Victoria

AUS-SPEC #1

DEVELOPER SPECIFICATION SERIES

CONSTRUCTION

MASTER COPY
REVISION C JUNE 2015

INTRODUCTION

This Specification series has been developed by the City of Greater Dandenong for use by Developers and Developer's Consultants when undertaking land development works. The Specifications are generally based on the Aus-Spec model and have been tailored to meet the specific requirements of the City of Greater Dandenong.

These documents may be used as the basis for contracts entered into by Developers with Contractors or as the standard requirements of the City.

These documents shall not be used for Council managed contracts.

REVISION C JUNE 2015

AMNENDMENT IS –

SUPPLY OF RECYCLED MATERIAL FOR ROADWORKS SECTION 257

REVISION B OCTOBER 2007

AMNENDMENT IS –

AUS-SPEC #2 section 261.10 Materials to read:

1. Paint shall comply with the requirements of AS 4049.3 or AS 4049.4 as directed by the Superintendent. In this Specification, the term 'paint' shall mean 'pavement marking paint'.

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CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

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SPECIFICATION CQS
QUALITY SYSTEM REQUIREMENTS

GENERAL

CQS1 SCOPE

1. This Specification covers the contractual requirements for the Quality System documentation and operation.

CQS2 PREAMBLE

1. The Contractor shall establish, implement and maintain a Quality System in accordance with this Specification and the requirements of AS/NZS 3905.2 and AS/NZS ISO 9002 — ***Standards***

2. The Quality System as expressed in the Quality Plan shall be used throughout the course of the Contract to ensure that the quality of the Contractor's and any sub-contractor's work complies with the requirements of the Contract Documents. This shall apply to all work under the Contract, both on site and off site. — ***Applicable to Work On and Off Site***

3. Notwithstanding any statements to the contrary in the Contractor's Quality Manual or Quality Plan, no part of the Quality System shall be used to pre-empt, preclude or otherwise negate the requirements of any part of the Contract Documents. Quality System elements shall be used as an aid in achieving compliance with the Contract Documents and documenting such compliance. In no way shall they relieve the Contractor of its responsibility to comply with the Contract Documents. — ***Compliance with Contract Documents***

CQS3 REFERENCE DOCUMENTS

1. Documents referenced in this specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. — ***Documents Standards Test Methods***

AS/NZS 3905.2 -	Guide to AS/NZS ISO 9001, AS/NZS ISO 9002 and AS/NZS ISO 9003 for construction.
AS/NZS 3913 -	Quality manuals - Guide to preparation.
AS/NZS ISO 8402	Quality management and quality assurance - Vocabulary.
AS/NZS ISO 9002	Quality systems - Model for quality assurance in production, installation and servicing.
AS/NZS ISO 10013	Guidelines for developing quality manuals.
SAA QS5 -	Guide to the assessment and auditing of quality management systems

2. Clause references shown on the right margin (keyword column) relate to AS/NZS ISO 9002 and are referenced in AS/NZS 3905.2 unless otherwise stated.

CQS4 DEFINITIONS — **Synonym or Abbreviation**

1. For the purpose of this Specification, the definitions as in AS/NZS 3905.2 and AS/NZS ISO 8402 and those below apply:

Corrective Action

Measures, including preventative measures, taken to rectify conditions which have caused or might cause nonconformity. — ***Corrective Action***

Corrective Action Request

A formal advice/instruction from the Superintendent regarding departures from the Quality System or Methods as approved in the Quality Plan. Unless specifically noted, it — ***CAR***

will not require raising of a Nonconformance Report.

Disposition

Action to be taken to resolve nonconformance. (Lot Specific) ***Rectification***

Hold Point

A defined position in the construction/manufacturing stages of the Contract beyond which work shall not proceed without mandatory verification and acceptance by the Superintendent. ***HP***

The issue of a Nonconformance Report (NCR) or a Notice of Nonconformance (NNC) automatically creates a Hold Point.

Inspection and Test Plan

The working document which identifies the specific inspections and tests to be carried out for works required by the Contract. ***ITP***

Lot

A lot consists of any part of the works which has been constructed/manufactured under essentially uniform conditions and is essentially homogeneous with respect to material and general appearance.

The whole of the work included in a lot shall be of a uniform quality without obvious changes in attribute values.

Method Statement

A document that specifies the key steps and sequence in the manufacture/construction for an activity; what, how and by whom it shall be done; what materials and equipment shall be used to achieve the required quality standards.

- ***Procedures***
- ***Technical Procedures***
- ***Process Descriptions***
- ***Specific Procedures***

Nonconformance Report

A mandatory (standard format) report submitted by the Contractor that details the nonconforming work and the Contractor's proposed disposition of the nonconformance. ***NCR***

Notice of Nonconformance

Formal instruction from the Superintendent regarding product nonconformance from that specified. It automatically creates a Hold Point and requires a Nonconformance Report from the Contractor. ***NNC***

Performance Audit

An examination to evaluate whether established methods and procedures are being adhered to in practice.

- ***Process Audit***
- ***Technical Proceudre Audit***
- ***Methods Audit***

Quality Assurance

The management actions covering planning, quality control testing, inspection and verification procedures integrated with production to provide a product fit for the purpose. ***QA***

Quality Assurance Representative

Appointed by the Principal for a specific project and responsible for the auditing, review and surveillance of procedures and documentation required by the Contractor's approved Quality Plan. ***QAR***

Quality Check Lists

Forms completed during the manufacture/construction process verifying key steps, and records required for the Quality Register. Check lists apply to each identified lot of work.

Quality Management Representative

Appointed by the Contractor for a specific project with the authority and responsibility for the implementation and operation of the Quality Plan, to ensure that Quality System requirements are not subordinated to design and productivity. ***QMR***

Quality Manual

A document setting out the general quality policies, procedures and practices of an organisation. ***QM***

Quality Plan

The Quality Assurance documentation specific to a Contract which comprises of the Corporate Quality Manual with its job specific annexures, method statements, inspection and test plans and check lists. ***QP***

Quality Register

The files containing all quality control records such as test results, completed check lists, certificates of compliance, consignment dockets for materials procured. ***QR***

Quality System Elements ***- System Element***

The administrative activities affecting quality that need to be implemented and controlled to ensure that the product or a service meets specified quality requirements. ***- Quality Management Element***

Special Processes

Those processes, the results of which cannot be directly examined to establish full conformance. Assurance of satisfactory conformance depends on evidence generated during the process.

System Audit

An examination of the documented Quality System represented by the Quality Manual, Quality Plan and Quality Register to evaluate their effectiveness in meeting the requirements of Australian Standards and the Specification.

Witness Point

A nominated position in the manufacture/construction stages of the Contract where the option of attendance may be exercised by the Superintendent, after notification of the requirement. ***WP***

CQS5 ABBREVIATIONS

1. Abbreviations used in this Specification are:

CAR	-	Corrective Action Request
CQS	-	Contract Quality System
HP	-	Hold Point

ITP		Inspection and Test Plan
NATA	-	National Association of Testing Authorities
NCR	-	Nonconformance Report
NNC	-	Notice of Nonconformance
QA	-	Quality Assurance
QAR	-	Quality Assurance Representative (Principal)
QM	-	Quality Manual
QMR	-	Quality Management Representative (Contractor)
QP	-	Quality Plan
QR	-	Quality Register
SED	-	System Element Description
WP	-	Witness Point

QUALITY MANUAL AND QUALITY PLAN

CQS6 QUALITY MANUAL

1. The Company Quality Manual shall cover and include the requirements as specified in the Quality System Documentation section of AS/NZS 3905.2 with guidance to preparation by AS/NZS 3913 and AS/NZS ISO 10013.

2. It shall incorporate all applicable System Element Descriptions with reasons for those not regarded as applicable. Additionally it should include standard Method Statements and Inspection and Test Plans for the activities usually undertaken by the Contractor. It would be normal to have these in separate volumes. ***SEDs***

CQS7 QUALITY PLAN

1. The Quality System shall be incorporated in the Project Quality Plan. The Company Quality Manual with its System Element Descriptions, standard Method Statements and Check Lists and the project specific components make up the Project Quality Plan. ***Content of PQP***

CQS8 ANNEXURES TO QUALITY MANUAL

The following details shall be provided by appropriate annexures to the Company Quality Manual:

CQS8.1 Organisation Structure

- The organisation structure for the management of the project with details of the specific responsibilities and authorities of the nominated key personnel. ***Structure***
- The Quality Management Representative (QMR) including this person's qualifications, technical experience and present position together with responsibilities and authorities to resolve quality matters. ***QMR***
- The personnel or contracted testing organisations who will be conducting each type of compliance inspection of testing of completed works, their experience, qualification and responsibilities. ***Personnel***
- The person authorised to change construction processes on site. ***Authority for Changes***

CQS8.2 Addendums to System Element Descriptions

The System Element Descriptions in the Company Quality Manual shall be augmented with suitable addendums to satisfy the requirements of this Specification. ***Additional SEDs***

CQS8.3 Register of Method Statements

A Register of Method Statements giving the title, identifier and revision status, shall be provided. This Register shall list all Method Statements that are to be included in the Quality Plan for the Contract and shall include any suitable Method Statements already incorporated in the Company Quality Manual. ***Content***

JOB SPECIFIC REQUIREMENTS

CQS9 GENERAL

1. In the Quality Plan, the System Element Descriptions in the Company Quality Manual will need augmentation to cover the requirements of AS/NZS ISO 9002, AS/NZS 3905.2 and this Specification. This shall be provided in the form of suitable Annexures or where applicable included in the Method Statements or Inspection and Test Plans.

CQS10 METHOD STATEMENTS

1. Method Statements shall be provided for all activities scheduled in Annexure CQS-B. This requirement applies to both contract and subcontracted work. The documentation shall cover, as applicable, planning, methods, verification and control. ***Documen-tation***

2. The presentation of Method Statements may be either descriptive, in the form of flow charts or a combination of both. In either case it must be accompanied by a Check List which shall include the relevant inspection and test points, surveying control points and Hold Points and the officer responsible to verify each check point. ***Presentation***

3. A system audit of each Method Statement shall be carried out by the Contractor whilst the process is in effect. ***System Audit***

4. The absence of a Method Statement for activities where it has been specified will automatically create a **Hold Point**. ***Requirement***

CQS11 DOCUMENT CONTROL

1. In addition to the requirements of AS/NZS ISO 9002 AS/NZS 3905.2, the Quality Plan shall specify the method of keeping Quality Registers, tracking and handling of NCRs and NNCs and site correspondence. ***Records***

2. A copy of AS/NZS 3905.2 and AS/NZS 9002 shall be kept on site. ***AS on Site***

CQS12 MEASURING AND TESTING EQUIPMENT

1. The Quality Plan shall include the latest NATA advice of the terms of registration and current signatories for the laboratories which will be providing the compliance test reports. ***NATA Registration***

2. Inspection, testing and measuring equipment shall be capable of producing the precision and/or degree of accuracy specified in the referenced Test Methods and this shall be demonstrable by records of calibration. ***Equipment Accuracy***

CQS13 PURCHASING

1. Except where the contract documents already stipulate another quality system standard for specific products or services, the quality assurance provisions detailed in this Specification shall apply to all subcontracted products or services which constitute work under the Contract. ***CQS to Cover All Work***

2. The Contractor shall ensure that the requirements of AS/NZS ISO 9002, AS/NZS 3905.2 and the requirements of this clause are included in all such subcontracts. ***Subcontracts***

CQS14 INSPECTION AND TEST PLANS

CQS14.1 Documentation

1. The Quality Plan shall include all inspections, tests and documentation necessary to ensure that the Works comply with Contract Documents. ***General Inclusions***

CQS14.2 Sampling and Testing

1. All compliance inspections and tests shall be based on lots. ***Lots***

2. The Inspection and Test Plans shall include details of the sampling methods. Sampling shall not be restricted to locations dimensioned or otherwise defined for setting out the Works in the Drawings or Specification, but shall be undertaken in a random or unbiased manner, as approved by the Superintendent, at any location within the Works to demonstrate its compliance with the Specification. ***Random Sampling***

3. The maximum lot sizes and minimum testing frequencies are listed in the Annexures to the relevant Specifications and/or in Annexure CQS-C to this Specification. Where no minimum frequency of testing, or maximum lot size is stated in the Specification, the Inspection and Test Plan(s) shall nominate appropriate frequencies for the Superintendent's approval. ***Lot Sizes Frequency of Testing***

4. The Inspection and Test Plans shall also uphold any time limits for testing which may be imposed by the Technical Specifications. ***Time Limits***

5. Where Test Methods are nominated in the Technical Specifications, sampling and testing shall be carried out by a NATA registered laboratory accredited for those test methods and sampling procedures. Sampling shall be conducted by personnel from the NATA registered laboratory which has been accredited for that sampling procedure and shall be supervised by the approved signatory from that laboratory. Test results shall be reported on NATA endorsed test documentation which shall include a statement by the approved signatory certifying that the correct sampling procedures have been followed. ***Sampling and Testing***

6. In special circumstances the Principal may accredit a laboratory that is not NATA registered for specific tests or inspection procedures. ***Special Accreditation***

7. Every testing agency or person providing written test reports for any and all testing undertaken shall use unique consecutive project specific serial numbering of the reports for identification and auditing purposes. ***Consecutive Numbering***

8. The Contractor shall reinstate all core holes, test holes, excavations and any other disturbance resulting from any testing activity. The reinstatement shall be to a standard which is at least equal to the specified requirements for the particular work. ***Reinstatement***

9. The responsibility for completion of inspections, tests and documentation shall be stated in the Quality Plan. ***Testing Responsibility***

CQS14.3 Hold Points

1. To assure compliance with the specified standards and requirements, mandatory Hold Points shall apply. Hold Points are those stages during the construction/manufacturing process where the Technical Specifications require "approval by the Superintendent" or where a NCR or NNC has been issued. The Contractor shall not proceed past the HP until approval has been received from the Superintendent to proceed. For ease of identification Hold Points may also be annotated on the margins of Technical Specifications. ***Super-intendent's Approval to Proceed***

2. To obtain the approval to proceed from the Superintendent, the Contractor shall: ***Requirements for Approval to Proceed***

- provide the information required by the Technical Specifications
- ensure and certify that the particular lot/process is conforming;
- ensure and certify that all underlying and adjacent lots affected by the lot in question are conforming;
- submit the appropriate form (Check List, NCR or NNC) at least 24 hours prior to the time the Contractor wishes to proceed with the placement/construction of the next lot, unless some alternative arrangements have been agreed with the Superintendent.

3. If the HP has resulted from a NCR or NNC, the Superintendent's approval may be conditional on a Witness Point being included. ***Witness Point***

CQS14.4 Content

1. As a minimum, the Inspection and Test Plans shall contain the following information: ***Information to be Provided***

- item number/lot type reference(s)
- activity description
- specification requirements or where impractical: specification reference
- sampling method
- test method
- test frequency

2. Inspection and Test Plans will typically have an associated Check List which shall require completion for each particular lot. ***Check List for Each Lot***

CQS15 INSPECTIONS

1. Incoming inspections shall be required for deliveries of materials that will be subsequently included in one or more lots. When completing Check Lists for particular Lots the inspection status shall be cited.

2. In-process and compliance inspections shall be completed by a responsible officer nominated in the Check List and certified by the Contractor's QMR indicating that the work has been completed in accordance with the Contract Documents.

3. The Contractor shall establish and maintain a system to ensure and demonstrate that all products or parts of products requiring inspection and/or testing are so inspected and/or tested.

4. The Contractor shall also establish and maintain a system for identifying the inspection status for all lots of work.

CQS16 IDENTIFICATION

CQS16.1 Lots

1. All items of work shall be subdivided into lots.

2. Lots shall be chosen by the Contractor but shall be within the limits given in Annexure CQS-C. In general, the size of the lot shall not exceed one day's output for each work process designated for lot testing. ***Lot Size***

3. Lot numbers shall be used as identifiers on all Quality System data. ***Lot Numbers***

4. The Contractor shall determine the bounds of each lot before sampling and shall physically identify each lot clearly. The physical identification of a lot shall be maintained until the Contractor has ensured that the lot has achieved the specified quality. ***Lot Identification***

CQS16.2 Lot Numbering

1. Each lot shall be given a unique lot number. The allocation of lot numbers shall be carried out by the Contractor to suit the circumstances, provided the lot numbering system complies with the following requirements: ***Numbering System***

- the lot number shall be entered in the Quality Register which shall provide at least the following information:
  - three dimensional location of the lot (chainage of the start and finish points, lateral location and layer location) and/or the particular structure (eg. pier or abutment number, pour number)
  - indication of conformance or nonconformance
  - summary of test results (eg. characteristic value) and
  - location of test sites, test identification numbers and test results
- for nonconforming lots a new number, or numbers, shall be allocated to the resubmitted/subdivided lot(s), but reference shall be maintained to the original lot number. ***Non-conforming Lots***

CQS16.3 Lot Identification

1. To ensure all site personnel can readily identify where the particular lots are in the field, the Contractor shall implement a field identification system which will clearly identify the bounds of each lot and the lot number. This identification system shall be detailed in the Quality Plan and shall be maintained during all stages of construction of the lot. ***Field Identification***

2. The boundaries of a lot may be changed if subsequent events cause the original lot to be no longer essentially homogeneous. This will require appropriate notation in the Quality Register by the QMR. ***Lot Boundaries***

CQS17 TRACEABILITY

1. The lot identification system, site records and sample numbering system shall allow test results to be positively identified with material incorporated in the works.

2. Traceability is required for concrete loads, asphalt loads and steel plate as follows: ***Materials for Traceability***

(a) Concrete used in bridge components, cast-in-place box culverts, retaining walls, road pavement subbase and base. Asphalt used in wearing courses, intermediate courses and drainage layers.

The trace shall start at the batch plant and finish at the location where the concrete or asphalt is incorporated in the Works. Records shall be kept of the batch quantities, mix and despatch time, testing details and location of placement.

(b) Steel plate in bridge girders and bridge columns.

The trace shall start at the steelworks and finish at the location of the plate in the girder or column. Records shall be kept of the steel heat number, testing details and location of the plate in the girder or column.

CQS18 SURVEYING CONTROL

1. Surveying Control shall be treated as a separate System Element and shall include all measurement, calculation and record procedures necessary to: ***Requirements***

(a) set out the Works

(b) verify conformance to the Drawings and Specification in relation to

dimensions, tolerances and three dimensional position,

(c) determine lengths, areas or volumes of materials or products, where required for measurement of work.

2. The Method Statements for Surveying Control shall address the process control parameters in AS/NZS 3905.2 for special processes which cannot be fully verified by subsequent inspection and test.

3. The Contractor shall appoint qualified surveyors who are eligible for membership of the Institution of Surveyors, Australia or the Institution of Engineering and Mining Surveyors, Australia to supervise and take responsibility for all Surveying Control. ***Surveyor Qualifications***

4. The procedures and equipment used must be capable of attaining the tolerances nominated in the Specification. ***Equipment***

5. Sampling for conformance verification purposes shall not be restricted to the locations used to set out the Works. ***Sampling Locations***

6. The Contractor shall submit a Survey Conformance Report for each lot or component where design levels, position and/or tolerances have been specified. The Survey Conformance Report shall show 'specified vs actual' for position (defined by co-ordinates or chainage and offset), level and tolerance as appropriate and shall be certified by the qualified surveyor responsible for the verification survey. ***Conformance Report***

7. Where work is to be covered up after conformance has been achieved, a **HOLD POINT** shall apply until the Survey Conformance Report has been submitted. ***Submission of Report***

8. All survey records shall be included in the Quality Records and recorded in the Quality Register. Verification field book pages shall be clearly labelled, dated and signed by the surveyor with cross indexed references to equipment used, lot/component identification and associated Survey Conformance Reports. Where automatic data recording systems are used for verification surveys, a printout of both raw (field) data and reduced data shall be retained in a similar manner as conventional field books. ***Quality Register***

CQS19 RECORDS

1. The Contractor shall keep and maintain all Quality System records as required by AS/NZS ISO 9002, AS/NZS 3905.2 and this Specification. They shall be systematically recorded, indexed and filed so as to be retrievable and accessible to the Superintendent or an appointed Quality Auditor on a job basis within one working day of requisition. ***Quality Register***

2. Conformance records shall be stored and maintained such that they are readily retrievable and in facilities that provide a suitable environment to minimise deterioration or damage and to prevent loss. ***Storage***

3. The Contractor shall make the quality records available to the Superintendent at all reasonable times. If requested by the Superintendent, the Contractor shall provide copies of the records or test results at no cost to the Principal. ***Copies of Records Contractor's Cost***

4. Within one month from the date of Practical Completion, the Contractor shall provide the Superintendent with a copy of the Quality Register. The Register shall contain ??? ***Finalisation***

5. The Contractor shall supply the Superintendent progressively with advice in writing of any amendments to design details for inclusion in Work-As-Executed Drawings (W.A.E). ***W.A.E.***

CQS20 NONCONFORMANCE

1. All nonconforming works detected by the Contractor's Quality System shall be ***NCR Within***

reported to the Superintendent via a Nonconformance Report within one working day of being detected. Nonconformance Reports shall be submitted with all records which indicate a departure from the requirements of the Contract Documents. The NCR shall indicate the proposed disposition.

One Day

2. If the disposition of the nonconformance cannot be determined within one working day, the Contractor shall submit a partially completed NCR identifying the nonconformance.

3. The nonconforming product shall not be covered up unless a disposition has been accepted/approved by the Superintendent and implemented by the Contractor.

Disposition

4. Where nonconformance can be overcome by simply reworking the lot with the original process, a NCR will be required but a Hold Point will not apply.

Reworking

5. With the exception of circumstances described in paragraph 3 above, a NCR will automatically create a HOLD POINT which shall apply until conformance has been achieved and the Superintendent has signed the Authorisation to Proceed.

Authorisation to Proceed

6. The Superintendent will issue a Corrective Action Request (CAR) when he detects nonconformance to the Contractors Quality System or Methods. Unless specifically stated, this will not create a Hold Point.

CARs

7. Where the Superintendent's inspections, surveillance or audits detect product nonconformance, he will issue a Notice of Nonconformance (NNC). This will immediately create a Hold Point and the Contractor is required to submit an NCR in accordance with this Clause.

NNCs

8. In instances where there is a discrepancy between the test results obtained by the Superintendent and those provided by the Contractor, the results from the Superintendent shall prevail except where the Superintendent may determine a specific audit test procedure to resolve the discrepancy.

Inspection and Rectification

9. The Contractor shall utilise the standard form for use as an NCR. This form is included as Annexure CQS-D to this specification. All actions shall be signed off by authorised representatives of the Contractor and Superintendent as applicable.

Standard Form

10. The Contractor shall establish a suitable numbering and registration system for all NCRs and NNCs, including cross referencing as required.

Register of NCRs & NNCs

11. The Contractor shall nominate a proposed disposition for any nonconformance within five working days or shall show cause to the Superintendent for any further delay. Under no circumstances will the deliberation on disposition of a nonconformance justify an extension of time to the Contract period.

Disposition in 5 Days

CQS21 DISPOSITION OF NONCONFORMANCE

1. The Contractor shall advise the Superintendent in the NCR of the proposed disposition of the particular nonconformance. This proposed disposition will constitute corrective action for the lot or lots referred to in the NCR and may comprise one of the following:

Proposed Disposition

(a) propose additional works to bring the lot up to the specified standard; or

(b) replace all or part of the lot to bring it up to the specified standard; or

(c) request utilisation of a lot for a reduced level of service if such a clause exists in the relevant Technical Specification; or

(d) for incidental defects, request that the Superintendent accept the lot without alteration as an exception with or without alteration to the respective unit rates.

2. Any proposed disposition shall be subject to the approval of the Superintendent. Reworked/replaced lots shall be verified to conform to the specified requirements.

CQS22 CORRECTIVE ACTION

1. The Contractor will be required to indicate on the NCR corrective action appropriate to ensure that the Quality Plan is effective in avoiding recurrence of the nonconformance and continues to be effective. ***QP Corrective Action***

CQS23 STATISTICAL TECHNIQUES

1. Random sampling techniques shall be used for each lot for the control of compaction of each continuous layer of earthworks, flexible pavement and asphalt. ***Random Sampling***

2. Annexure CQS-A defines the method to be used for determining test locations of random sampling in each lot. ***Test Locations***

3. Annexure CQS-C lists the maximum lot sizes and minimum test frequencies for the specified activities. ***Lot Sizes and Test Frequencies***

4. For compaction control of processes other than layers of earthworks, flexible pavement and asphalt, the sampling procedure will be proposed by the Contractor in his method statement and will require the approval of the Superintendent. In such cases the samples shall be each considered to be representative and all test results will be required to meet the appropriate tolerances for the lot. ***Sampling Procedure for Compaction***

CQS24 QUALITY AUDITS

1. The Contractor's Quality Audit Schedule shall be included in the project Quality Plan. Guidance for the requirements of the auditing process is given in SAA QS5. ***Audit Schedule***

2. The Audit Reports shall be provided for the Superintendent. ***Audit Reports***

SPECIAL REQUIREMENTS

ANNEXURE CQS-A

RANDOM SAMPLING

CQS-A1 GENERAL

1. Random sampling of test locations shall be used to control relative compaction of each layer of:

   (i) earthworks
   (ii) selected material zone
   (iii) flexible pavement
   (iv) asphalt
   (v)
   (vi)
   (vii)

which are generally rectangular in area.

CQS-A2 SAMPLING RATES

1. The number of samples (n) per lot shall be as indicated in the specific Specification Parts which are summarised in the Sub-Annexure to this Quality Requirements Specification.

CQS-A3 RANDOM SAMPLING LOCATIONS

1. Sampling locations within a lot for the control of relative compaction shall be determined as follows:

   (i) Representing the lot as a rectangle, sub-divide the lot lengthwise into equi-area sub-lots in accordance with the number of samples selected (n).

   (ii) Establish six grid lines within the lot, as illustrated in Figure CQS-A2;

   (iii) Throw a dice to select a number between 1 and 6. This determines which grid line to use for the sample location in sub-lot 1;

   (iv) Throw dice to select a group (1-6) in Table CQS-A1;

   (v) Throw dice twice to select two random numbers (between 1 and 6) for row and column in Table CQS-A1 and obtain random fraction R;

   (vi) Length co-ordinate for sample location in Sub-lot 1 = RL/n;

   (vii) For sample location in next sub-lot:-

   Add L/n to previous length co-ordinate.

   Add 1 (on a cycle of 6) to previous grid line.

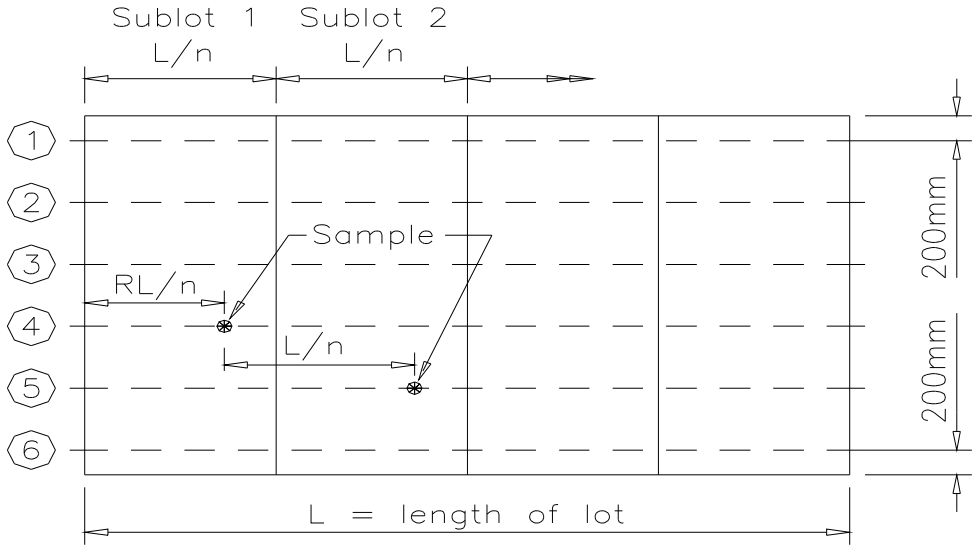

Figure CQS-A2 Sampling Locations for Rectangular Lot

GROUP	ROW	COLUMN					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	(1)	0.78178	0.45467	0.00347	0.27296	0.00020	0.36517
	(2)	0.59678	0.67931	0.25434	0.59054	0.32444	0.41504
	(3)	0.14464	0.17269	0.61154	0.18291	0.83242	0.50776
	(4)	0.89010	0.44764	0.07451	0.20428	0.49513	0.91440
	(5)	0.91941	0.47726	0.33160	0.30670	0.65114	0.36852
	(6)	0.51085	0.38148	0.22169	0.66578	0.67050	0.69559
(2)	(1)	0.81891	0.48626	0.88892	0.82994	0.16941	0.81528
	(2)	0.37410	0.60232	0.12070	0.79017	0.32981	0.34908
	(3)	0.45921	0.15648	0.58052	0.37413	0.08124	0.97145
	(4)	0.86614	0.94719	0.78872	0.91972	0.45149	0.15107
	(5)	0.26590	0.41140	0.95477	0.81267	0.24018	0.07324
	(6)	0.95205	0.39438	0.73697	0.59427	0.71146	0.00575
(3)	(1)	0.18694	0.36502	0.17828	0.84312	0.57003	0.58583
	(2)	0.91211	0.86936	0.43030	0.27672	0.47393	0.10342
	(3)	0.80714	0.34295	0.00775	0.90855	0.33368	0.21842
	(4)	0.67579	0.92686	0.18005	0.00645	0.11256	0.05278
	(5)	0.03184	0.69876	0.16676	0.43346	0.86992	0.03275
	(6)	0.15623	0.02905	0.72763	0.19095	0.80847	0.39729
(4)	(1)	0.72109	0.17970	0.22505	0.35561	0.98935	0.27818
	(2)	0.37348	0.19381	0.43331	0.75033	0.99963	0.42232
	(3)	0.12129	0.32386	0.56705	0.87165	0.84460	0.92955
	(4)	0.54948	0.08844	0.47061	0.78419	0.18731	0.93485
	(5)	0.15097	0.44967	0.48759	0.84161	0.19212	0.05146
	(6)	0.32360	0.66850	0.99382	0.94050	0.96449	0.96217
(5)	(1)	0.68091	0.54191	0.10910	0.94237	0.23161	0.15167
	(2)	0.97121	0.83626	0.70896	0.45296	0.69475	0.11264
	(3)	0.19723	0.98260	0.57429	0.94789	0.64457	0.20809
	(4)	0.84036	0.14095	0.29451	0.40256	0.34521	0.64924
	(5)	0.97500	0.98056	0.82276	0.97130	0.77329	0.89855
	(6)	0.83244	0.30828	0.06882	0.68471	0.71081	0.91649
(6)	(1)	0.75892	0.29685	0.70044	0.91238	0.53356	0.45239
	(2)	0.13229	0.19701	0.36074	0.32254	0.62045	0.26691
	(3)	0.34789	0.22179	0.91891	0.87651	0.91011	0.97469
	(4)	0.97211	0.68943	0.12831	0.50006	0.20793	0.61151
	(5)	0.24954	0.17809	0.56093	0.51524	0.69135	0.68967
	(6)	0.10062	0.11852	0.47089	0.64765	0.44644	0.35548

Table CQS-A1 - Table of Random Fractions

ANNEXURE CQS-B
METHOD STATEMENT REQUIREMENTS

CQS-B1 GENERAL

1. Method Statements are required to describe the key steps and sequence in the construction activities, how and by whom each step shall be undertaken and what materials and equipment shall be used. Method Statements may include a flow chart to clarify the sequence of key steps. One or more Method Statements may address a Construction Activity.

2. Each Method Statement will be supported by a Check List which shall identify relevant inspections, test points, materials requirements and Hold Points. Each requirement on the Check List will have an officer responsible identified and will require the nominated officer to sign off the requirement so indicating its satisfactory execution.

3. Method Statements and Check Lists shall be compatible with the appropriate Inspection and Test Plan. Check Lists will be completed for each lot of work during construction and compiled with other documents to comprise the Quality Register.

4. The Contractor shall submit Method Statements and Check Lists to describe the key steps in those Construction Activities listed below that are identified with a preceding asterisk (*).

Table CQS-B1 - Construction Activities

Item	Enter * here if required	Activity	Specification Number
1		Control of Traffic	C201
2		Temporary Roadways and Detours	C201
3		Control of Erosion and Sedimentation	C211
4		Clearing and Grubbing	C212
5		Earthworks - Cut	C213
6		Earthworks - Unsuitable Material	C213
7		Earthworks - Embankment	C213
8		Compaction and Quality Control	C213
9		Siting, Excavation, Bedding, Backfilling and Compaction of Stormwater Drainage	C220
10		Installation of Pipe Drainage	C221
11		Installation of Precast Box Culverts	C222
12		Siting and Installation of Drainage Structures	C223
13		Construction of Lined Open Drains including Kerb and Channel	C224
14		Stabilisation of Pavement or Subgrade Materials	C241
15		Provision of Subsurface Drainage as subsoil drains, pavement drains or free draining layer	C230-C233
16		Construction of Flexible Pavement Layers	C242
17		Construction of Concrete Pavement Layers	C247-C248
18		Construction of Asphalt Pavement Layers	C245
19		Sprayed Bituminous Surfacing	C244

Item	Enter * here if required	Activity	Specification Number
20		Bituminous Microsurfacing	C255
21		Construction of Segmental Paving	C254
22		Pavement Marking	C261
23		Minor Concrete Works	C271
24		Landscaping	C273

ANNEXURE CQS-D

NONCONFORMANCE REPORT

NCR No:

EXAMPLE

Date:.....

CONTRACT:

PRODUCT OR SERVICE: .....

SUB-CONTRACTOR (if appropriate): .....

INSPECTION & TEST PLAN No: .....

LOT No & DESCRIPTION/LOCATION: .....

DETAILS OF NONCONFORMANCE:.....

PROPOSED DISPOSITION: .....

IS A SUPPLEMENTARY REPORT ATTACHED: YES ☐ ..... NO ☐

CLIENT APPROVED ☐ COMMENT: .....

REJECTED ☐ .....

CLIENT SIGNATURE: ..... DATE: .....

DISPOSITION COMPLETED (CONTRACTOR) ..... DATE: .....

RELEASE OF HOLD POINT (CLIENT)..... DATE: .....

CLOSE OUT OF NONCONFORMANCE REPORT:

CONTRACTOR QMR: ..... DATE: .....

CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

CQC

QUALITY CONTROL REQUIREMENTS

SPECIFICATION CQC
QUALITY CONTROL REQUIREMENTS

CLAUSE CONTENTS PAGE

ANNEXURES

SPECIFICATION CQC
QUALITY CONTROL REQUIREMENTS

GENERAL

CQC1 SCOPE

1. This Specification covers the contractual requirements for the quality control testing and survey by the Contractor; including the minimum test frequencies to be employed to demonstrate conformance to the requirements of the technical specifications. ***Testing and Survey***

CQC2 LOTS

1. All items of work shall be subdivided into lots. Each lot shall be given a unique lot number.

2. Lots shall be chosen by the Contractor but shall be within the limits given in Annexure CQC-B. In general, the size of the lot shall not exceed one day's output for each work process designated for lot testing. ***Lot Size***

3. The lot numbers shall be used as identifiers on all surveys and test results. ***Lot Numbers***

4. The Contractor shall determine the bounds of each lot before sampling and shall identify each lot clearly. ***Lot Identification***

5. The boundaries of a lot may be changed if subsequent events cause the original lot to be no longer essentially homogeneous. ***Lot Boundaries***

6. The lot identification system and sample numbering system shall allow test results to be positively identified with material incorporated in the works. ***Test Results***

CQC3 SAMPLING AND TESTING

1. All compliance inspections and tests shall be based on lots. ***Lots***

2. The maximum lot sizes and minimum testing frequencies are listed in the Annexures to the relevant Specifications and/or in Annexure CQC-B to this Specification. Where no minimum frequency of testing, or maximum lot size is stated in the Specification, the Contractor shall nominate appropriate frequencies for the Superintendent's approval. ***Lot Sizes Frequency of Testing***

3. Sampling shall not be restricted to locations dimensioned or otherwise defined for setting out the Works in the Drawings or Specification, but shall be undertaken in a random or unbiased manner, as approved by the Superintendent, at any location within the Works to demonstrate its compliance with the Specification. ***Sampling Locations***

4. Where Test Methods are nominated in the Technical Specifications, sampling and testing shall be carried out by a NATA registered laboratory accredited for those test methods and sampling procedures. Sampling shall be conducted by personnel from the NATA registered laboratory which has been accredited for that sampling procedure and shall be supervised by the approved signatory from that laboratory. Test results shall be reported on NATA endorsed test documentation which shall include a statement by the approved signatory certifying that the correct sampling procedures have been followed. ***Sampling and Testing***

5. In special circumstances the Principal may accredit a laboratory that is not NATA registered for specific tests or inspection procedures. ***Special Accreditation***

6. The Contractor shall reinstate all core holes, test holes, excavations and any other disturbance resulting from any testing activity. The reinstatement shall be to a standard which is at least equal to the specified requirements for the particular work. ***Reinstatement***

7. Random sampling techniques shall be used for each lot for the control of compaction of each continuous layer of earthworks, flexible pavement and asphalt. Annexure CQC-A defines the method to be used for determining test locations of random sampling in each lot. ***Random Sampling***

8. For quality control of processes other than compaction of layers of earthworks, flexible pavement and asphalt, the sampling locations will be proposed by the Contractor and will require the approval of the Superintendent. ***Sampling Locations***

9. In all cases the samples shall be each considered to be representative of the lot and all test results will be required to meet the appropriate tolerances for the lot. ***All Test Results to Meet Tolerances***

CQC4 SURVEYING

1. Surveying Control shall include all measurement, calculation and record procedures necessary to: ***Requirements***

   (a) set out the Works

   (b) verify conformance to the Drawings and Specification in relation to dimensions, tolerances and three dimensional position

   (c) determine lengths, areas or volumes of materials or products, where required for measurement of work.

2. The Contractor shall appoint qualified surveyors who are eligible for membership of the Institution of Surveyors, Australia or the Institution of Engineering and Mining Surveyors, Australia to supervise and take responsibility for all Surveying Control. ***Surveyor Qualifications***

3. The procedures and equipment used must be capable of attaining the tolerances nominated in the Specification. ***Equipment***

4. Sampling for conformance verification purposes shall not be restricted to the locations used to set out the Works. ***Sampling Locations***

5. The Contractor shall submit a Survey Conformance Report to the Superintendent for each lot or component where design levels, position and/or tolerances have been specified. The Survey Conformance Report shall show 'specified vs actual' for position (defined by co-ordinates or chainage and offset), level and tolerance as appropriate and shall be certified by the qualified surveyor responsible for the verification survey. ***Conformance Report***

CQC5 RECORDS

1. Conformance records shall be stored and maintained such that they are readily retrievable and in facilities that provide a suitable environment to minimise deterioration or damage and to prevent loss. ***Storage***

2. The Contractor shall submit all conformance records to the Superintendent for inspection and approval. If requested by the Superintendent, the Contractor shall provide copies of the records or test results at no cost to the Principal. ***Copies of Records Contractor's Cost***

ANNEXURE CQC-A
RANDOM SAMPLING

CQC-A1 GENERAL

1. Random sampling of test locations shall be used to control relative compaction of each layer of:

   (i) earthworks
   (ii) selected material zone
   (iii) flexible pavement
   (iv) asphalt
   (v)
   (vi)
   (vii)

which are generally rectangular in area.

CQC-A2 SAMPLING RATES

1. The number of samples (n) per lot shall be as indicated in the specific Specification Parts which are summarised in the Sub-Annexure to this Quality Requirements Specification.

CQC-A3 RANDOM SAMPLING LOCATIONS

1. Sampling locations within a lot for the control of relative compaction shall be determined as follows:

   (i) Representing the lot as a rectangle, sub-divide the lot lengthwise into equi-area sub-lots in accordance with the number of samples selected (n).
   (ii) Establish six grid lines within the lot, as illustrated in Figure CQC-A2;
   (iii) Throw a die to select a number between 1 and 6. This determines which grid line to use for the sample location in sub-lot 1;
   (iv) Throw die to select a group (1-6) in Table CQC-A1;
   (v) Throw die twice to select two random numbers (between 1 and 6) for row and column in Table CQC-A1 and obtain random fraction R;
   (vi) Length co-ordinate for sample location in Sub-lot 1 = RL/n;
   (vii) For sample location in next sub-lot:-

   Add L/n to previous length co-ordinate.

   Add 1 (on a cycle of 6) to previous grid line.

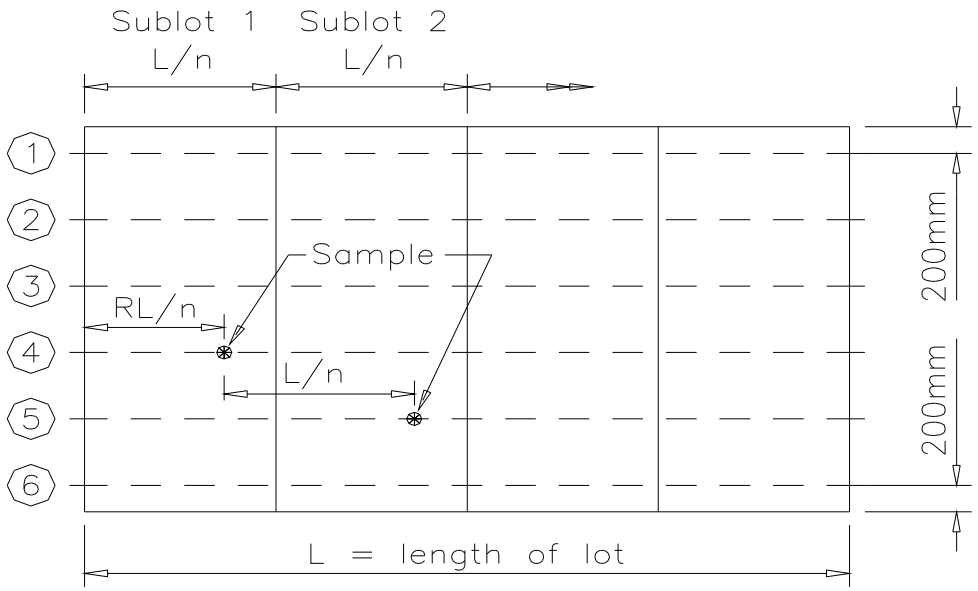

Figure CQC-A2 Sampling Locations for Rectangular Lot

GROUP	ROW	COLUMN					
		(1)	(2)	(3)	(4)	(5)	(6)
(1)	(1)	0.78178	0.45467	0.00347	0.27296	0.00020	0.36517
	(2)	0.59678	0.67931	0.25434	0.59054	0.32444	0.41504
	(3)	0.14464	0.17269	0.61154	0.18291	0.83242	0.50776
	(4)	0.89010	0.44764	0.07451	0.20428	0.49513	0.91440
	(5)	0.91941	0.47726	0.33160	0.30670	0.65114	0.36852
	(6)	0.51085	0.38148	0.22169	0.66578	0.67050	0.69559
(2)	(1)	0.81891	0.48626	0.88892	0.82994	0.16941	0.81528
	(2)	0.37410	0.60232	0.12070	0.79017	0.32981	0.34908
	(3)	0.45921	0.15648	0.58052	0.37413	0.08124	0.97145
	(4)	0.86614	0.94719	0.78872	0.91972	0.45149	0.15107
	(5)	0.26590	0.41140	0.95477	0.81267	0.24018	0.07324
	(6)	0.95205	0.39438	0.73697	0.59427	0.71146	0.00575
(3)	(1)	0.18694	0.36502	0.17828	0.84312	0.57003	0.58583
	(2)	0.91211	0.86936	0.43030	0.27672	0.47393	0.10342
	(3)	0.80714	0.34295	0.00775	0.90855	0.33368	0.21842
	(4)	0.67579	0.92686	0.18005	0.00645	0.11256	0.05278
	(5)	0.03184	0.69876	0.16676	0.43346	0.86992	0.03275
	(6)	0.15623	0.02905	0.72763	0.19095	0.80847	0.39729
(4)	(1)	0.72109	0.17970	0.22505	0.35561	0.98935	0.27818
	(2)	0.37348	0.19381	0.43331	0.75033	0.99963	0.42232
	(3)	0.12129	0.32386	0.56705	0.87165	0.84460	0.92955
	(4)	0.54948	0.08844	0.47061	0.78419	0.18731	0.93485
	(5)	0.15097	0.44967	0.48759	0.84161	0.19212	0.05146
	(6)	0.32360	0.66850	0.99382	0.94050	0.96449	0.96217
(5)	(1)	0.68091	0.54191	0.10910	0.94237	0.23161	0.15167
	(2)	0.97121	0.83626	0.70896	0.45296	0.69475	0.11264
	(3)	0.19723	0.98260	0.57429	0.94789	0.64457	0.20809
	(4)	0.84036	0.14095	0.29451	0.40256	0.34521	0.64924
	(5)	0.97500	0.98056	0.82276	0.97130	0.77329	0.89855
	(6)	0.83244	0.30828	0.06882	0.68471	0.71081	0.91649
(6)	(1)	0.75892	0.29685	0.70044	0.91238	0.53356	0.45239
	(2)	0.13229	0.19701	0.36074	0.32254	0.62045	0.26691
	(3)	0.34789	0.22179	0.91891	0.87651	0.91011	0.97469
	(4)	0.97211	0.68943	0.12831	0.50006	0.20793	0.61151
	(5)	0.24954	0.17809	0.56093	0.51524	0.69135	0.68967
	(6)	0.10062	0.11852	0.47089	0.64765	0.44644	0.35548

Table CQC-A1 - Table of Random Fractions

ANNEXURE CQC-B
MAXIMUM LOT SIZES AND MINIMUM TEST FREQUENCIES

GENERAL

1. The maximum lot sizes and minimum test frequencies are separately specified for all major activities covered by the Technical Specifications as listed hereunder.

2. The requirements applicable to this Contract are identified with an asterisk indicating that only these details are attached in this Annexure.

3. Where material/product quality certification can be obtained from the supplier, tests listed per contract/separable part need not be repeated.

Contents of Annexure CQC-B

Item	Sub-Annexure	Required (*) for this Contract	Reference Specification	Sub-Annexure Heading
1	B1		C213	Earthworks
2	B2		C220 C221 C222 C223 C224	Stormwater Drainage - Pipe Culverts, Box Culverts, Open Drains, Kerb & Channel, Drainage Structures
3	B3		C230 C231 C232 C233	Subsurface Drainage
4	B4		C241	Stabilisation
5	B5		C242	Flexible Pavements
6			C244	Sprayed Bituminous Surfacing
7	B7		C245	Asphalt
8	B8		C247 C248	Ready Mixed Concrete Production and Supply
9			C247	Mass Concrete Subbase
10			C248	Plain or Reinforced Concrete Base
11			C255	Bituminous Microsurfacing
12			C254	Segmental Paving
13			C271	Minor Concrete Works
14	B14		C261	Pavement Markings
15			C262	Signposting

Sub-Annexure B1
EARTHWORKS (Specification C213)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Excavation	Geometry	10,000m^2	1 Cross Section per 25m	Survey
Floor of Cuttings	Material Quality - CBR	5,000m^2	1 per 1,000m^2 *	AS1289.6.1.1
	Compaction	10,000m^2	1 per 500m2	AS1289.5.4.1
Foundation for Embankments	Compaction	5,000m^2	1 per 500m2	AS1289.5.4.1
Embankments - General	Geometry	One layer 10,000m^2	1 Cross Section per 25m	Survey
	Material Quality - CBR	One layer 5,000m^2	1 per 800m^3	AS1289.6.1.1
	Compaction/Moisture Content	One layer 5,000m^2	1 per 250m^3	AS1289.5.1.1 AS1289.5.4.1 AS1289.5.7.1
Road Carriageway Embankments - Select Zone	Geometry	One layer 10,000m^2	1 Cross Section per 25m	Survey
	Material Quality - Maximum Particle Size - CBR	 10,000m^2 10,000m^2	 1 per 1,000m^3 * 1 per 500m^3 *	 AS1289.6.1.1
	Compaction/Moisture Content	One layer 5,000m2	1 per 250m^3	AS1289.5.1.1, AS1289.5.4.1 AS1289.5.7.1
Fill Adjacent to Structures: Bridges, Retaining Walls and Cast-in-Situ Culverts	Material Quality - Maximum Particle Size - Plasticity Index	 1 Structure 1 Structure	 1 per 200m^3 * 1 per 200m^3 *	 AS1289.3.3.1
	Compaction/Moisture Content	1 Structure	1 per layer	AS1289.5.1.1, AS1289.5.4.1 AS1289.5.7.1

* Note: or part thereof, per lot.

Sub-Annexure B2
STORMWATER DRAINAGE - PIPE CULVERTS, BOX CULVERTS, OPEN DRAINS INCLUDING KERB & CHANNEL, DRAINAGE STRUCTURES
(Specifications C220, C221, C222, C223, C224)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Supply of Precast Units	Precast Quality - Suppliers documentary evidence and certification			
Siting and Excavation	Geometry	1 drainage line/structure	1 per drainage line/structure	Survey
Foundation	Compaction	1 drainage line/structure	1 per 20 lin m *	AS1289.5.4.1
Material surrounding Steel Structures	Material Quality - pH/Electrical Resistivity	1 drainage line/structure	1 per material	AS1289.4.3.1 AS1289.4.4.1
Bedding	Material Quality			
	- Particle Size Distribution	1 contract	1 per 200m^3 *	AS1141.11
	Compaction/Moisture Content	1 drainage line/structure	1 per layer, per 50 lin m	AS1289.5.7.1, AS1289.5.4.1
Concrete Bedding or Lining	Geometry		1 Cross Section per 25m	Survey and 3m Straight Edge
Installation of Precast Units	Geometry	1 drainage line/structure	1 per drainage line/structure	Survey
Selected Backfill	Material Quality			
	- Maximum Particle Size	1 contract	1 per 100m^3 *	
	- Plasticity Index	1 contract	1 per 100m^3 *	AS1289.3.3.1
	Compaction/Moisture Content	1 drainage line/structure	1 per 2 layers per 50m^2	AS1289.5.7.1, AS1289.5.4.1
Rock Fill for Gabions/ Wire Mattresses	Material Quality:			
	- Wet Strength	1 contract	1 per contract	AS1141.22
	- Wet/Dry Strength Variation	1 contract	1 per contract	AS1141.22
Kerb and Channel	Geometry		1 Cross Section per 25m	Survey and 3m Straight Edge
Pipe Inspection	No visible cracking	All	All	By closed circuit television (CCTV)

* Note: or part thereof, per lot.

Sub-Annexure B3
SUBSURFACE DRAINAGE (Specifications C230, C231, C232, C233)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Material Supply	Material Quality - Supplier's documentary evidence and certification.			
Excavation - Trench Base	Line and Grade	1 drainage line	1 per drainage line	Survey
	Compaction	1 drainage line	1 per 200 lin m*	AS1289.5.4.1
Bedding and Backfill				
- Filter Material	Compaction	1 drainage line	1 per drainage line	AS1289.5.4.1
- Selected Backfill	Compaction	1 drainage line	1 per 200 lin m*	AS1289.5.4.1
- Earth Backfill	Compaction	1 drainage line	1 per 200 lin m*	AS1289.5.4.1
Drainage Mat	Geometry	2000m^2	1 Cross Section per 25m	Survey

* Note: or part thereof, per lot

Sub-Annexure B4
STABILISATION (Specification C241)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Material Supply	Material Quality - Supplier's documentary evidence and certification.			
Mix Design	NATA certification - Supplier's documentary evidence and certification	1 mix	1 per mix	
Stationary Mixing Plant	Application rate of stabilising agent	1 day's production	1 per 100t	
	Compressive strength of product	1 day's production	1 per 400t	AS1289.6.1.1
In-Situ Spreading	Spread rate	1 layer 1,000m^2	1 per lot or 1 per 500m^2	
	Mix Uniformity	1 layer 1,000m^2	1 per 500m^2	Visual
Trimming and Compaction	Geometry	1 layer 2,000m^2, max 1 day's placement	One cross section per 25m	Survey
	Surface Quality	"	10 per 200m lane length *	3m Straight Edge
	Average Layer thickness	"	1 per lot	
	Average Width	"	1 per lot	Measure/Survey
	Relative Compaction/Moisture Content	"	3 per lot	AS1289.5.7.1 AS1289.5.8.1

* Note: or part thereof, per lot.

Sub-Annexure B5
FLEXIBLE PAVEMENTS (Specification C242)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Base and Subbase Supply	Material Quality - Supplier's documentary evidence and certification	1 contract		
Placement	Geometry: Alignment & Level	One layer 2,000m^2 or	1 Cross Section per 15m	Survey
	Width & Surface Trim	max 1 day's placement	10 per selected 200 lin m*	Measure & 3m Straight Edge
	Deflection Control - Benkelman Beam	One layer 5,000m^2 or max 1 day's placement	4 per 1,000m^2 minimum 10 per lot	T160
	Compaction/Moisture Content/	One layer 5,000m^2 or	10 per 5,000m^2 layer or	AS1289.5.2.1, T130, AS1289.5.4.1
	Dry Density Testing	max 1 day's placement	3 per lot if less	AS1289.5.8.1

* Note: or part thereof, per lot.

Sub-Annexure B7
ASPHALT (Specification C245)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification.			
Mix Design - Nominated Mix	Approval of mix and NATA certification. Supplier's documentary evidence and certification	1 mix per contract	1 per mix	
Production Mix	Temperature		1 per truck load	Measure
	Moisture Content	C245.7 from Spec		AS2891.10
	Grading	C245 Asphaltic Concrete as included as separate table below. Additionally, max lot size one 12 hr shift's production.		AS2891.3.3
	Binder Content			AS2891.3.1
	Resistance to Stripping	1 production mix	1 per mix per 5000t or once per month (whichever is the most frequent)	T640
Laying and Compaction	Temperature	1 day's laying per site	1 per truck load	Measure
	Levels	1 day's laying per site	1 cross section per 25m	Survey
	Shape	1 day's laying	10 per 200m* lane length	3m Straight Edge
	Relative Compaction/Layer Thickness	1 day's laying	6 cores per lot 10 nuclear density tests per lot	AS2891.9.3 or Nuclear Density Meter

* Note: or part thereof, per lot

Quantity of Asphalt in production lot	Minimum Frequency of Testing
Less than 100 tonnes	One per 50 tonnes or part thereof
101 to 300 tonnes	One per 100 tonnes or part thereof
301 to 600 tonnes	One per 150 tonnes or part thereof
Over 600 tonnes	One per 200 tonnes or part thereof

Table C245.7 Minimum Testing Frequencies for Asphalt Production

Sub-Annexure B8
READY-MIXED CONCRETE PRODUCTION & SUPPLY
(Specifications C247, C248)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Raw Materials Supply	Material Quality - Supplier's documentary evidence and certification.			
Mix Design	Compressive Strength	1 contract mix	1 per mix per contract	AS1012.9
	Aggregate Moisture Content	1 contract mix	1 per mix per contract	
	Consistency - Slump	1 contract mix	1 per mix per contract	AS1012.3.1
	Air Content	1 contract mix	1 per mix per contract	AS1012.4 Method 2
	Shrinkage	1 contract mix	1 per mix per contract	AS1012.13

* Note: or part thereof, per lot

Sub-Annexure B14
PAVEMENT MARKINGS (Specification C261)

ACTIVITY	KEY QUALITY VERIFICATION REQUIREMENTS	MAXIMUM LOT SIZE	MINIMUM TEST FREQUENCY	TEST METHOD
Materials Supply	Material Quality - Supplier's documentary evidence and certification.			
Paint Application	Wet Film Thickness	1 contract	1 per site visit or change in pressure settings	AS 1580.107.3
	Application Rate of Glass Beads	1 contract	1 per site visit or change in pressure settings	Annexure C261A
Thermoplastic Application	Cold Film Thickness	1 contract	1 per site visit or change in pressure settings	Measure by micrometer
	Application Rate of Glass Beads	1 contract	1 per site visit or change in pressure settings	Annexure C261A

CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C101

GENERAL

SPECIFICATION C101 – GENERAL

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SPECIFICATION C101 : DEVELOPMENT CONSTRUCTION – GENERAL

PROJECT SPECIFIC INFORMATION

C101.01 LOCATION AND DESCRIPTION OF PROJECT

EXAMPLE (TO BE COMPLETED BY COMPILER)

1. The Works comprise the construction of a subdivision at Highton, Greater Geelong, Lots 43-64 L.P.231527 in the Parish of Barrarbool, City of Greater Geelong, Victoria.

2. The subdivision involves the construction of two roads and the provision of services to 22 residential building sites.

3. Access to the subdivision is to be from Barrabool Road.

C101.02 EXTENT OF WORK

1. Works under this Contract comprise the supply of labour, materials and plant to construct the Works. It includes but is not limited to the following items of construction which shall be carried out in their entirety in strict accordance with and to the true intent and purpose of, the Conditions of Contract, these Technical Specifications, the Drawings listed herein, and under the supervision of the Superintendent.

EXAMPLE (TO BE COMPLETED BY COMPILER)

(a) General

- *Provision for control, protection and safety of traffic during construction including notifications to and obtaining approvals from Authorities.*
- *Notification of all appropriate property owners adjoining the Works.*
- *Setting out the Works.*
- *Erosion and sedimentation control of the Works, including stockpile areas.*
- *Site clearing and grubbing. Topsoil to stockpile.*
- *Site regrading.*
- *Topsoil spreading and revegetation to disturbed areas*.

(b) Roadworks

- *Earthworks, including excavation and embankment construction.*
- *Stormwater drainage, including kerb and channel, pipes, pits and headwalls.*
- *Sub-surface drainage.*
- *Pavement, consisting of unbound granular subbase and base, bituminous primer seal, and asphalt wearing surface.*
- *Guardfence.*
- *Signposting and linemarking.*
- *Ancillary works, including medians, paved footpath, turfing and landscaping*.

(c) Structures

- *Crib retaining wall*
- *Bridge, single span, comprising driven prestressed concrete piles, prestressed concrete bridge beams, and cast-in-situ reinforced concrete headstocks and deck.*

(d) Work by Others

- *Provision of electricity and gas services to the subdivision will be undertaken by the relevant authorities.*

- *The excluded work will be the responsibility of the Principal and Utility Authorities. Attention is drawn to the Conditions of Contract regarding the obligation of the Contractor to co-ordinate the works with any simultaneous and/or adjacent work by others. The Contractor shall liaise with these Contractors and Authorities to avoid disruption, delays and possible conflict.*

C101.03 SUBSURFACE CONDITIONS

EXAMPLE (TO BE COMPLETED BY COMPILER)

1. A geotechnical investigation was carried out during February 1992 for design purposes. A copy of the report from this geotechnical investigation is available for the information of the Contractor upon request to the Superintendent.

2. The Contractor's attention is drawn to the General Conditions of Contract Clause "Site Conditions". The Contractor should make its own assessment of the in-situ moisture content likely to be encountered at the actual time work is to be carried out.

Contractor to Inform Itself

GENERAL REQUIREMENTS

C101.04 DRAWINGS

1. The Drawings which form part of the Contract Documents are bound in a separate volume.

C101.05 STANDARDS AND TEST METHODS

1. Unless otherwise specified in the Contract, and where applicable, materials and workmanship shall be in accordance with the relevant standard of the Standards Association of Australia.

Australian Standards

2. A standard applicable to the Works shall be the edition last published 14 days prior to the closing date for tenders unless otherwise specified.

3. Overseas standards and other standard documents named in the Specification shall be applicable in the same manner as Australian Standards to relevant materials and workmanship.

Overseas Standards

4. Copies of any standards quoted or referred to in the Specification shall be kept on the site if so specified.

Copies to be kept on Site

5. Where no suitable AS test methods are available, those of the relevant State VicRoads shall be used. These are designated T123 etc.

Other Test Methods

C101.06 TESTING AND SURVEY

1. All testing and survey as required by the Technical Specifications shall be arranged and carried out by the Contractor and all test results and survey records made available to the Superintendent and Council. The cost of all such testing and survey shall be borne by the Contractor.

Contractor's Cost

2. The minimum frequency of testing and survey shall be in accordance with either the Specification for QUALITY SYSTEM REQUIREMENTS or QUALITY CONTROL REQUIREMENTS as appropriate for quality assurance or quality control contracts respectively. The appropriate requirements for this Contract are cited on the Form of Tender.

Minimum Frequency

C101.07 WORKING AREAS

1. The Principal will not be responsible for the safe-keeping of any of the Contractor's plant, equipment, tools, materials or other property. The Contractor may provide, and pay for, any security fencing considered necessary around any office, workshop or storage area, subject to the Superintendent's approval. ***Security***

2. If existing fencing is cut or altered by the Contractor, or if there is no existing site fencing, the Contractor shall provide and maintain temporary fencing to the satisfaction of the Superintendent during the Contract to prevent unauthorised entry into the property, and shall reinstate the fencing and remove temporary fencing on completion of the work. ***Temporary Fencing***

3. The Contractor shall erect appropriate regulatory, hazard, emergency information and fire signs, in accordance with AS 1319 Safety signs for the occupational environment, at prominent locations around the working areas and temporary site facilities. Signs shall include, but are not limited to: mandatory signs for personal protective equipment such as eye, head and foot protection, and DANGER signs such as “DANGER, Construction Site. No Unauthorised Access”. All words on word-message signs shall be approved by the Superintendent prior to sign manufacture or purchase. ***Safety Signs***

C101.08 SMOOTH JUNCTIONS

1. Construction work carried out under this Contract adjacent to or adjoining existing works, shall make smooth junctions with the existing work.

C101.09 SETTING OUT THE WORKS

1. The Superintendent will provide Permanent Marks as shown on the Drawings. The Superintendent will also establish bench marks related to the level datum. ***Provision of Marks***

2. Before any of the given survey marks on the base lines or the various control lines are affected by the Works, the Contractor shall transfer such survey marks to side positions clear of operations and shall note, and inform the Superintendent in writing, of the extent of such movement. ***Transfer of Marks***

3. The Contractor shall give the Superintendent not less than two full working days' notice of the intention to perform any portion of the relocation of survey control, establishment of recovery pegs, or setting out or levelling, so that suitable arrangements can be made for checking of the work by the Superintendent. ***Notice for Relocation***

4. The Contractor shall provide and fix adequate recovery pegs in suitable locations adjacent to the elements of work to enable location and construction to be checked. ***Recovery Pegs***

5. All pegs and profiles placed by the Contractor shall be removed on completion of work unless otherwise directed by the Superintendent. ***Removal***

C101.10 SITE MEETINGS

1. Regular site meetings will be held for the purpose of discussion of the progress and co-ordination of the Work under the Contract and any matters of doubt regarding the intent or interpretation of the Drawings or the Specification. The Contractor shall arrange for relevant sub-contractors or their responsible representatives to be present at these meetings. The meetings will be held at a time nominated by the Superintendent. ***Represen-tation***

2. The Superintendent shall also give Council 48 hours notice of the date, time and location of the meetings. A Council representative may attend these meetings. ***Advice to Council***

3. The Superintendent or Superintendent’s Representative shall chair site meetings, keep minutes of the proceedings and shall provide copies of the minutes for the ***Responsibility for Minutes***

Contractor, all present at the meeting and others concerned with the matters discussed.

C101.11 WORK-AS-CONSTRUCTED DRAWINGS

1. The Contractor shall supply the Superintendent with fully marked-up and certified Work-as-Constructed Drawings for the whole of the Contract prior to issue of the Final Certificate. Prints or reproducibles of the Contract Drawings will be supplied by the Principal free of charge for this purpose. A Work-As-Executed Certification Report, refer to Annexure C101A, shall be completed by an appropriate qualified Engineer of Surveyor commissioned by the Contractor. ***Submission***

2. Work-as-Constructed Drawings for Roadworks shall show in red ink all changes to the Contract Drawings and actual values of all levels shown on the Drawings. The Drawings shall be signed by a Surveyor and certified by the Contractor. ***Roadworks***

3. Work-as-Constructed Drawings for Bridgeworks shall show in red ink all changes to the Contract Drawings, including variations to levels, dimensions, concrete, reinforcement, prestressing and other materials, all non-conformances accepted without rectification, suppliers and model numbers of bearings and proprietary joints and type of barrier railings installed where both steel and aluminium alternatives are detailed. The Drawings shall be certified by the Contractor. ***Bridgeworks***

C101.12 ITEMS TO BE SUPPLIED BY THE PRINCIPAL

1. Items listed in the Schedule of Items to be supplied by the Principal (TBS Items) will be supplied, delivered and unloaded by the Principal free of cost to the Contractor at points to be nominated. The Contractor shall give the Superintendent notice of the time delivery of TBS Items are required in accordance with the Requirements of the Technical Specification or as specified below. ***Delivery***

2. If any TBS Item is found to be damaged or defective the Contractor shall so inform the Superintendent within 2 days of taking delivery of such item. If the Contractor does not report damage or defect, it shall be deemed that the TBS Item was free from damage or defect when received. The Contractor shall then be responsible for any replacement or making good as may be directed by the Superintendent in the case of a Quality Control Contract or in accordance with the Disposition of Nonconformance requirements in the Specification for QUALITY SYSTEM REQUIREMENTS in the case of a Quality Assured Contract. ***Damage or Defect***

3. The Contractor shall be responsible for the storage, protection and insurance of all TBS Items received. ***Contractor's Responsibility***

ENVIRONMENTAL REQUIREMENTS

C101.13 PROTECTION OF THE ENVIRONMENT

1. All work shall be carried out in such a manner as to avoid nuisance and/or damage to the environment. The Contractor shall comply with the conditions of approval imposed by the Environment Protection Act, the Country Fire Authority Act and any other local government requirements and environmental acts relevant to the project. ***Conformance to Acts***

2. The Contractor shall plan and carry out the Works to avoid erosion, contamination and sedimentation of the site and its surroundings. ***Erosion Control***

3. Herbicides and other toxic chemicals shall not be used on the site without the prior written approval of the Superintendent. ***Herbicides and Toxic Chemicals***

4. No noise or smoke or other nuisance, which in the opinion of the Superintendent ***Noise, Smoke***

is unnecessary or excessive shall be permitted by the Contractor in the performance of the Works under this Contract. Should work outside customary working hours be approved, the Contractor shall not use, during such period, any plant, machinery or equipment which in the opinion of the Superintendent is causing or is likely to cause a nuisance to the public. No noisy works and/or works likely to disturb nearby residents shall be undertaken during the hours precluding such activity as specified by Council. ***or Other Nuisances***

5. The Contractor shall ensure that fugitive dust from disturbed areas is minimised by a method approved by the Superintendent. ***Dust Control***

C101.14 DRAINAGE OF WORKS

1. The control and management of stormwater drainage through the site will be important during construction of the Works. ***Stormwater Control***

2. The Contractor shall provide for the effectual diversion of surface water from the Works and provide and ensure proper flushing for storm and subsoil water across and beyond the Works at all times. The flow of stormwater and drainage along existing gutters and water tables shall not be interrupted. ***Stormwater Diversion***

3. The Contractor shall provide efficient pumping equipment on site and shall keep trenches and excavations dewatered at all times during construction. ***Pumping***

4. All permanent retarding basins, and temporary erosion and sedimentation control shall be completed prior to commencement of earthworks.

