.	Accept
Between 0.05 l/m² and 0.1 l/m² below or between 0.1 l/m² and 0.15 l/m² above.	Rectify work or accept at 90% payment.
Between 0.1 l/m² and 0.2 l/m² below or between 0.15 l/m² and 0.25 l/m² above.	Rectify work or accept at a maximum 70% payment.
* For modified binders, variation from specified rates of application may be increased or decreased by an additional 0.05 l/m² from these shown in Table60.14.1.	

TABLE 60.14.2 - Application of Aggregate

Variation from the design rates of application	Assessment
Not more than 10% above or 5% below.	Accept

60.15 SCHEDULE OF DETAILS

***strikeout items or words not applicable**

*******(a) Nominal Rates of Application of Primer, Primerbinder or Binder and Aggregate (Clause 60.7)

Treatment	Type and/or Grade of material	Location	Nominal rates of application l/m²			Aggregate size nominal (mm)	Nominal rates of application for aggregate square metres per cubic metre
			Base Rate	Allow-ances	Total		

(b) Traffic Volumes (Clause 60.7)

The following data is to be used as a basis for determining rates of application.

Location	Section	Traffic volume AADT (one way)	% Heavy vehicles
Shoulders			
Lane 1			
Lane 2			
Lane 3			
Turn Lanes			
Ramps			
Other			

SECTION 65 - HOT MIX ASPHALT

Revision No.	Date	Affected Clause

SECTION 65 - HOT MIX ASPHALT

65.1 GENERAL

This section covers the requirements for the manufacture and placing of asphalt of Types T, V, H, N, L and R and of Sizes 7, 10, 14 and 20. The requirements relate to quality of materials, mix design, supply and placing of the asphalt.

65.2 DEFINITIONS

Hot Mix Asphalt (hereinafter referred to as Asphalt)

Asphalt is a designed and controlled, dense graded mixture of coarse and fine aggregates, filler and bitumen binder which is mixed, spread and compacted while hot to a uniform dense mass. Asphalt types are designated by the symbols T, V, H, N, L or R.

Asphalt Types

Asphalt Type L	- A light duty asphalt with low air voids and high durability when used as wearing course in very lightly trafficked areas (e.g. residential streets and car parks).
Asphalt Type N	- A normal duty asphalt suitable for intermediate and wearing courses for light to moderately trafficked areas.
Asphalt Type T	- Similar to a Type N mix with increased stiffness for use in base, intermediate and wearing courses in moderate to heavily trafficked areas.
Asphalt Type H	- Similar to a Type T asphalt with higher quality coarse aggregates for use as a wearing course in very heavily trafficked areas.
Asphalt Type V	- Similar to Type H asphalt but with higher air voids for improved stability at very heavily trafficked signalised intersections or roundabouts.
Asphalt Type R	- Similar to Type T asphalt but with a higher bitumen content for use as a fatigue resistant base layer in deep strength or full depth asphalt pavements greater than 175 mm deep.

Asphalt Base Course

Asphalt base course is that part of an asphalt pavement supporting the intermediate and wearing courses which rests directly on the subgrade or subbase pavement.

Asphalt Intermediate Course

Asphalt intermediate course is that part of the asphalt pavement immediately under the wearing course which rests on the asphalt or granular base pavements.

Asphalt Regulating Course

Asphalt regulating course is an asphalt course of variable thickness applied to the road surface to adjust the shape prior to surfacing or re-surfacing.

Asphalt Wearing Course

Asphalt wearing course is that part of the pavement upon which the traffic travels.

Binder

Binder is the bituminous or synthetic material used to hold a mixture of aggregates together as a cohesive mass.

Bulk Density

Bulk density is the mass per unit volume of the compacted mix (expressed in tonnes per cubic metre) where the volume is the gross volume including the total air voids.

Coarse Aggregates

Coarse aggregates are aggregates retained on a 4.75 mm AS sieve.

Fine Aggregates

Fine aggregates are aggregates passing a 4.75 mm AS sieve.

Mineral Matter

Mineral matter includes coarse and fine aggregates, plus filler.

Placing

Placing is the spreading and compacting of asphalt, including operations necessary for preparation of the surface.

Unsound Rock

Unsound rock is material, whether in the source or as spalls or as crushed particles, which is soft, friable, or composed of clay or weathered rock, or which contains matter which breaks up when alternately wetted and dried or which fails to meet one or more of the relevant requirements for marginal rock specified in Clause 65.3(b).

Assigned Los Angeles Abrasion Loss

The assigned Los Angeles Abrasion Loss is a hardness rating derived from Los Angeles Abrasion Loss test results and is assigned by VIC ROADS on the basis of past test data.

Assigned Polished Stone Value

The assigned Polished Stone Value is a friction rating derived from Polished Stone Value test results and is assigned by VIC ROADS on the basis of past test data.

65.3 AGGREGATES

(a) General

The combined aggregate mixture shall consist of crushed rock or a mixture of crushed rock and sand.

Aggregates shall consist of clean, hard, durable, angular rock fragments of uniform quality.

Aggregates produced from source rock which does not comply with the specified requirements but which has been proven to have satisfactory performance may be accepted for use subject to the written approval of the Superintendent.

Sand aggregates shall consist of clean, hard, durable grains free from lumps, clay, mica and foreign matter.

(b) Source Rock

Prior to the commencement of work, the Contractor shall confirm the proposed quarry source from which the source rock will be obtained.

Unless otherwise approved by the Superintendent, only those rock types listed in Table 65.3.1 shall be used.

Source rock shall be considered sound or marginal in accordance with the provisions of Table 65.3.1.

TABLE 65.3.1

Rock Type	Test Value			
	Sound Rock		Marginal Rock	
	Degradation Factor for Source Rock (min)	Secondary Mineral Content % (max)	Degradation Factor for Source Rock (range)	Secondary Mineral Content % (range)
ACID IGNEOUS				
Granitic Rocks (includes Granite, Adamellite, Granodiorite)	50	-	35-49	-
Granophyre	45	-	35-44	-
Rhyolite	45	-	35-44	-
Rhyodacite	45	-	35-44	-
INTERMEDIATE IGNEOUS				
Diorite	45	-	35-44	-
Porphyry	45	-	35-44	-
Trachyte	50	-	30-49	-
BASIC IGNEOUS				
Basaltic Rocks (includes Basalt, Dolerite, Limburgite)	50	25	30-49	26-30
METAMORPHIC				
Hornfels	40	-	20-39	-
Quartzite	45	-	30-44	-
Schist	45	-	30-44	-
Phyllite	45	-	30-44	-
Gneiss	45	-	30-44	-
Greenstone	45	-	30-44	-

The hardness of the source rock shall be measured by a Los Angeles Abrasion Loss test on the product and shall comply with the test values shown in Table 65.3.2.

TABLE 65.3.2

Rock Type	Assigned Los Angeles Abrasion Loss (max)
ACID IGNEOUS	
Granitic Rocks (includes Granite, Adamellite, Granodiorite)	30
Granophyre	20
Rhyolite	20
Rhyodacite	20
INTERMEDIATE IGNEOUS	
Diorite	20
Porphyry	20
Trachyte	25
BASIC IGNEOUS	
Basaltic Rocks (includes Basalt, Dolerite, Limburgite)	25
METAMORPHIC	
Hornfels	20
Quartzite	25
Schist	25
Phyllite	25
Gneiss	25
Greenstone	25

If at any time the Contractor proposes to obtain source rock from another quarry the Superintendent shall be notified in time to undertake additional investigation as may be required.

If the Contractor proposes to use a source rock type other than those listed in Table 65.3.1 the Superintendent will determine whether the rock type is acceptable and will set appropriate test values.

(c) Crushed Aggregate Products

(i) The Flakiness Index of each separate sized coarse aggregate, with a nominal size of 10 mm or larger, shall comply with Table 65.3.3.

(ii) Unsound rock and marginal rock in that fraction of the combined mixture retained on a 4.75 mm AS sieve shall not exceed the relevant percentages specified in Table 65.3.3. If no facilities exist at the mixing plant to sample the combined mixture, the unsound rock and marginal rock in that fraction of each aggregate retained on a 4.75 mm AS sieve shall not exceed the relevant percentages specified in Table 65.3.3.

TABLE 65.3.3

Type of Asphalt	Flakiness Index (%) max	Total of Marginal and Unsound Rock (% by mass) max	Unsound Rock (% by mass) max
V and H	35	8	3
T, N, L and R	35	10	5

(d) Crusher Fines

Crusher fines shall:

(i) consist of a uniformly graded product of separate particles from the crushing of rock which complies with the requirements of Clause 65.3(b) appropriate to the asphalt type being produced;

(ii) be free from lumps and aggregations;

(iii) comply with the grading limits specified in Table 65.3.4.

TABLE 65.3.4

Sieve Size AS (mm)	Percentage Passing (by mass)
6.70	100
4.75	70 - 100
0.600	20 - 55
0.075	5 - 20

(iv) comply with the relevant requirements specified in Table 65.3.5.

TABLE 65.3.5

Test Value	
Degradation Factor - Crusher Fines min	Plasticity Index max
60	3

(e) Aggregates for Asphalt Used as Wearing Course

(i) Coarse aggregates shall be a mixture of separate one-sized aggregates.

(ii) Coarse aggregates for Type T, H or V asphalt shall have a minimum assigned polished stone value of 48.

(iii) Fine aggregates shall be a mixture of one or more natural sands and crusher fines such that the fraction of the job mix passing a 4.75 mm AS sieve shall contain not less than 20% and not more than 65% by mass of natural sands unless otherwise approved by the Superintendent.

(f) Aggregates for Asphalt Used as Intermediate or Base Course

The combined aggregates shall consist either wholly of crushed material or of a mixture of crushed material and natural sands provided that the fraction of the job mix passing the 4.75 mm AS sieve shall contain not more than 50% by mass of natural sands unless otherwise approved by the Superintendent.

65.4 FILLER

Filler shall comply with Australian Standard 2357, Mineral Fillers for Asphalt.

The added filler required by Clause 65.7 to be included in wearing course mixes shall be hydrated lime, Portland cement or cement works flue dust.

65.5 BITUMINOUS MATERIALS

(a) Bitumen Class

Unless otherwise specified, the class of bitumen for each asphalt type shall be as specified in Table 65.5.

TABLE 65.5.1

Asphalt Type	Bitumen Class
L and N	170
T, H, V and R	320

Bitumen shall comply with Australian Standard 2008, Residual Bitumen for Pavements and with the additional requirement specified in Table 65.5.2.