C101.15 BLASTING

1. Blasting will not be permitted without the specific approval of the Council. If such approval is given then blasting shall be carried out strictly in accordance with the Specification - EARTHWORKS.

C101.16 LIMITS ON NOISE

1. The Contractor shall only use plant that have effective residential class silencers fitted to all engine exhaust, have engine covers fitted, are maintained in good order, and in addition meet the following requirements. ***Plant with Silencers***

   (a) On purchase have met the NAASRA Specification for Noise levels of plant and equipment, or

   (b) Have a Maximum Noise level (L_{AMAX}) less than 80 dB(A) when measured at a distance of 7 metres.

2. Operational hours of plant, including the entry and/or departure of heavy vehicles, shall be restricted to 7 am. to 5 pm. Monday to Saturday and at no times on Sundays or Public Holidays. Work outside of the hours specified shall not be undertaken without the prior approval of the Superintendent. ***Working Hours***

3. Noise emanating from the construction site when measured at noise sensitive locations shall be as determined by the State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade No.N1). The intent of this requirement is to avoid excessive noise and long periods of elevated noise that is reasonably anticipated to annoy or adversely effect the adjacent community. ***Noise Levels***

4. The Contractor will be responsible for any damage and compensation payments as a result of non observance of the above requirements. No claim by the Contractor arising out of these requirements will be considered by the Principal. ***Contractor's Responsibility***

C101.17 LIMITS ON GROUND VIBRATION

Levels

1. It is the intent of this Specification that ground vibration levels, transmitted from operating items of plant in the vicinity of residential premises shall not exceed levels that are close to the lower level of human perception inside the premise nor will cause structural damage to the building. Practices and vibration thresholds acceptable shall be determined in accordance with current Statutory Regulations. Where such regulation is not available, or jurisdiction is disputed, the criteria given in paragraphs 2 and 3 shall apply.

Limits

2. Vibration (RMS Z-Axis) generated by construction works shall not exceed

Curve 4 - for the period of 1 month or less

Curve 2 - for the period of more than 1 month

as defined in British Standard BS6472 "Evaluation of Human Exposure to Vibration in Buildings (1 HZ to 80 HZ)" when measured inside nearby residential premises.

Peak Particle Velocity

3. Ground vibrations generated by construction works shall not exceed a peak particle velocity (V_R max) limit of 5 mm/sec when measured within one metre of any residential premise.

Contractor's Responsibility

4. The Contractor shall be responsible for any damage and compensation payments as a result of non-observance of the above requirements. No claim by the Contractor will be considered by the Principal.

SPECIAL REQUIREMENTS

ANNEXURE C101-A

CITY OF GREATER DANDENONG
WORK-AS-EXECUTED CERTIFICATION REPORT

Project Title: _____

DA/BA No: _____

Design Consultant's Drawing No: _____

Name of Consultant: _____

Name and Address of Developer: _____

_____

I certify that the Work-as-Executed drawings represent the construction of Works for which Quality Records, providing a valid record of construction, is held by me and is available for inspection by Council.

I certify that the Works have been constructed in accordance with the Council approved drawings and standards with the exception of departures indicated on the Work-as-Executed drawings.

Each approved drawing has been reviewed and signed by me certifying that they contain all amendments reported by the Superintendent and visible in the finished works and accurately reflect the Works-as-Executed.

Contact Phone: _____ _____

Consulting Engineer/Surveyor Date

Contact Postal Address: _____ _____

Qualifications

_____

_____

_____

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C201

CONTROL OF TRAFFIC

SPECIFICATION C201 - CONTROL OF TRAFFIC

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SPECIFICATION C201 : CONTROL OF TRAFFIC

GENERAL

C201.01 SCOPE

1. The work to be executed under this Specification consists of all work necessary to provide for the safe movement of traffic and the protection of persons and property through and/or around the work site.

2. The extent of work includes the design, construction, maintenance and removal of temporary roadways and detours, the provision of traffic controllers, signposting, roadmarkings, raised pavement markers, lights, barriers and any other items required. All temporary traffic arrangements required by works under this Contract are included under this Specification except where specified otherwise. ***Works Included***

3. Control of traffic shall be in accordance with AS1742.3, SAA HB81, this Specification, the Traffic Management Plan and the Drawings. ***Standards***

4. Wherever the word 'should' occurs in AS 1742.3 the word 'shall' applies and the required action is the Contractor's responsibility. ***Contractor's Responsibility***

C201.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Australian Standards

AS 1165	-	Traffic Hazard Warning Lamps
AS 1742.3	-	Traffic Control Devices for Works on Roads
AS 1743	-	Road Signs Specifications
AS 1744	-	Standard Alphabets for Road Signs
AS 1906	-	Retroreflective Materials & Devices for Road Traffic Control Purposes
AS/NZS 4602	-	High visibility safety garments
SAA HB81	-	Field Guides for Traffic Control at Works on Roads

(b) AUSTROADS Publications

AUSTROADS	-	Guide to Traffic Engineering Practice - Intersections at Grade
AUSTROADS	-	Guide to the Geometric Design of Rural Roads

C201.03 TRAFFIC MANAGEMENT PLAN

1. The Contractor shall construct the work with the least possible obstruction to traffic. ***Minimise Obstruction***

2. The Contractor shall obtain all necessary approvals from Councils and other Authorities for temporary traffic arrangements except where specified otherwise. ***Contractor's Responsibility***

3. Two weeks before undertaking work which would involve any obstruction whatsoever to traffic the Contractor shall submit, for the Council's approval, a Traffic Management Plan in accordance with AS 1742.3. This constitutes a Hold Point. ***Traffic Management Plan***

HP

4. The Traffic Management Plan shall include:- ***Control PlanContents***

(a) design drawings for any temporary roadways and detours in accordance with Clause C201.11 showing pavement, wearing surface and drainage details,

(b) details of arrangements for construction under traffic in accordance with SAA HB81, and

(c) a signpost layout plan showing:

(i) location, size and legend of all temporary signs

(ii) temporary regulatory signs and temporary speed zones, and

(iii) all traffic control devices such as temporary traffic signals, linemarking, pavement reflectors, guideposts, guardfence and barrier boards.

(d) working times when traffic control measures are in place to minimise the disruption to traffic during periods of peak flows.

5. Where the Traffic Management Plan involves Regulatory Traffic Control Signs or Devices and/or where in the opinion of the Superintendent the disruption to local traffic is significant, the prior approval of the Council Local Traffic Committee will be sought and obtained. In such cases the period of notice shall be increased to five weeks in accordance with Clause C201.24. ***Notice***

6. The Traffic Management Plan shall be in accordance with the requirements of this Specification and the Drawings.

7. Special consideration to the safety of pedestrians and workers shall be given in the preparation of the Traffic Management Plan. Particular care shall be taken when requiring reversal of traffic flows or the separation of unidirectional flow by medians or other physical separation. ***Safety***

C201.04 SIDE ROADS AND PROPERTY ACCESSES

1. The Contractor shall provide safe and convenient passage for vehicles, pedestrians and stock to and from side roads and property accesses connecting to the roadway. Work which affects the use of side roads and existing accesses shall not be undertaken without providing adequate alternative provisions to the prior satisfaction of the Superintendent. ***Access***

WP

2. With the prior approval of the Superintendent, vehicular access may need to be denied due to particular construction activities. The Contractor is to keep these interruptions to an absolute minimum and must advise the property owners of such occurrences by way of letter drop at least 24 hours prior to such an interruption. The Contractor shall repeat this advice verbally to the property owner in a courteous manner. ***Notice to Property Owners***

WP

C201.05 TRAFFIC CONTROLLERS

1. Traffic controllers ar to be appropriately trained in the duties of traffic controllers in accordance with AS 1742.3 and SAA HB81. ***Trained Traffic Controllers***

C201.06 APPROVED CLOTHING FOR WORK PERSONNEL

1. All personnel shall wear high visibility clothing to the requirements of AS 1742.3 and AS/NZS 4602. ***Safety Clothing***

C201.07 TEMPORARY SPEED ZONING

1. Where a temporary speed limit has been approved by the Council or VicRoads, the Contractor shall arrange for the supply of appropriate temporary speed zoning signs, including posts and fittings, for erection. Where and when directed by the Superintendent, the Contractor shall erect these signs, cover the signs when the speed zone is not in use and remove the signs when the speed zone is no longer required as part of the provision for traffic. A diary recording operation times of the speed zone shall be kept by the Contractor.

Speed Zone Signs

C201.08 PLANT AND EQUIPMENT

1. During the day plant and equipment working in a position adjacent to traffic and having a projection beyond the normal width of the item, for example, a grader blade, shall have a fluorescent red flag attached to the outer end of the projection. During poor light conditions or at night, an additional traffic controller with an illuminated red wand shall direct traffic around such plant and equipment.

Plant Delineation

2. At night, where traffic is permitted to use the whole or portion of the existing road, all plant items and similar obstructions shall be removed from the normal path of vehicles to provide a lateral clearance of at least 6 m where practicable, with a minimum clearance of 1.2m.

Night Time Clearance

3. Plant and equipment, within 6m of the normal path of vehicles, shall be lit by not less than two yellow steady lamps suspended vertically from the point of the obstruction nearest to a traffic lane and one yellow steady lamp at each end of the obstruction on the side furthest away from the traffic lane.

Warning Lamps

TEMPORARY ROADWAYS AND DETOURS

C201.09 APPROVAL

1. The Contractor shall submit for the Council's approval the design of all proposed temporary roadways and detours.

Temporary Roads

C201.10 DESIGN STANDARDS

1. The standard of alignment and grading adopted shall be in accordance with specific provisions of this Specification and shall otherwise be in accordance with the AUSTROADS publication `Guide to the Geometric Design of Rural Roads'.

Alignment & Grading

2. Intersections shall be designed in accordance with the AUSTROADS publication `Guide to Traffic Engineering Practice - Intersections at Grade'.

Intersections

3. Design drawings, geometric standards, design speed, wearing surface type and pavement design of the proposed temporary roadways and detours shall be submitted by the Contractor with the Traffic Management Plan.

Standards & Pavement

C201.11 DESIGN DRAWINGS

1. Design drawings submitted for approval shall show:

Contents

(a) Alignment and grading at a horizontal scale of 1:2000 for rural roads and 1:500 for urban roads. Where the temporary road rejoins the existing road, levels showing the full cross section shall be extended along the existing road for a minimum length of 200m.

(b) A sight distance diagram if opposing traffic is to use a single carriageway

(c) Intersections, and any other locations where traffic may be required to make turning, merging or diverging movements, at a scale of 1:500.

(d) Pavement marking details.

(e) Pavement design details.

(f) Sufficient cross-sections to indicate the feasibility of making connections between various parts of the work.

(g) Sufficient dimensions, especially lane widths, to make clear the geometry and clearances of the proposed Works.

(h) A north point or some other location method to orientate the plan.

C201.12 DRAINAGE

1. Drainage structures and drains shall be constructed in accordance with the following Specifications: ***Standard***

C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C223	-	Drainage Structures
C224	-	Open Drains, including Kerb and Channel

2. Drainage proposed in accordance with Clause C201.03 shall be able to cope with upstream rainfall run-off resulting from all rainfall intensities up to that expected for a once in five year frequency, without overflow over the road. ***Design Frequency***

3. Pavements shall be designed and constructed to not pond water on the wearing surface or shoulders. Temporary formations to be constructed shall not dam water. ***Pavement Drainage***

C201.13 CONSTRUCTION OF EARTHWORKS AND PAVEMENT

1. Temporary roadways shall be constructed in accordance with the following Specifications: ***Temporary Roadways***

C211	-	Control of Erosion and Sedimentation
C212	-	Clearing And Grubbing
C213	-	Earthworks
C242	-	Flexible Pavements

C201.14 SURFACING

1. The wearing surface width shall extend across the full width of the traffic lanes plus the width for each shoulder, or as shown on the Drawings. ***Wearing Surface***

2. The wearing surface shall be carried onto any existing connecting roadway so as to finish square to the existing roadway centreline. ***Tie-in to existing work***

3. Surfacing shall be constructed in accordance with: ***Standards***

C244	-	Sprayed Bituminous Surfacing
		and/or
C245	-	Asphalt

C201.15 ROAD SAFETY BARRIER

1. W beam safety barrier shall be erected on all temporary embankments where the vertical height between the edge of the shoulder and the intersection of the embankment slope and natural surface exceeds 2m and as otherwise shown on the Drawings. ***Warrant***

2. Road Safety Barrier shall be erected in accordance with: ***Erection***

C264 - Non-Rigid Safety Barrier Systems (Public Domain)

C201.16 OPENING TO TRAFFIC

1. Temporary roadways and detours (including portable or temporary traffic signals sites) shall not be open to traffic until they have been inspected, approved and authorised in writing by the Superintendent. ***Approval to use***

2. All signposting, pavement marking, guardfence and portable or temporary traffic signals shall be completed before the opening of temporary roadways to traffic. ***Signposting***

3. Unless otherwise approved by the Superintendent, the opening of temporary roadways shall be arranged so that sections of existing roadway being replaced are not disturbed for a minimum of forty-eight hours in the event of temporary roadway failure and there is a warrant to redirect traffic back onto the existing roadway. The determination to redirect traffic shall be by the Superintendent. ***Existing Roadway Retained***

4. Unless otherwise approved by the Superintendent, traffic shall be switched to a temporary roadway or detour only where the Contractor's usual workforce will be on site for a minimum of two days thereafter. ***Traffic Switch***

C201.17 MAINTENANCE

1. The Contractor shall be responsible for the maintenance of temporary roadways and detours and shall ensure the road surface is kept safe for traffic. Any potholes or other failures shall be repaired without delay. ***Contractor's Responsibility***

C201.18 REMOVAL

1. Upon completion of the Work the temporary roadways and/or detour arrangements shall be removed and the area restored to a condition equivalent to that which existed prior to the commencement of the work. ***Restoration***

ARRANGEMENTS FOR TRAFFIC

C201.19 CONSTRUCTION UNDER TRAFFIC

1. Where a temporary roadway or a detour is not provided or available then, subject to the approval of the Superintendent, construction under traffic may be permitted provided a minimum of 3.5m lane width is available for through traffic on a two lane roadway and where 3.5m lanes are available in both directions for through traffic when working on multilane roads. ***Lane Width***

2. The carriageway/s shall be restored to a safe and trafficable state for through traffic prior to cessation of work each day in accordance with the approved Traffic Management Plan. ***Carriageway Restoration***

3. Full details of temporary signposting, traffic control devices and traffic control methods, in accordance with the appropriate arrangement diagrams in SAA HB81, are to be incorporated into the Traffic Management Plan. ***Signs and Markings***

C201.20 OPENING COMPLETED WORK

1. The Contractor shall give the Superintendent at least five working days written notice confirming the date of opening completed work to traffic. The procedure for opening shall be determined through consultation between the Superintendent, the Contractor and the Council. ***Written Notice***

2. The Contractor shall be responsible for the removal of all temporary traffic control devices no longer required for the safety of traffic, when the Works or part thereof are opened to traffic. ***Contractor's Responsibility***

TRAFFIC CONTROL DEVICES

C201.21 ARRANGEMENT OF TRAFFIC CONTROL DEVICES

1. The arrangement and placement of traffic control devices shall be carried out in accordance with the approved Traffic Management Plan, AS 1742.3 and SAA HB81. The arrangement diagrams illustrate the more common examples of the arrangement of traffic control devices and set out the minimum requirements. The traffic control devices shall be identified in the Traffic Management Plan. ***Arrangement Diagrams***

2. All temporary traffic control devices when no longer required shall be covered and/or removed without delay in order to maintain unambiguous safe guidance to traffic. ***Unnecessary Signs***

C201.22 MAINTENANCE OF TRAFFIC CONTROL DEVICES

1. All traffic control devices shall be maintained in accordance with AS 1742.3 so that they are in good order and in the correct positions day and night. They shall be neat and clean, and signs shall be clear and legible at all times. ***Contractor's Responsibility***

2. The Contractor may need to be contacted outside normal working hours to arrange for adjustments or maintenance of traffic control devices. The Contractor shall notify the Superintendent, the Council and the local Police, in writing, the names, addresses, and means of communicating with personnel nominated for this purpose. ***Out of Hours Contact***

C201.23 ADEQUATE TRAFFIC CONTROL DEVICES

1. Where the Contractor fails to provide and maintain adequate traffic control devices specified in this Specification, the Superintendent shall arrange to have such items provided and maintained. ***Default by Contractor***

C201.24 REGULATORY TRAFFIC CONTROL SIGNS AND DEVICES

1. A Regulatory Traffic Control Sign or Device shall be in accordance with AS 1742.3, and shall require approval by the Council's Delegated Officer. ***Prior Approval***

C201.25 SIGNS

1. Signs shall be designed and manufactured in accordance with AS 1743. Details of each letter shall be as shown in AS 1744. ***Specifications***

2. The reflective material used on signs shall be Class 2 material complying with AS 1906.1 except where otherwise specified. ***Reflective Material***

C201.26 SUPPLEMENTARY SIGNS

1. Signs supplementary to AS 1742.3 may be used in lieu of or in addition to those

shown in AS 1742.3 as follows:

- Heavy Machinery Crossing
- Cycle Hazard Grooved Road
- Tar Spraying Possible Short Delay
- Changed Traffic Conditions Ahead

C201.27 FLASHING ARROW SIGNS

1. Flashing arrow signs shall comply with AS 1742.3.

C201.28 BARRIER BOARDS

1. Barrier boards shall comply with AS 1742.3. ***Standard***

2. Trestles supporting the barrier boards may be manufactured of timber, metal or other suitable material and shall be yellow. The trestles shall provide firm supports for the barrier board and be kept in place by sandbags or other devices approved by the Superintendent. The bases of the trestles shall not protrude beyond the ends of the boards. ***Trestle Support***

C201.29 HIGH VISIBILITY MESH FENCING

1. High visibility mesh fencing shall be constructed where shown on the Drawings, Traffic Management Plan or as directed by the Superintendent.

2. High visibility mesh fencing shall be constructed in accordance with AS 1742.3, containment fences.

3. The mesh fencing shall be approximately 1m in height and of a red-orange coloured flexible material as approved by the Superintendent.

C201.30 TEMPORARY POST-MOUNTED DELINEATORS

1. In addition to the requirements of AS 1742.3, temporary post mounted delineators shall be provided in conjunction with high visibility mesh fencing which is erected parallel to and in close proximity to traffic.

C201.31 CONES AND BOLLARDS

1. Traffic cones and bollards shall comply with AS 1742.3 and be placed in accordance with the arrangement diagrams in SAA HB81. ***Standard and Placement***

2. Unless cones are firmly fixed in position they shall be used only while work is in progress, or in locations where there is an employee in attendance who shall reinstate any of the cones which have been dislodged by traffic. Otherwise they shall be removed and bollards or barriers substituted. ***Conditions of Use***

3. Cones and bollards used under night conditions shall be reflectorised in accordance with AS 1742.3. ***Reflectorised for Night Work***

C201.32 TRAFFIC WARNING LAMPS

1. Traffic warning lamps shall comply with AS 1165 and shall be installed in accordance with AS 1742.3. The Contractor shall ensure that warning lamps are in good working order, correctly aligned and positioned with respect to the direction of traffic flow ***Standards and Positioning***

each night, before the site is left unattended.

C201.33 TEMPORARY PAVEMENT MARKINGS

1. All pavement markings shall be reflectorised and consist of painted lines, roadmarking tape and/or raised pavement markers in accordance with the relevant Australian Standards or as otherwise approved by the Superintendent and shall be provided in accordance with AS 1742.3. ***Reflectorised Markings***

2. Where the adjoining roadway is edgelined, temporary roadways shall be similarly edgelined. ***Adjoining Work***

C201.34 TEMPORARY LINEMARKING

1. Where temporary linemarking is required on the final wearing surface, only pavement marking tape shall be used. ***On Final Surface***

2. Where the pavement linemarking has become ineffective in the opinion of the Superintendent, remarking shall be undertaken within forty-eight hours of direction by the Superintendent.

3. Where a single carriageway is opened adjacent to or used in lieu of an existing dual carriageway length, pavement arrows indicating the direction of flow of traffic shall be placed at not more than 500 m or at a spacing nominated by the Superintendent. The arrows shall be removed if the section is then reincorporated as dual carriageway. ***Pavement Arrows***

4. Immediately before or after placement of new markings all superseded pavement markings shall be obliterated or removed to the satisfaction of the Superintendent. ***Old Markings Removed***

5. On a final surface, obliteration by painting shall not be permitted.

C201.35 RAISED PAVEMENT MARKERS

1. Where raised pavement markers have become ineffective in the opinion of the Superintendent, they shall be replaced within twenty four hours of direction by the Superintendent. ***Ineffective Markers***

2. All superseded raised pavement markers shall be immediately removed from the pavement by the Contractor. ***Removal of Superseded Markers***

SPECIAL REQUIREMENTS

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CITY OF GREATER DANDENONG

DEVELOPMENT
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C211

CONTROL OF EROSION AND SEDIMENTATION

SPECIFICATION C211 - CONTROL OF EROSION AND SEDIMENTATION

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SPECIFICATION C211
CONTROL OF EROSION AND SEDIMENTATION

GENERAL

C211.01 SCOPE

1. The work to be executed under this Specification consists of the construction of structures and the implementation of measures to control erosion and sedimentation. These may be temporary or permanent.

2. The Contractor shall plan and carry out the whole of the Works to avoid erosion and sedimentation of the site, surrounding country, watercourses, waterbodies and wetlands.

3. All measures for erosion and sedimentation control shall be designed, installed and maintained by the Contractor in such a manner so as not to present a potential hazard to any person or property.

C211.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

Documents Standards Test Methods

(a) Council Specifications

C212	-	Clearing and Grubbing
C213	-	Earthworks
C224	-	Open Drains, Including Kerb and Channel
C273	-	Landscaping

(b) Victorian State Legislation

Environmental Protection Act, 1970
Water Act, 1989

(c) Other

Victorian Department of Natural Resources and Environment (DNRE)
Institute of Public Works Engineering Australia (IPWEA)
- Local Government Salinity Management Handbook (Draft, July 2001)

Kingston City Council and Melbourne Water:2003 – Keeping our Stormwater Clean – A Guide for Building Sites

C211.03 EROSION AND SEDIMENTATION CONTROL PLAN

1. For consideration of erosion and sedimentation control measures, the site shall be divided into sections based on the catchment area draining to each permanent drainage structure in the works. In addition to the area bounded by the road reserve, the sections shall include:

Site Sections

(a) access and haulage tracks,

(b) borrow pits and

(c) compound areas, such as Contractor's facilities and concrete batching areas.

2. The Contractor shall comply with the requirements of the Erosion and Sedimentation Control Plan as approved as part of the Development Design Plans. This Plan shall be superimposed on half-sized drainage drawings of the works and shall be detailed for each catchment area of the works. ***Section Plan***

3. The Plan shall consist of scale diagrams indicating: ***Plan Inclusions***

(a) features of the site including contours and drainage paths,

(b) relevant construction details of all erosion and sedimentation control structures,

(c) all permanent and temporary erosion and sedimentation control measures, including the control measures to be implemented in advance of, or in conjunction with, clearing and grubbing operations as required under the Specification for CLEARING AND GRUBBING,

(d) an order of works based upon construction and stabilisation of all culverts and surface drainage works at the earliest practical stage, and

(e) proposed time schedules for construction of structures and implementation of measures to control erosion and sedimentation.

4. In known salt affected areas, the Contractor shall seek advice from the relevant land and water resource authority to ensure that its Erosion and Sedimentation Control Plan conforms with the current salinity prevention measures outlined in the IPWEA publication, Local Government Salinity Management Handbook. ***Salinity Prevention***

5. No work shall commence until Council has approved the Erosion and Sedimentation Control Plan. Such approval shall not relieve the Contractor of the full responsibility to provide whatever measures are required for effective erosion and sedimentation control at all times. ***Contractor's Responsibility***

6. The Contractor shall adhere to the approved Erosion and Sedimentation Control Plan. The Contractor shall submit a revised Erosion and Sedimentation Control Plan for approval by Council fourteen days in advance of intended variation from the approved plan. ***Adherence to Plan***

C211.04 EROSION AND SEDIMENTATION CONTROL MEASURES

1. Erosion and sedimentation control measures shall include, but shall not be limited to, the following: ***Scope***

(a) The installation of permanent drainage structures before the removal of topsoil and commencement of earthworks for formation within the catchment area of each structure.

(b) The prompt completion of all permanent and temporary drainage works, once commenced, to minimise the period of exposure of disturbed areas.

(c) The stabilisation of diversion and catch drains to divert uncontaminated runoff from outside the site, clear of the site. Catch drains shall be installed and lined, as specified or as directed by the Superintendent, before the adjacent ground is disturbed and the excavation is commenced.

(d) The passage of uncontaminated water through the site without mixing with contaminated runoff from the site.

(e) The provision of contour and diversion drains across exposed areas before, during and immediately after clearing and the re-establishment and maintenance of these drains during soil removal and earthworks

operations.

(f) The provision of sediment filtering or sediment traps, in advance of and in conjunction with earthworks operations, to prevent contaminated water leaving the site.

(g) The restoration of the above drainage and sedimentation control works on a day to day basis to ensure that no disturbed area is left without adequate means of containment and treatment of contaminated water.

(h) The limitation of areas of erodible material exposed at any time to those areas being actively worked. Any area that is not approved by the Superintendent for clearing or disturbance by the Contractor's activities shall be clearly marked, fenced off or otherwise appropriately protected against any such disturbance.

(i) The minimisation of sediment loss during construction of embankments by means such as temporary or reverse superelevations during fill placement, constructing berms along the edge of the formation leading to temporary batter flumes and short term sediment traps.

(j) The progressive vegetation of the site, in accordance with the Specification for LANDSCAPING, as work proceeds.

(k) All stockpile sites shall be situated in areas approved for such use by the Superintendent. A 5m buffer zone shall exist between stockpile sites and any stream or flow path. All stockpiles shall be adequately protected from erosion and contamination of the surrounding area by use of the measures approved in the Erosion and Sedimentation Control Plan.

(l) Access and exit areas shall include shake-down or other methods approved by the Superintendent for the removal of soil materials from motor vehicles.

2. All permanent and temporary erosion and sedimentation control measures shall be constructed in accordance with the construction details in the Erosion and Sedimentation Control Plan and the details as shown on the Drawings.

PERMANENT EROSION AND SEDIMENTATION CONTROL

C211.05 EARTHWORKS FOR PERMANENT EROSION AND SEDIMENTATION CONTROL BASINS

Planned Levels

1. Earthworks for permanent erosion and sedimentation control basins shall be constructed to the planned levels and dimensions shown on the Drawings.

Site Preparation

2. The entire storage and embankment foundation area of permanent erosion and sedimentation control basins shall be cleared in accordance with the Specification for CLEARING AND GRUBBING and shall be stripped of topsoil and any unsuitable material under embankments removed in accordance with the Specification for EARTHWORKS.

Compaction Requirements

3. The embankments shall be constructed in accordance with the Specification for EARTHWORKS.

C211.06 INLETS, SPILLWAYS AND LOW FLOW OUTLETS FOR SEDIMENTATION CONTROL BASINS AND SEDIMENT TRAPS

Rock Mattresses

1. Inlets and spillways shall be constructed using rock filled woven galvanised steel mattresses and geotextiles, as shown on the Drawings. The rock filled mattresses shall be installed in accordance with the requirements for rock filled wire mattress and geotextile in the Specification for OPEN DRAINS, INCLUDING KERB AND CHANNEL.

2. A low flow outlet consisting of a 150mm diameter plastic pipe shall be installed as shown in the Drawings. ***Plastic Pipe Outlet***

C211.07 DROP INLET SEDIMENT CONTROL

1. Drop inlet sediment traps and inlet control banks shall be constructed on completion of each gully pit unless otherwise directed by the Superintendent. These drop inlet sediment traps and inlet control banks are additional to the temporary sedimentation control measures that may be required under Clause C211.10 during construction of the gully pits. ***Time of Construction***

2. The drop inlet sediment traps are intended to remove sediment from the surface flow before it enters the drainage system. The inlet control banks shall be constructed as required to prevent the surface flows bypassing the gully pits. ***Purpose***

3. The drop inlet sediment traps shall be constructed as shown on the Drawings. The associated inlet control banks shall consist of at least two courses of sandbags containing a 10:1 sand/cement mix. The bags shall be keyed at least 25mm into the surface, dampened sufficiently to ensure hydration of the cement and tamped lightly to provide mechanical interlock between adjacent bags. ***Control Banks***

C211.08 CLEANING SEDIMENTATION CONTROL STRUCTURES

1. The Contractor shall clean out permanent sedimentation control structures, cleaning out whenever the accumulated sediment has reduced the capacity of the structure by 50 per cent or more, or whenever the sediment has built up to a point where it is less than 300mm below the spillway crest. All permanent sedimentation control structures shall be cleaned out by the Contractor prior to Practical Completion of the Works. ***Contractor's Responsibility***

2. Accumulated sediment shall be removed from permanent sedimentation control structures in such a manner as not to damage the structures. The sediment removed shall be disposed of in such locations that the sediment will not be conveyed back into the construction areas or into watercourses. The Contractor shall provide and maintain suitable access to permanent sedimentation control structures to allow cleaning out in all weather conditions. ***Removal of Sediment***

TEMPORARY EROSION AND SEDIMENTATION CONTROL

C211.09 GENERAL

1. The Contractor shall ensure that effective erosion and sedimentation control is provided at all times during the Contract. ***Contractor's Responsibility***

2. Runoff from all areas where the natural surface is disturbed by construction, including access roads, depot and stockpile sites, shall be free of pollutants before it is either dispersed to stable areas or directed to natural watercourses. The Contractor shall be responsible for all temporary erosion and sedimentation control measures required for this purpose. ***Pollutant Free***

3. The Contractor shall provide and maintain slopes, crowns and drains on all excavations and embankments to ensure satisfactory drainage at all times. Water shall not be allowed to pond on the works unless such ponding is part of an approved Erosion and Sedimentation Control Plan. ***Maintenance by Contractor***

C211.10 TEMPORARY DRAINS

1. Runoff from areas exposed during the work shall be controlled by construction of ***Control of***

temporary contour drains and/or temporary diversion drains. Generally, a temporary contour drain or temporary diversion drain takes the form of a channel constructed across a slope with a ridge on its lower side. They may require progressive implementation and frequent alteration as the work progresses. ***Runoff***

2. Contour drains, which follow points on the natural surface of approximately the same elevation, shall be provided immediately after a construction site is cleared to intercept and divert runoff from the site to nearby stable areas at non-erosive velocities. Contour drains shall be formed with a grade of neither less than 1 per cent nor more than 1.5 per cent and shall be spaced at intervals of neither less than 20 m nor more than 50 m, depending on the erodibility of the exposed soil. Contour drains shall be constructed as shown on the Drawings. ***Contour Drains***

3. Diversion drains shall be provided across haul roads and access tracks when such roads and access tracks are identified as constituting an erosion hazard due to their steepness, soil erodibility or potential for concentrating runoff flow. Diversion drains shall be formed to intercept and divert runoff from the road or track to stable outlets. Spacing of diversion drains shall not be greater than that required to maintain runoff at non-erosive velocities. ***Diversion Drains***

C211.11 TEMPORARY SEDIMENT TRAPS

1. Temporary sediment-trapping devices shall be provided during construction to remove sediment from sediment-laden runoff flowing from areas of 0.5 hectares or more before the runoff enters natural watercourses or adjacent land. ***Sediment Traps***

C211.12 BATTER PROTECTION

1. The Contractor shall take all necessary action to protect batters from erosion during the Contract. ***Contractor's Responsibility***

2. Scour of newly-formed fill batters during and after embankment construction shall be minimised by diverting runoff from the formation away from the batter until vegetation is established. ***Scour Control***

C211.13 MAINTENANCE AND INSPECTION

1. The Contractor shall inspect all temporary erosion and sedimentation control works after each rain period and during periods of prolonged rainfall. Any defects revealed by such inspections shall be rectified immediately and these works shall be cleaned, repaired and augmented as required, to ensure effective erosion and sedimentation control thereafter. ***Contractor's Responsibility***

2. The Contractor shall provide and maintain access from within the road reserve or from other locations acceptable to the Superintendent, for cleaning out sedimentation control works. ***Access***

C211.14 REMOVAL

1. All temporary erosion and sedimentation control works shall be removed by the Contractor when revegetation is established on formerly exposed areas before the end of the Contract. All materials used for the temporary erosion and sedimentation control works shall be removed from the site or otherwise disposed by the Contractor to the satisfaction of the Superintendent. ***Contractor's Responsibility***

SPECIAL REQUIREMENTS

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C212

CLEARING AND GRUBBING

SPECIFICATION C212 - CLEARING AND GRUBBING

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SPECIFICATION C212
CLEARING AND GRUBBING

C212.01 SCOPE

Extent of Work

1. The work to be executed under this Specification consists of the clearing of all vegetation, both living and dead, all minor man-made structures (such as fences and livestock yards), all rubbish and other materials which, in the opinion of the Superintendent, are unsuitable for use in the Works, the chipping of the crowns of trees and the branches of shrubs, and the grubbing of trees and stumps from the area defined in Clause C212.02. The work also includes the disposal, in accordance with Clause C212.05 and C212.06, of all materials that have been cleared and grubbed. All natural landscape features, including natural rock outcrops, natural vegetation, soil and watercourses are to remain undisturbed except where affected by the Works as approved by the Council.

Erosion Control

2. In advance of or in conjunction with clearing and grubbing operations, effective erosion and sedimentation control measures shall be implemented in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

Boundary Fence Line

3. The clearing and grubbing required for boundary fencing is included in the Pay Item for Boundary Fencing and does not form part of the work under this Specification.

4. Explosives shall not be permitted to be used in clearing, grubbing or other demolition activities without the prior written approval of the Council.

C212.02 LIMITS OF CLEARING

Limits of Clearing

1. Unless otherwise specified or directed, the area to be cleared is that required by site regrading works, including the area occupied by the completed road formation and associated drainage works and erosion and sedimentation measures, plus a clearance of 2m beyond tops of cuts and toes of embankments. The Contractor shall ensure that only the absolute minimum area for construction is cleared.

Indicator Pegs

2. Before clearing commences, the limits of clearing shall be marked by pegs placed by the Contractor at 25m intervals around the area to be cleared.

C212.03 CLEARING OPERATIONS

Extent

1. The area within the limits of clearing shall be cleared of all vegetation, both living and dead, all minor man-made structures (such as fences and livestock yards), all rubbish and other materials which, in the opinion of the Superintendent, are unsuitable for use in the Works with the exception of certain trees marked for preservation. The Contractor shall plan clearing operations such that wherever possible, clearing is carried out progressively and only the minimum area of land is left disturbed at any time.

Trees to be preserved

2. The Contractor shall give the Superintendent written notice of seven days of the intention to clear any area of the work. The trees that are to be preserved are to be marked on the approved Development Design Plans. Council may nominate additional trees to be preserved. The Contractor shall arrange for an inspection by Council's Delegated Officer and shall obtain Council's approval to proceed with clearing and grubbing. Trees that shall be preserved shall be protected during site works by the erection of solid barricades, as shown on the Drawings and, generally at a distance of 4m from the trunk of the tree, unless otherwise authorised by the Superintendent. Refer to Tree Preservation Guidelines/Street Tree Strategy from Mick Smith

Utility Services

3. The Contractor shall take all measures to prevent damage to existing underground and overhead utility services.

4. The erection of structures, excavation and filling, changes to soil profiles, stockpiling of spoil, storage of other materials and driving or parking of any vehicle or machinery within 4m of the trunks of trees to be retained shall not be permitted unless part of the Works as approved by the Council. ***Disturbance Near Trees***

5. Damage to trees shall also include damage to bark and root systems. No tree roots are to be cut without the prior approval of the Superintendent and Council's Delegated Officer.

6. The Contractor shall plan all operations to ensure that there is no damage to any trees outside the limits of clearing specified or directed by the Superintendent. No growing trees shall be destroyed or damaged by the Contractor other than those specified and those indicated on the approved Development Design Plans or nominated by Council. ***Trees outside Limits of Work***

7. Any tree remaining within the road reserve but outside the limits of clearing which is, in the opinion of the Superintendent, unsound and likely to fall upon the roadway shall be cleared and disposed of in accordance with Clause C212.05, subject to prior approval of Council's Delegated Officer. ***Unsound trees in Road Reserve***

8. If directed by the Superintendent any branch, which overhangs the road formation, shall be cut back to within 0.5m of the tree trunk and disposed of in accordance with Clause C212.05. ***Overhanging branches***

9. Every precaution shall be taken to prevent timber from falling on private property and the Contractor shall dispose of any timber so fallen or produce the written consent of the owner to its remaining there. The cost of disposal of such fallen timber shall be borne by the Contractor. Prior to entering private property, the Contractor shall obtain consent from the Superintendent and the property owner ***Debris in Private Property***

10. Damage of any kind, including damage to trees, fencing, occurring during clearing operations shall be made good by the Contractor. ***Damage to Property***

C212.04 GRUBBING

1. All trees and stumps, on or within the limits of clearing, unable to be felled and removed by the clearing methods used by the Contractor shall be removed by grubbing. ***Extent***

2. Grubbing operations shall be carried out to a depth of 0.5m below the natural surface or 1.5m below the finished surface level, whichever is the lower. ***Depth***

3. Holes remaining after trees and stumps have been grubbed shall be backfilled promptly with sound material to prevent the infiltration and ponding of water. The backfilling material shall be compacted to at least the relative density of the material existing in the adjacent ground. ***Backfill Holes***

C212.05 CHIPPING OF CLEARED VEGETATION

1. The Contractor shall produce a wood-chip mulch derived from crowns of trees and branches of shrubs cleared under this Specification. The wood-chip mulch produced shall be stockpiled for subsequent use in accordance with the Specification for LANDSCAPING or for use at other locations as appropriate. ***Wood-chip Mulch***

2. The wood-chip mulch shall be produced from branches having a maximum diameter of 100 millimetres and the chipped material produced shall not have two orthogonal dimensions exceeding 75mm and 50mm. ***Dimensions***

C212.06 DISPOSAL OF MATERIALS

1. Unless otherwise specified elsewhere, all materials cleared and grubbed in accordance with this Specification shall become the property of the Contractor and shall be removed from the site and legally disposed of. ***Removal from Site***

2. Disposal of timber and other combustible materials by burning shall not be permitted. ***Burning not Permitted***

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CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C213

EARTHWORKS

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SPECIFICATION C213 : EARTHWORKS

GENERAL

C213.01 SCOPE

Scope

1. The work to be executed under this Specification consists of:-

   (a) removal of topsoil

   (b) all activities and quality requirements associated with site regrading, the excavation of cuttings, the haulage of material and the construction of embankments to the extent defined in the Drawings and Specification.

   (c) removal and replacement of any unsuitable material,

   (d) any spoil or borrow activities associated with earthworks, and

   (e) any additional processing of selected material for the selected material zone.

Quality

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

C213.02 REFERENCE DOCUMENTS

Documents Standards Test Methods

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specifications

C201	-	Control of Traffic
C211	-	Control of Erosion and Sedimentation
C212	-	Clearing and Grubbing
C220	-	Stormwater Drainage - General
C273	-	Landscaping

(b) Australian Standards

AS 1289.6.1.1	-	Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen.
AS 1289.3.3.1	-	Calculation of the plasticity index of a soil.
AS 1289.5.1.1	-	Determination of the dry density/moisture content relation of a soil using standard compactive effort.
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio.
AS 1289.5.7.1	-	Compaction Control Test (Rapid Method).
AS 2187		Explosives - Storage, transport and use (SAA Explosive Code)
		Part 1 Storage
		Part 2 Use of explosives

(c) Other

AUSTROADS	-	Explosives in Roadworks, Users Guide 1982.
EPA	-	State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade No. N1), Occupational Health and Safety (Noise) Regulations and Code of Practice for Noise.

C213.03 NATURAL SURFACE AND EARTHWORKS MATERIALS

(a) Natural Surface

1. The Contractor shall use a suitable qualified surveyor to provide construction set out services for the duration of the construction. They surveyor must be either a licenced surveyor or a surveyor working under the direction of a licenced surveyor.

Contractor's Surveyor

2. Computer generated road design data files in the format of the approved software containing the ground model may be supplied to the Contractor as advised prior to commencement of the Contract. If desired, the Contractor may verify the accuracy of the model by field surveys. If the Contractor considers any areas of the model not to be representative, or submitted plans to be inaccurate, the Contractor shall give not less than seven (7) days notice prior to commencement of Works to the Superintendent to allow checking. If the subsequent check survey reveals the ground model to be correct, then the Contractor shall bear the cost of the check survey.

Verify Accuracy of Ground Model

WP

(b) Earthworks Materials

1. The Contractor shall be responsible for any assumptions made by the Contractor in relation to the nature and types of the materials encountered in excavations and the bulking and compaction characteristics of materials incorporated in embankments.

Material Characteristics

2. The estimated quantity for general earthworks at any cutting includes all types of materials which may be encountered in the cutting.

3. Where material from excavations is acceptable for use in embankments, but the Contractor elects to:-

Embankment Material Deficiency

(a) Spoil it, or

(b) Use it for the Contractor's own purposes, or

(c) Use it as a source of pavement materials, or

(d) Construct embankments with dimensions in excess of those specified.

and a deficiency of material for embankment construction is thereby created, the Contractor shall make good that deficiency from sources of material meeting the quality requirements specified in Clause C213.23.

C213.04 PROTECTION OF EARTHWORKS

1. The Contractor's responsibility for care of the Works shall include the protection of earthworks.

Contractor's Responsibility

2. The Contractor shall install effective erosion and sedimentation control measures in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION, prior to commencing earthworks, and shall maintain these control measures for the duration of the contract.

Erosion and Sedimentation Control

3. Adequate drainage of all working areas shall be maintained throughout the period of construction to ensure run-off of water without ponding, except where ponding forms part of a planned erosion and sedimentation control system. In salt affected areas, the Contractor shall take adequate precautions to minimise ingress of surface water into the groundwater table.

Drainage of Working Areas/Salinity Prevention

4. When rain is likely or when work is not proposed to continue in a working area on the following day, precautions shall be taken to minimise ingress of any excess water into earthworks material. Ripped material remaining in cuttings and material placed on

Wet Weather Precautions

embankments shall be sealed off by adequate compaction to provide a smooth tight surface.

5. Should insitu or stockpiled material become over wet as a result of the Contractor not providing adequate protection of earthworks, the Contractor shall be responsible for replacing and/or drying out the material and for any consequent delays to the operations. ***Wet Material***

C213.05 SETTING OUT OF EARTHWORKS

1. Before earthworks operations commence and after survey controls are in place, batter profiles shall be established by the Contractor and the necessary pegs driven at 25m intervals or at each cross section shown on the Drawings, whichever is the lesser. The chainage/station, offset from control line and slope distance to finished surface level, shall be clearly marked on each peg. ***Batter Profiles***

2. The batter profiles shall be repositioned by the Contractor at each change in the slope of the batter and at intervals of not more than 5m of vertical height. ***Profile Location***

3. All pegs and batter profiles shall be maintained in their correct positions. They shall be removed by the Contractor on completion of the contract or separable part. ***Retention and Removal of Pegs***

4. The foregoing shall be the minimum requirement. Additional pegs and profiles may be required to suit the Contractor. These shall not be painted with the same colours used for the specified setting out pegs and stakes. ***Additional Pegs***

5. The position and extent of all transitions from cuttings to embankments and foundations for shallow embankments shall be marked with clearly labelled stakes in accordance with Clauses C213.15 and C213.24. ***Transitions Cuttings/ Embankments***

C213.06 STOCKPILE SITES

1. The Contractor shall obtain the written consent of the Superintendent to the use of any stockpile site which is not shown on the Drawings. Proposals in this regard shall be submitted at least three working days before stockpiling is due to commence and shall specify the maximum dimensions of the proposed stockpile. ***Additional Stockpile Sites***

WP

2. Any clearing and grubbing required for these sites shall be carried out in accordance with the Specification for CLEARING AND GRUBBING. Temporary erosion and sedimentation control measures shall be taken in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION. ***Clearing and Grubbing***

3. Restoration of stockpile sites following completion of the work shall be carried out in accordance with the Specification for LANDSCAPING. ***Restoration***

REMOVAL OF TOPSOIL

C213.07 SCOPE

1. Topsoil is surface soil which is reasonably free from subsoil, refuse, clay lumps and stones. ***Definition***

2. Removal of topsoil from any section of the Works shall only commence after erosion and sedimentation controls have been implemented and when clearing, grubbing and disposal of materials have been completed on that section of the Works in accordance with the Specifications for CONTROL OF EROSION AND SEDIMENTATION and CLEARING AND GRUBBING. ***Prerequisites***

3. Topsoil throughout the length of the Work shall be removed and stockpiled ***Extent of Work***

separately clear of the Work with care taken to avoid contamination by other materials The work shall include the following:-

(a) Cuttings ***WP***

Removal of the topsoil to a depth quoted in Annexure C213A or as directed by the Superintendent.

(b) Embankments

WP

Removal of topsoil over the base of embankments up to the depth below the natural surface quoted in Annexure C213A, or as directed by the Superintendent. For those embankments or sections of embankment where the height of embankment from natural surface to underside of pavement is less than two metres, topsoil which is deeper than the depth quoted in Annexure C213A shall be removed to its full depth as directed by the Superintendent.

(**c) Other Locations**

Removal of topsoil as directed by the Superintendent. ***WP***

C213.08 SURVEY AFTER REMOVAL OF TOPSOIL

1. The Contractor shall determine the surface levels in each cutting and embankment at sufficient locations to ensure compliance with the approved Development Design Plans. A schedule of these surface levels shall be submitted to the Superintendent for concurrence at least three working days before commencement of any work which will alter the ground surface as surveyed. Such work shall only commence with the approval of the Superintendent. ***Establish Surface Level***

C213.09 TOPSOIL STOCKPILES

1. The maximum height of stockpiles shall not exceed 2.5m and the maximum batter slope shall not exceed 2h:1v. ***Height and Batter***

2. Topsoil stockpiles shall not contain any timber or other rubbish and shall be trimmed to a regular shape. ***Stockpiles Trimmed***

3. To minimise erosion, stockpile batters shall be track rolled or stabilised by other means acceptable to the Superintendent. ***Erosion Control***

WP

4. Where seeding of stockpiles to encourage vegetation cover is specified, such work shall be carried out in accordance with the Specification for LANDSCAPING. ***Seeding Stockpile***

CUTTINGS

C213.10 SCOPE

1. Construction of cuttings shall include all operations associated with the excavation of material within the limits of the batters including benching, treatment of cutting floors and transition from cut to fill. ***Extent of Work***

C213.11 EXCAVATION

1. Materials encountered in cuttings shall be loosened and broken down as required so that they are acceptable for incorporation in the Works. In this regard, the Contractor's attention is drawn to Clauses C213.21, C213.22 and C213.23.

2. Cuttings shall have batter slopes as shown on the Drawings or as redetermined ***Batter Slopes***

by the Superintendent on the basis of site inspection and investigation during the excavation.

WP

3. The tops of all cuttings shall be neatly "rounded".

4. In all cuttings, undulations in the general plane of the batter shall not be permitted except that batters may require progressive flattening at the ends of cuttings due to the presence of less stable material.

Batters to be Even

5. Cut faces shall be cleaned of loose or unstable material progressively as the excavation proceeds.

Unstable Material

6. Where, after the removal of topsoil as specified in Clause C213.07, material of variable quality or moisture content is encountered, the Contractor shall adjust his excavation methods to ensure blending of the materials, to obtain material meeting the requirements of Clause C213.23.

Blending Material

C213.12 BATTER TOLERANCES

1. The tolerances for the excavation of batters, measured at right angles to the design grade line, shall be ±300mm.

Batter Tolerances

2. If the Contractor excavates the batter beyond the batter slope line and the tolerance applicable thereto, the Superintendent may authorise a minor change in the general slope of the batter to suit the convenience of the Contractor, but such a change shall not be regarded as a redetermination of the batter slope under Clause C213.11. Alternatively the Contractor shall submit details of the material and/or methods proposed to restore the specified slope and stability of the batter for the Superintendent's approval.

Excavation beyond Batter Line

3. For batters steeper than 1:1, if any section of the batter up to a height of 3m above the table drain level has been over excavated beyond the tolerance limit specified, the Superintendent may direct that the batter be restored to the average batter slope using randomly mortared stone. The stone shall be similar to the sound rock in the cutting and the mortar shall be coloured to match the colour of the rock.

Restoration of Batter Slope

C213.13 BENCHING IN CUTTINGS

1. Cut batters shall be benched as shown on the Drawings to provide drainage and erosion control. Notwithstanding the tolerances permitted under Clause C213.12, bench widths shall not be less than those shown on the Drawings.

Bench Construction

2. Benches shall be maintained and cleaned of loose stones and boulders regularly throughout the Contract period.

Bench Maintenance

C213.14 TREATMENT OF FLOORS OF CUTTINGS

1. The floors of cuttings shall be excavated, parallel to the designed grade line, to a designed floor level which shall be at the underside of the selected material zone or where there is no selected material zone, to the underside of the pavement subbase. The floors shall then be trimmed to a level of not more than 50mm above or below the designed floor level. Where the Superintendent considers that any underlying material is unsuitable for pavement support, the Superintendent may direct that it be removed in accordance with Clause C213.21.

Excavation Level

WP

2. The Contractor shall rip or loosen all material in the floor to a minimum depth of 200mm below the designed floor level for the width of the selected material zone (or subbase layer, where no selected material zone). The maximum dimension of any particles in the ripped or loosened zone shall not exceed 150mm.

Floor Material Ripped

3. Prior to ripping or loosening the cutting floor the Contractor shall determine the

CBR Testing

CBR of the material in the floor by AS 1289.6.1.1. Sufficient tests shall be taken to represent all the various materials which may exist in the cutting floor. If material in the floors of cuttings has a CBR value less than the value quoted in Annexure C213A, the Superintendent will direct the action to be taken.

4. Ripped or loosened material shall be made available for inspection by the Superintendent before recompaction commences. It shall be recompacted in accordance with Clause C213.36. No account shall be taken of the volume involved in loosening when measuring the volume of excavations. ***Inspection by Superintendent***

5. After recompaction, the floors of cuttings shall be re-trimmed parallel with the finished wearing surface so that their levels do not vary more than 10mm above or 40mm below the designed floor levels. ***Level Tolerances***

6. Prior to placing any subsequent layers over the completed cutting floor, the Contractor shall present the completed surface to the Superintendent for inspection. The Contractor shall verify as part of the quality system that the completed surface has achieved full conformance with all respects of this Specification. ***HP***

C213.15 TRANSITION FROM CUT TO FILL

1. After the removal of topsoil and before the excavation of any cutting commences the Contractor shall survey and mark the position of the intersection line between cutting and embankment occurring at the underside of the selected material zone or pavement subbase. ***Intersection Line***

2. Following excavation to the cutting floor, a terrace shall be excavated for the width of the selected material zone (or subbase layer, where no selected material zone) to a depth of 600mm below and parallel to the cutting floor, as shown in Figure C213.1. ***Terrace Construction***

3. The terrace shall extend into the cut to the point where the cutting floor is 600mm below the original stripped surface, or a distance of 20 metres, whichever is the lesser. ***Extent of Terrace***

4. The material excavated shall be either incorporated in the embankments or spoiled as directed by the Superintendent. Material incorporated in embankments shall be included in the excavated volume for General Earthworks and material spoiled shall be included in the excavated volume of Unsuitable Material to Spoil. ***Excavated Quantity***

5. The material placed above the terrace shall satisfy the requirements of Clause C213.23 and shall be compacted in accordance with Clause C213.36. ***Quality and Compaction***

BLASTING

C213.16 GENERAL

1. When explosives are permitted to be used by Council, the Contractor shall obtain all necessary licences from the appropriate authorities, and shall comply with all Government and Council regulations relating to transport, storage, handling and the use of explosives and also to the rules set out in AS2187, Parts 1 and 2. The transport of explosives shall be in accordance with the Australian Code for the Transport of Explosives by Rail and Road. Copies of the relevant licences and permits are to be provided to the Superintendent. ***Contractor to Obtain Licences*** ***HP***

2. The Contractor shall be liable for any accident, damage or injury to any person, property or thing, resulting from the use of explosives. ***Contractor's Responsibility***

3. Before the start of blasting operations, the Contractor, in the presence of the Superintendent, shall conduct a survey to determine and record the existing condition of all structures likely to be affected by any blast. ***Pre-blast Survey***

4. Structures shall include public utilities. The survey shall include all structures within 500m of any blast but shall be extended where the maximum instantaneous charge proposed is likely to produce peak particle velocities greater than allowable at structures more remote from a blast site. A written report of the survey, supported by photographs where necessary, together with a list of any existing defects in the structures, shall be submitted to the owner of each structure and to the Superintendent before blasting commences. ***Amendment Extent of Survey***

5. The Contractor shall advise the Superintendent of the proposed maximum instantaneous charge and the Contractor's validation of the adequacy of the proposed structural survey at least three working days before the survey is due to commence. The Superintendent may direct amendments to the scope of the survey as a result of blast monitoring during the work. All costs associated with the surveys and reports shall be borne by the Contractor. ***Amendment to Extent of Survey***

6. Before each blasting operation, the Contractor shall submit to the Superintendent written details of the proposed blasting procedure including the quantity and type of explosive to be detonated, the blasting pattern to be used and measures proposed to limit noise and to ensure that vibration from blasting does not adversely affect nearby structures. ***Proposed Blasting Procedure***

7. Ground vibration caused by blasting shall not exceed the values of peak particle velocity listed in Table C213.1: ***Ground Vibration***

Point of Potential Damage (within 1km of blasting site)	**Peak Particle Velocity**
Completed and cured bridge structures or sub-structures (eg completed abutment)	25mm/sec
Bridgeworks and structural retaining walls under construction	20mm/sec
Residential premises, schools, hospitals and other buildings	5mm/sec (with 10% not to exceed 10mm/sec)
Buildings or monuments of historical significance	2mm/sec

Table C213.1 - Limiting Peak Particle Velocity

8. The Contractor shall advise all residents within a radius of 1km, by letter drop before blasting operations commence, of the likely times, frequency and duration of blasting and precautions being taken to ensure that damage to property will not result. ***Advice to Residents***

9. Unless otherwise approved, blasting operations shall be confined to the periods Mondays to Fridays (excluding public holidays), 9am to 3pm. ***Time Limits***

10. When blasting operations are being carried out, precautions shall be taken relating to the safety of persons and animals and the road shall be closed to traffic and the appropriate signs erected in accordance with the Specification for CONTROL OF TRAFFIC. A standard warning procedure such as that given in the AUSTROADS Explosives in Roadworks, Users Guide 1982 shall be established and observed at all times. ***Safety Precautions***

C213.17 PRESPLITTING

1. Where presplitting is carried out the spacing of presplit drill holes shall not exceed 750mm centre to centre. ***Presplitting***

C213.18 BLASTING RECORDS

1. The Contractor shall maintain accurate records of each blast showing the details listed below:- ***Records to be kept***

Date and time of blast

Location, number and diameter of holes loaded

Depth of each hole loaded

Inclination of holes

Maximum and minimum burden

Types of explosives used

Charge distribution in each hole

Maximum instantaneous charge

Delay periods and sequence

Total amount of charges in the blast

Length and type of stemming in each hole

2. The records shall be prepared as holes are loaded and signed by the Powderman. A copy shall be provided to the Superintendent on the day of the blast. ***Record Preparation***

C213.19 CONTROL OF AIR BLAST OVER-PRESSURE

1. This Clause shall apply only where a noise sensitive location exists within 1km of the blasting site. ***Incidence***

2. The Contractor's attention is drawn to the recommendations given in the State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade No. N1), Occupational Health and Safety (Noise) Regulations and Code of Practice for Noise for the reduction of air blast over-pressure. ***Noise Control Manual***

3. The noise emanating from blasting operations shall not exceed an over-pressure level of 115 decibels (linear peak) at any noise sensitive location (such as residential premises, schools or hospitals). Up to 10 per cent of the total number of blasts may exceed this value provided a level of 120 decibels is not exceeded at any time. ***Noise Limitations***

4. The Contractor shall arrange for the monitoring of air blast over-pressure to ensure compliance with the specified limits. All monitoring shall be carried out by personnel possessing current NATA registration for such monitoring. All test results shall be reported on NATA endorsed test certificates which shall include a clear statement as to compliance or non-compliance with the requirements of this Specification. In general, a monitoring location will be near the perimeter of the noise sensitive location at the point closest to the maximum charge. The Contractor shall submit a copy of the monitoring record to the Superintendent. ***Monitoring of Air Blast Over-Pressure***

5. In the event that the measured air blast over-pressure exceeds the specified limits, the Contractor shall suspend further blasting work and shall submit to the Superintendent proposals detailing any additional steps and precautions the Contractor shall take to ensure that for any future blast, the limiting over-pressure shall not be ***Excessive Air Blast Over-Pressure***

exceeded. The Contractor shall not resume any blasting until such proposals have been submitted.

C213.20 CONTROL OF GROUND VIBRATION

Monitoring Vibrations

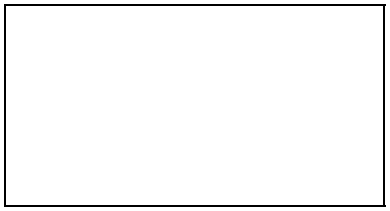
1. The Contractor shall arrange for the monitoring of ground vibrations to ensure compliance with the peak particle velocity limits shown in Table C213.1. All monitoring shall be carried out by personnel possessing current NATA registration for such monitoring. All test results shall be reported on NATA endorsed test certificates which shall include a clear statement as to compliance or non-compliance with the requirements of this Part of the Specification. In general a monitoring location shall be near the perimeter of the structure or building at the point closest to the maximum charge. The Contractor shall submit a copy of the monitoring record to the Superintendent.

Blasting Site Relationship

2. To minimise the risk of peak particle velocity limits being exceeded, the Contractor shall develop a blasting site relationship between peak particle velocity, distance and blasting charge.

Maximum Instantaneous Charge

3. For the first blast, monitors shall be set up at not less than five points at varying distances away from the blasting site. The Maximum Instantaneous Charge for the first blast shall not exceed that calculated from the following formula:



where MIC = Maximum Instantaneous Charge in kilograms

D = Distance in metres from charge to the point of potential damage

PPV = limiting peak particle velocity from Table C213.1

4. A log-log (base 10) graph of measured peak particle velocity (vertical axis) versus Scaled Distance (horizontal axis) shall be plotted, where

$$\text{Scaled Distance} = \frac{D}{\sqrt{MIC}}$$

The mean regression line shall be obtained by the least squares method.

Adjustment of Blast Design

5. For subsequent blasts, the MIC and other aspects of blast design may be adjusted provided that further ground vibration monitoring is undertaken and the mean regression line redetermined to demonstrate that peak particle velocity limits are not exceeded. The Contractor shall make the regression line plots available to the Superintendent, if so requested.

UNSUITABLE MATERIAL

C213.21 GENERAL

Definition

1. Unsuitable material is that occurring below the designed floor level of cuttings and below the nominated depth for stripping topsoil beneath embankments, which the Superintendent deems to be unsuitable for embankment or pavement support in its present position. Unsuitable material also includes material in cuttings which the Superintendent deems to be unsuitable for embankment construction.

2. Such material shall be excavated to the extent directed by the Superintendent. Material removed as unsuitable, as directed by the Superintendent, shall be incorporated in embankments in accordance with Clause C213.23 or spoiled in accordance with Clause C213.34. ***Extent of Excavation***

3. After removal of the unsuitable material, the floor of the excavation shall be re-presented to the Superintendent for inspection, prior to backfilling with replacement material, to determine whether a sufficient depth of unsuitable material has been removed. Prior to placing replacement material the excavated surface shall be compacted in accordance with Clause C213.36. ***Floor Inspection***

4. The unsuitable material which has been removed shall be replaced with material from cuttings, or with material borrowed in accordance with Clause C213.35, of the quality specified in Clause C213.23. Replacement material is deemed to form part of embankment construction. It shall be placed in accordance with Clause C213.26 and compacted in accordance with Clause C213.36. ***Replacement Material***

5. All costs associated with reworking or replacing any material which the Superintendent deems to have become unsuitable because of inappropriate construction activities shall be borne by the Contractor. ***Contractor's Costs***

EMBANKMENT CONSTRUCTION

C213.22 SCOPE

1. Embankment construction includes all operations associated with the preparation of the foundation areas on which fill material is to be placed, the placing and compacting of approved material within areas from which unsuitable material has been removed in accordance with Clause C213.21, the placing and compacting of fill material and of materials of specified quality in nominated zones throughout the Works and all other activities required to produce embankments as specified to the alignment, grading and dimensions shown on the Drawings. It also includes any pretreatment such as breaking down or blending material or drying out material containing excess moisture. ***Extent of Work***

C213.23 EMBANKMENT MATERIAL

1. Material for embankment construction shall be obtained from the cuttings within the Works in accordance with Clause C213.11,, supplemented by borrow in accordance with Clause C213.35 and from other sources as approved by the Superintendent if necessary. The material shall be free of tree stumps and roots, clay, topsoil, steel, organic material and other contaminents and shall be capable of being compacted in accordance with Clause C213.36. ***Location and Quality***

2. The work shall be programmed so that material of the quality specified in Clause C213.26 and C213.30 for the upper zones of the formation is available when required. ***Selection of Material***

C213.24 FOUNDATIONS FOR EMBANKMENTS

1. Following removal of topsoil in accordance with Clause C213.07, the embankment foundation area shall be made available for inspection by the Superintendent. ***Inspection***

2. Where the Superintendent considers that any underlying material is unsuitable, the Superintendent may direct that it be removed and replaced in accordance with Clause C213.21. ***Unsuitable Material***

a) Foundations for Shallow Embankments ***Shallow Embankments***

1. Shallow embankments are those embankments of a depth less than 1.0 metre from the top of pavement to natural surface. After removal of topsoil the Contractor shall survey and work out the extent of the area of shallow embankments.

2. Material in the foundations for shallow embankments which does not meet the requirements specified in Annexure C213A, shall be deemed unsuitable in accordance with Clause C213.21 and shall be replaced by material of the specified quality. ***Unsuitable Material***

3. Foundations for shallow embankments shall be prepared for embankment construction after removing topsoil and unsuitable material, by loosening the material exposed to a depth of 200mm, adjusting the moisture content of the loosened material and compacting as specified in Clause C213.36. The Contractor shall use equipment and techniques to minimise surface heaving or other foundation damage. ***Preparation of Foundations***

b) Other Embankments

1. For all other embankments the foundation shall be prepared by grading and levelling the general area, adjusting the moisture content where necessary and compacting the top 200mm as specified in Clause C213.36. ***Preparation***

2. Where a bridging layer has been specified as a foundation treatment in the Contract documents, it shall be supplied and placed as part of General Earthworks. The bridging layer shall consist of free-draining granular material with or without geofabric interlayer as specified on the Drawings. The granular material shall be end-dumped and spread in a single layer and in sufficient depth to allow the passage of earthmoving equipment with minimal surface heaving. The compaction requirements of Clause C213.36 shall not apply to the bridging layer. Where it is necessary to import suitable material from off site and no suitable borrow source is available as provided in Clause C213.35, the supply and placing of the bridging layer shall be treated as a Variation to the Contract. ***Bridging Layer***

3. A bridging layer may also be employed, subject to the approval of the Superintendent, where ground water or seepage is encountered in the foundation area or where the Contractor demonstrates that it is impracticable to achieve the degree of compaction specified for the foundation in Clause C213.36. A bridging layer shall not be acceptable if its proximity to the pavement is likely to affect the pavement design. ***Seepage from Foundations***

C213.25 HILLSIDE EMBANKMENTS

1. Where embankments are to be constructed on or against any natural slopes or the batters of existing embankments, the existing slope or batter, if it is steeper than 4 horizontal to 1 vertical in any direction shall be cut in the form of horizontal terraces over the whole area to be covered by new filling. The existing slope or batter shall be stepped in successive terraces, each at least 1 metre in width, the terraces to be cut progressively as the embankment is placed. Wherever possible terraces shall coincide with natural discontinuities. Subsoil drainage may be required in some instances. Material thus excavated shall be compacted as part of the new embankment material. ***Horizontal Terraces***

2. No account shall be taken of the material removed in terracing when determining the General Earthworks excavated volume. ***Excavated Volume***

C213.26 PLACING FILL FOR EMBANKMENT CONSTRUCTION

1. The methods of excavation, transport, depositing and spreading of the fill material shall be selected so as to ensure that the placed material is uniformly mixed. ***Uniformity of Material***

2. The embankment shall be constructed so as to derive its stability from the adequate compaction of the fine material embedding the large rock pieces rather than ***Embankment Stability***

mechanical interlock of the rock pieces. The fine material shall be compacted to meet the requirements of Clause C213.36.

3. Fill material for embankment construction shall be placed in layers parallel to the grade line and compacted in accordance with Clause C213.36. The layers shall be of uniform compacted thickness not exceeding 200mm, except that where more than 25 per cent by volume of the filling consists of rock with any dimension larger than 150mm, the Superintendent may approve an increase in the compacted layer thickness to 300mm, provided that the relative compaction specified in Clause C213.36 is attained. ***Layer Thickness***

4. The maximum dimension, measured in any direction, of rock pieces in the fill material for embankment construction shall not exceed two-thirds of the approved compacted layer thickness. Any larger rock pieces shall be reduced in size for incorporation in the embankment layers. ***Maximum Size Rock Pieces***

5. Rock material shall be broken down and evenly distributed through the fill material, and sufficient fine material shall be placed around the larger material as it is deposited to fill the voids and produce a dense, compact embankment. Where the Superintendent considers insufficient fine material is present to fill the voids, additional fine material shall be obtained from other places in the work or by a change in the method of winning fill material. ***Grading of Fill Material***

6. Stony patches with insufficient fine material to fill the voids shall be reworked with additional fine material being blended in to achieve a dense, compact layer. ***Reworking Stony Patches***

7. In placing embankment layers, the Contractor shall use equipment and techniques to avoid surface heaving or other damage to the foundations and underlying embankment layers. ***Equipment Selection for Placement***

8. After compaction, embankment material in the zone(s) below the selected material zone (or subbase layer, where no selected material zone) shall have a CBR value not less than that quoted in Annexure C213A for the depth(s) specified in Annexure C213A. ***CBR Value***

9. For the purpose of this Clause, the CBR value of the material shall be determined by Test Method AS 1289.6.1.1. ***Test Methods***

10. The Contractor shall be responsible for determining suitable sources of material and for any processing to satisfy these quality requirements. ***Contractor's Responsibility***

C213.27 EMBANKMENT BATTERS

1. The batter slopes shown on the Drawings represent the estimated requirements for the expected types of materials, and may be subject to redetermination by the Superintendent according to the Superintendent's assessment of the materials encountered. ***Batter Slopes***

2. When completed, the average planes of the batters of embankments shall conform to those shown on the Drawings or as determined by the Superintendent. No point on the completed batter shall vary from the specified slope line by more than ± 300mm when measured at right angles to the grade line. However, in no case shall the edge of the formation at the underside of the pavement be nearer to the roadway than shown on the Drawings. ***Slope Tolerances***

3. Undulations in the general plane of the batter shall not be permitted. ***Slope Undulations***

4. Where the Superintendent redetermines the slope of any section of an embankment batter which has been completed in accordance with this Clause the Superintendent shall order a Variation to the contract for the resetting out and removal or addition of fill material and retrimming of the batter. ***Slope Redeter-mination***

C213.28 ROCK FACING OF EMBANKMENTS

1. Where shown on the Drawings, embankment batters (including embankments at bridge abutments) shall be provided with a facing of clean, hard, durable rock. ***Extent***

2. The rock facing shall be built up in layers ahead of each layer of filling. Rock may be placed by hand or plant but shall be placed in such a manner that its least dimension is vertical and that mechanical interlock between the larger stones occurs. Any rock deposited in the rock facing which has an excess of fine material surrounding it shall be removed together with the excess fine material and replaced. ***Mechanical Interlock***

3. The Contractor shall adjust its working methods and programme the work so as to obtain hard and durable rock of the specified dimensions as it is required. The space between larger batter rocks shall be filled with progressively smaller rocks to form a 'graded filter' which prevents the leaching out of fines from the fill material but which does not overfill the voids between larger rocks, or cause the larger rocks to lose contact with one another. Fine material shall not cover the outside of the rocks on the face of the batter. ***Graded Filter***

4. The Contractor shall exercise extreme caution whilst placing the rock facing. Where embankment material is placed above other roads in use the outer rock layer shall be placed in such a manner as to prevent spillage down the batter. The Contractor shall ensure that, under no circumstances, could any rock be dislodged and roll onto any adjacent roadway or track in use. ***Caution in Placement***

C213.29 TRIMMING TOPS OF EMBANKMENTS

1. The tops of embankments shall be trimmed parallel to the designed grade line at levels equal to the finished surface level less the thicknesses of pavement courses and the selected material zone. ***Levels***

2. The tops of embankments at these levels shall be compacted to meet the requirements of Clause C213.36 and trimmed so that they do not vary more than 10mm above or 40mm below the levels as calculated above. ***Tolerances***

3. Prior to placing any subsequent pavement layers over the completed top of embankment filling, the Contractor shall present the completed surface to the Superintendent for inspection. The Contractor shall verify as part of the quality system that the completed surface has achieved full conformance with all respects of this Specification. ***Inspection by Superintendent***

C213.30 SELECTED MATERIAL ZONE

1. A selected material zone may be indicated on the Drawings as a zone below the subbase layer and in accordance with the following quality requirements: ***Dimension and Quality***

   (a) it shall be free from stone larger than 100mm maximum dimension

   (b) the fraction passing 19.0mm AS sieve shall have a CBR value of not less than that quoted in Annexure C213A.

2. The selected material shall be obtained from cuttings excavated under the Contract or from borrow areas as specified in Clause C213.35. If necessary, the Contractor shall use working methods to yield material for the selected material zone by breaking down oversize rock or by other means, including processing through a crusher, to ensure that the resulting material conforms to the requirements of this Clause. ***Winning Material***

3. The Contractor shall ensure that any material encountered of the quality specified for the selected material zone shall be either placed directly in the selected ***Selection of Material***

material zone or stockpiled at locations approved by the Superintendent for future use by the Contractor in the selected material zone until at least sufficient material is reserved to complete the selected material zone over the whole work. Should the Contractor fail to conserve material of the specified quality, the Superintendent may direct that material of equivalent quality be provided.

4. The Contractor shall have no right to monetary compensation or a claim for damages in respect of any loss the Contractor may claim to have suffered by reason of the Contractor's failure to reserve sufficient selected material or by reason of stockpiling material for the selected material zone. ***Cost of Handling***

5. The selected material zone shall be placed and compacted in layers with the compacted thickness of each layer not exceeding 150mm. Compaction shall be as specified in Clause C213.36. ***Layer Thickness***

6. After placement the selected material shall be homogeneous and free from patches containing segregated stone or excess fines. There shall be no areas containing material which does not comply with the specified requirements of this Clause. ***Homogeneous Layers***

7. The top of the selected material zone shall be compacted and trimmed parallel with the designed grade line at a level equal to the finished surface level minus the thickness of pavement layers adopted. The tolerances for the trimmed levels are given in Annexure C213A. ***Tolerances***

8. Prior to placing any subsequent pavement layers over the completed select material zone surface, the Contractor shall present the completed surface to the Superintendent for inspection. The Contractor shall verify as part of the quality system that the completed surface has achieved full conformance with all respects of this Specification. ***Inspection by Superintendent***

C213.31 FILL ADJACENT TO STRUCTURES

1. Supply and placement of fill adjacent to structures shall be deemed to be part of General Earthworks.

2. For the purpose of this Clause, structures shall include bridges, precast and cast-in-place box culverts and retaining walls. Fill adjacent to other culverts and drainage structures shall be provided in accordance with the particular Specifications for STORMWATER DRAINAGE as appropriate. ***Structure Types***

3. No filling shall be placed against structures, retaining walls, headwalls or wingwalls within 21 days after placing of the concrete, unless the walls are effectively supported by struts to the satisfaction of the Superintendent, or when the Contractor can demonstrate that 85 per cent of the design strength of the concrete has been achieved. ***Time of Placement*** ***HP***

C213.32 TREATMENT AT WEEPHOLES

1. Drainage adjacent to weepholes shall be provided by either a layer of broken stone or river gravel consisting of clean, hard, durable particles graded from 50mm to 10mm such that: ***Grading***

(a) The maximum particle dimension shall not exceed 50mm

(b) No more than 5 per cent by mass shall pass the 9.5mm A.S. sieve.

2. The broken stone or river gravel shall be continuous in the line of the weepholes, extend at least 300mm horizontally into the fill and extend at least 450mm vertically above the level of the weepholes. ***Extent***

3. Alternatively the Contractor may provide a synthetic membrane of equivalent ***Synthetic***

drainage characteristics at no extra cost to the Principal. It shall be stored and installed in accordance with Manufacturer's instructions. The use of a synthetic membrane shall be subject to the Superintendent's approval. ***Membrane***

C213.33 SELECTED BACKFILL

1. Selected backfill shall be placed adjacent to structures in accordance with Table C213.2. The selected backfill shall consist of a granular material having a maximum dimension not exceeding 50mm and a Plasticity Index, determined by AS 1289.3.3.1, neither less than 2 nor more than 12. ***Quality***

Structure Type	Selected Backfill	
	Width	Height
Bridge abutments	2m	H
Cast-in-place Box Culverts	H/3	H + 300mm
Corrugated Steel Pipes and Arches	0.5m	H + 500mm
Retaining Walls	H/3	H

(Where H = height of structure)

Table C213.2 - Selected Backfill, Width and Height

2. The selected backfill shall be placed in layers, with a maximum compacted thickness of 150mm. Layers shall be placed simultaneously on both sides of box culverts to avoid differential loading. Compaction shall start at the wall and proceed away from it, and shall meet the requirements of Clause C213.36. ***Placement in Layers***

3. The existing embankment slope behind the structure shall be cut in the form of successive horizontal terraces, each terrace being at least 1 metre in width, and the selected backfill shall be placed in accordance with Clause C213.26. ***Horizontal Terraces***

4. No selected backfilling shall be placed against structures, retaining walls, headwalls or wingwalls within 21 days after placing of the concrete, unless the walls are effectively supported by struts to the satisfaction of the Superintendent, or when the Contractor can demonstrate that 85 per cent of the design strength of the concrete has been achieved. ***Time of Placement***

5. Where a bridge deck is being concreted adjacent to an abutment, no filling shall be placed against the abutment within twenty-one days after placing concrete in the bridge deck, unless approved by the Superintendent. ***Adjacent to Concrete Deck***

6. In the case of spill-through abutments, rocks shall not be dumped against the columns or retaining walls but shall be built up evenly by individual placement around or against such structures. ***Spill through Abutments***

7. In the case of framed structures, embankments at both ends of the structure shall be brought up simultaneously, the difference between the levels of the embankments at the respective abutments, shall not exceed 500mm. ***Framed Structures***

C213.34 SPOIL

1. Spoil is surplus material from excavations under the Contract which is not required to complete the Works as specified or material from excavations under the Contract whose quality the Superintendent deems to be unacceptable for incorporation in the Works. ***Definition***

2. Where there is surplus material the Superintendent may direct that flatter batter slopes be provided on embankments which have not been commenced, and/or direct that the excess material be used in the uniform widening of embankments, the surface of which shall be shaped so as to provide a tidy appearance and effective drainage. The surplus material shall be spread and compacted as specified in Clauses C213.26 and C213.36 for material in embankments. ***Use in Embankments***

3. Alternatively, spoil shall be disposed of in the manner and at locations approved by the Superintendent within the specified working area for the Works or be removed and disposed of off site by the Contractor. Surplus material so deposited shall be compacted as specified in Clause C213.36 for material in embankments or to such lesser extent as may be approved by the Superintendent. ***Disposal of Spoil***

C213.35 BORROW

1. Unless provided by the Contract, borrow will only be authorised by the Superintendent if, in constructing cuttings and embankments to the batter slopes specified or directed by the Superintendent or in providing materials of the quality specified, and not by reason of excess widening of embankments or wastage by the Contractor of material of the quality specified in Clauses C213.23, C213.28, C213.29 or C213.31, there is an overall deficiency in either the quantity or the quality of material required to complete the Works. ***Borrow to be Authorized***

2. Where borrow material is required to complete the Works as specified, the location of borrow sites shall be as approved by the Superintendent, and the quality of material shall be acceptable to the Superintendent in accordance with Clauses C213.23, C213.28 or C213.31 as appropriate. The edges of borrow sites shall be no closer than 3 metres from any fence line, or edge of excavation or embankment. Adequate clearance shall be provided for the construction of catch drains. Borrow sites shall have drainage outlets acceptable to the Superintendent, cut batter slopes not steeper than 4h to 1v, and shall be left by the Contractor in a tidy and safe condition. ***Borrow Site Characteristics***

3. For borrow within the defined working area for the Works as specified, site preparation shall be in accordance with the Specification for CLEARING AND GRUBBING and Clause C213.07. Restoration of borrow sites shall be carried out in accordance with the Specification for LANDSCAPING. ***Site Preparation and Restoration***

4. If borrow material is obtained by uniformly widening a cutting, the requirements of Clauses C213.11, C213.12 and C213.14 as to the redetermination of batter slopes, the trimming of batters and the compaction of floors of cuttings respectively shall apply to the borrow area. ***Widening of Cutting***

5. If the Superintendent accepts that borrow has to be obtained from locations outside the specified working area for the Works, such work shall be treated as a Variation to the Contract. The Contractor shall be responsible for obtaining any permits required for entry on land and for the payment of any royalty for such borrow material. The Contractor shall also comply with any requirements of the Environment Protection Act, the Department of Natural Resources and Environment, the Local Council, landowners and the Land Conservation Council as appropriate. ***Contractor Responsibility***

COMPACTION AND QUALITY CONTROL

C213.36 COMPACTION AND MOISTURE REQUIREMENTS

1. In areas listed below, all layers shall be uniformly compacted to not less than the relative compaction specified before the next layer is commenced. Each layer of material shall be trimmed prior to and during compaction to avoid bridging over low areas. A smooth surface shall be presented at the top of each layer. ***Trimming and Compaction***

2. The following areas shall be compacted to provide a relative compaction, determined by AS 1289.5.7.1 for modified compactive effort, of not less than 92 per cent. ***92% Compaction Requirements***

- Each layer of material replacing unsuitable material as detailed in Clause C213.21.
- Each layer of material placed in embankments, up to 0.5 metres from the top of the pavement.
- The whole area on the floors of cuttings.
- Fill placed adjacent to structures up to 1.0 metre from the top of pavement.
- Material in unsealed verges and within medians up to the level at which topsoil is placed.
- Spoil (excluding unsuitable material)
- All other areas except those where 98 per cent relative compaction is specified.

3. Unsuitable material shall be stockpiled as directed by the Superintendent and compacted by track rolling. ***Unsuitable Material***

4. The following areas shall be compacted to provide a relative compaction of not less than 95 per cent as determined by AS 1289.5.7.1 for modified compactive effort: ***95% Compaction Requirements***

- Foundations for shallow embankments.
- Foundations other than shallow embankments.
- Each layer of the embankment within 0.5 metres from the top of pavement.
- Each layer of the selected material zone as specified in Clause C213.30.
- Any areas of material of specified quality which may be shown on the Drawings or specified elsewhere behind kerbs and/or gutters or adjacent to rigid pavements.
- The fill material placed adjacent to structures as specified in Clauses C213.31 and C213.33 in each layer within 1.0 metre from the top of the pavement.

5. At the time of compaction the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content which, unless otherwise approved by the Superintendent, is within the range set out in Annexure C213A of the optimum moisture content as determined by AS 1289.5.1.1 or AS 1289.5.7.1. Material which becomes wetted up after placement shall not be compacted until it has dried out so that the moisture content is within this range. The drying process may be assisted by aeration, or where approved by the Superintendent, by the use of hydrated or quick lime at the Contractor's cost. Alternatively the Contractor may transport the wet material to a stockpile site for drying out and later use as fill material. If there is insufficient moisture in the material for it to be compacted as specified, water shall be added. The added water shall be applied uniformly and thoroughly mixed with the material until a homogeneous mixture is obtained. ***Moisture Content*** ***Contractor's Responsibility for Drying and Wetting***

6. Compaction shall be undertaken to obtain the specified relative compaction for the full depth of each layer in embankments and for the full width of the formation over the entire length of the work. Compaction shall be completed promptly to minimise the possibility of rain damage. ***Prompt Compaction***

7. Any material placed by the Contractor that has attained the specified relative ***Moisture***

compaction but subsequently becomes wetted up so that the moisture content is greater than the apparent optimum, determined by AS 1289.5.7.1, shall be dried out and uniformly recompacted to the required relative compaction in accordance with this Clause before the next layer of material is placed. Alternatively, the Contractor may remove the layer of wetted material to a stockpile site for drying and later re-use.

Content above Optimum

C213.37 TEST LOCATIONS

1. The specified compaction and moisture tests shall be taken at the random test locations established in each lot in accordance with the specified minimum testing frequency. Prior to testing the Contractor shall work the lot to ensure uniform moisture content and compaction of all material within the lot.

Contractor to Prepare Area

2. The test/s then taken shall be considered to represent the total volume of material placed within the lot.

Test Representation

3. Where the Superintendent considers that the material which is present has not achieved uniformity required by this Clause or Clause C213.26, the Superintendent may take or direct further testing. The Superintendent shall nominate the area represented by the additional testing.

Further Testing

4. If such testing confirms that material not conforming to the Specification is present the cost of such tests shall be borne by the Contractor. The Contractor shall carry out remedial work as necessary to achieve conformance to the requirements of Clause C213.36.

Contractor's Cost

C213.38 DEFLECTION MONITORING

1. Following completion of the formation to the underside of the selected material zone in accordance with Clause C213.24 and C213.26, and completion of the selected material zone in accordance with Clause C213.30, the Contractor shall make the work available in lots, for the Superintendent or Council to carry out deflection monitoring.

Timing of Deflection Monitoring

2. A lot for deflection testing shall consist of a continuous length of formation, in compliance with Council requirements, and a single carriageway width which is generally homogeneous with respect to material and appearance. The Contractor shall identify the boundaries of each lot with stakes clearly labelled to the satisfaction of the Superintendent.

Lot Size

C213.39 WIDENING OF FORMATION

1. Road shoulders and formation shall be widened to accommodate footpaths, guardfence, streetlight plinths, emergency telephone bays and vehicle standing areas as shown on the Drawings.

Provision for Services

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C213.45 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C213.3 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Batter Slopes** a) Excavation	± 300mm	C213.12
	b) Embankment	± 300mm	C213.27
2.	**Floors**		
	a) Floor of Cutting	Parallel to the designed grade line and ± 50mm of the designed floor level	C213.14
3.	**Tops of Embankments**		
	Trimming tops of Embankments	Parallel to the designed grade line, +10mm or -40mm of the levels specified	C213.29
4.	**Selected Material**	Annexure C213A	C213.30

NOTE: Plus (+) is towards the roadway/surface and minus (-) is away from the roadway/surface. Tolerances are measured at right angles to design surfaces.

Table C213.3 - Summary of Limits and Tolerances

ANNEXURE C213A
EARTHWORKS - SUPPLEMENTARY INFORMATION

CLAUSE **DESCRIPTION** **VALUE**

C213.07 The depth below natural surface up to which the removal and measurement of top soil shall apply:

a) Cutting areas _____mm

b) Embankment areas _____mm

C213.14 Minimum CBR value in cutting floors used for design of pavement _____ %

C213.24 Requirements of material in foundations for shallow embankments:

Moisture Content - within the range of ___% to ___% of optimum.

C213.26 Upper Zones of Formation and

C213.30 Selected Material Zone

Material within each zone shall have a CBR value of not less than the following, under the nominated test conditions:

Location	Minimum CBR Value	Depth Soaking Period (Days)	Nominated
a. Selected Material Zone			
b. Material below Selected Material Zone to 1.0 metre from top of pavement			

C213.30 Construction tolerances for Selected Material Zone are + mm or - mm of the designed grade and crossfall.

C213.36 Moisture Content of material placed in embankments:

(a) Material in upper zones of formation:- within the range of % to % of optimum.

(b) All other embankment material:- within the range of % to % of optimum.

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CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C220

STORMWATER DRAINAGE

GENERAL

SPECIFICATION C220
STORMWATER DRAINAGE – GENERAL

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SPECIFICATION C220 : STORMWATER DRAINAGE – GENERAL

GENERAL

C220.01 INTRODUCTION

Purpose

1. Drainage works shall form a complete system carrying water through and away from the Works.

2. This is the general Specification common and applicable to all types of drainage lines, open drains, kerb and channel, and drainage structures and shall be read in conjunction with drainage Specifications:

C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C223	-	Drainage Structures
C224	-	Open Drains, including Kerb and Channel

as applicable to particular Contracts.

C220.02 SCOPE

1. The work to be executed under this Specification consists of:

(a) preparation for stormwater drainage construction,

(b) temporary drainage during construction,

(c) siting of pipes, pipe arches and box culverts.

(d) all activities and quality requirements associated with excavation and backfilling,

(e) all concrete work associated with stormwater drainage.

Quality

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

C220.03 EXTENT OF WORK

1. Details of the work are shown on the Drawings. The extent of works under this Contract is summarised as follows:

EXAMPLE (To be completed by compiler)

(a) *pipe culvert stormwater drainage*

(b) *precast box culvert stormwater drainage*

(c) *drainage pits, headwalls, wingwalls and aprons*

(d) *kerb and channel*

(e) *open concrete dish drains*

(f) *scour protection of open drains at outlets to drainage structures*

(g) *demolition and removal of existing redundant pipe culverts, headwalls and pits.*

C220.04 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

Documents Standards Test Methods

(a) Other Council Specifications

C211	-	Control of Erosion and Sedimentation
C213	-	Earthworks
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	-	Compaction control test (Rapid Method)

CONSTRUCTION

C220.05 TEMPORARY DRAINAGE DURING CONSTRUCTION

1. All drainage works carried out by the Contractor shall comply with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

Control

2. The Contractor shall make adequate provision for runoff flows at drainage works under construction to avoid damage or nuisance due to scour, sedimentation, soil erosion, flooding, diversion of flow, damming, undermining, seepage, slumping or other adverse effects to the Works or surrounding areas and structures as a result of the Contractor's activities.

Contractor's Responsibility

3. The Contractor shall not implement any proposals to dam up or divert existing watercourses (either temporarily or permanently) without the prior approval of Council by way of approved Drawings or written instruction.

Limitations

4. The Contractor's material and equipment shall be located clear of watercourses or secured so that they will not cause danger or damage in the event of large runoff flows.

Location of Equipment

C220.06 SITING OF CULVERTS

1. Before commencing construction of any culvert, the Contractor shall set out on site the culvert inlet and outlet positions to the location and levels shown on the Drawings, and shall present this set-out for inspection by the Superintendent.

Set-out

WP

2. The Superintendent may amend the inlet or outlet locations or designed levels or the culvert length to suit actual site conditions.

Amendments to planned work

3. Should the Contractor propose changes to the culvert location, length, designed levels, culvert strength, conditions of installation or cover to suit the construction procedures, the Contractor shall present the proposed culvert set-out in addition to the designed set-out for consideration by the Superintendent and Council. No changes shall be made unless the prior written approval of the Superintendent and Council is obtained.

Proposed Changes by Contractor

WP

C220.07 EXCAVATION

Topsoil

1. Before undertaking stormwater drainage excavation, topsoil shall be removed in

accordance with the Specification for EARTHWORKS.

2. In undertaking trench excavation, the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements. ***Safety***

3. Where public utilities exist in the vicinity of stormwater drainage works the Contractor shall obtain the approval of the relevant authority to the method of excavation before commencing excavation. ***Approval by Public Utility Authorities***

4. Excavation by blasting, if permitted by Council, shall be carried out to ensure that the peak particle velocity measured on the ground adjacent to any previously installed culvert of drainage structure does not exceed 25 millimetres per second. The Contractor shall comply with other requirements concerning blasting operations in the Specification for EARTHWORKS. ***Blasting Operation***

5. Trench or foundation excavation for stormwater drainage works shall be undertaken to the planned level for the bottom of the specified bedding or foundation level. All loose material shall be removed by the Contractor. ***Excavation Level***

6. Any material at the bottom of the trench or at foundation level which the Superintendent deems to be unsuitable shall be removed and disposed in accordance with the Specification for EARTHWORKS by the Contractor and replaced with backfill material in accordance with the requirements of this Specification and the Specifications for particular culvert types. The bottom of the excavated trench or foundation, after any unsuitable material has been removed and replaced, shall be parallel with the specified level and slope of the culvert. ***Unsuitable Material***

7. The excavated material shall be used in the construction of embankments backfilling or spoiled in accordance with the Specification for EARTHWORKS. ***Spoil***

C220.08 BACKFILLING

1. Backfilling shall be carried out in accordance with the requirements of the relevant culverts or drainage structures Specifications and to the compaction requirements specified below.

C220.09 COMPACTION

1. Foundations, bedding (other than for pipe drainage) and backfilling shall be compacted to the following requirements when tested in accordance with AS 1289.5.4.1 for standard compactive effort.

	Relative Compaction
Foundations or trench base to a depth of 150mm below foundation levels	95%
Material replacing unsuitable material	95%
Bedding material (other than for pipe drainage)	95%
Selected backfill and ordinary backfill material	
• below 1.5m of finished surface	95%
• within 1.5m of finished surface	100%
Backfill material within the selected material zone	100%

Compaction requirements adjacent to pipe drainage for concrete, steel or UPVC pipes

are set out in the specification for PIPE DRAINAGE.

2. All material shall be compacted in layers not exceeding 150mm compacted thickness. Each layer shall be compacted to the relative compaction specified before the next layer is commenced. ***Layers***

3. At the time of compaction, the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content which, unless otherwise approved by the Superintendent, is neither less than 60 per cent nor more than 95 per cent of the apparent optimum moisture content, as determined by AS 1289.5.7.1 (standard compaction). ***Moisture Content***

4. When compacting adjacent to culverts or drainage structures, the Contractor shall adopt compaction methods which will not cause damage or misalignment to any culvert or drainage structure. Any damage caused shall be rectified, and all costs of such rectification shall be borne by the Contractor. ***Precautions*** ***Contractor's Cost***

C220.10 CONCRETE WORK

1. For all concrete work, the Contractor shall comply with the Specification for MINOR CONCRETE WORKS in relation to the supply and placement of normal class concrete and steel reinforcement, formwork, tolerances, construction joints, curing and protection. ***Specification***

C220.11 SPRAYED CONCRETE

1. If sprayed concrete has been specified, shown on the Drawings or directed by the Superintendent, it shall comply with requirements in the Specification for MINOR CONCRETE WORKS. ***Standard***

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C220.14 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C220.1 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Excavation by Blasting**		
	peak particle velocity	≤25mm/sec	C220.07
2.	**Relative Compaction (Standard)**		
	(a) Foundations or trench base to a depth of 150mm below foundation levels	95%	C220.09
	(b) Material replacing unsuitable material	95%	C220.09
	(c) Bedding material	95%	C220.09
	(d) Selected backfill and ordinary backfill material: • below 1.5m of finished surface • within 1.5m of finished surface	 95% 100%	C220.09
	(e) Backfill material within the selected material zone	100%	C220.09
3.	**Backfill**		
	(a) Layers	≤ 150mm	C220.09
	(b) Moisture Content	>60%, <95%	C220.09

Table C220.1 - Summary of Limits and Tolerances

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CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C221

PIPE DRAINAGE

SPECIFICATION C221 - PIPE CULVERTS

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SPECIFICATION C221 : PIPE DRAINAGE

GENERAL

C221.01 SCOPE

1. This Specification covers the supply and installation of pipe culverts and pipe arches for stormwater drainage. ***Scope***

2. This Specification should be read in conjunction with the specification for STORMWATER DRAINAGE - GENERAL. ***Associated Specifications***

3. The work to be executed under this Specification consists of supply of pipes and pipe arches, bedding, installation and backfilling. ***Extent of Work***

4. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C221.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C213	-	Earthworks
C220	-	Stormwater Drainage - General
C223	-	Drainage Structures
C230	-	Subsurface Drainage - General
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving.
AS 1141.51	-	Unconfined compressive strength of compacted materials.
AS 1254	-	Unplasticized PVC (UPVC) pipes and fittings for storm or surface water applications.
AS 1289.3.3.1	-	Calculation of the plasticity index of a soil.
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.4.3.1	-	Determination of the pH value of a soil - Electrometric method.
AS 1289.4.4.1	-	Determination of the electrical resistivity of a soil - Sands and granular materials.
AS 1289.E6.1	-	Compaction control test - Density index method for a cohesionless material.
AS 1397	-	Steel sheet and strip - Hot dipped zinc coated or aluminium/zinc coated.
AS 1646	-	Elastomeric seals for waterworks purposes.
AS 1761	-	Helical lock-seam corrugated steel pipes.
AS 1762	-	Helical lock-seam corrugated steel pipes - Design and installation.
AS 2032	-	Code of practice for installation of UPVC pipe systems.
AS 2041	-	Buried corrugated metal structures.
AS/NZS 2566.1	-	Buried flexible pipelines, structural design
AS 3725	-	Loads on buried concrete pipes
AS/NZS 3750.9		Organic zinc-rich primer.

AS/NZS 3750.15		Inorganic zinc silicate paint.
AS 3887	-	Paints for steel structures - Coal tar epoxy.
AS 4058	-	Precast concrete pipes (pressure and non-pressure).
AS 4139	-	Fibre reinforced concrete pipes and fittings.
AS/NZS 4680	-	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles.
AS/NZS ISO 9002		Quality systems - Model for quality assurance in production, installation and servicing.

(c) AASHTO Standard

M190	Bituminous coated corrugated metal culvert pipe and pipe arches.

COMMON REQUIREMENTS

C221.03 GENERAL

1. Pipes and/or pipe arches shall be manufactured in accordance with the requirements of the relevant Australian Standard.

Compliance with Australian Standards

2. Documentation shall comprise a conformance certificate to AS 4058 or AS 4139 as appropriate for each batch of pipes or pipe arches to be included in the works. Conformance certificates are to be supplied at least 24 hours in advance of despatch to site.

Certification

3. Each unit shall be marked at time of manufacture with:

Marking

a) Class and size.

b) Manufacturer's name.

c) Date of casting.

4. Where a Contractor wishes to use drainage pipe other than the pipes described in clauses C221.04 to C221.22 inclusive, the Contractor shall submit, for agreement by the Superintendent, full details in accordance with AS/NZS 2566.1 of the characteristics of the pipe materials and embedment and design loads together with certification from the manufacturer of its suitability and quality for use in each particular application. Certification of the suitability of any pipe will address the deflection, strength, buckling and any other considerations appropriate to the particular application. Upon agreement, the Superintendent must submit an application for a variation to the development consent for approval by Council.

Buried Flexible Pipes, Submit for Approval

WP

5. The Contractor shall take all necessary steps to drain the excavation to allow the foundation, the bedding and any backfilling to be compacted to the specified relative compaction.

Excavation Drainage

6. Culverts shall be installed within 10mm of the grade line and within 10mm of the horizontal alignment specified on the Drawings. The Contractor shall relay any culvert which is not within these tolerances.

Tolerances

7. At the discharge end of culverts terminating at pits and headwalls a 3m length of 100mm diameter subsurface drain shall be laid in the trench 100mm above the invert level of the culvert and discharging through the wall of the pit or headwall at 100mm above the invert level of the culvert or headwall. The subsurface drainage pipe shall be sealed at the upstream end and shall be enclosed in a seamless tubular filter fabric in accordance with the Specification for SUBSURFACE DRAINAGE - GENERAL.

Subsurface Drain

8. Excavation and backfilling for culverts shall be undertaken in a safe manner and in accordance with all statutory requirements. ***Safety***

9. Where the Contractor proposes to travel construction plant in excess of 5 tonnes gross mass over culverts, the Contractor shall design and provide adequate protective measures for the crossings and shall submit the proposals to the Superintendent for prior approval. ***Construction Plant Movement***

REINFORCED CONCRETE AND FIBRE REINFORCED CONCRETE PIPES

C221.04 PIPES

1. Reinforced concrete pipes shall comply with AS 4058 and shall be of the class and size as shown on the Drawings. ***Reinforced Concrete Pipes***

2. Fibre reinforced concrete drainage pipes shall comply with AS 4139 and shall be of the class and size as shown on the Drawings. ***Fibre Reinforced Pipes***

3. Unless specified otherwise, joints shall be of the flexible type and the pipes shall have special sockets incorporating rubber ring joints complying with AS 1646 and as recommended by the manufacturer. ***Joints***

C221.05 EXCAVATION

1. Unless otherwise indicated on the Drawings or approved by the Superintendent, the formation shall be completed to subgrade level and the pipes then installed in the normal trench condition. ***Formation to Subgrade Level***

2. For normal trench conditions, the pipe shall be laid in an excavated trench with bedding as specified in Clause C221.06. The trench shall be excavated to a width 1.4 times the external diameter of the pipe, or to the external diameter of the pipe plus 300mm on each side, whichever is the greater. ***Normal Trench Conditions***

3. Care is necessary to avoid laying pipe drainage in trenches excavated to excessive width. Pipes laid in wide trench conditions will be deemed to be in embankment conditions (positive projection). Wide trench conditions apply when, for a single pipe, the width of trench, $W \geq D + 0.6$ metre where D is the pipe diameter. For multi-cell pipes wide trench conditions apply when the width of trench, $W \geq \Sigma D + \Sigma S + 0.6$ metre where S is the square spacing between the pipelines. This definition of wide trench conditions as equivalent to embankment conditions relates to the size and geometry of the excavation utilised at construction. Pipes shown on the Drawings to require trench conditions shall not be placed under embankment conditions without a design check for compliance of the pipe strength in accordance with AS3725. ***Wide Trench Conditions*** ***Design Check***

C221.06 BEDDING

1. Bedding shall be in accordance with this Specification, AS3725 and AS3725 Supplement 1 for the pipe support types and as shown on the appropriate Council standard drawings. Where the pipe support type is not shown on the Drawings, the support type shall be HS3 within road reserves and H2 elsewhere. ***Pipe Support Type***

C221.07 INSTALLATION

(a) General

1. Pipes shall be laid with the socket end placed upstream. Pipes which have ***Positioning of***

marks indicating the crown or invert of the pipes shall be laid strictly in accordance with the markings. Unless specified, no individual length of pipe shall be shorter than 1.2m. ***Pipes***

2. In the case of pipes 1,200mm or more in diameter, laid in situations where embankments are to be more than 3m high, measured above the invert of the pipe, pipes shall be stiffened temporarily by the Contractor by interior timber struts, erected before filling is placed. Struts shall be of hardwood measuring at least 100mm by 100mm or 125mm diameter. One strut shall be placed in a vertical position at each pipe joint, thence at a spacing not greater than 1,200mm. Struts shall bear against a sill laid along the invert of the pipe and a cap bearing against the crown of the pipe. Both the sill and the cap shall be continuous throughout the length of the pipe and they shall be of sawn hardwood, of cross section not less than 100mm by 100mm. Struts shall be made to bear tightly by the use of wedges between the top of the struts and the cap. Struts, sills and caps shall be removed on completion of the embankment, unless removal is ordered earlier. ***Stiffening of Culverts*** ***Removal of Struts***

3. Lifting holes in all pipes shall be sealed with plastic preformed plugs approved by the Superintendent, or a 3:1 sand:cement mortar, before the commencement of backfilling. ***Seal Lifting Holes***

4. Bulkheads shall be constructed in accordance with the Specification for DRAINAGE STRUCTURES on all lines where the pipe gradient exceeds 5 per cent. ***Bulkheads***

5. The Contractor shall present the laid and jointed pipes for inspection by the Superintendent prior to commencement of trench backfilling ***HP***

(b) Joints in Reinforced Concrete Pipes

(i) Rubber Ringed Joints

1. Before making the joint, the spigot and socket and the rubber ring shall be clean and dry. ***Clean and Dry Material***

2. The rubber ring shall be stretched on to the spigot end of the pipe, square with the axis and as near as possible to the end, care being taken that it is not twisted. The spigot end of the pipe shall then be pushed up to contact the socket of the pipe with which it is to join, and be concentric with it. The spigot end shall then be entered into the socket of the already laid pipe and forced home by means of a bar, lever and chain, or other method approved by the Superintendent. ***Procedure for Rolling Rubber Rings***

3. The joint shall be tested to ensure that the rubber ring has rolled evenly into place. ***Joint Test***

4. Where wedge shaped “skid” rubber rings are prescribed the Manufacturer’s instructions, which include the use of lubricants, shall be followed. ***“Skid” Rings***

(ii) Flush or Butt Joints

1. Flush or butt joints shall be used only where required to extend existing culverts. If pipes with flush or butt joints are required, the ends of the pipes shall be butted together. ***Jointing***

2. The joints shall be sealed with proprietary rubber sleeves, supplied and installed in accordance with the manufacturer's recommendations. ***Sealing***

(c) Joints in Fibre-Reinforced Cement Pipes

(i) New Pipes

1. Joints shall be of a flexible type. Rubber rings shall be used to seal joints in both rebated and spigot and socket jointed pipes in the manner specified in Clause ***Procedure***

C221.07(b). Alternatively, a jointing compound comprising plasticised butyl rubber and inert fillers may be used to seal such pipes in accordance with the manufacturer's instructions.

(ii) Direct Side Connections to Other Pipes

1. Direct side connections to other pipes shall be as detailed on the Drawings.

C221.08 BACKFILL

1. Select fill material to the side zones for pipe support type HS shall be compacted to the requirements shown in Table C221.3 when tested in accordance with AS 1289.5.4.1 for standard compactive effort. ***Type HS Pipe Support***

2. Ordinary fill to the side zones, for all pipe support types except type HS, and overlay zones, for all pipe support types, shall consist of Selected Backfill as defined in the Specification for EARTHWORKS. It shall be placed around the pipe to the dimensions shown in Figure C221.1. ***Other Pipe Support Types***

3. All material shall be compacted in layers not exceeding 150mm compacted thickness. Each layer shall be compacted to the relative compaction specified before the next layer is commenced. ***Layers***

4. At the time of compaction, the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content which, unless otherwise approved by the Superintendent, is neither less than 60 per cent nor more than 95 per cent of the apparent optimum moisture content, as determined by AS 1289.5.7.1 (standard compaction). ***Moisture Content***

5. The remainder of the trench to the underside of the subgrade, or selected material zone as specified in the Specification for EARTHWORKS, shall be backfilled with material satisfying the requirements for embankment material as defined in the Specification for EARTHWORKS. Where excavation is approved through the selected material zone, the section of trench within the select material zone shall be backfilled with selected material as defined in the Specification for EARTHWORKS. ***Trench Backfill***

6. When compacted adjacent to culverts or drainage structures, the Contractor shall adopt compaction methods which will not cause damage or misalignment to any culvert or drainage structure. Backfilling and compaction shall commence at the pipe or wall so as to confine remaining uncompacted material at commencement. ***Precautions***

UPVC PIPES

C221.09 CULVERT MATERIALS

1. Unplasticised PVC (UPVC) Pipes and Fittings shall be manufactured in accordance with AS 1254 and shall be of the type and size as shown on the Drawings. ***Specification***

2. Embedment material in the bedding, side support and overlay zones shall be in accordance with bed and haunch zone material in Clause C221.06.

3. Trench backfill material shall satisfy the requirements for embankment material as defined in the Specification for EARTHWORKS.

C221.10 EXCAVATION AND BEDDING

1. Unless otherwise indicated on the standard Drawings or approved by the Superintendent, the formation shall be completed to subgrade level and the pipes then installed in the normal trench condition. ***Formation to Subgrade Level***

C221.11 INSTALLATION

1. Embedment of the UPVC pipe shall be in accordance with the requirements of AS/NZS 2566.1 and to the dimensions shown in the standard drawings.

Laying and Jointing

2. Pipe laying shall be in accordance with Part 7 of AS 2032 and solvent-cement pipe jointing shall be in accordance with Part 3 of AS 2032. Jointing may be performed with the pipes either in the trench or at ground level. All pipes, or jointed pipelines, shall be lowered into the trench without being dropped. Pipelines shall be placed so that joints are not strained.

C221.12 BACKFILL

Embedment Compaction

1. Compaction of the material in the side support and overlay zones shall comply with the requirements of clause C221.06 except that the required relative compaction in the side support and overlay zones shall be 95 per cent (AS 1289.5.4.1 standard compaction).

Layers

2. All material shall be compacted in layers not exceeding 150mm compacted thickness. Each layer shall be compacted to the relative compaction specified before the next layer is commenced.

Moisture Content

3. At the time of compaction, the moisture content of the material shall be adjusted so as to permit the specified compaction to be attained at a moisture content. which, unless otherwise approved by the Superintendent, is neither less than 60 per cent nor more than 95 per cent of the apparent optimum moisture content, as determined by AS 1289.5.7.1 (standard compaction).

Trench Backfill

4. The remainder of the trench to the underside of the subgrade, or selected material zone as specified in the Specification for EARTHWORKS, shall be backfilled with material satisfying the requirements for embankment material as defined in the Specification for EARTHWORKS. Where excavation is approved through the selected material zone, the section of trench within the select material zone shall be backfilled with selected material as defined in the Specification for EARTHWORKS.

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C221.26 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances for materials and product performance related to the various clauses in this Specification are summarised in Table C221.5 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Culvert Position**		
	(a) Grade Line	± 10mm	C221.03
	(b) Horizontal Alignment	± 10mm	C221.03
2.	**Bedding**		
	(a) Bed and Haunch Zone Compaction	Table C221.3	C221.06
3.	**Backfill - Concrete Pipes**		
	(a) Side and Overlay Zone Compaction	Table C221.3	C221.08
4.	**Sprayed Concrete**		
	(a) Over crest of corrugations over bottom third of pipe circumference	> 100mm	C221.18
5.	**Bedding Zone Compaction**	≥95%	C221.20
6.	**Backfill - UPVC Pipes**		
	(a) Side and Overlay Zone Compaction	≥95%	C221.21

Table C221.5 - Summary of Limits and Tolerances

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C222

PRECAST BOX CULVERTS

SPECIFICATION C222 - PRECAST BOX CULVERTS

SPECIFICATION C222 : PRECAST BOX CULVERTS

GENERAL

C222.01 SCOPE

1. This Specification covers the installation of precast concrete box culverts and should be read in conjunction with the Specification for STORMWATER DRAINAGE - GENERAL.

2. The work to be executed under this Specification consists of: ***Extent of Work***

(a) preparation of foundations;

(b) provision of bedding;

(c) construction of base slabs;

(d) installation of precast culvert units;

(e) headwalls and wingwalls;

(f) backfilling against structures;

(g) provision and removal of coffer dams;

(h) excavation of inlet and outlet channels.

3. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C222.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C213	-	Earthworks
C220	-	Stormwater Drainage - General
C224	-	Open Drains, including Kerb and Channel
C242	-	Flexible Pavements
C271	-	Minor Concrete Works

(b) Australian Standards

AS1597.1	-	Precast reinforced concrete box culverts - Small culverts
AS1597.2	-	Precast reinforced concrete box culverts - Large culverts
AS/NZS ISO 9002		Quality Systems - Model for Quality Assurance in Production, Installation and Servicing.

(c) Other

AUSTROADS	-	Guide to Geotextiles

MATERIALS

C222.03 CULVERT UNITS, LINK AND BASE SLABS

Supply

1. The supply and testing of precast reinforced concrete box culvert units, link and base slabs shall be in accordance with AS 1597.1 for small culverts not exceeding 1200mm width and 900mm depth and AS 1597.2 for large culverts from 1500mm span and up to and including 4200mm span and 4200mm height with the following alterations or additional requirements:

   (a) Proof load testing shall be arranged by the Contractor in batches as specified in either AS 1597.1 or AS1597.2 as appropriate.

   (b) Lifting holes, galvanised lifting points or steel lifting eyes shall be provided in the culvert units, link and base slabs.

   (c) The end units shall have factory installed starter bars for headwall and wingwall construction.

   (d) Delivery and unloading shall be the Contractor's responsibility.

2. The Supplier shall implement and maintain a Quality System in accordance with ISO 9002 to ensure materials, manufacture and proof load testing conform to the appropriate Standards.

3. A conformance certificate, to AS 1597.1 or AS 1597.2, for the box culvert units shall be submitted at least 3 working days prior to despatch.

4. Each unit shall be marked at time of manufacture with:

   (a) Type and size

   (b) Casting date

   (c) Manufacturer’s name

   (d) Inspection pass and date.

C222.04 CONCRETE

Quality

1. The concrete and reinforcement for cast-in-situ base slabs shall comply with the Specification for MINOR CONCRETE WORKS.

C222.05 SELECTED BACKFILL

Quality

1. The quality of selected backfill shall comply with the requirements in AS 1597.2.

C222.06 ORDINARY BACKFILL

Quality

1. Ordinary backfill is material obtained from culvert excavations, cuttings and/or borrow areas which is in accordance with the requirements for the upper 1.0m of embankment construction as detailed in the Specification for EARTHWORKS.

CONSTRUCTION

C222.07 COFFER DAMS

Contractor’s Costs

1. At some sites it may be expedient for the Contractor to construct a coffer dam. All costs associated with the construction of coffer dams shall be borne by the Contractor.

2. Coffer dams shall be sufficiently watertight to prevent damage of the concrete by percolation or seepage through the sides, and shall be taken sufficiently below the level of the foundations to prevent loosening of the foundation materials by water rising through the bottom of the excavation. Coffer dams shall be adequately braced and shall be so constructed that removal will not weaken or damage the structure. ***Construction***

3. A coffer dam may be constructed to the actual size of the reinforced concrete invert slab and used as side forms for the concrete. The details of the coffer dam and formwork, and the clearances proposed shall be subject to the approval of the Superintendent, but the Contractor shall be responsible for the successful construction of the work. ***Contractor's Responsibility***

4. Coffer dams which have tilted or have moved laterally during sinking, shall be righted or enlarged to provide the clearances specified. This work will be at the Contractor's expense. ***Specified Clearances***

5. No timber or bracing shall be left in the concrete or in the backfill of the finished structure. Coffer dams, including temporary piles, shall be removed at least to the level of the invert after completion of the structure. ***Removal***

C222.08 EXCAVATION

1. Excavation shall be carried out in accordance with the provisions in the Specification for STORMWATER DRAINAGE - GENERAL. ***Specification***

2. The trench width shall be the width of the base slab plus 150mm minimum each side. ***Trench Width***

C222.09 FOUNDATIONS

1. Rock foundations shall be neatly excavated to the underside of the mass concrete or selected fill bedding shown on the Drawings. All minor fissures shall be thoroughly cleaned out and refilled with concrete, mortar or grout. All loose material shall be removed. ***Rock Foundations***

2. Where rock is encountered over part of the foundation only, or lies within 300mm below the underside of the mass concrete or selected fill, all material shall be removed to a depth of 300mm below the mass concrete or selected fill for the full width of the foundation over the length where the rock is encountered. This additional excavation shall be backfilled with ordinary backfill material. ***Additional Excavation***

3. Over-excavation or uneven surfaces shall be corrected with mass concrete so as to provide a uniform surface at least 50mm above the highest points of rock. ***Uniform Surface***

4. Earth foundations shall be finished to line and level to the underside of bedding shown on the Drawings. Care shall be taken to avoid disturbing material below this level. ***Line and Level***

5. All soft, yielding or unsuitable material shall be removed and replaced with ordinary backfill material as directed by the Superintendent and backfilled in accordance with the Specification for STORMWATER DRAINAGE - GENERAL. ***Unsuitable Material***

6. All bedding shall be in accordance with the standard drawings.

C222.10 INSTALLATION OF PRECAST UNITS

1. Precast units shall not be installed until the base slab has attained a minimum compressive strength of 20MPa. ***Minimum Strength***

2. Precast crown units shall be placed on a bed of mortar in the recesses in the ***Mortar Bed in***

base slab. Any gaps between the side walls and the sides of the recesses shall be packed with cement mortar. Lifting holes and butt joints between units shall be packed or sealed with cement mortar or grout. ***Recess***

3. Before placement of top slabs on U-shaped units or link slabs on adjacent crown units, the bearing areas of the supports shall be thoroughly cleaned and covered with a bed of mortar of minimum thickness 5mm after placement of precast unit. ***Mortar Bed on Supports***

4. Steel lifting hooks shall be cut flush with the surface of the concrete, cleaned to bright metal and coated with two coats of coal tar epoxy. Alternatively, they shall be cut off 12mm below the surface of the unit and the recess sealed with epoxy mortar. ***Lifting Hooks***

5. In the case of multi-cell culverts, a nominal 15mm gap shall be provided between adjacent cells. This gap shall be filled with cement mortar or grout. ***Gap Between Cells***

6. All mortar joints shall be protected from the sun and cured in an approved manner for not less than 48 hours. ***Curing of Joints***

7. All external surfaces of joints between precast crown units, both laterally and longitudinally, shall be covered full length, and minimum 250mm width, with strips of non-woven geotextile of minimum mass 270 g/m^2 in accordance with AUSTROADS Guide to Geotextiles. ***Joint Covering***

C222.11 BACKFILL

1. All bracing and formwork shall be removed prior to backfilling. ***Removal of Formwork***

2. Selected backfill shall be placed in the side zones of the box culverts and wingwalls, and to a depth of 300mm in the overlay zone of the culverts, in layers with a maximum compacted thickness of 150mm in accordance with the backfilling and compaction requirements of AS 1597.2. The remainder of the excavation shall be backfilled with ordinary embankment fill in accordance with the Specification for EARTHWORKS. ***Selected Fill***

3. No backfill shall be placed against wingwalls until 21 days after casting. ***Wingwalls***

4. Backfill layers shall be placed simultaneously on both sides of the culvert with a maximum 600mm level difference to avoid differential loading. Backfilling and compaction shall commence at the wall and proceed away from it. ***Sequence***

5. Where the slopes bounding the excavation are steeper than 4:1, they shall be cut in the form of successive horizontal terraces of at least 1m width before the backfill is placed. ***Horizontal Terraces***

C222.12 EXCAVATION OF INLET AND OUTLET CHANNELS

1. Excavation of inlet and outlet channels shall be carried out as shown on the Drawings and shall extend to join the existing stream bed in a regular manner as detailed in the Specification for OPEN DRAINS INCLUDING KERB AND CHANNEL. ***Extent***

C222.13 CONSTRUCTION LOADING ON CULVERTS

1. Construction vehicles and plant shall not pass over the culvert until 28 days after the casting of the base slab or until the cylinder compressive strength of the base slab concrete has reached 32MPa. ***Traffic Over Culvert***

2. Construction vehicle loads on culverts for various design fill heights shall be in accordance with AS 1597.2. ***Loading Restrictions***

LIMITS AND TOLERANCES

C222.14 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C222.1 below:

Item	Activity	Limits/Tolerances	Spec Clauses
1.	**Mass Concrete Correction**		
	a) Over highest poinst of rock	50mm	C222.09
2.	**Mass Concrete Bedding**		
	a) Level	± 10mm	C222.10
	b) Line	± 5mm	C222.10
3.	**Culvert Location**		
	a) Invert Level	±10mm	C222.11
	b) Grade	5mm in 2.5m (1 in 500)	C222.11
	c) Plan Position	±50mm	C222.11

Table C222.1 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C223

DRAINAGE STRUCTURES

SPECIFICATION C223 - DRAINAGE STRUCTURES

SPECIFICATION C223 : DRAINAGE STRUCTURES

GENERAL

C223.01 SCOPE

Associated Specifications

1. This Specification covers the construction of drainage structures and shall be read in conjunction with the Specification for STORMWATER DRAINAGE - GENERAL and other drainage Specifications as applicable:

C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C224	-	Open Drains, including Kerb and Channel

Extent of Work

2. The work to be executed under this Specification consists of the construction of headwalls, wingwalls, pits, side entry pits, inspection pits, junction boxes/pits, drop structures, inlet and outlet structures, energy dissipators, batter drains and other supplementary structures as shown on the Drawings.

Quality

3. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

C223.02 REFERENCE DOCUMENTS

Documents Standards Test Methods

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specifications

C213	-	Earthworks
C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C224	--	Open Drains, including Kerb and Channel
C271		Minor Concrete Works

Council Standard Drawings

(b) Australian Standards

AS 3996	-	Metal access covers, road grates and frames

CONSTRUCTION

C223.03 GENERAL

Concrete Work

1. Drainage structures shall be constructed in concrete and in accordance with the Specification for MINOR CONCRETE WORKS.

Time for Completion

2. All structures shall be constructed as soon as practicable and shall be completed not later than 28 days after the construction of the associated culverts, unless otherwise approved by the Superintendent.

C223.04 ALIGNMENT

1. Unless otherwise shown on the Drawings, headwalls and pits shall be constructed parallel to the road centreline and wingwalls at 135^{o} to the headwall.

2. Where the culvert is laid skew to the road, the wingwalls and headwalls shall be splayed so that the front edge of the wing bisects the angle between the centreline of the culvert and the headwall. ***Skew Angle***

3. Energy dissipators shall be constructed in accordance with the Drawings and with centreline on the axis of the culvert. ***Energy Dissipators***

C223.05 HEADWALLS AND WINGWALLS

1. The wingwalls shall be constructed to retain the batters effectively. Where the dimensioned drawings do not satisfy this requirement the Superintendent shall be notified before the headwalls and wingwalls are constructed. The Superintendent shall direct the Contractor as to the action to be taken. ***Batter Retention***

2. Where rock is encountered at the bottom of excavations for wingwalls and headwalls and after approval is given by the Superintendent, the depth of cut-off walls in uniform rock over the full width of the foundations may be reduced to less than that shown in the Drawings, but must be not less than 150mm into sound rock. ***Rock Foundations***

C223.06 PITS

1. All new pits, including access covers, grated pits and frames complying with AS 3996, shall be constructed to the details shown on the Drawings. Modification of existing pits is only to be carried out if such is shown on the Drawings. ***Modification***

2. Where the full depth of the excavation is in sound rock, and the Superintendent approves, part of the concrete lining of side entry pits and sumps may be omitted, provided that a neatly formed pit of the required dimensions is constructed. In all such cases the wall of the pit adjacent to and parallel to the road shall be constructed of concrete. ***Full Depth Rock Excavation***

3. Step irons shall be installed in accordance with the Drawings. ***Step Irons***

4. Step irons shall be either fixed firmly in the formwork prior to pouring the concrete for the pit walls or by using blockout formers to make recesses in the concrete to receive the arms of the step irons, or alternatively installed at a later date by drilling the pit wall. Holes may only be drilled using a rotary masonry bit or similar. Percussion tools shall not be used to form the hole for the step iron. ***Fixing Methods***

5. Where the step irons are installed in recesses or drill holes after the concrete wall is poured, the step irons shall be fixed in position by using an epoxy resin in accordance with the step iron and epoxy resin manufacturers' instructions and specifications. The Contractor shall ensure that no movement of the step irons occurs until the epoxy resin has reached the specified strength. ***Epoxy Fixing***

6. Inlet and outlet pipes shall be integrally cast into the pit at the time of pouring the concrete for the pit walls. ***Casting Pipes***

7. A subsoil drain shall be installed into the pit or headwall in accordance with the general requirements in the Specification for PIPE DRAINAGE. ***Subsoil Drain***

C223.07 PRECAST UNITS

1. Where precast units including kerb inlet lintels are provided in the design they shall be handled and installed in accordance with the manufacturer's instructions. ***Manufacturer's Instructions***

2. If the Contractor proposes to use precast units, detailed drawings and complete details of installation procedures shall be submitted for the approval of the Superintendent. ***Contractor's Responsibility***

3. Unless otherwise approved by the Superintendent, precast units shall not be delivered to the site before satisfactory documentary evidence has been submitted to the Superintendent that quality tests have been carried out. ***Delivery***

C223.08 JOINTING

1. Where drainage structures abut concrete paving, kerb and channel or other concrete structures, a 10mm wide joint shall be provided between the structure and paving, or kerb and channel or other concrete structures. The joint shall consist of preformed jointing material of bituminous fibreboard. ***Preformed Jointing Material***

C223.09 MASS CONCRETE BEDDING

1. Mass concrete bedding for reinforced concrete bases shall not be placed on earth or rock foundations until the foundations have been inspected and approved by the Superintendent. Following such approval, the surface of the foundation shall be dampened and a layer of concrete not less than 50mm thick, shall be placed over the excavated surface and shall be finished to a smooth even surface. ***Mass Concrete Base Foundation Inspection***

2. Unreinforced concrete bases may be cast on earth or rock foundations without the mass concrete bedding. ***Unreinforced Concrete Base***

C223.10 BACKFILL

1. Backfilling shall not commence until the compressive strength of concrete has reached at least 15MPa unless otherwise approved by the Superintendent. ***Commence-ment***

2. Selected backfill shall be placed against the full height of the vertical faces of structures for a horizontal distance equal to one-third the height of the structure. ***Selected Backfill***

3. Selected backfill shall consist of a granular material in accordance with the requirements in the Specification for EARTHWORKS. ***Composition***

4. Special care shall be exercised to prevent wedge action against vertical surfaces during the backfilling. Where the sides of the excavation are steeper than 4 horizontally to 1 vertically they shall be cut in the form of successive horizontal terraces at least 600mm in width, as the backfill is placed. ***Horizontal Terraces***

5. Backfill on both sides of the structure shall be carried up to level alternately in layers so as to avoid wedge action or excessive horizontal forces. Backfilling and compaction shall commence at the wall. Compaction shall be in accordance with the Specification for STORMWATER DRAINAGE - GENERAL. ***Procedure***

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C223.11 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C223.1 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Cut-off Walls**		
	Depth into sound rock	>150mm	C223.05
2.	**Mass Concrete Bedding**	>50mm	C223.09

Table C223.1 - Summary of Limits and Tolerances

CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C224

OPEN DRAINS
INCLUDING KERB & CHANNEL

SPECIFICATION C224 - OPEN DRAINS, INCLUDING KERB AND CHANNEL

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SPECIFICATION C224 : OPEN DRAINS, INCLUDING KERB AND CHANNEL

GENERAL

C224.01 SCOPE

1. The work to be executed under this Specification consists of the construction, lining and protection of all types of open drains including the construction of rock filled wire mattresses and gabions.

2. This Specification should be read in conjunction with the Specification for STORMWATER DRAINAGE - GENERAL, and other drainage Specifications as applicable:

C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C223	-	Drainage Structures

3. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C224.02 DEFINITION

1. Open drains are all drains other than pipe and box culverts and include catch drains, contour drains, diversion drains, table drains, batter drains, swales, channels, and kerbs and channels. ***Definition***

C224.03 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C211	-	Control of Erosion and Sedimentation
C220	-	Stormwater Drainage - General
C221	-	Pipe Drainage
C222	-	Precast Box Culverts
C271	-	Minor Concrete Works
C273	-	Landscaping

(b) Australian Standards

AS 1141.22	-	Wet/dry strength variation
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1289.5.7.1	-	Compaction control test (rapid method)
AS 2758.4	-	Aggregate for gabion baskets and wire mattresses
AS 2876	-	Concrete kerbs and channels - Manually or machine placed
AS/NZS 4534	-	Zinc and zinc/aluminium-alloy coatings on steel wire.

(c) Other

AUSTROADS	-	Guide to Geotextiles

UNLINED OPEN DRAINS

C224.04 GENERAL

1. Unless shown otherwise on the Drawings, drains shall be vee shaped or of trapezoidal cross section and shall not be less than 300mm deep and have a minimum waterway area of 0.2 square metres. ***Shape***

2. Open drains shall be graded to ensure free flow of water and, shall not have a grade of less than 1 per cent. ***Grade***

3. Where trees marked for preservation or rock outcrops occur in the line of a drain, the drain may be neatly diverted if approved by the Superintendent. ***Trees and Rock Outcrops***

WP

4. Open drains shall be extended as necessary to lead the water clear of the work to natural drainage depressions, culverts, or pits connected to underground drainage systems. The drains shall follow existing watercourses and depressions in the natural surface, unless other locations are shown on the Drawings ***Open Drains***

5. Open drains shall be located and constructed so as to avoid recharging groundwater encouraging a shallow watertable and creating or worsening salinity degradation of adjacent land. ***Salinity Prevention***

6. All work shall be undertaken in accordance with the requirements of the Specification for CONTROL OF EROSION AND SEDIMENTATION. ***Control of Erosion***

C224.05 TYPES

1. Catch drains shall be provided above the tops of cuttings or along the toes of embankments where shown on the Drawings before construction of the adjacent roadway. The edges of catchdrains shall be positioned not be less than 2m from the tops of cuttings or the toes of embankments nor more than is necessary to maintain the fall of the drains. ***Catch Drains***

2. Minor diversion and contour drains shall be constructed where shown on the Drawings or directed by the Superintendent. Minor diversion drains shall have the same capacity as the nearest pipe culvert on the line of the drain unless otherwise approved by the Superintendent. ***Diversion & Contour Drains***

3. Table drains, swales and depressed medians shall be constructed to the line and level shown or calculated from the Drawings. Their construction is deemed to be part of earthworks. ***Table Drains***

4. Inlet, outlet and diversion channels shall be excavated as shown on the Drawings and, unless indicated otherwise, shall extend to join the existing stream bed in a regular manner, avoiding disturbance in stream flow. The channel shall be excavated to the full width of the structure but the existing stream bed shall be preserved as far as possible outside the limits of the excavation. ***Channels***

C224.06 CONSTRUCTION

1. Material excavated from drains shall be placed on the lower sides of the drains and formed as banks with slopes not steeper than 4h:1v on the cross section of the bank to increase the capacity of the drains. This material shall be compacted in accordance with AS 1289.5.4.1 and shall be not less than 95 per cent for standard compactive effort. ***Excavated Material***

2. The Contractor shall ensure that none of the activities associated with the work disturbs any watercourse outside the site. Any excavation below the level of the natural channel shall be backfilled with suitable material compacted to a density equal to and compatible with that existing naturally. ***Contractor's Responsibility***

3. Any excess material shall be legally and responsibly disposed of by the Contractor. ***Excess Material***

4. Unlined drains and areas adjacent to open drains shall be revegetated immediately after the drains are complete, in accordance with the Specification for LANDSCAPING. ***Revegetation***

LINED OPEN DRAINS

C224.07 GENERAL

1. Lined open drains shall be formed as for unlined open drains with the inclusion of a lined invert in accordance with the Drawings. ***Shape***

2. Lining shall conform to the profile of the drain and shall be provided as soon as possible after forming the drain. ***Profile***

3. Before placing any lining material, the foundation material shall be shaped and compacted to form a firm base for the lining. Other than for kerb and channel constructed on pavement courses, the relative compaction, as determined by AS 1289.5.7.1 or AS 1289.5.4.1 shall not be less than 95 per cent for standard compactive effort. ***Compaction of Foundations***

C224.08 CONCRETE LINING

1. Concrete lining for open drains shall be cast-in-situ or sprayed concrete supplied and placed in accordance with the Specification for MINOR CONCRETE WORKS. Weepholes shall be provided in the concrete at intervals of 2m or as determined by the Superintendent. ***Method***

2. Contraction joints in concrete lining, consisting of narrow transverse and vertical grooves, 20mm deep, shall be formed neatly in the surface of the freshly placed concrete at intervals of 3m unless otherwise specified by the Superintendent. Expansion joints shall be placed at intervals not more than 15m and shall consist of preformed jointing material of bituminous fibreboard and shall be of sufficient depth to fill the joint. ***Jointing***

C224.09 STONE PITCHING

1. Stone Pitching shall consist of sound durable rock not less than 100mm thick, properly bedded on approved loam or sand and mortared to present a uniform surface. The exposed surface of each stone or block shall be approximately flat and not less than 0.05 square metres in area. Spaces between adjacent stones or blocks shall not exceed 20mm in width. ***Rock Quality and Placing***

C224.10 BATTER DRAINS

1. Batter drains shall be constructed using either half round steel pipes or precast nestable concrete units as shown and detailed on the Drawings. ***Type***

2. The units shall be installed in carefully excavated and template controlled trench to produce an even rim line of +0mm to –50mm from the batter line at the underside of topsoil. ***Installation***

3. Any over excavation and undulations in the batter line shall be backfilled and both sides of the drain compacted over the full length to form a firm shoulder against the rim of the batter drain. ***Compaction***

4. When topsoil is placed it shall be tapered over a width of 1m to zero thickness at the rim of the drain. Both sides of the drain shall then be turfed for minimum width of 600mm and pinned down as provided in the Specification for LANDSCAPING. ***Topsoil and Turfing***

C224.11 PROPRIETARY PRODUCTS

1. Unless shown on the Drawings, proprietary products may only be used with the approval of the Superintendent. Where specified, they must be used strictly in accordance with the manufacturer's instructions. ***Manufacturer's Instructions***

C224.12 KERB AND CHANNEL

1. Kerb and/or channels may be constructed in fixed forms, by extrusion or by slip forming, in accordance with AS 2876. ***Method***

2. The foundation, concrete quality, curing and testing details shall be in accordance AS 2876. ***Construction Details***

3. The top and face of the finished kerb and channel shall be true to line and the top surface shall be of uniform width, free from humps, sags or other irregularities. Kerb and channel shall have a steel float finish. ***Finish***

4. The level at any point on the surface of the channels shall be within ±10mm of design levels. When a straight edge 3m long is laid on top of or along the face of the kerb or on the surface of channels, the surface shall not vary more than 5mm from the edge of the straight edge, except at kerb laybacks, grade changes or curves or at side entry pits requiring channel depression. ***Tolerances***

5. Unless shown otherwise on the Drawings, contraction joints, shall be formed every 3m of channel length for a minimum of 50 per cent of cross sectional area. The joint shall be tooled 20mm in depth to form a neat groove of 5mm minimum width. ***Contraction Joints***

6. Unless shown otherwise on the Drawings, expansion joints, 15mm in width for the full depth of the kerb and channel, shall be constructed at intervals not exceeding 15m and where the channel abuts against side entry pits, retaining walls and overbridges. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard. ***Expansion Joints***

7. Where kerbs and/or channels are cast adjacent with a concrete pavement the same type of contraction, construction and expansion joints specified in the concrete base shall be continued across the kerb and/or channel. ***Adjacent Concrete Pavement***

8. All house stormwater outlets shall be provided and/or extended , to match the existing type and size of pipe, through the kerb as shown on the Drawings. Pipework shall be in accordance with the requirements for UPVC pipes in the Specification for PIPE DRAINAGE, or as directed by the Superintendent for other types of pipe. ***Stormwater Outlets***

9. Opposite all driveways, where shown on the Drawings or where directed by the Superintendent, barrier kerb shall be discontinued to provide for vehicular or pedestrian access. At such locations, kerb laybacks shall be constructed in accordance with the Drawings. Footpath crossovers shall be constructed to meet the laybacks as shown on the Drawings, or reinstated to match existing materials where not otherwise shown. ***Vehicular or Pedestrian Access***

10. After the new kerb and channel has been constructed and not earlier than three days after placing, the spaces on both sides of the kerb and/or channels shall be backfilled and reinstated in accordance with the Drawings, or as instructed by the ***Backfill Timing***

Superintendent.