TABLE 65.5.2

Class of Bitumen	Durability * Minimum time to reach the specified apparent viscosity level (SAVL) days
170	9
320	7
600	5

* AS 2341.13 Determination of Durability of Bitumen

(b) Bitumen Recovered

Bitumen recovered from mixed asphalt sampled either at the plant or at the roadbed shall comply with the requirement specified in Table 65.5.3.

TABLE 65.5.3

Class of Bitumen	Viscosity at 25°C kPa.s
170	100 - 350
320	300 - 1000
600	500 - 2000

(c) Bitumen Emulsion

Bitumen emulsion shall be a cationic rapid setting type manufactured from Class 170 bitumen and complying with Australian Standard 1160, Bitumen Emulsions for Construction and Maintenance of Pavements. Emulsion diluted with water shall contain a minimum bitumen content of 30%.

(d) Polymer Modified Binder

Where polymer modified binder is specified the Contractor shall comply with the following requirements:

(i) the material shall be handled in accordance with the manufacturer's specification;

(ii) a certificate of quality from the manufacturer shall be submitted for each load of modified binder received;

(iii) the modified binder shall be transported and stored in dedicated vehicles and/or storage facilities. Transport tankers and storage tanks shall be properly flushed and cleaned before being used to avoid possible contamination.

(e) Where requested by the Superintendent the Contractor shall provide test certificates as to the quality of bitumen used. Such certificates shall be issued by a laboratory registered by the National Association of Testing Authorities for the performance of such tests.

65.6 MIX DESIGN

The Contractor shall provide all mix designs.

The mix designs and the information listed below shall be submitted to the Superintendent at least two weeks prior to the proposed date for the commencement of supply of the asphalt. No asphalt shall be supplied until the mix has been approved by the Superintendent.

For all approved mixes the Contractor shall remain fully responsible for the performance of the mix.

The Superintendent shall also be notified before any changes are made to the components or proportions of components used in the approved mix.

New mix designs shall be carried out where it is proposed to change the source grading or nature of the components, or where current approved mix designs are more than two years old.

For every approved mix design, the Superintendent will allocate and advise the Contractor of a mix design number which shall be used to identify the particular mix.

The following information shall be submitted for each new mix design:

(a) grading test results for each component;

(b) proportion of each component in the mix;

(c) grading of the mix;

(d) unsound and marginal rock content of the coarse aggregate fraction;

(e) Flakiness Index of each separate coarse aggregate of size 10 and above;

(f) Degradation Factor and Plasticity Index for the crusher fines component;

(g) properties, as listed below, determined from tests performed on Marshall cylinders compacted at three different bitumen contents within the range specified in Table 407.072:

(i) stability (kN)

(ii) flow (mm)

(iii) air voids (%)

(iv) voids in mineral aggregates (%)

(v) bulk density (t/m^3)

(vi) bitumen film thickness (microns)

(h) graphs showing the properties listed in (g), plotted against the respective bitumen contents;

(i) 4 No., 8 kg sample batches of the combined aggregates for each mix size; and

(j) 1 No., 20 kg sample of each component of sand and aggregates.

65.7 MIX DESIGN REQUIREMENTS

The grading of mineral matter and the proportions of mineral matter and bitumen in the mix after mixing but before compaction, shall lie within the limits specified in Table 65.7.1 and 65.7.2 for each size of asphalt unless otherwise approved by the Superintendent.

The bitumen content shall be expressed as a percentage by mass of the total mix.

TABLE 65.7.1 - Grading of Mineral Matter (including any filler)

Sieve Size AS (mm)	Percentage Passing (by mass)			
	Size 7 Mix	Size 10 Mix	Size 14 Mix	Size 20 Mix
26.5				100
19.0			100	95 - 100
13.2		100	85 -100	77 - 90
9.5	100	90 - 100	70 - 85	63 - 80
6.70	80 - 100	70 - 90	60 - 75	52 - 65
4.75	70 - 90	58 - 76	50 - 70	45 - 55
2.36	45 - 65	40 - 58 *(40 - 46)	35 - 52 *(35 - 42)	30 - 43
1.18	34 - 55	27 - 48	24 - 40	20 - 35
0.600	22 - 45	17 - 38	15 - 30 *(15 - 26)	14 - 27
0.300	14 - 33	11 - 26	10 - 24	9 - 21
0.150	8 - 18	7 - 18	7 - 16	7 - 15
0.075	5 - 8	4 - 7	4 - 7	3 - 6
Total Mineral Matter	100	100	100	100

* For Asphalt Type T, V, H and N used for wearing course.

TABLE 65.7.2 - Proportions of Mineral Matter and Bitumen

Material	Percentage (by mass)			
	Size 7 Mix	Size 10 Mix	Size 14 Mix	Size 20 Mix
Mineral Matter	95.0 - 92.5	95.5 - 93.0	95.5 - 93.5	96.0 - 93.5
Bitumen	5.0 - 7.5	4.5 - 7.0	4.5 - 6.5	4.0 - 6.5
Total Mix	100	100	100	100

The Marshall cylinder test properties of the mix for asphalt Types T, V, H, N and L shall comply with Tables 65.7.3 and 65.7.4.

TABLE 65.7.3 - Asphalt Type T, V, H and N

Mix Size (mm)	Stability (kN) min	Flow (mm)		Air Voids (%)				Voids in Mineral Aggregates min	Bitumen film Thickness (micron) min
				Type V		Type H, N, T			
		min	max	min	max	min	max		
7	5.5	1.5	3.5			4.9	5.3	17	7.5
10	6.5	1.5	3.5	5.9	6.3	4.9	5.3	17	7.5
14	6.5	1.5	3.5	5.9	6.3	4.9	5.3	16	7.5
20	6.5	1.5	3.5			4.9	5.3	15	7.5

Asphalt Type R (Size 20)

The properties of the mix for asphalt Type R shall be established from the relevant Size 20 Type N mix with an increase in bitumen content of 1.0% by mass of the total mix.

TABLE 65.7.4 - Asphalt Type L

Mix Size (mm)	Stability (kN) min	Flow (mm)		Air Voids (%)		Voids in Mineral Aggregates min	Bitumen film Thickness (micron) min
		min	max	min	max		
7	4.5	1.5	3.5	3.8	4.2	16	8.0
10	5.5	1.5	3.5	3.8	4.2	16	8.0

Asphalt used for wearing course and asphalt containing aggregates of coarse or medium grained acidic rocks (e.g. granite, adamellite, granodiorite, quartz porphyry) shall contain not less than 1% added filler as specified in Clause65.4. Where the asphalt mixing process allows bitumen to be added to the aggregates before complete drying and heating of aggregates, the added filler in asphalt mixes containing coarse and medium grained acidic rocks shall be hydrated lime.

65.8 PRODUCTION TOLERANCES

The production tolerances on the grading aim of the mix before compaction shall be as specified in Table 65.8.1.

TABLE 65.8.1

Sieve Size AS (mm)	Tolerance on Percentage Passing (by mass)			
	Size 7 Mix	Size 10 Mix	Size 14 Mix	Size 20 Mix
26.5	Nil	Nil	Nil	Nil
19.0	Nil	Nil	Nil	±6
13.2	Nil	Nil	±6	±6
9.5	Nil	±6	±6	±6
6.70 - 4.75	±6	±6	±6	±6
2.36 - 0.600	±5	±5	±5	±5
0.300 - 0.150	±3	±3	±3	±3
0.075	±1.0	±1.0	±1.0	±1.0

The production tolerances on the grading aim of the mix after compaction shall be as specified in Table 65.8.1 except that the positive tolerance shall be increased by one percentage point.

The tolerance on the bitumen content in the mix shall be ±0.3% of the total mix by mass.

65.9 MIXING AND MIXING TEMPERATURES

The temperature of bitumen and aggregates at the mixing plant and the temperature of the asphalt as it is discharged from the mixing plant shall not exceed the limits specified in Table 65.9.1.

TABLE 65.9.1

Material	Temperature °C (max)
Bitumen delivered into plant storage	185
Bitumen delivered into mixer	165
Aggregates before mixing	200
Asphalt at discharge from mixing plant	175

The mixing period shall be such that at least 95% of the coarse aggregate particles are fully coated with bitumen.

After completion of mixing the moisture content of the mix shall not exceed 0.5%.

Asphalt which has been manufactured at temperatures in excess of limits specified in Table 65.9.1 or which has been stored in an insulated bin for more than 32 hours shall be rejected.

Material recycled from within the plant which is partially coated, fully coated or remaining in hot bins may be used in the mix at a proportion not greater than 5% by mass of the total aggregates.

65.10 ASPHALT RECYCLED FROM RECLAIMED ASPHALT PAVEMENT

(a) General Requirements

Unless otherwise specified, Reclaimed Asphalt Pavement (RAP) may be re-cycled by adding it to new asphalt during the mixing process subject to the requirements of this Clause being met, except that for wearing course asphalt no RAP shall be incorporated into Type H or V wearing course and restricted to a maximum of 10% in Type L, T and N wearing course.

All asphalt containing RAP shall comply with all aspects of Section 65 for the size and type of asphalt specified for use.

RAP shall consist of milled or excavated hot mix asphalt pavement free of foreign material such as unbound granular base, broken concrete or other contaminants and shall be crushed and screened to a maximum size not exceeding the size of asphalt produced.

The asphalt manufacturing process shall provide for addition of RAP to a batch plant pugmill or drum mixer separately from other mix components by a method that avoids damage to the mix by overheating.

(b) Asphalt Mixes Containing up to 10% of RAP

The Contractor shall nominate the proportion of RAP to be added to the new mix.

The mix containing the nominated proportion of RAP shall be designed in accordance with Clause 65.6 and meet all the mix design requirements specified in Clause 65.7 for the sizes and types of asphalt specified or proposed.

The Superintendent will allocate separate mix design numbers for all mixes containing RAP which shall remain current for two years or such lesser time if the RAP characteristics or other components significantly change to the extent that a new mix design is required.

(c) Asphalt Mixes Containing More Than 10% But Less Than 30% of RAP

In addition to the requirements of Clause 65.10(b) above, separate stockpiles of RAP shall be constructed to a maximum of 500 tonnes per stockpile. Prior to using any material from stockpile, representative samples of RAP shall be taken from the stockpile, mixed and combined and tested for grading, bitumen content and moisture content to determine any necessary adjustments required to the proportions of new materials to achieve the specified grading and bitumen content.

On the first 100 tonnes of mix produced from a new stockpile of RAP and for every 2000 tonnes of mix produced thereafter, the viscosity of bitumen recovered from a sample of fresh mix shall be tested for compliance with the requirements of Clause 65.5(b) and if necessary, action shall be taken to increase or decrease the viscosity of the added bitumen.

(d) Asphalt Mixes Containing More Than 30% of RAP

RAP may be used in the production of lean mix asphalt under VIC ROADS standard specification Section 423Q - Lean Mix Asphalt.

In addition to the requirements of Clause 65.10(b) and (c), acceptance of a mix containing more than 30% RAP will require the submission for approval of a job specific mix design for a given quantity of RAP, together with any special processes required to produce a consistent mix.

65.11 FREQUENCY OF INSPECTION AND TESTING AT THE MIXING PLANT

The Contractor shall test asphalt production at a frequency which is sufficient to ensure that all material supplied under the Contract complies with specified requirements. The frequency shall not be less than that shown in Table 65.11.1, except that the Superintendent may agree to a lower frequency where the Contractor has implemented a system of statistical process control and can demonstrate that such lower frequency is adequate to assure the quality of the product.

Furthermore, the Superintendent may agree to waive or reduce the requirement for the quick extraction tests where the Contractor can demonstrate that adequate control of the grading process is being achieved by a system of statistical process control based upon the full extraction test, a procedure that ensures consistent grading quality of cold feed components and an interlocking shutdown system of all the cold feed component feeders based upon failure of any feed mechanism to deliver materials at a uniform rate.

TABLE 65.11.1

Checks Required	Minimum Frequency
Scrutiny for segregation, uncoated particles, separated bitumen, excess bitumen or overheating before despatch from the plant	Each loaded truck
Temperature of asphalt before despatch from the plant	Each loaded truck or at intervals of 15 minutes if more than one truck is despatched in 15 minutes
Unsound rock content	On each day: one test on each component
Degradation Factor of crusher fines	At monthly intervals
Plasticity Index of crusher fines	At monthly intervals
Flakiness Index of coarse aggregate 10 mm and larger	At monthly intervals
Bitumen Content and Full Sieve Analysis of Asphalt (full extraction test)	On each day: one test per 500 tonnes or part thereof of the asphalt plant production
Sieve analysis of the coarser fraction of asphalt (quick extraction test)	On each day: one test per 100 tonnes or part thereof for each size of asphalt
Viscosity of Bitumen	Certification of specification compliance for each delivery of bitumen supplied to the mixing plant. In addition, the Contractor shall implement an inspection and test plan to ensure that bitumen in storage tanks is not contaminated or damaged and that the correct class is incorporated in the works.

The Contractor shall make available for inspection at the plant all work sheets and results of checks carried out.

65.12 RATE OF DELIVERY

Asphalt shall be placed at the highest practicable rate in order to minimise the time traffic is disrupted and to avoid intermittent paving.

65.13 AMBIENT CONDITIONS FOR PLACING

The surface on which asphalt is to be placed shall be essentially dry and free from puddles.

Asphalt shall not be placed when the ambient temperature is less than 5°C.

Wearing course asphalt shall not be placed when the ambient temperature is less than 10°C for Class 170/320 bitumen or less than 15°C for Class 600 bitumen and mixes containing polymer modified binders.

65.14 SURFACE PREPARATION

Prior to tack coating and placing of asphalt, the Contractor shall remove all deleterious material and sweep clean the area upon which asphalt is to be placed.

65.15 TACK COAT

A tack coat shall be applied to the cleaned surface prior to placing asphalt.

Tack coat shall consist of cationic bitumen emulsion and shall be applied only to a clean, essentially dry surface, free from puddles.

Tack coat shall be sprayed in a uniform film over the entire road surface.

Unless otherwise directed, the application rate for bitumen emulsion tack coat shall be 0.15 to 0.3 litres/m² (60% Bitumen content) or 0.3 to 0.6 litres/m² (30% bitumen content) except for joints and chases where rates shall be doubled.

The use of a lance or squeegee will be permitted only in those areas inaccessible to a sprayer or where a varying application rate is required.

When spraying the tack coat, all necessary precautions shall be taken to protect kerbs, channels, adjoining structures, traffic and parked vehicles.

Before asphalt is placed a period of time sufficient to allow the tack coat to set up and become tacky shall elapse.

Any tack coat not covered by asphalt shall be covered with clean grit or sand before the road is opened to traffic.

Where asphalt is to be spread over clean, freshly laid asphalt, or over a clean, primed surface, or where the depth of the layer exceeds 50 mm, the Superintendent may direct the Contractor to omit the tack coat.

65.16 DELIVERY

(a) General

Delivery shall be made during the hours of possession of site. Asphalt which is segregated, has been overheated, is too cold, contains separated bitumen or uncoated particles which does not comply with the Specification shall be removed from the site at the Contractor's expense.

(b) Delivery Dockets

Delivery dockets shall show:

(i) name of supplier and location of plant;

(ii) docket number;

(iii) name of user;

(iv) project name and location (or contract number);

(v) registered number or fleet number of the vehicle;

(vi) date and time of loading;

(vii) size and type of asphalt;

(viii) empty and loaded mass of the vehicle, or the total of the electronically measured batch weights printed on the docket;

(ix) class of bitumen, or proprietary name of modified binder;

(x) temperature of load at mixing plant when measured.

Payment

Where asphalt is scheduled for measurement by loose volume or mass, a copy of the delivery docket for each load shall be given to the Superintendent at the point of delivery, or delivered or mailed to the Superintendent at the end of each day's work.

Where asphalt is measured by other means and for Lump Sum Contracts, the Contractor shall make delivery dockets available for inspection on request by the Superintendent.

65.17 JOINTS AND JUNCTIONS

(a) General

The location of all joints shall be planned before work commences to achieve the specified offsets between layers and the final position of joints in the wearing course.

The work shall proceed in such a way to minimise the number of joints.

All joints shall be well bonded and sealed and the surface across the joint shall meet the requirements of Clause 65.23(b).

All cold joints between adjacent runs and abutting concrete edges shall be heavily tack coated.

(b) Transverse Joints

(i) Transverse joints in adjoining paver runs shall be offset by not less than 2 m.

(ii) Transverse joints shall be offset from layer to layer by not less than 2 m.

(c) Longitudinal Joints

(i) Longitudinal joints shall be offset from layer to layer by not less than 150 mm.

(ii) Longitudinal joints shall be parallel to the centre line of the carriageway as applicable.

(iii) Longitudinal joints in the wearing course shall coincide with lane line positions or the centre of a traffic lane unless otherwise specified.

Subject to approval by the Superintendent, a longitudinal joint may be located up to 300 mm from the traffic lane line or the centre of a traffic lane to achieve the minimum clearance between the paver screed and the traffic path of 1.2 metres and the minimum traffic path width of 2.8 metres.

(d) Junctions

At junctions where the new asphalt mat is required to match the level of existing pavement surface at the limits of work, chases shall be cut into the existing pavement.

(i) If cold planing is specified, a wedge of asphalt tapering from 0 to a depth of 2.5 times the nominal size of the asphalt shall be removed from the existing pavement to the minimum width as follows:

- side streets and median openings - 600 mm
- through carriageways with a speed limit of 75 kph or less - 2 m
- through carriageways with a speed limit of more than 75 kph - 4 m

(ii) If cold planing is not specified, a 40 mm wide by 20 mm deep chase shall be cut from the existing pavement and where directed, angled at about six transverse to one longitudinal to the direction of travel.

(e) Treatment of Exposed Edges Under Traffic

On completion of each day's work and prior to opening to traffic, the following treatment of exposed edges is to be adopted for asphalt work.

(i) Longitudinal Edges

All longitudinal joints within the trafficked area shall be matched up between paver runs except for a short section required to achieve the minimum offset between transverse joints. Any exposed longitudinal edges within the trafficked area shall be ramped down at a slope of not steeper than 5 horizontal to one vertical by constructing a temporary wedge of hot mixed or cold mixed asphalt. In unusual situations such as the sudden onset of inclement weather, a longer length of longitudinal joint may be exposed provided it is ramped down as specified.

(ii) Transverse Edges

At the end of the paving run in the transverse direction, the new asphalt mat shall be squared up to a straight line and ramped down by constructing a temporary wedge of hot mixed or cold mixed asphalt. Temporary ramping shall not be steeper than 20 horizontal to one vertical for traffic speeds of more than 75 km/h or 10 horizontal to one vertical for traffic speeds of 75 km/h or less.

(iii) Removal of Temporary Ramping

Before commencement of each day's work, all temporary ramping shall be removed by cutting back along a straight line to expose a vertical face of fully compacted asphalt at the specified layer depth.

65.18 COMMENCEMENT OF PLACING

The placement of any asphalt layer shall not commence until the consent to proceed is obtained from the Superintendent.

65.19 REGULATING COURSE

A regulating course of asphalt of the type and size specified shall be placed for correction of longitudinal and transverse pavement shape so that the resulting surface is parallel with the finished surface.

65.20 SPREADING

(a) General

Asphalt shall be spread in layers at the compacted thicknesses shown on the drawings or specified.

All asphalt shall be spread with an asphalt paver except for small areas where use of a paver is not practicable.

(b) Level Control

(i) General

Asphalt shall be spread in layers at the compacted thickness specified or shown on the drawings.

All asphalt shall be spread with an asphalt paver except for small areas where use of a paver is not practicable.

Unless otherwise specified, asphalt paver screed levels shall be controlled by a suitable combination of manual and automatic controls operating from fixed or moving references.

(ii) Manual Control

Manual control is permitted except where automatic level control is specified.

The Superintendent may direct that for the wearing course layer on new construction, the paver screed level controls shall remain at a fixed setting or that a joint matching shoe shall be used.

(iii) Automatic Control

1. Fixed Level Control

Where fixed level control is specified, the paver screed shall be automatically controlled by reference to stringline or other approved system.

2. Moving Reference Control

Where moving reference control is specified, both sides of the paver screed shall be automatically controlled by reference device. Levelling beams shall be supported independently of the paver and provide a minimum of 8 separate contact points over a minimum length of 9 metres.

(c) Spreading by Paver

Asphalt shall be spread without tearing or gouging.

The Contractor shall conduct spreading operations to ensure that the paver speed matches the rate of supply so that the number of paving stops are minimised.

If the paver is required to stop and asphalt in front of the screed cools to below 120°C, a transverse joint shall be constructed.

For asphalt work carried out on a road to be opened for traffic at the completion of work each day, each layer of asphalt shall cover the full width of the trafficked area. The requirements of Clause 65.17(e) shall be followed in respect of the treatment required for exposed edges.

(d) Spreading by Hand

Hand spreading shall only be used for small awkward areas where it is not practical to use a paver.

(e) Echelon Paving

Where the width of the mat to be placed in a single run exceeds 6 metres, two or more pavers shall be used in echelon.

65.21 COMPACTION

Asphalt shall be uniformly compacted to the standards specified in Clause 65.22 as soon as the asphalt has cooled sufficiently to support the roller without undue displacement.