11. Backfill material behind the kerb shall consist of granular material, free of organic material, clay and rock in excess of 50mm diameter, or material as approved by the Superintendent. ***Backfill Material***

12. Backfill material behind the kerb shall be compacted in layers not greater than 150mm thick, to a relative compaction of 95 per cent when tested in accordance with AS 1289.5.4.1, for standard compactive effort. The whole of the work shall be finished in a neat and workmanlike manner, free draining and free from surface undulations and trip hazards. ***Behind Kerb***

13. Pavement material adjacent to new channel shall be backfilled in accordance with the Drawings or as directed by the Superintendent. ***Pavement***

ROCK FILLED WIRE MATTRESSES AND GABIONS

C224.13 GENERAL

1. Rock-filled wire mattresses and gabions shall be placed at the locations shown on the Drawings. Installation shall be in accordance with the manufacturer's instructions. A geotextile, as shown on the Drawings, shall be placed between the wire cage and the material being protected. ***Location and Geotextile***

C224.14 MATERIALS

1. For wire mattresses and gabions, the galvanising requirements for wire of circular cross section cited in this Clause as ‘heavily galvanised’, shall comply with the coating mass requirements for round wire, Class W10, in AS/NZS 4534.

(a) Gabions

1. The gabions shall be of the sizes shown on the Drawings and fabricated of woven heavily galvanised wire mesh and PVC coated where specified on the Drawings. Each gabion shall be divided by diaphragms into cells whose length shall not be greater than the width of the gabions plus 100mm. Gabions shall have a nominal mesh size of 80mm x 100mm and body wire shall be a minimum diameter of 2.7mm heavily galvanised with an additional thickness of 0.4mm PVC coating where specified on the Drawings. The minimum core diameters of heavily galvanised selvedge wire and lacing wire shall be 3.4mm and 2.2mm respectively. ***Dimensions***

(b) Wire Mattresses

1. Unless specified otherwise, the wire mattresses shall be supplied in units having dimensions of 6m x 2m x 230mm, and shall be cut to suit areas as shown on the Drawings. The mattresses shall be divided by diaphragms into cells of length not exceeding 600mm. Unless otherwise specified, they shall be fabricated of woven heavily galvanised wire and PVC coated where specified on the Drawings. ***Mattress Dimension***

2. Mattresses shall have a mesh size of 60mm x 80mm and body wire shall be a minimum diameter of 2.0mm heavily galvanised with an additional minimum thickness of 0.4mm PVC coating where specified on the Drawings. The minimum core diameters of heavily galvanised selvedge wire and lacing wire shall be 2.7mm and 2.2mm respectively. ***Wire Dimensions***

(c) Geotextile

1. A chemically and biologically stable geotextile with a minimum strength rating (G) of 1350 and minimum mass of 180 grams per square metre, in accordance with AUSTROADS Guide to Geotextiles, shall be used. ***Type***

2. Samples, manufacturer's specification and instructions on installation shall be submitted to the Superintendent seven days before the intended use of geotextile. ***Sample***

(d) Rock Fill Material

1. The rock fill shall consist of clean hard rock complying with the requirements of AS 2758.4. ***Rock Quality***

2. Rock fill for gabions shall have particle sizes between 100mm and 250mm and preferably not greater than 200mm. Rock fill material may be placed by hand or suitable mechanical device to ensure fill is tightly packed with a minimum of voids. Fill material shall be levelled off 25mm to 50mm above the top of the mesh to allow for settlement. ***For Gabions***

3. Rock fill for wire mattresses shall have particle sizes between 75mm and two-thirds of the mattress thickness, or 250mm, whichever is the lesser. When the mattress is on a slope, rock fill material shall be placed into the units starting from the low end. Units shall be filled slightly overfull by 25mm to 50mm to allow for settlement and to provide an even tight and smooth surface of the required contour. ***For Wire Mattresses***

C224.15 ASSEMBLY AND ERECTION

1. Before laying out the gabions or wire mattresses, geotextile shall be placed on the founding material. The edges of wire mattresses shall be firmly tied to galvanised star pickets driven a minimum of 900mm into the surrounding ground at 1m maximum intervals and the star pickets cut off level with the top of the mattress. The upstream edge of wire mattresses shall be folded down into a trench of minimum depth 300mm and filled with rock fill. This edge shall be tied to star pickets. ***Procedure***

LIMITS AND TOLERANCES

C224.16 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C224.1 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Open Drains - General**		
	(a) Grading	Grade >1%	C224.04
	(b) Depth	>300mm	C224.04
	(c) Waterway Area	>0.2 sq m	C224.04
	(d) Catch Drain Location	>2m from top of cuttings or toes of embankments	C224.05
	(e) Compaction	>95% (standard compaction)	C224.06
2.	**Open Drains - Lining**		
	(a) Compaction of Foundation	>95% (standard compaction)	C224.07
3.	**Stone Pitching**		
	(a) Rock Dimensions	>100mm thickness	C224.09
	(b) Exposed Surface Area	>0.05 sq m	C224.09
	(c) Spaces between Stones	<20mm width	C224.09
4.	**Batter Drains**		
	(a) Rim line	+0, -50 from batter line	C224.10
	Kerb and Channel		
	(a) Compaction of foundation	To AS 2876	C224.12
5.			
	(b) Level of channel surface	Level ≤±10mm of design level	C224.12
	(c) Surface uniformity	Deviation of kerb and channel surface from 3m straight edge ≤5mm	C224.12
	(d) Contraction Joints		
	(i) Area	≥50% of CS area	C224.12
	(ii) Groove Width	≥5mm	C224.12
	(e) Expansion Joint Interval	≤15m	C224.12
	(f) Backfill behind Kerb		
	(i) Layer thickness	≤150mm	C224.12
	(ii) Compaction	>95% (standard compaction)	C224.12
6.	**Rock Fill for Gabions**		

Item	Activity	Limits/Tolerances	Spec Clause
	and Wire Mattresses		
	(a) Wet Strength	>100kN	C224.14d
	(b) Wet/Dry Strength variation	<45%	C224.14d
	(c) Particle size for Gabions	>100mm <250mm	C224.14d
	(d) Fill Level	>25mm <50mm above top of mesh	C224.14d
	(e) Particle size for Wire Mattresses	>75mm <150mm	C224.14d
7.	**Erection of Wire Mattresses**		
	(a) Star pickets for ties	Depth in ground >900mm Spacing <1m	C224.15
	(b) Trench Depth for upstream edge	Depth >300mm	C224.15

Table C224.1 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C230

SUBSURFACE DRAINAGE GENERAL

SPECIFICATION C230 - SUBSURFACE DRAINAGE-GENERAL

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ANNEXURE

SPECIFICATION C230 : SUBSURFACE DRAINAGE – GENERAL

GENERAL

C230.01 INTRODUCTION

Purpose

1. This is the general Specification common and applicable to all types of subsurface drainage and shall be read in conjunction with subsurface drainage specifications:

C231	-	Subsoil and Foundation Drains
C232	-	Pavement Drains
C233	-	Drainage Mats

as applicable to particular contracts.

C230.02 SCOPE

1. The work to be executed under this Specification consists of:

(a) preparation for subsurface drainage construction;

(b) siting of subsurface drainage facilities;

(c) the supply of all materials associated with the provision of the subsurface drainage system;

(d) all activities and quality requirements associated with the supply, placement and compaction of filter material;

(e) the provision of a detailed record of all subsurface drain installations;

(f) the marking on the ground of the location of all subsurface drains.

Quality

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

C230.03 EXTENT OF WORK

1. Details of the work are shown on the Drawings. The requirements of this Contract are summarised as follows:-

(TO BE COMPLETED BY COMPILER)

(a)

(b)

(c)

(d)

(e)

(f)

C230.04 REFERENCE DOCUMENTS

Documents Standards Test Methods

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specifications

C211	-	Control of Erosion and Sedimentation
C213	-	Earthworks
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving.
AS 1141.22	-	Wet/dry strength variation.
AS 1289.E5.1	-	Determination of minimum and maximum dry density of a cohesionless material.
AS 1477	-	Unplasticised PVC (UPVC) pipes and fittings for pressure applications
AS 2439.1	-	Perforated drainage pipe and associated fittings
AS 2758.1	-	Aggregates and rock for engineering purposes - Concrete aggregates
AS 3705	-	Geotextiles - Identification, marking and general data
AS 3706	-	Geotextiles - Methods of test
AS 3706.11	-	Determination of durability - Resistance to degradation by light and heat

(c) Other

AUSTROADS	-	Guide to Geotextiles.
ASTM-D2434-68		Test method for permeability of granular soils (Constant Head)

C230.05 TEMPORARY DRAINAGE DURING CONSTRUCTION

Erosion Control

1. All drainage works carried out by the Contractor shall comply with the Specification for CONTROL OF EROSION AND SEDIMENTATION.

Contractor's Responsibility

2. The Contractor shall make adequate provision for runoff flows at subsurface drainage works under construction to avoid damage or nuisance due to scour, sedimentation, soil erosion, flooding, diversion of flow, damming, undermining, seepage, slumping or other adverse effects to the Works or surrounding areas and structures as a result of the Contractor's activities.

Location of Equipment

3. The Contractor's material and equipment shall be located clear of watercourses or secured so that they will not cause danger or damage in the event of large runoff flows.

C230.06 SITING OF WORK

Set-out

WP

1. Before commencing construction of any subsurface drainage activity, the Contractor shall set out on site the position of the work to the location and levels shown on the standard Drawings, and shall present this set-out for inspection by the Superintendent.

Amendments to Planned Work

2. The Superintendent may amend the locations or designed levels or the lengths to suit actual site conditions.

3. Should the Contractor propose changes to the location, length, designed levels, conditions of installation or cover to suit the Contractor's construction procedures, the Contractor shall present the proposed set-out in addition to the designed set-out for consideration by the Superintendent. No changes shall be made unless the prior written approval of the Superintendent is obtained.

Proposed Changes by Contractor

C230.07 EXCAVATION

1. In undertaking trench excavation the Contractor shall provide any shoring, sheet piling or other stabilisation of the sides necessary to comply with statutory requirements.

Safety

2. Where public utilities exist in the vicinity of drainage works the Contractor shall obtain the approval of the relevant authority to the method of excavation before commencing excavation.

Approval by Public Utility Authorities

3. Excavation by blasting, if permitted, shall be carried out to ensure that the peak particle velocity measured on the ground adjacent to any previously installed drainage structure does not exceed 25 millimetres per second. The Contractor shall comply with other requirements concerning blasting operations in the Specification for EARTHWORKS.

Blasting Operation

4. Trenches shall be excavated to the line, grade, width and depth shown on the Drawings or as directed by the Superintendent. The bottom of the trench shall be constructed so that no localised ponding can occur. All loose material shall be removed by the Contractor.

Excavation Level

5. Any material at the bottom of the trench or at foundation level which the Superintendent deems to be unsuitable shall be removed and disposed in accordance with the Specification for EARTHWORKS by the Contractor and replaced with backfill material in accordance with the requirements of this Specification. The bottom of the excavated trench or foundation, after any unsuitable material has been removed and replaced, shall be parallel with the specified level or grade of the pipe.

Unsuitable Material

6. The excavated material shall be used in the construction of embankments backfilling or spoiled in accordance with the Specification for EARTHWORKS.

Spoil

C230.08 BACKFILLING

1. Backfilling shall be carried out in accordance with the requirements of the relevant subsurface drainage structures Specifications. The bedding material shall be approved by the Delegated Officer.

Detail

C230.09 OUTLET STRUCTURES FOR SUBSURFACE DRAINAGE

1. Subsurface drainage pipes shall be connected to discharge into drainage pits or to outlet structures as shown on the Drawings or as directed by the Superintendent. As a salinity prevention measure, and where practicable, discharge shall be on the downhill side of the embankment or in the cut-fill area so as to reduce the risk of recharge to the subsurface water table.

Discharge, Salinity Prevention

2. Outlets shall be spaced at a maximum interval of 150m.

Spacing

3. Outlets, including those discharging into drainage pits, shall be made rodent proof using galvanised wire netting in accordance with the Drawings.

Rodent Proof

4. The outlet shall be located so that erosion of the adjacent areas does not occur or shall be protected by the placement of selected stone or similar treatment together with a marker post to indicate location and assist maintenance. ***Erosion Control***

5. Outlet pipes from curtain drains shall be unslotted. At no point shall an outlet pipe be higher than the pipe at the end of the curtain drain. ***Outlet Pipe***

6. All concrete used in the construction of outlet structures shall conform to the requirements of the Specification for MINOR CONCRETE WORKS. ***Concrete Specification***

MATERIALS

C230.10 CORRUGATED PLASTIC PIPE

1. Corrugated plastic pipe shall be Class 1000 complying with AS2439.1 of 65mm or 100mm diameter as indicated on the Drawings. All pipe shall be slotted except where shown on the Drawings. ***Specification***

2. Joints, couplings, elbows, tees and caps shall also comply with AS2439.1 and only the manufacturer's recommended fittings shall be used. ***Fittings***

3. The Contractor shall obtain from the Manufacturer a Test Certificate demonstrating compliance with AS2439.1. ***Compliance***

WP

C230.11 OTHER TYPES OF SUBSURFACE DRAINAGE

1. Where a Contractor wishes to use a subsurface drainage pipe other than corrugated plastic pipe, the Contractor shall submit full details of the type of pipe, certification from the manufacturer of its suitability and quality and written acceptance by the Council for its use in each particular application. Certification of the suitability of any pipe will address the crushing strength, flexural strength, jointing system and slotting details. ***Submit for Approval***

C230.12 FILTER MATERIAL

(a) General

1. The types of filter material covered by this Specification shall include: ***Types***

   (a) Type A filter material for use in trench drains and Type B drainage mats

   (b) Type B filter material for use in trench drains and Type B drainage mats

   (c) Type C filter material comprising crushed rock for use in Type A drainage mats

   (iv) Type D filter material comprising uncrushed river gravel for use in Type A drainage mats

2. All filter material shall consist of clean, hard, tough, durable particles.

(b) Type A Filter Material

1. Type A filter material shall be crushed rock complying with the following requirements: ***Grading***

Test Method	Property	Requirement
AS 1141.11	Material passing AS sieve	Per cent by mass
	6.7mm	100
	4.75mm	85 to 100
	2.36mm	0 to 40
	1.18mm	0 to 5
	425um	0 to 2

Table C230.1 - Type A Filter Material

(c) Type B Filter Material

1. Type B filter material shall be granular material complying with the following grading requirements: ***Grading***

Test Method	Property	Requirement
AS 1141.11	Material passing AS sieve	Per cent by mass
	4.75mm	100
	2.36mm	95 to 100
	425um	20 to 80
	300um	0 to 30
	150um	0 to 2
	75um	0 to 0.1

Table C230.2 - Type B Filter Material

2. In addition to the above grading requirements, Type B filter material shall have a coefficient of saturated permeability, when compacted to its maximum dry density as determined by AS 1289.E5.1 and then tested in accordance with Test Method ASTM-D2434-68, of at least 8 metres per day after three hours of flow. ***Coefficient of Saturated Permeability***

3. Type B filter material shall not vary from its original grading as a result of compaction processes by more than the following amounts: ***Grading Variation***

AS Sieve	Variation From Grading Before Treatment (per cent of mass)
2.36mm	± 3
1.18mm	± 1
425um	± 1
300um	± 1
150um	± 0.5
75um	± 0.1

Table C230.3 - Type B Filter Material Variation

(d) Type C Filter Material

1. Type C filter material shall be crushed rock complying with the following requirements: ***Grading***

Test Method	Property	Requirement
AS 1141.11	Maximum particle size	37.5mm
	Maximum passing the 9.5mm AS Sieve	5% by mass
	Maximum (D90:D10)*	3
AS 1141.22	Minimum wet strength	100kN
	Maximum 10% fines wet/dry variation	30%
NOTE: The D90 value shall be determined by sieving the material using 75mm, 53mm, 37.5mm, 26.5mm, 19mm, 13.2mm and 9.5mm AS sieves, as appropriate, and then plotting the results on a graph of AS sieve size v percentage passing. The plotted points shall be joined by straight lines and the D90 value shall be determined as the theoretical sieve size corresponding to 90 per cent passing. D10 denotes the theoretical size of a sieve through which 10 per cent of the material would pass and shall be determined from the same graph used to determine the D90 value.		

Table C230.4 - Type C Filter Material

(e) Type D Filter Material

1. Type D filter material shall be uncrushed river gravel complying with the description of rounded aggregate in Table B1, Appendix B of AS2758.1 and the following requirements: ***Grading***

Test Method	Property	Requirement
AS 1141.11	Maximum particle size	75mm
	Maximum passing the 9.5mm AS sieve	5% by mass
	Maximum (D90 : D10)	3
AS 1141.22	Minimum wet strength	100kN
	Maximum 10% fines wet/dry variation	30%

Table C230.5 - Type D Filter Material

C230.13 GEOTEXTILE

(a) General

Properties and Labelling

1. The geotextile, other than seamless tubular filter fabric, shall consist of either a woven or a non-woven type which shall be manufactured from synthetic materials other than polyamide. Rolls of geotextile shall be marked with product identification and supplied with data sheets and information in accordance with the requirements of AS 3705.

2. The geotextile shall be bio-stable and resistant to attack by alkalis, acids, dry heat, steam, moisture, brine, mineral oil, petrol, diesel and detergents when tested in accordance with the appropriate parts of AS 3706.

Ultra Violet Light Resistant

3. The geotextile shall be resistant to ultra-violet light. No geotextile shall be left exposed to sunlight during storage and construction for a period longer than a total of twenty-one days. If exposure in excess of twenty-one days does occur, the geotextile shall be tested in accordance with AS 3706.11 and if its characteristics have deteriorated to or below 90 per cent of the characteristics claimed by the manufacturer or the characteristics determined on unexposed geotextile, whichever is the better, it shall be removed and replaced with a geotextile complying with this Specification.

4. The geotextile material type, strength rating “G”, and minimum mass requirements shall be as shown on the Drawings.

5. The type, properties, functions, design and construction requirements for a particular application of geotextile installation shall be compatible with recommendations provided by the AUSTROADS Guide to Geotextiles as well as requirements indicated on the drawings.

Water Transmission Rate

6. In addition to the above mentioned requirements, geotextiles for curtain drains shall consist of polyester, polypropylene or polyethylene. When subjected to a pressure of 200 kPa applied at right angles to the plane of the fabric and to a constant head of water no greater than 50mm applied to the top edge of the fabric, geotextiles for curtain drains shall have a rate of water transmission not less than 20 litres per hour per metre width of fabric through a 300mm length of the fabric.

(b) Seamless Tubular Filter Fabric

Specification

1. Seamless knitted tubular filter fabric shall be used to enclose all slotted pipes and shall be manufactured from either polypropylene or polyester. The fabric shall be free of imperfections in weave or yarn and have abrasion resistant and weave stability qualities such that it shall not form holes, ladder, deweave, tear or unravel more than 5mm from a cut end.

Fitting

2. Fitting of the seamless tubular filter fabric shall be in accordance with the requirements of Annexure C230A. Filter fabric that is excessively stretched, torn or otherwise damaged during fitting of the fabric, storage, transportation or pipe laying will be removed and replaced so as to eliminate any damaged lengths.

RECORDING OF DRAINAGE

C230.14 RECORDING OF SUBSURFACE DRAINAGE INFORMATION

1. The Contractor shall keep a detailed record of all subsurface drainage pipes and the completed subsurface drainage systems shall be shown on the work-as-constructed plans to be returned to the Superintendent upon completion of the Contract. ***Work As Constructed Plans***

3. The information to be included in the subsurface drainage information sheets shall include: ***Detail***

Date of completion of drain construction:

Drain Number:

Type of Drain:

Pipe Size:

Pipe Type:

Filter Type:

Grade of Drain:

Locations of Flushout Risers:

Locations of Outlets:

Geotextile-

Sheet	Yes/No
Seamless Tubular Filter Fabric	Yes/No

Response Time:

NOTE: Response Time shall be the time taken for water to travel from the inlet end of a drain or from a cleanout leading to a drain to the outlet end of the drain.

4. The costs associated with the preparation of Subsurface Drainage Sheets shall be borne by the Contractor. ***Contractor's Costs***

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C230.15 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C230.6 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Excavation by Blasting**		
	Peak particle velocity	≤25mm/sec	C230.07
2.	**Outlets**		
	Spacing	Max 150m	C230.09
3.	**Filter Material**		
	(a) Type A	Table C230.1	C230.12
	(b) Type B	Tables C230.2 and C230.3	C230.12
	(c) Type C	Table C230.4	C230.12
	(d) Type D	Table C230.5	C230.12
4.	**Geotextile**		
	(a) Exposure to sunlight	<21 days If >21 days deterioration not to exceed 10% of claimed characteristics	C230.13
	(b) Curtain Drains Water Transmission	>20 litres/hr/m	C230.13

Table C230.6 - Summary of Limits and Tolerances

ANNEXURE C230A
SLOTTED PIPES FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

1. PROCEDURE FOR FITTING SEAMLESS TUBULAR FILTER FABRIC TO SLOTTED PIPE

Seamless tubular filter fabric shall be fitted to slotted pipe immediately before the slotted pipe is to be laid in its final position in the work.

The filter fabric shall be initially pulled over and onto a short length of smooth pipe of internal diameter between 20mm and 30mm greater than the external diameter of the slotted pipe to be enclosed by filter fabric. The short, larger diameter pipe shall be referred to as the 'mandrel'.

The pipe to be enclosed by the filter fabric shall be passed through the mandrel. The filter fabric shall be slipped on to the pipe as the pipe emerges from the mandrel leaving enough overhang of the filter fabric to make a suitable joint with the filter fabric on the adjacent pipe. The filter fabric shall be firmly held to the forward end of the pipe so that it can not slip back along the pipe.

The pipe shall be pulled right through the mandrel allowing the filter fabric to progressively slip over the pipe. The filter fabric shall be restrained from easily slipping off the mandrel thus ensuring the filter fabric is stretch fitted onto the pipe.

When the end of the pipe emerges from the mandrel, the filter fabric shall be clamped to that end of the pipe so that the filter fabric can not slip down the pipe. The filter fabric shall remain clamped to each end of the pipe to ensure the filter fabric remains stretch fitted onto the pipe when the pipe is placed in its final position in the drain. The filter fabric shall be cut cleanly leaving enough overhang off the end of the pipe to make a fully covered join with the filter fabric on the adjacent pipe when the pipes are installed in the drain.

2. PRECAUTIONS TO BE TAKEN WHEN USING SLOTTED PIPE FITTED WITH SEAMLESS TUBULAR FILTER FABRIC

Slotted pipe fitted with seamless tubular filter fabric shall not be dragged over the ground. If carried, the pipe shall be lifted clear of the ground and the filter fabric shall be protected from damage at all times.

Seamless tubular filter fabric which has been so damaged as to affect its filtering properties shall be removed from the pipe and replaced with undamaged filter fabric.

If at any time during the installation of a slotted pipe it is found that the enclosed filter fabric has become loose on the pipe it shall be restretched to its correct position. If restretching causes any damage to the filter fabric, the damaged filter fabric shall be removed from the pipe and replaced with undamaged filter fabric.

CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C231

SUBSOIL AND FOUNDATION DRAINS

SPECIFICATION C231 - SUBSOIL AND FOUNDATION DRAINS

SPECIFICATION C231 : SUBSOIL AND FOUNDATION DRAINS

GENERAL

C231.01 SCOPE

1. The work to be executed under this Specification covers the excavation, bedding, installation and backfilling of subsoil and foundation drains. ***Scope***

2. Subsoil and foundation drains shall be constructed where and as shown on the Drawings or as directed by the Superintendent. ***Location***

3. This Specification should be read in conjunction with the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Associated Specification***

4. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C231.02 TERMINOLOGY

1. Subsoil drains are intended for the drainage of ground water and/or the pavement in cuttings. ***Subsoil Drains***

2. Foundation drains are required for the drainage of seepage, springs and wet areas within and adjacent to the foundations. ***Foundation Drains***

C231.03 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C213	-	Earthworks
C230	-	Subsurface Drainage - General

(b) Australian Standards

AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio

C231.04 ORDER OF CONSTRUCTION

(a) Subsoil Drains

1. Subsoil drains shall be constructed as soon as possible after necessary earthworks are completed in the area of the drain. Where stabilisation of the subgrade is required, subsoil drains shall be constructed after completion of stabilisation except that, where excessive ground water is encountered, they may be constructed prior to stabilisation of the subgrade. ***Timing of Work***

2. Where a Selected Material Zone is specified and excessive ground water is encountered, subsoil drains may be installed in two stages as follows: ***Two Stage Construction***

Stage 1: Standard subsoil drains installed below the base of the cutting prior to placement of select material in the Selected Material Zone.

Stage 2: Extension of subsoil drain to top of the Selected Material Zone after placement of selected material.

(b) Foundation Drains

1. Foundation drains shall be constructed after completion of clearing and stripping operations, and preceding the commencement of embankment construction. ***Timing of Construction***

CONSTRUCTION

C231.05 SUBSOIL DRAINS

(a) Excavation ***Associated Specification***

1. Excavation shall be undertaken in accordance with the requirement of the Specification for SUBSURFACE DRAINAGE - GENERAL.

2. The bottom of the trench shall be excavated to the same grade as the design pavement surface in the direction of the trench except where the grade of the design pavement surface in the direction of the trench is less than 0.5 per cent. In which case the trench depth shall be increased to provide a minimum grade of fall in the trench of 0.5 per cent. The bottom of the trench shall be excavated so that no localised ponding of water occurs. ***Minimum Grade***

3. If at any location the trench is excavated below the specified floor level, the trench shall be backfilled with non-porous subgrade material so that when the subgrade material is compacted to a relative compaction, determined by AS 1289.5.4.1, of at least 95 per cent (standard compaction), the bottom of the trench shall be at the specified floor level. ***Over-excavation***

4. Where a subsoil drain is constructed in two stages, the excavation for Stage 2 shall be carried out after placement and compaction of the selected material zone or the stabilised subgrade layer. The Stage 2 trench shall be excavated to the same line and width as the Stage 1 trench and to a depth to provide a clean, full contact with the filter material placed in Stage 1. All excavated material shall be disposed to waste or incorporated into fills. ***Two Stage Construction***

(b) Laying of Pipe ***Bedding***

1. The 100mm diameter corrugated slotted plastic piping, complying with the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be laid on a bed of filter material 50mm in thickness and shall be laid to the specified line and grade. The pipe shall not deviate from the specified line by more than 100mm at any point.

2. The type of filter material shall be as shown on the Drawings or as directed by the Superintendent. ***Filter Material***

3. Joints in the pipeline shall be kept to the minimum number and, where required, shall be made using a suitable external joint coupling. The inlet end of the pipe shall be fitted with a cap. ***Joints and Capping***

(c) Backfilling ***Filter Material***

1. The trench shall be backfilled with filter material to the level specified. The type of filter material shall be as shown on the Drawings or as directed by the Superintendent. The filter material shall be placed and compacted in layers with a maximum compacted thickness of 300mm. Tamping around and over the pipe shall be done in such a manner as to avoid damage or disturbance to the pipe.

2. The filter material shall be compacted for its full depth to a relative compaction of ***Compaction of***

not less than 100 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Filter Material***

3. The upper section of the trench, above the level specified for filter material backfill, shall be backfilled with selected free draining backfill material, conforming to the requirements of the Specification - EARTHWORKS, compacted for its full depth to a relative compaction of not less than 100 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Select Material***

4. Where shown on the Drawings or as directed by the Superintendent, a geotextile conforming with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be provided at the interface between the filter material and adjoining materials. Laps of 500mm shall be provided at joints in the fabric. ***Geotextile***

(d) Outlets ***Pipes and Structures***

1. Outlets are to be provided as shown on the Drawings or at maximum intervals of 150m. Subsoil drains shall discharge into side entry pits and other stormwater drainage structures. Outlets shall be constructed of unslotted plastic pipe of the same diameter as the main run when outside the targeted subsurface water catchment. An outlet structure in accordance with the Drawings shall be constructed at the discharge end.

(e) Flushout Risers ***Location***

1. Flushout risers are to be provided at the commencement of each run of subsoil drain line and at intervals of approximately 60m or as shown on the Drawings.

2. Details of the required risers construction are shown on the Drawings. The standard CI caps as shown on the Drawings shall be supplied by the Contractor. ***Details***

C231.06 FOUNDATION DRAINS

(a) Excavation

1. Excavation shall be undertaken in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL and Clause C231.05 of this Specification. ***Associated Specification***

(b) Laying of Pipe

1. The 100mm diameter corrugated slotted plastic piping, complying with the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be laid on a bed of filter material 50mm in thickness and shall be laid to the required line and grade. ***Bedding***

2. The type of filter material shall be as shown on the Drawings or as directed by the Superintendent. ***Filter Material***

3. Joints in the pipeline shall be kept to the minimum number and, where required, shall be made using a suitable external joint coupling. The inlet end of the pipe shall be fitted with a PVC cap. ***Jointing of Pipe***

(c) Backfilling

1. The trench shall be backfilled with filter material in accordance with the provisions of Clause C231.05(c). ***Filter Material***

2. The upper section of the trench, above the level specified for filter material backfill, shall be backfilled with suitable earth backfill material, compacted for its full depth to a relative compaction of not less than 95 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Earth Backfill and Compaction***

3. Where shown on the Drawings or as directed by the Superintendent, a geotextile, ***Geotextile***

conforming with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be provided at the interface between the filter material and adjoining materials. Laps of 500mm shall be provided at joints in the fabric.

(d) Outlets

1. An outlet structure in accordance with the detail shown on the Drawings and the Specification for SUBSURFACE DRAINAGE - GENERAL shall be constructed at the discharge end. The outlet shall be located so that erosion of the adjacent area does not occur or shall be protected by the placement of selected stone in the splash zone of the outlet.

Construction Detail

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C231.08 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C231.1 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Excavation**		
	Trench Grade	≥0.5%	C231.05(a)
2.	**Laying of Pipe**		
	Alignment	Deviation <100mm from specified line at any point	C231.05(b)
3.	**Subsoil Drain Backfill**		
	(a) Layer thickness	300mm max	C231.05(c)
	(b) Compaction (Relative)		
	Filter and Backfill material	100% standard	C231.05(c)
4.	**Outlet Spacing**	150m max	C231.05(d)
5.	**Flushout Riser Spacing**	60m approx	C231.05(e)
6.	**Foundation Drain Backfill**		
	(a) Layer thickness	300mm max	C231.05(c)
	(b) Compaction (Relative)		
	Filter material	100% Standard	C231.05(c)
	Backfill material	>95% Standard	C231.06(b)

Table C231.1 - Summary of Limits and Tolerances

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C232

PAVEMENT DRAINS

SPECIFICATION C232 - PAVEMENT DRAINS

ANNEXURE

SPECIFICATION C232 : PAVEMENT DRAINS

GENERAL

C232.01 SCOPE

1. This Specification covers the installation of Sub-Pavement Drains, Intra-Pavement Drains and Edge Drains. ***Scope***

2. Pavement drains shall be constructed where and as shown on the Drawings or as directed by the Superintendent. ***Location***

3. This Specification should be read in conjunction with the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Associated Specification***

4. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C232.02 TERMINOLOGY

1. Sub-Pavement Drains are intended for the drainage of the pavement layers where the subbase is not a macadam crushed rock. ***Sub-Pavement Drains***

2. Intra-Pavement Drains are intended for the drainage of the pavement layers of a flexible pavement where the subbase material is a macadam crushed rock or open graded asphalt. ***Intra-Pavement Drains***

3. Edge Drains are intended for the drainage of rigid pavements. ***Edge Drains***

C232.03 REFERENCE DOCUMENTS

1. Documents referenced in this specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C213	-	Earthworks
C230	-	Subsurface Drainage - General
C242	-	Flexible Pavements
C245	-	Asphalt

(b) Australian Standards

AS 1289.3.3.1	-	Calculation of the plasticity index of a soil.
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1477	-	Unplasticised PVC (UPVC) pipes and fittings for pressure applications.

C232.04 ORDER OF CONSTRUCTION

(a) Sub-Pavement Drains

1. Sub-pavement drains shall be constructed as soon as possible after necessary earthworks are completed in the area of the drain. Where stabilisation of the subgrade is required, sub-pavement drain shall be constructed after completion of stabilisation except that where excessive ground water is encountered, sub-pavement drains may be constructed prior to stabilisation of the subgrade. ***Timing of Construction***

2. Where a Selected Material Zone is specified and excessive ground water is encountered, sub-pavement drains may be installed in two stages as follows: ***Stage Construction***

Stage 1: Standard sub-pavement drains installed below the base of the cutting prior to placement of select material in the Selected Material Zone.

Stage 2: Extension of sub-pavement drain to top of the Selected Material Zone after placement of selected material.

(b) Intra-Pavement Drains

1. Intra-Pavement Drains shall be constructed after the completion of the layer below the crushed rock Macadam or 40mm open graded asphaltic concrete subbase and preceding the construction of the subsequent layers. ***Timing of Construction***

(c) Edge Drains

1. Edge Drains shall be constructed after the construction of the rigid pavement and before the placement and compaction of verge material. ***Timing of Construction***

CONSTRUCTION

C232.05 SUB-PAVEMENT DRAINS

(a) Excavation

1. Trenches 300mm wide shall be trimmed to the required line and to a depth of 600mm below the bottom of the subbase or below the base of the cutting where two stage construction of the Sub-Pavement Drain is required. ***Trench Dimensions***

2. The bottom of the trench shall be to the same grade as the design pavement surface except where the grade of the roadway is less than 0.5 per cent, in which case the depth of the trench shall be increased to provide a grade of 0.5 per cent in the trench. The bottom of the trench shall be excavated so that no localised ponding of water occurs. ***Trench Grade***

3. Where two stage construction of the sub-pavement is required, excavation for Stage 2 shall be carried out after placement and compaction of the Selected Material Zone. The Stage 2 trench shall be to the same line and width as Stage 1 and to a depth sufficient to provide a clean, full contact with the previously placed filter material. All excavated material shall be disposed to waste or incorporated into fills. ***Two-Stage Construction***

(b) Laying of Pipe

1. The 100mm diameter corrugated slotted plastic piping, complying with the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be laid on a bed of filter material 50mm in thickness and shall be laid to the specified line and grade . The pipe shall not deviate from the specified line by more than 100mm at any point ***Filter Bed***

2. The type of filter materials shall be as shown on the Drawings or as directed by the Superintendent. ***Type***

3. Joints in the pipeline shall be kept to the minimum number and, where required, shall be made using a suitable external joint coupling. The inlet end of the pipe shall be fitted with a cap. ***Jointing***

(c) Backfilling

1. The trench shall be backfilled with filter material to the level specified. The type of filter material shall be as shown on the Drawings or as directed by the Superintendent. ***Filter Material***

The filter material shall be placed and compacted in layers with a maximum compacted thickness not exceeding 300mm. Tamping around and over the pipe shall be done in such a manner as to avoid damage or disturbance of the pipe.

2. The filter material shall be compacted for its full depth to a relative compaction of not less than 100 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Compaction***

3. On the outlet section of pipes discharging through the fill batters the trench shall be backfilled with the nominated filter material to a depth of 50mm above the pipe. The balance of trench shall be backfilled with earth backfill material of maximum particle size of 50mm and shall be compacted for the full depth to a relative compaction of 95 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Pipe Outlet***

4. In case of sub-pavement drains of two stage construction, when it is not practical to place the Pavement Layers or the Selected Material Zone immediately after the construction of Stage 1, the filter material placed to the top of Stage 1 shall be protected from scour and/or contamination by covering with a 50mm thick plug of compacted select fill material having a maximum particle size of 25mm and Plasticity Index of not more than twelve as determined by AS 1289.3.3.1. This plug, any contaminated filter material and any select material covering shall be removed and replaced with the nominated filter material and compacted immediately ahead of the placement of the pavement layer. All excavated material shall be disposed to waste or incorporated in fills. ***Temporary Plug over Filter Material***

(d) Flushout Risers

1. Flushout risers are to be provided at the commencement of each run of sub-pavement drain line and at intervals of approximately 60m or as shown on the Drawings. ***Location***

2. Details of the required riser construction are shown on the Drawings. ***Details***

(e) Outlets

1. Outlets are to be provided as shown on the Drawings or at maximum intervals of 150m. Sub-pavement drains shall discharge into drainage pits and other stormwater drainage structures. Outlets shall be constructed of unslotted plastic pipe of the same diameter as the main run when outside the pavement area. An outlet structure in accordance with the Drawings shall be constructed at the discharge end. ***Location***

2. The outlet shall be made rodent proof in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Rodent Proof***

3. The outlet shall be located so that erosion of the adjacent area does not occur, or shall be protected by the placement of selected stone in the splash zone of the outlet. ***Erosion Control***

C232.06 INTRA-PAVEMENT DRAINS

(**a) Excavation**

1. A 'V' shaped trench approximately 50mm deep shall be cut to the required line in the pavement layer immediately below the MS75 crushed rock pavement layer. No excavation is required below a 40mm open graded asphaltic concrete subbase layer. ***Type***

2. The bottom of the trench is to be to the same grade as the roadway. The bottom of the trench shall be constructed so that localised ponding of water does not occur. ***Grade***

3. Where the pipe is to discharge through the fill batter a trench shall be constructed on a grade suitable for the pipe to discharge its contents without scour. After laying the pipe the trench shall be backfilled with fill material and compacted for the full depth to a relative compaction of not less than 95 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Discharge Pipe***

(b) Laying of Pipe

1. Thick walled unplasticised PVC pressure pipe, complying with AS 1477, and having a nominal diameter of 58mm, and a minimum pipe wall thickness of 6.5mm, shall be used with crushed rock subbases having not more than 10 per cent of material passing the 9.5mm AS sieve and having layer thicknesses neither less than 150mm nor more than 200mm or open graded asphalt subbases having layer thicknesses neither less than 80mm nor greater than 100mm. ***UPVC Pressure Pipe***

2. Where crushed rock subbases require pavement drains and have a depth exceeding 200mm, the type of pavement drain will need to be certified to have adequate crushing strength and written approval of the Council to the proposed pavement drain type will be required. Similar proposal and Council approval is required for pavement drain in asphalt subbases greater than 100mm in depth. ***Subbases >200mm Pipe Crushing Strength***

3. All pipe shall be slotted except where otherwise shown on the Drawings. Details of slot sizes and spacings shall be in accordance with Annexure C232-A for thick walled unplasticised PVC pressure pipe. ***Slot Size***

4. Thick walled unplasticised PVC pressure pipe shall have square ends and shall be butt jointed. ***PVC Pipe Joints***

5. Where spigot and socket type pipes are used, the pipes shall be joined with the socket ends facing upstream. ***Socket Joints***

6. The pipe shall be laid to the specified line and level. The pipe shall not deviate from the specified line by more than 100mm at any point. ***Level***

7. The inlet ends of all pipes shall be fitted with caps. ***Inlet Caps***

8. All pipes shall be securely held to the layer under the free-draining subbase to prevent movement of the pipes during placement and compaction of the free-draining subbase. At least seven days before commencement of pipe laying, the Contractor shall submit details of the proposed method of securing the pipes to the layer under the free-draining subbase for the approval of the Superintendent. ***Pipe Anchorage***

9. Notwithstanding the Superintendent's approval to the use of a method of securing the pipes to the layer under the free draining subbase, if such securing method allows movement of the pipes, the method shall be discontinued and the Contractor shall propose an alternative securing method for approval by the Superintendent. ***Alternative Securing Method***

10. Any additional costs resulting from the use of the alternative method of securing the pipes shall be borne by the Contractor. ***Contractor's Costs***

11. The outlet length of pipe from the outside edge of the free-draining subbase to an outlet structure in the embankment batter shall be unslotted and the pipe joints in this length of pipe shall be sealed with suitable couplings or mastic. ***Outlet Length***

(c) Backfilling

1. Subbase material shall be spread, compacted and trimmed, where appropriate, as follows: ***Subbase***

   (a) For crushed rock Macadam subbase, in accordance with the Specification for FLEXIBLE PAVEMENTS.

   (b) For open graded asphalt subbase, in accordance with the Specification for ASPHALT.

2. Tipping, spreading and compaction of the subbase shall be undertaken in such a ***Damage to***

manner as not to damage the intra-pavement drain pipes. If any pipes are damaged as a result of the tipping, spreading and compaction of the subbase, the Contractor shall remove and replace the damaged pipes. ***Pipes***

3. The thickness of the layer of subbase material enclosing the pipe shall be within the limits specified in Clause C232.06(b) for the type of pipe used in the intra-pavement drain. ***Subbase Layer Thickness***

(d) Outlets

1. Outlets are to be provided as shown on the Drawings or at maximum intervals of 150m. Intra-pavement drains shall discharge into gully pits and other stormwater drainage structures. Outlets shall be constructed of unslotted plastic pipe of the same diameter as the main run when outside the pavement area. An outlet structure in accordance with the Drawings shall be constructed at the discharge end. ***Location***

2. The outlet shall be made rodent proof in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Rodent Proof***

3. The outlet shall be located so that erosion of the adjacent area does not occur, or shall be protected by the placement of selected stone in the splash zone of the outlet. ***Erosion Control***

C232.07 EDGE DRAINS

(a) Excavation

1. The verge material shall be trimmed to subgrade level and to the minimum width shown on the Drawings. The bottom of the trench is to be constructed at the same grade as the roadway and in such a manner that localised ponding of water does not occur. ***Width and Level***

2. Where the grade of the roadway is less than 0.5 per cent the trench shall be excavated to provide a minimum grade of 0.5 per cent. ***Grade***

3. When the pipe is to discharge through the fill batter a suitable trench shall be excavated to provide the required grade. ***Discharge Pipe***

(b) Laying of Pipe

1. Generally, 65mm diameter slotted corrugated plastic pipe enclosed in seamless tubular filter fabric, complying with the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be used for edge drains. ***Slotted Plastic Pipe***

2. Where any part of a shoulder consists of material other than concrete, slotted thick walled unplasticised PVC pressure pipe, complying with AS 1477, shall be used. Spigot and socket type pipes shall be joined with the socket ends facing upstream and the ends of each pipe shall be securely held against the vertical face of the rigid pavement. At least seven days before commencement of pipe laying, the Contractor shall submit details of the proposed method of securing the pipes against the rigid pavement for the approval of the Council. ***Slotted UPVC Pressure Pipe***

3. The pipe shall be laid on a prepared bed to the specified line and level. The pipe shall not deviate from the specified line by more than 100mm at any point. ***Prepared Bed***

4. Joints in the pipe shall be kept to a minimum number and shall be made using an external joint coupling approved by the Superintendent. ***Jointing***

5. The inlet end of the pipe shall be fitted with a cap. ***Inlet Cap***

6. The outlet section of a pipe from the vertical face of the rigid pavement to an outlet in the embankment batter shall be unslotted and the pipe joints in this length of pipe shall be sealed with mastic. ***Outlet Pipe***

(c) Backfilling

1. The pipe shall be covered with Type B filter material to the dimensions shown on the Drawings. ***Filter Material***

2. Mechanical compaction of this filter material is not required, however after placement of the filter material it shall be soaked with water. Where necessary additional filter material shall be added and soaked to provide the final dimensions shown on the Drawings. ***Soaking of Filter Material***

3. Backfilling over the edge drain shall be done in such a manner as to avoid damage or disturbance of the pipe. Backfill material shall be selected material as required for verges and in accordance with the requirements of the Specification EARTHWORKS. Backfilling shall be compacted to a relative compaction of not less than 100 per cent (standard compaction) as determined by AS 1289.5.4.1. ***Procedure and Compaction***

(d) Flushout Risers

1. Flushout Risers are to be provided at the commencement of each run of edge drain line and at intervals of approximately 60m or as shown on the Drawings. ***Location***

2. Details of the required riser construction are shown on the Drawings. The standard CI caps as shown on the Drawings shall be supplied by the Contractor. ***Construction Detail***

(e) Outlets

1. Outlets are to be provided as shown on the Drawings or at maximum intervals of 150m. Edge drains shall discharge into side entry pits and other stormwater drainage structures. Outlets shall be constructed of unslotted plastic pipe of the same diameter as the main run when outside the pavement area. An outlet structure in accordance with the Drawings shall be constructed at the discharge end. ***Location***

2. The outlet shall be made rodent proof in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Rodent Proof***

3. The outlet shall be located so that erosion of the adjacent area does not occur, or shall be protected by the placement of selected stone in the splash zone of the outlet. ***Erosion Control***

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C232.08 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C232.1 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Excavation**		
	Trench Grade	≥0.5%	C232.05(a) C232.07(a)
2.	**Sub-Pavement Drain**		
	Laying of Pipe Alignment	Deviation <100mm from specified line at any point	C232.05(b)
	Backfill		
	(a) Layer thickness	300mm max	C232.05(c)
	(b) Compaction (Relative)		
	Filter material	100% Standard	C232.05(c)
	Backfill material	>95% Standard	C232.05(c)
3.	Flushout Riser Spacing	60m approx	C232.05(d) C232.07(d)
4.	Outlet Spacing	150m max	C232.05(e) C232.06(d) C232.07(e)
5.	Intra-Pavement Drain		
	(a) Alignment	Deviation <100mm from specified line at any point.	C232.06(b)
6.	**Edge Drains**		
	(a) Alignment	Deviation <100mm from specified line at any point	C232.07(b)
	(b) Compaction (Relative)		
	Backfill material	100% Standard	C232.07(c)

Table C232.1 - Summary of Limits and Tolerances

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C233

DRAINAGE MATS

SPECIFICATION C233 - DRAINAGE MATS

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SPECIFICATION C233 : DRAINAGE MATS

GENERAL

C233.01 SCOPE

1. The work to be executed under this Specification covers the installation of Drainage Mats (Blankets). ***Scope***

2. Drainage mats shall be constructed where and as shown on the Drawings or as directed by the Superintendent. ***Location***

3. This Specification should be read in conjunction with the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Associated Specification***

4. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C233.02 TERMINOLOGY

1. Type A drainage mats are intended to ensure continuity of a sheet flow of water under fills, to collect surface seepage from a wet seepage area or for protection of vegetation or habitat downstream of the road reserve where a fill would otherwise cut the flow of water. ***Type A Mats***

2. Type B drainage mats are constructed to intercept water which would otherwise enter pavements by capillary action or by other means on fills and to intercept and control seepage water and springs in the floors of cuttings. ***Type B Mats***

C233.03 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C230 - Subsurface Drainage - General
C232 - Pavement Drains

(b) Australian Standards

AS 1289.5.4.1 - Compaction control test - Dry density ratio, moisture variation and moisture ratio.

C233.04 ORDER OF CONSTRUCTION

1. Type A drainage mats shall be constructed after the site has been cleared and grubbed and before commencement of embankment construction. ***Type A Mats***

2. Type B drainage mats shall be constructed after completion of the subgrade construction and before construction of the pavement. ***Type B Mats***

CONSTRUCTION

C233.05 TYPE A MATS

1. Type A drainage mats shall be constructed under embankments as and where shown on the Drawings or as directed by the Superintendent. ***Location***

2. After the embankment foundation has been trimmed and any necessary trench drains installed, a geotextile complying with the requirement of the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be laid on the embankment foundation. The area of geotextile laid shall be sufficient to cover the area of the Type A drainage mat and an additional amount for enclosing the sides of the drainage mat after the filter material has been placed. Laps of minimum width of 500mm shall be provided at each join in the geotextile. ***Placing of Geotextile***

3. Type C filter material or Type D filter material, as shown on the Drawings or as determined by the Superintendent, shall be placed on the geotextile and compacted to the satisfaction of the Superintendent. The minimum thickness of the compacted filter material shall be 300mm plus an allowance for the expected consolidation of the embankment foundation under the embankment load or 500mm if the amount of the expected total consolidation of the embankment foundation is not known. The filter material shall be placed in two or more layers so that no layer, when compacted, has a thickness greater than 250mm. ***Placing of Filter Material***

4. After completion of placement and compaction of the filter material, geotextile shall be placed on top of and around the sides of the filter material so that the filter material is completely enclosed by geotextile. The geotextile shall be secured in such a manner as to prevent movement of the geotextile by wind or by construction plant placing subsequent layers of filter material or earth filling over the drainage mat. ***Securing of Geotextile***

5. An additional layer of geotextile shall be placed on the drainage mat under the base of any rock facing which may be placed as part of the embankment construction. The additional layer of geotextile shall extend beyond the outside and inside faces of the bottom layer of rock. ***Geotextile under Rock Facing***

6. Care shall be taken not to damage the geotextile during the construction of the drainage mat or during placement of subsequent layers of filter material, earth filling or rock facing. Any geotextile so damaged shall be repaired or replaced by the Contractor to the satisfaction of the Superintendent. ***Damaged Geotextile***

7. Type A drainage mats shall extend 2m beyond the toes of embankments and such extensions shall be covered by a 300mm thick layer of Type C filter material or Type D filter material, as determined by the Superintendent. This protective layer shall be placed immediately after completion of construction of each drainage mat. ***Protective Layer***

8. Outlets from Type A drainage mats may be surface outlets at the toes of embankments or piped outlets connected to other drainage systems. Where piped outlets are constructed they shall conform to the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL. ***Outlets***

C233.06 TYPE B MATS

1. Type B drainage mats shall be constructed in cuttings as and where shown on the Drawings or as directed by the Superintendent. Type B drainage mats shall be constructed for the full width of cuttings and for the pavement width in other locations. ***Location and Width***

2. After the subgrade material has been compacted and trimmed, a geotextile complying with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL, shall be laid on the subgrade. Laps of minimum width of 500mm shall be provided at each join in the geotextile. ***Placing of Geotextile***

3. Slotted thick walled unplasticised PVC pressure pipe complying with AS 1477, shall be laid on the geotextile at a distance of 200mm from and parallel to the longitudinal edges of the drainage blanket as shown in the Drawings. Details of slot sizes and spacings are shown in theSpecification for PAVEMENT DRAINS. ***UPVC Pressure Pipe***

4. Type A filter material shall be placed on the geotextile and compacted to achieve a relative compaction, determined by AS 1289.5.4.1, of at least 100 per cent (standard compaction). Alternatively, the Superintendent may approve the use of a coarser filter material having a maximum particle size of 75mm and a maximum D90/D10 ratio of three. ***Placing of Filter Material***

5. The thickness of the compacted filter material shall be as shown on the Drawings or as directed by the Superintendent. If the required thickness of compacted filter material is greater than 250mm, the filter material shall be placed in two or more layers so that no layer, when compacted, has a thickness greater than 250mm. ***Thickness of Filter Material***

6. After completion of placement and compaction of the filter material, geotextile shall be placed on top of and around the sides of the filter material so that the filter material is completely enclosed by geotextile. The geotextile shall be secured in such a manner as to prevent movement of the geotextile by wind or by construction plant placing pavement layers over the drainage mat. ***Securing of Geotextile***

7. Care shall be taken not to damage the geotextile during the construction of the drainage mat or during placement of subsequent pavement layers. Any geotextile so damaged shall be repaired or replaced by the Contractor to the satisfaction of the Superintendent. ***Damaged Geotextile***

8. The surface of the completed drainage mat shall be at the design level for the top of the drainage mat with a tolerance of plus zero and minus 40mm. ***Surface Level Tolerance***

9. Outlet structures where specified, or where directed by the Superintendent, shall be in accordance with the requirements of the Specification for SUBSURFACE DRAINAGE - GENERAL.

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C233.07 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C233.1 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Filter Material**		
	(a) Layer thickness	250mm max	C233.05 C233.06
	(b) Compaction (Relative) Type A filter material	100% Standard	C233.06
2.	**Type B Mats**		
	(a) Design level at top of mat	+0, -40mm	C233.06

Table C233.1 - Summary of Limits and Tolerances

CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C241

STABILISATION

SPECIFICATION C241 – STABILISATION

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SPECIFICATION C241
STABILISATION

GENERAL

C241.01 SCOPE

1. This Specification defines the materials requirements for stabilised materials provided by stationary plant production as well as materials and process requirements for in-situ stabilisation.

Scope

2. The work to be executed under this Specification consists of the supply and incorporation of stabilising binders with material in a nominated pavement course or subgrade layer (including materials for the selected material zone, and selected backfill), at specified locations in the work and the spreading, compaction, trimming and curing of such materials.

3. This Specification provides the requirements for stabilisation of the types of pavement courses and subgrade zones or layers as shown in Table C241.1.

Pavement Course Or Subgrade Zone Or Layer	Stabilising Binder
PAVEMENT COURSE	
Base and Subbase	Cement Blended Stabilising Agent Hydrated Lime (pugmill) Quicklime (in-situ)
SUBGRADE ZONE OR LAYER	
Selected Material Zone	Cement Blended Stabilising Agent Quicklime (in-situ) Hydrated Lime (pugmill)
Other Subgrade Layers	Cement Blended Stabilising Agent Quicklime (in-situ) Hydrated Lime (pugmill)
Selected Backfill Zone	Cement Hydrated Lime (pugmill)

Table C241.1
Types Of Pavement Courses, Subgrade Zones Or Layers And Stabilising Binder

Associated Specifications

4. The pavement course or subgrade zone or layer to be stabilised shall be as specified in the Specifications for FLEXIBLE PAVEMENTS, or as indicated on the Drawings.

Quality

5. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

C241.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

Documents Standards Test Methods

(a) Council Specifications

C201	-	Control of Traffic
C213	-	Earthworks
C220	-	Stormwater Drainage - General
C242	-	Flexible Pavements

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving.
AS 1289.5.7.1	-	Compaction control test (Rapid method)
AS 1289.5.8.1	-	Determination of field density and field moisture content of a soil using a nuclear surface moisture-density gauge - Direct transmission mode.
AS 1289.4.2.1	-	Determination of the sulphate content of a natural soil and the sulphate content of the ground water - Normal Method.
AS 1289.6.1.1	-	Determination of the California bearing ratio of a soil - Standard laboratory method for a remoulded specimen.
AS 2350.4	-	Setting time of Portland and blended cements.
AS 2350.9	-	Fineness of Portland fly ash cement.
AS 3582.1	-	Fly ash.
AS 3582.2	-	Slag - Ground granulated iron blastfurnace.
AS 3583.3	-	Determination of loss on ignition.
AS 3583.6	-	Determination of relative water requirement and relative strength.
AS 3583.12	-	Determination of available alkali.
AS 3583.13	-	Determination of chloride ion content.
AS 3583.14	-	Determination of insoluble residue content.
AS 3972	-	Portland and blended cements

(c) NSW RTA Test Methods

T432	-	Rate of Slaking of Quicklime

INSPECTION, SAMPLING AND TESTING

C241.03 MATERIALS PROPOSED FOR USE IN THE WORK

1. The Contractor shall provide a certificate from a laboratory with appropriate NATA registration stating that the stabilisation mix(s) submitted and the mix constituents comply with the mix nominated in Annexure C241A and that the stabilised material meets the requirements of the Specification for FLEXIBLE PAVEMENTS if incorporated into the works as a pavement layer or alternatively the Specification for EARTHWORKS or STORMWATER DRAINAGE GENERAL.

Contractor's Responsibility

C241.04 MATERIALS USED IN THE WORK

1. Regular inspection, sampling and testing of pavement and subgrade materials shall be undertaken by the Contractor while stabilisation is in progress in accordance with this Specification.

Sampling and Testing

MATERIALS

C241.05 CEMENT

1. The type of cement used as the stabilising agent or a constituent in a blended stabilising agent shall comply with AS 3972. ***Type***

2. The Contractor shall nominate the brand and source of all cementitious materials. ***Nominated Brand and Source***

3. Documentary evidence of the quality and source of the cement shall be furnished by the Contractor to the Superintendent upon request at any time. ***Proof of Quality***

4. If the Contractor proposes to use cement which has been stored for a period in excess of three months from the time of manufacture, the Contractor shall arrange a re-test, to ensure the cement still complies with AS3972, before the cement is used in the work. The cost of retesting cement, which has been stored for a period in excess of three months, shall be borne by the Contractor. Test results shall be forwarded to the Superintendent for approval at least 2 days in advance of usage of the material. ***Storage in Excess of 3 months***

C241.06 QUICKLIME

1. Quicklime, consisting essentially of calcium oxide in a highly reactive form, shall have the following properties at the point of spread: ***Properties***

(i) Available Lime The content of calcium oxide, determined by AS 3583.12, shall not be less than 85 per cent.

(ii) Slaking Rate The active slaking time shall not be greater than twenty minutes and the temperature rise on slaking, determined from the average of four samples tested in accordance with Test Method T432, shall not be less than 40°C in six minutes.

2. The particle size distribution of the quick lime determined by AS 1141.11 shall comply with the following requirements in Table C241.2. ***Particle Size***

AS Sieve	Per Cent Passing
13.2mm	100
9.5mm	96 - 100
4.75mm	70 - 100
2.36mm	0 - 90

Table C241.2 Particle Size Distribution of Quicklime

C241.07 HYDRATED LIME

1. Hydrated lime, consisting essentially of calcium hydroxide, whether used as the sole stabilising agent or blended with other additives, shall have the following properties: ***Properties***

(i) Available Lime The content of calcium hydroxide, determined by AS 3583.12, shall not be less than 80 per cent.

(ii) Form The material shall be in powder form.

(iii) Residue on Sieving (Particle Size) The residue on a 300 micron sieve, determined by AS 3583.14, shall not exceed 2 per cent.

2. The properties which characterise the particular hydrated lime to be used in the stabilising agent submitted as part of the mix design are:

(a) Percentage of calcium hydroxide

(b) Fineness - Percentage by mass passing the 45 micron sieve (AS 2350.9).

(c) Source.

C241.08 GROUND GRANULATED BLAST FURNACE SLAG

1. The ground granulated blast furnace slag shall conform to AS3582.2.

Properties

2. The properties which characterise the particular ground blast furnace slag to be used in the stabilising agent submitted as part of the mix design are:

(a) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).

(b) Relative strength (28 days) (AS 3583.6).

(c) Source.

C241.09 FLYASH

1. Flyash shall conform to AS3582.1.

Properties

2. The properties which characterise the particular flyash to be used in the stabilising agent submitted as part of the mix design are:

(a) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).

(b) Loss on ignition (AS 3583.3).

(c) Source.

C241.10 BLENDED STABILISING AGENTS

Requirements

1. The Contractor may utilise a blended stabilising agent. The Contractor shall obtain mill and batch information which will make the blended stabilising agent traceable to the supplier's test results. Handling and storage requirements of the Supplier shall be complied with by the Contractor who shall also arrange for sampling of the agent as required by the Superintendent.

2. The mass of components of the nominated blended stabilising agent shall not vary by more than ± 3 per cent from the blend percentages nominated in the mix design described in Annexure C241A.

Properties

3. When a blended stabilising agent is produced from a combined grinding of components the following properties will characterise the particular stabilising agent blend:

(a) Source of each component.

(b) Fineness - percentage by mass passing the 45 micron sieve (AS 2350.9).

(c) Setting time (AS2350.4).

C241.11 WATER

1. Water shall be free from harmful amounts of materials such as oils, salts, acids, alkalis and vegetable substances. The water shall not contain more than: ***Quality***

(a) 600 parts per million of chloride ion, determined by AS 3583.13.

(b) 400 parts per million of sulphate ion, determined by AS 1289.4.2.1.

(c) 1 per cent by mass of undissolved solids.

2. Water accepted as potable and fit for human consumption will not require testing to confirm suitability. ***Potable***

STABILISATION PROCESSES

C241.12 GENERAL

1. The Contractor shall submit details of the proposed equipment (including the mixing plant) and stabilisation procedures to be used in the work 14 days prior to commencement of the work. This submission, hereafter called the Work Plan, will nominate the sequence of operations, widths of stabilisation passes and provision for traffic if appropriate. ***Proposed Equipment and Procedures***

2. Notwithstanding submission to the Superintendent of the Contractor's equipment and stabilisation procedures, the work shall meet all the Specification requirements, and Statutory Requirements for Occupational Health and Safety, and the Contractor shall perform such tests as specified as the work proceeds, to ensure compliance. Costs of such tests shall be borne by the Contractor. ***Compliance Contractor's Cost***

3. Stabilisation of pavement materials shall not proceed during wet weather or if rain is imminent and likely to occur during any stage of the stabilisation process so as to significantly influence the resultant moisture content and uniformity of moisture content in the mix. ***Weather Conditions***

C241.13 APPLICATION OF STABILISING AGENT

(a) Stationary Mixing Plant

1. Application rate of stabilising agent shall be monitored at the pug mill or equivalent plant utilised as approved by the Superintendent. ***Application Rate***

2. Application rate measured in kilograms per tonne of product shall be monitored and recorded for every 100 tonnes of production. ***Measurement***

3. The achieved accuracy of application rate shall be ±10 per cent of the nominated rate nominated in Annexure C241A.

4. The application rate shall not be allowed to exceed the nominated rate by more than 10 per cent. The stabilising agent incorporated in excess of the nominated rate shall be at no cost to the Principal. ***Over Spread Contractor's Cost***

(b) In-Situ

1. The incorporation of stabilising agent is to follow a process where stabilising agent is spread on the pavement in advance of the specialist mixing equipment. Where special processes are proposed by the Contractor involving supply of stabilising agent within the mixing bowl of equipment the approval of the Superintendent is required and a demonstration of the process at Contractor's expense may be requested. ***Application Process***

2. Spreading shall be carried out using the mechanical spreader nominated in the Work Plan and subsequently approved by the Superintendent. Annexure C241A nominates the spread rate. ***Spreading Rate***

3. The actual spread rate shall be within ±10 per cent of the nominated rate. The Contractor shall verify this by testing the spread rate for each lot or 500 m^2 of pavement treated (whichever is less) in each application of binder. Spread rate testing shall be performed by weighing the contents of a suitable 4 sided tray placed on the pavement and between the wheels of the mechanical spreader. The rate of stabilising agent spread shall be calculated by dividing the mass collected (kg) by the area of the tray (m^2). ***Tolerances***

4. Where spreading vehicles are fitted with load cells, the Contractor shall ascertain the average spreading rate of the stabilising agent by dividing the mass of the stabilising agent spread per run by the area of the run. The Contractor shall record this data for each run and make it available to the Superintendent promptly. Such action will not cancel the Contractor's obligation to undertake prescribed testing of spread rate if required by the Superintendent. ***Load Cells***

5. The actual spread rate shall not exceed the nominated rate by more than 10 per cent. The stabilising agent spread in excess of the nominated rate shall be at no cost to the Principal. ***Over Spread Contractor's Cost***

6. Spreading shall not proceed during windy conditions which may cause loss of stabilising agent or cause nuisance or danger to people or property. ***Wind***

7. Traffic or equipment not involved in spreading or mixing of the stabilising agent shall not pass over the spread material until it has been mixed into the layer to be stabilised. ***Construction Traffic***

8. Any spillage of the stabilising agent on site or at any loading location related to the site shall be removed as soon as possible and within the same work shift of such spillage. ***Spillage***

C241.14 MIXING

(a) Stationary Mixing Plant

1. The stationary mixing plant shall be purpose built for the process of mixing road making materials. All equipment shall be maintained and calibrated so as to provide a uniformly mixed product without segregation of the aggregate material. ***Equipment***

2. The plant shall provide for the controlled and metered inclusion of water into the mix. ***Control of Water***

3. The stationary mixing equipment shall incorporate a delivery system for mix materials capable of producing a uniform mixture to design requirements. This performance shall be confirmed by monitoring of unconfined compressive strength of production, in accordance with AS 1289.6.1.1, with a pair of test specimens tested for each 400 tonnes of production. ***Uniform Mixture***

(b) In-situ

1. Mixing equipment shall be purpose built for the process of in-situ mixing of road making materials. It shall be capable of mixing to the depth specified for the layer to be ***Equipment***

stabilised and of distributing the stabilising agent uniformly through the full depth and over the whole area of the layer to be stabilised. A minimum of 2 passes of the mixing equipment is required. As mixing blades or tynes wear they shall be replaced so as to maintain mixing efficiency consistent with that demonstrated during the trial section. The mixing equipment will be capable of supplying a calibrated amount of water to the mixing bowl in a such manner as to provide a uniformly moist mix to a target moisture content.