65.22 REQUIREMENTS FOR TESTING AND ACCEPTANCE OF COMPACTION

(a) General

Work shall be tested and accepted for compaction on either a lot basis as provided in Clause 65.22(b) or on a procedural basis as provided in Clause 65.22(c). If not otherwise specified or directed, acceptance of compaction on freeways, highways and main roads where the quantity of the particular size or type of asphalt to be supplied exceeds 300 tonne shall be on a lot basis and for all other works, acceptance of compaction shall be on a procedural basis.

(b) Testing and Acceptance of Compaction on a Lot Basis

A lot presented for testing consists of that part of a particular layer of asphalt which is placed in one day under uniform conditions and is essentially homogeneous in respect to material and appearance.

For each lot, density tests shall be performed on core samples taken from the layer except that for a layer of nominal thickness 50 mm or greater a nuclear gauge may be used to measure density in situ. Sites for density testing shall be selected on an essentially random basis provided that no site shall be selected within 150 mm of a joint constructed against a cold edge.

For core sample tests, the layer thickness is the mean thickness of the core samples and for nuclear gauge tests, the layer thickness is the nominal layer thickness.

Asphalt Density Ratio is defined as the percentage ratio of the field bulk density to the assigned bulk density of the approved laboratory mix design.

The Characteristic Value of Density Ratio is the calculated value of $\bar{x}$ - 0.92S for six tests per lot where $\bar{x}$ and S are respectively the mean and standard deviation of the individual density ratio test values for the lot.

The work represented by a lot of six tests shall be assessed as shown in Table 65.22.1.

TABLE 65.22.1

For layers less than 50 mm thickness		For layers 50 mm thickness or greater	
Characteristic Value of the Density Ratio (Rc)	Assessment	Characteristic Value of the Density Ratio (Rc)	Assessment
93.0% or more	Accept lot	95.0% or more	Accept lot

Where one or more individual core thicknesses are less than the relevant values shown in Table 65.22.2, they shall be discarded and the acceptance assessment modified in accordance with Table 65.22.3 provided that there remain at least 4 test values.

TABLE 65.22.2

Size of Asphalt	Individual Core Thickness (mm) min
7	14
10	20
14	28
20	40

TABLE 65.22.3

For layers less than 50 mm thickness		For layers 50 mm thickness or greater	
Mean Value of the Density Ratio (Rm)	Assessment	Mean Value of the Density Ratio (Rm)	Assessment
94.5% or more	Accept lot	96.0% or more	Accept lot

(c) Acceptance of Compaction on a Procedural Basis
Acceptance of work as far as compaction is concerned shall be based on the adoption of approved placing procedures and a density test check plan that provides for a minimum test frequency of 5% of relevant lots to be tested. If not otherwise agreed, placing procedures shall be in accordance with Australian Standard AS 2734 Asphalt (Hot-Mixed) Paving - Guide to Good Practice.

65.23 SURFACE FINISH, AND CONFORMITY WITH DRAWINGS AND SPECIFICATION

The finished surface of asphalt wearing course shall be of uniform appearance, free of dragged areas, cracks, open textured patches and roller marks.

Each layer shall, after final compaction, comply within the following limits to the levels, lines, grades, thicknesses and cross-sections specified or shown on the Drawings.

(a) Level

The level of the top of each layer shall not differ from the specified level by more than 10 mm, except that where asphalt is placed against kerb and channel the surface at the edge of the wearing course shall be flush with or not more than 5 mm above the lip of the channel unless otherwise specified or shown on the Drawings.

(b) Shape

No point on the finished surface of the wearing course shall lie more than 4 mm below a 3 m straight edge laid either parallel to the centreline of the pavement or, except on crowned sections, at right angles to the centreline. For intermediate and base course layers, the distance below the straight edge shall not exceed 6 mm and 10 mm respectively.

(c) Thickness

Where payment has been scheduled at a rate per square metre, the average compacted thickness of asphalt pavement shall be not less than the thickness specified in Clause 65.24 or shown on the Drawings.

(d) Alignment

Where asphalt layers are not placed against a concrete edging, the edge of asphalt layers shall not be more than 50 mm inside nor more than 100 mm outside, the designed offset from centreline or design line. Within these tolerances, the rate of change of offset of the edge of layer shall not be greater than 25 mm in 10 m.

(e) Width

Where asphalt layers are not placed against a concrete edging, the width of asphalt layers shall not be less than the design or specified width of layer by more than 50 mm or greater than the design or specified width by more than 100 mm and the average width over any 300 m shall not be less than the design or specified width.

65.24 SCHEDULE OF DETAILS

Asphalt Requirements - Refer to Construction Plans

SECTION 70 - BRICK AND INTERLOCKING CONCRETE BLOCK PAVEMENTS

Revision No.	Date	Affected Clause

SECTION 70 - BRICK AND INTERLOCKING CONCRETE BLOCK PAVEMENTS

70.1 PAVING UNITS

Clay brick pavers shall comply with Brick Development Research Institute Design Note 13c. Concrete paving units shall comply with the CMAA Specification for Concrete Segmental & Paving Units (MA20). Pavers exhibiting substantial cracks such that is weakened shall be removed.

70.2 CONSTRUCTION DETAILS AND TOLERANCES

This Specification shall be read in conjunction with Cement and Concrete Association of Australia TN41: Specification for Construction of Trafficked Interlocking Concrete pavers.

70.2.1 Laying Patterns

The laying pattern shall be as specified on the drawings and any changes shall be subject to approval by the Engineer.

70.2.2 Tolerances on Surface Levels of Pavement

The general surface level of the pavement shall not deviate from the design level by more than ± 5mm.

The surface levels of the pavers immediately adjacent to surface drainage channels, gullies and outlets shall not finish below the design level or more than 5 mm above it.

The deviation from the design profile, measured under a 3m straight edge, shall not exceed 10 mm and shall not allow the ponding of water.

70.2.3 Levels of Adjacent Pavers

The abutting edge of any adjacent pavers shall match, but in no circumstances shall they differ by more than 2 mm.

Care shall be taken when interpreting this requirement for pavers with special characteristics, such as those intended to give a rough or rustic appearance.

70.3 CROSSFALL AND GRADIENTS

70.3.1 Minimum Value

Generaly cross falls and gradients shall never be less than 2% to ensure proper run-off without ponding.

70.4 SUBGRADE

70.4.1 Width of Subgrade

The subgrade shall be prepared to the required profile. It shall be sufficiently wide to extend to the rear face the proposed edge restraints or the face of existing abutting structures.

70.4.2 Drainage of Subgrade

The whole of excavation prepared for the pavement shall be drained by piped or channelled storm water drainage and subsoil drainage.

All drainage tenches withint he pavement areas shall be backfilled to ensure that they perform similarly to the undisturbed ground.

All piped and subsoil drainage constructed located beneath the pavement shall be completed in conjunction with subgrade preparation before the commencement of base course construction.

70.4.3 Removal of Unsuitable Material

Any unsuitable material shall be removed from the subgrade and replaced with appropriate material, suc as base course material, properly compacted.

70.5 BASE COURSE

Base course material and construction shall comply with relevant sections of this specification. The base shall be of sufficient width to extend 150mm beyond the rear face of all edge restraints except where the pavement abuts established structures offering suitable edge restraint.

The upper layer of the base course shall be graded to the required design profile and compacted to prevent infiltration of the bedding sand into its surface both during construction and throughout the life of the pavement. If available base course materials are unsuited to this requirement then the upper surface shall either be blinded by the application of crushed fines, which shall then be watered and compacted into the face or suitably sealed.

70.6 BEDDING COURSE

70.6.1 Bedding Course Material

Bedding material shall be a well-graded coarse sand. In the absence of other indications of suitability, sand of the sort complying with the requirements of the Concrete Code AS3600 for fine aggregates shall be used. Table 70.6.1.1 give grading requirements for bedding sand.

Table 70.6.1.1 : Bedding Sand Grading Envelope.

Sieve Size	Percent Passing
9.52mm	100
4.75mm	90-100
2.36mm	75-100
1.18mm	55-90
600microns	35-59
300microns	8-30
150microns	0-10

The sand bedding shall be spread loose, in a uniform layer. The precise depth shall be determined in the field prior to spreading.

The sand bedding shall be screeded in a loose condition to the nominated design profile and levels plus the necessary surcharge to achieve a uniformly thick layer following compaction in the range 20 to 25mm. Under no circumstances shall the bedding sand layer exceed 25mm following compacting of the pavement.

After laying the bedding sand, and prior to laying pavers cement shall be sprinkled on the bedding suface at the rate of 1.5kg per square metre.

Under no circumstances shall sand bedding material be used for levelling. (Note: it is essential that the sand bedding layer be of uniform thickness to ensure complete and uniform compaction of the bedding layer after the units are laid and compacted. Failure to achieve a sand bedding layer of uniform compacted thickness risks unacceptable deformations in the finished pavement under design loads).

70.6.2 Moisture Content of the Bedding Course

The moisture content of the bedding course shall be uniform when spread. Where material is stockpiled on site prior to spreading, it shall be covered. The moisture content shall be in the range of 4% to 8% at the time of placement.

70.6.3 Screening of Bedding Sand

The spread sand shall be carefully maintained in a loose condition and protected against precompaction both prior to and following Screening. Any precompacted sand or screeded sand left overnight shall be loosened before further paving units are placed. Sand shall be lightly screeded in a loose condition to the predetermined depth only, slightly ahead of the laying of the paving units. Under no circumstances shall the sand be screeded in advance of the laying surface to an extent to which paving will not be completed on that day.

Screeded sand must be fully protected against accidental precompaction including compaction by rain or dew. Any screeded sand which is precompacted prior to laying of units shall be removed and brought back to provide in a loose condition.

70.7 SURFACE COURSE

70.7.1 Control of Gauge and Pattern

The average size of pavers shall be determined by randomly selecting 20 and placing them in contact in a straight line on a level surface. Any blisters or other small projections shall be removed before the overall measurement is taken. The average length of the pavers is the overall measurement divided by 20 and the average width is similarly obtained. The laying gauge for the paving shall be determi ned for the particular pattern that has been chosen using the average size of the pavers together with a nominal joint width of 2.5mm. A grid of string lines set out using this method enables each paver to be laid in its correct position according to the pattern and guage. No paver shall have its position dictated by the position of its neighbour. No contact shall exist between adjacent pavers.

70.7.2 Control of Line

Where the paving pattern produces lines parallel to the long directions of the paved area, a dominant lne will exist in the centre of the pavement and particular care shall be taken to keep this line straight.

7.07.3 Setting Out the String Line Grid

Following the preparation of the bedding course and immediately prior to laying the paving, a grid of stinrg lines shall be set up covering the area to be paved.

70.7.4 Laying Pavers

Whole pavers shall be laid first within the established string line grid. A trowel point or bolster shall then be used to manipulate individual pavers to ensure that no point contacts exist between adjacent pavers and that they are evenly spaced. Ensuring that no point contact occurs will reduce the risk of edge chipping.

In filling to boundaries and obstructions (trimming) shall then proceed and be cfompleted prior to joint filling and compacting.

70.7.5 Trimming

Pavers shall be trimmed to shape and size to form boundaries and to work around any obstructions. Accurate trimming shall be carried out using masonry saw equipment designed for this purpose.

70.7.6 Joint Filling

A suitable joint filling sand shall be spread over the surface and brushed into the joints. Sand containing clay shall not be used. Table 70.7.6.1 gives grading requirements for sand to be used for joint filling.

TABLE 70.7.6.1 : Jointing Sand Grading Envelope

Sieve Size	Percent Passing
2.36mm	100
1.18mm	90-100
600microns	60-90
300microns	30-60
150microns	15-30
75microns	5-10

70.7.7 Compaction of the Surface Course of Pavers

Compaction shall follow laying and joint filling as soon as possible but shall not occur closer than one metre to the laying face. Apart from this edge strip, no area of paving shall be left uncompacted at the completion of the days Work.

A plate compactor shall have a plan area of not less than 0.25 square metres and it shall be fitted with a rubber roller attachment. Alternatively, plywood sheets shall be used to protect the pavers from damage while compaction is achieved using a vibrating roller. Compaction shall continue until edge lipping no longer occurs.

70.7.8 Edge Restraints

Edge restraints shall be provided along the perimeter of all paved areas. These shall be adequate to support the intended loads and to prevent the escape of bedding course material from beneath the paved surface. Edge restraints shall be formed before compacting adjacent units and the restraints, together with any concrete haunching, shall be mature before vibration of the surface course is undertaken. Haunching to an edge restrain shall be continued down to the level of the underside of the bedding course.

70.8 EARLY TRAFFICKING

Immediately after the finishing pass of the plate compactor, the paving shall be rolled with 6 passes of a Multi Wheel roller to achieve lock up. Traffic may then be permitted to use the pavement.

SECTION 75 - NATURE STRIPS

Revision No.	Date	Affected Clause

SECTION 75 : NATURE STRIPS

75.1 EXTENT

Nature strips shall mean all the areas within the Road Reserve and within those areas affected by the works as shown on the plan which are not to be paved with concrete, asphalt or other paving material under terms of this contract.

75.2 STAGES OF CONSTRUCTION OF NATURE STRIPS

The work of construction, maintenance and completion of nature strips falls into several stages with certain work required in each stage namely:

a) Preliminary formation only.

b) During construction of other works stage.

c) Final construction of nature strip stage.

75.3 PRELIMINARY FORMATION

The formation includes all work required to bring the top surface of the nature strips to the final level although not necessarily with nature strip material as specified below, and this work shall be paid for as part of the formation item.

Therefore as the other work of this contract proceeds the Contractor shall carry out sufficient grading and surfacing of the nature strips to:

a) Provide and maintain to the Engineer's satisfaction satisfactory vehicle and pedestrian access to all adjoining properties.

b) Ensure satisfactory drainage such that no water discharges onto Private Land.

In this sub-clause the expression surfacing means placing a sufficient quantity of loamy or sandy material approved by the Engineer to any place or places which the Engineer considers cannot be safely and comfortably traversed owing to the present of clayey, sticky, slippery or otherwise unstable material.

75.4 DURING CONSTRUCTION STAGE

While other parts of the work are being constructed the Contractor shall maintain the nature strips in a safe passable and drainable condition. If he intends to use the material then in the nature strips as the final material the Contractor shall take steps to keep the material in such a condition that it shall comply with the requirements specified below.

75.5 FINAL CONSTRUCTION OF NATURE STRIPS

a) When all other works of this contract have been completed or in the case of several streets or a long street in one contract when sufficiently long sections have been completed in the opinion of the Engineer, the Contractor shall grade, compact and finish the nature strips accurately to the levels, grades and sections shown on the drawings. The shape, compaction and finish of nature strips shall be to the satisfaction of the Engineer and shall be such that property owners can undertake establsihment of lawn without further works other than minor manual surface preparation such as raking and light topdressing or be able to easily mow any grass growth on a unimproved nature strip with a conventional domestic rotary power lawn mower.

b) If the soil in the nature strip areas or any portion of those areas does not comply with the requirements of this specification the Contractor shall remove all such soil and replace it with the requirements of this specification.

c) Unless in the opinion of the Engineer the soil in the nature strips or that being placed thereon contains sufficient moisture for satisfactory compaction the Contractor shall water the same prior to the final compaction.

If the soil contains too much moisture for satisfactory compaction the final compaction shall be delayed until the excess water has been removed.

75.6 MATERIAL REQUIRED

The top 100mm of soil in the nature strip shall be of approved imported/insitu loam top soil and shall comply with the following specification:

a) Contains sufficient humus plant foods to render it suitable in the opinion of the Engineer for the growth and maintenance of grass lawns.

b) Is free of gravel, stones, sticks, tins, iron, wire, roots, noxios weeds, builders' and contractors' scrap refuse and rubbish of all kinds and anythin which would be deleterious to the establishment growth and/or maintenance of grass lawns.

Payment

The nature strip works are an integral part of formation works. The contractor shall make adequate allowance in the relevant schedule item for all material plant and labour necewssary for the due completion of this section of the work.

SECTION 80 - BEACHING

Revision No.	Date	Affected Clause

SECTION 80 - BEACHING

80.1 DESCRIPTION

This section covers the requirements for the supply and placing of rock, stone or manufactured block beaching for the protection of batter slopes, drainage channels and culvert endwalls as shown on the drawings. Four types of beaching are covered by this section:

Type 1: Ungrouted rock beaching.

Type 2: Grouted rock beaching.

Type 3: Grouted flat stone beaching.

Type 4: Butted paving block beaching.

80.2 CONFORMITY WITH DRAWINGS

The finished surface of the beaching shall conform with the levels, lines and grades as shown on the drawings or as specified.

80.3 MATERIALS

Unless otherwise specified, the Contractor shall supply all materials necessary to construct the beaching as specified, including rock or paving blocks, bedding materials, geotextile, concrete, reinforcement and drainage pipes.

(a) Beaching Material

(i) Type 1 Beaching

Rock for Type 1 beaching shall consist of sound, dense field or quarry rock.

Field or quarry rock shall be resistant to the weathering action of air and water and shall be free from cracks and other structural defects which may reduce its mechanical strength and resistance to weathering.

All rocks, shall have a mass of between 20 and 70 kg and at least 60% by number shall be over 40 kg mass. Rocks shall be of such size that the layer of beaching is not less than 225 mm thick.

(ii) Type 2 Beaching

Rock for Type 2 beaching shall conform with the same general requirements as for Type 1 beaching except that the rocks shall be of such size that the layers of beaching shall be at least 150 mm thick and of mass between 10 kg and 40 kg with at least 60% by number having a mass of over 25 kg. The rocks shall be reasonably uniform in colour.

(iii) Type 3 Beaching

Type 3 beaching shall consist of sound dense flat stone.

Beaching stone shall be free from cracks and other structural defects and be reasonably uniform in size, shape and colour. Each piece shall be not less than 65 mm thick and have a face area not less than 0.1 m^2. At least 50% of the pieces by number shall have an area of more than 0.2 m^2.

Samples of beaching material shall be reviewed by the Superintendent prior to placement.

(iv) Type 4 Beaching

Paving blocks shall be of a type, face size, thickness and colour as specified.

(b) Bedding

Type 1 beaching shall not require a granular bedding. However a needle-punched non-woven geotextile, with a mass not less than 250 g/m² and with a robustness (geotextile strength Rating G) of 2000 to 3000, shall be laid over the trimmed surface where beaching is to be placed. The geotextile shall be buried to a depth of 300 mm at the edges of beaching and wrapped under the toe wall unless otherwise specified. The geotextile shall be laid evenly with no kinks or folds, and joints shall be formed by overlapping the geotextile by not less than 300 mm and not more than 500 mm.

Type 2 beaching shall not require bedding unless otherwise specified or shown on the drawings.

Bedding for Type 3 beaching shall consist of at least 30 mm of mortar, comprising one part Portland Cement, and nine parts sand.

Bedding for Type 4 beaching shall consist of a 50 mm minimum layer of bedding sand.

80.4 PREPARATION OF UNDERLYING SURFACE

Areas on which beaching is to be placed shall be trimmed as required to provide a finished surface level of beaching in accordance with the drawings. Any scours or hollows in the surface shall be filled with compacted crushed rock.

Unless otherwise specified trimmed material shall be removed from the site.

80.5 BEACHING PLACEMENT

(a) Beaching materials shall be firmly bedded on the prepared embankment and/or bedding if required and laid in courses commencing from the bottom of any slope. The general surface of the finished beaching shall not vary from a 3 m straight edge laid across the surface of the beaching by more than:

150 mmfor Type 1 Beaching
75 mmfor Type 2 Beaching
30 mmfor Type 3 Beaching
20 mmfor Type 4 Beaching

(b) Type 1 Beaching

Gaps between rocks shall be as narrow as practicable. Unless otherwise specified, voids shall be filled to at least mid-height of the rocks with topsoil.

(c) Type 2 Beaching

Width of joints may vary between 10 mm and 60 mm, with an average not exceeding 40 mm. Level difference between edges of adjacent rocks shall not exceed 40 mm. The joint pattern shall be random and the joints kept free from debris before grouting.

(d) Type 3 Beaching

Beaching material shall be thoroughly cleaned and saturated with water before being bedded on fresh mortar as specified in Clause 75.3(b).

The joint pattern shall be random and the joints kept free from debris prior to grouting. Width of joints may vary between 10 mm and 60 mm, with an average not exceeding 40 mm. Level difference between edges of adjacent stones shall not exceed 25 mm.

(e) Type 4 Beaching

The blocks shall be placed on the specified bedding sand and laid in accordance with the manufacturer's recommendation. Edge blocks shall be neatly cut to establish straight edges. Dry sand shall be broomed into the joints on completion and lightly watered. The sand used in this mixture shall all pass a 1.18 mm AS sieve and 10-20% shall pass a 0.075 mm AS sieve.

80.6 GROUTING

Grouting with mortar shall be carried out when the air temperature is above 5°C and work shall be kept moist for 3 days after grouting.

Joint mortar shall consist of one part Portland cement, six parts sand by volume, thoroughly mixed with water to produce grout of suitable consistency.

The joints shall be neatly finished by filling with mortar. Care shall be taken to keep the exposed rock face clean. Brooming of mortar across the face of the rocks will not be permitted.