2. The resultant mix shall be uniform over the full depth so that there are no lenses, pockets, lumps or granules of stabilising agent present in the layer or adjacent to it. ***Uniform Mixture***

3. The procedure nominated in the Work Plan shall minimise disturbance of the distribution of stabilising agent spread in advance of the mixing process. ***Disturbance***

4. The Contractor shall carry out visual inspections during mixing to ensure uniform mixing is being achieved in the layer. Inspection results shall be recorded as cited in the Specification Part for Quality Requirements. The Superintendent may require that additional passes by the mixing equipment be carried out to improve the visual uniformity of the mix and/or the moisture content. ***Additional Mixing***

C241.15 FIELD WORKING PERIOD

1. The time period from addition of water during the mixing process until the completion of compaction is nominated as the Field Working Period. This period may vary significantly with variations in the type of stabilising agent. ***Definition***

2. The nominated Field Working Period shall be provided in Annexure C241A for the stabilising agent approved for the works. The Nominated Field Working Period shall be based on laboratory tests determining the time from mixing until such time as the calculated Wet Density for modified compaction procedures decreases by more than 2 percentage points. This testing shall be undertaken utilising AS 1289.5.7.1 and samples of the materials representative of those to be utilised in the works. ***Based on Laboratory Tests***

3. The Contractor will complete the compaction process within the Nominated Field Working Period unless specific approval is provided by the Superintendent to an adjustment for site and seasonal conditions. ***Compaction within Field Working Period***

C241.16 TRIMMING AND COMPACTION

1. After mixing the layer shall be trimmed and compacted in accordance with the Specification for FLEXIBLE PAVEMENTS to produce a tight dense surface parallel with the finished wearing surface so that the levels do not vary from the design levels beyond the tolerance for primary trimming specified in Clause C241.18(a). ***Level Tolerance***

2. Subsequent secondary trimming may be undertaken on one or more occasions in preparation for primer seal and with the objective of meeting shape and level requirements. Secondary trimming shall involve cutting to waste. Work methods that lead to the development of laminations in the pavement will not be allowed and surface slurrying will not be accepted. The Contractor's survey control methods as stated in the Work Plan will be adequate to ensure that the pavement layer thickness is not reduced during secondary trimming to an extent such that it fails to comply with the requirement for layer thickness in accordance with the tolerance specified in Clause C241.18(b). When required by the Superintendent survey results shall be provided to confirm that the pavement layer thickness remains within tolerance after secondary trimming. This survey will be at no cost to the Principal. ***Secondary Trimming*** ***Contractor's Cost***

3. All trimmed material having been cut to waste shall be used as fill or spoiled as directed by the Superintendent. ***Trimmed Material***

4. Measurements with a 3 metre straight edge shall be taken at a minimum of 10 randomly selected stations so as to represent each 200 metre lane length or part thereof. ***Straight Edge Test***

Deviation of the surface from the bottom of a 3 metre straight edge placed in any direction will meet the tolerance shown in Clause C241.18(a). This testing will be undertaken immediately prior to sealing or prior to agreed practical completion for any work component.

5. The stabilised layer shall be compacted over the entire area and depth so that the relative compaction determined by AS 1289.5.7.1 is not less than as detailed in the Specification for FLEXIBLE PAVEMENTS, EARTHWORKS or STORMWATER DRAINAGE GENERAL as appropriate. ***Compaction***

6. To provide true relative compaction assessments the lots shall be sampled and tested within the nominated field working period in accordance with AS 1289.5.7.1. ***Test Method***

7. The maximum wet density (modified compaction) will be determined by sampling immediately after the determination of field density and testing will be undertaken within 2 hours of sampling. A determination of maximum wet density (modified compaction) representing the full layer depth is required for each sampling location when calculation of relative compaction is undertaken. ***Wet Density***

8. The field density may be determined by in-situ sand replacement testing or by single probe Nuclear Density Meter in direct transmission mode in accordance with AS 1289.5.8.1. ***In-Situ Dry Density***

C241.17 JOINTS

1. Joints are defined in this Specification to comprise interfaces between work episodes that are separated in time by more than the nominal field working period for the nominated stabilisation mix design. A longitudinal joint shall be considered to be a joint generally parallel to the road centreline. A transverse joint occurs when a length of work is terminated and extended at a later time after a period which exceeds the nominated field working period. ***Joint Type***

2. All longitudinal and transverse joints shall be formed by cutting back into the previously stabilised and fully compacted sections. A minimum longitudinal overlap of mixing runs shall be 75mm. Transverse joints shall be overlapped by a minimum of 2 metres. The material disturbed during cutting back shall be remixed at full depth and incorporated into the new work. No longitudinal joints shall be allowed within 0.5 metre of the centreline of a typical wheelpath. ***Cutting Back***

3. The level and shape of the joints shall be within the limits specified in Clause C241.18. ***Finish***

C241.18 TOLERANCES

(a) Levels and Surface Trim

1. The surface level after primary trimming shall be within a tolerance of +30mm and +10mm of the levels shown on the Drawings. ***Primary Trimming***

2. The surface level after secondary trimming shall be within a tolerance of +15mm and -15mm of the levels shown on the Drawings. ***Secondary Trimming***

3. The pavement surface after secondary trimming and immediately prior to sealing shall be of a quality such that deviation under a 3 metre straight edge does not exceed 12mm.

(b) Layer Thickness

1. The final thickness of the stabilised layer at any point shall be within a tolerance of +20mm and -10mm of the nominated layer thickness. ***Minimum Thickness***

2. The average thickness of the layer in a lot shall be determined from measurements of six randomly selected locations over any 200m length of a lot. The average thickness shall not be less than that required to meet the specified final thickness tolerances after trimming. ***Average Thickness***

3. The layer thickness shall be measured at the edges of the stabilising run before compaction commences. The layer thickness shall be measured relative to the finished design level. ***Method of Measurement***

(c) Width

1. The width measured at any point of the stabilised layer shall be not less than the specified width as shown in the Drawings by more than 50mm. ***Minimum Width***

2. The average width of the layer shall be determined from measurements at 3 sites selected at random by the Superintendent over any 200m length of a lot and shall be not less than the specified width. ***Average Width***

C241.19 CURING

1. The Contractor shall submit to the Superintendent details of the proposed method of curing as part of the Work Plan. ***Notice***

2. The stabilised work shall be protected against rapid drying out by keeping it continuously wet or damp during the period prior to the provision of a subsequent layer or the application of a prime or primer-seal. ***Water Curing***

3. Water curing shall consist of frequent light uniform spraying that will not produce significant run off or flooding on sections of the area. Slurrying of the surface or leaching of the stabilising agent shall be avoided. ***Caution***

LIMITS AND TOLERANCES

C241.20 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses of this Specification are summarised in Table C241.3 below:

Item	Activity	LimitsTolerances	Spec Clause
1.	**Quicklime**		
	a) Available Lime	>85% Calcium Oxide content	C241.06
	b) Slaking Rate	Active Slaking time < twenty minutes, and temperature rise on slaking not less than 40°C in six minutes (for an average of four samples).	C241.06
	c) Particle Distribution	Fraction passing AS Sieve: 100% for 13.2mm Sieve 96-100% for 9.5mm Sieve 70-100% for 4.75mm Sieve 0-90% for 2.36mm Sieve	C241.06
2.	**Hydrated Lime**		
	a) Available Lime	>80% Calcium Hydroxide	C241.07
	b) Particle Size	<2% residue on a 300 micron Sieve	C241.07
3.	**Blended Stabilising Agents**	Blend percentages shall not vary by more than ± 3% from those nominated in Annexure C241A	C241.10
4.	**Water**		
	a) Chloride ion content	<600 PPM Chloride ion	C241.11
	b) Sulphate ion content	<400 PPM Sulphate ion	C241.11
	c) Undissolved solids	<1 percent by mass of undissolved solids	C241.11
5.	**Application of Stabilising Agent**		
	a) Spread Rate or Incorporation Rate for in-situ plant.	Actual spread rate shall be within ± 10% of the nominated rate	C241.13

Item	Activity	LimitsTolerances	Spec Clause
6.	**Trimming and Compaction**		
	a) Surface Level	After primary trimming be within +30mm and +10mm of levels shown on Drawings After secondary trimming be within ±15mm of levels shown on Drawings	C241.18(a)
	b) Layer Thickness	Final thickness of layers shall not vary more than +20mm and -10mm of required thickness	C241.18(b)
	c) Shape	Shall not deviate more than 12mm under a 3m straight edge immediately prior to first sealing	C241.18(a)
7.	**Joints**		
	a) Longitudinal Overlap	> 75mm overlap of mixing runs	C241.17
	b) Transverse Overlap	> 2m overlap of transverse joints	C241.17
	c) Longitudinal Joints	Shall not be allowed within 0.5m of the centreline of a typical wheelpath	C241.17
8.	**Width**		
	a) Width of Stabilised Layer	At any point, the width shall be not less than 50mm short of the width shown on the Drawings with an average width always greater than that shown on the Drawings.	C241.18(c)

Table C241.3 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

ANNEXURE C241A
STABILISATION MIX DESIGN

Type of Stabilising Agent .....

Nominal Percentage of Stabilising Agent by Mass ..... %

Spread Rate of Stabilising Agent for contractual purposes ..... (kg/m^2)

Depth of Compacted Layer to be Stabilised ..... (mm)

Nominated Field Working Period ..... (hrs)

Nominated Target Unconfined Compressive Strength (UCS) (7 day accelerated curing) ..... MPa

Nominated Target CBR Value (4 day soaked) for stabilised modified subgrade ..... %

Period for Contractor's Curing .....(days)

Nominated Granular Material(s) .....(type)

Source of Nominated Granular Material .....

CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C242

FLEXIBLE PAVEMENTS

SPECIFICATION C242 - FLEXIBLE PAVEMENTS

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SPECIFICATION 242 : FLEXIBLE PAVEMENTS

GENERAL

C242.01 SCOPE

1. The work to be executed under this Specification consists of the supply, spreading, compaction and trimming of base and subbase courses of flexible and semi-rigid (bound) pavements to the specified levels and thicknesses as shown on the Drawings.

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C242.02 TERMINOLOGY

(a) Materials designated as 'base' require the provision of a wearing surface comprising either a sprayed bituminous seal or asphalt up to 50mm thick. ***Definitions***

(b) Materials designated as 'subbase' require a covering course of 'base'. The subbase may consist of one or more layers.

(c) A flexible pavement consists of a base and a subbase constructed of unbound materials. For the purpose of this Specification it also includes "semi-rigid" pavements.

(d) A semi-rigid pavement is one where the base and/or the subbase are constructed of bound materials.

(e) Bound material incorporates a binder to produce structural stiffness.

(f) Modified material incorporates small amounts of stabilising binder to improve the properties of the material without significantly affecting structural stiffness.

C242.03 REFERENCE DOCUMENTS

Documents Standards Test Methods

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specifications

C241	-	Stabilisation
C244	-	Sprayed Bituminous Surfacing

(b) Australian Standards

AS 1141.14	-	Particle shape, by proportional calliper.
AS 1141.22	-	Wet/dry strength variation.
AS 1289.3.1.1	-	Determination of the liquid limit of a soil - Four point Casagrande method.
AS 1289.3.3.1	-	Calculation of the plasticity index of a soil.
AS 1289.3.6.1	-	Determination of the particle size distribution of a soil - Standard method of analysis by sieving.
AS 1289.3.6.3	-	Determination of the particle size distribution of a soil - Standard method of fine analysis using a hydrometer.
AS 1289.5.2.1	-	Determination of the dry density/moisture content relation of

a soil using modified compactive effort.

AS 1289.5.3.1 - Determination of the field density of a soil - Sand replacement method using a sand-cone pouring apparatus.

AS 1289.5.4.1 - Compaction control test - Dry density ratio, moisture variation and moisture ratio.

AS 1289.5.8.1 - Determination of field density and field moisture content of a soil using a nuclear surface moisture - density gauge - Direct transmission mode.

AS 1289.6.1.1 - Determination of the California bearing ratio of a soil - Standard laboratory method for a remoulded specimen.

(c) NSW RTA Test Methods

T114 - Maximum Dry Compressive Strength of Road Materials
T116 - Unconfined Compressive Strength - Remoulded Material
T130 - Dry Density Moisture Relations for Mixtures of Road Materials and Cement.
T131 - Unconfined Compressive Strength
T160 - Benkelman Beam Deflection Test
T171 - Modified Texas Triaxial Compression Test

C242.04 PAVEMENT STRUCTURES

1. Flexible or semi-rigid pavement material types and layer thicknesses shall be as shown on the Drawings. ***Material Types and Layer Thickness***

C242.05 INSPECTION, SAMPLING AND TESTING

1. Inspection, sampling and testing of the pavement shall be undertaken by the Contractor in accordance with the requirements of this Specification before, during and after the construction of the pavement. Testing shall be carried out by a NATA registered laboratory with appropriate accreditation and suitably qualified personnel. ***Contractor's Responsibility***

2. The Contractor shall provide the Superintendent with written notice when testing is being carried out and copies of all test reports for approval to proceed. ***Written Notice***

3. Field density tests shall be carried out in accordance with AS 1289.5.3.1, or, with the Superintendent's concurrence, with a Nuclear Density Meter in accordance with Clause C242.19. ***Density Tests***

MATERIALS

C242.06 GENERAL

1. The Contractor shall submit details of all constituents of the proposed base and subbase materials, including sources of supply and the proposed type and proportion of any binder. These details shall be submitted to the Superintendent, supported with test results from a nominated NATA registered laboratory confirming that the constituents comply with the requirements of this Specification. If the proposed base or subbase is a bound material, the Contractor shall submit a completed Annexure C241A contained in the Specification for STABILISATION. ***Details of Proposed Base and Subbase to be Submitted***

2. No material shall be delivered until the Superintendent has approved the source of supply. ***Source of Supply***

3. If, after the Contractor's proposals have been approved, the Contractor wishes to make changes in any of the material constituents the Contractor shall inform the Superintendent in writing of the proposed changes. No delivery of material produced ***Variations by Contractor***

under the altered proposal shall take place without the approval of the Superintendent. The cost of testing associated with any altered proposal shall be borne by the Contractor. ***Contractor's Cost***

4. At least fourteen days before placement of the material on site, the Contractor shall submit a Certificate from a laboratory with appropriate NATA registration demonstrating and stating that the unbound material or the mix and its constituents comply with the requirements of this Specification. ***NATA Certificate***

5. Ongoing testing of materials during delivery and construction shall be undertaken on samples taken from the site. ***Sampling on-site***

C242.07 TRAFFIC CATEGORY

1. Pavement materials are specified in terms of the Traffic Categories given in Table C242.1 for the calculated design traffic of the pavement. ***Pavement Material Traffic Category***
2. The Traffic Category (or Design Traffic) for the pavement materials shall be as shown on the Drawings. ***Drawings***

Pavement Material Traffic Category	Description
1	Roads with design traffic equal to or exceeding 10^7 equivalent standard axle (ESA) repetitions.
2a	Roads with design traffic exceeding 4 x 10^6 ESAs but less than 10^7 ESAs.
2b	Roads with design traffic exceeding 10^6 ESAs but less than or equal to 4 x 10^6 ESAs.
2c	Roads with design traffic exceeding 10^5 ESAs but less than or equal to 10^6 ESAs.
2d	Roads with design traffic less than or equal to 10^5 ESAs.

Table C242.1 - Pavement Material Traffic Categories

C242.08 UNBOUND BASE AND SUBBASE

1. Unbound materials, including blends of two or more different materials, shall consist of granular material which does not develop significant structural stiffness when compacted. Material produced by blending shall be uniform in grading and physical characteristics. ***Granular Material***

2. Unbound crushed rock materials are designated as follows: ***Crushed Rock***

DGB20 20mm nominal sized densely graded base
DGS20 20mm nominal sized densely graded subbase
DGS40 40mm nominal sized densely graded subbase
GMB20 20mm nominal sized graded macadam base
GMS40 40mm nominal sized graded macadam subbase

3. Unbound natural gravel materials are designated as follows: ***Natural Gravel***

NGB20-2c 20mm nominal sized natural gravel base for Traffic Category 2c
NGB20-2d 20mm nominal sized natural gravel base for Traffic Category 2d
NGS20 20mm nominal sized natural gravel subbase
NGS40 40mm nominal sized natural gravel subbase

4. The acceptable material types for each Traffic Category are given in Table C242.2. ***Material Types***

Traffic Category	Acceptable Base Material	Acceptable Subbase Material
1	DGB20, GMB20	DGS20, DGS40, GMS40
2a	DGB20, GMB20	DGS20, DGS40, GMS40
2b	DGB20, GMB20	DGS20, DGS40, GMSS40
2c	DGB20, GMB20, NGB20-2c	DGS20, DGS40, GMS40, NGS20, NGS40
2d	DGB20, GMB20, NGB20-2c, NGB20-2d	DGS20, DGS40, GMS40, NGS20, NGS40

Table C242.2 - Acceptable Pavement Material Types

5. Base materials shall comply with the requirements of Table C242.3. ***Base***

Test Method	Description	Base Material Requirements			
		DGB20	GMB20	NGB20-2c	NGB20-2d
AS 1289.3.6.1	Coarse Particle Size Distribution % passing 75.0mm sieve % passing 53.0mm sieve % passing 37.5mm sieve % passing 26.5mm sieve % passing 19.0mm sieve % passing 13.2mm sieve % passing 9.5mm sieve % passing 6.7mm sieve % passing 4.75mm sieve % passing 2.36mm sieve % passing 0.425mm sieve % passing 0.075mm sieve	 - - - 100 95-100 - - 50-70 - 35-55 - -	 - - - 100 95-100 - - 30-55 - 20-30 - -	 - - - 100 93-100 - 71-87 - 47-70 35-56 14-32 6-20	 - - - 100 93-100 - 71-87 - 47-70 35-56 14-32 6-20
AS 1289.3.6.3	Fine Particle Size Distribution Ratios expressed as percentages (for that portion of the material passing 2.36mm sieve) A. Pass 425mm sieve % B. Pass 75μm sieve % Pass 425μm sieve C. Pass 13.5μm sieve % Pass 75μm sieve	 35-55 35-55 35-60	 30-50 30-50 -	 - - -	 - - -
AS 1289.3.1.1	Liquid Limit (if non plastic) ⩛	max 20	max 20	max 20	max 20
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	max 20	max 20
AS 1289.3.3.1	Plasticity Index ■	max 6	max 6	max 6	max 8
T114	Maximum Dry Compressive Strength on fraction passing 19mm sieve (only applies if Plasticity Index is less than 1)	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa	min 1.7 MPa
AS 1141.14	Particle Shape by Proportional Calliper % mis-shapen (2 : 1)	 max 35	 max 35	 -	 -

Test Method	Description	Base Material Requirements			
		DGB20	**GMB20**	**NGB20-2c**	**NGB20-2d**
AS 1141.22	Aggregate Wet Strength ◊				
	For category 1 or 2a	min 80	min 150	-	-
	For category 2b or 2c	min 70	min 130	-	-
	For category 2d	min 60	min 100	-	-
AS 1141.22	Wet/Dry Strength Variation ◊				
	$\frac{\text{Dry - Wet}}{\text{Dry}}$ %				
	For category 1 or 2a	max 35	max 30	-	-
	For category 2b or 2c	max 40	max 30	-	-
	For category 2d	max 45	max 30	-	-
AS 1289.6.1.1	4 day Soaked CBR (98% Modified Compaction)	-	-	80	60

Table C242.3 - Unbound Base Material Properties

NOTES ON TABLE C242.3:

Material consisting of rounded river stone shall have a minimum of two fractured faces on at least 75 per cent of the particles larger than 6.70mm.

➢ The maximum value of the Liquid Limit may be increased to 23 for non-plastic material, provided that the value determined is not influenced by the presence of adverse constituents.

■ For category 2d base materials the maximum Plasticity Index shall be 8.

◊ All fractions of the sample specified by AS 1141.22 must be within specification. The fraction with the highest wet/dry strength variation is the value for determining conformance with the specification. The fractions 19.0mm to 13.2mm and 6.7mm to 4.75mm must be tested.

6. Subbase materials shall comply with the requirements of Table C242.4 ***Subbase***

Test Method	Description	Subbase Material Requirements				
		DGS20	**DGS40**	**GMS40**	**NGS20**	**NGS40**
AS 1289.3.6.1	Coarse Particle Size Distribution					
	% passing 75.0mm sieve	-	-	-	-	-
	% passing 53.0mm sieve	-	100	100	-	100
	% passing 37.5mm sieve	-	-	-	-	95-100
	% passing 26.5mm sieve	100	-	-	100	80-97
	% passing 19.0mm sieve	95-100	50-85	50-75	96-100	-
	% passing 13.2mm sieve	-	-	-	-	-
	% passing 9.5mm sieve	-	-	-	65-89	48-85
	% passing 6.7mm sieve	50-70	30-55	15-35	-	-
	% passing 4.75mm sieve	-	-	-	47-80	35-73
	% passing 2.36mm sieve	35-55	25-50	5-15	32-67	25-58
	% passing 0.425mm sieve	-	-	-	14-42	10-33
	% passing 0.075mm sieve	-	-	-	6-26	3-21
AS 1289.3.6.3	Fine Particle Size Distribution Ratios expressed as percentages (for that portion of the material passing 2.36mm sieve)					

Test Method	Description	Subbase Material Requirements				
		DGS20	**DGS40**	**GMS40**	**NGS20**	**NGS40**
	A. Pass 425μm sieve %	35-55	35-60	25-50	-	-
	B. Pass 75μm sieve % Pass 425μm sieve	35-55	35-60	25-50	-	-
	C. Pass 13.5μm sieve % Pass 75μm sieve	35-60	35-65	-	-	-
AS 1289.3.1.1	Liquid Limit (if non plastic)	max 23	max 23	-	max 23	max 23
AS 1289.3.3.1	Plastic Limit (if plastic)	max 20	max 20	-	max 23	max 23
AS 1289.3.3.1	Plasticity Index	max 12	max 12	max 12	max 12	max 12
T114	Maximum Dry Compressive Strength on fraction passing 19mm sieve (only applies if Plasticity Index is less than 1)	min 1.0 MPa	min 1.0 MPa	-	1.0 MPa	1.0 MPa
AS 1141.14	Particle Shape by Proportional Calliper % mis-shapen (2 : 1)	max 35	max 35	max 35	-	-
AS 1141.22	Aggregate Wet Strength ♦	min 50kN	min 50kN	min 130kN	-	-
AS 1141.22	Wet/Dry Strength Variation ♦ Dry - Wet % / Dry	max 60	max 60	max 30	-	-
AS 1289.6.1.1	4 day Soaked CBR (98% Modified Compaction)	-	-	-	30	30

Table C242.4 - Unbound Subbase Material Properties

NOTES ON TABLE C242.4:

Material consisting of rounded river stone shall have a minimum of two fractured faces on at least 75 per cent of the particles larger than 6.70mm.

♦ All fractions of the sample specified by AS 1141.22 must be within specification. The fraction with the highest wet/dry strength variation is the value for determining conformance with the specification. The fractions 19.0mm to 13.2mm and 6.7mm to 4.75mm must be tested.

Modified TexasTriaxial Classification

7. Where the proposed unbound base or subbase material complies with all of the requirements of Table C242.3 or Table C242.4 as appropriate except gradings (AS 1289.3.6.1 and AS 1289.3.6.3), the Contractor may propose the use of the material, subject to approval of the Council, if the material complies with the RTA Modified Texas Triaxial Classification Number (T171) requirements specified in Table C242.5, (T171 tested at not less than 85 per cent of Optimum Moisture Content and 98 per cent of Maximum Dry Density as determined by AS 1289.5.2.1).

Traffic Category	Modified Texas Triaxial Classification Number (Test Method T171)	
	Base	**Subbase**
1	max 2.0	max 2.5

2a	max 2.2	max 2.5
2b	max 2.5	max 3.0
2c	max 3.0	max 3.0
2d	max 3.0	max 3.0

Table C242.5 - RTA Modified Texas Triaxial Classification Number Requirements

C242.09 LIME MODIFIED BASE AND SUBBASE MATERIALS

1. Modification of unbound base and subbase materials to meet the requirements of Clause C242.08 by the addition of hydrated lime or quicklime shall be subject to approval by the Superintendent and to the additional requirements of this clause. After modification, the material shall meet the requirements of Clause C242.08. ***Lime Modification***

2. Modification of materials for Traffic Categories 1, 2a and 2b shall only be by use of hydrated lime mixed in a stationary mixing plant at the supplier's quarry. ***Traffic Categories 1, 2a, 2b***

3. Modification of materials for Traffic Categories 2c and 2d may be by the use of either hydrated lime through a stationary mixing plant or by hydrated lime or quicklime utilising in-situ operations. ***Traffic Categories 2c, 2d***

4. Material requirements of hydrated lime and quicklime shall be in accordance with the Specification for STABILISATION. ***Lime***

5. The method of incorporating lime through the stationary mixing plant shall ensure that the lime is mixed uniformly through the material. ***Incorporation***

6. In-situ operations shall be in accordance with the Specification for STABILISATION. ***In-situ Operations***

7. The proportion of lime shall be not less than 1.5 per cent nor more than 4 per cent by mass. The material prior to lime treatment shall not contain any added pozzolanic material. ***Proportion***

8. The lime treated material shall yield an unconfined compressive strength not exceeding 1.0 MPa, when tested in accordance with Test Method T116 where sampling is undertaken within 24 hours of adding the lime and testing is after 7 days accelerated curing. ***Unconfined Compressive Strength***

9. For DGB20 material, prior to being treated with lime, the material shall comply with the requirements of DGS20 in Table C242.4, except that the aggregate wet strength shall not be less than 80kN and the wet/dry strength variation shall not exceed 60 per cent. ***DGB20***

10. For DGB20, the lime treated material shall yield a CBR value of not less than 100 when tested in accordance with AS 1289.6.1.1, where sampling is undertaken within 24 hours of adding the lime and testing is after 7 days of accelerated curing. ***CBR Value***

C242.10 BOUND BASE AND SUBBASE MATERIALS

1. Bound materials utilised in semi-rigid pavements as a base layer for Traffic Categories 1, 2a and 2b shall be supplied as a crushed rock product with stabilising agent incorporated in a stationary mixing plant (pugmill) at the supplier's quarry unless prior written approval is obtained from the Council. ***Traffic Categories 1, 2a, 2b***

2. Bound material to be used as subbase generally or base layer for Traffic ***Traffic***

Categories 2c and 2d may be supplied as a crushed rock product with stabilising agent incorporated in a pugmill or may be produced by the in-situ stabilisation of natural or blended gravel where stabilisation is undertaken by mobile plant at the site. ***Categories 2c, 2d***

3. Prior to stabilisation, the base layer material shall meet the requirements of Table C242.4 for subbase material for the appropriate Traffic Category. ***Material Requirements Prior to Stabilisation***

4. Material requirements for the stabilising agent shall be in accordance with the Specification for STABILISATION. ***Stabilising Agent***

5. The stabilisation process shall meet the requirements of the Specification for STABILISATION. ***Stabilisation***

6. The unconfined compressive strength (UCS) of the material after seven days accelerated curing as determined by RTA Test Method T131 shall be not less than 4MPa nor more than 10MPa. Sampling and test specimen compaction of the material shall be undertaken within one hour of the incorporation of the stabilising agent. ***Unconfined Compressive Strength***

DELIVERY, STOCKPILING AND PROCESSING OF PAVEMENT MATERIAL

C242.11 DELIVERY TO SITE

1. Materials shall be supplied sufficiently damp to avoid segregation and loss of fines during transit. ***Damp Condition***

C242.12 STOCKPILING OF UNBOUND MATERIALS

1. Stockpile sites shall be located as shown on the Drawings or as approved by the Superintendent. ***Stockpile Sites***

2. Stockpile sites, which shall be cleared of all vegetation and extraneous matter, shall be shaped to form a crown so as to be free draining and compacted over the whole area to provide a relative compaction, determined by AS 1289.5.4.1 for standard compactive effort, of not less than 95 per cent. ***Compacted and Free Draining***

3. Stockpiles and stockpile sites shall be maintained so as to prevent the stockpiled materials from becoming intermixed or contaminated with foreign material. ***Stockpile Requirements***

4. The total height of any stockpile shall not exceed 3m. ***Height***

5. Stockpiles shall be of uniform shape with side slopes neither steeper than 1.5h to 1v nor flatter than 3h to 1v. ***Shape***

6. The worked face of any stockpile shall be the full face of the stockpile. The stockpiled material shall be maintained at a moisture content sufficiently damp to avoid loss of fines. ***Maintained Damp***

7. At the completion of the works, stockpile sites shall be cleared of all surplus material and left in a clean and tidy condition. ***Completion of Work***

C242.13 DELIVERY OF MODIFIED OR BOUND MATERIALS

1. Modified or bound materials shall be delivered in vehicles fitted with covers of canvas or other suitable material to prevent loss of moisture during transport. ***Vehicle Deliveries***

2. The time between mixing and conveyance by delivery trucks to the site, shall be ***Time Limit***

such as to allow incorporation into the works including trimming and compaction within the nominated field working period.

3. Each truck load of bound material shall be identified by delivery dockets, indicating the time and date of mixing and registration or fleet number of the delivery truck, and such dockets shall be made available to the Superintendent at the point of delivery. ***Delivery Dockets***

4. Bound materials shall comply with the requirements of the Specification for STABILISATION.

SPREADING OF PAVEMENT MATERIAL

C242.14 SPREADING PAVEMENT MATERIALS

1. Unbound materials shall not be spread upon an underlying pavement layer which has a moisture content exceeding 90 per cent, the laboratory optimum moisture content as determined by AS 1289.5.2.1 or which has become rutted or mixed with foreign matter. The underlying layer shall be corrected to comply with this Specification before spreading of the next layer of pavement. ***Underlying Layer Quality***

2. Where the underlying layer was constructed by the Contractor, or where the Contractor's activities caused the underlying layer constructed by others to become non-complying with this Specification.

3. Each layer of material shall be deposited and spread in a concurrent operation and, after compaction, the finished surface levels on the base and subbase courses shall be within the permitted tolerances stated in Clause C242.22(c) without subsequent addition of material. The thickness of each compacted layer shall be neither less than 100mm nor more than 200mm for all pavement layer types, unless otherwise approved by the Superintendent. ***Tolerances***

4. At all work boundaries in bound materials the Contractor shall provide vertical faces to provide for transverse and longitudinal joints. ***Joints***

5. When spread for compaction processes the moisture content of the base or subbase materials shall be in the range of 60-90 per cent of laboratory optimum moisture content in accordance with AS 1289.5.2.1.

6. Bound materials shall not be spread when the ambient air temperature in shade is either below 5^{o}C or above 35^{o}C.

TRIMMING AND COMPACTION

C242.15 GENERAL REQUIREMENTS

1. Each layer of the base and subbase courses shall be uniformly compacted over its entire area and depth to satisfy the requirements of relative compaction set out in Clauses C242.19 and C242.20. ***Uniform Compaction***

2. On sections of pavement with one-way crossfall, compaction shall begin at the low side of the pavement and progress to the high side. On crowned sections, compaction shall begin at the sides of the pavement and progress towards the crown. Each pass of the rollers shall be parallel with the centreline of the roadway and uniformly overlap each preceding pass. The outer metre of both sides of the pavement shall receive at least two more passes by the compaction plant than the remainder of the pavement. ***Compaction Procedure***

3. At locations where it would be impracticable to use self propelled compaction ***Hand Operated***

plant, the pavement material shall be compacted by alternative hand-operated plant approved by the Superintendent. ***Plant***

4. Watering and compaction plant shall not be allowed to stand on the pavement being compacted. ***Plant Movement Restrictions***

5. If any unstable areas develop during rolling, the unstable material shall be rejected. The rejected material shall be removed for the full depth of the layer, disposed of and replaced with fresh material in accordance with Clause C242.24. ***Unstable Areas***

6. The placement of subsequent layers shall not be allowed until the requisite testing has been completed and the test results for each layer have been accepted by the Superintendent. ***Placing Subsequent Layers***

7. Any unbound material in a layer that has attained the specified relative compaction but subsequently becomes wetted up shall be dried out and, if necessary, uniformly recompacted and trimmed to meet the specified density requirements and level tolerances. ***Excessive Moisture Content***

C242.16 CURING OF BOUND MATERIALS

1. The curing of the surface layer of a lot shall commence after compaction is completed. ***Commence-ment Time***

2. The stabilised work shall be protected against rapid drying out by keeping it continuously wet or damp during the period prior to the provision of a subsequent layer or the application of a prime or primer-seal. ***Water Curing***

3. Water curing shall consist of frequent light uniform spraying that will not produce significant run off or flooding on sections of the area. Slurrying of the surface or leaching of the stabilising agent shall be avoided. ***Caution***

ACCEPTANCE OF COMPACTED LAYERS

C242.17 LOTS FOR ACCEPTANCE

1. Acceptance of work, as far as compaction is concerned, shall be based on density testing of the work in lots. A lot shall be nominated by the Contractor, but shall conform to the following: ***Lot Requirements***

   (a) cover only a single layer of work which has been constructed under uniform conditions in a continuous operation and not crossing any transverse construction joints;

   (b) for unbound materials it may equal a day's output using the same material.

C242.18 COMPACTION ASSESSMENT

1. The Superintendent shall assess compaction for each lot based on random sampling of test locations for in-situ dry density testing. ***Density Testing***

2. The Contractor shall arrange for testing to assess compaction on the basis of ten tests per 5000 sq m with a minimum of three (3) tests per lot, and present the results to the Superintendent for approval. ***Sampling***

3. Alternatively, when agreed by the Principal and Council, acceptance of lots may be determined according to the elastic rebound deflection. The elastic rebound deflection ***Benkelman Beam Testing***

shall be taken as the maximum deflection in accordance with RTA Test Method T160 utilising the Benkelman Beam or equivalent. The average maximum deflection for any lot shall not exceed 1.0mm, and the co-efficient of variation (CV) in recorded deflections shall not exceed 30 per cent. Measurements shall be taken at the rate of 4 per 1000 square metres, with a minimum of ten measurements per lot.

C242.19 RELATIVE COMPACTION

Calculation

1. The relative compaction of pavement material at each location tested for in-situ dry density shall be calculated in accordance with AS 1289.5.4.1 as follows:

$$\text{Relative Compaction (per cent)} = \frac{\text{In-situ dry density}}{\text{Comparative dry density}} \times 100$$

NOTE: The comparative dry density shall be the maximum dry density determined in the laboratory.

In-Situ Dry Density Testing

2. The Council may approve some or all of the in-situ dry density testing to be carried out with a single probe Nuclear Density Meter in the direct transmission mode in accordance with AS 1289.5.8.1.

Daily Samples

3. Each day that material is produced for placement in a layer or layers, a sample of the material shall be taken by the Contractor for maximum dry density testing to represent that day's production.

Maximum Dry Density

4. For unbound layers, the sample shall be tested in accordance with AS 1289.5.2.1 to determine the maximum dry density (modified compactive effort) for the material.

Time for Testing

5. For bound layers the sample shall be tested within two hours after the addition of stabilising agent to the mix in accordance with RTA Test Method T130 to determine the maximum dry density (modified compactive effort) for the material. This test method shall also be used to determine the optimum moisture content.

Comparative Dry Density

6. The maximum dry density so determined shall be used as the comparative dry density in relative compaction calculations for all like material from that lot or day's production placed in a single layer of work whichever is the lesser.

C242.20 COMPACTION REQUIREMENTS AND ACCEPTANCE

1. A lot shall be accepted for compaction if:

   (a) The minimum value of all calculated relative compaction for modified compactive effort is not less than 97 per cent within the lot or the area of pavement being assessed.

   (b) In the case of bound layers an area of pavement presented for compaction assessment has within that area a zone or zones with relative compaction less than 97 per cent (modified compactive effort) but equal to or greater than 92 per cent may be accepted by the Superintendent provided such zone or zones shall not comprise more than 5 per cent of the area presented.

   (c) In the case of bound layers of target final depth in excess of 250mm, the top 150mm shall meet the requirements of paragraph 1(b) in this clause whilst the bottom 150mm shall have a relative compaction equal to or greater than 92 per cent.

Rejection of Lots

2. Lots or areas of pavement not achieving these specified values shall be rejected. Unbound layers may be reworked as provided by Clause C242.21, but the bound materials in rejected layers/courses shall be removed and replaced with fresh materials in

accordance with Clause C242.24.

C242.21 REWORKING OF REJECTED UNBOUND LAYERS

1. Lots or areas of pavement that have been rejected in regard to compaction shall be reworked before resubmission for compaction assessment. ***Reworking***

2. Material that has become degraded, segregated or otherwise reduced in quality by reworking shall be rejected. The rejected material shall be removed, disposed of and replaced with fresh material complying with this Specification in accordance with Clause C242.24. When a lot or area of pavement is resubmitted for compaction assessment, testing shall be carried out in accordance with Clauses C242.18 and C242.19. ***Rejected Material***

3. All costs associated with corrective work carried out before the resubmission of a lot for compaction assessment, including rewatering, rerolling, removal and replacement of material as well as reworking shall be borne by the Contractor. ***Contractor's Costs***

C242.22 TOLERANCES

a) General

1. The tolerances stated are the acceptable limits of departure from the dimensions shown on the Drawings, which may occur during construction. ***Tolerances***

2. Areas for assessment of conformity with tolerance requirements shall be divided into lots and presented to the Superintendent together with survey reports covering line and level. ***Lots for Assessment of Conformity***

b) Width

1. At any cross section without kerb and/or channelling, and for pavement layers extending under the kerb and/or channelling, the horizontal dimension measured from the design centre line to the edge of the constructed pavement surface shall be neither less than 50mm less than the dimension nor more than 300mm greater than the dimension shown on the Drawings. ***Horizontal Dimensions***

2. The average width of the layer determined from measurements at three sites selected at random by the Superintendent over any 200 metre road length, or part thereof, shall be not less than the specified width. ***Average Width***

c) Levels and Surface Trim

1. The levels of the finished surface of the top of the unbound subbase course shall not vary from the design levels by more than ± 10mm. ***Subbase Surface Level***

2. Level tolerances at the top of the unbound base course shall not exceed those stated above for subbase. In addition, where kerb and channel exists or is being constructed, the level of the top of the base course adjacent to the kerb and channel shall not vary by more than ± 5mm from the lip level of the channel minus the design thickness of the wearing surface. ***Base Surface Level***

3. The design level of the top of the subbase course shall be determined from the design level of the finished road surface less the thickness of the base course and the wearing course, including an allowance for any flush seal layer in the pavement design. ***Subbase Design Level***

4. The pavement surface after trimming and immediately prior to sealing shall be of a quality such that the deviation under a 3 metre straight edge placed in any direction does not exceed 12mm. Measurements for conformance shall be taken in accordance with the maximum lot size and minimum test frequencies in the Specification Part for Quality Requirements. ***Straight Edge Deviation***

C242.23 ACTION ON REJECTION

(a) Unbound Materials

Rejection Criteria

1. A lot that has not complied with the requirements for width or level tolerance as set out in Clauses C242.22(b) and C242.22(c) respectively shall be rejected except as otherwise provided in this Clause. Rejected lots shall be removed, disposed of and replaced with fresh material in accordance with Clause C242.24.

Corrective Action

2. Notwithstanding the above, where the rejected lot can be corrected by further trimming, the Superintendent may allow the surface to be corrected without complete removal and replacement with fresh material. Such trimming shall be undertaken in a manner that produces a uniform, hard surface and shall be achieved by cutting only without filling. After any such cutting, the level tolerances in Clause C242.22(c) shall apply.

(b) Bound Materials

Rejection Criteria

1. An area of bound material that has not complied with the requirements for width or level tolerance as set out in Clauses C242.22(b) and C242.22(c) respectively shall be rejected except as otherwise provided for in this Clause. Rejected areas shall be removed, disposed of and replaced with fresh material in accordance with Clause C242.24.

Corrective Action Circumstances

2. Notwithstanding the above, the Superintendent may allow the Contractor to rectify the area in the following cases:

(i) Where the cause for rejection is under Clause C242.22(c), the course is a subbase course and rejection is due to departures from design level being too far below the design level, the Contractor may increase the thickness of the base course to make up such deficiency in thickness.

(ii) Where the cause for rejection is under Clause C242.22(c), the course is a subbase course and rejection is due to departures from design level being too far above the design level, the Contractor may propose a regrading of the design level of the base course, to allow for its design thickness to be laid, up to a maximum of 20mm above the original design level. Approval by the Superintendent shall be subject to the following requirements:

- The rate of change of grade from the original finished design surface level shall be less than 3mm per metre.
- The regrading shall not interfere with the proper design functioning of the drainage system.
- The regrading shall not interfere with levels at the property boundary, or increase or decrease footpath or footpath crossover levels or grades beyond Council's allowable design limits.
- The regrading shall not interfere with clearances.

(iii) Where the cause for rejection is under Clause C242.22(c), the course is a base course and rejection is due to departures from design level being too far above the design level, the Contractor may propose a regrading of the design level of the base course. Approval by the Superintendent shall be subject to the requirements of this Clause in (ii) above.

C242.24 REMOVAL AND REPLACEMENT OF REJECTED COURSES

1. Sections of the work that have been rejected shall be removed from the work and replaced with fresh material. Rejected material shall be removed from site. ***Rejected Material***

2. In rejected sections the material shall be removed over the full length of the rejected lot, except that a minimum length of 50 m of pavement layer shall be removed and replaced. Any damage to underlying or abutting layers or structures shall be made good by the Contractor using methods approved by the Superintendent. ***Length to be Removed***

3. The Superintendent may approve removal for less than the full width as constructed if the cause of the rejection of the work can be isolated transversely to the Superintendent's satisfaction. In this case, the new longitudinal cold joint shall be formed and located along the centreline of the road pavement. ***Superintendent's Discretion***

4. After removal of rejected base or subbase course material, the section shall be presented for inspection by the Superintendent before replacement work is commenced. ***Inspection Before Replacement***

5. Materials used as replacement materials, and the subsequent spreading, compaction, trimming, curing and testing of the replacement materials, shall comply with the requirements of this Specification. ***Replacement Material***

6. All costs associated with removals, replacements and corrections of base and subbase courses required under this Clause and the extra costs incurred by the Contractor in respect of delays caused by such removals, replacements and corrections shall be borne by the Contractor. ***Contractor's Costs***

C242.25 MAINTENANCE BEFORE COMPLETION OF WEARING SURFACE

1. Following the Superintendent's acceptance of any section of the work, the Contractor shall maintain the prepared surface of the base in the condition specified for acceptance until the wearing surface is completed. The base course of sections of the accepted work shall be covered with a primerseal over the full width of pavement in accordance with the Specification for SPRAYED BITUMINOUS SURFACING within seven days of the date of the acceptance of such sections, unless otherwise approved by the Superintendent. ***Primerseal***

2. Should the pavement condition deteriorate before the application of the primerseal and consent to proceed with the bitumen surfacing work is withdrawn by the Superintendent, the Contractor shall re-prepare the pavement and re-present the pavement for inspection by the Superintendent. ***Contractor's Responsibility***

3. The Contractor shall maintain adequate drainage of the pavement, and remove any ponded water within 12 hours of its creation if free drainage cannot be achieved, prior to the completion of the wearing course. ***Surface Drainage***

OPENING PAVEMENT TO TRAFFIC

C242.26 GENERAL REQUIREMENTS

1. For unbound pavements, construction plant and vehicles not involved in the current construction or testing of the work shall not be permitted to use the pavement until the primerseal has been applied, unless otherwise approved by the Superintendent. ***Restrictions on Movement***

2. For bound pavements, construction plant and vehicles not involved in the current construction or testing of the work shall not be permitted to use the pavement until the primerseal has been applied and seven days have elapsed since placement of the base. ***Restrictions on Movement of Construc-***

In any case only vehicles registered for legal road usage and loaded within legal limits will be allowed to use the pavement. ***tion Traffic***

3. For bound pavements, traffic shall not be allowed to use the constructed pavement until a minimum of seven days after completion of the full pavement depth and the primerseal. ***Open to Traffic Bound Pavement***

LIMITS AND TOLERANCES

C242.27 SUMMARY OF LIMITS AND TOLERANCES

The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C242.6 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Stockpile Sites**	(i) Relative Compaction >95% (ii) Stockpile height <3m (iii) Stockpile batter <1.5:1 and >3:1	C242.12 C242.12
2.	**Spreading Pavement Materials**		
	(i) Compacted Layer Thickness	≥100mm, ≤200mm	C242.14
3.	**Compaction Acceptance**		
	Minimum value of all calculated relative compaction results	≥97 per cent (modified compactive effort). For bound pavements may accept between 92% and 97% provided it represents less than 5% of the area.	C242.20
4.	**Width of Pavement**		
	(i) Design centre-line to edge of constructed pavement	-50mm to +300mm of dimensions on Drawings	C242.22(b)
	(ii) Average Width	The average width determined from 3 random sites over any 200m road length, or part thereof, shall be not less than the specified width.	C242.22(b)
5.	**Surface Level**		
	(i) Subbase levels	<±10mm from design level	C242.22(c)
	(ii) Base levels	<±10mm from design level	C242.22(c)
	(iii) Base levels adjacent to Kerb and Channel	<±5mm from the lip levels of adjacent gutter minus design thickness of wearing surface.	C242.22(c)
	(iv) Shape	Deviation from a 3m long straightedge on base surface immediately prior to sealing shall be less than 12mm	C242.22(c)

Table C242.6 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C244

SPRAYED BITUMINOUS SURFACING

SPECIFICATION C244 - SPRAYED BITUMINOUS SURFACING

ANNEXURES

SPECIFICATION C244 : SPRAYED BITUMINOUS SURFACING

GENERAL

C244.01 SCOPE

1. The work to be executed under this Specification consists of the supply of all materials and the application of any or all of the following types of sprayed bituminous surfacing as required under the Contract:

(a) Prime

The application of a primer of field or refinery prepared cutback bitumen without aggregate to provide penetration of the surface (preferably from 5 to 10mm) and waterproofing.

(b) Primerseal

The application of a primerbinder of field or refinery prepared cutback bitumen to provide surface penetration (preferably from 2mm to 5mm) and incorporation of a light cover of aggregate to provide a temporary wearing surface.

(c) Seal or Reseal

The application of a bituminous binder into which aggregate is incorporated to provide a durable wearing surface.

NOTE: This Specification does not include bituminous emulsion seals or polymer-modified seals.

2. The locations and required types of sprayed bituminous surfacings, including types of binders and aggregate sizes, shall be as shown on the Drawings and/or as detailed in Annexure C244.A.

3. For multiple application treatments, the binder and aggregate may be required to be laid in one or more separate applications indicated in Annexure C244.A.

4. Requirements for adhesion agent in the bitumen and tolerances for binder application rates are set out in Annexure C244.B.

5. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C244.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standard Test Methods***

(a) Council Specifications

C201 - Control of Traffic

(b) Australian Standards

AS 2008 - Residual bitumen for pavements.
AS 2157 - Cutback bitumen.
AS 2758.2 - Aggregate for sprayed bituminous surfacing.
AS 3568 - Oils for reducing the viscosity of bitumen for pavements.

(c) Victorian State Legislation

Country Fire Authority Act, 1958
Local Government Act, 1989

(d) Other

AUSTROADS - Design of Sprayed Seals (1990)
AUSTROADS - Bitumen Sealing Safety Guide (1996)

C244.03 CONTROL OF TRAFFIC

Contractor's Responsibility

1. The Contractor shall provide for control of traffic in accordance with the requirements of the Specification for CONTROL OF TRAFFIC while undertaking the work and shall take all necessary precautions to protect the work from damage until such time as the new seal coat has developed sufficient strength to carry normal traffic without disturbance of the aggregate.

Speed Control

2. Where early use of the new seal is required to facilitate the movement of traffic, vehicles may be allowed to run on the work after initial rolling has taken place provided that vehicles are controlled to such slow speeds that no lateral displacement of aggregate occurs. Where necessary, the Contractor shall use patrol vehicles to ensure that traffic travels at an acceptable speed.

Minimise Traffic Delays

3. The Contractor shall take all necessary steps to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or side tracks are included in the Contract or are otherwise available, traffic shall be temporarily diverted while the work is in progress.

Part Width Spraying

4. If facilities for the diversion of traffic are not available, the Contractor may spray part width of the pavement in the one operation and make available to traffic the adjacent strip of roadway, except during the actual spraying operation when all traffic movement through the work shall cease. Traffic shall not be permitted to encroach upon the edge of the sprayed bituminous material until such time as it is covered with aggregate.

MATERIALS

C244.04 SAMPLING AND TESTING OF MATERIALS

NATA Registration

1. Sampling and testing of materials shall be arranged by the Contractor and carried out by a laboratory with appropriate NATA registration in accordance with the relevant material specifications cited in this Specification.

C244.05 BITUMINOUS MATERIALS AND ADDITIVES

(a) Bituminous Materials

1. Bitumen shall conform to AS2008 - Residual Bitumen for Pavements. The binder for seals and reseals shall be Class 170 or class 320 bitumen.

(b) Refinery Cutback Bitumen

1. Refinery cutback bitumen shall conform to AS2157. ***Cutback Bitumen***

C244.06 AGGREGATE PRECOATING AGENT AND BITUMEN ADHESION AGENT

1. Aggregate precoating agents shall be approved by the Superintendent prior to use. ***Precoating Agent***

2. Bitumen adhesion agents shall be approved by the Superintendent prior to use. ***Adhesion Agent***

C244.07 OILS FOR REDUCING VISCOSITY OF BITUMEN

(a) Cutter Oil

1. Cutter oil shall conform to the requirements of AS 3568, displaying an Abel flash point of not less than 38°C and a viscosity at 40°C not greater than 2.0 millipascal seconds, with the following qualifications to the properties for its classification as set down in AS 3568 Table 1: ***Cutter Specification***

(i) Either “Aniline point” or “Aromatic content” is acceptable.

(ii) There shall be no “Density” requirement.

(iii) The presence of water, assessed visually as an immiscible phase in any sample of the material, shall be grounds for its rejection.

(iv) If the viscosity is calculated by the equation given in Table 1, Note 3 of AS 3568, “f” shall be taken to be 0.0009 per °C.

2. Delivery and storage procedures for cutter oil delivered in drums or in bulk shall ensure that all containers are free from any deleterious material prior to filling with cutter oil, and all drums are stored so as to ensure that entry of water through seals or welds in the drums is prevented. ***Delivery & Storage***

C244.08 AGGREGATE

1. Aggregate shall conform to AS2758.2. ***Specification***

2. The Contractor shall obtain test results for each lot/stockpile of aggregate and certification of compliance with AS2758.2 from a laboratory with appropriate NATA accreditation, before aggregate from the lot is incorporated in the Works. ***Test Requirements***

DESIGN OF BITUMINOUS SURFACING

C244.09 GENERAL

1. At least 15 days before commencing sprayed bituminous surfacing work, the Contractor shall submit to the Superintendent for approval, details of the proposed bituminous surfacing design for the work together with a certification that the nominated materials for the work meet the requirements of the Specification. ***Proposed Design***

2. The Contractor’s design rates of application of binder and aggregate for bituminous surfacing shall be in accordance with the AUSTROADS design procedure for Sprayed Seals and shall submit these design details to the Superintendent. Design application rates shall be known as "nominated application rates" and materials as "nominated materials". ***AUSTROADS Design Procedure***

3. The following additional details are required to be submitted with the proposed bituminous surfacing design. ***Additional Information Sought***

(a) Test results for all nominated materials.

(b) Aggregates - source, geological type, nominated grading, average least dimension (ALD)

(c) Precoating agent and bitumen adhesion agent - types, proportions and manufacturer (if applicable).

(d) Bitumen - refinery source and certification of compliance with AS 2008.

(e) Cutback bitumen - refinery source of bitumen, type of cutter, source of cutter, cutter oil fraction, certification of compliance with AS 2157.

PRECOATING OF AGGREGATE

C244.10 GENERAL

1. The aggregate precoating agent shall be applied to the aggregate in a manner and at a rate and time which will provide a complete, light, uniform, effective cover of all aggregate particles at the time of spreading. ***Application***

2. Precoating of aggregate shall not be carried out when rain is imminent. If aggregate has been precoated and rain appears imminent, the aggregate shall be adequately covered to prevent the precoating material being washed from the aggregate particles. ***Weather Conditions***

3. The Contractor shall take precautions, such as covering stockpiles, to prevent settlement of dust, penetration of moisture or drying out of the precoating agent on the stockpiled aggregate. ***Cover for Stockpiles***

4. Stockpiles precoated more than 7 days in advance of use shall be retreated unless otherwise approved by the Superintendent. ***Age of Precoating***

APPLICATION OF SPRAYED BITUMINOUS SURFACING

C244.11 GENERAL

1. The Contractor shall carry out sprayed bituminous surfacing so as to: ***Work Quality***

(a) provide a uniform application of binder with adequate adhesion to the underlying surface;

(b) provide a complete cover of interlocking aggregate particles, and

(c) achieve effective bond between binder and aggregate.

2. Details of equipment and methods to be used for sprayed bituminous surfacing shall be submitted to the Superintendent for approval prior to their use on the Works. ***Equipment and Methods***

C244.12 PLANT

1. A mechanical sprayer shall be used to apply primer, primerbinder and binder. The sprayer shall have a current certification approved by the relevant State VicRoads. ***Sprayer Certification***

2. The spray nozzles shall be of the make and type endorsed on the Sprayer ***Spray Nozzles***

Certificate. Any nozzles which may be damaged or become unduly worn or defective shall be replaced by satisfactory nozzles of similar type. A sufficient number of nozzles for this purpose shall be available at all times.

3. Mechanical spreading equipment shall be used to spread aggregate and shall be capable of achieving a uniform and accurate spreading rate. ***Aggregate Spreader***

4. Rollers shall be utilised in accordance with Clause C244.19. ***Rollers***

5. The Contractor shall remove from the site any plant or equipment considered by the Superintendent to be not fully operational or not in a satisfactory condition for carrying out work in accordance with this Specification. ***Faulty Equipment***

C244.13 PREPARATION OF PAVEMENT SURFACE

1. Before the application of primer, primerbinder or binder, the pavement surface shall be swept by the use of a mechanically-operated rotary road broom or suction broom to provide a uniformly clean surface. If necessary, additional sweeping shall be done by hand, using stiff brooms. Sweeping shall, where possible, extend at least 300mm beyond each edge of the area to be sprayed. ***Pavement Sweeping***

2. Adherent patches of foreign material shall be removed from the surface of the pavement. ***Foreign Matter on Pavement***

3. For the spraying of primer or primerbinder, the pavement surface shall be slightly damp so as to impede dust interfering with initial adhesion except where explicit instructions are provided with the seal design. ***Damp Pavement***

C244.14 REVIEW OF NOMINATED APPLICATION RATES

1. The Contractor shall select the locations where each lot of aggregate is to be incorporated in the Works. ***Aggregate Lots***

2. The Contractor shall review the bituminous surfacing design at each location based on the actual average least dimension (ALD) test result for the lot of aggregate instead of the nominated ALD value of the aggregate adopted at design submission. The revised application rates shall be known as "target application rates". ***Target Application Rates***

3. The Contractor shall give the Superintendent at least five working days notice of the Contractor's intention to commence sprayed bituminous surfacing. This notice shall confirm spray rates, aggregate size and ALD.

C244.15 BITUMEN TEMPERATURE REQUIREMENTS

1. Bituminous products shall be handled in accordance with the AUSTROADS “Bitumen Sealing Safety Guide”. Precautions set out in the following paragraphs are provided for ready reference however, all procedures shall follow the guidelines set out in the “Bitumen Sealing Safety Guide”.

2. Bitumen shall be within the temperature range shown in Table C244.1 when mixed with cutter oil. ***Incorporated with Cutter Oil***

Class	Temperature Range (°C)
170	160 - 190
320	170 - 200

Table C244.1 - Bitumen Temperatures

3. Refinery cutback bitumen shall be within the temperature range shown in Table C244.2 at the time of spraying. ***Spraying Temperature***

Grade	Temperature Range (°C)
AMC 00	10 - 35
AMC 0	35 - 55
AMC 1	60 - 80
AMC 2	75 - 100
AMC 3	95 - 115
AMC 4	110 - 135
AMC 5	120 - 150
AMC 6	135 - 160
AMC 7	150 - 175

Table C244.2 - Cutback Bitumen Spraying Temperatures

4. The Contractor shall measure and record the temperature of the binder, using a thermometer, which is accurate to within 2.5 per cent of the correct temperature. ***Measurement of Temperature***

5. If the temperature of the bituminous material is below the applicable lower limit from Table C244.1 or Table C244.2, the bituminous material may be heated provided safe heating practices are adopted. Burners shall not be used unless the level of the material in the heating tank is at least 250mm above the tops of the heating tubes. The Contractor shall comply with the statutory requirements related to the Country Fire Authority and the Local Government Acts. Two or more suitable fully-charged pressurised chemical fire extinguishers shall be placed conveniently to the heaters at all times while heating is in progress. ***Safe Heating Practices***

6. During heating, the temperature of the bituminous material shall not exceed the applicable upper limit from Table C244.1 or Table C244.2. The temperature of the bituminous material just above the heating tubes shall be checked at regular intervals to ensure that there is no local overheating. ***Heating Limits***

7. Bituminous materials shall not be held at temperatures within the ranges shown in Tables C244.1 and C244.2 for periods in excess of ten hours. ***Temperature Retention***

8. Any bituminous material which has been overheated or stored in temperatures in Tables C244.1 and C244.2 for more than 10 hours shall not be used in the work unless sampled, retested and confirmed to be within the conformance requirements of AS 2008. Non-conforming bituminous material shall be disposed of legally and responsibly. ***Overheated Bitumen***

C244.16 PAVEMENT TEMPERATURE AND WEATHER CONDITIONS

1. The Contractor shall measure and record pavement temperatures at regular intervals during the course of the work. For this purpose, a spirit or mercury-in-glass thermometer or other suitable type of thermometer shall be placed in direct contact with the pavement and allowed to remain in position until the reading becomes steady. When a spirit or mercury-in-glass thermometer is used to measure pavement temperature, the bulb of the thermometer shall be covered from direct sunlight with a small heap of grit or similar material. Suitably calibrated infra-red thermometers may be used. ***Measurement and Recording***

2. If the pavement is partly in sun and partly in shade, the temperatures for both conditions shall be taken and recorded. ***Sun and Shade Conditions***

3. Spraying primers, primerbinders and binders shall be undertaken only if the pavement temperature has been at or above 10°C for spraying for at least one hour before commencement of spraying and does not fall below 10°C for spraying during the period of spraying. ***Minimum Pavement Temperature***

4. Spraying shall not be carried out on a wet pavement, while rain appears imminent or during high winds or dust storms. ***Spraying Conditions***

C244.17 INCORPORATION OF CUTTER OIL, FLUX OIL AND ADHESION AGENT

(a) Cutting Back Bitumen

1. The Contractor shall determine and record the proportion of cutter oil added to each sprayer load, based on the measured air temperature in accordance with VicRoads Standard Specification for Roadworks and Bridgeworks Section 408 unless otherwise approved by the Superintendent. ***Contractor's Responsibility***

2. The cutter oil, without being previously heated, shall be pumped into the sprayer, followed by the hot bitumen. The full sprayer load of cutback bitumen shall be circulated at a rate of at least 700 litres per minute for twenty minutes to ensure that the mixture is homogeneous. ***Mixing Cutter Oil***

3. If a part sprayer load of field cutback bitumen is unused on the date of mixing, and needs to be returned to the heater tanks, it shall be placed in an empty tank reserved for that purpose. No bitumen or cutter shall be added to the returned cutback bitumen unless the tank is fitted with an effective mechanical mixing system. When the returned cutback bitumen is subsequently used as part of a sprayer load, allowance shall be made for the cutter oil contained in the returned cutback bitumen. ***Unused Cutback Bitumen***

(b) Fluxing Bitumen

1. Where flux oil is to be included, it shall be added to the bitumen in the sprayer and the mixture circulated at a rate of at least 700 litres per minute for at least twenty minutes before spraying. ***Mixing Flux Oil***

(c) Bitumen Adhesion Agent

1. Where bitumen adhesion agent is to be included, it shall be added to the bitumen in the sprayer and the mixture circulated at a rate of at least 700 litres per minute for at least twenty minutes before spraying. ***Mixing Adhesion Agent***

C244.18 APPLICATION OF PRIMER, PRIMERBINDER AND BINDER

(a) General

1. The area to be sprayed with primerbinder or binder shall be limited to the area which can be covered with aggregate at the target application rate within fifteen minutes of spraying bitumen or cutback bitumen. ***Limit on Spray Area***

(b) Primer and Primerbinder

1. Nominated and target application rates and quantities of primer and primerbinder shall apply to the whole material, including cutter oil, measured at 15°C. Primer, Primerbinder and Binder application rates outside the tolerances indicated in Annexure C244.B constitute a non-conformance. ***Application Rates***

2. After application of a primer, a period of at least forty-eight hours, or such longer period as determined to be necessary for the primer to become completely dry, shall elapse before the binder for a seal is applied. All traffic shall be kept off the primed ***Curing Time for Primer***

surface.

3. After application of a primerbinder, a period of at least fourteen days shall elapse before the binder for a seal is applied. ***Curing time for Primer Binder***

(c) Binder

1. The class of bitumen or grade of cutback bitumen shall be as specified in Annexure C244A. ***Class of Bitumen***

2. Nominated and target application rates and quantities of binder shall be based on the volumes of bitumen measured at a temperature of 15°C and shall not include any bitumen adhesion agent and/or cutter oil. If flux oil has been added to the bitumen, the quantity of flux oil shall be included as part of the binder. Binder application rates outside the tolerances provided in Annexure C244B shall constitute a non-conformance. ***Nominated and Target Rates***

3. Where bitumen adhesion agent and/or cutter oil have been added to the binder, the application rate of the total binder at 15°C shall be adjusted to allow for the quantities of bitumen adhesion agent and/or cutter oil in the mixture. ***Adjustment of Application Rate***

4. The Contractor shall determine the hot application rate of total binder, including bitumen adhesion agent and/or cutter oil using methods set out in VicRoads Standard Specification for Roadworks and Bridgeworks Section 408. ***Calculation of Hot Application***

5. Where refinery cutback bitumen is used as the binder, the target application rate of binder shall be increased by the Contractor to allow for the cutter oil in the mixture. ***Refinery Cut-back Bitumen Variation***

(d) Operation of the Sprayer

1. Where the longitudinal edges of spray runs are not required to overlap, special type end nozzles must be used. Where an overlap is required, the overlap of spray between adjacent longitudinal runs shall be in the range 50-100mm for special type end nozzles. If intermediate nozzles are to be used to overlap adjacent longitudinal sprays the nozzles shall be set in the normal manner for intermediate nozzles and the overlap shall be in the range 250-350mm. ***Spray Overlap***

2. The spraying of primer, primerbinder or binder for each run of the sprayer shall commence on a protective strip of heavy paper weighing not less than 215 grams per square metre laid across and held securely to the pavement surface beforehand by addition of cover aggregate. The sprayer shall commence moving at a sufficient distance in advance of the protective strip to ensure that the road speed for correct application and correct alignment is attained at the commencement of spraying. ***Protective Paper Strip***

3. The sprayer shall maintain a uniform rate of application throughout the length of each sprayer run. ***Rate of Application***

4. The spraying for each run shall terminate on a protective strip of paper laid across and held securely to the pavement surface beforehand. The width of paper at the commencement and/or termination of each run shall not be less than that endorsed on the Sprayer Certificate. ***Terminating Paper Strip***

5. Spraying shall cease immediately if any defect develops in the spraying equipment and spraying shall not recommence until the fault has been rectified. ***Equipment Defects***

6. Where any blockage or partial blockage of nozzles occurs, spraying shall cease immediately. If the blockage is due to the condition of the binder being sprayed and is likely to re-occur, that load together with any binder from the same bulk tanker or supply unit shall not be used in the Works. ***Nozzle Blockage***

7. Where a mechanical sprayer is not able to satisfactorily spray small areas or ***Hand Spraying***

areas of irregular shape, such areas shall be sprayed by means of the hand spray equipment attached to the sprayer. The work shall be planned so as to minimise the area sprayed by hand spray equipment.

8. After each sprayer run, the quantity of binder sprayed shall be checked against the area covered and any necessary adjustments shall be made to ensure that the target application rate is achieved in subsequent runs. If the actual application rate of binder after three runs differs by more than 5 per cent from the target application rate, the sprayer shall not be used until a new Sprayer Certificate has been obtained. ***Application Rate Checks***

9. Areas not within 5 per cent of the target application rate of primer, primerbinder or binder shall constitute a 'nonconformance' under the Contract. ***Nonconformance Application Rate***

C244.19 APPLICATION AND ROLLING OF AGGREGATE

1. The application of aggregate shall proceed immediately after spraying is commenced and shall be completed within fifteen minutes of spraying bitumen or cutback bitumen. ***Time for Completion***

2. Wet aggregate shall not be used. ***Wet Aggregate***

3. The Contractor shall apply the aggregate of the specified nominal size and at the target aggregate application rate. Sufficient loaded and measured trucks of dry aggregate shall be at the site to provide full cover for the area sprayed. ***Planning***

4. The aggregate shall be spread uniformly over the sprayed surface by means of suitable mechanical spreading equipment. ***Uniform Application***

5. Any bare or insufficiently covered areas shall be re-run by the mechanical spreader or covered by hand as necessary to give a uniform and complete coverage. Any aggregate spread in excess of the target aggregate application rate shall be removed before rolling is commenced if it is localised and can be efficiently removed by hand brooming. ***Deficient or Excess Aggregate***

6. After the aggregate has been applied to each section of the work, initial rolling shall be carried out with two or more dual axle smooth pneumatic tyred multi-wheel rollers of minimum load of one tonne per tyre and minimum tyre pressure of 550 kPa. A roller with a rubber surface drum providing equivalent compactive effort may be used in lieu of a multi-wheeled roller. Initial rolling shall continue until the aggregate is firmly embedded in the primerbinder or binder. Roller speed shall be 15-25km/h subject to safe working conditions. ***Initial Rolling***

7. If the aggregate is not evenly distributed over the surface of the pavement, the surface shall be traversed with a light drag broom after the initial rolling. If the broom has any tendency to dislodge aggregate particles bedded in the primerbinder or binder, the Contractor shall defer or eliminate the drag brooming. Where drag brooming is eliminated, the Contractor shall substitute light hand brooming. ***Brooming of Surface***

8. Backrolling shall then be carried out for a minimum period of one hour per 1000 square metres sprayed for roads having a traffic volume of less than 500 vehicles per lane per day and one hour per 1500 square metres sprayed for other roads, up to a maximum of twenty-four hours after the aggregate has been applied. ***Backrolling***

9. Where a bituminous surfacing is specified with separate applications of coarse and fine aggregate on a single application of binder, the coarse aggregate shall be applied first, rolled and any necessary brooming carried out as described above, before application of the fine aggregate and its subsequent rolling and brooming. In this case, the time limits for incorporation of aggregate shall apply only to the application of the coarse aggregate. ***Two Aggregate Application***

10. When the aggregate has been evenly spread and embedded in the binder, any ***Removal of***

remaining loose particles of aggregate shall be removed from the pavement and disposed of responsibly by the Contractor. ***Loose Particles***

C244.20 WORK RECORDS

1. Particulars of the work performed shall be recorded by the Contractor on a bituminous surfacing daily record form. Details of primer, primerbinder, binder and aggregate applied shall be recorded immediately after every sprayer run. Each form shall be signed by the Contractor's representative as a true record of the work performed. The Contractor shall supply to the Superintendent a copy of each completed form. ***Sprayer Run Records***

C244.21 PROTECTION OF SERVICES AND ROAD FIXTURES

1. The Contractor shall take all necessary precautions to prevent primer, primerbinder, binder, aggregate or other material used on the work from entering or adhering to gratings, hydrants or valve boxes, access chamber covers, bridge or culvert decks and other road fixtures. ***Contractor's Responsibility***

2. Immediately after aggregate has been spread over the binder, the Contractor shall clean off or remove any sprayed surfacing material and leave the services and road fixtures in a condition equivalent to that existing when the Contractor commenced the sprayed surfacing work. ***Services and Road Fixtures***

NONCONFORMANCE OF MATERIALS AND WORK

C244.22 GENERAL

1. If any materials supplied fail to conform to the requirements of the Contract or if any section of sprayed bituminous surfacing work fails to conform to the requirements of this Contract - whether failure of the work is due to bad workmanship, defective materials supplied by the Contractor or materials made defective by the method of operation adopted or any other cause, then such failure or failures shall constitute a 'nonconformance' under the Contract. ***Conditions***

2. If the nonconformance is not acceptable to the Principal, the nonconforming material shall be replaced or the nonconforming section of sprayed bituminous surfacing work shall be either replaced or corrected as proposed by the Contractor, subject to the approval of the Superintendent being attained. ***Replace or Correct***

3. Materials removed from the site by the Contractor shall be replaced with materials which conform to this Specification.

C244.23 ACCEPTANCE OF NONCONFORMANCES

1. Nonconformances of materials and work may be accepted at the absolute discretion of the Superintendent subject to deductions to the scheduled rate of the Pay Items applicable to the quantity of work incorporating the nonconforming material and work in accordance with the Clause “DEDUCTIONS”. All nonconformances not listed within the deductions clause shall be rectified to comply with this Specification as a cost to the Contractor. ***Superinten-dent's Authority***

2. Nonconformance related to the achieved application rates for primer, primerbinder or binder as determined from the bituminous surfacing daily record shall be dealt with by the Superintendent strictly on the basis set out below:

- Variations will be considered as departures from the design target application rates after allowing for adjustments due to adhesion agent, cutting oil, flux oil and temperature. Adjustments made on site due to surface condition and stockpile ALD dimension will also be allowed for, subject to a record of their

prior approval by the Superintendent being available.

- Variations up to ±5 per cent of the adjusted design target application rate shall be deemed as conforming being within Tolerance Threshold, T1.

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C244.23 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C244.3 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	Design of Bituminous Surfacing	Contractor to provide details of design to Superintendent at least 15 days before proposed commencement of work	C244.09
2.	Commencement of Work	Contractor to give 5 days notice to the Superintendent of intention to commence work	C244.11
3.	Sweeping of Pavement Surface	Sweeping shall extend at least 300mm beyond each edge of the area to be sprayed	C244.13
4.	**Bitumen Heating**		
	(a) Bitumen Temperature	When incorporated with cutter oil, bitumen shall be in temperature ranges as per Table C244.1.	C244.15
	(b) Refinery Cutback Bitumen Temperature	At the time of spraying shall be in temperature range as per Table C244.2.	C244.15
	(c) Retention of Temperature	Bituminous materials shall not be held at temperatures within the ranges of Tables C244.1 or C244.2 for periods in excess of 10 hours.	C244.15
5.	**Spraying Temperature**		
	(a) Pavement Temperature	Bituminous surfacing shall not be undertaken if the pavement temperature has not been at or above 10°C for at least one hour before commencement of spraying or if the pavement temperature falls below 10°C during the period of spraying.	C244.16

Item	Activity	Limits/Tolerances	Spec Clause
6.	Cutting Back Bitumen	Circulation of hot bitumen and cutter oil mixture in the sprayer shall be at the rate of at least 700 litres per minute for 20 minutes.	C244.17
7.	Fluxing Bitumen or adding Bituminous Adhesion Agent	Circulation of fluxing oil or bituminous adhesion agent with hot bitumen shall be at the rate of at least 700 litres per minute for 20 minutes.	C244.17
8.	**Application of Bituminous Material**		
	(a) Spray Area	Area to be sprayed shall be limited to area which can be covered by aggregate at target application rate within 15 minutes of spraying.	C244.18
	(b) Application Rates	Application rates and quantities shall apply to a temperature of 15°C and have T1 tolerances of ±5 per cent as set out in Clause C244.23 and T2 tolerances as set out in Annexure C244.B.	C244.18
	(c) Primer	At least a 48 hour period shall elapse after spraying of primer before binder for a seal is applied.	C244.18
	(d) Primerbinder	At least a 14 day period shall elapse after spraying of primerbinder before application of binder.	C244.18
9.	**Application of Aggregate**		
	(a) Spreading Time	Application of aggregate shall be completed within 15 minutes of spraying bitumen or cutback bitumen on each section.	C244.19
10.	**Rolling**		
	(a) Roller Numbers and Type	Initial rolling shall be carried out with two or more dual axle smooth pneumatic tyred multi-wheeled rollers. Minimum load of one tonne per tyre and minimum tyre pressure 550KPa.	C244.19
	(b) Backrolling	(i) For traffic volume of <500 vehicles per lane per day, backrolling for minimum of one hour per 1000 square metres sprayed.	C244.19
		(ii) For traffic volume >500 vehicles per lane per day, backrolling for minimum of one hour per 1500 square metres sprayed.	C244.19

Item	Activity	Limits/Tolerances		Spec Clause
11.	**Nonconformance**			
	(a) Bitumen		(i) Bitumen with viscosity at 60°C within the specified limits, but with other properties outside the limits specified in AS 2008, shall incur deductions.	C244.30
			(ii) For Class 170 bitumen or Class 320 bitumen having a viscosity at 60°C outside the limits specified in AS 2008, deductions shall apply.	C244.30
	(b) Refinery Bitumen	Cutback	(i) Cutback bitumen with viscosity at 60°C within the specified range according to Table 1 of AS 2157, but having any property outside the range specified by AS2157, shall incur deductions.	C244.30
			(ii) For cutback bitumen having a viscosity at 60°C outside the range specified in Table 1 of AS 2157, deductions shall apply.	C244.30

Table C244.3 - Summary of Limits and Tolerances

ANNEXURE C244.A - DETAILS OF WORK

Section		Prime	Primer Seal		Seal or Reseal	
Road Name From To		Binder Type	Binder Type	Aggregate Nom. Size	Binder Type	Aggregate Nom. Size

Note: Prime and Primer Seal Binder Type shall be indicated in this Annexure using the descriptive terms as follows:

Very Light Prime or Primer	-	equivalent cut back bitumen to grade AMCOO.
Light/Medium Prime or Primer	-	equivalent cutback bitumen to grade AMCO or AMC1.
Heavy Prime or Primer	-	equivalent cut back bitumen to grade AMC1 or AMC2.

ANNEXURE C244.B - BINDER DETAILS

BINDER TYPE	**ADHESION AGENT** (At 0.5 per cent of binder) **(YES/NO)**

Primer, Primerbinder and Binder Application Tolerance Thresholds T2
(Refer to Clause C244.23)

Nominal Aggregate Size (mm)	**Tolerance Thresholds T2 expressed as ± percentages**
0mm Prime	

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C254

SEGMENTAL PAVING

SPECIFICATION C254 - SEGMENTAL PAVING

CONTENTS

ANNEXURES

C254-A LAYING PATTERNS

SPECIFICATION C254 - SEGMENTAL PAVING

GENERAL

C254.01 SCOPE

1. This Specification covers the construction of both clay and concrete segmental paving for road pavements, medians, traffic islands, driveways, cycleways, footpaths and other pedestrian areas.

2. The work to be executed under this Specification consists of the supply, placement and compaction of segmental pavers including the provision of a sand bedding course and joint filling sand, over bound or unbound base and/or subbase layer/s.

3. This Specification should be read in conjunction with the appropriate Specifications for the construction of the base and subbase layers beneath the segmental paving, ie. FLEXIBLE PAVEMENTS, MASS CONCRETE SUBBASE.

Quality

4. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements.

C254.02 TERMINOLOGY

Size

1. Concrete segmental pavers are units of not more than 0.10 square metres in gross plan area, manufactured from concrete, with plain or dentated sides, with top and bottom faces parallel and with or without chamfered edges.

Concrete Pavers

2. Concrete pavers are identified by shape as being one of the following types:

Shape Type A

Dentated chamfered units which key into each other on four sides, are capable of being laid in herringbone bond, and by their plan geometry, when interlocked, resist the spread of joints parallel to both the longitudinal and transverse axes of the units.

Shape Type B

Dentated units which key into each other on two sides, are not (usually) laid in herringbone bond, and by their plan geometry, when keyed together, resist the spread of joints parallel to the longitudinal axes of the units and rely on their dimensional accuracy and accuracy of laying to interlock on the other faces.

Shape Type C

Units which do not key together and which rely on their dimensional accuracy and accuracy of laying to develop interlock.

Clay Pavers

3. Clay pavers are manufactured from clay, shale or argillaceous materials which may be mixed with additives. Clay pavers may have square, bevelled (chamfered), rounded or rumbled edges. They are generally rectangular in shape, with the length twice the width, plus 2mm.

Classification

4. Clay pavers are classified as either Class 1, 2, 3 or 4 according to their intended application, with increasing performance requirements (and thickness) from Class 1 to Class 4.

5. Laying patterns of pavers are identified as being either Herringbone, Basket-weave, or Stretcher as shown in Annexure C254-A. Each of these may be laid at either 90º or 45º to the line of edge restraints. A variation of Stretcher is the Zig Zag Running Bond, also shown in Annexure C254-A. ***Pattern***

C254.03 CHOICE OF PAVER TYPE, SHAPE, CLASS AND LAYING PATTERN

1. The choice of concrete or clay segmental pavers, the paver class (for clay pavers), shape type (for concrete pavers), shape name, colour, thickness and laying pattern shall be as shown on the Drawings for each area of application. ***Type***

2. Unless otherwise specified, concrete pavers for road pavements shall be placed in herringbone laying pattern and shall be in accordance with the requirements for the appropriate road application shown in Table C254.1. ***Concrete***

3. Unless otherwise specified, clay pavers for road pavements shall be Class 4, minimum 65mm nominal thickness, and placed in a herringbone laying pattern. ***Clay***

C254.04 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C213	-	Earthworks
C224	-	Open Drains including Kerb and Channel
C241	-	Stabilisation
C242	-	Flexible Pavements
C247	-	Mass Concrete Subbase
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving.
AS/NZS 4455	-	Masonry units and segmental pavers.
AS/NZS 4456.0	-	Masonry units and segmental pavers - Methods of test - General introduction and list of methods.
AS/NZS 4456.3	-	Determining dimensions.
AS/NZS 4456.5	-	Determining breaking load of segmental paving units.
AS/NZS 4456.9	-	Determining abrasion resistance.
AS/NZS 4586	-	Slip resistance classification of new pedestrian surface materials

(c) Concrete Masonry Association of Australia Specifications

T44	-	Concrete Segmental Pavements - Guide to Specifying.
T45	-	Concrete Segmental Pavements - Design Guide for Residential Access Ways and Roads.
T46	-	Concrete Segmental Pavements - Detailing Guide.

(d) Clay Brick and Paver Institute Specifications

Paver Note 1	-	Specifying and Laying Clay Pavers

MATERIALS

C254.05 GENERAL

1. The Contractor shall submit details of all proposed segmental paving materials, including bedding sand and joint filling sand. These details shall be submitted to the Superintendent for approval supported with test results from a nominated NATA registered laboratory, confirming that the constituents comply with the requirements of this Specification. ***Details Required***

2. No pavers shall be delivered until the Superintendent has approved the type and quality of the pavers and noted the source of supply as compliant to the requirements of this Specification. All pavers shall have suitable "slip resistance" for pedestrian traffic and vehicular traffic with a classification "W" according to AS/NZS 4586 for the Wet Pendulum Test. Where specific localities or levels of usage require a higher slip resistance classification, this classification shall be indicated on the Drawings Such approval shall not relieve the Contractor of any responsibility for supplying materials that comply with this Specification. ***Slip Resistance, Superintendent's Approval***

C254.06 CONCRETE SEGMENTAL PAVERS

1. Concrete segmental pavers shall comply with the requirements of T44, T45, T46, and AS/NZS 4455 for each area of application. ***Specification***

2. The material requirements for concrete pavers for each application, derived from T44, are shown in Table C254.1. ***Requirements***

Application	Characteristic breaking load [3] (kN)	Characteristic flexural strength[3] (MPa)	Minimum Thickness (mm)	Shape[4] (type)	Dimensional deviations (Category - AS 4455)	Abrasion resistance (mean abrasion index)
Residential Driveways						
Light Traffic	3	2	No limit	Any	DPA1 or DPB1	7
Medium Traffic[1]	5	3	No limit	Any	DPA1 or DPB1	7
Public Footpaths						
Low Volume	5	3	No limit	Any	DPB2	5
High Volume and Pedestrian Malls[1]	5	3	No limit	Any	DPB2	3.5
Roads[4]						
Minor	5	3	60	Any	DPB2	5
Local and Collector	5	3	80	Any	DPB2	5
Distributor	5	3	80	A	DPB2	5
Industrial Pavements[2]	10	4	80	A	DPB3	7

Table C254.1
Material Requirements for Concrete Segmental Pavers

Notes: 1. Capable of taking occasional 8.2-t axle loads.

2. The resultant joint width is a combination of paver dimensional deviation and laying procedures.

3. At 28 days.

4. Interlocking shapes offer superior performance in road applications.

3. The pavers shall meet the requirements for the relevant application given in Table C254.1 when tested in accordance with the following test methods: ***Test Methods***

- characteristic breaking load AS/NZS 4456.5
- characteristic flexural strength AS/NZS 4456.5
- Minimum thickness Not Applicable
- Shape type Not Applicable
- Dimensional deviations AS/NZS 4456.3
- Abrasion resistance AS/NZS 4456.9

C254.07 CLAY SEGMENTAL PAVERS

1. Clay segmental pavers shall comply with the requirements of Part 1 - Specifying Clay Pavers of Paver Note 1 - 'Specifying and Laying Clay Pavers' and with the requirements of AS/NZS 4455. ***Specification***

2. Clay pavers shall be classified as Class 1, 2, 3 or 4 in accordance with Paver Note 1 - Specifying and Laying Clay Pavers. Unless otherwise indicated, Class 4 pavers shall be used for all road and driveway pavements, medians and traffic islands. Class 2 or 3 pavers may be used for footpaths, cycleways and other pedestrian areas, except where they are subject to vehicular traffic with axle loads greater than 2.7 tonnes, in which case Class 4 pavers shall be used. Class 1 pavers shall only be permitted for low-volume pedestrian applications not subject to any vehicular traffic. ***Class***

3. The abrasion resistance as determined by the SCC Abrasion Test (Paver Note1) shall conform to the recommended characteristic abrasion losses contained in Paver Note 1. ***Abrasion Resistance***

C254.08 BEDDING SAND

1. The bedding sand shall be a well-graded sand, consisting of clean, hard, uncoated grains uniform in quality, generally passing a 4.75mm sieve. The bedding sand shall be from a single source or blended to achieve, when tested in accordance with AS 1141.11, the following grading: ***Grading***

AS Sieve	**% Passing**
9.52mm	100
4.75	95 - 100
2.36	80 - 100
1.18	50 - 85
600μm	25 - 60
300	10 - 30
150	5 - 15
75	0 - 10

2. The sand shall be of uniform moisture content when spread. It shall be covered when stored on site to protect it from rain penetration. ***Protection***

3. The bedding sand shall be free of deleterious soluble salts or other contaminants which may cause, or contribute to, efflorescence. ***Cleanliness***

C254.09 JOINT FILLING SAND

1. The joint filling sand shall be well graded passing a 2.36mm sieve, and when tested in accordance with AS 1141.11, having the following grading: ***Grading***

AS Sieve	% Passing
2.36mm	100
1.18	90 - 100
600μm	60 - 90
300	30 - 60
150	15 - 30
75	5 - 10

2. The sand shall be dry when spread. It shall be covered when stored on site to protect it from rain penetration. ***Protection***

3. The sand shall be free of deleterious soluble salts or other contaminants. ***Cleanliness***

4. Sand used for bedding is not suitable for joint filling.

C254.10 CONCRETE FOR EDGE RESTRAINTS

1. Concrete supplied and placed for the construction of edge strips shall comply with the Specification for MINOR CONCRETE WORKS. ***Specification***

2. Unless otherwise indicated on the Drawings, or where the edge restraint is provided by kerb and/or channel, the concrete used for edge restraints shall have a minimum 28-day characteristic compressive strength of 32MPa for edge restraints to pavers on road pavements and 25MPa for edge restraints to pavers on footpaths, cycleways, medians and driveways. ***Strength***

CONSTRUCTION

C254.11 SUBGRADE PREPARATION

1. The subgrade shall be formed to the required depth below finished surface level as shown on the Drawings in accordance with the Specification for EARTHWORKS. ***Levels***

2. The finished subgrade foundation for the provision of subbase and/or base shall be subject to the approval of the Superintendent. ***Superintendent's Approval***

C254.12 SUBBASE

1. Where shown on the Drawings a subbase or working platform shall be constructed in accordance with the relevant Specification for STABILISATION, FLEXIBLE PAVEMENTS, or MASS CONCRETE SUBBASE. ***Specifications***

2. The subbase shall be constructed to the specified thickness, compaction and depth below finished surface level and to the design grade and crossfalls of the finished surface. ***Levels***

3. The finished subbase shall be subject to the approval of the Superintendent. ***Superintendent's Approval***

C254.13 BASE

1. The base shall be constructed to the specified thickness and depth below ***Levels***

finished surface level, and to the design grade and crossfalls of the finished surface, as shown on the Drawings in accordance with the Specification for FLEXIBLE PAVEMENTS.

2. The base course shall extend in width to at least the rear face of all new edge restraints. ***Extent***

3. Notwithstanding the finished level tolerances contained within the Specification for FLEXIBLE PAVEMENTS for base of ± 10mm of design levels, the level on the finished surface of the base course for road pavements to be overlain with segmental paving shall be trimmed to within + 10mm or - 0mm of design levels. The deviation from a 3m long straight edge placed anywhere and laid in any direction on the top surface of the base course for all segmental paving shall not exceed 10mm. Sand bedding material shall not be used as a levelling material to compensate for base finishing outside the above tolerances. ***Tolerances***

4. The finished surface of the base shall drain freely without ponding. ***Free Drainage***

5. The finished base shall be subject to the approval of the Superintendent. ***Superintendent's Approval***

C254.14 EDGE RESTRAINTS

1. Edge restraints in the form of kerb and/or channel or edge strips shall be constructed along the perimeter of all segmental paving as shown on the Drawings. Concrete kerb and/or channel and edge strips shall be constructed in accordance with the Specifications for OPEN DRAINS INCLUDING KERB AND CHANNEL and MINOR CONCRETE WORKS. ***Requirements***

2. Faces of edge restraints abutting pavers shall be vertical.

3. Edge restraints shall be supported on compacted base and/or subbase of the thickness as shown on the Drawings. Where not otherwise specified or indicated, the minimum thickness of compacted base beneath the edge restraints shall be 100mm adjacent to road pavements and medians, and 50mm adjacent to footpaths, cycleways and driveways. ***Support***

4. Unless otherwise shown on the Drawings, contraction joints, 20mm depth shall be formed every 5m of edge restraint length. ***Joints***

5. After the concrete has hardened and not earlier than three days after placing, unless otherwise directed by the Superintendent the spaces at the back of the edge restraint shall be backfilled with earth, compacted in layers not greater than 150mm thick, then topsoiled to meet surrounding of design levels. ***Back Filling***

C254.15 SAND BEDDING COURSE

1. The sand bedding course shall be spread in a single uniform layer and screeded in a loose condition to the nominated design profile and levels plus that necessary to achieve a uniformly thick nominal 20-25mm layer following final compaction of the segmental paving. ***Allowance Levels***

2. Any depressions in the screeding sand exceeding 5mm shall be loosened, raked and rescreeded before laying pavers. ***Depressions***

3. For the manual placing of paving units, the bedding sand shall be maintained at a uniform loose density. For mechanised laying, the bedding sand shall be uniformly and firmly, but not fully, compacted. ***Compaction***

4. Screeded sand left overnight of subject to rain shall be checked for level and rescreeded where necessary before pavers are placed. The sand shall not be screeded ***Screeding***

more than two metres in advance of the laying face at the completion of work on any day.

C254.16 LAYING PAVERS

1. Pavers shall be uniformly placed on the screeded sand bedding to the nominated laying pattern. Pavers shall be placed so that they are not in direct contact with each other and shall have uniform 3mm nominal joint widths. The pavers shall be mixed between various pallets to ensure that any colour variation from one pallet of pavers to the next is evenly distributed over the entire paved area. ***Placement and Jointing***

2. The first row shall be located next to an edge restraint or an established straight line, and laid at a suitable angle to achieve the required orientation of pavers in the completed pavement. ***Sequence***

3. In each row, full units shall be laid first. Edge or closer units shall be neatly cut using a paver scour, or mechanical or hydraulic guillotine, and fitted subsequently. Cut pieces of pavers which are smaller in size than one quarter of a full block shall not be used. ***Odd Shapes***

4. Access chambers, drainage gullies and similar penetrations through the pavement shall be finished against the paving with a concrete surround or apron designed to suit and fit the laying pattern, otherwise complying with the requirements for edge restraints. ***Penetrations***

5. Where pavers are placed over an isolation, contraction or expansion joint in an underlying concrete pavement, a joint is to be provided in the pavers. The joint shall consist of 10mm thick preformed jointing material of bituminous fibreboard. ***Formed Joints***

6. Any foot or barrow traffic shall use boards overlaying paving to prevent disturbance of units prior to compaction. No other construction traffic shall be allowed on the pavement prior to compaction and provision of joint filling sand. ***Construction Traffic***

7. On completion of subsequent bedding compaction and joint filling operations, all joints shall have widths within the range 2-4mm. ***Tolerance***

C254.17 BEDDING COMPACTION

1. After laying the pavers the sand bedding shall be fully compacted and the surface brought to design levels and surface profiles by not less than two passes of a high frequency low amplitude plate compactor which covers at least 12 units. Compaction shall continue until all pavers form a smooth surface with adjacent paver edges matching. The level difference between adjoining edges of any two pavers shall be a maximum of 2mm, to avoid trip hazards, unless approved otherwise by the Superintendent for rough textured pavers. ***Compaction***

2. Any units which are structurally damaged during bedding compaction shall be removed and replaced. The pavement shall then be recompacted for at least one metre surrounding each replacement unit. ***Damage***

3. The paving operations shall be arranged so that the use of the plate compactor proceeds progressively behind the laying face without undue delay, and such that compaction is completed prior to cessation of construction activity on any day. Compaction shall not be attempted within one metre of the laying face except on completion of the pavement against an edge restraint. ***Progressive Compaction***

4. The finished surface level shall not vary from the design level at any point laid in any direction, by more than 6mm for all areas with Class 4 segmental pavements and 8mm for all other areas of segmental paving. Notwithstanding this, the finished surface of the segmental paving, including where the paving abuts an edge restraint other than a drainage inlet, shall not deviate from the bottom of a 3m straight edge laid in any direction, except at grade changes, by more than 6mm for road pavements and 8mm for ***Finished Levels***

all other areas of segmental paving.

5. The channels formed between abutting chamfered units shall finish with their inverts not less than 5mm nor more than 10mm above adjacent drainage inlets. ***Drainage Inlets***

6. All compaction shall be complete and the pavement shall be brought to design profiles before spreading or placing sand filling in the joints. ***Joint Filling***

C254.18 FILLING JOINTS

1. As soon as practicable after bedding compaction, and in any case prior to termination of work on any day, dry sand for joint filling shall be spread over the pavement and the joints filled by brooming. ***Timing***

2. To ensure complete filling of the joints, both the filling sand and pavers shall be as dry as practicable when sand is spread and broomed into the joints. ***Condition***

3. The pavement shall then receive one or more passes of a plate compactor and the joints then refilled with sand, with the process then repeated sufficiently to ensure that the joints are completely filled. ***Process***

C254.19 PROTECTION OF WORK

1. Other than wheeled trolleys, forklifts and cluster-clamp vehicles, construction and other traffic shall not use the pavement until bedding compaction and joint filling operations have been completed. ***Restricted Use***

C254.20 OPENING TO TRAFFIC

1. As soon as practicable after the filling of joints, construction vehicles may use the pavement, and should be encouraged to traverse the greatest possible area of pavement to assist in the development of 'lock-up'. ***No Tracking***

2. Excess joint filling sand shall be removed prior to opening to traffic. ***Excess Sand***

3. The pavement shall then be inspected by the Contractor at regular intervals up until the expiration of the Defects Liability Period to ensure that all joints remain completely filled. ***Inspections***

LIMITS AND TOLERANCES

C254.21 SUMMARY OF LIMITS AND TOLERANCES

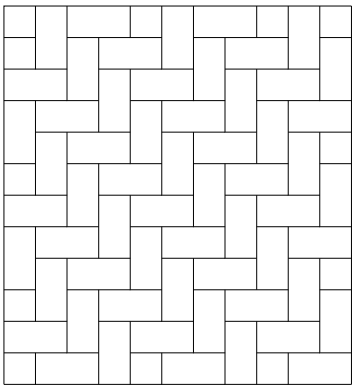
1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C254.2 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Base**		
	(a) Surface Level	Finished level of base for road pavements to be within +10mm or -0mm of design levels.	C254.13
		Finished level of base other than for road pavements, to be within ±10mm of design levels.	C254.13
		The top surface of the base for all segmental paving shall not deviate from a 3m straight edge, laid in any direction, by more than 10mm.	C254.13
2.	**Laying Paving Units**		
	(a) Joint widths	Within the range 2 -4mm.	C254.16
3.	**Completed Segmental Paving**		
	(a) Surface level	Finished surface level of pavers shall not vary from design levels by more than ±6mm for road pavements and ±8mm for other than road pavements.	C254.17
		Finished surface of pavers shall not deviate from a 3m straight edge, laid in any direction, by more than 6mm for road pavements and 8mm for other than road pavements.	C254.17
	(b) Level adjacent to drainage inlets	Invert level of channels between abutting chamfered units shall be not less than 5mm and not more than 10mm above the level of adjacent drainage inlets.	C254.17
	(c) Difference in level of adjacent pavers	≤2mm	C254.17

Table C254.2 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

ANNEXURE C254-A
LAYING PATTERNS



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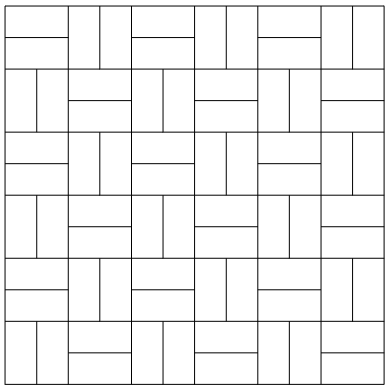

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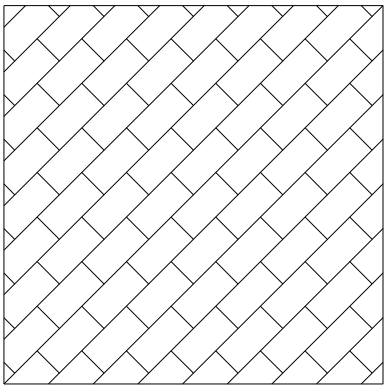
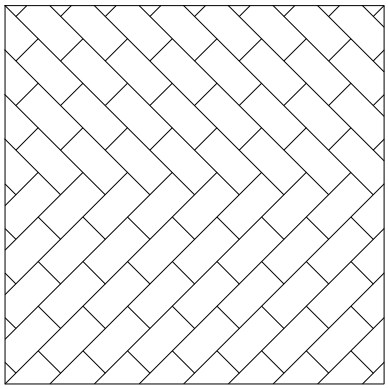


Stretcher



Zig Zag Running Bond

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CITY OF GREATER DANDENONG

DEVELOPMENT
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SPECIFICATION

C255

BITUMINOUS MICROSURFACING

SPECIFICATION C255: BITUMINOUS MICROSURFACING

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SPECIFICATION C255 : BITUMINOUS MICROSURFACING

GENERAL

C255.01 SCOPE

1. The work to be executed under this Specification consists of the design, supply, mixing and placement of bituminous microsurfacing for surface correction and wearing surface applications on road pavements, carparks, cycleways and footpaths.

2. Bituminous microsurfacing shall consist of a mixture of emulsified polymer modified bitumen binder, mineral aggregate, mineral filler, additives and water proportioned and mixed to form a slurry which is placed and spread evenly on the road surface. It shall be capable of being spread in variably thick layers for surface correction and for wearing surface applications. ***Bituminous Slurry***

3. The size, nominal thickness, and extent of bituminous microsurfacing shall be as shown on the Drawings or as directed by the Superintendent. ***Size and Extent***

4. For all new works on road and carpark pavements, this Specification should be read in conjunction with the Specification for SPRAYED BITUMINOUS SURFACING. For new works on road and carpark pavements, bituminous mircrosurfacing shall be preceded by the application of a sprayed bituminous seal a minimum of two weeks prior to the application of the bituminous microsurfacing wearing course. ***Preceded by Sprayed Bituminous Seal***

5. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C255.02 TERMINOLOGY

1. Bituminous microsurfacing is one of two types of bituminous slurry surfacing. It is distinguished from the other type, slurry seals, by the incorporation of polymer and other additives to the bituminous binder to improve the performance of the slurry surfacing. ***Polymer Modified Binder***

2. Bituminous microsurfacing is also commonly known under various proprietary names such as 'cold overlay', 'microsealing', 'paveseal', 'microasphalt', etc. ***Proprietary Names***

3. The size of the bituminous microsurfacing is based on the nominal largest stone size in the mix. For the purpose of this Specification, the size shall be either Size 5 or Size 7. ***Size***

C255.03 REFERENCE DOCUMENTS

Documents Standards Test Methods

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

(a) Council Specification

C244 - Sprayed Bituminous Surfacing

(b) Australian Standards

AS 1141.11	-	Particle size distribution by dry sieving
AS 1141.12	-	Material finer than 75 μm in aggregates (by washing)
AS 1141.22	-	Wet/dry strength variation
AS 1141.23	-	Los Angeles value
AS 1141.25	-	Degradation factor - source rock
AS 1141.42	-	Pendulum friction test (PAFV)
AS 1160	-	Bitumen emulsions for construction and maintenance of pavements
AS 1289.3.7.1	-	Determination of the sand equivalent of a soil using a power-operated shaker
AS 2008	-	Residual bitumen for pavements
AS 2357	-	Mineral fillers for asphalt
AS 2891.3.1	-	Bitumen content and aggregate grading (reflux method)

(c) International Slurry Surfacing Association

ISSA TB 100	-	Test method for wet track abrasion of slurry surfaces
ISSA TB 114	-	Wet stripping test for cured slurry seal mix
ISSA TB 139	-	Test method to classify emulsified asphalt/aggregate mixture systems by modified cohesion tester measurement of set and cure characteristics
ISSA TB 144	-	Test method for classification of aggregate filler-bitumen compatibility by Schulze-Breuer and ruck procedure

MATERIALS

C255.04 BINDER

1. The binder supplied and used in the works shall be an emulsified polymer modified bitumen, formulated to meet the performance requirements of the mix specified in Clauses C255.10 and C255.18. ***Polymer Modified Bitumen Emulsion***

2. Prior to emulsification, incorporation of polymer and additives, the bitumen shall comply with AS 2008. ***Specification***

3. The Contractor shall provide the Superintendent with sufficient information to verify that the binder supplied is the same as that nominated in the mix design. ***Verification***

C255.05 MINERAL AGGREGATES

1. Mineral aggregates shall consist of crushed rock or crushed gravel, or a mixture of crushed rock or crushed gravel and natural sand. It shall consist of clean, hard, angular, durable particles, and free form clay, dirt, organic material or other deleterious matter. ***Quality***

2. The aggregate from each source shall comply with the requirements given in Table C255.1. ***Aggregate Properties***

Property	Test Method	Requirement
Degradation Factor	AS 1141.25	50 minimum
Los Angeles Value	AS 1141.23	30 maximum
Aggregate Wet Strength	AS 1141.22	150 kN minimum
Wet/Dry Strength Variation	AS 1141.22	30% maximum
Polished Aggregate Friction Value	AS 1141.42	45 minimum
Sand Equivalent	AS 1289.3.7.1	60 minimum

Table C255.1 - Aggregate Properties

3. When tested in accordance with AS 1141.11 and AS 1141.12, the aggregate (including mineral filler) shall conform with the grading limits given in Table C255.2. ***Grading Limits***

Sieve Size	Percent Passing by Mass	
	Size 5	Size 7
13.2 mm	100	100
9.50 mm	100	100
6.70 mm	100	85-100
4.75 mm	90-100	70-90
2.36 mm	50-70	45-70
1.18 mm	30-50	28-50
600 μm	20-35	19-34
300 μm	12-25	12-25
150 μm	7-18	7-18
75 μm	4-10	5-15

Table C255.2 - Grading Limits for Combined Aggregate/Filler

4. The Contractor shall nominate the source/s of aggregates to the Superintendent, and shall submit NATA certified test reports on the quality and grading of the combined aggregate proposed to be used. ***NATA Certification***

5. The Contractor shall submit test results to the Superintendent for each lot/stockpile of aggregate a minimum of seven days prior to incorporation in the works. ***7 Days***

C255.06 MINERAL FILLER

1. Mineral filler shall consist of hydrated lime, flyash, portland cement, or other material approved by the Superintendent. ***Type***

2. The mineral filler shall be dry, free from lumps and any deleterious material, with a minimum of 85 per cent passing a 75 μm sieve. In all other respects, the mineral filler shall comply with the requirements of AS 2357. ***Quality***

3. The quantity of filler added to the bituminous microsurfacing during placement shall not vary by more than 1 per cent of the total aggregate (by mass) from the filler content nominated in the mix design. ***Proportion***

C255.07 WATER

1. Water added to the bituminous microsurfacing shall be potable and shall be compatible with the component materials. ***Potable***

C255.08 ADDITIVES

1. Details of the type, source and nominal proportions of additives shall be submitted to the Superintendent with the mix design. ***Type and Proportion***

C255.09 SAMPLING AND TESTING OF MATERIALS

1. Sampling and testing of materials shall be arranged by the Contractor and carried out by a NATA registered laboratory for the nominated test methods. ***Contractor's Responsibility***

2. All costs associated with sampling and testing of materials shall be borne by the Contractor. ***Contractor's Costs***

MIX DESIGN

C255.10 MIX PROPERTIES

1. The nominated mix design shall satisfy the properties given in Table C255.3. ***Mix Properties***

Mix Property	Test Method	Requirement
Wear Loss	ISSA TB 100 6 day	800 g/m^2 maximum
Traffic Time	ISSA TB 139 30 minutes 60 minutes	 12 kg.cm minimum 20 kg.cm minimum
Adhesion	ISSA TB 114 or ISSA TB 144	$\geq$ 90% or 11 grade points minimum (AAA, BAA)

Table C255.3 - Mix Properties

C255.11 NOMINATED MIX

1. At least seven days before commencing bituminous microsurfacing work, the Contractor shall submit to the Superintendent for approval, details of the nominated bituminous mircrosurfacing mix design for the work including the target application rate (m^3 of mix/m^2 of road surface) and the corresponding nominal layer thickness, together with NATA certification and test results demonstrating that the nominated mix and its constituents meet the requirements of the Specification. ***Submit for Approval***

2. The details of the nominated mix design shall include the following: ***Mix Design Details***

   (a) Bitumen emulsion content of the mix, and the residual binder content of the emulsion;

   (b) Target combined aggregate/filler grading;

   (c) Proportions of constituent materials used; and

   (d) Type and sources of aggregates, filler and binder.

C255.12 APPROVED MIX

1. When a nominated mix has been approved by the Superintendent, it shall be known as the 'approved mix'. Work shall not commence until a bituminous microsurfacing mix has been approved. ***Approved Mix***

2. The combined aggregate/filler grading and the binder content of the approved mix will be termed the 'approved grading' and the 'approved binder content' respectively. ***Grading and Binder Content***

PRODUCTION AND PAVING

C255.13 REQUIREMENTS OF PRODUCTION MIX

1. Bituminous microsurfacing produced in the paving unit at the site shall be known as the 'production mix'. ***Production Mix***

2. The production mix shall comply with the requirements given in Table C255.4. ***Permitted Variation***

Production Mix Properties	Maximum Permitted Variations from Approved Mix (by mass)	
	Size 5	Size 7
Grading*		
Passing 9.50mm AS sieve and larger	Nil	Nil
Passing 6.70mm	Nil	± 7%
Passing 4.75mm	± 6%	± 6%
Passing 2.36mm and 1.18mm	± 5%	± 5%
Passing 0.600mm	± 4%	± 4%
Passing 0.300mm	± 3%	± 3%
Passing 0.150mm	± 2%	± 2%
Passing 0.075mm	± 1.5%	± 1.5%
Residual Binder Content	- 0.5% + 1.0%	- 0.5% + 1.0%
* Notwithstanding, these allowable variations shall not fall outside the limits for design of nominated mix as given in Table C255.2.		

Table C255.4 - Maximum Permitted Variations from Approved Mix

C255.14 PAVING UNIT CALIBRATION

1. The paving unit to be used shall be calibrated for the component materials of the approved mix prior to the commencement of paving. Previous calibration documentation ***Calibration***

covering the same materials and approved mix shall be acceptable provided that calibration has been carried out within the previous twelve months.

2. The documentation shall include an individual calibration for each component material at various settings which can be related to the paving unit's metering devices. ***Documentation***

3. No paving unit shall be allowed on the work until the calibration has been verified and approved by the Superintendent. ***Approval by Superintendent***

C255.15 PREPARATION OF PAVEMENT

1. The existing surface shall be clean and free from any loose stones, dirt, dust and foreign matter. The surface shall be swept beyond the edge of the area to be surfaced by at least 300mm. Any foreign matter adhering to the pavement and not swept off shall be removed by other means. Any areas significantly affected by oil contamination shall be cleaned to the satisfaction of the Superintendent. ***Clean Pavement***

2. The Contractor shall take all necessary precautions to prevent the bituminous microsurfacing or other materials used on the work from entering or adhering to kerbs, gutters, driveways, gratings, hydrants, valve boxes, access chamber covers, bridge or culvert decks or other road fixtures. After the bituminous microsurfacing has been spread the Contractor shall clean off any such material and leave such gratings, access chamber covers and other road fixtures, in a clean and satisfactory condition. ***Protection of Services***

C255.16 WEATHER LIMITATIONS

1. Bituminous microsurfacing shall not commence if either the pavement or air temperature is below 10^{o}C and falling. ***Temperature***

2. Bituminous slurry may be applied when both pavement and air temperatures are above 7^{o}C and rising, or above 10^{o}C. ***Temperature***

3. Spreading shall not proceed during rain or when rain appears imminent. ***Rain***

C255.17 SPREADING

1. The surface may be pre-dampened if necessary by fogging ahead of the spreader box. Water used for pre-wetting the surface shall be applied so that the entire surface is damp with no apparent flowing water ahead of the spreader box. The application rate of the fog spray shall be adjusted to suit temperature, surface texture, humidity and dryness of the surface being covered. ***Water Fog Spray***

2. Bituminous microsurfacing shall be mixed and applied using a purpose built paver. The mix shall be of the desired consistency when deposited in the spreader box, and nothing more shall be added other than minor amounts of water for the purpose of overcoming temporary build-up of microsurfacing in the corners of the spreader box. ***Paving Unit***

3. The mixing time shall be sufficient to produce a complete and uniform coating of the aggregate and the resulting mixture shall be conveyed into the moving spreader box at a sufficient rate to always maintain an ample supply across the full width of the strike-off. ***Mixing Time and Rate***

4. The strike-off shall be adjusted to provide an application rate which will completely fill the surface voids and provide the nominal application rate of bituminous microsurfacing as scheduled. ***Application Rate***

5. After the bituminous microsurfacing has been spread, the Contractor shall ensure that all kerbs, gutters, driveways, gratings, hydrants, valve boxes, access chamber covers, etc are uncovered and left in a clean and satisfactory condition. ***Clean Services***

6. After the emulsion has broken and the mix is sufficiently stable, rolling shall be carried out using pneumatic tyred rollers to produce a dense, even, homogeneous compacted surface where there is insufficient local traffic to achieve satisfactory compaction across the mat. ***Rolling***

7. Bituminous microsurfacing shall be capable of carrying slow moving traffic (<40km/h) within one hour of application without permanent damage occurring, such as rutting or ravelling. When the time before the microsurfacing is capable of carrying traffic exceeds one hour, work shall cease unless specifically approved by the Superintendent. ***Traffic***

C255.18 SURFACE TEXTURE

1. The resulting surface after spreading shall be uniform in appearance, and free of areas exhibiting segregation or excessive or insufficient binder. ***Uniform Texture***

2. The surface texture shall be demonstrated on a short test run for approval by the Superintendent. If the surface texture is acceptable to the Superintendent, then all subsequent work shall be finished to an equivalent surface texture. ***Test Run***

3. Where increased surface texture is required, a fabric skirt may be trailed behind the spreader box. ***Increased Texture***

C255.19 JOINTS

1. Longitudinal joints in the wearing course shall be straight and placed at either the edge or the centre of a traffic lane. If necessary, the edges and joints shall be lightly screeded with a hand squeegee to achieve a smooth uniform appearance and to remove excess build-up of material. ***Uniform Joints***

C255.20 SAMPLING AND TESTING OF PRODUCTION MIX

(a) Lot Definition

1. Compliance sampling and testing of bituminous microsurfacing shall be undertaken on a lot by lot basis. For this purpose, 50m^3 or one day's production (whichever is the lesser), or such smaller quantity which is considered as representative of consistent production of the paving unit, shall be considered as representative of consistent production of the paving unit. ***Lots***

(b) Responsibility of Sampling

1. The Contractor shall be responsible for taking samples and shall supply all facilities, equipment and labour for that purpose. ***Contractor's Responsibility***

2. The costs associated with taking samples of production mix shall be borne by the Contractor. ***Contractor's Cost***

(c) Frequency of Sampling

1. For the testing of production mix, two 1.5kg representative samples of bituminous microsurfacing shall be taken from each lot at random intervals. The samples shall be taken from the discharge of the paving unit and the sample containers immediately sealed. ***Mix Samples***

2. For the testing of the binder, two 2L samples of bitumen emulsion shall be taken from each bulk delivery in accordance with AS 1160. ***Bitumen Emulsion***

(d) Testing

1. The samples of bituminous microsurfacing shall be treated and tested at a NATA registered laboratory to confirm compliance with Table C255.4. Prior to testing for Residual Binder Content and Aggregate Gradation, as determined by AS 2891.3.1, the samples shall be dried to constant weight in an oven at 60°C for a minimum of 15 hours. ***Mix Tests***

2. Each delivery of emulsion shall be tested for residual binder content in accordance with AS 1160 Appendix D and accompanied by a certification of specification compliance traceable to the relevant batch at the suppliers storage tank. ***Emulsion Tests***

C255.21 SHAPE AND LEVELS

1. Where a correction and wearing course have been placed, the finished surface level shall not vary from the design level at any point by more than ±10mm. Additionally immediately adjacent to any kerb and/or channel the finished surface level shall not be below nor more than 10mm above the level of the lip of the adjacent channel. ***Level Tolerances***

2. Notwithstanding the above, the deviation from a 3m long straight edge placed anywhere on the top of the finished surface shall not exceed 10mm when assessed within 24 hours of work completion. ***3m Straight Edge***

C255.22 NONCONFORMANCE OF MATERIALS AND FINISHED SURFACING

1. If any materials supplied fail to conform to the requirements in this Specification or if any section of bituminous microsurfacing fails to conform to the requirements of this Specification - whether failure of the work is due to bad workmanship, defective materials supplied by the Contractor or materials made defective by the method of operation adopted - then such failure or failures shall constitute a 'Nonconformance' under the Contract. Such nonconforming sections of bituminous microsurfacing work shall be either replaced or corrected. ***Non-conformance Conditions***

2. The cost of rectifying nonconformances, including any restoration work to any underlying or adjacent surface or structure, which becomes necessary as a result of such replacement or correction, shall be borne by the Contractor. Materials removed from the site by the Contractor shall be replaced with materials which conform to this Specification. ***Contractor's Cost***

LIMITS AND TOLERANCES

C255.23 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C255.5 below.

Item	Activity	Limits/Tolerances	Spec Clause
1.	Mineral Aggregate	As per Table C255.1	C255.05
2.	Combined Aggregate/filler	As per Table C255.2	C255.05
3.	Mineral Filler	> 85% passing a 75μm Sieve	C255.06
4.	Mix Properties		
	a) Design properties	As per Table C255.3	C255.10
	b) Permitted variations	As per Table C255.4	C255.13
5.	Surface Preparation	Sweeping shall extend at least 300mm beyond edge of area to be surfaced	C255.15
6.	Weather Limitations	Microsurfacing shall not commence if either air or pavement temperature is below 10°C and falling, and shall only commence if both air and surface temperature is above 7°C and rising or above 10°C	C255.16
7.	Shape and Levels		
	a) Finished Levels	Shall not vary at any point by more than ± 10mm from design levels. Immediately adjacent to kerb and/or gutters, levels shall not be below nor more than 10mm above design level	C255.21
	b) Finished Shape	Deviation from the bottom of a 3m straight edge shall not vary by more than 10mm	C255.21

Table C255.5 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

C255.24 CONTROL OF TRAFFIC

1. The Contractor shall provide for traffic in accordance with the requirements of the Specification for CONTROL OF TRAFFIC while undertaking the work and shall take all necessary precautions to protect the work from damage until such time as the new work has developed sufficient strength to carry normal traffic without damage.

2. The Contractor shall take all necessary steps to avoid or minimise delays and inconvenience to road users during the course of the work. Where adequate detours or side tracks are included in the Contract or are otherwise available, traffic shall be temporarily diverted while the work is in progress.

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CITY OF GREATER DANDENONG

SPECIFICATION

C256

SMALL SCALE ASPHALT WORK

SPECIFICATION 256: SMALL SCALE ASPHALT WORK

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SPECIFICATION 256 : SMALL SCALE ASPHALT WORK

GENERAL

256.01 SCOPE

1. The specification includes requirements for site preparation, placing and compacting of granular base, priming, tack coating and the spreading and compaction of asphalt.

256.02 DESCRIPTION OF WORKS

1. The works shall include any or all of the following items as specified in Schedule A:

Site clearing including excavation and removal of vegetation and topsoil.

Excavation of soil or rock to a depth consistent with the specified pavement thickness and finished pavement surface levels.

Excavation and removal from site or stockpiling on site of existing granular material.

Preparation of subgrade including the sterilisation for weed growth

Installation of sub-surface drains and connection to existing stormwater pit(s) or drains.

Installation of kerb and channel.

Installation of masonry or timber edging strips.

Installation of grated surface drains.

Supply, spread and compact of granular material.

Supply, place and compact asphalt base.

Supply, place and compact asphalt surfacing.

2. The Works shall be constructed in accordance with this specification and any plans and/or written instructions provided by the Service Management Team to the Contractor prior to the commencement of the Works.

256.03 EQUIPMENT AND LABOUR

1. The Contractor shall provide all equipment and labour to complete the work in accordance with this specification and any plans and written instructions provided by the Service Management Team.

256.04 MATERIALS

1. (a) Bitumen shall conform to the requirements of Australian Standard AS2008 "Residual Bitumen for Pavements".

(b) Cutback Bitumen Cutback bitumen shall conform to the requirements of AS2157.

(c) Bitumen Emulsion Bitumen emulsions shall conform to the requirements of AS 1160.

(d) Granular Material Granular material shall conform to the requirements of the Local Government or State VicRoads specification for 20 mm nominal maximum size base or sub-base.

(e) Asphalt Asphalt shall conform to the requirements of Australian Standard AS2150 "Asphalt (hot-mixed)".

256.05 SITE CLEARING

1. The area to be paved shall be cleared of all vegetation and topsoil to the limits shown on the drawings.

2. Any existing trees, shrubs or bushes outside the area to be cleared that are to be protected shall be identified by the Consulting Engineer and notified to the Contractor prior to the commencement of the Works. The Contractor shall put in place appropriate measures to safeguard such vegetation from damage for the duration of the Works.

3. Vegetation and soil contaminated with weeds shall be removed from the site and disposed of at a location and in a manner conforming with State Regulations and Local By-laws. Clean topsoil shall be stockpiled on site.

256.06 SUBGRADE PREPARATION

New Pavements

1. For new pavements, the Contractor shall excavate and remove so much of the underlying soil and/or rock as is necessary to achieve subgrade levels consistent with the specified pavement thickness and finished surface levels. All excavated material shall be removed from the site.

2. Any areas, which are excessively wet and/or soft shall be excavated to a firm base and infilled with suitable material to the level of the surrounding subgrade. Suitable fill material, other than topsoil, may be obtained from agreed excavations on site or may be imported. The Contractor shall not proceed with the removal and replacement of soft subgrade without the express consent of the Service Management Team/Client.

3. Following the removal and replacement of any soft material, the subgrade shall be compacted to 95% of the Maximum Dry Density as determined in accordance with Australian Standard AS 1289.6.1 and graded to provide a smooth, free draining surface.

Existing Unsealed Pavements

4. For existing unsealed pavements, where it is necessary to remove the existing granular material due to either its unsuitability or a requirement to further excavate the subgrade in order to meet pavement thickness and finished surface level requirements, the subgrade shall be prepared and compacted as for a new pavement.

5. Granular material deemed unsuitable for reuse in the pavement shall be removed from the site. Granular materia, which conforms to the requirements of this specification, shall be stockpiled on site in a location and in a manner which avoids contamination.

Sterilisation

6. For new pavements and for existing unsealed pavements, where the existing granular material has been removed the subgrade shall be treated with an appropriate herbicide to prevent weed growth. The herbicide shall be applied strictly in accordance with the manufacturer's instructions in a manner which ensures a total and uniform coverage of the area to be paved.

7. The Contractor shall take appropriate measures to ensure that the manner of application does not result in damage to vegetation beyond the area to be paved or in the herbicide entering any stormwater drainage system.

Subsurface Drainage

8. Where required, subsurface drains shall be installed at a minimum depth of 300 mm below the subgrade or to such other depth as specified on the drawings and shall be provided with a free outlet to a stormwater collection pit, drain or channel.

9. The drains shall be 100 mm slotted PVC pipe or slotted flexible polyethylene pipe and shall be laid in trenches of a minimum width of 200 mm, which shall be backfilled to the level of the subgrade using 7 mm nominal size screenings.

256.07 EDGE RESTRAINT

1. If there is no other edge constraint, such as a kerb or kerb and channel, the perimeter of the area to be paved shall be provided with an edge restraint such as timber or masonry edging as specified in the drawings.

2. Timber edging shall comprise red gum or treated pine slabs having a minimum thickness of 50 mm and a minimum width equal to the minimum compacted thickness of granular material and/or asphalt. The edging shall be fixed securely to the subgrade so that it will not move laterally or rotate under the action of rollers during the construction of the pavement.

3. Masonry edging shall be laid in a mortar bed placed on the compacted granular base material and constructed in accordance with good practice for masonry construction.

256.08 GRANULAR BASE

New Pavements

1. Where required, the base material shall be supplied, spread to the required thickness as specified in the drawings, graded to level and compacted. The minimum compacted density of the material shall be 95% of the Maximum Dry Density as determined in accordance with Australian Standard AS1289.6.2.

2. The finished surface of the base at any point shall not be above nor more than 10 mm below the level required to meet both the minimum thickness of asphalt surfacing and the finished pavement level at that point.

Existing Pavements

3. For existing unsealed pavements, where the existing granular material is of adequate quality and thickness, the surface shall be graded to level and compacted in accordance with the requirements for new pavements. Where the existing granular material comprises a limestone aggregate or other material with natural cementing properties, the layer shall be tyned prior to regrading and re-compaction to break the cementitious bonds and allow a better bond with the overlying asphalt.

4. Where the existing granular material is of adequate quality but inadequate thickness and finished pavement levels allow the placement of an additional layer of granular material, the Contractor shall tyne the existing pavement prior to placing additional material to promote bonding of the two materials. The new granular material and the existing material shall then be compacted as a single layer in accordance with the requirements for new pavements.

256.09 PRIME

1. Where specified, the Contractor shall prime the finished surface of the base prior to placing asphalt. The prime shall be a cutback bitumen sprayed at a rate of 1 l/m^2 unless otherwise specified in Schedule A or determined by the Contractor on site at the time or priming.

2. An emulsion tack coat may be used in place of a cutback prime on pavements subject to limited vehicular traffic, such as driveways, or to pedestrian traffic only.

256.10 TACK COAT

1. Tack coat shall only be applied to the existing asphalt surfaces, which have been thoroughly cleaned of all soil, weed growth and other contamination. Tack shall consist

of a 60/40 CRS emulsion and shall be applied at a rate of 0.21 l/m^2 to 0.31 l/m^2 of residual bitumen.

256.11 ASPHALT

General

1. Asphalt shall be supplied, placed and compacted to the minimum thicknesses specified in the drawings in accordance with the Australian Standard AS2734 except as noted herein.

2. Where the asphalt is to be machine laid, it shall be discharged from the delivery vehicle into the hopper of the paver and spread and compacted in a continuous operation.

Hand Spreading

3. Where the asphalt is to be hand spread, it shall be stockpiled on the pavement at a rate consistent with the rate at which it is being spread and compacted. Individual stockpiles should contain no more material than is required to cover an area of 15 m^2 to the minimum thickness specified in the Schedule. Asphalt stockpiles shall be spread using wooden lutes or the backs of rakes to avoid segregation of the mix and at such a rate that ensures that the asphalt temperature after spreading is adequate to achieve the specified level of compaction. Any segregated or cold mix shall be removed from site and not reincorporated in the asphalt. Asphalt shall not be thrown or scattered over the finished surface prior to compaction.

Base

4. Where specified, asphalt base shall comprise a dense graded asphalt of the nominal size specified in the drawings. The asphalt shall contain Class 320 bitumen and shall meet the requirements specified for a 50-blow Marshall design or 80-cycle gyratory design.

5. The asphalt shall be compacted using a vibrating steel-wheeled roller to a mean density of 94% of the laboratory compacted density.

Surfacing

6. The asphalt surfacing shall comprise a fine gap graded or dense grade asphalt of the maximum nominal size shown in the drawings. The mix may contain either a Class 320 or a Class 170 bitumen and shall meet the requirements specified for a 35-blow or 50-blow Marshall design or 50-cycle or 80-cycle gyratory design.

7. The asphalt shall be compacted using a vibrating steel-wheeled roller to achieve a mean density of 96% of the laboratory compacted density.

Finished Surface

8. The finished surface shall conform to the required levels within +/-5 mm and shall not deviate from a 3 m straightedge placed on the surface by more than 7 mm for machine-laid work and more than 10 mm for manually placed work.

256.12 TESTING AND QUALITY CONTROL

1. The Contractor shall undertake or arrange to be undertaken all testing as specified herein. The testing shall be undertaken by a laboratory certified by NATA for the specified test or tests. The type and frequency of testing shall be as specified in the Quality Control Requirements and results shall be provided to the Service Management Team within 7 days of the test being completed.

VICTORIA

SPECIFICATION

C257

SUPPLY OF RECYCLED MATERIAL FOR ROADWORKS

(Specification based on Resource NSW Publication, the Institute of Public Works Engineering Australia and Waste Management Association of Australia)

SPECIFICATION 257: SUPPLY OF RECYCLED MATERIAL FOR ROADWORKS

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SPECIFICATION FOR SUPPLY OF RECYCLED MATERIAL FOR ROADWORKS

257.01 Scope

This Specification covers the supply of recycled materials predominantly comprising crushed concrete, brick and reclaimed asphalt blends for use in pavements and related engineering construction. The requirements of this Specification are appropriate for most engineering projects for local government works.

There are numerous potential uses for recycled materials in engineering construction. The uses outlined beloware not intended to limit the utilisation of recycled materials. Instead, they indicate areas where high potential exists to use recycled materials and avoid the landfilling of valuable resources.

Pavement materials used in motorways, major highways, urban arterial roads or collector roads are covered inspecifications produced by State road authorities.

This Specification is limited to recycled materials without any additional strength enhancing agents. In pavement construction, there may be opportunities to utilise recycled material with additives such as slag, cement, lime, flyash etc., or blends of some or all of these materials to form lightly bound or heavily bound layers. In such circumstances, the designer/specifier should consider the fatigue characteristics of stabilised recycled materials to determine whether shrinkage or block cracking may present problems with the life of thepavement. Similarly, some additives can be used to alter the plasticity characteristics of a 'run of crusher' product to make it more suitable for use. Nothing in this Specification limits the scope for adopting innovative strategies for blending materials to achieve the required outcome.

Material Types

1. RECYCLED CONCRETE MATERIALS - Where it is proposed to make use of recycled materials in flexible pavements, the requirements of Vicroads Standard Section 820 shall be met for the manufacture of recycled concrete and plant mixed wet mix crushed concrete products. Where it is proposed to incorporate a cement treated bound layer in a pavement subbase using nominal 20mm sized recycled concrete material, the product shall conform to the requirements of Vicroads standard section 821.

2. RECLAIMED ASPHALT PAVEMENT (RAP)
Reclaimed, comingled asphalt and pavement material may be permitted to be used in new asphalt production provided it has been crushed and screened and is free of contaminants. Vicroads standard specification 407 must be complied with and the maximum allowable amount of RAP to be included will be determined by the mix design which is required to meet loading and service conditions of the pavement. Accredited comparative performance test results may submitted to justify the use of a higher percentage of RAP, where these tests show that the higher percentage of RAP provides better performance outcomes than the corresponding mix using virgin components.

3. CRUSHED GLASS FINE

Glass fines manufactured from container glass cullet, free from contamination and graded to a 5mm product may be used in non-wearing course asphalt layers as detailed in the product mix design where these meet the requirements of Vicroads standard section 702.

4. REGISTRATION OF MIX
Crushed granular mixes incorporating recycled materials must comply with Vicroads Code of Practice RC 500 series relevant to the proposed application. These materials may be classified as general or conditional according to their level of compliance with the code of practice.

5. MIX GUIDANCE MATRIX
Vicroads Technical Note 107 (September 2011) provides comprehensive advice on how materials are to be used as alternatives to conventional products.

257.02 Material Classes

The terminology and designated material classes used in this Specification are as follows:

Terminology

Road base – A generic term for road making materials which covers both basecourse and subbase. In this Specification, materials are not distinguished by their position in a pavement

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DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C261

PAVEMENT MARKINGS

SPECIFICATION C261 - PAVEMENT MARKINGS

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SPECIFICATION C261 : PAVEMENT MARKINGS

GENERAL

C261.01 SCOPE

1. 1. Paint shall comply with the requirements of AS 4049.3 or AS 4049.4 as directed by the Superintendent. In this Specification, the term 'paint' shall mean 'pavement marking paint'

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C261.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C201 - Control of Traffic

(b) Australian Standards

AS 1580.107.3	-	Determination of wet film thickness by gauge.
AS 1742.2	-	Traffic control devices for general use.
AS 1906.3	-	Raised pavement markers (retroreflective and non-retroreflective).
AS 2009	-	Glass beads for road-marking materials.
AS 4049.1	-	Solvent-borne paint - For use with drop-on beads.
AS 4049.2	-	Thermoplastic road marking materials.
AS 4049.3	-	Waterborne paint - For use with drop-on beads.

C261.03 TYPE OF MARKINGS

1. Details of the various types of pavement markings and devices are generally in accordance with the requirements of AS 1742.2. ***Standard***

C261.04 TYPES OF MATERIALS TO BE APPLIED

1. The materials shall be applied as follows: ***Locations for Use***

(a) Pavement Marking Paint

Permanent markings on all wearing surfaces. Temporary markings, other than on the final wearing surfaces. Traffic islands and kerbs where specified.

(b) Thermoplastic Pavement Marking Material

Permanent markings where explicitly indicated on the Drawings.

(c) Pavement Marking Tape

Temporary markings on final wearing surfaces.

(d) Reflective Glass Beads

To be applied to all painted and thermoplastic markings.

(e) Raised Pavement Markers

To be installed as permanent and temporary markings as shown on the Drawings.

C261.05 MATERIAL QUALITY

1. The Contractor shall submit to the Superintendent NATA Registered Laboratory Test Reports, at least seven days before work is scheduled to commence, on the quality of the materials, including paint, glass beads, raised pavement markers and thermoplastic material proposed for use. ***Contractor's Responsibility***

2. Only materials conforming to the requirements of the referenced Specifications/Standards shall be used. ***Quality Requirements***

C261.06 SETTING OUT

1. The Contractor shall set out the work to ensure that all markings are placed in accordance with the Drawings. ***Contractor's Responsibility***

2. The locations of pavement markings shall not vary by more than 20mm from the locations shown on the Drawings. ***Tolerance***

C261.07 SURFACE PREPARATION

1. Pavement markings shall only be applied to clean dry surfaces. The Contractor shall clean the surface to ensure a satisfactory bond between the markings and wearing surface of the pavement. ***Clean Dry Surface***

2. Pavement marking shall not be carried out during wet weather or, if in the opinion of the Superintendent, rain is likely to fall during the process. ***Wet Weather***

3. Where raised pavement markers are specified for pavements having a concrete wearing surface, the full area under each raised pavement marker shall be lightly scabbled to remove fine mortar material (laitance). ***Scabbling***

C261.08 PROVISION FOR TRAFFIC AND PROTECTION OF WORK

1. The Contractor shall provide for traffic, in accordance with the Specification for CONTROL OF TRAFFIC, while undertaking the work and shall protect the pavement markings until the material has hardened sufficiently so that traffic will not cause damage. ***Contractor's Responsibility***

C261.09 MAINTENANCE OF PAVEMENT MARKINGS

1. The Contractor shall be responsible for the maintenance, and replacement if necessary, of raised pavement markers and all pavement marking during the contract period and the contract defects liability period. ***Responsibility in Contract Period***

PAVEMENT MARKING PAINT

C261.10 MATERIALS

1. Paint shall comply with the requirements of AS 4049.1 or AS 4049.3 as directed by the Superintendent. In this Specification, the term 'paint' shall mean 'pavement marking paint'. ***Paint Quality***

2. Glass beads shall comply with the requirements of AS 2009 for drop-on beads. ***Glass Beads Quality`***

C261.11 MIXING OF PAINT

1. All paint shall be thoroughly mixed in its original container before use to produce a smooth uniform product consistent with the freshly manufactured product. ***Uniform Product***

C261.12 APPLICATION OF PAINT AND BEADS

1. All longitudinal lines shall be sprayed by an approved self propelled machine. The two sets of lines forming a one-way or two-way barrier line pattern shall be sprayed concurrently. ***Longitudinal Lines***

2. Hand spraying with the use of templates to control the pattern and shape shall be permitted for transverse lines, symbols, legends, arrows and chevrons. ***Hand Spraying***

3. The paint shall be applied uniformly and the wet film thickness shall be neither less than 0.35mm nor more than 0.40mm. ***Paint Thickness***

4. Glass beads shall be used on the markings and shall conform with the requirements for drop-on beads as described in AS 2009, except that E20 beads shall be adopted for use with 0.3 mm minimum dry film thickness linemarking applications of water-borne paint. Glass beads shall comply with size distribution requirements of table below. ***Glass Beads***

Sieve Size μm	% Passing			% Retained
	Drop-On Glass Beads	E20 Glass Beads	Type 3 Glass Beads	Intermix Glass Beads
2.36				
2.0				
1.7			100	
1.4		100	95 – 100	
1.18		95 – 100	80 – 95	0 – 3
1.0		80 – 95	10 – 40	
0.85	100	10 – 40	0 – 5	5 – 20
0.71		0 – 5	0 – 2	
0.60	90 – 100	0 – 2		
0.42	35 – 75			65 – 95
0.30	15 – 45			
0.15	0 – 5			
0.75	0 – 1			
Pan				0 - 10

5. Pavement markings shall be straight or with smooth, even curves where intended. All edges shall have a clean, sharp cut off. Any marking material applied beyond the defined edge of the marking shall be removed leaving a neat and smooth marking on the wearing surface of the pavement. ***Pavement Marking Finish***

6. The lengths of longitudinal lines shall not vary by more than 20mm from the lengths shown in AS 1742.2. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in AS 1742.2. ***Longitudinal Line Tolerances***

7. The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in AS 1742.2. ***Transverse Line Tolerance***

8. The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall not vary by more than 50mm from the dimensions shown on the Drawings or in AS 1742.2 as appropriate. Arrows and speed markings shall be placed square with the centreline of the traffic lane. ***Arrows, Chevrons Tolerance***

C261.13 FIELD TESTING

1. The thickness of the wet film applied to the road pavement shall be checked by the method described in AS 1580.107.3 Method B, comb gauge. ***Paint Application***

2. The application rate of glass beads applied to the surface of the markings shall be checked by the method described in Annexure C261A. ***Beads Application***

Road Speed km/h	Line Widths			
	75mm	100mm	125mm	150mm
8	371	495	619	742
13	603	804	1006	1207
16	742	990	1238	1484

1. Tolerance of +10% shall be permissible when measuring the above volume.

2. When two or more glass bead dispensers are to be used, each dispenser shall be checked separately to make up the totals shown.