80.7 PERIMETER WALLS

Perimeter and toe walls shall be constructed where shown on the drawings.

For Type 1 Beaching, toe walls 600 mm wide by 600 mm deep shall be constructed. They shall be lined with geotextile fabric and filled with hand packed rock, the larger voids between rocks being filled with smaller stones.

For Types 2, 3 and 4 Beaching, concrete perimeter walls shall be constructed around exposed edges of the beaching. Concrete used for this purpose shall comply with Section 610Q or Section 801Q.

Toe walls shall be 300 mm wide by 400 mm deep at the front face and reinforced with 8TM trench mesh top and bottom. The upper surface of the toe wall shall slope upwards at either the slope of the rock beaching or the adjacent verge as shown on the drawings. Side walls and top walls shall be 150 mm wide by 250 mm deep. The top of the walls shall be continuous with the beaching.

80.8 DRAINAGE

(a) Where specified, or shown on the drawings, a 100 mm diameter PVC pipe shall be laid down the batter in a trench beneath the bedding to discharge immediately above the top of the toe wall. The pipe shall be securely bedded within the backfilled compacted crushed rock or natural gravel trench.

(b) Weepholes consisting of 75 mm diameter PVC pipes shall be placed through the beaching at 2 m centres immediately above the top of the concrete toe wall and cut off flush with the face of beaching.

80.9 CLEANING

On completion of the work, the beaching shall be cleaned to remove all foreign materials and discolouration from the beaching surface. Any joint mortar adhering to the surrounding rock surfaces shall be removed.

SECTION 85 - STONE RETAINING WALL WORKS

Revision No.	Date	Affected Clause

SECTION 85 - STONE RETAINING WALL WORKS

85.1 DESCRIPTION

The work to be carried out under this Contract shall include the supply of all labour, materials and plant required for the construction of retaining walls as detailed in the drawings and as specified herinafter.

85.2 MATERIALS

(a) Stone Materials - Stone used in the construction shall be sound and hard bluestone or other approved rock. The stones shall not be smaller than 150mm x 300mm in two dimensions and weigh not less than 5.4kg each.

(b) Concrete Materials

(i) Foundations - Concrete for use in foundations shall comply with the requirements of Section 30 - Concrete.

(ii) Cement Mortar - Cement Mortar for bedding of stones and packing between stones shall consist of 1 part cement, 2 parts screened bluestone dust and 4 parts washed concrete sand.

The mortar shall be mixed on site in an approved mechanical mixer to a consistency producing a slump of not more than 125mm when tested in accordance with AS 1012, Part 3.

85.3 FOUNDATION

A trench shall be excavated to a depth and width sufficient to permit construction of the concrete foundation.

The subgrade shall be approved by the Engineer prior to the placement of the foundation.

Soft, wet or unstable areas of depths less thatn 150mm below the designed levels of the subgrade and all soft, wet or unstable areas of depths greater than 150mm which, in the opinion of the Engineer, have been caused by the Contractor's negligence or improper methods, shall be excavated and replaced with approved stable material spread and compacted by the Contractor at his own expense.

The Contractor shall so make and secure the excavation that the safety of the public and of personnel engaged in the works will not be endangered and shall properly shore all excavations where necessary so as to ensure the safe working of the excavation and to prevent any building and other structures, road or road surface over and adjacent to the line of works from settling, cracking, being shaken, slipping or from falling in, and to prevent any portion of the floors, sides, roofs and end faces of excavations beyond the exact cross-sections and dimensions determined on, from slipping, falling, running in or being afaced through joints and open space in the shoring, and maintain the said shoring until the completion of the work to the satisfaction of the Engineer. The Contractor shall be held entirely responsible for the strength and safety of all shoring.

Concrete for the foundation shall be placed and compacted in accordance with Section 30 - Concrete.

85.4 CONSTRUCTION

The retaining wall shall be constructed one course at a time for the full length. Placement of screenings behind the wall shall progress with each course. The first course of stones shall be set in a cement mortar bed on the concrete foundation. The vertical face between stones shall be filled with cement mortar. The second course of stones shall be constructed on top of the first in a similar manner and this procedure shall be continued until completion of the wall.

If pitchers are being used for construction, the perpendicular joints between courses shall be staggered. If random stones are being used, the larger stones shall be placed in the lower course. Stones of suitable shape and size shall be placed at frequent intervals to act as keys into the bank behind the wall and the top course be of selected spalls.

Stones shall be selected so that the best face is visible. The width of the retaining wall shall be not less than 200mm at the top and the layer of screenings behind the wall shall a minimum width of 150mm extending the full length and height of the wall.

The face of the retaining wall shall be constructed to have a slope of 8 vertically to 1 horizontally (8 in 1) unless otherwise stated and the bank shall be graded from the back of the screenings up to natural surface at a batter of 1 in 3.

Openings for vehicular crossings shall be provided in the wall where shown on the drawings or where directed by the Engineer.

The retaining wall shall be returned at such openings in the following manner. The top of the wall shall be continued around at the same level and the bottom shall be stepped up until the wall reaches a height of 600mm or until the wall meets the propery boundary, whichever is the sooner.

85.5 RELIEF DRAINS

Provision shall be made in the concrete foundation for installation of 100mm diameter A.C. or R.C. pipe relief drains as shown on the drawings. These drains shall be laid from the foundation to the A.G. trench behind the kerb and channel. The opening in the foundation shall be backfilled with 10mm nominal size screenings.

Relief drains shall be located either on the uphill side of a vehiclar access to a property or opposite the downhill side boundary of a property as shown on the drainage or as directed by the Engineer. The maximum distance between relief drains shall be 17 metres.

SECTION 90 - ERECTION OF SIGNS

Revision No.	Date	Affected Clause

SECTION 90 - ERECTION OF SIGNS

90.1 DESCRIPTION

This section covers the requirements for the handling, storage and erection of signs and sign supports.

90.2 SUPPLY OF MATERIALS

All signs, posts, fittings, other materials, equipment and labour necessary to erect the signs, including cement or concrete for post hole backfill shall be supplied by the Contractor.

90.3 CONFORMITY WITH DRAWINGS

(a) Foundations

Concrete foundations shall be poured such that the finished surface of foundation is flush with the finished surface at the base of the sign.

(b) Posts

(i) Posts are to be straight and plumb to within a tolerance of 1 in 100.

(ii) Post tops are to be 50± 10 mm below the top edge of the signboard.

(c) Signs

(i) Signs are to be mounted level to within a tolerance of 1 in 100.

(ii) Signs shall be mounted symmetrically on their posts unless shown as offset in the assembly drawings or directed by the Superintendent.

(iii) Where an assembly consists of two or more signs above each other, the signs shall be mounted with the adjacent edges touching unless otherwise shown on the sign assembly drawings.

(iv) The faces of the signs shall present an even surface free from twists, cracks, indentations or any other faults after erection.

90.4 ERECTION OF POSTS

All signs shall be erected so as to comply with the requirements of AS1742.2 : Manual of Uniform Traffic Control Devices - Traffic Control Devices for General Use.

Before the erection of posts proceeds, the Superintendent will review and confirm the required positions of all posts and signs.

(a) Steel and Timber Posts

Where posts are to be mounted in sockets, the Contractor shall drill a hole in the post and bolt the post to the socket to prevent movement or rotation of the post in the socket.

Signs to be mounted on two or more posts shall have posts positioned such that the sign face is rotated away from the approaching traffic to avoid specular reflection. Unless otherwise shown on the drawings, posts shall be positioned such that the sign is rotated away from the normal cross section by an amount equal to one tenth of the width of the sign.

Hardwood posts specified as frangible shall be set such that the centre of the lower hole of each post is between 50 mm and 125 mm above the finished surface at the base of the post.

(b) Foundations

All posts shall be set in footings to the appropriate depths. Foundation hole diameters shall be as follows:

For 32 mm and 50 mm Nominal Bore steel posts	-	225 mm diameter
For 80 mm to 150 mm Nominal Bore steel posts	-	300 mm diameter
For 180 mm x 100 mm Frangible Hardwood posts	-	300 mm diameter

Concrete used in foundations shall conform to the requirements of Section 30.3 and 30.4 of this specification.

Where posts are required to be mounted in sockets, the sockets shall be installed to the same depth, as indicated for the parent post with socket sizes as follows:

Post Size	Socket Size
32 mm Nominal Bore pipe	50 mm Nominal Bore pipe
50 mm Nominal Bore pipe	65 mm Nominal Bore pipe

The sockets shall be plugged at the bottom and shall protrude between 20 mm and 30 mm above the finished surface of the concrete foundation.

(c) Backfilling of Post Holes

(i) For 32 and 50 mm Nominal Bore Steel Posts, the following shall apply:

* Concrete collars are to be placed at the top and bottom of the post hole.

* Posts carrying up to 0.6 m² of signs area each are to have two concrete collars each 100 mm deep.

* Posts carrying more than 0.6 m² of sign area each are to have two concrete collars each 150 mm deep.

(ii) For 180 mm x 100 mm Frangible Hardwood Timber Posts, the following shall apply:

* Frangible Hardwood Posts shall be erected in accordance with the drawings.

* Select backfill with 4% cement added shall be used. If the post is erected in a concrete paved surface, an upper concrete collar 250 mm deep shall be provided.

90.5 ERECTION OF SIGNS

(a) Signs shall be attached to the post(s) or structures using Manufacturer's recommended type and number of fittings. When a sign is braced it should be attached to the post at every intersection point between a post and a sign bracing member.

(b) Signs shall be mounted to:

(i) Within a tolerance of ±40 mm of the height specified in the Sign and Post Schedule measured from the bottom of the sign or sign assembly to the lip of the kerb or edge of shoulder nearest the sign unless otherwise indicated in the drawings.

(ii) Within a tolerance of ±100 mm of the pegged sign location or specified location unless otherwise indicated in the drawings.

(c) When a sign is to be mounted on frangible posts on a cut batter having a slope steeper than or equal to 2:1, the mounting height at the shorter post may be reduced providing that:

(i) the uphill corner of the sign is a minimum of 800 mm above the ground at that point;

(ii) the sign at the longer post is 2200 mm minimum above the ground at that point.

(d) Where a sign is to be mounted on a utility pole with stainless steel straps, the brackets shall be attached to the pole using stainless steel strapping having a minimum width of 12 mm and a minimum breaking strain of 6.5 kN.

(e) Where the drawings indicate that a sign is to be erected so as to face oncoming traffic directly, it shall be mounted on posts which have been rotated in accordance with the requirements of clause 90.05(a), with the exception of signs mounted on structures over traffic lanes.

SECTION 95 - MISCELLANEOUS

Revision No.	Date	Affected Clause

SECTION 95 MISCELLANEOUS

95.A GUIDE POSTS

95.1 DESCRIPTION

This section covers the requirements for the supply and installation of guide posts.

95.2 DURABILITY

All materials used will retain 85% of their original colour, appearance and physical properties and be resistant to ultraviolet radiation for at least five (5) years when exposed to all weather conditions experienced in Victoria.

95.3 POSTS

(a) Strength

Posts shall be made from material that is no stronger than a 100 mm x 50 mm Class 3 timber post in shear or bending when acting as a cantilever with a length of 1050 mm.

Posts shall be capable of standing vertically when installed, deflecting by no more than 20° when subjected to a wind speed of 35 m/sec and returning to vertical when such wind is removed.

(b) Dimensions

The exposed length above ground shall be 1050 mm and present to traffic for at least the top 300 mm a face that is 90-100 mm wide. The area on which the delineator is to be placed is to be flat and the deviation from straightness across the remainder of any face shall not exceed 20 mm while the deviation from the straightness of the centreline of the post shall not exceed 10 mm. The top shall be square to the sides.

95.4 COLOUR AND SURFACE FINISH

All surfaces shall be smooth, free from sharp edges and burrs with the top 300 mm of all faces of the posts a smooth, colour-fast, opaque white surface capable of being repeatedly cleaned.

95.5 INSTALLATION OF POSTS

Posts shall be installed at the locations specified or shown on the drawings. Posts shall be set into the ground so that the posts are vertical and the tops present a uniform profile.

The Contractor shall determine the depth to which posts are to be set in the ground, but it shall be such as to ensure the stability and alignment of the posts under all conditions. Notwithstanding this provision, depths of embedment shall not be less than 400 mm.

95.6 DELINEATORS

The Contractor shall fix retroreflective type delineators to guide posts on both sides of the carriageway to expose to approaching traffic a red delineator on the left and a white delineator on the right.

Delineators shall have a total minimum reflective output equivalent to 100 cm^2 of Class 1A retroreflective material as defined in AS/NZS 1906.1. Regardless of the type of delineator used the minimum width of reflective material shall be 40 mm. Delineators made from retroreflective sheeting shall be manufactured such that the sheeting manufacturer's preferred orientation for optimum performance is followed.

The delineators shall be placed centrally on the posts, with the top of the delineator 40 mm below the top edge of the post and shall be attached by a vandal-proof and weatherproof means.

Fixing of delineators to posts which require a white coating to be applied shall be done by the Contractor after the final white surface coating has been applied.

95.7 WARRANTY

Suppliers of guide posts and delineators shall guarantee full replacement of guide posts and the cost of their installation should they fail on any specified requirement within 5 years of installation.

95B- FIXING RAISED PAVEMENT MARKERS

95.8 DESCRIPTION

This section covers the fixing of both reflective and non-reflective raised pavement markers to asphalt, concrete or sealed pavements using epoxy adhesive or hot melt bitumen adhesive.

95.9 TOLERANCES ON POSITION

Markers shall be affixed to the pavement at the positions shown on the drawings, or specified or directed by the Superintendent within the following limits, unless otherwise specified.

(a) Markers in Line with Broken Line Segments

Transverse position within 25 mm of the centreline of the segments.

Longitudinal position within 0.5 m of the specified position.

(b) Markers in a Longitudinal Group

Transverse position of the centre of each marker within 25 mm of the specified position and within 10 mm of a line joining the centres of the end markers of the group.

Longitudinal position of the end markers of the group within 0.5 m of the specified position.

Spacing of markers within the group within 50 mm of the specified spacing.

(c) Markers Adjacent to Unbroken Line

Clearance to edge of line within 5 mm of that specified.

Longitudinal mismatch between markers in transverse pairs at barrier line not more than 25 mm.

Longitudinal position of markers within 0.5 m or 10% of the specified spacing, whichever is the less.

(d) Orientation of Reflective Markers

Lower edge of the reflective face at 85° to 95° to the centreline of the roadway or any adjacent line.

95.10 MATERIALS

The Contractor shall supply all materials required to complete the work covered by this section, unless otherwise specified.

(a) Markers

Markers shall comply with the relevant requirements of AS 1906, Part 3.

(b) Adhesive

Epoxy adhesive shall be Standard Set or Rapid Set adhesive complying with the relevant requirements of AS 3554.

Hot melt bitumen adhesive shall comply with Section 853Q of Vic Roads specifications for road works.

95.11 MIXING EPOXY ADHESIVE

Adhesive components shall be batched so that the mixed adhesive contains not less than 45% nor more than 55% by volume of either component. Before starting work each day, or when changing to a different batch of adhesive, a hand-mixed colour standard shall be prepared for reference during the day.

When machine mixing is used the mixing equipment shall use positive displacement pumps which proportion the two components in the specified range. At the beginning of each day and at any other time ordered by the Superintendent, the Contractor shall check the proportions in the presence of the Superintendent. Adhesive which has remained in the mixing head for longer than 90 seconds for rapid set adhesive or 180 seconds for standard set adhesive shall be discharged to waste.

When hand-mixing is used not more than 500 g of each component shall be mixed at any time. The components shall be mixed on a flat surface and the mixed adhesive shall be used within 10 minutes of the time the two components are brought together.

Only standard set adhesive shall be mixed by hand, unless the Superintendent consents otherwise.

95.12 PREPARING HOT MELT ADHESIVE

Hot melt bitumen adhesive shall not be used on days of total fire ban without the written approval of the Country Fire Authority. Two nine kilogram Dry Powder extinguishers and one knapsack sprayer shall be carried at all times.

The hot melt bitumen adhesive shall be heated in accordance with the manufacturer's specification in a heater designed specifically for the purpose. It shall be regularly stirred in the heater during the laying operation to maintain uniformity of the component proportions.

95.13 PAVEMENT PREPARATION

The Contractor shall sweep or air blast each marker site as necessary to remove loose material before placing markers. Markers shall only be placed at locations where the pavement is free from dirt, oil, grease, paint, or any other material which would adversely affect the bond of the adhesive to the pavement, unless otherwise specified. Locations at which markers have not been placed because the pavement cannot be cleaned effectively shall be reported to the Superintendent each day in writing who will direct the course of action to adopt.

If required by the contract specific clauses, the Contractor shall clean the pavement at every marker site by sand blasting, chipping or burning of bitumen, grease, or oil as appropriate to ensure that the surface is clean and sound.

95.14 PLACING MARKERS

Markers shall not be placed in any of the following circumstances:

when the pavement is wet;

when the relative humidity is greater than 80%;

when the ambient temperature or the temperature of the road surface is less than 15°C for standard set adhesive or 0°C for rapid set or hot melt adhesive.

Epoxy adhesive shall be placed on the base of the marker in such quantity and manner as to completely cover the base of the marker and extrude slightly all round when the marker is placed on the road. The marker shall be then positioned correctly on the pavement and pressure shall be applied until the adhesive is uniformly extruded from each edge of the base of the marker indicating that the full base area is supported by adhesive. The thickness of adhesive remaining under the marker shall be approximately 1 mm. The orientation and position of the marker should then be visually checked and if necessary immediately corrected.

Hot melt bitumen adhesive shall be placed on the road in the correct position and the marker quickly placed, correctly orientated and pressed into the adhesive.

Adhesive of either type on the exposed surfaces of the marker shall be removed using soft rags moistened with kerosene, petrol, or mineral turpentine. Any adhesive on the pavement which might obscure the reflective faces or aspect of the marker shall be removed using a square-ended spatula or similar.

Where a marker is not positioned correctly within 10 seconds for hot melt bitumen adhesive, 2 minutes for rapid set machine mix adhesive, 4 minutes for standard set machine mix, or 10 minutes for standard set hand mix from the time mixing commences, it shall be discarded and a new marker placed.

Similarly, any marker dislodged by traffic after these times up to the end of the maintenance period shall be removed and replaced with a new marker.

On concrete and asphalt pavements, wherever possible markers shall be placed clear of longitudinal or transverse joints and on all pavements markers shall be placed clear of any surface cracks or positions from which markers have been removed and the surface is damaged.

95.15 PROTECTION FROM TRAFFIC

Markers shall be protected from traffic after placing for periods not less than those shown in Table95.15.1 below, unless the Superintendent directs or consents otherwise.

Table 95.15.1

Ambient Temperature (°C)	Standard Set Adhesive (hours) (min)	Rapid Set Adhesive (minutes) (min)	Hot Melt Adhesive (minutes) (min)
35	1¼	25	4
30	2	30	4
25	3½	35	3
15	6	40	3
10	-	45	2
5	-	60	2
0	-	85	2

95C - PAINTED PAVEMENT MARKINGS

95.16 GENERAL

This section covers the requirements for the supply and application of roadmarking paint and glass beads for new installations of longitudinal lines, intersection markings and other markings on the road surface.

95.17 STANDARDS

The position and dimensions of the roadmarking and linemarking shall conform to the following standards: (a) AS 1742;

(b) the linemarking drawings.

95.18 DEFINITIONS

(a) Roadmarking is the term used to define all transverse lines and markings applied by hand such as Stop/Give Way lines, pedestrian lines, arrows, and legends.

(b) Linemarking is the term used to define all longitudinal lines such as centre, lane, edge, turn and continuity lines.

95.19 MATERIALS

(a) Roadmarking Paint

Paints shall comply with the requirements of Australian Standard AS 4049.1 "Paints and related materials - Road marking materials, Part 1: Solvent-borne paint - For use with drop-on beads", or shall be a water-borne paint approved for use by the COUNCIL.

The paint shall be white unless otherwise specified.

(b) Glass Beads

Glass beads shall be used on the markings and shall conform with the requirements for drop-on beads as described in Australian Standard AS 2009 "Glass Beads for Traffic Marking".

95.20 SITE PREPARATION

The area to be marked shall be dry and free of dirt, gravel and other loose or foreign material to enable proper adhesion to the road surface.

95.21 LAYOUT OF MARKINGS

The set out for pavement markings shall be carried out by:

The Contractor in accordance with the above Standards.

95.22 PAINTING OF MARKINGS

Painting shall not commence until the Superintendent has inspected the set out and given consent to proceed.

Completed markings shall be uniform in appearance, texture, width and thickness and the surface shall be substantially free from streaks, overlaps, unbeaded areas, tyre marks or other defects. Edges and cut-offs should be neat and sharp, and care shall be taken to avoid overspray, dribbles, splash or spillage on to the surrounding area, or on to parked or passing vehicles. The Contractor shall be responsible for the cost of removal of paint from such vehicles.

Glass beads shall be sprinkled or sprayed on to the painted surface while it is still wet to produce a uniform coverage over the whole painted surface. Beads shall be applied to all markings.