3. Glass beads weigh approximately 1.53 grams per millilitre.

Table C261.1
Volume of glass beads (ml) required in 10 seconds of operation.

THERMOPLASTIC PAVEMENT MARKING MATERIAL

C261.14 MATERIALS

1. Thermoplastic pavement marking material shall comply with the requirements of AS 4049.2. ***Thermoplastic Quality***

2. In this Specification, the term 'thermoplastic material' shall mean 'thermoplastic pavement marking material'. ***Definition***

3. Glass beads shall be incorporated in thermoplastic material, in the proportion of 10 per cent of the total mass, as part of the aggregate constituent and shall comply with the requirements of AS 2009, Intermix type. ***Glass Bead Proportion***

4. Glass beads for surface application shall comply with the requirements of AS 2009, Drop-on beads.. ***Glass Bead Quality***

5. Tack coat material shall be to the manufacturer's specification as approved by the Superintendent. ***Tack Coat***

C261.15 PREPARATION OF THERMOPLASTIC MATERIAL ON SITE

1. Immediately before application, the thermoplastic material shall be uniformly heated in a suitable oil bath kettle to the temperature recommended by the manufacturer. The thermoplastic material shall not be heated above the temperature recommended by the manufacturer. The thermoplastic material shall not remain molten for more than six hours for hydrocarbon resins and four hours for wood and gum resins. Should over-heating occur and/or the time expire for molten materials, then the thermoplastic material shall be discarded. ***Heating***

C261.16 APPLICATION OF THERMOPLASTIC MATERIAL AND BEADS

1. Where the wearing surface of the pavement is smooth or polished, a tack coat of material may be required by the Superintendent and shall be applied in accordance with the recommendations of the thermoplastic manufacturer. The tack coat shall be applied immediately before the application of the thermoplastic material in accordance with the directions of the manufacturer of the thermoplastic material and the manufacturer of the tack coat material. ***Tack Coat Requirement***

2. All longitudinal lines shall be sprayed by a self propelled machine approved by the Superintendent. The two sets of lines forming a one-way or two-way barrier line shall be sprayed concurrently. The thermoplastic material shall be applied uniformly and the cold film thickness shall be 2.0mm with a tolerance of plus or minus 0.5mm. ***Longitudinal Lines***

3. Glass beads shall be applied by air propulsion to the surface of all longitudinal lines at a net application rate of 0.30 kilograms per square metre immediately after application of the thermoplastic material. The actual application rate shall be set to overcome any loss of beads between the bead dispenser and the sprayed line. ***Beads for Longitudinal Lines***

4. All transverse lines, symbols, legends and arrows shall be screeded. The screeded thermoplastic material shall be applied using a mobile applicator, approved by the Superintendent, and templates to control the pattern. ***Screed***

5. The thermoplastic material for transverse lines, symbols, legends and arrows shall be applied uniformly and the cold film thickness shall be 3.5mm with a tolerance of plus or minus 1.5mm. The surface finish shall be smooth. ***Tolerance***

6. Glass beads for other than longitudinal lines shall be uniformly applied to screeded markings at a net application rate of 0.30 kilograms per square metre immediately after application of the thermoplastic material by a method approved by the Superintendent. ***Beads for Other Markings***

7. Pavement marking shall be straight or with smooth, even curves where intended. All edges shall have a clean, sharp cut off. Any marking material applied beyond the defined edge of the marking shall be removed leaving a neat and smooth marking on the wearing surface of the pavement. ***Pavement Marking Finish***

8. The lengths of longitudinal lines shall not vary by more than 20mm from the lengths shown in AS 1742.2. The widths of longitudinal lines shall not vary by more than 10mm from the widths shown in AS 1742.2. ***Longitudinal Line Tolerances***

9. The lengths and widths of transverse lines shall not vary by more than 10mm from the lengths and widths shown in AS 1742.2. ***Transverse Line Tolerances***

10. The dimensions of arrows, chevrons, painted medians, painted left turn islands and speed markings shall not vary by more than 50mm from the dimensions shown on the Drawings or in AS 1742.2 as appropriate. Arrows and speed markings shall be placed square with the centreline of the traffic lane. ***Arrows, Chevrons, Tolerance***

C261.17 FIELD TESTING

1. The thickness of the cold film of thermoplastic material applied to the road pavement shall be checked by measurement, using a micrometer, of the thickness of thermoplastic material applied to a metal test plate. ***Thickness of Thermoplastic Material***

2. The application rate of glass beads applied to the surface of the markings shall be checked by the method described in Annexure C261A. ***Glass Beads Application Rate***

PAVEMENT MARKING TAPE

C261.18 MATERIALS

1. Pavement marking tape shall be a strippable type of tape, such as 'Staymark - Detour Grade', or equivalent tape approved by the Superintendent. ***Brands***

C261.19 APPLICATION OF PAVEMENT MARKING TAPE

1. The method of application of pavement marking tape, including surface preparation, shall be in accordance with the manufacturer's recommendations. ***Manufacturer's Recommen-dation***

C261.20 REMOVAL OF PAVEMENT MARKING TAPE

1. When directed by the Superintendent, the Contractor shall remove pavement marking tape in accordance with the manufacturer's recommendations. ***Manufacturer's Recommendation***

RAISED PAVEMENT MARKERS

C261.21 MATERIALS

1. Raised pavement markers, both reflective and non-reflective, shall comply with AS 1906.3 and shall have the dimensions shown on the Drawings. ***Standard***

2. The adhesive used for attaching the raised pavement markers to the wearing surface of the pavement shall be a hot melt bitumen adhesive or an equivalent product approved by the Superintendent. ***Bitumen Adhesive***

C261.22 INSTALLATION OF RAISED PAVEMENT MARKERS

1. Raised pavement markers shall be fixed to the wearing surface of the pavement using a hot melt bitumen adhesive or an equivalent product. The adhesive shall be freshly heated to the Manufacturer’s instructions and thoroughly mixed. The adhesive shall not be allowed to cool and be reheated prior to use. ***Adhesive Quality***

2. The adhesive shall be spread uniformly over the underside of the raised pavement marker to a depth of approximately 10mm. The raised pavement marker shall be pressed down onto the pavement surface in its correct position and shall be rotated slightly until the adhesive is squeezed out around all edges of the marker. The raised pavement marker shall not be disturbed until the adhesive has set. ***Method***

3. On rough surfaces, such as newly laid coarse sprayed bituminous seals, and where directed by the Superintendent, an initial pad of adhesive of diameter 20mm larger than the diameter of the base of the raised pavement marker, shall be provided. The adhesive shall be applied to fill the irregularities in the pavement surface to produce a flat, smooth surface flush with the upper stone level. The adhesive pad shall be allowed to set. Additional adhesive shall be applied to the pavement, as described above, and then the raised pavement marker shall be pressed down onto the adhesive pad on the pavement surface to ensure good adhesion.

Rough Surfaces

REMOVAL OF PAVEMENT MARKINGS

C261.23 GENERAL

1. The Contractor shall remove pavement markings, no longer required, from the wearing surface of pavements without significant damage to the surface.

Undamaged Pavement

2. The method of removal shall be approved by the Superintendent before commencement of the work.

Removal Method

LIMITS AND TOLERANCES

C261.24 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses of this Specification are summarised in Table C261.2 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Location of Markings**	± 20mm from specified location	C261.06
2.	**Longitudinal Lines**		C261.12
	(a) Length	± 20mm from lengths shown in AS 1742.2	C261.16
	(b) Width	± 10mm from widths shown in AS 1742.2	C261.12 C261.16
3.	**Transverse Lines**		
	(a) Length) (b) Width)	± 10mm from lengths and widths shown in AS 1742.2	C261.12 C261.16
4.	**Arrows, Chevrons, Painted Medians, Speed Markings etc.**	± 50mm from the dimensions shown in AS 1742.2	C261.12 C261.16
5.	**Application of Paint**		
	(a) Film Thickness	>0.35mm <0.40mm	C261.12
6.	**Application of Thermoplastic**		
	(a) Longitudinal Lines - Cold Film Thickness	2.0mm ± 0.5mm	C261.16
	(b) Transverse Lines, Symbols, Arrows etc. Cold Film Thickness	3.5mm ± 1.5mm	C261.16
7.	**Glass Beads**		
	(a) Volume used in operation	0.30 kg/sq m + 10%	C261.12 C261.16

Table C261.2 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

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CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C262

SIGNPOSTING

SPECIFICATION C262 – SIGNPOSTING

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SPECIFICATION C262 : SIGNPOSTING

GENERAL

C262.01 SCOPE

1. The work to be executed under this Specification consists of:

   (a) the supply and erection of the Regulatory, Warning, Guide, Information and Direction signs as described in AS 1742, AS 1743 and AS 1744.

   (b) the supply and erection of sign support structures to support the signs, and

   (c) the adjustment of existing signs and sign support structures.

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C262.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C201	-	Control of Traffic
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1163	-	Structural steel hollow sections
AS 1214	-	Hot-dip galvanised coatings on threaded fasteners
AS 1250	-	The use of steel in structures (SAA Steel Structures Code)
AS 1379	-	The specification and manufacture of concrete
AS/NZS 1554.1		Welding of steel structures
AS/NZS 1580.602.2		Measurement of specular gloss of non-metallic paint films at 20º, 60º and 85º
AS 1580.108.2	-	Dry film thickness - Paint inspection gauge
AS 1734	-	Aluminium and aluminium alloys - flat sheet, coiled sheet and plate
AS 1742	-	Manual of uniform traffic control devices
AS 1743	-	Road Signs - Specifications
AS 1744	-	Forms of letters and numerals for road signs
AS 1866	-	Aluminium and aluminium alloys - extruded rod, bar, solid and hollow shapes
AS 2700	-	Colour standards for general purposes
AS 3678	-	Structural steel - hot-rolled plates, floorplates and slabs
AS 3679.1	-	Structural steel - hot-rolled bars and sections
AS/NZS 4680	-	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles.

C262.03 PROVISION FOR TRAFFIC

1. The Contractor shall provide for traffic in accordance with the requirements of the Specification for CONTROL OF TRAFFIC while undertaking the work and shall organise the work to avoid or minimise delays and inconvenience to traffic. ***Minimise Inconvenience***

2. Where a sign is erected before its intended use by traffic and is visible to traffic, the face of the sign shall be completely and securely wrapped in porous cloth sheeting or other opaque covering material approved by the superintendent, until the Superintendent directs that the sign shall be uncovered. ***Premature Sign Exposure***

MATERIALS

C262.04 GENERAL

1. The Contractor shall advise the names of the proposed suppliers of signs and sign support structures for the Superintendent's concurrence. Only suppliers who have previously established or can now establish their competence to carry out the work in accordance with this Specification shall be used. ***Approved Supplier***

2. The Contractor shall supply documentary evidence, satisfactory to the Superintendent, that all materials and parts proposed for use comply with the requirements of the appropriate Australian Standard(s). ***Proof of Quality***

3. Details of the signs and sign support structures to be provided under the Contract shall be as shown on the Drawings. ***Details***

4. The dimensions, legend and background for each sign shall be in accordance with this Specification and the Drawings. ***Dimensions Legend and Background***

C262.05 SIGN BLANKS

1. Sign blanks shall be 1.6mm thick aluminium sheet alloy. The aluminium alloy shall be Type 5251 or Type 5052 and Temper H38 or Temper H36 in accordance with AS 1734. ***Aluminium Quality***

2. Sign blanks shall be free of cracks, tears and other surface blemishes and the edges shall be true and smooth. The dimensions of the sign blank shall be within plus or minus 1.5mm of the dimensions specified and the finished sign shall be flat within a maximum allowable bow of 0.5 per cent of the maximum dimension of the sign blank in any direction. ***Dimension Tolerances***

3. Sign blanks shall be one piece except where the sign is of such a size as to require more than one full sheet of aluminium in which case a multipiece sign shall be allowed. ***One Piece***

4. A multipiece sign shall be made up of the minimum number of pieces practical and sheets of the multipiece sign shall be butted together with a maximum gap of 1mm at any point along the joint. ***Multipiece Sign***

5. All joints shall be covered by a backing strip. The backing strip shall be riveted to each sheet with rivets, coloured to match the background material on the face of the sign, at a spacing not exceeding 200mm. Backing strips shall be of the same material and colour as used for the sign blank and shall have a minimum width of 50mm over the full length of the joint. ***Joint Backing Strips***

6. The aluminium extrusion used for mounting may be used as the backing strip for horizontal joints where it complies with the spacing requirements. ***Aluminium Extrusion as Backing Strip***

7. The face of each sign blank shall be chemically cleaned and etched or mechanically abraded. Where the sign blank is to receive a paint background, the face shall be spray painted with a compatible etch primer. ***Face Treatment***

8. The back of each sign blank shall be uncoated and the surface finish shall be rendered dull and non-reflective either by mechanical or chemical means and shall be free of scratches and blemishes. ***Back Treatment***

9. Signs shall be supplied with square holes or aluminium extrusion backing for mounting purposes, at the centre spacings as shown on the Drawings. ***Mounting***

C262.06 ALUMINIUM EXTRUSION BACKING

1. The signs shall include special aluminium extruded sections for mounting purposes. The aluminium shall be Type 6063-T5 in accordance with AS 1866. ***Design Section***

2. The aluminium extrusion shall be fixed at the centre spacings as shown on the Drawings and shall be riveted to the sign blank with correctly coloured rivets at a spacing not exceeding 200mm. ***Fixing***

C262.07 RETRO-REFLECTIVE MATERIAL FOR BACKGROUND AND LEGEND

1. The retro-reflective material shall be approved by the Council. The background and legend material shall be compatible both in application and durability. ***Approval***

2. Retro-reflective material shall conform in colour and class to the requirements of AS 1743 for Class 1, Class 2 and Class 2A materials. Unless shown otherwise on the Drawings, the material shall be Class 2. ***Standard***

C262.08 NON-REFLECTIVE BACKGROUND MATERIAL

(a) Background Paint ***Quality***

1. Background paint shall be an approved long life industrial quality, two compound polyurethane paint. The paint shall exhibit high standards of adhesion, abrasion resistance, resistance to weathering and colour fastness under widely varying conditions of exposure. The paint shall be compatible with the etch primer used on the sign blank.

2. The paint shall be applied using conventional air spray application to give a uniform cover free of blemishes. A minimum dry film thickness of 38 microns is required when tested in accordance with AS 1580.108.2. ***Application***

3. Background paint shall be as specified from one of the following colours: ***Colours***

(i) White - Gloss

(ii) 'Dark' Green - Matt Colour No G61 as specified in AS 2700.

(iii) 'Tourist' Brown - Matt Colour No X65, Dark Brown, as specified in AS 2700.

(iv) 'Dark Grey' - Matt Colour No N64, Dark Grey as specified in AS2700.

4. Exact colorimetric values are set out in AS 2700. ***Gloss Levels***

(i) For matt coatings, the gloss level, determined by AS/NZS 1580.602.2, using an 85° head, shall be neither less than 12 per cent of gloss nor more than 15 per cent of gloss.

(ii) For gloss coatings, the gloss level, determined by AS/NZS 1580.602.2 using a 20° head shall be neither less than 85 per cent of gloss nor more than 95 per cent of gloss.

(b) Background Sheet Material ***Quality***

1. Adhesive cast vinyl sheet material or other equivalent material approved by the Superintendent may be used in place of background paint. The material shall be of uniform density and compatible with the material used for the legend both in application and durability.

2. The colours and gloss levels shall be uniform and conform to the requirements of Clause C262.08(a). ***Colours and Gloss***

C262.09 NON-REFLECTIVE MATERIAL FOR LEGEND

(a) Legend Screening Ink

1. Screening ink shall be a high quality, full gloss, non-fade, non-bleed and scratch resistant type of ink compatible with the material to which it is applied. Screening ink shall have durability at least equal to the material to which the screening ink is applied. ***Quality***

(b) Legend Sheet Material

1. Adhesive cast vinyl sheet material or other equivalent material approved by the Superintendent may be used in place of screening ink. The material shall be of uniform density and compatible with the material used for the background both in application and durability. ***Quality***

(c) Colours and Finish

1. The requirements of Clause C262.08(a) shall also apply to non-reflective materials for legends but additional colours complying with AS 2700 may be specified. ***Colours and Gloss***

C262.10 RIVETS

1. Each rivet shall consist of a domed head and shank made of aluminium alloy and a steel mandrel which is discarded after securing the rivet. ***Head and Shank***

2. A paint coating shall be applied to the domed head so that when the rivet is in position it will show the same colour as the material to which it is attached. Paint may cover the shank of the rivet, providing the coating thickness does not restrict the insertion of the shank into the standard drilled hole for that rivet. ***Painted Head***

3. The paint shall be an alkyd enamel, which shall be applied after an appropriate treatment of the shank of the rivet to ensure long lasting adhesion. ***Paint Application***

C262.11 REFERENCE MARKINGS

1. All signs shall be clearly and permanently stamped or engraved with an identification coding. The coding shall appear in ciphers of height neither less than 6mm nor more than 10mm on the rear of the sign and shall be carried out in such a manner that the front face of the sign is not damaged. ***Identification Code***

2. For rectangular signs, the coding shall appear as near as practicable to the bottom rear left hand corner. For other shaped signs, the coding shall be positioned on or below the horizontal centre line and as near as practicable to the left hand rear edge. ***Location***

3. Manufacturers shall include coding information in the following format:- ***Information Shown***

Manufacturer's Name
Month and Year of Manufacture
Manufacturer and Class of Retro-Reflective Material

C262.12 SIGN SUPPORT STRUCTURES

(a) General

1. Sign support structures shall be fabricated from steel sections which shall comply with the requirements of AS 1163, AS 3678 and AS 3679.1. ***Standards***

2. Signs support structures shall be standard round galvanised posts of 50, 65 or 80mm nominal bore or purpose-designed steel structures as shown on the Drawings and manufactured in accordance with the requirements of AS 1250. ***Size***

3. Splices in members shall be restricted to a maximum of one splice per member. Splices shall be full penetration butt welds. ***Splices***

4. All welding shall be as shown on the Drawings and in accordance with the requirements of AS 1554.1, Category GP. ***Welding Standard***

(b) Protective Treatment

1. Except for standard galvanised posts, all steel components including brackets shall be protected by hot-dip galvanising after all fabrication processes are completed. ***Hot-Dip Galvanising***

2. The steel components shall be finished by the hot-dip galvanising process in accordance with AS/NZS 4680 to provide an average minimum coating thickness of 85 microns and a bright finished surface free from white rust and stains. ***Finish***

3. Bolts, nuts and washers and brackets shall be galvanised in accordance with AS 1214. ***Bolts, Nuts etc.***

4. Splices in standard galvanised posts shall be painted by using an organic zinc-rich primer, or inorganic zinc silicate paint, in accordance with the repair requirements in Appendix E of AS/NZS 4680. ***Splices***

5. Scratched and slightly damaged surfaces of galvanised coatings shall be renovated by using an organic zinc-rich primer, or inorganic zinc silicate paint, in accordance with the repair requirements in Appendix E of AS/NZS 4680. This method of renovation shall be restricted to areas not exceeding 2500 square millimetres on any one structure. Any structure with totally-damaged coating areas exceeding 2500 square millimetres shall be regalvanised by the Contractor. ***Damaged Surfaces***

(c) Attachment of Signs

1. Posts and other components shall be provided with the required sign attachment holes or fittings to suit the typical attachment systems as shown on the Drawings. Sign panels shall be attached to each supporting member at each extrusion section or bolt hole in the sign panel. ***Typical Systems***

2. The Contractor shall submit details of the proposed attachment systems for the Superintendent's approval. ***Contractor's Responsibility***

ERECTION OF NEW SIGNS

C262.13 SETTING OUT

1. The location of signs shall be as shown on the Drawings or as directed by the Superintendent. The Contractor shall set out the work to ensure that all signs and support structures are placed in accordance with the Drawings or as directed by the Superintendent. ***Location***

2. Signs shall be aligned approximately at right angles to the direction of the traffic they are intended to serve. On curved alignments, the angle of placement should be determined by the course of approaching traffic rather than the orientation of the road at the point where the sign is located. ***Alignment***

3. Work on the foundations of the sign support structure shall not commence until the Superintendent has approved the location and alignment of the sign support structure. ***Approval of Super-intendent***

C262.14 CLEARING

1. Any trees and undergrowth within three metres of the sign support structure and along a driver's line of sight to the front of the sign shall be cleared and removed. ***Extent of Work***

C262.15 SIGN STRUCTURE FOOTINGS

1. The footings for a simple pipe support or the footings for each post of a purpose-designed sign support structure shall be constructed in accordance with the Drawings or as directed by the Superintendent. ***Details***

2. The footings shall be neatly excavated to the depth and width shown on the Drawings. The material from the excavation shall be disposed of in a responsible and legal manner. ***Excavation***

3. When anchor bolt assemblies are specified they shall be accurately placed and firmly supported. Anchor bolt assemblies shall be provided with levelling nuts under the sign structure baseplates to allow adjustment of the structure after installation. ***Anchor Bolt Assemblies***

4. Steel reinforcement shall be placed as shown on the Drawings. ***Steel Reinforcement***

5. Concrete in the footings of sign support structures shall comply with the Specification for MINOR CONCRETE WORKS and have a minimum compressive strength at 28 days of 20MPa for pipe support footings and 32MPa for purpose-designed support footings. ***Concrete Quality***

6. If ready mixed concrete is used, the concrete shall be mixed and delivered in accordance with AS 1379. ***Ready Mixed Concrete***

C262.16 ERECTION

1. All components shall be accurately positioned and supported during erection. ***Position and Support***

2. The top of each pipe support post shall extend sufficiently beyond the upper extrusion section or bolt holes on the sign panels to enable attachment of the signs. The top of each post shall be below the top edge of the sign panel. ***Top of Post Level***

3. For pipe support multi-post installations, the tops of the posts shall be at the same level except where sign shape or the arrangement of sign panels dictates otherwise. ***Multi-Post Installation***

4. During erection, sign panels shall be suitably supported and braced and the sign face protected from damage. Signs damaged during erection shall be repaired to a standard equivalent to the original sign or replaced by the Contractor. ***Sign Damage***

5. Galvanised coatings on purpose-designed support structures which are scratched or slightly damaged during erection shall be renovated by using an organic zinc-rich primer, or inorganic zinc silicate paint, in accordance with the repair ***Treatment of Damaged Areas***

requirements in Appendix E of AS/NZS 4680. This method of renovation shall be restricted to areas not exceeding 2500 square millimetres on any one structure. Any structure with totally-damaged coating areas exceeding 2500 square millimetres shall be regalvanised.

ADJUSTMENT OF EXISTING SIGNS AND SUPPORT STRUCTURES

C262.17 GENERAL

1. Where shown on the Drawings and where directed by the Superintendent, the Contractor shall adjust existing sign panels and sign support structures. The work shall include minor adjustments of existing sign panels and/or sign support structures or the work may extend to the dismantling of signs and sign support structures, relocation or replacement of sign support structures including footings and re-erection of signs including all fittings. ***Extent of Work***

SPECIAL REQUIREMENTS

C262.18 STREET AND COMMUNITY FACILITY NAME SIGNS

1. All street and community facility name signs shall comply with Council's adopted signage system and with the details as shown on the Drawings. ***Signage System***

2. Proprietary signs shall be manufactured and installed in accordance with the requirements of AS 1742.5, Street Name and Community Facility Name Signs, to the following details: ***Proprietary Sign Requirements***

(*SAMPLE ONLY - TO BE COMPLETED BY COMPILER)*

a) Colour:

Legend - *Blue, Non-reflective*

Background - *Yellow, Class 1 Retroreflective*

b) Lettering and Numerals:

Font Type - *Series D*

Height - *100mm*

3. Details of Council's logo shall be supplied to the Contractor by the Council. ***Logo***

4. Details of the signs and legends to be provided under the Contract shall be as shown on the Drawings. ***Legends***

5. The Contractor shall submit details of Manufacturer, all sign materials and sign attachment system to the Superintendent for approval by the Council prior to commencement of sign manufacture.

LIMITS AND TOLERANCES

C262.22 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C262.1 below:

Item	Activity	Limits/Tolerances	Spec Clause

1.	**Sign Blanks**		
	(a) Dimensions	± 1.50mm	C262.05
	(b) Bow	< 0.5% of maximum dimension	C262.05
	(c) Butt gap in multipiece sign	< 1mm	C262.05
	(d) Rivet spacing in backing strip	< 200mm	C262.05
	(e) Backing strip width	>50mm	C262.05
2.	**Extrusion Backing**		
	(a) Rivet Spacing	<200mm	C262.06
3.	**Background Paint**		
	(a) For matt coatings, gloss level	>12% and <15%	C262.08
	(b) For gloss coatings, gloss level	>85% and <95%	C262.08
4.	**Reference Marking**		
	(a) Height of Coding	>6mm and <10mm	C262.11
5.	**Sign Support Structures**		
	(a) Protective Treatment thickness	>100 microns	C262.12b
	(b) Paint coating over Splices in standard galvanised posts	>100 microns	C262.12b
	(c) Damaged Surface of galvanised surfaces:		
	(i) Coating with zinc rich paint	Area <2500 sq. mm	C262.12b
	(ii) Regalvanise	Area >2500 sq. mm	C262.12b
6.	**Clearing**		
	(a) Trees and Undergrowth to be cleared	<3 metres from sign support structure	C262.14
7.	**Concrete in Foundations of Sign Support Structures**		
	(a) Strength	>25 MPa at 28 days	C262.15

Table C262.1 - Summary of Limits and Tolerances

CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C263

GUIDE POSTS

SPECIFICATION C263 - GUIDE POSTS

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SPECIFICATION C263 : GUIDE POSTS

GENERAL

C263.01 SCOPE

1. The work to be executed under this Specification consists of the setting out, supply of all materials and erection of guide posts at the locations shown on the Drawings or as directed by the Superintendent in areas where streetlighting is not provided.

C263.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C201 - Control of Traffic

(b) Australian Standards

AS 1604.1 - Specification for preservative treatment – Part 1: Sawn and round timber.
AS 1906.2 - Retroreflective devices (non-pavement application).
AS 2082 - Visually stress-graded hardwood for structural purposes.

C263.03 MATERIALS

(a) General

1. Guide posts shall be of timber or, as an alternative, the Superintendent may approve of a proprietary metallic or flexible (driveable or non-driveable) post. ***Type***

2. The surface of all posts shall have a gloss or semi-gloss white finish. The surface shall be smooth and easily cleaned. ***Surface Finish***

3. Proprietary posts shall be minimum 1350mm in length and shall have one face of 100mm width. ***Dimensions***

(b) Timber Posts

1. Timber posts shall be cut from Select Grade hardwood and conform with AS 2082. All surfaces shall be smooth and free from obvious saw marks. ***Quality***

2. The posts shall be of rectangular cross-section having dimensions of 100mm x 50mm and shall be 1,400mm in length. The tops of the guide posts shall be sloped so that one 100mm edge is 10mm lower than the opposite edge. ***Dimensions***

(c) Proprietary Posts

1. Where a proprietary metallic or flexible guide post is proposed, the Contractor shall supply details of the proposed guide post including the manufacturer's recommended installation procedure, technical specifications and test certificates for consideration by the Superintendent. The test certification shall address post strength, flexibility, impact and heat resistance and durability. The Superintendent's approval of the submitted details and acceptance of the nominated guide post type and supplier and the approval of Council is required prior to delivery or inclusion in the Works.

(d) Delineators

1. Corner-cubed delineators, conforming to AS 1906.2 shall be attached to each post. ***Standard***

2. The delineators shall be neither less than 80mm nor more than 85mm diameter. ***Diameter***

CONSTRUCTION

C263.04 GENERAL

1. The Contractor shall at all times conform to the requirements of the Specification for CONTROL OF TRAFFIC. ***Traffic Control***

2. Where the shoulder is in embankment or at natural surface level, the guide posts shall be placed near the outer edge of the shoulder and at a uniform distance, minimum 1m, from the pavement edge line. Where the shoulder is located in a cutting, the guide posts shall be placed on the road pavement side of the table drain, and minimum 1m from the pavement edge line, in such a manner as not to impede the flow of water in the drain. ***Positioning***

3. Guide posts shall be erected at the locations shown on the Drawings. ***Location***

4. Underground services laid in proximity to the guide posts shall be located prior to erection of posts, all care shall be taken not to damage such services. ***Underground Services***

C263.05 PROTECTIVE TREATMENT OF TIMBER GUIDE POSTS

1. The portion of the guide post below ground level shall be treated with creosote, such that the penetration and retention of creosote preservative conforms with the requirements for minimum Hazard Class H4 treatment in accordance with AS 1604.1. ***Creosote***

2. All timber above ground level shall be painted with pink primer and any holes, cracks, or other surface imperfections in the timber, shall be stopped with white putty. This work shall be followed by painting with a white undercoat and a white enamel finishing coat. ***Painting***

3. Painted surfaces shall be thoroughly dry before the second coat is applied. Paints shall be handled and applied in accordance with the manufacturer's directions. ***Dry Surfaces***

4. All paints shall be of the best quality, durable and suitable for exterior application on timber surfaces. ***Paint Quality***

C263.06 ERECTION OF GUIDE POSTS

1. Guide posts shall be set vertically in the ground to a depth of approximately 500mm. In order to offset shoulder irregularities this depth shall be varied so as to give uniform display of guide posts to a height of approximately 900mm above ground level, with the tops evenly graded. Each guide post shall be erected with the 100mm axis at right angles to the centre line of the road. ***Details***

2. Allowance shall be made in the height of guide posts above the ground for the effects of superelevation and other road geometry in order to keep the guide posts within the range of the beam of vehicle headlights. ***Vertical Alignment***

3. Backfilling shall be compacted in layers of depth not more than 150mm for the full depth of the guide posts up to ground level. The density of the compacted backfilling shall not be less than that of the adjacent undisturbed ground. Guide posts shall be firm ***Backfilling***

in the ground to the satisfaction of the Superintendent.

4. Proprietary guide posts, when installed in the ground in accordance with the recommendations of the manufacturer, shall resist overturning, twisting and displacement from wind and impact forces. ***Proprietary Guide Posts***

5. All necessary steps shall be taken to prevent people and stock from stepping into the post holes during the erection of the guide posts. ***Contractor's Responsibility***

C263.07 DELINEATORS

1. 'Corner Cubed' delineators, complying with AS 1906.2, shall be attached to each guide post using one way, anti-theft screws. In the case of proprietary posts, the delineators shall be glued or otherwise fastened to the post in such a manner that they are not dislodged or rendered inactive under vehicular impact. ***Fixing***

2. The delineators shall be mounted so that the top of the reflector is 50mm below the top of the guide post. ***Position***

3. The delineators shall be so arranged that drivers approaching from either direction will see only red delineators on their left side and white delineators on their right side. ***Arrangement***

SPECIAL REQUIREMENTS

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C264

NON-RIGID ROAD SAFETY BARRIER SYSTEMS

(Public Domain)

SPECIFICATION C264 – NON-RIGID ROAD SAFETY BARRIER SYSTEMS
(Public Domain)

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SPECIFICATION C264:
NON-RIGID ROAD SAFETY BARRIER SYSTEMS (Public Domain)

GENERAL

C264.01 SCOPE

1. The work to be executed under this Specification consists of the setting out, supply of all materials and erection of road safety barriers and terminals, in accordance with the requirements for non-rigid road safety barrier systems in AS/NZS 3845, at the locations shown on the Drawings or as directed by the Superintendent.

2. This Specification details the requirements for public domain non-rigid road safety barrier systems. Where a patented non-rigid road safety barrier system is specified and shown on the Drawings, all materials shall be in accordance with the manufacturer's specifications and, it shall be constructed strictly in accordance with the manufacturer's instructions.

C264.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

Documents Standards Test Methods

(a) Council Specifications

C201	-	Control of Traffic
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1906.2	-	Retroreflective devices (non pavement application).
AS/NZS 3845	-	Road safety barrier systems.
AS/NZS 4680	-	Hot-dip galvanised (zinc) coatings on fabricated ferrous articles

MATERIALS

C264.03 COMPONENTS

1. All steel components for public domain non-rigid road safety barrier systems, W-beam and Thrie-beam, shall be in accordance with AS/NZS 3845 and shall be of the type as shown on the Drawings.

Steel

2. Timber posts are to be used only in W-beam terminal sections, as detailed on the Drawings and shall be of the timber type, grade, size and treatment level in accordance with AS/NZS 3845. All surfaces shall be smooth and free from obvious saw marks.

Timber

C264.04 CERTIFICATION

1. Steel and timber road safety barrier components shall not be erected until the Contractor has produced documentary evidence to the Superintendent that the steel and timber road safety barrier components conform to the requirements of this Specification.

Evidence of Conformance

CONSTRUCTION

C264.05 GENERAL

1. The Contractor shall at all times conform to the requirements of the Specification for CONTROL OF TRAFFIC. ***Traffic Control***

2. Construction of non-rigid road safety barrier shall comply with AS/NZS 3845 except where explicit departures are detailed on the Drawings.

3. Road safety barriers shall be erected after the construction of the base on concrete pavements and after the placing of the initial layer of asphaltic concrete or sprayed seal on a flexible pavement, unless otherwise approved by the Superintendent. ***Timing of Construction***

4. The Contractor shall set out the work to ensure that all road safety barriers and terminal sections are located in accordance with the Drawings or as directed by the Superintendent. ***Set Out***

5. Underground cables and ducts laid in the road safety barrier area shall be located prior to the erection of posts and all care must be taken not to damage such cables and ducts. ***Cables and Ducts***

6. The posts should be set to the full depth as shown on the Drawings. If this is not possible due to the presence of an underground obstruction, an alternative method of setting the posts, as approved by the Superintendent, shall be used. ***Underground Obstruction***

7. Posts shall stand vertical and the spacing shall be such that when the safety barrier is erected no post movement is necessary in order to align holes or for any other reason. ***Post Accuracy***

C264.06 ERECTION OF STEEL POSTS

1. The safety barrier posts are to be located as shown on the Drawings. The top of the post shall be 710mm, 805mm or 865mm as appropriate for W-beam, Thrie-beam or modified blockout Thrie-beam respectively, above the ground level, unless otherwise shown on the Drawings. On terminal ends, the level of the posts shall be such as to conform to the extended crossfall of the main pavement unless otherwise shown on the Drawings. ***Positioning of Posts***

2. When erected in position the posts shall be on a smooth line both horizontally and vertically with the tops of posts within ±20mm of the heights specified in paragraph 1 of this Clause. ***Smooth Line/ Tolerances***

3. Steel posts shall be erected by driving, or by other means, as directed by the Superintendent, in accordance with the requirements for foundation posts in AS/NZS 3845. The open section of the post shall point in the same direction as adjacent traffic. The posts are to be firm in the ground and any movement at ground level shall not exceed 3mm in any direction when force tested in accordance with AS/NZS 3845. ***Foundation and Testing***

4. The posts shall not have any obvious deformation as a result of driving. Any damage which does occur to the posts is to be repaired within 24 hours using an organic zinc-rich primer in accordance with the repair requirements of Appendix E in AS/NZS 4680. ***Damage to Posts***

5. Any post which has been excessively damaged will be rejected by the Superintendent and shall be replaced by the Contractor.

C264.07 ERECTION OF TIMBER POSTS

1. The safety barrier posts are to be located as shown on the Drawings. The top of the posts shall be 710mm ±20mm above the ground level, unless otherwise shown on the Drawings. On terminal ends the level of the posts shall be such as to conform to the extended crossfall of the main pavement, unless shown otherwise on the Drawings. ***Positioning of Posts***

2. When erected in position the posts shall be on a smooth line both horizontally and vertically. ***Smooth Line***

3. The section of the timber posts to be cast into a reinforced concrete footing shall be wrapped in 12mm thick polystyrene foam sheeting before concrete casting. ***Polystyrene Foam***

4. Concrete used in the footings for timber posts shall have a minimum compressive strength of 32MPa at 28 days and shall conform with the requirements of the Specification for MINOR CONCRETE WORKS. ***Concrete***

5. Concrete footings shall be 600mm diameter, and shall have tolerances of minus zero or plus 50mm. Overbreak and excessive depth shall be filled with 32MPa concrete at no cost to the Principal. ***Footing Size***

6. Wire fabric reinforcing shall be as detailed on the Drawings. ***Reinforcing Fabric***

7. The surface area of the posts which will be above ground shall be painted with two coats of grey acrylic paint. ***Painting***

C264.08 ERECTION OF ROAD SAFETY BARRIER RAILS

1. Steel blockout pieces shall be erected with the open section pointing in the same direction as adjacent traffic. ***Blockouts***

2. All rail laps shall be in the same direction as adjacent traffic such that approach rail ends are not exposed to traffic. ***Rail Laps***

3. Stiffening pieces, 300mm long, shall be used on intermediate posts. ***Stiffening Pieces***

4. Road safety barrier rails and blockout pieces shall be handled and erected in such a manner that no damage occurs to the galvanising. Any minor damage occasioned to the galvanising shall be repaired within 24 hours using an organic zinc-rich primer in accordance with the repair requirements of Appendix E in AS/NZS 4680. ***Minor Damage to Galvanising***

5. Any road safety barrier rails or blockout pieces which have been excessively damaged will be rejected by the Superintendent and shall be replaced by the Contractor.

6. Road safety barrier rail attachment bolts and splice bolts are to be tightened initially such that the barrier can be erected. Adjustments are then to be made to the rails using the slotted holes provided to produce a smooth regular line, free of any kinks or bumps. The overall line of the top of the safety barrier rails is to visually conform with the vertical alignment of the road pavement. ***Erection Procedure***

7. When the alignment both vertically and horizontally is obtained the splice bolts are to be fully tightened. The bolt head (not the shoulder) should be in full bearing with the rail. ***Splice Bolt Tightening***

C264.09 END TREATMENT OF ROAD SAFETY BARRIERS

1. Both approach and departure ends of the road safety barrier shall be constructed ***Leading,***

with leading and trailing terminal sections at locations shown and as detailed on the Drawings. ***Trailing Terminals***

2. Modified eccentric loader terminals (MELT) shall be constructed, as detailed on the Drawings and, at approach end locations of road safety barriers as shown on the Drawings. Where the departure end of a road safety barrier is within the clear zone of opposing traffic, a MELT shall be constructed in place of a trailing terminal section. ***MELT***

3. The approach and departure ends of double sided road safety barriers shall have terminal sections as detailed on the Drawings. ***Double Sided Safety Barrier***

4. Non-rigid road safety barrier connections to rigid road safety barriers or bridge parapets shall be as detailed on the Drawings. ***Connections to Rigid Barriers***

C264.10 DELINEATORS

1. Delineators complying with AS 1906.2 shall be fixed with brackets to the road safety barrier, to the details and at the locations shown on the Drawings beginning at the first post and then in accordance with the following table:- ***Fixing***

Radius of Curve	**Spacing of Reflectors on Barrier**
m	every
30 - 90	3rd post
90 - 180	5th post
180 - 275	8th post
275 - 365	11th post
over 365 (including straight road)	16th post

2. The delineators shall be so arranged that drivers approaching from either direction will see only red reflectors on their left side, and white reflectors on their right. ***Arrangement and Colour***

SPECIAL REQUIREMENTS

LIMITS AND TOLERANCES

C264.15 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this specification are summarised in Table C264.1 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Vertical Alignment**		
	(a) Tops of steel posts.	± 20mm	C264.06
	(b) Tops of timber posts	± 20mm	C264.07
2.	***Post Movement***	≤ 3mm	C264.06
3.	**Concrete Footings**		
	(a) Diameter	-0mm or +50mm	C264.07

Table C264.1 - Summary of Limits and Tolerances

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CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C265

BOUNDARY FENCING

SPECIFICATION C265 - BOUNDARY FENCING

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SPECIFICATION C265 - BOUNDARY FENCING

GENERAL

C265.01 SCOPE

1. The work to be executed under this Specification includes setting out, clearing of fence line, supply of material and erection of boundary fencing and gates, in accordance with the Drawings or as directed by the Superintendent.

C265.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated.

Documents Standards Test Methods

(a) Council Specifications

C212	-	Clearing and Grubbing
C271	-	Minor Concrete Works

(b) Australian Standards

AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio
AS 1725	-	Galvanised Rail-less Chainwire Security Fences and Gates
AS 1742.2	-	Traffic control devices for general use
AS 2423	-	Galvanised Wire Fencing Products

MATERIALS

C265.03 GENERAL

1. All materials shall be supplied by the Contractor and shall be of dimensions, manufacture and quality in accordance with the requirements of this Specification and all galvanised wire fencing products shall conform to AS 2423.

Dimensions and Quality

2. For each type of material to be supplied, the Contractor shall submit to the Superintendent for approval the source, manufacturer, and also the type if applicable.

Details to be Provided

3. No materials shall be used until approved by the Superintendent.

Approved Materials

C265.04 GALVANISED POSTS AND BRACES

1. All posts and bracing shall be galvanised iron pipe in accordance with AS 1725. The pipes shall be to the dimensions shown on the Drawings.

Dimensions

2. All pipe joints shall be welded. All welds shall be satisfactorily cleaned and painted with a cold galvanising compound to the satisfaction of the Superintendent.

Welded Joints

C265.05 CHAIN WIRE

1. Galvanised chain wire mesh, 1,450mm wide (1830mm wide for Manproof Fencing) shall be of 3.15mm diameter wire woven to a 50 x 50mm square mesh. The

Dimensions and Zinc

selvedge edges of the chain wire shall be left barbed, and it shall be supplied in lengths of not less than 30m. The zinc coating shall be uniform, continuous, free from imperfections and thoroughly adherent. The coating shall be applied to the wire before the mesh is woven. The weight of the zinc coating shall not be less than 290 g/sq m of wire surface. ***Coating***

2. Where specified, the chain wire shall be coated in black PVC after galvanising. ***PVC Coating***

C265.06 WIRE NETTING

1. Wire netting shall be standard quality galvanised 1.40mm diameter wire, 40mm mesh, 1.05m wide for normal use and 1.60mm diameter wire, 50mm mesh, 0.90m wide where used in creek crossings. ***Dimensions***

C265.07 GATES

1. Gates shall be of galvanised tubular steel construction, 3.6 metres in width by 1.5 metres or 1.2 metres (as specified) in height, and shall be fitted with substantial hinges, catch, drop bolts and locking chains unless otherwise shown on the Drawings or directed by the Superintendent. ***Dimensions and Fittings***

2. Where required, gates shall have stout and well supported rabbit-proof mesh to a height of at least 900mm above ground level. ***Rabbit Proofing***

C265.08 REINFORCED CONCRETE POSTS

(a) Strainer Posts ***Dimensions***

1. Concrete strainer posts shall be approximately 150 x 150 square in section and lengths as shown on the Drawings. Each post shall be provided with 12mm dia holes to suit the spacing of the wires shown on the Drawings for the particular type(s) of fencing to be erected.

2. The posts shall be reinforced longitudinally with not less than four reinforcing bars each 12mm diameter. All posts shall have suitable stirrup reinforcement to control diagonal cracking. Longitudinal reinforcement shall have 25mm minimum cover. End cover on reinforcement shall be 25mm. ***Reinforcing Steel***

3. The concrete shall have a minimum 28 day compressive strength of 20MPa. ***Concrete Strength***

(b) Intermediate Posts

1. Intermediate Posts shall generally conform to the requirements for Strainer Posts, except that the longitudinal reinforcing bars may be 9mm dia. ***Quality***

C265.09 PRESTRESSED CONCRETE POSTS

(a) Strainer Posts

1. At least four longitudinal high carbon deformed high tensile strands (or equivalent) of 5mm diameter, shall be provided. The strands shall be tensioned to a stress of 800MPa minimum prior to placing concrete. Cross sectional dimensions of the posts shall be as shown on the Drawings. ***Tendons***

2. Concrete shall have a minimum compressive strength of 32MPa at 24 hours. ***Concrete***

3. In lieu of holes for wires, grooves may be provided to suit the spacing of the wires shown on the appropriate Drawings for the particular types of fencing to be erected. The grooves shall be at least 5mm deep and 5mm wide at the surface of the post. ***Grooves for Wire***

(b) Intermediate Posts

1. Intermediate posts and strainer stays shall generally conform to the requirements for Strainer Posts except that two only high tensile, high carbon deformed strands shall be required. ***Quality***

2. Cross sectional dimensions shall be as shown on the Drawings. ***Dimensions***

C265.10 STEEL POSTS (RURAL FENCING)

1. Steel posts shall be "STAR" pattern. Posts shall be drilled to suit the spacing of the wires shown on the Drawing(s), and shall be black varnished or galvanised. ***Type***

2. The total weight of 300 posts each 1.65m long shall be at least one (1) tonne. ***Weight***

C265.11 GALVANISED PIPE POSTS (RURAL FENCING)

1. Galvanised pipe posts shall be used where shown on the Drawings. The pipes shall be of the dimensions shown on the Drawings and shall be of first grade quality in accordance with AS 1725. ***Dimensions and Quality***

C265.12 WIRES

(a) Plain Wire

1. Plain wire shall be standard galvanised drawn annealed steel wire of diameters shown on the Drawings. ***Type***

(**b) High Tensile Plain Wire**

1. High Tensile wire shall be galvanised and of diameters shown on the Drawings. ***Type***

(c) Barbed Wire

1. Barbed wire including barbs shall be 2.5mm diameter galvanised drawn annealed steel wire, with clusters of four barbs spaced at 90mm maximum. Alternatively barbed wire may be of 1.6mm diameter high tensile steel wire, with clusters of barbs spaced at 90mm maximum. ***Type and Dimensions***

(d) Cable Wire

1. Cable wire shall consist of three pairs of 2 x 3.15mm galvanised iron wire tightly twisted around posts and located as shown in the Drawings. ***Type and Dimensions***

(e) Tie Wire

1. The wire shall be 2mm diameter galvanised wire. ***Type and Dimensions***

C265.13 CONCRETE BACKFILLING

1. All concrete backfilling of post holes specified on the Drawings shall be of minimum 20MPa 28 day compressive strength and shall conform to the requirements of the Specification for MINOR CONCRETE WORKS. ***Specification***

CONSTRUCTION

C265.14 GENERAL

1. Boundary fencing shall be erected prior to the commencement of other work on a particular section of the work, unless directed otherwise by the Superintendent. ***Construction Priority***

2. All fencing shall be erected in a workmanlike manner, and when completed shall be sound, strong and of neat appearance. ***Quality***

3. For a clear width of one metre on either side of the fence line, and for the full length of the line, all logs, boulders, stumps, roots, undergrowth and rubbish shall be removed and disposed of by the contractor in accordance with the Specification for CLEARING AND GRUBBING. Trees within this area shall be removed only as directed by the Superintendent and approved by Council. ***Clearing***

4. If trees on or adjacent to the fence line are to be retained the arrangement of the fencing at the trees shall be as directed by the Superintendent. ***Trees Retained***

5. Wire shall not be strained around or against any trees to be left in the fence line, and strainer posts are to be provided on both sides of each tree. ***Trees on Fence Line***

6. Where minor irregularities occur in the ground the vertical alignment of the fence shall not follow these irregularities, but shall be aligned to a uniform grade between definite changes in the natural slope of the ground. ***Uniform Grade***

7. All survey pegs shall be left undisturbed and the post spacing shall be altered slightly where necessary to avoid pegs. ***Survey Pegs***

8. The Contractor shall maintain the fencing at all times in a condition secure against the ingress or egress of stock, and shall take such precautions as are necessary to prevent people or stock from stepping into holes excavated for the construction of fencing. ***Stock Proof***

9. Where old fencing is to be replaced by new fencing, all holes left after removal of the old fencing shall be backfilled and rammed firmly in layers of maximum depth 150mm. ***Backfilling of Old Holes***

10. The Contractor shall be held responsible for any loss, damage, or injury to buildings, goods, crops, livestock, property of any kind or persons due to negligence on the Contractor's part. ***Contractor's Responsibility***

C265.15 CHAIN LINK FENCING

(a) Erection of Posts

1. All posts shall be erected vertically and set in concrete blocks approximately 250mm diameter and 600mm deep except for end, corner, strainer and gate posts which shall be set in concrete blocks approximately 250mm diameter and 900mm deep unless otherwise shown on the Drawings. Concrete shall have a minimum compressive strength of 20MPa at 28 days and shall conform to the requirements of the Specification for MINOR CONCRETE WORKS. ***Concrete Blocks and Quality***

2. Galvanised weather caps shall be fitted to all galvanised posts. ***Weather Caps***

3. Strainer posts shall be used at ends of fencing, angles, intersections with other fencing, gates and at intermediate points. Distances between strainer posts shall not exceed 120 metres. ***Strainer Posts***

(b) Erection of Wire

1. All wire shall be spaced as shown in the Drawings. Wire shall be securely fastened and strained to an even tension between strainer posts. ***Fasten and Strain***

2. Where specified, or shown on the Drawings, chain wire mesh shall be erected on the outside of the posts and fastened with two turns of the wire to each cable wire on both sides of each post and at intervals of not more than 900mm between posts and to each post midway between cable wires. ***Chain Wire Mesh***

C265.16 STOCK-PROOF FENCING

(a) Erection of Posts

1. All posts shall be erected vertically. Reinforced concrete posts shall be erected in neatly cut holes sunk in earth, or in rock where this is encountered. Steel posts, except where placed in rock, shall be driven with suitable driving equipment, care being taken not to damage the tops of the posts during driving. ***Method***

2. Where prestressed posts are proposed to be used, they shall be either erected as for reinforced concrete posts or shall be driven. Where driven, the Contractor shall use a suitable post driver which shall be equipped with two (2) sets of guiding rollers, to hold the post vertical and in position during driving. ***Driving Prestressed Posts***

3. A steel cap with a plywood cushion shall be used to protect the top of the post during driving. ***Protection Cap***

4. If the post cannot be driven for the full depth specified, or if it becomes significantly damaged, or cannot be driven vertically, it shall be removed. The same post if undamaged, or a new post, shall be erected as described for reinforced concrete posts. ***Removal of Posts***

5. Posts shall be sunk to the depths shown in Table C265.1.

Type of Post	Depth	
	Earth	Rock
Concrete Corner Posts & Strain Posts	900	*600
Concrete Intermediate Posts	600	*450
Steel Posts	450	450
Note* Permitted only in cases where posts of the correct length are provided (see below), otherwise the depth of sinking shall be the same as for earth.		

Table C265.1 - Post Depth in Ground

6. Cutting of concrete posts will not be permitted, and in order to take advantage of the lesser depth of sinking permitted in rock, it will be necessary to use posts manufactured in lengths to suit the depth of sinking. Where rock is encountered, steel posts shall be sunk in drill holes of sufficient diameter to permit them to be refilled with ***Variations to Post Length***

cement mortar consisting of one part of cement to two parts of clean sand.

7. Earth shall be backfilled around intermediate posts in layers of maximum depth 150mm for the full depth of the hole and up to ground level. The relative compaction of the rammed material shall be not less than that of the original undisturbed ground. ***Backfilling at Intermediate Posts***

8. Where concrete posts are placed in rock, the space around the posts shall be tightly filled with cement mortar consisting of one part of cement to two parts of sand, or concrete where this is available. ***Mortar Backfill***

9. Strainer posts shall be used at ends of fencing, angles, intersections with other fencing, gates and at intermediate points. These posts shall be backfilled with approved concrete to their full depth. ***Strainer Posts***

10. Distances between strainer posts shall not exceed 120m in the case of fencing using steel intermediate posts, and 90m in the case of fencing for the retention of cattle (for which only concrete posts are permitted). Junctions with existing fencing shall be made in an approved manner. ***Spacing of Posts***

(b) Erection of Wires

1. All wire shall be placed as shown on the Drawings. Wires shall be securely fastened and strained to an even tension between strainer posts with an approved wire strainer. Where barbed wire is to be used, it shall be tied in position at the top of intermediate posts, and where additional barbed wires are called for they shall be secured to the sides of the posts as shown on the Drawings. ***Fastening and Straining***

2. Where concrete posts are used and the barbed wires are secured either to the tops or sides of the posts by tie wire, the tie wire shall be stretched tight and shall fit snugly against the sides of the posts to prevent movement of the barbed wire. ***Barbed Wire***

3. Where prestressed posts are used, wires shall be securely tied so that they seat firmly in the grooves. ***Prestressed Posts***

4. All joints in wires shall be as shown on the Drawings. ***Wire Joints***

C265.17 RABBIT-PROOF FENCING

(a) General

1. Wire netting shall be erected on the side of the fence remote from the roadway in the case of road reserve boundary fences. In other cases netting shall be erected on the side of which the Superintendent shall direct. ***Netting Position***

2. The netting shall be erected so that there is a 200mm lap laid on the ground surface, or trenched 215mm into the ground as shown on the Drawings for the type of fence to be erected. ***Lap/Trench***

3. Netting shall be tied with tie wire or fixing clips approved by the Superintendent. ***Fixing of Netting***

4. The netting shall be loosely tied to fence wires then carefully strained without disturbing or breaking the mesh, and shall then be tied to the wires immediately on each side of the post and at intervals not exceeding 1m. ***Straining and Tying***

5. At each strainer post strut, additional netting shall be attached to the fence adjacent to the strainer post, to a height of 450mm above the strut. ***Additional Netting***

C265.18 CROSSING OF WATERCOURSES AND DEPRESSIONS

1. The crossing of all watercourses and depressions, shall be made secure by longer posts, suitably strutted as directed by the Superintendent. Additional cable wire and chain wire/wire netting shall be provided as necessary to make the fence stock proof. ***Marsupial Proof***

2. The fence shall allow the passage of floodwater without the accumulation of debris. If directed by the Superintendent, flood gates shall be provided in accordance with Clause C265.20. ***Floodwater***

C265.19 CONNECTIONS TO EXISTING FENCES

1. Existing cross fences shall be connected to the new fence using a strainer post with braces in each direction of strain (including cross fence) and the wires in both fences properly fastened to the post. ***Strainer Posts***

C265.20 FLOOD GATES

(a) General

1. Suitable provision for the passage of flood waters past the fence shall be made at all watercourses. In all cases flood gates shall be of the type indicated on the Drawings, or as directed by the Superintendent, and shall be erected so as to prevent the accumulation of flood debris, while remaining stock-proof or rabbit-proof. ***Requirements***

(b) Small Watercourses

1. Flood gates, in accordance with the Drawings, shall be provided in small gullies at the locations indicated on the Drawings or as directed by the Superintendent. The opening of each flood gate shall provide a waterway area at least twice that of the culvert opposite to which it is placed, or as otherwise directed by the Superintendent. ***Waterway Area***

(c) Large Gullies and Creeks

1. Flood gates, in accordance with the Drawings, shall be provided in gullies and creeks at the locations indicated on the Drawings, or as directed by the Superintendent. ***Location***

2. A 9mm galvanised wire rope shall be carried over the gully in one span, threaded through a strainer post and tied back to an anchor at an adjacent concrete intermediate post. Turnbuckles are to be provided at each end to tension the wire rope. Netting shall be suspended from the wire rope and shall be overlapped and securely tied. The netting shall be of sufficient length to lie on the ground for a distance of not less than 1.0m on the downstream side. ***Construction Detail***

3. Ballast, of sound timber securely tied to the netting, shall be provided at the downstream end of the netting. ***Netting Ballast***

4. The sides of the gully shall be trimmed, as necessary, to ensure that the flood gate shall be stock-proof or rabbit-proof. The flood gate shall have sufficient movement of the suspended portion under the flow of flood waters to prevent damage to the fence and the accumulation of debris against it. Each strainer post shall be stayed in three directions, as shown on the Drawings. ***Construction Requirements***

C265.21 ERECTION OF GATES

1. Where gates are specified or shown on the Drawings, they shall be erected so that they swing away from the road. Double gates shall be supplied if directed by the Superintendent, otherwise a single gate only shall be supplied. ***Swing Away From Road***

2. At the location of gates the surface shall be levelled and shall be nearly horizontal. The area where the gates swing shall be similarly levelled. ***Level Surface***

3. The gates shall be hung as indicated in the Drawings. ***Hanging***

C265.22 REMOVAL OF EXISTING FENCING

1. Where required, existing fencing is to be removed as shown on the Drawings. ***Location***

2. No fencing is to be removed if there is a risk of egress or ingress of stock. If the existing fence is a rabbit-proof fence, then the contractor shall ensure that at night and weekends and other such times when work is not in hand that the whole of the fence is maintained in a rabbit-proof condition, even if temporary fencing is required. ***Contractor's Responsibility***

3. All material removed in demolishing existing fencing shall be disposed by the Contractor as provided by Clause C265.23. ***Old Material***

C265.23 REMOVAL AND DISPOSAL OF SURPLUS MATERIAL AND RUBBISH

1. All surplus material, offcuts, timber, roots and other debris resulting from the fencing contract shall be removed or otherwise disposed of to the satisfaction of the Superintendent. ***Contractor's Responsibility***

2. The Contractor shall be responsible for any damage which may result from the lighting of fires associated with the work. ***Fire Damage***

C265.24 CATTLE GRIDS

1. Where shown on the Drawings, or as directed by the Superintendent, cattle grids shall be erected in accordance with the Drawings. ***Standard***

2. The cattle grid shall be evenly bedded on a continuous layer of compacted sand or other granular material approved by the Superintendent. The bedding material shall be compacted so that the relative compaction as determined by AS 1289.5.4.1 is not less than 95 per cent. ***Bedding***

3. Cattle grids shall be installed on raised abutments with approach ramps where possible. Alternatively, a cattle grid may be placed over an excavated pit, in which case adequate drainage shall be provided. ***Raised Abutments***

4. Crossfall for single lane cattle grids shall be level and for two lane cattle grids each section shall have a crossfall conforming to the crossfall of the approach road. ***Crossfall***

5. The cattle grid construction shall include all activities associated with the cattle grid including any adjustments to the fencing as shown on the Drawings. ***Extent of Work***

6. Advance signposting, in accordance with AS 1742.2, shall be provided on each approach to the cattle grid in accordance with the Specification for SIGNPOSTING.

SPECIAL REQUIREMENTS

CITY OF GREATER DANDENONG

DEVELOPMENT
CONSTRUCTION
SPECIFICATION

C271

MINOR CONCRETE WORKS

SPECIFICATION C271
MINOR CONCRETE WORKS

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SPECIFICATION C271
MINOR CONCRETE WORKS

GENERAL

C271.01 SCOPE

1. The Work to be executed under this Specification consists of the supply and placement of concrete, including sprayed concrete, and ancillary requirements like excavation, preparation of foundations, forming up, placement of reinforcement and backfilling for work shown on the Drawings but not having individual Specifications. These works include New Jersey type barriers, drainage pits and other supplementary structures, headwalls, box culverts, box culvert base slabs, driveways, footpaths, median toppings, retaining walls, footings, paving edge strips and works of a similar nature.

2. The work also includes supply and placement of miscellaneous minor concrete work for water and sewerage construction such as valve chambers, thrust and anchor blocks, bulkheads, pumping stations, bedding, encasement and cast-in-situ access chambers.

3. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C271.02 REFERENCE DOCUMENTS

Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Australian Standards

AS 1012.1	-	Sampling fresh concrete
AS 1012.3.1	-	Determination of properties related to the consistency of concrete - Slump test.
AS 1012.8	-	Making and curing concrete compression, indirect tensile and flexure test specimens in the laboratory or in the field.
AS 1012.9	-	Determination of the compressive strength of concrete specimens.
AS 1012.14	-	Securing and testing cores from hardened concrete for compressive strength.
AS 1141.14	-	Particle shape by proportional calliper.
AS 1141.21	-	Aggregate crushing value.
AS 1141.23	-	Los Angeles value.
AS 1141.24	-	Soundness (by use of sodium sulphate solution).
AS 1289.3.3.1	-	Calculation of the plasticity index of a soil.
AS 1289.5.1.1	-	Determination of the dry density/moisture content relation of a soil using standard compactive effort.
AS 1289.5.2.1	-	Determination of the dry density/moisture content relation of a soil using modified compactive effort.
AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio.
AS 1302	-	Steel reinforcing bars for concrete.
AS 1303	-	Steel reinforcing wire for concrete.
AS 1304	-	Welded wire reinforcing fabric for concrete.
AS 1379	-	The specification and manufacture of concrete.
AS 1478.1	-	Chemical admixtures for concrete, mortar and grout – Part 1: Admixtures for concrete.
AS 1554.3	-	Welding of reinforcing steel
AS/NZS 1859	-	Reconstituted wood-based panels.
AS 2082	-	Visually stress-graded hardwood for structural purposes.
AS 2271	-	Plywood and blockboard for exterior use.

AS 2758.1 - Concrete aggregates
AS 3600 - Concrete structures
AS 3610 - Formwork for concrete.
AS 3799 - Liquid membrane-forming curing compounds for concrete,
AS 3972 - Portland and blended cements.

(b) Council Documents

City of Greater Dandenong:2002 – Paths Asset Management Plan

EXCAVATION AND FOUNDATIONS

C271.03 GENERAL

1. The subgrade or subbase where specified, shall be formed at the required depth below the finished surface levels shown on the Drawings. Rock foundations shall be neatly excavated to form a bed for the concrete, and shall be thoroughly scraped and cleaned. Soil foundation shall, as far as possible, be excavated neatly from the solid material to coincide with the under-surface of the concrete, or of the subbase material (where specified). ***Foundations***

2. All soft, yielding or other unsuitable material shall be replaced with sound material approved by the Superintendent, and the subgrade shall be compacted to provide a minimum relative compaction of 92 per cent as determined by AS 1289.5.4.1 for modified compactive effort. If the subgrade is dry it shall be sprinkled with as much water as it will readily absorb, before the concrete is placed. ***Unsuitable Material***

3. The Contractor shall supply all necessary sheeting and bracing to safely support the excavation in accordance with Statutory requirements. The excavation shall be kept free of water. ***Shoring***

C271.04 NEW JERSEY TYPE BARRIERS, DRIVEWAYS AND FOOTPATHS

1. For New Jersey type barriers, driveways and footpaths a subbase of approved quality and of minimum 150mm compacted thickness, unless otherwise shown on the Drawings, shall be placed over the subgrade. The surface shall then be checked for uniformity, line and level, and all irregularities shall be made good. ***Subbase***

2. The subbase material shall be compacted to provide a minimum relative compaction as determined by AS 1289.5.4.1 of 97 per cent for standard compactive effort or 95 per cent for modified compactive effort as appropriate. ***Compaction***

3. The finished subbase shall not deviate more than 15mm under a straight edge 3 metres long, subject to any necessary allowance on vertical curves. ***Subgrade and Subbase Tolerances***

C271.05 DRAINAGE PITS AND OTHER SUPPLEMENTARY STRUCTURES

1. Where the excavation is in sound rock, and the Superintendent so directs, part of the concrete lining of gully pits and other structures may be omitted, provided that a neatly formed pit of the required dimensions is constructed, and provided that the wall of the pit adjacent to and parallel with the road is constructed of formed concrete in all cases. ***Pit Walls***

C271.06 RETAINING WALLS, HEADWALLS AND WINGWALLS

1. In the case of rock foundations for retaining walls, headwalls and wingwalls, the excavation shall be carried into the rock for a minimum depth of 150mm. Where cut-off walls are to be provided, the depth of cut-off in rock foundations may be ***Rock Foundations***

reduced to 100mm.