All markings are to be in accordance with the dimensions and spacings as set out in the Standards above.

95.23 APPLICATION RATES

The application rates for paint and glass beads shall be as follows:

(a) Paint

(i) Roadmarking - 0.3 mm minimum dry film (or 0.4 - 0.7 L/m² wet film, depending on type of paint used).

(ii) Linemarking - 0.2 mm minimum dry film (or 0.26 - 0.46 L/m² wet film, depending on type of paint used).

(b) Glass beads - 250 g/m² minimum retained in the painted marking.

95.24 PROTECTION OF WORK

The Contractor shall be responsible for protecting the work using traffic cones or other means, and ensuring that wet paint is not picked up and spread by tyres of passing traffic. If pick-up does occur, the Superintendent may direct that the spread paint be removed at the Contractor's cost. In such cases the method of removal shall be reviewed by the Superintendent.

95.25 TOLERANCES

The Contractor shall paint pavement markings so that:

(a) the distance between the centreline of the marking and the centreline of the set out mark is less than 30 mm; and

(b) the apparent line of the markings is a smooth, continuous alignment when viewed in the direction of the line; and

(c) the width of completed markings is within ±10 mm of the specified dimensions; and

(d) the length of completed stripes and blocks is within +10%, -0% of the specified length; and

(e) the gap between double lines is within ±10 mm of the specified gap; and

(f) the paint application rate is within +50%, -0% of the specified rate.

The acceptance of markings outside the above tolerance will be at the discretion of the Superintendent who will determine the extent of reduced payment for out-of-tolerance markings.

95.26 WET WEATHER

No payment shall be made for delays caused by wet weather.

SECTION 100 - LANDSCAPE WORKS

Revision No.	Date	Affected Clause

SECTION 100 - LANDSCAPE WORKS

100.1 EARTHWORKS

Earthworks shall generally be in accordance with Standard Specification Sections 10 and 25.
In addition to the above, the following shall apply:

100.1.1 Clearing of Site

The Contractor is required to inspect the site prior to tender submission to assess site limitations including access and extent of existing landscape items/debris to be removed from site.

100.1.2 Protection of Trees

Trees as shown on the drawings are to be adequately protected. When excavating, no disturbance is to occur within 2 metres of the base of any tree; only hand excavation shall be used. Any damage caused to the trees by Contractor's negligence shall be made good at Contractor's cost.

100.1.3 Excavation

Excavation of existing site material is to conform with the finished grades as shown.

100.1.4 Excavation in Rock

The Contractor shall allow for excavation in whatever type of material is encountered. No extra shall be paid for earthworks in rock.

100.1.5 Ripping

Ripping depth shall be to a minimum of 150mm with a maximum spacing between rip lines of 200mm.

100.1.6 Gypsum Application

Gypsum is to be applied at the specified rate to the ripped surface. Tolerance on application shall be +/- 50gm/m^2. Rate shall be 1 Kg/m^2 unless otherwise specified.

100.1.7 Final Grading

Final trimming and grading shall leave prepared grass areas with surface fall as indicated on the relevant plans. All surfaces are required to be free draining and shall be inspected for flat spots.

100.1.8 Cultivation

Area to be seeded shall be cultivated to a minimum depth of 100mm by mechanical means.

100.2 SEEDING/GRASSING WORKS

100.2.1 Preparatory Works

Soil shall be graded to a smooth surface to ensure free surface drainage. Clods and rock/stone greater than 50mm diameter shall be removed. The soil is to be cultivated to a fine friable tilth by mechanical means.

Surface is to be free of depressions and undulations with a maximum variation of 50mm over a 5 metre length.

100.2.2 Final Levelling

Lightly roll topsoil and allow to settle over a fourteen days fallow period prior to sowing. During the following period, lightly hose the prepared surface to aid settlement. Areas of subsidence are to be filled to maintain grades and drainage.

Prior to sowing, cultivate the seed bed to a depth of 25mm by raking the soil in transverse directions to provide a loose surface to receive the seed.

100.2.3 Fertilizer

Spread Pivot 900 fertiliser at a rate of 30 gm/m^2. Fertiliser to be premixed with the seed where possible.

100.2.4 Grass Seed

The seed blend is to be a 'Dry Land Mix' or similar comprising by weight:-

Sheeps fescue	20%
Shortstop Fescue	70%
Perennial Rye	10%

The sowing rate shall be at 45 gm/m^2.

100.2.5 Sowing of Seed

Seed shall be broadcast at a uniform rate.

Preparation and sowing operations may be suspended if the soil is wet or during adverse weather conditions.

100.2.6 Hydroseeding

(a) Techniques

The technique to be used shall be approved by the Superintendent. It shall involve a slurry of pulp, fertiliser and seed, applied by the Finn hydroseeder equipment or equivalent.

(b) Application

All hydroseeding shall be carried out on a front and the slurry shall be sprayed evenly over the area to ensure an even distribution of the seed mixture.

All hydroseeding shall be carried out on calm days. Operations will be suspended if the soil is wet or during periods of adverse weather conditions.

Sufficient seed shall be placed in a suitable hydroseeding machine to provide a seeding rate at least equal to 45gm/m^2. The seed, fertiliser, pulp and water shall be constantly agitated during the seeding operation.

(c) Establishment

All hydroseeding shall be maintained in a moist condition until satisfactory germination has occurred. This shall be achieved by applying the equivalent of a minimum of 25mm of rain in any period of 7 days. Satisfactory germination shall be determined by the Superintendent by random sampling throughout the area.

100.2.7 Protection of Sown Areas

At the start of the fourteen day fallow period a fence shall be erected on the alignment of granitic and concrete path edges and carpark and road reserve boundaries so that public access to the work areas is denied.

The fence is to be constructed as follows:-

- 1.5 metre star posts driven 0.5m into the ground at 3.0m centres.
- run wire at 0.3, 0.6 and 0.9 metre high intervals continuous and stay corners.
- fasten red and white striped road marking tape 50mm wide to the top and bottom wires and tie at regular intervals for secure fastening. Ensure tape remains fastened through remainder of contract/maintenance period.

100.2.8 Satisfactory Growth

After sowing the seed beds are to be kept in an evenly moist condition.

Satisfactory germination will be when 9% of the area is grassed to 50mm high and the Superintendent shall then notify in writing Practical Completion and the maintenance period shall commence.

100.2.9 Practical Completion

After satisfactory germination and growth the Contractor may apply for a Notice of Practical Completion. Upon receipt of this the Contractor shall cut the grass using a cylinder mower. Immediately after this cut, pivot 400 fertiliser shall be uniformly spread at the rate of 25 gm/m^2. The fertiliser shall not be spread on wet grass and shall be thoroughly watered after application.

100.2.10 Mowing

Allow for mowing during the maintenance period. The first cut shall be from 50mm down to 30mm and subsequent cuts shall be when the grass reaches 50mm in height.

100.3.1 MAINTENANCE AND REINSTATEMENT

100.3.1 General

The Contractor shall maintain and reinstate the works for a period of twelve weeks, during which all defects shall be made good, after the issue of the Certificate of Practical Completion by the Superintendent.

Maintenance and Reinstatement shall be the care and maintenance of the contract area by accepted horticultural practices as well as rectifying any defects apparent in the works under normal use. This shall include the following processes:-

Watering	Top Dressing
Mowing	Aerating
Fertilising	Renovating
Weeding	Maintaining site neat and tidy
Reseeding	

When plants or grassed areas are destroyed unlawfully by others during the Maintenance Period, such damage shall be rectified as specified for faulty materials and workmanship.

Rectification shall include replacement and reinstatement of stolen or damaged material with the provision that the Contractor's liability in relation to this clause shall be limited to the replacement once only of any particular plant or grass area. The Contractor is absolved of liability for any further malicious destruction of the replacement.

Any malicious damage or otherwise shall be reported to the Superintendent prior to replacement.

100.3.2 Commencement of Maintenance and Reinstatement

The Contractor shall give the Superintendent seven days notice that the works are practically complete for the commencement of the maintenance/reinstatement period. The site shall be inspected and any defects or deficiencies shall be noted by the Superintendent and rectified within seven days.

Prior to requesting Notice of Practical Completion, the Contractor shall ensure that all works of the Contract are complete.

100.3.3 Protection of Works

All planted and grassed areas shall be protected from damage whether it be malicious, irresponsible or accidental.

100.3.4 Mulched Areas

All mulched areas shall be maintained in a clean and tidy condition and be reinstated, if necessary, as specified.

100.3.5 Spraying

The Contractor shall spray against insects and fungus infestation if deemed necessary by the Superintendent. Spraying shall occur in accordance with the manufacturer's specifications.

100.3.6 Grass Areas

All grass areas shall be maintained by the Contractor by watering, weeding, reseeding, rolling, mowing, top dressing, trimming, top dressing, fertilising or other operations as necessary.

100.3.7 Watering

Grass and tree areas are to be watered regularly to ensure continuous healthy growth. The minimum acceptable requirement for trees and shrubs and grasses shall be 25mm of natural rainfall or its equivalent during every one week period except between October 1st and April 1st where for grasses 35mm or its equivalent shall be required.

100.3.8 Rubbish Removal and Weeding

During the Maintenance and Reinstatement period, rubbish and weed growth shall be removed by hand if possible. This work is to be carried out at weekly intervals to ensure the works area maintains a clean and tidy appearance and condition.

100.3.9 Reinstatement

The Contractor shall replace at his cost, all plants and turf that are missing, unhealthy or dead. Replacements shall be of a similar size and quality and identical species or variety to the failed plant(s). Replacement is required immediately the failed plant(s) is/are noticed.

100.3.10 Localised Soil Irregularities

Any localised settlement or erosion occurring after soil filling and/or preparation and sowing shall be reinstated.

100.3.11 Insurance

The Contractor is advised to seek and obtain adequate insurance to cover works through the Maintenance and Reinstatement period.

100.3.12 Emergency and Outstanding Works

Notwithstanding any contrary requirements or conditions of the contract, the Superintendent may instruct the Contractor to effect emergency maintenance works, or works outstanding to such an extent that they require immediate attention - ie. other authorities' requirements or outstanding works.

Should the Contractor fail to carry out the works within 24 hours of written notice, the Superintendent reserves the right with no further notice to effect such work(s) and charge it to the Contractor.

100.3.13 Satisfactory Completion

The Contractor shall ensure that all works of the Contract are complete immediately prior to the expiry date of the Contract. At Maintenance Period Expiry and prior to final payment the Contractor shall also vacate the site and remove all debris, fencing and stored material on or adjacent to the site and leave the area in a tidy condition to the satisfaction of the Superintendent.