2. Prior to the construction of cast-in-situ concrete walls on earth foundations, the latter shall be covered by a mass concrete bedding layer at least 50mm thick and finished to a uniform surface. No forms or other materials shall be placed upon the bedding layer within a period of 48 hours after the concrete has been placed. ***Earth Foundations***

3. Unless otherwise specified, precast concrete wall sections shall be placed on a fresh mass concrete bedding layer while it is still in plastic state. In the case of soil foundations, the concrete shall be not less than 50mm thick, and where the foundation is in rock, the concrete shall be of such thickness as is required to provide a uniform surface at least 50mm above the highest points of rock. ***Pre-cast Concrete***

FORMWORK

C271.07 GENERAL

1. Formwork shall be provided in accordance with AS 3610 to produce hardened concrete to the lines, levels and shapes shown on the Drawings or specified elsewhere. It shall have adequate strength to carry all applied loads, including the pressure of fresh concrete, vibration loads, weight of workers and equipment, without loss of shape. Forms shall be mortar tight and designed to allow removal without risk of damage to the completed structure. Joints in the formwork shall be perpendicular to the main axis of the shape of the concrete. ***Formwork Requirements***

2. Where concrete is placed in earth excavations, side forms shall be provided to prevent contact between concrete and the insitu earth. ***Side Forms***

3. Design of formwork for high sections shall be such that it shall not be necessary to drop concrete freely from a greater height than 1.2 metres or to move concrete along the formwork after deposition. ***Placement of Concrete***

4. Formwork material used shall be sound and suitable for the purpose intended and surface finish specified. ***Material***

5. Provision shall be made for the accurate location and firm support of fittings, bolts, anchorages and formers of holes as shown on the drawings. Temporary fittings used for the support of the formwork shall be arranged to permit removal without damage to the concrete. The use of wires and or bolts extending to the surface of the concrete shall not be permitted except where shown on the Drawings. ***Formwork Fittings***

6. Forms for edges of concrete shall be filleted and for re-entrant angles chamfered as shown on the Drawings. ***Edge Treatment***

7. Temporary openings shall be provided where necessary for cleaning out of formwork and inspection before concreting. ***Cleaning and Inspection***

C271.08 APPROVAL OF FORMWORK DESIGN

1. For box culverts and reinforced concrete retaining walls, detailed drawings, design calculations, description and/or samples of materials proposed for use shall be submitted for the Superintendent's concurrence before manufacture of the formwork is commenced. ***Approval to Design***

C271.09 PROVISION FOR DRAINAGE

1. Where shown on the Drawings, or where directed by the Superintendent, weepholes of 50mm diameter shall be provided in retaining walls and wingwalls. ***Weep Holes***

C271.10 CONSTRUCTION

1. The type and quality of material selected for formwork and the workmanship used in construction shall be such that the surface finish specified shall be obtained. Construction shall be such that the erection tolerances shall be obtainable.

Formwork Material

2. Timber for formwork shall be well seasoned, free from defects and, where in contact with fresh concrete, free from loose knots.

Timber Requirements

3. Timber forms for exposed surfaces shall be constructed from plywood or particle board with hardwood or approved softwood studs and wales. The plywood used for forms shall comply with AS 2271, the hardwood shall comply with AS 2082 and the particle board with AS/NZS 1859.

Timber Standards

4. Formwork for exposed surfaces shall be made from panels having uniform widths of not less than 1m and uniform lengths of not less than 2m, except where the dimensions of the member formed are less than the specified panel dimensions. Plywood panels shall be placed with the grain of the outer plies perpendicular to the studding or joists. Where form panels are attached directly to the studding or joists the panel shall be not less than 15mm thick. Form panels less than 15mm thick, otherwise conforming to these requirements may be used with a continuous backing of dressed material of 20mm minimum thickness. All form panels shall be placed in a neat, symmetrical pattern.

Formwork Panels for Exposed Surfaces

5. Forms for all surfaces which will be completely enclosed or permanently hidden below the ground may be constructed from dressed or undressed timber, steel, plywood or particle board.

Hidden Surfaces

6. Mild steel form surfaces in contact with concrete shall have all bolt and rivet heads counter-sunk and all welds ground back to even and smooth surfaces.

Mild Steel Surfaces

C271.11 ERECTION

(a) General

Formwork Position Tolerances

(i) Dimensions and position of forms, shall be carefully checked after the forms are erected. Forms shall be aligned accurately and the location of all fittings, hold formers, etc. checked prior to placing concrete. Departure of the forms from the surfaces shown on the drawings shall not exceed 1/300 of the space between supports for any surface visible in the completed work and 1/150 for hidden work. For tolerances in plan position and levels, refer to Clauses C271.24 and C271.27.

(ii) Joints as erected shall be mortar tight.

Mortar Tight

(iii) The interior surface of the forms shall be treated to ensure non-adhesion of the mortar. Commercial quality form oil or grease will be acceptable, but the oil or grease used on forms against surfaces to be exposed shall not stain or discolour the concrete surface. The coating shall be uniformly spread in a thin film and any surplus shall be removed prior to placing concrete. In the case of unlined timber forms, the timber shall be thoroughly wetted before oiling. Forms shall be treated before placing reinforcement to ensure that the form release agent will not contaminate the surface of the reinforcing steel or construction joints.

Coating of Internal Surfaces

(iv) Formwork hardware shall be treated with a form release agent and so arranged that it may be removed from the concrete without excessive jarring or hammering.

Release Agent

(b) Approval by the Superintendent

Reinforcement Placement

(i) The formwork shall be inspected by the Superintendent, and the placing of reinforcement in the spaces formed, where specified, shall not commence until the formwork is approved by the Superintendent.

(ii) Placing of concrete shall not commence until the reinforcement, where specified, has been accepted by the Superintendent, and all dirt, chips, hardened concrete, mortar and all foreign matter removed from the forms. ***Concrete Placement***

(iii) When an inspection is requested by the Contractor, a notice of not less than 24 hours, excluding Saturdays, Sundays and Public Holidays, shall be given to the Superintendent. ***Notice of Inspection***

MATERIALS FOR CONCRETE

C271.12 CEMENT

1. Cement shall be Type GP Portland Cement complying with AS 3972. ***Type***

2. If the Contractor proposes to use cement which has been stored for a period in excess of 3 months from the date of testing, a re-test shall be required at the Contractor's expense before the cement is used. ***Storage Time***

3. All cement shall be transported in watertight containers, and shall be protected from moisture until used. Caked or lumpy cement shall not be used. ***Transport and Storage***

C271.13 WATER

1. Water shall be free from injurious amounts of materials harmful to concrete and to its reinforcement and neither salty nor brackish. ***Quality***

2. Water which is not potable for human beings shall not be used in reinforced concrete. ***Potability***

C271.14 FINE AGGREGATE

1. Fine aggregates shall consist of clean, hard, tough, durable uncoated grains, uniform in quality, and shall conform to the requirements of AS 2758.1 in respect of bulk density, water absorption (maximum 5 per cent) material finer than 2 micrometres, impurities and reactive materials. ***Quality***

2. Fine aggregates shall be evenly graded within the absolute limits shown in Table C271.1, and shall not deviate from the proposed grading by more than the amounts in Table C271.1. ***Grading Requirements***

Australian Standard Sieve	Proportion Passing (% of Mass)	Deviation from Proposed Grading (% of Mass of Sample)
9.50mm	100	
4.75mm	90 - 100	±5
1.18mm	40 - 85	±10
300μm	8 - 30	±10
150μm	2 - 10	±5
75μm	0 - 4	±3

Table C271.1 - Fine Aggregate Grading

C271.15 COARSE AGGREGATE

Quality

1. Coarse aggregate shall consist of clean, hard, durable, crushed stone, crushed river gravel, screened river gravel or metallurgical furnace slag and shall conform to the requirements of AS 2758.1 in respect of particle density, bulk density, water absorption (maximum 2.5 per cent), material finer than 75 micrometres, weak particles, light particles, impurities and reactive materials, iron unsoundness and falling or dusting unsoundness. In all other respects, the coarse aggregate shall comply with this Specification. If required, coarse aggregate shall be washed to satisfy these requirements.

Wear Test

2. The percentage of wear shall be determined by AS 1141.23, and the loss of weight shall not exceed 30 per cent.

Additional Tests

3. When required by the Superintendent, coarse aggregate shall be tested for conformance for any or all of the properties set out below:

(i) Crushing Value - AS 1141.21
The aggregate crushing value shall not exceed 25 per cent.

(ii) Soundness - AS 1141.24
The loss of mass when tested with sodium sulphate shall not exceed 12 per cent.

(iii) Particle Shape - AS 1141.14
The proportion of mis-shapen particles (2:1 ratio) shall not exceed 35 per cent.

Grading Requirements

4. Coarse aggregate shall be evenly graded within the absolute limits shown in Table C271.2 and shall not deviate from the grading of the samples submitted under Clause C271.17 by more than shown.

Australian Standard Sieve (mm)	Proportion Passing (% of Mass)			Deviation Proposed Grading (% of Mass of Sample)
	40mm Nominal For Walls exceeding 150mm thickness	20mm Nominal For all other structures	Extrusion Concrete	
53.0	100			
37.5	95 - 100			±10
26.5		100		
19.0	30 - 70	95 - 100		±10
13.2			100	
9.50	10 - 35	25 - 35		±5
4.75	0 - 10	0 - 10		±5
2.36	0 - 2	0 - 2		

Table C271.2 - Coarse Aggregate Gradings

C271.16 ADMIXTURES

Quality and Use

1. Chemical admixtures and their use shall comply with AS 1478.1. Admixtures shall not contain calcium chloride, calcium formate, or triethanolamine or any other accelerator. Admixtures or combinations of admixtures other than specified below, shall not be used.

2. During the warm season, (October to March inclusive), a lignin or lignin-based (`ligpol') set-retarding admixture (Type Re or Type WRRe) approved by the Superintendent shall be used to control slump within the limits stated in Clause C271.21. The dosage shall be varied to account for air temperature and haul time in accordance with the manufacturer's recommendations. A copy of the NATA endorsed Certificate of Compliance with AS 1478.1 for Type Re or Type WRRe shall be submitted to the Superintendent, together with the proposed `dosage chart' in accordance with Clause C271.17. ***Retarder for Warm Season***

3. During the cool season, (April to September inclusive), only a lignin or lignin based set-retarding admixture containing not more than 6 per cent reducing sugars (Type WRRe complying with AS 1478.1) may be used in the mix. ***Retarder for Cool Season***

C271.17 TESTING OF MATERIALS

1. The Contractor shall submit to the Superintendent a copy of a NATA Certified Laboratory Test Report on the quality and gradings of the aggregates proposed to be used in the work. ***Contractor's Responsibility***

2. The materials shall only be used after receipt of the Superintendent's notification of acceptance, and then only so long as the materials accord with the Specification. ***Use of Material***

HANDLING AND TREATMENT OF CONCRETE

C271.18 MEASURING

1. All materials shall be measured by weight, except that:- ***Measurement of Material***

   (a) Water may be measured by volume with an approved adjustable water-measuring and discharging device, and,

   (b) Cement may be measured by bags as packed by the manufacturer in which case batches shall be proportioned on the basis of one or more unbroken bags of cement, and for this purpose one bag of cement shall be assumed to weigh 40kg. Bulk cement shall be weighed in an individual hopper and shall be kept separate from the aggregates until the components of the batch are discharged from the batching hopper.

   (c) Measurement by volume for smaller works may be undertaken with the prior approval of the Superintendent.

C271.19 MEASURING BY WEIGHT, ON-SITE MIXING

1. Where concrete is to be mixed on site, and where mix control is likely to be less efficient than at a central batching plant, the weights of cement, fine and coarse aggregate shown in Table C271.3 may be used as a guide to produce the classes of concrete specified. Small changes in the proportions of fine and coarse aggregate may be required to improve density or workability of the concrete. The use of proportions shown in Table C271.3 shall not relieve the Contractor of his obligation to provide concrete of the specified compressive strength. ***Mixing by Weight on Site***

MPa	Cement Kg	Fine Aggregates Kg	Coarse Aggregates Kg	Total Aggregates Kg
10	40	130	250	380
15	40	100	190	290
20	40	88	126	214

Table C271.3 - Materials in Batch containing 1 bag (40Kg) Cement

2. The proportions set out in Table C271.3 make allowance for moisture contents of aggregates of 6 per cent for fine aggregates and 1 per cent for coarse aggregates. Where the moisture content of aggregates exceeds 8 per cent or 3 per cent respectively, the proportions of the mix shall be changed to compensate for the excess water in the aggregate.

Variation in Aggregate Moisture Content

C271.20 MEASURING BY VOLUME, ON-SITE MIXING

1. Where measurement by volume is approved, the proportions of the materials shall be such as are required to produce a mix free of voids and having the specified strength at 28 days.

Mixing by Volume on Site

2. The nominal proportions given in Table C271.4 may be used as a guide for volume batching.

Volume Batching

MPa	Parts by Volume		
	Cement	Fine Aggregate	Coarse Aggregate
10	1	3	6
15	1	2.25	4.5
20	1	2	3

Table C271.4 - Volume Batching

3. The volumes of fine and coarse aggregates for each batch shall be measured in boxes or bins. The aggregates shall be measured loose (i.e. without compaction) in the boxes and shall be struck off level. Measurements by shovels or like methods will not be permitted. Batch proportions shall be so arranged that each batch contains 1 bag of cement. One 40kg bag of cement shall be assumed to have a volume of 27.5 litres.

Batch Measurement

C271.21 CONSISTENCY

1. A sufficient quantity of water shall be added to the mix so that the consistency of the concrete is such that it can be placed in the forms, compacted and worked into all corners without permitting the ingredients to segregate, or excess free water to collect on the surface. If required by the Superintendent, the Contractor shall determine the consistence of the concrete in accordance with AS 1012.3.1. Except for extruded concrete, the nominated slump shall not exceed 80mm, plus the field tolerance of ±15mm.

Consistency Requirements

2. In the case of concrete placed by an extrusion machine, the water in the mix shall be only sufficient to produce a slump of 10mm to 15mm.

Extruded Concrete Consistence

C271.22 MIXING AND DELIVERY

(a) General

(i) Concrete may be mixed either at the site or at a central mixing plant. All concrete shall be mixed with mechanically operated mixers. In an emergency, hand mixing may be permitted. ***Mechanical Mixing***

(ii) Any concrete which exhibits signs of segregation shall not be used. ***Segregation of Concrete***

(b) Machine Mixing at Site

(i) The mixing of concrete shall be done in a batch mixer which will ensure a uniform distribution of the materials throughout the batch. ***Mixer Requirements***

(ii) The mixer shall be of such capacity that one or more whole bags of cement may be used per batch of concrete. The volume of the mixed material shall not exceed the manufacturer's rated capacity of the mixer. ***Mixer Capacity***

(iii) The mixing time for each batch shall not be less than 1.5 minutes after all ingredients are assembled in the mixer, and prior to any portion of the batch being removed. ***Mixing Time***

(iv) The entire contents of a batch shall be discharged from the mixer before any materials are placed therein for the succeeding batch. ***Total Mix Discharge***

(c) Mixing in an Emergency

(i) In the case of breakdown of the mechanical mixing equipment, hand mixing in small quantities so as to complete a section of the work or reach a suitable construction joint is permitted. ***Hand Mixing***

(ii) Hand mixing shall be done on a water-tight platform of sufficient size to allow the mixing of at least two batches simultaneously. The amount of cement used shall be 10 per cent more than the amount specified for machine mixed concrete. ***Hand Mixing Conditions***

(iii) The fine aggregate and cement shall first be mixed until a uniform colour is obtained, and then spread on the mixing platform in a thin layer. The coarse aggregate, which shall have been previously drenched with water, shall then be spread over the fine aggregate and cement in a uniform layer, and the whole mass turned over as further water is added with a rose sprinkler. After the water is added, the mass shall be turned at least three times, not including shovelling into barrows or forms, until the mixture is uniform in colour and appearance. Hand-mixed batches shall not exceed 0.25 cubic metres each. ***Hand Mixing Procedure***

(d) Ready-Mixed Concrete

(i) The concrete shall be mixed and delivered in accordance with the requirements of AS 1379 relating to:- ***Mixing Standard and Discharge Times***

(1) Mixing and Delivery; and

(2) Use of Non-Agitating Equipment,

with the exception that in (1) the time taken from the introduction of water until the concrete is completely discharged shall be not more than 1.5 hours, and in (2) not more than 30 minutes.

(ii) The water used for flushing the chutes and for cleaning shall be discharged in an ***Cleansing and***

area acceptable to the Superintendent. The chutes shall be long enough to permit delivery to the whole of the area enclosed by the forms. ***Positioning of Chutes***

C271.23 PLACING AND COMPACTING CONCRETE

1. No concrete shall be mixed or placed, without the approval of the Superintendent, while the air temperature is, or is likely to be within 24 hours, below 5°C or while the shade temperature exceeds 38°C. All concrete shall be placed in the dry. Prior to placing concrete the area shall be clean and moist but free from any ponding of water. ***Air Temperature Requirements***

2. The concrete shall be mixed in the quantities required for immediate use and shall be placed in position as rapidly as possible. Any concrete which has developed initial set, or which does not reach the forms within 30 minutes after the water has been added (except when transported in agitator trucks) shall not be used. ***Placement within Time Limit***

3. The concrete shall be deposited in the forms, without separation of the aggregates. Concrete shall not be dropped freely from a height greater than 1.2 metres, or be deposited in large quantities at any point and moved or worked along the forms. Conveying equipment, including open troughs and chutes, where used, shall be made of metal, or have metal linings. Where used on steep slopes, troughs and chutes shall be equipped with baffles, or be placed in short lengths in such a way that the direction of flow of the concrete is changed. The concrete shall be placed in horizontal layers in one continuous operation between the ends of the work and/or construction joints. Care shall be taken to fill every part of the forms and to work the coarser aggregate back from the face. The freshly placed concrete shall be compacted by continuous spading, slicing or by vibrator units. Vibrators shall not be left in one position for more than 30 seconds, and shall not be permitted to rest on reinforcement. ***Placement in Forms, Vibrating***

4. Exposed surfaces of the concrete shall be struck off and finished with a wooden or steel float as required to achieve the desired finish. Where shown on the Drawings corners and edges shall be left neatly rounded or chamfered. Re-entrant angles shall be neatly filleted. ***Exposed Surfaces***

5. Concrete shall not be moved after it has been in the forms for more than 10 minutes. ***Initial Set***

6. In the case of concrete placed by an extrusion machine, small quantities of cement-sand slurry, comprised of two parts of plasterer's sand and one part of cement (by volume), together with sufficient water to bring it to a semi-fluid condition, shall be placed in the special receptacle in the machine, if the machine is so equipped and shall be fed onto the surface of the concrete at a rate sufficient to produce a smooth and uniform finish. ***Slurry for Extruded Concrete***

C271.24 FINISHING OF UNFORMED SURFACES

(a) Surfaces other than Wearing Surfaces

1. Unformed surfaces shall be compacted and tamped so as to flush mortar to the surface, screeded off and finally dressed with a wooden float to an even surface. Care shall be taken to drain or otherwise remove promptly any water which comes to the surface. A capping of mortar will not be permitted. ***Finish for Unformed Surfaces***

2. All future contact surfaces shall be left rough, with the coarse aggregate at the surface firmly embedded but not forced below the surface. ***Future Contact Surfaces***

(b) Wearing Surfaces

1. Where a concrete wearing surface is shown on the drawings the concrete shall be thoroughly compacted and the surface screeded off by a vibrating screed, or hand screeded where the distance between forms perpendicular to the direction of screed is no ***Finish for Wearing Surfaces***

greater than 2 metres. Immediately following compaction and screeding the concrete shall be tested for high or low spots and any necessary corrections made. The surface shall be finished true and uniform and free from any glazed or trowelled finish and shall be finally dressed with a wooden template or float, or by the use of belting in an approved manner. The departure from grade shall not exceed 5mm in any 3 metre length.

2. Where an asphalt wearing surface is specified, the surface of the concrete, after being compacted, screeded and corrected, shall be dressed with a wooden float and finally broomed to produce a rough surface. ***Surface to receive Asphalt***

(c) Finished Levels and Location

1. The unformed surface of concrete structures not adjacent to road pavements shall not vary more than 25mm in plan position and not more than 25mm from the specified levels. In the case of barriers, drainage pits and other structures adjacent to road pavements, the finished concrete shall not vary more than 10mm from the specified levels and alignment. Barriers, footpaths and similar shall not deviate from level or alignment by more than 5mm from a straight-edge 3 metres long, subject to any necessary allowances on vertical and horizontal curves. ***Surface Tolerance***

C271.25 CURING AND PROTECTION

1. All exposed surfaces of the freshly placed concrete shall be kept moist either by the use of plastic sheeting, damp sand or commercial curing compounds, in accordance with AS 3799, for a minimum period of 3 days. During this time the work must be adequately protected from the effects of excessive surface evaporation, rain, running water, vandalism and other causes likely to damage the concrete. All costs involved in making good or replacing any work that has been damaged due to the above mentioned factors shall be borne by the Contractor. ***Curing Requirements*** ***Contractor's Cost***

2. Curing for concrete shall generally be in accordance with the appropriate surface exposure classification in AS 3600. ***Exposure Classification***

C271.26 REMOVAL OF FORMS

1. All forms shall remain in place, after placement of concrete, for minimum periods specified hereinafter. These periods may be extended by the Superintendent if the air shade temperature falls below 10ºC during the periods specified. ***Walls, Sumps etc.***

Mass retaining walls, headwalls, wingwalls, gully pits, sumps, and similar drainage structures	48 hours
Footpaths, driveways and similar	48 hours
Sides of reinforced concrete walls when height of each day pour is:	
(i) under 0.6 metres	1 day
(ii) 0.6m to 3m	2 days
(iii) 3m to 6m	3 days
(iv) 6m to 9m	5 days
Supporting forms under deck slabs of culverts	10 days

2. To permit the satisfactory finishing of barriers, forms shall be removed in not less than 12 hours nor more than 48 hours after placing concrete, depending upon weather conditions. ***Barriers***

3. Care shall be taken in removing forms so that the concrete will not be cracked, chipped or otherwise damaged. The use of crowbars or other levering devices exerting pressure on the fresh concrete to loosen the forms will not be permitted. ***Protection of Concrete***

4. No superimposed load shall be allowed on any part of a structure until the concrete has reached at least 70 per cent of the design strength. ***Superimposed Load***

5. Hole formers such as pipes and bars shall be removed as soon as the concrete has hardened sufficiently for this to be done without damage to the concrete. ***Removal of Hole Formers***

C271.27 TREATMENT OF FORMED SURFACES

1. All concrete surfaces shall be true and even, free from stone pockets, depressions or projections beyond the surface. All arrises shall be sharp and true, and mouldings shall be evenly mitred or rounded. Care shall be exercised in removing forms to ensure this result. . Formed concrete surfaces shall have finishes in accordance with the classes of surface finish in AS 3610 as follows: ***Quality of Surfaces***

Non-visible surfaces Class 4

Visible surfaces - Class 2

2. As soon as the forms are removed from mass or reinforced concrete work, all rough places, holes and porous spots shall be repaired by removing defective work and filling with stiff cement mortar having the same proportions of cement and fine aggregate as used in the concrete, and shall be brought to an even surface with a wooden float. ***Repair of Defects***

3. Any tie wires or other fitments extending to outside surfaces, shall be cut back after removal of forms, to a depth of at least 40mm with sharp chisels or cutters. All cavities caused by removal of fitments or tie wires shall be wetted and carefully packed with cement mortar, as above. ***Removal of the Wires***

4. The surfaces of bolt cavities, tie wire holes, and all defects in concrete shall be coated prior to the placing of mortar, grout, or fresh concrete, with an approved bonding agent, in lieu of wetting with water. The method of application of such agent and the conditions in which it is to be used shall generally be as laid down by the manufacturer. ***Coating with Bonding Agent***

5. The formed surfaces of concrete structures not adjacent to road pavements shall not vary more than 25mm in plan position and not more than 25mm from the specified levels. In the case of drainage pits and other structures adjacent to road pavements, the finished concrete shall not vary more than 10mm from the specified levels and alignment. ***Surface Tolerance***

C271.28 JOINTS

1. Where horizontal construction joints are found to be necessary in walls, or cast-in-situ drainage structures the joints may be made at the base of walls and at other locations in the walls where approved by the Superintendent. In order to provide for bond between the new concrete and the concrete which has already set, the surface on which the new concrete is to be placed shall be thoroughly cleaned of loose material , foreign matter and laitance. The surface shall be roughened or keyed and saturated with water. After any excess water has been removed, the surface shall be thinly coated with a neat cement grout. ***Horizontal Construction Joint***

2. Retaining walls shall be provided with vertical expansion joints as shown on the Drawings. The expansion joints shall consist of jointing material of approved quality, and of thickness shown on the drawings, and a depth sufficient to fill the joint. The jointing material shall be neatly cut to fit the surface of the concrete. ***Vertical Expansion Joints***

3. Where barriers are extruded or cast in place, narrow transverse vertical grooves, 20mm deep, shall be formed neatly in the surface of the freshly placed concrete to produce contraction joints for the control of cracking. The contraction joints, shall be at intervals of 3 metres. ***Barrier Contraction***

4. In barriers, unless shown otherwise on the Drawings, expansion joints, 15mm in ***Barrier***

width for the full depth of the barrier, shall be constructed at intervals not exceeding 15m and where the barrier abuts against gully pits. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard. ***Expansion***

5. In footpaths, median toppings and driveways, unless otherwise shown on the Drawings, expansion joints, 15mm in width for the full depth of paving, shall be constructed at intervals not exceeding 15m and where the pavement abuts against gutters, pits and structures. Expansion joints shall consist of a preformed jointing material of bituminous fibreboard.

6. All unreinforced paving shall be provided with narrow vertical grooves, 20mm deep to induce contraction joints for the control of cracking. The joints shall be formed in the freshly placed concrete in a neat regular pattern to form "slabs" no bigger than $2m^2$. The ratio of the longest side to the shortest side shall not exceed 1.6.

C271.29 STRENGTH OF CONCRETE

1. When tested in accordance with AS 1012.9, the concrete shall have a compressive strength not less than that shown on the Drawings or if not shown shall have a compressive strength not less than that specified in Table C271.5 for the particular class of work. The cement content restrictions shown in Table C271.5 refer to Portland cement. Where General Purpose Blended cements are utilised the acceptable minima are indicated in brackets. ***Strength Requirement***

2. The strength shall be determined from the average of not less than two specimens, moulded from each class of concrete being used in the work, and selected to represent the whole of the concrete placed at the time of moulding. ***Determination of Strength***

3. In general, two pairs of test specimens shall be moulded for each 15 cubic metres of concrete, or part thereof, one pair being intended for the 7 day test if required and the other pair for a 28 day test. ***Moulding of Cylinders***

Use	MPa	Minimum Portland Cement per cu metre (Minimum GP Blended Cement)	Coarse Aggregate Nominal Size	Cylinder Strength Required	
				7 days	28 days
		KG	mm	MPa	MPa
Foundations, mass retaining walls	20	270 (330)	40	15	20
Mass concrete footings, pitching, linings etc.	20	270 (330)	20	15	20
Drainage structures, driveways footpaths, New Jersey barrier, miscellaneous minor concrete work	20	270 (330)	20	15	20
Reinforced concrete culverts, headwalls, base slabs, sign structure large footings, retaining walls	32	320 (380)	20	24	32
Extruded concrete	20	270 (330)	14	15	20

Table C271.5 - Concrete Strength Requirements

NOTE:
The total cement and Portland cement quantities indicated as minima are aimed at providing suitably durable concrete for exterior public works under normal circumstances.

4. The strengths specified at 28 days shall be increased by multiplying by factors as shown in Table C271.6 for tests at ages in excess of 28 days. ***Strength Age Factor***

*Age of test specimen in days of date of testing	Factor
28	1.00
35	1.02
42	1.04
49	1.06
56	1.08
70	1.10
84	1.12
112	1.14
140	1.16
168	1.18
196	1.20
224	1.22
308	1.24
365 and greater	1.25
*For intermediate ages the factor shall be determined on a pro-rata basis	

Table C271.6 - Concrete Age Conversion Factors

5. If the test specimens fail to achieve the specified strength, the Contractor may, with the approval of the Superintendent, arrange for cores to be taken from the work. If the average strength of such cores complies with the specified requirements nominated in Table C271.5, the concrete will be accepted. ***Cores and Test Acceptance***

6. If cores taken fail to satisfy the strength requirements, the concrete shall be removed. ***Failure of Cores***

C271.30 SAMPLING CONCRETE

1. Equipment and facilities shall be provided by the Contractor for the taking and storage of samples of any materials or concrete being used, or intended to be used in the work. ***Contractor's Responsibility***

2. Concrete test specimens shall be cylinders 300mm long and 150mm diameter, moulded concurrently in the presence of the Superintendent or Superintendent's representative, in accordance with AS 1012.8, from samples taken in accordance with AS 1012.1. ***Moulding of Test Cylinders***

STEEL REINFORCEMENT FOR CONCRETE

C271.31 MATERIAL

1. Steel reinforcement shall comply with the requirements of the appropriate following Australian Standards:- ***Standards***

(a) AS 1302 Steel Reinforcing Bars for Concrete.

(b) AS 1303 Steel Reinforcing Wire for Concrete.

(c) AS 1304 Welded Wire Reinforcing Fabric for Concrete.

2. The type and size of bars shall be as shown on the Drawings. ***Type and Size***

3. Steel reinforcement shall be free from loose or thick rust, grease, tar, paint, oil, mud, millscale, mortar or any other coating, but shall not be brought to a smooth polished condition. ***Quality***

4. The Contractor shall supply evidence satisfactory to the Superintendent that steel reinforcement complies with AS 1302, AS 1303 or AS 1304, as appropriate. Test certificates shall show the results of mechanical tests and chemical analysis. ***Documentary Evidence***

5. Where the material cannot be identified with a test certificate, samples shall be taken and testing arranged by the Contractor. The samples shall be selected randomly and consist of three specimens each at least 1.2 m in length. ***Further Sampling***

6. Plastic bar chairs or plastic tipped wire chairs shall be capable of withstanding a load of 200kg mass on the chair for one hour at 23 ± 5^{o}C without malfunction. The Contractor shall demonstrate that the proposed chairs conform with these requirements. ***Bar Chairs***

C271.32 BENDING

1. Reinforcement shall be formed to the dimensions and shapes shown on the Drawings. It shall not be bent or straightened in a manner that will injure the material, and bars with kinks or bends not shown on the drawings will not be accepted. Heating of reinforcement for purposes of bending will only be permitted if uniform heat is applied. Temperature shall not exceed 450^{o}C and the heating shall extend beyond the portion to be bent. Heated bars shall not be cooled by quenching. ***Cutting and Bending***

C271.33 SPLICING

(a) General

1. All reinforcement shall be furnished in the lengths indicated on the Drawings. If splicing is required, it shall be in accordance with the provisions of AS 1302. ***Plan Lengths***

2. The cost of any test ordered in connection with splices not shown on the drawing shall be borne by the Contractor. ***Contractor's Cost***

(b) Lapped Splices

1. Laps in reinforcing bars, wire or fabric shall be as shown on the Drawings. Laps not shown on the Drawings shall be as follows for unhooked bars:- ***Lap Dimensions***

Plain bars, Grade 250	40 bar diameters
Deformed bars, Grade 400	35 bar diameters

Hard-drawn wire	50 bar diameters

2. Splices in reinforcing fabric shall be so made that the overlap, measured between outermost transverse wires of each sheet of fabric is not less than the spacing of those wires plus 25mm. ***Splice Dimensions***

C271.34 MARKING

1. Bars of identical shape shall be made up in bundles of three and securely tied together by soft iron wire. Each bundle shall have a stout metal label of not less than 40mm diameter attached to it. Each metal label shall be punched with the appropriate marking in accordance with the steel list shown on the drawings. If called for on the Drawings the marking shall incorporate a prefix, and bars with different prefixes shall be stored separately. ***Marking Details***

C271.35 STORAGE

Reinforcement shall be stored above the surface of the ground and shall be protected from damage and from deterioration by exposure. ***Protection of Reinforcement***

C271.36 DELIVERY AND RECEIPT OF REINFORCEMENT

C271.37 PLACING

1. Reinforcement shall be accurately placed as shown on the Drawings and shall be securely held by blocking from the forms, by supporting on concrete or plastic chairs, or metal hangers, and by wiring together at all intersections or at 0.5m centres, whichever is the greater distance, using annealed iron wire of diameter not less than 1.25mm. Steel shall not be supported on metal supports which extend to the surface of concrete, on wooden supports, or on pieces of coarse aggregate. Reinforcement shall have the minimum cover shown on the Drawings. ***Reinforcement Position***

2. The Superintendent may approve the use of tack welding instead of wire ties on reinforcing wire. All welding of reinforcing steel shall be in accordance with AS 1554.3. Tack welding of cold-worked and hard grade bars shall not be permitted. ***Tack Welding***

3. The reinforcement in each section of the work shall be approved by the Superintendent before any concrete is deposited in the section and adequate time shall be allowed for inspections and any corrective work which may be required. Notice for inspection shall not be less than four normal working hours. ***Inspection Required***

4. Splices shall be staggered where practicable and when not shown on the drawings they shall be arranged as directed by the Superintendent. ***Splices***

5. Bars forming a lapped splice shall be securely wired together in at least two places, unless welded. ***Lapped Splice***

6. The clear cover of any bar, including stirrups, to the nearest concrete surface shall be as shown on the Drawings. Where not so indicated it shall be as stated below: ***Bar Cover***

(a) Concrete normally in contact only with air

(i)	Slabs:	40mm
(ii)	Other than slabs:	45mm

(b) Concrete in contact with earth or fresh water

(i)	Slabs of box culverts:	50mm
(ii)	Other than culverts:	50mm

In no cases shall the cover be less than 1½ times the diameter of the bar.

BACKFILLING

C271.38 GENERAL

1. Backfilling at barriers, paving, etc, and minor concrete works shall not commence until after the concrete has hardened and not earlier than three days after placing.

Adjacent to Walls

2. No filling shall be placed against retaining walls, headwalls or wingwalls within 21 days after placing of the concrete, unless the walls are effectively supported by struts to the satisfaction of the Superintendent, or when the Contractor can demonstrate that 85 per cent of the design strength of the concrete has been achieved.

Selected Backfill

3. Selected backfill shall be placed against retaining walls and cast-in-place box culverts for a horizontal distance equal to one-third of the height of the wall. It shall consist of granular material, free from clay and stone larger than 50mm gauge. The Plasticity Index of this selected backfill material shall not be less than 2 or more than 12 when tested in accordance with AS 1289.3.3.1. The material shall be placed in layers not exceeding 150mm and shall be compacted to provide a relative compaction of not less than 92 per cent as determined by AS 1289.5.4.1 for modified compactive effort.

C271.39 TREATMENT AT WEEPHOLES

Size & Type of Backfill Material

1. Drainage adjacent to weepholes shall be provided by either a layer of broken stone or river gravel consisting of clean, hard, durable particles graded from 50mm to 10mm such that:

   (a) The maximum particle dimension shall not exceed 50mm

   (b) No more than 5 per cent by mass shall pass the 9.5mm A.S. sieve.

Extent of Material

2. The broken stone or river gravel, enclosed in a filter fabric suitable for drainage without scour, shall be continuous in the line of the weepholes, extend at least 300mm horizontally into the fill and extend at least 450mm vertically above the level of the weepholes.

Synthetic Membrane

3. Alternatively the Contractor may provide a synthetic membrane of equivalent drainage characteristics at no extra cost to the Principal. It shall be stored and installed in accordance with Manufacturer's instructions. The use of a synthetic membrane shall be subject to the Superintendent's approval.

SPRAYED CONCRETE

C271.40 GENERAL

Definition

1. Sprayed concrete is concrete pneumatically applied at high velocity on to a surface. Application may be either a wet or dry process. A sound homogeneous product shall be provided with surface finish reasonably uniform in texture and free from blemishes.

Depth

2. The minimum depth of sprayed concrete to be applied shall be 75mm.

Colour

3. Sprayed concrete lining in open drains shall be coloured to match the adjoining rock colour.

Strength

4. Sprayed concrete shall have a minimum cement content of 380 kg/m^3 as discharged from the nozzle and shall have a minimum compressive strength of 25 MPa

at 28 days when tested by means of 75mm diameter cores taken from in-place sprayed concrete.

5. Cores shall be secured, accepted, cured, capped and tested in accordance with AS 1012.14. Equipment and facilities shall be provided by the Contractor for the taking of cores from the work. The Contractor shall arrange for a laboratory with appropriate NATA registration for the curing and testing of the cores. Copies of test results shall be forwarded to the Superintendent. ***Test Cores***

6. At least 14 days prior to applying any sprayed concrete the Contractor shall submit to the Superintendent details of his proposed procedure, plant, materials and mix proportions. Materials shall comply with AS 3600. ***Contractor's Responsibility***

C271.41 TEST PANELS

1. Not less than 10 days before applying concrete, the Contractor shall prepare at least 3 test panels for each mix proposed, in conditions similar to those in the works and in the presence of the Superintendent. The test panels shall be made by applying a 75mm thickness of sprayed concrete to a hardboard panel approximately 750mm square. The sprayed concrete shall be applied to the panels in the same manner, using materials including steel reinforcing fabric, equipment, pressures and curing that will be used in the Works. The panels shall be submitted to the Superintendent for examination. ***Test Panels***

2. The Contractor shall cut four 75mm diameter cores from one test panel for each proposed mix approximately 48 hours after the panel has been sprayed. The cores shall be tested as for cores from in-place sprayed concrete. One core shall be compression tested at 3 days, one core at 7 days and the remaining two cores at 28 days. ***Cores***

3. Should any of the cores reveal defects such as lack of compaction, dry patches, voids or sand pockets or should the test panel exhibit an unacceptable surface finish, the Contractor shall modify the mix design and/or method of placement and prepare fresh test panels for testing and inspection. ***Defective Core***

4. Sprayed concrete shall not be applied to the Works until the Contractor produces test panels for the approval of the Council. ***Approval***

C271.42 SURFACE PREPARATION

1. Earth surfaces shall be graded, trimmed and compacted and shall be dampened prior to applying the sprayed concrete. The Contractor shall take any precautions necessary to prevent erosion when the sprayed concrete is applied. ***Earth***

2. Rock surfaces shall be cleaned of loose material, mud and other foreign matter that might prevent bonding of the sprayed concrete onto the rock surface. The rock surface shall be dampened prior to applying the sprayed concrete. ***Rock***

3. Corrugated steel pipes shall be cleaned of loose material, mud and any other foreign matter. ***Steel Pipes***

4. The Contractor shall remove free water and prevent the flow of water which could adversely affect the quality of the sprayed concrete. ***Water Flow***

C271.43 APPLICATION OF SPRAYED CONCRETE

1. Application shall begin at the bottom of the area being sprayed and shall be built up making several passes of the nozzle over the working area. The nozzle shall be held so that the stream of material shall impinge as nearly as possible perpendicular to the surface being coated. The velocity of discharge from the nozzle, the distance of the nozzle from the surface and the amount of water in the mix shall be regulated so as to produce a dense coating with minimum rebound of the material and no sagging. ***Procedure***

Rebound material shall be removed after the initial set by air jet or other suitable means from the surface as work proceeds and disposed of.

2. Spraying shall be discontinued if wind causes separation of the nozzle stream. ***Wind Problem***

3. Concrete shall not be sprayed in air temperatures less than 5ºC. ***Air Temperature***

4. Construction joints shall be kept to a minimum. A joint shall be formed by placing or trimming the sprayed concrete to an angle between 30º and 45º to the sprayed concrete surface. The joint edge shall be cleaned and wetted by air-water jet before recommencing concrete spraying. ***Construction Joints***

5. When spraying around reinforcement, concrete is to be sprayed behind the reinforcement before concrete is allowed to accumulate on the face of the reinforcement. ***Spraying around Reinforcement***

6. Adjoining surfaces not requiring sprayed concrete shall be protected from splash and spray rebound. Splash or rebound material on these adjoining surfaces shall be removed by air-water jet or other suitable means as work proceeds. ***Protection of Adjoining Surfaces***

C271.44 CURING

1. Curing shall commence within one hour of the application of sprayed concrete and may be by water or by colourless wax emulsion curing compound complying with AS 3799 and applied in accordance with manufacturer's specifications. ***Commence-ment***

2. In water curing, the surface of the sprayed concrete shall be kept continuously wet for at least seven days. ***Water Curing***

LIMITS AND TOLERANCES

C271.45 SUMMARY OF LIMITS AND TOLERANCES

1. The limits and tolerances applicable to the various clauses in this Specification are summarised in Table C271.7 below:

Item	Activity	Limits/Tolerances	Spec Clause
1.	**Subgrade**		
	(a) Relative Compaction	≥92% (modified compactive effort)	C271.03
2.	**Barriers, Footpaths etc.**		
	(a) Finished Subbase	To be trimmed and compacted so that the levels do not vary more than 15mm under a straight-edge 3 metres long.	C271.04
	(b) Relative Compaction of Subbase	≥95% (modified compactive effort) ≥97% (standard compactive effort)	C271.04
3.	**Formwork**		C271.11
	(a) Position of Forms	Forms shall be aligned accurately so that departure of the forms from the surfaces specified on the Drawings shall not exceed 1/300 of the space between supports for any surface visible in the completed work and 1/150 for hidden work.	
4.	**Fine Aggregate**		
	(a) Grading	To be evenly graded within the absolute limits and shall not deviate from the grading of sample aggregate as per Table C271.1.	C271.14
5.	**Coarse Aggregate**		
	(a) Percentage of wear	Loss of weight shall not exceed 30%	C271.15
	(b) Crushing Value	Crushing value shall not exceed 25%	C271.15
	(c) Soundness	The loss of mass when tested with sodium sulphate shall not exceed 12%	C271.15
	(d) Particle Shape	The proportion of mis-shapen particles (2:1 ratio) shall not exceed 35%	C271.15
	(e) Grading	To be evenly graded within the absolute limits and shall not deviate from the grading of sample aggregate as per Table C271.2.	C271.15

Item	Activity	Limits/Tolerances	Spec Clause
6.	**Aggregate Moisture Content**	Where moisture content of fine aggregate exceeds 8%, or moisture content of coarse aggregate exceeds 3%, the proportion of mix shall be changed.	C271.19
7.	**Consistency**	In accordance with AS 1012.3, Method 1 the slump shall not exceed the nominated slump ±15mm.	C271.21
		In the case of concrete placed by extrusion machine, the slump will be between 10mm and 15mm.	C271.21
8.	**Ready-Mixed Concrete**		
	(a) Mixing & Delivery	The time taken from the introduction of water until the concrete is completely discharged shall be not more than 1.5 hours.	C271.22
		Where non-agitating equipment is used the concrete shall be completely discharged not more than 30 minutes after the addition of water.	
9.	**Placing & Compacting of Concrete**	Concrete shall not be placed without the approval of the Superintendent if the air temperature within 24 hours is likely to be below 5°C or the shade temperature is likely to exceed 38°C.	C271.23
10.	**Finishing of Unformed/Formed Concrete Surfaces**		
.	(a) Wearing Surface	To be finished true and uniform so that departure from designed grade shall not exceed 5mm in any 3 metre length.	C271.24 (b)
	(b) Finished Surface		
	(i) Not Adjacent to Roads	≤25mm Plan position ≤25mm Level	C271.24(c) C271.27
	(ii) Adjacent to Roads	≤10mm Alignment ≤10mm Level	

Table C271.7 - Summary of Limits and Tolerances

SPECIAL REQUIREMENTS

CITY OF GREATER DANDENONG

DEVELOPMENT CONSTRUCTION SPECIFICATION

C273

LANDSCAPING

SPECIFICATION C273 - LANDSCAPING

CLAUSE CONTENTS PAGE

SPECIFICATION C273 : LANDSCAPING

GENERAL

C273.01 SCOPE

1. The work to be executed under this Specification consists of:

   (a) The vegetation of cut and fill batters, median areas, pathway verges, open drains and other areas within the site. Vegetation includes the initial surface preparation, topsoiling, fertilising, sowing of seed and may include surface protection works, hydroseeding, hydromulching and straw mulching.

   (b) The supply of plants, planting at locations as shown on the Drawings, fertilising, mulching, staking, watering and maintenance of plants.

2. Requirements for quality control and testing, including maximum lot sizes and minimum test frequencies, are cited in the Specification Part for Quality Requirements. ***Quality***

C273.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

C211	-	Control of Erosion and Sedimentation.
C213	-	Earthworks.

(b) Australian Standards

AS 1160	-	Bitumen emulsion for construction and maintenance of pavements.
AS 2507	-	The storage and handling of pesticides.
AS 4419	-	Soils for landscaping and garden use.
AS 4454	-	Composts, soil conditioners and mulches.
AS 4843	-	Synthetic weed blocking fabric.

VEGETATION OF SLOPES AND DRAINS

C273.03 EXECUTION AND TIMING OF WORK

1. In association with the work to be executed under this Specification, the Contractor shall implement effective erosion and sedimentation control measures in accordance with the Specification for CONTROL OF EROSION AND SEDIMENTATION. ***Contractor's Responsibility***

2. The work to be executed under this Vegetation of Slopes and Drains includes the vegetation of cut and fill batters, pathway verges, median areas, open drains and other areas within the site. Vegetation includes the initial surface preparation, topsoiling, fertilising and either sowing of seed or turfing as shown on the Drawings. ***Vegetation***

3. Exposed ground shall be vegetated before the area exceeds one hectare or lesser area in compliance with Council requirements. ***Exposed Ground***

C273.04 MATERIALS

(a) Topsoil

1. The Contractor shall use topsoil stockpiled on site under the Specification for EARTHWORKS. Where imported topsoil is required it shall comply with AS 4419 and shall:- ***Quality***

- be of a friable, porous nature;
- be free of weeds and weed seeds, bulbs, corms and vegetable propagules;
- contain no refuse or materials toxic to plant growth;
- contain no stumps, roots, clay lumps or stones larger than 25mm in size;
- have an organic content of at least 3 per cent by mass;
- have a pH neither less than 6.0 nor more than 7.5;
- have a soluble salt content not exceeding 0.06 per cent by mass.

(b) Herbicide

1. Herbicide used shall be an approved glyphosate based herbicide.

(c) Seed ***Seed Type and Supplier***

1. All seed used shall be of approved species and varieties approved and shall be sown at the application rates. The Contractor shall submit to the Superintendent the name/s of the proposed species, seed supplier/s and application rates within two weeks of the acceptance of the tender.

2. The Contractor's attention is drawn to the lead time that may be required to procure some native seed species. The native seed shall be delivered to the site in separate lots for each species and variety, clearly labelled to show species, variety and weight. ***Lead Time for Native Seed***

3. All seed must be accompanied by a "Certificate of Authenticity" which shall be furnished by the Contractor to the Superintendent upon request at any stage of the work. ***Certification***

4. The Contractor shall not take possession of the seed more than seven days before sowing is to occur. The seed shall be stored in clean, air tight containers and kept away from direct sunlight. It shall not be exposed to the elements at any stage during storage. ***Storage***

5. The Contractor shall replace at his own expense any exotic seed batch found not true to type. ***Contractor's Cost***

(d) Turf

1. Turf shall consist of 25mm depth of dense, well rooted, vigorous grass growth with 25mm depth of topsoil. The type of grass turf to be used shall be Couch and Buffalo and in accordance with the Drawings. Unless specified, Kikuyu grass shall not be used. Turf shall be free of weeds, soil pests and diseases. The turf shall be supplied as rolls in long lengths of uniform width, not less than 300mm, and shall be in sound unbroken condition.

(e) Fertiliser

1. Fertiliser shall be an approved organic type. ***Type***

(f) Vegetable Mulch

1. Vegetable mulch used in hydromulching shall consist of straw, chaff, wood fibre, paper pulp or similar material all finely shredded to a maximum dimension of 10mm. Meadow hay or weeds shall not be used and paper pulp if used shall not exceed 50 per cent by mass of the total mulch. ***Composition***

(g) Binder

1. The binder used in hydromulching and strawmulching shall be Grade ASS, slow setting anionic bitumen emulsion, complying with AS 1160.

(h) Wetting Agent

1. The soil wetting agent added in hydromulching or hydroseeding shall be approved and applied at the application rate specified.

C273.05 VEGETATION OF SLOPES 3 TO 1 OR FLATTER

(a) Preparation of Surface

1. Slopes shall be sprayed with herbicide applied at the rate specified in Annexure C273A to kill weed infestation. Sprayed areas shall remain undisturbed for two weeks. ***Herbicide Treatment***

2. The surface shall then be tyned to a depth of 200mm to produce a loose surface and all large stones, rubbish and other materials that may hinder germination shall be removed before topsoiling. ***Preparation***

(b) Topsoiling

1. Topsoil shall be uniformly applied to provide an average compacted thickness of 50mm with a minimum compacted thickness of 30mm at any location. The topsoiled area shall be cultivated to a depth of 50mm to provide a roughened surface with soil lumps not exceeding 25mm dimension. ***Application***

(c) Mixing of Seed

1. The Contractor shall give the Superintendent two days' notice before each sowing operation. Seed shall be sown on the day of mixing with pesticide. ***Notice***

(d) Incorporation of Pesticide

1. Immediately before sowing, all grass and native seed shall be treated with pesticide. The pesticide shall be thoroughly mixed as a dry powder with the seed at the rate specified to the equivalent mass of seed to be spread on 1 hectare of the surface. ***Mixing***

(e) Sowing

1. Sowing shall be carried out with an appropriate mechanical seeder. Where practicable, passes shall follow finished surface contours. Seed shall be sown at a depth of 5mm or shall be raked or harrowed to provide 5mm cover. ***Seeder***

2. Seed and fertiliser shall be evenly distributed over the areas to be sown at the rates approved. Fertiliser shall be applied concurrently with the seeding operation. ***Sowing Rate***

(f) Turfing

1. Turf shall be placed on the prepared topsoiled surface. Runs of turf shall butt hard against each other and be placed perpendicular to the direction of water flow. Turf seams shall then be topdressed with topsoil. ***Placing***

2. Four to six weeks after placement, the turf shall be lightly topdressed with topsoil ***Topdressing***

to correct any undulations or unevenness in the established turf.

(g) Watering

1. The Contractor shall water areas to be sown to a moist condition and shall rewater areas to a moist condition without surface runoff on a daily basis for a minimum of 15 days after sowing, or as otherwise directed by the Superintendent, to promote and maintain growth.

C273.06 VEGETATION OF OPEN DRAINS

(a) Preparation of Surface

1. The Contractor shall so execute the work that the excavation of open drains to the specified profiles is followed within seven days by the vegetation of the surface as specified in this Clause. Topsoil shall be spread to provide an average compacted thickness of 50mm with a minimum compacted thickness of 30mm at any location. ***Profile and Topsoil***

(b) Sowing

1. Before sowing, the surface shall be watered. Seed and fertiliser shall then be applied uniformly at the rates specified by one of the following procedures as directed by the Superintendent: ***Procedure***

(i) Mechanical sowing.

(ii) Hydromulching or hydroseeding.

(iii) By hand.

(c) Surface Protection

1. Where shown on the Drawings or directed by the Superintendent, one of the following protective treatments shall be applied immediately to all or part of the sown surface. ***Methods***

(i) Spraying with Bitumen Emulsion

An anionic slow setting bitumen emulsion, conforming with Grade ASS of AS 1160, shall be sprayed over the surface at a rate of 1 litre of bitumen emulsion per square metre of surface. ***Application Rate***

(ii) Lining with Organic Fibre Mat

The channel surface shall be lined with an approved organic fibre mat. The runs of matting shall be laid along the direction of water flow. The matting shall be laid loosely on the soil surface and not stretched. ***Laying***

The upstream end of the matting shall be slotted into a trench 150mm wide by 150mm deep and pinned to the base of the trench at 200mm centres. The trench shall be backfilled with soil and compacted by foot. ***Anchorage***

The pins shall be `U' shaped, 4mm gauge wire, 50mm wide and 150mm long legs. ***Pins***

Adjacent runs of matting shall be overlapped 100mm with the higher run lapped over the lower run. The matting shall be pinned along the sides of each run at 500mm centres and along the middle of each run at 1m centres. End overlaps shall be 150mm wide with the higher run end lapped over the start of the lower run and pinned at 200mm centres. ***Lapping***

(iii) Turfing

Turf shall be as specified under Clause C273.04(d). ***Quality***

Runs of turf shall butt hard against each other and be placed perpendicular to the direction of water flow in the drain, and pinned into position at 500mm centres. ***Placing***

Seams of turf shall be topdressed with topsoil. ***Topdressing***

(d) Watering

1. The Contractor shall water treated areas in order to promote and maintain growth.

LANDSCAPE PLANTING

C273.07 EXECUTION AND TIMING OF WORK

1. The work to be executed includes the ground preparation, the supply of plants, planting as shown on the Drawings, fertilising, mulching, staking, watering and maintenance of plants. ***Extent of Work***

2. The Contractor shall give the Superintendent a minimum of two days' notice of commencement of planting. Landscape planting shall not be carried out in extreme weather conditions (above 35ºC or below 10ºC). ***Notice of Commence-ment***

C273.08 MATERIALS

(a) Topsoil

1. Topsoil shall comply with the requirements of Clause C273.04(a).

(b) Herbicide/Weed Blocking Fabric

1. Herbicide shall comply with the requirements of Clause C273.04(b).

2. Synthetic weed blocking fabric shall comply with AS 4843.

(c) Fertiliser

1. Fertiliser shall be a slow-release type in pellet form, with a nine months' release period and having Nitrogen:Phosphorus: Potassium (N:P:K) ratios of 6.3 : 1.8 : 2.8 or as approved. ***Quality***

(d) Mulch

1. All mulches used for landscape planting shall consist of organic material complying with the requirements of AS 4454. Mulch shall be composted or pasteurized. The use of other materials as ground cover shall be as indicated on the Drawings and approved by Council. ***Quality***

2. A 10 kilogram sample of mulch proposed by the Contractor shall be submitted for approval to the Superintendent two weeks before its intended use. The mulch subsequently used shall be consistent in every respect with the sample approved by the Superintendent. ***Sample***

(e) Plant Material

1. The Contractor shall obtain all plants from a nursery located in an area having a similar climate to the site of the Works. ***Source***

2. There shall be no substitution of any species without the Superintendent's approval. All plant material shall be true to species and sizes. Plants shall be healthy, of good form, not soft or forced and with large robust root systems. They shall not be rootbound and shall be free from disease and insect pests. All container soil mix shall contain between 20 per cent and 25 per cent clay by volume. Trees shall have a single leading shoot. For hardening off purposes, all plants shall be delivered to a site within the locality of the Subdivision at least four weeks before planting out. Plant root systems shall be maintained moist at all times with particular attention being paid to watering during the on-site period before and during planting. Plant stock shall be classified and planted in accordance with the Drawings. ***Quality***

(f) Stakes

1. All stakes shall be 25mm square by 1,500mm long hardwood and sharpened at one end. ***Size***

C273.09 MOUND PLANTING

The following process shall be followed for all plantings within subdivisions. ***Services***

1. Check location of underground services as built before commencing works. The Contractor shall contact all service authorities and locate all relevant services. The following offsets for trees are required.

Powerlines – 6 metres
Fence boundary – 6 metres

2. Prior to planting and grassing works, all perennial and annual weeds shall be controlled by herbicide application. Herbidice treatment shall be with a non-volatile, water soluble, liquid, non-selective, knockdown herbicide of trade-name "Roundup" or similar approved type. The areas to be treated are to be sprayed twice, one month before, and then 7 days prior to commencement of planting and grassing works. ***Pre-Planting Herbicide Treatment***

3. Refer to plant schedule on drawing for plant species, pot sizes and quantities. All plants shall be true to species and the best of their respective kinds. Tubestock shall be young and vigorous, free of pests, disease and weeds and without roots coiled around the inside of the tube. Provide local provenance material available in suitable condition where possible. Tubestock to be inspected (pre-purchase) by Mike Smith (City of Greater Dandenong). ***Planting Material***

For all mass planting install plant specimens in groups of 5-10 of the same species. No tree species to be planted within drip lines of existing trees. Setout of planting areas to be approved by Superintendent prior to excavation of planting holes. Layout to be confirmed by the Delegated Officer (City of Greater Dandenong).

Mike Smith Phone No: 9797 1768 to arrange the inspection.

Suitable Nursery contacts include:
Din San Nursery: Phone 9551 1988
Plants of Provenance: (Mark Elliston) Phone 0419 899 598
Greenlink Sandbelt Indigenous Nursery Phone 9556 4433

4. Remove the plant from the container with minimum disturbance to the root ball, ensure that the root ball is moist and place it in its final position, in the centre of the hole and plumb, and with the topsoil level of the plant root ball level with the finished surface of the surrounding soil ***Planting Procedure***

5. Apply 'Osmocote' for native slow release fertiliser, at the rate recommended by the manufacturer to each plant prior to backfilling plant with topsoil. ***Fertilising***

6. Backfill plant hole with in-situ topsoil and lightly water to eliminate air pockets, and remove all rocks, weeds or other debris. Ensure that in-situ topsoil is not placed over the top of the root ball, so that the plant stem remains the same height above ground as it was in the container. ***Backfilling***

7. All plants shall be watered before planting and immediately after planting, and at such other times during the contract period as is required to maintain growth free of water stress. ***Watering***

8. Supply and install individual tree guards to each tree and shrub (exclude tufties and groundcovers). Install plastic tree guards such as 'Treemas Treeguard Sleeves' – Standard Sleeve (or similar approved) and install (3) Standard bamboo stakes per guard. ***Tree Guards***

Contact: Treemax Phone 9429 6000

9. Any stock found to be dead, damaged or missing due to any cause whatsoever during the contract period shall be replaced by the Contractor. Stock replacement shall be of the same kind as specified in the Plant Schedule. ***Stock Replacement***

10. Supply and spread Eucalmulch or similar approved on mound. Material permitted: leaf matter and tree loppings from Eucalyptus, Tristania, Melaleuca or other native species. Place mulch to a depth of 75mm, clear of plant stems, and ensure plants are not buried by mulch. ***Mulch***

11. Supply and install treated and redried pine plinth edging to all edges between garden beds and lawn areas and as indicated on drawings. The plinth shall be 100 x 19mm on edge, the top flush with the adjoining lawn. The plinth shall be fixed at 1200mm max. centres with 75 x 25 x 400mm treated pine stakes, galvanised nailed to finish 20mm below the plinth level. ***Timber Edge***

C273.10 CARE OF LANDSCAPE PLANTING

1. Maintenance shall include the care of the contract areas by accepted horticultural practices, as well as rectifying any defects that become apparent in the works under normal use. Watering, pruning, mowing, weeding, rubbish removal, replanting, cultivating, reinstatement of mulch, insecticide, fertilising, replacement and keeping the site neta and tidy throughout the contract and maintenance period. Practical completion shall be reached when all species are healthy and vigorous. The planting establishment period commences at the date of practical completion. The Contractor shall maintain the works for a period of 3 years following practical completion. ***Maintenance***

2. Missing plants, dead plants and plants nominated by the Superintendent as unhealthy shall be replaced by the Contractor. Replacement plants shall be of similar size and quality and of identical species and variety to the plant being replaced. ***Replacement Plants***

3. Weed and grass growth in mulched areas shall be killed by treatment with herbicide in accordance with the manufacturer's instructions at monthly intervals during the construction period and contract maintenance period. Contact of the herbicide with the new plants shall be avoided and any damage repaired or damaged plant material replaced by the Contractor at no cost to the Principal. ***Weed Control***

Contractor's Cost

SPECIAL REQUIREMENTS

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CITY OF GREATER DANDENONG

SPECIFICATION

C303

SERVICE CONDUITS

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SPECIFICATION 303 - SERVICE CONDUITS

GENERAL

303.01 SCOPE

1. The work to be executed under this Specification includes the supply of materials and the installation of electrical and telephone conduits, pits and footings for street lighting columns in accordance with the Specification and Drawings.

2. The Specification excludes the installation of wiring, equipment and street lighting columns

3. Electrical conduits and pits shall be installed in accordance with AS 3000 (SAA Wiring Rules) and the Service and Installation Rules of the local electricity supply Authority. ***Electricity***

4. Telephone conduits and pits shall be installed in accordance with the AUSTEL Customer Premises Cabling Manual. ***Telephone***

5. The Contractor shall complete all necessary notices, pay all fees and charges and arrange for all inspections and tests required by the relevant Authority.

303.02 REFERENCE DOCUMENTS

1. Documents referenced in this Specification are listed in full below whilst being cited in the text in the abbreviated form or code indicated. ***Documents Standards Test Methods***

(a) Council Specifications

271	-	Minor Concrete Works

(b) Australian Standards

AS 1289.5.4.1	-	Compaction control test - Dry density ratio, moisture variation and moisture ratio.
AS 1477	-	Unplasticised PVC (UPVC) pipes and fittings for pressure applications.
AS/NZS 2053	-	Conduits and fittings for electrical installations.
AS 3000	-	Electrical Installation - Buildings, Structures and Premises (known as the SAA Wiring Rules)

(c) Australian Telecommunications Authority (AUSTEL) Standards

Customer Premises Cabling Manual

MATERIALS

303.03 GENERAL

1. All pipes, fittings and pits shall be sourced from quality assured suppliers. The superintendent may reject any components deemed not to be fit for the purpose. ***WP***

303.04 CONDUITS

1. Conduits and conduit fittings for all electrical cabling shall be category 'A' orange ***Electrical***

coloured heavy duty rigid UPVC manufactured in accordance with AS/NZS 2053 and with solvent welded joints. All conduits shall be of the sizes shown on the Drawings.

2. Conduits and conduit fittings for all telephone cabling shall be Class 12 white coloured UPVC manufactured in accordance with AS 1477 and with solvent welded joints. All conduits shall be of the sizes shown on the Drawings. ***Telephone***

3. The Developer shall provide conduits and pits complying with the relevant authority's requirements for each property on the basis of one conduit per property. ***Conduit No.***

303.05 JUNCTION PITS

1. Electrical junction pits shall to the standards required by the relevant electricity company, with 'Electricity' impressed in the lid, ***Electrical***

2. Telephone pits shall be to the standards required by the relevant telephone company, with the relevant telephone Company's symbol impressed in the lid. ***Telephone***

303.06 CONCRETE FOOTINGS

1. Concrete footings for street lighting columns shall be 20MPa compressive strength in accordance with the requirements of the Specification for MINOR CONCRETE WORKS. ***Quality***

303.07 ANCHOR BOLTS

1. Anchor bolt assemblies to be cast into street lighting column footings shall be to the relevant Australian Standard design requirements. ***Supply***

CONSTRUCTION

303.08 LAYOUT OF CONDUIT

(a) Roadway Crossings

1. The conduits shall be installed where shown on the Drawings after construction of earthworks to sub-grade level. The grade of the conduit shall be such as to provide a minimum cover over the conduit of 400mm to the top of select sub-grade level under pavement and shoulders. ***Minimum Cover***

2. The conduit shall be laid on a straight grade and line, in a trench not more than 300mm wide and on a bed of compacted sand of 50mm minimum thickness. Backfill over the conduit shall be compacted so that the relative compaction as determined by AS 1289.5.4.1 is not less than 100 per cent. ***Laying Conditions***

3. Draw wire shall be provided in all conduits. ***Draw Wire***

4. A mark shall be made in the face of kerb on both sides of the road indicating the location of the conduit crossing. The mark shall consist of the letter E for electrical or T for telephone, as appropriate, routed into the concrete and at minimum 75mm high. ***Marks in Kerb***

5. Where kerb and channel construction has not yet commenced, temporary timber post markers shall be installed at the conduit crossings so that markings in the face of kerb can be made at the correct locations at the time of kerb and channel construction. ***Temporary Markers***

(b) Other Locations

1. The conduit shall be laid on a straight grade and line and in normal trench conditions on a bed of compacted sand 50mm minimum thickness. The width of trench ***Laying Conditions***

shall not exceed 300mm and the minimum cover over the conduit to finished surface level shall be 300mm. Backfill over the conduit shall be compacted so that the relative compaction as determined by AS 1289.5.4.1 is not less than 95 per cent.

2. Draw wire shall be provided in all conduits. ***Draw Wire***

303.09 JUNCTION PITS

1. Junction pits shall be installed at locations shown on the Drawings. ***Location***

2. All junction pits shall be installed firmly in the ground on a drainage bed of 5mm nominal size screened aggregate of minimum thickness 150mm. All conduit connections to junction pits shall be made waterproof by bitumastic sealant or other method approved by the Superintendent. ***Installation Method***

WP

3. A 50mm diameter UPVC drain shall be provided in each junction pit. The drain shall be graded to a stormwater drainage pit or discharge through an embankment batter. ***Drain***

303.10 FOOTINGS FOR STREET LIGHTING COLUMNS

1. The Contractor shall construct concrete footings at the locations for street lighting columns shown on the Drawings. ***Location***

2. Excavation for footings shall be neatly cut from solid material. Excavated material shall be disposed of at locations approved by the Superintendent. ***Excavation***

WP

3. Footings shall be constructed to the dimensions and details as shown on the Drawings. ***Dimensions***

4. The anchor bolt assembly shall be accurately located and firmly supported. ***Anchor Bolt Assembly***

5. Concrete and reinforcement shall be supplied and placed in accordance with the requirements of the Specification for MINOR CONCRETE WORKS. ***Concrete Specification***

6. Concrete shall not be placed until the formwork and anchor bolt assembly location have been approved by the Superintendent. ***WP***

SPECIAL REQUIREMENTS